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February 21, 2024

Via Email

City of Bandon
City Council
555 Highway 101
Bandon OR 97411
(541) 347-2437
planning@cityofbandon.org, dnichols@ci.bandon.or.us

Re: Oregon Coast Alliance Testimony for the Gravel Point Consolidated Request Appeal, 23-045 (Bandon Beach Ventures)

Dear City Council,

On behalf of Oregon Coast Alliance (ORCA), please accept this letter in support of the appeal. ORCA is an Oregon nonprofit corporation whose mission is protection of coastal natural resources and working with coastal residents and communities to enhance community livability, via participation in land use planning decision-making.

The City has identified this as a *de novo* hearing. As that term is used in statute and case law, that means that the applicant can raise any issues and provide any evidence in support of its testimony. The City, however, appears to limit the matters to those raised in the notices of appeal and changes to the application. First, as noted, a *de novo* hearing is one where the issues are not limited, and, therefore, the City is incorrect as a matter of law. Limiting the appeal is a procedural error that prejudices ORCA's substantial rights. Second, the applicant has submitted numerous reports into the record on appeal that include a variety of changes to the application. It appears as though the applicant is getting a *de novo* hearing but the appellants get a limited hearing. The City must treat the parties equally in this regard. Again, if the City limits the appellants while allowing the applicant to make whatever changes it deems necessary, then the City will have prejudiced Petitioner's substantial rights and committed a procedural error.

In addition to the procedural error, the applicant has not satisfied the conditional use criteria contained at Bandon Municipal Code (BMC) 16.12.040. Pursuant to BMC 16.12.040A, the conditional use must be consistent with the comprehensive plan. The application, however, is not consistent with the comprehensive plan. For example, as it relates to Policy 4, Implementation Measure A,

> "[t]he City shall not vacate rights-of-way or sell City property when it is found that the vacation or sale would have an adverse impact on one or more of the following:
>
> > Scenic views or access to views
> > Wildlife
> > Wetlands
> > Storm drainage
> > Existing or future utilities.
>
> The City shall only vacate rights-of-way when there is a clear benefit to the City. The City shall utilize the Transportation System Plan as a source of identification of rights-of-way to be vacated."

The applicant alleges that:

> "the BCP states that City should not vacate streets if there is an adverse effect on scenic views, access to views, wildlife, wetlands, or public utilities. The applicant has a proposed a street vacation of the current configuration but will dedicate new streets as part of the vacation approval process (heard by the City Council at a later date) and the proposed street configuration avoids major impact to the existing wetlands and limits disturbance of the existing wildlife habitat."

The applicant, however, has not demonstrated that there are no adverse effects. Regardless, there must be a condition of approval that ensures that a street vacation proceeding will occur, and this land use application will not be finalized until that vacation is secured. As noted in prior testimony, under *Rhyne v. Multnomah County*, 23 Or LUBA 442, 447 (1992), the current application cannot be approved until the separate application is approved. The City must impose a condition that requires the separate application review, and that process must provide all of the substantive and procedural steps provided here.

It is imperative that the City include direct access to the development off of Highway 101. Indeed, the Bandon Transportation Refinement Plan recommends extending Face Rock Drive eastward to connect with Highway 101 at 20th Street as well as extending Edna Street westward to Beach Loop Road. A direct access to Highway 101 from the resort would obviate the need to connect Carter Street to the resort. To the extent the refinement plan is encompassed within the comprehensive plan, the proposal is inconsistent with the comprehensive plan.

The applicant has not satisfied BMC 16.12.040C, which requires that "the site size and dimensions provide adequate area for aesthetic design treatment to mitigate possible adverse effect from the use of surrounding properties and uses[.]" Neighboring property owners have demonstrated that wildlife that frequent the area will be reduced if not eliminated: Along with this added road traffic, we will likely see a decrease in the beautiful wildlife that are home to the Bandon coast. We personally love the deer in our neighborhood (which visit our property daily). This was a major attraction for us in moving to the city of Bandon." (Hader Testimony). Moreover, their home will be adversely affected by the a 40-foot long by 5-foot-high sign: "With the proposed Beach Loop Road entrance to Gravel Point right behind our home, we will have an unwanted, approximately 40-foot-long by 5-foot-high sign polluting the view out our windows. It is unknown whether this signage will be illuminated all night long (which would create added concerns)." (Hader Testimony).

The applicant has not satisfied BMC 16.12.040E, which requires that "[t]he characteristics of the site are suitable for the proposed use considering size, shape, location, topography and natural features." Neighboring property owners have indicated that the site is not suitable:

> "This development is too large for the location not in the sense of acreage, but in the sense of traffic, impacts on the neighborhoods nearby, overuse of resources – both natural and utilities, and the lack of readily available housing for the many employees it would require." (Westover Testimony).

The development will create significant traffic that is not suitable for the neighborhood and overuses city resources that are at or above capacity.

The applicant has not satisfied BMC 16.12.040F, which requires that "[a]ll … public facilities and services have adequate capacity to serve the proposal, and are available or can be made available by the applicant[.]" For example, the both the water and wastewater treatment plants are operating at or above their engineered capacity, and beyond their designed service life. The applicant must demonstrate that, despite the overwhelming evidence, that the public facilities and services have adequate capacity. The attached memorandum and exhibits, prepared by Sheryl Bremmer[1] and Mary O'Dea[2]. Both Bremmer and O'Dea have experience with the City's public facilities and services, and their memorandum clearly demonstrates that the City does not have adequate capacity, pursuant to BMC 16.12.040F.

The memorandum, first, shows that the water and wastewater treatment plants are operating at or above their engineered capacity. *See* Memo at 1-5. The memo demonstrates that "any future water needs will not be available from either Greiger or Ferry Creek according to the 2003 Water Management and Conservation Plan (Exhibit 1)." Memo at 1. Beyond that, there are credible concerns about the deterioration of the water lines, the insufficient storage capacity of treated water, the unexpected costs associated with deferred maintenance and new regulations,

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[1] City of Bandon Planning Commissioner 2010 – 2020, Hearings Officer 2012 – 2020; Co-Chair City of Bandon Utilities Commission 2020, Commissioner 2015-2020.

[2] Co –Chair 2016-2020, Chair City of Bandon Utilities Commission.

and, most importantly, is that the water treatment facility is long passed its engineered service life span. *Id*. The same is true of the wastewater plant: it is working beyond its engineered service life and there are no foreseeable plans to increase its capacity. Memo at 2. Operating beyond its engineered service life results in several tangible concerns, including maintenance, lack of City planning and no area in which to expand. *Id*. Capacity is also an issue given the figures presented in the Memorandum. Memo at 3. The City's public facilities and services are at capacity and the proposed development would exceed and exacerbate the existing hurdles.

Second, the long term practice of the City to not adequately budget for the water and sewer utilities' operation, maintenance, and capital improvements since FY 2011-2012 has created a backlog of expensive deferred maintenance and capital improvement projects. Deferred maintenance and costly upgrades are necessary to satisfy BMC 16.12.040F. *See* Memo at 6 (water treatment plant requires more than $18 million in capital improvements); *id.* (replacement of water lines more than $14 million).

Third, there are no foreseeable plans or projects to increase water or sewer utility capacity and no source of funding for any such increase has been identified. *See* Memo at 6-7. Flows for fire hydrants are dwindling, and that implicates the issue of safety and fire suppression deficiencies. *Id*. Surrounding properties have hydrant flow deficits. There is simply no substantial evidence in the record that the City has enough water flow to provide fire protection, let alone provide services to a large development. The applicant cannot satisfy BMC 16.12.040F until the safety of the residents have been addressed through sufficient hydrant flows. The City's public service to protect against fire safety is clearly inadequate given the capacity issues.

Finally, the record does not contain substantial evidence that adequate water for fire protection is available. The City's staff, however, only gives conclusory responses without a substantive basis that can otherwise be challenged. Evidence supporting these arguments is submitted into the record, including the article "City of Bandon situation dire and systems dysfunctional" ("there are loud and glaring doubts as to the managerial capacity and financial capacity of the water and wastewater systems. The jurisdictional, legal and financial inadequacies are so serious that I fear there is a good chance the drinking water system will soon not be able to maintain Oregon's drinking water requirements or meet Bandon's desired level of service and the sewer system is compromised to the point that it may not meet discharge requirements."), "Water treatment plan issues outlined" ("the commission found that the water utility is operating at a loss and the city has not been able to put money aside for routine maintenance and replacement of parts that are in poor condition."), and "Bandon's water problem solvable" ("The problem is water flow. Due to a substandard water system in some areas, the city can't meet state fire codes, the city's fire chief says. State law requires sprinklers in buildings constructed in those areas."). Again, the City cannot simply brush these articles under the rug, and the water and wastewater services cannot be made available absent significant upgrades, maintenance, and planning.

Public comments allege that “[a]n in-depth analysis is required to ensure that the existing systems can accommodate the additional load without compromising the safety and well-being of the community.” (Baily/Williams Testimony). Additional testimony expresses the basic problem with the City, on one hand, identifying infrastructural shortcomings, and, on the other hand, alleging that there is allegedly sufficient capacity for the proposed development:

> “There is a lot of conflicting information about this issue. The City of Bandon regularly reminds us that our wastewater system is in need of repair and that our water storage capacity is inadequate and needs updating. Additionally, the roads are substandard and there is a dirth of law enforcement. The outgoing City manager thanked the City employees for their ability to do more with less. Yet the City has assured the Gravel Point team that they can meet the needs of their project.”

(Post Testimony). The City cannot have it both ways, by raising issues about the capacity and quality of the sewer and water systems, and then approving large developments that will only exacerbate the issues the City has already identified. The public is merely echoing the red flags already raised by the City.

The record contains new evidence in the form of brief statements from someone identified only as “Steve,” alleging that the water and sewer systems have adequate capacity. First, some expertise must be established for such matters that require expertise, and that has not occurred here. Second, for the water system, the applicant alleges that adjusting a CAD model input for a 10-inch pipe instead of a 6-inch pipe results in sufficient water. That, however, does not demonstrate installing a 10-inch pipe is feasible, nor that there is water available. For the sewer system, the bare allegations about the pump station capacity must be backed up by actual figures. For example, the underlying data about the pump station and the gpd have not been submitted into the record.

The applicant has not satisfied BMC 16.12.040G, which requires that the “proposed use will not alter the character of the surrounding area in a manner which substantially limits, impairs, or precludes the use of surrounding properties for the permitted uses listed in the underlying zoning district[.]” Numerous comments from neighboring residents have expressed concern about the impact of the proposed use, including increased traffic, sewer, water, lack of infrastructure, and so forth, which will limit, impair, and preclude use of the surrounding properties for the permitted uses. For example, public testimony alleges as follows:

> “We are concerned that the significant increase in road traffic behind our home will prevent safe pedestrian and dog walking, as well as bike riding, along Beach Loop Road. As it stands now, with sidewalks not in place that span Beach Loop Road, we (along with our animals), are forced to walk on the shoulder of the road. This is a safety concern of ours and feel it will be a cause of more pedestrian accidents if not properly addressed.” (Hader Testimony).

> “Beach Loop Road is narrow with no shoulders and has many pedestrians and cyclists. It is already a dangerous situation which will only be compounded if the main entrance to Gravel Point is off Beach Loop.” (Michael/Robb Testimony)
>
> “Further, the influx of several hundred more tourists coming and going throughout the year, especially in the summer, will make both traffic and access to the amenities that we moved here to enjoy be even more difficult to access and over used. I live near the beach and I can attest that trash, unattended dogs, dog poop, and people climbing on the sea stacks and handling the animals in the tidepools increases greatly in the summer.” (Westover Testimony).

The City has not yet acknowledged and assessed these impacts to the surrounding properties and has not acknowledged that the impacts will limit, impair, or preclude such uses.

Because testimony has recently been entered into the record, I respectfully request that the record to this *de novo* hearing remain open for, at least, one week.

For the foregoing reasons, ORCA respectfully requests that the application be denied.

Sincerely,

Sean T. Malone
Attorney for Oregon Coast Alliance

Cc:
Client

Enclosure :

MEMORANDUM

Bremmer/O’Dea Memorandum

EXHIBITS

Exhibit 1. City of Bandon Water, Coos County, Oregon, Water Management and Conservation Plan October 2003 (https://www.cityofbandon.org/documents)

Exhibit 2. City of Bandon Water Master Plan 1992

Exhibit 3. 2003 City of Bandon Water Master Plan Addendum

Exhibit 4. Draft 2022 Revised Water Master Item 5.3.2 (https://www.cityofbandon.org/general/page/agenda-citycouncil-september-12-2022)

Exhibit 5. Off-channel Reservoir Feasibility Study 2016 (https://www.cityofbandon.org/documents)

Exhibit 6.City of Bandon Sewer Master Plan 2002 (https://www.cityofbandon.org/documents)

Exhibit 7. Wastewater Treatment Facilities Condition Assessment May 2018

Exhibit 8. Staff report to Planning Commission. Planning Commission Agenda Documentation. Date: March 24th, 2022 PUBLIC HEARING: Annexation of 19-Acre Parcel located in East Bandon and Portion (4334 feet) of Highway 101 (28S-14W-31BC / TL 2100, 2200, 2201, 2300, 2700, 3600, 3700, 4200, 4300, 4400) – Request to annex property into the City of Bandon, initiated by the City of Bandon – 22- 022, Item No: 5.1 , pgs. 6- 7 (https://www.cityofbandon.org/general/page/planning-commission-2)

Exhibit 9, Staff report to City Council: City Council Agenda Documentation. Date: April 11, 2022 Public hearing on annexation into the City of Bandon. ITEM 4.1, pgs 6-7. (https://www.cityofbandon.org/general/page/city-council-2)

Exhibit 10. Bandon City Council Minutes for September 12, 2022, City Council Agenda Documentation, October3, 2022, Item No. 6.1.1 (file name: 6.1.1_city_council_meeting_minutes_10.3.22)

Exhibit 11. City of Bandon Comprehensive Plan (Ordinance 1501 5-05-2003)

ARTICLES

“City of Bandon situation dire and systems dysfunctional.”

“Water treatment plan issues outlined.”

“Bandon’s water problem solvable.”

City of Bandon
Coos County, Oregon

WATER MANAGEMENT AND CONSERVATION PLAN

OCTOBER 2003

The Dyer Partnership
Engineers & Planners, Inc.

275 Market Avenue
Coos Bay, Oregon 97420
(541) 269-0732 Fax (541) 269-2044
www.dyerpart.com

Project No. 4501.39A

City of Bandon

Coos County, Oregon

Water Management and Conservation Plan

October 2003

Project No.4501.39A

REGISTERED PROFESSIONAL ENGINEER
61321PE
Michael J. Dees
OREGON
JULY 13, 1999
MICHAEL J. DEES

Expires: 12/31/03

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Introduction

Chapter 1

Introduction

1. 1 Brief Community Description

Bandon is a small, seaside community on the Southern Oregon Coast. A scenic coastal setting overlooking the Pacific Ocean and Coquille River mouth make it a popular tourist destination. It has a temperate climate and is in close proximity to state parks, rivers, lakes and forests. The City's economic base includes motels, resorts, restaurants and gift shops. The Port of Bandon and associated fishery industries also provide an important economic base. Bandon has a substantial base of retired population. Its summer population swells with summer residents. Bandon is located on at the junction of Highway 101 and 42S. It is 22 miles south of Coos Bay and 84 miles west of Roseburg on Highway 42 and 42S.

Fish processing, part time residential population increases and tourist activities during the summer portion of the year increase water demand. Surrounding Bandon, is a large cranberry growing industry dating from the 1920's. The cranberry farmers also require a great deal of water during the summer. Unfortunately, this time period corresponds with seasonal low flow conditions in Bandon's only current water sources, Geiger Creek and Ferry Creek which also must supply water to numerous cranberry growers.

Bandon's attractiveness has caused a steady increase in population regardless of State or National economic conditions. Therefore, within the next 20 years, as documented by the Water Master Plan Update, Bandon may begin to experience water shortages if no action is taken.

1.2 Purpose of WMCP and Basis in Division 86

This is the first Water Management and Conservation Plan developed for the City of Bandon. A progress report is anticipated to be submitted to the Oregon Water Resources Department (WRD) within five years (by 2008). The report will include a description of Bandon's progress toward implementing water conservation measures and other actions called for in this plan.

The water management and conservation plan (WMCP) is developed by a water supplier. The plan describes the water system and its long term needs, identifies its sources of water and explains how the water supplier will manage and conserve those supplies to meet present and future needs.

The requirements for completing these plans are tied to the revised rules surrounding water permit extensions as described under OAR 690-315 which apply to all suppliers serving over 1,000 persons to complete a WMCP in association with water permit extensions. OAR 690-086 details the requirement of WMCP's.

Oregon municipal water suppliers are permitted to "grow into" their water rights over a long period of time. Previously, the Oregon Water Resources Department issued five year permit extensions until such time as a community perfected a particular right and a certificate of water right was issued. The rules have been updated and eliminate the five year permit renewing extensions. Water right extension will now require that the supplier prepare a WMCP which will allow the extension to be made for as long as a 50 year period. However the supplier will be required to gain WRD approval for any expansion of the use of water under an extended permit based on demonstration of the need in the next 20 years. That is, a portion of the water right known as "green light" water. Additional use of water beyond this amount will require a WMCP update.

Water conservation is viewed as a critical element in the State's water supply inventory. Conservation actions must be considered as an alternative to increased development of water.. All water suppliers must implement a core group of water conservation measures.

1.3 Previous Studies and Information

The following studies, reports and other sources of information have been used in the compilation of the Water Management and Conservation Plan.

- City of Bandon Water Master Plan Update, 2003, The Dyer Partnership.
- City of Bandon 1991 Comprehensive Plan, (with Amendments re: Public Facilities)
- Comprehensive Water System Master Plan, December 1992, HGE Engineers and Planners
- Coos County Water Management Plan, 1990, CH_2M Hill
- Ferry Creek Project Evaluation Under PL84-984, April 1990, Tucson Myers & Associates
- South Bandon Refinement Plan, Infrastructure Element, June 1997, Dyer Partnership, Inc.
- Wastewater System Master Plan, June 2002, Dyer Partnership, Inc.
- Bandon Water System Improvements Construction Drawings, November 1998, Lee Engineering, Inc.
- Municipal Water Management In Oregon Coastal Communities: Surmounting the "Conservation Paradox", September 2000, Coastal Oregon Marine Experiment Station Oregon State University.
- Seawater Desalination in California, October 1993, California Coastal Commission, Susan E. Pantell, Principal Author.
- Bandon Water System Improvements Construction Drawings, November 1998, Lee Engineering, Inc.
- Department of Environmental Quality. May 2000. Source Water Assessment Report: City of Bandon. PWS 4100074.

- Department of Environmental Quality. May 2000. Source Water Assessment Brochure: 2/14/03 City of Bandon. PWS 500074
- DEQ Water Sampling Project, Project Number: OR-98-09.5-319 DEQ Contract No. :096-011/2/03, City of Bandon Water Resource Committee
- Source Water Protection Plan, September 17, 2003, City of Bandon Water Resource Committee
- Water Meter and Billing records from 1998 to 2003.
- Water Plant Records from 1998 to 2003.
- Annual Water Use Records for Geiger and Ferry Creeks 1998 to 2003.

1.4 Organization of this Document

This document complies with the requirements for development of a Water Management and Conversation Plan. This plan contains four main elements as required by the referenced ORS sections:

- Chapter 2 - ORS 690-086-0140 - Municipal Water Supplier Description
- Chapter 3 - ORS 690-086-0150 - Municipal Water Conservation Element.
- Chapter 4 - ORS 690-086-0160 - Municipal Water Curtailment Element
- Chapter 5 - ORS 690-086-0170 - Municipal Water Supply Element.

Within each chapter subsection, the specific reporting requirements under the statue are first referenced in italics. The remainder of chapter subsection provides the required information.

1.5 Authorization

The City of Bandon contracted with The Dyer Partnership, Engineers & Planners, Inc. on January 1, 2003 to prepare this Water Management and Conservation Plan in conjunction with the Water Master Plan Update. Included in the contract was a Scope of Engineering Services on which this Plan is based.

1.6 Acknowledgments

This plan is the result of contribution made by a number of individuals and agencies. We wish to acknowledge the efforts of Matt Winkel, City Manager: Richard Anderson, Public Works Director; Gene Davidson, Water Treatment Plant Supervisor; Jason Locke, Community Development Director, Lanny Boston, Fire Chief; Beverly Lanier, Administrative Assistant and the staff of the City of Bandon.

We also wish to thank the members of the Water Resources Committee for their guidance, fact review and editing assistance during the preparation of this report: The members are: Larry Roberts, Chairman; James Shivley, Vice Chairman; and committee members: Zita Ingham, Tim Arnold, Carol Doty, David Kauffman, Michael Scalici, Wayne Scherer, Patricia Soltys and Scott Vierck.

Section

2

Municipal Water Suppliers Description

Municipal Water Supplier Description

Chapter

2

(OAR 690-86-140)

2.1 Supplier's Source

Requirement: *A description of the supplier's source(s) of water; including diversion, storage and regulation facilities; exchange agreements; intergovernmental cooperation agreements; and water supply or delivery contracts;*

The City of Bandon normally provides water to its service area by withdrawal from diversion points located at both the Geiger Creek reservoir and the Ferry Creek reservoir. Ferry Creek basin has an area of 1130 acres (1.75 square miles) above its diversion point. Geiger Creek basin has an area of 1290 acres (2.0 square miles) above its impoundment diversion point.

The City has held water right permits for the impoundments and diversion since 1961. The water surface elevation of the Ferry Creek impoundment is approximately 65 ft and for the Geiger Creek impoundment is about 60 ft. The reservoir permits do not convey storage rights to the City. This means that the City may not exceed its water rights withdrawal rates from stored volume, nor withhold water from downstream users in excess of its actual usage or withdraw in amounts which do not allow passage of water to senior water rights. Both impoundment locations are just above the natural confluence of the two creeks and the site is jointly occupied by the Bandon Fish Hatchery. Withdrawal of water from the impoundments is operated in cooperation with the Hatchery through an interconnected withdrawal piping system supplying both the hatchery and the city. The inlets to both water supply withdrawal locations are at the inside toe of the respective dams. The City also holds a senior water right located on Geiger Creek upstream of the impoundment with a priority date of 1916, but has no piping from the permitted diversion location. In April, 2000, a water right transfer was issued by the Water Resources Department for Bandon, which allows the City to use an alternative withdrawal location downstream of the Ferry and Geiger Creek confluence for all three water permits, including the upstream Geiger Creek water right. This change was partially made to allow withdrawal of the Hatchery's required water prior to the City's withdrawal during low flow periods. The hatchery use is non-consumptive and is therefore available to the City after use by the hatchery, thereby avoiding conflict with the hatchery's more senior water right. Pumping from this withdrawal location is only performed during low flow periods. Both impoundments have a combined storage volume of 2.5 million gallons, in the absence of siltation. Ferry Creek impoundment was restored to near its original volume in 2000 by dredging. Geiger Creek impoundment is reported to have partial siltation, but due to steep terrain on either side of the pond, does lend itself to dredging for silt removal. Measurement of flows is accomplished by using readings from the Bandon Water Treatment Plant for raw water withdrawal. The fish hatchery and the Bandon Water Plant assume that 25% of the withdrawal is from Geiger Creek and 75% is from Ferry Creek. The withdrawal piping is interconnected with the hatchery raw water feed piping and is maintained, operated and recorded by Bandon Fish Hatchery personnel.

A pump station with a floor elevation of 51.8 ft has suction piping connected to the impoundment water withdrawal piping system. This pump facility is called the "Lower Pump Station" and transmits raw source water to a third impoundment called the "Middle Pond". This impoundment is identified on U.S.G.S. maps as "Bandon Reservoir". It has a surface elevation of about 124 ft and is located 590 ft northeast of the lower pump station and about 800 feet southwest from the City's water treatment plant. Adjacent to the Middle Pond is the Middle Pump Station with a floor elevation of 128.8 ft. Raw water is pumped from the middle pond to the Clarifier unit at the water treatment plant with a surface elevation of 188.0 ft. An aerial photo is included as Figure 2.1.1 which shows the water treatment plant site, middle pond, Fish Hatchery and the Ferry Creek and Geiger Creek Reservoirs.

The middle pond is a valuable component of the Bandon water supply system. It allows for some gravity settlement of the raw water prior to treatment. More significantly, backwash and drainage water from operations at the water plant is drained into the middle pond (after settlement in the plant's backwash ponds located at the water plant site). This avoids the loss of backwash and plant drainage water which normally occurs at most treatment plants and is particularly important during source low flow periods .

2.2 Service Area and Population

Requirement: *A delineation of the current service areas and an estimate of the population served and a description of the methodology(is) used to make the estimate*

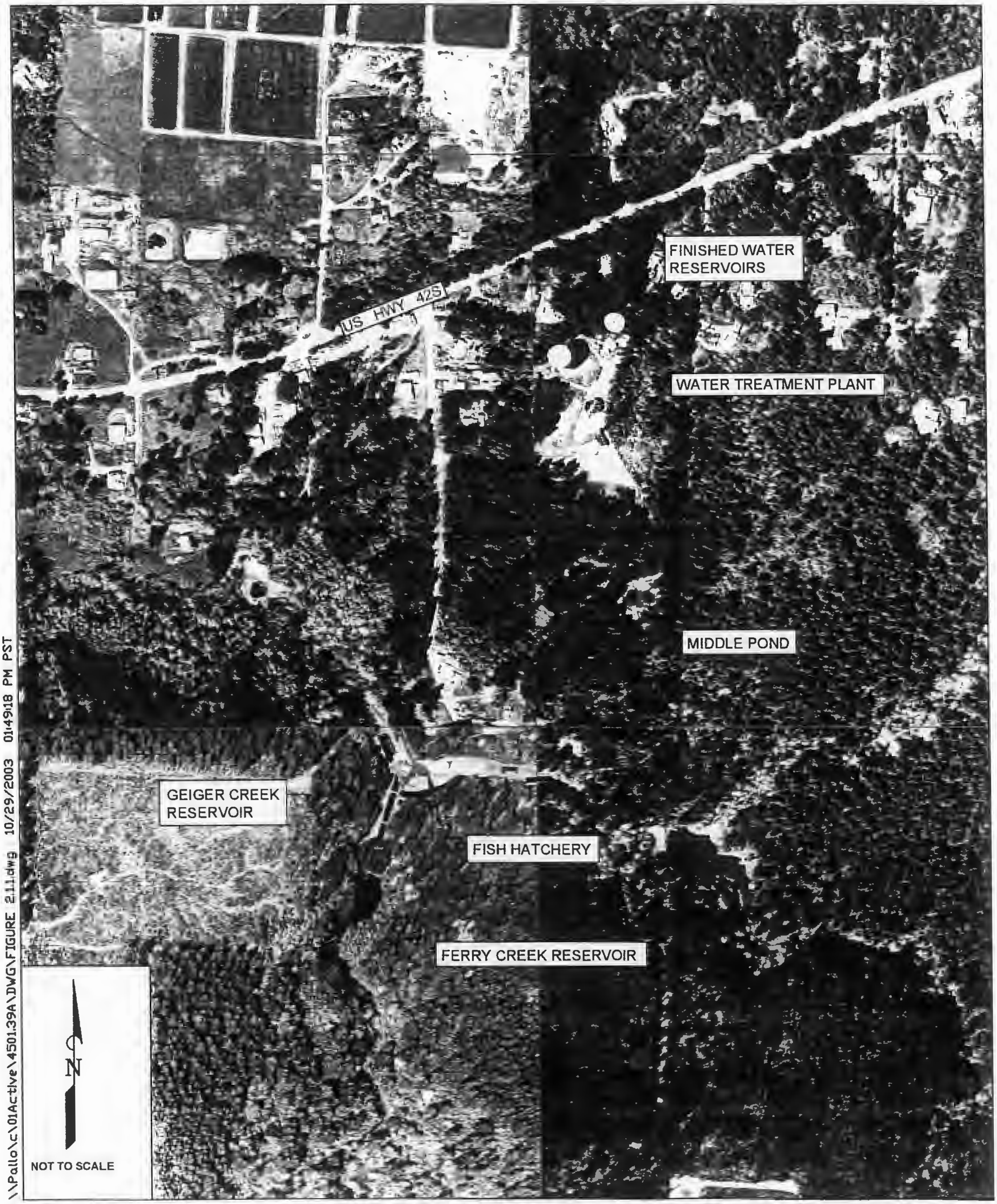
The service area for the City of Bandon includes the City of Bandon and areas within the Urban Growth Boundary.

The full time population of Bandon within the city limits is estimated to currently be 2985. The full time service population outside of the city limits is estimated to be 196. During the summer peak service period an additional "vacation rental or second home" population of 280 is estimated inside the city limits and 9 outside the city limits. Furthermore, the transient population inside the city limits (motels, RV parks, etc.) is estimated to be 730 persons per day during the summer peak season and 256 per day during the winter off-peak season.

The methodology used to make these estimates is described in further detail in the Water Master Plan Update, June 2003, Dyer Partnership. The method consists of using the 2000 U.S. census[1] to determine full time population, average full time residential occupancy rates and number of "secondary homes". An occupancy rate of 2.2 persons per home was calculated. Part-time population was estimated by multiplying the number of secondary homes by 2.2 persons. Using water billing records for outside users, the outside full time and part-time population was estimated using the same ratios as calculated for inside city limit occupancy. The transient population was estimated based on a survey conducted in 2002 for preparation of the Wastewater Master Plan. The survey had a participation rate of 50%. The survey asked owners of motels, hotels, RV parks and "bed-and breakfast" establishments how many rooms or spaces they had, and the occupancy of those rooms or spaces for both winter and summer season. By extrapolation of survey data, the transient population was estimated for the City of Bandon.

[1] U.S. Census Bureau, Census 2000 Redistricting Data (P.L. 94-171) Summary File, Table PL1,.

\\Pallo\c\01Active\4501.39A\DWG\FIGURE 2.11.dwg 10/29/2003 01:49:18 PM PST



THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.
DATE: OCT., 2003
PROJECT NO.: 4501.39A

CITY OF BANDON
WATER MANAGEMENT AND CONSERVATION PLAN

WATER TREATMENT FACILITIES

FIGURE NO.
2.1.1

2.3 Existing System Reliability

Requirement: *An assessment of the adequacy and reliability of the existing water supply considering potential limitations on continued or expanded use under existing water rights resulting from existing and potential future restrictions on the community's water supply;*

The water supply sources of Ferry Creek and Geiger Creek are described in Section 1 above. These sources are generally adequate and reliable at the present time. However, it is apparent that in the 20 to 25 year future, water shortages are likely to occur during the summer season due to low flow. Water rights transfers have been effected so that a conflict between the City and the fish hatchery need not occur, but the fact remains that there are a total of 1.6 CFS of prior water rights on lower Geiger Creek, non withstanding the hatchery's use and a low flow of 0.9 CFS as reported in the 1992 Water Master Plan (date unknown). Under the arrangement of the water rights diversion transfer executed in 2000, the City could remove 0.45 CFS (if it was actually present in the upper reach of Geiger Creek) but would have no other claim.

Water rights withdrawal location transfers have been executed and pump equipment installed so that a conflict between the City and the fish hatchery need not occur. The City is now able to withdraw water below the hatchery discharge. This also has the consequence, for the City, of being able to use water that Ferry Creek water rights holders above the hatchery and senior to the City but junior to the hatchery (totaling 0.65 CFS) are not be able to withdraw, because the hatchery's senior right water up to 3 CFS must be allowed to and through the hatchery. Once it has passed them, there is no way for these upstream users to withdraw the water. However, there is still a 0.5 CFS claim with priority senior to the City's below the alternative City withdrawal location on Ferry Creek. The lowest flow in Ferry Creek (above the confluence with Geiger Creek) was 1.3 CFS as reported in the 1992 Water Master Plan (date unknown).

Other information available includes the Tucson Myers report of April 1990. Data Correlation of Ferry Creek with Pony Creek for a location at the confluence of Geiger and Ferry Creek and appears to include both creeks. Data was compiled from 1950 to 1980 and the value for flow exceeded 99 out of 100 years was computed. The lowest flow month was determined to be for September at 1.06 mgd or 1.64 CFS. Another report was prepared by CH2M Hill in July of 1993 for Coos County based on assumed run off values and predicted rain fall. This report predicted much lower flows than the Tucson Myers report. However CH2M Hill acknowledged in the report that the mathematical basis of their estimate does not match observed flow. The explanation was that "springs" add to the volume. Basing the flows on observed Pony Creek flows Therefore, for purposes of this report 1.3 CFS will be assumed to be the 1/100 low flow value for Ferry Creek. The net result of the withdrawal arrangement, estimated low flow and water rights constraints, is that 0.8 CFS would be available to the City from Ferry Creek during estimated low flow.

Senior water rights on lower Geiger Creek, not withstanding the hatchery's use, total 1.6 CFS, with an estimated low flow above the confluence of 0.9 CFS. Under the arrangement of the City's water rights diversion transfer executed in 2000, the City could remove 0.45 CFS (if it was actually present in the upper reach of Geiger Creek) but would have no other direct claim. In any case, the net result after hatchery use is that 0.9 CFS would be usable by the City during low flow.

Therefore, the total water supply available to the City in Ferry and Geiger Creeks could be as low as 1.70 CFS during a dry month. This supply would consist of water that had passed through the hatchery fish pens from both Ferry and Geiger Creeks and was diverted by the City from downstream of the confluence of the two creeks by means of the alternative lower pump station.

The current water use projections as developed in the Water Master Plan Update indicated a 1.70 CFS (MDD) for 2003 increasing to 2.41 CFS (MDD) by 2023. The single day demand exceeding the supply stream could be met by tank storage and impoundment reservoir storage for a few days. In 2023, this is a deficient of 0.71 CFS or 0.459 million gallons per day. The current tank storage is 3 million gallons and raw water impoundment storage is 2.5 million gallons. On a maximum month basis in 2023, the City is only projected to require 1.44 CFS from an estimated minimum available source of 1.70 CFS. This demand assumes no unexpected increases (or decreases) in projected demand patterns. Therefore, the existing raw water supply source from Ferry and Geiger Creeks is anticipated to provide adequate water during the maximum demand month. However, during some period of days in a dry period, the City may have to curtail water use for a several days.

Concerning water source reliability, a Source Water Assessment was recently completed in May, 2000 by the Department of Environmental Quality. This assessment was completed for Bandon's drinking water protection area in order to identify the surface areas that supply water to the City of Bandon’s public water system intake and to inventory the potential contaminant sources that may impact the water supply.

The Source Water Assessment delineated the drinking water protection area and determined that it is primarily dominated by forest and agricultural land uses interspersed with areas of residential use. A total of 27 potential contaminant sources were identified in the watershed. The potential contaminant sources consisted of roadways, bridges, excavation locations, utilities stations and transmission lines, forest clear cuts, cranberry bogs, and residential housing development.

Risk associated with the roadways was considered moderate due to low volume of traffic. The greatest concern was associated with cranberry bogs due to the potential use of pesticides and herbicides, which may be washed into the impoundments as run-off. Residential development was considered to be a low to moderate risk due to septic tank leach ate. A transformer storage and maintenance facility located in the watershed was considered a high risk due to concern regarding spills, leaks, or improper handling chemicals and other materials including PCBs during transportation, use, storage and disposal which may impact the drinking water.

A subsequent Water Sampling Project in 2002 and a Drinking Water Protection Plan, recently completed by the Bandon Water Resources Committee, further addresses contaminants and risks as well as plans to prevent both. The Drinking Water Protection Plan determined that several areas of concern in the Source Water Assessment were not substantiated. Trace amounts of herbicides were detected in a small percentage of raw water samples, in trace amounts well below action limits. No trace of these herbicides was detected following treatment.

It is clear that additional water supply is required for the City's future but that it will not be supplied from Ferry or Geiger Creek flows due to volume limitations during dry periods of the year.

2.4 Water Use

Requirement: *A quantification of the water delivered by the water supplier that identifies current and available historic average annual water use, peak seasonal use, and average and peak day use;*

Water use for average annual demand (ADD), maximum month average demand (MMD), maximum day demand in the year (MDD) as well as peak hour demand are listed below in Table 2.4.1 (Table 3.3.3 extracted from the Water Master Plan Update). The demands for the study period 2000 to 2002 are based on City records. The projections are based upon an annual growth rate of 1.76% annual.

Table 2.4.1
Bandon Projection of Peak Demand Rates (Gal x 1,000)

Factor	Yr 2000-2002 Sty. Period	2003	2008	2013	2018	2023
ADD	442.8	458.5	500.3	545.9	595.7	650.0
MMD	633.2	655.7	715.4	780.7	851.8	929.5
MDD	1062.7	1100.4	1200.7	1310.2	1429.6	1559.9
PHD	1800.0	1866.1	2036.22	2221.8	2424.5	2645.5

2.5 Water Rights

Requirement: *A tabular list of water rights held by the municipal water supplier that includes the following information:*

(a) Application, permit, transfer, and certificate numbers (as applicable);
(b) Priority date(s);
(c) Source(s) of water;
(d) Type(s) of beneficial uses specified in the right;
(e) Maximum instantaneous and annual quantity of water allowed under each right;
(f) Maximum instantaneous and annual quantity of water diverted under each right to date;
(g) Average monthly and daily diversions under each right for the previous year, and if available for the previous five years;
(h) Currently authorized date for completion of development under each right; and
(i) Identification of any stream flow-dependent species listed by a state or federal agency as sensitive, threatened or endangered that are present in the source, any listing of the source as water quality limited and the water quality parameters for which the source was listed, and any designation of the source as being in a critical ground water area.

Table 2.5.1
Water Rights

a	b	c	d	e	f	g	h	i
C9754	1910	Spring Br. #3	Municipal	2.0/63.1	2.0/15.8 Est.	0	Not applicable	Unknown
P3011	1916	Upper Geiger Creek	Municipal	5.0/157.7	0/0	0	Not applicable	No
P27232	1961	Lower Geiger Creek	Municipal	3.0/94.6	0.78/15.3	.17	Not applicable	No
P27233	1961	Ferry Creek	Municipal	3.0/94.6	2.32/5.1	.51	Not applicable	No

Col. a = Permit Number
Col. b = Priority Date
Col. c = Water Source
Col. d = Type of Use
Col. e = Max Water Right. Instantaneous cubic feet per second / 1 Million cubic feet per year
Col. f = Max. Use to Date Instantaneous cubic feet per second / 1 Million cubic feet per year
Col. g = Ave. Month cubic feet per second use in previous year.
Col. h = Date for completion of Development
Col. i = Stream dependant species or limitation

2.6 Customer Profile

Requirement: *A description of customers served including other water suppliers and the estimated numbers; general water use characteristics of residences, commercial and industrial facilities, and any other uses; and a comparison of the quantities of water used in each sector with the quantities reported in the water supplier's previously submitted water management and conservation plan and progress reports;*

The City of Bandon provides drinking water to residential, institutional, commercial, industrial and municipal customers within the City's water service area. A portion of the City's water serves transient facilities such as RV parks, vacation rentals and motels. The City is estimated to have 1706 water service accounts distributed between various user as summarized below in Table 2.6.1

Table 2.6.1- Existing Service Profile
2000-2002

Account	No. of Services	Gal. X 1,000 Average Year Use	Gal. Ave. Day Use per Service	Typical EDU Per Svc.	EDU's/ Class	% of Total Use
Residential-Inside	1250	71053.33	155.7	1.00	1250	44.0
Residential– Outside	87	4685.33	147.0	0.94	82	2.9
Commercial- Inside	325	60947.67	513.8	3.30	1072	37.7
Commercial-Outside	18	3207.33	498.2	3.20	56	2.0
City Use –Charged	24	5768.00	656.9	4.22	101	3.6
City Used –No Charge	2	182.00	249.3	1.60	3	0.1
Metered Totals	1706	145,843.667			2566	90.2
Loss	1	15,775.333	43,220.1	277.59	278	9.8
Consumption Totals		161,619.000			2844	100.0

Residential Accounts. Inside Residential water customers in Bandon make up about 73 % of total accounts. Outside Residential users average about 5 %. Total residential users therefore comprise 78 % of the account base. The average per household occupancy is 2.2 persons per home. Residential water use in the City of Bandon is not unlike that seen in may coastal communities. Due to the typically wet climate and cool temperature, water use for outdoor recreation and landscape irrigation is generally less than that of communities in more arid regions

Commercial Accounts. Commercial accounts with the City consist of a variety of customer types. Hotels, motels and other establishment catering to the summertime and holiday tourist market constitute a significant portion of the commercial base. Inside commercial accounts make up 19 % of total accounts. Outside commercial users comprise 1 % of total accounts.

Comparison with Other Oregon Cities

The U.S. Department of the Interior documented the per capita water use for Oregon in the 1995 U.S. Geological Survey - Circular 1200. The water use pattern of Bandon is compared with the goals of an interagency team made up of personnel from the DEQ, Oregon Economic and Community Development Department (OECDD), Oregon Health Division (OHD), the Oregon Department of Water Resources (WRD), the USDA-Rural Utilities Service, Rural Community Assistance Corporation, and the Department of Land Conservation and Development. The interagency team developed target design numbers based on the USGS study and their experience with Oregon communities. The team has adopted a maximum ADD of 235 gpcd, a MDD of 588 gpcd (2.5 times the ADD), and a PHD of 1,175 gpcd (5 times the ADD).

Bandon currently is estimated to have a full time population of 2985 in the City limits and 196 outside the City limits in the service area. Therefore, the service area population is 3181. Total water consumption, including losses is estimated to be 161,619 gallons per year averaged over the past three-year study period. Therefore Bandon's' per capital consumption rate is 139.2 gpcd including domestic, commercial, industrial, and public use and loss. This is well below the target value of 235 gpcd noted above. Bandon's MDD factor was 2.40 compared with the target factor of 2.5 and the PHD factor was estimated to be a maximum of 2.78 compared with the target value of 5. These use characteristic comparison factors are summarized below in Table 2.6.2.

Table 2.6.2
Comparison of Bandon Water Use Characteristics with Other Oregon Cities

Use Characteristics	Bandon	Oregon Cities
Average Use per day	139.2 gpcd	235 gpcd
Domestic Use	46.9 %	53 %
Commercial Use	39.7.0%	14 %
Industrial Use	-------	17 %
Public Use & Loss	13.5%	16 %
MDD factor	2.40	2.5
PHD factor	4.07	5.0

2.7 Interconnections

Requirement: *Identification and description of interconnections with other municipal supply systems;*

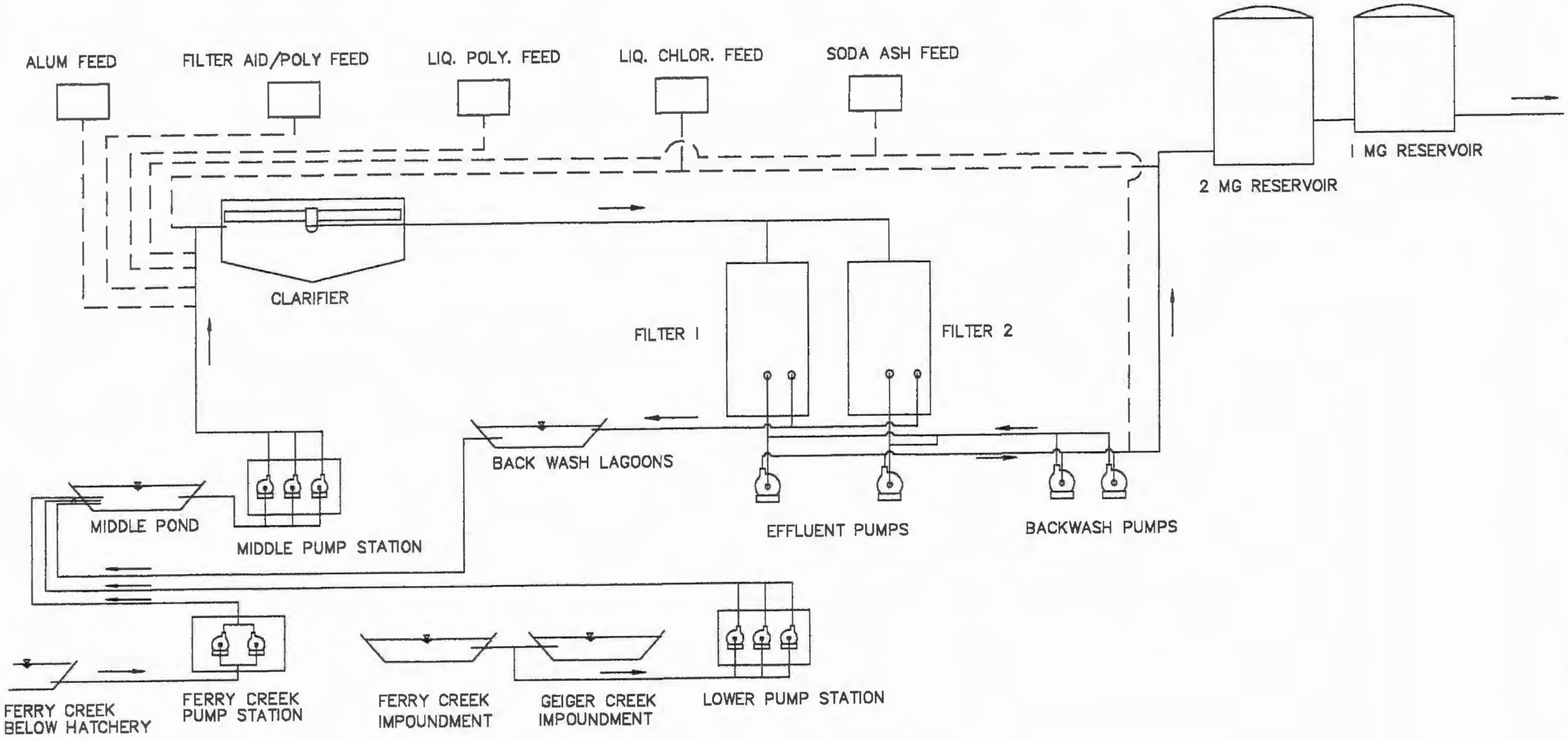
There are no interconnections with other municipal supply systems. Due to the distance between communities in this area of the Southern Oregon Coast, none are expected in the future.

2.8 System Schematic

Requirement: *A schematic of the system that shows the sources of water, storage facilities, treatment facilities, major transmission and distribution lines, pump stations, interconnections with other municipal supply systems, and the existing and planned future service area;*

Figure 2.8.1, on the following page, provides a schematic drawing of the system showing the elements required in item (8) above.

\\Pallo\c\01Active\4501.39A\DWG\FIG 2.8.1.dwg 09/29/2003 10:41:55 AM PDT



THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.
DATE: AUG, 2003
PROJECT NO.: 4501.39A

CITY OF BANDON
WATER CONSERVATION AND MANAGEMENT PLAN
WATER TREATMENT FACILITY

FIGURE NO.
2.8.1

2.9 System Leakage

Requirement: *A quantification and description of system leakage that includes any available information regarding the locations of significant losses.*

Water plant production, raw water consumption and metered water use records were examined for the past five year period. (1998-2002). The difference between finished water metered leaving the water production and storage facilities and water metered for sale averages 8.26 %. Due to the new condition of the plant, raw water pumping system and raw water transmission lines, an assumption is made that there is no more than a 1.5 % loss at the treatment plant. Therefore, total losses are estimated to be 9.76%. No significant losses are identified.

Municipal Water Conservation Element

Section
3

Municipal Water Conservation Element

(OAR 690-86-150)

Section

3

3.1 Progress of Conservation Measures

Requirement: *A progress report on the conservation measures scheduled for implementation in a water management and conservation plan previously approved by the Department, if any;*

A previous water management and conservation plan has not been previously developed. This report will establish the base line for future water conservation reporting.

3.2 Water Use Measurement and Reporting

Requirement: *A description of the water supplier's water use measurement and reporting program and a statement that the program complies with the measurement standards in OAR chapter 690, division 85, that a time extension or waiver has been granted, or that the standards are not applicable; By December 31 of each year, any governmental entity holding water rights shall submit to the Department a report detailing monthly water use under the rights for each point of diversion. Reporting shall be for the previous water year (October 1 to September 30).*

As part of the auditing process, the City must account for all water diverted from each source. This is typically accomplished through a metering device at or near the point of diversion. OAR 690-085-0015 requires that, "Where practical, water use shall be measured at each point of diversion." However, the rule also states that:

> "...measurements may be taken at a reasonable distance from the point of diversion if the following conditions are met:
>
> a) The measured flow shall be corrected to reflect the flow at the point of diversion. The correction will be based on periodic flow measurements at the point of diversion taken in conjunction with flow measurements at the usual measuring point;
>
> b) If the measured flow includes flow contributions from more than one point of diversion, the measured flow shall be proportioned to reflect the flow at each point of diversion using the method prescribed subsection (a) of this section;
>
> c) A description of the correction method shall be submitted with the annual report the first time it is used and any time it is changed, or once every five years, whichever is shorter."

If the point of diversion is relatively close to the water treatment plant, it is common for many communities to use a single influent meter at the water plant to measure the amount of water that is diverted.

In the case of Bandon, raw water flow is measured at the treatment plant influent by a magnetic flow meter. The balance between the Geiger Creek and Ferry Creek diversions is controlled by the Fish Hatchery. The Hatchery maintains a balance so that flow from Ferry and Geiger Creek reservoir produce equal overflow at their primary spillways. It has been assumed in the past that 1/4 of the total raw water flow is from Geiger Creek and 3/4 from Ferry Creek. There are no flow measurement devices located in the withdrawal piping system from the reservoirs. Neither is the main lower pump station metered, although the alterative Ferry Creek pump station below the confluence of the two Creeks is equipped with a flow meter. It is recommended that the main lower pump station be equipped with a flow meter so that water pumped to the middle pond may be measured. This would also provide a more accurate raw water diversion measurement, because the current reported raw water diversion values are too high. They include backwash and drainage water, which is returned to the water plant by way of the middle pond. The actual raw water diversion values from Ferry and Geiger Creek are expected to nearly match the finished water plant effluent values (within 1.5% to account for evaporation and minor loss from the Back Wash and Middle Ponds.). Table 3.2.1 below, summarizes the reported and estimated true water diverted from the City's two active sources converted to gallons x 1000.

Table 3.2.1
Summary of Reported and Estimated Annual Water Diversion From Each Source
(2000 –2002)

Year	Geiger Creek Annual Diversion (Gal. X 1000)	Ferry Creek Annual Diversion (Gal. X 1000)	Total Raw Water Diverted (Gal. x 1000)
2000	45,087 (Rpt.) 42,211 (Est.)	135,262 (Rpt.) 126,634 (Est.)	180,349 (Rpt.) 168,845 (Est.)
2001	41,923 (Rpt.) 37,531 (Est.)	125,769 (Rpt.) 112,593 (Est.)	167,692 (Rpt.) 150,125 (Est.)
2002	46.672 (Rpt.) 41,472 (Est.)	140,015 (Rpt.) 124,416 (Est.)	186,687 (Rpt.) 165,888 (Est.)

3.3 Other Conservation Measures

Requirement: *A description of other conservation measures, if any, currently implemented by the water supplier, including any measures required under water supply contracts;*

As described elsewhere in this plan, Bandon currently implements two significant water conservation measures. The first is the re-use of water treatment plant backwash and tank drainage water by discharge to the backwash ponds which drain to the Middle Raw Water Pond, with subsequent recovery as raw plant water. The second is the WRD permitted alternative withdrawal of raw water below the fish hatchery during low flow periods. This allows the hatchery to use its senior right "once through" water requirement and then for the City to withdraw the same water for its requirements.

3.4 Bench Mark Schedule

Requirement: *A description of the specific activities, along with a schedule that establishes five-year benchmarks, for implementation of each of the following conservation measures that are required of all municipal water suppliers:*

3.4.1 Water Audit

Requirement: *An annual water audit that includes a systematic and documented methodology for estimating any un-metered authorized and unauthorized uses;*

The City of Bandon currently maintains detailed and computerized water use records for all users, including City users which are not charged (such as fire hydrant flushing). These metered water uses are compared with raw water and plant production records on a monthly basis to check for leakage. Un-metered authorized uses do not occur. Unauthorized uses would be in the form of water theft from fire hydrants. Community police and public works personnel routinely watch for such criminal activity. No additional actions are required.

3.4.2 Unmetered Services

Requirement: *If the system is not fully metered, a program to install meters on all un-metered water service connections. The program shall start immediately after the plan is approved and shall identify the number of meters to be installed each year with full metering completed within five years of approval of the water management and conservation plan;*

The Bandon Water System is fully metered. No additional actions are required

3.4.3 Meter Test and Maintenance Program

Requirement: *A meter testing and maintenance program;*

Bandon currently has in place provisions for the continuing replacement of all existing meters with new, accurate, and consistent electronic water meters Modern meters are capable of nearly 100 percent accuracy. The new meters offer automated-meter-reading (AMR) systems capable of significantly increasing the efficiency of the reading and billing process. It has been demonstrated that older style meters, when aged, tend to report lower water use than actual, thus reducing water utility revenues. City records indicate that new style AMR type meters have been used for replacement of existing meters since early 1999. In the past seven years approximately 455 meters have been installed or replaced. Of this number 35% are estimated to be new services and the remaining 65% to be replacements. The current number of meters in service is about 1750. This leaves an estimated 1345 meters in service older than 7 years. It is proposed that the City institute a program to replace and/or service all meters on a seven year cycle. This goal would require 250 meters per year to be initially replaced or serviced. Testing of the AMR meters in the future will determine if this replacement /service cycle needs to be continued.

A program to increase the replacement rate of mechanical meters has been developed in the Water Master Plan Update as a Priority III project. It would have an estimated annual cost of $56,697 per year. Due to the City's very low leakage and "under read" situation, it is recommended that the City continue with its current policy of replacement as required until 2013, at which time, the meter replacement and testing program should be fully developed.

3.4.4 Rate Structure

Requirement: *A rate structure under which customers' bills are based, at least in part, on the quantity of water metered at the service connections;*

The City of Bandon bills customers, in part, on the quantity of water metered at the service connections. Customers have a base fee to cover per account charges such as reading and billing and a volumetric charge per 1000 gallons of use.

3.4.5 Leak Detection Program

Requirement: *If the annual water audit indicates that system leakage exceeds 10 percent, a regularly scheduled and systematic program to detect leaks in the transmission and distribution system using methods and technology appropriate to the size and capabilities of the municipal water supplier*

The City of Bandon has a three year average (2000 to 2002) unaccounted water loss rate of 9.7%. Of this amount, less than 8.5% is estimated to occur in the distribution system. There is no formal leakage detection plan currently in place. Should leakage increase, the City would initially use visual inspection along water line routes to locate leaks. In areas east of the Pacific Ocean (due to ocean noise) , sonic leak detection equipment could be employed.

3.4.6 Low Water Use Landscaping Education Program

Requirement: *A public education program to encourage efficient water use and the use of low water use landscaping that includes regular communication of the supplier's water conservation activities and schedule to customers; Note education materials available for school events, mailing, etc.*

Included in the appendix of this Plan are educational materials available for school events in conjunction with the water use efficiency benchmark goal discussed in Section 3.6.2. Furthermore, the Drinking Water Protection Plan, ready for adoption by the City, also proposes education programs and materials for water quality and quantity maintenance.

3.5 Leak Reduction - Resource Issues Triggered

Requirement: *If the municipal water supplier proposes to expand or initiate diversion of water under an extended permit for which resource issues have been identified under OAR 690-086-0140(5)(i), a description of the specific activities, along with a schedule that establishes five-year benchmarks, for implementation of a system-wide leak repair or line replacement program* *to reduce system leakage to no more than 15 percent or sufficient information to demonstrate that system leakage currently is no more than 15 percent.*

OAR 690-086-0140(5)(i) addresses identification of any stream flow-dependent species listed by a state or federal agency as sensitive, threatened or endangered that are present in the source, any listing of the source as water quality limited and the water quality parameters for which the source was listed, and any designation of the source as being in a critical ground water area. The current sources of City water, Ferry and Geiger Creeks, are both impounded with the Bandon Fish Hatchery located at the toes of the impoundments. Above the hatchery where water is normally withdrawn, there are no known anadromous species of fish or any other known threatened or endangered species. During low stream flow periods, in order to avoid conflict with the hatchery's water rights and needs of the hatchery fish, the City established a WRD permitted alternative location below the hatchery in Ferry Creek in the year 2000. This is a major conservation accomplishment, in that the hatchery water use is non-consumptive and the water is able to be used "twice" under the two separate water use permits. The City of Bandon is not believed to currently divert water under an extended permit for which resource issues have been identified under OAR 690-086-0140(5)(i).

In the future, Bandon may wish to re-develop the certificated 2 CFS Simpson Creek water right and 20 5/8 acre-foot impoundment which was last used in the 1950's. This project is uncertain at this time due to concerns regarding water quality and quantity. While the resumption of use has been identified in the Water Master Plan Update, it is listed as a Priority IV project and not likely to be considered in the next 5 year period. It is likely that Simpson Creek could have OAR 690-086-0140(5)(i) issues associated with it.

In any case, Bandon's leakage rate is well below 15% as demonstrated by the information in Table 3.4.7.1 below:

Table 3.4.7.1
Overall System Losses

Year	Est. True Raw Diversion X 1,000 Gal.	Raw Plant Influent X 1,000 Gal.	Est. Plant Influent X 1,000 Gal.	Finished Plant Water X 1,000 Gal.	Metered Water Delivered X 1,000 Gal.	Distribution System Loss X 1,000 Gal.	Plant Loss %	Distribution Loss %	Total Loss %
2000	168,845	181,759	2,495	166,350	152,692	13,658	1.50%	8.21%	9.71%
2001	150,125	167,691	2,218	147,906	135,438	12,468	1.50%	8.43%	9.93%
2002	165,888	186,988	2,451	163,436	149,401	14,035	1.50%	8.59%	10.09%
Ave.	161,619	178,813	2,388	159,231	145,844	13,387	1.50%	8.41%	9.76%

Total raw water diverted for the City averaged approximately 162 million gallons per year during the. period 2000 to 2002. Unaccounted water in the City's distribution system averages around 13 million gallons per year or 36,700 gallons per day; losses on this order are minor and not economical to reduce. No additional actions are required

3.6 Efficiency Measures - Resource Issues or Population Size Triggered

Requirement: *If the municipal water supplier serves a population greater than 1,000 and proposes to expand or initiate diversion of water under an extended permit for which resource issues have been identified under OAR 690-086-0140(5)(i), or if the municipal water supplier serves a population greater than 7,500, a description of the specific activities, along with a schedule that establishes five-year benchmarks, for implementation of each of the following measures; or documentation showing that implementation of the measures is neither feasible nor appropriate for ensuring the efficient use of water and the prevention of waste:*

As noted in Section 3.5 - Leak Reduction - Resource Issues Triggered above, it is not believed that the current water supply source is resource issue impacted in accordance with OAR 690-086-0140(5)(i). The current population of Bandon is estimated to be 2, 975 which is less than 7,500 persons. Therefore, Bandon is not believed to be subject to the above requirements. However, future use of the Simpson Creek Water Source may trigger this requirement.

3.6.1 System Wide Leak Repair Program

Requirement: *A system-wide leak repair program or line replacement to reduce system leakage to 15 percent, and if the reduction of system leakage to 15 percent is found to be feasible and appropriate, to reduce system leakage to 10 percent.*

Bandon's leakage is 9.7%. See Section 3.5 for discussion of this issue. No additional actions are considered economically feasible.

3.6.2 Technical and Financial Assistance to Customers

Requirement: *Technical and financial assistance programs to encourage and aid residential, commercial and industrial customers in implementation of conservation measures*

On request, residential, commercial and institutional users will be provided with information informing them of water conservation measures. Periodically, grade school children in Bandon are taken to the water treatment plant for field trips. Water conservation materials as shown in the appendix of this plan, will be made available for use in these school programs.

3.6.3 Financed Retrofitting of Fixtures

Requirement: *Supplier financed retrofitting or replacement of existing inefficient water using fixtures, including distribution of residential conservation kits and rebates for customer investments in water conservation*

Bandon's water usage is already very low. Furthermore, the City's water rates are much lower than the average Oregon community. The City water operation does not generate sufficient revenue to subsidize low use water fixtures. Furthermore, Bandon's current water use characteristics reflect existing conservative use when compared to other Oregon Cities as shown in Table 3.6.3.1 below

Table 3.6.3.1
Comparison of Bandon Water Use Characteristics with Other Oregon Cities

Use Characteristics	Bandon	Oregon Cities
Average Use per day	139.2 gpcd	235 gpcd
Domestic Use	46.9 %	53 %
Commercial Use	39.7.0%	14 %
Industrial Use	-------	17 %
Public Use & Loss	13.5%	16 %
MDD factor	2.40	2.5
PHD factor	2.78	5.0

3.6.4 Financial Inducements to Conservation

Requirement: *Adoption of rate structures, billing schedules, and other associated programs that support and encourage water conservation*

Bandon has had relatively low water rates historically. This is due in part to the City ordinance which requires rate increases to be approved by a vote of the people. Concurrent with the preparation of this report, the Water Master Plan Update has been prepared. In that document, fire flow deficiencies have been identified along with a number of capital improvement projects.

Rate increases have been recommended to pay for the ranked capital improvement projects. If a rate increase is passed, this will have some effect towards reducing the use of water further. However, it is not anticipated that this reduction will be as significant as it might be in other communicates, because the current consumption of water is thought to be near its inelastic demand amount now.

3.6.5 Reuse and Recycle

Requirement: *Water reuse, recycling, and non-potable water opportunities*

Under current Oregon regulations, recycling of household gray water is not permitted. As previously noted however, the water treatment plant has very little consumptive use and its backwash and process drainage water is recovered. No other reuse or recycle actions are anticipated in the near or mid-term future.

3.6.6 Other Conservation Measures

Requirement: *Any other conservation measures identified by the water supplier that would improve water use efficiency.*

No other conservation measures have been identified that would improve water use efficiency.

Section

4

Water Curtailment Element

Section

4

Water Curtailment Element

(OAR 690-86-160)

4.1 Definition of Water Curtailment Element

A water curtailment element is defined as a short term, mandatory program intended to drastically reduce water consumption, usually due to an emergency, catastrophic event, or serious water shortage. According to OAR 690-86-160, a water provider is to develop a water curtailment element with planning criteria, specific operating guidelines, and the enforcement measures that may be required in the event of a serious emergency or water shortage.

Most water systems have critical components, which if damaged or destroyed, could cripple or prevent delivery of potable water to its consumers. Such a crisis could last from a few hours to many days. As part of a comprehensive water management and conservation plan, a curtailment element would provide the City with the planning and information necessary for managing a "short term" supply deficiency crisis.

Due to drought conditions, equipment failure, or other water system problems, the City's water supply may become significantly and seriously depleted. The deficiency, which could last from weeks to months, could be serious enough that there is not enough water to provide for the needs of the community. Being prepared for curtailment situations will allow a water provider to survive serious "long-term" supply-deficiencies.

The City previously adopted a resolution describing a Water Emergency Plan. While the plan provided the City with the beginnings of a curtailment element, the resolution did not contain all of the elements required by OAR 690-86-160.

The following sections provide information required by OAR 690-86-160 for water curtailment elements. The City may wish to develop a comprehensive emergency plan for all City operations. A curtailment element can be used as the water supply element of such a comprehensive emergency plan.

4.2 Supply Deficiencies

Requirement: *A description of the type, frequency and magnitude of supply deficiencies within the past 10 years and current capacity limitation. The description shall include an assessment of the ability of the water supplier to maintain delivery during long-term drought or other source shortages caused by a natural disaster, source contamination, legal restrictions on water use, or other circumstances*;

4.2.1 Historical Deficiencies

The City of Bandon's water system has not had a history of major water supply deficiencies due to source deficiencies. Water supply problems which have resulted in a struggle to satisfy the daily water demands were generally caused by problems at the old treatment plant which was replaced in 2000. At that time, there were problems associated with the start-up of the new water treatment facilities.

However, minimum available source flows which occur during dry summer months have created concern. Over the past ten years, the City Council has not declared a water emergency. However, provision of an alternative withdrawal location below the Bandon Hatchery to avoid conflict with the hatcheries demand was a result of concern over possible shortages. Due to the steady growth of Bandon and the historical low flows possible in Ferry and Geiger Creeks, it is anticipated that the City may experience a water supply emergency in the future unless additional water supply is developed

4.2.2 Existing Capacity Limitations

The capacity limitations of the Bandon raw water supply were detailed in Section 2 of this Plan. As noted, the water supply sources of Ferry Creek and Geiger are generally adequate and reliable at the present time. However, it is apparent that in the future, water shortages are likely to occur during the summer season due to low flow. Water rights transfers have been effected so that a conflict between the City and the fish hatchery need not occur. Even so, the total water supply available to the City in Ferry and Geiger Creeks could be as low as 1.70 CFS during a dry month. This supply would consist of water that has passed through the hatchery fish pens from both Ferry and Geiger Creeks and is diverted by the City from downstream of the confluence of the two creeks by means of the City's alternative lower pump station

The current water use projections as developed in the Water Master Plan Update indicated a 1.70 CFS maximum day demand (MDD) for 2003 increasing to 2.41 CFS (MDD) by 2023. The single day demand exceeding the supply stream could be met by tank storage and impoundment reservoir storage for a few days. In 2023, this would be a projected deficit of 0.71 CFS or 0.459 million gallons per day. The current tank storage is 3 million gallons and raw water impoundment storage is 2.5 million gallons. On a maximum month basis in 2023, the City is only projected to require 1.44 CFS from an estimated minimum available source of 1.70 CFS. This demand assumes no unexpected increases (or decreases) in projected demand patterns. Therefore, the existing raw water supply source from Ferry and Geiger Creeks is anticipated to provide adequate water during the maximum demand month. However, during some period of days in a dry period, the City may have to curtail water use for a several days

It is clear that additional water supply is required for the City's future and that it will not be supplied from Ferry or Geiger Creek flows. The City is endeavoring to develop or participate in new summertime stored water sources to offset their raw water needs when stream flows in the primary sources are not adequate. Bandon will also take serious steps to maintain its existing low lost water rate and develop appropriate water conservation measures within the community.

4.3 Stages of Alert

Requirement: *A list of three or more stages of alert for potential shortage or water service difficulties. The stages shall range from a potential or mild alert, increasing through a serious situation to a critical emergency;*

The following are provided as four stages of alert for the City of Bandon's Water Curtailment Plan:

Alert Stage No 1: Water Alert Status

This level-of-alert serves primarily as a tool to inform the public that a potential problem exists. The problem may not yet warrant mandatory water conservation, but does suggest voluntary conservation. If the public is aware of potential problems, they will be more likely to accept and abide by more serious requirements should the alert status be increased.

A Stage No. 1 alert could be declared if a water shortage or equipment failure poses a potential threat to the ability of the water system to meet customer demands. Indicators include a moderate decrease of flows in Ferry or Geiger Creeks along with regional forecasts that predict drought or low stream flows in the watershed. Other indicators include moderate decreases in reservoir levels (below one-half total capacity) at an earlier than normal date and an inability for the system to restore reserves in a timely manner. National indices are referenced to provide further support for requiring specific curtailment actions.

It may be appropriate to declare this alert stage at the beginning or during major construction or maintenance of existing water system components. A possible scenario would include taking one reservoir temporarily off-line to paint or clean it or perform some minor maintenance.

Alert Stage No 2: Water Warning Status

This level-of-alert serves as the first level of action for the City to enact mandatory water use requirements within the system. This level would include all planned activities requiring temporary conservation including construction and maintenance activities as well as preparing for expected drought conditions.

A Stage No. 2 alert could be declared if a water shortage or equipment failure poses a serious threat to the ability of the water system to meet the demands of its customers. Indicators may include a significant decrease in the Ferry or Geiger Creek flows along with regional forecasts that low stream flows are expected to drop further. Other indicators may include a significant decrease in Ferry or Geiger Creek reservoir levels (below three-quarter total capacity) at an earlier than normal date and an inability for the system to restore reserves in a timely manner.

It may be appropriate to declare this alert stage if a component within the water system breaks down or is taken off-line for an extended period of time. This would include major repairs or renovations within the water treatment plant, major renovation of a reservoir, or another major improvement project.

Scenarios that would require this level-of-alert would typically be those that could be planned and prepared for. This alert stage could be instituted as a follow up status to Level 1 after the public has been informed of potential problems and given an opportunity to carry out voluntary conservation activities.

Alert Stage No 3: Water Emergency Status

This level-of-alert serves to raise the alert status from a warning to an emergency status. A wider range of water use activities is affected. This is the most restrictive level of mandatory water conservation activities carrying the highest penalties to enforce the curtailment status.

A Stage No. 3 Alert could be declared if a water shortage or equipment failure poses a severe and immediate threat to the ability of the water system to meet the demands of its customers. Indicators may include an eminent loss of a portion or total source of supply. Other indicators could include a chemical spill in a water supply, severe equipment failure, and other severe water supply issues.

Scenarios that would result in a declaration of a water emergency would be of an unplanned nature. This may include natural disasters such as earthquakes or landslides, acts of terrorism or sabotage, complete failure of water system components, and other emergency conditions. A few specific scenarios are listed below:

- Landslide that destroys, intakes, and/or raw water supply piping,
- Collapse or failure of a storage reservoir,
- Severe source contamination by pesticide, chemical spill, sabotage, etc.,
- Landslide that destroys treated water line from water plant to City system or the raw water intake system, and
- Extreme drought conditions resulting in the near inability to obtain raw water for basic service.

Alert Stage No 4: Critical Water Supply Status

This level-of-alert serves to assist the water system in supplying the minimum amount of water to the consumers to sustain life. This level differs from level three in that the decision of how much water to use may be taken away from the consumer and would probably include rationing of drinking water. This extreme level-of-alert is reserved for extreme water supply problems.

A Stage No. 4 Alert would be declared if the ability to deliver water was disrupted for greater than 24 hours or the ability to produce finished water was disrupted for a period longer than 3 days with less than a 3 day storage reserve.

4.4 Pre-Determined levels of Shortage

Requirement: *A description of pre-determined levels of severity of shortage or water service difficulties that will trigger the curtailment actions under each stage of alert to provide the greatest assurance of maintaining potable supplies for human consumption;*

Predetermined levels of severity and descriptions of specific scenarios that will invoke a predefined level of water curtailment alert are listed below. These items represent "triggers" that will initiate a specific alert stage in the plan.

It is appropriate to have a number of issues that serve as potential triggers for a phase of a curtailment plan. The plan is organized so that one, two, or combinations of triggers will initiate specific actions from the community. This approach to curtailment triggers allows more evidence to be gathered to suggest an appropriate response and provides the City with more flexibility to manage the water system during difficult water shortages and crisis. The following includes indicators for each level-of-alert.

Stream flows. Currently the City relies on its two primary water sources – Ferry and Geiger Creeks – for all its water needs. Low seasonal stream flows have resulted in past concern. As was discussed in Sections 2 and 3, records indicate that water available to Bandon may be as low as 1.7 CFS from Ferry and Geiger Creek flows. The City should establish a Stage No. 1 curtailment trigger of 2.5 CFS combined flow. 2.5 CFS would be in excess of the low stream flows but serve as a warning of impending deficiency. An appropriate level for Stage No. 2 alert would be 2.0 CFS and for Stage No. 3, a flow of 1.7 CFS and below.

Palmer Index (PI). The Palmer index is a widely used scale for measuring drought conditions. The PI is based on long-term records of temperature and precipitation and is tabulated by the US National Weather Service on a weekly basis. PI calculations are made for 350 climate divisions in the United States and posted on the NOAA and National Weather Service websites.

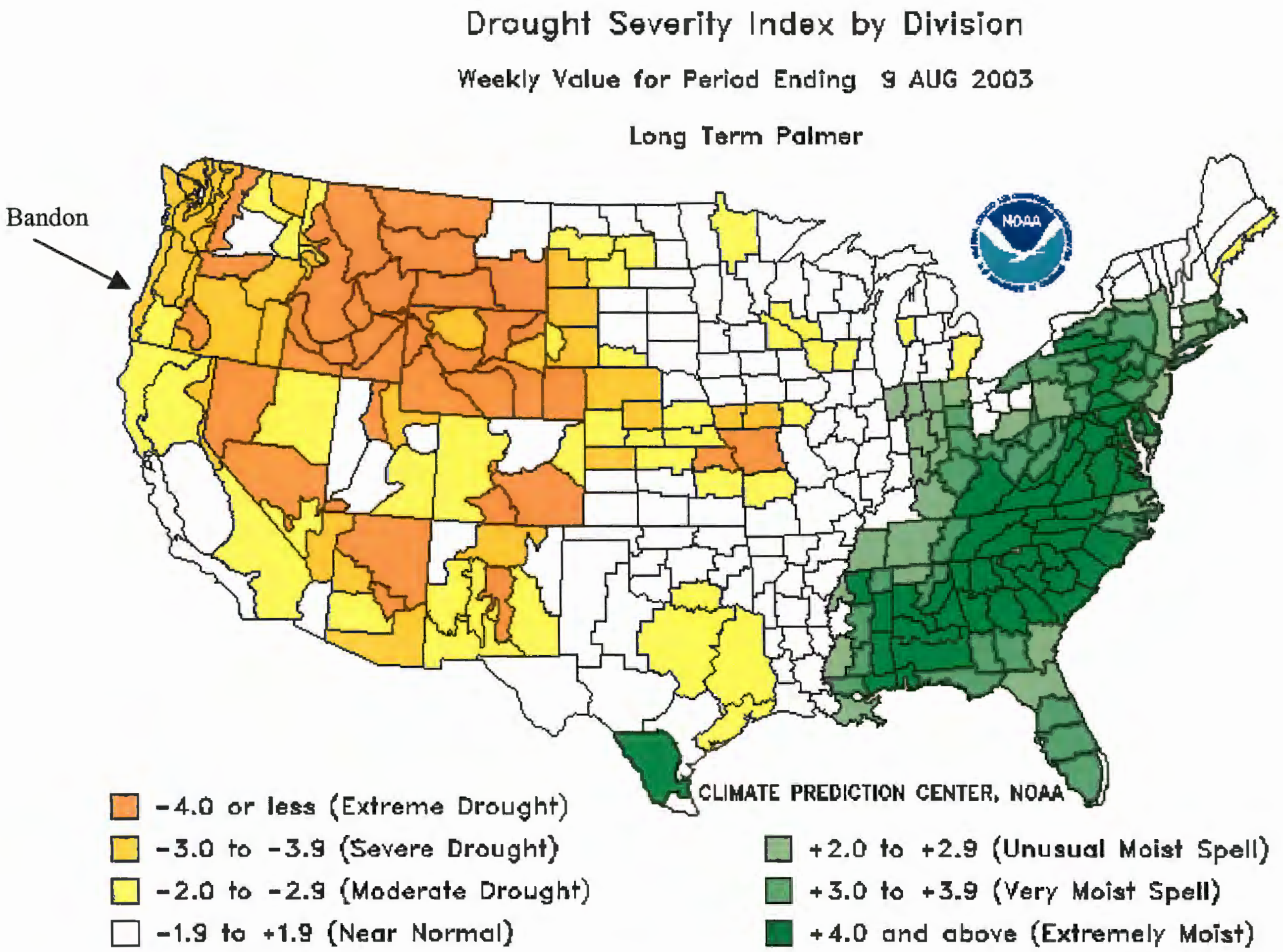
Normal weather has an index of zero in all seasons in any climactic region; droughts have negative index values while wet periods have positive values. Consecutive negative values from week to week can provide initial warning of an impending drought. Long-term negative values can assist the City in determining the severity of the drought condition.

In terms of a water curtailment plan, the area of interest is the negative or drought index regime. Conveniently, the negative PI regime is divided into three drought levels; moderate drought (-2 to –3), severe drought (-3 to –4), and extreme drought (-4 and lower). The City should use the three tiers of the negative PI as triggers for the first three levels of the curtailment plan.

For the purposes of curtailment triggers, the ranges of interest are for values less than –2. An appropriate division is as follows:

-2 to –3 = Stage 1 Curtailment
-3 to –4 = Stage 2 Curtailment
Less than –4 = Stage 3 Curtailment

FIGURE 4.4.1

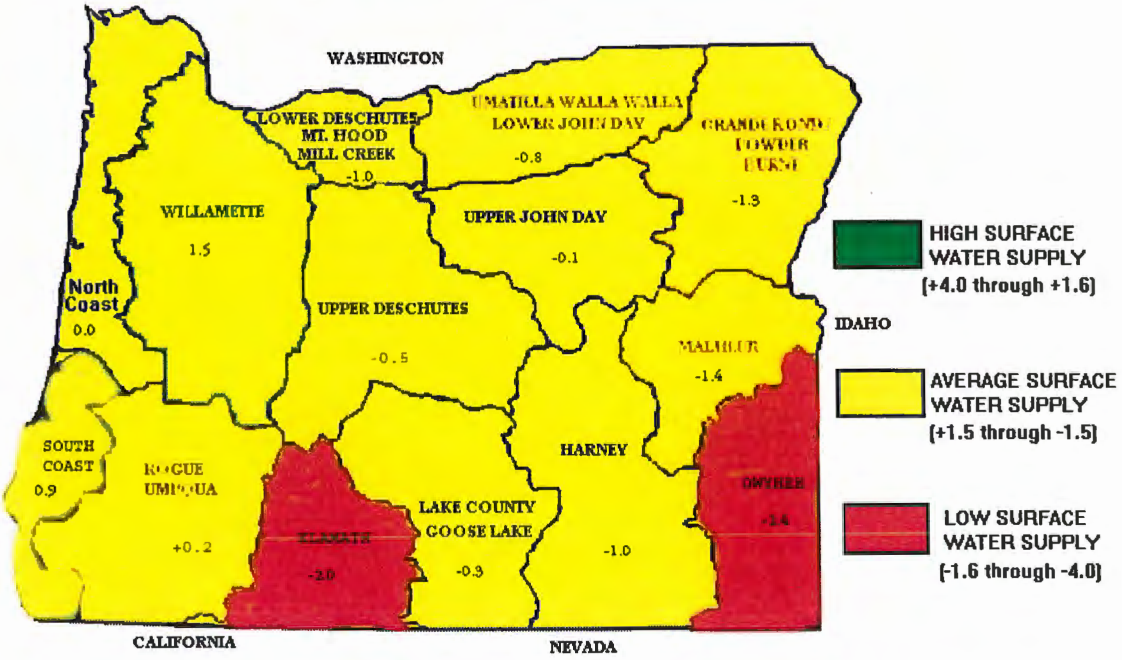


Using a multiple trigger curtailment plan, the PI can provide valuable information for the determination of the severity of a water supply crisis even though the PI is not necessarily supply specific. The PI is updated weekly and is easily accessible at the following website: http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/regional_monitoring/palmer.gif

Surface Water Supply Index (SWSI). The SWSI is similar to the Palmer Index in that it is an index that describes the current state of water resources in a given area. Calculated monthly by the National Resource Conservation Service (NRCS) for the major river basins within the state of Oregon, the SWSI can be used to identify which river basins are above, below, or at the normal surface water supplies. Figure 4.4.2 shows the SWSI for the various basins in the state of Oregon for the month of August, 2003. Based on this information, water supplies are still normal in the Bandon area.

FIGURE 4.4.2
SURFACE WATER SUPPLY INDEX

(SWSI)
August 1, 2003



For the purposes of curtailment triggers, the ranges of interest are between –1.5 and –4. An appropriate division is as follows:

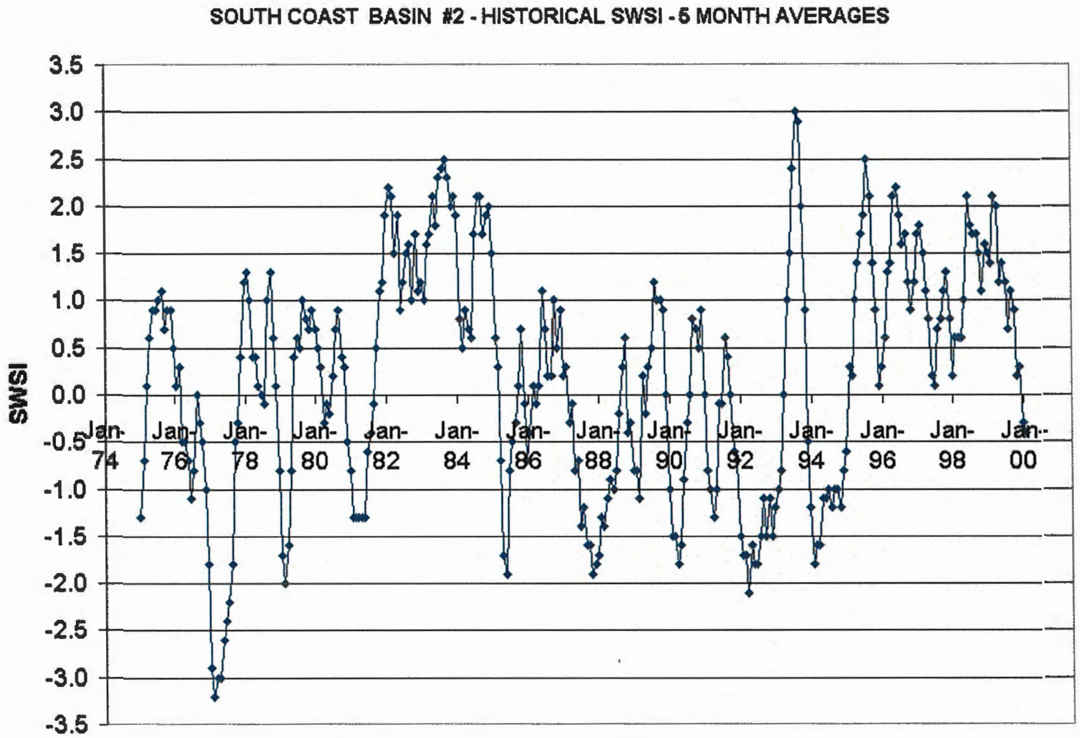
-1.5 to –2.5 = Stage 1 Curtailment
-2.5 to –3.25 = Stage 2 Curtailment
-3.25 to –4.0 = Stage 3 Curtailment

The SWSI for Oregon is updated monthly and can be viewed and downloaded at the following website: http://www.or.nrcs.usda.gov/Snow/watersupply/swsi.html

In addition to monthly SWSI data, significant historical data is available on the website to indicate the frequency and reoccurrence intervals expected for the various levels of curtailment. Figure 4.4.3 summarizes the history of the SWSI in the South Coast basin since 1974. The history of the SWSI suggests the sensitivity the area has to annual rainfall and the impact it has on surface water availability. In other words, the SWSI "bounces around" in relation to varying precipitation levels.

The figure suggests that, based on the above-recommended criteria, the City would have experienced Level 3 curtailment conditions only once over the past 25 years while Level 1 curtailment may have been experienced on six occasions.

FIGURE 4.4.3
HISTORY OF THE SWSI IN THE SOUTH COAST BASIN SINCE 1974



Combining information from the Palmer Index and the SWSI will provide valuable insight to both the "big picture" and the local conditions based on readily available and accepted information.

System Manager Assessment. Few will know more about the viability and condition of a water supply than the operators and managers of the water system. If the operators and/or system managers consider it necessary to invoke Level 1 curtailment actions, the ordinance should provide them with that ability. Specifically, the chief water treatment plant operator , the public works director or the City Manager independently should have the authority to invoke Stage 1 curtailment actions. This "trigger" is important for such items as maintenance or construction on a critical system component, knowledge of raw water deficiencies other than volume, or other situations requiring specific curtailment actions.

A Stage No. 2 or 3 alert will have an economic impact on the City of Bandon. It is strongly recommended that the decision to activate a Stage No. 2 alert include a consensus of two out of three of the system manager group consisting of the City Manager, chief water plant operator and public works director or persons acting with their designated authority.

A Stage No. 4 alert will require consensus of all three persons comprising the system manager group.

4.5 Standby Water Use Curtailment Actions

Requirement: *A list of specific standby water use curtailment actions for each stage of alert ranging from notice to the public of a potential alert, increasing through limiting nonessential water use, to rationing and/or loss of service at the critical alert stage.*

Each level-of-alert includes a description of conservation measures appropriate to that level. These measures provide guidelines and required actions, define acceptable and prohibited water usage, and describe the penalties for not abiding by the declaration of water curtailment.

The fire department must be kept informed of all Stage of Alert conditions. In addition, press releases should be provided to the local radio and television station and the local daily free newspaper, the Coffee Break, for each stage of alert condition.

Table 4.5.1, following, describes stand-by water use curtailment actions for each level-of-alert. Suggested Public notice texts are provided in Table 4.5.2,

TABLE 4.5.1
SUMMARY OF RECOMMENDED WATER CURTAILMENT PLAN

Alert Stage	Stage Activation	Action Measures
No. 1 Water Alert	1. PI (-2 to –3) and/or 2. SWSI (-1.5 to –2.5) and/or 3. Ferry Creek and Geiger Creek combined available flow below 2.5 cfs and/or 4. Staff assessment.	1. Water status sign will indicate Water Alert Stage No. 1. 2. Call for voluntary reduction in all water use; mandatory for watering. 3. Prohibit outside watering only between 9 p.m. to 7 a.m. 4. Restrict outside watering for even addresses on even numbered days & odd addresses on odd numbered days. No outside watering on Sundays. 5. Prohibit water wasted down gutters or streets & wash down of paved surfaces, streets, & structures. 6. Water use for wash down of paved surfaces & structures only for health & safety purposes. 7. Public outreach promoting conservation. 8. Implement watering citations. 9. Cease sale of water to users not currently on the system. 10. Prohibit new hook-ups to the City's water system. 11. Prohibit water to be used by Fire Department for drills or truck washing.
No. 2 Water Warning	1. PI (-3 to –4) and/or 2. SWSI (-2.5 to –3.25) and/or 3. Ferry Creek and Geiger Creek combined available flow below 2.0 cfs and/or 4. Staff assessment.	1. Water status sign will indicate Water Warning Stage No. 2. 2. All Stage No. 1 prohibited activities are also forbidden under Stage No. 2. 3. Curtailment citations and penalties remain in-place. 4. Continue public outreach to community. 5. Watering of any lawn, landscaping bushes, shrubs & trees is prohibited. 6. Watering of any vegetable or flower garden or fruit tree is restricted to watering by hand using either a hose with self-closing nozzle, a container (e.g. bucket), or a drip irrigation system. 7. Prohibit washing of any vehicle, except a commercial fixed washing facility. 8. Prohibit water for the use of scenic/ recreational fountains, ponds & lakes except required to support fish. 9. Prohibit use of water in any air conditioner or air-cooling mechanism, except at a commercial business. 10. Prohibit adding water to any swimming pool.
No. 3 Water Emergency	1. PI (-4 and lower) and/or 2. SWSI (-3.25 to –4.0) and/or 3. Ferry Creek and Geiger Creek combined available flow below 2.0 cfs and/or 4. Staff assessment.	1. Water status sign will indicate Water Emergency Stage No. 3. 2. All Stage No. 2 prohibited activities are also forbidden under Stage No. 3. 3. Water curtailment penalties remain in place. 4. Continue public outreach to community. 5. 70% of previous month water consumption. Billing for overage usage will notify users that residential customers are allotted 50 gallons/capita (1550 gallons per month/person) based on the number of persons living at each household and that billing penalty and surcharges will be adjusted or removed if 70% of previous month usage results in allocation less than 50 gallons/capita. Aggrieved customer to provide proof of residency for persons claimed for higher allocation to receive refund or penalty adjustment. 6. Commercial & industrial users will be restricted to the 85% volume of water used in prior month or same month in prior year, whichever is greater. 7. Restaurants discontinue routinely offering water to customers unless specifically requested 8. Implement a surcharge pricing structure for water use over the allotted use. Recommend double the consumption rate charge for all an usage over water allocation amount and $10 base penalty surcharge for residential customers and $40 for commercial and industrial users..
No. 4 Critical Water Supply	1. Delivery disruption > 24 hrs., forecasted storage < 1 day, and/or 2. Production disruption > 3 days, forecasted storage < 3 days, and/or 3. Staff assessment.	1. Water status sign will indicate Critical Water Supply Stage No. 4. 2. City may discontinue water service through its normal distribution system. 3. If water remains in the City's finished water tanks, water may be provided in small quantities to residents in their containers either directly from a designated tank or location within the City. 4. If water is not available in the City's finished water tanks, the City would locate a source of potable water & have it delivered to the City. Small quantities of potable water would be provided to residents, at no cost, in their containers.

PI – Palmer Index, SWSI – Surface Water Supply Index

Table 4.5.2
Suggested Public Notice Texts for Water Alerts

Stage 1 Water Alert
As of _________, until further notice, the City of Bandon has issued a Stage 1 Water Shortage Alert for it customers due to _____________. The City requests voluntary reduction of all water use. Outside watering will only be permitted for even addresses on even dates and odd addresses on odd dates with no Sunday watering and no watering between the hours of 9 p.m. and 7 a.m. Washing of paved surfaces is prohibited except for health and safety purposes. Other restrictions apply. Further information is available __________________.

Stage 2 Water Warning
As of _________, until further notice, the City of Bandon has issued a Stage 2 Water Shortage Warning Notice for it customers due to _____________. The City requests voluntary reduction of all water use. All outside watering is prohibited except for vegetable, flower garden or fruit trees which are restricted to hand watering. Washing vehicles or paved surfaces is prohibited except for health and safety purposes. Water use for scenic ponds, fountains, or lakes is prohibited except as required to support fish. The filling of swimming pools is prohibited. Other restrictions apply. Further information is available __________________.

Stage 3 Water Emergency
As of _________, until further notice, the City of Bandon has issued a Stage 3 Water Emergency Notice for it customers due to _____________. Penalties and surcharges are in effect for residential water use exceeding 70% of the previous month's usage and for commercial or industrial use exceeding 85% of the previous month's usage or same month's usage in previous year. Outside watering is prohibited except for vegetable, flower garden or fruit trees which are restricted to hand watering. Washing vehicles or paved surfaces is prohibited except for health and safety purposes. Water use for scenic ponds, fountains, or lakes is prohibited except as required to support fish. The filling of swimming pools is prohibited. Other restrictions apply. Further information is available __________________.

Stage 4 Critical Water Supply
As of _________, until further notice, the City of Bandon has issued a Stage 4 Critical Water Supply Emergency Notice for it customers due to _____________. The City has discontinued water service ____________________. Crews are attempting to re-establish water service. Upon resumption of service a boil order may be in effect. Drinking water will be provided to customers in quantities of up to ________ gallons in customer's own containers at the following locations:_________________. Further information is available __________________.

Alert Cancellation or Downgrade
As of _________, the City of Bandon has (cancelled, reduced) the Stage _____ Alert Notice for its customers due to _____________. The alert status is currently (normal, Stage X). (Insert current alert description or special instructions such as boil order). Further information is available __________________.

Section

5

Municipal Water Supply Element

Section
5

Municipal Water Supply Element

(OAR 690-86-170)

5.1 Definition of Municipal Water Supply Element

The Municipal Water Supply Element relates the demand for future additional water with respect to the permits for which extensions are requested. It provides a long-range plan in which the demand forecast is compared to the available supplies. Future additional water sources and plans to utilize them are addressed. The role of water conservation towards supplying a portion of the required water is also addressed.

5.2 Service Area and Population Projection

Requirement: *A delineation of the current and future service areas consistent with state land use law that includes available data on population projections and anticipated development consistent with relevant acknowledged comprehensive land use plans and urban service agreements or other relevant growth projections;*

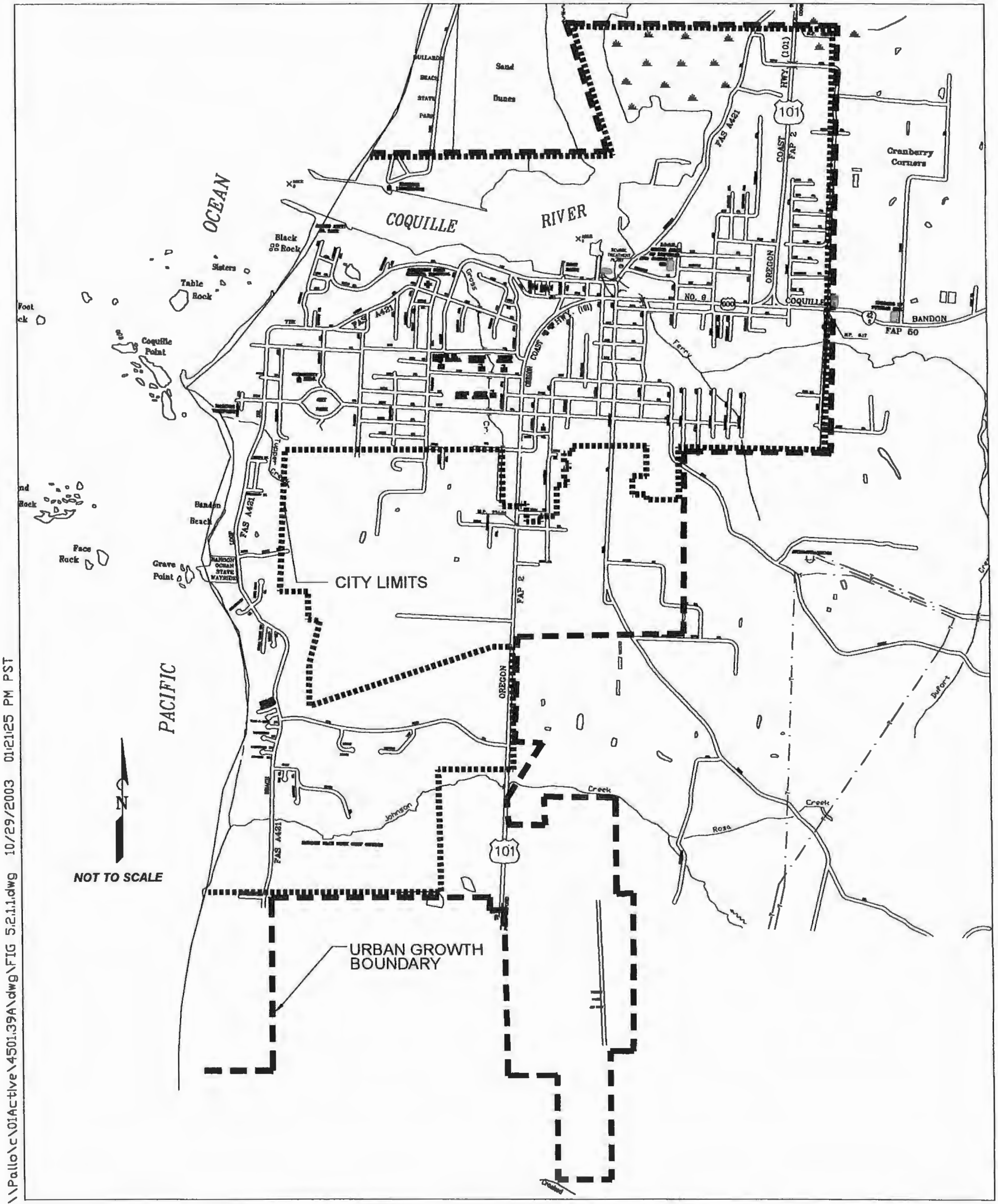
5.2.1 Service Area

The current City Limits Boundary comprises the service area for the City of Bandon with the exception of a small percentage of residential and commercial customers located within the Urban Growth Boundary. The City's Urban Growth Boundary (UGB) comprises the future service area for the City of Bandon. Figure 5.2.1.1 shows both the City Limits boundary and the UGB. At the present time there are no plans to seek an increase in the area of the UGB. These service areas are consistent with comprehensive land use policies.

5.2.2 Population Projection

A growth rate of 1.76% per year has been selected for projections used in this Plan and in the Water Master Plan addendum over the next 20 years (to the year 2023), as suggested by the Revised Coos County Population Report for 1997. Growth occurs through infill of existing land in the City limits or through annexation of property in the UGB.

The 2000 population census for the City of Bandon included 2,833 full time residents. Housing units totaled 1535 with 248 units listed as vacant. Of the 248 vacant units, 120 are listed as vacation or seasonal use. Vacation or seasonal use housing therefore accounts for 4.23% of the housing base. This results in an occupancy rate of about 2.2 persons per occupied housing unit. About 24 building permits are issued annually. At 2.2 persons per unit this would give a city population of 2991 which is a close match to the projected 2003 population of 2985 based on the selected 1.76% annual population growth rate



\\Pallo\c\01Active\4501.39A\dwg\FIG 5.2.1.1.dwg 10/29/2003 01:21:25 PM PST

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

DATE: JULY, 2003
PROJECT NO.: 4501.39

CITY OF BANDON
WATER MANAGEMENT AND CONSERVATION PLAN

AREA MAP

FIGURE NO.
5.2.1.1

Bandon serves as a second or part-time home for some residents. These residents include retirees that travel in the winter ("snow-birds"), full-time residents of other Oregon locations, and some condominium and transient-rental residents. While these part-time residents are not included as Bandon residents in census counts, they do use water and should be accounted for.

As noted above, there are approximately 120 vacation or seasonal use residential water connections in the City system. Assuming an occupancy rate of 2.2 persons per unit when occupied will add, for the purposes of this study, a peak total of 280 persons living part-time inside the city limits of Bandon in 2003. This peak period is assumed to occur during the summer months. When these persons are present, they are assumed to consume water at the same rate as the permanent population. It is also estimated that the part-time population will grow at the same rate as the full-time population or 1.76 percent.

Outside residential customers averaged 6.9% of inside residential customers in the year 2000. This increased to 7.0% in 2001 and 7.1% in 2002. Outside residential services averaged 90 in 2002. In January 2000 there were 81 outside residential customers. This is a short term growth rate of 3.5%. Based on the assumption of 2.2 persons per service, the outside city limits service population is estimated to currently be 205 persons and 93 services. As is the case for inside city limits population growth, the long term growth rate will be reduced in comparison to recent short term growth rates. A value of 2.0% is recommended.

The full-time and part-time occupation ratios are assumed to be the same as the inside city limits residential population. Therefore, for purposes of this report, 4.23% of outside residential users are assumed to be part-time. This results in an estimate of 9 part-time outside residents for the year 2003.

A significant portion of commercial water use within the City is related to the lodging industry. It is important that the tourist population be approximated to provide a sound basis of water use projection.

A survey of Bandon motels and RV parks was conducted last year (2002) and collected data on the numbers of rooms and spaces, as well as the approximate occupancy rates throughout the year. It was determined that sixteen motels with approximately 385 lodging units and two RV parks having 22 spaces serve the Bandon tourist/transient population. The survey had a 50% return rate. Based on the results, the occupancy rates were extrapolated onto the total number of rooms available to generate population levels. The results of the projection with a 1.76% annual increase are included in Table 5.2.2.1 below:

Table 5.2.2.1
Current Population Estimate and Projections

Year	2003	2008	2013	2018	2023
Residential Inside - Full Time	2985	3257	3554	3878	4231
Residential Outside - Full Time	196	216	238	263	290
Residential Inside - Peak additional	280	306	333	364	397
Residential Outside - Peak additional	9	10	12	13	14
Transient - Off Peak	256	279	304	332	362
Transient - Peak Additional	474	517	565	616	670
Total Peak Population	4200	4585	5006	5466	5964
Total Off-Peak Population	3437	3752	4096	4478	4883

5.3 Schedule of Water Rights Utilization

Requirement: *An estimated schedule that identifies when the water supplier expects to fully exercise each of the water rights and water use permits currently held by the supplier.*

The peak hours demand for Bandon is projected to be 2.8 CFS in 2023. As may be seen in Table 5.3.1 below, current water rights are adequate for the 20 year future. However, as noted in Chapter 2 of this Plan, water availability rather than water rights is the limiting source constraint for Bandon's future water needs.

Table 5.3.1
Bandon Water Rights

Location	Identification	Right Type	Magnitude	Priority Date
NE 1/4, SE 1/4,&NE1/4,NE 1/4 Sec 29 T29S, R14W	Spring Br. #3 , Mill Cr #4 (Simpson Cr.)	Certificate 9754	2.0 CFS	January 24, 1910
NE 1/4,NE 1/4, SW 1/4 Sec 4 T29S, R14W	Geiger Creek & Geiger Cr. Res.	Permit 3011	5.0 CFS	June 19, 1916
SW 1/4,SE 1/4, Sec 28 T28S, R14W	Geiger Creek & Geiger Cr. Res.	Permit 27232	3.0 CFS	March 7, 1961
SW 1/4,SE 1/4, Sec 29 T28S, R14W	Ferry Creek & Ferry Cr. Res.	Permit 27233	3.0 CFS	March 7, 1961

If the peak hour factor for water demand is projected at a growth rate of 1.76% per year, then Table 5.3.2 below provides an estimate of scheduled water rights utilization.

Table 5.3.2
Estimated Schedule of Water Rights Perfection

	Year	2023	2028	2033	2038	2043	2048	2053	2058	2063	2068	2073
Water Right	**PHD CFS**	2.8	3.1	3.3	3.6	4.0	4.3	4.7	5.2	5.6	6.1	6.7
Certificate 9754	2.0 CFS			Previously exercised								
Permit 3011	5.0 CFS			Not fully exercised in time frame								
Permit 27232	3.0 CFS			Fully exercised by 2065								
Permit 27233	3.0 CFS			Fully exercised by 2026								

5.4 Water Demand Projections

Requirement: *Based on the information provided in section (1) of this rule, an estimate of the water supplier's water demand projections for 10 and 20 years, and at the option of the municipal water supplier, longer periods*

Listed below in Table 5.4.1 is the projected water demands for the City of Bandon for the the next 20 years in 5 year increments. The source of this information is from the Water Master Plan Addendum completed in August 2003.

Table 5.4.1
Bandon Projection of Peak Demand Rates (CFS)

Factor	Yr 2000-2002 Sty. Period	2003	2008	2013	2018	2023
ADD	0.69	0.71	0.77	0.84	0.92	1.01
MMD	0.98	1.01	1.11	1.21	1.32	1.44
MDD	1.64	1.70	1.86	2.03	2.21	2.41
PHD	2.81	2.89	3.13	3.42	3.74	4.11

ADD= Average Day Demand (yearly average)
MMD=Maximum Month average Day (highest use month - average day)
MDD=Maximum Day Demand (highest use day per year)
PHD=Peak Hour Demand=(highest hourly use per year)

5.5 Comparison of Projected Water Needs with Available Water

Requirement: *A comparison of the projected water needs and the sources of water currently available to the municipal water supplier and to any other suppliers to be served considering the reliability of existing sources*

As noted in Chapter 2 of this Plan, the total water supply available to the City in Ferry and Geiger Creeks could be as low as 1.70 CFS during a dry month. This supply would consist of water that had passed through the hatchery fish pens fish from both Ferry and Geiger Creeks and was diverted by the City from downstream of the confluence of the two creeks by means of the alternative lower pump station.

The current water use projections as developed in the Water Master Plan Update indicated a 1.70 CFS (MDD) for 2003 increasing to 2.41 CFS (MDD) by 2023. The single day demand exceeding the supply stream could be met by tank storage and impoundment reservoir storage for a few days. In 2023, this is a deficit of 0.71 CFS or 0.459 million gallons per day. The current tank storage is 3 million gallons and raw water impoundment storage is 2.5 million gallons. On a maximum month basis in 2023, the City is only projected to require 1.44 CFS from an estimated minimum available source of 1.70 CFS. This demand assumes no unexpected increases (or decreases) in projected demand patterns. Therefore, the existing raw water supply source from Ferry and Geiger Creeks is anticipated to provide adequate water during the maximum demand month. However, during some period of days in a dry period, the City may have to curtail water use for a several days

5.6 Alternative Sources of Water

Requirement: *If any expansion or initial diversion of water allocated under existing permits is necessary to meet the needs shown in section (3) [5.4 Water Demand Projections] of this rule, an analysis of alternative sources of water that considers availability, reliability, feasibility and likely environmental impacts. The analysis shall consider the extent to which the projected water needs can be satisfied through:*

(a) Implementation of conservation measures identified under OAR 690-086-0150;
(b) Interconnection with other municipal supply systems and cooperative regional water management; and
(c) Any other conservation measures that would provide water at a cost that is equal to or lower than the cost of other identified sources.

5.6.1 Conservation Measures

The City of Bandon's water consumption and conservation record is already enviable in comparison to many Oregon Communities. Further conservation measures, beyond those already in place, do not appear likely to provide additional water. Rather, the City will concentrate on maintaining its low leakage rate through water audit reviews and careful construction inspection during new construction or repair to pipelines and other water infrastructure. Because of Bandon's proximity to the Pacific Ocean (cool temperatures, fog hydration of landscaping) and a significant portion of the population retired on fixed income, water use is already very low.

5.6.2 Cooperative Regional Water Management

Windhurst Road Reservoir
Windhurst Road Reservoir was recently completed and has been in operation for less than 2 years. It was originally conceived and constructed as a cooperative supply of water for a group of cranberry growers. Due to a market recession and subsequent reduced requirement for irrigation water, the growers decided to sell additional capacity to help offset bond payments and operation costs. The reservoir is owned and operated by a local cranberry owners association. The reservoir is located on the south edge of Bandon and water from it may be released into Geiger Creek without additional infrastructure improvements. The City could withdraw it from their normal water diversion point. The reservoir has a useable storage volume of 405 to 425 acre-feet. At the time of this report, there was still about 100 acre-feet of storage available for yearly lease. The source of this water is Bill Creek, which is a tributary of Bear Creek, which flows into the Coquille River. The reservoir is off line. That is, it is not formed by the impoundment of Bill Creek, but rather by pumping from Bill Creek during the months between November to May. Bill Creek watershed is approximately 7 square miles in area and has very steep sides. Therefore, during run-off events, large amounts of water are present. However, during dry periods of the year, the flow is minimal. The water quality is reported to be of good quality and appears to be suitable as municipal source water. The terms of use by the City as currently proffered by the reservoir owners are for $500 per acre-foot per year. The reservoir operator's current position is that the City would be responsible for re-sale of the reserved 100 acre-feet of water if the City did not require it. Therefore, the City would have to budget $50,000 per year, for 100 acre-feet of water and could recover this cost if the stored water was not required, only if the City could find a buyer. Under these conditions, the raw water cost is $1.53 per thousand gallons. The 100 acre-feett capacity translates to 31.8 million gallons. This quantity of water could be very useful in a drought situation to help supplement or supply raw water through a dry month or two.

It is recommended that the City attempt to negotiate an emergency use arrangement by which other leasers would commit to re-sell water to the City only if required. This arrangement is anticipated to be more cost effective in the long term even if the unit cost of emergency supply water was several times more expensive than $500 per acre-foot. In a water shortage situation severe enough to warrant use of this source, it is also recommended that the unit cost for the purchased water be added as a surcharge to customer's water bills during declared curtailment stages as a further conservation measure.

Let us assume that the City could negotiate an arrangement whereby water was available on emergency demand for $1000 or even $1,500 per acre-foot payable only upon demand. The City is not anticipated to require additional water except for a period of days. Furthermore, on the highest demand day of the year in 2023, 2.41 CFS could be required and 1.70 CFS is met from Ferry and Geiger Creeks. Therefore, during a record low flow month, the cost for up to .71 CFS per day (458,853 gpd or .711 acre-foot per day) for 7 days would be $4,977 to $7,466. A reserve fund established for this purpose is anticipated to be much less expensive than any infrastructure improvements, which might be constructed.

Johnson Creek Reservoir

The Johnson Creek Reservoir project is in the development stage with the Bandon Cranberry Water District as the sponsoring agency. Most of the project participants are cranberry farmers. Progress has been made regarding permits and environmental studies, but these are not yet complete. The City has committed $150,000 to be set aside for this project which will address studies, design, permitting and all other costs apportioned to the City up to the sale of construction bonds. Preliminary design estimates provide for a total storage volume of 1,100 acre-feet, of which 200 acre-feet would be for use by the City of Bandon. To deliver water from the reservoir to the City of Bandon would require a pump station able to pump approximately 300 to 350 gallons per minute a distance of 2500 feet to a release point in upper Geiger Creek. The cost of this pump unit and 2500 feet of 8 inch pipe is estimated to be $50,000 for the station and $75,000 for the pipe line.

This project still requires the Environmental Wetland delineation to be completed and the in reservoir habituate study to be completed. It appears likely that the fish ladder requirement will be waived based upon planned mitigation activities which include removal of stream blockage about 1/2 mile downstream from the proposed reservoir and fish passage culvert construction on nearby steams. The dam will also include provision of a cone value for aeration of overflow. Hydraulic studies need to be completed to confirm the annual fill nature of the proposed impoundment.

Progress on the reservoir has slowed due to the drop in cranberry prices from about $70 a unit to $18 per unit. Cranberry prices are again rising. It is anticipated that the project will again become active in about 2 years. At this time, geo-technical investigations, final design and construction can be expected to take another 2 to 3 years.

The construction cost is estimated to be between $2 million and $3 million depending on land purchase costs and the results of the geotechnical investigations, which may dictate sealing near the proposed dam location. Therefore, the City's share to bond is estimated to be (200/1100) x $3 million or $546,000. Operation and Maintenance costs in the future are expected to be about $20/acre-foot per year or $4,000 per year. 200 acre-feet per year or 65.17 million gallons would supply the required difference between Geiger and Ferry Creek supplies during drought years (1.7 CFS or 1.099 MGD available) and the projected maximum month average day demand of 1.33 MGD well past the year 2053.

5.6.3 Other Conservation Measures

No other water conservation measures have been identified.

5.7 Water to be Diverted Under Existing Permits

Requirement: *If any expansion or initial diversion of water allocated under existing permits is necessary to meet the needs shown in section (3)[* 5.4 Water Demand Projections *] of this rule, a quantification of the maximum rate and monthly volume of water to be diverted under each of the permits.*

The City of Bandon requests a pumping rate authorization under the permits for Ferry Creek and Geiger Creek to allow for an instantaneous combined rate of 2.80 CFS by the end of the 20 year planning period (yr 2023). At the present time, the water from Simpson Creek is not used but is anticipated to be re-developed within the 20 year planning period. It is requested that pumping authorization for up to 2.0 CFS be authorized for the 20 year planning period for Simpson Creek. It is anticipated that the Spring Creek source would be utilized in the event of an emergency due to equipment failure, natural disaster, sabotage, contamination, or other interruption of the Ferry or Geiger Creek Sources.

5.8 Mitigation Actions

Requirement: *For any expansion or initial diversion of water under existing permits, a description of mitigation actions the water supplier is taking to comply with legal requirements including but not limited to the Endangered Species Act, Clean Water Act, Safe Drinking Water Act.*

At the present time, the City is not required to undertake any mitigation actions or take any actions to comply with regulations or other requirements. As specific projects are developed, all legal and regulatory requirements will be complied with.

5.9 New or Additional Water Rights

Requirement: *If acquisition of new water rights will be necessary within the next 20 years to meet the needs shown in section (3) [*5.4 Water Demand Projections *] of this rule, an analysis of alternative sources of the additional water that considers availability, reliability, feasibility and likely environmental impacts and a schedule for development of the new sources of water. The analysis shall consider the extent to which the need for new water rights can be eliminated through:*

(a) Implementation of conservation measures identified under OAR 690-086-0150;
(b) Interconnection with other municipal supply systems and cooperative regional water management; and
(c) Any other conservation measures that would provide water at a cost that is equal to or lower than the cost of other identified sources.

5.9.1 Conservation Measures

As noted previously in Section 5.6.1, the City of Bandon's water consumption and conservation record is already enviable in comparison to many Oregon Communities. Further conservation measures, beyond those already in place, do not appear likely to provide additional water.

5.9.2 Cooperative Regional Water Management

Under the plans to obtain water from either Windhurst or Johnson Creek reservoirs, water rights with be held by the cranberry growers association rather than by the City of Bandon.

5.9.3 Other Conservation Measures

No other water conservation measures have been identified.

H.G.E. PROJECT 4210

COMPREHENSIVE WATER SYSTEM MASTER PLAN

Prepared for:

City of Bandon

COOS COUNTY, OREGON

THIS PROJECT RECEIVED A GRANT FROM THE UNITED STATES DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT THROUGH THE STATE OF OREGON ECONOMIC DEVELOPMENT DEPARTMENT COMMUNITY DEVELOPMENT BLOCK GRANT PROGRAM

HGE INC
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DECEMBER 1992

COMPREHENSIVE WATER SYSTEM
MASTER PLAN

DECEMBER 1992

Prepared for:

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City of Bandon

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Reed Callier	City Council, President
Judith Densmore	City Council
Leland Sutton	City Council
Patrick Watson	City Council
Frank Maciejewski	City Council
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CITY OF BANDON
WATER SYSTEM MASTER PLAN

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SUMMARY AND RECOMMENDATIONS

CITY OF BANDON
WATER SYSTEM MASTER PLAN

SUMMARY AND RECOMMENDATIONS

This chapter provides a summary of findings and recommendation of this study. The purpose of this document is to provide a planning tool for the City which can be utilized to plan for water supply, treatment, storage and distribution needs over the next 20 years.

Cost estimates, financing options, and a discussion on implementing improvements are provided. A Capital Improvement Plan has been provided which satisfies the requirements of new legislation for Systems Development Charges.

S.1 WATER SERVICE AREA

The service area for the Bandon Water System consists of the City Limits of Bandon and its Urban Growth Area. The total number of water accounts was 1,289 in 1991.

S.2 PROJECTED WATER DEMAND

Water demand characteristics for existing and projected populations are listed in Tables S-1 and S-2. An average annual growth rate (AAGR) of 2.5 percent has been used for planning purposes. In 1992 the estimated service population was 2,482 people. The quantity of water produced was enough to supply the equivalent of 2,188 single-family households.

S-3 PRIORITIES

For purposes of this report, the Water System Development Plan has been separated into four priority categories with Priority I being the most critical need. Although an AAGR of 2.5 percent has been used for long-term planning purposes, the short-term population growth rate may fluctuate significantly. Therefore, water demand (the major factor controlling need for improvements) and the number of Equivalent Dwelling Limits (EDU's) have also been listed as factors to indicate when the project should be initiated. An EDU's defined as having the equivalent water consumption of the four priority categories and indicators for project initiation are presented in Table S-3.

TABLE S-1

SERVICE POPULATION AND SINGLE-FAMILY RESIDENTIAL EQUIVALENT DWELLING UNITS (EDU'S)

YEAR	POPULATION INSIDE CITY LIMITS	POPULATION OUTSIDE CITY LIMITS	TOTAL SERVICE POPULATION	TOTAL SERVICE EDU'S
1992	2,393	89	2,482	2,188
1997	2,706	101	2,808	2,476
2002	3,063	114	3,170	2,801
2007	3,466	128	3,594	3,169
2012	3,921	145	4,066	3,586
2017	4,436	165	4,601	4,057

TABLE S-2

PROJECTED WATER DEMAND CHARACTERISTICS

YEAR	AAD[1] (mgd)	MDD[2] (mgd)	PHD[3] (mgd)
1992	0.54	1.13	1.74
1997	0.61	1.28	1.97
2002	0.70	1.44	2.23
2012	0.89	1.85	2.86
2017	1.01	2.09	3.23

---

[1] Average Annual Demand

[2] Maximum Daily Demand

[3] Peak Hourly Demand

TABLE S-3 PRIORITY CATEGORIES

PRIORITY	FULL-TIME PERMANENT SERVICE POPULATION (RANGE)	SERVICE EDU'S (RANGE)	WATER DEMAND-MGD (RANGE)		ESTIMATED YEAR PROJECT INITIATED (RANGE)
			AVERAGE DAILY (ADF)	MAXIMUM DAILY (MDF)	
I	2,482	2,188	.54	1.13	IMMEDIATE
II	2,880-3,250	2,540-2,870	.63- .71	1.3-1.5	1998-2003
III	3,250-3,680	2,870-3,250	.71- .81	1.5-1.7	2003-2008
IV	3,680-4,600	3,250-4,060	.81-1.0	1.7-2.1	2008-2017

S-4 WATER USAGE CHARACTERISTICS

Water Losses

- Non-metered (non-revenue producing) water is presently 23 percent of the total produced.
- Typical values for non-metered water in other communities ranges from 15 to 35 percent.

User Traits

- Customers inside City Limits constitute the vast majority of metered water consumption in Bandon, approximately 97 percent.
- Single-family residential consumption is approximately 49 percent of the total amount of metered water usage.
- In 1992 it is estimated that there were about 1,030 single-family residences (part-time and full-time occupation) in the Bandon service area, based on water billings.
- When commercial, industrial, and multi-family residential water usage is included, Bandon produces enough water to supply the equivalent of 2,188 single-family residences (EDU's).

Per Capita Water Usage

- Bandon's average annual per capita demand (included non-metered water usage) ranged from 164 - 221 gallons per capita day (gpcd) during the time period evaluated (1988 - 1991).
- Two primary reasons for the apparent steady increase in per capita demand are:
    1) Water demand from tourists and part-time residents is growing faster than the full-time population.
    2) The 1990 Census population was significantly lower than previous certified population estimates, which resulted in a computed increase in per capita flow.
- Average usage in the Pacific Northwest is 185 gpcd (survey conducted in late 1970's). Average along the Oregon Coast, based on recent studies completed by H.G.E., INC., typically exceeds 200 gpcd because of additional, tourist-related water usage.
- Bandon's average daily, metered consumption was 192 gpd per single-family residential customer (inside City Limits) in 1991.

Peaking Factors

- The maximum daily water demand in Bandon is approximately 2.1 times the average daily water demand.

S-5 WATER SUPPLY

- Bandon's present sources of water supply are Ferry Creek and Geiger Creek.
- Water rights have been over-allocated for Ferry Creek and Geiger Creek. There is a total of 16.57 cfs of water rights, while combined stream flows in the two creeks are estimated to be as low as 2.6 cfs during summer months.
- Bandon has low priority for water diversion. The City can only reserve approximately 0.4 to 0.5 cfs (0.26 to 0.32 mgd) and this would require transferring the water right for upper Geiger Creek downstream to the City's present diversion location.

- Water supply has not been a critical issue in Bandon during past years because of excellent cooperation and coordination between the City, the fish hatchery, and farmers. However, water supply could become a critical issue very soon. As the population and water demand increases in Bandon, consumption of some user(s) will need to decrease.

- The long-term water solution for Bandon is most likely the construction of a large impoundment on Ferry Creek to store surface water. Groundwater supply is another possibility, although the probability for a cost effective solution is low. Either alternative will take several years to implement. Therefore, additional research necessary to select the final plan should start immediately, followed by preliminary engineering and initiation of the permitting process required for construction.

- The recommended implementation schedule and estimated costs are as follows in order of priority:

TABLE S-4

FINAL SOURCE INVESTIGATION AND INITIATION OF PRELIMINARY ENGINEERING AND PERMITTING PROCESS

Implementation Date	Description	Estimated Cost
1993	Investigate City use of Hatchery Overflow water.	Cost included in development of formal agreement.
1993	Phase I Hydrogeological Investigation	$5,000 - $7,500
1993	Phase 2 Hydrogeological Investigation (if merited)	$10,000 - $30,000 per well field site
1993	Formal Agreement with other Water Right Holders to Maintain Minimum City Diversion	$30,000 - $50,000
1994	Large Impoundment - Initiate Preliminary Engineering and Permitting Process (if large scale groundwater development is not feasible)	$150,000
	TOTAL	**$45,000 - $237,500**

- It is recommended that Bandon budget $237,500 for final source investigation and initiate preliminary engineering and the permitting process for a large impoundment. If hydrogeological investigations demonstrate that a groundwater source is feasible, then money budgeted for a large impoundment could go towards development of a municipal well field instead.

- A report prepared by Tucson Myers and Associates estimated the cost for a large, multi-purpose impoundment to be approximately $8,000,000.

- An additional **$67,500** should be budgeted for maintenance of the Ferry Creek impoundment as a Priority I improvement.

S-6 WATER TREATMENT FACILITIES

- The Bandon water treatment facility was constructed during 1981, utilizing City labor to a great extent to minimize expenditures.

- Used filters were purchased from the Umpqua Basin Water Association near Roseburg, dismantled, moved to the site, and reconstructed to serve the needs of Bandon.

- Bandon has received quality water treatment at minimum expense for some 12 years of service after completed installation.

- Increased water demands, aging equipment (filters are now some 30 years old, having served an effective lifetime at another facility before installation in Bandon), and lack of automated process equipment have contributed to problems with treatment.

- Three boil water issues were ordered by the Oregon State Health Division during the last two (2) years. Amendments to the Safe Drinking Water Act, which becomes effective in June 1993, will require more stringent water treatment than has been needed in the past. The existing plant will not be able to consistently comply with the new treatment regulations in the future.

- Alternate methods of disinfection were considered. Chlorination is still the safest, most cost-effective method of disinfecting water for Bandon while maintaining a chlorine residual in the distribution system. Proposed chlorination facilities will allow adequate space to accommodate the future addition of ammonia in case THM formation in Bandon's potable water becomes more of a concern in the future.

- Significant improvements will be required to the existing chlorination facilities to comply with new drinking water standards and the requirements of the 1988 Uniform Building and Fire Codes.

- Improvements are also needed to the pump stations and transmission piping used to transmit raw water from the impoundments to the middle pond and treatment plant.

- The combined impact of improved treatment equipment, automatic controls, and modern filtration and chemical handling equipment should limit the need for additional manpower to operate the plant, based on a preliminary manpower analysis. A minimum equivalent manpower of 1.5 operators should initially be provided to satisfy manpower requirements at the water treatment facility. Additional manpower needs may be required for non-plant related activities.

S-7 TREATED WATER STORAGE

- Bandon currently has 1,000,000 gallons of storage in a single steel reservoir.

- A shortage of treated-water storage exists, with the total volume of storage sometimes being exceeded by one days water demand. If there is a problem with supply or treatment, that takes more than one day to solve, the City could completely run out of water.

- A 2.0 million gallon reservoir, located adjacent to the existing reservoir, should be constructed as a Priority I improvement. This will satisfy the City's storage needs for approximately 3,170 equivalent dwelling units (EDU's) and for a time period of approximately 15 years, based on a 2.5% AAGR.

- As a Priority III improvement, another 750,000 gallons of storage, located near the south end of town, is recommended. City reservoir storage would then total 3.75 million gallons, which should be sufficient for the next 25 years (service to 4,060 EDU's). A booster pump station will also be necessary to increase water pressure out of the reservoir.

S-8 TREATED WATER DISTRIBUTION AND TRANSMISSION SYSTEM

- A computer model was developed to simulate flows and pressures throughout the Bandon Water System for existing and future conditions.

- Emphasis of the proposed improvements is to create a looped distribution system around Bandon. This is the most critical need, and insures that the potential exists to transmit adequate quantities of water throughout town.

- Recommended improvements to increase system capacity have been prioritized based on need and cost.

- High priority improvements have been identified and are listed in a Capital Improvement Plan.
- Priority I improvements basically consist of constructing a 16-inch diameter pipeline from the storage reservoir to the distribution system. This is the most critical need since the existing 12-inch diameter transmission main is hydraulically undersized, and because the town would be entirely without water if the existing line, which was constructed in the 1950's (almost 40 years old), is out of service for repairs.
- It is also recommended that undersized pipelines in the vicinity of the public school be replaced as part of the Priority I project.

S-9 CAPITAL IMPROVEMENT PLAN

- A Capital Improvement Plan summarizing the recommended improvements is presented in Table S-5.
- The estimated total cost of Priority I improvements is $3,772,177.

S-10 SYSTEM DEVELOPMENT CHARGES

- Preliminary SDC computations were made in Chapter 12.
- The computed water system SDC, with 50 percent grant funding, is $1,270 per EDU. Note that the cost for long-term water supply is not included.
- The current water system SDC in Bandon is $250 for a 5/8" x 3/4" water meter.
- SDC's assessments based on a 5/8" x 3/4" water meter are the equivalent of those based on an EDU.

S-11 FINANCING OPTIONS

- Financing options for proposed water system improvements are described in Chapter 12.

TABLE S-5

SUMMARY OF ESTIMATED PRELIMINARY COSTS

PRIORITY I - Immediate (1993 Estimate of Service EDU's - 2,243)

Upgrade existing treatment plant, add treated-water reservoir storage, distribution and transmission system improvements, raw-water pump station improvements, repairs and maintenance of Ferry Creek impoundment, and preliminary engineering and permitting for long-term water supply

Proposed Improvement	Construct Cost	Engineer& Inspect	Legal& Admin	Conting	Total Cost
Maintain Ferry Ck Impoundment	$50,000	$10,000	$2,500	$5,000	$67,500
Preliminary Engineering and Permits for Long-Term Water Supply		$187,500	$50,000	$0	$237,500
Lower Pump Sta. Improvements	$94,000	$18,800	$4,700	$9,400	$126,900
Replace line from Lower Pump Sta. to Middle Pond	$32,745	$6,549	$1,637	$3,275	$44,206
Middle Pump Sta. and Middle Pond Expansion	$104,500	$20,900	$5,225	$10,450	$141,075
Treatment Plant Upgrade	$1,278,275	$255,655	$63,914	$127,828	$1,725,671
New Storage Reservoir, 2 Million Gallons	$663,000	$132,600	$33,150	$66,300	$895,050
Transmission and Distribution Improvements	$395,759	$79,152	$19,788	$39,576	$534,275
Total	$2,618,279	$711,156	$180,914	$261,828	$3,772,177

TABLE S-5 (Continued)

PRIORITY II - 1998-2003 (Service EDU's Range - 2,540-2,870)

Distribution System Improvements

Proposed Improvement	Construct Cost	Engineer& Inspect	Legal& Admin	Conting	Total Cost
Distribution Improvements	$571,820	$114,364	$28,591	$57,182	$771,957

PRIORITY III - 2003-2008 (Service EDU's Range - 2,870 -3,250)

Distibution Improvements and New 0.75 MG Storage Reservoir and Booster Pump Station

Proposed Improvement	Construct Cost	Engineer& Inspect	Legal& Admin	Conting	Total Cost
Distribution Improvements	$503.550	$100,710	$25,178	$50.355	$679,793
New 0.75 MG Storage Reservoir And Booster Pump Station	$688.600	$137,720	$34,430	$68,860	$929,610
Total	$1,192.150	$238,430	$59,608	$119,215	$1,609,403

PRIORITY IV - 2008-2017 (Service EDU's Range - 3,250-4,060)

Distribution System Improvements

Proposed Improvement	Construct Cost	Engineer& Inspect	Legal& Admin	Conting	Total Cost
Distribution Improvements	$767,968	$153,594	$38,398	$76,797	$1,036,757

Notes:

a) Capital cost for long-term water supply solution(s) not included.
b) EDU stands for single-family residential equivalent dwelling unit.

- There is intense competition in Oregon for the limited grant funds available for financing water system improvements. However, Bandon's project should rank very well compared to other communities, based on the documented health threat from inadequate water treatment and the relatively low income level in Bandon (1980 Census).

- The most likely grant programs are the Oregon Community Development Block Grant (OCDBG) program and the Farmers Home Administration (FmHA) program.

- In 1993 the maximum grant available from the OCDBG program will be increased to $750,000. However, Bandon still has a current OCDBG grant for the wastewater system, and this may reduce the chance of Bandon receiving a second grant until after construction of the wastewater treatment plant improvements are complete.

- FmHA switched over to using 1990 census data (updated from 1980 census) in February 1993. Bandon's Median Household Income (MHI) in 1990 was $17,708. This is below the poverty level established by FmHA for rural communities in Oregon. Bandon is still eligible for up to a 75 percent grant and a low interest loan at an annual interest rate of 5 percent.

- Preliminary analysis made prior to late February 1993 indicated that Bandon was eligible to receive approximately a $1,000,000 grant for the Priority I project, based on 1980 census data and comparable water rates in other Oregon communities. However, at this time, it appears that Bandon may no longer qualify for a FmHA grant because the agency increased its estimated average for water bills in the State from $20 per month to $25 per month.

- Presently, the average residential water bill in Bandon is approximately $14.25 per month when both user fees and property taxes are included (user fee component of $11.50).

- To be eligible for a FmHA grant, FmHA requires the initial loan be based on a 40-year repayment period, although there is no penalty for early repayment. An increase in Bandon's average residential bill of approximately $8.70 per month would be necessary to pay back a FmHA loan for Priority I improvement costs, with no grant. This would increase the total average bill to approximately $23 per month.

- Prior to February 1993, FmHA estimated the average water bill in Oregon was $20 per month for communities similar to Bandon. Since the increase in rates necessary to pay for Priority I improvements will increase the average monthly bill for residential customers to above $20, Bandon was eligible for FmHA grant funds. However, since FmHA has increased their average for comparable water rates to $25 per month, Bandon may no longer be eligible for a grant since FmHA will not provide grant monies to a community if the grant keeps water rates below the State average.

- We recommend that Bandon still submit a funding pre-application to FmHA. This is and excellent loan program with an annual interest rate presently at 5%. The transition is still being made between the procedures used for grant computations based on the 1980 census and those based on the 1990 census. Bandon may still be eligible for grant funds. FmHA needs to make the final grant/loan determination, and their findings may vary significantly from our preliminary analysis. Also, FmHA anticipates having twice as many dollars of grant funds available next fiscal year than it had this year, due to the new administration's economic stimulus program.

- The FmHA loan could be repaid with revenue from either user fees, property taxes or a combination of both. If the City of Bandon decides to complete all the proposed project components recommended as Priority I improvements, and pays back the loan entirely with user fees, the average monthly rate would increase about $8.70 per month (with zero grant).

- The monthly rate (user fee) would increase approximately $4.35 per month and the property tax rate would increase about $0.70 per $1,000 (zero grant), if the loan was repaid with 50 percent user fees and 50 percent property taxes. Using 100 percent property taxes to repay the loan would increase the tax rate approximately $1.40 per $1,000. If Bandon receives a grant, the estimated increases would be lower.

S-12 IMPLEMENTATION

Project implementation is discussed in Chapter 11. Our recommendation is that Bandon immediately submit a preapplication, and subsequently a final application, for FmHA financing. After FmHA makes a grant/loan determination, the community needs to select the final project scope and proceed with a bond election to provide City authority to sell bonds to finance the project. After financing is secured, it will take about one and one-half years to complete construction.

CHAPTER 1

INTRODUCTION

CITY OF BANDON
WATER SYSTEM MASTER PLAN

CHAPTER 1
INTRODUCTION

1.1 BACKGROUND

Bandon is a coastal City which attracts many tourists. Its temperate climate and attractive environment are enhanced by ocean, nearby forests, nearby state parks, rivers, lakes and estuaries. A substantial portion of the population are retired that live in Bandon. People are not only drawn from Oregon, but from the remainder of the United States. The City's economy includes numerous motels, resorts and small businesses such as restaurants and gift shops which serve tourists, recreational and retirement needs. The Port of Bandon and associated fishery industries provide an important economic base.

Bandon is located on Oregon's south coast along Highway 101, 22 miles south of Coos Bay and 84 miles west of Roseburg via Highway 42 and 42S. A vicinity map is provided as Figure 1-1.

Bandon and the surrounding area experience a large influx of tourists and part-time residents during the summer, holidays and school vacation. Fish processing, which requires large quantities of water, peaks at different times of the year depending on the species being processed. Tourism and fish processing create large, seasonal fluctuations in water demand.

1.2 CURRENT SITUATION

The last comprehensive evaluation of long-term water system needs for Bandon was completed by H.G.E., INC., Engineers and Planners in 1974. Recommendations in the document were based on a 20-year planning period, and this length of time has nearly expired.

In the fall of 1992, the Bandon City Council retained H.G.E., INC. to complete a new Water System Master Plan.

Other concerns which necessitated conducting a new evaluation of the water system include:

A. High turbidities in treated water necessiated to boil water orders being issued by the Oregon State Health Division 3 times during the last 2 years to consumers of City water, because of the potential health threat.

B. A shortage of treated water storage exists, with the total volume of storage sometimes being exceeded by a water demand equating to one day. If there is a problem with supply or treatment that takes more than one day to solve, the City could completely utilize their available water.

CITY OF BANDON

WATER SUPPLY PLAN UPDATE - 1992

LOCATION MAP

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FIGURE 1-1

C. There is a single pipeline (transmission main) between the City's storage reservoir and the distribution system. The pipeline is approaching capacity. Also, another concern is that if this line develops a major rupture or break there is no way to supply the City with treated water.

D. The Bandon Fish Hatchery and cranberry farmers have legal authority (water rights) to virtually cut off the City's supply of raw water from Geiger Creek and Ferry Creek.

E. The new Surface Water Treatment Rule (SWTR) included amendments to the EPA Safe Drinking Water Act, which will change treatment standards for the City's water supply and become effective in June 1993.

1.3 PLANNING SCOPE

The objective of this Study is to establish a long-range, water-system development program for the present and future needs of the Bandon water service area. This plan will also assist the City in establishing System Development Charges to finance future expansion of the water system. Needs will be addressed relative to water source, treatment and distribution. An outline of the basic considerations of this Study is presented as follows:

1) Determine existing water requirements based on present water consumption, land use plans and fire flow requirements.

2) Project water demands for the next 25 years, to the fiscal year 2017.

3) An examination of the existing water source will be conducted for the area's present and future needs. Other potential water sources will be investigated. A water rights availability investigation for the current source and possible future sources will also be performed.

4) Analyze the existing treatment system for present and future needs, including requirements for treatment sizing and changing standards, that will be required to make the City's water supply in full compliance with the enacted requirements of the EPA Safe Drinking Water Act.

5) Analysis of the existing distribution, transmission and storage system and its ability to meet existing and future demands. This will include a computer modeling analysis to determine where inadequacies exist and initially where restrictions are creating an inability to deliver adequate water supplies through the system. Long range system needs will also be developed by the application of growth projections into the model, and with a detailed layout of future system needs arranged in priorities.

6) Prepare a base map and show the existing water distribution system and proposed additional pipelines needed to satisfy present conditions and future growth.

7) Total cost estimates for various alternatives will be prepared and recommendations will be separated into priorities for development.

8) Recommendations will include a detailed plan for financing the proposed improvements with federal financing and/or a bonding program.

9) Preparation of a complete report of the work. Data should be presented to show various proposals, complete with supporting data, preliminary plans, and cost estimates. Justification should be given to show the selected program represents the best interests of the residents of Bandon.

1.4 AUTHORIZATION

In August 1992 the Bandon City Council authorized H.G.E., INC. Engineers and Planners to prepare a Water System Master Plan for the City of Bandon.

1.5 PLANNING AREA

The planning area includes the City of Bandon and the Urban Growth Area. A map showing the present City limits and Urban Growth Boundary is included as Figure 1-2.

1.6 PREVIOUS STUDIES AND REPORTS

Previous studies and reports utilized during the course of the study are included in the following list:

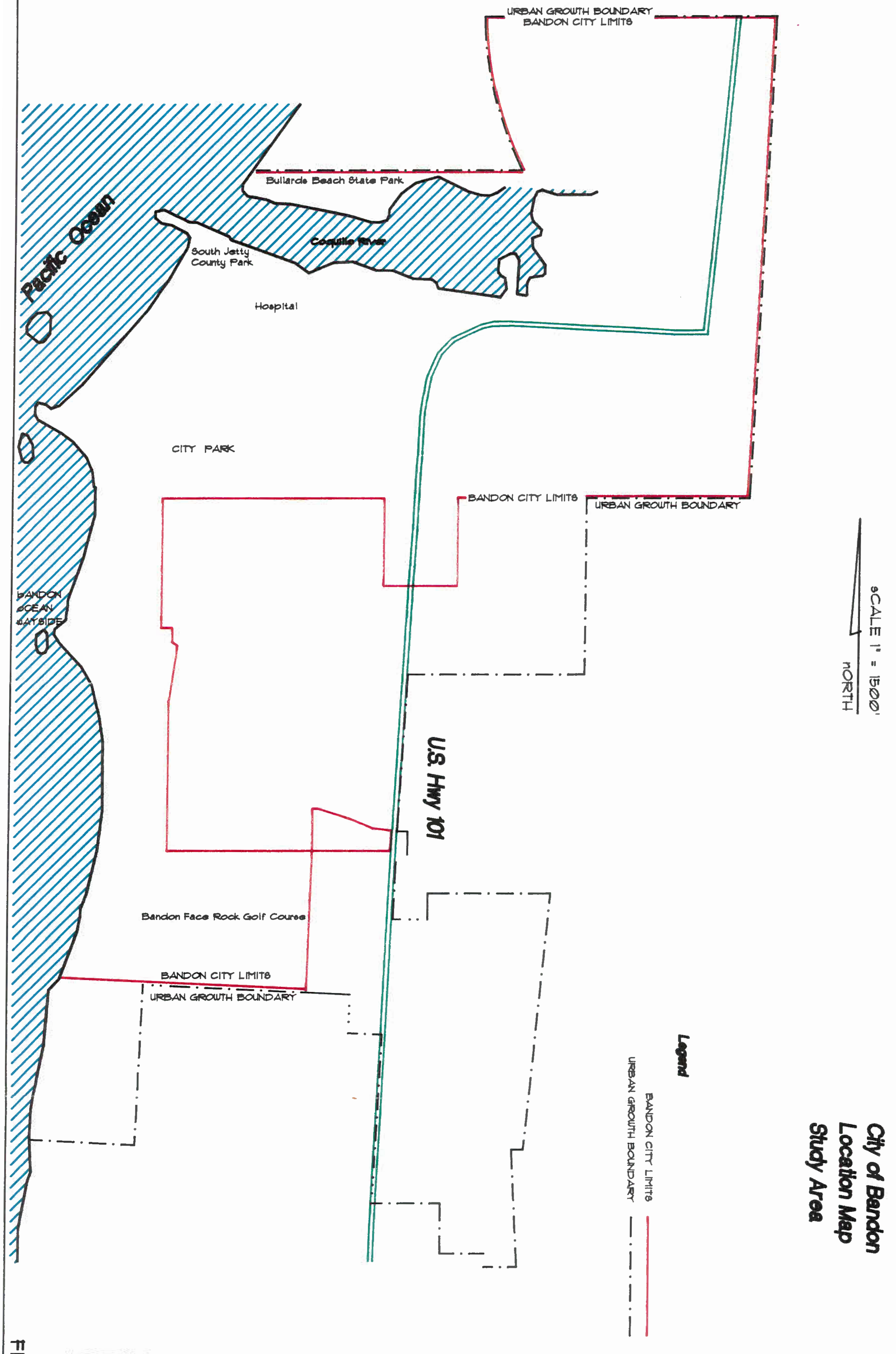
Brown and Caldwell. *"City of Bandon, Wastewater Treatment Facilities Plan"*, November 1990.

CH_2M Hill. *"Preliminary Reports: The Coos County Water Management Plan"*, Draft.

H.G.E., INC. *"A Comprehensive Development Program for Water System Improvements"*, April 1974.

Tucson Myers & Associates. *"Ferry Creek Project Evaluation Under PL84-984"*, April 1990.

University of Oregon. *"Draft: City of Bandon 4.5. Demographic Analysis"*, November 1990.



City of Bandon
Location Map
Study Area

FIGURE 1-2

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19 N.W. 5TH AVE., PORTLAND, OREGON 97209 (503) 222-1687

1.7 ORGANIZATION

The overall structure of this Study follows the flow of water from the source to the consumer as shown schematically in Figure 1-3. Separate chapters have been written to evaluate each of the following system components:

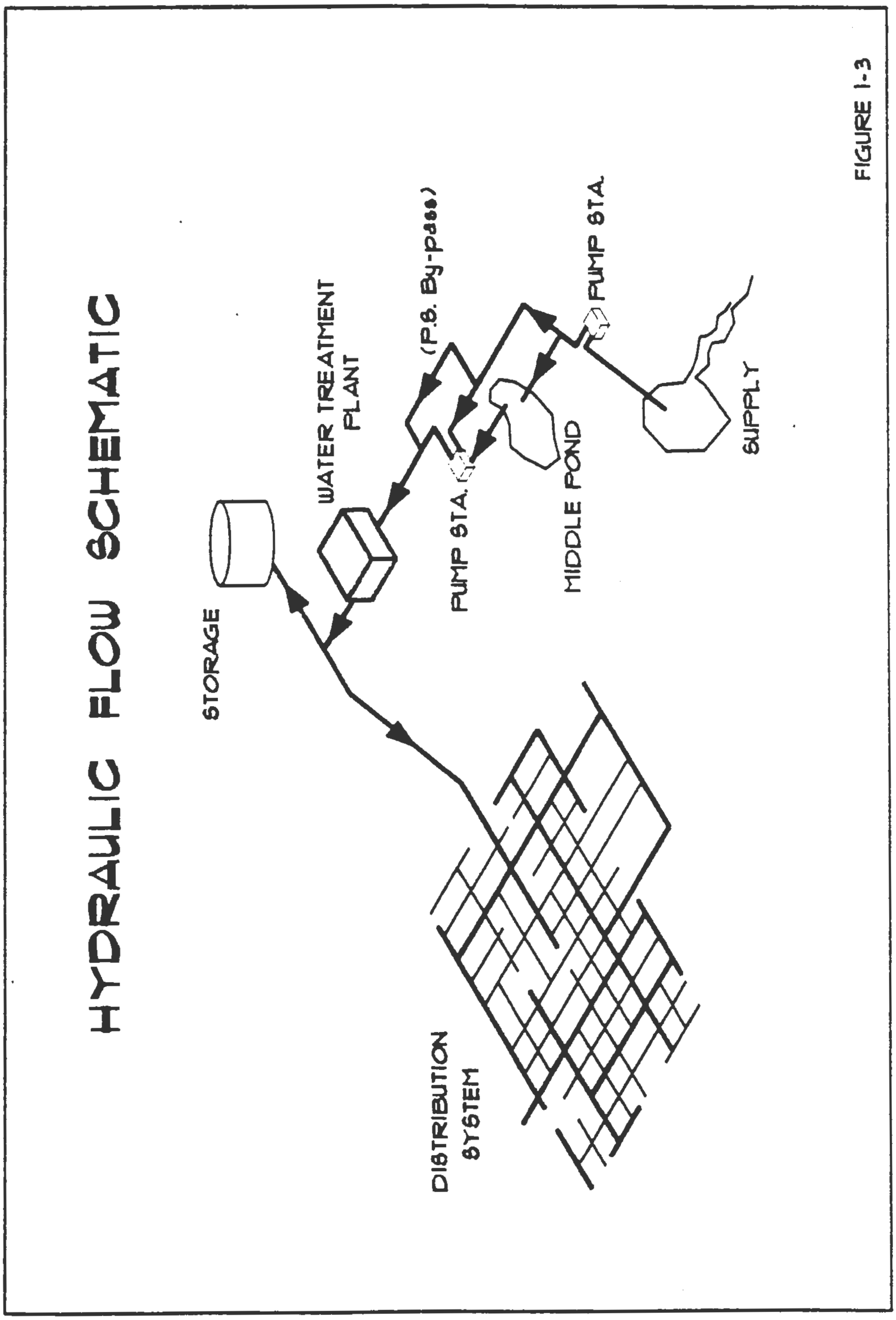
a) Water Supply
b) Water Treatment
c) Treated Water Storage
d) Treated Water Distribution and Transmission System

Tables and figures in this report are numbered consecutively within each chapter, and they generally appear in the text of the report on the page or pages following the first reference. A complete list of tables, figures, and plates is contained in the Table of Contents.

1.8 ACKNOWLEDGMENTS

Preparation of this study required the assistance of City Staff for compiling data and history of events. The courtesy, assistance and cooperation of Ben McMakin, City Manager, has been sincerely appreciated. We wish to acknowledge the personal experience and background information on the Bandon Water System provided by Steve Gaber, Planning Director, Ed Hammond, Treatment Plant Supervisor, Don Richards, Superintendent of Public Works, and Gene Davidson, Plant Operator.

FIGURE 1-3
HYDRAULIC FLOW SCHEMATIC



CHAPTER 2

METHODOLOGY USED FOR WATER SYSTEM EVALUATION

CITY OF BANDON
WATER SYSTEM MASTER PLAN

CHAPTER 2
METHODOLOGY USED FOR WATER SYSTEM EVALUATION

2.1 GENERAL

This section of the Study covers the procedure used to evaluate the existing water system, priorities for recommended improvements, and the method used to develop cost estimates.

2.2 SYSTEM DESCRIPTION

An inventory of the existing facilities is made and discussed in Chapter 3. This information has been used, in conjunction with the City's Land Use Plan and the water requirements developed in Chapter 5, to evaluate the capabilities and adequacy of the present and future water system. Each system component will be evaluated as to its capability, useful life remaining, and its ability to meet State and Federal requirements and future needs.

2.3 REGULATORY REQUIREMENTS

The existing regulatory stipulations and requirements of the new amendments to the Safe Drinking Water Act are summarized in Chapter 6.

2.4 DESIGN PERIOD

This Study is based on a 25-year planning period with further projections to the year 2017. It is felt that this time frame is adequate to allow for adaption to future needs, while being short enough to insure that the facilities will be effectively used within their economic life. Recommended system improvements are developed for construction in phases (priorities) and all components are designed to allow future expansion. Alternate recommendations are made for future improvements which are dependent on growth patterns and other variables which cannot be accurately predicted at this time.

2.5 PRIORITIES

Major water system improvements of the order proposed in this Study require considerable financial resources. In developing a water plan, therefore, it is necessary to consider the relative importance of the proposed improvements and to assign priorities to the development program accordingly.

By prioritizing the proposed improvements, construction costs can be extended over a longer period of time in an effort to remain within the financial capabilities of the community.

Prioritizing will also assist in the establishment of System Development Charges through justification of development fees. Initial improvements should be based on the short-range or immediate critical needs and should provide the greatest benefit at the lowest cost. Later improvements should follow the long-range guidelines and meet future demands as the community develops and can finance the improvements.

Priority categories are dependent on water demand and population growth, and will be developed in Chapter 5.

2.6 BASIS FOR COST ESTIMATES

2.6.1 General

Cost estimates presented in this Study include four components, each of which is discussed separately in this section. It must be recognized that the estimates are preliminary and are based on the level and detail of planning presented in this Study. As the project proceeds forward it may be necessary to update the estimates from time to time, as more information becomes available.

2.6.2 Construction Cost

Estimated construction costs in this facility plan are based on actual construction bidding results for similar work, published cost guides, and other construction cost experience of the authors within the State of Oregon. Estimates are based on preliminary layouts of the proposed improvements.

Future changes in the cost of labor, equipment, and materials may justify comparable changes in the cost estimates presented herein. For this reason, it is common engineering practice to relate the cost estimates to a particular index that varies in proportion to long term changes in the national economy. The Engineering News Record (ENR) construction cost index is most commonly used. It is based on a value of 100 for the year 1913, and its value for the past 10 years is shown in Table 2-1.

TABLE 2-1

ENR COST INDEX PROJECTION

Year	20-City ENR (August)	% Change
1980	3304	
1981	3616	9.4%
1982	3899	7.8%
1983	4066	4.3%
1984	4146	2.0%
1985	4195	1.2%
1986	4295	2.4%
1987	4401	2.5%
1988	4541	3.2%
1989	4607	1.5%
1990	4751	3.1%
1991	4892	3.0%
1992	5032	2.9%

All cost estimates in this study are based on the current (August 1992) ENR Construction Cost Index value of 5032. Construction costs will increase in the future. Therefore, cost estimates presented in this Study should be updated depending on the actual time of construction. Estimates can be prepared at any future date by comparing the predicted ENR Construction Cost Index with the current index value of 5032.

2.6.3 Engineering, Inspection and Construction Management

Engineering, inspection and construction management costs have been assumed to be 20 percent of the construction cost. This includes costs for the engineering company to conduct preliminary surveys, perform detailed design analyses, prepare construction drawings, prepare construction specifications, advertise for construction bids, conduct construction stakeout surveys, provide partial inspection during construction, administer construction related activities such as change orders, and to prepare final drawings showing the project as-built.

2.6.4 Contingencies

A contingency factor equal to 10 percent of the estimated construction cost has been added. In recognizing that the cost estimates are based on preliminary design, allowances must be made for variations in final quantities, bidding market conditions, adverse construction conditions, unanticipated specialized investigation and studies, and other difficulties that cannot be foreseen at this time, but which may tend to increase final costs.

2.6.5 Legal and Administrative

An allowance of 5 percent of construction cost has been added for legal and administration. This allowance is intended to include internal project planning and budgeting, grant administration, liaison, interest on interim financing, legal services, review fees, legal advertising, and other related expenses associated with the project.

2.6.6 Cost Estimate Summary

Cost estimates presented in this Study include a combined allowance of 35 percent for contingencies, engineering, legal and administrative costs.

2.7 RECOMMENDED IMPROVEMENTS

The assessment of the City of Bandon's water system will be summarized and a recommended plan for improvements will be developed in Chapter 11. Financing of the improvements will be considered in Chapter 12.

CHAPTER 3

EXISTING WATER SYSTEM

CITY OF BANDON
WATER SYSTEM MASTER PLAN

CHAPTER 3
EXISTING WATER SYSTEM

3.1 GENERAL

This chapter includes a brief description of the existing water facilities. Following chapters will discuss the components of the system that have been investigated in detail and required improvements.

System locations and sizing were developed from available records, on-site inspection, and with the assistance of Ben McMakin, City Manager; Ed Hammond, Treatment Plant Supervisor; Don Richards, Superintendent of Public Works, and Gene Davidson, Plant Operator.

3.2 SUPPLY

Schematic views of the water supply system are provided as Figures 3-1 and 3-2.

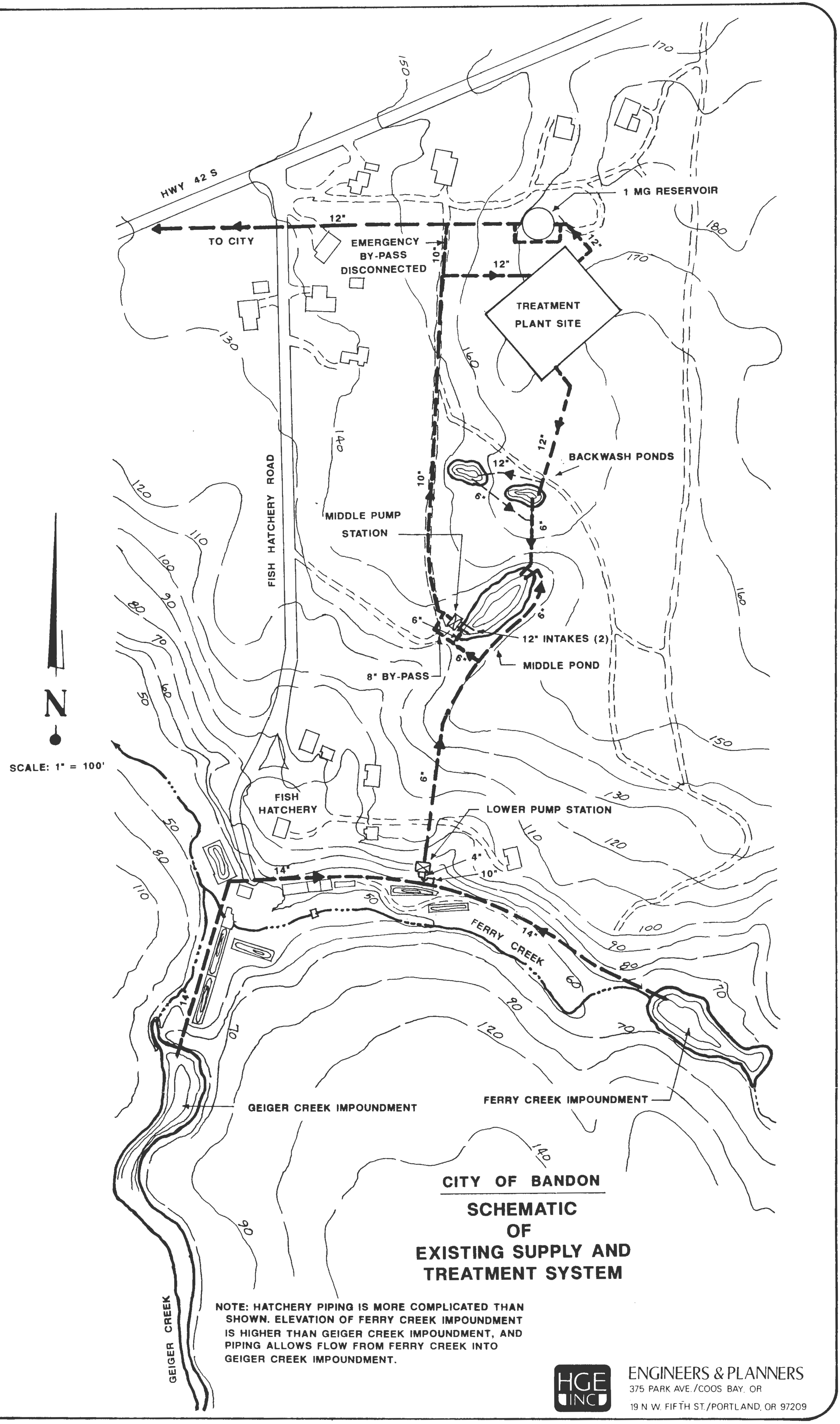
The present sources of supply are Ferry Creek and Geiger Creek. Water is diverted from small impoundments on each creek. Drainage areas above the dams are similar in size and amount to approximately 1.75 square miles (1,130 acres) for Ferry Creek, and 2.0 square miles (1,290 acres) for Geiger Creek.

Both dams are of earth fill construction. Approximate dam and impoundment dimensions are listed in Table 3-1.

TABLE 3-1. Approximate dimensions of the dams and impoundments.

	FERRY CREEK	GEIGER CREEK
Dam Height	10 feet	15 feet
Dam Length	100 feet	110 feet
Water Depth (Average)	2 feet*	4 feet
Impoundment width (average)	100 feet	80 feet
Impoundment length (average)	350 feet	800 feet
Impoundment storage	500,000 gal.	2,000,000 gal.

*Ferry Creek impoundment is silted in.



CITY OF BANDON

SCHEMATIC OF EXISTING SUPPLY AND TREATMENT SYSTEM

NOTE: HATCHERY PIPING IS MORE COMPLICATED THAN SHOWN. ELEVATION OF FERRY CREEK IMPOUNDMENT IS HIGHER THAN GEIGER CREEK IMPOUNDMENT, AND PIPING ALLOWS FLOW FROM FERRY CREEK INTO GEIGER CREEK IMPOUNDMENT.

FIGURE 3-1

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CITY OF BANDON
EXISTING HYDRAULIC SCHEMATIC OF IMPOUNDMENTS TO TREATED WATER STORAGE RESERVOIR

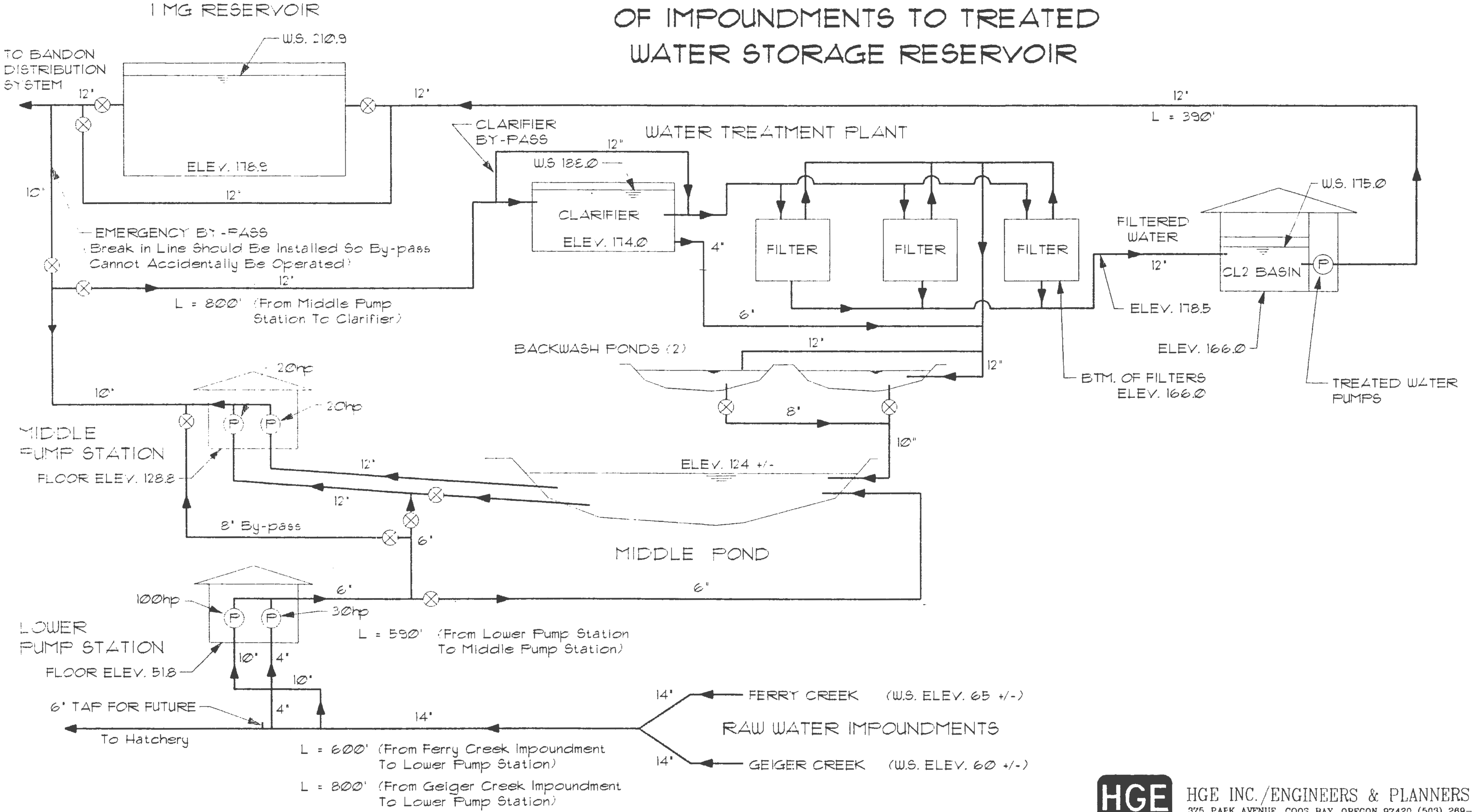

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FIGURE 3-2

Water gravity flows out of the impoundments (Figure 3-2) to either the hatchery or the City's Lower Pump Station. Water is pumped from the Lower Pump Station to either the a) middle pond, b) Middle Pump Station, or c) directly to the treatment plant. During normal operation water is generally pumped into the middle pond, which serves as a "settling basin" in which suspended sediments have a chance to settle out.

After treatment the water is pumped out of the chlorine contact basin (clearwell) to the City's 1-million gallon (MG), steel, treated-water storage reservoir. Treated water gravity flows from the 1 MG reservoir through a 12-inch line into the City's distribution system.

3.3 TREATED WATER STORAGE

Bandon has one treated-water storage reservoir. The steel reservoir has a capacity of 1 million gallons. The base elevation is 178.9 feet and the maximum water surface elevation is 210.9 feet.

3.4 DISTRIBUTION AND TRANSMISSION SYSTEM

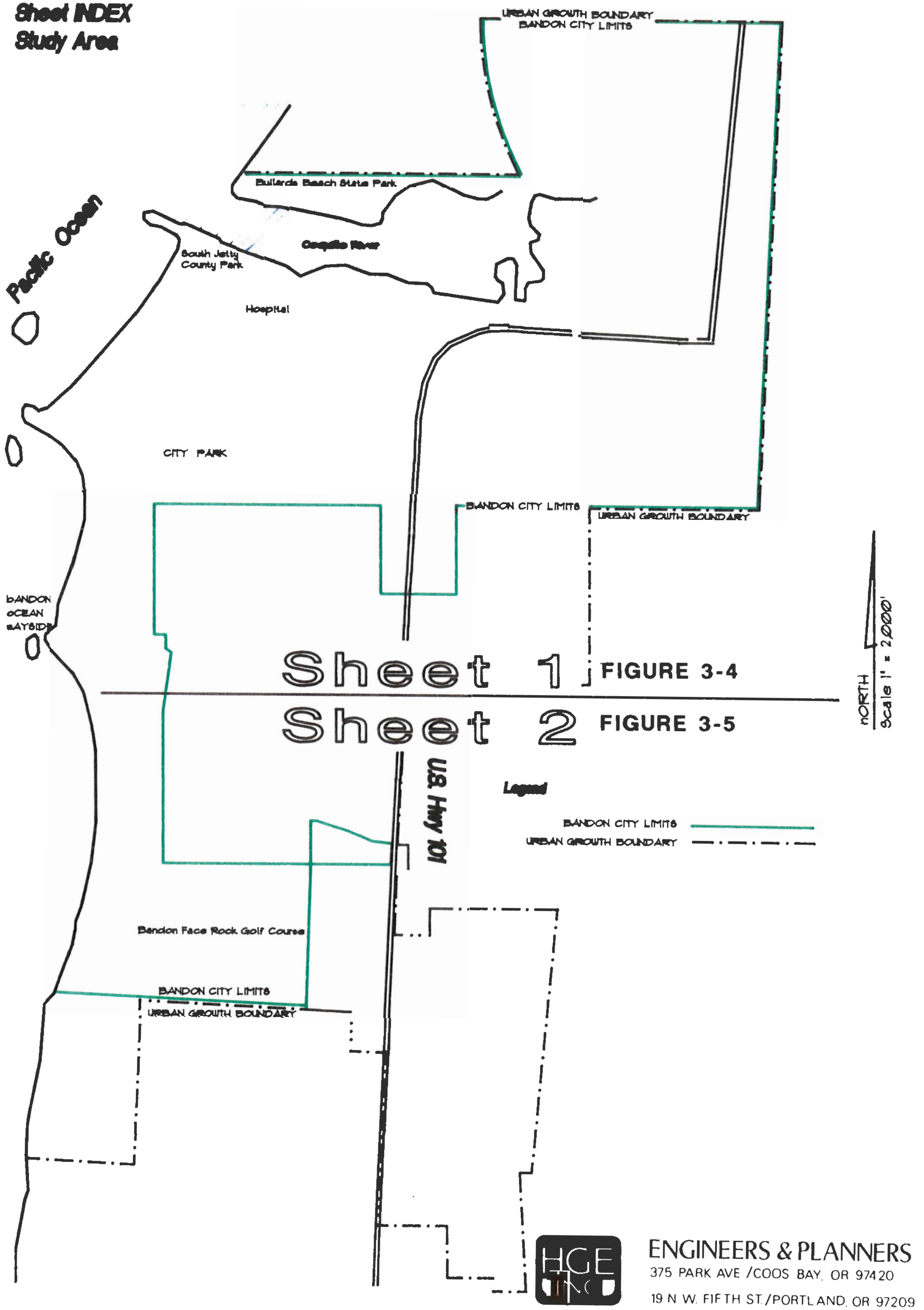
Figures 3-3, 3-4 and 3-5 show Bandon's existing transmission and distribution piping network. The base map was generated using AUTOCAD Software. Information utilized in construction of the maps was provided by City staff and from the Oregon State Highway Department.

A single, 12-inch diameter transmission main feeds the entire City of Bandon. The line was constructed in the 1950's (approximately 40 years old).

Presently there is one pressure zone in Bandon (no pressure reducing stations or pressure boosting stations). Elevations of current development range from about Elevation 9 (100-year flood level) to Elevation 105. When the reservoir is nearly empty static pressures range from 75 psi to 30 psi. Static pressures range from about 85 psi to 40 psi when the reservoir is full. West of Highway 101, static pressures in most areas exceed 40 psi. If development occurs East of Highway 101, especially above Elevation 90, pressures may be less than satisfactory for operation of household appliances.

City of Bandon
Sheet INDEX
Study Area

FIGURE 3-3



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City of Bandon Existing Water Distribution System

FIGURE 3-4

Sheet 1 of 2

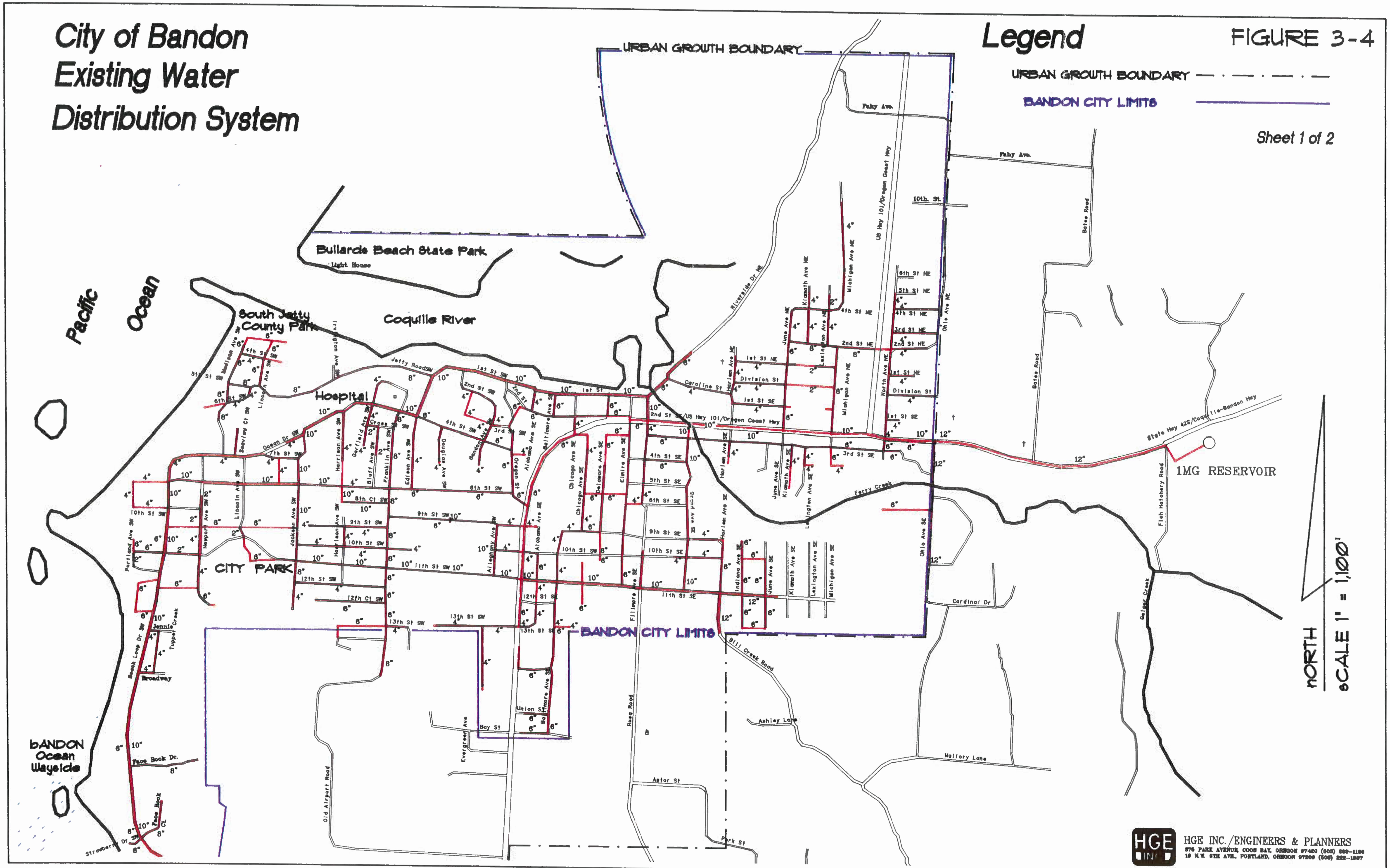

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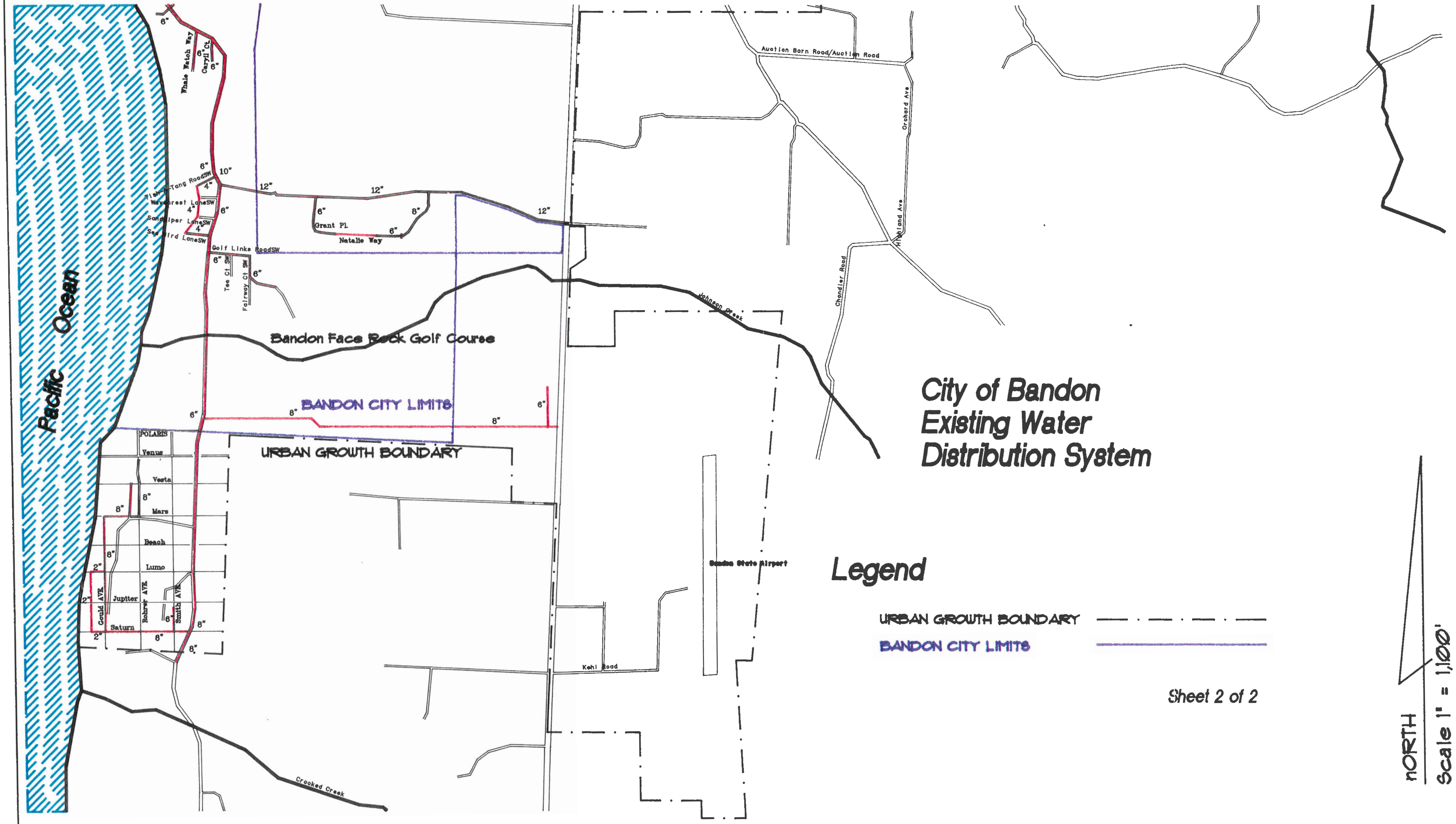
FIGURE 3-5



City of Bandon Existing Water Distribution System

Legend

URBAN GROWTH BOUNDARY — · —

BANDON CITY LIMITS ———

Sheet 2 of 2

Scale 1" = 1,100'

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CHAPTER 4

POPULATION ESTIMATES AND LAND USE

CITY OF BANDON
WATER SYSTEM MASTER PLAN

CHAPTER 4
POPULATION ESTIMATES AND LAND USE

4.1 GENERAL

The actual population of customers served by the Bandon water system fluctuates due to the influx of tourists during the summer, holidays and school vacations. Full-time resident populations will be used in this study due to difficulties in estimating the seasonal variation in population. Per capita flows will therefore be higher during periods of high tourism.

Estimates of future population are used in conjunction with land use planning considerations and existing water demand to project future water requirements in Chapter 5.

4.2 SERVICE POPULATION

The service area for the Bandon water system includes the existing City limits and urban growth area as shown in Figure 1-2.

Actual estimates of population are only made once every 10 years during the official Census. As mandated by Oregon laws, the Center for Population Research and Census at Portland State University (PSU), acting on behalf of the State Board of Education, annually estimates the July 1st population for each incorporated City and County in Oregon.

The 1991 certified population estimate for Bandon was 2,335 people. In 1991, there were 41 water connections outside the City limits. Based on the 1990 census estimate of 2.09 persons per household in Bandon, it is estimated 86 persons were served outside the City limits. The 1991 service population within the Urban Growth Boundary (UGB) is therefore estimated to be 2,421 people (2,335 + 86).

4.3 SERVICE AREA POPULATION PROJECTIONS

The University of Oregon is conducting a demographic analysis for Bandon. Findings will be utilized by the City in updating the City's Comprehensive Plan. During the 1980 decade the average annual growth rate (AAGR) in Bandon was 2.4 percent. During the 1990 decade there was a decrease in population, with an AAGR of -0.4 percent.

A summary of estimated population growth from the draft report[1] states: *"Estimated population in Bandon will grow at an average annual rate of between 1.3 percent and 0.1 percent. Our best estimate is 0.7 percent annually"*.

---

[1] "Draft: City of Bandon U.S. Demographic Analysis", prepared by University of Oregon, not complete.

An AAGR of 2.5 percent was used in the Wastewater Facilities Plan[2], which was the basis for sizing the wastewater system improvements presently under construction.

Potential population projections within the City limits, for a range of AAGR's, are compared with projections from the University of Oregon Demographic Analysis and with projections from the Wastewater Facilities Plan in Table 4-1.

A reasonable growth rate needs to be selected for sizing the capacity of proposed water system improvements. Some impact to growth in Bandon may have occurred recently, because of restrictions on new development, while improvements to the wastewater system are being implemented (building permits are still being granted but discharge into the wastewater in system is not being allowed for new development until improvements to the wastewater system are complete). There is considerable potential for new development in Bandon as there presently is in all communities located along the Oregon Coast. However, many of the potential residents are at retirement age and will not impact population to the level of families with children. Based on the 1990 census the average number of residents per household in Bandon is only 2.09 persons.

An annual growth rate of 2.5 percent is considered reasonable for planning long-term water system improvements and is consistent with other facilities planning documents recently completed for Bandon, including the Wastewater Facilities Plan.

Service population projections for this 1992 Water System Master Plan are shown in Table 4-2. The total service population projected in the year 2017 is 4,601 people. There is adequate buildable land within the Urban Growth Area to support this population.

4.4 WATER DEMAND AND EQUIVALENT DWELLING UNITS

Although an AAGR of 2.5 percent is reasonable for long-term projections, short-term growth rates may vary significantly. Therefore, the scheduling of recommended improvements will also be based on water demand and Equivalent Dwelling Units (EDU's). Priority categories and tentative schedules for initiating improvements based on these other indicators will be developed in Chapter 5.

---

[2] "City of Bandon, Wastewater Treatment Facilities Plan", November 1990, Brown and Caldwell.

TABLE 4-1.

CITY OF BANDON
POTENTIAL POPULATION PROJECTIONS
WITHIN CITY LIMITS

Alternatives for Population Forecasts

	Demographic Analysis Population Forecasts			Wastewater Facilities Plan	Water Study Possible Growth Rates			
	High	Medium	Low					
Year	1.3%	0.7%	0.1%	2.5%	5.0%	2.5%	1.3%	0.7%
1990	2,215	2,215	2,215	2,690	2,260	2,260	2,260	2,260
1991	2,244	2,231	2,217	2,757	2,335	2,335	2,335	2,335
1992	2,273	2,246	2,219	2,826	2,452	2,393	2,365	2,351
1993	2,303	2,262	2,222	2,897	2,574	2,453	2,396	2,368
1994	2,332	2,278	2,224	2,969	2,703	2,515	2,427	2,384
1995	2,363	2,294	2,226	3,043	2,838	2,577	2,459	2,401
1996	2,393	2,310	2,228	3,120	2,980	2,642	2,491	2,418
1997	2,425	2,326	2,231	3,198	3,129	2,708	2,523	2,435
1998	2,456	2,342	2,233	3,278	3,286	2,776	2,556	2,452
1999	2,488	2,359	2,235	3,359	3,450	2,845	2,589	2,469
2000	2,520	2,375	2,237	3,443	3,622	2,916	2,623	2,486
2001	2,553	2,392	2,239	3,530	3,803	2,989	2,657	2,504
2002	2,586	2,408	2,242	3,618	3,994	3,064	2,691	2,521
2003	2,620	2,425	2,244	3,708	4,193	3,140	2,726	2,539
2004	2,654	2,442	2,246	3,801	4,403	3,219	2,762	2,557
2005	2,689	2,459	2,248	3,896	4,623	3,299	2,798	2,575
2006	2,723	2,477	2,251	3,993	4,854	3,382	2,834	2,593
2007	2,759	2,494	2,253	4,093	5,097	3,466	2,871	2,611
2008	2,795	2,511	2,255	4,195	5,352	3,553	2,908	2,629
2009	2,831	2,529	2,257	4,300	5,619	3,642	2,946	2,647
2010	2,868	2,547	2,260	4,408	5,900	3,733	2,984	2,666
2011	2,905	2,564	2,262	4,518	6,195	3,826	3,023	2,685
2012	2,943	2,582	2,264	4,631	6,505	3,922	3,063	2,703
2013	2,981	2,600	2,267	4,747	6,830	4,020	3,102	2,722
2014	3,020	2,619	2,269	4,865	7,172	4,120	3,143	2,741
2015	3,059	2,637	2,271	4,987	7,531	4,223	3,184	2,761
2016	3,099	2,655	2,273	5,112	7,907	4,329	3,225	2,780
2017	3,139	2,674	2,276	5,240	8,302	4,437	3,267	2,799

Note: Water study population estimates for 1990 and 1991 are estimates made by Center for Population Research, Portland State University, for July 1, 1990 and 1991

TABLE 4-2.

Year	Inside City Limits	Outside City Limits	Total
1988	2,490	80	2,570
1989	2,535	82	2,617
1990	2,260	84	2,344
1991	2,335	86	2,421
1992	2,393	88	2,482
1993	2,453	90	2,544
1994	2,515	93	2,607
1995	2,577	95	2,672
1996	2,642	97	2,739
1997	2,708	100	2,808
1998	2,776	102	2,878
1999	2,845	105	2,950
2000	2,916	108	3,024
2001	2,989	110	3,099
2002	3,064	113	3,177
2003	3,140	116	3,256
2004	3,219	119	3,338
2005	3,299	122	3,421
2006	3,382	125	3,506
2007	3,466	128	3,594
2008	3,553	131	3,684
2009	3,642	134	3,776
2010	3,733	138	3,870
2011	3,826	141	3,967
2012	3,922	145	4,066
2013	4,020	148	4,168
2014	4,120	152	4,272
2015	4,223	156	4,379
2016	4,329	160	4,489
2017	4,437	164	4,601

Note: *Inside City Limits estimates for 1988-1991 are from Center for Population Research, PSU*

4.5 LAND USE

The Generalized Land Use and Zoning Map shown in Appendix A is based on information provided by the City of Bandon. Water distribution and storage facilities, in conjunction with the supply system, must be of sufficient capacity to furnish water for fighting fires, in addition to maintaining adequate flow for residential, commercial and industrial demands. Therefore, land use planning has been considered in this water study in conjunction with the existing water system evaluation when improvements are recommended. For purposes of this report, land use has been divided into three categories: residential, commercial and industrial.

CHAPTER 5

WATER REQUIREMENTS

CITY OF BANDON
WATER SYSTEM MASTER PLAN

CHAPTER 5
WATER REQUIREMENTS

5.1 GENERAL

Water demands in this section are based on population projections developed in Chapter 4 and on meter readings for the last 5 years taken at the Bandon Water Master Meter. Existing and projected water requirements, in conjunction with land use plans, are the basis for sizing and capacities incorporated into the proposed facilities.

To define the characteristics of water use, the following terms are used:

> **Average Annual Demand** (AAD) - Total use for the year divided by the number of days in the year.
>
> **Maximum Month Demand** (MMD) - Total use for the month with the highest total use during the year, divided by the number of days in the month.
>
> **Maximum Day Demand** (MDD) - Total use for the day with the highest total use during the year.
>
> **Peak Hour Demand** (PHD) - Total use for the hour with the highest total use for the year. Usually expressed in terms of a 24-hour period.

5.2 PRESENT WATER DEMAND

The quantity of water produced each day with the City's existing treatment plan, during the 4-year, 8-month period from January 1, 1988 through August 31, 1992, is shown on Figure 5-1. Daily water production during the 1991 calendar year is shown on Figure 5-2.

Maximum daily water demand generally occurs during the summer, although the highest water demand during the time period evaluated occurred during January 1991, when there was cold, freezing weather. The excessive water use was due to broken pipes and water taps left open to prevent freezing. It is not reasonable to design a water system around this condition. The primary concern is summer water usage. Maximum daily summer demand occurred on July 25, 1991 and was 1.1 million gallons per day (MGD).

Figure 5-3 shows the normalized monthly demand (ratio of monthly demand to average annual flow) for the years 1988-1991. This figure shows that water demand fluctuates throughout the year, with typical winter demands being about one-half the typical summer demands.

FIGURE 5-1.

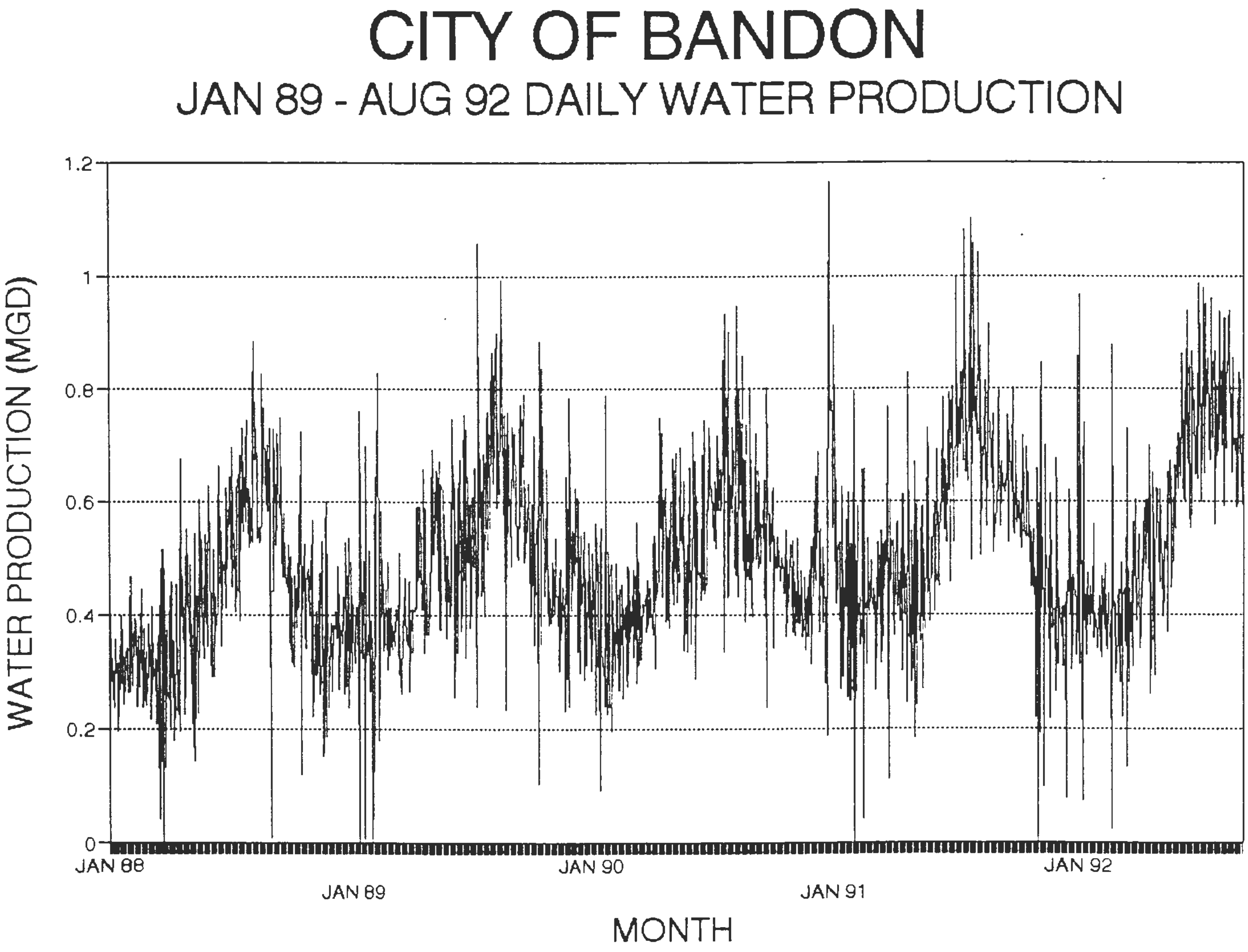

CITY OF BANDON
JAN 89 - AUG 92 DAILY WATER PRODUCTION
WATER PRODUCTION (MGD)
1.2
1
0.8
0.6
0.4
0.2
0
JAN 88
JAN 89
JAN 90
JAN 91
JAN 92
MONTH

FIGURE 5-2.

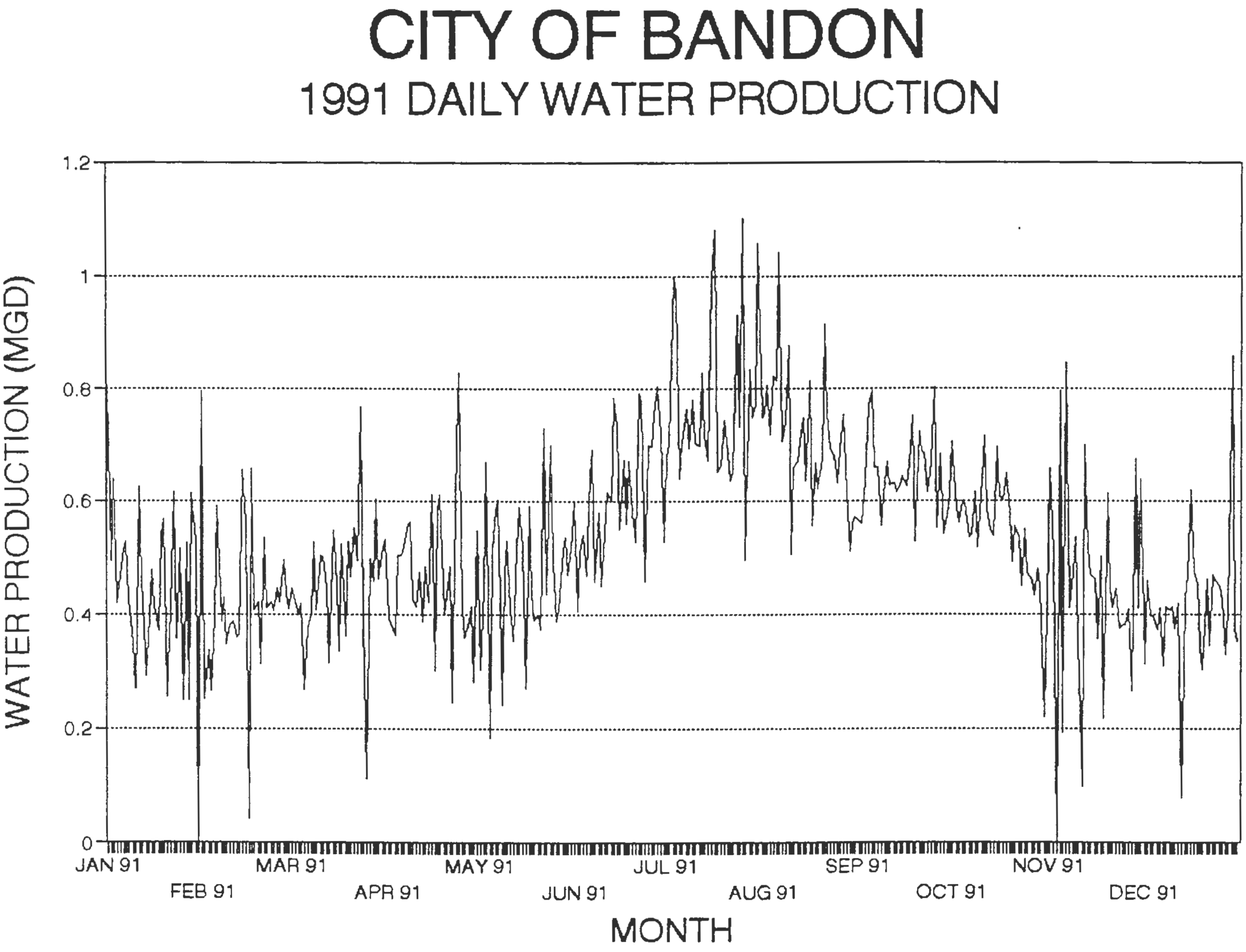
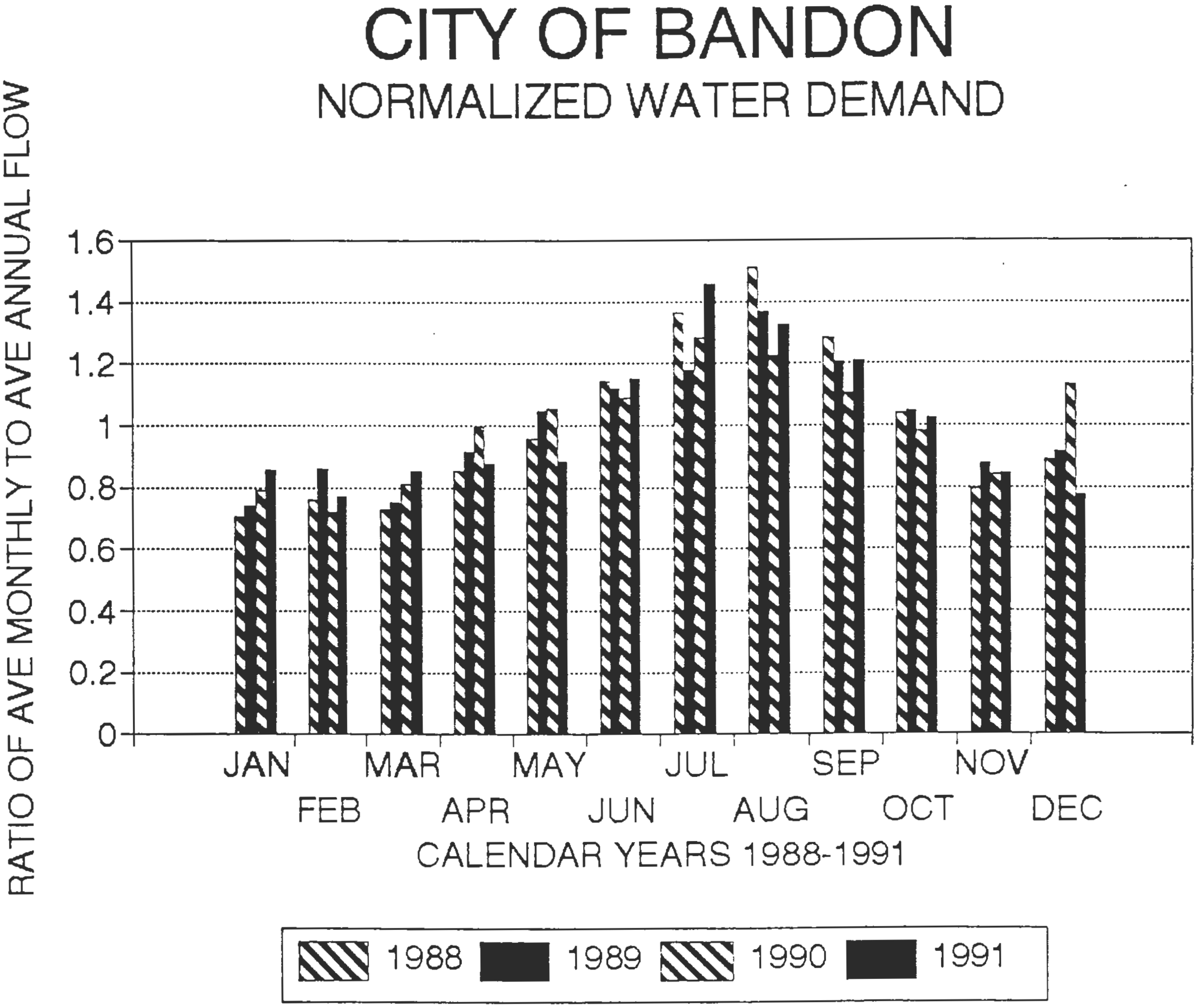

CITY OF BANDON
1991 DAILY WATER PRODUCTION
WATER PRODUCTION (MGD)
1.2
1
0.8
0.6
0.4
0.2
0
JAN 91
FEB 91
MAR 91
APR 91
MAY 91
JUN 91
JUL 91
AUG 91
SEP 91
OCT 91
NOV 91
DEC 91
MONTH

FIGURE 5-3.


CITY OF BANDON
NORMALIZED WATER DEMAND
RATIO OF AVE MONTHLY TO AVE ANNUAL FLOW
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC
CALENDAR YEARS 1988-1991
1988
1989
1990
1991

Water use begins to increase in April, and generally peaks in July or August. Maximum monthly usage typically ranges from 1.4 to 1.5 times the annual average.

5.3 WATER USER CHARACTERISTICS

Bandon billing records provide breakdowns of water usage by the following customer classes:

BILLING CODE	CLASSIFICATION
WA01	Residential (Single Family and Duplexes) - Inside City Limits
WA02	Commercial/Industrial (Includes Multi-Family Residential) - Inside City Limits.
WA03	Residential (Single Family and Duplexes) - Outside City limits
WA04	Commercial/Industrial (Includes Multi-Family Residential) - Outside City Limits

Information from a utility billing analysis provided by the City of Bandon for the one-year (12 month) period from February 1991 through January 1992 is summarized in Table 5-1 and shown in Figure 5-4 (12-month period started on February 1, 1992 because of unusually high water usage during freezing weather in January 1991).

Inside City Limits

Customers inside City Limits constitute the vast majority of metered water consumption in Bandon, approximately 97 percent.

Single-Family Residential

Single-family residential consumption was approximately 49 percent (47 percent inside City Limits, 2 percent outside) of the total amount of metered water usage.

Residential consumption generally is used for domestic usage with some summer irrigation of lawns and gardens.

Commercial/Multi-Family

Commercial/Multi-family residential usage was 51 percent (50 percent inside City Limits, 1 percent outside). Multi-family residential (except for duplexes with 1 meter per unit, which are considered residential) usage is included in the City's commercial billing category.

TABLE 5-1. City of Bandon Equivalent Dwelling Units Computation February 1991 Through January 1992

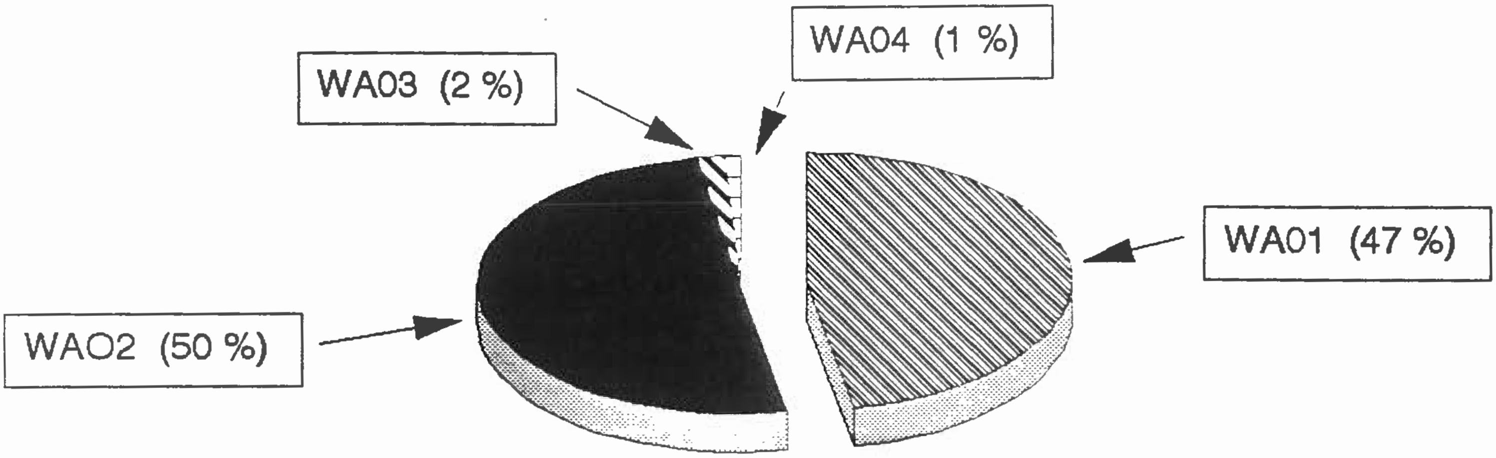
BILLING CODE	CLASSIFICATION	ACCOUNTS BILLED	ANNUAL CONSUMPTION BILLED (1000 GAL)	PERCENT CONSUMPTION	AVERAGE DAILY CONSUMPTION (GPD)	CONSUMPTION PER ACCOUNT (GPD)	NUMBER EDU'S
WA01	RESIDENTIAL-CITY	1,007	701,692	47%	193,666	192	1,007
WA02	COM/IND-CITY	235	75,372	50%	206,485	877	1,074
WA03	RESIDENTIAL - OUTSIDE CITY	39	2,388	2%	6,537	166	34
WA04	COM/IND-OUTSIDE CITY	7	1,380	1%	3,792	511	20
	TOTAL	1,289	149,820	100%	410,479	1,747	2,135

NOTE: COMM/IND INCLUDES MULTI-FAMILY RESIDENTIAL

FIGURE 5-4.

CITY OF BANDON
WATER PURCHASE BY CUSTOMER CLASS

FEBRUARY 1991 THROUGH JANUARY 1992



WA01 - SINGLE FAMILY RESIDENTIAL AND DUPLEXES INSIDE CITY
WA02 - COMM/IND INSIDE CITY, INCLUDES MULTI-FAMILY
WA03 - SINGLE FAMILY RESIDENTIAL AND DUPLEXES OUTSIDE CITY
WA04 - COMM/IND OUTSIDE CITY

Industrial

Seafood processors use large quantities of water in Bandon. Peak daily usage is approximately 200,000 gallons per day. The quantity of water used fluctuates significantly, and depends on the season and on how much seafood is brought in for processing that day.

Equivalent Dwelling Units

Equivalent dwelling units (EDU's) are a useful concept for evaluating water usage. An EDU is defined as having the equivalent water consumption of a single-family dwelling unit. EDU computations for Bandon are listed in Table 5-1. Based on metered water consumption, an EDU uses an average of 192 gallons per day (GPD). In 1991 there was a total of approximately 2,135 EDU's. Therefore, the City of Bandon supplied enough water during 1991 to meet the equivalent needs of 2,135 single-family households.

The 1991 service population estimate for Bandon was 2,421 people. There presently is approximately 1.13 people (full-time residents) per EDU. This number appears low because commercial and industrial water usage is included.

5.4 NON-METERED (NON-REVENUE PRODUCING) WATER

Non-metered water is the difference between the water produced at the treatment plant and the metered consumption. The cause of this discrepancy can be:

1. Leakage within the distribution system.
2. Unauthorized use or connections without meters.
3. Inaccurate water meters.
4. Water for fire fighting and operational use, such as street cleaning, line flushing, water main testing and sewer flushing.
5. Other approved, but non-metered water uses.

The City of Bandon provided records of monthly water sales for the 12-month period of February 1991 to February 1992. During the one-year period, approximately 150 million gallons of water was sold. Approximately 195 million gallons of water was produced at the treatment plant over the same time period. Non-metered water was approximately 23 percent of the total produced. Typical non-metered usage for water systems ranges from 15 to 35 percent (annual average). Often a significant portion of the water is for approved, but non-metered water users, such as parks. The City of Florence recently metered all water users, including public and municipal customers, and found that these previously non-metered users consume up to 10 percent of the water produced annually.

Bandon is at the low end of the range observed in Oregon coastal communities for non-metered water. Some reduction in water leakage is expected as the City replaces deteriorated lines. However, it should be noted that it is difficult to achieve substantial reductions in non-metered water usage for communities that start with the percentage of non-metered water usage in the range of Bandon's.

5.5 PER CAPITA DEMANDS

Water demands in Bandon have been summarized in Figure 5-5 and Table 5-2. Per capita demands in Table 5-2 have been computed in gallons per capita per day (gpcd) by dividing the water demand by the service population.

Maximum day demand (MDD) during 1991 was 1.1 MGD, 2.06 times higher than the Average Annual Demand (AAD) of 0.535 MGD. The Maximum Monthly Demand (MMD) in 1991 was 0.77 MGD, 1.45 times more than the AAD.

Bandon's average annual per capita demand ranged from 164 to 221 gpcd during the time period considered. There are two primary reasons for the steady increase in per capita demand:

1) Water demand from tourists and part-time residents is growing faster than the full-time population.

2) The 1990 census population was significantly lower than previous certified population estimates, which resulted in a computed increase in per capita flow.

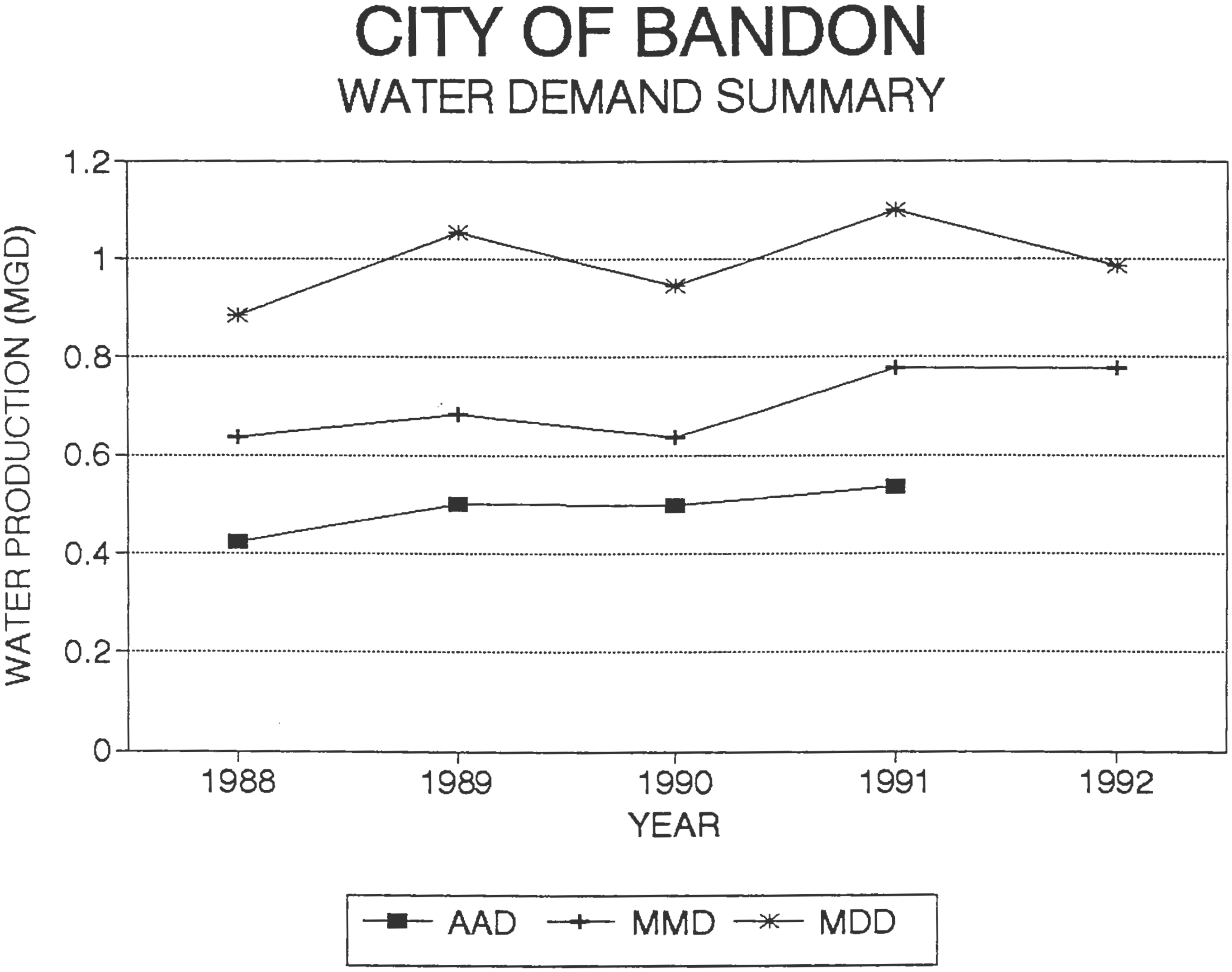
Per capita flows are similar in most communities. The United States Department of Health, Education and Welfare developed average consumption records for the Pacific Northwest in the late 1970's, and determined the average per capita consumption was approximately 185 gpcd.

5.6 PER CAPITA DESIGN VALUES

Design Flows

A statistical plot (log-log plot) was made of the water system flows for various demand conditions (Figure 5-6). The percent of time a flow condition is exceeded is plotted along the horizontal axis and the flow rate is plotted along the vertical axis. Recurrence intervals for different flow parameters are shown in Table 5-3. Peak hourly flow must be extrapolated from other flow conditions, since it is not measured for the Bandon system. The measured data falls relatively well along a straight line. A summary of per capita design flows is presented in Table 5-4.

FIGURE 5-5



AAD = AVERAGE ANNUAL DEMAND

MMD = MAXIMUM MONTHLY DEMAND

MDD = MAXIMUM DAY DEMAND

TABLE 5-2

WATER DEMAND SUMMARY

		Average Annual Demand (AAD)		Maximum Month Demand (MMD)			Maximum Day Demand (MDD)		
Year	Service Population	Flow (MGD)	Per Capita Flow (GPCD)	Flow (MGPD)	Per Capita Flow (GPCD)	Peaking Factor MMD/AAD	Flow (MGPD)	Per Capita Flow (GPCD)	Peaking Factor MDD/AAD
1988	2,570	0.423	164	0.637	248	1.51	0.884	344	2.09
1989	2,617	0.502	192	0.686	262	1.37	1.056	404	2.10
1990	2,344	0.497	212	0.637	272	1.28	0.946	404	1.90
1991	2,421	0.535	221	0.777	321	1.45	1.100	454	2.06
2 yr Ave	2,383	0.516	217	0.707	296	1.37	1.023	429	1.98
Design			221		321	1.5		454	2.1

TABLE 5-3

RECURRENCE INTERVALS FOR FLOW PARAMETERS.

Flow Parameter	Number of Times Exceeded	Probability of Exceedence (Percent)
Peak Hourly	1 hour per year = 1/8,760	0.011
Peak Daily	1 day per year = 1/365	0.274
Peak Weekly	1 week per year = 1/52	1.92
Maximum Month	1 month per year = 1/2	8.33
Average Daily	6 months per year = 6/12	50

FIGURE 5-6

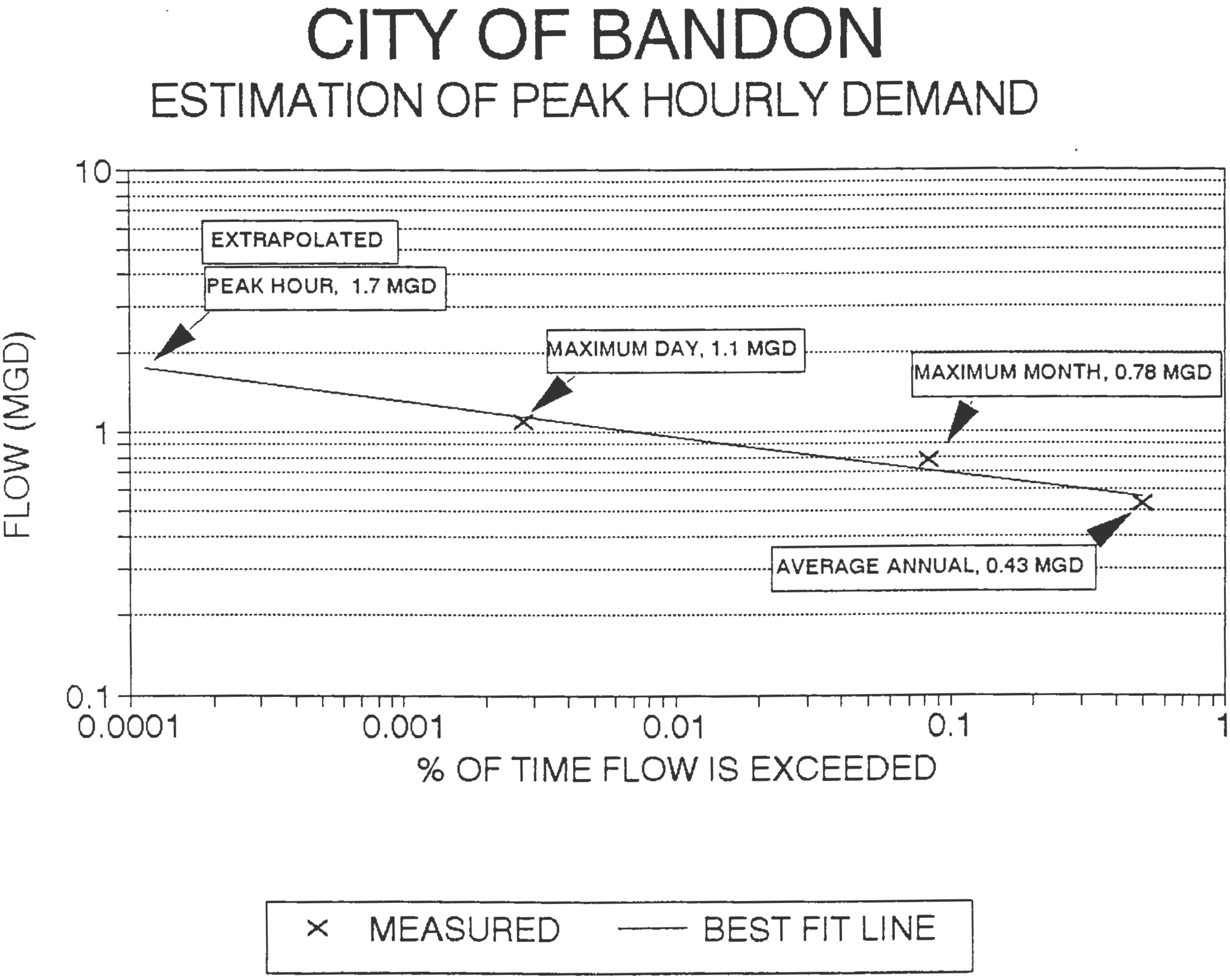

CITY OF BANDON
ESTIMATION OF PEAK HOURLY DEMAND
FLOW (MGD)
10
1
0.1
0.0001
0.001
0.01
0.1
1
% OF TIME FLOW IS EXCEEDED
EXTRAPOLATED
PEAK HOUR, 1.7 MGD
MAXIMUM DAY, 1.1 MGD
MAXIMUM MONTH, 0.78 MGD
AVERAGE ANNUAL, 0.43 MGD
× MEASURED
—— BEST FIT LINE

TABLE 5-4

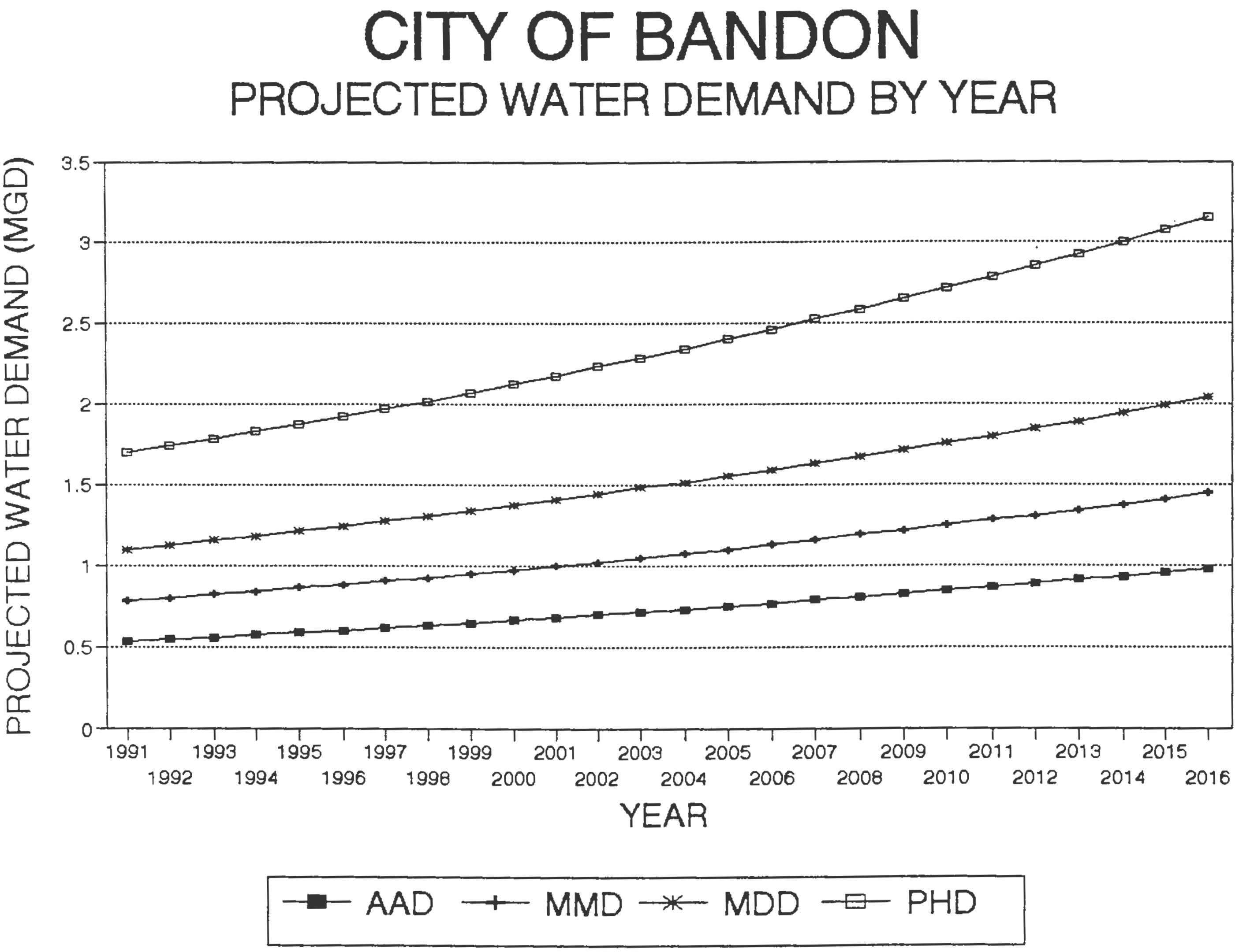
PER CAPITA DESIGN FLOWS AND PEAKING FACTORS

	Per Capita Flows (GPCD)
	HGE 1991
Demand	Design
Average Annual	221
Maximum Month	321
Maximum Day	454
Peak Hour	702
	Peaking Factors
	HGE 1991
Demand	Design
ADD	1
MMD/AAD	1.5
MDD/MMD	1.4
MDD/AAD	2.1
PHD/AAD	3.2
PHD/MMD	2.2
PHD/MDD	1.5

5.7 PROJECTED WATER DEMAND

The projected demand is based on the design per capita flows and projected service area population. Projected future service area demands for various flow conditions through the year 2017 are shown in Figure 5-7 and are listed in Table 5-5. Projected EDU's are also included in Table 5-5.

FIGURE 5-7



AAD = AVERAGE ANNUAL DEMAND
MMD = MAXIMUM MONTHLY DEMAND
MDD = MAXIMUM DAY DEMAND
PHD = PEAK HOUR DEMAND

TABLE 5-5

			Projected Flow			
Year	Service Population	Service EDU'S	AAD	MMD	MDD	PHD
1991	2,421	2,135	0.53	0.78	1.10	1.70
1992	2,482	2,188	0.54	0.80	1.13	1.74
1993	2,544	2,243	0.56	0.82	1.16	1.79
1994	2,607	2,299	0.57	0.84	1.18	1.83
1995	2,672	2,357	0.59	0.86	1.21	1.88
1996	2,739	2,416	0.60	0.88	1.24	1.92
1997	2,808	2,476	0.61	0.90	1.28	1.97
1998	2,878	2,538	0.63	0.93	1.31	2.02
1999	2,950	2,601	0.65	0.95	1.34	2.07
2000	3,023	2,666	0.66	0.97	1.37	2.12
2001	3,099	2,733	0.68	1.00	1.41	2.18
2002	3,177	2,801	0.70	1.02	1.44	2.23
2003	3,256	2,871	0.71	1.05	1.48	2.29
2004	3,337	2,943	0.73	1.08	1.52	2.34
2005	3,421	3,017	0.75	1.10	1.55	2.40
2006	3,506	3,092	0.77	1.13	1.59	2.46
2007	3,594	3,169	0.79	1.16	1.63	2.52
2008	3,684	3,249	0.81	1.19	1.67	2.59
2009	3,776	3,330	0.83	1.22	1.72	2.65
2010	3,870	3,413	0.85	1.25	1.76	2.72
2011	3,967	3,498	0.87	1.28	1.80	2.79
2012	4,066	3,586	0.89	1.31	1.85	2.86
2013	4,168	3,676	0.91	1.34	1.89	2.93
2014	4,272	3,767	0.94	1.38	1.94	3.00
2015	4,379	3,862	0.96	1.41	1.99	3.07
2016	4,488	3,958	0.98	1.45	2.04	3.15
2017	4,601	4,057	1.01	1.48	2.09	3.23

AAD = AVERAGE ANNUAL DEMAND
MMD = MAXIMUM MONTHLY DEMAND
MDD = MAXIMUM DAY DEMAND
PHD = PEAK HOUR DEMAND

5.8 PRIORITIES

For purposes of this report, the water development plan has been separated into three priority categories. Water demand, service EDU's and full-time service population are all indicators of when the project should be initiated. The four priority categories are presented in Table 5-6.

TABLE 5-6
PRIORITY CATEGORIES

PRIORITY	FULL-TIME PERMANENT SERVICE POPULATION (RANGE)	SERVICE EDU'S (RANGE)	WATER DEMAND-MGD (RANGE)		ESTIMATED YEAR PROJECT INITIATED (RANGE)
			AVERAGE DAILY (ADF)	MAXIMUM DAILY (MDF)	
I	2,482	2,188	0.54	1.13	IMMEDIATE
II	2,880-3,250	2,540-2,870	.63 - .71	1.3 - 1.5	1998-2003
III	3,250-3,680	2,870-3,250	.71 - .81	1.5 - 1.7	2003-2008
IV	3,680-4,600	3,250-4,060	.81 - 1.0	1.7 - 2.1	2008-2017

5.9 FIRE FLOW REQUIREMENTS

The amount of water used in fire fighting in comparison to total yearly water consumption is negligible, but heavy demands during major potential fires greatly influence the design of the distribution system and storage reservoirs.

Adequacy of a water system to supply fire flows is determined by the volume of flow and the duration of flow available throughout the system.

Communities are surveyed and graded by the Insurance Services Office as to the level of fire protection provided to establish fire insurance rates. The City presently has a Class 5 rating; Class 1 is the best class (10 is the worst). A Class 5 rating is considered a good rating for a community the size of Bandon.

Evaluations are based on a limited level of fire suppression deficiencies. Fully sprinkled buildings, regardless of size, and any building with a needed fire flow of over 3,500 gpm will not be considered when establishing a community's protection class, except for response distance and aerial ladder needs. Buildings that have larger than a 3,500 gpm needed fire flow, and are not sufficiently protected, may have a poorer class assigned to that individual property. This puts the responsibility of fire protection for large properties or large fire protection problems on the individual property owners instead of on the community.

Recommended fire flows for single-family residential dwellings are based on a complicated formula that includes square footage as a variable. The maximum fire flow recommended is 1,500 gpm.

Bandon's water storage requirements for fire flow will be based on a flow of 3,500 gpm and a corresponding duration of 3 hours, for a total of 630,000 gallons. This will also provide adequate storage to supply fire flows for the general public.

Distribution lines need to be adequately sized to carry the fire flow from storage reservoirs to fire hydrants. The distribution system will be evaluated based on a flow of 3,500 gpm in commercial areas and 1,500 gpm in residential areas.

5.10 WATER CONSERVATION PROGRAM

Reducing per capita use through a water conservation program might delay the need for new facilities and extend the life of existing facilities. Four general approaches to water conservation include:

1. Public education and awareness programs.

2. Installation of flow reduction or restriction devices in households, such as flow restrictors in shower heads.

3. Increase water rates, particularly rate schedules which increase with increasing consumption.

4. Mandatory rationing, such as every other day lawn irrigation.

The success of a water conservation program is impossible to predict. It has been documented in many communities that reduction in water usage has been limited or temporary due to voluntary conservation programs. Therefore, prudent planning requires that future needs be projected based on existing per capita flows.

CHAPTER 6

REGULATORY REQUIREMENTS

CITY OF BANDON
WATER SYSTEM MASTER PLAN

CHAPTER 6
REGULATORY REQUIREMENTS

6.1 GENERAL

Bandon presently gets all of its water from Ferry Creek and Geiger Creek, surface water sources.

Regulatory requirements for water treatment are significantly different for groundwater and surface water sources. Groundwater is typically protected from the environment since the aquifer is underground, while surface water is exposed to the environment and is more likely to become contaminated with pathogens.

Rules applying to both treatment technologies will be summarized in this Chapter (Chapter 6).

6.2 SURFACE WATER SOURCES

The following is a brief summary of the rules included in the Clean Drinking Water Act of 1981 and the new Surface Water Treatment Rule (SWTR) finalized in June 1989. The Oregon State Health Division and U.S. Environmental Protection Agency (EPA) are responsible for supervising public water systems in the State of Oregon.

6.2.1 Existing Requirements

Minimum requirements for water quality have been set by the Environmental Protection Agency. Contamination sampling and analytical requirements vary for each class of contaminant and EPA rules and regulations must be consulted. For example, the coliform density samples must be taken at regular time intervals and in numbers proportionate to the population served by the system. Turbidity sampling must be taken continuously, or at a minimum, once every four hours. Inorganic chemical sampling must be repeated yearly, while organic chemical sampling must be accomplished at three year intervals. Monitoring for radioactive contaminant waste is also required.

Samples must be analyzed by State approved laboratories, except measurements for turbidity and free chlorine residual, which may be performed by any person acceptable to the State.

The maximum contaminant level for turbidity in drinking water is presently one turbidity unit, as determined by the monthly average. Note that because of mathematical roundoff the maximum level is actually 1.49 units.

If the maximum allowable limit has been exceeded, the community must report the occurrence to the State Health Division within 48 hours. If the monthly average of the daily samples exceeds the maximum allowable limit the water supplier must also notify the public.

Microbiological contaminants should be sampled at least twice a month based on Bandon's population.

6.2.2 Requirements of New Surface Water Treatment Rule

The new Surface Water Treatment Rule (SWTR) is less subjective than the existing requirements. It assumes that all surface sources are at some risk to contamination by pathogens and that current regulations are insufficient to prevent waterborne disease outbreaks. The SWTR is designed to control microbiological contamination in general and to provide protection from waterborne pathogens. All filtration systems must be in compliance with the new rule by June 29, 1993 and non-filtering systems by December 30, 1991.

Public water systems subject to the Rule must achieve at least:

A. 99.9% (3 log) removal and/or inactivation of Giardia lamblia cysts; and

B. 99.99% (4 log) removal and/or inactivation of viruses.

To accomplish these removals, most systems must disinfect and filter. Filtration can be avoided if certain source water quality and site specific conditions are met.

Filtration requirements are different for the different filtration technologies. All filtration technologies must produce final water turbidities less than 5 NTU and turbidity levels must be met in 95% of the filtered water measurements taken each month. A summary of the acceptable filtration technologies and their respective performance technologies for treated surface water follow:

A. Conventional and Direct

   1. 95 percent of turbidity readings less than or equal to 0.5 NTU each month.

   2. State may substitute a higher turbidity level up to 1 NTU, if system can still achieve 99.9% removal and/or inactivation of Giardia.

   3. Performance must be documented.

   4. Needs one year pilot study.

B. Alternate methods.

1. 95 percent of turbidity readings less than or equal to 1 NTU each month.
2. Performance must be documented.
3. One year pilot study required to demonstrate performance.

C. Slow Sand

1. 95 percent of turbidity readings less than or equal to 1 NTU each month.
2. State may substitute a higher turbidity level if there is no significant interference with disinfection at the higher level.
3. One year pilot study required to demonstrate performance.

6.2.3 Criteria for Avoiding Filtration

The new Surface Water Treatment Rule specifies criteria under which "filtration" is required as a treatment technique for public water systems supplied by surface water sources. This rule requires mandatory filtration for virtually all public water systems using surface water by June 29, 1993. A filtration process removes sediment, organic matter, viruses, bacteria, and harmful organisms before the water is disinfected. In establishing these criteria, EPA must consider source water quality, protection afforded by watershed management, treatment techniques such as disinfection practice and length of water storage, and other factors relevant to the protection of health.

The Oregon State Health Division will be responsible for determining which water systems need filtration. An exemption to the filtration requirement can be made, but an exemption requires that a detailed assessment of the unfiltered surface water supply be completed. This assessment must address the source water quality, the disinfection system, watershed management, a sanitary survey of the water system facilities, and the history of waterborne disease outbreaks.

Source Water Quality *(For Filtration Exception)*

Raw water quality of a source is generally used as the best indicator of the ability of disinfection alone to inactivate Giardia and enteric viruses. The most important parameters used in evaluating the source water quality are turbidity and coliform counts. SWTR source water requirements for unfiltered systems are as follows:

A. Turbidity[1]

1. Turbidity of source water must not exceed 5 NTU. Brief periods of turbidity above 5 NTU because of unusual conditions may be allowed.

2. A raw water coliform sample must be collected on each day that the supply exceeds 1 NTU.

3. Daily turbidity readings, taken at a minimum every 4 hours that the system serves water to the public, in the form of grab samples, are required. Continuous turbidity monitoring can be substituted for the grab sample monitoring upon approval from the State.

B. Coliform Count

1. Source water prior to disinfection must have the following in 90 percent or more of the measurements:

    a. Fecal coliform level ≤ 20/100 ml, or
    b. total coliform level ≤ 100/100 ml

2. Raw water coliform monitoring requirements must be provided in accordance with Table 6-1.

TABLE 6-1. RAW WATER COLIFORM MONITORING REQUIREMENTS.

POPULATION	SAMPLES REQUIRED PER MONTH
Less than 1,000	1
1,001 - 2,500	2
2,501 - 83,000	1/800 persons

Note: Laboratory analysis is a complicated procedure, but source concentrations indicate the number of coliform bacteria per 100 ml sample.

Disinfection System ***(For Filtration Exception)***

Any disinfection system must provide adequate treatment, reliable facilities, and maintenance of disinfectant residuals in the system. The SWTR source water requirements for unfiltered systems are as follows:

---

[1] Because the standards are 1 and 5 NTU and not 1.0 and 5.0 NTU respectively, readings up to 1.49 and 5.49 are allowable based on rounding to the nearest whole number.

A. Disinfection will inactivate 99.9 percent (3 log removal) of Giardia cysts and 99.99 percent (4 log removal) of enteric viruses.

B. Disinfection system must have redundant components including auxiliary power supply with automatic start-up and alarm to ensure that disinfectant application is maintained continuously while water is being delivered to the distribution system, or automatic shut-off of delivery of water to the distribution system whenever there is less than 0.2 mg/l of residual disinfectant concentration in the water.

C. Residual disinfectant concentration cannot be less than 0.2 mg/l for more than 4 hours and total chlorine, combined chlorine, or chlorine dioxide can not be undetectable in more than 5 percent of the samples each month, for any two consecutive months that the system serves water to the public.

Inactivation of Giardia and viruses is based on a CT value. A CT value is calculated by multiplying the concentration of a disinfectant in milligrams per liter and the contact time in minutes. The required CT value to achieve the minimum inactivation is dependent on the type of disinfectant used, the chlorine residual, pH, and temperature. Contact time must also be documented through tracer studies. Disinfection must achieve at least 3 log reduction of Giardia.

Watershed Management *(For Filtration Exception)*

An effective watershed control program is essential in assuring quality water for an unfiltered water system. When establishing a watershed control program, both man-made and natural contamination sources should be examined. A list of possible concerns that should be addressed follows:

A. Man-made Contamination Sources

1. Roads.

    a. Access to unauthorized personnel and excessive public use.
    b. Potential for accidental spills or dumped loads.

2. Residential Areas.

    a. Failing sewage disposal.

3. Industrial Areas.

4. Agriculture and Forestry.
    a. Production of turbidity resulting from soil disturbances.
5. Recreation

B. Natural Contamination Sources.

1. Transmission of Giardia from aquatic mammals.
2. Landslides.
3. Algae growth in reservoir or lake storage within the watershed.

A watershed control program must be developed in written form. It should contain a description of the physical characteristics of the watershed, maps, detailed descriptions of contamination sources and associated control measures, utility watershed policies, and other information. The document must be available for review by regulatory agencies and should be updated regularly and revised as necessary.

Sanitary Survey *(For Filtration Exception)*

An annual sanitary survey of the unfiltered water supply must be conducted by the Oregon State Health Division or a third party approved by the State. The survey should provide a comprehensive review of the City's water system operation, including watershed control, the disinfection system and raw water quality.

Disease Outbreak History *(For Filtration Exception)*

Any system supplying unfiltered water must have a record clear of waterborne disease outbreaks or must show that any outbreaks that were identified were resolved through appropriate water system modifications.

6.3 GROUNDWATER SOURCES

6.3.1. Existing Requirements for Groundwater Treatment

Water samples must be routinely collected and submitted for laboratory analyses. Frequency of sampling and maximum contaminate levels for inorganic and organic chemicals are prescribed by Oregon Administrative Rules, Chapter 333, Public Water Systems. If the groundwater source is not directly influenced by surface water, and water quality is acceptable, then no treatment is required. However, immediate corrective actions must be taken when the results of analyses or measurements indicate that maximum contaminant levels have been exceeded. In certain instances, as with most coastal communities that use groundwater, some treatment is preferable to improve the taste and aesthetics of the water.

6.3.2 Potential Disinfection Requirements for Groundwater in the Future

The Oregon State Health Division is advising water suppliers of potential groundwater requirements for disinfection, although no formal schedule for implementation has been established. The basic requirement will be 4-log (99.99 percent) inactivation of viruses.

This level of virus inactivation is easier to achieve than 3-log inactivation of Giardia. However, some modifications to existing piping for construction of a disinfection (usually chlorine) contact basin may be required in the future.

6.4 ADDITIONAL LABORATORY SAMPLING REQUIREMENTS OF AMENDED SAFE WATER DRINKING ACT

The 1986 amendments to the Safe Drinking Water Act require sampling for additional contaminants. A phased approach was proposed, with each phase requiring additional samples. There will be a total of 5 phases. Starting January 1, 1993 all community water systems (both groundwater and surface water sources) must analyze their water for the Phase II synthetic organic contaminants (SOC's), including about 40 pesticides. The amendments require that each source be sampled in each of four consecutive quarters of a calendar year determined by the State. Costs for these analyses (Phase II) have been estimated to be as high as $1,000 to $1,500 per sample (up to $4,000 to $6,000 per source for the full year of monitoring), and possibly higher.

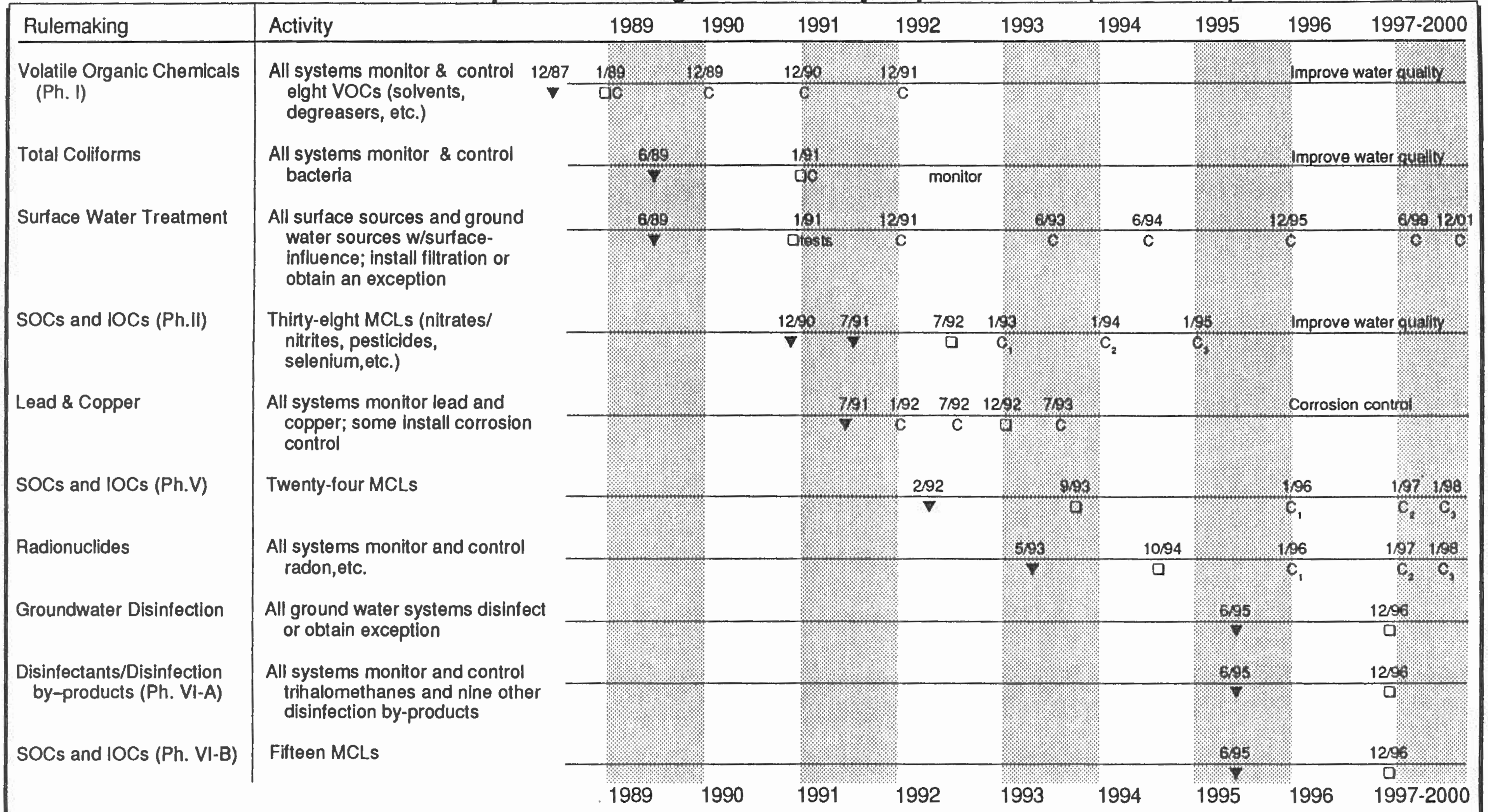
Full sampling will need to be performed unless it has been determined that the system is not vulnerable to contamination, and a waiver has been granted by the State. Aquifer vulnerability is a function of both pesticide use and aquifer susceptibility. At least one quarter of sampling is required even with a waiver. The laboratory test results for one quarter of testing are useful in justifying a waiver.

6.5 SCHEDULE OF ANTICIPATED DRINKING WATER QUALITY IMPROVEMENTS (1989-2000) AND LABORATORY TESTING

A summary of anticipated water quality improvements and laboratory testing needs required under the new Safe Drinking Water Act, copied from the December 1991 issue of "Pipeline" published by the Oregon State Health Division is shown in Table 6-2.

State of Oregon

Schedule of Anticipated Drinking Water Quality Improvements (1989-2000)



Note: Many systems are already monitoring for and controlling some contaminants covered by these rulemakings

C = date when regulated systems must monitor and start controlling problem contaminants (see dates in text)
C1 = date when all large systems must monitor and start controlling problem contaminants; population greater than 300
C2 = date when all medium systems must monitor and start controlling problem contaminants; population 100-299
C3 = date when all small systems must monitor and start controlling problem contaminants; population less than 100
▼ = U.S. EPA finalizes rulemaking
☐ = Oregon Health Division adopts final state rule

Dec. 1991

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TABLE 6-2

CHAPTER 7

WATER SUPPLY

CITY OF BANDON
WATER SYSTEM MASTER PLAN

CHAPTER 7
WATER SUPPLY

7.1 GENERAL

This Chapter includes a discussion on present and future water needs of the City, utilization of the existing sources, water availability, water rights, environmental concerns, and alternatives for future additional water supply.

7.2 PRIOR STUDIES AND RECOMMENDATIONS

April 1990. "Ferry Creek Project Evaluation Under PL84-984", Tucson Myers & Associates.

This report describes the preliminary formulation and economic feasibility of a raw water storage project on Ferry Creek to meet the long-term water needs of the City of Bandon. Projected water needs through the year 2030 were based on an annual growth rate of 2.5 percent and a per-capita water use of 200 gpcd. A reservoir with about 1,400 acre-feet of storage was recommended to meet the future water needs in the Bandon area through the year 2030. Of that total, active storage was distributed as follows:

- *A. Bandon - 55.2 percent or 752 acre-feet.*
- *B. Irrigation (Cranberry Production) - 12.3 percent or 167 acre-feet.*
- *C. Fish Hatchery - 32.5 percent or 442 acre-feet.*

Physical features of the recommended project include:

- *A. An 81 foot high, zoned earth fill dam.*
- *B. Hydro-generation plant with a capacity of 120 kw.*
- *C. Pumping plant and discharge line from dam to City's water treatment plant.*
- *D. Pumping plant and discharge line for delivery of irrigation water.*
- *E. Relocation of existing hatchery to site downstream of dam.*

Estimated total project cost was $8,049,500.

Not Complete. "The Coos County Water Management Plan", CH_2M Hill. Preliminary findings and Recommendations.

A new reservoir(s) with significant storage volume would be necessary to meet year 2050 demands. Four alternative source options for Bandon were identified as of October 1992:

1. *Raise existing dams on Ferry Creek and Geiger Creeks as interim measures to meet near-term water needs.*
2. *Construct new dam and reservoir on Ferry Creek, downstream of existing reservoirs. Construction would flood current location of hatchery and relocation of facilities would become part of project cost.*
3. *Construct an off-stream reservoir in an adjacent watershed to provide storage for water pumped from Ferry and Geiger Creeks.*
4. *Construct a new multipurpose reservoir to satisfy municipal and agricultural demands.*

7.3 SCOPE OF 1992 H.G.E., INC., WATER SYSTEM MASTER PLAN

The two most recent, prior evaluations of water supply indicate that a large dam and impoundment will be required to meet the long-term water needs of Bandon. An identical recommendation was made in the 1974 Water Study completed by H.G.E., INC., with construction recommended by 1984. The dam would probably be located downstream of the existing fish hatchery, but could potentially be located in an adjacent watershed. A detailed analysis of reservoir sizing was conducted in the Tucson Myers & Associates Report. Preliminary dimensions and cost estimates are available for a large multi-purpose storage reservoir.

Concerning water supply issues, the scope of this "1992 Water System Master Plan", prepared by H.G.E., INC. is intended to:

1. Evaluate condition of existing dams and impoundments.
2. Estimate time-frame within which an adequate water supply will become a critical concern in Bandon.
3. Present interim solutions to provide an adequate water supply until a long-term solution such as a large impoundment can be constructed.
4. Consider the potential for developing Bradley Lake as a municipal water source.

5. Briefly consider the potential for groundwater supply and develop cost estimates for a more detailed evaluation.

7.4 CONDITION OF EXISTING DAMS AND IMPOUNDMENTS

The Ferry Creek dam and impoundment are shown in Photos 7-1 and 7-2, Photos 7-3 and 7-4 show the Geiger Creek dam and impoundment. Spillways for the two dams are shown in Photos 7-5 and 7-6.

A combined total of approximately 2.5 million gallons of water could be stored in the two impoundments, if there was no siltation behind the dams. This is a relatively small quantity of raw storage, that would be consumed in less than three days during peak summer demands. Presently, there are **no** water rights for water stored in the impoundments. Bandon and other water rights holders legally cannot divert water in excess of the amount flowing freely in the creeks.

Both dams are intended to serve as diversion structures only. The elevated water level allows water to gravity flow into the fish hatchery ponds. Also, the impoundments serve as settling basins since the slower water velocities behind the dam allow time for sediment to settle out.

Approximate dimensions of the existing dams and impoundments are listed in Table 3-1.

The drain for the Ferry Creek impoundment is blocked with wooden boards. This allows City staff and hatchery personnel the opportunity to visually inspect the condition of the Ferry Creek impoundment. The boards rotted out and the impounded water drained out during the winter of 1991/92. An inspection of facilities while drained was recorded on video cassette by City staff for documentation. H.G.E., INC. personnel reviewed the video and made field inspections of the facilities.

7.4.1 Ferry Creek

A. Structural Stability of Earthen Dam.

A detailed geotechnical analysis, beyond the scope of this study, would be required to accurately evaluate the structural integrity of the dam. Visually, the dam appears to be in good condition. City staff and hatchery personnel should continue to observe the condition and record any changes. If (when) heavy equipment is used to remove accumulated sediment behind the dam, care must be taken to insure that the structural integrity of the dam is not negatively impacted.

B. Wooden Causeways (Docks).

Two wooden docks extend out into the impoundment. One goes to the valve which controls the intake into the water supply line, the other is used to access

PHOTO 7-1. FERRY CREEK DAM

PHOTO 7-2. FERRY CREEK IMPOUNDMENT

PHOTO 7-3. GEIGER CREEK DAM

PHOTO 7-4. GEIGER CREEK IMPOUNDMENT

PHOTO 7-5. FERRY CREEK DAM SPILLWAY

PHOTO 7-6. GEIGER CREEK DAM SPILLWAY

the drain. Both docks were in poor condition when the impoundment was drained down. Hatchery personnel have done some minor repairs since then.

C. Intake.

The screened intake was repaired by hatchery personnel when the Ferry Creek impoundment was drained down. City staff feel that the Ferry Creek intake structure presently is in good condition.

D. Intake Valve.

The valve which operates the 14-inch line between the intake and the lower pump station will not close all the way and appears to be in poor condition. This valve is accessed from one of the wooden docks.

E. Siltation.

Except in the immediate vicinity of the water supply intake and drain where velocities are high enough to keep sediment scoured out, the Ferry Creek impoundment is virtually completely silted in. Average water depth when the impoundment is full, appears to be 1 to 2 feet. There has been significant siltation in the impoundment for at least 20 years, and it was noted in earlier reports. The material appears to be dense and well packed. There is also submerged woody debris in the impoundment.

F. Spillway.

There are some submerged logs and woody debris in the vicinity of the spillway.

7.4.2 Geiger Creek

Since the Geiger Creek impoundment has not been drained down for recent inspections, the current condition of the dam and impoundment is not known. However, it appears that the general condition is much better than the Ferry Creek impoundment, and there also appears to be less siltation in the impoundment.

7.4.3 Recommendations for Improving Condition of Existing Dams and Impoundments

It is recommended that Bandon budget $67,500 for a) repairing the wooden causeways in the Ferry Creek impoundment, b) replacing the Ferry Creek intake valve, and c) partial removal of sediment and woody debris in the Ferry Creek impoundment. Some of the money could also be utilized for repairs at Geiger Creek if it becomes apparent that conditions are worse than they initially appear. A cooperative effort with the State

Fish and Wildlife Department may prove to be of economic assistance to the City of Bandon in improving the existing impoundments, and this approach is encouraged.

There will not be enough money within the recommended budget to remove all the sediment in the Ferry Creek impoundment. However, there should be sufficient funds to remove a significant quantity, especially in close proximity to the dam. Additional dredging could be done in the future, if warranted. It is not possible at this time to accurately estimate the cost per cubic yard of removal and disposal of sediment from the impoundment. Initially there appear to be two options.

The first option would utilize a dredge consisting of pumps mounted on a floating barge, similar to the equipment owned by the Port of Bandon. Water and sediment would be pumped to a cleared storage site, probably located between the two impoundments. This approach was recently used to clean out the City's backwash pond. Runoff from the storage site would be a significant concern which would need to be addressed during the regulatory permitting and engineering design process. The advantage to this approach is that the work could potentially be done during the winter when water availability is not critical from the Ferry Creek source.

The second option for removal of sediment would be to drain the impoundment down and use ground based equipment such as a dragline. Ferry Creek would need to be diverted around the impoundment, and potentially might be piped to the Geiger Creek impoundment where the water could be utilized for municipal and hatchery use.

An application for a joint Division of State Lands/U.S. Army Corps of Engineers permit to remove material will be necessary for any option.

Final selection of the sediment removal technique and final cost per cubic yard of removal is dependent on permit approval and relevant regulatory agency review and comments.

7.5 WATER REQUIREMENTS

Bandon's existing and projected water requirements are discussed in Chapter 5. Water sources must be capable of providing enough water to supply the Maximum Daily Demand (MDD) of summer.

Bandon needs to plan beyond 25 years when evaluating future water sources. Water is a limited resource and is in demand from many user groups. It is important to establish priority dates for water rights as early as possible in order to insure water availability in the future.

Water supply requirements projected through the year 2050 (58 years from now) are listed on Table 7-1. An annual growth rate of 2.5 percent (compounded) has been used to estimate the increase in water demands.

TABLE 7-1

PROJECTED WATER SOURCE REQUIREMENTS

YEAR	SERVICE POPULATION	SERVICE EDU'S	MDD	
			(MGD)	(CFS)[1]
1991	2,421	2,135	1.1	1.70
1993	2,544	2,243	1.16	1.79
1998	2,878	2,538	1.31	2.02
2003	3,256	2,871	1.48	2.29
2008	3,684	3,249	1.67	2.59
2013	4,168	3,676	1.89	2.93
2018	4,716	4,159	2.14	3.32
2023	5,335	4,705	2.42	3.75
2028	6,036	5,323	2.74	4.24
2033	6,830	6,023	3.10	4.80
2038	7,727	6,814	3.51	5.43
2043	8,743	7,710	3.97	6.15
2048	9,891	8,723	4.49	6.95
2050	10,392	9,164	4.72	7.31

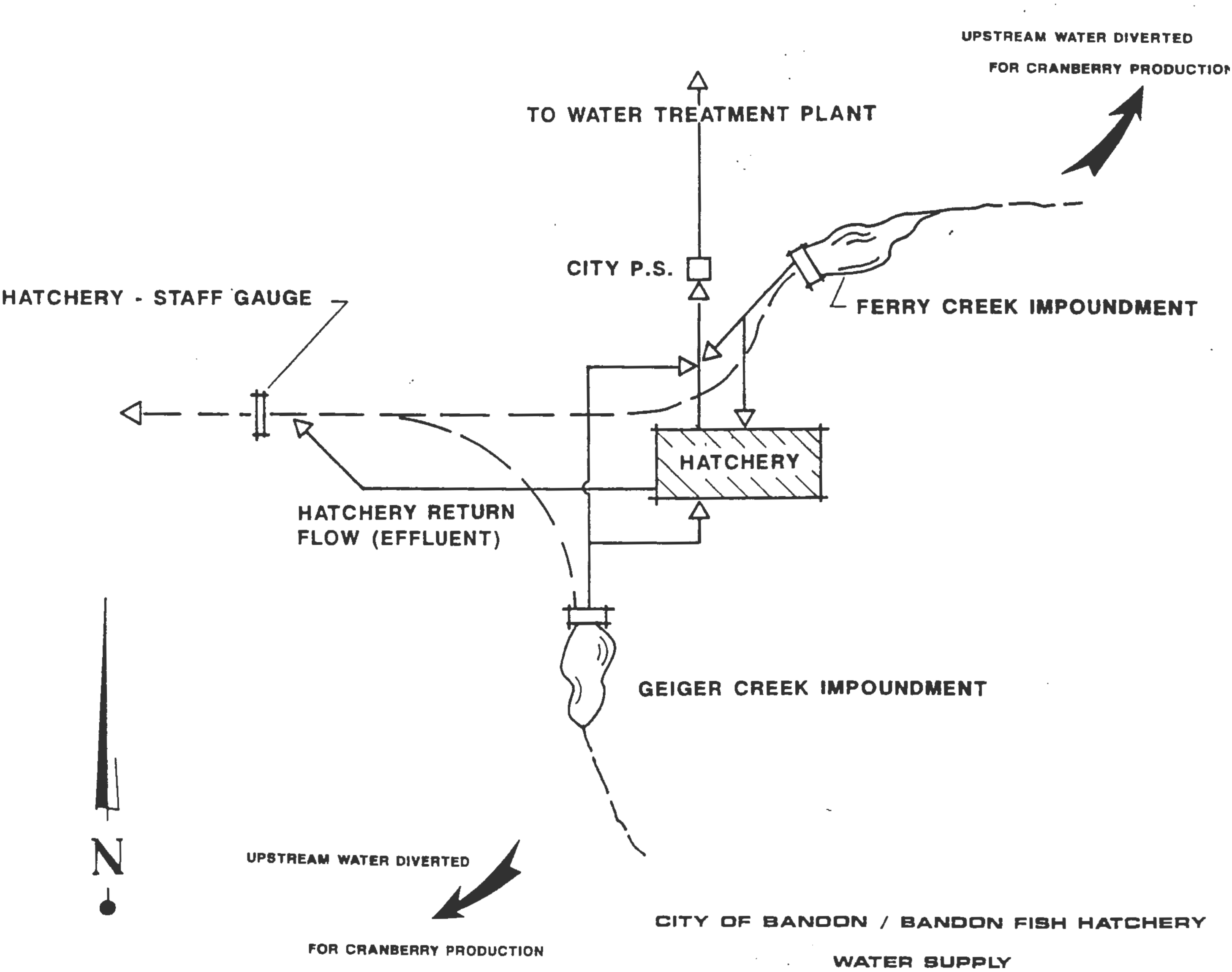
[1] CFS is abbreviation for cubic feet per second and is common terminology for stream flow

7.6 PRESENT WATER SUPPLY

Bandon's current sources of water are Ferry Creek and Geiger Creek, a tributary of Ferry Creek. Water is diverted from small impoundments on each creek. The impoundments contain minimum water storage, and are intended primarily to aid in the diversion of water from the creeks.

Other major water users in the Ferry Creek drainage basin include the Bandon Fish Hatchery and local farmers who divert water for cranberry production. Figure 7-1 is a schematic which shows the City's present water supply sources.

FIGURE 7-1
SCHEMATIC OF CITY'S WATER SOURCES AND OTHER USERS



7.6.1 Streamflow

Flows in Geiger Creek and Ferry Creek were estimated in Tucson Myers & Associates' report. Streamflows were estimated using measured stream data from Pony Creek at Coos Bay, and then adjusting for annual precipitation and drainage basin areas. Monthly flows[1] expected to be equaled or exceeded 50 percent of the time (average flows) are listed in Table 7-2.

A staff gage was requested by the City of Bandon and installed on upper Geiger Creek in the summer of 1991 by the State of Oregon Water Resources Department. Staff gage measurements are recorded by the County Water Master. The staff gage was installed at this point to validate the City's water rights permit for upper Geiger Creek. Detailed analyses of staff gage readings has not been made yet. However, some monthly readings were available from the County Water Master, and are shown in Table 7-2.

According to information provided by the Oregon State University, Agricultural Experiment Station, 1992 was the driest precipitation year in over 30 years of records. Therefore, measured flows should be lower than the estimated values (based on 50 percent recurrence interval). It is interesting to note that the measured flows on upper Geiger Creek during the months of June, July and August 1992 compare almost exactly with the estimated flows for the same months. Therefore, it is assumed that the Tucson Myers & Associates estimates are accurate enough for preliminary water supply evaluation (includes upper Geiger, lower Geiger, upper Ferry and lower Ferry Creeks) during summer months.

7.6.2 Water Rights

City Water Rights

According to a Distribution Report furnished by the District 19 Watermaster, DWR (Department of Water Resources), the City of Bandon has the following water rights on file:[2]

SOURCE	TRIB TO	POINT OF DIVERSION				P/C	RATE	PRIORITY
		TWNSHP	RNGE	SEC	Q/Q	*	CFS	DATE
SPRING BR#3	FERRY CRK	28 S	14 W	29	NENE	C	2.00	1/24/1910
GEIGER CREEK	FERRY CRK	29 S	14 W	4	NESW	P	5.00	6/19/1916
FERRY CREEK	COQUILLE R	28 S	14 W	29	SWSE	P	3.00	3/07/1961
GEIGER CREEK	FERRY CRK	28 S	14 W	29	SWSE	P	3.00	3/07/1961

*P = Permit/C = Certificate

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[1] Estimate from "Ferry Creek Project Evaluation Under PL84-984", April 1990, prepared by Tucson Myers and Associates.

[2] "Ferry Creek Project Evaluation Under PL84-984", April 1990, prepared by Tucson Myers & Associates.

TABLE 7-2.

CITY OF BANDON
COMPARISON BETWEEN ESTIMATED AND MEASURED FLOWS IN FERRY CREEK AND GEIGER CREEK

MONTHLY FLOWS WITH 50 PERCENT RECURRENCE INTERVAL, ESTIMATED IN TUCSON MYERS & ASSOCIATES REPORT

ESTIMATED RUNOFF, CFS	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
UPPER GEIGER	3.19	3.01	2.72	2.29	1.26	0.71	0.57	0.47	0.42	0.69	1.68	3.70
LOWER GEIGER	6.79	6.40	5.80	4.84	2.67	1.51	1.23	0.99	0.89	1.46	3.56	7.87
UPPER FERRY CREEK	8.00	7.53	6.82	5.70	3.14	1.78	1.45	1.16	1.04	1.71	4.20	9.24
LOWER FERRY CREEK	2.00	1.88	1.70	1.43	0.79	0.44	0.35	0.29	0.25	0.44	1.04	2.32
TOTALS	20.0	18.8	17.0	14.3	7.9	4.4	3.6	2.9	2.6	4.3	10.5	23.1

COMPARISON BETWEEN MEASURED AND ESTIMATED FLOWS IN UPPER GEIGER CREEK

RUNOFF COMPARISON, CFS	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
ESTIMATED UPPER GEIGER	3.19	3.01	2.72	2.29	1.26	0.71	0.57	0.47	0.42	0.69	1.68	3.70
MEASURED UPPER GEIGER, 1991								0.84		0.81	0.57	0.95
MEASURED UPPER GEIGER, 1992	1.88	2.60	1.29	0.74		0.65	0.56	0.50		0.45		

Figure 7-2 illustrates the approximate locations of points of diversion for City water rights. Neither City staff nor the Water Master have information as to when the City has utilized Spring Branch #3 as a water supply source[2]. The point of diversion reference shows a location mainly to the north of Highway 42S. The upper Geiger Creek source has not been utilized in the past.

Information presented in the Tucson Myers & Associates report on water rights for all users from the Geiger Creek and Ferry Creek tributaries has been reorganized in Table 7-3. The water rights summary in Table 7-3 lists the water rights by priority date. Estimated low streamflows are also listed. When organized in this fashion it becomes obvious that the major problem with the City's present water sources is that water rights have been over allocated. There is a total of 16.57 cfs of water rights for the tributaries, yet the estimated low streamflow is only 2.65 cfs.

Senior Water Rights and Streamflow

Priority dates are established for water rights based on the application date. Senior water rights have priority when there is a shortage of water. The process requires that the first person (group) to obtain a water right is the last to be shut off in times of low streamflow. Users with more recent water rights could potentially have their water supply shut off by the State if there is not sufficient flow to satisfy the needs of senior water users.

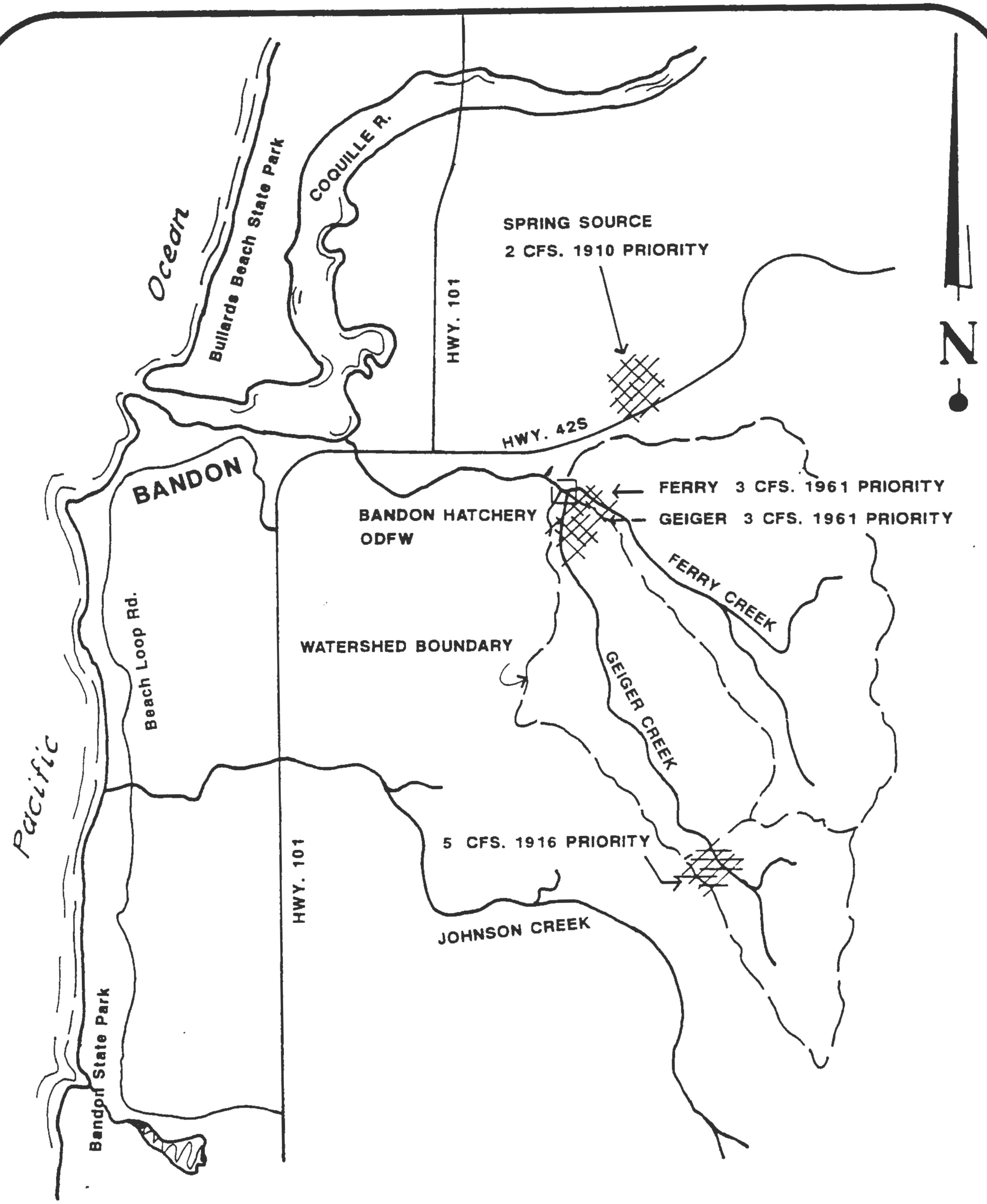
Bandon is almost at the bottom of the priority list for water rights based on seniority. The City does have the most senior water rights of all users, established in 1916 for upper Geiger Creek. However, even though the water right is for 5 cfs, the streamflow measured at this location has been as low as 0.45 cfs. Also, in order to guarantee this water for City use, either a new intake and pipeline would need to be constructed at this diversion point, or more realistically an application made to the State Water Resources Department to transfer the water rights downstream to the City's present diversion location.

Bandon Fish Hatchery

The fish hatchery has enough senior water rights to essentially use all water in the creeks during low flow months. At best, the City could reserve approximately 0.4 to 0.5 cfs, based on the upper Geiger Creek water right.

Fortunately, the hatchery (Oregon Department of Fish and Wildlife) has been very cooperative concerning the City's water supply needs. Prior to the 1970's, approximately 50 to 60 tons of fish were produced at the hatchery. Production has been cut significantly, largely because of problems with water availability. At present, annual production ranges from 20 to 30 tons.

The Bandon fish hatchery is responsible for providing salmon and steelhead smolts for the Coquille River system, Tenmile system, Eel Lake and part of the Coos River system. Although all the eggs are still shipped to the Bandon Hatchery, due to a shortage of water final rearing



CITY OF BANDON

WATER RIGHTS MAP

HGE INC
ENGINEERS & PLANNERS
375 PARK AVE./COOS BAY, OR 97420
19 N W. FIFTH ST./PORTLAND, OR 97209

FIGURE 7-2

TABLE 7-3

WATER RIGHTS SUMMARY

SOURCE	PRIORITY DATE	RATE (CFS)			TOTAL WATER RIGHTS (CFS)	LOW FLOW (CFS)
		BANDON	HATCHERY	OTHER		
UPPER GEIGER CREEK	1916	5				
SUBTOTAL		5			5	0.45
LOWER GEIGER CREEK	1925		1.5			
	1932			0.4		
	1939			0.3		
	1943			0.4		
	1944			0.5		
	1961	3				
SUBTOTAL		3	1.5	1.6	6.1	0.9
FERRY CREEK	1925		1.5			
	1931			0.08		
	1945			0.5		
	1946			0.07		
	1961	3				
	1979			.32		
SUBTOTAL		3	1.5	0.97	5.47	1.3
TOTAL		11	3	2.57	16.57	2.65

of some smolt must now take place at the Cole River Hatchery near Shady Cove, Oregon and at the Butte Falls Hatchery. Conversations with Oregon Department of Fish and Wildlife personnel indicate that the State considers the Bandon Hatchery very important, and long-term. plans include continued usage of the hatchery. Water diversion from Geiger and Ferry Creeks is presently considered to be at a minimum level, and the State desires to increase diversion to the full 3 cfs allowed by a combination of their two existing water rights, (existing is 1.5 cfs from Ferry Creek and 1.5 cfs from Geiger Creek), so that local fish eggs do not need to be sent out of the area for rearing at a greater expense.

The Bandon Fish Hatchery is a "non-consumptive" user. Water diverted from the creeks flows through hatchery ponds and then returns to Ferry Creek. A staff gage downstream of the hatchery is maintained and read by hatchery personnel. Staff gage readings indicate the quantity of flow remaining in Ferry Creek, at the hatchery, after all upstream diversions from Ferry Creek and Geiger Creek have occurred. Presently, the only large water user downstream from the hatchery is a cranberry farmer, although there are water right allocations between the hatchery and City intakes.

Water available for hatchery use (staff gage readings), and measured water usage by the hatchery are shown plotted on Figure 7-3. The weir used by the hatchery as the control structure for streamflow measurements has limited capacity, so high streamflows are not shown on this figure. It is important to note that typically from June through October the flow in the creeks available for the fish hatchery drops below the available 3 cfs which is permitted under the combining of the hatchery's existing rights for Ferry Creek and Geiger Creek. Therefore, the hatchery potentially has the authority to request that the State cut off or reduce water consumption by upstream users (including Bandon) during the summer months.

Based on recent production, the hatchery needs a minimum diversion of 1.1 to 1.2 cfs during the late summer and early fall. Available streamflow this summer (1992) has dropped below 0.9 cfs, but the late summer demands for the hatchery follow the need for cranberry irrigation and maximum City usage. The City of Bandon has provided the hatchery with aeration equipment which may help the hatchery maintain production with reduced water usage.

The hatchery has also been considered for expansion, and a cooperative agreement with the City of Bandon for increased storage may offer dual use benefits. Since the hatchery is a non-consumptive user, there is a short-term alternative which might be available for the City in the event that there is an emergency water shortage during the interim before a long-term solution is finalized. Water could be diverted downstream of the hatchery and pumped either back into one of the existing impoundments or to the water treatment plant. Staff at the Oregon State Health Division (ODHD) was contacted to discuss these possibilities. The individuals contacted expressed no concern with the concept since the water would be treated through the City's water treatment plant, but noted that two issues might need to be addressed: 1) potentially high coliform counts in the untreated water and 2) if the hatchery chlorinates/dechlorinates there may be some chemical by-products which need to be monitored.

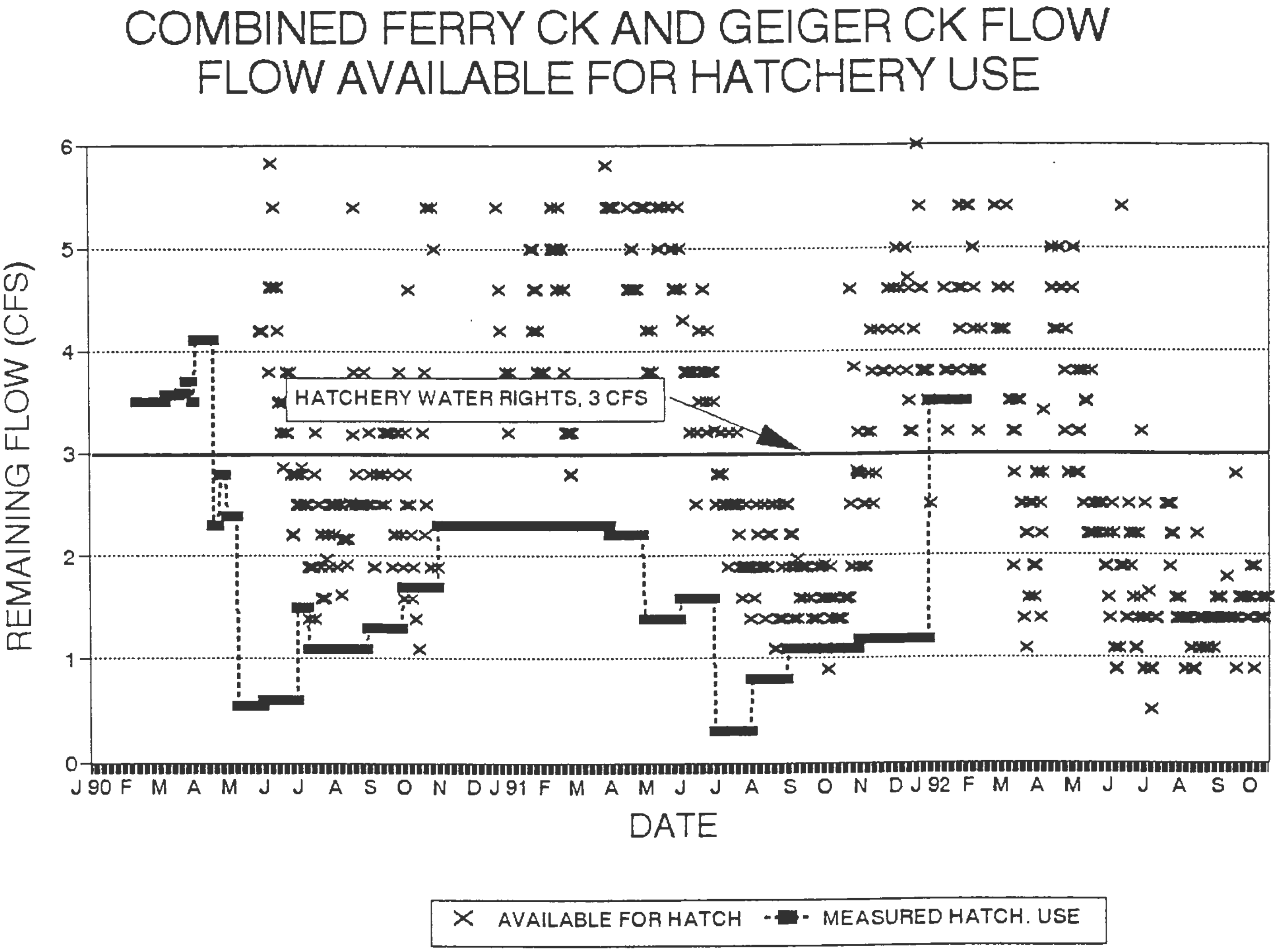
Based on conversations with hatchery personnel, there presently is no chlorination/dechlorination of water and no chemical addition during typical hatchery operation. Occasionally, there are chemicals added when the ponds are cleaned.

Instream Water Rights

During 1991 the State applied for instream water rights to Geiger and Ferry Creeks. Quantities range from 7 cfs to 19 cfs downstream of the hatchery depending on the month. Under existing laws this application has no impact on existing water rights but would prohibit the State from

FIGURE 7-3

COMBINED FERRY CREEK AND GEIGER CREEK FLOW
AVAILABLE FOR HATCHERY USE



granting additional water rights in the future, since the instream water rights generally exceed the total flow available in the creeks.

However, some groups have proposed legislation which would set the priority date for instream water rights at 1859, the date of Statehood. If this type of legislation passes it could effectively prohibit Bandon from using any creek flow except the volumes stored during the winter in a large impoundment. Because of the huge impacts which could potentially occur throughout the State of Oregon, it is unlikely that this type of legislation could be approved.

7.7 OTHER CREEKS AND RIVERS

There are no streams within reasonable proximity of Bandon that have sufficient "non-committed" water available to justify development as a municipal water source for the City. Salinity in the Coquille River extends upstream to the City of Coquille, presently eliminating the river as a feasible water source for Bandon.

7.8 BRADLEY LAKE

Bradley Lake was identified as a potential, municipal water source in the Resource Department's South Coast Basin Plan. According to the District 19 Watermaster, Bandon presently has no water rights for municipal diversion from Bradley Lake.

The lake has a surface area of approximately 20 acres, Only about 6.5 million gallons of water would be available for each 1 foot of water depth. There is not sufficient water available to consider the lake as a feasible source of water unless there is significant inflow into the lake during the summer. However, there is no documentation available on stream flows for the Bradley Lake outlet.

In the past residents of Bandon have indicated the creek flowing out of Bradley Lake becomes non-existent drys up during the summer. H.G.E., INC. staff contacted personnel from Oregon State Parks Department which observe the creek on a regular basis. Personnel contacted from the State Park felt that there is flow in the outlet from the lake year round.

Projected water requirements are listed in Section 7.5 (based on annual growth rate of 2.5 percent). If water diversion from Geiger and Ferry Creeks is maintained constant at estimated 1993 levels, an additional 320,000 gpd (.5 cfs) would be necessary to meet water demands in the year 2003 (10 years). To meet projected needs in 20 years (year 2013), a supplemental flow of 730,000 gpd (1.14 cfs) would be required.

A staff gage would need to be installed at the outlet from Bradley Lake to accurately measure streamflows and to determine whether there is adequate flow available to consider the lake as a potential water source. Cost for installation would be approximately $3,500, and an estimated$3,500 per year would be needed to monitor the gage.

Depending on the location of the intake, a large pump station and approximately 31,000 feet of transmission main would be required to pipe water from Bradley Lake to the City's existing treatment plant. Therefore, it would be less expensive to construct a new treatment plant in the vicinity of Bradley Lake. About 5,300 feet of 8-inch transmission main (shortest distance) would be required to interconnect with the 8-inch diameter line on Beach Loop (estimated total cost of $250,425. Ultimately, a second pipeline could intertie with the distribution line planned in the future along Highway 101 (Chapter 10). A 750,000 gpd treatment plant and lake intake would cost approximately $2,000,000. The capital cost of smaller treatment plants can be roughly estimated at between $2.00 and $3.00 per gallon per day of capacity.

It should be noted that shallow lakes similar to Bradley Lake typically have poor quality water for municipal supply. Port Orford has an intake in Garrison Lake (a similar lake to Bradley Lake). However, Port Orford rarely uses the lake for water supply because of algae problems and customer complaints about the taste and odor of the water.

Initially, it is recommended that Bradley Lake be eliminated from further consideration as a possible water source because of potential water quality problems, apparent limited water availability, potential public and agency opposition to dropping the lake level, and relatively high cost for development. However, if a large impoundment on Ferry Creek or development of a ground water source(s) are found to be unfeasible in the future or take too long to develop, then Bandon should consider installing a staff gage on the outlet from Bradley Lake. Also, the City may wish to consider earlier installation of the staff gage, or locate historic documentation that the outlet from the lake disappears or is reduced to minimal flow during the summer. This documentation could help justify the large expenditure which will be necessary by Bandon in the future for a large impoundment.

7.9 IMPOUNDED SURFACE WATER

Major impoundment projects can require several years for planning, environmental assessment, engineering design and construction. Although the hatchery initially appears supportive of a large impoundment which will provide a dependable source of water for fish production, there are major issues which will need to be addressed, and close coordination with agencies will be necessary to relocate and construct a new fish hatchery.

Bandon would need to submit a joint Division of State Lands(DSL)/U.S. Army Corps of Engineers application for construction. The Corps of Engineers will determine whether or not an environmental impact statement (EIS) is required. Other agencies will review the application to determine if the project is consistent with regulatory requirements. The application will be distributed for public comment. Land ownership and planning issues will need to be researched and documented for a major impoundment project.

The height of existing dams could be increased to provide a short-term solution to water supply problems until a large impoundment is constructed. However, it should be stressed that very large quantities of raw water must be stored to significantly increase the volume of available water. In order to meet the City's water needs in 10 years (based on an annual 2.5 percent growth rate, year 2003) the available water supply needs to be increased by 0.5 cfs, if the hatchery's production remains constant at present levels. This quantity of water, stored to continuously supplement needs for a 5 month period from June through October, would require an impoundment volume of approximately 50 million gallons (150 acre-feet). Careful consideration should be given before making a significant investment in a temporary measure which possibly would later be flooded out if the large impoundment is constructed.

Preliminary engineering will be necessary to conduct a detailed soil analysis of the site proposed for the large dam(s). As part of the preliminary engineering phase, detailed cost estimates for raising the heights of the existing dam must be prepared for the proposed development. The City would then have the necessary information to decide whether it is cost-effective to raise the existing dam heights as a temporary measure.

Some of the planning and permitting issues which will need to be addressed include:

A. Geological investigation.

B. Develop cost estimates for raising height of existing dams.

C. Update construction cost estimates for large dam and impoundment, including costs for new fish hatchery.

D. Research land ownership and cost of property acquisition.

E. Apply for water rights - initial estimates are for 8 cfs and 800 acre-feet of active storage.

F. Apply for joint Corps of Engineers/DSL permit for construction.

Estimated Cost Breakdown

Engineering and Permits	$120,000
Legal and Administrative	30,000
Total Cost Preliminary Engineering and Permits	$150,000

7.10 GROUNDWATER

There has been very limited success with the use of groundwater for municipal water supply on the Oregon Coast. Two notable exceptions are the Coos Bay/North Bend Water Board and the City of Florence. H.G.E., INC. recently completed a plan for Florence which will increase their municipal well capacity from 1 mgd to 2 mgd.

Typically, water from coastal wells will require treatment. This is not required by State or Federal regulations, but is necessary to improve taste, odor and color of the water. High iron content, due to decaying vegetative matter in the aquifer, is usually the primary problem.

Municipal wells should have large capacities, (minimum of 100 gpm or 144,000 gpd), in order to be cost effective. Typically, on the coast the groundwater aquifer needs to be in a dunal area (sand has high permeability and allows water to flow through rapidly) to have a well field with this quantity of production. However, in addition to potential access to a dunal well field, Bandon may have the potential for a groundwater supply within the existing watershed. Since the existing watershed does provide a substantial level of water first consideration in developing a groundwater supply should be centered on the existing watershed.

Copies of representative well logs from the Bandon area have been included in Appendix B. Well capacities range from 5 gpm (7,200 gpd) to 40 gpm (57,600 gpd). Two logs are for wells in Bullards Beach State Park. One has a rated capacity of approximately 20 gpm, the other 27 gpm. The County Water Master periodically monitors water levels in a well located in the Ferry Creek watershed. The well has a rated capacity of approximately 40 gpm. Water levels have dropped almost 20 feet (20 percent) during the last year.

Well logs in the area indicate that there is a low probability of developing new wells with sufficient capacity for municipal production. However, because of the significant expenditure which will be required to construct a large impoundment for storing surface water, it is recommended that the City conduct a detailed hydrogeological study to further investigate the feasibility of groundwater production.

A two phased approach is recommended. The first phase would be a feasibility study, which includes locating well field areas that are within a reasonable distance of Bandon. Initially, two potential areas appear to be in the vicinity of Bullards Beach and south of Bradley Lake. Potential well field capacities, probable treatment requirements and preliminary cost estimates for developing the well fields would be provided in this feasibility study. The first phase of the feasibility study would cost approximately $5,000 to $7,500. If it appeared that groundwater might be a feasible option for municipal supply, then the second phase should be initiated. The second phase would be a detailed hydrogeologic investigation which would include drilling test wells to better estimate actual well field production, water quality, treatment requirements and to refine construction cost estimates. The second phase investigation would cost between $10,000 and $30,000 per well field, depending on the number of test wells required for development.

7.11 WATER SUPPLY SUMMARY AND RECOMMENDATIONS

1. Water rights have been over-allocated for Ferry Creek and Geiger Creek, the City's present sources of water supply. There is a total of 16.57 cfs of water rights, while combined streamflows in the two creeks are estimated to be as low as 2.6 cfs during summer months.

2. Bandon has low priority for water diversion from Geiger Creek and Ferry Creek. The City can only reserve approximately 0.4 to 0.5 cfs (0.26 to 0.32 mgd), and this would require transferring the water right for upper Geiger Creek downstream to the City's present diversion location.

3. The Bandon Fish Hatchery has senior water rights for 3 cfs from lower Geiger Creek and Ferry Creek, and has the legal authority to essentially eliminate the City's water supply during summer months (except for the 0.4 to 0.5 cfs of water the City has rights to on Upper Geiger Creek). There is an additional 2.25 cfs of irrigation water rights which are senior to the City's rights at the existing impoundments.

4. Water supply has not been a critical issue in Bandon during past years because of the excellent cooperation and coordination between the City, the hatchery, and farmers. However, water supply could become a critical issue very soon. As the population and water demand increases in Bandon, consumption of some user(s) will need to decrease.

5. Although coordination of water consumption by different water rights holders has worked well in the past, it is suggested that the City consider developing a formal agreement which will assure Bandon a minimum quantity of water diversion. Legal and City Administrative fees to develop and negotiate such an agreement would probably range from $30,000 to $50,000.

6. The long-term water solution for Bandon is most likely the construction of a large impoundment on Ferry Creek to store surface water. Groundwater supply is another possibility, although the probability for success is low. Either alternative will take several years to implement. Therefore, additional research necessary to select the final plan should be started immediately, followed by preliminary engineering and initiation of the permitting process required for construction.

7. As a short-term solution, in the interim, and until the long-range solution can be implemented, overflow water from the hatchery could be utilized by the City during emergency conditions. Water would be diverted downstream of the hatchery and pumped back upstream to one of the existing impoundments or to the middle pond. Concerns with the alternative include setting a satisfactory location downstream from the hatchery for diversion, possible public opposition to reducing remaining streamflows in Ferry Creek below present levels, water rights issues and hatchery concerns about recirculating fish diseases back through the hatchery.

   These issues should be addressed during development of the cooperative agreement discussed in paragraph 5. The low flow measured downstream of the hatchery during the summer of 1992 was approximately 0.9 cfs. Limiting additional diversion to 0.5 cfs for City use could supply Bandon's water needs for up to 10 years, based on an annual increase in water demand of 2.5 percent.

8. The recommended implementation schedule and estimated costs are as follows:

Source Investigation and Initiation of Preliminary Engineering and Permitting Process.

Implementation Date	Description	Estimated Cost
1993	Investigate City use of Hatchery Overflow water.	Cost included in development of formal agreement.
1993	Phase 1 Hydrogeological Investigation	$ 5,000 - $ 7,500
1993	Phase 2 Hydrogeological Investigation (if merited)	$ 10,000 - $ 30,000 per well field site
1993	Formal Agreement with other Water Right Holders to Maintain Minimum City Diversion.	$ 30,000 - $ 50,000
1994	Large Impoundment - Initiate Preliminary Engineering and Permitting Process (if large scale groundwater development is not feasible)	$150,000
	TOTAL	**$ 45,000 - $237,500**

9. It is recommended that Bandon budget $237,500 for final source investigation and to initiate preliminary engineering and the permitting process for a large impoundment. If hydrogeological investigations demonstrate that a groundwater source is feasible, then money budgeted for the large impoundment could go towards development of a municipal well field instead.

10. The report prepared by Tucson Myers & Associates estimated the cost for a large, multi-purpose impoundment to be approximately $8,000,000.

11. It is recommended that an additional **$67,500** be budgeted for maintenance of the Ferry Creek impoundment as a Priority I improvement. Maintenance items include a) repairing the wooden causeway, b) replacing the Ferry Creek intake

valve, and c) removing the maximum quantity of sediment and woody debris possible within the proximity of the impoundment which can be reached by shore based equipment, within the budget available.

7.12 WATER SUPPLY SDC'S

The money used for maintenance of the Ferry Creek impoundment does not increase the capacity of the water system, and therefore is not eligible for SDC's. A large impoundment should be sized to meet the projected water needs of the City through the year 2050. The proportional cost of the preliminary process is $23 per EDU ($237,500/10,392 EDU's, as per Table 7-1 and Section 7.11).

CHAPTER 8

WATER TREATMENT

CITY OF BANDON
WATER SYSTEM MASTER PLAN

CHAPTER 8
WATER TREATMENT

8.1 EXISTING WATER TREATMENT FACILITIES

A water treatment facility was constructed for Bandon, in 1981, to treat waters from Ferry Creek and Geiger Creek. The treatment facility provides for chemical coagulation, flocculation, sedimentation, and filtration. In addition, pH and alkalinity adjustment, taste and odor control, and disinfection (chlorination) are provided for treatment. Design capacity of the existing plant is provided for daily outputs of 1,500,000 gpd. The plant was planned to facilitate future expansion, with improved raw water pumping improvements to be developed at a later date.

The Bandon water treatment facility utilizes surface water intakes from small impoundments on Ferry and Geiger Creeks. Water gravity flows from the Ferry and Geiger Creek intakes to the intake (lower) pump station by gravity. The lower pump station is located adjacent to the Bandon Fish Hatchery. Water is lifted from the lower pump station by centrifugal pumps, and flows are transmitted either into the middle pond for storage, or directly into the water treatment facility where chemical flash mix, coagulation, and flocculation facilities are provided. Chapter 3, Existing System, includes a more detailed description of the intake and pumping system between the impoundments and the treatment plant.

The Bandon water treatment facility was constructed utilizing City labor to a great extent to minimize expenditures. Used filters were purchased from the Umpqua Basin Water Association near Roseburg, dismantled, moved to the site, and reconstructed to serve the community water treatment needs for the City of Bandon. Overall, the construction approach for this treatment facility was very unique in the State of Oregon, and City staff should be commended for their extensive efforts at minimizing community cost. The City of Bandon has received quality water treatment at minimum expense for some 12 years of service from the completed installation.

In general, coagulation and flocculation prepares the raw water supply for treatment through a combination of sedimentation, filtration, and disinfection. Water treatment plants require the addition of a coagulant to develop a floc that should settle to the bottom of the sedimentation basin provided, before flows reach the filters. Good sedimentation increases the length of filter runs before the filter media seals with soil and foreign matter, and reduces the need for frequent backwashing.

The Bandon water treatment facility does provide the complete coagulation, flocculation, sedimentation, filtration and disinfection that is often regarded as a complete water treatment facility. However, the amount of automated equipment is minimal, and the filters are no longer adequate to provide quality potable water on a permanent basis. Existing facilities can achieve compliance with the Surface Water Treatment Rule for limited output, but plant production capabilities during high turbidity periods are limited in comparison to the anticipated plant capacity. Special care is required in conditioning the incoming waters in the middle pond, by allowing sediments time to settle out before pumping the water to the treatment plant. In addition, operation is very manpower intensive during time periods when raw water turbidities are high. Delivery of quality water would not be possible without the willingness of operational staff to work long hours with limited plant facilities.

Sedimentation is provided with an Eimco solids contact clarifier designed with a turbine for chemical mixing. This unit is equipped with radial weirs to minimize the upflow rate for the clarifier, and to provide a maximum level of sedimentation. The Bandon unit was designed for the installation of tube settlers at a later date, to increase the flow capabilities of the sedimentation process. Filtration is provided with three 13-foot diameter Permutit automatic, valveless, gravity filters equipped with mixed media, graded from coarse to fine. These units are designed to function at flows of up to 1.5 mgd during heavy usage, summer demand periods.

Disinfection is utilized to destroy harmful viruses and bacteria in water by inactivation or by destruction. Chlorine is utilized at the Bandon water treatment plant for disinfection purposes. It is common practice to apply chlorine as early in the treatment process as possible, in order to reduce the growth of algae and other organic substances that may tend to accumulate in process units. Pre-chlorination also assists in the elimination of taste and odors in the finished water supply, and is utilized in the operation of the Bandon water treatment system. A clearwell-chlorine contact basin for disinfection follows the filtration process, and approximately 52 minutes of chlorine contact time (CT) is provided for disinfection purposes at the plant design capacity of 1.5 mgd.

Water from the clearwell is pumped into the single, one-million gallon storage reservoir located just north of the treatment plant. Pumping units are rated for 1050 gpm against 61 feet of TDH when each pump is operating separately, or 1750 gpm against 75 feet of TDH when operating together.

8.2 EVALUATION OF THE WATER TREATMENT PLANT INSTALLATION AND RECOMMENDATIONS FOR IMPROVEMENTS

The Bandon Water Treatment Facility was constructed as a minimum cost facility, and maintenance of developed facilities has been limited due to financial constraints since the plant began operation in 1981. In addition to capacity concerns which will require an expansion in treatment system capabilities, certain plant components will require improvements or rehabilitation for continued successful operation. Process limitations reduce the ability of the plant to produce water during high turbidity periods, at a rate approaching the original design capacity of 1.5 mgd. Because of limited equipment and process facilities, some of the remaining equipment is also subjected to extreme abrasion due to heavy sediment loads, and equipment failures and malfunctions will begin to become a concern. An analysis of major plant facilities follows, with emphasis on areas where process concerns are apparent. Some of the existing plant components can continue to be utilized to provide quality water treatment for the long-term future of the City of Bandon, but this will require either a reduction in flow through the plant, or the addition of recommended increased process tankage to provide for more adequate water treatment for incoming waters. Since the most effective operation of treatment plant components is achieved with on-off operation of facilities, all improvements to provide capacity for the recommended 2.1 mgd plant capacity are recommended as Priority I improvements.

8.2.1 Intake Pump Station and Transfer Structures

The existing intake pump station (lower pump station) is an antiquated concrete block structure. This structure is a conversion of a building that originally served another purpose. Deterioration is rapidly occurring on the intake pump station structure, and this building should be replaced in the near future.

Two pumps are available for usage in the intake pump station. Both are horizontal centrifugal pumps. One is a 30 Hp Pacific Pump which has recently been rehabilitated and can transmit flows of 650 gpm against a total dynamic head of 120 feet to the middle pond. The second pump is a 100 Hp Cornell Pump which is in excellent condition. This pump can transmit flows of 1600 gpm to the middle pond, or can be utilized to transfer flows in a bypass mode around the middle pond and directly to the water treatment facility at a flow of approximately 1200 gpm (see Figure 3-2). Both are horizontal centrifugal pumps. In addition to the individual capabilities of each pump, the smaller 30 Hp pump is piped to deliver water directly into the suction side of the pumps located adjacent to the middle pond.

The facility commonly referred to as the middle pond is an open-water storage reservoir. A 6-inch pipeline exists between the intake pumps at the lower pond, and the middle pond and middle-pond pump station, a distance northerly of some 565 feet. In 1955, the middle pond and pump station were constructed to provide storage, reserve capacity for pumping directly into the City distribution system, and for adding chlorine as a disinfectant. The building for the middle-pond pump station is of concrete block construction that has been maintained in good condition. The chlorination facilities have been removed and relocated at the water treatment plant. The existing pumps are 20 Hp units, sized at 500 gpm each, when operating independently of one another. No automatic control or telemetry system exists for any of the lower or middle pond pumping and supply system.

The lower pump station to middle pond to treatment plant pumping arrangement would initially appear to be a duplication of facilities and energy, but there are substantial benefits to maintenance of the middle pond and pump station during heavy runoff periods. When turbidity flashes create unsettled raw water conditions which would create difficulties in the treatment process, the plant operator has the choice of pumping for short intervals directly from the middle pond, or to allow for blending of Ferry Creek or Geiger Creek incoming waters with storage in the middle pond. Two other significant benefits are associated with continued usage of the middle pond. First, settling of influent turbidities does occur within the quiescent waters of the middle pond, and secondly there are known to be 3 good springs in the middle pond basin, which increases the availability of water for usage through the community system.

Several deficiencies and/or inadequacies are apparent with the raw water intake and transfer facilities. Concerns and potential improvements are addressed as follows:

Lower Pump Station

The existing structure for the lower pumping station is deteriorating rapidly, and needs to be replaced with any major improvement in treatment capacity and operations. A new structure should be constructed of an adequate size to relocate the existing 100 Hp and 30 Hp pumps, and for an additional 100 Hp unit owned by the City. The second unit is identical to the existing pump in operation. The existing building is located in a marshy area, and every attempt should be made to relocate the pump station on the hill above the present location, and at an elevation above the existing marshy conditions.

A relatively new 480 V power supply and electrical switchgear is located in the existing intake building, and this equipment can be relocated to the new building structure. To allow for control of pumping rates, variable speed drives should be added to all of the relocated units, in conjunction with the installation of a raw water flow meter that could be utilized for monitoring of flows and control of pumping rates. City staff has a surplus sonic flow meter that could be utilized for flow monitoring and control purposes. An integrated telemetry, alarm and control system should be installed at the water treatment facility, with provisions for controlling the operations of both the lower pump station, and middle pond pumping facilities, and for balancing pumping operations with need in the distribution system and at the water treatment plant. Cost estimates for lower pump station improvements are presented as follows:

TABLE 8-1. Preliminary Cost Estimates for Proposed City of Bandon Lower Pump Station

Building Structure	$ 46,000
Electrical, Telemetry and Flow Recorder	29,000
Mechanical Piping and Valving	19,000
Construction Cost	$ 94,000
Engineering and Inspection	18,800
Legal and Administrative	4,700
Contingencies	9,400
TOTAL COST	**$126,900**

Intake to Middle-Pond Pressure Main

The existing 6" transmission main is inadequate to provide capacity for transmission of flows to 2.1 mgd (year 2017 projection) of treatment capacity needed to satisfy the project design demands. The transmission main through this section should be replaced with a 14" diameter pressure pipeline. Cost estimates are provided as follows:

TABLE 8-2. Preliminary Cost Estimate for Proposed City of Bandon Intake to Middle-Pond Pressure Mains

14" Transmission Main	590 c.f.@ 55.50 =	$32,745
Construction Cost		32,745
Engineering & Inspection		6,550
Legal and Administrative		1,640
Contingencies		$ 3,275
	TOTAL COST	**$44,210**

Middle Pond and Middle-Pond Pump Station

The middle-pond pump station was constructed in 1955, but the building has been well maintained and remains in good condition today. However, several improvements should be considered with any water system expansion and upgrading program. Existing pumps are antiquated units, designed for 500 gpm each, transmitting flows through a 10" pipeline to the water treatment facility. An improvement in pumping capacity to 1500 gpm for each of the two pumps should be provided, with variable speed drives to control the volume of flow transmitted to the treatment facility. Existing electrical switchgear also needs replacing, but the City is fortunate to have a new MCC available for placement at the middle pond pump station. This MCC can be modified at minimum expense for this application. Other needs at the middle-pond pump station include a new heater, and a dehumidifying system to remove the moisture that accumulates within the station. All of the existing suction and discharge piping associated with the station should also be replaced, and with pipe of adequate sizing. Telemetry and control should also be provided, and interconnected with the treatment facility and the intake pump station for control.

In addition to the pump station, middle pond improvements should include an enlargement of the middle pond to provide increased capacity for storage and settling at this location. Additional storage capacity of some 500,000 gallons would appear feasible at the existing location and with minimum cost. Provisions should also be maintained for bypassing the middle pond and pump station during periods of adequate water supply and good quality.

Cost projections for middle pond pump station and basin improvements are projected as follows:

TABLE 8-3. Preliminary Cost Estimate for Proposed City of Bandon Middle Pond Pump Station and Basin Improvements

Pumps, Piping and Valves	$ 33,000
Electrical and Telemetry	31,000
Painting and Reconditioning	4,500
Middle Pond Exterior Piping	6,000
Middle Pond Earthwork	30,000
Construction Cost	104,500
Engineering & Inspection	20,900
Legal & Administrative	5,225
Contingencies	10,450
TOTAL COST	**$141,075**

Middle Pond to Water Treatment Plant Transmission Main

The transmission main from the middle pond to the water treatment plant is 10" diameter, which is adequate to provide capacity for flows of 2.1 mgd at the water treatment plant, when new pumps are installed at the middle pond pump station.

8.2.2 Water Treatment Facility

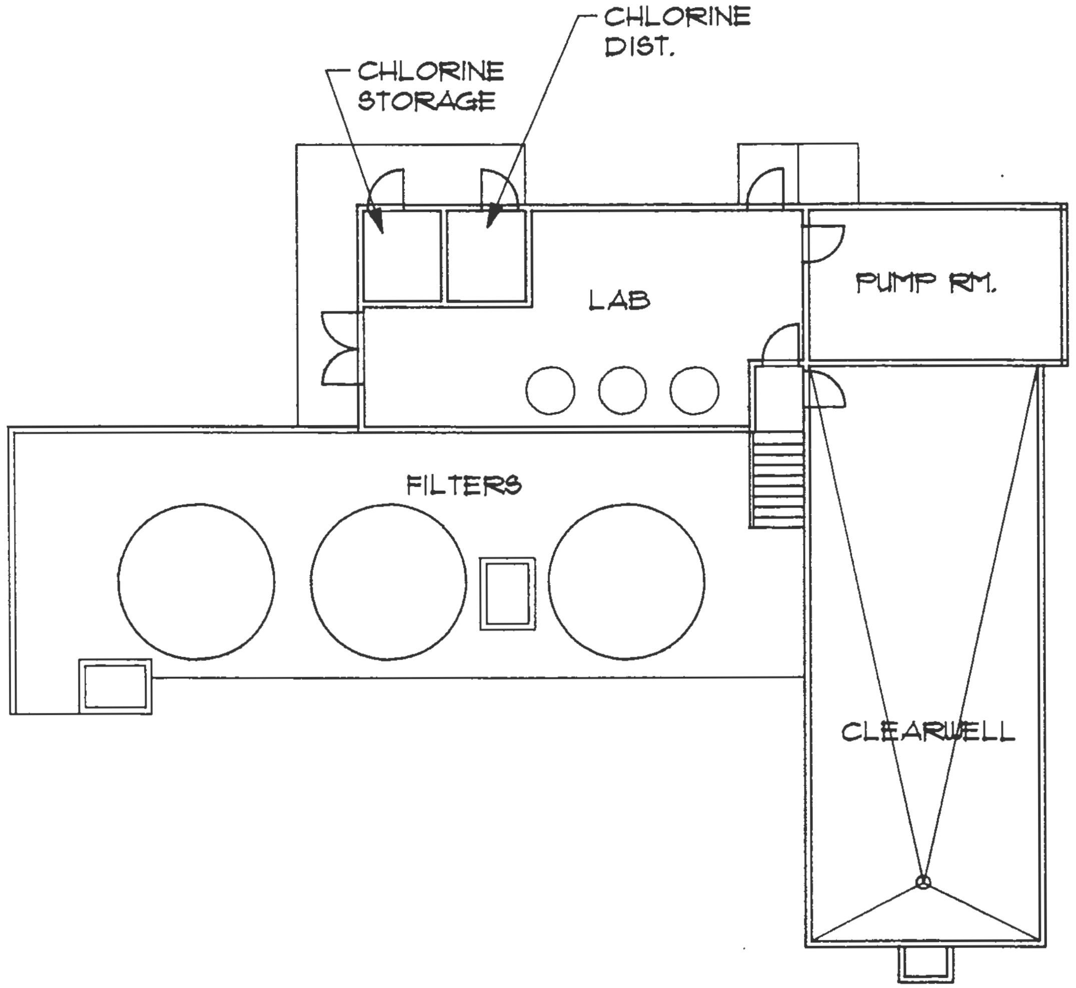
The existing water treatment facility was initially designed for expansion, and major components exist which can satisfactorily be utilized for expansion to anticipated flow levels of 2.1 mgd. The proposed layout for improvements is shown on Figure 8-1 (solids contact clarifier not shown). Primary components are evaluated independently, as follows:

Solids Contact Clarifier

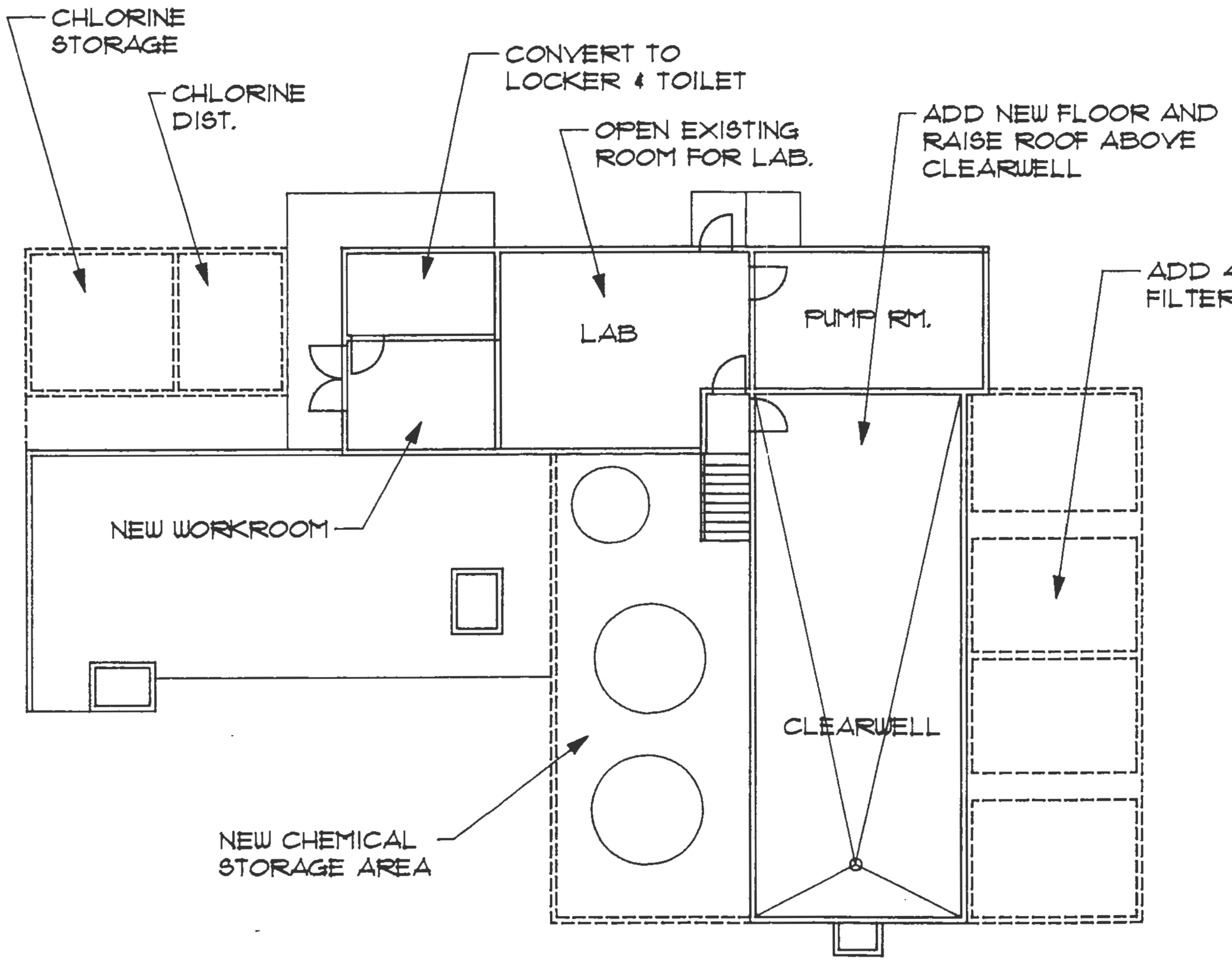
Water from the intake pump station and/or the middle pond pump station enters the 50-foot diameter solids contact clarifier at the center of a turbine cone. Immediately ahead of the turbine mixer, prechlorination and alum chemical injectors induce chemicals into the raw water, and thorough mixing is accomplished within the turbine. In addition, soda ash is introduced into the line between the clarifier and the filters for pH adjustment. Flocculation occurs within the turbine chamber, with all of the flow directed downwards in a manner whereby the flocculated particles are deposited on the basin bottom.

CITY OF BANDON

WATER TREATMENT PLANT



EXISTING FLOOR PLAN



PROPOSED FLOOR PLAN

HGE INC./ENGINEERS & PLANNERS
375 PARK AVENUE, COOS BAY, OREGON 97420 (503) 269-1166
19 N.W. 5TH AVE., PORTLAND, OREGON 97209 (503) 222-1687

FIGURE 8-1

Once the chemically flocculated water enters the sedimentation basin surrounding the turbine cone, settling of flocculated particles continues, and the flow path for the water rises vertically to the surface, with discharge into the radial weirs spanning between the turbine cone and the sedimentation basin wall. Flows are then transmitted through a 12" influent pipeline to the filters provided.

The solids contact clarifier is a quality, efficient coagulation-flocculation and sedimentation process. Provisions were made during the initial design for plant expansion, by the addition of tube settlers within the basin for increased sedimentation capacity. Tube settlers are polystyrene tubes which are designed to increase the available area for sedimentation within smaller tankage areas. Existing area for sedimentation is available to continue present operation with the existing units for 1.5 mgd, but planned expansion will require addition of tube settler units with Priority 1 Improvements.

In addition, the initial concrete walls for the sedimentation structure were not a quality installation. A vinyl coating system should be installed to eliminate leakage through the wall. The basin exterior should also be sandblasted to improve the aesthetics of the unit. Radial weirs for the sedimentation basin are intended to be installed level, and the existing units at the Bandon water treatment plant need to be substantially adjusted to a level condition, and in a manner which will improve overall operations. When leveling is complete, all of the structural steel work within the interior of the solids contact clarifier should be sandblasted and repainted. A 4" flow meter should also be installed on the sludge dewatering line to provide an accurate measure of wasted water to the backwash basins. In addition all of the original metalwork should be sandblasted, and refinished to provide a quality effective lifetime.

Estimated costs for modifications to the solids contact clarifier are offered as follows:

TABLE 8-4. Preliminary Cost Estimate for Proposed City of Bandon Solids Contact Clarifier Improvements

Tube Settler Installation	$ 56,500
Interior Basin Sealing, Exterior Finish	15,275
Recondition all Metalwork, Level Weirs, and Sonic Flow Meter	11,500
Construction Cost	$ 83,275
Engineering & Inspection	16,650
Legal and Administrative	4,150
Contingencies	8,325
TOTAL COST	**$112,400**

Filtration, Chemical Feed Equipment, Treated Water Pumping, Control Building, Laboratory, and Toilet Facilities

A) Filtration

Filtration at the Bandon water treatment facility is provided by three (3) 13-foot diameter, Permutit automatic valveless gravity filters. These units are equipped with mixed granular media, graded from coarse to fine. Filters are constructed of steel, and are now some 30 years old, having served an effective lifetime at another water treatment facility before they were installed at the Bandon plant. The interior backwash chamber of the filters appears to be separating from the steel exterior tankage, and some of the backwash ceramic diffusers are creating operational concerns. It is becoming increasingly difficult to develop adequate cleansing of the filters by backwashing. In addition, the design of the automatic, valveless gravity filters provides for gravity backwash with the first waters that pass through the filters on each filter cycle. The available head for backwashing is substantially less than would normally be utilized with a pumped or head type backwash system. It is virtually impossible to complete adequate backwashing with this type of system, using coastal waters. To develop a quality filtration process, these units should be replaced with conventional open gravity filters, constructed either from concrete or marine aluminum to prevent the corrosion that occurs with steel tankage. In order to produce the needed 2.1 mgd needed for projected design flows during the study period, four filters of approximately 150 square feet each should be provided.

The layout of the existing water plant was provided to make best usage of the existing automatic valveless style filters. A remodel to a more conventional design will be somewhat difficult to provide with a finished project that is functional, aesthetically pleasing, makes use of existing structures, and allows for new construction while maintaining existing facilities in operation. It is recommended that four (4) new filters be placed just east of the existing treated water clearwell (see Figure 8-1). The units should be developed high enough in elevation to allow for the discharge piping to enter into the top of the existing clearwell. Filters should be constructed either with package-type marine aluminum units, or with poured in place concrete construction to minimize corrosion and long term maintenance costs. Choice of equipment to be utilized should be made during the design phase of recommended improvements, with the final decision to be made after consideration of cost, and City of Bandon preferences for material types. Either material choice should provide equivalent performance. The existing roof structure for the clearwell should be replaced with a precast concrete corefloor to allow for construction while the clearwell remains in operation. A new above level structure surrounding the filters and the new space over the clearwell will be constructed. All filter piping and controls should be placed in this new chemical feed and filter piping gallery. In addition, positive ventilation should be provided for the clearwell.

New turbidity monitoring and recording equipment should be provided for a) the raw water source for the middle pond; b) filtered effluent from each of the four filters; and c) the treated water transferred to the clearwell. In addition, a new backwash pump should be installed to provide an adequate source of water for backwashing each of the proposed four new filters.

Solids from the existing plant are presently discharged into two backwash ponds developed between the water treatment plant and the middle pond. Continuance of this means of handling solids is encouraged, with ultimate disposal to agricultural property. To facilitate the air drying of backwash sludges a diaphragm pump should be purchased with sufficient discharge hose to move sludge into a broader location for air drying.

b) Chemical Feed Equipment

Chemical feed equipment can be relocated into the new area created over the existing clearwell, and filter piping, controls, and individual turbidimeters can be provided in the new space provided. However, since there have been vast improvements in chemical feeders since the Bandon plant was initially completed, it is recommended that direct chemical injection pumps be installed to transfer concentrated chemicals directly to the point of application. To minimize material and manpower requirements for the expanded treatment facility it is recommended that the plant be converted to liquid chemical storage, and that 6000-gallon storage vessels be provided for both liquid alum and liquid caustic soda, with filter aid being delivered in barrel lots for distribution. It is recommended that a portion of the area presently dedicated to the filters be converted to covered and heated storage for liquid chemicals. This will minimize the labor involved with handling of dry chemicals, and should reduce the overall cost of both purchasing and handling chemicals for the treatment operation.

c) Treated Water Pumping

A third, treated-water pump should be provided of identical sizing to the two existing units to allow for one pump to be maintained in standby at all times. New distribution piping and valving will also be required to interconnect the new pump into the treated-water discharge piping system.

d) Control Building Laboratory and Toilet Facilities

The existing chemical feed area can be readily utilized for a needed expansion of the laboratory, and for developing a shop and maintenance workroom. Expansion of the plant will also require full-time attendance by a plant operator. A toilet, shower and locker room should be developed in the areas presently occupied by the chlorination rooms.

In addition to building structural improvements, substantial electrical and mechanical modifications are needed to upgrade existing facilities for continued long-term usage of existing facility components. Electrical modifications should include new electrical controls and telemetry improvements to provide 24 hour monitoring and operator notification of any equipment or process concerns, remodeling of the existing motor control center to provide separate operating nd alarm lights for each major equipment component, the addition of single phase and lightning protection for all motors, and new lighting and convenience outlets for new and existing rooms to be remodeled. Mechanical changes should include desludge timers and meters, and a new transducer type level controller for both the clearwell and the existing 1,000,000 gallon reservoir, with electrical interconnections to new recording devices.

Cost projections for filtration, chemical feed equipment, treated water pumping, control building, laboratory and toilet facility improvements are provided on Table 8-5.

TABLE 8-5. Preliminary Cost Estimates for Proposed City of Bandon Water Filtration and Control Building Improvements

Overhead, Bond & Insurance	$ 140,000
Structural Improvements	274,700
Pumps and Control Valves	89,500
Filter: Media & Surface Washers	88,000
Turbidity Monitoring, Recording, Chemical Feed and Storage	97,800
Mechanical and Plumbing	195,000
Electrical	155,000
Construction Cost	$1,040,000
Engineering & Inspection	208,000
Legal and Administrative	52,000
Contingencies	104,000
TOTAL COST	**$1,404,000**

8.2.3 Disinfection

Chlorination is by far the most common method of disinfecting domestic drinking water. It is standard practice in the United States. Chlorination practice is of proven effectiveness, it has low capital and operating costs, and water treatment personnel worldwide have had extensive experience with it. However, recently there have been growing concerns over the handling and storage of chlorine as a hazardous material, and concerns that chlorine compounds (THM's) in drinking water have been documented to cause cancer when concentrations exceed certain levels.

Bandon recently completed an extensive evaluation of treated water from the distribution system and found all monitored chlorine compounds well below established maximum contaminant levels (MCL's). Also, treatment plant operators are well-trained in the use of chlorine and are experienced and comfortable handling chlorine. However, because of potential concerns, consideration was given to four (4) alternative disinfection methods:

1) Ultraviolet Light
2) Ozonation
3) Ammonia-Chlorine (chloramines)
4) Chlorination

Ultraviolet light has not been approved for disinfection of potable water, and will not be considered further in this report.

The advantages to ozone are that it requires less contact time than chlorine (ozone dissipates quickly so it can be applied in heavy concentrations) and the use of ozone precludes the formation of chlorine compounds. However, ozone is not utilized extensively for water treatment in the United States primarily because of the expense of generating ozone, and due to the limited understanding of ozone as a disinfectant. Ozone is a highly reactive gas formed by electrical discharges in the presence of oxygen, which leads to special concerns about operator training and handling. In addition, since ozone dissipates quickly it does not provide a residual disinfectant to protect the water in the distribution system, so chlorination would still be required to maintain required system residuals.

Since experience with ozone is very limited for potable water disinfection, and because of the many unknowns which exist relative to bacteriological demands, and due to the inability to maintain an effective residual for the system, the Oregon State Health Division requires a one-year pilot study in the State of Oregon. There presently are no water systems in Oregon utilizing ozone for disinfection, although the City of Portland is conducting a pilot study to determine its suitability for their needs. It appears that Portland's pilot study may recommend a combination of ozone and chlorine treatment.

Operation and maintenance of an ozone generator is complex and difficult, and Bandon would undoubtedly need to hire additional personnel with specialized training for operation of the facility. Personnel with capabilities to provide ozone generation are very limited, and turnover could be a major concern for Bandon over time. In addition, timing of the pilot study and for the potential installation of an ozone generation system would require an extended time variance from the Surface Water Treatment Rules by the Oregon State Health Division. Based on experience in Oregon, this could be difficult to attain, and there is no assurance that the pilot test would develop a system that would function for disinfection, and within the financial ability of Bandon residents. Based on initial cost projections of construction and operation and maintenance, and since a chlorination system would still be needed to maintain chlorine residuals, this alternative is not recommended.

Chlorine-and-ammonia compounds (chloramines) are effective as primary disinfectants and preclude the formation of THM's in potable water. This system is used by the Coos Bay-North Bend Water Board. The gas fed equipment for ammonia is very similar to the gas feed equipment for chlorine. Essentially, the City would end up with twice the amount of disinfectant equipment; one set for chlorine and one set for ammonia. Separate chlorine and ammonia systems feed the gaseous disinfectants directly into the water where they combine to form chloramines. There is no benefit from an operator handling and safety standpoint since chlorination is still required. The primary benefit is the reduction in formation of THM's. However, prior sampling has shown that THM concentrations in the Bandon water system are well below established MCL's (maximum level established by EPA based on potential health risk). Usage of ammonia in Coos Bay-North Bend's water system has led to complaints by many customers about ammonia-related deaths of fish in aquariums. Also, the cost of an ammonia-chlorine system is more expensive to build and operate for a relatively small water system like Bandon's, than a chlorination system. Initially, it is recommended that ammonia not be used in conjunction with chlorine as a disinfectant for the Bandon system. However, the proposed building size for chlorination equipment and storage should accommodate the future addition of ammonia in case THM formation in Bandon's potable water becomes more of a concern in the future.

Chlorine disinfection remains as the preferred alternative for the Bandon Treatment Facility, and this will continue usage of a practice that has been utilized in Bandon since at least 1955. The City does have some existing equipment which can be utilized and incorporated into the recommended improvements.

A new separate chlorination or disinfectant building should be developed that provides continued usage of 150 pound chlorine cylinders for safety purposes; offers compliance with all fire, and safety laws, including construction with non-combustible materials; and is constructed at a loading ramp level that allows for ease of loading and unloading the tankage. Adequate heating, ventilation, lighting, and chlorine disinfection panels should be installed to assure satisfactory operation of the disinfection facility. Automatic switchover for all operating conditions should be provided, and auxiliary power should be considered for the proposed installation. Requirements of the 1988 Uniform Building and Fire Codes are creating extensive concerns with recent construction of chlorination facilities, and each project is evaluated independently for code compliance. Analysis and concerns by the local fire marshall effect the requirements for each installation, and budgeting for facility costs is difficult until negotiations are completed and final plans submitted for review. In addition to heating, ventilation and a maximum level of safety equipment, the City of Bandon may be required to install chlorine scrubbers to internally remove any contaminants that could develop from a chlorine spill, and standby generation to assure that safety equipment is available for usage at all times. The City of Bandon has available three V-75 Wallace and Tiernan chlorinators that can be modified to vacuum feed operation, and utilized for operation. (One is currently being utilized, and two units are available for placement as the standby unit). Utilization of this existing equipment is a cost effective option that will offer a long term lifetime.

Chlorine contact time in the existing clearwell will be limited with the expansion of the existing treatment plant to 2.1 mgd, and it is imperative that chlorine contact be increased to approximately 51 minutes of storage at peak flows and high pH conditions. This can readily be achieved at the Bandon water treatment complex as a combination of the existing clearwell, the transmission pipeline into the existing 1,000,000 gallon reservoir, and with storage in the reservoir itself (piping future reservoir(s) in series with the existing reservoir will further increase the contact time available). Therefore, no additional chlorine contact storage is required, and the clearwell should be sufficient for the foreseeable future.

Cost estimates for disinfection improvements are provided on Table 8-6.

TABLE 8-6. Preliminary Cost Estimates for Proposed City of Bandon Disinfection Improvements

Overhead, Bond & Insurance	$ 14,000
Structural Improvement	29,000
Mechanical and Plumbing	14,000
Chlorine Scrubber	52,000
Chlorination Equipment	27,000
Electrical & Standby Generation	19,000
Construction Cost	$155,000
Engineering & Inspection	31,000
Legal and Administrative	7,750
Contingencies	15,500
TOTAL COST	**$209,250**

8.2.4 Transmission Main From Clearwell to Treated-Water Storage Reservoir

As a portion of the water treatment plant improvements developed in 1981, a new 12" diameter transmission main to the 1,000,000 gallon, distribution storage reservoir was constructed. This main is capable of providing system capacity into the distribution system for the foreseeable future.

8.3 SUMMARY OF RECOMMENDED IMPROVEMENTS

Existing components of the City of Bandon raw water transmission and filtration system must be expanded and upgraded to satisfy the requirements of the Surface Water Treatment Rule. Filtration components must necessarily be provided to satisfy maximum peak daily demands, and most economical treatment plant design is achieved by on-off operation of developed facilities. In addition, the initial cost of constructing facilities with capacity for satisfying future demands is minor in comparison to the complete addition of expanded system components at a future date. Therefore, from the standpoint of economy within the study life, it is recommended that treatment and raw water transmission improvements for all recommended priorities be constructed during the development phase for Priority 1 improvements. A summary of recommended treatment and raw water transmission improvements is provided on Table 8-7.

TABLE 8-7. Preliminary Cost Estimates for Proposed City of Bandon Raw Water Transmission and Treatment Plant Improvements

Lower Pump Station	$ 94,000
Intake to Middle Pump Transmission Main	32,745
Middle Pond Pump Station & Basin Expansion	104,500
Water Treatment Facility	
Solids Contact Clarifier	83,275
Filtration & Control Building Improvements	1,040,000
Disinfection Improvements	155,000
Construction Cost	$1,509,520
Engineering & Inspection	301,900
Legal and Administrative	75,475
Contingencies	150,950
TOTAL COST	**$2,037,845**

8.4 MANPOWER REQUIREMENTS

Projected improvements to the Bandon Water Treatment Facility should be developed with an improved programmable controller system that will operate major components electronically. An improved telemetry system should also be provided. Manpower needs should be limited to process controls, handling of chemical and disinfection materials, and maintenance of developed facilities.

The combined impact of improved equipment, automatic controls and modern filtration and chemical handling equipment should limit the need for additional manpower at the water treatment facility.

Based on an evaluation of existing manpower needs, it is believed that one full-time operator and one part-time relief operator should initially offer adequate staffing for the expanded water treatment facility. Assuming an allowance for 20% of the plant superintendents time to supervise treatment facility operations, it is recommended that an equivalent manpower of 1.5 operators be provided for the expanded facilities. This will provide for one full-time operator, one one-half time relief operator for weekend duty, and an allowance for plant superintendence. An allowance for the relief operator to provide full-time relief during vacation periods is also provided within the recommended manpower allocation. Manpower requirements at other locations could necessitate a need for increased labor to meet all demands placed on operational personnel. An example of additional program needs would be for enforcement and supervision of a backflow prevention program, etc.

8.5 SYSTEM DEVELOPMENT CHARGES FOR WATER TREATMENT PLANT IMPROVEMENTS

Proposed water treatment plant improvements are proposed for development to both satisfy existing consumer needs in conjunction with satisfying requirements of the Surface Water Treatment Rule, and to provide capacity for growth in the community. Portions of the existing treatment facility are projected for continued usage through the study period, and should receive some value for allocation to growth. However, to simplify the allocation process, we would suggest that new treatment plant construction simply be allocated proportional to system usage. Treatment plant improvements have been sized to meet the needs of the community for 25 years, and allocation should be made on this basis.

CHAPTER 9

TREATED WATER STORAGE

CITY OF BANDON
WATER SYSTEM MASTER PLAN

CHAPTER 9
TREATED WATER STORAGE

9.1 EXISTING STORAGE

Bandon currently has 1.0 million gallons of treated water storage in one reservoir. The steel reservoir is approximately 25 to 30 years old (plus) and presently is in good condition. It is located adjacent to the City's water treatment plant, east of town and south of Highway 42S, near the intersection of Highway 42S and Fish Hatchery Road.

9.2 RESERVOIR STORAGE REQUIREMENTS

Reservoir storage is provided for several purposes: (1) to reduce pump sizing and water supply rates over the day, (2) to equalize supply and demand over a long period of high consumption, (3) to provide water for fire protection, and (4) to furnish adequate supply during mechanical breakdowns, pipe repairs, replacement, or new construction. For purposes of analysis, reservoir storage requirements are based on the following:

1) Storage for Equalizing Flows and Emergency Usage

Equalizing storage provides water for normal daily flow fluctuations, and is utilized to maintain adequate storage levels for fire protection and domestic consumption. Emergency storage, on the other hand, is required storage to protect against a total loss of supply. This could occur during required repairs of the water transmission system, or by mechanical failure at the water treatment plant.

2) Fire Reserve

Requirements for fire reserve are based on a fire flow demand of 3,500 gpm for a duration of 3 hours (630,000 gallons), based on considerations discussed in Chapter 5 relative to fire flow requirements.

3) Total Storage

The total amount of storage required is the sum total of the component requirements. In the past, Oregon State Health Department(OSHD) regulations recommended that a system provide a minimum 24 hours emergency storage at maximum daily consumption plus fire flow or 3 days average daily consumption plus fire flow, depending on the size of community. At present the OSHD only requires that a minimum pressure of 20 psi be maintained at all times.

9.3 TOTAL STORAGE REQUIREMENTS

In order to compute reservoir requirements, the number of days necessary to make emergency repairs must be determined. The determination is somewhat subjective, and depends on what level of safety the community is willing to finance. At a minimum, one peak day of storage protection should be provided. For this case, total storage requirements are equal to the MDD plus fire flow (does not include a separate allowance for equalizing storage). H.G.E., INC. recommends storage requirements be based on three days ADD plus fire flow. This ensures adequate storage for fire protection and gives the City three days to complete repair of ruptured transmission mains, major distribution system breaks, treatment plant disruptions, or other system problems. Storage requirements based on the two alternatives are summarized in Table 9-1.

9.4 PROPOSED STORAGE VOLUME

Bandon presently has a significant shortage of treated water storage. The total volume currently available is less than the maximum day demand (MDD). This means if there is a disruption of water supply for a 24 hour period during the summer, such as a supply problem in one of the creeks or a breakdown at the treatment plant, the City could completely lose its water supply.

A 2.0 million gallon reservoir should be constructed immediately as a Priority I improvement. This will satisfy the City's storage needs for approximately 3,170 equivalent dwelling units (EDU's) and for a time period of about 15 years, based on a 2.5% AAGR. As a Priority III improvement, another 750,000 gallons of storage is recommended. City reservoir storage would then total 3.75 million gallons, which should be sufficient for the next 25 years (service to 4,057 EDU's).

9.5 RESERVOIR TYPES

Reservoirs are generally one of the following types:

- Ground level, gravity flow
- Ground level, booster pumps
- Elevated reservoir
- Standpipe

The selection of reservoir type depends on the site location. Water surface in the reservoir must be at the right elevation to provide adequate water pressures in the distribution system. A gravity flow reservoir is the preferred type when a suitable site is available with the proper ground elevation. However, when the only sites available are at too low of a ground elevation, the water surface in the reservoir must be raised either physically (elevated reservoir or standpipe) or lifted with booster pumps.

TABLE 9-1. TOTAL WATER STORAGE REQUIREMENTS
CITY OF BANDON
(MILLION GALLONS)

				Total Storage Required		Additional Storage Needed		
Full-Time Service Population	Service EDU's	Average Annual Demand AAD (MGD)	Maximum Daily Demand MDD (MGD)	Alternative 1 MDD+Fire (MG)	Alternative 2 3*ADF+Fire (MG)	Alternative 1 MDD+Fire (MG)	Alternative 2 3*ADF+Fire (MG)	Year 2.5% AAGR
2,421	2,135	0.53	1.10	1.73	2.22	0.73	1.22	1991
2,482	2,188	0.54	1.13	1.76	2.26	0.76	1.26	1992
2,544	2,243	0.56	1.16	1.79	2.30	0.79	1.30	1993
2,607	2,299	0.57	1.18	1.81	2.34	0.81	1.34	1994
2,672	2,357	0.59	1.21	1.84	2.39	0.84	1.39	1995
2,739	2,416	0.60	1.24	1.87	2.43	0.87	1.43	1996
2,808	2,476	0.61	1.28	1.91	2.47	0.91	1.47	1997
2,878	2,538	0.63	1.31	1.94	2.52	0.94	1.52	1998
2,950	2,601	0.65	1.34	1.97	2.57	0.97	1.57	1999
3,023	2,666	0.66	1.37	2.00	2.62	1.00	1.62	2000
3,099	2,733	0.68	1.41	2.04	2.67	1.04	1.67	2001
3,177	2,801	0.70	1.44	2.07	2.72	1.07	1.72	2002
3,256	2,871	0.71	1.48	2.11	2.77	1.11	1.77	2003
3,337	2,943	0.73	1.52	2.15	2.82	1.15	1.82	2004
3,421	3,017	0.75	1.55	2.18	2.88	1.18	1.88	2005
3,506	3,092	0.77	1.59	2.22	2.93	1.22	1.93	2006
3,594	3,169	0.79	1.63	2.26	2.99	1.26	1.99	2007
3,684	3,249	0.81	1.67	2.30	3.05	1.30	2.05	2008
3,776	3,330	0.83	1.72	2.35	3.11	1.35	2.11	2009
3,870	3,413	0.85	1.76	2.39	3.17	1.39	2.17	2010
3,967	3,498	0.87	1.80	2.43	3.24	1.43	2.24	2011
4,066	3,586	0.89	1.85	2.48	3.30	1.48	2.30	2012
4,168	3,676	0.91	1.89	2.52	3.37	1.52	2.37	2013
4,272	3,767	0.94	1.94	2.57	3.44	1.57	2.44	2014
4,379	3,862	0.96	1.99	2.62	3.51	1.62	2.51	2015
4,488	3,958	0.98	2.04	2.67	3.58	1.67	2.58	2016
4,601	4,057	1.01	2.09	2.72	3.65	1.72	2.65	2017

9.6 RESERVOIR LOCATION

Final selection of a reservoir site is a complicated process. Some of the considerations include: soil stability, proper elevation for hydraulic operation and utilization of existing reservoirs, topography, access, distance from distribution system, and availability of property. Generally reservoirs should be spread-out (evenly distributed) throughout the City. This places the storage close to where it is needed and can reduce the size of transmission and distribution system piping.

However, there is only one area in Bandon which has adequate elevation for construction of a ground level, gravity flow reservoir, and this is in the vicinity of the existing 1 MG reservoir. It is recommended that the Priority I reservoir (2 MG) be constructed adjacent to the existing reservoir. The City owns the site; there is adequate property available; the cost of access and interconnecting piping will be minimized; and soil conditions appear suitable for reservoir construction based on performance of the existing reservoir.

The Priority III reservoir should be located in the south section of town. In order to provide adequate pressures a ground level reservoir and booster pumps are recommended. Final location of the Priority III reservoir should be determined in 10 to 15 years, so that growth patterns which have occurred in the interim can be evaluated.

9.7 RESERVOIR MATERIAL

Reservoirs are typically constructed from steel or concrete. Steel reservoirs are typically less expensive to construct, but are more expensive to maintain because of corrosive action. Material selection also depends on site conditions. If the reservoir is partially or completely buried it should be constructed from concrete since it is not possible to access buried portions for maintenance. Bandon's existing reservoir is constructed from steel and City staff are comfortable with its performance. The reservoir was painted more than 5 years ago, but the paint system is holding up well. Other than routine maintenance, and occasional reconditioning the reservoir has served the City well. Cost estimates for reservoir construction in this study are based on a steel reservoir.

9.8 STORAGE RECOMMENDATIONS

A 2.0 MG steel, ground-level reservoir located adjacent to the City's existing 1 MG steel reservoir is recommended as a Priority I improvement. Initially, it appears there is adequate space available and the topography will work at this site for reservoir construction. If it becomes apparent during final design that the reservoir needs to be partially buried to make it fit on the site, either the reservoir material will need to be changed to concrete, the proposed site be relocated slightly downhill, or the reservoir made smaller. Also, the existing reservoir bypass needs to be eliminated to prevent the potential for accidental usage or leakage. This can be done by the installation of two valves and a vacant space between the valves, located in a concrete vault. If an emergency should develop, a pre-cut spool could be manually inserted between the valves to provide an emergency supply to the City that would be separate from the storage facilities.

Recommendations for Priority III storage improvements include construction of a ground-level, 750,000 gallon steel reservoir and booster pump station, located in the southern portion of town.

Cost estimates are presented in Table 9-2.

9.9 RESERVOIR SDC'S

Based on information developed in Chapter 5, the AAD per EDU is 250 gpd (includes non-metered water). Priority I reservoir costs can be proportionately allocated at $335 per EDU [$895,050/(2,000,000 gallons/(3 x 250 gpd))]. Bandon's reservoir storage is presently under capacity by 1.3 million gallons (Table 9-1). Therefore 35 percent of Priority I costs can be allocated to new development. One hundred percent of the Priority III reservoir and booster pump station costs can be allocated to new development. Priority III storage costs are proportionately allocated at $930 per EDU [$929,610/(750,000 gallons/(3 x 250))]. The total cost per EDU for reservoir storage is $1,255 ($325 + $930).

TABLE 9-2. PRELIMINARY COST ESTIMATE FOR PROPOSED CITY OF BANDON WATER STORAGE IMPROVEMENTS.

PRIORITY I - Immediate *2 Million Gallon Reservoir*	
Site Work Reservoir Costs Foundation and Painting Site Piping, Valving & Telemetry Cathodic Protection	$ 25,000 $490,000 $ 63,000 $ 65,000 $ 20,000
SUBTOTAL CONSTRUCTION COSTS	**$663,000**
Engineering and Inspection Contingencies Legal and Administrative	$132,600 $ 33,150 $ 66,300
TOTAL CAPITAL COSTS	**$895,050**

PRIORITY III - Service EDU's: 3,250-4,060 or AAD between 0.8 and 1 MGD; project initiated between 2008-2017 (date based on 2.5% AAGR). *0.75 Million Gallon Reservoir and Booster Pump Station.*	
Site Work Reservoir Costs Foundation and Painting Site Piping, Valving & Telemetry[1] Cathodic Protection Pumps Pump Hardware and Piping Standby Generator Electrical 500 Gallon Pressure Tank Site Evaluation & Acquisition	$ 25,000 $270,000 $ 38,600 $150,000 $ 15,000 $ 30,000 $ 40,000 $ 50,000 $ 30,000 $ 5,000 $ 35,000
SUBTOTAL CONSTRUCTION COSTS	**$688,600**
Engineering and Inspection Contingencies Legal and Administrative	$137,720 $ 68,860 $ 34,430
TOTAL CAPITAL COSTS	**$929,610**

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[1] Does not include pipeline cost between storage and distribution system.

CHAPTER 10

TREATED WATER DISTRIBUTION AND TRANSMISSION SYSTEM

CITY OF BANDON
WATER SYSTEM MASTER PLAN

CHAPTER 10
TREATED WATER DISTRIBUTION AND TRANSMISSION SYSTEM

10.1 GENERAL

Chapter 8, Water Treatment, included an evaluation of the transmission piping between existing impoundments and the treatment plant, and from the treatment plant to the existing 1.0 MG, treated water storage reservoir. Transmission and distribution piping between the treated-water storage reservoir and town will be discussed in this Chapter (Chapter 10).

Transmission piping is a term used for pipelines through which large quantities of water are primarily transported (transmitted) from one location to another. Distribution piping generally is used to refer to the network of pipes which distribute water to customers in town. In some instances, water lines serve both functions.

10.2 COMPUTER MODELING

A computer model was developed to simulate actual flows and pressures throughout the Bandon Water System for future conditions. The model was used to simulate existing and future flows throughout the system. Recommendations for distribution and transmission improvements based on information from this analysis are presented in Section 10.5.

Analysis of the water system was performed with the "Micro Hardy Cross" software program. Pipe networks as large as 4000 pipes, 200 pumps, 200 control valves and 2000 loops may be modeled. The program supports either Hazen-Williams, Darcy-Weisback or the Chezy-Manning pressurized conduit formulas for pipe friction losses. Graphics capabilities include convergence plots, pump head curves, loop hydraulic profiles, network plan views, and contour mapping of pressures, hydraulic grade line elevations or ground elevations.

10.2.1 Basic Assumptions

The network of distribution lines for a City may consist of thousands of individual pipes and nodes. A reliable computer model of the transmission and distribution system can be obtained through eliminating smaller distribution mains. In developing the model, the following assumptions should be noted:

- The actual distribution network must be reduced in size to match the limits of the computer model.

- Internal characteristics of individual lines cannot be realistically determined, therefore, average friction factors for each material type in the system should be utilized. The accuracy of any model can only be field tested for pressure and flows at a small percentage of the nodes. This limited information cannot guarantee the accuracy of calculated data at remaining locations within the system.

- The objective of Master Planning is to insure that adequate pressures and flows are available throughout sections of the system. The availability to provide information for smaller distribution lines is possible, but is beyond the scope of a Master Water Plan.

10.2.2 Data Base

A schematic diagram of the existing transmission and distribution system provided by the City, which showed pipe sizes and locations was utilized to prepare a base map showing major water lines. The base map was generated using AUTOCAD computer software. Pipe lengths were computed with AUTOCAD. Elevation of nodes were determined using topography information compiled from aerial photography dated January 1973.

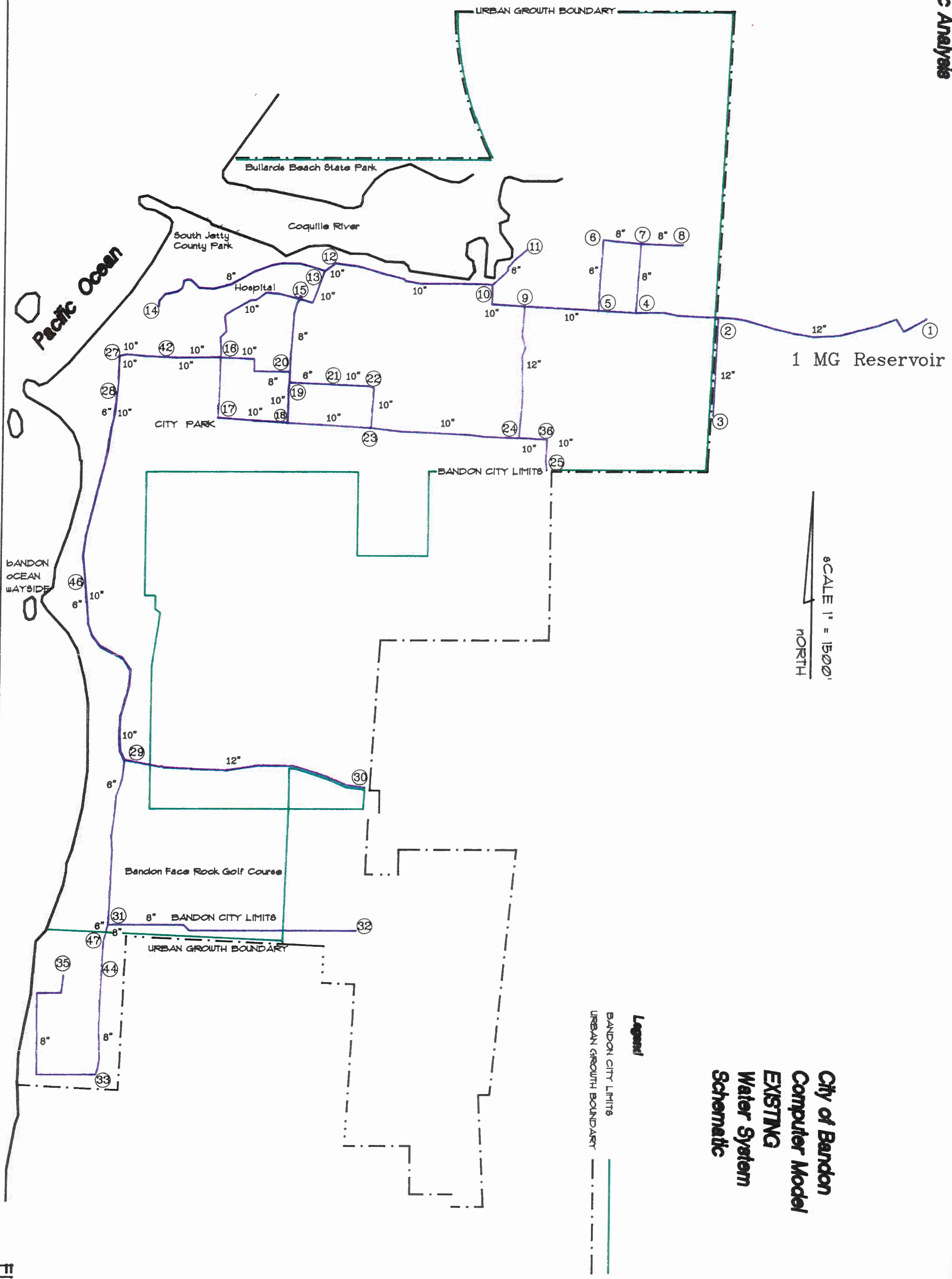
10.3 EXISTING SYSTEM MODELING

10.3.1 Network

A schematic diagram of the existing system is shown in Figure 10-1. This represents the existing system modeled by the computer. In general, only pipelines with diameters of 8 inches or greater were included. Information for pipelines and nodes was entered into the program to simulate the existing distribution system. Node data included numerical identification, elevation, and flow supply or demand. Pipe data included length, diameter, roughness coefficient and both upstream and downstream node numbers. An average roughness coefficient of C=110 was assumed for all pipelines (Darcy-Weisback formula).

10.3.2 Supply

For the existing system, the supply was taken from the City's 1 MG reservoir. The hydraulic gradeline for the reservoir was set at elevation 194.9 feet, mid-level. The elevation of the reservoir base is 178.9 feet and the maximum water-surface elevation is 210.9 feet.



City of Bandon
Computer Model
EXISTING
Water System
Schematic

HGE Inc. / 375 Park Avenue
Coos Bay, Oregon 97420

FIGURE 10-1

10.3.3 Performance Criteria

The OSHD requires that a minimum pressure of 20 psi be maintained throughout the system. Most household water-using appliances, however, require pressures of 40 psi to operate properly. The system was therefore modeled assuming that a minimum of 20 psi of pressure be maintained at all nodes, during all fire flow conditions plus peak hourly domestic demand, with an ideal pressure of 40 psi during peak hourly domestic demand (no fire flow).

10.3.4 Test Conditions

The existing and future system was computer modeled for the following conditions:

Condition a) Test: Maintain 40 psi residual pressure
Flow Condition: Peak Hourly Demand

Condition b) Test: Acceptable energy loss in pipelines
Flow Condition: Peak Hourly Demand

Condition c) Test: Maintain 20 psi residual pressure
Flow Condition: Peak Hourly Demand plus Fire Flow

10.3.5 Water Demand Allocations

Distribution lines should be sized to provide capacity for the peak hourly demand (PHD) plus fire flow. Water demands were allocated equally to each node. Each node was multiplied by the appropriate peaking factor to obtain average daily, maximum daily and peak hourly demands. Flows at nodes representing more than one land use and nodes in lightly populated areas were adjusted accordingly.

10.3.6 Applied Fire Flows

The maximum fire flow requirements typically used by the Insurance Services Office (ISO) when determining a communities fire insurance rating are 1,500 gpm in residential areas and 3,500 gpm in commercial areas. Based on a variety of factors ISO determines the recommended fire flow in specific locations, and depending on the spacing and square footage of building, the recommended flow may be less than the maximum.

Fire flows were added (only one at a time) during peak hourly demands to determine pipeline sizing requirements. It is not economically feasible to size the proposed pipelines to provide a fire flow of 3,500 gpm during peak hourly demands (PHD). The general design goal was to ultimately be able to provide at least 1,500 gpm (residential protection) of fire flow in most areas of town after improvements are made.

10.3.7 Data Calibration

City staff measure and record flows from hydrants during periodic line flushing. These records give a general indication of the fire protection available in different areas of town. However, there is not sufficient information available to calibrate the computer model since the City's domestic water demand and the residual water pressure at the hydrant during testing are not known. In the future it may be worthwhile for City staff to also measure the water pressure at an adjacent hydrant or household immediately before and during the hydrant test. This would provide sufficient information to accurately calibrate future computer model tests.

Results of a general comparison between the City's hydrant test results and the computer simulation are shown in Table 10-1. Line flushing most likely occurred when the system demand was between the ADD (Average Daily Demand) and PHD (Peak Hourly Demand). The measured hydrant flows fall within the range computed with the computer model.

Since the computer model could not be accurately calibrated, an average roughness coefficient was assumed for all pipelines. The model is still considered to provide a reasonable representation of the system, and serves as an excellent design tool for establishing line sizing in the system.

The most important item which should be noted from Table 10-1 is the significant variance in available flow depending on how much other water consumption is occurring at the same time. During peak water usage in the summer (PHD) there is very limited fire protection available. Although less than desired, the volume of available fire flows is significantly higher when the water demand drops to average levels (ADD). Residential customers and businesses generally will cut back on water usage during a fire. However, the first few minutes is often the most critical in protecting against major fire losses.

10.4 LOOPED DISTRIBUTION SYSTEM VERSUS BRANCHING

Schematic examples of a looped distribution system and a branched distribution system are shown in Figure 10-2. A looped system is desired because:

A) Water is carried by many interconnected pipes, which significantly increases the hydraulic capacity of the system.

B) Increased factor of safety. If a pipe is out of service, water can still be fed to customers from a different direction (pipeline).

C) Decreased line flushing, sediment is more likely to be kept in suspension since there is a constant circulation of flow.

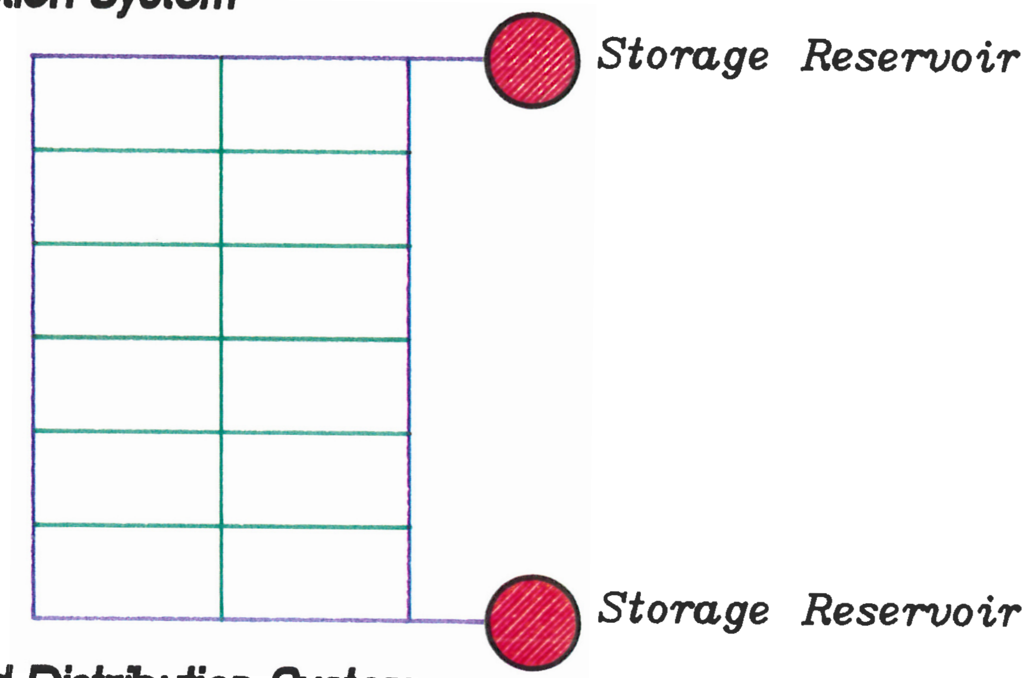
TABLE 10-1.

CITY OF BANDON

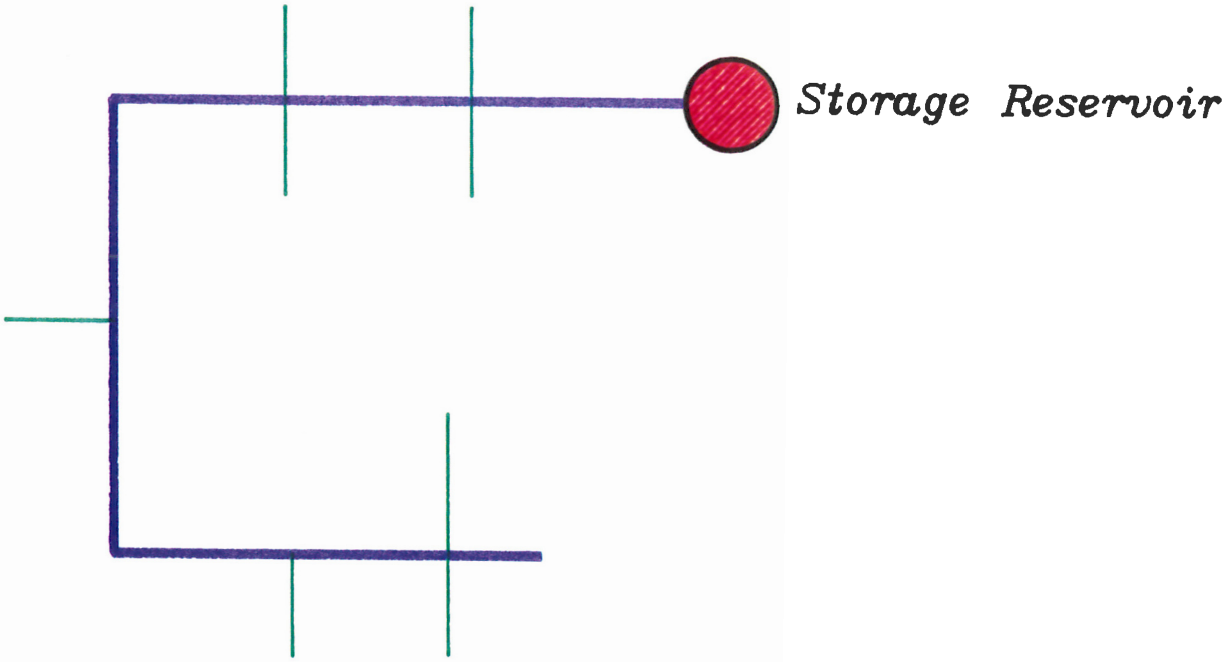
HYDRANT TESTS
EXISTING CONDITIONS
1992 DEMAND FLOWS

NODE NUMBER	LOCATION	MEASURED HYDRANT FLOW	COMPUTER SIMULATION		
			ADD + FIRE	MDD + FIRE	PHD + FIRE
8	2ND & HWY 101 N.E.	980	1000	700	200
12	1ST & EDISON	400	800	500	100
16	8TH & JACKSON S.W.	650	800	450	100
20	8TH & FRANKLIN	300	800	425	100
23	11TH & ALLEGHENY S.W.	350	800	500	100
27	8TH & MADISON S.W.	600	700	400	100
29	BEACH LOOP & SEABIRD	---	600	300	100
30	SEABIRD & HWY 101 S.E.	---	550	300	100
31	BEACH LOOP & POLARIS	---	375	250	75
32	HYW 101 S.E. & +/- UGB	---	250	150	0
34	BEACH LOOP & SATURN	---	350	225	75
35	ROHRER & VENUS	---	250	225	75

City of Bandon Schematic of Looped Versus Branching Distribution System



Looped Distribution System



Branching Distribution System

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19 N.W. 5TH AVE., PORTLAND, OREGON 97209 (503) 222-1687

Figure 10-2

Branching distribution systems are not desirable, if economics, land ownership, and geography allow a looped system, since:

A) Water is carried through single pipes which restricts the hydraulic capacity of the system.

B) If a branched pipeline is out of service, customers are without water.

C) Due to lack of circulation, sediment settles out in dead-end lines, which leads to the need for line flushing and increases the potential of bacterial contamination.

As can be seen from Figure 10-1 (does not show any system pipelines smaller than 6-inches in diameter, and primarily shows 8-inch and larger diameter), Bandon has large areas of town served principally with a branched system, especially the southern portion of the City.

10.5 SYSTEM RECOMMENDATIONS

Recommended system improvements are shown on Figures 10-3, 10-4 and 10-5. Cost estimates are provided in Table 10-2. Proposed improvements have been divided into four priority categories. The division is based on relative improvements in hydraulic capacity and anticipated growth patterns in the community. If economics allow, it is desirable to combine improvements within priority categories. If growth patterns vary, it may be necessary to change the order of priorities.

The emphasis of proposed improvements is to create a looped distribution system around Bandon. This is the most critical need, and insures that the potential exists to transmit adequate quantities of water throughout town. Pipelines constructed within the interior of loops will increase the overall hydraulic capacity of the system. Sizing of interior lines is not as critical, although future sizing should be restricted to a minimum of 6-inches in diameter (smallest line size that Insurance Services Office will recognize as providing fire protection). However, if the interior line will potentially feed a significantly developed area (or area with large water needs), considerations should be given to increasing the minimum line size to 8-inches in diameter. In these cases it may be prudent planning to have an Engineer size the pipeline, and the computer model of the system developed for this Water System Master Plan could be utilized for this purpose.

Priority I improvements basically consist of constructing a 16-inch diameter pipeline from the storage reservoir to the distribution system. This is the most critical need since the existing 12-inch diameter transmission main is hydraulically undersized, and because the town will be entirely without water if the existing line, which was constructed in the 1950's (almost 40 years old) is out of service for repairs. It has been assumed in the computer analysis that the City will continue to maintain the 12-inch line for future use.

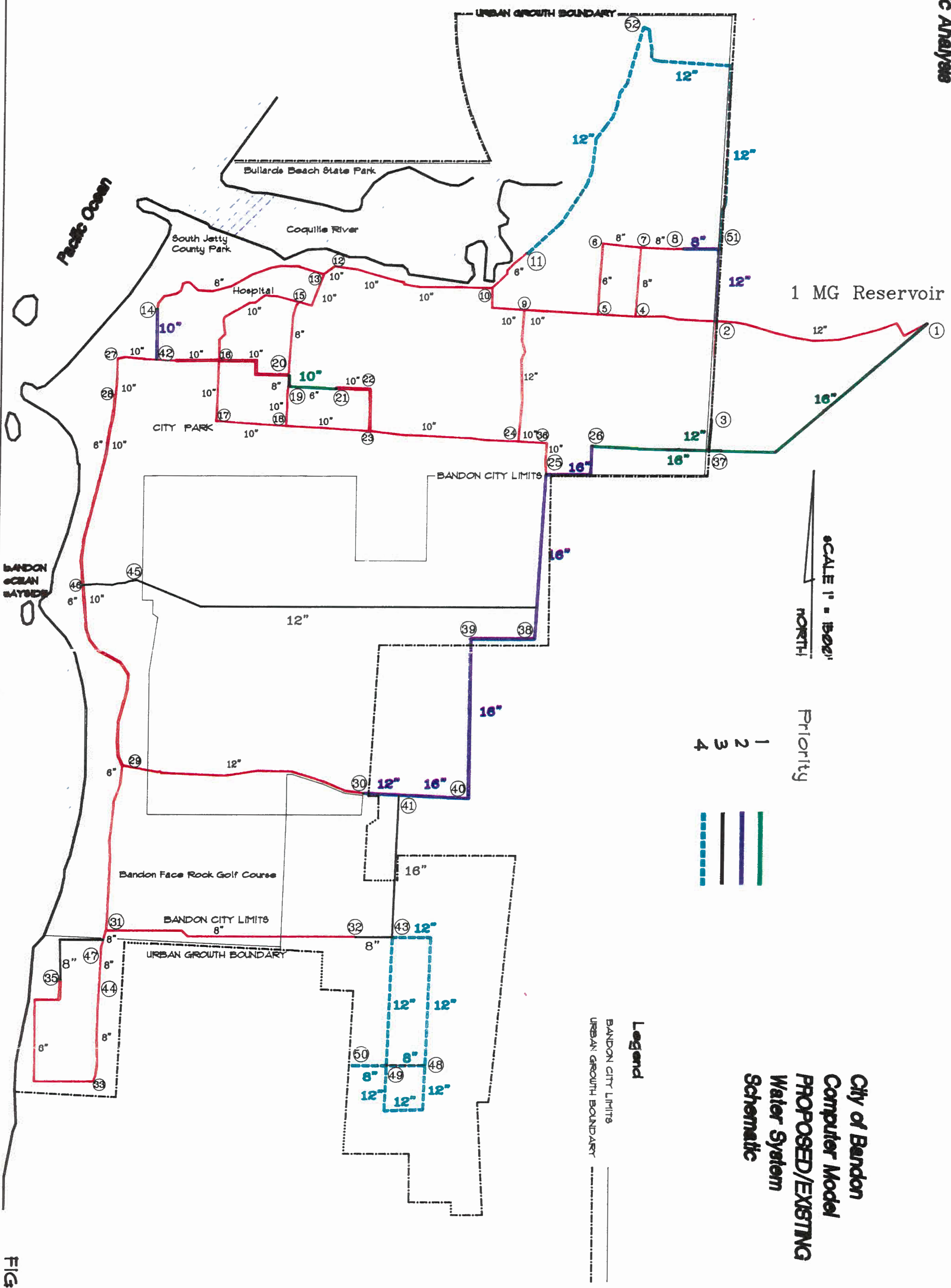
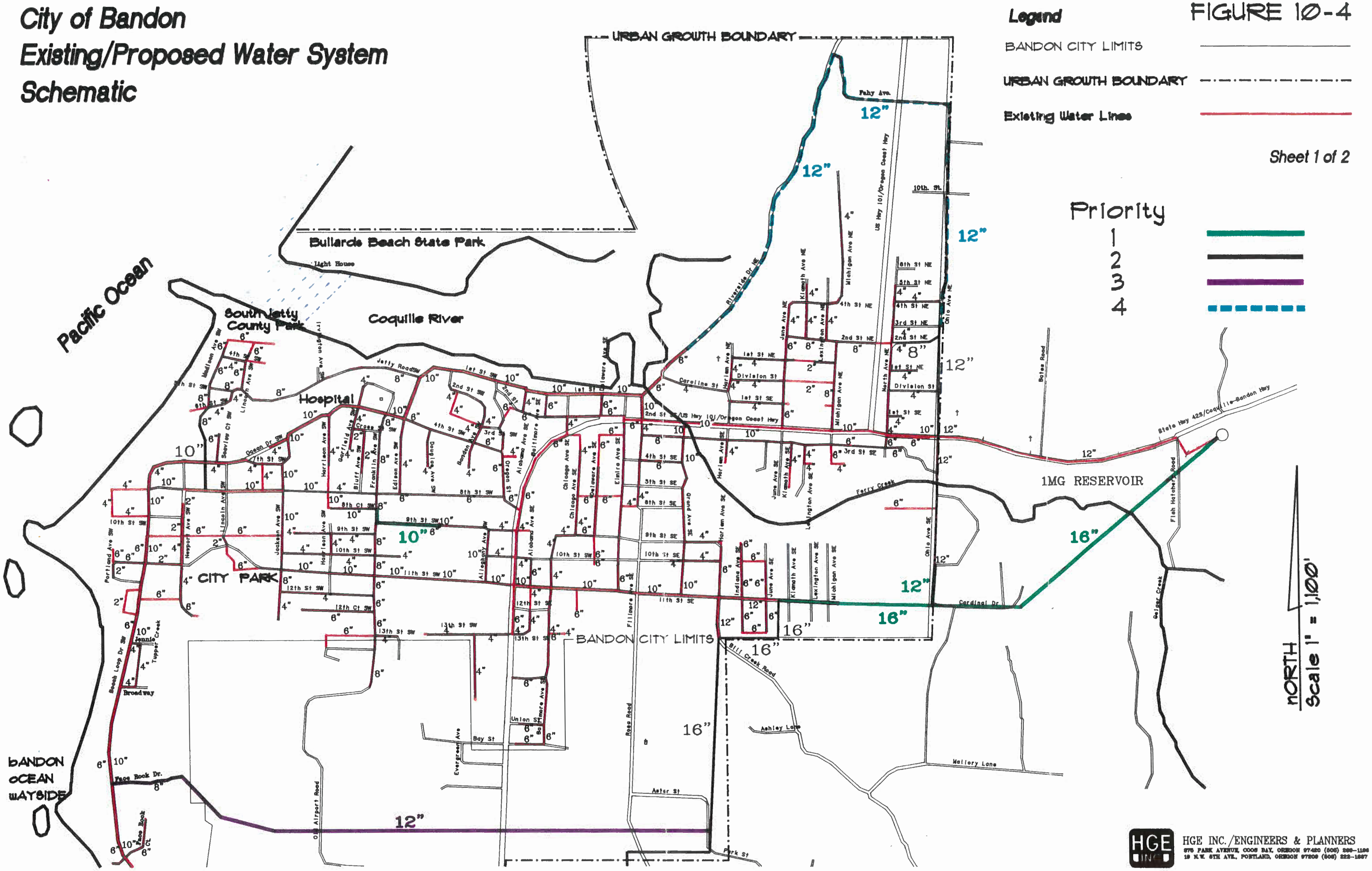


FIGURE 10-3

HGE Inc. / 375 Park Avenue
Coos Bay, Oregon 97420

City of Bandon
Existing/Proposed Water System Schematic

FIGURE 10-4



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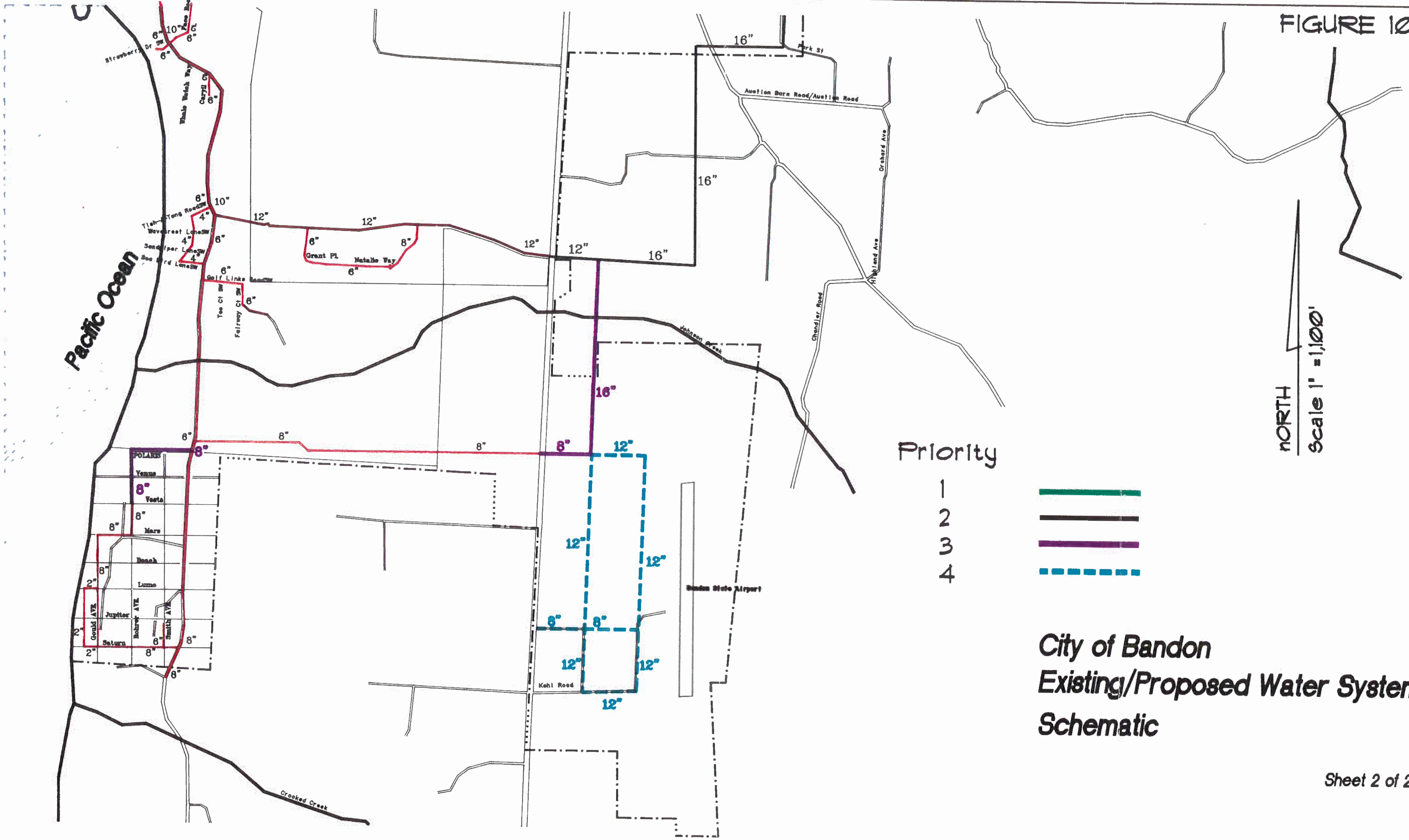
19 N.W. 5TH AVE., PORTLAND, OREGON 97209 (503) 222-1687

FIGURE 10-5



City of Bandon
Existing/Proposed Water System Schematic
Schematic

Sheet 2 of 2

Legend

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19 N.W. 5TH AVE., PORTLAND, OREGON 97209 (503) 222-1667

TABLE 10-2

CITY OF BANDON
RECOMMENDED DISTRIBUTION IMPROVEMENTS
ENR COST INDEX = 5032

PIPE NUMBER	STARTING NODE	ENDING NODE	DIAMETE (INCH)	LENGTH (FEET)	UNIT COST	CONSTRUCT COST	TOTAL COST	PHASE	SUBTOTAL	CUMULATIVE TOTAL
22	19	20	10	169	$41	$6,929	$9,354	I		
23	19	21	10	785	$41	$32,185	$43,450	I		
42	1	37	16	3,229	$65	$209,885	$283,345	I		
43	37	3	12	500	$46	$23,000	$31,050	I		
44	37	26	16	1,904	$65	$123,760	$167,076	I	$534,275	$534,275
45	25	38	12	2,654	$46	$122,084	$164,813	II		
46	38	39	12	1,043	$46	$47,978	$64,770	II		
47	39	40	12	2,615	$46	$120,290	$162,392	II		
48	40	41	12	1,129	$46	$51,934	$70,111	II		
49	41	30	12	582	$46	$26,772	$36,142	II		
50	14	42	10	819	$41	$33,579	$45,332	II		
64	8	51	12	575	$46	$26,450	$35,708	II		
65	2	51	12	1,403	$46	$64,538	$87,126	II		
70	25	26	16	1,203	$65	$78,195	$105,563	II	$771,957	$1,306,232
51	41	43	16	2,319	$65	$150,735	$203,492	III		
52	43	32	8	650	$35	$22,750	$30,713	III		
54	39	45	12	5,737	$46	$263,902	$356,268	III		
55	45	46	12	873	$46	$40,158	$54,213	III		
68	35	47	8	743	$35	$26,005	$35,107	III	$679,793	$1,986,024
59	43	48	12	2,698	$46	$124,108	$167,546	IV		
60	48	49	8	631	$35	$22,085	$29,815	IV		
61	43	49	12	2,069	$46	$95,174	$128,485	IV		
62	48	49	12	2,108	$46	$96,968	$130,907	IV		
63	49	50	8	561	$35	$19,635	$26,507	IV		
66	51	52	12	4,456	$46	$204,976	$276,718	IV		
67	11	52	12	4,457	$46	$205,022	$276,780	IV	$1,036,757	$3,022,781
TOTAL				45,912		$2,239,097	$3,022,781		$3,022,781	

It is also recommended that undersized pipelines in the vicinity of the public school be replaced as part of the Priority I Project.

Note that Priorities II and III include an extension of the 16-inch diameter transmission main to the south City limits. The 16-inch line will form the "backbone" of the distribution system.

A comparison of available fire flow with the existing system and after Priority I improvements are complete is provided in Table 10-3. Available fire flows shown can only occur at one location at a time. Since the computer model could not be calibrated, actual fire flows will vary from the estimated values. The amount of fire protection available throughout town will increase significantly after Priority I, although available flow will still be much less than desired in the west and south portions of the City.

As domestic demands approach the year 2017 projections, the volume of flow available for fire protection will drop, and construction of subsequent priority categories will be necessary.

A comparison is provided in Table 10-4 of conditions after construction of:

A) Priority I improvements

B) Priority I and II improvements

C) Priority I, II and III improvements

The Priority IV, 12-inch loop around the north portion of the town should provide a minimum fire flow of 1,500 gpm for most potential customers in this area. After Priority IV improvements, fire protection may be limited to about 1,250 gpm in the airport and industrial park area, during PHD, because of the relatively high elevation in the area.

It has been assumed that development of the most southern end of Beach Loop Drive will be residential and that a fire flow of 600 gpm during PHD is acceptable. If commercial development is anticipated or larger fire flows are required, then it may be necessary to replace the 2,700 feet of existing 6-inch diameter line between Seabird Lane and Polaris Street.

Static pressures exceeded 40 psi throughout the areas modeled. After the looped system in town is constructed most areas will have residual pressures exceeding 40 psi during PHD. The exceptions are generally east of Highway 101, where elevations exceed 100 feet. With looping and proper line size, it should be possible to have residual pressures greater than 30 psi up to elevation 105, and greater than 20 psi up to elevation 125. As

TABLE 10-3.

CITY OF BANDON

COMPUTER SIMULATION

COMPARISON OF CONDITIONS WITH EXISTING SYSTEM AND SYSTEM AFTER PRIORITY I IMPROVEMENTS

		COMPUTER SIMULATION		
		EXISTING SYSTEM	AFTER PRIORITY I IMPROVEMENTS	
NODE NUMBER	LOCATION	1992 DEMAND PHD + FIRE	1992 DEMAND PHD + FIRE	2017 DEMAND PHD + FIRE
8	2ND & HWY 101 N.E.	200	1,200	1,000
12	1ST & EDISON	100	1,500	500
16	8TH & JACKSON S.W.	100	1,300	400
20	8TH & FRANKLIN	100	1,350	400
23	11TH & ALLEGHENY S.W.	100	1,450	500
27	8TH & MADISON S.W.	100	950	250
29	BEACH LOOP & SEABIRD	100	600	150
30	SEABIRD & HWY 101 S.E.	100	550	150
31	BEACH LOOP & POLARIS	75	250	50
32	HYW 101 S.E. & +/- UGB	0	150	0
34	BEACH LOOP & SATURN	75	250	50
35	ROHRER & VENUS	75	225	50

TABLE 10-4.

CITY OF BANDON

COMPUTER SIMULATION

COMPARISON OF CONDITIONS WITH
DIFFERENT PRIORITY IMPROVEMENTS

2017 DEMAND CONDITIONS
PHD + FIRE FLOW

NODE		COMPUTER SIMULATION PRIORITY I IMPROVEMENTS	PRIORITY I & II IMPROVEMENTS	PRIORITY I, II & III IMPROVEMENTS
8	2ND & HWY 101 N.E.	1,000	1,950	2,000
12	1ST & EDISON	500	1,950	2,000
16	8TH & JACKSON S.W.	400	1,800	1,850
20	8TH & FRANKLIN	400	1,800	1,850
23	11TH & ALLEGHENY S.W.	500	1,850	1,900
27	8TH & MADISON S.W.	250	1,650	1,700
29	BEACH LOOP & SEABIRD	150	2,150	2,300
30	SEABIRD & HWY 101 S.E.	150	1,950	2,100
31	BEACH LOOP & POLARIS	50	200	900
32	HYW 101 S.E. & +/- UGB	0	100	1,200
34	BEACH LOOP & SATURN	50	150	600
35	ROHRER & VENUS	50	150	600

noted in earlier discussion, some household appliances need 40 psi of water pressure for satisfactory performance.

10.6 SYSTEM DEVELOPMENT CHARGES

Proposed pipeline diameters are sized based on the projected PHD in the year 2017 and fire flow. All residents, existing and future, will benefit proportionally from improvements.

In 2017, it has been projected that there will be 4,057 service EDU's. The cost per EDU is therefore $745 ($3,022,781/4,057).

CHAPTER 11

WATER SYSTEM DEVELOPMENT PLAN

CITY OF BANDON
WATER SYSTEM MASTER PLAN

CHAPTER 11
WATER SYSTEM DEVELOPMENT PLAN

This Chapter includes a summary of preliminary cost estimates for proposed improvements, a flow chart showing the implementation process, a time line for scheduling improvements, and considerations for future developments.

11.1 SUMMARY OF PROPOSED IMPROVEMENTS

A summary of the proposed improvements is presented in Table 11-1 with the preliminary estimated costs for construction, engineering and inspection, legal and administration costs.

11.2 IMPROVEMENT IMPLEMENTATION

The City Council should set an initial scope for the project based on recommendations in this Study. The scope should include improvements the Council feels will satisfy the highest priority needs in the community and which will be affordable to residents regardless of whether the City is successful in securing governmental grants and loans.

A local bond issue should be held for Priority I improvements at the earliest possible opportunity, with potential local cost reductions if grants should become available. Depending on the success in obtaining grant monies, the City could either expand the construction to include Priority II recommendations, or reduce the level of local bonding. Thus, the amount of the bond issue needed to finance construction can be established for that portion of the previously prioritized improvements which the City Council feels the community can afford, and for the level of service desired by residents.

Once the bond election has been held and approved, the City can authorize the Engineer to design and advertise the improvement project for construction bids.

A schematic of the implementation is shown on Figure 11-1.

A time-line for water system improvements is shown in Table 11-2. The schedule shown is for planning purposes only and actual times will vary. Bandon's needed water improvements may have special requirements, such as environmental studies, which must be considered separately and are not included. It will require approximately 18 months from the date the City Council sets the initial scope of the project for water treatment, storage, and distribution and transmission improvements until construction begins. An additional year will be required to complete all phases of construction. The schedule could be accelerated by authorizing specific portions of the engineering design to begin before the bond election is held.

TABLE 11-1

SUMMARY OF ESTIMATED PRELIMINARY COSTS

PRIORITY I - Immediate (1993 Estimate of Service EDU's - 2,243)

Upgrade existing treatment plant, add treated-water reservoir storage, distribution and transmission system improvements, raw-water pump station improvements, repairs and maintenance of Ferry Creek impoundment, and preliminary engineering and permitting for long-term water supply

Proposed Improvement	Construct Cost	Engineer& Inspect	Legal& Admin	Conting	Total Cost
Maintain Ferry Ck Impoundment	$50,000	$10,000	$2,500	$5,000	$67,500
Preliminary Engineering and Permits for Long-Term Water Supply		$187,500	$50,000	$0	$237,500
Lower Pump Sta. Improvements	$94,000	$18,800	$4,700	$9,400	$126,900
Replace line from Lower Pump Sta. to Middle Pond	$32,745	$6,549	$1,637	$3,275	$44,206
Middle Pump Sta. and Middle Pond Expansion	$104,500	$20,900	$5,225	$10,450	$141,075
Treatment Plant Upgrade	$1,278,275	$255,655	$63,914	$127,828	$1,725,671
New Storage Reservoir, 2 Million Gallons	$663,000	$132,600	$33,150	$66,300	$895,050
Transmission and Distribution Improvements	$395,759	$79,152	$19,788	$39,576	$534,275
Total	$2,618,279	$711,156	$180,914	$261,828	$3,772,177

TABLE 11-1 (Continued)

PRIORITY II - 1998-2003 (Service EDU's Range - 2,540-2,870)

Distribution System Improvements

Proposed Improvement	Construct Cost	Engineer& Inspect	Legal& Admin	Conting	Total Cost
Distribution Improvements	$571,820	$114,364	$28,591	$57,182	$771,957

PRIORITY III - 2003-2008 (Service EDU's Range - 2,870 -3,250)

Distibution Improvements and New 0.75 MG Storage Reservoir and Booster Pump Station

Proposed Improvement	Construct Cost	Engineer& Inspect	Legal& Admin	Conting	Total Cost
Distribution Improvements	$503.550	$100.710	$25,178	$50,355	$679,793
New 0.75 MG Storage Reser And Booster Pump Station	$688.600	$137,720	$34,430	$68,860	$929,610
Total	$1.192.150	$238.430	$59,608	$119,215	$1,609,403

PRIORITY IV - 2008-2017 (Service EDU's Range - 3,250-4,060)

Distribution System Improvements

Proposed Improvement	Construct Cost	Engineer& Inspect	Legal& Admin	Conting	Total Cost
Distribution Improvements	$767,968	$153,594	$38,398	$76,797	$1,036,757

Notes:

a) Capital cost for long-term water supply solution(s) not included.

b) EDU stands for single-family residential equivalent dwelling unit.

FIGURE 11-1

PLANNING FLOW CHART

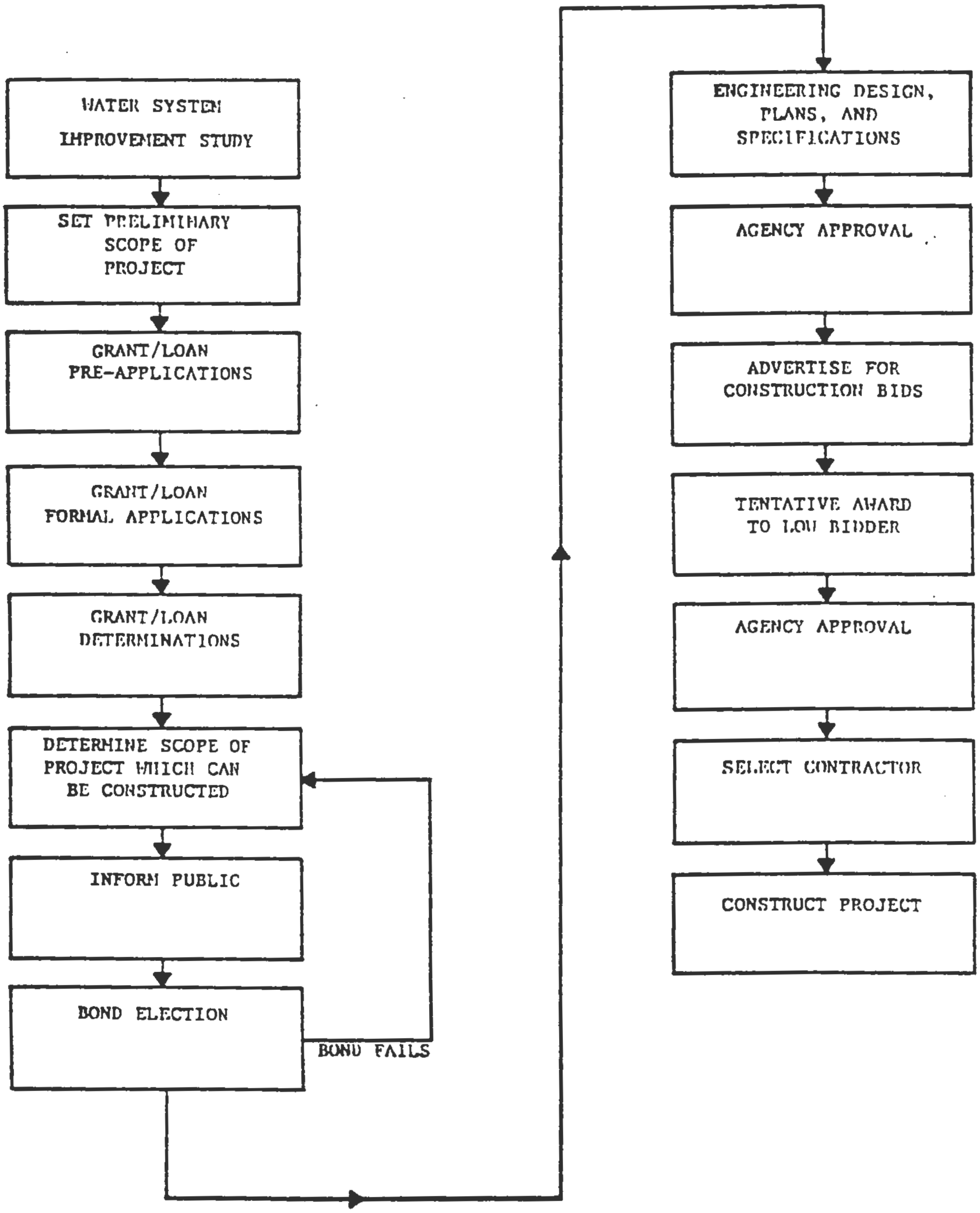

TABLE 11-2

TIME LINE FOR WATER SYSTEM IMPROVEMENTS[1]

TASK	TIME	CUMULATIVE TIME
Prepare Grant/Loan Pre-Applications	2 Weeks	0.50 Months
Pre-Applications Reviews	1 Month	1.50 Months
Prepare Grant/Loan Formal Applications	2 Weeks	2 Months
Grant/Application Reviews Grant/Loan Determinations	3 Months	5 Months
Determine Scope of Project Which Can be Constructed	1 Month	6 Months
Inform Public, Bond Preparation, Bond Election	3 Months	9 Months
Engineering Design, Plans and Specifications	6 Months	15 Months
Agency Review	1 Month	16 Months
Tentative Award to Low Bidder	2 Weeks	17 Months
Begin Construction	2 Weeks	17.5 Months
Complete Construction	1 Year	30 Months

---

[1] Schedule is for planning purposes only. Actual times will vary.

CHAPTER 12

FINANCING OPTIONS FOR PROPOSED WATER SYSTEM IMPROVEMENTS

CITY OF BANDON
WATER SYSTEM MASTER PLAN

CHAPTER 12
FINANCING OPTIONS FOR PROPOSED WATER SYSTEM IMPROVEMENTS

12.1 INTRODUCTION

The funding of needed water improvements for Bandon may be accomplished by the sale of bonds, through the acquisition of Federal or State grants and/or loans, through special assessments, local improvement districts, serial levies, capital improvement (sinking) funds, systems development charges, and other sources of income. It is rarely possible to finance improvements solely with grants, and some level of local funding or borrowing from available loan programs is virtually always necessary. The most successful financing plans utilize State or Federal grants and/or loans which best address the characteristics of needed improvements.

Some programs target economic development and the creation or retention of jobs; others must benefit areas of low to moderate income families; and others are specifically provided for specific types of improvements such as the need for Bandon water improvements. On occasion, it is possible to package loans and grants from more than one source.

A thorough consideration of applicable State and Federal funding programs, in addition to potential means of securing local funding, is needed to minimize the long-term cost of water system improvements for Bandon, while providing quality construction. This funding analysis is provided in this report.

12.2 PUBLIC WORKS FINANCING PROGRAMS

Four grant programs and four loan/bond sale programs have been considered. The programs are listed below.

Grants

Federal

1. Economic Development Administration
2. Farmers Home Administration

Federal Administered by State

3. Oregon Community Development Block Grants

State

4. Special Public Works Fund

Loans/Bond Sales

Federal

1. Farmers Home Administration

State

2. Special Public Works Fund (Oregon Bond Bank)
3. Water Resources Department
4. Safe Drinking Water Funding Program
5. Small Scale Energy Loan Program

Each of the available grant and loan programs varies in terms of the extent and complexity of the application process. In all cases, it is extremely important to communicate the program needs to the funding agency at the earliest possible date. A close working relationship with the potential grantor or lending agency can optimize the timing and amount of the grant and/or loan assistance.

In most cases, the grant and/or loan application must be accompanied with or preceded by a Notice of Intent filed with both the local and State Clearinghouses. The subsequent A-95 review process assures the applicant and the grantor/lender agency that the project will be in compliance with regional goals and guidelines and State rules and regulations. Following is a brief overview of potential public works financing programs and an assessment of their availability.

Economic Development Administration

The emphasis of the Economic Development Administration (*EDA*) grant program is on projects which create permanent jobs, especially in economically depressed areas. A survey of businesses is required to demonstrate the potential number of jobs that might be created if the proposed project is completed. There is a higher chance of receiving the grant if the community can demonstrate that the existing system is at capacity, for example if there is a moratorium on new connections. Bandon qualifies under the criteria of the water system being utilized to capacity.

Grants require a local match, usually in the range of 40 to 50 percent of the project cost, although local match can be as low as 20 percent. The maximum grant is about $1,000,000 but is sometimes higher.

This program could possibly be used in conjunction with a Farmers Home Administration (*FmHA*) grant. The *FmHA* program is primarily provided for the benefit of residential users. However, *EDA* has recently offered grants to communities in Oregon for commercial usage, when FmHA provides funding for the residential and small commercial users. However the community must still demonstrate the potential for creation of jobs from the project.

Farmers Home Administration and the Consolidated Farmers Home Administration Act of 1961.

The grant and loan program under this Act is administered by the U.S. Department of Agriculture, Farmers Home Administration *(FmHA)*. This program should be considered a viable program for water improvements for Bandon, even though the State office of FmHA has allocated much of their monies to communities with lower median household incomes in recent years. The program is limited to rural communities having less than 10,000 population and which are not likely to decline in population in the foreseeable future. The 1991 certified population estimate for Bandon is 2,335 people, so the City presently meets the population criteria.

FmHA GRANT PROGRAM

As of April 1, 1984, *FmHA* has changed its criteria on funding for grant and low interest cost loans. *FmHA* now utilizes "MEDIAN HOUSEHOLD INCOME" *(MHI)* rather than Median Family Income in their computations for determining eligibility for their program. This allows for single person households to be included along with family type households.

The Farmers Home Administration is now basing its grant and loan determination on the 1990 census data. Availability of grants from the *FmHA* is dependent on the *(MHI)* and projects are competitive with one another, on the basis of community need.

Maximum grant availability based on *MHI* from 1980 census data is as follows:

- Less than $22,205 . . . . 75% maximum grant
- $22,205 to $27,756 . . . . 55% maximum grant
- Greater than $27,756 . . . . Ineligible for grant

The City of Bandon has a *MHI* (1990 Census) of $17,708, and could qualify for grant funding of up to 75 percent of the project cost. However, *FmHA* requires eligible communities to finance the project with loans up to the extent of the communities ability to pay; then the grant is available to cover the remainder. *FmHA* has a limited amount of grant funds available at the State and Federal level, and requirements of the Safe Drinking Water Act have dramatically increased the current number of applications from Oregon communities. However, Bandon can document a potential health threat due to inadequate water treatment, which should rank the City's application relatively high compared to other communities.

FmHA LOAN PROGRAM

Bandon does fall within the established criteria for loans, and this is an excellent financial assistance program. Eligibility criteria for borrowers follows:

- Be unable to obtain needed funds from other sources at reasonable rates and terms.
- Have legal capacity to borrow and repay loans, to pledge security for loans, and to operate and maintain the facilities or services.
- Be financially sound and able to manage the facility effectively.
- Have a financially sound facility based on taxes, assessments, revenues, fees, or other satisfactory sources of income to pay all facility costs including operation and maintenance, and to retire the indebtedness and maintain a reserve.

FmHA loans are available for water system improvements at one of the following interest rates: (Effective March 1993)

- Less than $22,205 . . . . 5 percent
- $22,205 to $27,756 . . . . 5.625 percent
- Greater than $27,756 . . . . 6.125 percent

Based on the 1990 Census data, and since a health threat can be documented, Bandon presently qualifies for a 5 percent loan. The maximum term for all loans to cities is 40 years. However, no repayment period can exceed any local statutory limitation on borrowing authority, nor the useful life of the improvement to be financed. Interest rates are set periodically and are based on the current market yields for municipal obligations, and rates could improve slightly from current levels. The City would need to advertise bonds on the open market before receiving a *FmHA* loan, to demonstrate that comparable financing from another source is not available. However, this is often just a formality, as low interest, long term loans are very difficult to obtain in the financial market place.

Since the Bandon project will involve a substantial commitment of *FmHA* Loan Funds to one project, it may be possible and expected that a combination of loan sources be considered. This could allow for a commitment of some loan funds from FmHA and additional funds from another program, such as the Oregon Bond Bank program of the Special Public Works Fund. However, for grant eligibility it is anticipated that the majority of needed loan funds must be authorized on a 40 year basis.

Community Development Block Grant Program

The State of Oregon Economic Development Department administers the Community Development Block Grant *(CDBG)* program. This program is funded by the U.S. Department of Housing and Urban Development. Funds allocated under this grant program are provided for projects designed specifically to improve the conditions of low and moderate income housing areas. The maximum Grant for 1993 will be $750,000 for a public works construction project.

To qualify for a grant the project must meet at least one of the following three national objectives:

- Benefit to low and moderate income persons
- Prevention/elimination of slums and blight
- Urgent need

Under current policy 51 percent of a city's population must have low and moderate incomes to be eligible. The 1980 census data indicates that Bandon will meet this criteria. Grant awards in 1993 will be based on the 1980 Census data except Public Works projects, which will be determined at a later date, but will likely be based on 1990 Census data or approved CDBG income survey. The proposed water system project meets the national objectives of benefit to low and moderate income persons.

Special Public Works Fund
Oregon Economic Development Department

The State of Oregon Economic Development Department administers the Oregon Special Public Works Program. Applications may be submitted throughout the year.

This program is funded through the Oregon Lottery. Loans and grants may be made available for infrastructure construction projects related to economic development and the retention or creation of jobs. Eligible projects shall provide for the improvement or extension of publicly owned and operated infrastructure necessary to enable a benefitted business to create pledged jobs within the community; or provide system capacity or capability to serve economic development where a high probability of industrial development where a high probability of industrial development and job creation exists, or may be documented.

FIRM BUSINESS COMMITMENT - SPWF PROGRAM

Grants of up to $500,000 are available for projects with a firm business commitment to create permanent jobs, if the project is constructed. In general, the jobs must be industrial or manufacturing related. Commercial jobs such as restaurants, stores, etc., generally do not qualify. SPWF grant funds are dependent upon the demonstrated economic need of the applicant and a firm business commitment pledging the creation/retention of new or existing jobs. Grant funds, if warranted, are allocated at a rate of $10,000 per pledged job. Thirty percent of the jobs pledged must be at or above the local family wage income level.

A direct loan and grant is limited to a maximum amount of $1,000,000; whereas, a bond financed loan and grant is eligible for up to $10,000,000. The maximum grant available is $500,000.

Bandon is in Coos County, which is a Severely Affected Community (SAC). SAC communities are eligible for grant assistance up to $250,000 without a firm business commitment pledging job creation; however, the applicant must satisfy the capacity building criteria within the applicants handbook. The maximum combined SAC and firm business commitment grant available, still subject to demonstrated need, is $500,000. Loans are also available, with a maximum grant and loan total of $1,000,000.

CAPACITY BUILDING, HIGH PROBABILITY OF JOB CREATION/RETENTION - SPWF PROGRAM

Loans only are available for this category of project. The Special Public Works Program has recently been expanded by the Oregon State legislature, to satisfy financial demands generated by the Safe Drinking Water Act. Bandon should fit well into this program if an increase in system capacity and the potential for job creation or savings can be demonstrated.

OREGON BOND BANK - SPWF PROGRAM

The Oregon Bond Bank (OBB) is an SPWF financing element of the SPWF program, not its own program. All funding applications are analyzed for inclusion into an OBB sale. OBB bond sales usually occur two to three per year. The interest rate of revenue bond financed loans are a pass through of the rates of each individual sale to the municipalities that participate in the sale. OEDD enhances the credit of each community by lending approximately 17% of the necessary amount from collateral funds, and by providing funds establishing the debt service reserve. The department also pays the costs of bond issuance. Loan terms may range from 10 to 25 years, although a 20 year term is typical. In summary, the state sells revenue bonds to generate the proceeds to lend to municipalities that have entered into a loan agreement with the state and pledged their enterprise funds, other funds, and Limited Tax General Obligation (LTGO) to secure its individual debt and provide the revenues necessary to service the debt.

The Oregon Bond Bank has been developed to finance industrial and commercial expansion, where potential exists for the same. Revenue bonds are secured by repayments and other revenue pursuant to agreements between the State of Oregon acting by and through its Economic Development Department, and specific benefitted municipalities. The Oregon Bond Bank Fund pools municipal loans into one bond issue and provides small communities affordable access to the financial markets. Bonds are repaid by local revenues and at interest rates lower than what is available to most Oregon communities. The Oregon Bond Bank Fund also pays the cost of issuance and funds the debt service reserve.

The Oregon Bond Bank Fund substantially increases funds available through the Special Public Works Program to assist Oregon municipalities, and offers communities a viable financing alternative in a "Measure 5" environment. The Economic Development Department expects to regularly issue bonds to provide permanent financing for Special Public Works Program applicants.

Bandon may be in a position to demonstrate that planned water improvements would provide for future industrial and commercial expansion. Economic Development Department plans to pass through the exact interest rate allotted to the State for this program directly to borrowers. The State will pay for all debt reserve costs, bond issuance costs and attorney fees. This is a loan program that Bandon could acquire funding directly from the State without the necessity for revenue or general obligation bonding.

The Special Public Works Fund programs cover the costs for bonds issuance and interim financing. This is a substantial benefit since these costs can become large, and the Economic Development Department feels a loan through the SPWF program is the equivalent of a grant equal to 10 to 15 percent of the project cost.

Safe Drinking Water Funding Program

The SPWF program also coordinates the Safe Drinking Water Funding Program with State Water Resources (SWR) and the Oregon State Health Division. The SPWF program component was approved by the last legislative session to provide project financing through the SWR general obligation bonding authority for communities to meet new safe drinking water standards. At present, the SWR bonding authority has been interdicted by the State Treasurer. The SPWF program can finance those projects that possess an economic development connection, firm business commitment or capacity building. If a community does not possess an economic development connection, the request is referred for funding to SWR. The SPWF program would provide funds to cover debt service reserve and issuance costs, if a SWR bond sale could be arranged.

Oregon Department of Energy,
Small Scale Energy Loan Program

Funds could be made available under this program as a demonstration project or as a conventional energy savings or conservation program. The Department of Energy Small Scale Energy Loan Program *(SELP)* program offers help to anyone who wants to save money on energy costs. *SELP* was created by Oregon voters in 1980, and has financed more than $150 million in projects since that time. This is a self supporting program that operates without tax funds. Confidence would need to be generated of the potential for power savings or creation and this may be difficult to demonstrate with the Bandon Water System. The finished project must at least break even in power costs with the pre-study and improvement program. The study phase would be utilized to generate data that would show power savings or creation for recommended improvements. This program is a loan program, repayable over a 15 year repayment period. A fee of one-tenth of one percent of the loan request is required at the time of application. Loan closing costs and fees vary.

12.3 LOCAL FUNDING SOURCES

A significant portion of the project will need to be financed with local funding sources. If the City does receive a low interest loan from State or Federal agencies the annual payment may be reduced. However the method of repayment selected will be conditional upon agency approval. The local funding sources considered include:

General Obligation Bonds
Revenue Bonds
Improvement Bonds (Localized Improvement District)
Serial Levies
Sinking Funds
Ad Valorem Tax
System User Fees
Assessments
System Development Charges (SDC's)

The 1991 legislature clarified and defined the impact of Ballot Measure 5 on municipal finance in several special ways that cities, counties and special districts need to be very careful to understand and follow when they consider bonding for the financing of needed improvements.

The following information was provided in part by Howard A. Rankin, Expert Bond Counsel:

> Chapters 287 and 288 of the Oregon Revised Statutes describe the borrowing and bonding of counties, cities and special districts, generally.
>
> The advance sheets of the Laws of 1991 indicate that the general bond limitation of ORS 287.004 are still in force, except that the old three percent (3%) limitation on all issued and outstanding bonds of true cash value of all taxable property within the City's boundaries has been changed to a 3% limitation on "real market value" as determined by the County Assessor.
>
> The above limitation still does not apply to bonds issued for water, sanitary or storm sewers, sewer disposal plants, nor to bonds issued to pay assessments for improvements in installments under statutory or charter authority (i.e. revenue bonds).
>
> All cities should be careful to check their current charters for any additional impacts or limitations on bonding capabilities.

A description of each of the listed local funding sources follows.

General Obligation Bonds

Financing of water improvements by General Obligation Bonds is accomplished by the following procedures:

1. The Consulting Engineer prepares a detailed cost estimate to determine the total monies required for construction.
2. An election is held.
3. When voter approval is granted (by a majority of the registered voters), bonds are offered for sale and the money for detailed planning and construction is obtained prior to preparation of final engineering plans and the start of project construction, *unless interim financing has been developed.*

The General Obligation Bond is backed by the full credit of the issuer and authorizes the issuer to levy ad valorem taxes. The issuer can make the required payments on the bonds solely from the tax levy or may instead use revenue from assessment, user charges, or some other source.

Oregon Revised Statutes limit the maximum term of G.O. Bonds to 40 years for cities. Except in the event that Farmers Home Administration will purchase the bonds, the realistic term for which general obligation bonds would be issued is 15-20 years.

There are 6 general election dates each year on which an election for General Obligation Bonds can be held. The next likely election date for this project is May 18, 1993.

Ballot Measure 5 has limited the ability of communities to levy property taxes. It is still unclear what the impacts of Ballot Measure 5 will be. It appears that capital improvement projects, such as the proposed water system improvements are exempt from property tax limitations if an election is held and new public hearing requirements are met.

Cities, counties and special districts (all non-school taxing entities) must be very careful when seeking approval from the voters for a general obligation bond, new tax base, annual budget levy or special levy. The new law now requires that all non-school taxing entities, including cities, counties and special districts, hold a special public hearing more than thirty (30) days before filing the election statement with the County Clerk. The notice of this special public hearing must be sent to all other non-school taxing entities with overlapping taxing jurisdictions no later than ten (10) days before the special public hearing. This special public hearing is the opportunity for all overlapping taxing entities to determine the compaction impact of the proposed election on their respective assessment capability. Effectively, the municipality proposing the election measure must be thoroughly prepared with notice of special public hearing published no later than forty-one (41) days before final public hearing and filing of the election statement.

For example:

> To conduct a August 10, 1993 election, which might require filing with the County Clerk 60 days before the election, the new law requires the following schedule:
>
> File with the County Clerk - June 11, 1993
>
> Hold the special hearing - May 12, 1993
>
> Publish notice of hearing - May 1, 1993

If the special public hearing procedures are not followed and no certificate included in the filing that attests that the special public hearing was conducted pursuant to law, the County Clerk is required to reject the filing for an election, causing additional unnecessary delays. Bandon should consult with the City Attorney and consider hiring a competent Bond Counsel before proceeding with a General Bond Election, to insure that all requirements of the new law are met.

Revenue Bonds

A revenue bond is one that is payable solely from charges made for the services provided. Such bonds cannot be paid from tax levies or special assessments, and their only security is the borrower's promise to operate the water system in a way that will provide sufficient net revenue to meet the obligations of the bond issue. Revenue bonds are most commonly retired with revenue from user fees.

Successful issuance of revenue bonds depends on bond market evaluation of the dependability of the revenue pledged. Normally there are no legal limitations on the amount of revenue bonds to be issued, but excessive issue amounts are generally unattractive to bond buyers because they represent high investment risk. In rating revenue bonds, buyers consider the economic justification for the project, reputation of the borrower, methods for billing and collecting, rate structures, and the degree to which forecasts of net revenues are realistic.

Under the provisions of the Oregon Uniform Revenue Bond Act (ORS 288.805-288.945), municipalities may elect to issue Revenue Bonds for revenue producing facilities without a vote of the electorate. In this case, certain notice and posting requirements must be met and a 60-day waiting period is mandatory. A petition signed by 5% of the municipality's registered voters may cause the issue to be referred to an election.

The Farmers Home Administration may fund revenue bonds in which user rates are committed for the repayment of the bonds.

The new laws enacted by the 1991 legislature have eliminated the limitation on revenue bonds that formerly required that the revenues pledged to payment of the bonds have a direct relationship to the services financed by the bonds. The new law allows revenue bonds to be paid with any revenue pledged for "any public purpose", without the relationship restriction. The law has also broadened the definition of revenue to include all city revenue whether or not derived from the operation or use of a facility. Therefore, a pledge of cigarette or gasoline tax receipts may be pledged for the payment of revenue bonds financing a wastewater treatment plant, for instance.

The law has also expanded the ability of municipalities to finance revenue bonds by allowing the bonds to be secured by mortgages of City property, security interests in equipment, and even letters of credit. The impact of such a radical departure from previous funding capability will be determined as municipalities attempt to finance sagging infrastructure, and legal challenges are raised throughout the process.

Improvement Bonds (Localized Improvement District)

Improvement bonds may be issued to assess certain portions of water improvements directly against the parties being benefitted. An equitable means of distributing the assessed cost must be utilized so that all property, whether developed or undeveloped, receives the assessment on an equal basis. Cities are limited to improvement bonds not exceeding three percent of true cash value. For a particular improvement, all property within the assessment area is assessed on an equal basis, regardless of whether it is developed or undeveloped.

With improvement bond financing, an improvement district is formed, the boundaries are established, and the benefitted properties and property owners are determined. The engineer usually determines an approximate assessment, either on a square foot or a front-foot basis. Property owners are then given an opportunity to demonstrate against the project. The assessment against the properties are usually not levied until the actual total cost of the project is determined. Since this determination is normally not possible until the project is completed, funds are not available from assessments for the purpose of making monthly payments to the contractor. Therefore, some method of interim financing must be arranged, or a preassessment program, based on the estimated total costs, must be adopted. It is common practice to issue warrants to cover debts, with the warrants to be paid when the project is complete.

The primary disadvantage to this source of revenue are:

1. The property to be assessed must have a true cash valuation at least equal to 50% of the total assessments to be levied. This may require a substantial cash payment by owners of undeveloped property.

2. An assessment district is very cumbersome and expensive when facilities for an entire community are contemplated.

This program should not be considered for improvements to satisfy City needs in general, but could be a definite consideration for future expansions to annexations or property developments.

Serial Levies

Under Oregon Revised Statutes, if approved by the voters, the City can levy taxes for a fixed period of time to construct new facilities and for facility maintenance. Generally, when a serial levy is presented to the voters, it is based upon a specific program and listing of planned improvements.

Since the time frame required for construction of Bandon Water Improvements is very limited, it is doubtful that residents could afford a serial levy of sufficient size to provide for needed construction revenues.

Sinking Funds

Sinking funds can be established by budget for a particular capital improvement need. Budgeted amounts from each annual budget are carried in a sinking fund until sufficient revenues are available for the needed project. The funds can also be developed with revenue derived from system development charges or serial levies. Once again, Bandon water system financial needs cannot be met with a sinking fund, because of the limited time in which priority one improvements should be completed.

Ad Valorem Tax

Many communities utilize an ad valorem tax as the basis of repaying general obligation bonds for system expansions, and supplement them with additional water use charges. This means of financing reaches all property to be ultimately benefitted by the water system, whether the property is presently developed or not. Construction costs are more equally distributed among all property owners and the program does not impose a penalty on existing residential or business development.

System User Fees

Monthly charges are made to all residences, businesses, etc., that are connected to the water system. Water use charges are established by resolution, and can be modified as needed to serve increased or decreased operating costs. Rates are established depending on the various classes of users and the metered demand through their connection. By establishment of proper use charges, the Council could repay the City share of bond amortization without imposition of property taxes, and this would appear most favorable. However, a proposal to substantially increase monthly use charges might meet resistance from citizens with low or fixed incomes, who gain some advantages from repayment through taxation.

Assessments

In some cases the beneficiary of a public works improvement can simply be assessed for the cost of the project. It is not uncommon for an industrial or commercial developer to provide up-front capital to pay for a City administered improvement to serve the development.

System Development Charges

System Development Charges *(SDC'S)* can be charged to all users of transportation, water, sewer, storm drainage and parks & recreation facilities. The fee is usually charged as each piece of property is developed, and it goes into a capital construction fund to pay for improvements required by the development. The Oregon System Development Charges Act, House Bill 3224, became effective on July 1, 1991. This new legislation requires that Capital Improvement Plans be developed, and that the methodology used to compute *SDC's* be documented and reviewed by the community, before *SDC's* can be charged.

A full *SDC* analysis is outside the scope of work for this project. However, an estimation of the portion of the proposed improvements which will satisfy future growth and the *SDC* computations based on proportional usage have been made, see Table 12-1. Costs to be paid off by user fees or property tax versus *SDC's* should be allocated proportionately between existing and future growth when computing *SDC's*. With the costs associated with future growth defined, the actual *SDC* per service or per *EDU* (Equivalent Dwelling Unit) can be determined. The basic information and proposed methodology required for developing water system *SDC's* were discussed in each chapter relevant to that particular improvement.

Revenue collected from *SDC's* can only be used to pay for specific items listed in a capital improvement plan *(CIP)*. The *CIP* for proposed improvements is presented as Table 12-1. If the City wishes to collect *SDC's* to fund other water system improvements, the *CIP* and *SDC's* will need to be modified accordingly. Cost estimates and *SDC's* can be updated annually to account for inflation using the Engineering News Record *(ENR)* construction cost index (discussed in Chapter 2).

The total *SDC* (for the Capital Improvement Plan listed in Tables 11-1 and 12-1) is $2,535, with no grant funds. Note that the capital cost for long-term water supply is not included since the scope of this project is not known, but this is expected to be a significant expenditure in the future. *SDC's* can not be assessed on portions of the project paid for with grant funds. As a preliminary estimate it has been assumed the City will receive 50 percent grant monies, this reduces the *SDC* to $1,270 per *EDU*. If the City does receive a grant in excess of this percentage it will need to reimburse the difference. The present water system *SDC* is $250 per *EDU*.

Bandon's present *SDC* assessment is based on a 5/8 x 3/4 inch water meter. This is the meter size generally used by a single-family residential dwelling, and therefore is equivalent to charges based on an *EDU* (single-family residential equivalent dwelling unit).

TABLE 12-1

SUMMARY OF PRELIMINARY SDC COMPUTATIONS

PRIORITY I

Upgrade existing treatment plant, add treated-water reservoir storage, distribution and transmission improvements, raw-water pump station improvements, repairs and maintenance of Ferry Creek impoundment, preliminary engineering and permitting for long-term water supply.

Proposed Improvement	Total Cost	Design EDU'S	Cost Per EDU (SDC)
Maintain Ferry Creek Impoundment	$67,500	Maintenance	$0
Preliminary Engineering and Permits for Long-Term Water Supply	$237,500	10,392	$23
Lower Pump Station Improvements	$126,900	4,057	$31
Replace line from Lower Pump Station to Middle Pond	$44,206	4,057	$11
Middle Pump Station and Middle Pond Expansion	$141,075	4,057	$35
Treatment Plant Upgrade	$1,725,675	4,057	$425
New Storage Reservoir, 2 Million Gallons	$895,050	2,667	$335
Transmission and Distribution Improvements	$534,275	4,057	$132
Total	$3,772,181		$992

PRIORITY II

Distribution System Improvements

Proposed Improvement	Total Cost	Design EDU's	Cost Per EDU (SDC)
Distribution Improvements	$771,957	4,057	$190

TABLE 12-1 (Continued)

PRIORITY III

Distribution Improvements and New 0.75 MG Storage Reservoir and Booster Pump Station

Proposed Improvement	Total Cost	Design EDU's	Cost Per EDU (SDC)
Distribution Improvements	$679,793	4,057	$168
New 0.75 MG Storage Reservoir and Booster Pump Station	$929,610	1,000	$930
Total	$1,609,403		$1,097

PRIORITY IV

Distribution System Improvements

Proposed Improvement	Total Cost	Design EDU's	Cost Per EDU (SDC)
Distribution Improvements	$1,036,757	4,057	$256

TOTAL SDC

Proposed Improvement	Total Cost	Design EDU's	Cost Per EDU (SDC)
Total CIP	$7,186,243		$2,535

Notes:

a) Capital cost for long-term water supply solution(s) not included.
b) EDU stands for single-family residential equivalent dwelling unit.

The Oregon System Development Charges Act permits two types of charges: (1) a reimbursement fee, and (2) an improvement charge. A reimbursement fee is a charge for unused capacity in capital improvements already under construction. This is a "buy in" charge for new development to utilize excess capacity in an existing facility paid for by others. An improvement charge is a fee associated with capital improvements to be constructed.

SDC's charged before construction will be considered improvement fees. After construction the charges will be considered reimbursement fees. The cost estimate should be modified to reflect the actual cost of construction and *SDC's* recomputed. After debt for an improvement is paid off, the cost for the improvement would be eliminated from computations. To insure that new developments are not charged twice through system development charges and user fees, the revenue generated from reimbursement fees is typically used directly to pay back existing loans for the improvements. New legislation requires that the methodology for establishing fees be available for public inspection. Bandon should schedule a public meeting to discuss proposed *SDC's* and the basis for computation.

12.4 PROPOSED FINANCIAL PROGRAM

Total capital improvement costs have been estimated in the previous Chapters and are listed in Table 11-1. The City of Bandon must develop an adequate financial program for anticipated first priority construction, either through increased water use fees or ad valorem taxation.

Bandon may not receive governmental grants. Annual payments for a debt service of 6.5 percent for 20 years have been estimated and summarized in Table 12-2. This information gives a worst case scenario for needed annual payments and increases in monthly user fees for residential customers.

Bandon still has the option of financing the project with general obligation bonds, with repayment through either usage charges, property taxes, or a combination of both, even after the passage of Ballot Measure 5. Howard Rankin, Bond Counsel, was contacted in Portland, and stated this could occur if the community followed the necessary public hearing process. A Bond Counsel should be consulted further if the community is interested in pursuing this option.

A preliminary analysis of the potential to receive *FmHA* grant funds was made. Two of the criteria that must be considered are the *MHI* and existing, average water bills.

1) *MHI*

Using a *MHI* of $17,708 (1990 Census) and 2,135 *EDU's*, the minimum annual indebtedness for Bandon is $189,032 ($17,708 x 2,135 EDU's x 0.5%). There is an outstanding debt on the water system of $520,000 (principal remaining 1992/93) with an annual payback of $71,202. This reduces the minimum future indebtedness to $117,831.

2) *AVERAGE WATER BILL*

FmHA will not provide grants to communities with monthly rates less than the state average, which was determined by FmHA to be $25.00. The monthly water rate in Bandon presently is $6.80 plus $0.815 per 1000 gallons of usage. However, there is also an annual payment of $71,202 per year on outstanding water system bonds which is being repaid with property taxes, not user fees.

The 1991 adjusted water sales totaled 150,000,000 gallons. If the bonds were being repaid with user fees the usage fee would increase by $0.475 per 1000 gallons. The effective water rate is actually $6.80 plus $1.29 per 1000 gallons. The average monthly usage per month has been computed to be 5,760 gallons per *EDU*. Therefore the "effective" average water bill is $14.23, about $10.75 less than the state average. Based on *FmHA* criteria, the community should be able to pay a minimum annual debt of $275,415 ($10.75 x 2,135 *EDU's* x 12 months).

The minimum indebtedness is based on average water rates controls. However, it should be noted that if the City was planning a rate increase to cover projected O & M expenses it will lower the minimum indebtedness required by *FmHA* (and increase grant).

It is assumed that annual O & M costs will increase a minimum of $20,000 by the time the project is constructed. Assuming, a minimum annual indebtedness of $255,415, the minimum *FmHA* loan would need to be $4,382,688.

FmHA does not provide grant funds to pay for "future" capacity. As a rough initial estimate it is assumed that 15 percent of the Priority I project cost is for future capacity. This would increase the loan by about $550,000. Also, the City would need to develop interim financing which increases the loan amount by approximately $100,000. The total minimum loan (preliminary estimate) would be approximately $5,032,688, which is greater than the estimated Priority I project cost. Therefore, it does not initially appear that Bandon will qualify for a FmHA Grant. However, there are some items which must be noted. Prior to February 1993, FmHA was still using 1980 census data and a comparable monthly rate of $20 for water systems. Based on that information Bandon qualified for a $1,000,000 grant. FmHA still is going through a transition period, converting from the grant formula used until February 1993 to the current formula. Therefore, Bandon may actually be eligible to receive more grant funds than our preliminary computations show. Also, FmHA expects to receive twice as much grant funds next fiscal year as they had allocated this year, as part of the new administration's economic stimulus program. This could provide additional opportunities for Bandon through the FmHA program.

FmHA would make the final grant/loan determination and their computations will vary from the preliminary values shown.

Bandon does qualify for a $750,000 *OCDB* grant, and the City's application should be very competitive relative to other communities for funding. Note that receiving an *OCDB* grant will reduce the *FmHA* grant by a like amount (City must maintain minimum annual indebtedness). However, *FmHA* has limited grant funds available to distribute throughout the state, and combining funding agencies may improve the City's chance of receiving grants.

If Bandon received only an *OCDB* grant and not a *FmHA* grant, the City would have the option of repaying the local share with *FmHA* loan (at any reasonable length of repayment less than 40 years). Some of the options for financing the proposed Priority I project are listed in Table 12-2.

Our recommendation is that Bandon submit grant applications to both the *FmHA* and *OCDBG* programs.

After FmHA has made a preliminary grant/loan determination, the City staff and council can select the final project scope.

TABLE 12 - 2

CITY OF BANDON
SOME OPTIONS FOR FINANCING THE PROPOSED PRIORITY I PROJECT

ITEM	SPWF LOAN	FmHA LOAN	OCDB GRANT AND FmHA LOAN
Capital Costs[1]	$3,772,177	$3,772,177	$3,772,177
Grant	$0	$0	$750,000
Interim Financing	$0	$100,000	$100,000
Total Loan	$3,772,177	$3,872,177	$3,122,177
Repayment Terms	6.5% / 20 years	5% / 40 years	5% / 20 years
Annual Debt Service	$342,350	$225,665	$181,955
USER FEE ONLY			
Commodity Charge[2] (per 1000 gallons)	$2.30	$1.50	$1.21
Increase in Average Monthly User Fee[3]	$13.15	$8.70	$7.00
PROPERTY TAXES ONLY			
Increase in Tax Rate per $1,000[4]	$2.15	$1.42	$1.15
50% USER FEES AND 50% PROPERTY TAXES			
Increase in Average Monthly User Fee	$6.60	$4.35	$3.50
Increase in Tax Rate	$1.10	$0.71	$0.58

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[1] Includes contingencies, administration, legal, engineering and inspection. Does not include projected O & M costs.

[2] Based on 1991 adjusted water sales of 150,000,000 gallons and projected sales in future based on 2.5 percent annual growth rate.

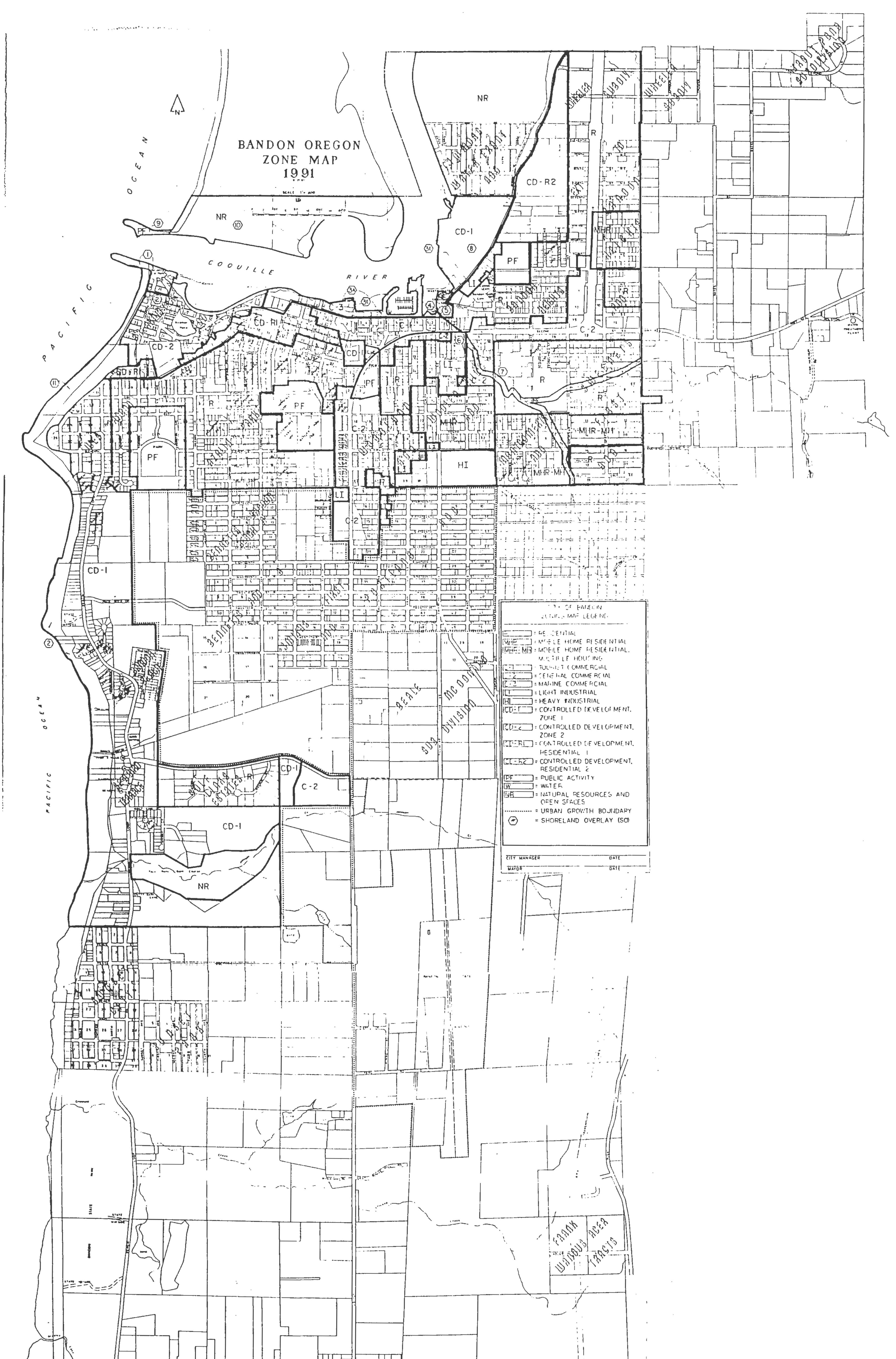
[3] Average residential consumption of 5,760 gallons per month. Information provided by the City.

[4] A total assessed value for Bandon of $158,433,891 (does not include Urban Renewal District). Existing total tax rate for Bandon Property owners is $17.84/1,000, existing City tax rate is $0.95/$1,000.

APPENDICES

APPENDIX A

LAND USE AND ZONING MAP

BANDON OREGON
ZONE MAP
1991
N
PACIFIC OCEAN
COQUILLE RIVER
NR
CD-R2
CD-I
PF
LI
MHR
R
C-3
C-1
C-2
CD-RI
CD-2
CD-R1
HI
MHR-MH
MHR-MH
CD-I
CD-I
C-2
NR
CITY OF BANDON
ZONING MAP LEGEND
R = RESIDENTIAL
MHR = MOBILE HOME RESIDENTIAL
MHR-MH = MOBILE HOME RESIDENTIAL, MULTIPLE HOUSING
C-1 = TOURIST COMMERCIAL
C-2 = GENERAL COMMERCIAL
C-3 = MARINE COMMERCIAL
LI = LIGHT INDUSTRIAL
HI = HEAVY INDUSTRIAL
CD-1 = CONTROLLED DEVELOPMENT, ZONE 1
CD-2 = CONTROLLED DEVELOPMENT, ZONE 2
CD-R1 = CONTROLLED DEVELOPMENT, RESIDENTIAL 1
CD-R2 = CONTROLLED DEVELOPMENT, RESIDENTIAL 2
PF = PUBLIC ACTIVITY
W = WATER
NR = NATURAL RESOURCES AND OPEN SPACES
= URBAN GROWTH BOUNDARY
= SHORELAND OVERLAY (SO)
CITY MANAGER
DATE
MAYOR
DATE
BEALE
MC DONALD
SUB DIVISION
FRANK WADDUS ACRE TRACTS

APPENDIX B

REPRESENTATIVE WELL LOGS

RECEIVED
MAY 6 1966
STATE ENGINEER
SALEM OREGON

North well 7880

OTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the
TATE ENGINEER, SALEM, OREGON 97310 within 30 days from the date of well completion.

WATER WELL REPORT
STATE OF OREGON
(Please type or print)

G5348

State Well No. 28/14W-18a
State Permit No.

1) OWNER:

ame STATE HIGHWAY DEPARTMENT
ddress STATE HIGHWAY BUILDING
SALEM ORE

2) LOCATION OF WELL:

ounty COOS Driller's well number
¼ ¼ Section 18S T. 28S R. 14 W.M.
earing and distance from section or subdivision corner

BULLARDS BEACH PARK

0.06 cfs

3) TYPE OF WORK (check):

Well ☑ Deepening ☐ Reconditioning ☐ Abandon ☐
andonment, describe material and procedure in Item 12.

4) PROPOSED USE (check):

omestic ☐ Industrial ☐ Municipal ☐
rrigation ☐ Test Well ☐ Other ☑

(5) TYPE OF WELL:

Rotary ☐ Driven ☐
Cable ☑ Jetted ☐
Dug ☐ Bored ☐

6) CASING INSTALLED:

Threaded ☐ Welded ☑

6" Diam. from 0 ft. to 61 6" ft. Gage .250
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

) PERFORATIONS:

Perforated? ☐ Yes ☑ No

ype of perforator used
ize of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

8) SCREENS:

Well screen installed? ☑ Yes ☐ No

anufacturer's Name Johnson
Telescope Model No. Stainless Steel
. 5 Slot size 9 Set from 71 ft. to 61 ft.
iam. Slot size Set from ft. to ft.

9) CONSTRUCTION:

ell seal—Material used in seal Bentonite
epth of seal 16 ft. Was a packer used? NO
iameter of well bore to bottom of seal 10 in.
ere any loose strata cemented off? ☐ Yes ☑ No Depth
as a drive shoe used? ☐ Yes ☑ No
as well gravel packed? ☐ Yes ☑ No Size of gravel:
ravel placed from ft. to ft.
id any strata contain unusuable water? ☐ Yes ☑ No
ype of water? depth of strata
thod of sealing strata off

) WATER LEVELS:

atic level 30 ft. below land surface Date APRIL 18
tesian pressure lbs. per square inch Date

(11) WELL TESTS:

Drawdown is amount water level is lowered below static level

Was a pump test made? ☑ Yes ☐ No If yes, by whom? DON BARRING.
Yield: 27 gal./min. with 8½ ft. drawdown after 7 hrs.
" " " "
" " " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☑ Yes ☐ No

(12) WELL LOG:

Diameter of well below casing 6
Depth drilled 71 ft. Depth of completed well 71 ft.

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifiers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
BROWN FINE SAND	0	34
BLUE FINE SAND WITH BLACK PEAT SHOWING	34	45
BLUE FINE SAND	45	71
BLUE CLAY SHOWING	71	

Work started APRIL 11 1966. Completed APRIL 19 18
Date well drilling machine moved off of well APRIL 19 1966

(13) PUMP:

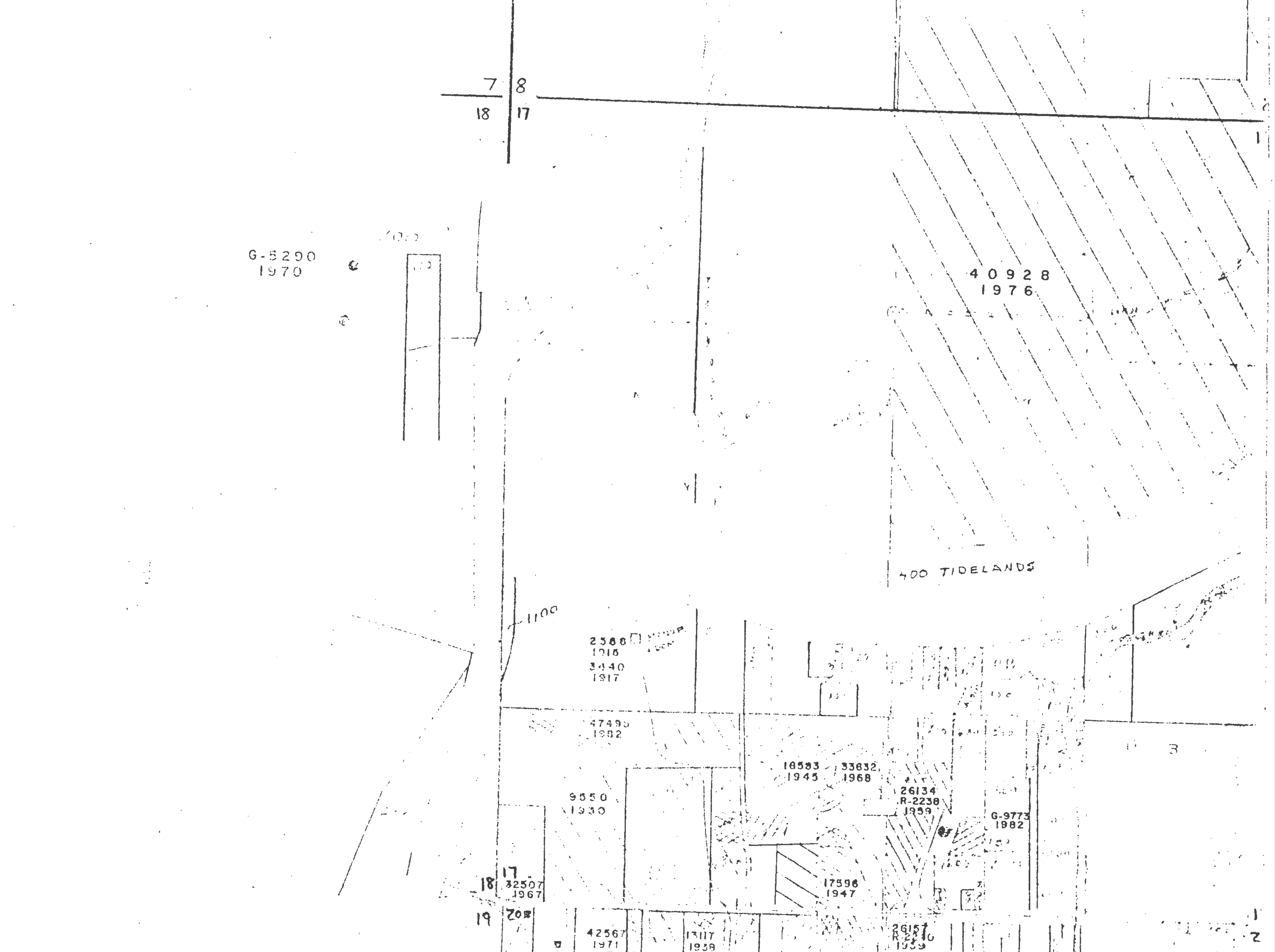
Manufacturer's Name
Type: H.P.

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME BARRINGTON WELL DRILLING
(Person, firm or corporation) (Type or print)
Address R/1 BOX 295 NORTH BEND, ORE
Drilling Machine Operator's License No. 25 and 293
[Signed] Donald E. Barrington
(Water Well Contractor)
Contractor's License No. 201 Date April 20, 1966

(USE ADDITIONAL SHEETS IF NECESSARY)


7
8
18
17
1
40928
1976
400 TIDELANDS
G-5290
1970
1100
2586
1916
3440
1917
47495
1982
9550
1930
18583
1945
33632
1968
26134
R-2238
1959
G-9773
1982
17596
1947
3
17
32507
1967
18
19
20
42567
1971
1317
1938
26157
1959
1
2

NOTICE TO WATER WELL CONTRACTOR
The original and first copy
of this report are to be
filed with the

STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date
of well completion.

Miscellaneous

WATER WELL REPORT
STATE OF OREGON
(Please type or print)

(Do not write above this line)

RECEIVED
AUG 24 1973
STATE ENGINEER
SALEM, OREGON

State Well No. ~~7CC~~ 28S/14W-18

State Permit No.

---

(1) OWNER:
Name C. A. Gross
Address P.O. Box 126 Bandon, Oregon

(2) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL:
Rotary ☐ Driven ☐
Cable ☒ Jetted ☐
☐ Bored ☐

(4) PROPOSED USE (check):
Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐

(5) CASING INSTALLED:
Threaded ☐ Welded ☒
6" Diam. from 0 ft. to 45'-5" ft. Gage .250
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

(6) PERFORATIONS:
Perforated? ☐ Yes ☒ No.
Type of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS:
Well screen installed? ☒ Yes ☐ No
Manufacturer's Name Houston
Type Stainless steel Model No. telescope
Diam. 6 Slot size .008 Set from 44'-5" ft. to 49'-1" ft.
Diam. Slot size Set from ft. to ft.

(8) WELL TESTS:
Drawdown is amount water level is lowered below static level
Was a pump test made? ☐ Yes ☒ No If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " "
" " "
Bailer test 18 gal./min. with 10 ft. drawdown after 1 hrs.
Artesian flow g.p.m.
Temperature of water 52 Depth artesian flow encountered ft.

(9) CONSTRUCTION:
Well seal—Material used Bentonite
Well sealed from land surface to 18 ft.
Diameter of well bore to bottom of seal 10 in.
Diameter of well bore below seal 6 in.
Number of sacks of cement used in well seal 0 sacks
Number of sacks of bentonite used in well seal 1 sacks
Brand name of bentonite Yellowstone
Number of pounds of bentonite per 100 gallons
of water 100 lb / 50 gal. lbs./100 gals.
Was a drive shoe used? ☐ Yes ☒ No Plugs Size: location ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL:
County COOS Driller's well number
¼ ¼ Section 18 T. 28s R. 14w W.M.
Bearing and distance from section or subdivision corner
Tax lot 1-3

(11) WATER LEVEL: Completed well.
Depth at which water was first found 10 ft.
Static level 4 ft. below land surface. Date 8-17-73
Artesian pressure lbs. per square inch. Date

(12) WELL LOG:
Diameter of well below casing --
Depth drilled 50 ft. Depth of completed well 49 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. *Report each change in position of Static Water Level and indicate principal water-bearing strata.*

MATERIAL	From	To	SWL
Sand loose tan	0	3	
Sand muddy brown	3	10	
Sand fine blue	10	50	

Work started 8-16- 1973 Completed 8-17 1973
Date well drilling machine moved off of well 8-17 1973

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] Orville W. Miller Date 8-19, 1973
(Drilling Machine Operator)
Drilling Machine Operator's License No. 469

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name George R. Miller & Son Well Drilling
(Person, firm or corporation) (Type or print)
Address Route 1, Box 770 Bandon, Oregon
[Signed] George R Miller
(Water Well Contractor)
Contractor's License No. 322 Date August 19, 1973

(USE ADDITIONAL SHEETS IF NECESSARY)

SP*45656-119

WATER WELL REPORT
STATE OF OREGON

APR 25 1983
WATER RESOURCES DEPT.
SALEM, OREGON

State Well No. 28S/14W-19aa
State Permit No.

) OWNER:
me H. R. Amos
ddress Route 2 Box 2500
ity Bandon State Ore

2) TYPE OF WORK (check):
ew Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
abandonment, describe material and procedure in Item 12.

3) TYPE OF WELL:
otary Air ☐ Driven ☐
otary Mud ☐ Dug ☐
able ☒ Bored ☐

(4) PROPOSED USE (check):
Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐
Thermal: Withdrawal ☐ Reinjection ☐

) CASING INSTALLED: Steel ☒ Plastic ☐
Threaded ☐ Welded ☒
6 " Diam. from + 1 ft. to 65'-4" ft. Gauge .250
" Diam. from ft. to ft. Gauge

LINER INSTALLED: NO
" Diam. from ft. to ft. Gauge

6) PERFORATIONS: Perforated? ☐ Yes ☒ No
ype of perforator used
ize of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

7) SCREENS: Well screen installed? ☒ Yes ☐ No
anufacturer's Name Johnson
e Stainless steel Model No. telescope
iam. 6 Slot Size .008 Set from 64'-5" ft. to 68'-9" ft.
iam. Slot Size Set from ft. to ft.

8) WELL TESTS: Drawdown is amount water level is lowered below static level
as a pump test made? ☐ Yes ☒ No If yes, by whom?
d: gal./min. with ft. drawdown after hrs.
" " " "
r test gal./min. with drill stem at ft. hrs.
ailer test 6 gal./min. with 25 ft. drawdown after 1 hrs.
rtesian flow g.p.m.
perature of water 52 Depth artesian flow encountered ft.

CONSTRUCTION: Special standards: Yes ☐ No ☒
ell seal—Material used Cement with 4% bentonite
ell sealed from land surface to 20 ft.
iameter of well bore to bottom of seal 10 in.
iameter of well bore below seal 6 in.
umber of sacks of cement used in well seal 8 sacks
ow was cement grout placed? Pumped via tremie pipe

as pump installed? NO Type HP Depth ft.
as a drive shoe used? ☐ Yes ☒ No Plugs Size: location ft.
id any strata contain unusable water? ☐ Yes ☒ No
ype of Water? depth of strata
od of sealing strata off
as well gravel packed? ☐ Yes ☒ No Size of gravel:
ravel placed from ft. to ft.

(10) LOCATION OF WELL:
County Coos Driller's well number
NE ¼ NE ¼ Section 19 T. 28s R. 14w W.M.
Tax Lot # Parcel 200 Lot 2 Blk Subdivision
Address at well location: Same

(11) WATER LEVEL: Completed well.
Depth at which water was first found 34 ft.
Static level 34 ft. below land surface. Date 4-8-83
Artesian pressure lbs. per square inch. Date

(12) WELL LOG: Diameter of well below casing 0
Depth drilled 70 ft. Depth of completed well 68'-9" ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
Clay soil dark brown	0	1	
Sandy clay brown	1	4	
Sand medium brown	4	14	
Clay sandy gray	14	19	
Sand very fine muddy brown	19	62	
Sand very fine & gravel brown	62	70	
Claystone gray	70	---	

Work started 4-6 19 83 Completed 4-8 19 83
Date well drilling machine moved off of well 4-8 19 83

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] (Drilling Machine Operator) Date 4-15, 1983
Drilling Machine Operator's License No. 469

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name Bill Miller Well Drilling
(Person, firm or corporation) (Type or print)
Address Route 1, Box 1115 Bandon, Oregon 97411
[Signed] (Water Well Contractor)
Contractor's License No. 600 Date 4-15, 1983

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the

WATER RESOURCES DEPARTMENT,
SALEM, OREGON 97310
within 30 days from the date of well completion.

SP*12658-690

WATER WELL REPORT
STATE OF OREGON

APR 25 1983
WATER RESOURCES DEPT.
SALEM, OREGON

State Well No. 28S/14W-19aa
State Permit No.

) OWNER:
me H. r. Amos
dress Route 2 Box 2500
y Bandon State Ore

) TYPE OF WORK (check):
w Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
abandonment, describe material and procedure in Item 12.

) TYPE OF WELL:
ary Air ☐ Driven ☐
ary Mud ☐ Dug ☐
ole ☒ Bored ☐

(4) PROPOSED USE (check):
Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐
Thermal: Withdrawal ☐ Reinjection ☐

CASING INSTALLED:
Steel ☒ Plastic ☐
Threaded ☐ Welded ☒
6" Diam. from +1 ft. to 67'-9" ft. Gauge .250
" Diam. from ft. to ft. Gauge

LINER INSTALLED: NO
" Diam. from ft. to ft. Gauge

) PERFORATIONS:
Perforated? ☐ Yes ☒ No
pe of perforator used
e of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

) SCREENS:
Well screen installed? ☒ Yes ☐ No
nufacturer's Name Johnson
Stainless steel Model No. telescope
am. 6 Slot Size .008 Set from 67 ft. to 71 ft.
am. Slot Size Set from ft. to ft.

) WELL TESTS:
Drawdown is amount water level is lowered below static level
s a pump test made? ☐ Yes ☒ No If yes, by whom?
gal./min. with ft. drawdown after hrs.
test gal./min. with drill stem at ft. hrs.
iler test 6 gal./min. with 20 ft. drawdown after 1 hrs.
esian flow g.p.m.
nperature of water 52 Depth artesian flow encountered ft.

CONSTRUCTION:
Special standards: Yes ☐ No ☒
ll seal—Material used Cement with 4% bentonite
ll sealed from land surface to 20 ft.
ameter of well bore to bottom of seal 10 in.
ameter of well bore below seal 6 in.
mber of sacks of cement used in well seal 14.5 sacks
w was cement grout placed? Pumped via tremie pipe

s pump installed? NO Type HP Depth ft.
s a drive shoe used? ☐ Yes ☒ No Plugs Size: location ft.
any strata contain unusable water? ☐ Yes ☒ No
e of Water? depth of strata
d of sealing strata off
well gravel packed? ☐ Yes ☒ No Size of gravel:
vel placed from ft. to ft.

(10) LOCATION OF WELL:
County Coos Driller's well number
NE ¼ NE ¼ Section 19 T. 28s R. 14W W.M.
Tax Lot # 200 Lot 3 Blk Subdivision
Address at well location: Same

(11) WATER LEVEL: Completed well.
Depth at which water was first found 37 ft.
Static level 37 ft. below land surface. Date 4-18-83
Artesian pressure lbs. per square inch. Date

(12) WELL LOG:
Diameter of well below casing ~~XX~~ 0
Depth drilled 71 ft. Depth of completed well 71 ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
Clay soil dark brown	0	2	
Sandy clay brown	2	5	
Sand medium browm	5	13	
Clay sandy gray	13	17	
Gravel medium brown	17	20	
Sand very fine muddy brown	20	65	
Gravel fine & Sand fine brown	65	71	

Work started 4-15 19 83 Completed 4-18 19 83
Date well drilling machine moved off of well 4-21 19 83

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] (Drilling Machine Operator) Date 4-22, 19 83
Drilling Machine Operator's License No. 469

Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name Bill Miller Well Drilling
(Person, firm or corporation) (Type or print)
Address Rt. 1, Box 1115 Bandon, Ore. 97411
[Signed] (Water Well Contractor)
Contractor's License No. 600 Date 4-22, 19 83

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the
WATER RESOURCES DEPARTMENT,
SALEM, OREGON 97310
within 30 days from the date of well completion.

WATER WELL REPORT
STATE OF OREGON

RECEIVED
MAY 4 1982
WATER RESOURCES DEPT
SALEM, OREGON

State Well No. 28s/14w-19aa

State Permit No.

OWNER:
ame H. R. Amos
ddress Rt 2, Box 2500
ity Bandon, Ore State

2) TYPE OF WORK (check):
ew Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐

abandonment, describe material and procedure in Item 12.

3) TYPE OF WELL:
tary Air ☐ Driven ☐
tary Mud ☐ Dug ☐
ble ☒ Bored ☐

(4) PROPOSED USE (check):
Domestic ☒ Industrial ☐ Municipal ☐
Irrigation ☐ Test Well ☐ Other ☐
Thermal: Withdrawal ☐ Reinjection ☐

) CASING INSTALLED:
Steel ☒ Plastic ☐
Threaded ☐ Welded ☒

6 " Diam. from 0 ft. to 63'-4" ft. Gauge .250
" Diam. from ft. to ft. Gauge

LINER INSTALLED: No
" Diam. from ft. to ft. Gauge

6) PERFORATIONS:
Perforated? ☐ Yes ☒ No

ype of perforator used
ize of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

7) SCREENS:
Well screen installed? ☒ Yes ☐ No

nufacturer's Name Johnson
ype Stainless steel Model No. teescope
iam. 6 Slot Size .008 Set from 60 ft. to 64'-5" ft.
iam. Slot Size Set from ft. to ft.

8) WELL TESTS:
Drawdown is amount water level is lowered below static level

as a pump test made? ☐ Yes ☒ No If yes, by whom?
ld: gal./min. with ft. drawdown after hrs.
" " " "
ir test gal./min. with drill stem at ft. hrs.
ailer test 20 gal./min. with 20 ft. drawdown after 1 hrs.
rtesian flow g.p.m.
mperature of water 52 Depth artesian flow encountered ft.

) CONSTRUCTION:
Special standards: Yes ☐ No ☒

Well seal—Material used Cement
Well sealed from land surface to 18 ft.
Diameter of well bore to bottom of seal 10 in.
Diameter of well bore below seal 6 in.
Number of sacks of cement used in well seal 9 sacks
How was cement grout placed? Pumped via tremie pipe

Was pump installed? No Type HP Depth ft.
Was a drive shoe used? ☐ Yes ☒ No Plugs Size: location ft.
Did any strata contain unusable water? ☐ Yes ☒ No
ype of Water? depth of strata
ethod of sealing strata off
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL:
County Coos Driller's well number
NE ¼ NE ¼ Section 19 T. 28s R. 14w W.M.
Tax Lot # Lot 5 Blk Subdivision
Address at well location: ~~XXXX~~
Same

(11) WATER LEVEL: Completed well.
Depth at which water was first found 30 ft.
Static level 30 ft. below land surface. Date 4-27-82
Artesian pressure lbs. per square inch. Date

(12) WELL LOG:
Diameter of well below casing 0

Depth drilled 65 ft. Depth of completed well 64'-5" ft.

Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL
Clay soil dark brown	0	2	
Sand medium with clay brown	2	17	
Sand coarse with gravel tan	17	21	
Sand & gravel brown 50-50	21	25	
Sand very fine muddy brown	25	55	
Clay brown	55	62	
Gravel fine brown	62	64&	1/2
Claystone blue	64-1/2	--	----

Work started 4-22 19 82 Completed 4-27 19 82
Date well drilling machine moved off of well 4-27 19 82

Drilling Machine Operator's Certification:

This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.

[Signed] Andrew W. Miller Date 5-2, 19 82
(Drilling Machine Operator)

Drilling Machine Operator's License No. 469

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

Name Bill Miller Well Drilling
(Person, firm or corporation) (Type or print)
Address Rt. 1, Box 1115 Bandon, Ore. 97411

[Signed] Andrew W. Miller
(Water Well Contractor)

Contractor's License No. 600 Date 5-2, 1982

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report
are to be filed with the

WATER RESOURCES DEPARTMENT,
SALEM, OREGON 97310
within 30 days from the date of well completion.

SP*12658-690

MAD. SON ROAD		
7-11-78	→	78.46
8-28-78	→	79.04
9-1-78	→	80.31
10-06-78		80.36
11-22-78	80.17	
1979		
02-26	79.51	
03-28	78.43	
04-06	78.56	
06-11	80.17	
09-28	81.13	
11-09	81.07	
12-17	79.62	
1980		
03-28	77.85	
05-22	77.72	
12-29	73.80	
1981		
03-17	78.54	
07-23	81.36	
1982		
02-26	75.13	
04-26	74.64	

BANDON		
1982		1988
04-26	74.64	04-08 74.35
05-28	75.95	06-02 78.57
06-23	76.85	
08-12	P	1989
10-25	69.65	01-03 79.75
12-14	78.57	01-14
1983		79.18
02-28	75.43	03-21 78.05
03-31	74.71	04-18 77.03
07-18	77.36	
1984		
02-22	76.43	
1985		
03-05	76.52	
03-21	77.25	
04-30	76.70	
06-10	77.84	
10-18	81.94	
1986		
01-21	79.69	
1987		
04-07	73.83	
11-16	87.14	
1988 03-05	74.82	

02-05-88	74.32
✓03-03-88	74.38
04-18-89	77.03
05-31-89	76.05
06-19-89	77.18
07-08-89	Running
08-23-89	84.61
09-28-89	Running
✓12-07-89	87.22
11-30-89	80.47
02-27-90	78.62
03-12-90	78.35
04-30-90	79.85
05-21-90	79.45
05-30-90	80.21
02-13-92	80.0
04-28-92	82.17
06-18-92	PUMPING 108.71
07-31-92	Pump running 111.47
08-31-92	Pump Running 111.58
09-22-92	Pump Running 107.31
10-05-92	Pumping 112.64

RECEIVED
OCT 27 1965
STATE ENGINEER
SALEM OREGON

NOTICE TO WATER WELL CONTRACTOR
The original and first copy
of this report are to be
filed with the
STATE ENGINEER, SALEM, OREGON 97310
within 30 days from the date
of well completion.

WATER WELL REPORT
STATE OF OREGON
(Please type or print)

7751
State Well No. 28/14w-28 G
State Permit No.

OWNER:

ame John Conrad
ddress R1 Box 77 Bandon
ore

) LOCATION OF WELL:

unty Coos Driller's well number
W ¼ NE ¼ Section 28 T. 28 S R. 14 W W.M.
earing and distance from section or subdivision corner

) TYPE OF WORK (check):

Well ☑ Deepening ☐ Reconditioning ☐ Abandon ☐
ndonment, describe material and procedure in Item 12.

) PROPOSED USE (check):

omestic ☑ Industrial ☐ Municipal ☐
rigation ☑ Test Well ☑ Other ☐

(5) TYPE OF WELL:

Rotary ☐ Driven ☐
Cable ☑ Jetted ☐
Dug ☐ Bored ☐

) CASING INSTALLED: Threaded ☐ Welded ☑

6" Diam. from 0 ft. to 110'8" ft. Gage .250
" Diam. from ft. to ft. Gage
" Diam. from ft. to ft. Gage

PERFORATIONS: Perforated? ☐ Yes ☑ No

pe of perforator used
ze of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

) SCREENS: Well screen installed? ☑ Yes ☐ No

anufacturer's Name Johnson
Tekscope Model No.
6 Slot size .008 Set from 110 ft. to 115 ft.
am. 6 Slot size .010 Set from 110 ft. to 120 ft.

) CONSTRUCTION:

ell seal—Material used in seal Bentonite
pth of seal 18 ft. Was a packer used? No
ameter of well bore to bottom of seal 9 in.
ere any loose strata cemented off? ☐ Yes ☑ No Depth
as a drive shoe used? ☐ Yes ☑ No
as well gravel packed? ☐ Yes ☑ No Size of gravel:
avel placed from ft. to ft.
d any strata contain unusable water? ☐ Yes ☑ No
pe of water? depth of strata
hod of sealing strata off

) WATER LEVELS:

atic level 79 ft. below land surface Date 10-21-65
tesian pressure lbs. per square inch Date

(11) WELL TESTS: Drawdown is amount water level is lowered below static level

Was a pump test made? ☑ Yes ☐ No If yes, by whom?
Yield: 37 gal./min. with 21 ft. drawdown after 72 hrs.
" " " "
" " " "
Bailer test gal./min. with ft. drawdown after hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? ☐ Yes ☐ No

(12) WELL LOG: Diameter of well below casing Filled

Depth drilled 130 ft. Depth of completed well 120 ft.

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Sandy Top soil	0	1
Packed Brown sand	1	7
" gray "	7	18
Red cement sand	18	19
Fine Brown sand	19	30
White sandy clay	30	46
Fine gray sand	46	75
gray silt	75	85
Coarse gray sand	85	121
gray sand with		
clay & wood.		
Placed gravel To	120	130
set screen on same		

Work started 10-16 1965 Completed 10-21 1965
Date well drilling machine moved off of well 10-21 1965

(13) PUMP:

Manufacturer's Name Berkley
Type: Sub. 10 Stage H.P. 1½

Water Well Contractor's Certification:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME George R Miller
(Person, firm or corporation) (Type or print)
Address R1 Box 561 Bandon

Drilling Machine Operator's License No. 33

[Signed] George R Miller
(Water Well Contractor)

Contractor's License No. 92 Date 10-25 1965

(USE ADDITIONAL SHEETS IF NECESSARY)

APPENDIX C

SAMPLE
COMPUTER ANALYSIS

```
RUN NO. 375- 998


NETWORK NAME : CITY OF BANDON


PRIORITY III
PEAK HOUR DEMAND = 3.23 MGD
NO FIRE FLOW
ABCD
ABC OPEN, D CLOSED


Analysis Statistics :

Analysis Method :  Hazen Williams

Tolerance level was set to     0.0 gpm
The solution was found (or stopped) after  13 Iterations
Maximum head error was    0.0 ft
Maximum flow error was    0.0 gpm
```

```
12/ 3/1992                    PIPE REPORT                    Page  2
 Run # 375- 998

        Flow         Head From   To                         Roughness
        Rate   Vel.  Loss Node Node  Dia. Length            C        K
         gpm    fps   ft              in     ft
=====================================================================
   1   684.7    1.9   6.3    1    2 12.00   3665          110     0.00
   2   -20.5   -0.1  -0.0    2    3 12.00   1585          110     0.00
   3   450.3    1.8   2.5    2    4 10.00   1327          110     0.00
   4   360.4    1.5   0.8    4    5 10.00    616          110     0.00
   5   -51.9   -0.6  -0.5    5    6  6.00   1145          110     0.00
   6  -100.7   -0.6  -0.2    6    7  8.00    625          110     0.00
   7    41.1    0.3   0.1    4    7  8.00   1116          110     0.00
   8  -108.4   -0.7  -0.3    7    8  8.00    685          110     0.00
   9   363.5    1.5   1.6    5    9 10.00   1208          110     0.00
  10   358.3    1.5   1.1    9   10 10.00    847          110     0.00
  11    48.8    0.6   0.3   10   11  6.00    820          110     0.00
  12   260.7    1.1   1.8   10   12 10.00   2620          110     0.00
  13   211.9    0.9   0.1   12   13 10.00    217          110     0.00
  14   120.5    0.5   0.1   13   15 10.00    739          110     0.00
  15    42.6    0.3   0.2   13   14  8.00   2590          110     0.00
  16    42.6    0.2   0.0   15   16 10.00   2061          110     0.00
  17   -27.6   -0.1  -0.0   16   20 10.00   1337          110     0.00
  18    29.1    0.2   0.0   15   20  8.00   1012          110     0.00
  19    -8.0   -0.0  -0.0   16   17 10.00    984          110     0.00
  20   -56.8   -0.2  -0.0   17   18 10.00   1143          110     0.00
  21    32.1    0.2   0.0   18   19  8.00    661          110     0.00
  22    47.3    0.2   0.0   19   20 10.00    169          110     0.00
  23   -64.0   -0.3  -0.0   19   21 10.00    785          110     0.00
  24  -112.8   -0.5  -0.1   21   22 10.00    613          110     0.00
  25  -161.6   -0.7  -0.2   22   23 10.00    660          110     0.00
  26  -137.7   -0.6  -0.3   18   23 10.00   1372          110     0.00
  27  -348.1   -1.4  -2.9   23   24 10.00   2420          110     0.00
  28   -43.6   -0.2  -0.1    9   24 10.00   2100          110     0.00
  29  -440.4   -1.8  -0.9   24   36 10.00    475          110     0.00
  30   527.4    1.5   0.8   26   36 12.00    738          110     0.00
  31   -38.2   -0.1  -0.0   25   36 12.00    505          110     0.00
  32    29.4    0.1   0.0   16   42 10.00   1032          110     0.00
  33   -74.5   -0.3  -0.0   27   28 10.00    650          110     0.00
  34   -18.1   -0.2  -0.4   28   29  6.00   6360          110     0.00
  35  -105.2   -0.4  -0.4   28   46 10.00   3097          110     0.00
  36  -139.8   -0.4  -0.3   29   30 12.00   3844          110     0.00
  37    94.4    1.1   3.4   29   31  6.00   2710          110     0.00
  38  -149.6   -1.0  -3.0   31   32  8.00   4061          110     0.00
  39   -65.7   -0.4  -0.3   33   44  8.00   1689          110     0.00
  40   -31.9   -0.2  -0.1   33   35  8.00   2838          110     0.00
  41    48.8    0.3   0.0   33   34  8.00    372          110     0.00
  42  1560.1    2.5   6.2    1   37 16.00   3229          110     0.00
  43   -69.3   -0.2  -0.0    3   37 12.00    500          110     0.00
  44 -1442.1   -2.3  -3.2   26   37 16.00   1904          110     0.00
  45   855.3    1.4   1.7   25   38 16.00   2654          110     0.00
  46   806.5    1.3   0.6   38   39 16.00   1043          110     0.00
  47   533.4    0.9   0.7   39   40 16.00   2615          110     0.00
  48   484.6    0.8   0.3   40   41 16.00   1129          110     0.00
  49  -188.6   -0.5  -0.1   30   41 12.00    582          110     0.00
  50    -6.2   -0.0  -0.0   14   42 10.00    819          110     0.00
```

```
12/ 3/1992                  PIPE REPORT                  Page  3
 Run # 375- 998

       Flow            Head From   To                      Roughness
       Rate    Vel.    Loss Node Node  Dia. Length         C         K
        gpm     fps      ft             in     ft
=====================================================================
  51   247.2     0.4     0.1   41   43 16.00   2319      110      0.00
  52  -198.4    -1.3    -0.7   32   43  8.00    602      110      0.00
  53   -80.7    -0.5    -0.2   35   44  8.00    650      110      0.00
  54   224.2     0.6     1.2   39   45 12.00   5737      110      0.00
  55   175.4     0.5     0.1   45   46 12.00    873      110      0.00
  56   -21.4    -0.1    -0.0   29   46 10.00   3260      110      0.00
  57   195.2     2.2     1.3   31   47  6.00    257      110      0.00
  58  -195.2    -1.2    -0.6   44   47  8.00    486      110      0.00
  59     0.0     0.0     0.0   43   48 12.00   2698      110      0.00
  60     0.0     0.0     0.0   48   49  8.00    631      110      0.00
  61     0.0     0.0     0.0   43   49 12.00   2069      110      0.00
  62     0.0     0.0     0.0   48   49 12.00   2108      110      0.00
  63     0.0     0.0     0.0   49   50  8.00    561      110      0.00
  64  -157.2    -1.0    -0.5    8   51  8.00    575      110      0.00
  65   206.0     1.3     1.9    2   51  8.00   1403      110      0.00
  66                           51   52  8.00   4456      110      0.00 SHUT
  67     0.0     0.0     0.0   11   52  8.00   4457      110      0.00
  68                           35   47  8.00    743      110      0.00 SHUT
  69    25.7     0.1     0.0   27   42 10.00    620      110      0.00
  70  -865.9    -1.4    -0.8   25   26 16.00   1203      110      0.00
```

```
    12/ 3/1992                  PIPE HEAD ERRORS                  Page  4
     Run # 375- 998

     Pipe     From      To    Starting     Ending   Drop in    Pipe     Head
     No.      Node     Node       Head       Head      Head    Loss    Error
                                    ft         ft        ft      ft       ft
    ===================================================================


    12/ 3/1992                  NODE REPORT
     Run # 375- 998

              Water     Ground     H.G.L.  Pressure         X         Y
             Demand      Elev.      Elev.             Co-ord.   Co-ord.
                gpm         ft         ft       psi        ft        ft
    ===============================================================
>>>       1 -2244.8      178.9      194.9       6.9         0         0 FIXED HEAD
          2    48.8       73.0      188.6      50.1         0         0
          3    48.8       80.0      188.6      47.0         0       . 0
          4    48.8       71.0      186.1      49.8         0         0
          5    48.8       71.0      185.3      49.5         0         0
          6    48.8       71.0      185.8      49.7         0         0
          7    48.8       73.0      186.0      48.9         0         0
          8    48.8       75.0      186.3      48.2         0         0
          9    48.8       18.0      183.8      71.8         0         0
         10    48.8       12.0      182.7      73.9         0         0
         11    48.8       14.0      182.4      72.9         0         0
         12    48.8       12.0      180.9      73.1         0         0
         13    48.8       18.0      180.8      70.5         0         0
         14    48.8       20.0      180.6      69.5         0         0
         15    48.8       68.0      180.7      48.8         0         0
         16    48.8       82.0      180.6      42.7         0         0
         17    48.8       83.0      180.6      42.3         0         0
         18    48.8       70.0      180.7      47.9         0         0
         19    48.8       71.0      180.6      47.5         0         0
         20    48.8       70.0      180.6      47.9         0         0
         21    48.8       68.0      180.7      48.8         0         0
         22    48.8       69.0      180.8      48.4         0         0
         23    48.8       68.0      181.0      48.9         0         0
         24    48.8       69.0      183.8      49.7         0         0
         25    48.8       77.0      184.7      46.6         0         0
         26    48.8       72.0      185.5      49.1         0         0
         27    48.8       83.0      180.6      42.3         0         0
         28    48.8       85.0      180.7      41.4         0         0
         29    48.8       50.0      181.0      56.7         0         0
         30    48.8       78.0      181.4      44.8         0         0
         31    48.8       53.0      177.6      53.9         0         0
         32    48.8       82.0      180.6      42.7         0         0
         33    48.8       50.0      175.5      54.3         0         0
         34    48.8       50.0      175.4      54.3         0         0
         35    48.8       50.0      175.6      54.4         0         0
         36    48.8       75.0      184.7      47.5         0         0
>>>      37    48.8       97.0      188.7      39.7         0         0
>>>      38    48.8      105.0      183.0      33.8         0         0
>>>      39    48.8       94.0      182.4      38.3         0         0
>>>      40    48.8       95.0      181.7      37.5         0         0
         41    48.8       87.0      181.5      40.9         0         0
         42    48.8       79.0      180.6      44.0         0         0
>>>      43    48.8       98.0      181.3      36.1         0         0
```

```
           Water     Ground      H.G.L.   Pressure         X         Y
          Demand      Elev.       Elev.               Co-ord.   Co-ord.
             gpm         ft          ft        psi         ft        ft
=============================================================================
      44    48.8       52.0       175.7       53.6          0         0
      45    48.8       73.0       181.2       46.8          0         0
      46    48.8       71.0       181.1       47.6          0         0
      47     0.0       50.0       176.3       54.7          0         0
>>>   48     0.0       98.0       181.3       36.1          0         0
>>>   49     0.0       98.0       181.3       36.1          0         0
      50     0.0       88.0       181.3       40.4          0         0
      51    48.8       74.0       186.8       48.8          0         0
>>>   52     0.0      100.0       182.4       35.7          0         0
```

```
             ==== NODES ====
No.     Gnd.El. H.G.L.E.    Demand    X-Cord    Y-Cord
          (ft)      (ft)     (gpm)      (ft)      (ft)
=================================================
   1     178.9     194.9
   2      73.0               48.8
   3      80.0               48.8
   4      71.0               48.8
   5      71.0               48.8
   6      71.0               48.8
   7      73.0               48.8
   8      75.0               48.8
   9      18.0               48.8
  10      12.0               48.8
  11      14.0               48.8
  12      12.0               48.8
  13      18.0               48.8
  14      20.0               48.8
  15      68.0               48.8
  16      82.0               48.8
  17      83.0               48.8
  18      70.0               48.8
  19      71.0               48.8
  20      70.0               48.8
  21      68.0               48.8
  22      69.0               48.8
  23      68.0               48.8
  24      69.0               48.8
  25      77.0               48.8
  26      72.0               48.8
  27      83.0               48.8
  28      85.0               48.8
  29      50.0               48.8
  30      78.0               48.8
  31      53.0               48.8
  32      82.0               48.8
  33      50.0               48.8
  34      50.0               48.8
  35      50.0               48.8
  36      75.0               48.8
  37      97.0               48.8
  38     105.0               48.8
  39      94.0               48.8
  40      95.0               48.8
  41      87.0               48.8
  42      79.0               48.8
  43      98.0               48.8
  44      52.0               48.8
  45      73.0               48.8
  46      71.0               48.8
  47      50.0                0.0
  48      98.0                0.0
  49      98.0                0.0
  50      88.0                0.0
  51      74.0               48.8
  52     100.0                0.0
```

```
           ==== PIPES ====
No.  From    To  Diam.  Length     K   HW-C
                  (in)   (ft)
=================================================
  1     1     2  12.00    3665  0.00   110
  2     2     3  12.00    1585  0.00   110
  3     2     4  10.00    1327  0.00   110
  4     4     5  10.00     616  0.00   110
  5     5     6   6.00    1145  0.00   110
  6     6     7   8.00     625  0.00   110
  7     4     7   8.00    1116  0.00   110
  8     7     8   8.00     685  0.00   110
  9     5     9  10.00    1208  0.00   110
 10     9    10  10.00     847  0.00   110
 11    10    11   6.00     820  0.00   110
 12    10    12  10.00    2620  0.00   110
 13    12    13  10.00     217  0.00   110
 14    13    15  10.00     739  0.00   110
 15    13    14   8.00    2590  0.00   110
 16    15    16  10.00    2061  0.00   110
 17    16    20  10.00    1337  0.00   110
 18    15    20   8.00    1012  0.00   110
 19    16    17  10.00     984  0.00   110
 20    17    18  10.00    1143  0.00   110
 21    18    19   8.00     661  0.00   110
 22    19    20  10.00     169  0.00   110
 23    19    21  10.00     785  0.00   110
 24    21    22  10.00     613  0.00   110
 25    22    23  10.00     660  0.00   110
 26    18    23  10.00    1372  0.00   110
 27    23    24  10.00    2420  0.00   110
 28     9    24  10.00    2100  0.00   110
 29    24    36  10.00     475  0.00   110
 30    26    36  12.00     738  0.00   110
 31    25    36  12.00     505  0.00   110
 32    16    42  10.00    1032  0.00   110
 33    27    28  10.00     650  0.00   110
 34    28    29   6.00    6360  0.00   110
 35    28    46  10.00    3097  0.00   110
 36    29    30  12.00    3844  0.00   110
 37    29    31   6.00    2710  0.00   110
 38    31    32   8.00    4061  0.00   110
 39    33    44   8.00    1689  0.00   110
 40    33    35   8.00    2838  0.00   110
 41    33    34   8.00     372  0.00   110
 42     1    37  16.00    3229  0.00   110
 43     3    37  12.00     500  0.00   110
 44    26    37  16.00    1904  0.00   110
 45    25    38  16.00    2654  0.00   110
 46    38    39  16.00    1043  0.00   110
 47    39    40  16.00    2615  0.00   110
 48    40    41  16.00    1129  0.00   110
 49    30    41  12.00     582  0.00   110
 50    14    42  10.00     819  0.00   110
 51    41    43  16.00    2319  0.00   110
 52    32    43   8.00     602  0.00   110
 53    35    44   8.00     650  0.00   110
```

```
54    39   45  12.00    5737   0.00  110
55    45   46  12.00     873   0.00  110
56    29   46  10.00    3260   0.00  110
57    31   47   6.00     257   0.00  110
58    44   47   8.00     486   0.00  110
59    43   48  12.00    2698   0.00  110
60    48   49   8.00     631   0.00  110
61    43   49  12.00    2069   0.00  110
62    48   49  12.00    2108   0.00  110
63    49   50   8.00     561   0.00  110
64     8   51   8.00     575   0.00  110
65     2   51   8.00    1403   0.00  110
66    51   52   8.00    4456 -SHUT-  110           SHUT
67    11   52   8.00    4457   0.00  110
68    35   47   8.00     743 -SHUT-  110           SHUT
69    27   42  10.00     620   0.00  110
70    25   26  16.00    1203   0.00  110
```

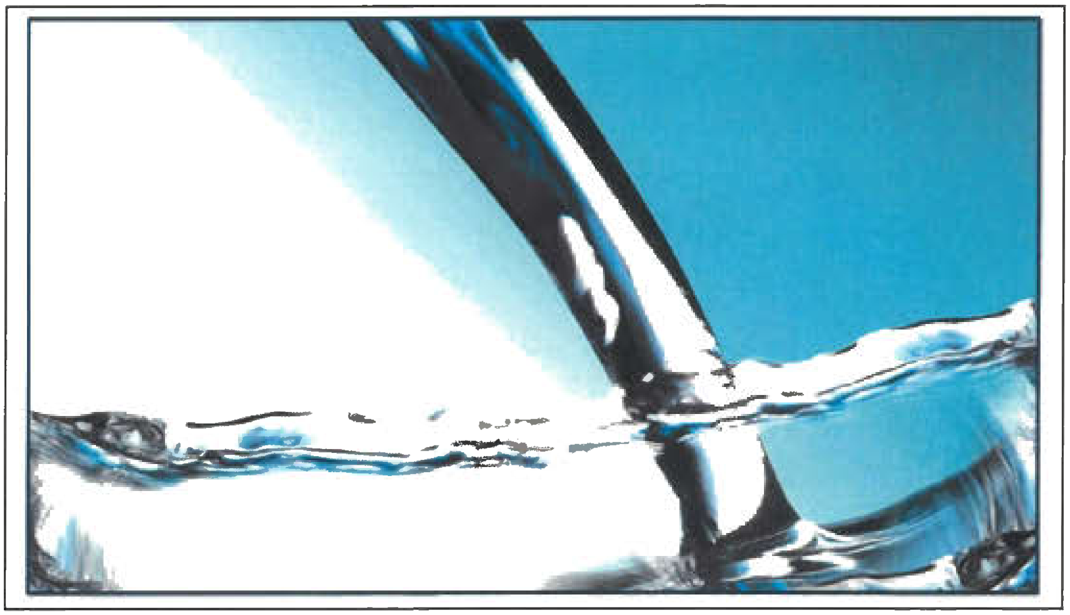
```
         ==== LOOPS ====
 o.  TYPE  ---- LOOP PIPES -------------------

   1 CLOSED        7   -6   -5   -4
   2 CLOSED      -28   10   12   13   14   18  -22   23   24   25
                  27
   3 CLOSED      -18   16   17
   4 CLOSED       21   22  -17   19   20
   5 CLOSED      -25  -24  -23  -21   26
   6 CLOSED       35  -56  -34
   7 CLOSED        1    2   43  -42
   8 CLOSED        2   43  -44   30  -29  -28   -9   -4   -3
   9 CLOSED      -31   45   46   47   48  -49  -36   56  -35  -33
                  69  -32   19   20   26   27   29
  10 CLOSED      -50  -15   14   16   32
  11 CLOSED       51  -52  -38  -37   36   49
  12 CLOSED      -39   40   53
  13 CLOSED       45   46   54   55  -35  -33   69  -32   19   20
                  26   27   29  -31
  14 CLOSED       47   48  -49  -36   56  -55  -54
  15 CLOSED      -58  -39   40   68
  16 CLOSED       59   60  -61
  17 CLOSED       62  -60
  18 CLOSED      -65    3    7    8   64
  19 CLOSED      -64   -8   -6   -5    9   10   11   67  -66
  20 CLOSED      -70   31  -30
```

City of Bandon
Coos County, Oregon

WATER MASTER PLAN ADDENDUM

OCTOBER 2003



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Project No. 4501.39

City of Bandon
Coos County, Oregon

Water Master Plan Addendum

October 2003

Project No.4501.39

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Introduction

Section

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Introduction

1.1 Background and Need

The City of Bandon's latest Comprehensive Water System Master Plan was prepared in December, 1992 by HGE Engineers and Planners. The study period for that plan was for twenty years. With the passage of ten (10) years, amendment of certain Master Plan items is now necessary.

The majority of Priority I improvements, as generally described and recommended in the 1992 Master Plan, have been implemented. These projects were:

- Ferry Creek Impoundment dredging to remove accumulated silt and restore reservoir capacity.
- Lower Pump Station Improvements
- Replacement of the line from the lower pump station to the Middle Pond
- Middle Pump Station Improvements.
- Water Treatment Plant expansion
- New 2 Million gallon storage reservoir. The older 1 million gallon storage reservoir located at the water plant site was also fully repaired and restored.
- Line Improvements including a new Raw Water Line from the Middle Pump Station to the improved water treatment plant. The Transmission Line construction generally fulfilled the recommendations for Priority 1 improvements by providing transmission to the southeast portion of the urban growth boundary and connection to the existing water system on Harlem Ave SE. and Ohio Ave. SE. The recommended Priority I, 9th St SW water line extension to Franklin has also been completed.

The Priority II 16" Transmission Line continuing from the southeast portion of the urban growth boundary and continuing west and south to Face Rock Road and Highway 101; then south to Seabird Lane and the Priority III, 12" extension on Face Rock to Highway 101, thus completing a major southern loop has not yet been constructed. The Priority IV north loop has not yet been constructed either. This proposed loop runs from Highway 42-S north along Ohio Avenue, west on Fahy Avenue and then connects with the existing line on Riverside Drive been constructed.

Raw water intake modifications have been made since the Master Plan report of 1992, implementing the recommendation to enable withdrawal of water in Ferry Creek after passage through the Fish Hatchery tankage. Because the Hatchery's use of water is for pass through without withdrawal, this modification largely mitigates the potential conflict between the Hatchery and City water rights during low source flow situations.

The water treatment plant improvements completed in 2000 continued efficient conservation of backwash and plant drainage water by conveyance of these waters to the middle pond for re-pumping to the treatment plant as raw water.

A Priority I recommendation which has still not been executed is for preliminary engineering and permits associated with Long-Term Water Supply.

As water demand increases in conjunction with the growth of the area's population, concerns over source water availability are becoming a greater issue for Bandon. In response, the City will want to ensure that appropriate source water will be available to meet future water demands. This Master Plan Addendum has been prepared to update evaluation of the City's water needs through the next 20-year planning period and update the identification of current deficiencies in the performance of the water system.

1.2 Study Objective

Oregon Health Division (OHD)

The purpose of a Water Master Plan is to furnish the City of Bandon with a comprehensive planning document which provides engineering assessment and planning guidance for the successful management of its water system over the next 20 years. This Addendum satisfies the Oregon Health Division (OHD) requirement for communities to have a current master plan when 300 or more service connections exist (OAR 333-061-0060). The principal objectives include:

- Evaluation of the existing water system components
- Prediction of future water demands
- Evaluation of the capability of the existing system to meet future needs
- Comparison of source water availability and projected water demand
- Recommendations for improvements needed to meet future needs and/or address deficiencies

This addendum outlines updated recommended water system improvements that are considered necessary to comply with State and Federal standards and to provide for anticipated growth. The capital improvements are presented as projects with estimated costs to allow the City to plan and budget as needed. Supporting technical documentation is included to aid in grant and loan funding applications and meet the requirements of the Oregon Economic and Community Development Department (OECDD), the Oregon Department of Water Resources (WRD), the Rural Development Administration (RDA), as well as Oregon Health Division (OHD).

Oregon Department of Water Resources (WRD)

This addendum was prepared to fulfill the requirements of a water master plan as outlined by the OHD. The Oregon Department of Water Resources under authority of Oregon Administrative Rules (OAR) 690-86 also outlines the requirements of a Conservation and Management Plan as required by the WRD. The City is currently under a Stipulated Order to develop a Water Management and Conservation Plan and submit it to WRD for review and acceptance.

A report entitled "Water Management and Conservation Plan", prepared under separate cover, has been developed for the OAR 690-86 and WRD requirements.

1.3 Scope of Study

This document is an addendum to the Comprehensive Water System Master Plan prepared in December 1992 by HGE Engineers and Planners. References in parenthesis indicate the original Water Master Plan Chapter which is modified or updated. The scope of this report provides updates to the following items:

Section 1 - Introduction (WMP Chapter 1)
Section 2 - Population Projection (WMP Chapter 4)
Section 3 - Number of Connections and Water Use Projections (WMP Chapter 5)
Section 4 - Water Rights and Available Supply (WMP Chapter 7)
Section 5 - Treatment Plant Capacity (WMP Chapter 8)
Section 6 - Distribution Modeling (WMP Chapter 10)
Section 7 - Capital Improvement Plan (WMP Chapter 11)
Section 8 - Project Prioritization and System Development Charge Eligibility (WMP Chapter 11)
Section 9 - Financing Options (WMP Chapter 12)

Planning Period

As suggested by OAR 690-086-0140 and typical of most water master plans, the planning period for this addendum is 20 years, ending in the year 2023. The period is short enough for current users to benefit from system improvements, yet long enough to provide reserve capacity for future growth and increased demand. It is recommended that an update to this report be prepared within 5 to 10 years depending on the growth in the community.

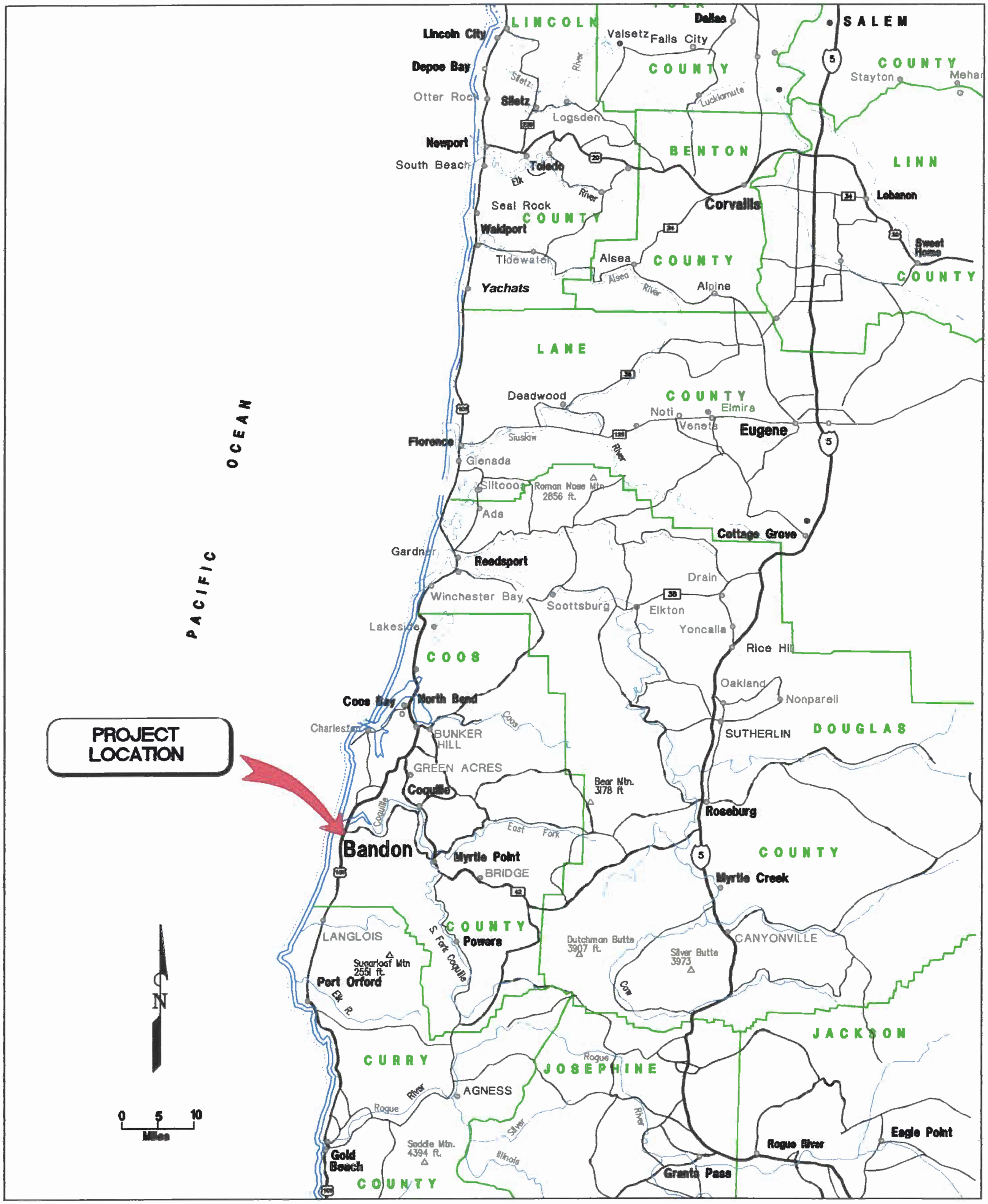
Planning Area

The City's Urban Growth Boundary (UGB) plus the additional limits of the system defined by raw water sources and transmission is considered the study area in this Plan. Figure 1.3.1 shows the location of the City of Bandon in Oregon, and Figure 1.3.2 shows the City limits and the UGB.

Work Tasks

In compliance with Oregon Health Division and Oregon Department of Water Resources plan elements and standards, this study provides descriptions, analysis, projections, and recommendations for the City's water system over the next 20 years. The following elements are included:

- Study area characteristics including land use and population trends and projections
- Description of the existing water system including supply, treatment, storage and distribution
- Existing regulatory environment including regulations, rules and Plan requirements
- Current water usage quantities and allocations
- Projected water demands
- Existing system capacity analysis and treatment evaluation
- Improvement alternatives and recommendations with associated costs



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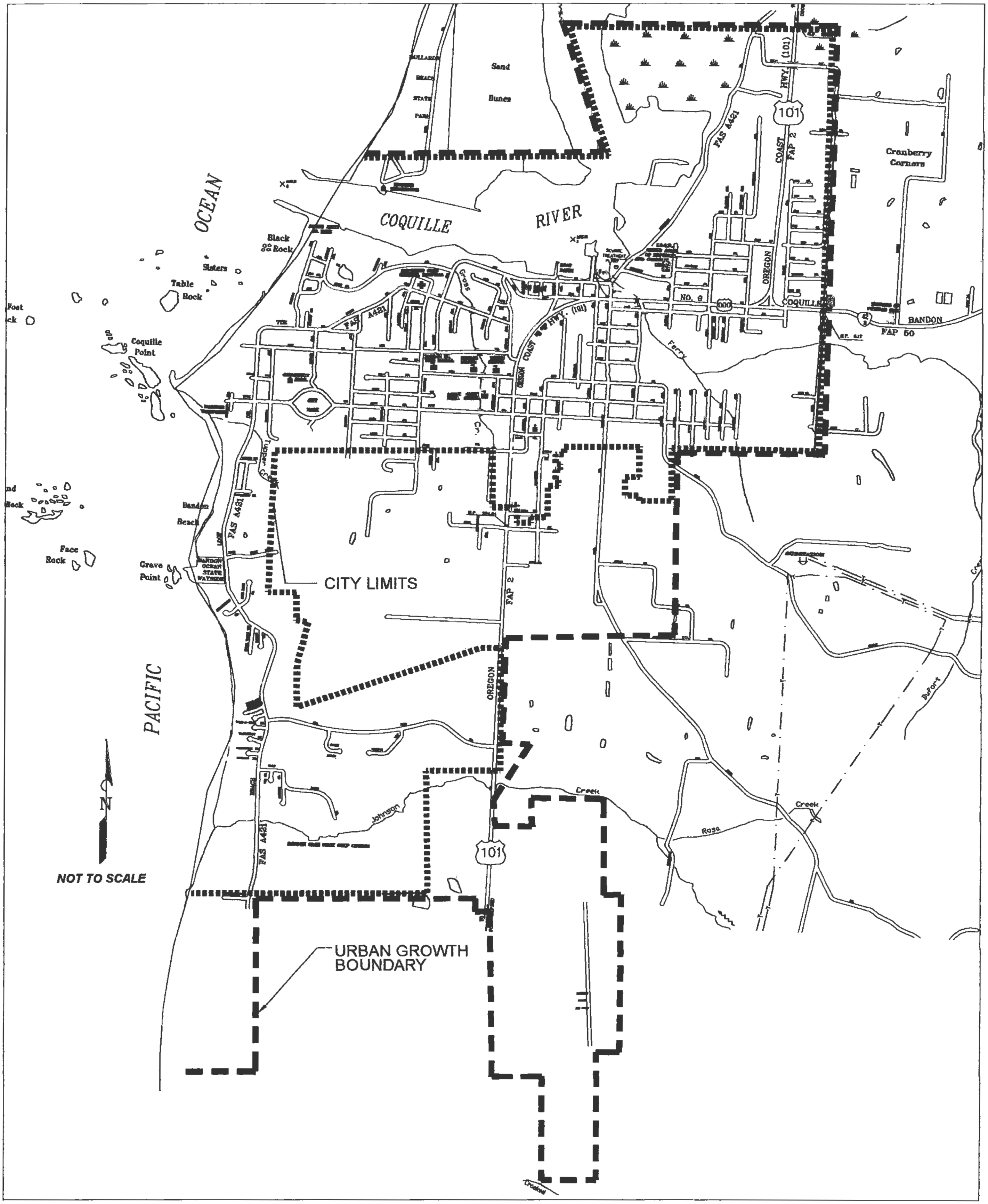
THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF BANDON*** ***WATER MASTER PLAN ADDENDUM***	**FIGURE NO.**
DATE: JULY, 2003 PROJECT NO.: 4501.39	***LOCATION MAP***	***1.3.1***



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DATE: JULY, 2003
PROJECT NO.: 4501.39

CITY OF BANDON
WATER MASTER PLAN ADDENDUM

AREA MAP

FIGURE NO.
1.3.2

- Recommendations for water management planning and water usage curtailment
- A summary of recommendations in the form of a Capital Improvement Plan
- Funding options
- Maps of the existing system and recommended improvements

1.4 Previous Studies and Information

The following studies, reports and other sources of information have been used in the compilation of the Master Plan:

- City of Bandon 1991 Comprehensive Plan, (with Amendments re: Public Facilities)
- Comprehensive Water System Master Plan, December 1992, HGE Engineers and Planners
- Coos County Water Management Plan, 1990, CH_2M Hill
- Ferry Creek Project Evaluation Under PL84-984, April 1990, Tucson Myers & Associates
- South Bandon Refinement Plan, Infrastructure Element, June 1997, Dyer Partnership, Inc.
- Wastewater System Master Plan, June 2002, Dyer Partnership, Inc.
- Bandon Water System Improvements Construction Drawings, November 1998, Lee Engineering, Inc.
- Municipal Water Management In Oregon Coastal Communities: Surmounting the "Conservation Paradox", September 2000, Coastal Oregon Marine Experiment Station Oregon State University.
- Seawater Desalination in California, October 1993, California Coastal Commission, Susan E. Pantell, Principal Author.
- Department of Environmental Quality. May 2000. Source Water Assessment Report: City of Bandon. PWS 4100074.
- Department of Environmental Quality. May 2000. Source Water Assessment Brochure: 2/14/03 City of Bandon. PWS 500074
- DEQ Water Sampling Project, Project Number: OR-98-09.5-319 DEQ Contract No. :096-011/2/03, City of Bandon Water Resource Committee
- Source Water Protection Plan, September 17, 2003, City of Bandon Water Resource Committee
- Water Meter and Billing records from 1998 to 2003.
- Water Plant Records from 1998 to 2003.

- Annual Water Use Records for Geiger and Ferry Creeks 1998 to 2003.

The information in this Plan is for preliminary planning and budgeting purposes. Detailed surveys and elevation information must precede design and some changes from this Plan are anticipated.

1.5 Authorization

The City of Bandon contracted with The Dyer Partnership, Engineers & Planners, Inc. on January 1, 2003 to prepare this Addendum to Water Master Plan. Included in the contract was a Scope of Engineering Services on which this Plan is based.

1.6 Acknowledgments

This plan is the result of contribution made by a number of individuals and agencies. We wish to acknowledge the efforts of Matt Winkel, City Manager; Richard Anderson, Public Works Director; Gene Davidson, Water Treatment Plant Supervisor; Jason Locke, Community Development director; Lanny Boston, Fire Chief ; Beverly Lanier, Administrative Assistant and the staff of the City of Bandon.

We also wish to thank the members of the Water Resources Committee for their guidance, fact review and editing assistance during the preparation of this report: The members are: Larry Roberts, Chairman; James Shivley, Vice Chairman; and committee members: Zita Ingham, Tim Arnold, Carol Doty, David Kauffman, Michael Scalici, Wayne Scherer, Patricia Soltys and Scott Vierck.

Section

2

Study Area

Section

2

Population Projections

2.1 Population

Existing population and population projections play a significant role in infrastructure planning. A number of resources are available for determining population figures for permanent residents. However, projections accounting for transit and part time populations have had to be developed specifically for Bandon in order to evaluate the water consuming population relying on the City water system. To further complicate matters, different types of populations use different average daily volumes of water. The concept of equivalent population will therefore be developed to relate other than full time resident populations, businesses and commercial activities to the standard, or equivalency of a typical full time resident at home in Bandon. All discussion of population hereafter will differentiate between permanent and part-time population and transient population.

Since 1992 Bandon has experienced a growth rate higher than projected in the 1992 Master Plan and generally higher than most other communities in Oregon. Economic conditions were difficult in the early 1980's due to the decline of the forest products industry. Bandon's livability characteristics, however, especially for retired persons and those enjoying outdoor recreation, have attracted a long term growing populace to the Oregon Coast regardless of the local economic climate.

Estimating current and future water consuming population within the City of Bandon presents many special challenges. A significant portion of water use is consumed by commercial and governmental users, motels, condominiums, and part-time residential facilities. Because the nature of these facilities is for non-residential or part-time occupation only, they are not accounted for within the United States Census or included within the estimates developed by Portland State University. However, throughout the year, many part-time residents and Bandon visitors are included within the water-consuming population.

In addition, Bandon serves a number of outside residential and commercial customers. These customers will also consist of full-time and part time users and while not included in census population counts, must be accounted for in determination of service population.

In order to account for the entire service population, a separate analysis has to be performed for both peak and off-peak population levels. The following discussion outlines the methodology used to estimate the service population for the City of Bandon water system.

2.2 Full Time Residential Population

Based on U.S. Census Data[1], the City of Bandon's population increased from 2215 to 2833 between 1990 and 2000. This equates to an average annual growth rate of 2.49 percent. During this same period, the

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[1] Source: U.S. Census Bureau, Census 2000 Redistricting Data (P.L. 94-171) Summary File, Table PL1, and 1990 census.

County's average annual growth rate was 0.408 percent. In the decade prior to this however, population decreased. The growth rate for Bandon during the previous 20-year census dates (1980-2000) was 1.024 percent.

Growth in Bandon is expected to continue at a rate higher than that experienced in the county during the last decade. A growth rate of 1.76% per year will be used for projections within this Master Plan over the next 20 years (to the year 2023), as suggested by the Revised Coos County Population Report for 1997. This is the growth rate used for the Wastewater System Master Plan prepared last year and for other planning reports prepared for Bandon. Growth occurs through infill of existing land in the City limits or through annexation of property in the UGB. The most recent population projections are shown in Table 2.2.1.

Table 2.2.1
Bandon Population Growth Rates

	Year							
Item	1990	1995	2000	2003	2008	2013	2018	2023
City of Bandon Population	2,215	2,610	2,833	2985	3257	3554	3878	4231
Growth Rate %	N/A	3.25	2.01	1.76	1.76	1.76	1.76	1.76

For the purposes of this study, an existing (2003) full-time residential population of 2985 persons is used for the inside city limits full time residential population, with an average annual growth rate of 1.76 percent for the 20-year planning period.

The 2000 population census for the City of Bandon included 2,833 full time residents. Housing units totaled 1535 with 248 units listed as vacant. Of the 248 vacant units, 120 are listed as vacation or seasonal use. Vacation or seasonal use housing therefore accounts for 4.23% of the housing base. This results in an occupancy rate of about 2.2 persons per occupied housing unit. About 24 building permits are issued annually. At 2.2 persons per unit this would give a city population of 2991 which is a close match to the projected 2003 population of 2985 based on the selected 1.76% annual population growth rate

2.3 Part Time Residential Population

Bandon serves as a second or part-time home for some residents. These residents include retirees that travel in the winter ("snow-birds"), full-time residents of other Oregon locations, and some condominium and transient-rental residents. While these part-time residents are not included as Bandon residents in census counts, they do use water and should be accounted for. It should be noted that this population segment may be classified as tourist under other definitions. However, because this segment is assumed to consume water at the same rate as permanent residents, they are treated separately.

As noted above, in the year 2000, there were approximately 120 vacation or seasonal use residential water connections. Assuming an occupancy rate of 2.2 persons per unit during peak season adds 264 part-time persons. Based on the growth rate of 2.01% which occurred between 2000 and 2003, the current inside part time population is projected to be 280 persons. This peak occupancy occurs during the summer months. When these persons are present, they are assumed to consume water at the same rate as the permanent population. It is also estimated that the part-time population will grow at the long term rate of 1.76 percent. The projection for part time residential population is shown below in Table 2.3.1.

Table 2.3.1
Part-Time Bandon Population Growth Rates

Item	Year							
	2000	2001	2002	2003	2008	2013	2018	2023
Inside Population - Peak Additional	264	269	275	280	306	333	364	397

2.4 Tourist / Transient Population

A significant portion of commercial water use within the City is related to the lodging industry. It is important that the tourist population be approximated to provide a sound basis of water use projection*.

A survey of Bandon motels and RV parks was conducted last year (2002) and collected data on the numbers of rooms and spaces, as well as the approximate occupancy rates throughout the year. It was determined that sixteen motels with approximately 385 lodging units and two RV parks having 22 spaces serve the Bandon tourist/transient population. The survey had a 50% return rate. Based on the results, the occupancy rates were extrapolated onto the total number of rooms available to generate population levels. However, transient population does not consume water in the same volume as "home" domicile population whether full or part time. The results are shown below in Table 2.4.1

Table 2.4.1
Transient Population Estimate for 2002

Projected Population	Hotels/Motels	RV Parks	Total
Summer Daily 5 months	703	14	717
Winter Daily 7 months	245	7	252
Annual Daily Average	436	10	446

Table 2.4.2
Transient Population Growth Rates

Item	Year							
	2000	2001	2002	2003	2008	2013	2018	2023
Summer Daily	N/A	N/A	717	730	796	869	948	1034
Winter Daily	N/A	N/A	252	256	279	304	337	362
Annual Daily Average	N/A	N/A	446	454	495	540	589	643

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*Note that this population's water use is included in commercial demands and projections.

2.5 Outside Residential Population

In the year 2000, 81 outside residential customers averaged 6.9% of inside residential customers. This increased to 7.0% in 2001 and 7.1% in 2002 with 90 outside residential services. This is a short term growth rate of 3.5%. Based on the assumption of 2.2 persons per service and a 3.5% short term growth rate, the outside city limits residential population is estimated to currently include 205 persons with 93 services. As is the case for inside city limits population growth, the long term growth rate will be reduced in comparison to recent short term growth rates. A value of 2.0% is recommended.

The full-time and part-time occupation ratios are assumed to be the same as the inside city limits residential population. Therefore, for purposes of this report, 4.23% of outside residential users are assumed to be part-time. This results in an estimate of 196 full time residents and 9 part-time residents for the year 2000. Projections are made in Table 2.5.1.

Table 2.5.1
Outside Bandon Water Service Population Growth Rate

Outside Residential Population	Year							
	2000	2001	2002	2003*	2008*	2013*	2018*	2023*
Full - Time	170	180	190	196	216	238	263	290
Peak - Additional	8	8	8	9	10	12	13	14
Total	178	188	198	205	226	250	276	304

2.6 Total Water Service Population

The sum of each population group described above for the City of Bandon is shown below in Table 2.6.1. Table 2.6.1 summarizes both peak and off-peak population estimates for the City of Bandon current population and projections for the planning period.

Table 2.6.1
Current Population Estimate and Projections

Year	**2003**	**2008**	**2013**	**2018**	**2023**
Residential Inside - Full Time	2985	3257	3554	3878	4231
Residential Outside - Full Time	196	216	238	263	290
Residential Inside - Peak additional	280	306	333	364	397
Residential Outside - Peak additional	9	10	12	13	14
Transient - Off Peak	256	279	304	332	362
Transient - Peak Additional	474	517	565	616	670
Total Peak Population	4200	4585	5006	5466	5964
Total Off-Peak Population	3437	3752	4096	4478	4883

In Figure 2.6.1, the historical full-time residential population estimates are plotted with the projections for the peak and off peak population described above.

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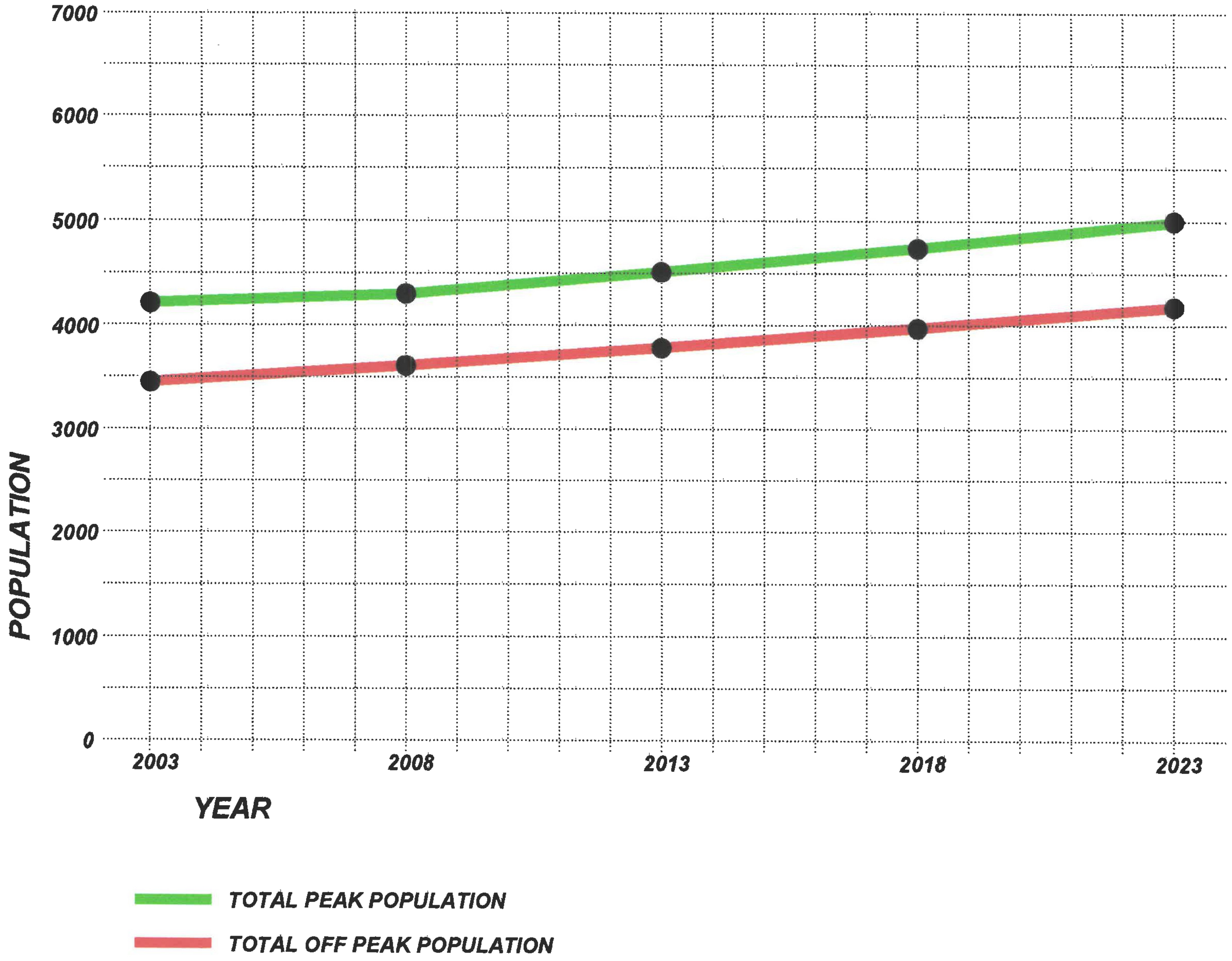

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CITY OF BANDON
WATER MASTER PLAN ADDENDUM
POPULATION PROJECTION

FIGURE NO.
2.6.1

Connections and Water Use Projects

Section

3

Connection & Water Use Projections

Section

3

3.1 Description and Definitions

Water demand can be defined as the quantity of water delivered to the system over a period of time to meet the needs of consumers, provide filter backwashing water, and to supply the needs of fire fighting and system flushing. In addition, virtually all systems have an amount of leakage or loss that cannot be feasibly or economically reduced or eliminated. Total demand, therefore, includes all consumption and lost water. Demand varies seasonally with the lowest usage in winter months and the highest usage during summer months. Variations in demand also occur with respect to time of day (diurnal) with higher usage occurring during the morning and early evening periods and lowest usage during nighttime hours.

The objective of this section is to determine the current water demand characteristics and to project future demand requirements that will establish system component adequacy and sizing needs. Water demand is described in the following terms:

> *Average Annual Demand (AAD)* - The total volume of water delivered to the system in a full year expressed in gallons. When demand fluctuates up and down over several years, an average is used.
>
> *Average Daily Demand (ADD)* - The total volume of water delivered to the system over a year divided by 365 days. The average use in a single day expressed in gallons per day.
>
> *Maximum Monthly Demand (MMD)* - The gallons per day average during the month with the highest water demand. The highest monthly usage typically occurs during a summer month.
>
> *Peak Weekly Demand (PWD)* - The greatest seven day average demand that occurs in a year. Expressed in gallons per day.
>
> *Maximum Day Demand (MDD)* - The largest volume of water delivered to the system in a single day expressed in gallons per day. The water supply, treatment plant and transmission lines should be designed to handle the maximum day demand.
>
> *Peak Hourly Demand (PHD)* - The maximum volume of water delivered to the system in a single hour expressed in gallons per day. Distribution systems should be designed to adequately handle the peak hourly demand. During this peak usage, storage reservoirs supply the demand in excess of the maximum day demand.

Demands described above, expressed in gallons per day (gpd), can be divided by the population served to arrive at a demand per person or a per capita demand which is expressed in gallons per capita per day (gpcd). Per capita demands can be multiplied by future population projections to determine future water demands.

3.2 Current Water Consumption Demands

For the purposes of this study, water consumption demand is based on the City's monthly records for the three-year period, January 2000 to December 2002. Prior records appear to have an error in either the raw water or finished water meter (greater amount of finished water recorded than raw water diverted). Plant improvements completed in 2000 appear to have corrected this problem. Production data is based on records for water production at the water treatment plant. Total water diversion data is based on the raw water meter that measures the water diverted from both Ferry Creek and Geiger Creek and on the finished water meter.

Water sales records allow calculation of an Equivalent Dwelling Unit (EDU) and provide measurement of unaccounted water (lost water) when compared with plant production records. Water sold is typically less than the amount of water produced at the plant due to system leaks, inaccuracies in customer meters, and other unmetered use such as fire flows and system flushing. In the case of Bandon, water is produced at the plant very efficiently compared with the amount of raw water diverted from the two Creeks. This is primarily due to the reuse of plant drainage and backwash water through the Middle Pond. In fact, during the wet season, there may be is a net gain of raw water in Middle Pond with respect to the volume of water withdrawn from the Creek due to accumulation of run off in the Middle Pond 's small watershed.

Diverted Water

As part of the auditing process, the City must account for all water diverted from each source. This is typically accomplished through a metering device at or near the point of diversion. OAR 690-085-0015 requires that, "Where practical, water use shall be measured at each point of diversion." However, the rule also states that:

> "...measurements may be taken at a reasonable distance from the point of diversion if the following conditions are met:
>
> a) The measured flow shall be corrected to reflect the flow at the point of diversion. The correction will be based on periodic flow measurements at the point of diversion taken in conjunction with flow measurements at the usual measuring point;
>
> b) If the measured flow includes flow contributions from more than one point of diversion, the measured flow shall be proportioned to reflect the flow at each point of diversion using the method prescribed subsection (a) of this section;
>
> c) A description of the correction method shall be submitted with the annual report the first time it is used and any time it is changed, or once every five years, whichever is shorter."

If the point of diversion is relatively close to the water treatment plant, it is common for many communities to use a single influent meter at the water plant to measure the amount of water that is diverted.

In the case of Bandon, raw water flow is measured at the treatment plant influent by magnetic flow meter. The balance between the Geiger Creek and Ferry Creek diversions is controlled by the Fish Hatchery. The Hatchery maintains a balance so that flow from Ferry and Geiger Creek reservoir produce equal overflow at their primary spillways. It has been assumed in the past that 1/4 of the total raw water flow from Geiger Creek and 3/4 from Ferry Creek. Their are no flow measurement devices located in the withdrawal piping system from the reservoirs. Neither is the main lower pump station metered, although the alterative Ferry Creek pump station below the confluence of the two Creeks is equipped with a flow meter. It is recommended that the main lower pump station be equipped with a flow meter so that water pumped to the middle pond may be measured. This would also provide a more accurate raw water diversion measurement, because the current reported raw water diversion values are too high. They include backwash and drainage water, which is returned to the water plant by way of the middle pond. The actual raw water diversion values from Ferry and Geiger Creeks are expected to nearly match the finished water plant effluent values (within 1.5% to account for evaporation and minor loss from the Back Wash and Middle Ponds)[1]. A detailed explanation of difference between the reported raw water and estimated true raw water diversion is provided in following paragraphs. Table 3.2.1 below, summarizes the reported and estimated true water diverted from the City's two active sources converted to gallons x 1000.

Table 3.2.1
Summary of Reported and Estimated Annual Water Diversion From Each Source
(2000 –2002)

Year	Geiger Creek Annual Diversion (Gal. X 1000)	Ferry Creek Annual Diversion (Gal. X 1000)	Total Raw Water Diverted (Gal. x 1000)
2000	45,087 (Rpt.) 42,211 (Est.)	135,262 (Rpt.) 126,634 (Est.)	180,349 (Rpt.) 168,845 (Est.)
2001	41,923 (Rpt.) 37,531 (Est.)	125,769 (Rpt.) 112,593 (Est.)	167,692 (Rpt.) 150,125 (Est.)
2002	46.672 (Rpt.) 41,472 (Est.)	140,015 (Rpt.) 124,416 (Est.)	186,687 (Rpt.) 165,888 (Est.)

Treated Water

The City of Bandon Plant Production Records for the years 2000 to 2002 are shown in Table 3.2.2 on the following pages. The records obtained for the years 1998 and 1999 do not appear valid because the meters indicated greater plant finished water than plant raw water. This table compares the plant records for influent and effluent with the annual Oregon Water Resources Department Water Use Reports. Columns estimating the true diversion from Geiger and Ferry Creeks are included. This correction is based upon the observation that middle pond raw water intake to the plant as recorded includes water drainage and backwash water. For purposes of this report, it is assumed that a maximum 1.5%[1] loss occurs due to evaporation or minor leakage from the plant, through the backwash pond and the middle pond.

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[1] See "Raw Water Measurement" page 3-6

Table 3.2.2 - City of Bandon Plant Water Records

Year	Plant Raw Water Influent [1]				Plant Finished Water Effluent [2]				Reported Raw Water [3]			Est. True Raw Water [4]		
2000	Total	Max	Min.	Average	Total	Max	Min.	Average	Geiger	Ferry	Total	Geiger	Ferry	Total
January	10.902	0.463	0.072	0.352	9.644	0.410	0.064	0.311	2.726	8.177	10.902	2.447	7.342	9.789
February	9.373	0.541	0.000	0.323	8.292	0.479	0.000	0.286	2.343	7.030	9.373	2.104	6.312	8.416
March	11.156	0.456	0.221	0.360	9.868	0.403	0.195	0.318	2.789	8.366	11.155	2.504	7.512	10.016
April	11.788	0.504	0.393	0.393	10.418	0.446	0.348	0.347	2.944	8.833	11.777	2.644	7.931	10.575
May	14.567	0.960	0.264	0.470	12.886	0.849	0.233	0.416	3.642	10.925	14.567	3.270	9.810	13.080
June	18.212	0.585	0.392	0.607	16.111	0.518	0.347	0.537	4.553	13.659	18.212	4.088	12.264	16.352
July	23.796	0.871	0.492	0.768	21.051	0.771	0.435	0.679	5.949	17.847	23.796	5.342	16.025	21.366
August	24.201	0.851	0.315	0.691	20.939	1.351	0.455	0.675	6.050	18.151	24.201	5.313	15.940	21.253
September	19.824	0.315	0.860	0.661	18.224	0.717	0.423	0.607	4.956	14.868	19.824	4.624	13.873	18.497
October	16.235	0.717	0.166	0.524	16.239	0.617	0.404	0.524	3.709	11.128	14.837	4.121	12.362	16.483
November	10.747	0.528	0.000	0.358	10.799	0.486	0.000	0.360	2.687	8.060	10.747	2.740	8.221	10.961
December	10.958	0.702	0.000	0.353	11.879	0.529	0.332	0.383	2.739	8.218	10.958	3.014	9.043	12.058
Yr. Total	181.759			0.488	166.350			0.454	45.087	135.262	180.349	42.211	126.634	168.845

[1] Jan-June supported by daily log DMR. Records. July by May 27,'03 retrival record. Aug. to Dec by Production Records
October based on daily production records (conflicts w/other records & report totals)

[2] Jan.-July not available. Aug.-Dec. Supported by Production Records. Aug. based on daily flow records.
Jan-July calculated based on ave. ratio (.88463) of Raw Water to Effluent for years 1999,2001,2002

[3] Supported by Annual Reports to WRD

[4] Plant finished water multiplied by 1.015

Year	Plant Raw Water Influent [1]				Plant Finished Water Effluent [2]				Reported Raw Water [3]			Est. True Raw Water [4]		
2001	Total	Max	Min.	Average	Total	Max	Min.	Average	Geiger	Ferry	Total	Geiger	Ferry	Total
January	11.158	0.775	0.000	0.360	9.880	0.718	0.000	0.319	2.790	8.369	11.158	2.507	7.521	10.028
February	10.382	0.760	0.000	0.371	9.204	0.700	0.000	0.329	2.596	7.787	10.382	2.336	7.007	9.342
March	11.477	0.711	0.000	0.370	9.720	0.654	0.000	0.314	2.869	8.608	11.478	2.466	7.399	9.866
April	12.353	0.845	0.180	0.458	11.024	0.754	0.148	0.367	3.088	9.265	12.353	2.797	8.392	11.189
May	14.107	0.716	0.150	0.455	12.353	0.651	0.138	0.398	3.527	10.581	14.107	3.135	9.404	12.538
June	15.335	0.710	0.291	0.529	13.775	0.651	0.270	0.459	3.834	11.501	15.335	3.495	10.486	13.982
July	18.564	0.777	0.275	0.599	16.817	0.647	0.323	0.542	4.641	13.923	18.564	4.267	12.802	17.069
August	19.306	0.780	0.511	0.623	17.132	0.731	0.462	0.553	4.827	14.480	19.306	4.347	13.042	17.389
September	17.197	0.770	0.393	0.573	15.115	0.623	0.419	0.504	4.299	12.898	17.197	3.835	11.506	15.342
October	14.943	N/A	N/A	0.482	13.121	0.508	0.341	0.423	3.736	11.207	14.943	3.329	9.988	13.318
November	11.701	N/A	N/A	0.390	10.317	0.417	0.279	0.344	2.925	8.776	11.701	2.618	7.854	10.472
December	11.169	N/A	N/A	0.360	9.448	0.363	0.267	0.305	2.792	8.376	11.169	2.397	7.192	9.590
Yr. Total	167.691			0.464	147.906			0.405	41.923	125.769	167.693	37.531	112.593	150.125

[1] Jan-Sept supported by daily log DMR. Records. Oct.-Dec by Annual WRD report

[4] Plant finished water multiplied by 1.015

Table 3.2.2 (continued) City of BandonPlant Water Records

Year	Plant Raw Water Influent[1]				Plant Finished Water Effluent[2]				Reported Raw Water[3]			Est. True Raw Water[4]		
2002	Total	Max	Min.	Average	Total	Max	Min.	Average	Geiger	Ferry	Total	Geiger	Ferry	Total
January	11.495	0.571	0.168	0.371	10.192	0.538	0.146	0.329	2.874	8.621	11.495	2.586	7.759	10.345
February	10.779	0.533	0.221	0.385	9.701	0.502	0.197	0.346	2.695	8.084	10.779	2.462	7.385	9.847
March	12.411	0.598	0.306	0.400	11.254	0.564	0.273	0.363	3.103	9.308	12.411	2.856	8.567	11.423
April	12.421	0.506	0.204	0.414	11.034	0.467	0.171	0.368	3.105	9.316	12.421	2.800	8.400	11.200
May	15.446	N/A	N/A	0.498	13.281	0.547	0.339	0.428	3.862	11.585	15.446	3.370	10.110	13.480
June	18.232	N/A	N/A	0.608	15.307	0.630	0.312	0.510	4.558	13.674	18.232	3.884	11.652	15.537
July	23.387	N/A	N/A	0.754	19.358	0.706	0.573	0.624	5.847	17.540	23.387	4.912	14.736	19.648
August	24.253	N/A	N/A	0.782	20.074	0.785	0.406	0.648	6.063	18.189	24.253	5.094	15.281	20.375
September	18.627	0.858	0.222	0.621	17.039	0.817	0.187	0.568	4.582	13.745	18.327	4.324	12.971	17.295
October	15.433	0.716	0.242	0.498	14.153	0.691	0.204	0.457	3.858	11.575	15.433	3.591	10.774	14.366
November	12.443	0.654	0.164	0.415	11.407	0.634	0.127	0.380	3.111	9.332	12.443	2.895	8.684	11.578
December	12.061	0.572	0.144	0.389	10.636	0.549	0.040	0.343	3.015	9.046	12.061	2.699	8.097	10.796
Yr. Total	186.988			0.511	163.436			0.447	46.672	140.015	186.687	41.472	124.416	165.888

[1] Jan-April & Sept.-Dec. supported by daily log DMR. Records. May-Aug. by Annual WRD report

[2] Jan.-April & Sept.-Dec. by daily log DMR Records. May-Aug. by May 72,'03 retrival record

[3] Supported by Annual Reports to WRD for Jan.-Sept. Report not available until Oct.'03 for last water yr. Oct.-Dec. calculated based on Plant Raw Water Influent. Geiger 1/4 & Ferry 3/4 of total.

[4] Plant finished water multiplied by 1.015

Summary	Plant Raw Water Influent[1]				Plant Finished Water Effluent[2]				Reported Raw Water			Est. True Raw Water		
Year	Total	Max	Min.	Average	Total	Max	Min.	Average	Geiger	Ferry	Total	Geiger	Ferry	Total
2000	181.759	0.960	0.000	0.488	166.350	1.351	0.000	0.454	45.087	135.262	180.349	42.211	126.634	168.845
2001	167.691	0.845	0.000	0.464	147.906	0.731	0.000	0.405	41.923	125.769	167.693	37.531	112.593	150.125
2002	186.988	0.858	0.144	0.511	163.436	0.785	0.040	0.447	46.672	140.015	186.687	41.472	124.416	165.888
CFS														
3 Yr. Ave.	178.813	0.888	0.048	0.488	159.231	0.956	0.013	0.435	44.561	133.682	178.243	40.405	121.214	161.619

Unaccounted Water ("Lost" Water)

General

The difference between the quantity of water diverted from the raw water source to the treatment plant and the quantity of water delivered through the distribution system and measured at customer meters or otherwise metered in the treatment process is referred to as unaccounted water. The difference can be attributed to system leaks, inaccuracies in customer meters, unmetered services, and other unmetered use such as fire flows and system flushing.

The Oregon Administrative Rules (OAR) Section 690-86, states that all water systems should work to reduce unaccounted water levels to 15 %. If the reduction of "lost" water to 15 % is found to be feasible, the water provider should work to reduce unaccounted water levels to 10 %.

Raw Water Measurement

Available data used for this report relies on daily monitoring of the raw water influent meter at the plant. This amount measured is not actually the raw water amount withdrawn from the Creeks. Rather, it also includes the recovered backwash, filter to waste, and other miscellaneous amounts of water, which are drained to the Middle Pond and re-pumped through the plant. It is recommended that a flow meter be installed at the lower pump station to allow the City to account for the water removed from Geiger and Ferry Creeks directly. The existing plant influent meter actually measures the water removed from middle pond. The pump station located downstream of the hatchery for use during low flow conditions is provided with such a meter. The true amount of water diverted from Ferry and Geiger Creeks is therefore less than reported. Because all back-wash, filter-to waste, tank drainage, etc. is run through the back-wash pond and then to the Middle Pond, the actual difference between the finished water and raw water is very small. For purposes of this report it will be assumed to be, at most, 1.5% based on spray down wash loss and evaporation from ponds.

Raw Water Losses – Ferry Creek & Geiger Creek to Middle Pond. The water improvements projects completed in 2000 provided a new lower pump station and new yard piping for both of the creek sources, with the exception of original intake piping through the dam section. In addition, the majority of the suction piping from the point of diversion, piping through the lower pump station and the discharge piping to the Middle Pond is located within the cleared Hatchery compound. The configuration of these pipes is such that any leaks would be readily apparent to personnel at the Hatchery or at the Water Treatment Plant. No leaks have been noted. Therefore, it is assumed that the system is tight and any losses are negligible in this segment of the system.

Raw Water Losses – Middle Pond to Water Plant. The water improvements projects completed in 2000 provided a new Middle Pond pump station and new discharge piping to the water plant. Because of the new (and tested) condition of the pipe, it is assumed that losses in this portion of the raw water system are negligible. In addition, the impoundment dam was repaired in recent years. The face and toe of the dam are visible for inspection and no leakage has been observed. In addition, due to the capture of run-off in the middle pond during the winter months, there is a net gain in raw water at certain times of the year.

Treatment Plant Losses. Treatment plant losses are defined as the difference between the water entering the plant and water leaving the plant plus all accountable uses within the treatment process. Due to the configuration of the treatment facilities both prior to and after completion of the new plant in 2000, losses through the treatment plant were not significant. The configuration of the treatment plant allows reclamation of turbidimeter, filter to waste and after process drainage and backwash water by conveyance to the Middle Pond as noted above. Therefore losses are assumed to be no more than 1.5%.

Distribution System Losses. Distribution system losses include all losses due to leakage, unmetered use, inaccurate consumption meters, and other sources of unaccountable water use. The city meters water use for all users including water used for municipal purposes and for which no charge is made. Over the period of analysis, the City has experienced water losses in the distribution system averaging only 6.7 % of the total finished water leaving the plant site tanks. It is not expected that the City can further reduce this loss at any reasonable investment.

Overall System Losses. Overall systems losses are defined as the difference between the water diverted at the raw water source and the sum of all accounted water uses. The overall system losses should also be equal to the sum of the raw, treatment, and distribution system losses. Table 3.2.3 summarizes the overall system losses in the City of Bandon water system.

Table 3.2.3
Overall System Losses

Year	Est. True Raw Diversion X 1,000 Gal.	Raw Plant Influent X 1,000 Gal.	Est. Plant Influent X 1,000 Gal.	Finished Plant Water X 1,000 Gal.	Metered Water Delivered X 1,000 Gal.	Distribution System Loss X 1,000 Gal.	Plant Loss %	Distribution Loss %	Total Loss %
2000	168,845	181,759	2,495	166,350	152,692	13,658	1.50%	8.21%	9.71%
2001	150,125	167,691	2,218	147,906	135,438	12,468	1.50%	8.43%	9.93%
2002	165,888	186,988	2,451	163,436	149,401	14,035	1.50%	8.59%	10.09%
Ave.	161,619	178,813	2,388	159,231	145,844	13,387	1.50%	8.41%	9.76%

Total raw water diverted for the City averaged approximately 162 million gallons per year during the. period 2000 to 2002. Unaccounted water in the City's distribution system averages around 13 million gallons per year or 36,700 gallons per day; losses on this order are minor and not economical to reduce.

Metered Water Consumption

Detailed water records were obtained from the City of Bandon for the years 1999 to 2002 with a portion of 2003. Review of the records indicated that prior to 2000, the plant water records contained errors due to a mis-calibration of influent and/or effluent flow meters. Rather than risk the introduction of errors into this analysis, it was decided to only use records for the years 2000-2002. The year 2003 records are for less than a complete year and therefore do not contribute to annual average or maximum annual calculations.

Shown in Table 3.2.4 on the following pages are the records for water accounts WA01, WA03, WA02, WA04, WA58 and WA59. These accounts are for Residential Inside, Residential Outside, Commercial Inside, Commercial Outside, City Use Charged and City Use Un-charge respectively. For each month of the 3-year study period and within each account class or sector, the water use, number of customer accounts and a calculation of the average use per day per customer is presented. For each year and for each class, the total use is summed. On an annual basis for each sector, an average monthly water use, average number of customers and average daily use per customer are computed. Finally, for the 3-year study period, an average yearly consumption, monthly consumption, number of customers and usage rate per customer are computed for each account sector as well as for the aggregate of all users.

Table 3.2.4 - City of Bandon Metered Water Records for Years 2000 to 2003

	WA01			WA03			WA02			WA04			WA58			WA59		
	Residential - Inside			**Residential - Outside**			**Commercial - Inside**			**Commercial - Outside**			**City Use - Charged**			**City Use - No Charge**		
	Use	**Cust.**	**Use/ Day per cust**	**Use**	**Cust.**	**Use/ Day per cust**	**Use**	**Cust.**	**Use/ Day per cust**	**Use**	**Cust.**	**Use/ Day per cust**	**Use**	**Cust.**	**Use/ Day per cust**	**Use**	**Cust.**	**Use/ Day per cust**
2000 Jan	4962	1220	0.131	268	81	0.107	4822	307	0.507	123	13	0.305	726	22	1.065	8	2	0.129
Feb	3898	1233	0.113	209	82	0.091	3053	310	0.352	92	13	0.253	599	22	0.972	10	2	0.179
Mar	5074	1229	0.133	261	86	0.098	4199	315	0.430	157	13	0.390	601	22	0.881	12	2	0.194
Apr	4965	1231	0.134	256	84	0.102	4352	312	0.465	203	14	0.483	482	22	0.730	10	2	0.167
May	5367	1225	0.141	282	86	0.106	4487	316	0.458	213	14	0.491	500	22	0.733	12	2	0.194
June	6508	1229	0.177	324	84	0.129	6198	316	0.654	167	14	0.398	557	22	0.844	30	2	0.500
July	9643	1247	0.249	525	84	0.202	7533	314	0.774	229	16	0.462	1632	22	2.393	20	2	0.323
Aug	9011	1247	0.233	676	86	0.254	7965	315	0.816	114	16	0.230	1485	23	2.083	21	2	0.339
Sept	7111	1239	0.191	425	87	0.163	6178	316	0.652	182	16	0.379	1582	23	2.293	18	2	0.300
Oct	5995	1243	0.156	354	86	0.133	5663	319	0.573	735	16	1.482	1269	23	1.780	19	2	0.306
Nov	5113	1247	0.137	322	86	0.125	4437	316	0.468	284	16	0.592	986	23	1.429	17	2	0.283
Dec	4683	1242	0.122	330	85	0.125	3771	315	0.386	179	16	0.361	177	23	0.248	21	2	0.339
Total/Yr.	72330			4232			62658			2678			10596			198		
Ave.	6028	1236	0.160	353	85	0.136	5222	314	0.544	223	15	0.485	883	22	1.288	17	2	0.271

	WA01			WA03			WA02			WA04			WA58			WA59		
	Residential - Inside			**Residential - Outside**			**Commercial - Inside**			**Commercial - Outside**			**City Use - Charged**			**City Use - No Charge**		
	Use	**Cust.**	**Use/ Day per cust**	**Use**	**Cust.**	**Use/ Day per cust**	**Use**	**Cust.**	**Use/ Day per cust**	**Use**	**Cust.**	**Use/ Day per cust**	**Use**	**Cust.**	**Use/ Day per cust**	**Use**	**Cust.**	**Use/ Day per cust**
2001 Jan	4735	1231	0.124	344	85	0.131	4174	317	0.425	208	16	0.419	303	23	0.425	8	2	0.129
Feb	4142	1250	0.118	252	87	0.103	3172	316	0.358	118	16	0.263	75	23	0.116	12	2	0.214
Mar	4593	1248	0.119	302	88	0.111	3810	318	0.386	176	16	0.355	124	23	0.174	13	2	0.210
Apr	4218	1245	0.113	351	87	0.134	3802	322	0.394	170	16	0.354	210	23	0.304	10	2	0.167
May	5307	1256	0.136	352	88	0.129	4348	321	0.437	239	17	0.454	198	23	0.278	17	2	0.274
June	6057	1247	0.162	352	87	0.135	5225	319	0.546	184	18	0.341	161	23	0.233	14	2	0.233
July	7450	1263	0.190	459	86	0.172	6594	321	0.663	253	17	0.480	212	23	0.297	23	2	0.371
Aug	8149	1264	0.208	506	86	0.190	6997	320	0.705	275	17	0.522	120	24	0.161	13	2	0.210
Sept	6762	1257	0.179	456	86	0.177	6632	323	0.684	200	17	0.392	234	25	0.312	19	2	0.317
Oct	5635	1259	0.144	379	86	0.142	5749	324	0.572	242	16	0.488	318	25	0.410	18	2	0.290
Nov	5527	1251	0.147	353	89	0.132	5032	323	0.519	542	16	1.129	220	25	0.293	11	2	0.183
Dec	4095	1247	0.106	336	89	0.122	3416	330	0.334	172	16	0.347	252	25	0.325	11	2	0.177
Total/Yr.	66670			4442			58951			2779			2427			169		
Ave.	5556	1252	0.146	370	87	0.140	4913	321	0.502	232	17	0.462	202	24	0.278	14	2	0.231

Table 3.2.4 (Cont.) - City of Bandon Metered Water Records for Years 2000 to 2003

	WA01			WA03			WA02			WA04			WA58			WA59		
	Residential - Inside			**Residential - Outside**			**Commercial - Inside**			**Commercial - Outside**			**City Use - Charged**			**City Use - No Charge**		
	Use	**Cust.**	**Use/ Day per cust**	**Use**	**Cust.**	**Use/ Day per cust**	**Use**	**Cust.**	**Use/ Day per cust**	**Use**	**Cust.**	**Use/ Day per cust**	**Use**	**Cust.**	**Use/ Day per cust**	**Use**	**Cust.**	**Use/ Day per cust**
2002 Jan	5225	1249	0.135	409	88	0.150	4135	341	0.391	227	17	0.431	427	25	0.551	15	2	0.242
Feb	3907	1249	0.112	259	89	0.104	3082	334	0.330	172	17	0.361	301	25	0.430	10	2	0.179
Mar	4195	1249	0.108	402	88	0.147	3260	336	0.313	187	20	0.302	312	25	0.403	11	2	0.177
Apr	4699	1264	0.124	331	88	0.125	3985	340	0.391	242	21	0.384	372	26	0.477	15	2	0.250
May	5781	1257	0.148	382	92	0.134	4605	338	0.439	270	20	0.435	357	26	0.443	13	2	0.210
June	7172	1256	0.190	575	91	0.211	5770	337	0.571	312	23	0.452	498	26	0.638	15	2	0.250
July	8891	1264	0.227	490	91	0.174	6779	336	0.651	367	23	0.515	471	26	0.584	18	2	0.290
Aug	10796	1265	0.275	811	92	0.284	9507	341	0.899	470	23	0.659	520	26	0.645	22	2	0.355
Sept	7017	1272	0.184	497	92	0.180	6185	339	0.608	253	23	0.367	289	26	0.371	20	2	0.333
Oct	6652	1286	0.167	525	92	0.184	6046	342	0.570	425	23	0.596	397	27	0.474	13	2	0.210
Nov	4892	1273	0.128	361	90	0.134	3969	344	0.385	864	25	1.152	189	27	0.233	12	2	0.200
Dec	4933	1264	0.126	340	90	0.122	3911	346	0.365	376	25	0.485	148	27	0.177	15	2	0.242
Total/Yr.	74160			5382			61234			4165			4281			179		
Ave.	6180	1262	0.160	449	90	0.162	5103	340	0.493	347	22	0.512	357	26	0.452	15	2	0.245

Summary

	Residential - Inside			**Residential - Outside**			**Commercial - Inside**			**Commercial - Outside**			**City Use - Charged**			**City Use - No Charge**			**Annual Total**		
2000	**Use**	**Cust.**	**Use/ Day per cust**	**Use**	**Cust.**	**Use/ Day per cust**	**Use**	**Cust.**	**Use/ Day per cust**	**Use**	**Cust.**	**Use/ Day per cust**	**Use**	**Cust.**	**Use/ Day per cust**	**Use**	**Cust.**	**Use/ Day per cust**	**Use**	**Cust.**	**Use/ Day per cust**
Total/Yr.	72330			4232			62658			2678			10596			198			152692		
Ave./Mo.	6028	1236	0.160	353	85	0.136	5222	314	0.544	223	15	0.485	883	22	1.288	17	2	0.271	12724	1674	0.250
2001																					
Total/Yr.	66670			4442			58951			2779			2427			169			135438		
Ave./Mo.	5556	1252	0.146	370	87	0.140	4913	321	0.502	232	17	0.462	202	24	0.278	14	2	0.231	11287	1702	0.218
2002																					
Total/Yr.	74160			5382			61234			4165			4281			179			149401		
Ave./Mo.	6180	1262	0.160	449	90	0.162	5103	340	0.493	347	22	0.512	357	26	0.452	15	2	0.245	12450	1742	0.235
3 Year Ave																					
Total/Yr.	71053			4685			60948			3207			5768			182			145844		
Ave./Mo.	5921	1250	0.155	390	87	0.146	5079	325	0.513	267	18	0.486	481	24	0.672	15	2	0.249	12154	1706	0.234

Equivalent Dwelling Unit Calculations

Projections for population growth are often utilized to estimate the future demand for public utility services, such as water and sewer. Typically, the current demand is associated with the consumption of an average residential or dwelling unit. An occupancy rate may be determined and projections of population can be related to the number of residential dwelling units. However, residential dwelling units are only a portion of the demand. Commercial, industrial, vacation rental, institutional and municipal customers will also demand services. Accounting for these customer types requires comparing the demand for services from the respective customer with the demand from the "average" residential dwelling unit. Other classes of users may be assumed to increase at the same rate as the population. Census based studies count all dwelling units such as single-family residential homes, apartments, living quarters within larger structures and so on. This is the usual definition of a dwelling unit. However, the City maintains water consumption and billing data on customer accounts rather than on individual usage or even dwellings. It is recommended that an equivalent dwelling unit (EDU) be based on a typical single-family dwelling unit (SFDU). In this way, the number of "residential" accounts corresponds with the WA01 type residential-inside customer. These WA01 accounts averaged 1250 over the 2000-2002 study period and consumed a yearly average of 155 gallons per day. For purposes of this report, this value will be used to define the equivalent dwelling unit (EDU). If we assume 2.2 persons per dwelling unit as indicated in the 2000 census to apply to single family dwelling units as well, then the average yearly consumption per person is about 70.5 gallons/day.

Table 3.2.5 calculates the average study period City EDU totals based on the SFDU model. This calculation uses the average yearly water consumption for each billing sector compared with the consumption of inside residential service connections as the basis of the EDU.

Table 3.2.5
Bandon Service & EDU Sector Summary Based on Metered Water Consumption 2000-2002

Account	**No. of Services**	**Gal. X 1,000 Average Yr. Use**	**Gal. Ave. Day. Use/Svc.**	**Typ. EDU Per Svc.**	**EDU's/ Class**	**% of Total Use**
Residential-Inside	1250	71053.33	155.7	1.00	1250	44.0
Residential–Outside	87	4685.33	147.0	0.94	82	2.9
Commercial-Inside	325	60947.67	513.8	3.30	1072	37.7
Commercial-Outside	18	3207.33	498.2	3.20	56	2.0
City Use – Charged	24	5768.00	656.9	4.22	101	3.6
City Used – No Charge	2	182.00	249.3	1.60	3	0.1
Metered Totals	1706	145,843.67			2564	90.2
Loss	1	15,775.33	43,220.1	277.59	278	9.8
Consumption Totals		161,619.00			2842	100.0

Note that the average diversion during the 2000-2002 study period was 161,619,000 gallons per year and the metered use was 145,843,667 gallons leaving 15,775,333 (9.76%) gallons as loss. Of this amount 13,337,000 gallons (8.26%) are identified as distribution system loss and 2,388,000 gallons (1.5%) as treatment plant loss.

Hydraulic Peaking Factors (ADD, MMD, MDD, PHD)

Average Day Demand (ADD)

The average annual demand (ADD) can be defined as the average water demand for any day in a given year. ADD is most commonly used to size facilities based on average water demand including lost water. The ADD is the typical basis of Master Planning modeling analysis. Peaking factors are commonly used to develop relationships between the ADD and the other planning criteria. Higher peak rates such as maximum month average day, maximum day demand and peak hourly demand are estimated by multiplication of the base ADD projected for a given year by the peak factors. The ADD values for the year 2000-2002 study period are presented in Table 3.2.6. For analysis purposes, the total of diverted raw water is used so that losses are included. Water system planning requires that all water diverted from the source be analyzed and considered as total water system consumption.

Table 3.2.6
Summary Average Day Water Demands (ADD)

Year	Average Annual Metered Use (Gal. X 1000)	Total Raw Water Diverted (Gal. x 1000)	Average Day Raw Water Demand (Gal. x 1000)
2000	152,692	168,845	462.6
2001	135,438	150,125	411.3
2002	149,401	165,888	454.5
Average	145,844	161,619	443.0

Included in the table are losses derived from the plant production records. Water system planning requires that all water diverted from the source be analyzed and considered as total water system consumption.

Maximum Monthly Demand (MMD)

Water demand in the City of Bandon fluctuates monthly with the highest demands generally between the months of June and September. The higher summertime flows can most likely be attributed to a combination of increased outdoor water use (i.e. landscaping) and the increase in population due to tourism and vacationers. A summary of the City's maximum month water demand and calculated peaking factors from 2000 to 2002 are provided in Table 3.2.7.

Table 3.2.7
Maximum Month Water Demand (Including Losses)

Year	Max Month (Days)	Max Month Demand (Gal X 1,000)	ADD (gpd x 1,000)	MMD (gpd x 1,000)	Peaking Factor (MMD/ADD)
2000	July (31)	21,366	462.6	689.2	1.49
2001	August (31)	17,389	411.3	560.9	1.36
2002	August (31)	20,375	454.5	657.3	1.45
Average	N/A	19,710	443.0	635.8	1.43

As developed in Table 3.2.5, a MMD peaking factor of 1.43 is appropriate for the City's demand data. Peaking factors tend to be consistent from one water system to another. It is common for water systems have a MMD peaking factor on the order of 1.5 times the ADD.

Maximum Day Demand (MDD)

To determine the maximum day demand, a number of techniques are available. The demand values can be based upon raw water usage or actual finished water production data over recent years, common peaking factors, statistical analysis, or a combination of these techniques. Data is available for daily plant finished water production over the last 3 years. MDD will be approximated based on the maximum finished water production day within the system rather than reported raw water influent because the plant influent values do not reflect actual raw water diversion. Maximum finished water production days over the last three years with available data were previously presented in Table 3.2.2 and will be used with the computed loss percentages for the year previously developed in Table 3.2.2 to estimate the maximum day demand. The results are shown below in Table 3.2.8.

Table 3.2.8
Summary Of Maximum Water Production Days

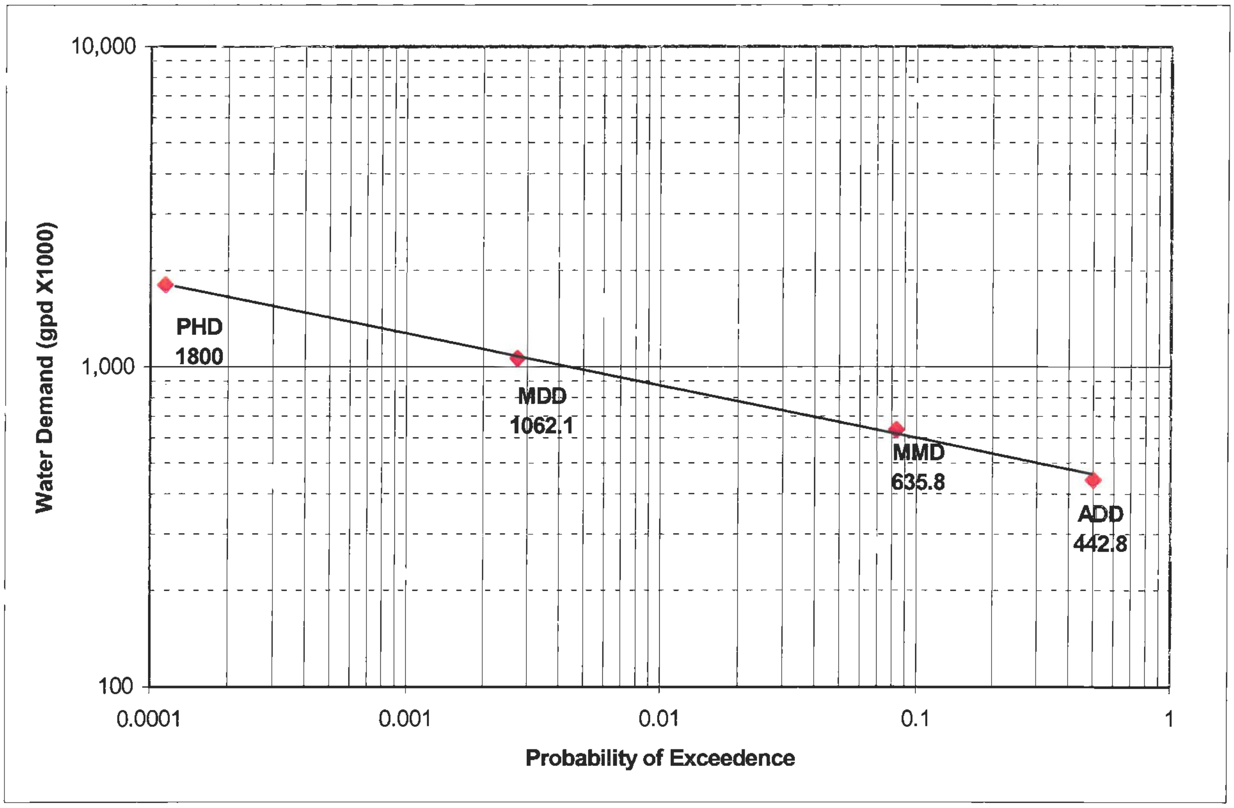
Year	Date When MDD Occurred	MDD Eff. (gpd x 1000	Loss Factor	MDD Est. Raw (gpd x 1000	ADD (gpd x 1000)	Peaking Factor (MDD/ADD)
2000	Aug. 25	1351	9.71%	1482.2	462.6	3.20
2001	28-Aug	731	9.93%	803.6	411.3	1.95
2002	14-Sep	817	10.09%	899.4	454.5	1.98
Ave.		966	9.91%	1062.1	442.8	2.40

The MDD is the demand that is experienced on the highest demand day of the year. The MDD is commonly used to size facilities to provide capacity for periods of high demand. The MDD may be experienced on a holiday such as the Fourth of July or during a festival. The MDD is usually associated with the warmest part of the year when agriculture, irrigation, and recreational uses of potable water are at their greatest. Peaking factors between 2 and 2.5 are commonly used for MDD. A peaking factor of 2.40 with a value of 1062.1 gpd is appropriate for the City based on demand data.

Peak Hour Demand (PHD)

Recorded hourly demand data is not available. One method that can approximate the Peak Hourly Demand (PHD) is to plot the probability of exceedence of demand versus the various known water demand values. A logarithmic trend line across known quantities can be used to predict unknown quantities. Figure 3.2.1 shows the probability of exceedence plot and the resulting demand value of 1,800,000 gpd estimated for the PHD.

FIGURE 3.2.1 PROBABILITY OF DEMAND EXCEEDENCE TO PREDICT PHD



PHD is associated with the highest demand experienced during a single hour. Peak hour demand is commonly experienced during the early morning hours when many water users are bathing, cooking, and engaging in other activities that require widespread water use. PHD is used to size facilities for short periods of extreme demand. Peaking factors between 3 to 5 are commonly used for PHD.

A value of 4.07 as determined from the probability plot of data is typical. Though the PHD value is not as critical for reserve and treatment planning, the PHD will be used in the computer modeling process to ensure that the storage and distribution system will continue to function during short, peak demand situations. The results of PHD estimation are shown in Table 3.2.9 below.

Table 3.2.9
Summary Of Peak Hour Water Production Estimates

Year	Basis	PHD (gpd x 1000)	ADD (gpd x 1000)	Peaking Factor (PHD/ADD)
2000-2003 Ave.	Fig. 3.2.1 Prob.	1,800	442.8	4.07

A summary of the planning criteria along with their associated peaking factors is provided in Table 3.2.10.

Table 3.2.10
Summary Of Average and Peak Water Demands and Peaking Factors - 2000-2002

Demand Parameter	Total (gpd)x 1000	Peaking Factor
Average Day (ADD)	442.8	1.00
Maximum Month (MMD)	635.8	1.43
Maximum Day (MDD)	1062.1	2.40
Peak Hour Demand (PHD)	1800.0	4.07

3.3 Projected EDU's, Service Connections and Water Demands

General

Future water demand estimates are prepared using the past records of water produced and water sold along with projected population estimates. The goal of projecting future water demand is not to build larger facilities to accommodate excessive water consumption, but rather to evaluate the capability of existing components and to size new facilities for reasonable demand rates. Excessive water consumption should not be projected into the future estimates. Water demand projections should be based on acceptable water loss quantities, reasonable conservation measures, and the community's expected water use characteristics.

There is a degree of uncertainty associated with future water demand projections for any community. Uncertainties in projections exist because of the estimates used to define the community's current water use and the built-in assumptions made with respect to anticipated growth in a community. The impact of water conservation measures on a community's future water consumption also is difficult to predict.

Use Comparison with Other Oregon Cities

The U.S. Department of the Interior documented the per capita water use for Oregon in the 1995 U.S. Geological Survey - Circular 1200. According to the study, the average per capita water use for Oregon is 235 gallons per capita day (gpcd) including domestic, commercial, industrial, and public use and loss. Of the total 235 gpcd, 53 % is domestic use, 14 % is commercial, 17 % is industrial, and 16 % is public use and loss. An interagency team made up of personnel from the DEQ, Oregon Economic and Community Development Department (OECDD), Oregon Health Division (OHD), the Oregon Department of Water Resources (WRD), the USDA-Rural Utilities Service, Rural Community Assistance Corporation, and the Department of Land Conservation and Development has developed target design numbers based on the USGS study and their experience with Oregon communities. The team has adopted a maximum ADD of 235 gpcd, a MDD of 588 gpcd (2.5 times the ADD), and a PHD of 1,175 gpcd (5 times the ADD).

Bandon currently is estimated to have a full time population of 2985 in the City limits and 196 outside the City limits in the service area. Therefore, the base service area population is 3181. Total water consumption, including losses is estimated to be 161,619 gallons per year averaged over the past three-year study period. Therefore Bandon's per capita consumption rate is 139.2 gpcd including domestic, commercial, industrial, and public use and loss. This is well below the target value of 235 gpcd noted above. Bandon's MDD factor was 2.40 compared with the target factor of 2.5 and the PHD factor was estimated to be a maximum of 4.07 compared with the target value of 5.

According to OAR 690-86-140, a water system should endeavor to reduce unaccounted water levels to 15 % or less of the total water diverted from their raw water sources. As developed previously in this report, the City experiences very low unaccounted water levels (less than 10%) and is in compliance with the OAR . The resulting projected demands will assume an unaccounted water level of 9.76 % of the total raw water diverted to the system. The results of the comparison of Bandon water use characteristics with other Oregon Cities are shown in the following Table 3.3.1.

Table 3.3.1
Comparison of Bandon Water Use Characteristics with Other Oregon Cities

Use Characteristics	Bandon	Oregon Cities
Average Use per day	139.2 gpcd	235 gpcd
Domestic Use	46.9 %	53 %
Commercial Use	39.7.0%	14 %
Industrial Use	-------	17 %
Public Use & Loss	13.5%	16 %
MDD factor	2.40	2.5
PHD factor	4.07	5.0

Projection of EDU's and Service Connections By Sector

Projections of EDU's and service connections by sector are calculated below in Table 3.3.2. The forecasts use the proscribed rate introduced in Section Two of 1.76% per year. The projection period is from 2003 to 2023. The method of projection will first estimate the 2003 EDU and service connection numbers based upon the 2000 to 2002 average values for these parameters when multiplied by a two (2) year growth rate $[(1+0.0176)^2 = 1.03551]$. The source of the 2000 to 2002 data is Table 3.2.5 - "Bandon Service & EDU Sector Summary Based on Metered Water Consumption 2000-2002"

The two-year growth period is assumed because the "average" year for the study period is 2001. For each five-year increment thereafter, the preceding incremental value will be multiplied by a compounding factor $[(1+0.0176)^5 = 1.09115]$

Table 3.3.2
EDU and Service Connection Projections

Account	Yr 2000-2002 Sty. Period		2003		2008		2013		2018		2023	
	Svc.	EDU	Svc.	EDU	Svc.	EDU	Svc.	EDU	Svc.	EDU	Svc.	EDU
Residential Inside	1250	1250	1294	1294	1412	1412	1541	1541	1682	1682	1835	1835
Residential Outside	87	82	90	85	98	93	107	101	117	110	128	120
Commercial Inside	325	1072	337	1110	367	1211	401	1322	437	1442	477	1574
Commercial Outside	18	56	19	58	20	63	22	69	24	75	26	82
City Use Charged	24	101	25	105	27	114	30	125	32	136	35	148
City Use No Charge	2	3	2	3	2	3	2	4	3	4	3	4
Totals	1706	2564	1767	2655	1928	2897	2103	3161	2295	3449	2504	3764

Projection of Average Day Demand By Sector

Projections of average day demand (ADD) by sector are calculated below in Table 3.3.3. The forecasts method is the same as used for the previous projection of EDU's and service connections. The source of the 2000 to 2002 base data is Table 3.2.4 - "City of Bandon Metered Water Records for Years 2000 to 2003" with values increased by 9.76% to account for lost water.

Table 3.3.3
Bandon ADD (GPD x 1,000) Sector

Account	Yr 2000-2002 Sty. Period		2003		2008		2013		2018		2023	
	Mtr.[1]	Total[2]	Mtr.[1]	Total[2]	Mtr.[1]	Total[2]	Mtr.[1]	Total[2]	Mtr.[1]	Total[2]	Mtr.[1]	Total[2]
Residential Inside	194.7	215.7	201.6	223.4	220.0	243.7	240.0	266.0	261.9	290.2	285.7	316.7
Residential Outside	12.8	14.2	13.3	14.7	14.5	16.1	15.8	17.5	17.3	19.1	18.8	20.9
Commercial Inside	167.0	185.0	172.9	191.6	188.7	209.1	205.9	228.1	224.6	248.9	245.1	271.6
Commercial Outside	8.8	9.7	9.1	10.1	9.9	11.0	10.8	12.0	11.8	13.1	12.9	14.3
City Use Charged	15.8	17.5	16.4	18.1	17.9	19.8	19.5	21.6	21.3	23.6	23.2	25.7
City Use No Charge	0.5	0.6	0.5	0.6	0.6	0.6	0.6	0.7	0.7	0.7	0.7	0.8
Totals	399.6	442.8	413.8	458.5	451.5	500.3	492.6	545.9	537.5	595.7	586.5	650.0

[1] Metered Amounts

[2] Total amounts include loss allowance

Projection of Peak Demand Rates for System
Projections of the maximum month average day (MMD), maximum annual demand day (MDD) and the peak annual hour demand (PHD) are calculated in Table 3.3.4 . The forecast method will use the values computed in Table 3.3.3 above multiplied by the factors computed in Table 3.2.10 - Summary Of Average and Peak Water Demands and Peaking Factors - 2000-2002. The factors will remain constant through the study period.

Table 3.3.4
Bandon Projection of Peak Demand Rates (Gal x 1,000)

Factor	Yr 2000-2002 Sty. Period	2003	2008	2013	2018	2023
ADD	442.8	458.5	500.3	545.9	595.7	650.0
MMD	633.2	655.7	715.4	780.7	851.8	929.5
MDD	1062.7	1100.4	1200.7	1310.2	1429.6	1559.9
PHD	1800.0	1866.1	2036.22	2221.8	2424.5	2645.5

The demand projections presented in Table 3.3.4 will be used in the Distribution Modeling Section of this report to analyze available capacity in existing systems throughout the planning period as well as to size new facilities for future demand.

Listed below in Table 3.3.5 are the identical demand rates present in Table 3.3.4, but in terms of CFS. These values are useful for comparison with water rights and stream diversion values, which are typically presented in terms of CFS.

Table 3.3.5
Bandon Projection of Peak Demand Rates (CFS)

Factor	Yr 2000-2002 Sty. Period	2003	2008	2013	2018	2023
ADD	0.69	0.71	0.77	0.84	0.92	1.01
MMD	0.98	1.01	1.11	1.21	1.32	1.44
MDD	1.64	1.70	1.86	2.03	2.21	2.41
PHD	2.81	2.89	3.13	3.42	3.74	4.11

Section

4

Water Rights & Supply

Section

4

Water Rights & Supply

4.1 Raw Water Sources

Ferry and Geiger Creeks. The City of Bandon has water rights within the Ferry Creek and Geiger Creek drainage systems and currently utilizes these as the City's water supply source. The intakes are located in the Ferry Creek Watershed in the Coquille River Sub-Basin. The geographic area providing water to Bandon's intake (the drinking water protection area) extends upstream approximately two miles in a southeasterly direction and encompasses a total area of 4 square miles. The elevation change from the upper edge of the watershed to the intake is approximately 400 feet. These basins drain into the estuary portion of the Coquille River.

Ferry Creek basin has an area of 1130 acres (1.75 square miles) above its diversion point. Geiger Creek basin has an area of 1290 acres (2.0 square miles) above its diversion point. Both Ferry and Geiger Creeks have perennial features. However, flows vary significantly based upon rainfall and season. Both streams typically run high during the winter and low during the drier summer months. In most years, flow levels are at a minimum in the months of August and September, coinciding with the time when water demand in the City of Bandon is at its peak and other area streams are nearly dried up. High winter flows bring with them turbidity, which results in more difficult water treatment conditions. The low summer flows require careful monitoring of water availability from the creeks and conservative use by the community. These sources are generally adequate and reliable at the present time.

Information regarding predicted low flows for these sources includes the Tucson Myers report of April 1990. A data correlation of Ferry Creek flow with Pony Creek flow was performed. The correlation location was at the confluence of Geiger and Ferry Creeks. Data used was from 1950 to 1980. The value was computed for flow that exceeded 99 out of 100 years. The lowest flow month was calculated for September at 1.06 mgd or 1.64 CFS. CH2M Hill prepared another report in July of 1993 for Coos County based on assumed run off values and predicted rain fall. This report predicted much lower flows than the Tucson Myers report. However CH2M Hill acknowledged in the report that that the mathematical basis of their estimate does not match observed flow. The explanation was that "springs" add to the volume. Basing the flows on observed Pony Creek flows, the Tucson Myers report can be expected to under report as well. Therefore, for purposes of this report 1.3 CFS (lowest recorded value) can safely be assumed to be the 1/100 year low flow value for Ferry Creek. Low flow values reported for Geiger Creek are 0.9 CFS .

Simpson Creek

In addition the City has certificate water rights to Simpson Creek (#9754) in the amount of 2.0 CFS and a priority date of January 24, 1910 near its headwater. Associated with this water right is a reservoir certificate (#9755) for 20 5/8 acre-feet. This is 6,720,219 gallons of storage, not all of which would be usable. The source is based on a very small basin with headwaters beginning north of Highway 42S and east of the Winterville area. There is significant development in this basin consisting of cranberry bogs, roads and homes with septic tanks. The City has not used the Simpson Creek source since the 1950's. It is reported that water quality issues made use of this water unattractive in comparison with water available from the City's other sources. Little is currently known regarding its reliability or quality. The original impoundment and diversion site was recently investigated (May 29, 2003) and found to still be in existence as an impoundment on Mill Creek (A.K.A. Simpson Creek). The flow on this day appeared to be between 3/4 and 1 CFS. The pond has a sandy/mud bottom and is surrounded by heavy vegetation. The remains of a concrete weir still exist. The local property owners currently have pumps in the impoundment for irrigation. One property owner who was interviewed indicated that they were aware that the City of Bandon had a water right in this impoundment. Remains of a12" wooden pipe and a valve were also located downstream from the impoundment dam. Use of this source would require installation of a new raw water pipe line. Access to the site is by means of a private driveway across from the Twin Fir Saw Shop on Highway 42S. One then proceeds 1/8 of a mile to the drive fork between #55518 and #55519. By foot, one follows the east fork branch and stream to a 100-foot trail leading to the Mill Creek concrete weir remains. Information from a 1948 report by Cornell, Howland, Hayes & Merryfield titled, "City of Bandon, Water Supply Investigation, Flow Measurements on Possible New Sources" provides flow data at the Mill Creek weir for the months of June 11 through October 8 of that year. Minimum flow in August was about 95,000 gallons per day, 66 gpm or 0.147 cfs. The high flow in the limited flow measurement period was June 11 through 14 at 190,000 gallon per day. A more complete study would be required to determine the projected 95% exceedance flow for this source. An agreement dated 8 September 1910 (Filed 1 April, 1911 Book 59 deeds, 402) appears to convey perpetual easement for a water line which originally supplied Bandon from the Mill Creek impoundment. It is recommended that a yield of 139 gpm (0.2 mgd) be considered as the minimum useful yield for Bandon to consider for development as a viable source of raw water considering the volume of water required for a municipal water supply. However, due to the relative proximity of this source to the water treatment plant, a lower yield might be considered cost effective. At a minimum, it is recommended that the City establish a recording gage station at this location and that water quality testing be conducted.

Consideration has also been given to pumping water to the Simpson Creek reservoir after restoration from Geiger and Ferry Creeks during high flow periods, rather than use the assumed lower quality Simpson Creek water. This would require that the reservoir be taken "off-line" from Simpson Creek.

Discussion with the Oregon Water Resources Department (WRD) indicated that all of the above actions are viable alternatives. However they also indicated that due to non-use of the water or storage for such a long period of time, a review of the existing water and storage rights must be performed if use is now considered. This would require the equivalent of the new water rights application. Water rights transfer issues also arise if a transfer of water from Geiger and Ferry Creeks to the Simpson reservoir is proposed. If the Simpson source is not determined to be viable or adequate in volume to warrant re-development, then lease of the water right for in-stream use by the State or others might be considered. The WRD also indicated that they wish to revoke the rights, if they believe the City will not be able to use these rights in the future even though they are "certificated".

Therefore, to develop Simpson Creek as a water source or off line storage facility will require that the City take the following actions prior to construction:

- Gage the Simpson Creek Flow
- Perform a source water assessment
- Conduct water quality analysis
- Perform a dam safety/geotechnical evaluation
- Apply to WRD for a revised water rights/storage permit for Simpson Creek or water transfer permit from Ferry and Geiger Creeks
- Preliminary Engineering Report for pump stations, transmission lines, intakes and impoundment
- Easements, permits, public participation
- Plans and Specifications

Source Water Assessment
A Source Water Assessment was completed in May, 2000 by the Department of Environmental Quality for Bandon. The assessment was made in order to identify the surface areas that supply water to the City of Bandon's public water system intake and to inventory the potential contaminant sources that may impact Ferry and Geiger Creeks. An assessment summary publication, dated 2/14/03 is available at: http://www.deg.state.or.us/wq/dwp/swareports/pws00074_Bandon.pdf

An inventory of potential contamination sources was performed within Bandon's drinking water protection area for Ferry Creek and Geiger Creek watersheds. The delineated drinking water protection area is primarily dominated by forest and agricultural land uses, interspersed with areas of residential use. A total of 27 potential contaminant sources were identified in the watershed. The potential contaminant sources consisted of roadways, bridges, excavation locations, utilities stations and transmission lines, forest clear cuts, cranberry bogs, and residential housing development.

Risk associated with the roadways is considered moderate due to low volume of traffic. The greatest number of concerns is associated with cranberry bogs due to the potential use of pesticides and herbicides, which may be washed into the impoundments as run-off. Residential development is currently considered to be a low to moderate risk. The principal risk is due to septic tank leachate. A transformer storage and maintenance facility located in the watershed is considered a high risk due to concern regarding spills, leaks, or improper handling of chemicals and other materials. The materials, including PCBs, may pose a risk during transportation, use, storage and disposal.

The City prepared a Water Sampling Project in response to the issues raised by the Source Water Assessment. The test program was conducted between 3/18/01 and 3/4/02 with a final report issued 1/2/03. The program tested for 25 chemicals commonly used for roadside maintenance, transmission line maintenance, forestry and agriculture. Only 3 herbicides were detected in trace amounts well below the Health Advisory Level using EPA standards. Seventeen samples were taken. Norflurazon (Evetal) was detected in one sample, Napropamide (Devrinol) in three samples and Dichlobenil (Casoron) in 9 samples. Water which passed through the water treatment plant showed no traces of the herbicides.

4.2 Water Rights

All water in Oregon is publicly owned. Because of this public ownership, a water right is generally required for anyone to use water regardless of whether the water originates from surface or underground sources.

Oregon's water laws are based on the principal of prior application. That is, if a person obtains a water right on a particular source before someone else, that person would then posses a "senior" water right that would permit them first use of the water during times of lower flows or droughts. A "junior" water right is one that is obtained after other water rights for a particular source have been assigned. A water right may be both "senior" to some and "junior" to others.

During periods of low water availability under previous state law, a water right holder could use as much water as their water right allows as long as the use is truly beneficial and all senior water rights are satisfied. This method of resource appropriation governed all water used until the water is exhausted. Under the current revised rules surrounding water permit extensions in OAR 690-315, the withdrawal of water for a municipal user becomes more complicated. Updated rules contained in OAR 690-86 modify the formerly routine five-year extension, which allowed cities to "grow into" their water right. Extensions will now generally be for longer periods of time (typically 20 years) and will require preparation of a

Water Management and Conservation Plan (WMCP). The rule modifications introduce the concept of "green light water" which is a portion of the water right which the city may divert until an updated WMCP is submitted and approved by the Oregon Water Resources Department (WRD). Certificated water rights do not fall under this requirement.

The City holds permit water rights to obtain a total of 3.0 cfs of surface water from Ferry Creek by way of the Ferry Creek Reservoir. Additionally, permits exist to remove water from Geiger Creek in the amount of 5.0 cfs from a point of diversion upstream of the Geiger Creek reservoir and 3.0 cfs from the reservoir itself.

In April 2000 an order was issued by WRD approving transfer application T-8195. This order allows Bandon to divert water associated with all three water rights discussed above from an alternative location downstream of the fish hatchery. This avoids a conflict of water rights with the fish hatchery during periods of low flow because the hatchery use is non-consumptive. The water is available to the City after flowing through the hatchery pens. The City briefly used this option in the summer of 2002.

Bandon has total water rights as follows: Spring Source 2 cfs 1910 priority; Geiger Creek 5 CFS 1916 priority; Lower Geiger Creek 3 CFS 1961 priority; Ferry Creek 3 CFS 1961 priority. The hatchery has rights for 1.5 CFS on Ferry Creek and 1.5 CFS on Geiger Creek, totaling 3 CFS. The hatchery water passes through the hatchery facility and can be pumped afterward for use by the City.

Table 4.2.1 summarizes all water rights held by the City for surface water sources.

Table 4.2.1
Surface Water Rights Documentation Summary

Location	Identification	Right Type	Magnitude	Priority Date
NE 1/4, SE 1/4,&NE1/4,NE 1/4 Sec 29 T29S, R14W	Spring Br. #3 , Mill Cr #4 (Simpson Cr.)	Certificate 9754	2.0 CFS	January 24, 1910
NE 1/4,NE 1/4, SW 1/4 Sec 4 T29S, R14W	Upper Geiger Creek	Permit 3011	5.0 CFS	June 19, 1916
SW 1/4,SE 1/4, Sec 28 T28S, R14W	Geiger Creek & Geiger Cr. Res.	Permit 27232	3.0 CFS	March 7, 1961
SW 1/4,SE 1/4, Sec 29 T28S, R14W	Ferry Creek & Ferry Cr. Res.	Permit 27233	3.0 CFS	March 7, 1961

Note that Bandon is permitted to withdraw water for permits 3011, 27232 and 27233 below the point of confluence of Ferry Creek and Geiger Creek through permit amendment 8195 issued March 29, 2000. No additional water rights, for either surface or groundwater sources, are currently held by the City of Bandon.

Water rights withdrawal location transfers have been executed and pump equipment installed so that a conflict between the City and the fish hatchery need not occur. The City is now able to withdraw water below the hatchery discharge. This also has the consequence, for the City, of being able to use water that Ferry Creek rights holders above the hatchery and senior to the City but junior to the hatchery (totaling

0.65 CFS) would not be able to withdraw, because the hatchery's senior right water (3 CFS) must be allowed to and through the hatchery. Once water passed the hatchery, there would be no way for these upstream users to withdraw it. However, there is still a 0.5 CFS claim with priority senior to the City's below the alternative City withdrawal location on Ferry Creek. The lowest recorded flow in Ferry Creek is 1.3 CFS. The net result is that 0.8 CFS from Ferry Creek would be available to the City during a predicted low flow period because all other senior water rights holders must let the hatchery claim pass.

The lowest estimated flow on Upper Geiger Creek is 0.45 CFS. The City has the most senior water right for this water (5 CFS). Water rights senior to the City's on lower Geiger Creek, not-withstanding the hatchery's use, total 1.6 CFS, with an estimated low flow of 0.9 CFS. Under the arrangement of the City's water rights diversion transfer executed in 2000, the City could remove all the available Upper Geiger Creek flow of 0.45 CFS (if it was actually present in the upper reach of Geiger Creek) but would have no other direct claim. However the net result is that after hatchery use, at least 0.9 CFS would be usable by the City during low flow for reasons similar to the explanation of the Ferry Creek water rights situation.

Therefore, the total water supply available to the City in Ferry and Geiger Creeks could be as low as 1.70 CFS during a dry month. This supply will consist of water that has passed through the hatchery fish pens from both Ferry and Geiger Creeks and was diverted by the City from downstream of the confluence of the two creeks by means of the alternative lower pump station.

The current water use projections as developed in Section 3 indicated a 1.70 CFS (MDD) for 2003 increasing to 2.41 CFS by 2023. The single day demand exceeding the supply stream could be met by tank storage and impoundment reservoir storage for a few days. On a maximum month basis in 2023, the City is only projected to require 1.44 CFS from an estimated minimum available source of 1.70 CFS. This demand assumes no unexpected increases (or decreases) in projected demand patterns. Therefore, the existing raw water supply source from Ferry and Geiger Creeks is anticipated to provide adequate water during the maximum demand month. However, during some period of days in a dry period, the City may have to curtail water use for a several days.

4.3 Instream Water Rights

Instream rights are protective water rights established to preserve minimum perennial streamflows in our waterways. Like regular water rights, instream rights are issued with a priority date, a flow magnitude, and a certificate number. Instream rights differ from normal water rights in that they commonly vary from month to month and sometimes week to week throughout the year. For instance, the instream rights for a stream in January may be 5 cfs, while in September the instream right requires 1.5 cfs in the same stretch of water. The primary reason for the establishment of instream water rights has been for the protection and preservation of salmon and other anadromous fish species.

An individual or community may hold water rights on bodies of water where instream rights have been established. However, if the instream right priority date is senior to the individual or community right, the instream right flow magnitude must be satisfied before the individual or community is able to remove water from that source.

Instream rights have been applied for in both Geiger and Ferry Creeks by the State of Oregon in 1991. Quantities range from 7 CFS to 19 CFS downstream of the hatchery depending on the month. Under current laws this application has no effect on the existing water rights senior to it including the City's, but would prohibit the State from granting additional water rights in the future, since the instream water rights exceed the total flow available in the creeks. There has been concern that legislation may be passed in the future which would set the priority date for instream water rights at 1859, the date of Statehood. Passage of this legislation is not considered likely due to the impacts that would occur thoughout the State of Oregon.

4.4 Interconnections With Other Systems

The City of Bandon is not close enough to another significantly sized public water supply system to develop a physical interconnection to the benefit of Bandon. Due to the distance from other public water suppliers there are no plans to investigate the viability of developing a regional water system.

4.5 Groundwater Sources - Wells

No groundwater sources are presently utilized by the Bandon water system. As discussed in the 1992 Water Master Plan, a review of well logs for the area indicates that there is a low probability of developing new wells with sufficient capacity for municipal production. Although a hydrologic study of the area has not been performed, information regarding the yield of existing wells within several miles of the City indicates that groundwater is not a viable source for meeting the City's water needs. Well log records for the past five years were thoroughly examined for the following locations. The highest yield (85.7 gpm) occurred in R14W/T28S Section 31, SW 1/4 of SW 1/4. This is a location adjacent to and east of Highway 101 and just north of Johnson Creek.

Table 4.5.1
Bandon Area-Maximum Well Yields

Bandon Area Well Log Review (1/1/98 to Present)			
Range	Township	Sections	Max. Yield, GPM
14W	28S	All 36	85.7
14W	29S	3 to10 & 16 to 21	67.7
15W	28S	24,25,36	50.0
15W	29S	1,12,13,24	53.0

A well yield of 139 gpm (0.2 mgd) is recommended as the minimum useful yield for Bandon to consider as a viable source of raw water considering the volume of water required for a municipal water supply.

4.6 Other Sources

Bradley Lake
Bradley Lake was discussed in the 1992 Water Master Plan as a potential municipal water source. Since that time, ownership of the lake area has passed from the Oregon Parks Department to private ownership. The watershed area for this lake is 1482 acres along the China Creek drainage basin. This drainage basin is slightly larger than either Ferry Creek or Geiger Creek sources above the City's diversion points. The surface of the lake is 18 feet above sea level. The lake is 1,800 feet from the Pacific Ocean. The lake has a surface area of approximately 20 acres yielding about 6.5 million gallons per foot of storage. This is a shallow lake. Therefore, the water quality would likely be affected by algae with associated taste and odor problems. As noted in the 1993 WMP, a large pump station and about 31, 000 feet of transmission main would be required to convey water from Bradley Lake to the existing treatment plant. Estimated cost for this project would be about $2,500,000. It is therefore anticipated that a less expensive option would be to construct a small treatment plant at or near Bradley Lake and convey the treated water to the existing 8-inch diameter line on Beach Loop. The distance of this transmission line would be about 5,500 feet. The cost for this project, including the package treatment plant is estimated to be about $1,500,000.

In recent years, several Oregon communities have had success in using similar algae impacted waters from shallow lakes by treating with on-site chorine generation systems that also provide other oxidizing agents such as the Miox process. These processes have greatly reduced taste and odor problems. It is recommended that Bandon make arrangements with the owner of the lake property and install a staff gage on the outlet from Bradley Lake to help determine if a viable flow of water exists during the summer time. Prior to any significant expenditure by the City, a water rights investigation should also be conducted to determine if all available summer flow is already allocated.

Windhurst Road Reservoir
Windhurst Road Reservoir was recently completed and has been in operation for less than 2 years. It was originally conceived and constructed as a cooperative supply of water for a group of cranberry growers. Due to a market recession and subsequent reduced requirement for irrigation water, the growers decided to sell additional capacity to help offset bond payments and operation costs. The reservoir is owned and operated by a local cranberry owners association. The reservoir is located on the south edge of Bandon and water from it may be released into Geiger Creek without additional infrastructure improvements. The City could withdraw it from their normal water diversion point. The reservoir has a useable storage volume of 405 to 425 acre-feet. At the time of this report, there was still about 100 acre-feet of storage available for yearly lease. The source of this water is Bill Creek, which is a tributary of Bear Creek, which flows into the Coquille River. Windhurst is an "off-line" reservoir. It is not formed by the impoundment of Bill Creek, but rather by pumping from Bill Creek during the months between November to May. Bill Creek watershed is approximately 7 square miles in area and has very steep sides. Therefore, during run-off events, large amounts of water are present. However, during dry periods of the year, the flow is minimal. The water quality is reported to be of good quality and appears to be suitable as municipal source water. The terms of use by the City as currently proffered by the reservoir owners are for $500 per acre-foot per year. The reservoir operator's current position is that the City would be responsible for re-sale of the water if the City did not use it. Therefore, the City would have to budget $50,000 per year (if the entire 100 acre-foot amount was reserved) and could only recover this cost unused water, if the City could find a buyer. Under these conditions, the raw water cost is $1.53 per thousand gallons. The 100 acre-foot capacity translates to 31.8 million gallons. This quantity of water could be very useful in a drought situation to help supplement or supply raw water through a dry month or two.

It is recommended that the City attempt to negotiate an emergency use arrangement by which other leasers would commit to re-sell water to the City only if required. This arrangement is anticipated to be more cost effective in the long term even if the unit cost of emergency supply water was several times more expensive than $500 per acre-foot. In a water shortage situation severe enough to warrant use of this source, it is also recommended that the unit cost for the purchased water be added as a surcharge to customer's water bills during declared curtailment stages as a further conservation measure.

Let us assume that the City could negotiate an arrangement whereby water was available on emergency demand for $1000 or even $1,500 per acre-foot payable only upon demand. The City is not anticipated to require additional water except for a period of days. Furthermore, on the highest demand day of the year in 2023, 2.41 CFS could be required and 1.70 CFS is met from Ferry and Geiger Creeks. Therefore, during a record low flow month, the cost for up to .71 CFS per day (458,853 gpd or .711 acre-foot per day) for 7 days would be $4,977 to $7,466. A reserve fund established for this purpose is anticipated to be much less expensive than any infrastructure improvements, which might be constructed.

Johnson Creek Reservoir
The Johnson Creek Reservoir project is in the development stage with the Bandon Cranberry Water District as the sponsoring agency. Most of the project participants are cranberry farmers. Progress has been made regarding permits and environmental studies, but these are not yet complete. The City has

committed $150,000 to be set aside for this project which will address studies, design, permitting and all other costs apportioned to the City up to the sale of construction bonds. Preliminary design estimates provide for a total storage volume of 1,100 acre-feet, of which 200 acre-feet would be for use by the City of Bandon. To deliver water from the reservoir to the City of Bandon would require a pump station able to pump approximately 300 to 350 gallons per minute a distance of 2500 feet to a release point in upper Geiger Creek. The cost of this pump unit and 2500 feet of 8 inch pipe is estimated to be $50,000 for the station and $75,000 for the pipe line.

This project still requires the Environmental Wetland delineation to be completed and the in reservoir habitat study to be completed. It appears likely that a fish ladder requirement will be waived based upon planned mitigation activities which include removal of stream blockage about 1/2 mile downstream from the proposed reservoir and fish passage culvert construction on nearby steams. The dam will also include provision of a cone valve for aeration of overflow. Hydraulic studies need to be completed to confirm the annual fill characteristics of the proposed impoundment.

Progress on the reservoir has slowed due to the drop in cranberry prices from about $70 a BBL to $18 BBL. Cranberry prices are again rising. It is anticipated that the project will again become active in about 2 years. The best current estimate is that, geotechnical investigations, final design and construction can be expected to take another 2 to 3 years.

The construction cost is estimated to be between $2 million and $3 million depending on land purchase costs and the results of the geotechnical investigations, which may dictate sealing near the proposed dam location. Therefore, the City's share to bond is estimated to be (200/1100) x $3 million or $546,000. Annual operation and maintenance costs in the future are expected to be about $20/acre-foot per year or $4,000 for all 200 acre-ft.. The volume of 200 acre-feet or 65.17 million gallons would supply the required difference between Geiger and Ferry Creek supplies during drought years (1.7 CFS or 1.099 MGD available) and the projected maximum month average day demand of 1.33 MGD well past the year 2053.

Desalination
Unless surface impoundments are constructed in the future, the most apparent source of long-term water supply is by seawater desalination. There are currently two basic technologies, Reverse Osmosis (RO) and Distillation. For RO, pressure is applied to the intake water, forcing water molecules through a semi-permeable membrane. The salt molecules do not pass, leaving potable product water. For distillation, the intake water is heated to produce steam. The steam is then condensed to produce water with low salt concentration. Distillation plants require significant economies of scale to be competitive with RO plants. Current California plants, other than offshore oil and gas platforms, range in size from 20 to112,000 acre-ft production per year. Seawater plants in California which produce municipal quality water are estimated to operate at a cost of $1350 to $3000 per acre-foot. Energy use varies widely, depending upon the technology used and ranges from 2,500 to 29,500 kilowatt hours per acre-foot with RO plants at the lower end of the estimate. For every 100 gallons of seawater input, 15 to 50 gallons of fresh water is produced with RO producing the higher recovery rates. The remainder is concentrated brine solution. Produced water quality ranges from 1 to 500 ppm with 250 to 400 ppm typical for municipal use. Desalination plants can use either a pipeline into the ocean or wells on the beach or seafloor for intake of water. If brackish rather than seawater water is used, the costs are less. In comparison with a seawater source water, the cost of water produced from a brackish groundwater source is about 38%; for a municipal wastewater source the cost is about 42% (excluding pretreatment) of the seawater source cost. Plant sizes range from 5 to 65 square feet per acre-foot capacity per year. Plant height is 15 to 20 feet for reverse osmosis equipment and 30 to 45 feet for distillation equipment.

In the case of Bandon, a "beach" well intake along the Coquille River could be envisioned so that brackish well water is utilized. Ideally, waste brine would be mixed with sewage outflow to provide dilution and mitigate the environmental effects of concentrated brine or temperature effects. If such a facility were constructed, it is anticipated to be in the 500,000 gallons per day or 560 acre-feet per year range, assuming a reliable minimum 1.70 CFS from Ferry and Geiger Creeks. This type of facility is not anticipated prior to 2023. Based on current technology the cost of water produced is estimated to be $600 per acre-foot.

Long Term Goal
The long-term goal for Bandon should still be to develop, or by cooperative venture participate in, a major impoundment. The Ferry Creek impoundment, discussed in previous years, located downstream of the hatchery is at this time assumed to generate widespread public and regulatory opposition and to be cost prohibitive. The cooperative ventures with the Cranberry Water District for Windhurst and or Johnson Creek appear to be the most feasible within the 20 year planning period.

Summary
The supply of Ferry Creek and Geiger Creek water available to the City is estimated to be as little as 1.099 MGD (1.7 CFS) during drought conditions if there are no negative changes to the watersheds and the current water rights arrangements with the hatchery and cranberry growers remain the same. The current maximum month average day demand is 0.656 MGD and the maximum demand day of the year is estimated to be 1.100 MGD. From this year forward, it is possible for the City to see a period of demand days which exceed the available raw water supply, requiring use of reservoir storage. By 2023 the maximum month average day demand is projected to be 0.939 MGD and the maximum demand day of the year is estimated to be 1.560 MGD. Either a purchase arrangement for Windhurst Water or participation in the Johnson Creek Reservoir project is recommended to avoid water curtailment situations for a period of several days per year, during the next 20 year period. The use of Simpson Creek impoundment as a reserve raw water storage option does not appear promising. Participation in the Johnson Creek Reservoir project would provide adequate raw water supply in conjunction with the Ferry Creek and Geiger Creek sources and given careful management, for at least the next 50 years.

Existing Treatment Plant Facility

Section

5

Section

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Existing Treatment Plant Facility

5.1 Water Treatment Facility

The City of Bandon completed construction of its water treatment and filtration plant in 2000 and has a current total treatment capacity of 2.0 MGD (1400 gpm). The water treatment plant is a custom plant and includes a multi-media filtration system and makes use of the following processes:

- Prechlorination
- Alum Chemical Coagulation
- Filter Aid Polymer Addition
- Up-Flow Sludge Cone Clarification with Tube Settlers
- Multi-Media Filtration
- pH Adjustment
- Disinfection (Post Chlorination)
- Reservoir Chlorine Contact

The use of rapid sand filtration, such as the plant employs, is considered desirable for treating highly turbid water, as may occur in the source streams during the rainy season. However, the up-flow sludge cone clarifier unit is reported to provide good settlement and attenuates turbidity spikes resulting from a muddied Geiger and Ferry Creek source. Furthermore, the middle pond provides for some settlement subsequent to removal from the source streams and prior to pumping through the clarifier. Plant personnel have also modified the piping to the filters so that future filter tank 3 and 4 may receive water prior to filtration units 1 and 2. These concrete tanks provide for additional gravity sedimentation prior to introduction of the water through the active filter units if conditions so warrant. This reduces chemical costs and frequency of backwash, especially during winter season when turbidity from Ferry and Geiger Creeks is higher. Accumulated sludge in the concrete tanks is removed by pumping to the backwash pond.

More frequent backwashing of filters may be required when turbidity levels are elevated. Because of decreased water demand during the winter rainy season and the abundance of source water, more frequent backwashing of filters does not have a noticeably negative impact on the raw water supplies or the environment in general. However, the layout of the plant provides for recovery of all backwash water in the middle pond if required.

The water treatment plant incorporates modern flow control and monitoring systems. Flow records are automatically graphed and reduced to daily consumption; monthly reports are forwarded to the Oregon

Health Division in compliance with OAR Chapter 333. In addition, daily rainfall records at the plant are kept. All customers connected to the municipal water system are metered and monthly billing is based upon usage.

The water treatment plant has been relatively free from malfunction thus far in its service life and has been well maintained. It continues to produce quality potable water for the water service population of Bandon.

The treatment plant is arranged so that it can be upgraded to a 4.0 MGD plant by upsizing the raw and treated water pumps. Piping within the lower and middle pump stations was designed for this expanded plant condition. The clarifier was sized to operate at a maximum capacity of 2.0 MGD. Space and piping headers are provided to allow for the addition of two new filters. Space is also provided within the plant building for the addition of chemical tanks, feed units and pumps.

Plant and Facility Security

The plant site and grounds, including the treated water storage tank, have a 6 feet high chain link perimeter fence. The fence is topped with 3 strand barbed wire. The plant building and perimeter gates are locked when plant personnel are not present. The facility has motion detection equipment installed at the gates and in certain outside equipment access areas. The motion detection devices are monitored by a security company.

Located within the water treatment plant grounds is a cell phone transmission tower and equipment building. Some security concerns have been expressed over the presence of cell phone maintenance personal on site who may be unknown to the water plant operator. It is recommended that a security evaluation of the plant site be conducted by City Staff and appropriate actions undertaken. It is anticipated that grant funding is available for any capital improvements required. The appropriate security actions recommended are as follows:

- Vulnerability Analysis
- Security Report
- Security Training
- Capital Improvement

A Security Vulnerability Assessment Engine for use by the City is provided at www.nrwa.org . The explanation of the engine is presented below. Italic text below is copied directly from this site:

To make implementation of this new mandate as simple and economical as possible, we have developed this engine that, after completion of 45 questions, will provide you with a hard copy of:

(1) a Vulnerability Assessment
(2) a revision to your Emergency Response Plan (if you currently have one)
(3) a certification of completion form to send to your State Primacy Agency
(4) a cover letter to the EPA for submitting the material.

This NRWA/ASDWA assessment has been determined by EPA to address all six of the EPA identified elements common to a comprehensive Vulnerability Assessment. If you have not prepared an emergency response plan, you are required to prepare one within six months of the completion of the Vulnerability Assessment.

This document is meant to encourage smaller systems to review their system vulnerabilities, but it may not take the place of a comprehensive review by security experts. Completion of this document will meet the requirement for a Vulnerability Assessment as directed under the Public Health Security and Bioterrorism Preparedness and Response Act of 2002 an d must be submitted to the Administrator of U.S. EPA no later than June 30, 2004 in order to meet the provisions of the Act.

The user must sign for and provide information regarding specific information for the system under consideration including the name of the responsible utility official. The engine selects the water system in question from a data base (for example, when information regarding Bandon was entered, the program filled in information from an existing data base for Bandon). In order to prepare for a session with the engine, the user is asked to be prepared with the following information:

Before Starting this Assessment

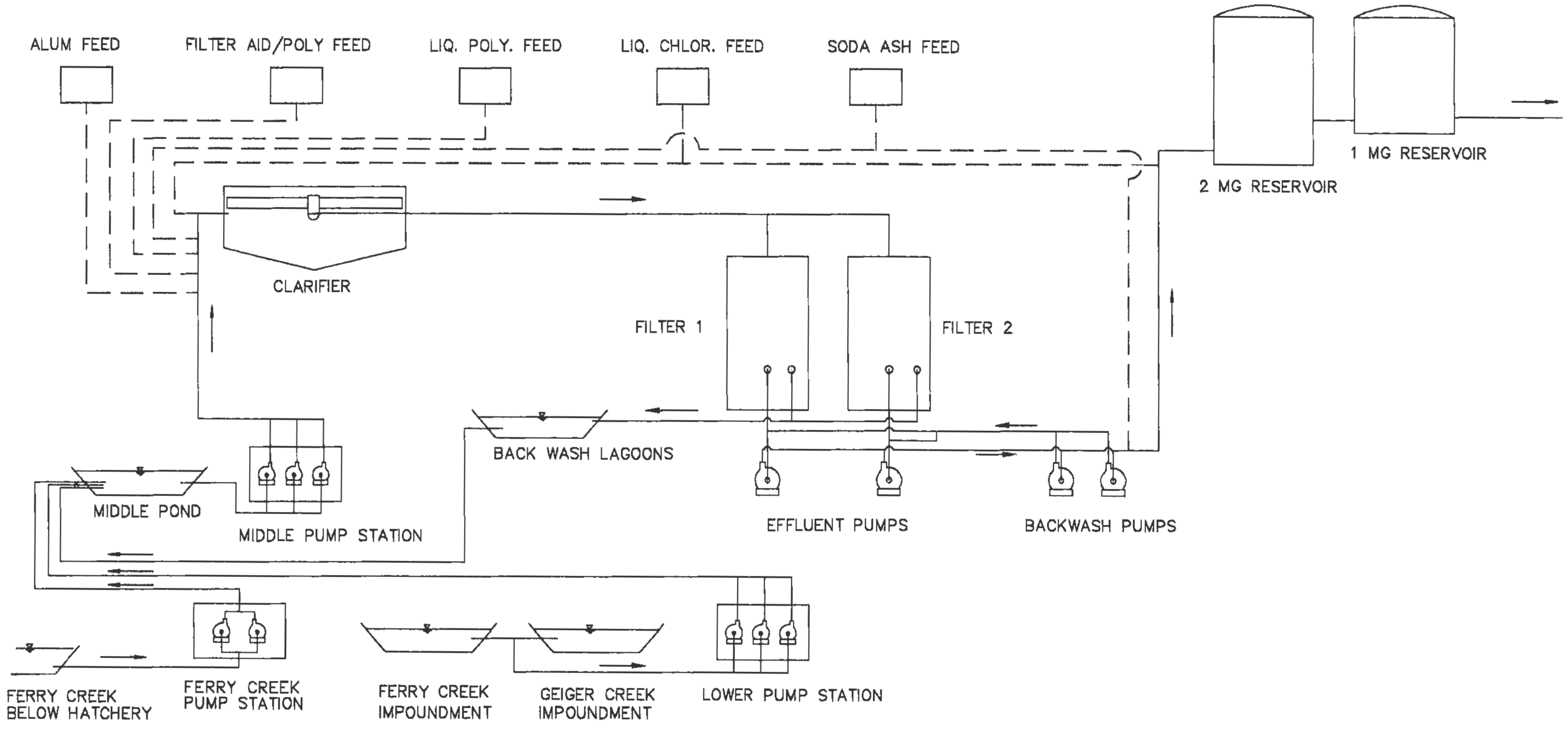
Systems should make an effort to identify critical services and customers, such as hospitals or power facilities, as well as critical areas of their drinking water system that if attacked would result in a significant disruption of vital community services or a complete shut down of the system (i.e. unable to provide an adequate supply of water for fire prevention, unable to provide safe potable water, or releasing hazardous chemicals that could cause catastrophic results). When prioritizing the potential water system vulnerabilities and consequences factor into the decision process the critical facilities, services, and single points in the system that if debilitated could result in significant disruption of vital community services or health protection.

When evaluating a system's potential vulnerability, systems must know what type of assailants and threats they are trying to protect against. Systems should contact their local law enforcement office to see if they have information indicating the types of threats that may be likely against their facility. Systems should also refer to the U.S. EPA "Baseline Threat Information for Vulnerability Assessments of Community of Water Systems" to help assess the most likely threats to their water system. This document is available to CWSs serving greater than 3,300 people. If your system has not yet received instructions on how to receive a copy of this document, then contact you Regional U.S. EPA Office immediately. You will be sent instructions on how to securely access it via the Water Information Sharing and Analysis Center (ISAC) website or obtain a hard copy that can be mailed directly to you. Some of the typical threats to your facility may be vandalism, an insider (i.e. disgruntled employee), a terrorist, or a terrorist working with a system employee

Physical security issues take the form of locks, fences, motion and perimeter alarm equipment, identification and confirmation of site visitors and delivery personnel, cooperation with local police for increased surveillance, and "neighborhood watch" type approach for pump stations, water tanks, fire hydrants, and reservoirs. Background checks for new hires and contract service personnel are also recommended.

The water treatment facility is shown in Figure 5.1.1.

\\Pallo\c\01Active\4501.39\dwg\FIGURE 5.1.1 water treatment facility.dwg 10/29/2003 11:24:52 AM PST



THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

DATE: AUG, 2003
PROJECT NO.: 4501.39

CITY OF BANDON
WATER MASTER PLAN ADDENDUM
WATER TREATMENT FACILITY

FIGURE NO.
5.1.1

The City of Bandon Treatment Plant Equipment

The OAR rules governing water treatment requires that treatment be sufficient to achieve at least 99.9 percent (3-log) inactivation and/or removal of *Giardia lamblia* cysts and at least 99.99 percent (4-log) inactivation and/or removal of viruses as determined by OHD. The filtration plant process is assumed to provide a portion of the cyst and virus removal. Disinfection must provide the remainder. The residual concentration in the water entering the distribution system also cannot be less than 0.2 mg/L for more than four hours. Inactivation ratio is determined based on "CT" which is the residual concentration (C) in mg/L times the contact time (T) in minutes. Required CT values are published in OAR and are dependent on the water temperature, pH, and chlorine residual.

A Water Treatment Plant Evaluation was conducted December 12, 2002 by the OHD. The plant was rated with a 2.0-log removal due to the filtration process and a 2.0-log inactivation from disinfection with a required minimum of 228 minutes chlorine contact time. This means that the plant meets all current removal efficiency requirements for water plants. The treatment process includes both prechlorination and post-chlorination. The three million gallons of tank capacity provide, even with effective volume reduced, a greater than 228 minute chlorine contact time (CT) for the treated water.

A CT analysis has been scheduled, but not yet performed by a subcontractor to OHD. Previous Performance Analysis OHD estimated the plant's CT time to be approximately 228 minutes with one-million gallons of storage. Prechlorination likely provides about 15 minutes of the total contact time as water passes through the treatment units themselves.

The above estimates indicate that prechlorination probably is not required for the purposes of obtaining longer CT times. However, it is generally acknowledged that prechlorination improves the overall treatment process. This is in all probability due to the fact that the addition of an oxidant before the treatment process effectively lowers the pH of the raw water into a range where coagulants are more effective. The results include faster flocculation rates and larger floc formation.

It should be noted that prechlorination has been shown to increase total trihalomethanes (TTHM's) due to the chlorination of organic matter. TTHMs can cause liver, kidney and central nervous system problems and are known to be carcinogenic. The current Maximum Concentration Limit (MCL) for total TTHM's is 0.1 mg/L for communities of over 10,000 people. Prechlorination also results in chlorinated water running through the metal treatment units, which causes increased corrosion of the metal parts. These concerns have caused many water treatment plant operators to think twice about prechlorinating in the past though it is often required at some plants to obtain adequate disinfection.

The City should be aware that the new Disinfectant Byproducts Rule (DBPR) will lower the MCL for TTHMs and require small communities (less than 10,000 population) to be in compliance by December of 2003. Prechlorination in many communities may cause the water system to be in noncompliance with regard to TTHMs. The City should begin monitoring the TTHM levels within the system to determine if it will be in compliance with the upcoming requirements.

Surface water rule updates on the horizon will require additional treatment for the removal of Cryptosporida. There are only two recognized treatment methods. The most common is ultraviolet (UV) light treatment. This method will provide 3 to 4 log removal for "crypto". Bandon should consider the addition of this treatment process equipment in the future.

Raw Water Metering, Sampling and Chemical Addition

Raw water pumped from the middle pond is sampled for pH and turbidity as well as flow rate. Based upon this information, two different types of polymer, soda ash for pH adjustment, alum for clarification and filtration or chlorine may be added and mixed. The chemical feed rates is based upon operator determination and pre-set feed ranges controlled by flow, pH and turbidity automatic instrument readings. The alum feed system consists of an alum storage tank with two pumps. The soda ash system consists of a mixer tank with two pumps and dilution water equipment. It is possible, due to the presence of two pumps and the piping configuration, to both pre-feed and post feed with respect to the filters. The filter aid polymer consists of a mixing tank and an aging tank, a pump and dilution water equipment. In addition to cold water for mixing and dilution, a hot water dilution water source is provided. Filter aid polymers may be introduced both before and after the clarifier. The liquid polymer system pumps from a 55-gallon drum, has both cold and hot water dilution feed and may be introduced into the treatment process prior to the clarifier.

Clarifier Equipment

Raw water pumped from middle pond after chemical addition and mixing then enters the clarifier unit. This clarifier was upgraded in the year 2000 plant improvements by the addition of settling tubes and overflow weir and trough modification. Structural repairs to control leakage were also made. However, the tank shows signs of concrete deterioration and should be replaced in the future. Because this unit has no redundancy, it is provided with a by-pass line. The clarifier has a treatment capacity of 2 mgd. The condition of the clarifier may warrant an increase in the prioritization of this replacement project. Careful examination of the inside tank walls should be made at the first opportunity during scheduled maintenance.

Filtration Equipment

Clarified water flows by gravity to the two filter units. Filter aid polymer may be added prior to the filter units. Each filter is rated 700 gpm, are dual media types and each have a surface area of 138.3 square feet. Filter backwash design is at a rate of 2,800 gpm with a typical 10 minute cycle time. The backwash pumps use the filter effluent line connected to the two million gallon reservoir as the supply source for the backwash pumps. Backwash flow rate is metered. Backwash is assisted with air scour provided by a blower at a rate of 560 scfm. Following backwash, the filters were designed to run in "filter to waste" mode at a rate of 700 gpm for 5 minutes. Head loss sensors in the filters control the effluent pump rates. The variable frequency speed control effluent pumps remove water directly from the plenum of the filters, rather than from a clear well as is typically the case for this type of plant. Flow rate and turbidity are monitored for the water pumped from each individual filter. Following the backwash suction, soda ash may be added for pH control. Following the chemical addition location, a sample stream is taken for chlorine residual and pH measurement. Finally, chlorine is added to the finished water as it proceeds to the new two million gallon reservoir.

Disinfection Equipment

The Bandon water treatment plant uses on site hypo-chloride generation. This system is much safer than the gas chlorine system previously used. This system combined with the large chlorine contact time available through both the two million gallon and the one million gallon reservoirs will provide adequate disinfection for the foreseeable future.

Treated Water Pump Equipment

Two filter effluent pumps move treated water directly from the filter units at the treatment plant to a two million gallon reservoir, which then flows through a 1.0 million gallon reservoir. Flow is then metered and enters the distribution system. This provides for extensive chorine contact time prior to distribution. In addition to providing treated water to the reservoirs, water is removed from a treated water header to provide backwash water for the filters.

Metering is provided for measuring the volume of water being sent to the distribution system. This meter is installed on the effluent line from the finished water storage reservoirs. The additional meter has allowed the City to better account for water used in the treatment process.

Backwash Lagoon

Backwash and process water flows into two backwash lagoons located south of the water treatment plant. The backwash lagoons are square earth lined ponds. Drainage from the backwash lagoons flows to the Middle Pond whereby water is recycled for treatment. The solids that accumulate in the lagoon are removed periodically and placed in an onsite storage location.

5.2 Treated Water Storage

Two tanks provide treated water storage totaling 3,000,000 gallons. One tank holds one million gallons with a bottom elevation of 178.9 feet. The other two million gallon tank has a bottom elevation of 162.0 feet. Both tanks are located adjacent to the water treatment plant and have overflow elevations of 218.5 feet. Neither tank has cathodic protection. A brief description of each tank is provided below.

One Million Gallon Tank

The 1.0 million gallon steel reservoir is located on a northeasterly portion of the water plant site. The tank is a round welded steel tank on a concrete foundation. The tank was originally constructed in 1955. In conjunction with the water plant improvements performed in 2000, extensive repairs were made and the tank was repainted. The tank is considered now to be in good condition. It has a bottom elevation of 178.8 feet and a water surface elevation when full of 218.5 feet.

Two Million Gallon Tank

The "new tank" is located approximately 142 feet southwest of the one million gallon tank. The "new tank" is a 2,000,000 gallon welded steel tank. The bottom elevation of the tank is 162.0 feet and it has a water surface elevation when full of 218.5 feet which is the same as the original tank. A new vault and master meter were constructed in 2000 to measure the flow leaving the treatment and storage facility and entering the Bandon distribution system.

Water Level Controls

A water level sensor is located in the effluent line between the two million gallon tank and the master meter. This sensor provides signal to automatically control the filter effluent pumps in order to maintain the desired water levels in the storage tanks. The elevation of the reservoirs provides adequate service pressure to the majority of the system and pressures exceeding 80 psi to many of the properties in the lower elevation areas of the City. With the existing level controls, pumping arrangements, and treatment systems, the Bandon water system functions essentially as an automatic system.

Storage Volume

The City's reservoirs should have enough capacity to :

- Store 25 percent of the MDD for equalizing supply and demand with the water system.
- Emergency storage for the City equal to one MDD.
- Provide for a minimum fire demand of 3,000 gpm for a three hour period.

A summary of the optimum storage requirement is provided in Table 5.1.1

Table 5.2.1
Optimum City Water Storage Requirement

STORAGE REQUIREMENT	PLANNING YEAR				
	2003	2008	2013	2018	2023
Equalizing	425,000	465,000	507,500	552,500	602,500
Emergency	1,700,000	1,860,000	2,030,000	2,210,000	2,410,000
Fire Reserve *	540,000	540,000	540,000	540,000	540,000
Total Gallons	2,665,000	2,865,000	3,077,500	3,302,500	3,552,500
Existing Reserve Gallons	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000
Reserve Shortfall Gallons	0	0	77,500	302,500	552,500

* Based on a fire demand of 3,000 gpm for 3 hours.

Current water storage capacity is adequate. However, in order to provide adequate fire volume to Southern Bandon, storage placement approximately 1/3 mile NW of Seabird and Beach Loop is recommend (See Section 6). By the end of this study period, it is recommended that Bandon construct an additional 500,000 gallons of storage for equaling, emergency and fire reserve purposes.

5.3 Water Quality

Since operation of the new plant began, treated water quality has been excellent. Lead and copper levels are well below action levels. The last test listed was in August 1998 and indicated 0.0018 mg/l of lead and 0.2600 mg/l of copper. Action levels are Lead = .015 mg/l Copper = 1.3 mg/l. There have been no pH violations in the last 5 years. (limit pH 7.1). Bandon has met all requirements of the surface water treatment rules (1. Met MCL, 2. Under 5 NTU, 3. Met CT's req'd, 4. Met Cl at entry 5. Met Cl in Dist.) for at least the past five years. For at least the past five years there have been no nitrates detected nor have there been any coliform violations. The results for the latest round of chemical testing are listed below in Table 5.2.1. No organic chemicals of any kind have been detected. Note that parameters listed under the MCL heading are the limits for these chemical contaminants.

Table 5.3.1
Bandon Chemical Finished Water Chemical Analysis

Date	Chemical	Source ID	Results	MCL
Sep 11, 2002	1,1,1-TRICHLOROETHANE	EP-A	0.0000	0.2000
Sep 11, 2002	1,1,2-TRICHLOROETHANE	EP-A	0.0000	0.0050
Sep 11, 2002	1,1-DICHLOROETHYLENE	EP-A	0.0000	0.0070
Sep 11, 2002	1,2,4-TRICHLOROBENZENE	EP-A	0.0000	0.0700
Sep 11, 2002	1,2-DICHLOROETHANE	EP-A	0.0000	0.0050
Sep 11, 2002	1,2-DICHLOROPROPANE	EP-A	0.0000	0.0050
Sep 11, 2002	2,4,5-TP (SILVEX)	EP-A	0.0000	0.0500
Sep 11, 2002	2,4-D	EP-A	0.0000	0.0700
Sep 11, 2002	ALACHLOR (LASSO)	EP-A	0.0000	0.0020
Sep 11, 2002	ANTIMONY	EP-A	0.0000	0.0060
Sep 11, 2002	ARSENIC	EP-A	0.0000	0.0500
Oct 07, 2002	ASBESTOS	DIST-A	0.0000	7.0000
Sep 11, 2002	ATRAZINE	EP-A	0.0000	0.0030
Sep 11, 2002	BARIUM	EP-A	0.0110	2.0000
Sep 11, 2002	BENZENE	EP-A	0.0000	0.0050
Sep 11, 2002	BENZO (A) PYRENE	EP-A	0.0000	0.0002
Sep 11, 2002	BERYLLIUM	EP-A	0.0000	0.0040
Sep 11, 2002	BHC-GAMMA (LINDANE)	EP-A	0.0000	0.0002
Sep 11, 2002	CADMIUM	EP-A	0.0000	0.0050
Sep 11, 2002	CARBOFURAN	EP-A	0.0000	0.0400
Sep 11, 2002	CARBON TETRACHLORIDE	EP-A	0.0000	0.0050
Sep 11, 2002	CHLORDANE	EP-A	0.0000	0.0020
Sep 11, 2002	CHROMIUM	EP-A	0.0000	0.1000
Sep 11, 2002	CIS-1,2-DICHLOROETHYLENE	EP-A	0.0000	0.0700
Sep 11, 2002	CYANIDE	EP-A	0.0000	0.2000
Sep 11, 2002	DALAPON	EP-A	0.0000	0.2000
Sep 11, 2002	DI(2-ETHYLHEXYL) - ADIPATE	EP-A	0.0000	0.4000
Sep 11, 2002	DI(2-ETHYLHEXYL) - PHTHALATE	EP-A	0.0000	0.0060
Sep 11, 2002	DIBROMOCHLOROPROPANE (DBCP)	EP-A	0.0000	0.0002
Sep 11, 2002	DICHLOROMETHANE	EP-A	0.0000	0.0050
Sep 11, 2002	DINOSEB	EP-A	0.0000	0.0070
Sep 11, 2002	DIQUAT	EP-A	0.0000	0.0200
Sep 11, 2002	ENDOTHALL	EP-A	0.0000	0.1000
Sep 11, 2002	ENDRIN	EP-A	0.0000	0.0020
Sep 11, 2002	ETHYLBENZENE	EP-A	0.0000	0.7000
Sep 11, 2002	ETHYLENE DIBROMIDE (EDB)	EP-A	0.0000	0.0001
Sep 11, 2002	FLUORIDE	EP-A	0.0000	4.0000
Sep 11, 2002	GLYPHOSATE	EP-A	0.0000	0.7000
Sep 11, 2002	GROSS ALPHA, EXCLUDING RA & U	EP-A	0.7500	15.0000

Date	Chemical	Source ID	Results	MCL
Sep 11, 2002	HEPTACHLOR EPOXIDE	EP-A	0.0000	0.0002
Sep 11, 2002	HEXACHLOROBENZENE	EP-A	0.0000	0.0010
Sep 11, 2002	HEXACHLOROCYCLOPENTADIENE	EP-A	0.0000	0.0500
Sep 11, 2002	MERCURY	EP-A	0.0000	0.0020
Sep 11, 2002	METHOXYCHLOR	EP-A	0.0000	0.0400
Sep 11, 2002	MONOCHLOROBENZENE	EP-A	0.0000	0.1000
Sep 11, 2002	NICKEL	EP-A	0.0605	0.1000
Sep 11, 2002	NITRATE (AS N)	EP-A	0.0000	10.0000
Sep 11, 2002	NITRITE (AS N)	EP-A	0.0000	1.0000
Sep 11, 2002	O-DICHLOROBENZENE	EP-A	0.0000	0.6000
Sep 11, 2002	OXAMYL (VYDATE)	EP-A	0.0000	0.2000
Sep 11, 2002	HEPTACHLOR	EP-A	0.0000	0.0004
Sep 11, 2002	P-DICHLOROBENZENE	EP-A	0.0000	0.0750
Sep 11, 2002	PENTACHLOROPHENOL	EP-A	0.0000	0.0010
Sep 11, 2002	PICLORAM	EP-A	0.0000	0.5000
Sep 11, 2002	POLYCHLORINATED BIPHENYLS (PCB)	EP-A	0.0000	0.0005
Sep 11, 2002	RADIUM, COMBINED (226, 228)	EP-A	0.2150	5.0000
Sep 11, 2002	SELENIUM	EP-A	0.0000	0.0500
Sep 11, 2002	SIMAZINE	EP-A	0.0000	0.0040
Sep 11, 2002	SODIUM	EP-A	25.0000	
Sep 11, 2002	STYRENE	EP-A	0.0000	0.1000
Sep 11, 2002	TETRACHLOROETHYLENE	EP-A	0.0000	0.0050
Sep 11, 2002	THALLIUM	EP-A	0.0000	0.0020
Sep 11, 2002	TOLUENE	EP-A	0.0000	1.0000
Sep 11, 2002	TOXAPHENE	EP-A	0.0000	0.0030
Sep 11, 2002	TRANS-1,2-DICHLOROETHYLENE	EP-A	0.0000	0.1000
Sep 11, 2002	TRICHLOROETHYLENE	EP-A	0.0000	0.0050
Sep 11, 2002	URANIUM, COMBINED	EP-A	0.0080	
Sep 11, 2002	VINYL CHLORIDE	EP-A	0.0000	0.0020
Sep 11, 2002	XYLENES	EP-A	0.0000	10.0000

Deficiencies /Desirable Improvements Noted

The new plant appears to be operating well. However, it was designed to have a streaming current meter located just prior to the clarifier in the future. The operator has also expressed his desire to have the plant equipped with this analysis device in order to better control chemical feed rates. The use of this device provides for quicker response to changing conditions and often will result in a chemical cost savings.

An interest in UV disinfection equipment has also been expressed. UV disinfection would permit Bandon to meet the upcoming Cryptosporida inactivation rules.

It was noted that the clarifier concrete structure is deteriorating. Steel reinforcement is reported to be exposed in some locations in the concrete basin. It is therefore recommended that a new clarifier (or pair of clarifiers) be constructed within the next ten years or sooner if investigations warrant.

It is recommended that flow measurement equipment be installed in the lower pump station, so that raw water flow may be measured to the middle pond. Ideally, a pair of flow meters should be installed at the location where the suction pipe for the station bfurcates in order to meter the specific flow from Ferry Creek and from Geiger Creek.

It was also noted that algae growth occurs in both the clarifier and in the filter basins. This is due to natural ultraviolet light exposure. It would be relatively inexpensive to provide a screen over the top of the outdoor filter basins to block the sunlight. The filter basin dimensions are ten feet (inside dimension) by eighteen feet - four inches (out to out). Currently there are only two basins in operation. On the other hand, the clarifier has circumference of 163 feet. (52-foot diameter). This would present a very expensive cover problem. In view of the expected ten-year remaining service life of the clarifier no cover for the clarifier is recommended. However, consideration should be given to shading of the new future clarifier.

For purposes of equalization, emergency and fire reserve, it is recommended that Bandon construct at an additional 500,000 gallons of finished water storage within the time frame of this study period. As determined by hydraulic distribution analysis in Section 6, additional storage is needed now in the southern portion of Bandon to provide adequate pressure and flow for fire fighting. It is recommended that 250,000 gallons be placed in service as soon as possible. An additional 250,000 gallon tank should be constructed adjacent to the proposed southern Bandon tank and pump station site by 2015.

Finally, the installation of cathodic protection for the existing steel tanks should be considered. These units are relatively inexpensive, use very little power and provide significantly greater protection to the steel than coating systems alone. The conditions of the tanks should be closely monitored with particular attention given to paint blistering and pinhole failures in the coating systems.

Conclusion

The maximum day demand is projected to be 1,559,900 gallons per day. The water plant is rated and capable of treating up to 2,000,000 gallons per day in its present condition. Therefore, assuming timely maintenance and upkeep, no major improvements or expansions are anticipated as being required during the next twenty-year period except for clarifier replacement. Desirable improvements include the provision of a streaming current meter, UV disinfection system, covers for the two active filter basins and cathodic protection for the steel tank reservoirs. The costs for the recommended improvements are addressed in Section 7.

Distribution Modeling

Section

6

Section

6

Distribution Modeling

6.1 General

Purpose

Distribution Modeling, as a part of the Master Planning effort, is used to help plan for the provision of adequate pressures and flows through out all portions of the water distribution system. By modeling the system, existing deficiencies may be identified, although these are usually already known due to observed or reported pressure and delivery problems. The modeling process can help identify remedies and cost effective improvements. For future system planning, modeling is essential in order to determine the effectiveness of the proposed improvements, proper sizing and connection locations.

Through the assistance of distribution modeling, a list of capital improvements associated with pipe line and storage projects was identified. These projects will be prioritized based on the anticipated growth and development needs within the Bandon service area.

Basic Assumptions

The pipelines, fittings, valves and tanks of the City's actual water distribution system are represented within the computer model as "elements". The connection locations of these elements are identified as "nodes". For purposes of analysis, elements represent simplified descriptions of portions of the real system. For example, a water line running along a street has numerous fittings such as bends, tees, in-line values, service connections and so on. The pipe section may have variable roughness due to different age or material within a run of pipe. Assumptions are made regarding the average characteristics of specific elements. These assumptions include friction loss in each pipe element due to average roughness and fittings. In addition, water service demands are usually represented as "clustered" at nodes rather along the entire length of the pipe as is really the case. In addition, very small pipes which have little effect on the overall performance of the system are usually not included in the analysis. Rather, their water demand is included with other demands at node clusters. Where two water lines run adjacent and parallel to each other, an "equivalent pipe" is often modeled which represents the characteristics of the combined pipes. These assumptions allow a reasonable number of elements to be included in the model, permit useful decisions to be made, and allow analysis based on obtainable information (the internal characteristics of each individual line cannot be realistically determined). Pipe elements are identified by three characteristics. These are roughness (C factor), diameter in inches (D) and length in feet (L). For municipal distribution analysis the following "C" or roughness parameters are listed below in Table 6.1.1 and have been proven over time to result in accurate results:

Table 6.1.1
Bandon Analysis "C" Values

Pipe Type	Condition	C
PVC	Relatively New Pipe	125
Non-PVC	Older Pipe	110

A minimum pressure of 20 psi is required under all service conditions by the Oregon Health Division (OHD) to protect against backflow into the system. During fire flow simulations, this is the minimum acceptable pressure produced in any part of the service area. A maximum pressure of 90 psi at customer services should not be exceeded due to potential damage to water heaters and customer pipes and fixtures. Desirable service pressure is in the range of 40 to 60 psi.

Explanation of Basic Analysis Terms

The pressures represented within a distribution model as well as the flows represented into and out of the system are calculated and reported at the "nodes" or pipe junctions. In order to determine an expected service pressure at each node the elevation with respect to the water supply (such as a tank or pump) must be entered into the model data base. For example, a pipe node at elevation 100 feet connected to a water tank with water surface elevation 200 feet and no flow through the pipes will have a pressure of 100 "feet" (static head). Because one foot of water head is equal to 0.433 pounds per square inch (psi), in psi units, the node would have a pressure of 43.3 psi. If a "valve" is opened completely at the node, water flows from the tank. There is loss of pressure through the pipe (dynamic head loss) due to friction which increases with the flow. The flow would increase until the dynamic head loss equaled the static head. In the case of a 4" diameter pipe with a C factor of 100 and a length of 1000 feet, the flow would balance at 306 gallons per minute (gpm) with the pipe open and discharge at atmospheric pressure. If it was desired to maintain 20 psi residual pressure (46.16 feet of head) at this location, the flow would only be 260 gpm. The calculations become more complicated as the pipes are interconnected and flow can move through various routes. Using the computer program, one is able to compute the flows and friction losses in the pipes throughout the network for all the interconnected "elements" and determine the available pressure at the nodes for specific flow demands or determine available flows at specified residual pressures. This mimics the function of the City's water distribution system and allows prediction of performance under various existing or future conditions.

6.2 Specific Computer Modeling Criteria for Bandon

Computer Program

Water Cad for Windows Version 4.1 was used for the Distribution Modeling. This program helps engineers design and analyze complex pressurized piping systems. The program has a graphical interface which allows scaled Auto Cad drawings of the distribution system to be used for the geometric input of data regarding pipe length and connections. The model includes provisions for pipes, pumps, tanks and control valves. Supply and demand schedules may be varied. The program has features which simplify fire flow analyses to help determine how the system performs under extreme conditions.

Data Sources

Entered data for the pipe elements includes length, diameter, C factor and the identification number of the node at each end. Entered data for the nodes includes elevation and flow demands. The source of the pipe length and location data includes: 1.) Infrastructure Mapping for the City of Bandon last updated March 3, 2003 by Dyer Partnership. 2.) South Bandon Refinement Plan, Infrastructure Element, Dyer Partnership, June 1997 3.) USGS Bandon Quadrangle 7.5 minute series (topographic) and 4.) Bandon Public Works Topographic Maps. Flow demands were based upon the projected usage information presented in Section 3 of this report.

Data Produced by Model Analysis

Outputs generated by the program include Fire Flow Reports and Peak Hour Demand (PHD) reports for both existing system geometry and for the system expanded for future service. The fire flow reports provide information regarding the maximum available flow at any portion of the system with a 20 psi residual remaining, assuming all other locations within the system are experiencing average day demand. The output is summarized for these reports as a color coded graphic map of the distribution system which shows maximum flow value contours.

The PHD reports are summarized as a color coded graphic map which show the pressures available at all locations in the system at PHD. Simulations were made for various improvements and the flow improvements (in any) noted.

Those modeled line improvements which provided significant increases in system performance were investigated for feasibility of construction, contribution to system revenue generation (i.e. new services could be provided along line route) and location with respect to anticipated development. Where possible line improvement locations where determined but undersized service lines already exist, alternative reinforcement locations were sought which would provide for new service areas. For locations well within the distribution network, this was not possible in all cases and our recommendations include some new lines which parallel existing lines.

Comparison with In-field Testing

The computer model results were compared with fire flow test results provided by the City of Bandon. The following formula was used to compute the flow from the fire hydrants: $Q=29.8\ Cd^2(p)^{0.5}$

Where Q = discharge, gpm
C= coefficient, normally 0.90
d=diameter of outlet, inches
p=pitot gage reading, psi.

The tests were generally conducted during very low flow periods at night with very low background demand. The computer simulations assumed an average day demand. The field tests were reported to be conducted with the storage tanks "about half full". At night, it is likely that the tanks were often nearly full. This would produce results a little higher than produced by the model assumption of a 10 foot water tank elevation below full level. In some cases, the difference between the static pressure and the pressure measured during the flow test was not dropped by a recommended margin of 10 psi due to concerns regarding disturbance of sediment in water lines and customer complaints. In addition, the tests predict the available flow through the specific opening of the fire hydrant being tested. In many cases, this will result in predictions of lower available flow than could be withdrawn though larger or multiple openings or multiple area hydrants. Further, some fire hydrants are located off adequately sized mains with only 4" lead pipes. On the other hand, the computer model predicts only the flow available to the "node" location which might be withdrawn from a group of fire hydrants in the vicinity.

To determine the predicated fire flow at 20 psi available at the hydrant the following formula was used: $Q_r = Q_f(Hr/Hf)^{0.5}$.

Where Q_r = the computed discharge at the specified residual pressure (20 psi), gpm
Q_f = total discharge during test, gpm
Hr = drop in pressure original (static) value to specified residual (20 psi), psi
Hf = pressure drop during test, psi.

The computer program checked to insure that no other location in the modeled water system was dropped below 20 psi. Therefore, in some computer simulation results, the available flow from a node will have an associated residual pressure greater than 20 psi (and resulting lower flow) because of this pressure limitation elsewhere in the system.

Computer generated predictions compared with field test predictions are shown below in Table 6.2.1 for selected locations.

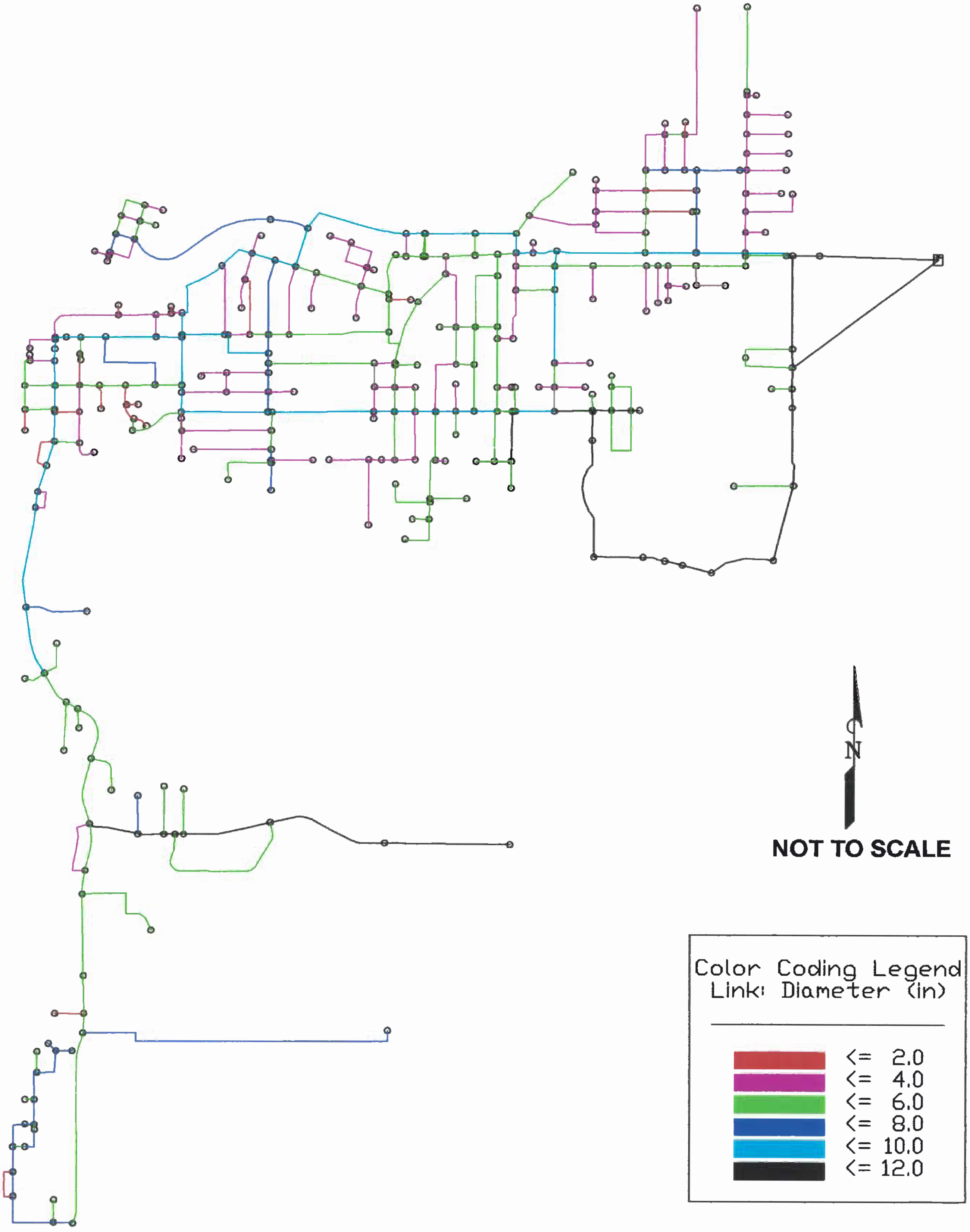
Table 6.2.1
Fire Flow Prediction Comparison

	GPM Predicted by	
Location	**Field Test**	**Computer**
Hwy 101 at Ocean Spray	408	337
Saturn	475	293
Polaris off Beach Loop	586	371
Golf Course (back side)	514	423
Sea Bird at Beach Loop	747	461
Sea Bird at Grant Place	700	459
Seabird at 101	648	453
Beach Loop at Whale Watch	665	831
Beach Loop at Face Rock	582	1125
Beach Loop at Queen Anne	652	1456
11th at Portland	713	1484
Jackson and Ocean	1111	2035
Jackson and 12th	772	2013
9th and Harrison	992	825
Franklin and 4th	1418	2163
Franklin and 12th	882	1460
Baltimore and 1st	1777	2461
101 and 9th	955	2220
101 and 17th	358	298
1st SE and Elmira	2573	2417

Table 6.2.1, continued	**GPM Predicted by**	
Location	**Field Test**	**Computer**
Harlem and Division	943	1194
4th SE and Klamath	1016	1091
2nd NE and Klamath	764	2232
North Ave and Division	1488	833
5th NE and Ohio	524	310
10th NE and Michigan	286	225
Cardinal and Ohio	1112	1881
Bills Creek and Harlem	2906	3078

6.3 Existing System Analysis

A schematic model diagram representing the existing Bandon Water Distribution System is shown as Figure 6.3.1. A larger map which identifies the specific node and pipe numbers has been provided to the City of Bandon along with specific output results for various scenarios. Demand in the system is based on the average day demand (ADD of) 458,500 gpd or 318.4 gpm which includes distribution system loss. This value was determined in Section 3 of this report. The flow demands are factored by 2.78 for the peak hour demand (PHD). Figure 6.3.2 represents the expected service pressures available during the PHD for the existing system. Available pressures are shown in the form of pressure contours. It is desired to provide Fire flows of at least 1000 gpm to residential areas and a minimum of 3000 gpm to commercial areas. The Fire Flow simulation model of the existing system assumes that the elevation of water in the storage tanks is at an elevation of 208.5 feet which is 10 feet below maximum height. The simulations also assume that the water treatment plant is providing water at full capacity. The computer model provides a flow contour map which represents the available fire flow to each location in the system assuming average day background demand and that no other location in the system drops below 20 psi. The model produces this contour map by "running" the system with each node in turn dropped to 20 psi residual and the resulting available flow noted (in addition to the assigned average day flow). The existing system available fire flow contour map is included as Figure 6.3.3.



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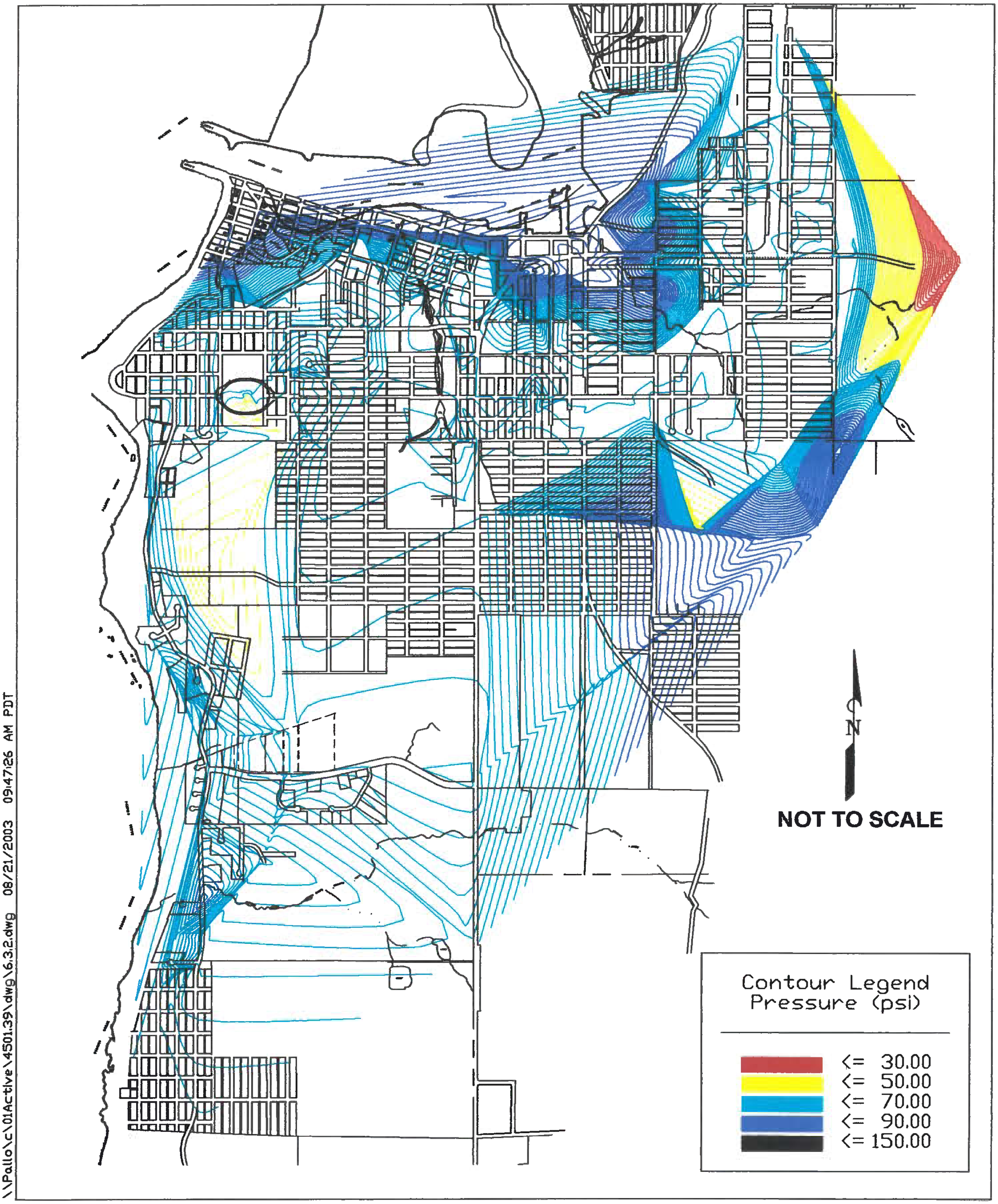
THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

DATE: AUG, 2003
PROJECT NO.: 4501.39

CITY OF BANDON
WATER MASTER PLAN UPDATE

EXISTING WATER DISTRIBUTION MODEL

FIGURE NO.
6.3.1



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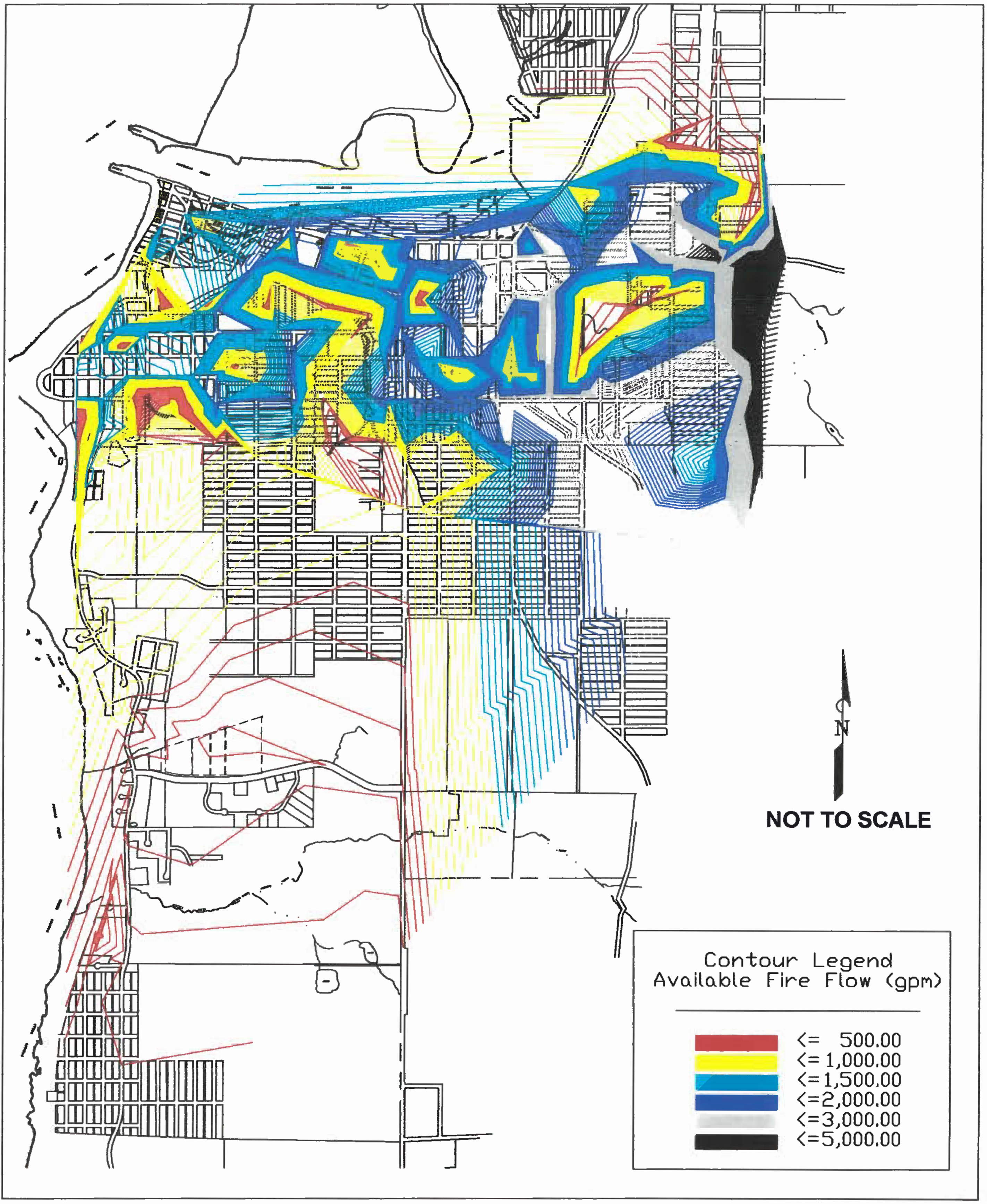
THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

DATE: AUG, 2003
PROJECT NO.: 4501.39

CITY OF BANDON
WATER MASTER PLAN UPDATE

EXPECTED SERVICE PRESSURES DURING PHD

FIGURE NO.
6.3.2



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ENGINEERS & PLANNERS, INC.

DATE: AUG, 2003
PROJECT NO.: 4501.39

CITY OF BANDON
WATER MASTER PLAN UPDATE

EXISTING WATER SYSTEM FIRE FLOWS

FIGURE NO.
6.3.3

6.4 Future System Analysis

Proposed improvements are shown on Figure 6.4.1. The improvements are discussed below. In order to serve the southern portion of the urban growth boundary, expansion of the Bandon Distribution system generally involves completion of a 12" main south along the east side of Highway 101 completing loops with an east-west 12" line extension on Face Rock and/or 24th street and then connection with the existing 12" line on Seabird. In the more distant future, extension of the highway 101 line is envisioned to the Ocean Spray plant and connection with an existing 8" east-west line in this area, thus completing the southern most loop within the urban growth boundary.

Within the looped area between 11th Street, Beach loop, Face Rock and Hwy 101, 8" lines should be run south from the existing 10" line on 11th Street for ultimate connection with the east-west main extension along or near Face Rock Drive. These proposed line extensions are on Franklin Baltimore and Jackson. This will require that 8" reinforcement piping be installed in Jackson from 12th Street southward and in Franklin between 11th and 13th Streets. Both of these locations are already served by 4" water lines

As development continues in the area south of Face Rock and north of Seabird, the previous southern 8" line extensions should be continued south of Seabird.

Ultimately, service mains in the south eastern portion of the urban growth boundary as shown on Figure 6.4.1, south of Johnson Creek should be completed.

In order to serve the northern portion of the urban growth boundary, expansion of the Bandon Distribution system generally involves completion of a 12" main north along Ohio, west on 10th Street NE and southwest to River Drive, completing a loop in the northeast portion of the Urban Growth Boundary.

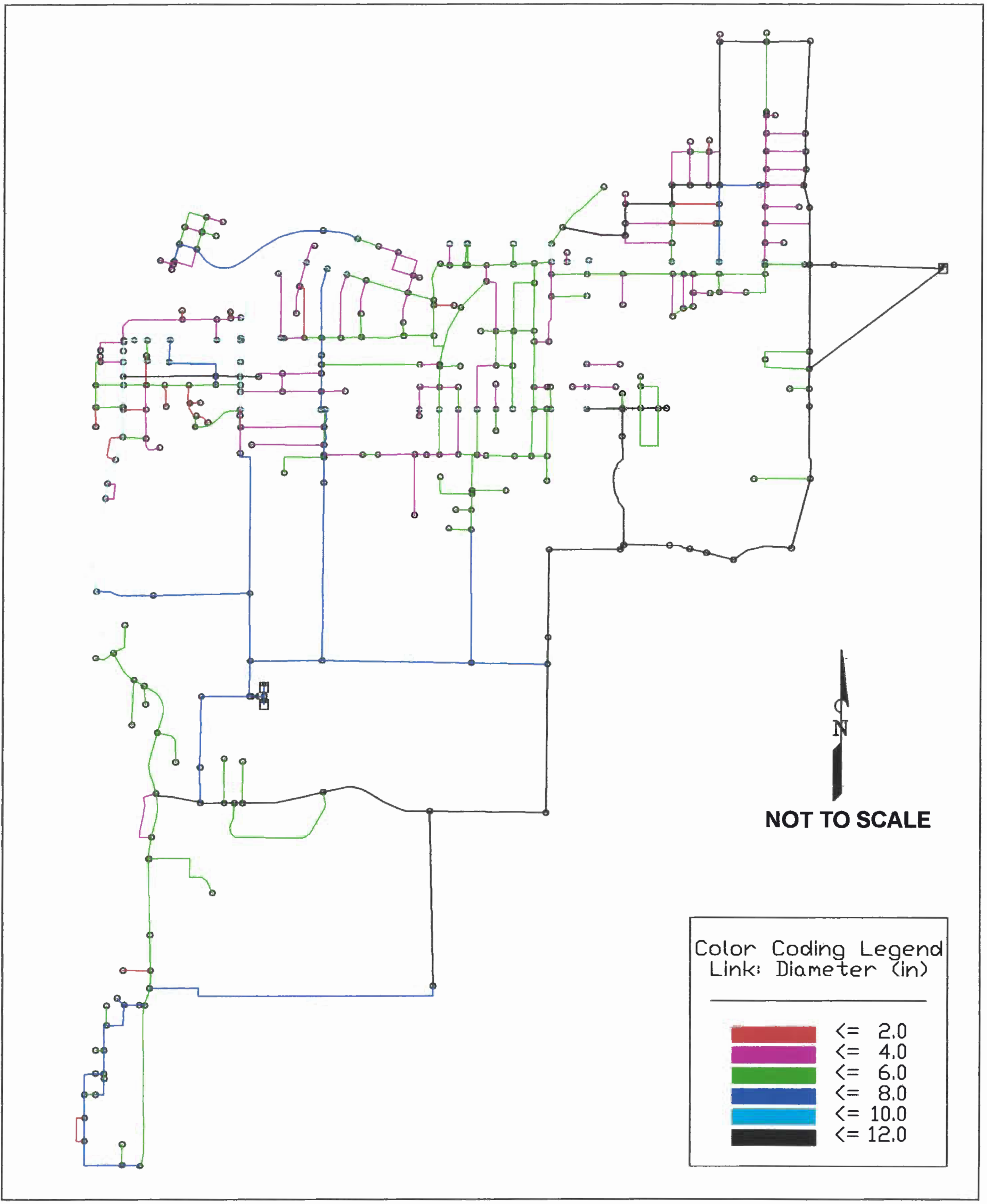
Water line reinforcement within the existing Bandon distribution system recommended to increase fire flows and complete sub-loops within the system are estimated to increase fire flows locally by about 200 to 300 gallons per minute. The following are recommended improvements:

- 10" reinforcement on Grand Ave SE between 9th Street SE and 10th Street SE
- Connection of 4" water lines on 13th Street between Franklin and Allegany;
- Completion of water line on 13th Street between Alabama and Baltimore and between 101 and Alabama with 6" line
- 6" line on Highway 101 between 13th and 14th Streets
- 4" extensions of Douglas and Bandon to 8th Streets
- 6" extension on Chicago between 9th and 10th Streets
- 6" line on North Ave between 3rd SE and 4th SE and connection with existing 4" on 4th SE.
- 6" on 4th SE west of Michigan to end of existing line
- East-west connection of southern ends of lines on June, Klamath and Lexington.
- 6" extension of 9th Street line to Jackson Ave
- Extension of 2nd W line between Douglas and Edison
- 10" Reinforcement north of the Park (9th Street) between Beach Loop and Jackson.
- Complete loop from Polaris to Beach Loop

In addition, the provision of a storage tank with pump station in the southern area of Bandon will significantly increase available fire flows.

Fire flow simulation criteria is based upon the guidelines published in "Fire Suppression Rating Schedule" by the Insurance Services Office (ISO). As noted in the "South Bandon Refinement Plan", flows of 1000 gpm are sufficient for one or two family dwelling not exceeding two stories in height. Commercial, industrial, and institutional buildings require higher available flows. Typical ranges are 3000 to 6000 gpm For purposes of this study, a flow in commercial areas of 3,000 gpm is considered desirable. Flow simulations are run for one fire demand event at a time with a concurrent average day demand.

Available Fire flow contours for the year 2023 with all recommended improvements are shown in Figure 6.4.2. The background flow is average daily demand estimated for this future condition.



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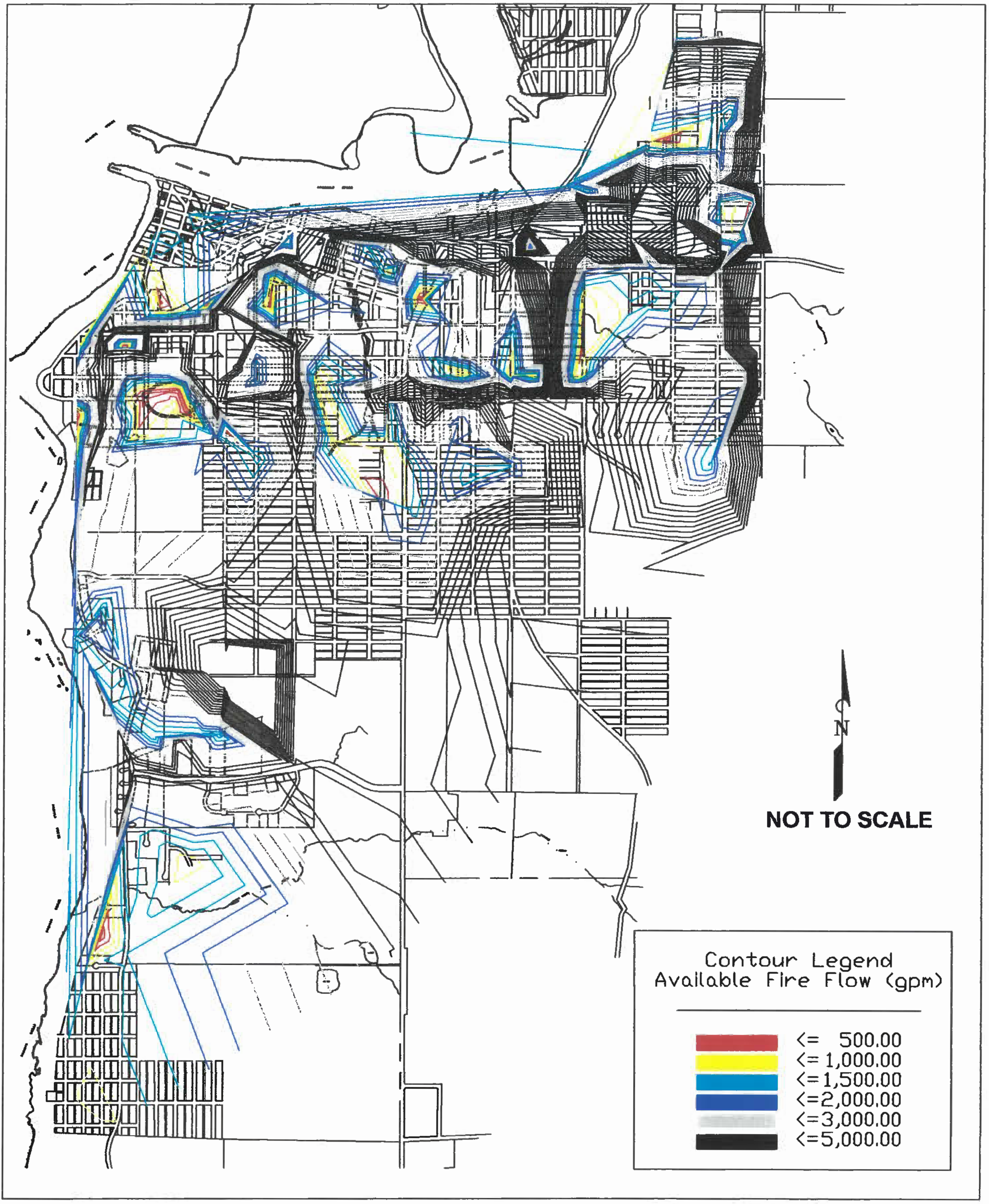
THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

DATE: AUG, 2003
PROJECT NO.: 4501.39

CITY OF BANDON
WATER MASTER PLAN UPDATE

2023 DISTRIBUTION SYSTEM MODEL WITH PROPOSED IMPROVEMENTS

FIGURE NO.
6.4.1



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THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF BANDON*** ***WATER MASTER PLAN UPDATE***	**FIGURE NO.**
DATE: AUG, 2003 PROJECT NO.: 4501.39	***2023 FIRE FLOWS WITH ALL IMPROVEMENTS***	**6.4.2**

6.5 Conclusions and Recommendations

Based on computer modeling, the current system appears to be adequate for the delivery of peak hour demands throughout the service area. However, the ability to deliver fire flow to certain areas of the community is less than desirable. The developed area of west Bandon can not currently support fire flows with demands greater than 1500 gpm. Certain areas within Bandon served by 4" lines can not support high fire flows (greater than 1000 gpm) either. Those customers at the southern end of Beach Loop Road can expect only about 500 gpm of fire flow at most. A similar low fire flow capacity situation exists in the north Bandon area for those customers served off of the North Avenue line. The downtown area of Bandon can not support fire flows in the 3,000 gpm range at the present time.

Improvements which will greatly improve the current fire delivery capacity are developed in Section 7. These improvements are based upon reasonable provisions to close loops within the existing system and to provide main service loops for future development areas. Unless considered absolutely necessary to prevent future "bottle necks", replacement or reinforcement along routes already served by smaller lines was avoided. Rather, new lines were recommended such that new service is provided as well as reinforcement.

Capital Improvements Plan

Section

7

Section

7

Capital Improvement Plan

7.1 Basis for Cost Estimates

The cost estimates presented in this Plan will typically include four components: construction cost, engineering cost, contingency, and legal and administrative costs. Each of the cost components are discussed in this section. The estimates presented herein are preliminary and are based on the level and detail of planning presented in this Study. As projects proceed and as site-specific information becomes available, the estimates may require updating. System improvements that are recommended in the City of Bandon, are detailed in this section along with associated costs.

Construction Costs

The estimated construction costs in this Plan are based on actual construction bidding results from similar work, published cost guides, and other construction cost experience. Reference was made to the as-built drawings, and system maps of the existing facilities to determine construction quantities, elevations of the reservoirs and major components, and locations of distribution lines. Where required, estimates will be based on preliminary layouts of the proposed improvements.

Future changes in the cost of labor, equipment, and materials may justify comparable changes in the cost estimates presented herein. For this reason, common engineering practices usually tie the cost estimates to a particular index that varies in proportion to long-term changes in the national economy. The Engineering News Record (ENR) construction cost index is most commonly used. This index is based on the value of 100 for the year 1913. Average yearly values for the past ten years are summarized in Table 7.1.1.

Table 7.1.1
ENR Index 1992 to 2002

YEAR	INDEX	% CHANGE/YR
1992	4983	3.06
1993	5208	4.52
1994	5336	2.46
1995	5443	2.01
1996	5521	1.43
1998	5852	2.95
1999	5992	2.39
2000	6222	3.84
2001	6343	1.94
2002	6538	3.07
	Average Annual	2.77

Construction costs are based upon current dollar values. Cost estimates presented for construction performed in later years should be projected with an increase of three percent per year. Future yearly

ENR indices can be used to calculate the cost of projects for their construction year based on the annual growth in the ENR index. The cost estimates provided within this Master Plan addendum include the assumption that all projects are constructed under public contract. City construction projects or "in-house" projects can often be performed at a lower cost than the contracted rates represented herein. This would allow the City to do more with the funding that is available. City construction projects also provide the opportunity for the public works staff to gain exposure and improve public relations with the residents of Bandon. City personnel are experienced with waterline replacement projects; however, the City should be cautious in undertaking too large of a project because other services may suffer or construction may be too complex for staff skill levels and available City equipment. In addition, some projects or portions of projects may be constructed under private contract by developers as a condition of necessary infrastructure improvements to support their projects. Regardless of the project size or who constructs the project , it is recommended that, should the City implement "in-house" improvements or approve private development improvements that the project be supported with quality control inspections, field staking and surveying. Projects should generally follow the recommendations of this Master Plan Addendum with regard to sizing and locations of lines.

It is also recommended that in the event other public works projects are being performed in the same location, (i.e., sewer, street, storm, etc.), planning priority be given to combining these water projects with the projects at hand. In doing this, the City will save money by eliminating repetitive mobilization, demolition, and road patching in the same locations.

Contingencies

A planning level contingency factor equal to approximately 15 percent (15%) of the estimated construction cost has been added. In recognition that the cost estimates presented are based on conceptual planning, allowances must be made for variations in final quantities, bidding market conditions, adverse construction conditions, unanticipated specialized investigation and studies, and other difficulties which cannot be foreseen at this time but may tend to increase final costs.

Engineering

The cost of engineering services for major projects typically includes special investigations, a pre-design report, surveying, foundation exploration, preparation of contract drawings and specifications, bidding services, construction management, inspection, construction staking, start-up services, and the preparation of operation and maintenance manuals. Depending on the size and type of project, engineering costs may range from 15 to 25 percent of the contract cost when all of the above services are provided. The lower percentage applies to large projects without complicated mechanical systems. The higher percentage applies to small, complicated projects.

Additional engineering services may be required for specialized projects. This could include geotechnical evaluations, structural evaluations, and other specialized consulting activities.

Legal and Administrative

An allowance of three percent (3%) of construction cost has been added for legal and administrative services. This allowance is intended to include internal project planning and budgeting, grant administration, liaison, interest on interim loan financing, legal services, review fees, legal advertising, and other related expenses associated with the project.

Land Acquisition

Some projects may require the acquisition of additional right-of-way or property for construction of a specific improvement. The need and cost for such expenditures is difficult to predict and must be reviewed as a project is developed. Effort was made to include costs for land acquisition, where expected, within the cost estimates included in this Plan.

Conservation.

Water reclaimed through lost water reduction and conservation measures can be considered a new water source. However, the effectiveness and reliability of such programs is not guaranteed. Furthermore, Bandon's current water use and water loss rates are enviable by most standards. Further conservation and lost reduction measures will not be dramatic.

7.2 Recommended Projects

A number of projects were recommended in previous sections of this report. For each major component of the system, projects have been developed and preliminary cost estimates prepared for the purposes of budgeting for improvements.

A written description for each recommended project is provided along with a cost estimate. The location of each project is shown on Figure 7.2.1.

Section 8 provides a summary and groups projects into priorities. Section 9 provides and analysis of the financial impact to the City's water system and the potential impact to ratepayers.

7.3 Water Source Projects

Several new raw water source options were discussed in Section 4. Within the 20 year study period, only the Simpson Creek reservoir restoration project and the Johnson Creek Reservoir project involve new construction. The other viable option investigated involved lease or water purchase option contract arrangements for the existing Windhurst Reservoir. Long term supply appears likely to require desalination to supply a portion of Bandon's water needs after 2023 if these reservoir projects can not be executed.

Available water resources are becoming increasingly scarce. Water use projections and estimates of minimum flows available in Ferry and Geiger Creeks indicate that with adequate finished water storage, good conservation measures and curtailment plans in place, the current water supply is just barely adequate for the next 20 years. Developing additional water sources may be a difficult and potentially expensive task, however, the City should not wait for its water supply to become deficient before it acts to develop additional water sources. Raw water sources should be developed to supply enough water for the 50-year (or longer) demand projections. The City should, at a minimum, develop systems now to provide adequate raw water for the 20-year MDD of 2.41 cfs. This may involve water purchase arrangements.

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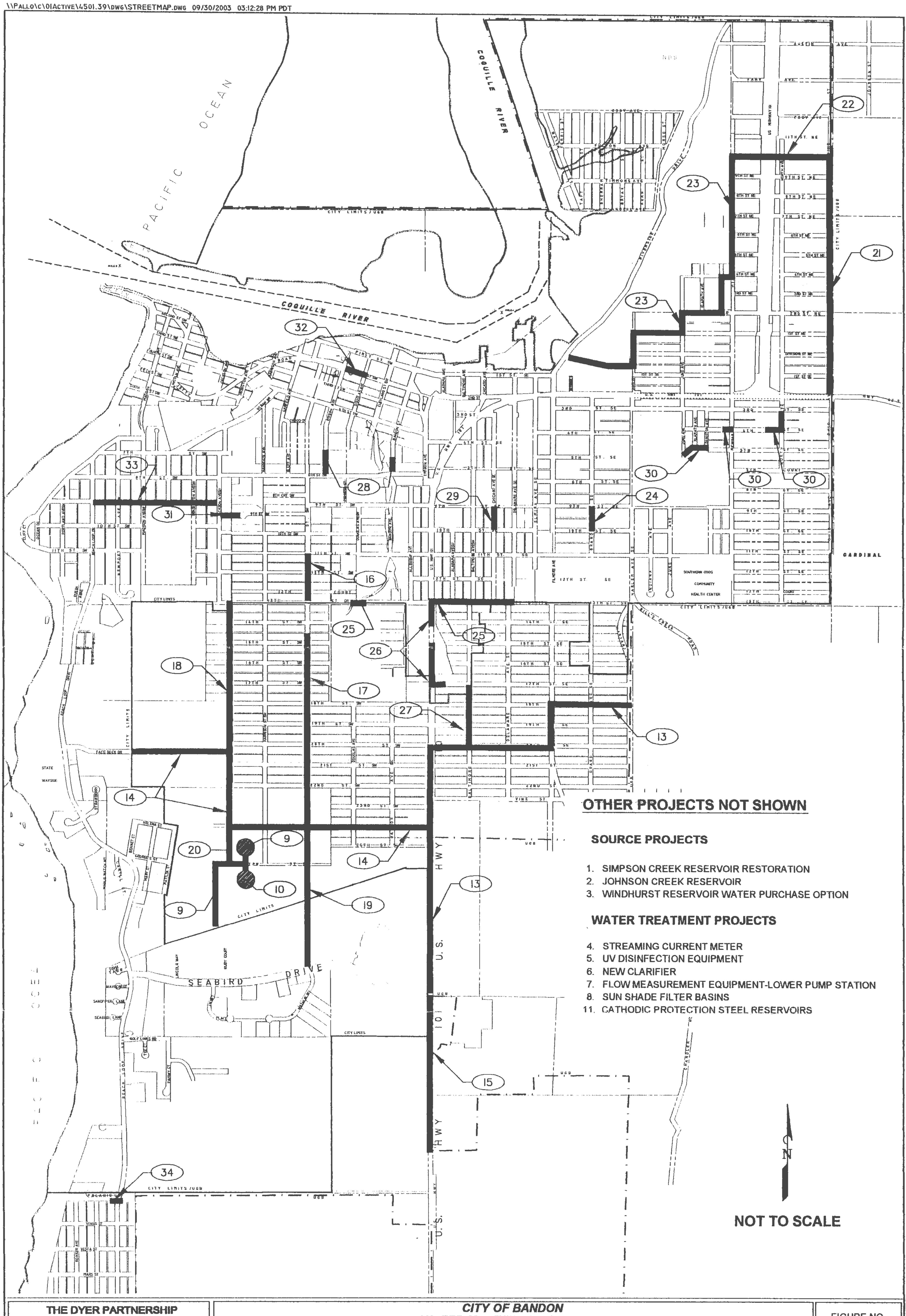

OTHER PROJECTS NOT SHOWN

SOURCE PROJECTS

1. SIMPSON CREEK RESERVOIR RESTORATION
2. JOHNSON CREEK RESERVOIR
3. WINDHURST RESERVOIR WATER PURCHASE OPTION

WATER TREATMENT PROJECTS

4. STREAMING CURRENT METER
5. UV DISINFECTION EQUIPMENT
6. NEW CLARIFIER
7. FLOW MEASUREMENT EQUIPMENT-LOWER PUMP STATION
8. SUN SHADE FILTER BASINS
11. CATHODIC PROTECTION STEEL RESERVOIRS

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS
DATE: JULY, 2003
PROJECT NO.: 4501.39

CITY OF BANDON
WATER MASTER PLAN UPDATE

CAPITAL IMPROVEMENT PLAN - PROJECT LOCATIONS

FIGURE NO.
7.2.1

Project Number 1 – Simpson Creek Reservoir Restoration

The City would like to consider construction to restore the Spring Creek (a.k.a Simpson Creek) storage capacity of the reservoir. The City has senior certificated storage rights for the 20 5/8 acre-feet reservoir and 2 CFS water rights. Water from the Simpson Creek flows would be adequate to maintain the volume of the reservoir until needed during dry periods, however, the quality of this water may be questionable. Alternately, consideration was given to pumping raw water from the City's existing supply sources of Ferry and Geiger Creeks during high flow periods. It would be necessary to construct a raw water transmission line approximately 3500 feet long from the reservoir to the plant. The reservoir would also require dredging to restore storage capacity. The existing earth fill dam would also require rehabilitation. Furthermore, the dam would have to meet current design standards. Preliminary planning assumes that flow from the pond could require pumping to the water treatment plant. Water quality issues must be addressed and resolved prior to undertaking this project. A cost estimate for this project is provided below:

Table 7.3.1
Simpson Creek Raw Water Storage

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Water Gage and Recording	LS	1	$4,000	$4,000
2	Water Rights re-application	LS	1	$4,500	$4,500
3	Dam analysis and geotechincal study	LS	1	$18,000	$18,000
4	Site preparation	AC	2	$2,000	$4,000
5	Road Improvement	LF	300	$22	$6,600
6	Dredging to remove sedimentation	CY	17000	$5	$76,500
7	Const. Fac. & Temp. Controls	LS	1	$6,000	$6,000
8	Demolition	LS	1	$3,500	$3,500
9	Dam reconstruction	CY	760	$18	$13,680
10	Water intake	EA	1	$5,500	$5,500
11	Primary spillway	EA	1	$6,000	$6,000
12	Emergency spillway	EA	1	$12,000	$12,000
13	Fence	LF	1500	$14	$21,000
14	Pipe line to water plant - 6" PVC	LF	3500	$25	$87,500
15	AC Patch	LF	600	$20	$12,000
16	Pump Station	EA	1	$20,000	$20,000
17	Electrical and Telemetry	LS	1	$10,000	$10,000
18	Misc. Fittings and Appurtenances	LS	1	$53,756	$53,756
		Project Subtotal			***$364,536***
		Contingency			***$54,680***
		Engineering			***$72,907***
		Legal Admin.			***$10,936***
		Project Total			***$503,060***

Project Number 2 – Johnson Creek Reservoir

Details concerning the Johnson Creek proposed reservoir are addressed in Section 4 of this report. The project would include mitigation, planning, design and construction share for the proposed 1,100 acre feet of storage. The City would own 200 acre-feet of the capacity. Additional costs would include a pump and transmission line to transfer water to Geiger Creek for use by the City. The earliest that this reservoir could be expected to come on line is in the year 2008. A cost estimate for this project is provided below:

Table 7.3.2
Johnson Creek Reservoir

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	City share of Preliminary Studies/Design	LS	1	$150,000	$150,000
2	8" Water Line	LF	2500	$30	$75,000
3	Pump Unit	LS	1	$50,000	$50,000
4	City share of Construction	LS	1	$546,000	$546,000

Project Subtotal	***$821,000***
Contingency	***$123,150***
Engineering (additional)	***$16,420***
Legal Admin.	***$24,630***
Project Total	***$985,200***

Project Number 3 – Windhurst Reservoir Water Purchase Option

This project is not actually a capital improvement project. This reservoir is complete and at the time of this report had 100 acre feet of storage available for yearly lease. No additional infrastructure improvements are necessary to release water for the City's use directly into Geiger Creek. The proffered cost is currently $500 per acre foot per year for leased water storage. In Section 4, other options such as purchase on demand options were discussed. For purposes of this report, an option to purchase on demand is recommended and developed as a cost option. An annual cost estimate for this lease arrangement is provided below:

Table 7.3.3
Windhurst Reservoir Water Lease Option

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Purchase Option	AC-FT	4.977	$1,500	$7,466
2	Misc. Costs	LS	1	$300	$300

Project Subtotal	***$7,766***
Contingency	***$1,165***
Engineering	***$0***
Legal Admin.	***$388***
Project Total	***$9,319***
Assumed occurrence 1/5 years	***$1,864***

7.4 Water Treatment Projects

A number of improvements are recommended for the water treatment plant. While the treatment plant is relatively new and in good condition, some minor improvements are recommended to improve the operation and effectiveness of the treatment process. No major improvements are anticipated in the planning period with the exception of the clarifier replacement. Listed below are projects identified for waster treatment improvements in Section 5.

Project Number 4 – Streaming Current Meter

The plant was designed to have a streaming current meter located just prior to the clarifier in the future. The plant equipped with this analysis device would have better control of chemical feed rates. The use of this device provides for quicker response to changing conditions and often will result in a chemical cost savings. A cost estimate for this project is provided below:

Table 7.4.1
Streaming Current Meter

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Labor	LS	1	$4,000	$4,000
2	Streaming Current Meter	EA	1	$12,000	$12,000

Project Subtotal	***$16,000***
Contingency	***$3,200***
Engineering	***$2,880***
Legal Admin.	***$480***
Project Total	***$22,560***

Project Number 5 – UV Disinfection Equipment

An interest in ultra-violet (UV) disinfection equipment has also been expressed by the City. UV disinfection would permit the City of Bandon to meet the upcoming Cryptosporida inactivation rules as discussed in Section 5 of this report. A cost estimate for this project is provided below:

Table 7.4.2
UV Disinfection Equipment

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$5,460.00	$5,460.00
2	Packaged On-Site Disinfection System	LS	1	$31,200.00	$31,200.00
3	Electrical Improvements	LS	1	$5,200.00	$5,200.00
4	Misc. Fittings and Appurtenances	LS	1	$7,280.00	$7,280.00

Project Subtotal	***$49,140***
Contingency	***$9,828***
Engineering	***$8,845***
Legal Admin.	***$1,474***
Project Total	***$69,287***

Project Number 6 – New Clarifier

The existing clarifier concrete structure is deteriorating as noted in Section 5. It is therefore recommended that a new clarifier be constructed within the next ten years. The capacity of the clarifier should match that of the plant and be sized for 2 mgd. A cost estimate for this project is provided below:

Table 7.4.3
New Clarifier

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$48,000	$48,000
2	New Clarifier	LS	1	$320,000	$320,000
3	Misc. Fittings and Appurtenances	LS	1	$64,000	$64,000

Project Subtotal	***$432,000***
Contingency	***$64,800***
Engineering	***$86,400***
Legal Admin.	***$12,960***
Project Total	***$596,160***

Project Number 7 – Flow Measurement Equipment - Lower Pump Station

Flow meters at the lower pump station should be installed to measure flow from both the Geiger Creek and from Ferry Creek sources. This may be accomplished by construction of a meter vault and installation of a pair of flow meters at the location where the suction pipe for the station bifurcates. Doppler type flow meters are recommended due to the expense of 16" magnetic flow meters. The use of Doppler meters will not require that the existing lines be cut. A cost estimate for this project is provided below:

Table 7.4.4
Flow Measurement Equipment - Lower Pump Station

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$1,980	$1,980
2	Meter Vault	EA	2	$4,000	$8,000
3	Doppler Units	EA	2	$2,500	$5,000
4	Recording Units	EA	2	$1,750	$3,500
5	Signal & Power	LS	1	$2,900	$2,900
3	Misc. Fittings and Appurtenances	LS	1	$2,600	$2,600

Project Subtotal	***$23,980***
Contingency	***$3,597***
Engineering	***$4,796***
Legal Admin.	***$719***
Project Total	***$33,092***

Project Number 8 – Sun Shade Filter Basins

It was noted that algae growth occurs in both operational filter basins. This is due to natural ultraviolet light exposure. It would be relatively inexpensive to provide a screen over the top of the outdoor filter basins to block the sunlight. The filter basin dimensions are ten feet (inside dimension) by eighteen feet - four inches (out to out). A cost estimate for this project is provided below:

Table 7.4.5
Sun Shade Filter Basins

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Labor	LS	1	$1,000	$1,000
2	Sun Shade and Frame	SF	85	$55	$4,675

Project Subtotal	***$5,675***
Contingency	***$851***
Engineering	***$1,419***
Legal Admin.	***$170***
Project Total	***$8,115***

7.5 Treated Water Storage

Project Number 9 - South Bandon 0.25 Million Gallon Reservoir & Pump Station

The City has adequate treated water storage capacity for existing demand levels. However, additional treated water storage reserves would provide greater security to the City and would help provide needed fire improvements in portions of the service area. Additional storage will be required within about 8 years in any case. It is recommended that a 0.25 MG treated water reservoir be constructed in the southern portion of the City. However, there are several significant problems associated with placement of storage in the south portion of Bandon. The highest ground in south Bandon between Beach Loop Road, Hwy 101 and north of Johnson Creek is about 80 feet. To match the existing tank water elevations of 218 ft would require an elevated steel tank 138 feet tall. While it is possible to construct both single pedestal and multi-leg tanks of this height in seismic zone IV, the cost is 5 to 6 time the cost of a corresponding ground storage reservoir. Previously, in Oregon, insurance companies have refused to insure elevated tanks in seismic zone IV although this policy has been relaxed recently. In addition, the proximity to the Bandon State Airport makes this alternative less feasible due to glide slope restrictions. A ground storage tank with an associated hydro-pneumatic tank and pump station is feasible. Constructing the new reservoir along Seabird will distribute reserves and provide more uniform flow and pressure distribution in the southern half of the water system.

A steel tank, either welded or bolted, is suited for a reservoir of this volume. Various paints, coatings, or bonded surfaces are available to protect the steel tank from the elements. The pump station would need to include properly sized pumps for both normal draft and for fire flow demands. While a specific reservoir site has not been established at this time, a reservoir site is shown on Figure 7.2.1 for planning purposes. The City will need to perform a reservoir site study to confirm the best location for a new treated water reservoir. A cost estimate for the project is provided below:

Table 7.5.1
South Bandon 0.25 Million Gallon Reservoir & Pump Station - New .25-MG Reservior

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$20,000	$20,000
2	Demolition and Site Prep	LS	1	$15,000	$15,000
3	.27-MG Bolted Steel Tank	EA	1	$171,600	$171,600
4	Site Work, Fencing, and Access	LS	1	$30,000	$30,000
5	Misc. Fittings and Appurtenances	LS	1	$46,800	$46,800
6	8" line connection to Existing	LF	800	$30	$24,000
7	New Pump Station	EA	1	$140,000	$140,000

Project Subtotal	***$447,400***
Contingency	***$67,110***
Engineering	***$67,110***
Legal Admin.	***$13,422***
Land Acquisition	***$75,000***
Project Total	***$670,042***

Project Number 10 - 2nd Phase South Bandon 0.25 Million Gallon Reservoir

The City will require an additional 250,000 increment of storage by 2015 (assuming that Project 9 is constructed previously). This storage will provide for adequate equalization, emergency and fire reserve storage as determined in Section 5. A cost estimate for the project is provided below

Table 7.5.2
2nd Phase South Bandon 0.25 Million Gallon Reservoir

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$5,000	$5,000
2	Demolition and Site Prep	LS	1	$2,500	$2,500
3	.25-MG Bolted Steel Tank	EA	1	$171,600	$171,600
4	Site Work, Fencing, and Access	LS	1	$2,500	$2,500
5	Misc. Fittings and Appurtenances	LS	1	$12,000	$12,000
6	Upgrade Pump Station	EA	1	$40,000	$40,000

Project Subtotal	***$233,600***
Contingency	***$35,040***
Engineering	***$35,040***
Legal Admin.	***$7,008***
Land Acquisition	***$75,000***
Project Total	***$385,688***

Project Number 11 – Cathodic Protection Steel Reservoirs

The installation of cathodic protection for the existing steel tanks should be considered. The cathodic protection units are relatively inexpensive, use very little power and provide significantly greater protection to the steel than coating systems alone. A cost estimate for this project is provided below:

Table 7.5.3
Cathodic Protection Steel Reservoirs

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Equipment	LS	1	$8,000	$8,000
2	Labor	LS	1	$4,000	$4,000
3	Electrical	LS	1	$2,800	$2,800
4	Misc. Items	LS	1	$1,000	$1,000

Project Subtotal	***$15,800***
Contingency	***$2,370***
Engineering	***$1,580***
Legal Admin.	***$474***
Project Total	***$20,224***

7.6 Distribution System Improvements

A number of distribution system improvement projects have been developed for this Master Plan Addendum. A project and cost estimate has been prepared and is presented below and on the following pages. For recommendations on project prioritization, see Section 8.

For the location of each distribution system improvement project, see Figure 7.2.1.

Project Number 12 – System-Wide Water Meter Replacement

This project includes provisions for the continuing replacement of all existing meters with new, accurate, and consistent electronic water meters Modern meters are capable of nearly 100 percent accuracy. The proposed meters offer automated-meter-reading (AMR) systems capable of significantly increasing the efficiency of the reading and billing process. The replacement of water meters with new meters should be considered a relatively high priority so that the City may gather accurate data cost effectively and have greater assurance that the meters do not under read . It has been demonstrated that older style meters, when aged, tend to report lower water use than actual, thus reducing water utility revenues. City records indicate that new style AMR type meters have been used for replacement of existing meters since early 1999. In the past seven years approximately 455 meters have been installed or replaced. Of this number 35% are estimated to be new services and the remaining 65% to be replacements. The current number of meters in service is about 1750. This leaves an estimated 1345 meters in service older than 7 years. It is proposed that the City institute a program to replace and/or service all meters on a seven year cycle. This goal would require 250 meters per year to be initially replaced or serviced. Testing of the AMR meters in the future will determine if this replacement /service cycle needs to be continued. A cost estimate for this project is provided below:

Table 7.6.1
System-Wide Water Meter Replacement

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1750	$14	$24,400
2	Demolition and Site Prep	LS	1750	$8	$14,630
3	Install New Water Meters	EA	1750	$145	$253,750
4	New AMR Equipment	LS	1	$5,625	$5,625

Project Subtotal	***$298,405***
Contingency	***$44,761***
Engineering	***$44,761***
Legal Admin.	***$8,952***
Project Total	***$396,879***
Annual (7 year cycle)	**$56,697**

Project Number 13 – Harvard to Filmore to Seabird

Routing a 12" main westward from Harvard to Filmore then south and west to Seabird is a key component of the strategy to complete a transmission loop for the southern service area. Provision of future fire flows in this area depends on this water line. This project includes provisions to construct approximately 6,380 feet of new 12" waterline. A cost estimate for this project is provided below:

Table 7.6.2
Harvard to Filmore to Seabird

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$25,820	$25,820
2	Demolition	LS	1	$15,490	$15,490
3	New 12-inch Waterline	LF	6360	$45	$286,200
4	Fire Hydrant Assembly	EA	13	$2,475	$32,175
5	Connections to Exist 12-inch	EA	2	$2,500	$5,000
6	Connections to Exist 8-inch	EA	1	$1,500	$3,500
7	Highway 101 bore	LF	85	$120	$10,200
8	Misc. Fittings and Appurtenances	LS	1	$65,375	$65,375
9	AC Patch	LF	50	$20	$1,000

Project Subtotal	***$444,760***
Contingency	***$66,714***
Engineering	***$88,952***
Legal Admin.	***$13,343***
Project Total	***$613,769***

Project Number 14 – Face Rock extension to South Loop Line - by 24th Street

This project completes a loop with an east-west 12" line extension from the existing 8" Face Rock line. For purposes of this report, it is assumed that the line will be routed south to 24th street and then be constructed eastward, crossing Highway 101 and then connecting with the Project 13 12" line on Filmore. This route selection is due to apparent development, as shown by aerial photo, along this route. This project includes provisions to construct approximately 6,400 feet of new 12" waterline. A cost estimate for this project is provided below:

Table 7.6.3
Face Rock extension to South Loop Line - by 24th Street

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$48,864	$48,864
2	Demolition	LS	1	$29,318	$29,318
3	New 12-inch Waterline	LF	6400	$45	$288,000
4	Fire Hydrant Assembly	EA	13	$2,475	$32,175
5	Connections to Exist 8-inch	EA	2	$1,750	$3,500
6	Connections to Exist 12-inch	EA	1	$2,500	$2,500
7	Misc. Fittings and Appurtenances	LS	1	$64,735	$64,735

Project Subtotal	***$469,092***
Contingency	***$70,364***
Engineering	***$93,818***
Legal Admin.	***$14,073***
Project Total	***$647,347***

Project Number 15 – Highway 101 - Seabird to Ocean Spray

This project completes the southern Bandon loop with an existing east-west 8" line currently running from Beach Loop to Highway 101 and terminating at the Ocean Spray Facility. This project is envisioned to be constructed in the future if development to the south Urban Growth Boundary warrants. This project includes provisions to construct approximately 2,800 feet of new 12" waterline. A cost estimate for this project is provided below:

Table 7.6.4
Highway 101 - Seabird to Ocean Spray

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$21,880	$21,880
2	Demolition	LS	1	$13,130	$13,130
3	New 12-inch Waterline	LF	2800	$45	$126,000
4	Fire Hydrant Assembly	EA	6	$2,475	$14,850
5	Connections to Exist 12-inch	EA	2	$2,500	$5,000
6	Misc. Fittings and Appurtenances	LS	1	$29,170	$29,170

Project Subtotal	***$210,030***
Contingency	***$31,505***
Engineering	***$42,006***
Legal Admin.	***$6,301***
Project Total	***$289,841***

Project Number 16 – Franklin 11th to 13th

On Franklin an 8" line extension south from the existing 10" line on 11th Street to 13th St is proposed. This will require that on Franklin between 11th and 13th an existing 6" line be paralleled in order to provide adequate capacity for demands to the south. This project eliminates a developing "bottleneck" between 11th and 13th. This project includes provisions to construct approximately 600 feet of new 8" waterline. A cost estimate for this project is provided below:

Table 7.6.5
Franklin 11th to 13th

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$5,120	$5,120
2	Demolition	LS	1	$3,070	$3,070
3	New 8-inch Waterline	LF	600	$30	$18,000
4	Fire Hydrant Assembly	EA	2	$2,475	$12,375
5	Connections to Exist 4-inch	EA	2	$1,000	$2,000
6	Connections to Exist 8-inch	EA	1	$1,750	$1,750
7	Misc. Fittings and Appurtenances	LS	1	$6,825	$6,825
8	AC Patch	LF	600	$20	$12,000

Project Subtotal	***$61,140***
Contingency	***$9,171***
Engineering	***$12,228***
Legal Admin.	***$1,834***
Project Total	***$84,373***

Project Number 17 – Franklin 15th SE to 24th SE

On Franklin, an 8" line extension south from the existing 8" line between 14th and 15th should be continued south to 24th street SE for ultimate connection with the east-west main extension on 24th street. This project includes provisions to construct approximately 1,800 feet of new 8" waterline. A cost estimate for this project is provided below:

Table 7.6.6
Franklin 15th SE to 24th SE

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$10,595	$10,595
2	Demolition	LS	1	$6,360	$6,360
3	New 8-inch Waterline	LF	1800	$30	$54,000
4	Fire Hydrant Assembly	EA	4	$2,475	$12,375
5	Connections to Exist 8-inch	EA	1	$1,750	$1,750
6	Connections to Exist 12-inch	EA	1	$2,500	$2,500
7	Misc. Fittings and Appurtenances	LS	1	$14,125	$14,125

Project Subtotal	***$101,705***
Contingency	***$15,256***
Engineering	***$20,341***
Legal Admin.	***$3,051***
Project Total	***$140,353***

Project Number 18 – Jackson 12th to Face Rock

On Jackson, an 8" line extension south from the existing 8" line on 12th Street for ultimate connection with the east-west Face Rock extension is proposed. This will require that on Jackson, between 12th and to a location south of 13th, an existing 4" line to be paralleled or replaced in order to provide adequate capacity for demands to the south. This project eliminates a developing "bottleneck" between 12th and 13th. This project includes provisions to construct approximately 2,040 feet of new 8" waterline. A cost estimate for this project is provided below:

Table 7.6.7
Jackson 12th to Face Rock

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$14,960	$14,960
2	Demolition	LS	1	$8,970	$8,970
3	New 8-inch Waterline	LF	2040	$30	$61,200
4	Fire Hydrant Assembly	EA	4	$2,475	$9,900
5	Connections to Exist 8-inch	EA	1	$1,750	$1,750
6	Connections to Exist 12-inch	EA	1	$2,500	$2,500
7	Misc. Fittings and Appurtenances	LS	1	$14,570	$14,570

Project Subtotal	***$113,850***
Contingency	***$17,078***
Engineering	***$22,770***
Legal Admin.	***$3,416***
Project Total	***$157,113***

Project Number 19 – Franklin 24th to Seabird

On an extension of Franklin, an 8" line continuing south from the Project 17 extension for ultimate connection with the east-west existing 8" line on Seabird. This will complete a sub-loop within the southern service area and significantly improve fire flow capacity. This project constructs approximately 2,700 feet of new 8" waterline. A cost estimate for this project is provided below:

Table 7.6.8
Franklin 24th to Seabird

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$15,130	$15,130
2	Demolition	LS	1	$9,080	$9,080
3	New 8-inch Waterline	LF	2700	$30	$81,000
4	Fire Hydrant Assembly	EA	6	$2,475	$14,850
5	Connections to Exist 12-inch	EA	2	$2,500	$5,000
6	Misc. Fittings and Appurtenances	LS	1	$20,170	$20,170

Project Subtotal	***$145,230***
Contingency	***$21,785***
Engineering	***$29,046***
Legal Admin.	***$4,357***
Project Total	***$200,417***

Project Number 20 – Jackson 24th to New South Tank Line

On Jackson, an 8" line extension continuing south from the Project 14 extension for connection with the tank feed line associated with project 9. This will complete connection with the east-west existing 8" line on Seabird and complete a sub-loop within the southern service area, significantly improving fire flow capacity. This project includes provisions to construct approximately 800 feet of new 8" waterline. A cost estimate for this project is provided below:

Table 7.6.9
Jackson 24th to New South Tank Line

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$15,130	$15,130
2	Demolition	LS	1	$9,080	$9,080
3	New 8-inch Waterline	LF	800	$30	$24,000
4	Fire Hydrant Assembly	EA	6	$2,475	$14,850
5	Connections to Exist 12-inch	EA	2	$2,500	$5,000
6	Misc. Fittings and Appurtenances	LS	1	$8,770	$8,770

Project Subtotal	***$76,830***
Contingency	***$11,525***
Engineering	***$15,366***
Legal Admin.	***$2,305***
Project Total	***$106,025***

Project Number 21 – Ohio Avenue - Highway 42S to 10th Street NE

In order to provide adequate fire protection in the northern portion of the urban growth boundary, expansion of the Bandon distribution system will generally involve completion of a 12" main north along Ohio, west on 10th Street NE and southwest on River Drive, completing a loop in the northeast portion of the Urban Growth Boundary. This portion of the loop will significantly increase fire flows on those streets east of Highway 101 and north of Highway 42S. This project includes provisions to construct approximately 4,510 feet of new 12" waterline. It is anticipated that this segment will be completed prior to project 14 or 15 listed below due to the immediate improvement to existing customers. A cost estimate for this project is provided below:

Table 7.6.10
Ohio Avenue - Highway 42S to 10th Street NE

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$33,231	$33,231
2	Demolition	LS	1	$19,939	$19,939
3	New 12-inch Waterline	LF	4510	$45	$202,950
4	Fire Hydrant Assembly	EA	10	$2,475	$24,750
5	Connections to Exist 6-inch	EA	1	$25	$25
6	Connections to Exist 8-inch	EA	3	$30	$90
7	Connections to Exist 12-inch	EA	2	$2,500	$5,000
8	Misc. Fittings and Appurtenances	LS	1	$33,035	$33,035
9	AC Patch	LF	3360	$20	$67,200

Project Subtotal	***$386,220***
Contingency	***$57,933***
Engineering	***$77,244***
Legal Admin.	***$11,587***
Project Total	***$532,984***

Project Number 22 – 10th Street NE - Michigan Ave. to Ohio Ave

A key segment of the northern loop discussed above is construction of a 12" main between Michigan Ave. and Ohio Ave. This project includes provisions to construct approximately 2,230 feet of new 12" waterline and a highway bore under Highway 101. A cost estimate for this project is provided below:

Table 7.6.11
10th Street NE - Michigan Ave. to Ohio Ave

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$17,298	$17,298
2	Demolition	LS	1	$10,379	$10,379
3	New 12-inch Waterline	LF	2231	$45	$100,395
4	Fire Hydrant Assembly	EA	3	$2,475	$7,425
5	Connections to Exist 12-inch	EA	3	$2,500	$7,500
6	Misc. Fittings and Appurtenances	LS	1	$23,064	$23,064
7	AC Patch	LF	2231	$20	$44,620
8	Boring under Roadway	LF	85	$120	$10,200

Project Subtotal	***$220,881***
Contingency	***$33,132***
Engineering	***$44,176***
Legal Admin.	***$6,626***
Project Total	***$304,816***

Project Number 23 – River Road to Michigan

A key segment of the northern loop discussed in project 21 is completion of the loop by construction of a 12" main north from the River Rd and Caroline Area and connection with the Michigan Ave. terminus of the 12" line described as Project 22. This project includes provisions to construct approximately 4,600 feet of new 12" waterline. A cost estimate for this project is provided below:

Table 7.6.12
River Road to Michigan

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$32,910	$39,942
2	Demolition	LS	1	$19,746	$19,971
3	New 12-inch Waterline	LF	4600	$45	$207,000
4	Fire Hydrant Assembly	EA	4	$2,475	$9,900
5	Connections to Exist 12-inch	EA	2	$2,500	$5,000
6	Misc. Fittings and Appurtenances	LS	1	$43,880	$44,380
7	AC Patch	LF	4160	$20	$83,200

Project Subtotal	***$409,393***
Contingency	***$61,409***
Engineering	***$81,879***
Legal Admin.	***$12,282***
Project Total	***$564,962***

The following water line reinforcement projects (#24 to #34) within the existing Bandon distribution system are recommended to increase fire flows and complete sub-loops. These projects strengthen the system in general and provide significantly increased fire flows locally by about 200 to 300 gallons per minute.

Project Number 24 – Grand Avenue SE between 9th SE & 10 SE

This project is for installation of 10" reinforcement on Grand Ave SE between 9th Street SE and 10th Street SE. A cost estimate for this project is provided below:

Table 7.6.13
Grand Avenue SE between 9th SE & 10 SE

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$2,704	$2,710
2	Demolition	LS	1	$1,622	$1,620
3	New 10-inch Waterline	LF	330	$35	$11,550
4	Fire Hydrant Assembly	EA	1	$2,475	$2,475
5	Connections to Exist 10-inch	EA	2	$2,000	$4,000
6	Misc. Fittings and Appurtenances	LS	1	$3,605	$3,605
7	AC Patch	LF	330	$20	$6,600

Project Subtotal	***$32,560***
Contingency	***$4,884***
Engineering	***$6,512***
Legal Admin.	***$977***
Project Total	***$44,933***

Project Number 25 – 13th Street - Franklin to Delaware

This project includes connection of 4" water lines on 13th Street between Franklin and Allegany; completion of 6" water line and replacement of 4" on 13th Street between Highway 101 and Baltimore and a 6" waterline between Baltimore to Chicago to Delaware. A cost estimate for this project is provided below:

Table 7.6.14
13th Street - Franklin to Delaware

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$6,956	$6,956
2	Demolition	LS	1	$4,174	$4,174
3	New 6-inch Waterline	LF	1240	$30	$37,200
4	Fire Hydrant Assembly	EA	3	$2,475	$7,425
5	Connections to Exist 6-inch	EA	3	$1,750	$5,250
6	Connections to Exist 4-inch	EA	2	$1,500	$3,000
7	Misc. Fittings and Appurtenances	LS	1	$9,275	$9,275
8	AC Patch	LF	1240	$20	$24,800

Project Subtotal	***$98,080***
Contingency	***$14,712***
Engineering	***$19,616***
Legal Admin.	***$2,942***
Project Total	***$135,350***

Project Number 26 – Hwy 101 13th to 14th & 15th to 17th

This project includes construction of 6" line sections on Highway 101 between 13th and 14th and 15th to 17th and then east on 17th to connection with the existing 6" line. This will feed into a weak delivery area of Bandon helping fire flows, especially when Project 27 is completed. A cost estimate for this project is provided below:

Table 7.6.15
Hwy 101 13th to 14th & 15th to 17

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$5,000	$5,000
2	Demolition	LS	1	$2,000	$2,000
3	New 6-inch Waterline	LF	950	$40	$38,000
4	Fire Hydrant Assembly	EA	1	$2,475	$2,475
5	Connections to Exist 6-inch	EA	4	$1,000	$4,000
6	Misc. Fittings and Appurtenances	LS	1	$8,895	$8,895
7	AC Patch	LF	950	$20	$19,000

Project Subtotal	***$79,370***
Contingency	***$11,906***
Engineering	***$15,874***
Legal Admin.	***$2,381***
Project Total	***$109,531***

Project Number 27 – Baltimore Ave. Extension South

This project includes construction of a 8" line south on Baltimore from 17th Street to connection with the new southern loop 12" line on 20th Street in the future. A cost estimate for this project is provided below:

Table 7.6.16
Baltimore Ave. Extension South

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$1,870	$1,870
2	Demolition	LS	1	$1,125	$1,125
3	New 8-inch Waterline	LF	830	$30	$24,900
4	Fire Hydrant Assembly	EA	2	$2,475	$4,950
5	Connections to Exist 6-inch	EA	1	$1,200	$1,200
6	Misc. Fittings and Appurtenances	LS	1	$6,210	$6,210
7	AC Patch	LF	830	$20	$16,600

Project Subtotal	***$56,855***
Contingency	***$8,528***
Engineering	***$11,371***
Legal Admin.	***$1,706***
Project Total	***$78,460***

Project Number 28 – Douglas and Bandon Extension to 8th Street

This project includes construction of 6" extensions on Douglas and Bandon Streets to 8th Street A cost estimate for this project is provided below:

Table 7.6.17
Douglas and Bandon Extension to 8th Street

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$2,940	$2,940
2	Demolition	LS	1	$1,765	$1,765
3	New 6-inch Waterline	LF	525	$25	$13,125
4	Fire Hydrant Assembly	EA	1	$2,475	$2,475
5	Connections to Exist 4-inch	EA	4	$1,000	$4,000
6	Misc. Fittings and Appurtenances	LS	1	$3,920	$3,920
7	AC Patch	LF	50	$20	$1,000

Project Subtotal	***$29,225***
Contingency	***$4,384***
Engineering	***$7,306***
Legal Admin.	***$877***
Project Total	***$41,792***

Project Number 29 – Chicago - 9th to 10th

This project includes construction of a 6" extension on Chicago between 9th and 10th Streets A cost estimate for this project is provided below:

Table 7.6.18
Chicago - 9th to 10th

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$1,720	$1,720
2	Demolition	LS	1	$1,035	$1,035
3	New 6-inch Waterline	LF	270	$25	$6,750
4	Fire Hydrant Assembly	EA	1	$2,475	$2,475
5	Connections to Exist 4-inch	EA	1	$1,000	$1,000
6	Connections to Exist 6-inch	EA	1	$1,500	$1,500
7	Misc. Fittings and Appurtenances	LS	1	$2,045	$2,045
8	AC Patch	LF	270	$20	$5,400

Project Subtotal	***$21,925***
Contingency	***$3,289***
Engineering	***$5,481***
Legal Admin.	***$658***
Project Total	***$31,353***

Project Number 30 – North Av., 3rd SE to 4th SE & June, Klamath, Lexington

This project involves completion of a local loop in the eastern service area just south of Highway 42S. A 6" line should be run from 3rd Street SE and North Avenue south and then west to the existing 4" on 4th SE. A 6" line should be installed on 4th SE west of Michigan to the end of the existing line 4" line. To complete the loop, an east-west connection of the southern ends of 4" lines on June, Klamath and Lexington is recommended. A cost estimate for this project is provided below:

Table 7.6.19
North Avenue, 3rd SE to 4th SE & June, Klamath, Lexington Connection

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$4,700	$4,700
2	Demolition	LS	1	$2,820	$2,820
3	New 6-inch Waterline	LF	875	$25	$21,875
4	Fire Hydrant Assembly	EA	1	$2,475	$2,475
5	Connections to Exist 4-inch	EA	4	$1,000	$4,000
6	Connections to Exist 6-inch	EA	2	$1,500	$3,000
7	Misc. Fittings and Appurtenances	LS	1	$6,270	$6,270
8	AC Patch	LF	875	$20	$17,500

Project Subtotal	***$62,640***
Contingency	***$9,396***
Engineering	***$15,660***
Legal Admin.	***$1,879***
Project Total	***$89,575***

Project Number 31 – 9th Street Extension to Jackson Avenue

This project consists of a 6" extension of the existing 4" line on 9th Street, west to Jackson Ave. This extension would have to be made between property lines at the end of a cul-de-sac, but will help provide additional fire flow to the area between 8th and 11th and Jackson and Franklin. A cost estimate for this project is provided below:

Table 7.6.20
9th Street Extension to Jackson Avenue

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$1,800	$1,800
2	Demolition	LS	1	$1,080	$1,080
3	New 6-inch Waterline	LF	260	$25	$6,500
4	Fire Hydrant Assembly	EA	1	$2,475	$2,475
5	Connections to Exist 4-inch	EA	1	$1,000	$1,000
6	Connections to Exist 10-inch	EA	1	$2,000	$2,000
7	Misc. Fittings and Appurtenances	LS	1	$2,395	$2,395
8	AC Patch	LF	50	$20	$1,000

Project Subtotal	***$18,250***
Contingency	***$2,738***
Engineering	***$4,563***
Legal Admin.	***$548***
Project Total	***$26,098***

Project Number 32– 2nd W Street Extension - Douglas to Edison

This project consists of a 6" extension westward of the existing 4" line on 2nd W line between Douglas and Edison. The end of the existing line is at the Coast Guard Station. This extension is on relatively steep terrain, but will help provide additional fire flow to the area between 1st and 4th and Edison and Oregon. A cost estimate for this project is provided below:

Table 7.6.21
2nd W Street Extension - Douglas to Edison

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$2,020	$2,020
2	Demolition	LS	1	$1,215	$1,215
3	New 6-inch Waterline	LF	320	$25	$8,000
4	Fire Hydrant Assembly	EA	1	$2,475	$2,475
5	Connections to Exist 4-inch	EA	1	$1,000	$1,000
6	Connections to Exist 10-inch	EA	1	$2,000	$2,000
7	Misc. Fittings and Appurtenances	LS	1	$2,695	$2,695
8	AC Patch	LF	50	$20	$1,000

Project Subtotal	***$20,405***
Contingency	***$3,061***
Engineering	***$5,101***
Legal Admin.	***$612***
Project Total	***$29,179***

Project Number 33 – 9th Street - Jackson to Beach Loop

This project completes a 10" through town connection with Beach Loop by way of 11th, Jackson and 9th. This project significantly improves fire flow delivery to the western part of currently developed Bandon. A cost estimate for this project is provided below:

Table 7.6.22
9th Street - Jackson to Beach Loop

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$12,585	$12,585
2	Demolition	LS	1	$7,550	$7,550
3	New 10-inch Waterline	LF	2000	$35	$70,000
4	Fire Hydrant Assembly	EA	4	$2,475	$9,900
5	Connections to Exist 10-inch	EA	2	$2,000	$4,000
6	Misc. Fittings and Appurtenances	LS	1	$16,780	$16,780
7	AC Patch	LF	2000	$20	$40,000

Project Subtotal	***$160,815***
Contingency	***$24,122***
Engineering	***$32,163***
Legal Admin.	***$4,824***
Project Total	***$221,925***

Project Number 34– Polaris to Beach Loop

This project extends the 8" on Polaris Street back to the 6" Beach Loop line to complete a loop through the south subdivision area. This project improves fire flow delivery. A cost estimate for this project is provided below:

Table 7.6.23
Polaris to Beach Loop

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$970	$970
2	Demolition	LS	1	$580	$580
3	New 8-inch Waterline	LF	75	$30	$2,250
4	Fire Hydrant Assembly	EA	1	$2,475	$2,475
5	Connections to Exist 8-inch	EA	2	$1,750	$1,750
6	Misc. Fittings and Appurtenances	LS	1	$1,295	$1,295
7	AC Patch	LF	75	$20	$1,500

Project Subtotal	***$9,320***
Contingency	***$1,398***
Engineering	***$2,330***
Legal Admin.	***$280***
Project Total	***$13,328***

Prioritization and SDC Eligibility

Section

8

Prioritization and SDC Eligibility

Section

8

8.1 Project Prioritization

Thirty-four recommended water system improvement projects have been developed in Section 7 of this Master Plan Addendum. Some projects are critical and should be undertaken as soon as possible. Others should be undertaken as funding becomes available. Still others have been developed for long-term planning purposes and will not be constructed unless development trends or other circumstances require it.

To assist the City in its planning efforts, the projects have been assigned a Priority Rating from 1 to 4 with 1 being the most critical projects and 4 being long-term planning projects. A brief description of each priority rating and the projects assigned that rating is provided below.

Priority 1 Projects

Priority 1 projects should be considered the most critical and should be undertaken as soon as funding can be made available. These projects include improvements that are considered necessary to maintain the quality of the system, maintain health or fire flow guidelines, and bring the system into compliance with the various regulatory agencies. It is recommended, in general, that planning be started immediately and construction completed by the year 2008.

Projects falling within this category include the planning and development of a raw water supply options to prevent the development of supply problems, a project to protect the City's steel reservoir investment, a raw water metering project to provide proper long term planning and resource use data and a number of distribution projects intended to provide the base for improved hydraulic performance in the Southern Service Area.

Priority 2 Projects

Priority 2 projects are typically important projects that should be undertaken as funding becomes available. Often these projects include important distribution system improvements and other important elements. While these projects are not included in the “critical” list, they should be considered as important and necessary for good water system performance. in general, the City should plan to begin planning for these projects no latter than 2008 and complete them by 2013.

Priority 3 Projects

Priority 3 projects typically include distribution projects that are not considered as critical. The projects should, however, be undertaken as funding becomes available or as conditions change, placing the project in a higher priority bracket. Projects within this category may be considered optional based on need, development levels, availability of funding, and system performance. As other public works projects arise in the vicinity of Priority 3 projects, the City should consider including the water system improvement projects in the planning process. For budgeting purposes, it should be assumed that planning for these projects will begin no latter than 2013 and that construction will be completed by 2018.

If the City is able to secure appropriate funding, Priority 3 projects should be developed. The City may wish to prioritize projects within the Priority 3 set to determine which projects shall be undertaken first.

Priority 4 Projects

Priority 4 projects include projects that depend on long-term conditions such as development, population growth, annexation issues, or new regulatory requirements. Priority 4 projects include improvements that may not be considered critical but would improve system efficiency and operation. For budget purposes, it is recommended that the City assume that planning will be started no latter than 2018 and construction completed by 2023.

8.2 System Development Charge (SDC) Definition

System development charges (SDCs) are fees assessed to new development within a utility or infrastructure system to compensate for the expenditures necessary to accommodate the new users. In the past, these were known as "impact fees". In Oregon, SDCs may consist of two parts in accordance with ORS 223.297 to 223.314. The first part is the reimbursement portion and the second part is the improvement portion. The collection of SDCs from new users of the water system should recover previously incurred costs for excess capacity and develop additional financing for water capital improvements necessary to service future water customers. The City should evaluate its current SDS charges to insure that they reflect actual reimbursement costs.

The eligibility of the capital improvement projects developed in the previous Section is addressed in this Section. Those portions of the recommended projects which are to be constructed to accommodate new growth may be considered as the basis for the improvement portion of Bandon water SDC's. The reimbursement portion for existing water system infrastructure will be developed in a separate report. That report will need to develop a defensible method for recovering excess capacity costs already incurred.

8.3 System Development Charge (SDC) Eligibility

Listed below in Table 8.3.1 are the proposed improvements as presented in Chapter 7. A percentage is estimated for each project presenting the portion which is constructed to provide or support new service. This is the SDC eligible portion. Those parts of projects which improve service to existing customers or are to be constructed to meet new regulatory requirements for existing customers are ineligible. Most projects will provide both functions.

New customer EDUs will comprise 29% of the total system EDUs by the end of this next 20 year period, based on the current estimate of 2655 EDUs and 3764 EDUs by 2023. Therefore projects which benefit all customers equally (and have a service life of at least 20 years) will have an SDC eligibility of 29%. For purposed of this report, these will be referred to as Type A projects.

Projects which are not required to serve current customers but rather are needed for future customers only will have an SDC eligibility of 100%. This will be referred to as Type B project.

Those projects in the southern, largely undeveloped portion of Bandon which increase fire protection for existing customers and also provide for new service will be functionally apportioned on the basis of 75% for new service and 25% for increased existing system fire protection. This will be a Type C project. The 25% portion for existing system fire protection will contain a 29% SDC eligibility sub-portion. Therefore the SDC eligibility of Type C projects will be [(0.25 x 0.29) + 0.75] x Project Cost or 82.25%.

Those projects within the developed portion of Bandon which are proposed generally for fire protection will be apportioned on the basis of 20% for new service and 80% for increased fire protection. This will be referred to as a Type D project. The SDS eligibility is calculated as: [(0.80 x 0.29) + 0.20] x Project Cost or 43.20%.

The prioritized projects as developed in Section 7 as listed below in Table 8.3.1 with an estimated SDC eligibility percentage.

Table 8.3.1
Bandon Prioritized Projects with SDC Eligible Costs

Project No.	Priority I Project Description	Total Project Cost	Type	SDC Eligible %	SDC Cost
3	Wind Hurst Reservoir Water Purchase Options (annual)	$1,864	A	29.00	$541
9	South Bandon 0.25 Million Gallon Reservoir & Pump Station	$670,042	B	100.00	$670,042
13	Harvard to Filmore to Seabird	$613,769	C	82.25	$504,825
14	Face Rock extension to Highway 101 - by 24th Street	$647,347	C	82.25	$532,443
24	Grand Avenue SE between 9th SE & 10 SE	$44,933	D	43.20	$19,411
33	9th Street - Jackson to Beach Loop	$221,925	D	43.20	$95,872
34	Polaris to Beach Loop	$13,328	D	43.20	$5,758
	Total Priority 1 Projects	***$2,213,208***			***$1,828,891***

Project No.	Priority II Project Description	Total Project Cost	Type	SDC Eligible %	SDC Cost
2	Johnson Creek Reservoir	$985,200	B	100.00	$985,200
4	Streaming Current Meter	$22,560	A	29.00	$6,542
5	UV Disinfection Equipment	$69,287	A	29.00	$20,093
11	Cathodic Protection Steel Reservoirs	$20,224	A	29.00	$5,865
16	Franklin 11th to 13th	$84,373	C	82.25	$69,397
18	Jackson 12th to Face Rock	$157,113	B	100.00	$157,113
21	Ohio Avenue - Highway 42S to 10th Street NE	$532,984	D	43.20	$230,249
26	Highway 101 - 13th to 14th & 15th to 17th	*$109,531*	D	43.20	$47,317
27	Baltimore Ave. Extension South	$78,460	B	100.00	$78,460
31	9th Street Extension to Jackson Avenue	$26,098	D	43.20	$11,274
	Total Priority 2 Projects	***$2,085,830***			***$1,611,511***
	Total Priority 1 & 2 Projects	***$4,299,038***			***$3,440,402***

Project No.	Priority III Project Description	Total Project Cost	Type	SDC Eligible %	SDC Cost
6	New Clarifier	$596,160	D	43.20	$257,541
7	Flow Measurement Equipment - Lower Pump Station	$33,092	A	29.00	$9,597
10	2nd Phase South Bandon 0.25 Million Gallon Reservoir	$385,688	B	100.00	$385,688
12	System-Wide Water Meter Replacement (annual)	$56,697	A	29.00	$16,442
17	Franklin 15th SE to 24th SE	$140,353	B	100.00	$140,353
22	10th Street NE - Michigan Ave. to Ohio Ave.	$304,816	C	82.25	$250,711
25	13th Street - Franklin to Delaware	***$135,350***	D	43.20	$58,471
28	Douglas and Bandon Extension to 8th Street	$41,792	B	100.00	$41,792
	Total Priority 3 Projects	***$1,693,948***			***$1,160,595***
	Total Priority 1, 2 & 3 Projects	***$5,992,986***			***$4,600,997***

Project No.	Priority IV Project Description	Total Project Cost	Type	SDC Eligible %	SDC Cost
1	Simpson Creek Reservoir Restoration	$503,060	B	100.00	$503,060
8	Sun Shade Filter Basins	$8,115	A	29.00	$2,353
15	Highway 101 - Seabird to Ocean Spray	$289,841	B	100.00	$289,841
19	Franklin 24th to Seabird	$200,417	B	100.00	$200,417
20	Jackson 24th to New South Tank Line	$106,025	B	100.00	$106,025
23	River Road to Michigan	$564,962	C	82.25	$464,681
29	Chicago - 9th to 10th	$31,353	D	43.20	$13,544
30	North Ave., 3rd SE to 4th SE & June, Klamath, Lexington	$89,575	C	82.25	$73,675
32	2nd W Street Extension - Douglas to Edison	$29,179	A	29.00	$8,462
	Total Priority 4 Projects	***$1,822,527***			***$1,662,059***
	Total Priority 1, 2, 3 & 4 Projects	***$7,815,513***			***$6,263,057***

System Development Charge (SDC) eligible costs of capital improvement projects may be paid with funds collected for this purpose from new development. The amount collected from new development as an SDC improvement portion can be no greater than required for the proposed capital improvements. (A SDC reimbursement portion, computed separately, may also be collected based on repayment for capital improvements already constructed with capacity available for the new users.)

However, it is not required under Oregon regulations, that only SDC funds may be used for the SDC eligible portion of these projects. Current water SDC charges ($1,333 per EDU) will not be adequate to provide for all SDC eligible portions of the water projects recommended in Table 8.3.1 above. Based on the projected growth rate for Bandon for the next 20 years, the City is expected to add 1,109 EDU's to the water system. At the current water SDC rate, this would provide only $1,478,300 of the $6,263,000 eligible water capital improvements portion.

A SDC update study for water, sewer, transportation, storm drainage and parks is currently being prepared. Based upon eligible costs in both the reimbursement category and the capital improvements category, maximum defensible SDC charges will be identified. It will be a policy decision by the City of Bandon whether to charge the full amount allowed under law or not.

Section
9

Financing and Prioritization

Section

9

Financing Options

Most communities are unable to finance major infrastructure improvements without some form of governmental funding assistance, such as low interest loans or grants. In this section, a number of major federal, state, and local funding programs appropriate for the recommended improvements are discussed.

9.1 Grant and Loan Programs

Some level of outside funding assistance in the form of grants or low interest loans will be necessary to make the proposed improvement projects affordable for the City of Bandon. The amount and types of outside funding will dictate the amount of local funding that the City must secure. In evaluating grant and local programs, the major objective is to select a program, or a combination of programs, which are best suited and available for the intended project.

A brief description of the major Federal and State funding programs that are typically utilized to assist qualifying communities in the financing of infrastructure improvement programs is given below. Each of the government assistance programs has certain prerequisites and requirements. These assistance programs promote such goals as aiding economic development, benefiting areas of low to moderate-income families, and providing for specific community improvement projects. With each program having specific requirements, not all communities or projects may qualify for every program

Economic Development Administration (EDA) Public Works Grant Program

The EDA Public Works Grant Program, administered by the U.S. Department of Commerce, is aimed at projects which directly create permanent jobs or remove impediments to job creation in the project area. Thus, to be eligible for this grant, a community must be able to demonstrate the potential to create jobs from the project. Potential job creation is assessed with a survey of businesses to demonstrate the prospective number of jobs that might be created if the proposed project was completed.

Proposed projects must be located within an EDA-designated Economic Development District. Priority consideration is given to projects that improve opportunities for the establishment or expansion of industry and that create or retain private sector jobs in both the near-term and long-term. Communities, which can demonstrate that their existing system is at capacity (i.e., moratorium on new connections), have a greater chance of being awarded this type of grant. EDA grants are usually in the range of the 50 to 80 percent of the project cost; therefore some type of local funding is also required. Grants typically do not exceed 1 million dollars.

Water and Waste Disposal Loans and Grants (RDA)

Until October 1, 1992, the U.S. Department of Agriculture, Farmers Home Administration (FmHA), administered these programs. These loans and grants are now administered by the newly formed Rural Development Administration (RDA) through Rural Utilities Service (RUS). While these programs are administered by a new agency, the program requirements are essentially the same as under the old FmHA.

The Rural Utilities Service (RUS) is one of three entities that comprise the USDA's Rural Development mission area. Administered by the USDA Rural Development office, the RUS supports various programs that provide financial and technical assistance for development and operation of safe and affordable water supply systems and sewer and other forms of waste disposal facilities.

The RDA has the authority to make loans to public bodies and non-profit corporations to construct or improve essential community facilities. Grants are also available to applicants who meet the median household income (MHI) requirements. Eligible applicants must have a population less than 10,000. Priority is given to public entities in areas smaller than 5,500 people to restore a deteriorating water supply, or to improve, enlarge, or modify a water facility and/or inadequate waste facility. Preference is given to requests that involve the merging of small facilities and those serving low-income communities.

In addition, borrowers must meet the following stipulations:

- Be unable to obtain needed funds from other sources at reasonable rates and terms.
- Have legal capacity to borrow and repay loans, to pledge security for loans, and to operate and maintain the facilities or services.
- Be financially sound and able to manage the facility effectively.
- Have a financially sound facility based on taxes, assessments, revenues, fees, or other satisfactory sources of income to pay all facility costs including operation and maintenance, and to retire the indebtedness and maintain a reserve.
- Water and waste disposal systems must be consistent with any development plans of State, multi-jurisdictional area, counties, or municipalities in which the proposed project is located. All facilities must comply with Federal, State, and local laws including those concerned with zoning regulations, health and sanitation standards, and the control of water pollution.

Loan and grant funds may be used for the following types of improvements:

- Construct, repair, improve, expand, or otherwise modify rural water supply and distribution facilities including reservoirs, pipelines, wells, pumping stations, water supplies, or water rights.
- Construct, repair, improve, expand, or otherwise modify waste collection, pumping, treatment, or other disposal facilities. Facilities to be financed may include such items as sewer lines, treatment plants, including stabilization ponds, storm sewer facilities, sanitary landfills, incinerators, and necessary equipment.
- Acquire a water supply or a water right.
- Legal and engineering costs connected with the development of facilities.
- Other costs related to the development of the facility including the acquisition of right-of-way and easements, and the relocation of roads and utilities.
- Finance facilities in conjunction with funds from other agencies or those provided by the applicant.

Interim commercial financing will normally be used during construction and Rural Development funds will be available when the project is completed. If interim financing is not available or if the project cost is less than $50,000, multiple advances of Rural Development funds may be made as construction progresses.

The maximum term on all loans is 40 years. However, no repayment period will exceed any statutory limitation on the organization's borrowing authority nor the useful life of the improvement of the facility to be financed. Interest rates are set quarterly and are based on current market yields for municipal obligations. Current interest rates may be obtained from any Rural Development office.

The following rates currently apply for the Rural Development program: (04/01/03).

> ***Market rate.*** Those applicants pay the market rate whose median household income (MHI) of the service area is more than the $40,916 (Oregon MHI). The market rate is currently 4.625 percent.
>
> ***Intermediate rate.*** The intermediate rate is paid by those applicants whose MHI of the service area is less than $40,916 but greater than $32,733. The intermediate rate is currently 4.50 percent.
>
> ***Poverty line rate.*** Those applicants whose MHI of the service area is below $32,733 (80 percent of the non-metropolitan MHI) pay the lowest rate. Improvements must also be to correct a regulatory violation or health risk issue to qualify for this lowest rate. The current poverty line rate is 4.5 percent.

Maximum grant amounts, based on MHI, are provided in Table 9.1.1. The grants are calculated on the basis of eligible costs that do not include the costs attributable to reserve capacity or interim financing. In addition, grant funds cannot be used to reduce total user costs below that of comparable communities funded by RUS.

Table 9.1.1
Maximum RDA Grant Funds Based On Median Household Income

Median Household Income (MHI)	Maximum Grant
<$28,641 and a regulatory violation or documented health	75%
$32,733 to $28,641	45%
>$40,916	0%

Eligibility for the Rural Water and Waste Disposal grants and loans are currently based on 2000 census data. The MHI in the City of Bandon, based on 2000 census data, is $ 29,492. At this MHI, the City is eligible for grant funding in the amount of 45%. The City may also be eligible for a RDA loan at the poverty line rate of 4.5 percent.

There are other restrictions and requirements associated with these loans and grants. If the City becomes eligible for grant assistance, the grant will apply only to eligible project costs. Additionally, grant funds are only available after the City has incurred long-term debt resulting in an annual debt service obligation equal to one-half percent of the MHI. In addition, an annual funding allocation limits the RDA funds. To receive an RDA loan, the City must secure bonding authority, usually in the form of general obligation or revenue bonds.

RDA will advise the applicant as to how to assemble information to determine engineering feasibility, economic soundness, cost estimates, organization, financing, and management matters in connection with the proposed improvements. If financing is provided, the RDA will also make periodic inspections to monitor project construction.

Applications for financial assistance are made at area offices of the RDA. For additional information on RDA loans and grant programs call 1-541-673-0136 or visit the RUS website at http://www.usda.gov/rus/water/.

The Oregon Rural Development website is http://www.rurdev.usda.gov/or/.

Emergency Community Water Assistance Grants (ECWAC)

Available through the USDA Rural Utilities Service (RUS) as part of the Water and Waste Disposal programs, ECWAC is available to communities when disaster strikes. Congress may appropriate funds for the program after a flood, earthquake, or other disaster if Federal assistance is warranted.

In order to receive assistance through an ECWAC grant, an applicant must fulfill the following requirements:

- Demonstrate that a significant decline in quantity or quality of water occurred within two years of the date the application was filed with RUS.
- Public bodies and nonprofit corporations serving rural areas, including cities or towns whose population does not exceed 10,000 people may be eligible.

Projects that are eligible for assistance include the following:

- Extend, repair or perform significant maintenance on existing water systems.
- Construct new water lines, wells, or other sources of water, reservoirs, and treatment plants.
- Replace equipment and pay costs associated with connection or tap fees.
- Pay related expenses such as legal and engineering fees and environmental impact analyses, or acquire rights associated with developing sources of treating, storing, or distributing water.
- Achieve compliance with the requirements of the Federal Water Pollution Control Act (33 U.S.C et seq.) or with the Safe Drinking Water Act when noncompliance is directly related to a recent decline in potable water quality.

The maximum grant available through ECWAC is $500,000. Grants for repairs, partial replacement, or significant maintenance on an established system cannot exceed $75,000. Otherwise, grants may be made for 100 percent of eligible project costs.

Applications are filed with any USDA Rural Development office. For additional information on RDA loans and grant programs call 1-541-673-0136 or visit the RUS website at http://www.usda.gov/rus/water/.

Technical Assistance and Training Grants (TAT)

Available through the USDA Rural Utilities Service (RUS) as part of the Water and Waste Disposal programs, TAT grants are intended to provide technical assistance and training to associations on a wide range of issues relating to the delivery of water and waste disposal services.

Rural communities with populations of less than 10,000 persons are eligible along with private, nonprofit organizations that have been granted tax-exempt status by the IRS.

TAT funds may be used for the following activities:

- Identify and evaluate solutions to water and/or waste related problems of associations in rural areas.
- Assist entities with preparation of applications for Water and Waste Disposal loans and grants.
- Provide training to association personnel in order to improve the management, operation and maintenance of water and/or waste disposal facilities.
- Pay expenses related to providing the technical assistance and/or training. This may include the preparation of a Water Master Plan.

Grants may be made for up to 100 percent of the eligible project costs. Applications are filed with any USDA Rural Development office. For additional information on RDA loans and grant programs call 1-541-673-0136 or visit the RUS website at http://www.usda.gov/rus/water/.

Oregon Community Development Block Grant (OCDBG) Program

The Community Development Program section of the Oregon Economic and Community Development Department (OECDD) administers the OCDBG Program. Funds for the program come from the U.S. Department of Housing and Urban Development. OCDBG funds under the Public Works category are targeted to water and wastewater systems.

The national objective of the program is the development of viable urban communities, by providing decent housing and a suitable living environment and expanding economic opportunities, principally for persons of low and moderate income. The State of Oregon has the following objectives for the funds it administers:

- Improving the availability and adequacy of public facilities and infrastructure;
- conserving the existing housing supply and improving housing conditions;
- increasing the supply of housing affordable to low and moderate income persons – particularly those with the lowest incomes; and
- increasing business and employment opportunities.

Only non-metropolitan cities and counties in rural Oregon can apply for and receive grants. Eligible activities include the following:

- Community Facilities
- Housing Rehabilitation
- Public Works Water and Sewer Improvements
- Public Works Infrastructure for New Housing
- Emergency Projects
- Section 108 Loan Guarantees

In 2003, Oregon expects $16.630 million dollars in federal funds under this program. Of that amount, $432,600 will be used for State Administration and $166,300 for technical assistance, leaving approximately $16 million to provide improvement grants to qualified applicants. OCDBG grants are available for each of three phases necessary to complete water and/or wastewater system improvements.

- Phase 1: Technical assistance grants for planning and grant applications. Maximum grant $30,000.
- Phase 2: Grants for engineering, financial analysis, and environmental assessment.
- Phase 3: Grants for construction.

Total public works project grants are limited to $750,000 for the combined total of all phases. Grants awarded may be used for the following public works applications:

- Projects which are necessary to bring municipal water and sewer systems into compliance with:
  - ⇒ The requirements of the Safe Drinking Water Act or the Clean Water Act administered by the Oregon Health Division (OHD)
  - ⇒ The requirements of water quality statutes, rules or permits administered by the Oregon Department of Environmental Quality (DEQ) or the Environmental Quality Commission (EQC)
- Projects where the municipal system has not been issued a notice of non-compliance from the Oregon Health Division or the Department of Environmental Quality. The department may determine that a project is eligible for assistance if there is a high probability that within two years the system will be notified of non-compliance and it is reasonable and prudent to use program funds to bring the water or sewer system into compliance with current regulations or requirements proposed to take effect within the next two years.

Applications may now be submitted year-round for Public Works grants under the OCDBG Program. Only cities and counties may apply. To be eligible, a city must have at least 51 percent residents with low or moderate incomes, based on 2000 census data or a local survey. Based on survey results, and as listed in Appendix A - Eligible Applicants for 2002 Programs from the Oregon Economic and Community Development Program. As of the 2000 Census, 56.7 percent of residents in Bandon are classified as Low/Moderate Income.

For additional information on the OCDBG programs, call 1-800-233-3306 or visit the OECDD website at http://www.econ.state.or.us/cdbg.htm.

Oregon Special Public Works Fund

The Special Public Works Fund (SPWF) program provides financing to local governments to construct, improve, and repair infrastructure in order to support local economic development and create new jobs locally, especially family wage jobs. In order to be eligible, the following conditions must be satisfied.

- The existing infrastructure must be insufficient to support current or future industrial or eligible commercial development; and
- there must be a high probability that family wage jobs will be created or retained within:
  - ⇒ the boundary to be served by the proposed infrastructure project; or
  - ⇒ industrial or eligible commercial development of the properties served by the proposed infrastructure project.

The SPWF program is capitalized through biennial appropriations from the Oregon Lottery Economic Development Fund by the Oregon State Legislature, through bond sales for dedicated project funds, through loan repayments and other interest earnings. The Oregon Economic and Community Development Department (OECDD) administers the fund. Cities are eligible applicants and the following criteria is used to determine project eligibility.

Firm Business Commitment. In addition to creating or retaining permanent jobs as a result of the project, there must be private and/or public investment in the project equal to at least twice the SPWF funding. Firm business commitment can be characterized by the following:

- Specific industrial/manufacturing and eligible commercial businesses committing to create permanent full-time-equivalent jobs.
- Up to $10,000 in grant funds may be awarded for each full-time-equivalent job created (based on demonstrated financial need).
- Of jobs created, 30 percent must be "family wage" jobs.
- Public and/or private investment equal to at least 2x infrastructure cost.

Capacity Building. Capacity building efforts can be characterized by the following:

- Infrastructure capacity to support industrial/manufacturing development.
- Document recent interest by eligible business(s) in locating within the municipality.
- Demonstrate ongoing marketing efforts of industrial lands.
- Demonstrate distressed community status. Grant funds of up to $250,000 per project may be awarded to distressed communities without a firm business commitment.

All projects must principally benefit industrial or eligible commercial users.

The SPWF is primarily a loan program. Grant funds are available based upon economic need of the municipality. The maximum loan term is 25 years, though loans are generally made for 20-year terms. The grant/loan amounts are determined by a financial analysis based on a demonstrated need and the applicant's ability or inability to afford additional loans (debt capacity, repayment sources and other factors). Borrowers that are "credit worthy" may be funded through the sale of state revenue bonds. Loans are generally repaid with utility revenues, local improvement districts (LIDs), general funds, or voter approved bond issues.

Determination of the final amount of financing and the loan/grant/bond mix will be based on the financial feasibility of the project, the individual credit strength of an applicant, the ability to assess specially benefited property owners, the ability of the applicant to afford annual payments on loans from enterprise funds or other sources, future beneficiaries of the project, and six other applicable issues.

The maximum SPWF loan per project is $10 million, if funded from SPWF revenue bond proceeds. Projects financed directly from the SPWF may receive up to $1 million. The maximum SPWF grant is $500,000 for a construction project and cannot exceed 85 percent of the total project cost. Grants are made only when loans are not feasible.

Technical Assistance grants and loans may finance preliminary planning and engineering studies and economic investigations to determine infrastructure feasibility. Up to $10,000 in grant funds and $20,000 in additional loan funds may be awarded to eligible applicants with under 5,000 persons living within the City.

For additional information on the OCDBG and other OECDD programs, call 1-800-233-3306 or visit the OECDD website at http://www.econ.state.or.us/spwf.htm.

Water/Wastewater Financing Program

The 1993 Legislature created the Water/Wastewater Financing Program for communities that must meet Federal and State mandates to provide safe drinking water and adequate treatment and disposal of wastewater. The legislation was intended to assist local governments in meeting the Safe Drinking Water Act and the Clean Water Act.

Funding for the program is capitalized through a biennial appropriation from the Oregon Lottery Economic Development Fund by the Oregon State Legislature. The Oregon Economic and Community Development Department (OECDD) administers the program.

Program eligibility is limited to projects necessary to ensure compliance with the applicable State regulatory agency standards or rules. Cities, counties, districts and other public entities are eligible for the program. Eligible activities include the following:

- Water source, treatment, storage, and distribution improvements.
- Wastewater collection and capacity.
- Storm system.

- Purchase of rights-of-way and easements necessary for infrastructure development.
- Design and construction engineering.

While loans and grants may be awarded, grant funding must be accompanied by loans from the Community Development Program. Loans are based on a municipality's ability to repay. Grant funding is available only if a loan is not feasible. OECDD will structure a financing package that may include direct loans, bond loans, and/or grants and may include funds from other Community Development programs for which the project is eligible. The mix of loan/grant/bond financing will depend on the financial feasibility of the project and will consider utility rates, per capita income, existing debt, and other factors.

The limitations on the eligible projects and related funding assistance is summarized below:

- Projects financed with bond funds
  Loan - max. $10 million
  Grant - max. $500,000

- Projects financed with SPWF funds (lottery funds)
  Loan - max. $500,000
  Grant - max. $500,000

- Technical Assistance (for eligible applicants under 5,000 population)
  Loan - max. $20,000
  Grant - max. $10,000

Interested applicants should contact OECDD prior to submitting an application. Applications are accepted year-round. For additional information on this and other OECDD programs, call 1-800-233-3306 or visit the OECDD website at http://www.econ.state.or.us/wtrww.htm.

Drinking Water State Revolving Fund (DWSRF)

Each year the state of Oregon Health Division receives an allotment from the Federal Government for the Safe Drinking Water Revolving Loan Fund. A water system must submit a letter of interest by May of each year to receive funding for the following. The funds along with a 20 percent state match are used to make low interest loans to finance needed drinking water system improvements. As of May 2000, a change in the DWSRF policy allows disadvantaged communities to receive up to $250,000 or 25 percent of the loan amount (whichever is less) in the form of principal forgiveness for water safety improvement projects. Funds may be used for the following types of activities:

- **Planning**: Master Plans, pilot studies, and feasibility studies that are part of a compliance related construction project.
- **Preliminary and Final Engineering and Design**: Surveying, legal review, preparation of engineering drawings, and specifications for construction. Also, costs necessary for recipients to contract environmental review services.
- **Construction Costs**: All aspects of a public water system from source of supply, filtration, treatment, storage, transmission, and metering.

- **Source Water Protection**: As part of a source water management plan for a watershed or a delineated source water protection area for a well. Up to $100,000 may be loaned.

- **Property Acquisition**: The acquisition of real property directly related to or necessary for the proposed project including rights-of-way, easements, and facility sites.

- **Anti-Terrorism**: Project can include or consist of the cost to add or improve security measures to protect drinking water facilities.

While many activities are eligible for DWSRF financing, the following activities are considered ineligible activities:

- Dams or rehabilitation of dams.

- Purchase of water rights, except if the water rights are owned on a system that is being purchased through a consolidation project.

- Reservoirs, except for finished water reservoirs and those reservoirs that are part of the treatment process.

- Administrative costs.

- Operation and maintenance expenses.

- Projects primarily intended to supply or attract future growth.

The program's financing is available to all sizes of water systems. Municipal, nonprofit and privately owned community water systems are eligible, as well as nonprofit non-community systems. Terms of the loan are 20 years at 80 percent of the state/local bond rate. Financially disadvantaged applicants can get up to a 30-year loan at an interest rate of 1 percent, as well as the possibility of some principal forgiveness. The loan limit per project has been increased from $2 million to $4 million as of May 2000.

The Oregon Health Division and the Oregon Economic and Community Development Department (OECDD) rate proposed projects. Highest ratings are given to projects that present the following:

- Project addresses the most serious risk to human health.

- Project is necessary to ensure Safe Drinking Water Act compliance.

- Applicant has the greatest financial need, on a per household basis, according to affordability criteria.

Special consideration is given to projects at small water systems that serve 10,000 or fewer people, consolidating or merging with another system as a solution to a compliance problem, and which have an innovative solution to the stated problem.

Additional consideration will be given to disadvantaged communities. The definition of a disadvantaged community has changed to one in which the ratio of average annual water rate to the local median household income exceeds 1.75 percent. Determination of the median household income is based upon the 2000 Census, with the possibility of special surveys where incomes might have fallen. The above ratio is subject to adjustment.

Applicants with 300 or more service connections are eligible for assistance with final design and construction projects only if they maintain a current, approved master plan that evaluates the needs of the water system for at least a twenty-year period and includes the major elements outlined in OAR 333-061-0060(5). Systems with less than 300 service connections may receive funding for an engineering feasibility analysis instead of a master plan.

Interested parties should contact the OECDD for details. For additional information on the DWSRF programs, call 1-800-233-3306 or visit the OECDD website at http://www.econ.state.or.us/safe_wtr.htm.

State Water Resources Department: Water Development Loan Fund

The Water Development Loan Fund (WDLF) may grant loans to individuals, cities, local governments, and other public and private entities. The goal of the fund is to provide low-cost, long-term, fixed-rate financing incentives that promote projects that achieve the state's long-term water management goals.

Eligible projects include:

- **Drainage projects:** facilities installed to provide for the removal of excess water to increase soil versatility and productivity.
- **Irrigation projects:** facilities designed to provide water to land for the purpose of irrigation.
- **Community water supply project:** an undertaking, in whole or in part, in Oregon for the purpose of providing water for municipal use. A community is an incorporated or unincorporated town or locality with more than three service connections and a population of less than 30,000 people.
- **Fish protection project:** an undertaking, in whole or in part, in Oregon for the purpose of watershed protecting fish or fish habitat.
- **Watershed project:** a water development project in Oregon that provides more than one use. The primary use of the project must be one of the uses listed above. Secondary uses may include other water uses that are compatible with the primary use.

Funds to finance a water development project are obtained through the issuance and sale of self-liquidating bonds. The bonds are repaid by participants in the program and at no cost to the state or the Oregon taxpayer. The amount and type of loan security required depends on the borrower and the type of project. A first lien on real estate is required security for all loans. Other security may also be required.

Interested parties should contact the Water Resources Department for details. For additional information on the WDLF programs, call 1-800-624-3199 or visit the WRD website at http//www.wrd.state.or.us.

Oregon Department of Energy, Small Scale Energy Loan Program (SELP)

The SELP program was created by voters in 1980 and offers loans to projects whose purpose is to promote energy conservation and renewable energy resource development. Eligible applicants include cities, counties, special districts, individuals, and non-profit groups. Loans will cover up to 100 percent of construction costs, including engineering, fees, and studies. The finished project must at least break even in power costs.

The program offers low-interest loans for projects that:

- conserve natural gas, electricity, oil, or other source of energy;
- produce energy from renewable resources such as water, wind, geothermal, solar, biomass, waste materials or waste heat; and
- use recycled materials to create products.

Interested parties should contact the Oregon Office of Energy for details. For additional information on the Office of Energy programs, call 1-503-378-4040 or visit the Office of Energy website at http://www.energy.state.or.us.

9.2 Local Funding Sources

The amount and type of local funding obligations for infrastructure improvements will depend, in part, on the amount of grant funding anticipated and the requirements of potential loan funding. Local revenue sources for capital expenditures include ad valorem taxes, various types of bonds, service charges, connection fees, and system development charges. The following sections identify those local funding sources and financing mechanisms that are most common and appropriate for the improvements identified in this study.

General Obligation Bonds

A general obligation (G.O.) bond is backed by the full faith and credit of the issuer. For payment of the principal and interest on the bond, the issuer may levy ad valorem general property taxes. Such taxes are not needed if revenue from assessments, user charges or some other source are sufficient to cover debt service.

Oregon Revised Statutes limit the maximum term to 40 years for cities. Except in the event that Rural Development Administration will purchase the bonds, the realistic term for which general obligation bonds should be issued is 15 to 20 years. Under the present economic climate, the lower interest rates will be associated with the shorter terms.

Financing of water system improvements by general obligation bonds is usually accomplished by the following procedure:

- Determination of the capital costs required for the improvement.
- An election authorizing the sale of general obligation bonds.
- Following voter approval, the bonds are offered for sale.
- The revenue from the bond sale is used to pay the capital costs associated with the projects.

From a fund raising viewpoint, general obligation bonds are preferable to revenue bonds in matters of simplicity and cost of issuance. Since the bonds are secured by the power to tax, these bonds usually command a lower interest rate than other types of bonds. General obligation bonds lend themselves readily to competitive public sale at a reasonable interest rate because of their high degree of security, their tax-exempt status, and their general acceptance.

These bonds can be revenue-supported wherein a portion of the user fee is pledged toward payment of the debt service. Using this method, the need to collect additional property taxes to retire the obligated bonds is eliminated. Such revenue-supported general obligation bonds have most of the advantages of revenue bonds, but also maintain the lower interest rate and ready marketability of general obligation bonds. Because the users of the water system pay their share of the debt load based on their water usage rates, the share of that debt is distributed in a fare and equitable manner.

Advantages of general obligation bonds over other types of bonds include:

- The laws authorizing general obligation bonds are less restrictive than those governing other types of bonds.
- By the levying of taxes, the debt is repaid by all property benefited and not just the system users.
- Taxes paid in the retirement of these bonds are IRS-deductible.
- General obligation bonds offer flexibility to retire the bonds by tax levy and/or user charge revenue.

The disadvantage of general obligation bond debt is that it is often added to the debt ratios of the underlying municipality, thereby restricting the flexibility of the municipality to issue debt for other purposes. Furthermore, general obligation bonds are normally associated with the financing of facilities that benefit an entire community and must be approved by a majority vote and often necessitate extensive public information programs. A majority vote often requires waiting for a general election in order to obtain an adequate voter turnout. Waiting for a general election may take years, and too often a project needs to be undertaken in a much shorter period of time.

Revenue Bonds

The general shift away from ad valorem property taxes and toward a greater reliance on user fees makes revenue bonds a frequently used option of long-term debt. These bonds are an acceptable alternative and offer some advantages to general obligation bonds. Revenue bonds are payable solely from charges made for the services provided. These bonds cannot be paid from tax levies or special assessments; their only security is the borrower's promise to operate the system in a way that will provide sufficient net revenue to meet the debt service and other obligations of the bond issue.

Many communities prefer revenue bonding, as opposed to general obligation bonding because it insures that no tax will be levied. In addition, debt obligation will be limited to system users since repayment is derived from user fees. Another advantage of revenue bonds is that they do not count against a municipality's direct debt, but instead are considered "overlapping debt." This feature can be a crucial advantage for a municipality near its debt limit or for the rating agencies, which consider very closely the amount of direct debt when assigning credit ratings. Revenue bonds also may be used in financing projects extending beyond normal municipal boundaries. These bonds may be supported by a pledge of revenues received in any legitimate and ongoing area of operation, within or outside the geographical boundaries of the issuer.

Successful issuance of revenue bonds depends on the bond market evaluation of the revenue pledged. Revenue bonds are most commonly retired with revenue from user fees. Recent legislation has eliminated the requirement that the revenues pledged to bond payment have a direct relationship to the services financed by revenue bonds. Revenue bonds may be paid with all or any portion of revenues derived by a public body or any other legally available monies. In addition, if further security to finance revenue bonds is needed, a public body may mortgage grant security and interests in facilities, projects, utilities or systems owned or operated by a public body.

Normally, there are no legal limitations on the amount of revenue bonds to be issued, but excessive issue amounts are generally unattractive to bond buyers because they represent high investment risks. In rating revenue bonds, buyers consider the economic justification for the project, reputation of the borrower, methods and effectiveness for billing and collecting, rate structures, provision for rate increases as needed to meet debt service requirements, track record in obtaining rate increases historically, adequacy of reserve funds provided in the bond documents, supporting covenants to protect projected revenues, and the degree to which forecasts of net revenues are considered sound and economical.

Municipalities may elect to issue revenue bonds for revenue producing facilities without a vote of the electorate (ORS 288.805-288.945). In this case, certain notice and posting requirements must be met and a 60-day waiting period is mandatory. A petition signed by five percent of the municipality's registered voters may cause the issue to be referred to an election.

Improvement Bonds

Improvement (Bancroft) bonds can be issued under an Oregon law called the Bancroft Act. These bonds are an intermediate form of financing that is less than full-fledged general obligation or revenue bonds, but is quite useful especially for smaller issuers or for limited purposes.

An improvement bond is payable only from the receipts of special benefit assessments, not from general tax revenues. Such bonds are issued only where certain properties are recipients of special benefits not accruing to other properties. For a specific improvement, all property within the improvement area is assessed on an equal basis, regardless of whether it is developed or undeveloped. The assessment is designed to apportion the cost of improvements, approximately in proportion to the afforded direct or indirect benefits, among the benefited property owners. This assessment becomes a direct lien against the property, and owners have the option of either paying the assessment in cash or applying for improvement bonds. If the improvement bond option is taken, the City sells Bancroft improvement bonds to finance the construction, and the assessment is paid over 20 years in 40 semi-annual installments with interest. Cities and special districts are limited to improvement bonds not exceeding three percent of true cash value.

With improvement bond financing, an improvement district is formed, the boundaries are established, and the benefited properties and property owners are determined. The engineer usually determines an approximate assessment, either on a square foot or a front-foot basis. Property owners are then given an opportunity to object to the project assessments. The assessments against the properties are usually not levied until the actual cost of the project is determined. Since this determination is normally not possible until the project is completed, funds are not available from assessments for the purpose of making monthly payments to the contractor. Therefore, some method of interim financing must be arranged, or a preassessment program, based on the estimated total costs, must be adopted. Commonly, warrants are issued to cover debts, with the warrants to be paid when the project is complete.

The primary disadvantage to this source of revenue is that the property to be assessed must have a true cash value of at least 50 percent of the total assessments to be levied. As a result, a substantial cash payment is usually required by owners of undeveloped property. In addition, the development of an assessment district is very cumbersome and expensive when facilities for an entire community are contemplated. In comparison, general obligation bonds can be issued in lieu of improvement bonds, and are usually more favorable.

Capital Construction (Sinking) Fund

Sinking funds are often established by budgeting for a particular construction purpose. Budgeted amounts from each annual budget are carried in a sinking fund until sufficient revenues are available for the needed project. Such funds can also be developed with revenue derived from system development charges or serial levies.

A city may wish to develop sinking funds for each sector of the public services. The fund can be used to rehabilitate or maintain existing infrastructure, construct new infrastructure elements, or to obtain grant and loan funding for larger projects.

The disadvantage of a sinking fund is that it is usually too small to undertake any significant projects. Also, setting aside money generated from user fees without a designated and specified need is not generally accepted in the municipal budgeting process.

Connection Fees

Most cities charge connection fees to cover the cost of connecting new users to water and wastewater systems. Based on recent legislation, connection fees can no longer be programmed to cover a portion of capital improvement costs.

The City of Bandon has established a charge of $300 for a meter deposit to connect new services to the municipal water system.

System Development Charges

A system development charge (SDC) is essentially a fee collected as each piece of property is developed, and which is used to finance the necessary capital improvements and municipal services required by development. Such a fee can only be used to recover the capital costs of infrastructure. Operating, maintenance, and replacement costs cannot be financed through system development charges.

The Oregon Systems Development Charges Act was passed by the 1989 Legislature (HB 3224) and governs the requirements for systems development charges effective July 1, 1991. Two types of charges are permitted under this act: 1)-improvement fees, and 2) reimbursement fees. SDCs charged before construction are considered improvement fees and are used to finance capital improvements to be constructed. After construction, SDCs are considered reimbursement fees and are collected to recapture the costs associated with capital improvements already constructed or under construction. A reimbursement fee represents a charge for utilizing excess capacity in an existing facility paid for by others. The revenue generated by this fee is typically used to pay back existing loans for improvements.

Under the Oregon Systems Development Charges Act, methodologies for deriving improvement and reimbursement fees must be documented and available for review by the public. A capital improvement plan must also be prepared which lists the capital improvements that may be funded with improvement fee revenues, and the estimated cost and timing of each improvement. However, revenue from the collection of SDCs can only be used to finance specific items listed in a capital improvement plan and to pay for the new user's share of existing excess capacity. The projects and costs developed in this Water Master Plan Amendment may be used for this purpose. SDCs cannot be assessed on portions of the project paid for with grant funding.

The City of Bandon has an active SDC program for the water system. The water system SDC varies depending on the type of the service being developed. For example, according to the fee schedule last revised 8/22/02, a single family dwelling water service has a charge of $1,333.

Local Improvement District (LID)

A local improvement district (LID) or multiple LIDs can be formed by the City to be responsible for securing and repaying debt. A LID incorporates property owners within a defined boundary who agree to fund all or a portion of an improvement project. LID projects are best suited for improvements that benefit a limited number of users rather than the entire system.

The City may be required to assist in the LID process through facilitation and administration of the project. Agreements should be prepared detailing who will pay for engineering and planning costs, administration costs, interim financing, and other costs related to a public works project.

The LID formation process requires public hearings, at which, a remonstrance (no vote) of two thirds of the influenced area can halt the process. A successful LID project can result in liens against the LID properties at the end of the project or a full payment from all or some of the property owners.

Disadvantages to a LID include the requirement of a significant amount of time and interest from the City if they choose to administer the LID. It is not uncommon to have some or many residents within the LID boundary that are opposed to the project. Those in opposition to the LID must either rally enough support to derail the project or work for some other compromise. The political and administrative fallout is often borne by the City and its representatives.

Ad Valorem Taxes

Ad valorem property taxes are often used as revenue source for utility improvements. Property taxes may be levied on real estate, personal property, or both. Historically, ad valorem taxes were the traditional means of obtaining revenue to support all local governmental functions.

A marked advantage of these taxes is the simplicity of the system; it requires no monitoring program for developing charges, additional accounting and billing work is minimal, and default on payments is rare. In addition, ad valorem taxation provides a means of financing that reaches all property owners that benefit from a water system, whether a property is developed or not. The construction costs for the project are shared proportionally among all property owners based on the assessed value of each property.

Ad valorem taxation, however, is less likely to result in individual users paying their proportionate share of the costs as compared to their benefits. In addition, the ability of communities to levy property taxes has been limited with the passage of Ballot Measure 5 and other subsequent legislation. While the impacts of the various legislative efforts are still unclear, capital improvement projects are exempt from property tax limitations if new public hearing requirements are met and an election is held.

User Fee

User fees can be utilized to retire general obligation bonds, and are commonly the sole source of revenue to retire revenue bonds and to finance operation and maintenance. User fees represent monthly charges for all residences, businesses, and other users that are connected to the applicable system. These fees are established by resolution and can be modified, as needed, to account for increased or decreased operating and maintenance costs.

User fees should be based on a metered volume of water consumption. Through metered charges, an equitable and fair system of recovering water system costs is used. Flat fees and unmetered connections should be avoided. Large water users should pay a larger portion of the water system costs; This can be accomplished through higher rates and metered billing.

The monthly base rate for water service is $6.80, and the volumetric rate is $0.815 per 1000 gallons for inside residential users. The monthly base rate for outside residential users is $27.78 with a volumetric rate of $1.358 per 1000 gallons. Basic commercial rates are the same.

Assessments

Under special circumstances, the beneficiary of a public works improvement may be assessed for the cost of a project. For example, the City may provide some improvements or services that directly benefit a particular development. The City may choose to assess the industrial or commercial developer to provide up-front capital to pay for the administered improvements.

9.3 Recommended Funding

The City should begin investigating and developing funding as soon as possible for the Priority 1 and Priority 2 improvements as developed in Section 7 of this Plan. Letters of interest should be submitted to place the City on the Project Priority Lists if Federal or State Funding is to be considered.

Bandon has an unusually low rate structure which precludes the City from grant funding eligibility. This is because Federal and State grant programs require that water rates at least equal the average State water rate (which is currently about $38 per month) before grants are offered. The City would not be eligible for loans until this rate amount is reached. The loan programs generally require that loan payment amounts be generated from user rates and that rates be raised to accommodate these loan repayment amounts as well as cover actual operations and maintenance costs for the water system.

Two factors in Bandon would help the City in terms of obtaining funds to design and construct the recommended improvements. Those factors are:

- Population of approximately 2,833 (small community)
- 2000 census Median Household Income (MHI) of $29,492

Because of the Median Household Income in Bandon, the City is eligible for low interest loans to cover the project's cost. Generally, water rates must be increased somewhat for a city to accrue the funds required to make the annual loan payments. Once the debt service on loans results in a water rate near the State average, additional eligible improvements may be funded with grant monies when a city is otherwise eligible for grants. Based on the average inside residential customer use of 4343 gallons per month, a base fee of $6.80, and the volumetric rate is $0.815 per 1000 gallons month, the average water bill for inside residential users is $10.34. A major rate increase would be required to qualify for government program grant funding.

Priority 1 Improvements

For Priority 1 Improvements the City should consider:

- Re-allocation of Johnson Creek set aside funds for Priority I Projects
- Use of available SDC funds for eligible portions of Priority I Projects
- Water rate increase to begin covering project costs.
- Use of available City discretionary funds
- General Obligation bond funding

Priority 2 Improvements

For Priority 2 Improvements the City should consider developing or applying for:

- Revenue Bonds
- Loan from the Rural Development Water and Waste Program

Priority 3 Improvements

Priority 3 improvements are not considered critical at this time. However, the City may consider constructing some or all of the projects in this priority at a later date. Funding for the projects can also be developed at a later date using public funding sources if the future water rate structure allows grant and low interest loan eligibility.

Priority 4 Improvements

Priority 4 improvements are provided for long-term planning. LIDs, SDCs, and developer participation will be the likely sources of funding for a portion of these projects. If development pressures do not require the construction of Priority 4 infrastructure, these projects may not be undertaken.

9.4 Impact to Ratepayers

Construction of the proposed projects may require ratepayers in the City to pay higher rates for water service. Approval of a project that creates a rate increase will not be an easy decision for the Council. However, the City's water system does need improvement and failure to construct the projects now may increase the cost and possibly the scope of the projects if constructed later. The City should begin a public relations campaign to explain the need for the projects to ratepayers. Feedback from public hearings can be anticipated and should be addressed to educate the ratepayers on the importance of the projects. A well-informed public will enhance the acceptance of the projects and improve the City's opportunity to pass a bond issue.

Any planned improvements must be funded with new funding sources. New funding sources include loans or internal funding. Loans and increased internal funding will require a rate increase to cover the loan payment and the capital improvement fund transfers.

As previously mentioned, one of the typical requirements for obtaining grants is that the community's average residential water bill is at least equal to the state average. According to various funding agencies, the statewide average water bill is approximately $38.00 per month. Generally, communities that do not charge at least the state average water rate will not likely qualify for grant programs. Typically, funding agencies state that they do not subsidize water system improvements so that communities can maintain low water rates.

The potential impact to ratepayers was estimated for each set of priority projects. The analysis assumed the City would obtain a 20-year internal revenue loan at an interest rate of 3.50 percent for Priority I improvements and external revenue loans at an interest rate of 5.5 percent for Priority II through IV improvements. The monthly re-payment per $ 1 million for a 20 year loan is $5,799.60 at 3.5% and $6,878.87 at 5.5%. Based on the 2003-2004 budget, it was assumed the City has approximately $620,000 in available SDC funds and $150,000 available for the Johnson Creek Reservoir which should be re-allocated to "seed" the Priority 1 projects.

The projected rate increases are based on two scenarios. The first assumes that all projects are undertaken immediately. The second assumes that Priority I projects are completed within the next 5 year period, that Priority II projects are completed within the following 5 year period and so on. The burden of the loan payments is spread out over the existing 2,655 EDU's within the City system for the first scenario. For the second scenario, the Priority II (yr 2008 to 2013) project rate base is assumed to be provided by 2897 EDUs, the Priority III (yr 2013-2018) project rate base by 3161 EDUs and the Priority IV (yr 2018 to 2023) project rate base by 3449 EDUs.

Under the second scenario, it is also assumed that Priority II through IV projects will have 5 years of accumulated SDC payments to help offset the project costs. For Priority II projects, 242 new EDU's expected between 2003 to 2008 and providing $1,333 each will be assumed to provide $322,586 as "Funding from Other Sources". For Priority III projects, 264 new EDU's expected between 2008 to 2013 and providing $1,333 each will be assumed to provide $351,912. For Priority IV projects, 288 new EDU's expected between 2013 to 2018 and providing $1,333 each will be assumed to provide $383,904. Of course, if SDC rates are adjusted upward in the future, the contribution share will change.

An annual cost adjustment of 3% has been made to project costs under the second scenario, staged project approach.

Impact to Ratepayers – Priority 1

Constructed During	Cost of Projects	Funding from Other Sources	Required Loan Amt	Monthly Payment	Monthly EDU Pay.
Yrs 2003-2008	$2,213,208	$770,000	$1,443,208	$8,370.03	$3.15

Priority 1 projects include the "south loop" water line project (12" line - Harvard to Filmore to Seabird) and water reservoir with pump station in the Beach Loop/Seabird area as well as other fire flow reinforcement projects. It also includes a recommendation to enter into a purchase option for Windhurst water if possible. If the City were to undertake all Priority 1 projects, the potential monthly impact to rate payers is equal to a rate increase of approximately $3.15 per EDU.

Impact to Ratepayers – Priority 2

Constructed During	Cost of Projects	Funding from Other Sources	Required Loan Amt	Monthly Payment	Monthly EDU Pay.
Yrs 2003-2008	$2,085,830	$0	$2,085,830	$14,348.15	$5.40
Yrs 2008-2013	$2,418,048	$322,586	$2,095,462	$14,414.41	$4.98

Priority 2 projects include a number of distribution system improvements and the installation of plant improvement equipment Priority 2 projects will generally improve hydraulic performance.

The cumulative impact to ratepayers for Priorities 1 and 2, if undertaken together, is $ 8.55.

Impact to Ratepayers – Priority 3

Constructed During	Cost of Projects	Funding from Other Sources	Required Loan Amt	Monthly Payment	Monthly EDU Pay.
Yrs 2003-2008	$1,693,948	$0	$1,693,948	$11,652.45	$4.39
Yrs 2013-2018	$2,276,525	$351,912	$1,924,613	$13,239.16	$4.19

Priority 3 projects include a new water plant clarifier, flow measurement equipment for raw water, additional finish water storage and a number of distribution system improvements.

The cumulative impact to rate payers for Priorities 1, 2 and 3 if all were undertaken together is $12.94.

Impact to Ratepayers – Priority 4

Constructed During	Cost of Projects	Funding from Other Sources	Required Loan Amt	Monthly Payment	Monthly EDU Pay.
Yrs 2003-2008	$1,822,527	$0	$1,822,527	$12,536.93	$4.72
Yrs 2018-2023	$2,839,438	$383,904	$2,455,534	$16,891.30	$4.90

The Priority 4 projects are not considered critical at this time to the health and operation of the water system. As funding becomes available, or as situations change, the projects should be undertaken. The Priority 4 projects include a number of distribution improvement projects for expanded service area.

The cumulative impact to rate payers for Priorities 1, 2, 3 and 4, if all were undertaken together is $17.66.

Affordability

One major consideration in deciding on any proposed capital improvements is the users' ability to support the full cost, (including debt repayment) of utility service. Several measures of household affordability or ability-to-pay have been proposed or are currently being utilized. The majority of affordability indicators are largely a function of income and employment. A summary of affordability measures and thresholds from selected studies is provided in Table 9.4.1. The Environmental Protection Agency (EPA no date) compiled this information for assessing affordability issues with the Safe Drinking Water Act.

Table 9.4.1
Summary of Affordability Measures and Thresholds

Source	Indicator(s)	Threshold
Water Utility Financing Study (1980)	Ratio of annual user charge & median household income	1.5 – 2.5% - Questionable >2.5% - Unaffordable
Rural Utilities Service Water & Waste Disposal Loans & Grants	Debt service portion of annual user charge & median household income (MHI)	>0.5% & MHI below poverty line or >1.0% & MHI between 80 & 100% of statewide non-metropolitan MHI
Department of Housing & Urban Development	Ratio of water & sewer bills, & household income	1.3 to 1.4%
National Consumer Law Center "The Poor and the Elderly – Drowning in the High Cost of Water", circa 1991	Ratio of sum of water & sewer bills & household income	>2.00 %
EPA Economic Guidance for Water Quality Standards Workbook	Ratio of annual user charge & median household income	<0.8% - no hardship expected 0.8 – 1.5% - mid-range >1.5% may be unreasonable burden
EPA's Municipality's Ability-to-Pay (MABEL) 1990	1. Ratio of annual user charge & median household income. 2. Increase in average user charge	1. >1.0% must provide additional security. 2. >25% - system probably cannot issue debt
EPA Affordability of the 1986 SDWA Amendments (1993)	Ratio of Pre & post SDWA costs & median household income	>2.0% - not affordable
State of New York's Affordability Criteria for Drinking Water Projects	$0 to $24,725 MHI $24,725 to $39,557 MHI $39,557 and above MHI	1% MHI $247 + (MHI-24,725)*0.0235 1.5% MHI
State of Idaho Assessment Tools for SRF Loans	Ratio of annual user charge & median household income	1.5% MHI

Abbreviations: AUC – annual user charge
MHI – median household income

One of the most common affordability indicators is the ratio of annual user charges to the median household income. The threshold of affordability for this ratio varies from 1.5 to 2.5 percent of median household income. OECDD utilizes 1.75 percent of the median household income as a threshold for qualifying for grant monies. For Bandon this is ($29,492 x 1.75%)/12 = $43.00/month.

One limitation of using the ratio of annual user charges to the median household income is determination of a representative median household income for a community. A summary of the affordability calculation is given in Table 9.4.2.

Table 9.4.2
Affordability of Projected Water User Costs

Description	Rate	% MHI
City of Bandon Median Household Income (MHI) (2000 Census)		$29,492
Current Average Inside Residential User Rate	$10.34	0.42%
Annual User Charge/MHI, % (Priority 1)	$13.49	0.55%
Annual User Charge/MHI, % (Priority 1& 2)	$18.89	0.77%
Annual User Charge/MHI, % (Priority 1,2 & 3)	$23.23	0.95%
Annual User Charge/MHI, % (Priority 1,2,3 & 4)	$28.00	1.14%

As illustrated in Table 9.4.2, the affordability analysis in Bandon is affected significantly by the MHI used. Based on the 2000 MHI, all affordability indices all Priority 1,2,3 and 4 projects fit under the 1.75 percent threshold

Summary

Based on the recommended projects and the analysis in this section, the City should make arrangements to undertake the Priority 1 and Priority 2 projects. This will likely require the City to secure a General Obligation loan and raise rates to make the loan payments. Grants and other funding options are not viable until water rates are significantly higher.

It should be noted that the above analysis describes potential impacts to ratepayers. The priority ratings are provided to assist the City in developing a capital improvement program to maintain and improve the City's drinking water and fire protection system. It will be easier to develop these programs if the City is aware of the potential impact to ratepayers. The actual impact to ratepayers will depend on many factors including the interest rate and loan package obtained by the City, the population growth rate over the planning period, the projects that the City will choose to undertake, the bidding and construction climate at the time the projects commence, and other important factors.

Approval of a project that creates a rate increase will not be an easy decision. However, the City's water system needs improvement and funding assistance may be available to the City in the future. Failure to construct the project now may increase the cost and possibly the scope of the project if constructed later. Once the source of funding is identified, the City can begin informing the ratepayers about the need for the project. A well-informed public will increase acceptance of the project and improve the City's opportunity to pass a bond issue.

CITY OF BANDON

CITY COUNCIL AGENDA DOCUMENTATION	**DATE: September 12, 2022**
SUBJECT: Water System Master Plan Approval	**ITEM NO.** 5.3.2

BACKGROUND:

The City of Bandon needs to update its Water System Master Plan. Dyer Engineers prepared a draft plan in 2020. The plan was subsequently modified and updated in 2021, and again in 2022. Recent modifications include the potential to use a well field as a seasonal backup supply instead of constructing an off-channel reservoir. A well field would be significantly less expensive bpoth initially, and operationally but involves some initial risk until a test well is drilled.

There are a number of issues discussed in the plan itself, that will be summarized in a presentation from Dyer Engineers.

FISCAL IMPACT:

There are numerous fiscal impacts discussed in the plan itself. Some of those impacts have been addressed by the 2018 General Obligation Bonds.

RECOMMENDATION:

Motion to adopt Resolution No. 22-19, Adopting the Water System Master Plan

SUBMITTED BY:

Dan Chandler City Manager

RESOLUTION NO. 22-19

A RESOLUTION OF THE MAYOR AND CITY COUNCIL OF THE CITY OF BANDON, OREGON, ADOPTING THE WATER SYSTEM MASTER PLAN

WHEREAS, the City has prepared a Water System Master Plan; and

WHEREAS, the Mayor and City Council have determined it is in the best interest of the City of Bandon to adopt the Water System Master Plan,

NOW, THEREFORE, BE IT RESOLVED by the Mayor and City Council that the Water System Master Plan is hereby adopted; and

BE IT FURTHER RESOLVED that this resolution shall be effective immediately upon its adoption and approval.

ADOPTED by the City Council of the City of Bandon, this 12th day of September, 2022.

____
Mary Schamehorn, Mayor

Attest:

____
June Hinojosa
City Recorder

CITY OF BANDON
COOS COUNTY, OREGON

WATER MASTER PLAN

JUNE 2022

The Dyer Partnership
Engineers & Planners, Inc.

Project No. 101.100

1330 Teakwood Avenue
Coos Bay, Oregon 97420
(541) 269-0732
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759 West Central Avenue
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481 South Main Street
Lebanon, Oregon 97355
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City of Bandon

Coos County, Oregon

Water Master Plan

June 2022

Project No. 101.100

11,809
JULY 16, 1982
STEVE B. MAJOR
EXPIRES: 12/31/2022

The Dyer Partnership
Engineers & Planners, Inc.

1330 Teakwood Avenue
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EXECUTIVE SUMMARY

SECTION 1: **EXECUTIVE SUMMARY**

This Water Master Plan (WMP) was compiled to provide guidance to address the future water needs of the City of Bandon. This Plan summarizes the components of the existing water distribution system, analyzes local water demand patterns, evaluates the performance of the water system with respect to critical service standards, identifies the improvements necessary to remedy system deficiencies and accommodate future growth. This Plan recommends specific projects for inclusion in the water distribution system Capital Improvement Program (CIP). A financing plan that will facilitate successful implementation of the recommended CIP was also developed.

1.1 Source of Supply and Water Supply Rights

Raw water is currently diverted from Ferry and Geiger Creek and treated. Bandon has total water rights as follows: spring branch of Ferry Creek 2 cubic feet per second (cfs) with a 1910 priority; Geiger Creek 5 cfs with a 1916 priority; Lower Geiger Creek 3 cfs with a 1961 priority; and Ferry Creek 3 cfs with a 1961 priority. The hatchery has rights for 1.5 cfs on Ferry Creek and 1.5 cfs on Geiger Creek, totaling 3 cfs. The hatchery water passes through the hatchery facility and can be pumped afterward for use by the City during low flow conditions.

Low flow conditions are becoming more of a concern. The City has been working on an off-channel storage project to supplement raw water supplies since 2016. Water right permits are required from the Oregon Water Resources Department (OWRD) for a change in location of storage, change of use, and use of the stored water. The storage water right has been approved and Final Orders for the other two should be submit to the City within the next three months.

Due to the high costs anticipated with the off-channel storage project the City is also exploring the possibility of developing a groundwater well field. Initial subsurface reviews have been completed and the next steps are to work with OWRD on required groundwater permits and to drill a test well to determine actual production rates. If feasible a total of three to six wells would be drilled. A copy of the preliminary feasibility report is included within the Appendix.

1.2 Existing System

Since the early 1900s, potable water has been supplied to the residents of the City of Bandon. Improvements have been made to satisfy demand and to maintain excellent water quality. The City's current water system consists of facilities for diversion, treatment, transmission, storage and distribution of water.

Water is drawn from Ferry Creek and Geiger Creek. The raw water is conveyed to and treated at the Water Treatment Plant (WTP) then held in the storage tanks.

Distribution and Storage System

Finish water pumps convey water from the WTP to the City's potable water pumps which feeds the distribution system. The distribution system consists of approximately 34 miles of piping ranging from 2-inch to 12-inch diameter pipe. The City has one pressure zone, and two potable water storage tanks with a total volume of three million gallons.

Distribution System Modeling

The City's water distribution system was evaluated using a hydraulic computer model, with emphasis on selected vital or high fire flow areas within the City. Based on the results of this model, the following vital areas were shown to have less fire flow than those recommended by the Oregon Fire Code: Harbor Lights Middle School, Bandon High School, Ocean Crest Elementary School, Fire Department, Sunset Oceanfront Lodging, Best Western at Face Rock, Windermere on the Beach, and Shooting Star Motel.

Water storage capacity within the City was evaluated and the total amount of existing storage was found to be sufficient. The City has sufficient treated water storage with the existing tanks through the planning period, Year 2041.

1.3 Water Demand

The population currently being served by the City's water system is 3,344; with residents both inside and outside of City Limits. Modest residential growth is expected. Population growth during the 20-year planning period is estimated to occur at an average rate of 0.7 percent per year. The population growth rate was determined using Portland State University College of Urban and Public Affairs: Population Research Center. The total population was attained by United States Census Bureau Fact Finder data

System water demand was compiled for both the amount of water pumped to the City, the amount produced at the WTP, and the amount diverted from raw water sources. The 7-year maximum for each demand value was used due to the impact the Coronavirus had on the demand in 2020 and 2021. The 7-year maximum average day demand is calculated to be 0.569 Million Gallons per Day (MGD), with a maximum month and daily demand of 0.729 MGD and 0.993 MGD, respectively. No additional WTP capacity is needed for future water demand. The average of the last five years non-account (water sold less water produced) water in the City's system is approximately sixteen percent.

Future water demand was based on the 7-year maximum water production/consumption parameters, projected growth within the City, and anticipated non-account water (13 percent). Population growth was projected using a 0.7 percent annual growth for the City over a 20-year period. The anticipated potable water use population for the Year 2041 is 3,845. The projected water demand production in the Year 2041 in terms of annual average day, maximum month and daily demand are 0.654, 0.838 and 1.14 MGD, respectively.

Based on the projected Maximum Daily Demand (MDD), the City's existing water rights on Ferry Creek and Geiger Creek, assuming the water is available, is sufficient to meet the City's demand through the planning Year 2041.

Reduced flows on Ferry Creek show there have been periods when creek flows have been lower than listed demand. This is one of the drivers for developing the Off-Channel Reservoir system or groundwater well field. Either system would provide raw water for extended periods of time.

1.4 Capital Improvement Plan

A total of thirty (30) improvement projects are recommended in the Capital Improvement Plan. Total project costs of these improvements is estimated between $27,513,045 to $32,248,800, depending upon which raw water supply option is chosen. These improvements were prioritized into three groups.

Recommended Priority I Improvements include WTP improvements, treated water storage tank improvements, the Middle Pond and Lower Pump Station improvements and further investigation into the feasibility of developing a groundwater well field. Total estimated cost for the Priority I Improvements is $9,041,400. The City has previously secured funding for a portion of the improvements at $3,109,250.

The Priority II Improvement is the Off-Channel Reservoir or the groundwater well field. Further work on the feasibility of the well field, included in Priority I costs, needs to be completed prior to making a final determination. The estimated total project cost for the Off-Channel Reservoir and groundwater well field is $8,342,000 and $3,606,245, respectively.

Recommended Priority III Improvements include distribution system improvements, system-wide meter replacement and a new 0.25 million gallon reservoir. The total cost for Priority III Improvements is $14,865,400.

1.5 Financing and Implementation Plan

Various funding programs were evaluated for financing the Priority I Improvements through the use of either low-interest loans or a combination of low-interest loans and grants. The projected monthly debt service ($/Equivalent Dwelling Unit (EDU)) from viable funding programs ranged from $5.40 to $8.60. The lowest projected average monthly user rates, including existing and new debt service and system Operation and Maintenance (O&M) costs, is $53.13 per EDU.

Recommendations for implementing the elements of this Water Master Plan include the following:

- Submit Plan to the Oregon Health Authority (OHA) and Oregon Water Resources Department (OWRD) for review and approval.
- Schedule and attend “One-Stop” meeting to discuss financing options for the proposed Priority I Improvements.
- Submit necessary applications to the funding agencies requesting a loans and grants to finance the Priority I Improvements.
- Following favorable review by the selected financing agencies, secure the authority to issue revenue or General Obligation Bonds in the amount needed to finance the Priority I Improvements.
- Authorize the development of an Environmental Review Report, detailed design of recommended improvements and preparation of plans and specifications for the Priority I Improvements. Secure the necessary special use permits.
- Receive construction bids and award contracts for Priority I Improvements.
- Initiate study of user rates for water system and implement proposed changes.
- Revise System Development Charges (SDCs) and rates for the water system based on the CIP given in this WMP.

A tentative schedule for implementation of the Water Master Plan over the next three years is shown in Table 1.5.1.

TABLE 1.5.1
PROJECT IMPLEMENTATION SUMMARY

Item No.	Key Activity	Implementation Date
1	City Council Adopts the Water Master Plan	August 2022
2	Submit Plan to OHA and OWRD for Review and Approval	August 2022
3	Approval of Plan by Oregon Health Authority & Oregon Department of Water Resources	December 2022
4	Attend "One-Stop" Meeting	January 2023
5	Submit Application for Financing for Phase I and Associated Environmental Evaluation/Notice for Project	February 2023
6	Obtain Financing for Priority I Improvements	July 2023
7	Start Environmental Review Process, Preparation of Plans, Specifications for Phase I	August 2023
8	Complete Environmental Review, Design & Preparation of Plans, Specifications, & Contract	March 2024
9	Health Authority Approval of Plans & Specifications	May 2024
10	Advertise for Priority I Construction Bids	June 2024
11	Receive Construction Bids for Priority I Improvements	July 2024
12	Start Construction of Priority I Improvements	August 2024
13	Complete Construction of Priority I Improvements	June 2025

SECTION 2:
INTRODUCTION

SECTION 2: **INTRODUCTION**

2.1 Background

Listed below is a summary of the plans, reports, and improvements the City of Bandon has completed over the past twenty seven years.

The majority of Priority I Improvements, as generally described and recommended in the 1992 Water System Master Plan, have been implemented. These projects included:

- Ferry Creek impoundment dredging to remove accumulated silt and restore reservoir capacity.
- Lower Pump Station improvements.
- Replacement of the line from the Lower Pump Station to the Middle Pond.
- Middle Pond Pump Station improvements.
- Water Treatment Plant expansion.
- New two million gallon storage reservoir. The older one million gallon storage reservoir located at the water plant site was also fully repaired and restored.
- Line improvements including a new raw water line from the Middle Pond Pump Station to the upgraded Water Treatment Plant. The transmission line construction generally fulfilled the recommendations for Priority I Improvements by providing transmission to the southeast portion of the Urban Growth Boundary (UGB) and connection to the existing water system on Harlem Ave. SE. and Ohio Ave. SE. The recommended Priority I 9th St. SW water line extension to Franklin has also been completed.

The 1992 Master Plan also discussed the merits of constructing a new raw water intake downstream of the fish hatchery. This would eliminate any concerns with availability of water during low flow years since the hatchery has a senior water right to the City's rights. This facility was construction in 2001.

The Dyer Partnership, Engineers & Planners, Inc. completed a Water Master Plan Addendum in October, 2003. This document updated the information contained in the 1992 Master Plan and reevaluated the City's water system and needs.

A number of improvements, as generally described and recommended in the 2003 Addendum, have been implemented. These projects included:

- UV disinfection equipment at the Water Treatment Plant.
- New clarifier at the Water Treatment Plant.
- Cathodic protection at the existing steel reservoir tanks.
- New 12-inch line from Seabird Drive to Kehl Lane, Ocean Spray Facility, along US Highway 101.

- New 12-inch line along Michigan Avenue from 2nd Street to 10th Street.
- New 8-inch line along Madison Avenue from 6th Street to 8th Street.

A high priority listed in both the 1992 Master Plan and 2003 Addendum was for the development of a long term water supply. The City has been working to develop an off channel water storage facility but to date, final approval has not been given.

As water demand increases in conjunction with the growth of the area's population, concerns over source water availability are becoming a greater issue for the City of Bandon. In response, the City will want to ensure that appropriate source water will be available to meet future water demands.

2.2 Plan Objective

The purpose of the Plan is to provide the City with a comprehensive planning document that provides engineering assessment and planning guidance for the successful management of its water system over the next 20-years and beyond. This document satisfies the Oregon Health Authority (OHA) requirement for communities with 300 or more service connections to have a current master plan (Oregon Administrative Rules (OAR) 333-061-0060). The principal objectives include:

- Evaluation of the existing water system components.
- Prediction of future water demands.
- Evaluation of the capability of the existing system to meet future needs.
- Recommendations for improvements needed to meet future needs and/or address deficiencies.

The Plan outlines water system improvements necessary to comply with State and Federal standards and to provide for anticipated growth. The capital improvements are presented as projects with estimated costs to allow the City to plan and budget as needed. Supporting technical documentation is included to aid in grant and loan funding applications and meets the requirements of Business Oregon Infrastructure Finance Authority (IFA), Oregon Water Resource Department (OWRD), Rural Development (RD), as well as OHA.

2.3 Scope of Plan

The overall scope of this Plan consists of: 1) an examination of the City's existing water supply sources and system; 2) a determination of the adequacy of existing water sources and need to develop new water sources for future potable water service; 3) development of a Capital Improvement Plan (CIP) for updating the existing system; 4) and an assessment of various funding alternatives for completion of CIP projects.

Planning Period

The planning period for this Plan is 20-years, ending in the Year 2041. The period is short enough for current users to benefit from system improvements, yet long enough to provide reserve capacity for future growth and increased demand.

Planning Area

The planning area includes the City Limits, Urban Growth Boundary (UGB), and areas anticipated to be incorporated or added during the planning period.

Work Tasks

In compliance with Oregon Health Authority (OHA) and Oregon Water Resources Water Department (OWRD) plan elements and standards, this Plan provides descriptions, analysis, projections, and recommendations for the City's water system over the next 20-years. The following elements are included:

- **Executive Summary.** Provides a summary of the conclusions and recommendations from this Plan.
- **Study Area Characteristics.** Identifies applicable Study Area characteristics, land use, population trends, and projections.
- **Regulatory Environment.** Identifies current and future regulatory requirements and regulations that affect the planning, operation and maintenance of community water systems.
- **Existing Water System.** Description and evaluation of the existing water system including supply, treatment, storage, and distribution.
- **Water Use and Projected Demand.** Determines the City's future water demand based on current use, projected population, and economic growth.
- **Design Criteria and Cost Basis.** Outline design requirements, basis of cost estimating.
- **Seismic Risk Assessment and Mitigation Plan.** Identifies critical facilities capable of supplying key community needs: including fire suppression, health and emergency response, and community drinking water supply points. Identification and evaluation of the likelihood and consequences of seismic failures for each critical facility is also completed. Additionally, it includes recommendations to minimize water loss from each critical facility, capital improvements, or recommendations for further study or analysis.
- **Alternatives Analysis and Capital Improvement Plan.** Identifies and evaluates various alternatives for the City's water system. Select the most cost-effective program that will meet the City's water needs within the planning periods. Identify and describe a CIP for the water system with a recommended implementation schedule.
- **Financing.** Identifies various local financing mechanisms and the most applicable funding programs. Develop a financing program for proposed improvements. Financing program will include: propose monthly rate structure, implementation schedule, and System Development Charges (SDC).

2.4 Authorization

The City of Bandon contracted with The Dyer Partnership, Engineers & Planners, Inc. on October 18, 2018 to prepare this Water Master Plan (WMP); included in the Contract was a Scope of Engineering Services on which this Plan is based.

2.5 Past Studies and Reports

Documents that discuss the City's water system and facilities have been used in the preparation of and analyses in this Plan. A list of these studies and reports follows.

- Water Meter and Billing Records from 2015 to 2021.
- Water Plant Records from 2015 to 2021.
- Water System Survey Report, December 2017, Oregon Health Authority.
- Off-Channel Reservoir Feasibility Study, 2016, The Dyer Partnership, Engineers & Planners, Inc.
- Water Master Plan Addendum, October 2003, The Dyer Partnership, Engineers & Planners, Inc.
- City of Bandon 1991 Comprehensive Plan, (with Amendments regarding Public Facilities).
- Comprehensive Water System Master Plan, December 1992, HGE Engineers and Planners, Inc.
- Coos County Water Management Plan, 1990, CH_2M Hill.
- Ferry Creek Project Evaluation Under PL84-984, April 1990, Tucson Myers & Associates.
- South Bandon Refinement Plan, Infrastructure Element, June 1997, The Dyer Partnership, Engineers & Planners, Inc.
- Bandon Water System Improvements Construction Drawings, November 1998, Lee Engineering, Inc.
- DEQ Water Sampling Project, Project Number: OR-98-09.5-319 DEQ Contract No. :096-011/2/03, City of Bandon Water Resource Committee.
- Source Water Protection Plan, September 17, 2003, City of Bandon Water Resource Committee.
- Water Management and Conservation Plan, October 2003, The Dyer Partnership, Engineers & Planners, Inc.

2.6 Acknowledgements

This Plan is the result of contributions made by a number of individuals and agencies. Dyer wishes to acknowledge the efforts of Mary Schamehorn, Mayor, Jim Youravish, Plant Operator, Lanny Boston, Fire

Chief, and the Bandon Utilities Commission. The assistance of the City's Staff was invaluable in compiling information on the City's services to the community.

SECTION 3:
STUDY AREA CHARACTERISTICS

SECTION 3: **STUDY AREA CHARACTERISTICS**

3.1 Study Area

The City of Bandon is located in southern Coos County along the southern Oregon Coast as shown in Figure 3.1.1.

The area encompassed within the City Limits is approximately four square miles. The southern portion of the Urban Growth Boundary (UGB) is outside of the City Limits. The Study Area for this Water Master Plan (WMP) includes the City Limits and UGB as shown on Figure 3.1.2.

3.2 Physical Environment

The following provides information about the physical environment in and around the City of Bandon.

Soils

There are many general classifications of surficial geologic formations found in the local Bandon area. The formations are described as follows.

- **Bandon Series.** The Bandon Series consists of well drained soils moderately deep to an ortstein pan that formed in marine and eolian sands on incised marine terraces. Slope is zero to 50 percent.

- **Blackrock Series.** The Blacklock Series consists of poorly drained soils that are shallow to an ortstein pan, and formed in sandy marine sediments. These soils are in depressions on marine terraces. They are underlain by a cemented pan at a depth of 12 to 20 inches. Slopes range from zero to seven percent.

- **Bullards Series.** The Bullards Series consists of very deep, well drained soils that formed in mixed eolian marine deposits. Bullards soils are on terraces and have slopes of zero to 60 percent.

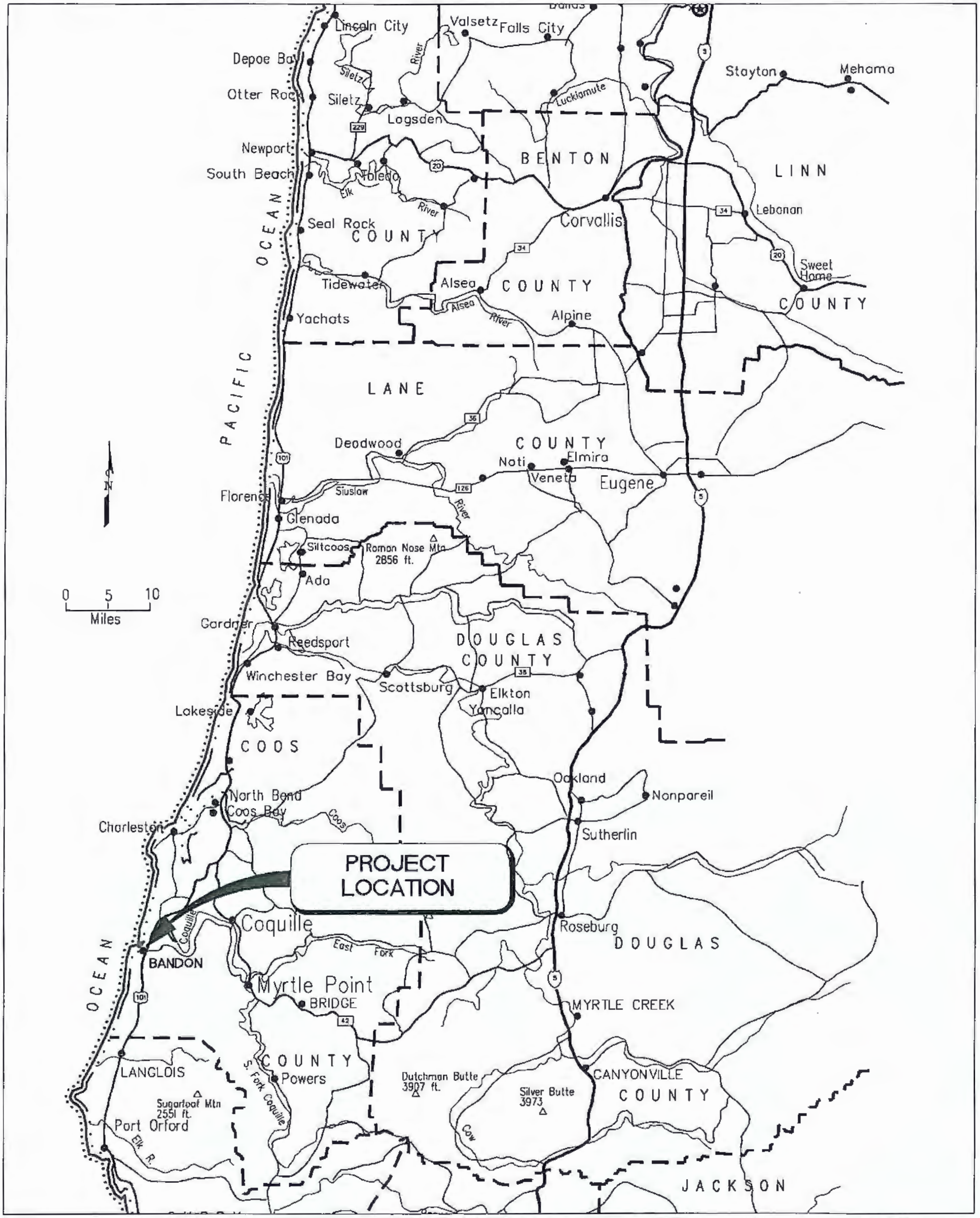
- **Chetco Series.** The Chetco Series consists of very deep, very poorly drained soils that formed in silty alluvium over marine clay. The soils are on flood plains and lowlands and have slopes of zero to three percent.

- **Clastop Series.** The Clatsop Series consists of deep, very poorly drained soils formed in mixed alluvium along tide influenced flood plains. Slopes are zero to three percent.

- **Heceta Series.** The Heceta Series consists of very deep, poorly drained soils on deflation plains, interdunal depressions, swales and sandy lowlands. They formed in recently stabilized dune sand. Slopes range from zero to three percent.

- **Udorthents Series.** The Udorthents Series consists of poorly drained soils on level plains. Slopes range from zero to one percent.

- **Waldport Series.** The Waldport Series consists of very deep, excessively drained soils formed in mixed eolian sand. They are on stabilized dunes and have slopes of zero to 70 percent.



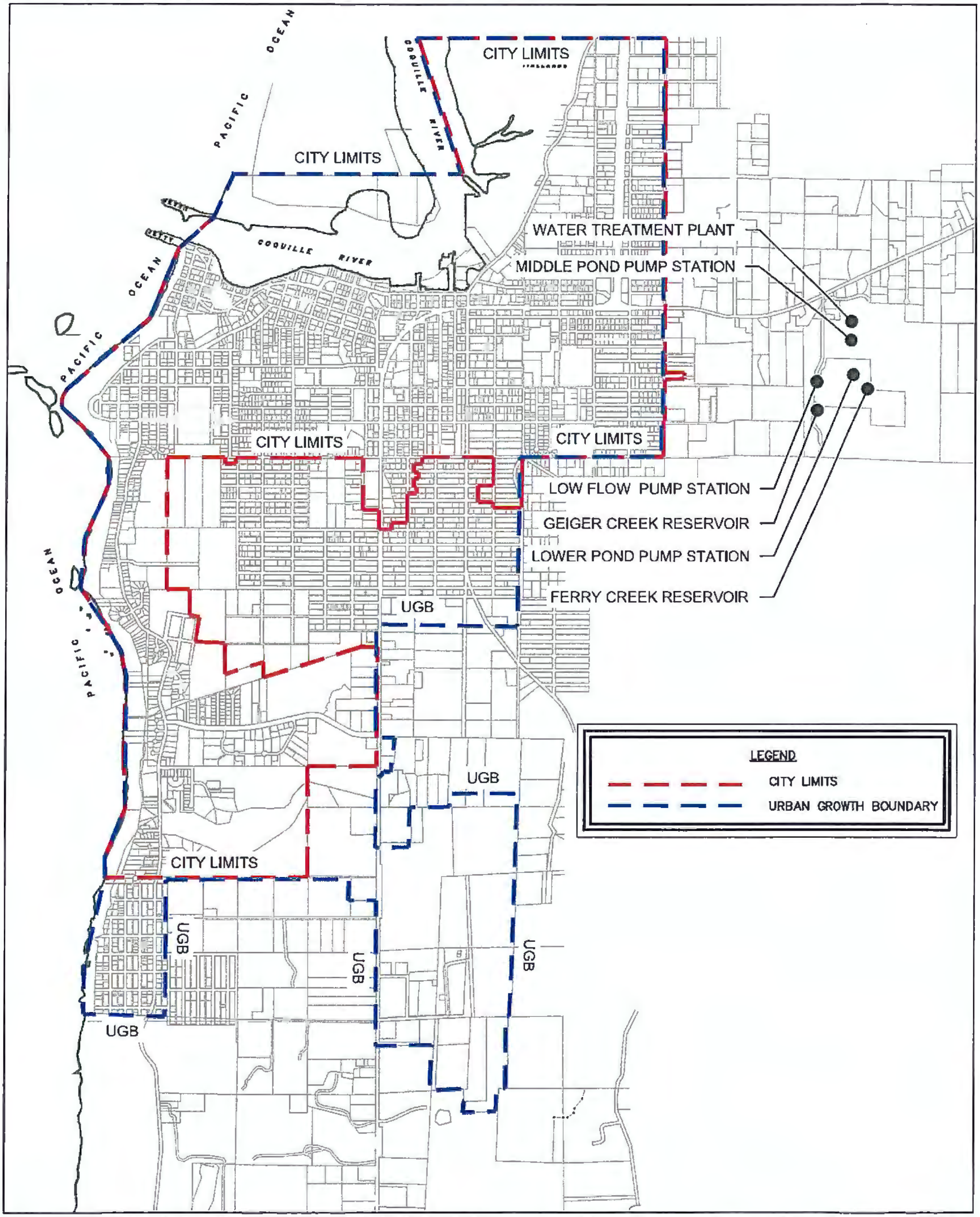
THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

DATE: JULY 2020
PROJECT NO.: 101.100

CITY OF BANDON
WATER MASTER PLAN

LOCATION MAP

FIGURE NO.
3.1.1



THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

DATE: JULY 2020
PROJECT NO.:101.100

CITY OF BANDON
WATER MASTER PLAN

STUDY AREA MAP

FIGURE NO.
3.1.2

- **Willanch Series.** The Willanch Series consists of very deep, poorly drained soils that formed in mixed alluvium. These soils are in depressions on flood plains and have slopes of zero to three percent.

Geologic Hazards

There are several areas within the City that are susceptible to geologic hazards. These hazards include river flooding, earthquakes, high groundwater and erosion. A discussion of each hazard and expected locations are discussed below. Specific hazard maps are included in Appendix A.

- **Flooding**. The Federal Emergency Management Agency (FEMA) has developed flood plain information for the area within the City. All areas within its boundaries have been designated Zone AE or VE. Zone AE is an area with one percent annual chance of a flood event. Zone AE is an area with one percent annual chance of a flood event with additional hazards due to storm-induced velocity.

  The land area adjacent to a river, stream, lake, estuary, or other water body that is subject to flooding is referred to as a floodplain. The floodplain consists of two main sections: floodway and flood fringe. Floodways are defined as the channel of a river or stream, and the over bank areas adjacent to the channel. The floodway carries the bulk of the floodwater downstream and is usually the area where water velocities and forces are the greatest. The floodway area is reserved to conduct water of a 100-year flood out of the area. Within the floodway, no fill or structure is allowed that would cause any rise in the base flood elevation. The flood fringe refers to the outer portion of the floodplain, which begins at the edge of the floodway and continues outward. The flood fringe is characterized by shallow flooding usually consisting of standing or slow moving water. Residential buildings within the flood fringe need to be constructed above the base flood elevation. Other buildings may be flood-proofed.

  Portions of the City adjacent to the Pacific Ocean, Coquille River, and Ferry Creek are within the 100-year floodplain. The extent of the floodplain within the Study Area is presented in Appendix A. New development within the flood boundaries shown must be in accordance with the minimum standards of the Flood Insurance Act.

  Ocean flooding due to winter storm surges and tsunamis is a threat to beaches and built up sand areas. Ocean flooding and seasonal rain causes ponding on areas of accreted sand. Construction of the jetty system has caused accretions of sand north and south of the Coquille River, with cyclical building and depletion caused by ocean currents and wave action.

- **Earthquakes**. Earthquakes are the products of deep-seated geologic faulting and the subsequent release of large amounts of energy. The relative earthquake hazard includes factors such as earthquake induced landslides, liquefaction, and shaking amplification.

  The City is vulnerable to earthquake hazards because of: its proximity to the Cascadia Subduction Zone (CSZ), its regional seismicity topography, bedrock geology, and local soil profiles. The CSZ is off the Oregon Coast and presents the potential for an earthquake of magnitude 9.0 or higher. An event of such magnitude would result in buildings and infrastructure suffering varying amounts of damage. Large portions of US Highway 101 and roads across the Coast Range would be impassable. Many of the buildings were constructed on soil that would be subject to liquefaction while experiencing a severe ground shaking event. Additionally, principal roads that provide ingress and egress to the City are susceptible to earthquake induced landslides.

- **High Groundwater.** High groundwater or ponding can lead to: flooding of below-grade structures, flotation or damage to buoyant structures such as pipelines and tanks, differential settling of structures, and complications in the installation of underground facilities. In addition, high groundwater may result in shrink-swell related damage as the soil responds to changing levels of the water table and threats to water quality in areas of waste disposal. Within the Study Area, several soil types (Blackrock, Chetco, Clatsop, Heceta, Waldport, and Willanch) are considered to have moderate to high potential for ponding and perched water tables. High groundwater conditions are likely to exist near water bodies (e.g. rivers, creeks) within the Study Area.

- **Wave Movement.** Wave movement in the form of tsunamis is considered the greatest hazard within the Study Area. Tsunamis are large ocean waves generated at sea by large earthquakes in the ocean floor. Tsunamis are difficult to detect at sea, having wavelengths of a hundred miles or more and amplitudes seldom exceeding around a foot. As tsunamis approach land, the shallower depth causes the water to pile upon itself, thus increasing the height of the wave. The resulting wave(s) can be tens of feet high, can arrive several hours apart, and can cause extensive damage. The Oregon Department of Geology and Mineral Industries completed maps showing potentially areas impacted by tsunamis. In their simulation the tsunami was caused by a 9.2 earthquake within the Cascadia Subduction Zone. A majority of the City is in the area of inundation.

- **Erosion and Deposition.** Natural erosion occurs mainly along the ocean beaches and along the banks of Ferry Creek. Areas of sand have built up north and south of the mouth of the Coquille River since the construction of the jetty. Most areas of the coastline in the vicinity of the City are subject to sand accretion; however, beach erosion has been noted in some areas in the UGB. Undercutting and caving of stream banks is confined to the floodplain of the waterway, primarily at the outside curve of river bends, and may cause damage to adjacent structures. Sediments carried downstream by river currents contribute to sand accumulations on beaches.

- **Landslides.** Landslides pose a significant risk within the Study Area. They can cause property and road damage, personal injury and death, and water source contamination. The steep terrain around Ferry Creek and the Pacific Ocean increase the landslide risk associated with their respective areas. A Landslide Hazard Map can be found in Appendix A, Figure A.1.

Water Resources

Water resources within the Study Area include only surface water.

Surface Waters

The City draws all of its domestic drinking water from Ferry and Geiger Creeks. The intakes are located in the Ferry Creek Watershed within the Coquille River Sub-Basin. The geographic area providing water to the City of Bandon's intake (the drinking water protection area) extends upstream approximately two miles in a southeasterly direction and encompasses a total area of four square miles. The elevation change from the upper edge of the watershed to the intake is approximately 400 feet. These basins drain into the estuary portion of the Coquille River.

Ferry Creek Basin has an area of 1,130 acres (1.75 square miles) above its diversion point. Geiger Creek Basin has an area of 1,290 acres (2.0 square miles) above its diversion point. Both Ferry and Geiger Creeks have perennial features. However, flows vary significantly based upon rainfall and the season. Both streams typically run high during the winter and low during the drier summer months. In most years, flow levels are at a minimum in the months of August and September, coinciding with the time when water demand in the City of Bandon is at its peak and other area streams are nearly dried up. High winter flows bring with them turbidity, which results in more difficult water treatment conditions. The low summer flows require careful monitoring of water availability from the creeks and conservative use by the community. These sources are generally adequate and reliable at the present time.

The City uses the low flow intake below the fish hatchery during extreme low flows during the summer months. The fish hatchery has senior water rights and has access to the water prior to the City.

Ground Waters

There are currently no permitted existing or proposed municipal ground water sources within the City.

Environmentally Sensitive Areas

The combination of dunes, rangeland, pasture and other wetlands provide a unique environment for the City and should be considered and protected in facilities planning. A discussion of environmentally sensitive areas and environmental topics pertinent to public facilities planning is presented below.

Wetlands

There are a number of significant wetland areas within the City. These areas are shown in Appendix A. The majority of the wetland areas can be found in the lowland areas throughout the City, along creeks and rivers.

Riparian Zones

The transition zone between creeks and uplands are also sensitive. The habitat should be protected with erosion control, provide cover for animals, and shading for reducing water temperatures. In addition to exceeding the physical tolerance levels of fish, high temperatures lower the oxygen concentrations, increase disease potential for aquatic life, and produce conditions favorable to invasive species.

Coos County has implemented setback requirement for all structures located near the bank of identified perennial and intermittent water sources. The County requires all residential structural development to have a 50-foot setback and forest/farmland to have a 100-foot setback from the streambank unless Oregon Department of Fish and Wildlife (ODFW) staff agree that this setback is unnecessary or a reduction in the setback would not jeopardize streambank, stability, water quality, or other conditions.

Air Quality and Noise

The Federal Clean Air Act has established several classifications for allowable air quality according to land uses, designations, and conditions. Air pollutants in the Study Area consist primarily of emissions from automobile and motorboat exhaust, residential fireplaces, wood stoves, and backyard burning. The most concentrated source of vehicle exhaust is highway traffic along US Highway 101, but traffic is not concentrated enough to cause a localized air pollution problem. Air quality in the area is expected to be in compliance with Federal and State standards for all criteria pollutants.

Energy Production and Consumption

Major energy resources identified in the Study Area are wood, wood byproducts, and wind. Wood and wood byproducts are both in good supply and are used locally for heating with wood burning stoves.

Other sources of energy are transported into the Study Area. Natural gas distribution is not available within the Study Area.

Solar energy is a potential source of energy for area residents depending upon access to southern exposure. Wind power may also be a viable future energy source for the Study Area due to high prevailing winds near the Study Area.

Residential, recreation, and transportation use comprises the majority of the energy consumption within the Study Area. Energy consumption is expected to increase within the Study Area due to population growth during the planning period. The City of Bandon, Pacific Power and Coos Curry Electrical serves the Study Area with electrical power.

Rare, Threatened and Endangered Species

A number of rare, threatened, and endangered species are known to reside near or within the Study Area. A list of these species within the Study Area is provided in Table 3.2.1. This list is based on information obtained from the Oregon Natural Heritage Information Center (March 2016) and the ODFW.

TABLE 3.2.1
LIST OF THREATENED AND ENDANGERED SPECIES IN THE STUDY AREA

Common Name	Scientific Name	Status (Federal/State)[1]
Oregon Coast Coho Salmon	Oncorhynchus kisutch	LT
Marbled Murrelet	Brachyramphus marmoratus	LT
Northern Spotted Owl	Strix occidentalis caurina	LT
Western Snowy Plover	Charadrius nivosus nivosus	LT
California Brown Pelican	Pelecanus occidentalis californicus	LE

(1) Federal: LT-Listed Threatened: LE-Listed Endangered

Wild and Scenic River System

There are no Wild and Scenic Rivers within the Study Area.

Historic Sites

Within the City of Bandon there are nine items listed in the National Register of Historic Places: the Coquille River Life Boat Station, Coquille River Light, Breuer Building, Bullard's Beach Site, Running Foxe Midden, First National Bank of Bandon, Philpott Site and Archeological Sites 35CS8 and 35CS9.

3.3 Socioeconomic Environment

The future need for water service and facilities within the City depends upon the socioeconomic conditions within the City and surrounding area. The local economic conditions, trends, population, land use, and public facilities will be discussed hereafter.

Economic Conditions and Trends

Regional economic conditions and trends will likely affect population growth and future water consumption in the City. The main industries are tourism, agriculture, commercial fishing, and sport fishing. The largest employers are comprised of City, County, State, and Federal governments. The leading industries in the Study Area are tourism, retail trade, accommodation, fishing, food services, and forestry. Coos County employment growth rate for 2017 to 2018 was 1.2 percent and -0.8 percent for 2019-2020 which was impacted due to the coronavirus. This 2017-2018 growth rate is lower than the average for Oregon counties, but is near the average for the Country. Tourism or residential development can create a large, immediate demand for water and sewer services. Immigration to the area slowed in 2008, but has been slowing increasing since 2010. The popularity of the Bandon Dunes Golf Resort has also provided an economic boost for the City.

Based on US Census Bureau data, the Median Household Income (MHI) level in the City of Bandon for 2020 was $37,262. The MHI for Coos County was $49,445. The MHI for 2021 is not currently available.

Population

There are several alternatives that can be used to project the population growth over the planning period. For this Plan, as well as for the City's Wastewater Facilities Plan, the Population Research Center, Portland State University information was used in the development of the population projects. The City's population from the 2020 census was 3,321. The average growth rate for Coos County for the years 2018 to 2032 is estimated at zero percent, with a projected population growth rate of 0.7 percent for the City for the same time period. The average growth rate within the City from 2010 through 2018 averaged 0.3 percent. Portland State also showed a 2018 population of 3,422 which is higher than the 2020 census population. Therefore, the population projections will be based off of the 2020 population and a 0.70 percent growth rate. Given this population growth rate, the population projection for the next 20-years is shown in Table 3.3.1.

TABLE 3.3.1
CURRENT AND PROJECTED CITY POPULATION ESTIMATES

Year	2021	2026	2031	2036	2041
Residential Population	3,344	3,463	3,586	3,713	3,845
Population Growth Rate	0.70%	0.70%	0.70%	0.70%	0.70%

The City's population is not the service population since they do provide water service to both residential and commercial developments outside of the City Limits. The additional services add to the population projects listed above. There are 1,696 residential connections, as of December 2021, inside City Limits which equate to 1.97 people per connection. With 136 connections outside City Limits, as of December 2021, that would add an additional 252 people. It is predicted the population located within the vicinity of the City Limits will grow at the same rate as the City. Table 3.3.2 lists the current and projected service population.

TABLE 3.3.2
CURRENT AND PROJECTED SERVICE POPULATION ESTIMATES

Year	2021	2026	2031	2036	2041
Service Population	3,596	3,724	3,856	3,993	4,135
Population Growth Rate	0.70%	0.70%	0.70%	0.70%	0.70%

The City also has a transient population associated with tourism. The commercial connections within and outside the City Limits will be used to determine the additional demands generated by this group.

Land Use

Land use within the City is categorized into six general categories: residential, commercial, industrial, public facilities, controlled development and natural resources. The City of Bandon Zoning Map is shown in Figure 3.3.1. The land use categories are briefly discussed below.

Residential Lands

The City residential lands are throughout the community and on each side of US Highway 101. Residential land use ranges from single-family dwellings to multi-family dwellings, to bed and breakfasts. Detailed descriptions of each residential land use zone are described below.

1. **Residential 1 (R1).** The R1 zoning houses residential dwellings, residential care homes and foster care facilities as well as public utilities. The R1 zone is intended to provide sufficient and desirable location for residential use.

2. **Residential 2 (R2).** The R2 zoning houses residential dwellings, residential care homes and foster care facilities as well as public utilities. The R2 zone reserves and designated suitable areas to accommodate residential development.

Commercial Lands

The commercial properties are clustered around US Highway 101 and the Coquille River. Commercial activities generally include retail and tourist related services. Small shops and restaurants catering to the tourist market make up the majority of the commercial properties in the City.

1. **Old Town Commercial (C1).** The purposes of the Old Town Commercial is to provide space and protection for businesses and promote a mix of businesses that will serve residents and visitors to the area; while excluding uses which would detract from its appeal as an aesthetically pleasing commercial zone for residents and visitors. Uses for this zone include specialty stores, gourmet food shops, museums, eating and drinking establishments and more.

2. **General Commercial (C2).** The purpose of the General Commercial zone is to provide sufficient and appropriate space for general shopping, business and commercial needs of the City and the surrounding areas; while encouraging development of such space in a pleasant and desirable manner. These areas are intended to encourage the continuing quality of business retail services and to protect these uses which would break up continuity. Services for this zone include grocery stores, automobile repair and service, medical clinic, office, public utilities and more.

3. **Marine Commercial (C3).** The Marine Commercial zone provides and retains areas suitable for users and uses which depend upon or benefit from a waterfront location. Utilization for this zone include piers, docks, seafood processing, boat storage, channel maintenance and more.

Industrial Lands

There are a few properties zoned industrial within the City. The properties lay on the northern and southern border of the City Limits, and between Elmira Avenue and Fillmore Avenue from US Highway 101 and 6th Street.

1. **Light Industrial (LI).** The purpose of the Light Industrial zone is to provide a space for industrial uses with little or slight nuisance effect to adjacent land uses. Uses for this zone are warehousing, dairy or cranberry processing, self-storage and more.

2. **Heavy Industrial (HI).** The purpose of the Heavy Industrial zone is to provide a space for industry to ensure the future well-being of the City. Services for this zone include public utilities, including service structures.

Public Facilities Lands

Public facility lands consist of those required for parks, and recreation areas. The Water Treatment Plant and City Shops are included within the public facilities lands.

1. **Public Facility (PF).** The Public Facility zone seeks to identify and reserve publicly owned and areas for the development of needed public facilities and services. Conditional uses for this zone include recreational facilities, public parking and schools.

2. **Water (W).** The Water zone seeks to identify estuarine areas and management units as well as natural, conservation and development areas. Purposes for this zone include protection of wildlife habitat, restoration measures, research observations and bridge crossings.

Controlled Development

Controlled development zones consist of areas where local features and qualities are maintained through developments that are of a controlled nature and scale.

1. **Controlled Development Zone 1 (CD-1).** The CD-1 zone seeks to maintain the scenic and unique qualities of the City's ocean front and surrounding areas. It is intended for a mix of residential, tourism and recreational uses.

2. **Controlled Development Zone 2 (CD-2).** The CD-2 zone seeks to enhance and protect the natural resources and habitat characteristics of the Bandon Jetty and its bluff area; and to develop the coastal village atmosphere and exclude uses which would be inconsistent with the area character.

3. **Controlled Development Zone 3 (CD-3).** The CD-3 zone seeks to provide appropriate development in the entry into the South Jetty area while protecting and enhancing its natural resources. This area serves as a transitional area between the commercial uses of the Old Town and Waterfront area and the residential South Jetty neighborhood.

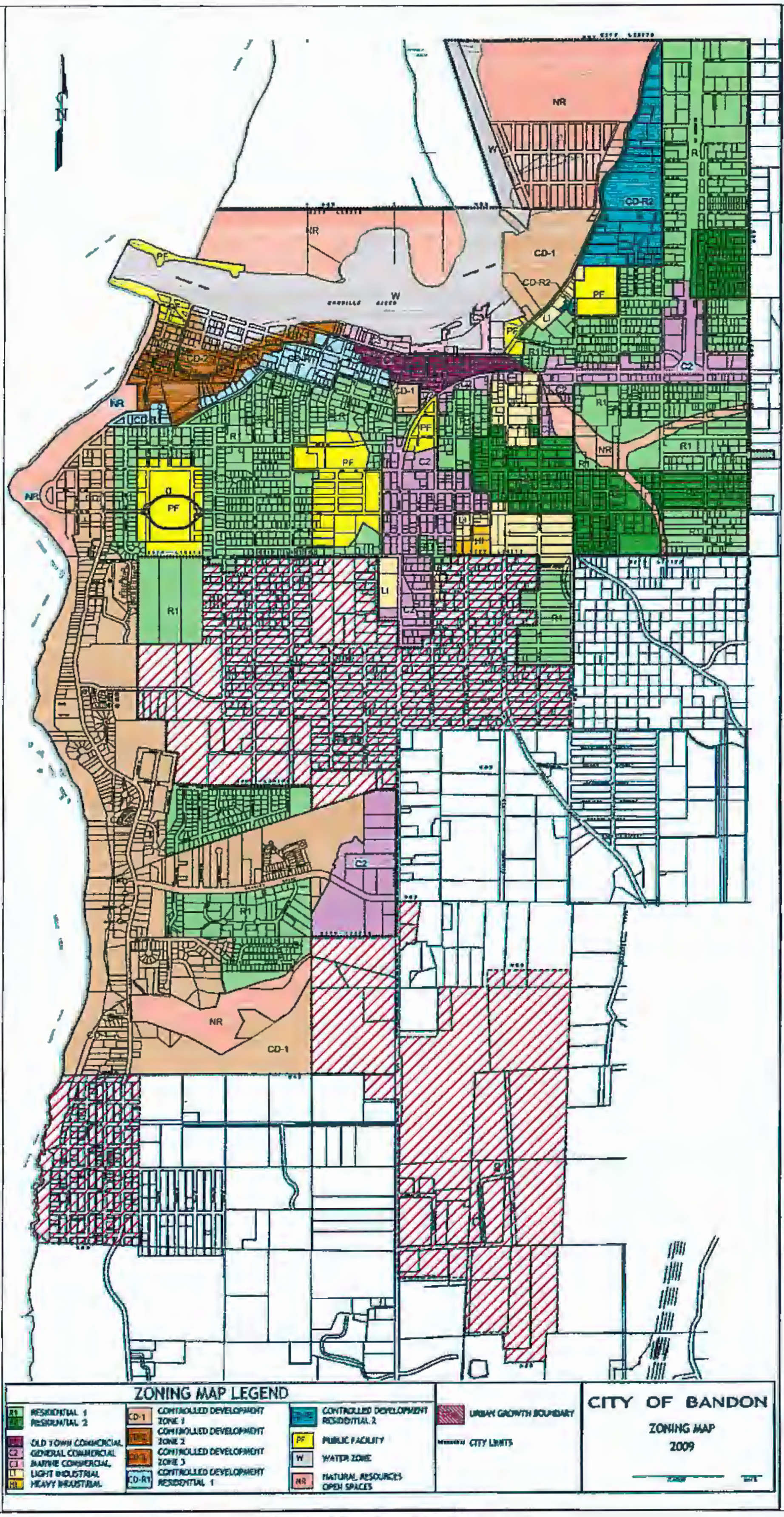
4. **Controlled Development Residential 1 (CD-R1).** The CD-R1 zone recognizes the unique qualities of the area and nearby properties overlooking the Jetty area, the Coquille River and Old Town. Qualities will be maintained by controlling the scale and nature of the developments in this zone. The vistas and residential character of this area shall be protected.

5. **Controlled Development Residential 2 (CD-R2).** The CD-R2 zone recognizes the unique qualities of the view areas overlooking the ocean, the Coquille River and their adjacent properties by controlling the nature and scale of development in this zone. The vistas and residential character of this area shall be protected.

Natural Resources

The Natural Resource zone consists of areas of natural value.

1. **Natural Resources and Open Spaces (NR).** The Natural Resources zone protects natural resources, such as open space areas, significant fish and wildlife habitats, outstanding scenic views and sites, ecological and scientific natural areas, wetlands and watersheds, historical areas and structures, and areas necessary to maintain or protect the quality of air, land and water resources from inappropriate or incompatible development. Natural Resources zone uses shall be limited to those uses that are consistent with protection of natural values, these uses include marine and wildlife sanctuaries, harvesting wild crops, low intensity recreational uses which do not use structures.



THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF BANDON*** ***WATER MASTER PLAN***	FIGURE NO.
DATE: JULY 2020	***ZONING MAP***	***3.3.1***
PROJECT NO.: 101.100		

SECTION 4:

REGULATORY ENVIRONMENT

SECTION 4: **REGULATORY ENVIRONMENT**

4.1 Municipal Water Management Plans

The Oregon Water Resources Department (OWRD) has developed rules that govern water management planning (Water Management and Conservation Plans; Oregon Administrative Rules (OAR) Chapter 690, Division 86). Included in the rules are groundwater management, hydroelectric power development, instream flow protection, interstate cooperation, water resources protection on public riparian lands, conservation and efficient water use, water allocation, and water storage. The Water Resources Commission has adopted a statewide policy on Conservation and Efficient Water Use (Statewide Water Resource Management; OAR 690-410). The policy requires major water users and suppliers to prepare water management plans. Municipal water suppliers are encouraged to prepare water management plans, and are required to do so if a plan is specified by a condition of a water use permit. The following elements are to be included in the plan: description of the water system, a water conservation element, a water curtailment element, and a long-range water supply element.

The City's most recent Water Management and Conservation Plan was completed in October of 2003.

4.2 Public Water System Regulations

Drinking water regulations were established in 1974 with the signing of the Safe Drinking Water Act (SDWA). The SDWA and subsequent regulations were the first to apply to all public water systems in the United States. The Environmental Protection Agency (EPA) was authorized to set standards and implement the Act. With the enactment of the Oregon Drinking Water Quality Act in 1981, the State of Oregon accepted primary enforcement responsibility for all drinking water regulations within the State. Requirements are detailed in OAR Chapter 333, Division 61. Since its inception, the SDWA and associated regulations have been amended a number of times, with the most recent amendments in January 2019.

One of the main elements of these drinking water regulations is the establishment of Maximum Contaminant Levels (MCLs) for inorganic, organic, microbiological, radionuclide contaminants, and turbidity. A MCL is the maximum allowable level of a contaminant in water delivered to the users of a public water system. Concentrations above the MCL for a contaminant are considered violations and require the water supplier to perform immediate corrective action and notify the public of such violations.

Surface Water Treatment Rule (SWTR)

The Surface Water Treatment Rule (SWTR) is one amendment to the Safe Drinking Water Act (SDWA). This rule affects all public water systems using surface water sources and established, among other requirements, that water must be treated through filtration and disinfection. This rule is required for all water providers using a surface water source unless certain water quality criteria and site-specific requirements are met. Treatment requirements, performance standards and MCLs are generally summarized as follows (excluding MCLs for inorganic materials, radioactive substances, and secondary contaminants) for a water system:

- For conventional filtration treatment, the turbidity level of representative samples of filtered water must at no time exceed one Nephelometric Turbidity Units (NTU), measured as specified in OAR 333-061-0030(3)(b). That is to say, zero percent of the turbidity measurements can exceed one NTU. Turbidity is monitored continuously with results reported every four hours.

- For conventional filtration treatment, the turbidity level of representative samples of filtered water must be less than or equal to 0.3 NTU in at least 95 percent of the measurement taken each month, measured as specified in OAR 333-061-0030(3)(b). The turbidity levels can rise above 0.3 NTU no more than five percent of the time.

- Total coliform-positive (coliform present) samples shall not exceed more than one sample collected during a month. Two monthly samples are required. A set of at least three repeat samples are required for each positive sample. Repeat sampling continues until the MCL is exceeded or a set of repeat samples with negative results (coliform absent) is obtained. Confirmed presence of fecal coliform or *E. coli* requires immediate notification of the public.

- At least 99.9 percent (3-log) inactivation and/or removal of *Giardia lamblia* cysts at a point downstream at or before the first customer.

- At least 99.99 percent (4-log) inactivation and/or removal of viruses at a point downstream at or before the first customer.

- A free chlorine residual of 0.2 milligrams/liter (mg/l) after 30 minutes of contact time shall be achieved under all flow conditions before the first customer. OAR 333-061-0050(5)(c)(B)

- The residual disinfectant concentration in the distribution system, measured as total chlorine, combined chlorine, or chlorine dioxide, as specified in OAR 333-061-0032(3)(d) cannot be undetectable in more than five percent of the samples each month, for any two consecutive months.

The adoption of the 1989 SWTR has improved the quality of drinking water and greatly reduced the number of infections caused by water borne pathogens. The SWTR set standards to reduce water concentration of *Giardia* and viruses, with a goal to reduce the risk of infection to less than one in 10,000 people per year. However, some water sources have a high concentration of pathogens that, even when treated to the levels required by the rule, do not meet the health goal. Specifically, the rule does not specifically control the protozoan *Cryptosporidium*, which has been linked to at least 50 deaths of *Cryptosporidium*-caused illness outbreaks in Wisconsin, Nevada, Oregon, and Georgia. Although the public health benefits of disinfection are significant and well recognized, it has been found that the Disinfection Byproducts (DBP) also pose health risks at certain levels. The SDWA Amendments, signed by President Clinton in August 1996, mandated the establishment of a series of new drinking water regulations in response to these and other concerns. Since the enactment of the Amendments, the Environmental Protection Agency (EPA) has been busy developing, proposing, and finalizing regulatory actions. Some of the recent regulatory actions are summarized below.

Long Term 1 Enhanced Surface Water Treatment Rule

One of the first rules developed by the EPA under the SDWA Amendments was the Interim Enhanced Surface Water Treatment Rule (IESWTR). The IESWTR was promulgated to address health risks from microbial contaminants without significantly increasing the potential risks from chemical contaminants. This rule applies to public water systems that use surface water or Ground Water Under the Direct Influence of Surface Water (GWUDI) and serves at least 10,000 people. For water systems with a population of less than 10,000, the Long Term 1 Enhanced Surface Water Treatment Rule (LT1ESWTR) was adopted. This rule was adopted in January 2002 and includes the following provisions:

- Maximum Contaminant Level Goal (MCLG) is set at zero.

- Filtered systems must comply with strengthened Combined Filter Effluent (CFE) turbidity performance requirements to assure 2-log removal of *Cryptosporidium*.

- Conventional and direct filtration systems must continuously monitor the turbidity of individual filters and comply with follow up activities based on this monitoring.

- Specific CFE turbidity requirements depend on the type of filtration. For conventional and direct filtration, the CFE shall be less than 0.3 NTU 95 percent of the time, and at no time higher than one NTU.

- Perform CFE turbidity monitoring at least every four hours; record continuous Individual Turbidity Effluent measurements (at least every 15 minutes).

- Disinfection profiling and benchmarking provisions to ensure continued microbial protection.

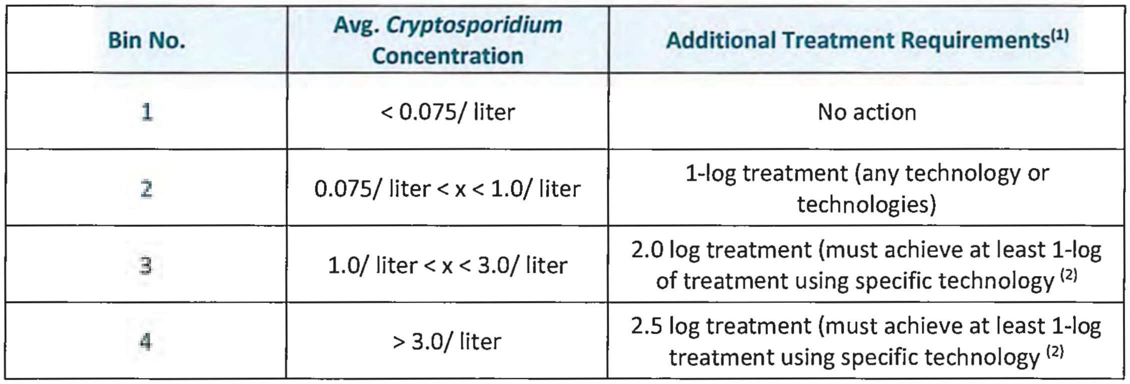
- Requirements for covers on new finished water reservoirs.

The City currently complies with all LT1ESWTR requirements.

Long Term 2 Enhanced Surface Water Treatment Rule

The Long Term 2 Enhances Surface Water Treatment Rule (LT2ESWTR) was proposed and reviewed by a Federal Advisory Committee at the same time as the Stage 2 Disinfection Byproduct Rule (DBPR). The requirements of this rule would pertain to all public water systems that use surface waters or GWUDI. The rule would incorporate system specific treatment requirements for one of four categories or "bins" depending upon the results of source water *Cryptosporidium* monitoring. Treatment requirements for each system would depend on system's existing treatment equipment and removal capabilities. To comply with additional treatment requirements, water providers would choose technologies from a "toolbox" of options. Proposed treatment requirements for average *Cryptosporidium* are presented in Table 4.2.1.

TABLE 4.2.1
PROPOSED TREATMENT REQUIREMENTS FOR AVERAGE
***CRYPTOSPORIDIUM* CONCENTRATIONS**



Bin No.	Avg. *Cryptosporidium* Concentration	Additional Treatment Requirements[1]
1	< 0.075/ liter	No action
2	0.075/ liter < x < 1.0/ liter	1-log treatment (any technology or technologies)
3	1.0/ liter < x < 3.0/ liter	2.0 log treatment (must achieve at least 1-log of treatment using specific technology [2]
4	> 3.0/ liter	2.5 log treatment (must achieve at least 1-log treatment using specific technology [2]

(1) For systems with conventional treatment that are in full compliance with IESWTR.
(2) Acceptable technologies include ozone, chlorine dioxide, ultraviolet, membranes, bag/cartridge filters, or in-bank filtration.

For small systems monitoring requirements, it is anticipated that source water *E. coli* concentrations would be utilized for *Cryptosporidium* monitoring. Observed *E. coli* concentrations above certain levels would trigger *Cryptosporidium* monitoring. The recommended *E. coli* monitoring for small systems would begin two and a half years after rule promulgation and would include 24 samples over one year. After six years of the system characterization, a second round of monitoring is proposed.

This rule only applies to public water systems serving populations greater than 10,000; therefore the City is not currently required to monitor *Cryptosporidium.* In the future, this rule may expand its reach and begin to impact the City's existing treatment and monitoring processes.

In summary, the rules are getting tougher with increased treatment standards, lower MCLs, and more regulated substances. Water suppliers must stay informed of upcoming standards and requirements to ensure that their system will stay in compliance. Proper preparation is critical. When upcoming MCLs are established, a supplier should begin to test for these materials to determine if compliance will be a problem. Advanced planning will allow a utility more time to make necessary modifications to treatment techniques. Additional information on recent and pending regulations can be found at www.epa.gov/safewater/standards.html.

Stage 1 Disinfectants/Disinfection Byproducts Rule

Stage 1 Disinfectants/Disinfection Byproducts Rule (Stage 1 DBPR) was published along with the IESWTR to control disinfectants and formation of their harmful byproducts. This rule establishes Maximum Residual Disinfectant Level Goals (MRDLGs) and Maximum Residual Disinfectant Levels (MRDLs) for three disinfectants: chlorine (4.0 mg/l), chloramines (4.0 mg/l), and chlorine dioxide (0.8 mg/l). The rule also establishes MCLGs and MCLs for specific disinfection byproducts as given in Table 4.2.2.

TABLE 4.2.2
MCLGS AND MCLS FOR STAGE 1 DISINFECTANTS

Disinfection By-Product	MCLG (mg/l)	MCL (mg/l)	Time Period
Total trihalomethanes (TTHM)	N/A	0.08	Annual Average
Bromodichloromethane	0	0.08	Annual Average
Dibromochloromethane	0.06	0.08	Annual Average
Bromoform	0	0.08	Annual Average
Haloacectic acids (HAA5)	N/A	0.06	Annual Average
Dichloroacetic acid	0	0.06	Annual Average
Trichloroacetic acid	0.02	0.06	Annual Average
Chlorite	0.8	1	Monthly Average
Bromate	0	0.01	Annual Average

Water system providers must monitor and control the use of disinfectants and meet the requirements for Total Trihalomethanes (TTHM) and the sum of five Haloacetic Acids (HAA5). In addition, water systems that use surface water or GWUDI and use conventional filtration treatment are required to also remove a specified percentage of organic materials, measured as Total Organic Carbon (TOC) that may react with disinfectants to form disinfection byproducts.

Furthermore, Oregon's decision to join the EPA Region 10 and the States of Utah and Washington in participation in the Area Wide Optimization Program (AWOP) is anticipated to create more stringent treatment standards which the existing Water Treatment Plant can now meet only under ideal conditions. The AWOP performance goals are listed below in Table 4.2.3.

TABLE 4.2.3
AWOP PERFORMANCE GOALS

Sedimentation	Turbidity	Criteria
Settled water	Less than 2 NTU, 95% of the time	Avg. annual raw water turbidity > 10 NTU
Settled water	Less than 1 NTU, 95% of the time	Avg. annual raw water turbidity ≤ 10 NTU
Filtration	**Turbidity**	**Criteria**
Filtered water	< 0.1 NTU, 95% of the time	Based on 4-hour incremental max valves
		(15 min. period following backwash excluded)
Filtered water	Max. 0.3 NTU following backwash	Return to < 0.1 NTU < 15 minute of backwash

The objective of AWOP is to achieve "performance goals" without major capital expenditures. While these goals are not currently tied to regulatory compliance requirements, it is anticipated that they will be in time. Statements by the State such as, "to achieve optimized treatment and provide maximum protection of public health, you must achieve the described AWOP performance goals," suggests that these goals would better protect the public, and therefore should not be ignored.

Stage 2 Disinfection Byproduct Rule, Effective March 6, 2006

The Stage 2 Disinfection Byproduct Rule (Stage 2 DBPR) is being promulgated simultaneously with the Long Term 2 Enhanced Surface Water Treatment Rule to address concerns about risk tradeoffs between pathogens and DBPs. Stage 2 DBPR builds upon the Stage 1 DBPR to address higher risk public water systems for protection measures beyond those required for existing regulations. These rules strengthen protection against microbial contaminants, especially *Cryptosporidium*, and at the same time, reduce potential health risks of DBPs. The final Stage 2 DBPR contains maximum contaminant level goals for chloroform, monochloroacetic acid and trichloroacetic acid. National Primary Drinking Water Regulations, which consist of MCLs, monitoring, reporting, and public notification requirements for total trihalomethanes and haloacetic acids. The regulations include revisions to the reduced monitoring requirements for bromate. This document also specifies the best available technologies for the final MCLs. The EPA is approving additional analytical methods for the determination of disinfectants and DBPs in drinking water. The Stage 2 DBPR rule is intended to reduce potential cancer, reproductive problems, and developmental health risks from DBPs in drinking water. The requirements of this rule apply to community water systems and non-transient non-community water systems that add and/or deliver water that is treated with a primary or residual disinfectant other than Ultraviolet (UV). For public water systems serving fewer than 10,000 people; Stage 2 compliance monitoring began October 1, 2013.

An Initial Distribution System Evaluation (IDSE), conducted by the water provider, is intended to select new compliance monitoring sites that reflect locations with system high TTHM and HAA5 concentrations. Water providers would recommend new or revised monitoring sites based on their IDSE study. The results from the IDSE study would not be used for compliance purposes. For surface water systems with less than 10,000 people, water providers must monitor either quarterly (population from 500 to 9,999) or semi-annually (population less than 500) for one year at two distribution system sites per plant. These sites must be in addition to the Stage 1 DBPR compliance monitoring sites. Water providers that certify to the State that all samples taken in the last two years were below 40 mg/l TTHM / 30 mg/l HAA5 are not required to conduct the IDSE.

For long-term compliance monitoring, the principles of reduced compliance monitoring strategy (for very low DBP levels) utilized in Stage 1 DBPR would continue in the Stage 2 DBPR. Water providers would collect paired samples (TTHM and HAA5) at the site representing the highest TTHM and the highest HAA5 locations in the distribution system, as identified under the IDSE. If the highest levels of TTHM and HAA5 are observed at the same location, then only one sample would be needed. Monitoring would be either quarterly (population from 500 to 9,999) or annually (population less than 500).

The City has never been in violation of either Stage 1 or Stage 2 DBPR. As long as the City maintains its current treatment process, no future violations are foreseen.

Filter Backwash Recycle Rule

The EPA is required to regulate the recycling of filter backwash water within the treatment process of a public water system. The filter backwash recycle rule provisions impact all conventional and direct filtration systems, which recycle filter backwash and use of surface water or GWUDI. Under the rule, the following provisions will be required.

- Recycle water from filter backwash, supernatant from sludge thickening, and liquids from sludge dewatering must pass through all filtration processes for treatment.

Specific information on the regulations concerning public water systems may be found in the Oregon Administrative Rules (OAR), Chapter 333, Division 61. The rules are located at:
http://public.health.oregon.gov/HealthyEnvironments/DrinkingWater/Rules/Documents/pwsrules.pdf

The City has a backwash recycle system, and complies with the Filter Backwash Recycle Rule.

Arsenic and Clarifications to Compliance and New Source Monitoring Rule

In January 2001, the Arsenic and Clarifications to Compliance and New Source Monitoring Rule was enacted. The major features of this rule included the following:

- Include health effects statements in Consumer Confidence Reports for arsenic levels from 5 to 50 microgram per liter (ug/l) and when systems are in violation of the arsenic MCL of 0.010 mg/l.
- All new systems/sources must collect initial monitoring samples for all Inorganic Compounds (IOCs), Synthetic Organic Compounds (SOCs), and Volatile Organic Compounds (VOCs).
- The new arsenic MCL of 10 ug/l became effective on January 23, 2006.
- One sample must be taken and analyzed after effective date of MCL. Surface water systems must take annual samples.
- A system with a sampling point result above the MCL must collect quarterly samples at that sampling point, until the system is reliably and consistently below the MCL.

The City has had 'non-detect' levels of Arsenic in every sample since 1984. Oregon Health Records do not show sample results prior to this date.

4.3 Responsibilities as a Water Supplier

Per OAR 333-061-0025, water suppliers are responsible for taking all reasonable precautions to assure that the water delivered to water users does not exceed maximum contaminant levels, to make certain that water system facilities are free of public health hazards, and to verify that water system operation and maintenance are performed as required by these rules. This includes, but is not limited to, the following:

- Routinely collecting and submitting water samples for laboratory analyses at the frequencies prescribed by OAR 333-061-0036;

- Taking immediate corrective action when the results of analyses or measurements indicate that maximum contaminant levels have been exceeded and report the results of these analyses as prescribed by OAR 333-061-0040;

- Reporting as prescribed by OAR 333-061-0040, the results of analyses or measurements which indicate that maximum contaminant levels have not been exceeded;

- Notifying all customers of the water system and the general public in the service area, as prescribed by OAR 333-061-0042, when the maximum contaminant levels have been exceeded;

- Notifying all customers served by the water system, as prescribed by OAR 333- 061-0042, when reporting requirements are not being met, when public health hazards are found to exist in the system, or when the operation of the system is subject to a permit or a variance;

- Maintaining monitoring and operating records and making these records available for review when the system is inspected;

- Maintaining a pressure of at least 20 pounds per square inch (psi) at all service connections at all times;

- Following up on complaints relating to water quality from users and maintaining records and reports on actions undertaken;

- Conducting an active program for systematically identifying and controlling cross connections;

- Submitting, to the Oregon Health Authority, plans prepared by a Professional Engineer registered in Oregon for review and approval before undertaking the construction of new water systems or major modifications to existing water systems, unless exempted from this requirement;

- Assuring that the water system is in compliance with OAR 333-061-0032;

- Assuring that the water system is in compliance with OAR 333-061-0210 through OAR 333-061-0272 relating to certification of water system Operators; and

- Assuring that transient non-community water systems utilizing surface water sources or groundwater sources under the influence of surface water are in compliance with OAR 333-061-0065(2)(c) relating to required special training.

4.4 Summary of City's Compliance with Regulations

The City has had no violations and are compliant with the current regulatory regulations. The City's reportable turbidity over the past four years has been less than 0.5 NTU.

SECTION 5:
EXISTING WATER SYSTEM

SECTION 5: **EXISTING WATER SYSTEM**

The City's existing water system consists of raw water intake facilities, treatment plant facilities, treated water storage, and the treated water distribution system. These components are discussed in detail below. A water systems map is shown in Figure 5.5.1.

5.1 Water Rights and Raw Water Supply

The nature and status of existing raw water supplies and water rights is crucial to the formulation of a successful long-range plan for the City. The following is a discussion of the sources, availability, and reliability of the City's raw water sources.

Raw Water Sources

The City has two active sources of raw water: Ferry and Geiger Creeks; and one inactive source, Simpson Creek. An overall map of the Study Area showing the major components of the City's water system is displayed in Figure 3.1.2.

Ferry and Geiger Creeks

The City of Bandon has water rights within the Ferry Creek and Geiger Creek drainage systems and currently utilizes these as the City's water supply source. The intakes are located in the Ferry Creek Watershed within the Coquille River Sub-Basin. The geographic area providing water to the City of Bandon's intake (the drinking water protection area) extends upstream approximately two miles in a southeasterly direction and encompasses a total area of approximately four square miles. The elevation change from the upper edge of the watershed to the intake is approximately 400 feet. These basins drain into the estuary portion of the Coquille River.

Ferry Creek Basin has an area of 1,130 acres (1.75 square miles) above its diversion point. Geiger Creek Basin has an area of 1,290 acres (2.0 square miles) above its diversion point. Both Ferry and Geiger Creeks have perennial features. However, flows vary significantly based upon rainfall and seasons. Both streams typically run high during the winter and low during the drier summer months. In most years, flow levels are at a minimum in the months of August and September, coinciding with the time when water demand in the City of Bandon are at its peak and other area streams are nearly dried up. High winter flows bring with them turbidity, which results in more difficult water treatment conditions. The low summer flows require careful monitoring of water availability from the creeks and conservative use by the community. These sources have served the City well but there is growing concern with the physical condition of each source and availability of water during low flow years.

Information regarding predicted low flows for these sources includes the Tucson Myers report of April 1990. A data correlation of Ferry Creek flow with Pony Creek flow was performed. The correlation location was at the confluence of Geiger and Ferry Creeks. Data used was from 1950 to 1980. The value was computed for flow that exceeded 99 out of 100 years. The lowest flow month was calculated for September at 1.06 Million Gallons per Day (MGD) or 1.64 cubic feet per second (cfs). CH2M Hill prepared another report in July of 1993 for Coos County based on assumed run off values and predicted rain fall. This report predicted much lower flows than the Tucson Myers report. However, CH2M Hill acknowledged in the report that the mathematical basis of their estimate does not match observed flow. The explanation was that "springs" add to the volume. Basing the flows on observed Pony Creek flows, the Tucson Myers report can be expected to under report as well.

Ferry Creek has a gauging station that is located close to the proximity of the low water point of diversion. Oregon Water Resources Department (OWRD) has published data for the years 1977 to 1982, 1994 to 1996 and 2017 to present. The lowest flow of 0.4 cfs was recorded for the 1978 water year. The OWRD website for Ferry Creek also shows a low flow event of 0.15 and 0.26 cfs in 1981 and 1995, respectively. These numbers did not match any of the daily flows for those two months. Table 5.5.1 summarizes recorded low flows for the water years 1977 to present.

TABLE 5.1.1
RECORDED LOW FLOWS

Water Year	Low Flow Date	Flow (cfs)
1977	October 6, 1977	0.8
1978	October 4, 1978	0.4
1979	October 10, 1979	1.3
1980	October 5, 1980	1.7
1981	October 1, 1981	1.7
1982-1993	No Data	NA
1994	September 9, 1994	1.4
1995	September 19, 1995	2.7
1996-2016	No Data	NA
2017	September 13, 2017	2.6
2018	September 28, 2018	2.2
2019	August 20, 2019	2.4
2020	October 21, 2020	2.0
2021	August 17, 2021	2.4
2022	Incomplete Data Set	N/A

In the winter months the flow rate is highly variable and depends on the precipitation which is attributed to surface water runoff. This watershed is very responsive to precipitation and drought which cause large fluctuations in flowrate. During the drier months the flows in Ferry Creek are at the lowest which also correspond to the highest water demand period for agricultural diversion.

Off-Channel Reservoir

Although approval is still pending, 100 acre-feet of water rights have been "moved" to the Off-Channel Reservoir by manner of Water Right Permit Amendment. Eighty-five acre-feet from the Geiger Creek Reservoir and 15 acre-feet from the Ferry Creek Reservoir was "moved" for storage at the Off-Channel Reservoir. The environmental review is complete and land has been acquired for the construction of the Off-Channel Reservoir. This will provide a maximum 100 acre-feet of water storage. Water will be diverted from the confluence of Geiger Creek and Ferry Creek during the peak runoff season for raw water storage and will supplement the low flows of late summer.

Oregon Water Resources Department on September 28, 2017 approved the right to change the diversion of 1.6 cfs from Geiger Creek to the off-channel storage facility and change the use from domestic to municipal. The two requirements of the Final Order are: construction has to be completed by October 1, 2022 and a claim for beneficial use application submitted by October 1, 2023. The City is in the process of filing for a time extension since the other two applications listed below have not yet been approved.

There are still two applications pending approval. Application R88383 is for the ability to store the water and Application S88383 is the ability to use the water. The OWRD internal review was approved on

January 25, 2018. The Department indicated on May 13, 2022 the Proposed Final Order for each application will begin processing within the next two to three months.

Supplemental Groundwater Supply

The City is also exploring the possibilities of using groundwater to supplement their water supply during an emergency or seasonal basis. GSI Water Solutions, Inc. has been retained to evaluate the feasibility of this option. The scope of this analysis included the following:

- Evaluation of the hydrogeologic setting in the vicinity of the City. This evaluation included reviewing available geologic reports, geologic spatial data, and well logs to develop a conceptual model of the local hydrogeologic system.
- Determination of feasibility moving forward.
- Impact to existing water rights, the need to apply for a new groundwater water right or the need to transfer the surface water right to a groundwater right.
- Potential impacts to existing wells.
- Preliminary well siting.
- Preliminary well design.
- Planning level cost estimate.
- Report and recommendations.

The conclusions of this analysis are groundwater is available and a well system is feasible to supplement the City's raw water supply. However, there are two major factors that need to be completed prior to development of an operational well field. These items are summarized as follows:

- A surface water to groundwater water right application has to be filed with OWRD. The OWRD has to review the application and issue a preliminary decision (a proposed Final Order and/or a draft preliminary determination) confirming the agency can approve the application, including the proposed well locations. This review process could take up to twenty-four months after the application is received.
- After approval is given by OWRD, the drill of a test well and observation well to determine the actual output available will be completed. The observation well will be used to assess the potential impacts to the groundwater. If the yield meets expectations the well field would be developed.

A copy of the technical memorandum is included in Appendix E.

Water Rights

All water in Oregon is publicly owned. Based on this public ownership, a water right is generally required for anyone to use water regardless of whether the water originates from surface or underground sources.

Oregon's water laws are based on the principal of prior application. That is, if a person obtains a water right on a particular source before someone else, that person would then possess a "senior" water right that would permit them first use of the water during times of lower flows or droughts. A "junior" water right is one that is obtained after other water rights for a particular source have been assigned. A water right may be both "senior" to some and "junior" to others.

During periods of low water availability under previous State law, a water right holder could use as much water as their water right allows as long as the use is truly beneficial and all senior water rights are satisfied. This method of resource appropriation governed all water used until the water is exhausted. Under the current revised rules surrounding water permit extensions in Oregon Administrative Rules (OAR) 690-315, the withdrawal of water for a municipal user becomes more complicated. Updated rules contained in OAR 690-86 modify the formerly routine five year extension, which allowed cities to "grow into" their water right. Extensions will now generally be for longer periods of time (typically 20-years) and will require preparation of a Water Management and Conservation Plan (WMCP). The rule modifications introduce the concept of "green light water" which is a portion of the water right which the City may divert until an updated WMCP is submitted and approved by the Oregon Water Resources Department. Certificated water rights do not fall under this requirement.

The City holds permit water rights to obtain a total of 3.0 cfs of surface water from Ferry Creek and 2.0 cfs from the Spring Branch of Ferry Creek by way of the Ferry Creek Reservoir. Additionally, permits exist to remove water from Geiger Creek in the amount of 5.0 cfs from a point of diversion upstream of the Geiger Creek Reservoir and 3.0 cfs from the reservoir itself.

In March 2000, an order was issued by OWRD approving Transfer Application T-8195. This order allows the City of Bandon to divert water associated from three of the four water rights discussed previously from an alternative location downstream of the fish hatchery. This avoids a conflict of water rights with the fish hatchery during periods of low flow because the hatchery use is non-consumptive. The water is available to the City after flowing through the hatchery pens. The City used this option in the summer of 2002.

In September 2017 an order was issued by OWRD approving the change in character of use from domestic to municipal for the Geiger Creek source and allowing the diversion of 1.6 cfs from Geiger Creek to the off-channel storage facility. Construction of this source must be completed by October 1, 2022 and certificate of beneficial use submitted by October 1, 2023.

The City also has another application in for the permitting of the off channel storage facility and for the use of the stored water. This application was filed in April 2017. To date OWRD is proposing to approve the application but is waiting for comments from the Department of Environmental Quality and Coos County Water Master. There is not an anticipated approval date.

Bandon has total water rights as follows: Geiger Creek 5 cfs with a 1916 priority; Lower Geiger Creek 3 cfs with a 1961 priority; Ferry Creek 3 cfs with a 1961 priority and Spring Branch of Ferry Creek of 2 cfs with a 1910 priority. The hatchery has rights for 1.5 cfs on Ferry Creek and 1.5 cfs on Geiger Creek, totaling 3 cfs. The hatchery water passes through the hatchery facility and can be pumped afterward for use by the City.

The City's storage water rights include 90 acre-foot (ac-ft) at the Geiger Creek Reservoir and 20-5/8 ac-ft at the Spring Branch of the Ferry Creek Reservoir. Water right documentation is provided in Appendix B and summarized in Table 5.1.2.

TABLE 5.1.2
WATER RIGHTS DOCUMENTATION SUMMARY

App. No.	Permit No.	Cert. No.	Trans. No.	P-date	Stream/Reservoir	Magnitude	Comment
S-4982	S-3011	N/A	N/A	6/19/1916	Geiger Creek	5.0 cfs	
S-34672	S-27232	N/A	N/A	3/7/1961	Geiger Creek	3.0 cfs	
S-34673	S-27233	N/A	N/A	3/7/1961	Ferry Creek	3.0 cfs	
E-481	E-27	9754	N/A	1/24/1910	Spring Branch of Ferry Creek	2.0 cfs	
R-5017	R-368	N/A	N/A	7/5/1916	Geiger Creek Res.	90.0 ac-ft	
R-501	R-28	9755	N/A	1/24/1910	Spring Branch of Ferry Creek Res.	20-5/8 ac-ft	
S-4982	S-3011	N/A	T-12632	3/29/2000	Geiger Creek	5.0 cfs	Move Point of Diversion
S-34672	S-27232	N/A	T-8195	3/29/2000	Geiger Creek	3.0 cfs	Move Point of Diversion
S-34673	S-27233	N/A	T-8195	3/29/2000	Ferry Creek	3.0 cfs	Move Point of Diversion
S-4982	S-3011	N/A	T-12632	9/28/2017	Geiger Creek	1.6 cfs	To Supply Off Channel Storage
S-4982	S-3011	N/A	T-12632	9/28/2017	Geiger Creek	N/A	Change Domestic to Municipal Use
R-88382	Pending	N/A	N/A	Pending	Off Channel Storage	100 ac-ft	Allow Off Channel Storage Facility
R-88383	Pending	N/A	N/A	Pending	Use Stored Water	1.6 cfs	Allow Off Channel Storage Usage

Diverted Water

The City has a raw water meter at the Water Treatment Plant (WTP) a new meter was installed in April 2020. The estimated amount of water diverted from this source for the water years 2015 to 2021 is presented in Table 5.1.3.

TABLE 5.1.3
HISTORICAL WATER DIVERSION (2015 – 2021)

Parameter	2015	2016	2017	2018	2019	2020	2021
Total Gallons, gal	226,607,745	232,863,328	243,805,729	274,925,603	275,598,235	185,170,475	192,751,674
Avg. Daily, cfs	0.97	0.96	1.00	1.13	1.11	0.78	0.82
Max Monthly, cfs	1.37	1.32	1.42	1.52	1.57	1.05	1.05
Max Daily, cfs	1.66	1.73	1.70	3.2	2.7	1.26	1.31
Total Water Rights	13						

The City has noticed inconsistencies with the raw water meter since 2014. The raw water meter was replaced in April 2020. The old pressure differential meter's flow had a buildup of barnacles and slime within the tube. This condition would definitely affect the readings. The new magnetic flow meter has proven to read within five gallons per minute (gpm) of the flow meters located on the filters.

Raw water flow diversion for 2020 and 2021 was approximately thirty percent less than previous years. The decline in demand is contributed to COVID-19 and the reduction of tourist visiting the area.

5.2 Raw Water Facilities

The raw water facilities consist of two raw water intake diversion structures and a raw water transmission main. These facilities are discussed in detail below.

Raw Water Intake

There are raw water intakes located at both Ferry Creek and Geiger Creek that feed the Lower Pump Station. The water gravity flows from each source to the Lower Pump Station where it is either pumped by two small pumps each with a capacity of 350 gpm and a large pump with a capacity of 700 gpm to the Middle Pond; or to the Water Treatment Plant at a maximum of 700 gpm. At the Middle Pond Pump Station two pumps and volutes each with a capacity of 350 gpm and a larger pump with a capacity of 700 gpm pump the water to the WTP at a maximum rate of 1,400 gpm.

Another intake location is along Ferry Creek just downstream of the hatchery. The Low Flow Pump Station uses two 700 gpm pumps for a total of 1,400 gpm to move the raw water to the Middle Pond. The Low Flow Pump Station concrete wet well and submersible pumps are in good condition, refer to Figure 5.2.1, but there is a fish screen that is setup for an air scour cleaning cycle but no air compressor was ever supplied. Therefore, the City has to periodically clean the screen. The Lower Pump Station building is in good condition and is a Concrete Masonry Unit (CMU) block building with a metal roof. Refer to Figure 5.2.1.

The Middle Pond Pump Station building, refer to Figure 5.2.3, is in good condition and is a CMU block building with a metal roof. Currently all the pump stations have the capacity of the WTP (1,400 gpm) but lack any redundancy. Both the Lower Pump Station and the Middle Pond Pump Stations would benefit from upgrades to the flow capacity to prevent the pumps from running constantly (twenty-four hours a day - seven days a week) during high demand periods. Backup power and better ventilation would improve the quality of the pump stations. The Middle Pond Pump Station would benefit from a new dock at the pond and a new flow meter for outgoing flow.

FIGURE 5.2.1
LOW FLOW PUMP STATION

FIGURE 5.2.2
LOWER PUMP STATION

FIGURE 5.2.3
MIDDLE POND PUMP STATION

5.3 Water Treatment Plant

The City of Bandon completed construction of its water treatment and filtration plant in 2000 and has a current total treatment capacity of 2.0 MGD (1,400 gpm). The Water Treatment Plant is a custom plant, includes a multi-media filtration system, and makes use of the following processes:

- Pre-chlorination
- Alum Chemical Coagulation
- Filter Aid Polymer Addition
- Up-Flow Sludge Cone Clarification with Tube Settlers
- Multi-Media Filtration
- pH Adjustment
- Disinfection (Post Chlorination and Ultraviolet Disinfection)

- Reservoir Chlorine Contact

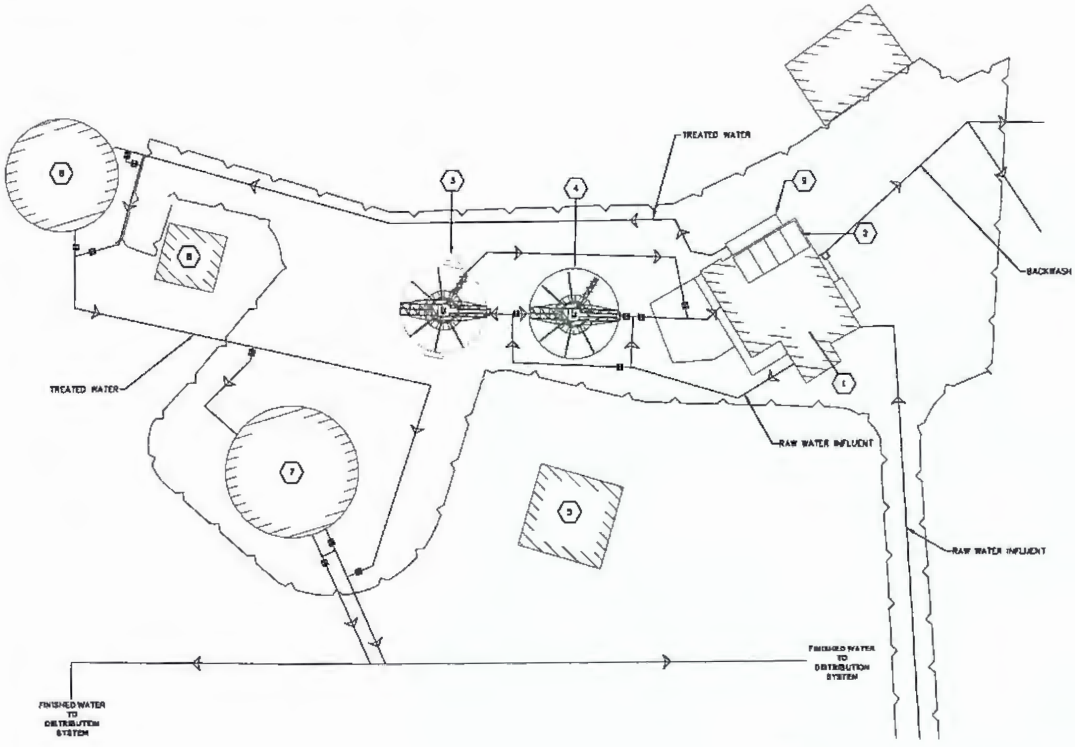
The use of rapid sand filtration, such as the plant employs, is considered desirable for treating highly turbid water, as may occur in the source streams during the rainy season. The up-flow sludge cone clarifier unit is reported to also provide good settlement and attenuates turbidity spikes resulting from muddied Geiger and Ferry Creek sources. During summer months when the sun shines on the side of the clarifier it warms the water which creates and inversion within the tank and increases turbidities. Some type of screening is needed to provide for more uniform raw water quality going to the filters. Furthermore, the Middle Pond provides for some settlement subsequent to removal from the source streams and prior to pumping through the clarifier. Plant personnel have also modified the piping to the filters so that Filtration Units 1 and 2 receive water and Tanks 3 and 4 are reserved for future expansion. These concrete tanks provide for additional gravity sedimentation prior to introduction of the water through the active filter units, if conditions so warrant. This reduces chemical costs and frequency of backwash, especially during winter season when turbidity from Ferry and Geiger Creeks is higher. Accumulated solids in the filters are removed by pumping to the backwash pond.

More frequent backwashing of filters may be required when turbidity levels are elevated. Based on decreased water demand during the winter rainy season and the abundance of source water, more frequent backwashing of filters does not have a noticeably negative impact on the raw water supplies or the environment in general. However, the layout of the plant provides for recovery of all backwash water in the Middle Pond. Backwash water goes to two settling ponds prior to discharging to the Middle Pond.

The Water Treatment Plant incorporates modern flow control and monitoring systems. Chemical feed rates are controlled by the raw water flow meter. As mentioned in the previous section, the inability of raw water flow meter to provide accurate readings created problems with plant operations and flow recording. The installation of the new meter corrected both items. Flow records are automatically graphed and reduced to daily consumption; monthly reports are forwarded to the Oregon Health Authority in compliance with OAR Chapter 333. In addition, daily rainfall at the plant is also recorded.

The treatment plant is arranged such that it can be upgraded to a 4.0 MGD plant by upsizing the raw and treated water pumps. Piping within the Lower and Middle Pump Stations was designed for this expanded plant condition. The clarifier is sized to operate at a maximum capacity of 2.5 MGD. The original clarifier can be replaced to provide the additional capacity required. Two of the four filter bays are empty. The two empty filter bays can be filled with media as space and piping headers are already provided to allow for the addition of two new units. Space is also provided within the treatment plant building for the addition of chemical tanks, feed units and pumps.

The Water Treatment Plant Site Plan is shown in Figure 5.3.1.



KEY NOTES:

1	EXISTING WATER TREATMENT PLANT BUILDING
2	EXISTING FILTERS
3	EXISTING CLARIFIER (WORKING)
4	EXISTING CLARIFIER (OUT OF SERVICE)
5	CELL TOWER AND BUILDING NO.1
6	CELL TOWER AND BUILDING NO.2
7	2 MILLION GALLON STORAGE TANK
8	1 MILLION GALLON STORAGE TANK
9	UV FILTER BUILDING

PLAN SCALE
N.T.S.

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS

DATE: JULY 2020
PROJECT NO.: 101.100

CITY OF BANDON WATER MASTER PLAN

WATER TREATMENT PLANT EXISTING SITE PLAN

FIGURE NO.
5.3.1

Plant and Facility Security

The plant site and grounds, including the treated water storage tank, have a six feet high chain link perimeter fence. The fence is topped with three strands of barbed wire. The plant building and perimeter gates are locked when plant personnel are not present. The facility has motion detection equipment installed at the gates and in certain areas for outside equipment access areas. The motion detection devices are monitored by a security company.

Located within the Water Treatment Plant grounds is a cell phone transmission tower and equipment building. Some security concerns have been expressed over the presence of cell phone maintenance personal onsite who may be unknown to the Water Treatment Plant Operator. It is recommended that a security evaluation of the plant site be conducted by City Staff and appropriate actions undertaken. It is anticipated that funding is available for any capital improvements required. The appropriate security actions recommended are as follows:

- Vulnerability Analysis
- Security Report
- Security Training
- Capital Improvement

A Security Vulnerability Assessment Engine for use by the City is provided at www.nrwa.org.

Physical security issues take the form of: locks, fences, motion and perimeter alarm equipment, identification and confirmation of site visitors and delivery personnel, cooperation with local police for increased surveillance, and a "neighborhood watch" type approach for pump stations, water tanks, fire hydrants, and reservoirs. Background checks for new hires and contract service personnel are also recommended.

Water Treatment Plant and Office

The WTP office and building is a CMU building with a metal roof. The building includes the chemical feed area, soda ash feed, piping gallery, office and laboratory. The building is in good condition but is in need of minor improvements. The improvements to the building would include new flooring in the front office area and new cabinetry at the sample island.

Raw Water Metering, Sampling and Chemical Addition

A new raw water meter was installed in April 2020. Raw water pumped from the Middle Pond is sampled for pH and turbidity as well as flow rate. A Streaming Current Monitor (SCM) was added to the chemical monitoring system in April 2021. Based upon information provided by the SCM, two polymers (Superfloc N-300 and Superfloc C-573), soda ash for pH adjustment, alum for clarification and filtration or chlorine may be added and mixed. Refer to Figure

FIGURE 5.3.2
POLYMERS ADDITION

5.3.2. The chemical feed rates is based upon Operator determination and information received from the SCM, flow meter, pH meter and turbidity meter. Feed rates are automatically adjusted within a predetermined range. The alum feed system consists of an alum storage tank with two pumps. The soda ash system consists of a mixer tank with two pumps and dilution water equipment. It is possible, due to the presence of two pumps and the piping configuration, to both pre-feed and post feed with respect to the filters. The filter aid polymer consists of a mixing tank and an aging tank, a pump and dilution water equipment. In addition to cold water for mixing and dilution, a hot water dilution water source is provided. Filter aid polymers may be introduced both before and after the clarifier. The polymer system pumps from a 55-gallon drum, has both cold and hot water dilution feed and may be introduced into the treatment process prior to the clarifier.

Clarifier Equipment

Raw water pumped from Middle Pond after chemical addition and mixing then enters the clarifier unit. Currently there are two clarifiers onsite, the original that is used only when necessary and a new clarifier that was installed in 2007. The original clarifier is in poor condition. The new clarifier is a 59 foot diameter glass fused to steel tank with 24-inch deep settlers and is in good condition. In 2019 the City installed steel cladding to the east and south sides of the tank to prevent the dark blue color of the tank walls from creating thermal loading and the subsequent increases in turbidity during summer months, which makes the water more difficult to treat. The new clarifier has a treatment capacity of 2.5 MGD. If the original clarifier is replaced the color of the tank should be white. Refer to Figure 5.3.3.

FIGURE 5.3.3
CLARIFIER EQUIPMENT

Filtration Equipment

Clarified water flows by gravity to the two filter units. Refer to Figure 5.3.4. Filter aid polymer may be added prior to the filter units. Each filter is rated 700 gpm, are dual media types and each have a surface area of 138.3 square feet. In 2018, the basins were cleaned, repaired and covered in an epoxy coating to protect the surface from deterioration. The filter media was also replaced. Filter backwash design is at a rate of 2,800 gpm with a typical ten minute cycle time. The backwash pumps use the filter effluent line connected to the two million gallon reservoir as the supply source. The backwash flow rate is metered. Backwash is assisted with air scour provided by a blower at a rate of 560 standard cubic feet per minute (scfm). Refer to Figure 5.3.5. Following backwash, the filters were designed to run in "filter to waste" mode at a rate of 700 gpm for five minutes. Head loss sensors in the filters control the effluent pump rates. The variable frequency speed control effluent pumps remove water directly from the plenum of the filters, rather than from a clear well as is typically the case for this type of plant. Flow rate and turbidity are monitored for the water pumped from each individual filter. Following backwash, soda ash may be added for pH control. Following the chemical addition location, a sample stream is taken for chlorine residual and pH measurement. Finally, chlorine is added to the finished water as it proceeds to the new two million gallon reservoir.

FIGURE 5.3.4
DUAL MEDIA FILTERS

FIGURE 5.3.5
AIR SCOUR BLOWER

Disinfection Equipment

The City of Bandon Water Treatment Plant uses onsite hypochlorite generation and Ultraviolet (UV) light for disinfection. Refer to Figure 5.3.6 for the chlorine dosing pumps and Figure 5.3.7 for the UV system. The hypochlorite system is much safer and provides more disinfection than the gas chlorine system previously used. This system combined with the large chlorine contact time available through both the two million gallon and the one million gallon reservoirs will provide adequate disinfection for the foreseeable future. The UV clarifier was installed in 2007 and has a design flow of two MGD.

FIGURE 5.3.6
CHLORINE DOSING PUMPS

FIGURE 5.3.7
UV SYSTEM

FIGURE 5.3.8
TREATED WATER PUMP

Treated Water Pump Equipment

Two filter effluent pumps, refer to Figure 5.3.8, move treated water directly from the filter units at the treatment plant through the UV system, then to the one million gallon reservoir.

Treated water then flows into the two million gallon reservoir. This provides for extensive chorine contact time prior to distribution. In addition to providing treated water to the reservoirs, water is removed from a treated water header to provide backwash water for the filters. Each reservoir may be isolated to perform required maintenance.

Metering is provided for measuring the volume of water being sent to the distribution system. This meter is installed on the effluent line from the finished water storage reservoirs. The addition of this meter has allowed the City to better account for water used in the treatment process.

Backwash Lagoon

Backwash and process water flows into two backwash lagoons located south of the Water Treatment Plant. The backwash lagoons are square earth lined ponds. Drainage from the backwash lagoons flows to the Middle Pond whereby water is recycled for treatment. The solids that accumulate in the lagoons are removed periodically and placed in an onsite storage location. The ponds are currently in good shape and require no upgrades. Historical water production and backwash water volumes are listed in Table 5.3.1.

TABLE 5.3.1
HISTORICAL WATER PRODUCTION & BACKWASH WATER VOLUMES FOR THE WTP

Parameter	Year							Average
	2015	2016	2017	2018	2019	2020	2021	
Total Treated Water (MG)	159,464,560	175,229,045	182,756,184	195,668,209	207,880,981	191,862,017	185,130,487	185,427,355
WTP Backwash (MG)	9,966,213	10,189,463	11,450,794	12,595,108	11,428,297	9,552,536	9,821,935	10,714,907
WTP Backwash (%)	6.25%	5.81%	6.27%	6.44%	5.50%	4.98%	5.31%	5.79%

5.4 Treated Water Storage

Two tanks provide treated water storage totaling 3,000,000 gallons and provide chlorine contact time. One tank holds one million gallons with a bottom elevation of 178.9 feet. The other tank holds two million gallons and has a bottom elevation of 162.0 feet. Both tanks are located adjacent to the Water Treatment Plant and have overflow elevations of 218.5 feet. A brief description of each tank follows.

One Million Gallon Tank

The one million gallon steel reservoir is located on a northeasterly portion of the water plant site. Refer to Figure 5.4.1. The tank is a welded steel tank on a concrete foundation. The tank was originally constructed in 1955. In conjunction with the water plant improvements performed in 2000, extensive repairs were made and the tank was repainted. The tank was painted again in 2013. In 2014 the tank underwent cathodic protection upgrades. There is corrosion showing on the inside of the tank which is a sign of failed coatings. The tank is considered to be in fair condition.

FIGURE 5.4.1
ONE MILLION GALLON RESERVOIR

Two Million Gallon Tank

The two million gallon steel reservoir is located approximately 142 feet southwest of the one million gallon tank. The "new tank" is a welded steel tank. A new vault and master meter were constructed in 2000 to measure the flow leaving the treatment and storage facility and entering the City of Bandon distribution system. In 2014 the tank underwent cathodic protection upgrades. Both the interior and exterior of the tank needs recoating. The City did go out to bid for seismic upgrades on the outlet line in September 2015. The bids came in higher than available funding and the project was not completed. The project was rebid in November 2021 and the low bid came within budget. The project was never awarded due to delivery issues with the equipment. The project could not be completed before Memorial Day weekend which was a requirement of the Bandon Fire Department. The City has ordered the seismic valve equipment and will be ordering the pipe fittings later this year to ensure the project can be constructed in the Spring 2023.

FIGURE 5.4.2
TWO MILLION GALLON RESERVOIR

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Water Level Controls

A water level sensor is located in the effluent line between the two million gallon tank and the master meter. This sensor provides signal to automatically control the filter effluent pumps in order to maintain the desired water levels in the storage tanks. The elevation of the reservoirs provides adequate service pressure to the majority of the system and pressures exceeding 80 pounds per square inch (psi) to many of the properties in the lower elevation areas of the City. With the existing level controls, pumping arrangements, and treatment systems, the City of Bandon water system functions essentially as an automatic system.

Storage Volume

Current water storage capacity is adequate. However, in order to provide equalization and adequate fire volume to southern Bandon, additional treated water storage placement should be considered. Table 5.4.1 summarizes the storage reservoir information.

TABLE 5.4.1
STORAGE FACILITIES SUMMARY

Reservoir	Material	Year Constructed	Nominal Volume, gal	Base/Overflow Elevation, ft
One Million Gallon	Welded Steel	1955	1,000,000	178.90/218.5
Two Million Gallon	Welded Steel	2000	2,000,000	162.00/218.5

5.5 Water Distribution System

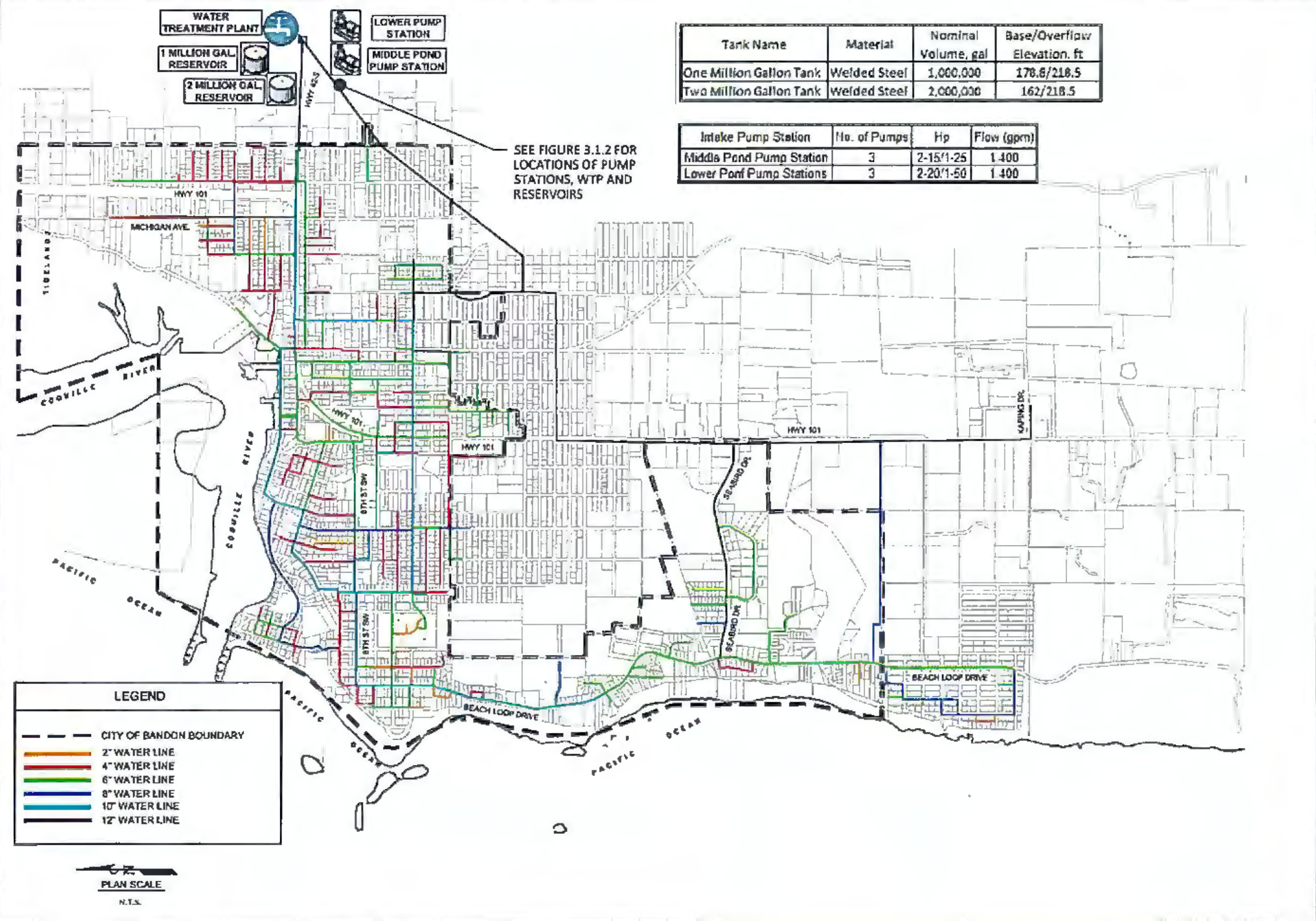
An overview of the City's water distribution system is presented in Figure 5.5.1. The City of Bandon's water distribution system is a combination of pipe materials and sizes. The distribution system consists of 12-inch main lines from the City's Water Treatment Plant and 2 to 12-inch diameter lateral pipe with service lines consisting of ¾ and 1-inch diameter pipe. The most prevalent pipe within the distribution system (34 percent) consists of 6-inch diameter pipe.

In addition to varying by diameter, the water distribution system is also composed of a variety of pipeline materials. The material that was used to construct water lines over the years depended primarily on the accepted and available materials of the time. In the 1940s and 1950s, cast iron, steel, and galvanized piping was commonly used. Later, Asbestos Cement (AC) piping was utilized for water main construction in the 1970s. Today ductile iron, PVC and Polyethylene (PE) pipe materials are used almost exclusively in the construction of new water and service lines. The City's piping consists primarily of AC and PVC pipe for distribution pipes; and galvanized steel and polyethylene pipe for service lines. A summary of the distribution system pipe size and material inventory (not including service lines) is given in Table 5.5.1. Current materials of choice for replacement are PVC pipe for lateral mains and PE pipe for service lines.

TABLE 5.5.1
DISTRIBUTION SYSTEM SIZE AND MATERIAL INVENTORY

Pipe Diameter, Inch	Materials of Construction					
	Asbestos Cement	Cast Iron	Ductile Iron	PVC	Total	% of Total
2	266			6,214	6,480	3.7%
4	33,697		282	9,574	43,553	24.5%
6	31,090		5,984	22,799	59,873	33.7%
8	2,565			15,611	18,176	10.2%
10	17,756	2,892	586	4,261	25,495	14.3%
12	1,441		10,414	12,295	24,150	13.6%
Total	86,815	2,892	17,266	70,754	177,727	100.0%
% of Total	48.9%	1.6%	9.7%	39.8%	100.0%	--

The existing condition of the distribution system depends greatly on the materials that were used to construct the system as well as the level of workmanship at the time of construction. Although a historical log of distribution system repairs has not been maintained, City Staff believe there are no major leaks within the system.



Tank Name	Material	Nominal Volume, gal	Base/Overflow Elevation. ft
One Million Gallon Tank	Welded Steel	1,000,000	178.8/218.5
Two Million Gallon Tank	Welded Steel	2,000,000	162/218.5

Intake Pump Station	No. of Pumps	Hp	Flow (gpm)
Middle Pond Pump Station	3	2-15/1-25	1400
Lower Ponf Pump Stations	3	2-20/1-50	1400

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS
DATE: JULY 2020
PROJECT NO.: 161.100

CITY OF BANDON WATER MASTER PLAN

EXISTING WATER SYSTEM

FIGURE NO. 5.5.1

Computer modeling was conducted to analyze the performance of the existing City of Bandon water system. Hydraulic analysis software called WaterCAD® CONNECT Edition (Version 10.2) by Haestad Methods was used to perform the complex calculations necessary to analyze the water distribution system. Pipe diameter and materials data was input into the computer model. A discussion on the computer modeling results of the distribution system is presented in Section 8.

5.6 Water Quality

Since operation of the updated plant began, in 2000, treated water quality has been excellent and there have been no recent violations. Lead and copper levels are well below action levels. The City of Bandon has met all requirements of the surface water treatment rules for at least the past five years. There have been no nitrates detected nor have there been any coliform violations for at least the past five years. No organic chemicals of any kind have been detected.

5.7 Financial Management

The financial management of the City's water system was reviewed by examining the current system charges, revenue, and Operations and Maintenance (O&M) budget.

System Charges and Revenue

The City collects water system charges to retire debt and finance the operation and maintenance of the water system. A summary of the current system charges is given below in Table 5.7.1.

TABLE 5.7.1
MONTHLY WATER SYSTEM CHARGES

Service	Base Rate	Rate $/1,000 gals After first 2,000 gals	Average Monthly Rate(1)
Inside City			
Residential	$31.50	$1.30	$33.45
Commercial/Industrial	$41.50	$1.30	--
Outside City			
Residential	$43.13	$2.17	$46.39
Commercial/Industrial	$53.13	$2.17	--
City Use			
Inside and Outside City	$9.62	$1.15	

(1) Average monthly rate was determined using the average monthly use per EDU in 2021 (3,500 gallons)

In addition to the base rate and additional usage charge the City adds a ten percent utility tax fee for inside City accounts only. That would put the average residential rate at $33.45.

The City collects revenue for the water system operation from service fees, new connections, System Development Charges (SDCs), and other miscellaneous sources. There are five funds that the revenues can be included in however the revenues from the five funds increase the total revenue for all water funds. A summary of the revenue budget for the fiscal year 2022 to 2023 is presented in Table 5.7.2.

TABLE 5.7.2
WATER OPERATIONS REVENUE

Revenues						
Fund	**Water Fund (940)**	**Water Plant Improvement Fund**	**Water Plant Reserve Fund (942)**	**Water SDC Reimbursable Fund (720)**	**Water System SDC Imp (721)**	**Total**
Other Taxes	$1,047,000		$2,500			$1,049,500
Reimbursements	$6,500					$6,500
Miscellaneous	$66,935	$3,980		$41,900	$159,930	$268,765
Transfer from Other Funds		$283,000				$283,000
Beginning Fund Balance	$252,227	$731,513	$806,099	$312,663	$1,475,798	$2,772,201
Total Revenues	$1,372,662	$1,018,493	$808,599	$354,563	$1,635,728	$5,190,045

Operation and Maintenance Budget

Each fiscal year, the City proposes, approves and adopts an annual budget for the water system. The General Fund is an internal service fund, which acts as a cost center for personnel, equipment, and materials to the other internal funds. A portion of the O&M budget is directed to the Construction Fund, and Equipment Replacement Reserve Fund; which was created for the distribution of funds required by the City's Capital Improvement Plan (CIP). Additional funds are distributed to the Debt Service Fund for the purpose of timely payments of long-term financing of water system improvements. There are five funds that the requirements can be included in; however, the five funds make up the total requirements for all water funds. A summary of the water operations expenditures is presented in Table 5.7.3.

TABLE 5.7.3
WATER OPERATIONS EXPENDITURES

Expenditures						
Fund	**Water Fund (940)**	**Water Plant Improvement Fund**	**Water Plant Reserve Fund (942)**	**Water SDC Reimbursable Fund (720)**	**Water System SDC Imp (721)**	**Total**
Personnel Services	$441,615					$441,615
Materials & Services	$466,590			$10,000	$10,000	$486,590
Capital Outlay	$116,000	$502,815	$808,599	$10,000	$510,000	$1,947,414
Debt Services	$39,759					$39,759
Contingency & Reserves	$308,698					$308,698
Fund Balance		$515,678		$334,563	$1,115,728	$1,965,969
Total Requirements	$1,372,663	$1,018,493	$808,599	$354,563	$1,907,106	$5,461,424

SECTION 6:

WATER USE AND PROJECTED DEMANDS

SECTION 6: **WATER USE AND PROJECTED DEMANDS**

6.1 Description and Definitions

Water demand can be defined as the quantity of water delivered to the system over a period of time to meet the needs of consumers, provide filter backwashing water, and to supply the needs of firefighting and system flushing. In addition, virtually all systems have an amount of leakage or loss that cannot be feasibly or economically reduced or eliminated. Total demand, therefore, includes all consumption and lost water. Demand varies seasonally with the lowest usage in winter months and the highest usage during summer months. Variations in demand also occur with respect to time of day (diurnal) with higher usage occurring during the morning and early evening periods and lowest usage during nighttime hours.

The objective of this section is to determine the current water demand characteristics and to project future demand requirements that will establish system component adequacy and sizing needs. Water demand is described in the following terms:

Average Annual Demand (AAD)
The total volume of water delivered to the system in a full year is expressed in gallons. When demand fluctuates up and down over several years, an average is used. This number uses the combined metered flow coming out of the treatment units.

Average Daily Demand (ADD)
The total volume of water delivered to the system over a year divided by 365 days or 366 days during leap years (2016 and 2020). The average use in a single day expressed in gallons per day (gpd). This number uses the combined metered flow coming out of the treatment units.

Dry Season Daily Demand (DDD)
The gallons per day average during the months of June through October. This number uses the combined metered flow coming out of the treatment units.

Maximum Monthly Demand (MMD)
The gallons per day average during the month with the highest water demand. The highest monthly usage typically occurs during a summer month. This number uses the combined metered flow coming out of the treatment units.

Peak Weekly Demand (PWD)
The greatest seven day average demand that occurs in a year is expressed in gallons per day. This number uses the combined metered flow coming out of the treatment units.

Maximum Day Demand (MDD)
The largest volume of water delivered to the system in a single day expressed in gallons per day. The MDD is commonly used to size facilities to provide capacity for periods of high demand. The MDD usually occurs during the warmest part of the year when agriculture, irrigation, and recreational uses of potable water are at their greatest. Higher use is also commonly associated with holidays, such as the Fourth of July, or during events, such as County Fairs. This number uses the combined metered flow coming out of the treatment units.

Peak Hourly Demand (PHD)
The maximum volume of water delivered to the system in a single hour expressed in gallons per day. Distribution systems should be designed to adequately handle the peak hourly demand. During this peak usage, storage reservoirs supply the demand in excess of the maximum day demand. Peak hour demand is

commonly experienced during the early morning hours when many water users are bathing, cooking, and engaging in other activities that require widespread water use.

Demands expressed in gpd, can be divided by the population served to come up with a demand per person or a per capita demand which is expressed in gallons per capita per day (gpcd). Per capita demands can be multiplied by future population projections to determine future water demands.

Loss/Lost Water
Metered source water less revenue producing water and authorized unmetered water uses.

Non-account Water
Metered source water less metered water sources. This value takes into account the combined metered flow coming out of the treated water storage tanks and the volume of water sold.

Unaccounted for Water
The amount of non-account water less known or estimated losses and leaks.

For most communities, the known or estimated losses and leaks within a water system are not known. Rather the amount of system loss or leakage is estimated based on an audit of water usage within the system. To the extent possible, the above water conservation terms will be used in this Plan.

6.2 Current Water Demand

For the purposes of this Plan, current water demand was evaluated using three different methods:

1. Water Diverted
2. Raw Water Treated
3. Water Consumption

These different water demands are discussed in detail below.

Water Diverted

As part of the auditing process, the City must account for all water diverted from each source. This is typically accomplished through a metering device at or near the point of diversion. Oregon Administrative Rules (OAR) 690-085-0015 requires that, "Where practical, water use shall be measured at each point of diversion." However, the rule also states that:

"...measurements may be taken at a reasonable distance from the point of diversion if the following conditions are met:

- The measured flow shall be corrected to reflect the flow at the point of diversion. The correction will be based on periodic flow measurements at the point of diversion taken in conjunction with flow measurements at the usual measuring point;
- If the measured flow includes flow contributions from more than one point of diversion, the measured flow shall be proportioned to reflect the flow at each point of diversion using the method prescribed subsection (a) of this section; and

- A description of the correction method shall be submitted with the annual report the first time it is used and any time it is changed, or once every five years, whichever is shorter."

If the point of diversion is relatively close to the Water Treatment Plant (WTP), it is common for many communities to use a single influent meter at the water plant to measure the amount of water that is diverted. This is the case for the City of Bandon.

As stated in Section 5.1, there was concern about the accuracy of the raw water flow meter for years 2016 until April 2020 when a new raw meter was installed. The disparity between the raw water, and the treated water data can be seen in Table 6.2.1. The new raw water flow meter and future installation of flow meters at the individual intake sites would increase data accuracy, and provide a means of measuring any losses between the intakes and the Water Treatment Plant. In addition, water treated values does not take into account filter to waste flows. This waste stream is not metered and could amount for up to an additional five percent of water treated.

TABLE 6.2.1
RAW WATER VS. WATER TREATED

Time Period	Raw Water (gallons)	Water Treated (gallons)	Percent Difference
2015	226,607,745	159,464,560	30%
2016	232,863,328	175,229,045	25%
2017	243,805,730	183,201,480	25%
2018	274,925,603	195,668,209	29%
2019	275,598,235	207,880,981	25%
2020*	185,170,475	191,862,017	-4%
2021	192,751,675	185,130,487	4%

*New raw water meter installed in April

Raw Water Treated

For planning purposes, demand projections and unit design factors for water consumption should be based on the City's yearly water production data rather than historical customer water consumption records (meter readings). This methodology incorporates all system losses and unmetered usage in the projected water requirements developed later in this Water Master Plan (WMP). The amounts of treated water produced, pumped to the City for consumption, and utilized for backwash are discussed below.

Water Treatment Plant Production

The amount of water produced at the Water Treatment Plant and sent to the treated water storage tanks for eventual City consumption is based on daily records maintained by City Staff. The amount of treated water produced at a WTP is equal to the sum of the amount of water sent to the treated water storage tanks plus the amount of water used for backwash, and miscellaneous water usage at the WTP (pump seals, sanitary usage, etc.). The City does not currently record miscellaneous water usage at the WTP or backwash to waste flows, therefore this additional usage at the WTP is not known. Water Treatment Plant production will be based on the master meter for treated water sent to town, which is calibrated every year, and the amount of water used for backwash.

Water production data was used to calculate the Average Annual Demand (AAD), Average Daily Demand (ADD), Dry Season Daily Demand (DDD), Maximum Monthly Demand (MMD), Peak Weekly Demand (PWD), and Maximum Daily Demand (MDD). A definition of each of these water demand parameters was previously given in Section 6.1. A summary of the water demand parameters for the years 2015 to 2019 is presented in Table 6.2.2. The maximum water production for the time periods reviewed was observed in the Year 2019.

TABLE 6.2.2
ANNUAL, MONTHLY, WEEKLY AND DAILY TREATED WATER PRODUCTION

			Treated			
Year	**AAD, gpy***	**ADD, gpd***	**DDD, gpd**	**MMD, gpd**	**PWD, gpd**	**MDD, gpd**
2015	159,464,560	436,889	557,150	652,358	705,185	993,152
2016	175,229,045	478,768	554,905	623,465	685,925	840,581
2017	183,201,480	501,922	564,379	644,691	705,490	757,602
2018	195,668,209	536,077	629,953	686,177	727,557	743,112
2019	207,880,981	569,537	603,010	709,912	755,003	813,473
2020	191,862,017	524,213	635,304	722,216	767,518	846,796
2021	185,130,487	507,207	656,980	729,079	761,087	878,195
Max	207,880,981	569,537	656,980	729,079	767,518	993,152
Average	186,048,172	488,414	576,597	651,673	706,040	833,612

* gpy- gallons per year; & gpd- gallons per day

AAD/ADD

Over the past five years, the overall Average Annual Demand (AAD) and the Average Daily Demand (ADD) water production has ranged from 159 to 207 Million Gallons (MG) per year or approximately 0.437 to 0.569 Million Gallons per Day (MGD). The average water production over this period was approximately 186 MG per year or 0.488 MG per day.

DDD

The Dry Season Daily Demand (DDD) value represents the daily water production during the dry season months (June through October), which includes the highest water demand months (usually July or August). Although this value is not typically calculated for water systems, it is presented in this Plan to allow a comparison of dry season production with available water to be diverted from the City's raw water sources. The DDD over the time period reviewed ranged from approximately 0.555 MGD to 0.657 MGD.

MMD

The Maximum Monthly Demand (MMD) represents the highest flow produced over a month. For the City, the MMD typically occurs in the months of July or August. From the years 2015 to 2021, the MDD ranged from approximately 0.623 to 0.729 MGD. The average MMD flow for this period was 0.652 MGD.

PWD

The Peak Weekly Demand (PWD) is the peak water production over a week. This flow usually occurs during the month of the highest water production (e.g. July or August). The PWD over the last five years has ranged from 0.686 to 0.768 MGD. The average PWD flow for this period was 0.706 MGD.

MDD

The Maximum Monthly Demand (MDD) values given in Table 6.2.2 are the highest daily water production rates for the given time periods. The MDD typically occurs in the month with the peak week of maximum water production. Over the last five years, the MDD has ranged from approximately 0.743 to .993 MGD. The average MDD over this time period was approximately .834 MGD.

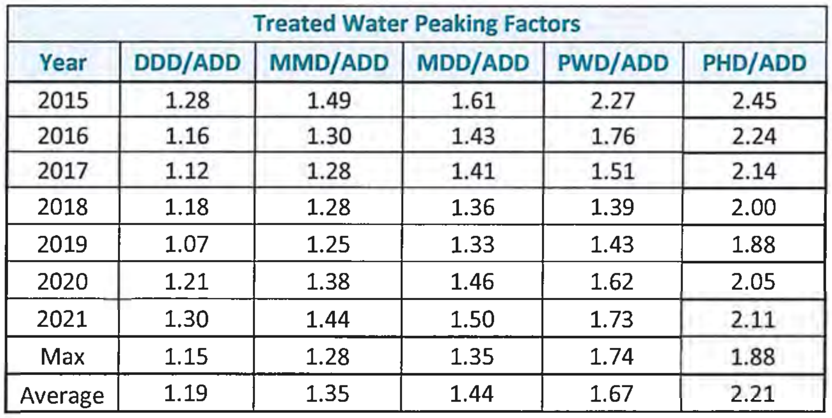
Peaking Factor

Peaking factors are commonly used to develop relationships between the ADD and the other planning criteria. These factors are used primarily for calculating future water demand. Peaking factors tend to be similar from one water system to another. Typically, MMD is approximately 1.5 times the ADD while the PWD is generally between 1.5 and 2.0 times the ADD. Peaking factors between 2 and 2.5 are commonly used for MDD. As the DDD is a unique value for this Plan, there are no typical peaking values for comparison.

The peak hourly demand is often used in the computer modeling process to ensure that the storage and distribution system will continue to function during short, peak demand situations. This value may be calculated by plotting the probability of occurrence of demand versus the various water demand values. From this logarithmic plot, the PHD value can be extrapolated.

The PHD was estimated by means of an extrapolation based on probability. Such a projection is based on the principle that an average monthly flow is likely to occur 6/12 of the time or 50 percent, and a peak monthly flow occurs 1/12 of the time or 8.3 percent. Likewise, peak weekly flow will take place 1/52 of the time or 1.9 percent; peak daily flow occurs once in 365 days or 0.27 percent, a peak hour flow happens once in 8,760 hours or 0.011 percent. Using this method and the flow data for the max year of 2019 (MDD equals 0.993 MGD; PWD equals 0.768 MGD; MMD equals 0.729 MGD; ADD equals 0.57 MGD), the PHD for the City was estimated to be 1.07 MGD. The calculated peaking factor (PHD/ADD) is 2.52, which is below the range of peak factors of three to five which is commonly used for PHD. A summary of the calculated flow peaking factors is presented in Table 6.2.3.

TABLE 6.2.3
SUMMARY OF TREATED WATER PRODUCTION PEAKING FACTORS



Treated Water Peaking Factors					
Year	DDD/ADD	MMD/ADD	MDD/ADD	PWD/ADD	PHD/ADD
2015	1.28	1.49	1.61	2.27	2.45
2016	1.16	1.30	1.43	1.76	2.24
2017	1.12	1.28	1.41	1.51	2.14
2018	1.18	1.28	1.36	1.39	2.00
2019	1.07	1.25	1.33	1.43	1.88
2020	1.21	1.38	1.46	1.62	2.05
2021	1.30	1.44	1.50	1.73	2.11
Max	1.15	1.28	1.35	1.74	1.88
Average	1.19	1.35	1.44	1.67	2.21

Water Pumped to the City for Consumption

The water pumped to the City for consumption is equivalent to the water produced at the WTP minus the backwash and miscellaneous usage at the WTP. As miscellaneous usage is not metered at the WTP, this was not accounted for in the data.

In addition to having flow meters on both treatment filters, and a backwash meter, the City also has a flow meter directly downstream of the WTP storage tanks. This meter is intended to measure the flow conveyed to the City and is the only meter that is calibrated on a yearly basis. Ideally the flows tabulated on this meter should be equal to the metered flows from both the treatment units minus the flow used for the backwash processes. However, there is also filter to waste flows that is recorded on the individual filter meters but flows are not going into the system. For these reasons the flow meters on the filters were not used when developing the various flow tables. A summary of water pumped to the City for the years 2015 through 2019 is shown in Table 6.2.4. The AAD, ADD, MMD, PWD, and MDD were derived from the flow data from the meter next to the storage tank; not including the water used for backwash.

TABLE 6.2.4
ANNUAL, MONTHLY, WEEKLY AND DAILY WATER PUMPED TO THE CITY

			Pumped to City			
Year	**AAD, gpy**	**ADD, gpd**	**DDD, gpd**	**MMD, gpd**	**PWD, gpd**	**MDD, gpd**
2015	149,498,347	419,418	526,852	618,316	673,076	918,987
2016	165,039,582	411,944	525,650	591,820	651,540	811,664
2017	171,750,685	402,658	527,720	605,822	672,180	757,602
2018	183,073,101	459,669	591,386	647,409	695,345	743,112
2019	201,825,466	469,325	575,489	673,704	712,348	813,473
2020	182,338,908	477,596	606,219	698,118	746,081	839,977
2021	174,689,056	509,317	629,859	700,062	722,647	853,090
Max	201,825,466	509,317	629,859	700,062	746,081	918,987
Average	167,340,429	423,422	542,902	615,842	673,035	807,841

The average calculated peaking factor (PHD/ADD) is 2., which is slightly lower than the common range of peak factors of three to five used for PHD. A summary of the calculated flow peaking factors is presented in Table 6.2.5.

TABLE 6.2.5
SUMMARY OF TREATED WATER PUMPED TO THE CITY FLOW PEAKING FACTORS

			Pumped Water Peaking Factors		
Year	**DDD/ADD**	**MMD/ADD**	**MDD/ADD**	**PWD/ADD**	**PHD/ADD**
2015	1.26	1.47	1.60	2.19	2.56
2016	1.28	1.44	1.58	1.97	2.60
2017	1.31	1.50	1.67	1.88	2.66
2018	1.29	1.41	1.51	1.62	2.33
2019	1.23	1.44	1.52	1.73	2.29
2020	1.27	1.46	1.56	1.76	2.25
2021	1.24	1.37	1.42	1.67	2.11
Max	1.24	1.37	1.46	1.80	2.11
Average	1.27	1.44	1.55	1.83	2.40

Water Consumption

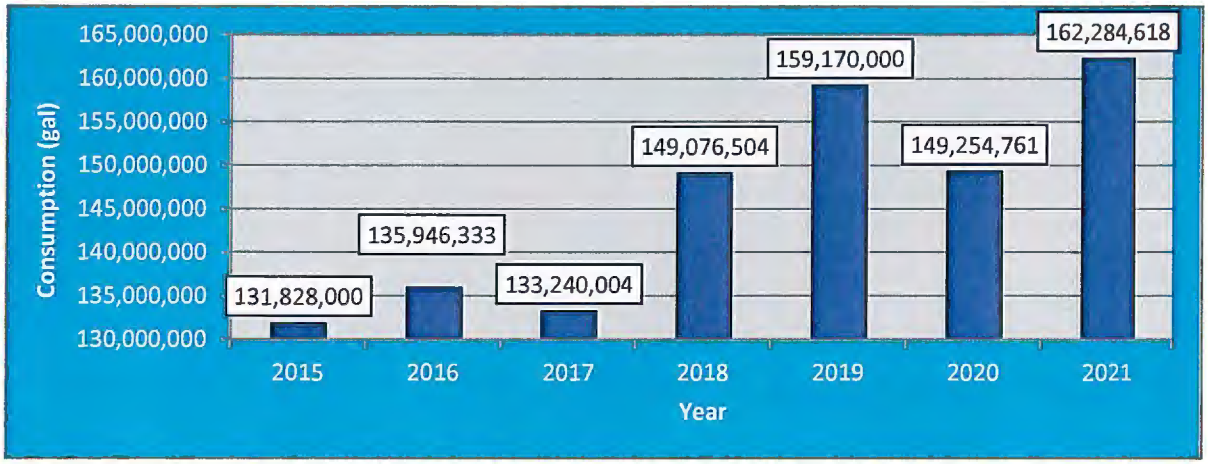
Water consumption or sales records allow for: determination of actual water consumption by the City's water users, calculation of an Equivalent Dwelling Unit (EDU), and provide measurement of non-account water when compared with plant production records.

Water Sales

Water consumption was based on the City's water consumption records for the years 2015 through 2021. A graph of the total annual amount of water sold to customers is presented in Figure 6.2.1.

The largest historical amount of water consumed by the City was in the Year 2021.

FIGURE 6.2.1
TOTAL METERED CONSUMPTION 2015 – 2021



Equivalent Dwelling Units

The number of EDUs, or residential housing units within a system, is determined to calculate the average cost for water services to a typical residence. The average cost per residential connection is not only used to educate the system users but is also used by regulatory and funding agencies for comparing costs with other communities. Since a water system typically consists of commercial, institutional, and industrial users, the most common method of calculating the average residential user cost is to evaluate each source on the basis of water consumption relative to the typical residential account or EDU.

Total metered consumption data for users on the City's system is compiled over a period of time (typically a year). The average water usage per EDU is calculated by dividing the residential water usage by the total number of residential connections on the system. The average EDU value is then used to assess an EDU by dividing the total water usage by the equivalent for the commercial accounts.

For the EDU calculation, the different sources (or sectors) on the City's system were divided into the following categories.

- Residential Inside City (single family dwellings, mobile home parks, multi-family, and assisted living).
- Residential Outside City (single family dwellings, mobile home parks, multi-family, and assisted living).
- Commercial/Industrial Inside City (supermarkets, motels, etc.)
- Commercial/Industrial Outside City (supermarkets, motels, etc.)
- City Use – Inside/Outside City (city shop, parks, buildings, etc.)

The estimated number of EDUs is summarized in Table 6.2.6. The estimated annual residential water consumption, inside the City, per EDU, based upon calendar Year 2021, is 42,000 gallons or 3,500 gallons per month. Residential accounts outside of the City equated to a higher number of EDUs than connections due to being assessed at a higher rate. For commercial accounts, inside and outside of the City, usage per connection and monthly charges were calculated. The monthly charge was compared to the inside City residential monthly charge and adjusted accordingly. Due to the structure of the rate system usage and costs both have to be used to determine the equivalent EDU totals.

TABLE 6.2.6
ESTIMATED NUMBER OF EDUS (YEAR 2021)

Number of Connections	Usage	EDU [1] (gpy)	EDU [2] (gpy) (FUNDING USAGE)
	Annual		
Residential-In City			
1,696	71,247,422	1,696	1,696
Residential-Out of City			
136	5,889,488	188	188
Commercial/Industrial-In City			
382	51,387,030	640	567
Commercial/Industrial-Out of City			
37	6,006,000	90	18
City Use-No Charge			
3	477,678	0	0
City Use-Charge			
54	27,277,000	90	25
Total			
2,242	**162,284,618**	**2,704**	**2,494**

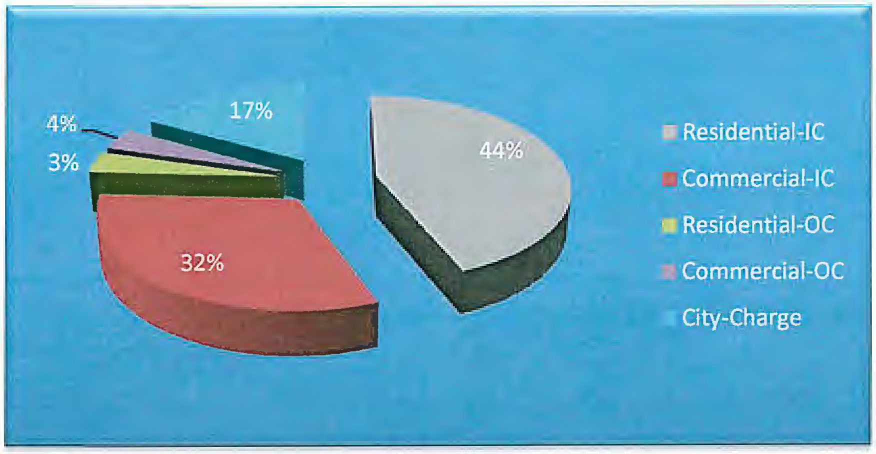
(1) Usage used to determine number of EDUs based on average usage per residence is 42,009 gallons per year.
(2) Usage used to determine number of EDUs based on funding standards is 90,000 gallons per year for commercial accounts only.

Business Oregon does not recognize the usage per EDU as unique to the specific planning area, but rather employ the use of a more generalized usage rate per EDU. The usage rate they use is 7,500 gallons per month (90,000 gallons per year) per dwelling unit. This is applied to commercial and other accounts only. The net effect is that the number of EDUs goes down due to the larger base usage amount. The other component to the EDU calculations above relates to the current user fee schedule. Fees charged to the different classifications will also affect the number of EDUs.

It should be reiterated that Table 6.2.6 shows the consumption levels per category within the system. All losses, non-account water, and other water uses are not accounted for within the consumption data. Water system planning requires that all water diverted from the source be analyzed and considered as total water system consumption.

Residential sources account for approximately 47 percent of all water consumed within the system. The remaining system users (e.g. commercial, public, and non-profit) utilize 54 percent of the metered water. About eight percent of the service connections are outside the City boundaries. These connections account for seven percent of the City's total water usage. The distribution of EDUs based on water consumed and cost per average residential unit inside the City is summarized in Table 6.2.6 and shown in Figure 6.2.2.

FIGURE 6.2.2
PERCENT USAGE PER SOURCE



Non-account Water

Water sold is typically less than the amount of that leaving the treated water storage tank due to system leaks, unmetered use at the WTP (backwash water, turbidimeter water, wash down, etc.), unmetered use within the distribution system, inaccuracies in customer meters, and other unmetered use such as fire flows and system flushing. A comparison of the amount of water treated (sum of water pumped to the City) and the amount of water consumed is given in Table 6.2.7.

TABLE 6.2.7
COMPARISON OF WATER PRODUCED, BACKWASH, PUMPED AND CONSUMED

Time Period	Treated Water	Backwash	Water Pumped	Water Consumed	% Non-account [1]
2015	159,464,560	9,966,213	153,087,416	131,828,000	12%
2016	175,229,045	10,189,463	150,359,493	135,946,333	18%
2017	183,201,480	11,450,794	146,970,264	133,240,004	22%
2018	195,668,209	12,595,108	167,779,047	149,076,504	19%
2019	207,880,981	11,132,556	196,748,425	159,170,000	19%
2020	191,862,017	9,522,503	182,339,514	149,254,761	18%
2021	185,130,487	9,821,924	175,308,563	162,284,618	7%
Average	178,181,612	10,668,366	154,549,055	145,828,603	16%

(1) Percent unaccounted is based on the quotient of the water consumed and water pumped to the City.

Over the last five years, the average amount of non-account water pumped to the City is approximately 13 percent. The variation between the annual non-account percentages could be contributed to the inaccuracy of the flow meters within the distribution system.

Potential sources of lost treated water include the following:

- Leakage within the City's water distribution system.

- Inaccurate water meters.
- Unauthorized use or connections without meters.
- Unmetered water for firefighting and operations such as street cleaning, water main flushing and testing.

The OAR Section 690-86, states that all water systems should work to reduce system leakage levels to 15 percent or less. If the reduction of system leakage to 15 percent is found to be feasible, the water provider should work to reduce system leakage to ten percent. With the amount of non-account water within its system, the City has met regulatory standards and requirements. The City will need to work at reducing the amount of non-accounted water to be consistently within the ten percent mark. Reductions in lost water can result in increased revenues, reduced expenses, and improved water system performance.

Summary

The current water demand parameters for water treated and water pumped to the City were compiled and provided in Table 6.2.8 and 6.2.9. These parameters were based on the maximum value from the years 2015 to 2021 for the water demand data. This water demand criteria will serve as the basis for the planning criteria of this Water Master Plan.

TABLE 6.2.8
SUMMARY OF CURRENT TREATED WATER PRODUCTION

Demand	Total (gpd)	Peaking Factor	Per Capita Demand (gpd)
ADD	569,537	1	170
DDD	656,980	1.15	196
MMD	729,079	1.28	218
PWD	767,518	1.35	230
MDD	993,152	1.74	297

TABLE 6.2.9
SUMMARY OF CURRENT DEMAND OF WATER PUMPED TO THE CITY

Demand	Total (gpd)	Peaking Factor	Per Capita Demand
ADD	509,317	1	152
DDD	629,859	1.29	188
MMD	700,062	1.41	209
PWD	746,081	1.51	223
MDD	918,987	1.62	275

6.3 Projected Water Demand

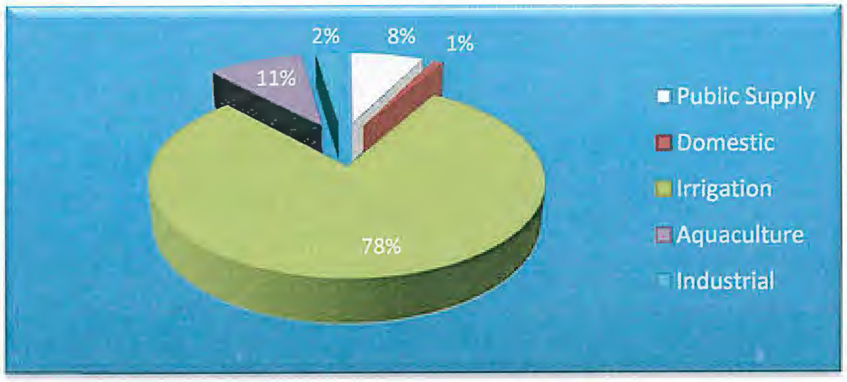
Water demands are projected to Year 2041 using the past records of water produced and water sold along with projected population estimates and anticipated additional water demand (e.g. industry). The goal of projecting future water demand is not to build larger facilities to accommodate excessive water consumption; but rather to evaluate the capability of existing components and to size new facilities for reasonable demand rates. Large amounts of leakage and excessive water consumption should not be projected into the future estimates. Rather, efforts should be made to reduce leakage and lost water to a reasonable level and utilize lower, more acceptable demand rates for planning efforts. Water demand projections should be based on acceptable water loss quantities, reasonable conservation measures, and the community's expected water use characteristics.

There is a degree of uncertainty associated with future water demand projections for any community. Uncertainties in projections exist because of the estimates used to define the community's current water use and the built-in assumptions made with respect to anticipated growth in a community. The impact of water conservation measures on a community's future water consumption is also difficult to predict.

Future per Capita Water Usage and Growth

The US Department of the Interior 2010 US Geological Survey - Circular 1405 documented the per capita water use in Oregon is 113 gpcd. A total of 6,730 MGD of water was used by Oregon in Year 2010. Total water withdrawals are separated by water use categories. The categories with their representative water use amounts are shown in Figure 6.3.1.

FIGURE 6.3.1
STATE OF OREGON USAGE



Based on treated water records, the average per capita use in the City of Bandon is 170 gpcd. This includes all domestic, commercial, tourist, and City use divided by population. For this Plan, future water demand for water pumped to the City will be based on the current water pumped parameters (per capita usage), projected growth within the City (see Section 3.3), and anticipated unaccounted for water. This methodology assumes that water demand characteristics within the City will basically remain the same as the existing per capita basis with consideration for changes in anticipated non-account water. The future anticipated non-account water is discussed below.

Anticipated Lost Water

Responsible water planning should not include the propagation of high lost water levels into water demand projections. According to OAR 690-86-140, a water system should endeavor to reduce system leakage to 10 percent or less of the total water diverted from their raw water sources. The City's non-account average of 13 percent over the last seven years is slightly higher than optimal, and needs to be addressed. Completion of several project within the Capital Improvement Plan (CIP) developed in Section 10 will help to mitigate water loss.

Future water demand will be based on maximum water production form the Year 2015 through 2021 since flows are measured by the master meter on the line going to town and measured backwash flows.

The master meter is the most accurate of all existing meters since it is the only meter that is calibrated every year.

Summary of Future Water Demand

The ADD projections were calculated by multiplying the projected population (shown in Table 3.3.2) by the per capita usage (170 gpcd). The DDD, MMD, MWD, and PWD were then determined by multiplying the ADD by their respective peaking factors. A summary of the water production demand projections is presented in Table 6.3.1.

TABLE 6.3.1
FUTURE WATER PRODUCTION DEMAND

Parameter/Year	2021	2026	2031	2036	2041
Total Population	3,344	3,463	3,586	3,713	3,845
Water Demand					
ADD	569,537	589,752	610,684	632,359	654,804
DDD	656,980	680,298	704,444	729,447	755,338
MMD	729,079	754,957	781,753	809,500	838,232
PWD	767,518	794,760	822,968	852,178	882,425
MDD	993,152	1,028,402	1,064,904	1,102,701	1,141,840

*Growth rate of 0.7% applied from years 2021 through 2041 reflecting the City of Bandon reducing and users outside.

SECTION 7:
DESIGN CRITERIA AND COST BASIS

SECTION 7: DESIGN CRITERIA AND COST BASIS

7.1 Design Life of Improvements

The design life of a water system component is sometimes referred to as its useful life or service life. Design life is based on such factors as the type and intensity of use, type and quality of materials used in construction, and the quality of workmanship during installation. The estimated and actual design life for any particular component may vary depending on the above factors. The establishment of a design life provides a realistic projection of service upon which to base an economic analysis of new capital improvements.

The base planning period for this Water Master Plan is 20-years, ending in the Year 2039. The planning period is the time frame during which the recommended water system is expected to provide sufficient capacity to meet the needs of all anticipated users. The required system capacity is based on population, water demand projections, and land use considerations. The planning period for a water system and the design life for its components may not be identical. For example, a properly maintained steel storage tank may have a design life of 60-years, but the projected fire flow and consumptive water demand for a planning period of 20-years determines its size. At the end of the initial 20-year planning period, water demand may be such that an additional storage tank is required; however, the existing tank with a design life of 60-years would still be useful and remain in service for another 40-years. The typical design life for system components are discussed below.

Raw Water Intakes and Transmission

Intake structures including concrete impoundments should have design lives of 50 to 100-years when properly constructed and maintained. Water transmission piping should easily have a design life of 40 to 60-years if quality materials and workmanship are incorporated into the construction. Modern PVC and cement mortar-lined ductile iron piping can last up to 100-years when properly designed and installed.

Water Treatment Facility

Major structures and buildings should have a design life of approximately 50-years. Pumps and equipment usually have a useful life of about 15 to 20-years. The useful life of treatment equipment can be extended when properly maintained; if additional treatment capacity is not required. Filter media normally has a design life of ten to 15-years. Flow meters typically have a design life of ten to 15-years. Valves usually need to be replaced after 15 to 20-years of use.

Treated Water Transmission and Distribution Piping

Water transmission and distribution piping should easily have a design life of 40 to 60-years if quality materials and workmanship are incorporated into the construction. Modern PVC and cement mortar lined ductile iron piping can last up to 100-years when properly designed and installed. The City does have a lot of asbestos cement pipe that is reaching the end of its design life. Over time this material becomes soft and is subject to failure.

Treated Water Storage

Distribution storage tanks should have a design life of 50 to 60-years (steel construction) to 70 to 80-years (concrete and welded steel construction). Steel tanks with a glass-fused coating can have a design life similar to concrete construction. Actual design life will depend on the quality of materials, the workmanship during installation, and the timely administration of maintenance activities. Several practices, such as the use of cathodic protection, regular cleaning, and frequent painting can extend or assure the service life of steel reservoirs.

7.2 Sizing and Capacity Criteria

Demand projections presented in Section 6 are based on population projections offered in Section 3. The projections assume an average 0.6 percent annual growth rate until the Year 2039.

Accurately predicting growth is difficult, especially beyond 20-years into the future. As time progresses, all of the projections should be updated to reflect actual population and demand. The analysis and presentation of recommended improvement alternatives can be found in Section 8.

Raw Water Source

The raw water sources and reservoirs must be capable of meeting Maximum Daily Demand (MDD) of the system over a period of 50-years. The selection of a source is a long-term commitment that cannot be easily changed. Water rights are becoming more critical as the State's population and water demand increases; and the number of viable water sources remains constant. In the City's case, the water sources need to be sufficient to handle the water demand during the dry season months (June through October). The appropriate design parameter for this dry season evaluation would be the MDD.

Intake and Raw Water Pumping Facilities

Intake piping and pump facilities are not easily expanded and should be sized to meet, at a minimal, the anticipated MDD well into the future. A design life of 50 years is common for these facilities.

Pumps and other mechanical equipment can be expected to last approximately 15 to 20-years under normal conditions before extensive maintenance or replacement is necessary. Commonly, two pumps are installed in a pumping station, each having capacity equal to the capacity of a Water Treatment Plant or the MDD predicted within a planning period. Duplex pumping systems can be designed to alternate after each cycle to extend the life of the equipment. If future demands increase beyond the ability of a single pump, the second pump can serve as a lag pump in parallel to sustain higher flow rates during peak demand times.

Transmission Piping

The existing transmission lines must have the ability to handle at least the 20-year MDD. The capacity of the raw water and treated water transmission piping will be evaluated against the 20-year MDD.

Water Treatment Facility

Water treatment plants are typically designed to handle the 20-year MDD flow since these facilities can be expanded and typically have an overall design life of around 20-years. The existing treatment plant components will be evaluated against the 20-year MDD flow.

Treated Water Storage

The total treated water storage capacity must include reserve storage for equalization storage, emergency storage, and fire reserve. An alternative method to analyzing the treated water storage requirements suggests itemizing the potential requirements for treated water within the system. A discussion of these various needs follows.

Equalization Storage

Equalization storage is used to meet fluctuations of the supply capacity of the treatment plant and peak demand of the distribution system. Equalizing storage is typically 25 percent of the MDD of the water system.

Emergency Storage

To protect against a total loss of water supply such as would occur with a broken transmission main, a prolonged electrical outage, treatment plant breakdown, or source contamination emergency storage is required. The emergency storage reserve is set at one MDD or three times the Average Daily Demand (ADD). For the emergency storage calculations it was assumed that supply disruption will occur on a day of maximum demand and be corrected within 24 hours.

Fire Reserve Storage

To provide sufficient water for fire suppression in the water system fire reserve storage is utilized. The amount of fire reserve is based on the maximum flow and duration of flow needed to confine a major fire. Guidelines for determining the required fire flow and duration are generally determined using the "Fire Suppression Rating Schedule" by the Insurance Services Office (ISO) and/or the International Fire Code adopted by the State of Oregon. The needed fire flow and associated fire reserve storage dictated by these two methods can vary considerably.

The ISO needed fire flow is calculated using factors related to type of construction, type of occupancy, exposure to connected buildings, and building affective area. Using their formula a single wood framed dwelling totaling 2,400 square feet would require approximately, 1,000 gallons per minute (gpm) for two hours.

The 2014 Oregon Fire Code recommends fire flows of 1,000 gpm for a minimum of one hour; for one or two family dwellings not exceeding two stories in height or 3,600 square feet. Generally, for rural residential dwellings, 500 gpm is utilized as a basis for fire flow suppression. Most residences within City of Bandon are less than 3,600 square feet. Therefore, for this Plan, the fire reserve storage required for residential areas will be calculated using fire flows of 1,000 gpm and duration of one hour.

Commercial and institutional buildings typically require higher fire flows with longer durations. Determination of these flows are unique to each building under consideration and will depend upon such factors as the square footage of the floor area, and the type of construction based on the International Building Codes (IBC) classifications. For this Plan, commercial areas will be calculated using fire flows of 4,500 gpm and duration of two hours.

Another important design parameter for reservoirs is elevation. Ideally, reservoirs should be located at similar elevations to allow hydraulic balance within the distribution system. Within a given service area, the need for altitude valves, check valves, Pressure Reducing Valves (PRVs), booster pumps, pumper trucks for extracting fire flows, and other control devices is reduced when a consistent water surface is maintained in all reservoirs.

Distribution reservoirs should also be located at an elevation that maintains adequate water pressure throughout the system; sufficient water pressures at high elevations and reasonable pressures at lower elevations. The pressure range in the system should stay within the range of 25 to 100 pounds per square inch (psi) and never drop below 20 psi at any usage rate.

All of the above criteria will be used to evaluate the adequacy of existing storage and the need, if any, for future additional storage in Section 8.

Distribution System

Distribution mains are typically sized for fire flows and 20-year population demand, or fire flow and saturation development demand. The mains should be at least 6-inch diameter to provide minimum fire flow capacity. All pipelines should be large enough to sustain a minimum line pressure of approximately 20 psi. The State of Oregon requires a water distribution system is designed and installed to maintain a pressure of at least 20 psi at all service connections at all times. The distribution system must be sized to handle the peak hourly flows and to provide fire flows while maintaining minimum pressures.

In addition to the above design criteria, the following general guidelines are recommended for the design of water distribution systems.

- 6-inch diameter lines - minimum size lateral water main for gridiron (looped) system and dead-end mains.
- 6-inch diameter lines - minimum size for permanently dead-ended mains supplying fire hydrants and for minor trunk mains.
- 8-inch and larger diameter - as required for trunk (feeder) mains.

The distribution system lateral mains should be looped whenever possible. A lateral main is defined as a main not exceeding a 6-inch diameter, which is installed to provide water service and fire protection for a local area including the immediately adjacent property. The normal size of lateral mains for single-family residential areas is 6-inch diameter. However, 8-inch diameter or greater lateral mains may be required to meet both the domestic and fire protection needs of an area.

The installation of permanent dead-end mains and dependence of relatively large areas on a single main should be avoided. For the placement of a fire hydrant on a permanently dead-ended main, the minimum size of such laterals should be 6-inch diameter. However, 6-inch diameter mains may be used for a stub out without exceeding 500 feet in length supplying a single fire hydrant not on a public street and for internal fire protection. On new construction, the minimum size lateral main for supplying fire hydrants within public ways should be 6-inch diameter provided 6-inch diameter mains are looped.

A computer model of the distribution system was developed as part of this Water Master Plan. The model utilized actual pipe sizes, system configuration, and materials as well as system pipe junction elevations and storage tank elevations. A computer model of the City's distribution system was checked to determine the maximum flow rate available at various locations within the system. The model was developed using a software program called WaterCAD® CONNECT Edition (Version 10.2) by Haestad Methods.

The requirements for firefighting within the City were developed by consulting with the local Fire Chief. For a detailed discussion of the distribution system performance and fire flow analysis, see Section 8.

7.3 Basis for Cost Estimates

The cost estimates presented in this Plan will typically include four components: construction cost, engineering cost, contingency, and legal and administrative costs. Each of the cost components are discussed in this section. The estimates presented herein are preliminary and are based on the level and detail of planning presented in this WMP. As projects proceed and as site-specific information becomes available, the estimates may require updating. System improvements that are recommended in the City are detailed in this section along with associated costs.

Construction Costs

The estimated construction costs in this Plan are based on actual construction bidding results from similar work, published cost guides, other construction cost experience, and material prices. Reference was made to the as-built drawings, and system maps of the existing facilities to determine construction quantities, elevations of the reservoirs and major components, and locations of distribution lines. Where required, estimates will be based on preliminary layouts of the proposed improvements.

Future changes in the cost of labor, equipment, and materials may justify comparable changes in the cost estimates presented herein. For this reason, common engineering practices usually tie the cost estimates to a particular index that varies in proportion to long-term changes in the national economy. The Engineering News Record (ENR) Construction Cost Index is most commonly used. This Index is based on the value of 100 for the Year 1913. Average yearly values for the past ten years are summarized in Table 7.3.1.

TABLE 7.3.1
ENR CONSTRUCTION COST INDEX – 2011 TO 2021 (1)

Year	Index	% Change
2011	9,070	3.08%
2012	9,308	2.62%
2013	9,547	2.57%
2014	9,806	2.71%
2015	10,054	2.53%
2016	10,338	2.82%
2017	10,737	3.86%
2018	11,062	3.02%
2019	11,281	1.98%
2020	11,466	1.64%
2021	12,133	5.82%
	Average Annual	2.97%

(1) Index based on July of each year at 20-City average labor rates and material prices.

Cost estimates presented in this Plan for construction performed should be projected with a minimum increase of three percent per year. Between 2020 and 2021 the precent change was 5.82 percent Based on projects bid in 2021 and 2022 prices have increased by over ten percent. With the continued problems with the supply chain we anticipate project costs to increase by 15 to 20 percent. Future yearly ENR Indices can be used to calculate the cost of projects for their construction year based on the annual growth in the ENR Index but also look at costs of projects bid for similar work within the last eighteen months.

It is also recommended that in the event other public works projects are being performed in the same location, (sewer, street, storm, etc.), planning priority be given to combining these water projects with the projects at hand. By proceeding in this manner, the City will save money by eliminating repetitive mobilization, demolition, and road patching for the same locations.

Contingencies

A planning level contingency equal to approximately 15 percent of the estimated construction cost has been added. In recognition that the cost estimates presented are based on conceptual planning, allowances must be made for variations in final quantities, bidding market conditions, adverse construction conditions, unanticipated specialized investigation and studies, and other difficulties which cannot be foreseen at this time but may tend to increase final costs.

Engineering

The cost of engineering services for major projects typically includes special investigations, a predesign report, surveying, foundation exploration, preparation of contract drawings and specifications, bidding services, construction management, inspection, construction staking, startup services, and the preparation of operation and maintenance manuals. Depending on the size and type of project, engineering costs may range from 15 to 25 percent of the contract cost when all of the above services are provided. The lower percentage applies to large projects without complicated mechanical systems. The higher percentage applies to small, complicated projects.

Additional engineering services may be required for specialized projects. This could include geotechnical evaluations, Environmental Reports, structural evaluations, and other specialized consulting activities.

Legal and Administrative

An allowance of four percent of construction costs has been added for legal and administrative services. This allowance is intended to include internal project planning and budgeting, grant administration, liaison, interest on interim loan financing, legal services, review fees, legal advertising, and other related expenses associated with the project.

Land Acquisition

Some projects may require the acquisition of additional right-of-way or property for construction of a specific improvement. The need and cost for such expenditures is difficult to predict and must be reviewed as a project is developed. Efforts were made to include costs for land acquisition, where expected, within the cost estimates included in this Plan.

Environmental Review

In order for a project to be eligible for Federal and/or State grants and loans, a review of anticipated environmental impacts of the proposed improvements is required. The primary goal of the environmental review is to help public officials make decisions that are based on the understanding and consideration of the environmental consequences of their actions; and to take actions that protect, restore, and enhance the environment. To accomplish these tasks, the National Environmental Policy Act (NEPA) was promulgated.

The NEPA requires Federal agencies or monies originating from Federal programs to either prepare or have prepared written assessments or statements that describe the:

- Effected environment and environmental consequences of a proposed project.
- Reasonable or practicable alternatives to the proposed project.
- Any mitigation measures necessary to avoid or minimize adverse environmental effects.

The environmental review includes one of the following four levels in the order of increasing complexity.

- Determination of categorical exclusion without an environmental impact or assessment report.
- Determination of categorical exclusion with an environmental impact or assessment report.
- Preparation of an environmental impact or assessment report.
- Preparation of an environmental impact statement.

Within this Plan, the cost for performing the anticipated environmental review was estimated for the projects to be financed with publicly financed grants and loans. The cost for the environmental review will be based on previous experience in preparing the required documents. If funding is obtained from a public funding agency, then the City will likely be required to submit some form of Environmental Report that examines the potential impact of the proposed improvements on local habitat and species. Review and approval by the affected agencies could take up to twelve months or more.

Permitting

Permitting is important because many activities associated with constructing and maintaining the water system requires permits to comply with State and Federal requirements for work within wetland areas or waterways. Typically, Oregon Division of State Lands and US Corps of Engineers are required in these instances. Compliance with storm water, erosion control, flood plain, and other various environmental requirements are often involved with the construction of transmission lines, raw water intakes, discharge facilities, raw and finished water reservoirs, and other items. For the cost estimates prepared in this WMP, it was assumed that the General Contractor would bear the cost of all permitting. Therefore, no permitting costs are included in these estimations.

SECTION 8:

ANALYSIS AND IMPROVEMENT ALTERNATIVES

SECTION 8: ANALYSIS AND IMPROVEMENT ALTERNATIVES

This section of the Water Master Plan (WMP) presents detailed analyses of each major component within the system and where appropriate, provides an evaluation of proposed alternatives and recommended option(s). Cost estimates for the recommended improvements are given in the Capital Improvement Plan, Section 9. Improvement phasing and potential impacts to ratepayers are discussed in Section 10.

8.1 Water Rights

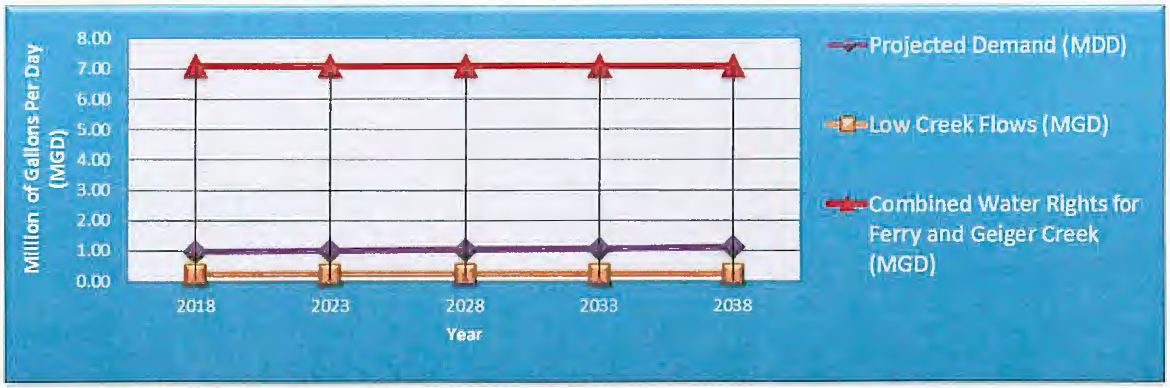
The City of Bandon is permitted to withdraw water with the following Permits 3011, 27232 and 27233; and below the point of confluence of Ferry Creek and Geiger Creek through Permit Amendment 8195 issued March 29, 2000. This point of diversion is typically used during low flow periods occurring during late summer early fall months. The purposed for developing this point of diversion was to avoid conflicts with the fish hatchery that has a senior water right of 3.0 cubic feet per second (cfs) prior to City use. The fish hatchery's water right is for water flowing through the hatchery and not for consumption which allows the City to draw water below the 3.0 cfs during low flow periods.

The two lowest recorded flows in Ferry Creek were 0.8 cfs in October 1977 and 0.4 cfs in October 1978. There were a total of seven days in October 1977 where the average flow was 0.80 cfs.

The total water supply available to the City in Ferry and Geiger Creeks has been as low as 0.80 cfs for up to a week during a dry month. This supply will consist of water that has passed through the hatchery fish pens from both Ferry and Geiger Creeks and was diverted downstream of the confluence of the two creeks by means of the Low Flow Pump Station.

The current water use projections as developed in Section 6 indicated a Maximum Daily Demand (MDD) of 0.980 Million Gallons per Day (MGD) or 1.52 cfs (MDD) for Year 2019 increasing to 1.11 MGD or 1.70 cfs by Year 2039. The single day demand exceeding the supply stream could be met by tank storage or impoundment reservoir storage for a few days. On a maximum month basis in Year 2039, the City is projected to require 1.33 cfs per day for a thirty day period. In summary, Ferry and Geiger Creeks have recorded flows significantly less than this for a seven day period. Refer to Figure 8.1.1 water right comparison versus projected MDD versus recorded low raw water flows.

FIGURE 8.1.1
WATER RIGHT COMPARISON



The numbers stated for MDD and Maximum Monthly Demand (MMD) is based on water production records. The raw water diverted is another parameter that needs to be considered. Raw water diversion averaged 0.755 MGD or 1.17 cfs for 2019. Historic records show that there are periods when that amount of water is not available. The raw water flow meter was just replaced and a data base needs to be developed over time before diverted raw water values can be used in the decision process.

Therefore, the existing raw water supply source from Ferry and Geiger Creeks has provided adequate water during the maximum demand month for the last thirty plus years. However, historic records show that if the City experiences low flows as recorded in 1977 and 1978 there would be a serious water shortage. Based on the projected MDD, the City's existing water rights on Ferry and Geiger Creeks are sufficient to meet the City's demand through the planning period and well beyond. This does not mean the water will be available.

8.2 Raw Water Sources

Raw Water Pump Stations

The Middle Pond Pump Station requires upgrades to provide capacity and system reliability. To improve capacity the pumps at the Middle Pond Pump Station should be replaced to allow for 1,400 gallons per minute (gpm) flow and redundancy. A flow meter should also be placed at the Pump Station to provide a reading of water entering and being pumped to the Water Treatment Plant (WTP). Next, the current ventilation system does not provide adequate air flow and an exhaust fan should be installed to increase air movement inside the Pump Station. The Pump Station also does not have any electrical backup if local power becomes unavailable. Backup power is needed to provide the ability to pump water when there is a power outage. The WTP also lacks backup power. It is recommended that the backup generator is added at the WTP site also provide emergency power to the Middle Pond Pump Station. Finally, the dock at the Middle Pond needs replacement, a small wooden dock would be sufficient.

The Lower Pump Station requires upgrades to provide capacity. To improve capacity the pumps at the Lower Pump Station should be replaced to allow for 1,400 gpm flow and redundancy. A backup generator should be installed to provide the ability to pump water when there is a power outage. Next, the current ventilation system does not provide adequate air flow and an exhaust fan should be installed to increase air movement inside the Pump Station.

The Pump Station on Ferry Creek, low flow diversion point, currently has no emergency power source and should be connected to a backup generator for power in emergency situations. The backup generator for the Lower Pump Station could also be used for this Pump Station since the Pump Stations should not be running at the same time.

Raw Water Storage

Ferry Creek and Geiger Creek convey surface and base flow to two small existing dams that impound raw water within the watershed. A capacity survey in 2014 indicated that together they store approximately 3.38 acre-feet of raw water. These two dams are considered balancing reservoirs and are capable of supplying the raw water demand for approximately 2.5 days during normal conditions. Balancing reservoirs are intended to supply immediate fluctuations in water demand and do not impound water as a long term supply source. Both balancing reservoirs supply raw water to a small settling pond called Middle Pond. Raw water is pumped from Middle Pond to the City of Bandon's Water Treatment Plant for municipal use.

In 2016 the City began evaluating alternatives to address the insufficient emergency water supply. It was found that Ferry Creek and Geiger Creek dams were owned by the Oregon Department of Fish & Wildlife (ODFW) during this investigation. The ODFW also determined that the dams were unsafe. Since that time repairs have been made to remove this classification.

Off-Channel Reservoir

In October of 2016 the 'Off-Channel Reservoir Feasibility Study' was completed. This study discussed the feasibility of developing a reservoir that could provide the City with water during extreme drought conditions. The Off-Channel Reservoir would be considered an impounding or storage reservoir. Storage reservoirs are intended to divert and store raw water during high flow conditions and then use the stored raw water during low flow conditions.

The study evaluated the need for and developed the schedule for creek flow augmentation, and compared raw water availability with future demand projections. The analysis showed that in extreme drought conditions, the water available for diversion could not meet the projected demands. Additionally, after accounting for fish passage flow requirements, it was concluded that streamflow augmentation was needed. Once the need for an Off-Channel Reservoir was determined, a diversion/augmentation schedule was developed in which 108 days were designated for available water diversion, and 143 days were designated for streamflow augmentation.

The recommended reservoir would be approximately 11.5 acres in size, six to eight feet higher than the average base elevation, and approximately 16 feet deep. The reservoir was sized to hold a maximum of 100 acre-feet of water. While augmenting during summer months, the reservoir storage reaches its minimum volume of 45 acre-feet before recharging.

The Off-Channel Reservoir supply water would be diverted from Ferry Creek utilizing the City's existing Low Flow Pump Station. Diverted water would be pumped to the reservoir in a new 12-inch diameter pipe located within a utility easement and parallel to the City's existing treated water main. Water from the Off-Channel Reservoir would gravity flow to the creek while augmenting creek flows, and would gravity flow to the Low Flow Pump Station, and subsequently be pumped to the Middle Pond for City use when operating as an emergency water supply.

Assuming the following: the reservoir is at its minimum volume (45 acre-feet); there is no available flow for diversion from the creeks; the system demand is equal to the 2041 Dry Season Daily Demand (DDD); and the Off-Channel Reservoir combined with the existing reservoirs would be able to provide approximately 24 days of raw water supply. This varies from the study's 30 day supply estimate as the demand projections have been updated. In the event of an extreme drought, it is likely that the City would require some form of water curtailment. If it was assumed that the water usage dropped to the 2036 Average Daily Demand (ADD) as a result of the curtailment. Usage would typically have a more significant drop when under curtailment. The reservoir would provide approximately 28 days of storage.

Wells

Ground water was also evaluated to determine if this could be a viable water source during low flow conditions. In May 2022 the Supplemental Groundwater Supply Feasibility Evaluation was completed. This study discussed the feasibility of developing a well field that could provide the City with water during extreme drought conditions.

The study evaluated the local and regional hydrogeologic setting with one geologic unit, marine terrace deposits, appearing favorable for the development of a supplemental groundwater supply with a 30 day capacity of 300 to 500 gpm. The study anticipates that a single new properly designed waster supply well could potentially achieve a yield of 75 to 100 gpm, presuming that at least 50 feet of saturated and screenable aquifer material is present at specific well sites. Based on the assumptions a total of three to six wells would be necessary to meet the target capacity.

The preferred well field site is located in the vicinity of the existing water treatment facility. A total of six wells are shown. Two other well field sites were located on the north and south sides of the Ferry Creek Reservoir. If the wells were developed a new groundwater permit would have to be applied for.

Oregon Water Resources Department (OWRD) is likely to find the following with respect to the department's review criteria for new groundwater permits:

1. **Whether Water is Available.** Although groundwater is available for the proposed use, the use would have the Potential to Cause Substantial Interference (PSI) with surface water, and additional surface water use is not available any month of the year. The OWRD is expected to find that water is not available for the proposed use.

2. **Basin Program Rules.** The use of groundwater for municipal use is consistent with the basin program rules.

3. **Injury to Existing Water Rights.** There is uncertainty as to whether the proposed use would cause injury to existing water users. These uncertainties can only be resolved after an application has been submitted and OWRD's groundwater section has completed its review. Based on GSI's estimations of pumping interference from a new full-scale wellfield, two existing water users would be impacted, which are discussed below:

   – **ODFW Fish Hatchery.** The Oregon Department of Fish and Wildlife's (ODFW's) hatchery has a water right certificate for non-consumptive use of water from Ferry Creek. The ODFW's Water Right Certificate No. 7904 has a priority date of July 20, 1925, which is junior to some of the City's existing water rights (including Certificate No. 9754, see Section 3.3). GSI indicated it is unlikely that OWRD would determine that a full-scale wellfield would cause injury to ODFW's fish hatchery because a groundwater system by nature will result in less direct stream depletion than the City's existing surface water intakes on Ferry Creek.

   – **Exempt (Domestic) Wells.** There are existing exempt (domestic) wells located a few hundred feet north of the City's Water Treatment Plant (along Houston Lane, Melton Road). These wells are exempt from needing a water right to use groundwater. Some of these wells are shallow (less than 50 feet). Therefore, pumping interference from a full-scale wellfield could preclude the exempt wells from obtaining groundwater. GSI suggests it is possible that OWRD would determine that there may be injury to existing exempt (domestic) wells from a full-scale wellfield depending on where the wells are located. New wells located near the City's Water Treatment Plant would likely cause injury to the exempt wells while new wells located south of Ferry Creek would not likely result in injury to the exempt wells.

4. **Consistency with OWRD Administrative Rules.** As part of their evaluation under the Division 33 rules, ODFW and the Department of Environmental Quality (DEQ) would be expected to recommend either denial of the application or require that the City provide mitigation to address impacts to listed fish species in the affected surface water source.

Based on the expected finding that water is not available for the proposed use, and expected recommendations from ODFW and DEQ, OWRD would likely deny an application for a new municipal groundwater permit from wells in the area of the City. One option to potentially change this outcome could be to provide mitigation to offset the impacts to surface water, as described below.

To obtain a new groundwater permit, the City would likely need to resolve the concerns described above regarding PSI, surface water not being available, and impacts to listed fish species. Historically, the method to resolve these issues has typically been to provide mitigation. Mitigation has been provided in the form of transferring a surface water right instream in the affected surface water source, or possibly cancelling a water right certificate that authorizes use from the affected surface water source. However, OWRD has very recently announced that it will generally not accept mitigation when water is not available. Further discussions with OWRD are recommended to determine if the agency would accept mitigation in this situation.

8.3 Water Treatment Facilities

Water Treatment Plant Operations and Building Improvements

The Water Treatment Plant deficiencies are typically related to insufficient capacity, or poor condition of existing facilities. The WTP capacity relative to projected demands, and the general condition and functionality of the existing WTP were assessed and are discussed below.

The maximum day demand is projected to be 1,106,428 gallons per day by Year 2039. The Water Treatment Plant is rated and capable of treating up to 2,000,000 gallons per day in its present condition. Therefore, assuming timely maintenance and upkeep, no major improvements or expansions are anticipated as being required during the next 20-year period.

One of the two clarifiers at the WTP is aged, is not functioning correctly, and cannot be relied on for normal operation. Replacing the clarifier will provide redundancy to the system and would facilitate continued water treatment while completing maintenance tasks on the unit in service. This improvement would also allow the City of Bandon to treat larger volumes of water and prepare for possible future expansion. The bond issue the City passed in 2019 included monies for a new second clarifier. In 2020 the Oregon Structural Specialty Code replaced ASCE 7-10 with ASCE 7-16 as the basis for structural design. The net result of this change is a glass fused to steel tank is no longer an option for the new clarifier. The glass fused to steel tank manufactures can not meet the new code for the connection of the tank to concrete footing without adding a steel bottom. The steel bottom is not an option since the base needs to be cone shaped to collect solids. The only option for the new clarifier is to replace the existing concrete clarifier with a new concrete clarifier that meets the new structural codes. The change in materials is estimated to add an additional $1,200,000 to the overall total project cost.

The existing raw water clarifier currently in service is a glass fused to steel bolted steel tank blue in color. The tanks surfaces exposed to sunlight rise in temperature causing an inversion within the tank during the warm summer months. This inversion creates a thermal movement of settled particles from the bottom of the tank to the surface. The net result is turbidity to the plant which increases or creates problems with treatment. The City installed an exterior barrier on the south side of the tank in 2019 thus greatly reducing the temperature inversion.

Although overall conditions at the WTP are good, there are some improvements that would increase the functionality of the facility. The plant was designed to have a streaming current meter located just prior to the clarifier. The streaming current monitor was added in 2021 to improve the efficiency of the chemical feed systems. The raw water flow meter was replaced in 2020. These two instrumentation upgrades eliminated the chemical feed issues. The City should provide a roof over the top of the outdoor filter basins to block the sunlight and prevent algal growth. It was originally recommended to provide three backup generators to provide standby power at the WTP, Middle Pond Pump Station and Lower Pump Station to provide the ability to treat water when there is a power outage. The City is now in the process of designing a system with only one generator that would provide power for the three facilities listed but also the Low Water Pump Station, Fish Hatchery and several residential dwellings. Finally, the proposed upgrades to the plant will require Programmable Logic Controller (PLC) modifications to the Supervisory Control and Data Acquisition (SCADA) system.

The WTP building overall is in good condition but the flooring in the front office is deteriorating and needs replacement to provide a safe working environment. Additionally, a new sample island in the laboratory will allow for additional storage and increased organization of laboratory equipment.

8.4 Treated Water Storage

Two tanks provide treated water storage totaling 3,000,000 gallons. One tank stores one million gallons and the other stores two million gallons. Both tanks require general rehabilitation. The one million gallon tank needs interior recoating. The two million gallon tank needs both the interior and exterior recoated. In addition to the rehabilitation of both tanks, the two million gallon tank needs seismic improvements to maintain a viable water source in the event of an earthquake.

The interior coating and seismic improvements to the two million gallon tank was bid in December 2021. The bid came within budget but the projects were not awarded due to the anticipated delivery date for the seismic monitoring equipment. Materials were not due on-site until June 2022 which would not allow for the reservoir to be taken off line due to the heavy summer months demand. The City has purchased the seismic monitoring equipment and the project will be rebid in December 2022.

Design Storage Capacity

There are three parameters used to determine the treated water storage requirements of a given water system. These parameters are defined as follows:

1. Equalization was set at 25 percent of MDD.
2. Emergency storage was set at one MDD (Treated water delivered to City).
3. Fire flow was set at 4,500 gpm for a two hour duration.

The MDD for the individual reservoir assessments was based on the MDD per capita, and the population served in each service area. An analysis of this required storage is shown in Table 8.4.1.

TABLE 8.4.1
ENTIRE SYSTEM FIRE FLOW ASSESSMENTS

Parameter/year	2021	2026	2031	2036	2041
Water Demand (GPD)					
MMD	993,152	1,028,402	1,064,904	1,102,701	1,141,840
Necessary Storage (gal)					
Emergency Storage (1 x MDD)	993,152	1,028,402	1,064,904	1,102,701	1,141,840
Equalization (.25 x MDD)	248,288	257,101	266,226	275,675	285,460
Fire Reserve (4500 GPM @ 2 Hours)	540,000	540,000	540,000	540,000	540,000
Total Required Storage	1,781,440	1,825,503	1,871,130	1,918,376	1,967,300
Storage Assessment (gal)					
Existing Storage	3,000,000	3,000,000	3,000,000	3,000,000	3,000,000
Surplus Storage	1,218,560	1,174,497	1,128,870	1,081,624	1,032,700

Recommended Storage Improvements

Although an additional reservoir is not required based on storage capacity, it is recommended that the City of Bandon construct an additional 250,000 gallons of storage approximately one third of a mile NW of Seabird and Beach Loop for equalization in the southern portion of the City. This reservoir would provide emergency water to the surrounding area if it was cut off from the primary reservoirs at the WTP due to broken water lines during a seismic event.

Corrosion was noted on the interior of both the one and two million gallon tanks and on the exterior of the two million gallon tank during the last reservoir inspections. Both tanks are not outfitted with seismic features. The two million gallon tank deficiencies are being addressed. After the larger tank is upgrade focus should be on upgrading the one million gallon reservoir.

8.5 Distribution System

A hydraulic model was utilized to assist in evaluating the capability of the City's existing water system in providing proper water flows (primarily fire flow) to selected areas. The basis for and results from the hydraulic model along with proposed water distribution system improvements are discussed below.

Hydraulic Modeling

With the advent of computer hydraulic models, an entire municipal water system can be mathematically analyzed with respect to existing hydraulic characteristics and "what if" scenarios. The mapping, calibration, and analysis of the City's water distribution system using a computer hydraulic model are discussed below.

The existing distribution piping network was evaluated with a computer model; specifically, WaterCAD software by Haestad Methods. WaterCAD is a state-of-the art software tool primarily used in the analysis and modeling of water distribution systems. This program employs mathematical algorithms based on hydraulic principles to predict system pressures and flow rates within a water system. Fire flows are of particular interest since the magnitude of these flows dictates the necessary hydraulic capacity of the water system.

Calibration of Computer Model

Information on the current operating parameters of the distribution system were entered into the computer model. Input parameters included daily system flows, pump flow rates, flow curves, and operating pressures at pump stations and water treatment plants. User demand was more or less allocated evenly to each node of the existing system. A more refined allocation of the demand is not necessary based upon the projected user demand even at peak flows; it is substantially less than fire flow requirements.

A model is a representation of an existing system used to predict the behavior of the system based upon real changes. A model is only useful if it can be calibrated and validated. The accuracy of the model output with existing conditions was checked or calibrated using water pressures and flows observed and collected in the field by the City's Fire Department. The hydraulic model solves for pressures and flows available in the main lines and not from hydrants. Pressures were calibrated for the system first by adjusting friction factors until the pressures in the model closely approximated measured pressures in the real system. In general, calibration is within approximately plus or minus ten percent; which is considered a reasonable level of accuracy given the uncertainties in the model data.

Hydraulic Analysis of the Existing System

The existing distribution system was modeled using a hydraulic computer modeling software. This model included current piping, Pump Stations, reservoirs, and the Water Treatment Plant. The model contained 380 pipe elements and 306 nodes or junctions. Due to adequate system pressures and a relatively well-looped distribution network, hydraulic performance of the system is adequate in most areas. Residual pressures of 20 pounds per square inch (psi) were used as a constraint on the system. This is a requirement of the Oregon Health Authority. Greater fire flows may be attained due to the lack of this constraint in the physical system.

Performance of the distribution system with respect to maximum available fire flow capabilities was specifically examined at selected vital areas within the City that were identified with the assistance of the City's Fire Department staff. The locations examined were chosen for a number of reasons including potential fire suppression, representation of a portion of the City, and identification of potentially undersized lines. The actual fire flow requirements for each of these vital areas were determined using the 2018 International Fire Code, and compared to the available fire flow.

The fire flow model was run with the requirement of maintaining minimum residual pressures of 20 psi throughout the system during a fire flow event. A map displaying existing fire hydrant locations can be found in Figure 8.5.1. Existing fire flows throughout the City are shown in Figure 8.5.2.

Table 8.5.1 lists critical facilities in the City of Bandon, their required fire flow based on Oregon State Fire Code and current available fire flow. It was assumed that each building was a Type IIA or IIIA building construction. The only facilities that had fire suppression systems in place was the Southern Coos Hospital and Health Center. Fire flow available is based on the WaterCAD model and the fire flow metered came from the 2006 meter readings provided by the City.

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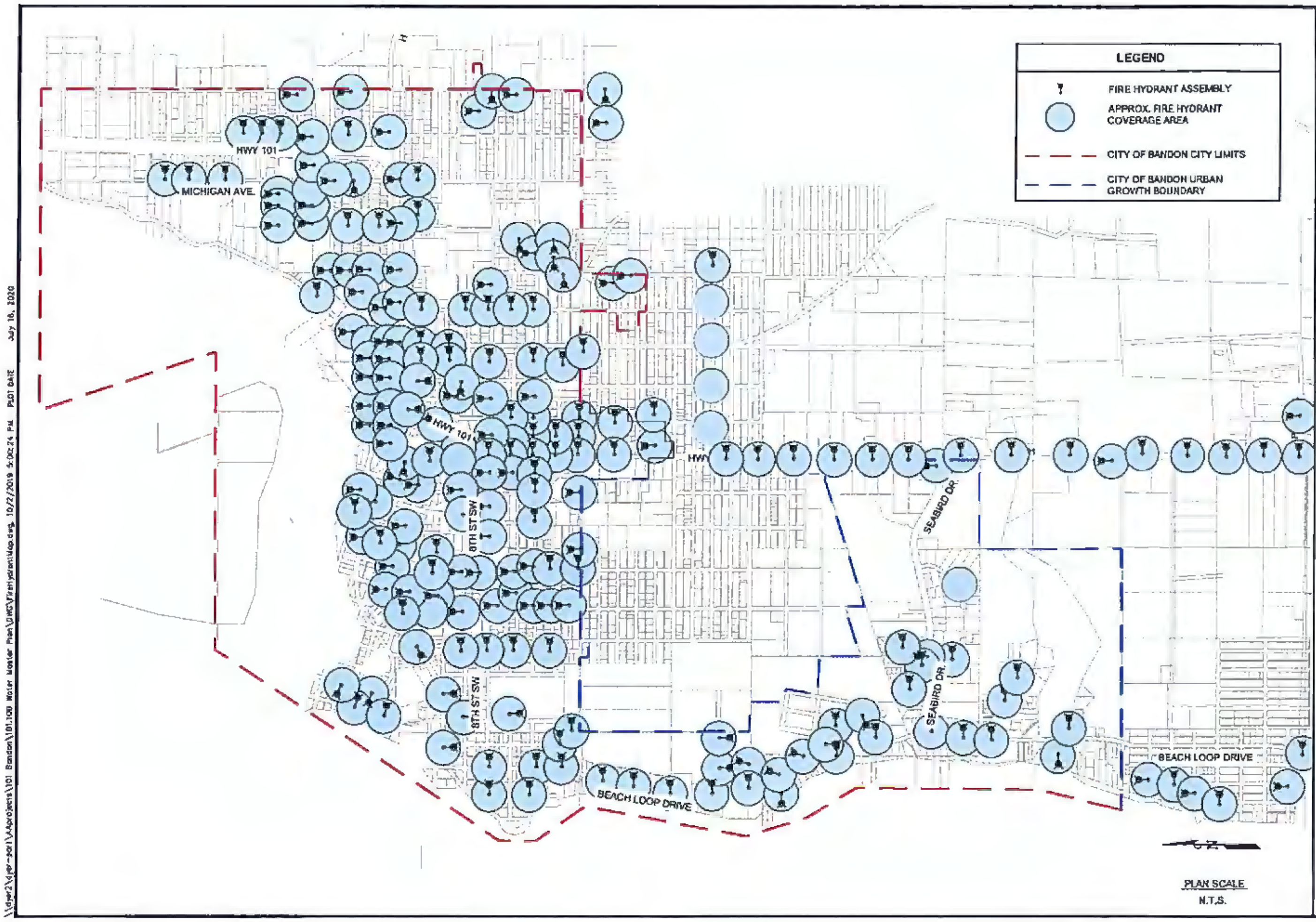

FIGURE NO.
8.5.1

CITY OF BANDON WATER MASTER PLAN

FIRE HYDRANT MAP

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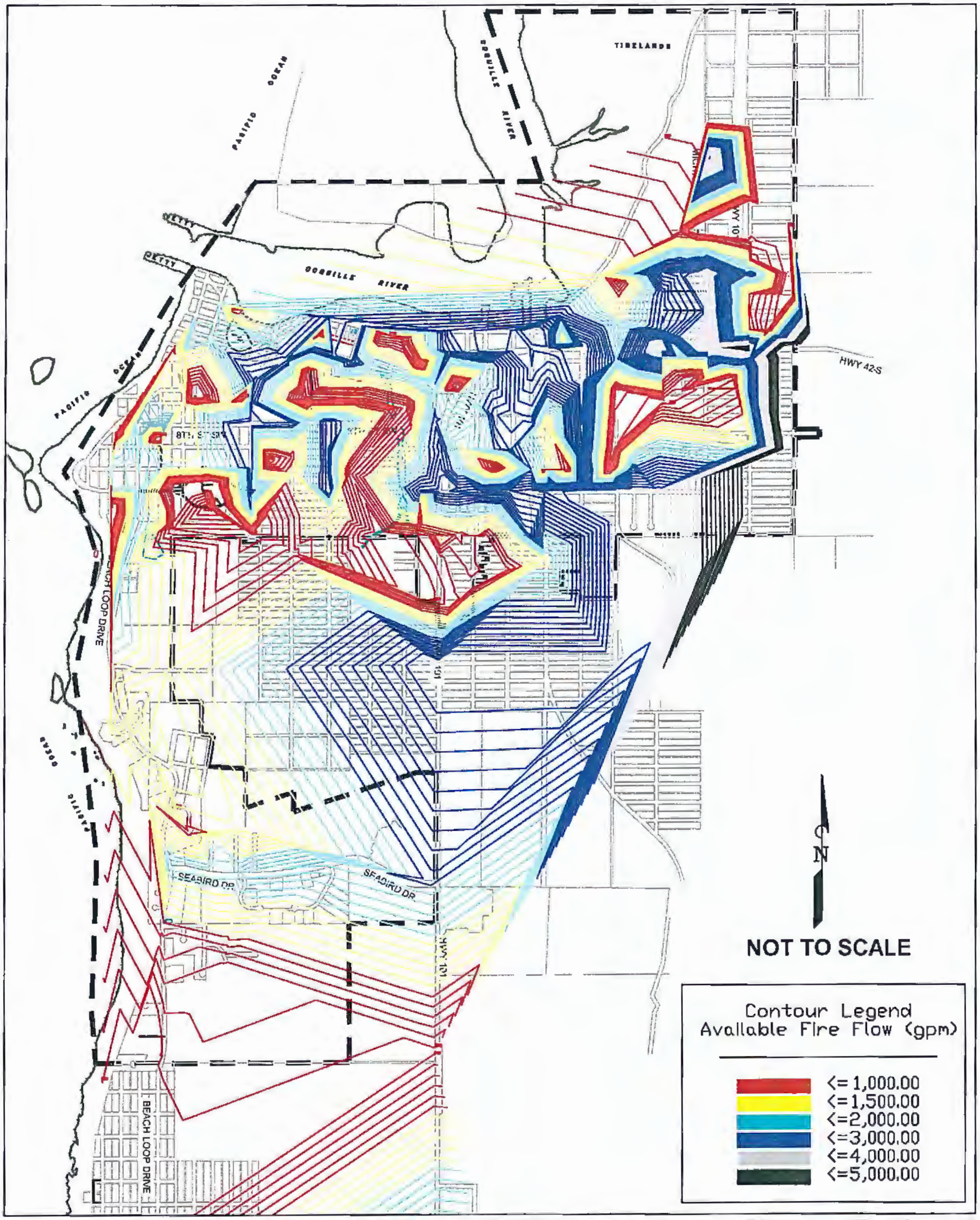
PROJECT NO.: 101.100



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CITY OF BANDON
WATER MASTER PLAN

EXISTING WATER SYSTEM FIRE FLOWS

FIGURE NO.
8.5.2

TABLE 8.5.1
FIRE FLOW PARAMETERS FOR VITAL AREAS

Location	Required Flow (gpm)	Fire Flow Available (gpm)	Fire Flow-Meter Reading (gpm)	Amount Deficient
Harbor Lights Middle School	3,000	2,145	N/A	957
Bandon High School	3,000	1,997	N/A	1,116
Ocean Crest Elementary School	2,750	2,801	N/A	538
Fire Department	2,000	315	358	1,357
Shopping Center	3,500	3,623	N/A	N/A
Southern Coos Hospital and Health Center	2,250	3,136	N/A	N/A
Coast Community Health Center	1,500	3,915	N/A	N/A
Bandon Inn	1,750	2,463	N/A	N/A
LaKris Inn	1,500	2,366	955	N/A
Sunset Oceanfront Lodging	2,250	1,817	582	895
Lighthouse Cove Inn	1,500	2,777	955	N/A
Best Western at Face Rock	3,250	917	N/A	2,843
Windermere on the Beach	1,750	917	N/A	1,343
Table Rock Motel	1,500	1,799	N/A	N/A
Shooting Star Motel	1,500	683	358	797

Fire Flow Water Line Improvements

Based on the results from the computer hydraulic model, and discussions with City Staff, several proposed improvements were identified for the City's distribution system. Fire flow improvements either improve looping within the distribution system, or increases pipe sizes. Both methods increase fire flows within the distribution system. These proposed improvements are discussed below.

Looping Improvements

Chicago - 9th to 10th: This project will increase fire flows along 9th and 10th Streets and to the surrounding area, and includes construction of a 6-inch line extension on Chicago between 9th and 10th Streets.

***9th Street Extension to Jackson Avenue*:** This project will increase fire flows to the area between 8th and 11th and Jackson and Franklin and consists of a 6-inch line extension of the existing 4-inch line on 9th Street, west to Jackson Avenue.

2nd W Street Extension - Douglas to Edison: This project will increase the fire flows along 2nd Street between Douglas and Edison and to the surrounding area, and consists of a 6-inch line extension westward of the existing 4-inch line on 2nd W line between Douglas and Edison.

***Baltimore Avenue Extension South*:** This project will increase the fire flows along Baltimore Avenue and to the surrounding area, and includes the construction of an 8-inch line south on Baltimore from 17th Street to connection with the southern loop 12-inch line on 20th Street.

Douglas and Bandon Extension to 8th Street: This project will increase the fire flows along Douglas Street and Bandon Street and to the surrounding area, and includes the construction of 6-inch line extensions on Douglas and Bandon Streets to 8th Street.

Franklin - 24th to Seabird: This project will increase the fire flows along Franklin Avenue and to the surrounding area, and includes the extension of an 8-inch line on Franklin Avenue continues south for connection with the east-west existing 8-inch line on Seabird.

Face Rock Extension to South Loop Line by 24th Street: This project completes a loop with construction of an east-west 12-inch line extension from the existing 8-inch Face Rock line. This new water line is near the recommended new reservoir. This looping will facilitate better distribution of this stored water.

Jackson - 24th to New South Tank Line: This will increase the fire flows along Jackson Street, and the surrounding area. This new water line is near the recommended new reservoir. This project includes the construction of an 8-inch line along Jackson Street extending south from 24th Street to the connection with the new tank feed line. This will complete connection with the east-west existing 8-inch line on Seabird and complete a sub-loop within the southern service area.

Polaris to Beach Loop: This project improves fire flow delivery to the cul-de-sac. This project extends the 8-inch line on Polaris Street back to the 6-inch Beach Loop line to complete a loop through the south subdivision area.

Pipe Upsizing Improvements

8th Street - Oregon Avenue to Franklin Avenue: This project increases the fire flow to Harbor Lights Middle School and Bandon High School. The project is on 8th Street, and includes an 8-inch line replacing the existing 6-inch line between Oregon Avenue and continuing west to Franklin for ultimate connection with the north-south line extension on Franklin Avenue.

Beach Loop Road - Seabird Lane to Best Western: This project will provide necessary fire flow to two hotels south of Seabird along Beach Loop. The project is on Beach Loop Road, a 10-inch line replacing the existing 6-inch line from just south of Seabird Lane to the water line connection for the Best Western Inn at Face Rock Hotel.

13th Street - Franklin Avenue to Allegheny Avenue: This project will provide necessary fire flows to the Rural Fire Department and a motel. This project is on 13th Street, and includes an 8-inch line replacement of the existing 4-inch line between Franklin Avenue and Allegheny, then turning south to run to the dead-end of Allegheny Avenue.

Ohio Avenue - Highway 42S to 10th Street NE: In order to provide adequate fire protection in the northern portion of the Urban Growth Boundary, expansion of the City of Bandon's distribution system will generally involve completion of a 12-inch main line north along Ohio, west on 10th Street NE and southwest on River Drive, completing a loop in the northeast portion of the Urban Growth Boundary. This portion of the loop will significantly increase fire flows on streets east of US Highway 101 and north of Highway 42S.

10th Street NE - Michigan Avenue to Ohio Avenue: A key segment of the northern loop discussed above is construction of a 12-inch main line between Michigan Avenue and Ohio Avenue.

Jackson - 12th to Face Rock: This project increases fire flows along and around Jackson Avenue and includes an 8-inch line extension south from the existing 8-inch line on 12th Street for ultimate connection with the east-west Face Rock extension is proposed. This project eliminates a developing "bottleneck" between 12th and 13th Streets.

Michigan Avenue to Caroline Street: This project will increase fire flow in the neighborhood around Michigan Avenue and Caroline Street, and will include construction of a new line that will replace the existing 4-inch and 6-inch line from the intersection of 4th and Michigan Avenue and winding through the neighborhood and terminating at the intersection of Caroline Street and Harlem Avenue.

13th Street – US HWY 101 to Delaware: This project will increases the fire flows along 13th Street and includes completion of a 6-inch water line and replacement of a 4-inch line on 13th Street between US Highway 101 and Baltimore; and a 6-inch water line from Baltimore to Chicago to Delaware.

North Avenue - 3rd SE to 4th SE & June, Klamath, and Lexington: This project involves completion of a local loop in the eastern service area just south of Highway 42S. This will increase the fire flows along and around North Avenue between 3rd and 4th Street.

9th Street - Jackson to Beach Loop: This project significantly improves fire flow delivery to the western part of developed areas within the City of Bandon. This project completes a 10-inch line through town connection with Beach Loop by way of 11th, Jackson and 9th.

US HWY 101 - 13th to 14th & 15th to 17th**:** This project will increase the fire flows along US Highway 101 and includes construction of 6-inch line sections on US Highway 101 between: 13th and 14th; 15th to 17th; and then east on 17th to connection with the existing 6-inch line.

Franklin - 11th to 13th**:** This project eliminates a developing "bottleneck" between 11th and 13th Streets. The project is on Franklin Avenue and includes an 8-inch line extension south from the existing 10-inch line on 11th Street to 13th Street.

Polaris to Beach Loop: This project improves fire flow delivery to the cul-de-sac. This project extends the 8-inch line on Polaris Street back to the 6-inch Beach Loop line to complete a loop through the south subdivision area.

Fire Flow Improvement Impacts

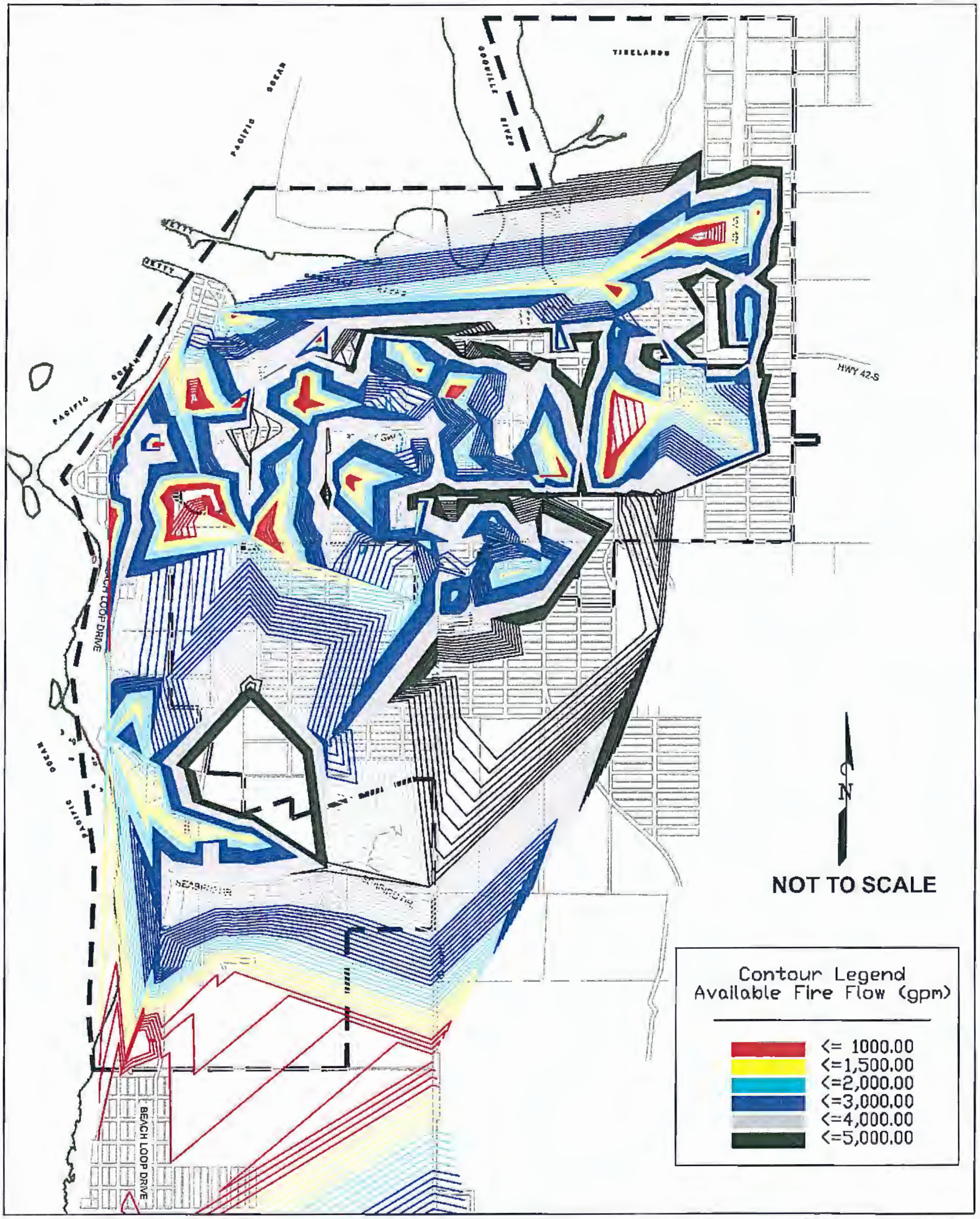
A WaterCAD model was developed with the recommended fire flow improvements. Fire flows at the critical areas within the system were reevaluated. Figure 8.5.3 displays the City's fire flows following the completion of the recommended projects. The recommended improvements eliminate the fire flow deficiencies listed in Table 8.5.1.

Leak Detection and Repair Program

Over the last five years the City has experienced an average of 18 percent water loss when comparing water sent to the City versus water consumed. In 2019 the water loss was at 21 percent. On two separate occasions the City has brought in an independent contractor to see if they could locate any large leaks. None were found.

With the Water Treatment Plant's treated water master meter being calibrated on a yearly basis the potential losses are most likely within the distribution and record keeping systems. Aged water meters and unaccounted water usage are two good places to start.

The City should develop a program to detect and repair leaks to reduce the volume of water losses. Testing older water meters for accuracy should be a priority. Loss records should be maintained on a monthly basis.



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DATE: JULY 2020
PROJECT NO.: 101.100

CITY OF BANDON
WATER MASTER PLAN

PROPOSED WATER SYSTEM FIRE FLOWS

FIGURE NO.
8.5.3

SECTION 9:

SEISMIC RISK ASSESSMENT & MITIGATION PLAN

SECTION 9: SEISMIC RISK ASSESSMENT AND MITIGATION PLAN

The City of Bandon will be required to develop a seismic risk assessment and mitigation plan. According to Oregon Administrative Rules (OAR) 333-061-0060-5-A-J: a seismic risk assessment and mitigation plan for water systems fully or partially located in areas identified as VII to X using the Map of Earthquake and Tsunami Damage Potential for a Simulated Magnitude 9 Cascadia Earthquake. The City lies in a level IX area and therefore is required to develop this documentation.

The primary seismic threat in this region is the Cascadia Subduction Zone. This is a 680-mile long zone of active tectonic convergence where oceanic crust of the Juan de Fuca Plate is subducting beneath the North American Continent at a rate of four centimeters per year. Over the last 5,400 years numerous large earthquakes have occurred within this zone with an average interval of 500 years. The last recorded event was 1700 AD. If the next large scale earthquake occurs within the average interval, another large scale event is expected by 2200 AD.

The Seismic risk assessment must:

- Identify critical facilities capable of supplying key community needs: including fire suppression, health and emergency response, and community drinking water supply points.
- Identify and evaluate the likelihood and consequences of seismic failures for each critical facility.

The mitigation plan may:

- Encompass a 50-year planning horizon.
- Include recommendations to minimize water loss from each critical facility, capital improvements, or recommendations for further study or analysis.

With regards to building code requirements, structural design requirements were based on the zone the structure was located within. The zones ranged from zero to four with four having the most requirements. Coastal communities are typically in Zone 4. This system has been replaced but at the time of construction of the Pump Station buildings, Water Treatment Plant (WTP) building and raw water clarifier it was in place. Reference will be made to the various zones throughout this section.

9.1 Critical Facilities

The City primarily serves residential areas; therefore the critical facilities to which it supplies water are minimal. Currently the critical facilities are limited to the City's treatment and distribution facilities. The Bandon Rural Fire Protection District's Firehouse and Southern Coos Hospital and Health Center facilities are served by the City but are separate entities from the City and thus not considered further in this Section.

City Raw Water Intakes

The City's raw water supply is pumped to the Water Treatment Plant from either the Lower Pump Station which is fed by Ferry Creek and Geiger Creek impoundments or the Low Flow Pump Station fed by Ferry Creek. Each intake feeds the Middle Pond and raw water is pumped from this pond to the plant via the Middle Pump Station. The intake buildings at the Lower and Middle Pump Stations are constructed of

Concrete Masonry Unit (CMU) block and sits on a concrete slab. The pumps are connected to ductile iron raw water piping. There are currently no signs of structural failure or decay. These buildings were designed to withstand seismic loads for Zone 3.

The Low Flow Pump Station is a below grade concrete wet well sitting on a concrete slab. This structure would fare better in a seismic event but was not designed to withstand seismic loads.

City Water Treatment Plant

The potable water drinking supply comes from the City's WTP. The raw water clarifier that was constructed in 2007 was design to withstand a seismic event for Zone 4. The building that houses the treatment plant is a CMU building with a metal roof. The rooms within the facility are the office, bathroom, mechanical room, and chemical room. The exterior filter units are also constructed of poured in place concrete. This building and filter units were designed to withstand a seismic event for Zone 3. See Section 5 for more details on the WTP.

City Reservoirs

The City currently has two reservoirs. Both are welded steel with a concrete foundation. These reservoirs are described in detail in Section 5. Neither of the City's reservoirs are currently equipped with seismic anchoring or valving. Design details could not be found for either tank. Neither of the tanks are showing visible signs of structural failure. The City did bid a project in September 2015 and December 2021 to install seismic valving on the outlet of the two million gallon reservoir. The bids came in higher than the available funding the first bid and materials were not available in a timely fashion the second time. The project is planned to go out to bid a third time in December 2022.

9.2 Likelihood of Seismic Failures

All critical facility locations lie in a Level 8 or 9 damage area as specified by the Department of Geology and Mineral Industries (DOGAMI) Map of Earthquake and Tsunami Damage Potential. In addition, these facilities, were all designated as having a very high risk for seismic hazards by O-HELP. The O-HELP is a program developed by Oregon State University to display seismic hazards and ground deformation hazard ratings for given addresses. It is an interactive map found at http://ohelp.oregonstate.edu/.

There is a high probability that seismic failure will occur at most of the critical facilities in the event of a large-scale seismic event. The contributing factors are lacking seismic design, and in some cases aged structures that may be more prone to structural failure. These conclusions are not obtained from structural analysis, and should be further investigated to provide the City with a better idea of where their seismic mitigation efforts should be placed. The Capital Improvement Plan will include structural investigation to all critical facilities.

9.3 Consequences of Seismic Failures

The potential consequences resulting from seismic failure at each of the critical facilities are discussed below.

City Raw Water Intakes

There is concern that both Ferry Creek and Geiger Creek impoundments would liquefy during a seismic event. Assuming debris flow would not reach the Low Flow Pump Station, this Pump Station becomes more critical. If the off-channel storage facility was built that facility would stand the best of chance of surviving a seismic event. The Low Flow Pump Station would still be utilized to pump raw water to the Middle Pond but would not have to worry about drawing water from Ferry Creek.

The Middle and Lower Pump Station buildings would be compromised since they were not designed to the more restrictive requirements of Zone 4 and it is questionable if they would remain operational. The City has a portable pump that could be used to pump water from the Middle Pond to the WTP.

City Water Treatment Plant

Seismic damage at the WTP could happen since the facility was not designed to Zone 4 standards. Production capabilities of the plant could be compromised. Given that there is redundancy in many of the WTP components it is possible that the damage may not shut down the WTP completely, but rather limit its capacity. If the structural failure did cause complete shutdown or minimizes the capacity so much that the demand greatly exceeds the supply, the City will eventually be left without water to fight fires, or to keep its users hydrated. This would pose a health risk to the community.

City Reservoirs

In the event that any of the reservoirs or associated piping experienced seismic failure it is likely the reservoirs could no longer provide water to the service area. Depending on the degree of seismic failure in a tank, or its associated piping, water loss may occur, and/or the flows from the tank may be limited or cut off entirely. If the outlet or inlet pipe is broken near the perimeter of the reservoir, before the isolation valve, the entire reservoir could be drained. This would leave the users with no emergency water source to fight fires or hydrate users. This would pose a severe health risk to the community.

9.4 Seismic Mitigation Plan

The City recognizes the threat of being located so close to the Cascadia Subduction Zone. Currently, the City has limited information on the ability of their system to withstand a large seismic event. Current system assessments have been the result of visual inspections by City Staff, non-structural engineers and information from construction plans. It is safe to say the critical facilities have not been designed for the worst case event. Before the City can develop a refined plan to mitigate all the known threats within their system, more evaluations need to be completed that will determine: all structural failure points, the potential for these failures to occur, and the structural improvements that would minimize any impacts due to a large-scale seismic event. It is recommended that the City develop a schedule for the evaluations of their critical facilities. Funds for the evaluations should be added to the City budget, and the evaluations should be completed within the next five years.

Additional seismic improvements are recommended as part of the Capital Improvement Plan in Section 10.

SECTION 10:

CAPITAL IMPROVEMENT PLAN & PHASING PLAN

SECTION 10: CAPITAL IMPROVEMENT PLAN AND PHASING PLAN

10.1 Background

A Capital Improvement Plan (CIP) is a long term plan for replacement of existing or installation of new infrastructure required to improve a system's function or maintenance. The CIP for water systems provides the City Staff and residents with a systematic approach to dealing with its short term and long term infrastructure needs and demands.

Under Oregon Revised Statutes ORS 223.309(1), a capital plan, public facilities plan, master plan or comparable plan must be prepared before the adoption of System Development Charges (SDCs). This plan must list the capital improvements that may be funded with improvement fee revenues and include the estimated cost and timing of each improvement. Oregon Revised Statutes discuss which improvements may be funded by SDC revenues (ORS 223.307) and what types of projects qualify for credit purposes. The Capital Improvement Plan may be modified at any time pursuant to ORS 223.309 (2).

Water system improvements recommended to the City are provided in this Plan along with associated costs. The recommended improvements for the City's CIP were derived from the analysis presented in Sections 8 and 9. A breakdown of the cost estimates for each project can be found in Appendix C.

10.2 Project Phasing

To assist the City in its planning efforts, the proposed capital improvements have been assigned into one of three priorities with Priority I and II being the most critical projects and Priority III being long-term projects.

The priority of each project was presented and discussed with City Staff. The estimates presented are preliminary and are based on the level and detail of planning presented in this Water Master Plan (WMP). As projects proceed and as site-specific information becomes available, the estimates may require updating.

Compilation of an Environmental Report is typically a requirement of government organizations funding infrastructure projects. The purpose of this Environmental Report is to consider any adverse effects that the project may have on the surrounding environment and propose mitigation measures to minimize these impacts. The estimated cost for compiling an Environmental Report for each priority was included in this WMP.

Priority I Improvements

Priority I Improvement projects include projects to the Water Treatment Plant, two Million Gallons (MG) treated water reservoir, one MG reservoir, Middle Pond Pump Station, and the Lower Pump Station and Low Flow Pump Station.

The City went out for a General Obligation Bond Measure in November of 2019 to ask voters to approve monies to construct a second functional raw water clarifier. The bond measure passed but during design it was realized due to code changes the second raw water clarifier would have to be constructed out of concrete not glass fused to steel material. The change in material type added approximately $1,240,000 to the total project cost. Total project cost will be included within Priority I costs. The total for Priority I projects is $9,041,400. The following is a description of these projects.

Project Descriptions

1. Water Treatment Plant (Total Project Cost: $4,947,800)

A number of projects are recommended for the Water Treatment Plant. The projects are recommended to improve the operation and effectiveness of the treatment process. The most significant projects at the WTP are the clarifier replacement and installation of generators.

A. Water Treatment Plant Building (Total Project Cost: $598,000)

Flow Measurement Equipment
The raw water flow meter at the WTP has been replaced. Flow meters should be added to the filter to waste line going to the backwash ponds, the Middle Pump Station, Lower Pump Station and the Low Flow Pump Station. The filter to waste line is not metered and this process line has high volumes of unaccounted filtered water. Accurate readings at the intake will provide useful data for future projects and could be useful in identifying the overall water balance of the system. The flow meters at the pump stations can also be used to evaluate the performance of the pumps and be an indicator to the need for pump maintenance.

Filter Sun Shade Roof Structure
It was noted that algae growth occurs in both filter basins. This is due to natural ultraviolet light exposure. It would be relatively inexpensive to provide a roof over the top of the outdoor filter basins to reduce the sunlight and prevent the algae growth.

PLC Modifications
The proposed upgrades to the plant will require Programmable Logic Controller (PLC) modifications at the WTP. The existing system is outdated and replacements parts are no longer available. The new system also includes upgrading all current operational programs.

Flooring in Front Office
The flooring in the front office is deteriorating and needs replacement to provide a safe working environment.

Sample Island
The sample island in the laboratory is in poor condition. A new sample island will allow for additional storage and increased organization of laboratory and testing equipment.

B. Backup Generator System (Total Project Cost: $1,302,000)

A new backup generator located at the entrance to the Water Treatment Plant will service the WTP, Middle Pump Station, Lower Pump Station, Low Flow Pump Station, fish hatchery and several residential dwellings. The generator will allow for continued use of the raw water supply and treatment system if local power is unable to provide electrical service. A covered area and the appropriate integration with the plant and pump station electrical systems will be required to provide for a working system. Since the City has started design of this system the anticipated total project cost will be included within Priority 1 costs but not included in the financial evaluation.

C. Existing Clarifier Replacement (Total Project Cost: $3,047,800)

The City constructed a new 50' diameter glass-fused-to-steel raw water clarifier in 2007, and the existing concrete clarifier was taken out of service. A new clarifier is required to provide redundancy and increase treatment plant capacity. The existing concrete clarifier will be replaced with a new 50' diameter concrete clarifier. A glass-fused-to-steel clarifier is no longer an option due to a code change in 2020. Therefore, a concrete clarifier is required. Part of the budget passed in the 2019 Bond Issue included $1,810,000 for the existing clarifier replacement project. Due to change in materials the total project cost increased to $3,050,000 an increase of approximately $1,240,000. Only the difference in amounts will be included in the financial evaluation.

2. 2 MG Treated Water Storage Tank (Total Project Cost: $2,130,400)

The City's two million gallon storage tank requires rehabilitation in the form of coating the inside and outside of the tank and seismic upgrades. There is 36,874 square feet on the interior and 32,456 square feet on the exterior that has to be recoated. There is a larger interior surface than exterior due to the steel floor. All surfaces will be sand blasted prior to application of a primer coat and two finish coats. These projects will ensure the integrity of the storage tank and allow for continued safe drinking water storage. The seismic improvements and interior recoating of the reservoir was bid in December 2021. The project was not awarded due to equipment delivery dates conflicting with the construction timeframe. The City did prepurchase the seismic monitoring system, $51,370, and will be ordering the pipe and fittings prior to the rebid date later this year. The cost listed above does not include these two items.

3. 1 MG Treated Water Storage Tank (Total Project Cost: $985,300)

The City's one million gallon storage tank requires rehabilitation in the form of coating the inside of the tank and seismic upgrades. There is 19,500 square feet of surface area that has to be recoated. Additional costs have been added for the abatement of lead based paint. All surfaces will be sand blasted prior to application of a primer coat and two finish coats. These projects will ensure the integrity of the storage tank and allow for continued safe drinking water storage.

4. Middle Pond Pump Station (Total Project Cost: $322,100)

Projects at the Middle Pond Pump Station include replacing the smaller two of the three pumps with two new pumps to provide greater capacity and allow for redundancy at the pump station. Other projects include a new ventilation system, replacement of the dock and painting the interior of the building.

Pump Replacement

The existing pumps at the Middle Pond Pump Station are in fair condition but have a limited capacity. Replacing the two smaller existing pumps will increase the pump station capacity from 1,400 gallons per minute (gpm) when all three pumps are running to 1,400 gpm with just two of the three pumps running. This will provide pump redundancy at the pump station which will prevent total system failure and increase the functionally of the system.

Ventilation System

The current ventilation system at the Middle Pond Pump Station need to be upgraded to lower the humidity and regulate the temperature allowing for longevity of the components inside the pump station while providing safe working conditions.

Replace Dock

The small dock at the Middle Pond Pump Station is deteriorated. The dock provides a walkway into the pond for better inspection and ease of access. Replacement of the dock will ensure safe working conditions.

5. Lower Pump Station (Total Project Cost: $318,300)

Projects at the Lower Pump Station include new pumps and upgrades to the ventilation system.

Pump Replacement

The existing pumps at the Lower Pump Station are in fair condition but have a limited capacity. Replacing the two existing pumps at the Lower Pump Station will increase the pump station capacity from 1,400 gpm when all three pumps are currently running to 1,400 gpm with just two of the three pumps running. This will provide pump redundancy at the pump station which will prevent total system failure and increase the functionally of the system.

Ventilation System

The current ventilation system at the Middle Pond Pump Station needs to be upgraded to lower the humidity and regulate the temperature allowing for longevity of the components inside the pump station while providing safe working conditions.

6. Groundwater Supply (Total Project Cost: $337,500)

To determine if ground water is a feasible raw water source during low flow conditions additional coordination with Oregon Water Resources Department (OWRD) is required. A preliminary ground water right application needs to be filed. After the City gets the green light to develop a well field, an exploratory well and testing program should be instituted to determine if satisfactory outputs can be obtained. Costs for Priority I work, as listed in the GSI Report, is $25,000 for an OWRD permit application and coordination and up to $312,500 for exploratory drilling and testing program. If results are favorable a full-scale wellfield design and projects costs should be developed and a full-scale wellfield constructed. Costs for design and construction of the full-scale wellfield will be included within Priority II project costs.

TABLE 10.2.1
PRIORITY I PROJECT COSTS

Project No.	Project Name	Project Cost
1	Water Treatment Plant	
1A	Water Treatment Plant Building	$598,000
1B	Backup Generator System	$1,302,000
1C	Existing Clarifier Replacement	$3,047,800
2	2 MG Treated Water Storage Tank Improvements	$2,130,400
3	1 MG Treated Water Storage Tank Rehabilitation	$985,300
4	Middle Pond Pump Station	$322,100
5	Lower Pond Pump Station	$318,300
6	Groundwater Supply	$337,500
	Priority I Total Project Cost	**$9,041,400**

Priority II Improvements

Priority II Improvement projects for this WMP represent projects that require addressing once the Priority I Improvement projects have been completed and financing is available. Due to the cost of, and need for additional raw water during low flow years two options were evaluated: off-channel reservoir and groundwater supply. The off-channel reservoir option has been advancing since 2014 and is currently going through the permitting process with OWRD. The groundwater supply option was started in 2021 and still going through the preliminary analysis to determine as to whether or not this is a viable option. Costs to complete the preliminary analysis are included within the Priority I projects. If groundwater is available the City will have to choice which of the two options they will pursue.

Project Descriptions

7. Raw Water Supply

A. Off-Channel Reservoir (Total Project Cost: $8,342,000)

The City purchased a ten-acre parcel in 2014 for the purpose of constructing an Off-Channel Reservoir. No property will have to be purchased for this project. This parcel is contiguous to another ten-acre parcel the City owns and the twenty acre site will provide an adequately sized site to construct the 100 acre-foot raw water storage reservoir, settling ponds, and overflow basin. This property is not within the City, but is in close proximity. It has access to electric service and there is a utility easement that runs from the property to the Low Flow Pump Station. The property is approximately the same elevation as the Middle Pond, so the same pumps at the Low Flow Pump Station can be used to pump water to the proposed Off-Channel Reservoir.

A series of sedimentation basins will allow lower Operation and Maintenance (O&M) costs by allowing sediment to settle out before entering the raw water storage reservoir. These basins can be cleaned much easier than the larger storage reservoir. Emergency overflow will be directed to a bioswale and energy-dissipater basin and then flow back to Geiger Creek. The site will be enclosed by a 50-foot wide buffer of natural vegetation (brush) and will be security-fenced and gated.

The reservoir will be constructed of native materials, as determined by the geotechnical study, appropriate for reservoir construction. Materials excavated for the reservoir will be used to construct the berm. This will minimize trucking of materials in and out of the site.

The sedimentation basins and raw water storage reservoir will be lined to eliminate leakage and so nearby wells are not adversely impacted by water from the local water table migrating into the basins. The raw water storage reservoir will be covered to eliminate evaporation. The combination of the liner and cover will serve as significant water conservation measures.

The floating cover will keep water cool and minimize algae growth. Mixers and aerators will keep the water from stratifying. Stratification of stored water results in difficulty in treating this water, the possibility of algal blooms, and adverse impacts to fish if this water is released into the stream.

Water for the reservoir will be pumped from the existing Low Flow Pump Station, located downstream from the fish hatchery, through a new 12-inch diameter pipe, located in an existing utility easement. An existing 12-inch treated water main and electrical lines already utilize the easement. Water will be diverted from the reservoir by gravity to the Low Flow Pump Station, where it will be pumped to the Middle Pond.

Water may be released for stream augmentation at the Low Flow Pump Station, if determined necessary by regulatory agencies. During low creek flows up to twenty five percent of the flow going to the Middle Pond may have to be diverted. There is also the potential of placing a hydro-electric generator on the water line going to the creek. This would help reduce O&M costs.

A fish screen will be provided at the outlet of the raw water storage basin if required by regulatory agencies.

A Supervisory Control and Data Acquisition (SCADA) system will be installed to provide telemetry control of valves and pumps.

The project cost was developed using the cost estimate developed in the 'Off-Channel Reservoir Feasibility Study, 2016 and applying the Engineering News Record (ENR) as described in Section 7. The revised cost estimate is included within Appendix C. See Figure 10.2.1 for a preliminary project layout.

B. Groundwater Supply (Total Project Cost: $3,606,245)

The following narrative is taken directly from GSI's Supplemental Groundwater Supply Feasibility Evaluation, which is include within Appendix E. The cost for the Exploratory Drilling and Testing Program is included in Project 6.

"Based on stream depletion modeling (see Section 3.2), GSI believes it is likely that OWRD would grant approval for new wells located anywhere within the City's watershed because the input parameters for the stream depletion models are based on hydraulic properties that OWRD co-authored. However, as a contingency plan this well siting evaluation also identified backup well locations within the prescriptive delineations (within 500 feet by 1,000 feet of original point of diversion) in the event that OWRD does not agree with the stream depletion model results.

Further, OWRD will only approve of well locations that do not cause injury to existing water users. Based on GSI's estimations of pumping interference, two existing local water users would be impacted, which are discussed in Section 3.1 and summarized below:

> *ODFW Fish Hatchery: The Oregon Department of Fish and Wildlife's (ODFW's) hatchery has a water right certificate for non-consumptive use of water from Ferry Creek. GSI believes it is unlikely that OWRD would determine that the proposed well locations would cause injury to ODFW's fish hatchery because a groundwater system by nature will result in less direct stream depletion than the City's existing surface water intakes.*
>
> *Exempt (Domestic) Wells: There are existing exempt (domestic) wells a few hundred feet north of the City's water treatment plant (along Houston Lane, Melton Road). Pumping interference from a full-scale wellfield could preclude the exempt wells from obtaining groundwater. GSI believes it is possible that OWRD would determine injury to existing exempt (domestic) wells from a full-scale wellfield located near the City's water treatment plant.*

Due to the possibility that OWRD may determine injury to existing exempt (domestic) wells from a full-scale wellfield located near the City's water treatment plant, backup well locations that are far from existing exempt wells were identified as a contingency plan. These backup well locations are identified on Figure 6.

Well Siting Results

Results of the well siting evaluation are presented on Figure 6. A preferred group and two backup group well locations were identified, with six well locations per group (total of eighteen well locations). Key results for each group are summarized below:

Preferred Well Locations: The preferred well locations are able to meet all applicable regulatory setbacks outright and are close to existing water system infrastructure. The thickness of the marine terrace deposits at these locations is estimated to be between 80-100 feet, which exceeds the minimum thickness of 50 feet of screenable saturated aquifer material anticipated to be necessary to produce a sustainable well yield of 75-100 gpm. With respect to pumping interference, all six of the preferred well locations maintain a separation distance of at least 400 feet from one another. In terms of water right considerations, the preferred well locations would require evidence of similar stream depletion to facilitate a surface water to groundwater transfer. GSI believes it is likely that OWRD would be in agreement that the similar stream depletion conditions are satisfied by the preferred well locations, however OWRD may determine that the preferred well locations cause injury to existing exempt (domestic) wells north of the City's water treatment plant. Overall, development of a supplemental groundwater supply at the preferred well locations appears most favorable although there are some uncertainties that cannot be resolved until a water right transaction is submitted and reviewed by OWRD.

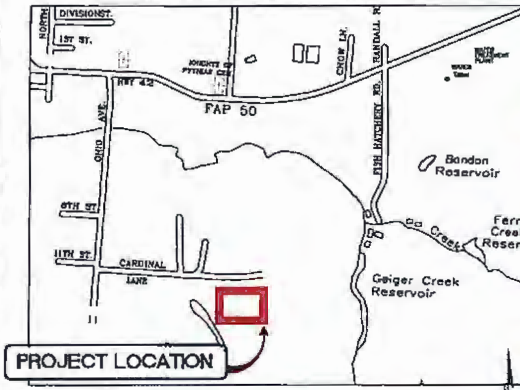
Backup Well Locations: The backup well locations represent contingency locations in the event that OWRD does not agree with the stream depletion modeling results or determines that a full-scale wellfield near the City's water treatment plant will cause injury to existing exempt (domestic) wells. Two additional series of backup well locations were identified, which are discussed below:

- *B Series Backup Wells: This series of backup well locations were sited on the north side of Ferry Creek to prioritize proximity to the City's water treatment plant. Two of the backup well locations are unable to meet all applicable regulatory setbacks outright and would require a waiver from OWRD/OHA (locations 5b and 6b on Figure 6, within 500 feet of HAZWASTE site). The thickness of the marine terrace deposits at these locations is estimated to be 30-50 feet, which could be insufficient to produce a sustainable well yield of 75-100 gpm/well. With respect to pumping interference, a majority of the backup well locations are unable to maintain a separation distance of at least 400 feet. Overall, development of a supplemental groundwater supply at the B Series backup well locations is less favorable than the C Series and may not be feasible due to the limited aquifer thickness.*
- *C Series Backup Wells: This series of backup well locations were sited on the south side of Ferry Creek to prioritize hydrogeologic feasibility (thickness of marine terrace deposits). All six of the backup well locations are able to meet all applicable regulatory setbacks outright. The thickness of the marine terrace deposits at these locations is estimated to be 60-90 feet, which could be sufficient to produce a sustainable well yield of 75-100 gpm/well. With respect to pumping interference, a majority of the backup well locations are able to maintain a separation distance of at least 400 feet and the potential for injury to existing groundwater users is low. Overall, development of a supplemental groundwater supply at the C Series backup well locations is more favorable than the B Series and appears feasible, but may be more expensive due to the additional conveyance that would be required."*

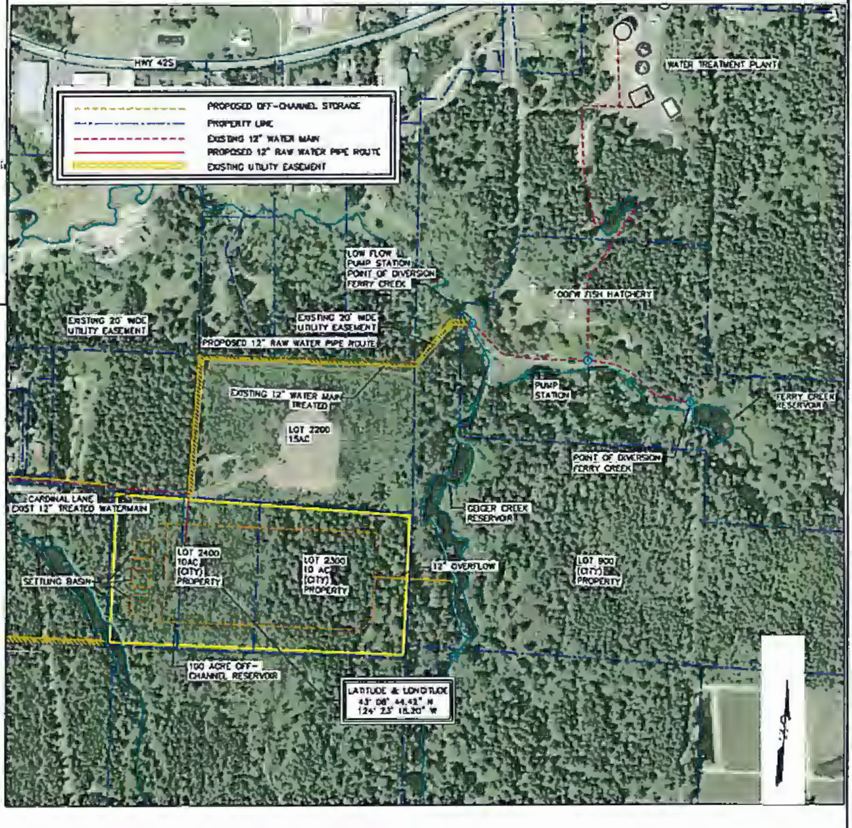
The costs listed in Table 10.2.2 for this project is listed as the high, worst case or well field C, option in Table 4 of GSI's Report.

TABLE 10.2.2
PRIORITY II PROJECT COSTS

Project No.	Project Name	Project Cost
7A	Off-Channel Reservoir	$8,342,000
	OR	
7B	Groundwater Supply	$3,605,245



VICINITY MAP
SCALE: 1" = 1000'



🟨	PROPOSED OFF-CHANNEL STORAGE
🟦	PROPERTY LINE
🟥	EXISTING 12" WATER MAIN
🟥	PROPOSED 12" RAW WATER PIPE ROUTE
🟨	EXISTING UTILITY EASEMENT

LATITUDE & LONGITUDE
43° 08' 44.42" N
124° 23' 15.20" W

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS
DATE: JULY 2020
PROJECT NO.: 101.100

CITY OF BANDON WATER MASTER PLAN

INTAKE AND OFF-CHANNEL RESERVOIR MAP

FIGURE NO.
10.2.1

\\dyer2\d\dyer-pdx\AAprojects\101 Bandon\101.100 Water Master Plan\DWG\FIG 10.2.1 Reservoir And Channel Map.dwg, 7/15/2020 2:08:33 PM PLOT DATE July 16, 2020

Priority III Improvements

Priority III Improvement projects for this WMP represent projects that require addressing once the Priority II Improvement project has been completed and financing is available. These projects are discussed in detail below. Recommended improvements include construction of new water lines, a reservoir, and installation of Automatic Meter Reading (AMR) system. The total cost estimate for Priority III Improvement projects is $14,865,400.

Project Descriptions

8. 8TH ST SW – Oregon AVE to Franklin AVE SW (Total Project Cost: $602,700)

On 8th Street, an 8-inch line replacing the existing 6-inch line between Oregon Avenue and continuing west to Franklin for ultimate connection with the north-south line extension on Franklin Avenue. This project includes provisions to construct approximately 1,650 feet of new 8-inch water line.

9. Beach Loop DR – Seabird DR to Best Western (Total Project Cost: $569,300)

On Beach Loop Road, a 10-inch line replacing the existing 6-inch line from just south of Seabird Lane to the water line connection for the Best Western Inn at Face Rock Hotel. This project will provide necessary fire flow to two hotels south of Seabird along Beach Loop. This project includes provisions to construct approximately 1,300 feet of new 8-inch water line.

10. 13TH ST SW – Franklin AVE SW to Allegheny AVE SW to Allegheny RD (Total Project Cost: $702,500)

On 13th Street, a 8-inch line replacement of the existing 4-inch line between Franklin Avenue and Allegheny, then turning south to run to the dead-end of Allegheny Avenue. This project includes provisions to construct approximately 2,150 feet of new 8-inch water line.

11. Ohio AVE NE – Highway 42S to 10TH ST NE (Total Project Cost: $1,566,000)

On Ohio Avenue, a 12-inch main line extension west on 10th Street NE and southwest on River Drive is proposed. This project includes provisions to construct approximately 3,910 feet of new 12-inch water line.

12. 10TH ST NE – Michigan Avenue - Ohio AVE (Total Project Cost: $534,100)

A key segment of the northern loop discussed above is construction of a 12-inch main line between Michigan Ave. and Ohio Ave. This project includes provisions to construct approximately 1,193 feet of new 12-inch water line and a highway bore under US Highway 101.

13. Jackson AVE SW – 12TH ST SW to Face Rock DR (Total Project Cost: $615,700)

On Jackson, an 8-inch line extension south from the existing 8-inch line on 12th Street for ultimate connection with the east-west Face Rock extension is proposed. This project includes provisions to construct approximately 2,200 feet of new 8-inch water line.

14. Michigan AVE – 10TH ST NE to 4TH ST NE to Lexington AVE NE to 2ND ST NE to June AVE NE to 1ST ST NE to Harlem ST to Caroline ST SE (Total Project Cost: $1,519,300)

The new line will replace the existing 4-inch and 6-inch line from the intersection of 4th and Michigan Avenue and winding through the neighborhood and terminating at the intersection of Caroline Street and Harlem Avenue.

15. 13TH ST NE – Highway 101 to Delaware AVE SE (Total Project Cost: $366,400)

This project includes completion of a 6-inch water line and replacement of a 4-inch line on 13th Street between US Highway 101 and Baltimore; and a 6-inch water line from Baltimore to Chicago to Delaware.

16. System Wide Water Meter Replacement (Total Project Cost: $1,203,700)

This project includes provisions for the continuing replacement of all existing meters with new, accurate, and consistent electronic water meters. Modern meters are capable of nearly 100 percent accuracy. The proposed meters offer Automated-Meter-Reading systems capable of significantly increasing the efficiency of the reading and billing process. The replacement of water meters with new meters should be considered a priority so that the City may gather accurate data cost effectively and have greater assurance that the meters do not under read.

17. Chicago AVE SE – 9TH ST SE to 10TH ST SW (Total Project Cost: $89,700)

This project includes construction of a 6-inch line extension on Chicago between 9th and 10th Streets.

18. North AVE SE – 3RD ST SE to 4TH ST SE & June AVE SE, Klamath AVE SE, Lexington AVE SE (Total Project Cost: $319,400)

This project involves completion of a local loop in the eastern service area just south of Highway 42S. A 6-inch line should be run from 3rd Street SE and North Avenue south and then west to the existing 4-inch on 4th SE. A 6-inch line should be installed on 4th SE west of Michigan to the end of the existing line 4-inch line.

19. 9TH ST SW to Jackson AVE SW (Total Project Cost: $73,500)

This project consists of a 6-inch line extension of the existing 4-inch line on 9th Street, west to Jackson Ave. This extension would have to be made between property lines at the end of a cul-de-sac.

20. 2ND W ST – Douglas AVE SW to Edison AVE SW (Total Project Cost: $101,500)

This project consists of a 6-inch line extension westward of the existing 4-inch line on 2nd W line between Douglas and Edison. The end of the existing line is at the Coast Guard Station. This extension is on relatively steep terrain.

21. 9TH ST – Jackson AVE SW to Beach Loop DR (Total Project Cost: $661,700)

This project completes a 10-inch line through town connection with Beach Loop by way of 11th, Jackson and 9th.

22. Highway 101 – 15TH ST SE to 17TH ST SE down 17TH (Total Project Cost: $299,400)

This project includes construction of 6-inch line sections on US Highway 101 between: 13th and 14th; 15th to 17th; and then east on 17th to connection with the existing 6-inch line.

23. Baltimore AVE SE – 17TH ST SE to 20TH ST SE (Total Project Cost: $230,200)

This project includes construction of an 8-inch line south on Baltimore from 17th Street to connection with the southern loop 12-inch line on 20th Street.

24. Franklin AVE SW – 11TH ST SW to 13TH ST SW (Total Project Cost: $303,600)

On Franklin an 8-inch line extension south from the existing 10-inch line on 11th Street to 13th Street. This will require that on Franklin between 11th and 13th an existing 6-inch line be paralleled in order to provide adequate capacity for demands to the south. This project includes provisions to construct approximately 700 feet of new 8-inch water line.

25. South Bandon 0.25 Million Gallon Reservoir & Pump Station (Total Project Cost: $2,731,000)

The City has adequate treated water storage capacity for existing demand levels. However, additional treated water storage reserves would provide greater equalization and security to the City and would help provide needed fire projects in portions of the service area. A ground storage tank with an associated hydro-pneumatic tank and pump station is feasible. Constructing the new reservoir along Seabird will distribute reserves and provide more uniform flow and pressure distribution in the southern half of the water system. A new access road and pump station will need to be constructed in order to provide access and distribution at the new reservoir.

26. Franklin AVE SW – 15TH ST SE to 24TH ST SE (Total Project Cost: $645,500)

On Franklin, an 8-inch line extension south from the existing 8-inch line between 14th and 15th should be continued south to 24th Street SE for ultimate connection with the east-west main extension on 24th Street. This project includes provisions to construct approximately 2,450 feet of new 8-inch water line.

27. Franklin AVE SW to 24TH ST SW to Seabird DR (Total Project Cost: $580,900)

On Franklin, an extension of an 8-inch line continues south for connection with the east-west existing 8-inch line on Seabird. This will complete a sub-loop within the southern service area and significantly improve fire flow capacity. This project constructs approximately 1,900 feet of new 8-inch water line.

28. Face Rock DR to Jackson AVE SW (Total Project Cost: $633,500)

This project completes a loop with an east-west 12-inch line extension from the existing 8-inch Face Rock line. This project includes provisions to construct approximately 1,280 feet of new 12-inch water line.

29. Jackson AVE SW – Face Rock DR to New South Tank Line (Total Project Cost: $383,000)

On Jackson, an 8-inch line extending south for connection with the tank feed line. This will complete connection with the east-west existing 8-inch line on Seabird and complete a sub-loop within the southern service area. This project includes provisions to construct approximately 1,500 feet of new 8-inch water line.

30. Polaris ST to Beach Loop DR (Total Project Cost: $132,800)

This project extends the 8-inch line on Polaris Street back to the 6-inch Beach Loop line to complete a loop through the south subdivision area.

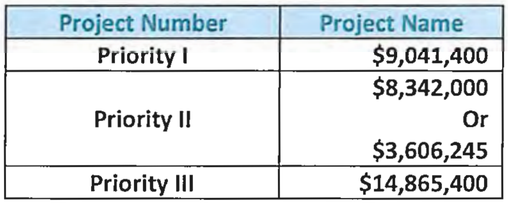
TABLE 10.2.3
PRIORITY III PROJECT COSTS

Project No.	Project Name	Project Cost
8	8TH ST SW - Oregon AVE to Franklin AVE SW	$602,700
9	Beach Loop DR - Seabird DR to Best Western	$569,300
10	13TH ST SW - Franklin AVE SW to Allegheny AVE SW to Allegheny RD	$702,500
11	Ohio AVE NE - Highway 42S to 10TH ST NE	$1,566,000
12	10TH ST NE - Michigan Avenue - Ohio AVE	$534,100
13	Jackson AVE SW – 12TH ST SW to Face Rock DR	$615,700
14	Michigan AVE - 10TH ST NE to 4TH ST NE to Lexington AVE NE to 2ND ST NE to June AVE NE to 1ST ST NE to Harlem ST to Caroline ST SE	$1,519,300
15	13TH ST NE – Highway 101 to Delaware AVE SE	$366,400
16	System Wide Water Meter Replacement	$1,203,700
17	Chicago AVE SE - 9TH ST SE to 10TH ST SW	$89,700
18	North AVE SE – 3RD ST SE to 4TH ST SE & June AVE SE, Klamath AVE SE, Lexington AVE SE	$319,400
19	9TH ST SW to Jackson AVE SW	$73,500
20	2ND W ST – Douglas AVE SW to Edison AVE SW	$101,500
21	9TH ST – Jackson AVE SW to Beach Loop DR	$661,700
22	Highway 101 – 15TH ST SE to 17TH ST SE down 17TH	$299,400
23	Baltimore AVE SE – 17TH ST SE to 20TH ST SE	$230,200
24	Franklin AVE SW – 11TH ST SW to 13TH ST SW	$303,600
25	South Bandon 0.25 Million Gallon Reservoir & Pump Station	$2,731,000
26	Franklin AVE SW – 15TH ST SE to 24TH ST SE	$645,500
27	Franklin AVE SW to 24TH ST SW to Seabird DR	$580,900
28	Face Rock DR to Jackson AVE SW	$633,500
29	Jackson AVE SW – Face Rock DR to New South Tank Line	$383,000
30	Polaris ST to Beach Loop DR	$132,800
	Priority III Total	$14,865,400

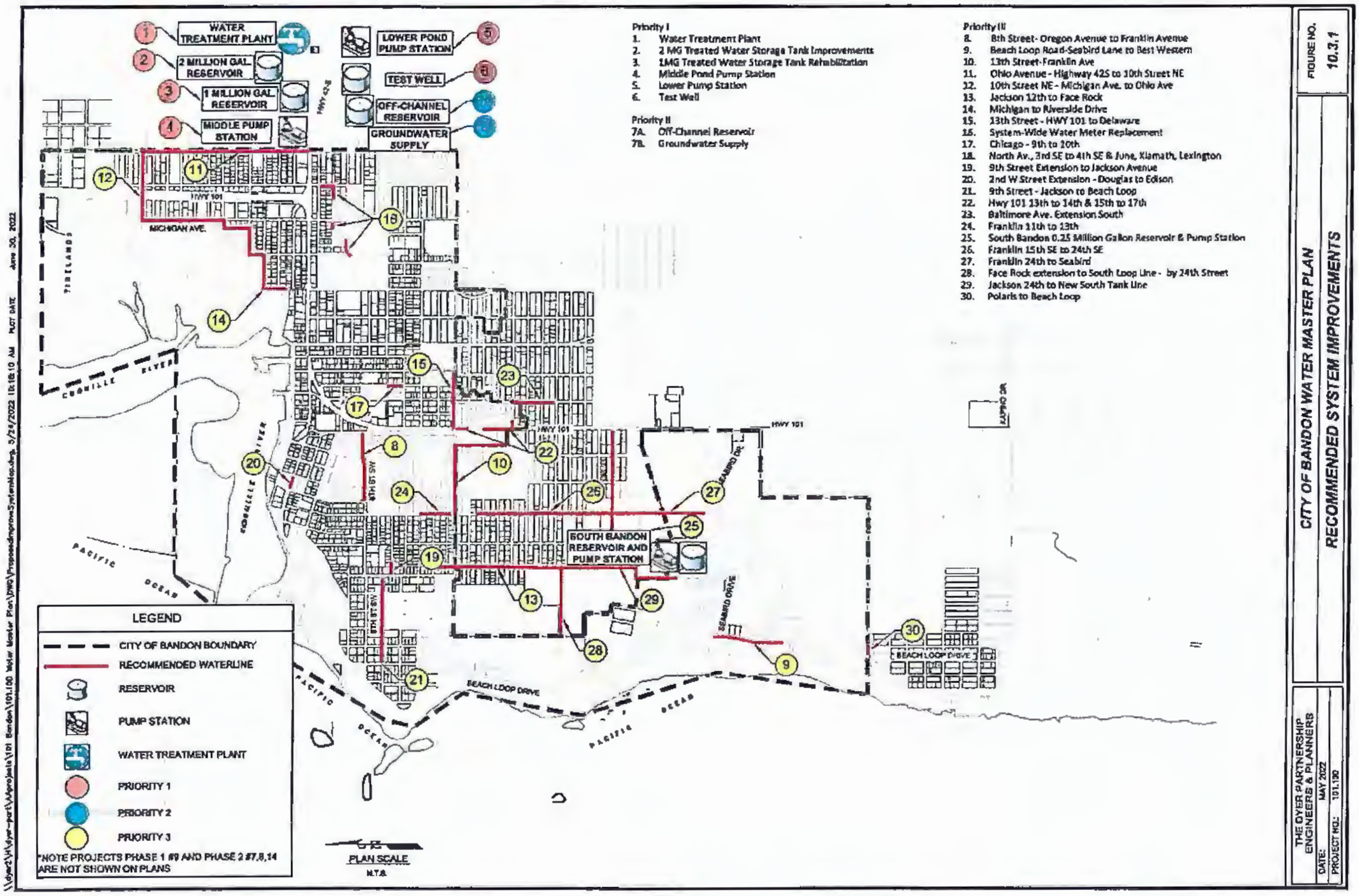
10.3 Summary of Projects

A summary of all the project priorities and costs of the recommended capital improvements (Priority I, II, and III) is provided in Table 10.3.1. A map showing the recommended improvements is shown in Figure 10.3.1. For simplicity sake some water line routing is shown as a straight line knowing that there will be routing changes due to existing structures or physical features. The additional length of water line required to avoid these features has been added to the estimates.

TABLE 10.3.1
PROJECT PRIORITY



Project Number	Project Name
Priority I	$9,041,400
Priority II	$8,342,000 Or $3,606,245
Priority III	$14,865,400



Priority I
1. Water Treatment Plant
2. 2 MG Treated Water Storage Tank Improvements
3. 1MG Treated Water Storage Tank Rehabilitation
4. Middle Pond Pump Station
5. Lower Pump Station
6. Test Well

Priority II
7A. Off-Channel Reservoir
7B. Groundwater Supply

Priority III
8. 8th Street- Oregon Avenue to Franklin Avenue
9. Beach Loop Road-Seabird Lane to Best Western
10. 13th Street-Franklin Ave
11. Ohio Avenue - Highway 42S to 10th Street NE
12. 10th Street NE - Michigan Ave. to Ohio Ave
13. Jackson 12th to Face Rock
14. Michigan to Riverside Drive
15. 13th Street - HWY 101 to Delaware
16. System-Wide Water Meter Replacement
17. Chicago - 9th to 20th
18. North Av., 3rd SE to 4th SE & June, Klamath, Lexington
19. 9th Street Extension to Jackson Avenue
20. 2nd W Street Extension - Douglas to Edison
21. 9th Street - Jackson to Beach Loop
22. Hwy 101 13th to 14th & 15th to 17th
23. Baltimore Ave. Extension South
24. Franklin 11th to 13th
25. South Bandon 0.25 Million Gallon Reservoir & Pump Station
26. Franklin 15th SE to 24th SE
27. Franklin 24th to Seabird
28. Face Rock extension to South Loop Line - by 24th Street
29. Jackson 24th to New South Tank Line
30. Polaris to Beach Loop

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS
DATE: MAY 2022
PROJECT NO.: 101.100

CITY OF BANDON WATER MASTER PLAN
RECOMMENDED SYSTEM IMPROVEMENTS

FIGURE NO.
10.3.1

\\dyer2\Wdyer-part\Projects\101 Bandon\101.100 Water Master Plan\DWG\ProposedImprovSystemMap.dwg, 5/24/2022 10:18:10 AM PLOT DATE June 30, 2022

SECTION 11:

FINANCING

SECTION 11: **FINANCING**

11.1 Grant and Loan Programs

Outside funding assistance, in the form of grants or low interest loans, will be necessary to make some of the proposed improvements affordable to the residents of the City of Bandon. The amount and types of outside funding will dictate the amount of local funding the City will have to secure. In evaluating grant and local programs, the major objective is to select a program, or a combination of programs, which are most applicable and available for the intended project.

A brief description of the major and State funding programs, which are typically utilized to assist qualifying communities in the financing of major water system improvement programs, is given below. Each of the government assistance programs has particular prerequisites and requirements. With each program having its specific requirements, not all communities or projects may qualify for each of these programs.

Economic Development Administration Public Works Grant Program

The Economic Development Administration (EDA) Public Works Grant Program, administered by the US Department of Commerce, is aimed at projects which directly create permanent jobs or remove impediments to job creation in the project area. Thus, to be eligible for this grant, a community must be able to demonstrate the potential to create jobs from the project. Potential job creation is assessed with a survey of businesses to demonstrate the prospective number of jobs that might be created if the proposed project was completed.

Proposed projects must be located within an EDA designated Economic Development District. Priority consideration is given to projects that improve opportunities for the establishment or expansion of industry and projects that create or retain private sector jobs in both the near term and long term. Communities, which can demonstrate that the existing system is at capacity (e.g. moratorium on new connections), have a greater chance of being awarded this type of grant. The EDA grants are usually fifty percent or less of the project cost; therefore, some type of local funding is also required. Grants typically do not exceed one million dollars.

Rural Development Administration Loans and Grants

The Rural Development Administration (Rural Development) manages the loans and grants for water programs that were formerly overseen by the Farmers Home Administration. While these programs are administered by a new agency, the program requirements are essentially the same. The Rural Utilities Service (RUS) is one of three entities that comprise the US Department of Agriculture's (USDA) Rural Development mission area. The RUS supports various programs that provide financial and technical assistance for development and operation of safe and affordable water supply systems.

Rural Development has the authority to make loans to public bodies and non-profit corporations to construct or improve essential community facilities, including water systems. Grants are also available to applicants who meet the Median Household Income (MHI) requirements. While eligible applicants must have a population less than 10,000, priority is given to public entities in areas smaller than 5,500 people to restore deteriorating infrastructure systems. Preference is also given to projects that involve the merging of facilities and those serving low-income communities.

In addition, borrowers must meet the following stipulations:

- Be unable to obtain needed funds from other sources at reasonable rates and terms.
- Legal capacity to borrow and repay loans, to pledge security for loans, and to operate and maintain the facilities or services.
- Financially sound entity based on taxes, assessments, revenues, fees, or other satisfactory sources of income to pay all facility costs including Operation and Maintenance (O&M), and to retire the indebtedness and maintain a reserve.
- Water systems must be consistent with any development plans of State, multi-jurisdictional area, County, or municipality in which the proposed project is located. All facilities must comply with Federal, State, and local laws including those concerned with zoning regulations, health and sanitation standards, and the control of water pollution.

Loan and grant funds may be used for the following types of improvements:

- Construct, repair, improve, expand, or otherwise modify infrastructure systems.

In some cases, funding may also be available for related activities such as:

- Legal and engineering costs connected with the development of facilities.
- Land acquisition, water and land rights, permits, and equipment.
- Start-up operations and maintenance.
- Purchase of facilities to improve service or prevent loss of service.

Interim financing must be used during the length of the project and Rural Development funds are made available when the construction phase of the project is completed. If interim financing is not available or if the project cost is less than $50,000; multiple advances of Rural Development funds may be made as construction progresses.

The maximum term on all loans is 40 years. However, no repayment period will exceed any statutory limitation on the organization's borrowing authority, nor the useful life of the improvement of the facility to be financed. Interest rates are set quarterly and are based on current market yields for municipal obligations. Current interest rates may be obtained from any Rural Development office.

The following rates currently apply for the Rural Development program:

> ***Market Rate.*** Those applicants pay the market rate whose MHI of the service area is more than the $61,400 (Oregon non-metropolitan MHI). The market rate is currently 2.50 percent.
>
> ***Intermediate Rate.*** Those applicants whose MHI of the service area is between $49,120 (eighty percent of the State MHI) through $61,400 pay the intermediate rate. The intermediate rate is paid by those applicants whose MHI of the service area is less than eighty percent of the Oregon non-metropolitan MHI. The current intermediate line rate is 2.00 percent.

Poverty Line Rate. Those applicants whose MHI of the service area is below $49,120 (eighty percent of the State MHI) pay the lowest rate. Improvements must also be required by a governing agency to correct a regulatory violation or health risk. The current poverty line rate is 1.50 percent.

The City of Bandon is eligible for the intermediate rate since there is no regulatory violations or health risks despite the City's being eligible for the poverty line rate because of MHI. The MHI for the City of Bandon is listed at $37,262. If the City had a health or sanitary issue, and the project is needed to merit regulatory standards, then the City would meet both qualifications for the poverty rate.

Other restrictions and requirements may be associated with these loans and grants. If the City becomes eligible for grant assistance, the grant will apply only to eligible project costs and is only available after a City has incurred long-term debt resulting in an annual debt service obligation equal to one-half of one percent of the MHI. To receive a Rural Utilities Service Loan, the City must secure bonding authority, usually in the form of General Obligation or Revenue Bonds.

Applications for financial assistance are made at area offices of Rural Development. For additional information on Rural Development loans and grant programs, call 866-923-5626 Ext. 1 or visit the RUS website at https://www.rd.usda.gov/programs-services/rural-economic-development-loan-grant-program. The Oregon Rural Development website is https://www.rd.usda.gov/or.

Technical Assistance Grants (TAG)

Available through the USDA RUS as part of the water programs, technical assistance grants are intended to provide technical assistance to associations on a wide range of issues relating to the delivery of water services. Technical Assistance Grant funds may be used for the following activities:

- Identify and evaluate solutions to water related problems.
- Assist entities with preparation of applications for water loans and grants.
- Provide training to association personnel in order to improve the management, operation and maintenance of water.
- Pay expenses related to providing the technical assistance and/or training.

Technical Assistant Grants may be made for up to 100 percent, not to exceed $30,000, of the eligible project costs. Applications are filed with any USDA Rural Development office. For additional information on Rural Development loans and grant programs, call 866-923-5626 Ext. 1 or visit the RUS website at https://www.rd.usda.gov/programs-services/water-waste-disposal-technical-assistance-training-grants.

Oregon Community Development Block Grant (CDBG) Program

The Community Development Block Grant Program (CDBG) section of the Business Oregon - Infrastructure Finance Authority (IFA) administers the CDBG Program. Grants and technical assistance are available to develop livable urban communities for persons of low and moderate incomes by expanding economic opportunities and providing housing and suitable living environments.

Non-metropolitan cities and counties in rural Oregon can apply for and receive grants. Oregon Tribes, urban cities (Ashland, Bend, Corvallis, Eugene, Gresham, Hillsboro, Medford, Portland, Salem and

Springfield) and counties (Clackamas, Multnomah, Washington, Marion) receive funds directly from Housing and Urban Development (HUD).

All projects must meet one of three national objectives:

- The proposed activities must benefit low and moderate income individuals.
- The activities must aid in the prevention or elimination of slums or blight.
- There must be an urgent need that poses a serious and immediate threat to the health or welfare of the community.

Funding amounts are based on:

- The applicant's need;
- The availability of funds; and
- Other restrictions defined in the program's guidelines.

The following are the maximum grants possible for any individual project, by category:

- Microenterprise: $100,000
- Public Works Water and Wastewater Improvements: $2,500,000
- Community/Public Facilities: $1,500,000
- Community Capacity/Technical Assistance: no specific per-award-limit but limited overall funds.
- Regional Housing Rehabilitation: $400,000 - $500,000
- Emergency Projects: $500,000

For additional information on the CDBG programs, call 503-346-8620 or visit the Infrastructure Finance Authority (IFA) website at https://www.oregon.gov/biz/programs/CDBG/Pages/default.aspx.

Oregon Special Public Works Fund

The Special Public Works Fund (SPWF) provides funds for publicly owned facilities that support economic and community development in Oregon. Special Public Works Funds provide funding for construction and/or improvement of infrastructure needed to support industrial, manufacturing and certain types of commercial development. Funds are available to public entities for:

- Emergency projects as a result of a disaster,
- Energy systems,
- Levee certification, and
- Telecommunication systems

Public agencies that are eligible to apply for funding are:

- Cities
- Counties
- County service districts (organized under ORS Chapter 451)
- Tribal councils;
- Ports
- Districts as defined in ORS 198.010
- Airport Districts (ORS 838)

Facilities and infrastructure projects that are eligible for funding are:

- Water and sewer utilities,
- Local roads, bridges, and other transportation system facilities,
- Emergency services buildings, including 911 system and ambulance facilities.
- Police and fire stations,
- Medical treatment centers,
- Emergency and auxiliary shelters,
- Storm water drainage,
- Port facilities,
- Infrastructure required for access to school,
- City halls,
- City and county courts, and
- Jails

Loans

Loans for development (construction) projects range from less than $100,000 to $10 million. The Infrastructure Finance Authority offers very attractive interest rates that reflect tax-exempt market rates for highly qualified borrowers. Initial loan terms can be up to 25 years or the useful life of the project, whichever is less.

Grants

Grants are available for construction projects that create or retain trade sector jobs. They are limited to $500,000 or 85 percent of the project cost, whichever is less. The grants are based on up to $5,000 per eligible job created or retained. As this grant is dependent on job creation, it is not ideal for municipal water infrastructure projects.

Limited grants are available to plan industrial site development for publicly owned sites and for feasibility studies. For additional information on IFA programs, call 503-346-8620 or visit the IFA website at: https://www.orinfrastructure.org/Infrastructure-Programs/SPWF/#:~:text=The%20Special%20Public%20Works%20Fund,and%20community%20development%20in%20Oregon.

Water/Wastewater Financing Program

Water/wastewater financing is available for construction and/or improvement of water and wastewater systems to meet State and Federal standards. This loan program funds the design and construction of public infrastructure needed to ensure compliance with the Safe Drinking Water Act or the Clean Water Act.

The public entities that are eligible to apply for the program are:

- Cities
- Counties
- County service districts (organized under ORS Chapter 451)
- Tribal councils;
- Ports
- Special districts as defined in ORS 198.010

The proposed project must be owned and operated by a public entity as listed above. Allowable funded project activities may include:

- Reasonable costs for construction improvement or expansion of drinking water system, wastewater system, or stormwater system;
- Water source, treatment, storage, and distribution;
- Wastewater collection, treatment, and disposal facilities;
- Stormwater system;
- Purchase of rights of way and easements necessary for construction;
- Design and construction engineering; or
- Planning/technical assistance for small communities.

To be eligible for funding:

- A system must have received, or is likely to soon receive, a Notice of Non-Compliance by the appropriate regulatory agency or is for a facility plan or study required by a regulatory agency
- A registered Professional Engineer will be responsible for the design and construction of the project

Funding and Uses
Loan and grant amounts are determined by a financial analysis of the applicant's ability to afford a loan (debt capacity, repayment sources, and other factors).

Loans
Program guidelines, project administration, loan terms and interest rates are similar to the Special Public Works Fund program. The maximum loan term is 25 years or the useful life of the infrastructure financed, whichever is less. The maximum loan amount is $10 million per project through a combination of direct and/or bond-funded loans. Recently IFA, was offering lower, reduced interest rates for municipalities whose household income is less than the statewide median income. The current terms of this loan are for 30 years at 2.11 percent interest. Due to the current financial climate this rate is estimated to increase a maximum of 0.75 percent in June 2022; therefore, a rate of 2.86 percent interest was used during funding alternatives analysis.

Loans are generally repaid with utility revenues or voter-approved bond issues. A limited tax general obligation pledge also may be required. "Creditworthy" borrowers may be funded through the sale of State Revenue Bonds.

Grants
Grant awards up to $750,000 may be awarded based on a financial review.

An applicant is not eligible for grant funds if the applicant's annual MHI is equal to or greater than 100 percent of the State average MHI for the same year.

Funding for Technical Assistance
The Infrastructure Finance Authority offers technical assistance with financing for municipalities with populations of less than 15,000. The funds may be used to finance preliminary planning, engineering studies, and economic investigations.

Technical assistance projects must be in preparation for a construction project that is eligible and meets the established criteria.

- Grants up to $20,000 may be awarded per project.
- Loans up to $60,000 may be awarded per project.

Interested applicants should contact Business Oregon prior to submitting an application. Applications are accepted year-round.

Clean Water State Revolving Fund (CWSRF)

Each year the Oregon Health Authority (OHA) receives an allotment from the Federal government for the Clean Water State Revolving Fund. The funds along with a twenty percent State match are used to make low interest loans to finance needed drinking water system improvements. Funds may be used for the following types of activities:

Planning
Master plans, pilot studies, and feasibility studies that are part of compliance related construction project.

Preliminary and Final Engineering and Design
Surveying, legal review, preparation of engineering drawings, and specifications for construction. Costs necessary for recipients to contract environmental review services are included.

Construction Costs
All aspects of a public water system from source of supply, filtration, treatment, storage, transmission, and metering.

Source Water Protection
As part of a source water management plan for a watershed or a delineated source water protection area for a well.

Property Acquisition
The acquisition of real property directly related to or necessary for the proposed project including rights-of-way, easements, and facility sites.

While many activities are eligible for CWSRF financing, the following activities are considered ineligible activities. These activities include dams or rehabilitation of dams, purchase of water rights unless owned on a system that is being purchased through a consolidation project, finished water reservoirs, administrative costs, operation and maintenance expenses, and projects primarily intended to supply or attract future growth.

The program's financing is available to all sizes of water systems. Municipal, nonprofit and privately owned community water systems are eligible, as well as nonprofit non-community systems. Terms of the loan are 30 years at eighty percent of the State / local bond rate. This rate is currently 1.0 percent. Financially disadvantaged applicants can get up to a 30 year loan at an interest rate of one percent, as well as the possibility of some principal forgiveness.

The Oregon Health Authority and Business Oregon Infrastructure Finance Authority (IFA) rate proposed projects. Highest ratings are given to projects that present the following:

- Addresses the most serious risk to human health.
- Necessary to ensure Safe Drinking Water Act compliance.
- Applicant has the greatest financial need, on a per household basis, according to affordability criteria.

Additional consideration will be given to disadvantaged communities. The definition of a disadvantaged community has changed to one in which the average annual water rate will exceed 1.25 percent of local MHI. The above ratio is subject to adjustment with the availability of 2010 Census figures and inflation indexing thereafter.

Applicants with 300 or more service connections are eligible for assistance with final design and construction projects; only if they maintain a current, approved master plan that evaluates the needs of the water system for at least a 20-year period and includes the major elements outlined in Oregon Administrative Rules (OAR) 333-061-0060(5). Systems with less than 300 service connections may receive funding for an engineering feasibility analysis instead of a master plan.

11.2 Local Funding Sources

The amount and type of local funding obligations for water system improvements will depend, in part, on the amount of grant funding anticipated and the requirements of potential loan funding. Local revenue sources for capital expenditures include various types of bonds, water service charges, connection fees, and System Development Charges (SDC). Local revenue sources for operating costs include water service charges. The following sections identify those local funding sources and financing mechanisms that are most common and appropriate for the improvements identified in this Plan.

General Obligation Bonds

A General Obligation (G.O.) Bond is back by the full faith and credit of the issuer. For payment of the principal and interest on the bond, the issuer may levy ad valorem general property taxes. Such taxes are not needed if revenue from assessments, user charges or some other sources are sufficient to cover debt service.

Oregon Revised Statutes limit the maximum term to 40 years for cities. Except in the event that Rural Utilities Service will purchase the bonds, the realistic term for which General Obligation Bonds should be issued is 15 to 20 years. Under the present economic climate, the lower interest rates will be associated with the shorter terms.

Financing of water system improvements by General Obligation Bonds is usually accomplished by the following procedure:

- Determination of the capital costs required for the improvement.
- An election authorizing the sale of General Obligation Bonds.
- Following voter approval, the bonds are offered for sale.
- The revenue from the bond sale is used to pay the capital costs associated with the projects.

From a fund raising viewpoint, General Obligation Bonds are preferable to revenue bonds in matters of simplicity and cost of issuance. Since the bonds are secured by the power to tax, these bonds usually command a lower interest rate than other types of bonds. General Obligation Bonds lend themselves readily to competitive public sale at a reasonable interest rate because of their high degree of security, tax-exempt status, and general acceptance.

These bonds can be revenue-supported wherein a portion of the user fee is pledged toward payment of the debt service. Using this method, the need to collect additional property taxes to retire the obligated bonds is eliminated. Such revenue-supported General Obligation Bonds have most of the advantages of revenue bonds, but also maintain the lower interest rate and ready marketability of General Obligation Bonds.

Other advantages of General Obligation Bonds over other types of bonds are as follows:

- The laws authorizing General Obligation Bonds are less restrictive than those governing other types of bonds.
- By the levying of taxes, the debt is repaid by all property benefited and not just the system users.
- Taxes paid in the retirement of these bonds are IRS deductible.
- General Obligation Bonds offer flexibility to retire the bonds by tax levy and/or user charge revenue.

The disadvantage of General Obligation Bond debt is that it is often added to the debt ratios of the underlying municipality, thereby restricting the flexibility of the municipality to issue debt for other purposes. Furthermore, General Obligation Bonds are normally associated with the financing of facilities that benefit an entire community, must be approved by a majority vote and often necessitate extensive public information programs. A majority vote often requires waiting for a general election in order to obtain an adequate voter turnout. Waiting for a general election may take years, and too often a project needs to be undertaken in a much shorter amount of time.

The City passed a General Obligation Bond issue in 2019. Part of the monies were allocated for the replacement of the older raw water clarifier. Since the City must have voter approval for any utility rate increases, the City may have to pass another General Obligation Bond issue to fund a portion of the proposed improvements.

Revenue Bonds

Revenue Bonds are becoming a frequently used option for long-term debt. These bonds are an acceptable alternative and offer some advantages to General Obligation Bonds. Revenue Bonds are payable solely from charges made for the services provided. These bonds cannot be paid from tax levies or special assessments; their only security is the borrower's promise to operate the system in a way that will provide sufficient net revenue to meet the debt service and other obligations of the bond issued.

Many communities prefer Revenue Bonds because the debt obligation will be limited to system users since repayment is derived from user fees. Another advantage of Revenue Bonds is that they do not count against a municipality's direct debt, but instead are considered “overlapping debt.” This feature can be a crucial advantage for a municipality near its debt limit or for the rating agencies, which consider very closely the amount of direct debt when assigning credit ratings. Revenue Bonds also may be used in financing projects extending beyond normal municipal boundaries. These bonds may be supported by a pledge of revenues received in any legitimate and ongoing area of operation, within or without the geographical boundaries of the issuer.

Successful issuance of Revenue Bonds depends on the bond market evaluation of the revenue pledged. Revenue Bonds are most commonly retired with revenue from user fees. Recent legislation has eliminated the requirement that the revenues pledged to bond payment have a direct relationship to the services financed by Revenue Bonds. Revenue Bonds may be paid with all or any portion of revenues derived by a public body or any other legally available monies. In addition, if additional security to finance Revenue Bonds was needed, a public body may mortgage grant security and interests in facilities, projects, utilities or systems owned or operated by a public body.

Normally, there are no legal limitations on the amount of Revenue Bonds to be issued; but excessive issue amounts are generally unattractive to bond buyers because they represent high investment risks. In rating Revenue Bonds, buyers consider the economic justification for the project, reputation of the borrower, methods and effectiveness for billing and collecting, rate structures, provision for rate increases as needed to meet debt service requirements, and track record in obtaining rate increases historically. In addition, other factors considered include adequacy of reserve funds provided in the bond documents, supporting covenants to protect projected revenues, and the degree to which forecasts of net revenues are considered sound and economical.

Municipalities may elect to issue Revenue Bonds for revenue producing facilities without a vote of the electorate (ORS 288.805-288.945). In this case, certain notice and posting requirements must be met and a 60-day waiting period is mandatory. A petition signed by five percent of the municipality's registered voters may cause the issue to be referred to an election.

Improvement Bonds

Improvement (Bancroft) bonds can be issued under an Oregon law called the Bancroft Act. These bonds are an intermediate form of financing that is less than full-fledged general obligation or revenue bonds. However, these types of bonds are quite useful especially for smaller issuers or for limited purposes.

An improvement bond is payable only from the receipts of special benefit assessments, not from general tax revenues. Such bonds are issued only where certain properties are recipients of special benefits not accruing to other properties. For a specific improvement, all property within the improvement area is assessed on an equal basis, regardless of whether it is developed or undeveloped. The assessment is designed to apportion the cost of improvements, approximately in proportion to the afforded direct or indirect benefits, among the benefited property owners. This assessment becomes a direct lien against the property, and owners have the option of either paying the assessment in cash or applying for improvement bonds. If the improvement bond option is taken, the City sells Bancroft improvement bonds to finance the construction, and the assessment is paid over twenty years in forty semi-annual installments with interest. Cities and special districts are limited to improvement bonds not exceeding three percent of true cash value.

With improvement bond financing, an improvement district is formed, the boundaries are established, and the benefited properties and property owners are determined. The Engineer usually determines an approximate assessment, either on a square foot or a front-foot basis. Property owners are then given an opportunity to object to the project assessments. The assessments against the properties are usually not levied until the actual cost of the project is determined. Since this determination is normally not possible until the project is completed, funds are not available from assessments for the purpose of making monthly payments to the Contractor. Therefore, some method of interim financing must be arranged, or a pre-assessment program, based on the estimated total costs, must be adopted. Commonly, warrants are issued to cover debts, with the warrants to be paid when the project is complete.

The primary disadvantage to this source of revenue is that the property to be assessed must have a true cash value at least equal to fifty percent of the total assessments to be levied. As a result, owners of undeveloped property usually require a substantial cash payment. In addition, the development of an assessment district is very cumbersome and expensive when facilities for an entire community are contemplated. In comparison, General Obligation Bonds can be issued in lieu of improvement bonds, and are usually more favorable.

Capital Construction (Sinking) Fund

Sinking funds are often established by budget for a particular construction purpose. Budgeted amounts from each annual budget are carried in a sinking fund until sufficient revenues are available for the needed project. Such funds can also be developed with revenue derived from SDC.

A City may wish to develop sinking funds for each sector of the public services. This fund can be used to rehabilitate or maintain existing infrastructure, construct new infrastructure elements, or to obtain grant and loan funding for larger projects.

The disadvantage of a sinking fund is that it is usually too small to undertake any significant projects. Also, setting aside money generated from user fees without a designated and specified need is not generally accepted in municipal or public utility budgeting processes.

System Development Charges

A System Development Charge (SDC) is a fee collected as each piece of property is developed and is used to finance the necessary capital improvements and municipal services required by the development. Such a fee can only be used to recover the capital costs of infrastructure. Operating, maintenance, and replacement costs cannot be financed through the SDC.

Two types of charges are permitted under the Oregon Systems Development Charges Act: improvement fees, and reimbursement fees. The SDCs charged before construction are considered improvement fees and are used to finance capital improvements to be constructed. After construction, SDCs are considered reimbursement fees and are collected to recapture the costs associated with capital improvements already constructed or under construction. A reimbursement fee represents a charge for utilizing excess capacity in an existing facility paid for by others. The revenue generated by this fee is typically used to pay back existing loans for improvements.

Under the Oregon SDC Act, methodologies for deriving improvement and reimbursement fees must be documented and available for review by the public. A Capital Improvement Plan (CIP) must also be prepared which lists the capital improvements that may be funded with improvement fee revenues and the estimated cost and timing of each improvement. Thus, revenue from the collection of SDCs can only be used to finance specific items listed in a CIP. In addition, SDCs cannot be assessed on portions of the project paid for with grant funding. The current SDC and rate structure should be re-evaluated and adjusted to account for the improvements described herein.

User Fees

User fees are used as a source of revenue to retire Revenue Bonds and to finance operation and maintenance. User fees represent monthly charges of all residences, businesses, and other users that are connected to the water system. These fees are established by resolution and can be modified, as needed, to account for increased or decreased operating and maintenance costs. The monthly charges are usually based on the class of user (e.g. single family dwelling, multiple family dwelling, schools) and the quantity of water through a user's connection.

Assessments

Under special circumstances, the beneficiary of a public works improvement may be assessed for the cost of a project. For example, a City may provide some improvements or services that directly benefit a particular development. A City may choose to assess the industrial or commercial developer to provide up-front capital to pay for the administered improvements.

11.3 Financing Strategy

A financing strategy or plan must provide a mechanism to generate capital funds in sufficient amounts to pay for the proposed improvements over the relatively short duration in design and construction, generally two years. The financing strategy must also identify the manner in which annual revenue will be generated to cover the expense for long-term debt repayment and the on-going operation and maintenance of the system. The objectives of a financial strategy include the following:

- Identify the capital improvement cost for the project and the estimated expense for O&M.
- Evaluate the potential funding sources and select the most viable program.
- Determine the availability of outside funding sources and identify the local cost share.
- Determine the cost to system users to finance the local share and the annual cost for O&M.

With any of the proposed funding sources within the financial strategy, the City is advised to confirm specific funding amounts with the appropriate funding agencies prior to making financing arrangements.

Total estimated cost for the Priority I Improvements is $9,041,400. The City has previously secured funding for a portion of the improvements at $3,109,250. A financial strategy to address financing of the Phase I Improvements within the Capital Improvement Plan is discussed below.

Grants and Low Interest Loans

Three types or programs of project funding were identified as viable for funding the City's proposed Phase I Improvements: 1) Rural Development Water and Waste Disposal Grants and Loans; 2) Business Oregon Water/Wastewater Financing Program; and 3) Clean Water State Revolving Fund. Private financing was not considered due to the fact that interest rates are historically higher than State or Federal rates. Based on these funding programs, three alternative funding packages were compiled and evaluated. These alternatives are designated as A, B, and C. A summary of the funding alternatives for these improvements is given in Table 11.3.1.

The projected rate increases anticipated from the funding options range from $5.40 to $8.60 per Equivalent Dwelling Unit (EDU) per month. These rate increases are very similar in magnitude and should be investigated further at a "One-Stop" meeting with the funding agencies. For the purposes of this financing plan, further evaluation will be made with the rate increase associated with Alternative A.

TABLE 11.3.1
FUNDING ALTERNATIVES FOR PRIORITY I IMPROVEMENTS

Funding Source	Grant Amount, $ (1)	Loan Amount, $ (1)	Loan Term, yrs	Interest Rate, %	Rate Increase, $/EDU/mth (2)
Alternative A – Rural Development (RD)/Water/Wastewater Financing Program Grants & Loans					
RD 25/75 (Grant/Loan)	$1,483,038	$4,449,113	40	2	$5.40
Alternative B – Water/Wastewater Financing Program Grants & Loans					
Water/Wastewater 20/80 (Grant/Loan)	$750,000	$5,182,150	30	2.86	$8.60
Alternative C – Clean Water State Revolving Fund Loan					
DWSRF (Loan)	--	$5,932,150	30	1.0	$7.65

(1) Amount based on current dollars.
(2) Based on 2,494 EDUs. EDUs associated with non-profit or City use was not included in the total EDU tabulation.

Local Financing Requirements

The financing plan for the Priority I Improvements is based on the City securing authorization to issue bonds for $4,449,113. A breakdown of approximate monthly water user costs for the improvements, based on current water O&M budget and debt reserve is given in Table 11.3.2. The estimated total monthly average cost to each EDU is anticipated to be approximately $53.13.

TABLE 11.3.2
APPROXIMATE MONTHLY USER COSTS

Item	Annual Cost	Monthly User Cost/EDU (1)
Debt Service on $4,153,950	$161,677	$5.40
Debt Service at 10%	$16,168	$0.54
Existing Debt Service	$39,759	$1.32
2022 - 2023 Operational O & M	$1,372,663	$45.87
Total	**$1,590,266**	**$53.13**

(1) Based on 2,494 EDUs

Affordability

One major consideration in deciding on any proposed capital improvements is the user's ability to support the full cost, including debt repayment, of utility service. Several measures of household affordability or ability-to-pay have been proposed or are currently being utilized.

The majority of affordability indicators are largely a function of income and rates. One of the most common affordability indicators is the ratio of annual user charges to the MHI. The threshold of affordability for this ratio varies from 1.5 to 2.5 percent of MHI. Business Oregon utilizes 1.25 percent of the MHI as a threshold for qualifying for grant monies (August 2018 SDWRLF).

Affordability of rates and projected rate increases are also factors when bond rating agencies are determining credit quality. Fitch Ratings generally considers combined water and sewer service rates higher than two percent of MHI (or one percent for individual water utilities) to be financially taxing (Water and Sewer Revenue Bond Rating Guidelines, Fitch Ratings September 3, 2015). A summary of affordability measures and thresholds from selected studies is provided in Table 11.3.3. If the City was given a funding package equivalent to funding Alternative A for the Priority I projects, the affordability percentage for the City of Bandon users would be 1.71 percent. This is on the low end of average affordability, and potential grant funding may be limited.

TABLE 11.3.3
SUMMARY OF AFFORDABILITY MEASURES AND THRESHOLDS

Source	Indicator(s)	Threshold
Future Investment in Drinking Water & Wastewater Infrastructure (2002)	Ratio of annual user charge & MHI	2.5% of MHI
Rural Utilities Service Water & Waste Disposal Loans & Grants	Debt service portion of annual user charge & MHI	>0.5% & MHI below poverty line or >1.0% & MHI between 80 & 100% of statewide non-metropolitan MHI
Department of Housing & Urban Development	Ratio of water & sewer bills, & household income	1.3 to 1.4%
National Consumer Law Center "The Poor and the Elderly – Drowning in the High Cost of Water", circa 1991	Ratio of sum of water & sewer bills & household income	>2.00 %
EPA Economic Guidance for Water Quality Standards Workbook (1995)	Ratio of annual user charge & MHI	<1.0% - no hardship expected 1.0 – 2.0% - mid-range >2.0% may be unreasonable burden
Affordability Criteria for Small Drinking Water Systems: An EPA Science Advisory Board Report (2002)	Discussion of affordability threshold, expenditure baselines, and differences in cost, income, and benefits	<1.0% must provide additional security >2.5% - system probably cannot issue debt
National Drinking Water Advisory Council Affordability Recommendations (2003)	EPA national affordability threshold given size category	grounds for consideration of measures other than median income
State of Oregon Assessment Tools for SRF Loans	Ratio of annual user charge & MHI	1.5% MHI

Abbreviations: AUC – Annual User Charge
MHI – Median Household Income

One limitation of using the ratio of annual user charges to the MHI is determination of a representative MHI for a community. Currently, most funding agencies utilize the 2020 Census data for making this determination. The 2020 Census Data has the City of Bandon's MHI at $37,262 per year. The affordability of existing and future water rates within the City is summarized in Table 11.3.4.

TABLE 11.3.4
AFFORDABILITY OF PROJECTED WATER USER COSTS FOR THE CITY OF BANDON

AFFORDABILITY TABULATIONS	
Median Household Monthly Income (MHI)	$37,262
Current Monthly Rates	
Estimated Monthly User Charge/EDU ($)	$33.45
Annual User Charge/ MHI (%)	1.08%
Projected Monthly Rates	
Estimated Monthly User Charge/EDU ($)	$53.13
Annual User Charge/ MHI (%)	**1.71%**

11.4 Recommendations

The following recommendations are made to the City to implement the elements of this Water Master Plan (WMP).

1. Submit Plan to the Oregon Health Authority (OHA) and Oregon Department of Water Resources (OWRD) for review and approval.
2. Schedule and attend "One-Stop" meeting to discuss financing options for the proposed Priority I Improvements.
3. Submit necessary applications to the funding agencies requesting a loans and grants to finance the Priority I Improvements.
4. Following favorable review by the selected financing agencies, secure the authority to issue revenue or General Obligation Bonds in the amount needed to finance the Priority I Improvements.
5. Authorize the development of an Environmental Review Report, detailed design of recommended improvements and preparation of plans and specifications for the Phase I Improvements. Secure the necessary special use permits.
6. Receive construction bids and award contracts for Priority I Improvements.
7. Initiate study of user rates for water system and implement proposed changes.
8. Revise SDCs and rates for the water system based on the CIP given in this WMP.

11.5 Project Implementation

A tentative schedule, identifying the key activities and approximate implementation date for the Water Master Plan over the next three years, is presented in Table 11.5.1 on the following page.

TABLE 11.5.1
PROJECT IMPLEMENTATION SUMMARY

Item No.	Key Activity	Implementation Date
1	City Council Adopts the Water Master Plan	August 2022
2	Submit Plan to OHA and OWRD for Review and Approval	August 2022
3	Approval of Plan by Oregon Health Authority & Oregon Department of Water Resources	December 2022
4	Attend "One-Stop" Meeting	January 2023
5	Submit Application for Financing for Phase I and Associated Environmental Evaluation/Notice for Project	February 2023
6	Obtain Financing for Priority I Improvements	July 2023
7	Start Environmental Review Process, Preparation of Plans, Specifications for Phase I	August 2023
8	Complete Environmental Review, Design & Preparation of Plans, Specifications, & Contract	March 2024
9	Health Authority Approval of Plans & Specifications	May 2024
10	Advertise for Priority I Construction Bids	June 2024
11	Receive Construction Bids for Priority I Improvements	July 2024
12	Start Construction of Priority I Improvements	August 2024
13	Complete Construction of Priority I Improvements	June 2025

APPENDICES

APPENDIX A: STUDY AREA INFORMATION

Layers Currently Showing

Landslide Hazard

☐ Low - Landsliding Unlikely
🟨 Moderate - Landsliding Possible
🟧 High - Landsliding Likely
🟥 Very High - Existing Landslide

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

DATE: JULY 2020
PROJECT NO.: 101.100

CITY OF BANDON
WATER MASTER PLAN

LANDSLIDE HAZARD MAP

FIGURE NO.
A.1

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.
DATE: JULY 2020
PROJECT NO.: 101.100

CITY OF BANDON
WATER MASTER PLAN

EARTHQUAKE HAZARD MAP

FIGURE NO.
A.2

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

DATE: JULY 2020
PROJECT NO.: 101.100

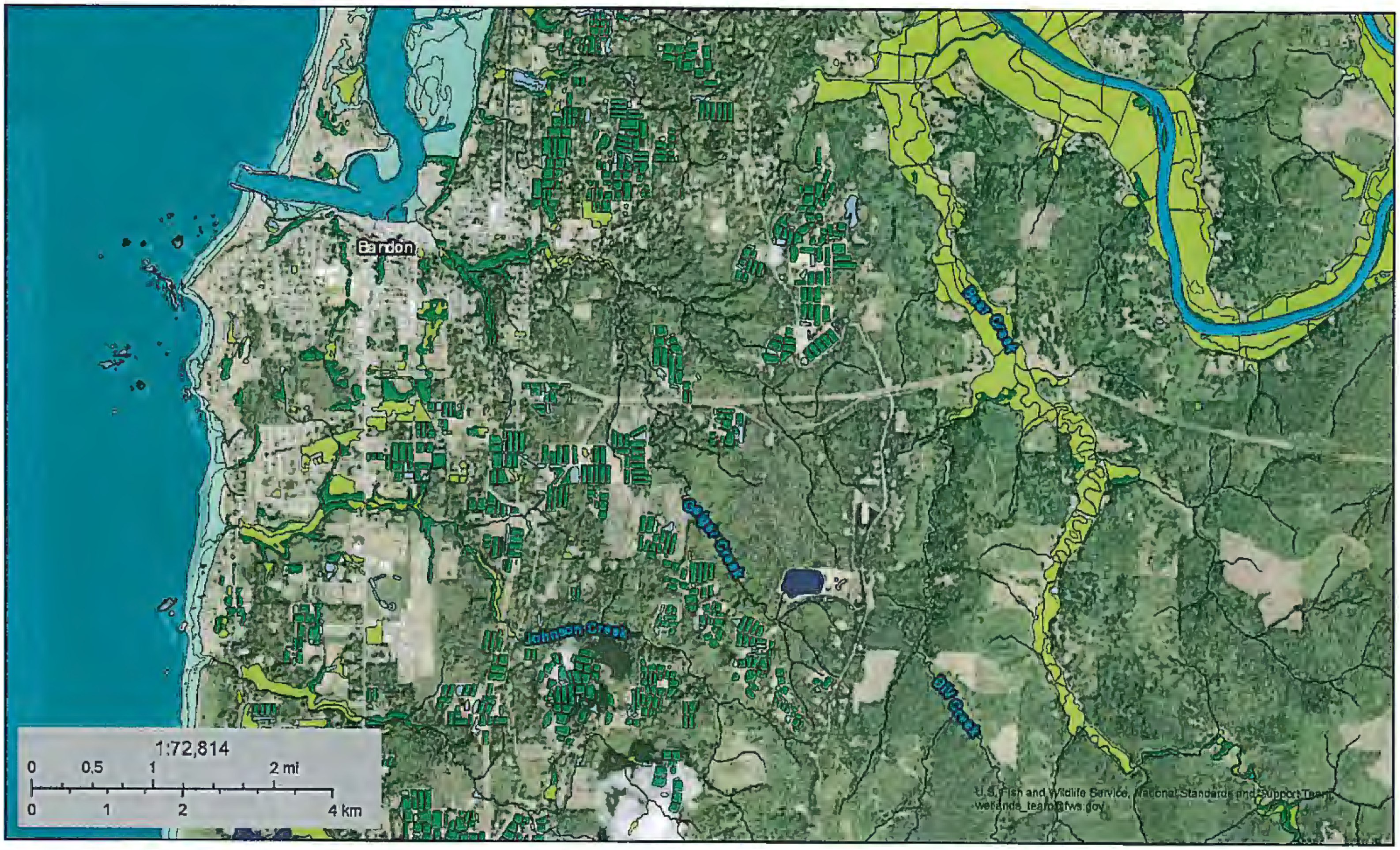
CITY OF BANDON
WATER MASTER PLAN
WETLAND HAZARD MAP

FIGURE NO.
A3

U.S. Fish and Wildlife Service

National Wetlands Inventory

City of Bandon



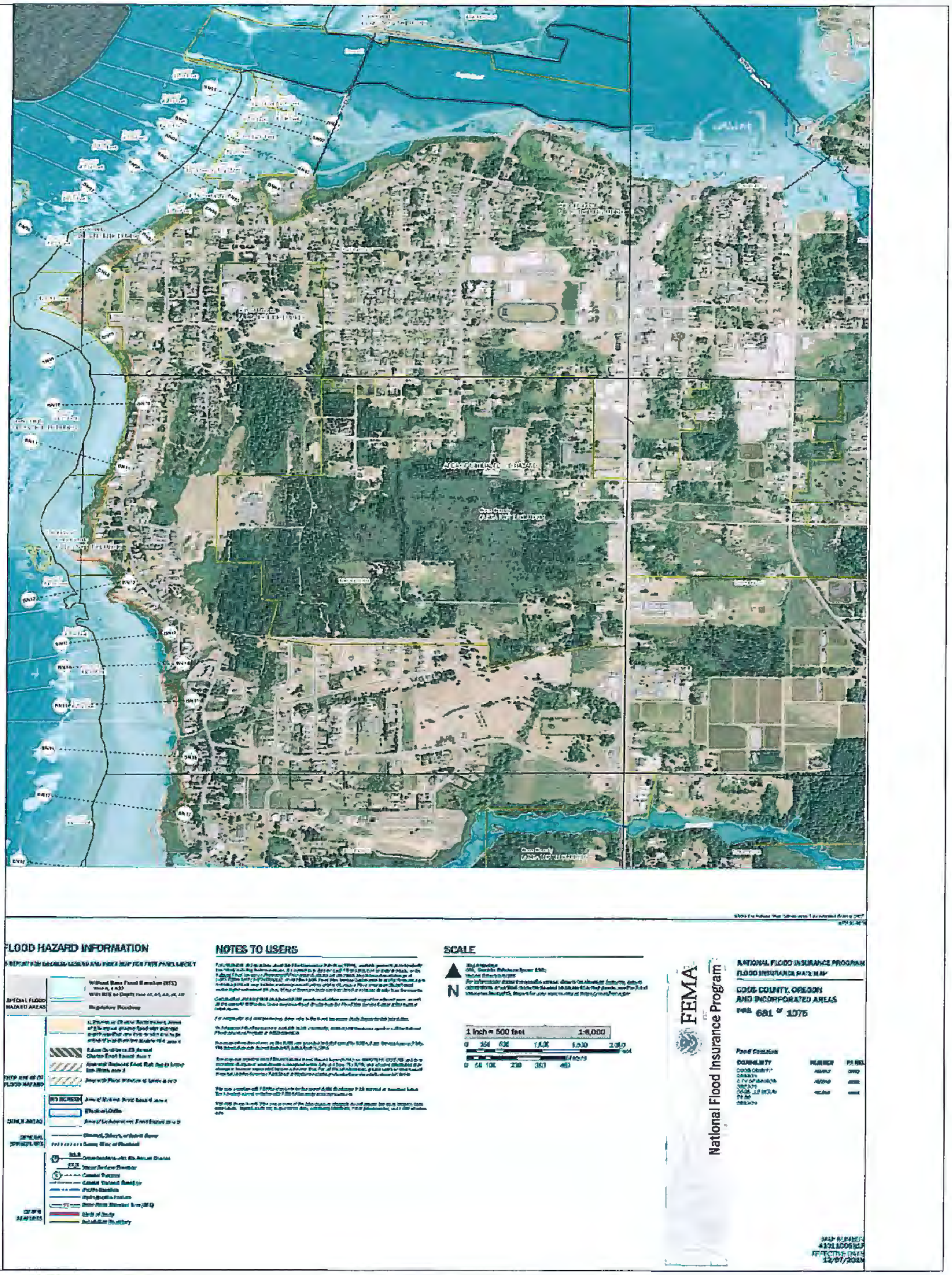
January 31, 2019

Wetlands

- ■ Estuarine and Marine Deepwater
- ■ Estuarine and Marine Wetland
- ■ Freshwater Emergent Wetland
- ■ Freshwater Forested/Shrub Wetland
- ■ Freshwater Pond
- ■ Lake
- ■ Other
- ■ Riverine

This map is for general reference only. The US Fish and Wildlife Service is not responsible for the accuracy or currentness of the base data shown on this map. All wetlands related data should be used in accordance with the layer metadata found on the Wetlands Mapper web site.

National Wetlands Inventory (NWI)
This page was produced by the NWI mapper



THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	CITY OF BANDON WATER MASTER PLAN	FIGURE NO.
DATE: JULY 2020 PROJECT NO.: 101.100	FEMA FIRM MAP	A4

APPENDIX B: WATER RIGHTS CERTIFICATES & PERMITS

RECEIVED
MAR 7 19[illegible]
STATE ENGINEER

Permit No. [illegible]

F [illegible]
249

***APPLICATION FOR PERMIT**

To Appropriate the Public Waters of the State of Oregon

I, City of Bandon
(Name of applicant)

of City Hall, Bandon, Oregon,
(Mailing address)

State of Oregon, *do hereby make application for a permit to appropriate the following described public waters of the State of Oregon, SUBJECT TO EXISTING RIGHTS:*

If the applicant is a corporation, give date and place of incorporation

Incorporated February 18, 1891, at Bandon, Oregon

1. The source of the proposed appropriation is Ferry Creek
(Name of stream)

, a tributary of Coquille River

2. The amount of water which the applicant intends to apply to beneficial use is 3 *cubic feet per second.* See Remarks (1)
(If water is to be used from more than one source, give quantity from each)

***3. The use to which the water is to be applied is* Municipal
(Irrigation, power, mining, manufacturing, domestic supplies, etc.)

4. The point of diversion is located 1374.40 *ft.* S (N. or S.) *and* 1263.0F E (E. or W.) *from the* ~~corner of~~ center of Sec. 29, T. 28S., R14W. W. M.
(Section or subdivision)

(If preferable, give distance and bearing to section corner)

(If there is more than one point of diversion, each must be described. Use separate sheet if necessary)

being within the SW 1/4 SE 1/4 (Give smallest legal subdivision) *of Sec.* 29, *Tp.* 28 S (N or S)*,*

R. 14 W (E. or W.)*, W. M., in the county of* Coos

5. The See Remarks (2) (Main ditch, canal or pipe line) *to be* (Miles or feet)

in length, terminating in the (Smallest legal subdivision) *of Sec.* *, Tp.* (N or S)

R. (E. or W.) *, W. M., the proposed location being shown throughout on the accompanying map.*

DESCRIPTION OF WORKS

Diversion Works—

6. (a) Height of dam *feet, length on top* *feet, length at bottom* *feet; material to be used and character of construction* (Loose rock, concrete, masonry, rock and brush, timber crib, etc., wasteway over or around dam)

See Remarks (2)

(b) Description of headgate (Timber, concrete, etc., number and size of openings)

(c) If water is to be pumped give general description (Size and type of pump)

(Size and type of engine or motor to be used, total head water is to be lifted, etc.)

---

*A different form of application is provided where storage works are contemplated.

**Application for permits to appropriate water for the generation of electricity, with the exception of municipalities, must be made to the Hydroelectric Commission. Either of the above forms may be secured, without cost, together with instructions by addressing the State Engineer, Salem, Oregon.

27283

Canal System or Pipe Line—

7. *(a) Give dimensions at each point of canal where materially changed in size, stating miles from headgate. At headgate: width on top (at water line)* .... *feet; width on bottom* .... *feet; depth of water* .... *feet; grade* .... *feet fall per one thousand feet.*

(b) At .... *miles from headgate: width on top (at water line)* .... *feet; width on bottom* .... *feet; depth of water* .... *feet; grade* .... *feet fall per one thousand feet.*

(c) Length of pipe See Remarks (2) *ft.; size at intake,* .... *in.; size at* .... *ft. from intake* .... *in.; size at place of use* .... *in.; difference in elevation between intake and place of use,* .... *ft. Is grade uniform?* .... *Estimated capacity,* .... *sec. ft.*

8. *Location of area to be irrigated, or place of use* See accompanying map Sheet 1

Township North or South	Range E. or W. of Willamette Meridian	Section	Forty-acre Tract	Number Acres To Be Irrigated
28 S	R14W	19	All	
		20	All	
		29	All	
		30	All	
		31	All	
		32	W 1/2	
28 S	R15W	24	All	
		25	All	
		36	All	

(If more space required, attach separate sheet)

(a) Character of soil ....

(b) Kind of crops raised ....

Power or Mining Purposes—

9. *(a) Total amount of power to be developed* .... *theoretical horsepower.*

(b) Quantity of water to be used for power .... *sec. ft.*

(c) Total fall to be utilized .... (Head) *feet.*

(d) The nature of the works by means of which the power is to be developed ....

(e) Such works to be located in .... (Legal subdivision) *of Sec.* .... *Tp.* .... (No. N. or S.)*, R.* .... (No. E. or W.)*, W. M.*

(f) Is water to be returned to any stream? .... (Yes or No)

(g) If so, name stream and locate point of return .... *, Sec.* .... *, Tp.* .... (No. N. or S.)*, R.* .... (No. E. or W.)*, W. M.*

(h) The use to which power is to be applied is ....

(i) The nature of the mines to be served ....

Municipal or Domestic Supply—

[illegible]

10. (a) To supply the city of Bandon, Oregon

Coos (Name of) County, having a present population of 1635

and an estimated population of 3000 in 1980

(b) If for domestic use state number of families to be supplied

(Answer questions 11, 12, 13, and 14 in all cases)

11. Estimated cost of proposed works, $ See Remarks (2)

12. Construction work will begin on or before See Remarks (2)

13. Construction work will be completed on or before See Remarks (2)

14. The water will be completely applied to the proposed use on or before January 1980

CITY OF BANDON.
(Signature of applicant)
BY Claude E. Waldrop
Claude E. Waldrop, Mayor.

Remarks: (1) There being insufficient water available in this stream at low flow to satisfy the rights of the existing water right holders and the future requirements of the City of Bandon, it is requested that this water right application be granted to the exclusion of all subsequent applications on this stream in accordance with ORS 537.190 Section (2).

(2) Water under this permit will be diverted through existing facilities of the Oregon State Game Commission and the City of Bandon.

STATE OF OREGON,
County of Marion, } ss.

This is to certify that I have examined the foregoing application, together with the accompanying maps and data, and return the same for

In order to retain its priority, this application must be returned to the State Engineer, with corrections on or before , 19

WITNESS my hand this day of , 19

STATE ENGINEER

By
ASSISTANT

PERMIT

STATE OF OREGON, }
County of Marion, } ss.

This is to certify that I have examined the foregoing application and do hereby grant the same, SUBJECT TO EXISTING RIGHTS and the following limitations and conditions:

The right herein granted is limited to the amount of water which can be applied to beneficial use and shall not exceed 3.0 *cubic feet per second measured at the point of diversion from the stream, or its equivalent in case of rotation with other water users, from* Ferry Creek

The use to which this water is to be applied is municipal

This permit is issued to the exclusion of all subsequent appropriations under the provisions of the order by the State Engineer entered at Volume 11, pages 137-8, Special Order Record of the State Engineer.

If for irrigation, this appropriation shall be limited to -- *of one cubic foot per second or its equivalent for each acre irrigated*

and shall be subject to such reasonable rotation system as may be ordered by the proper state officer.

The priority date of this permit is March 7, 1961

Actual construction work shall begin on or before April 13, 1962 *and shall thereafter be prosecuted with reasonable diligence and be completed on or before October 1, 19*63.

*Complete application of the water to the proposed use shall be made on or before October 1, 19*63.

WITNESS my hand this 13th *day of* April, 19 61

Lewis A. Stanley
STATE ENGINEER

Application No. 34673
Permit No. 27233

PERMIT

TO APPROPRIATE THE PUBLIC
WATERS OF THE STATE
OF OREGON

This instrument was first received in the office of the State Engineer at Salem, Oregon, on the 7th *day of* March
*19*61, *at* 8:00 *o'clock* A *M.*

Returned to applicant:

Approved:

Recorded in book No. .... *of*
Permits on page

STATE ENGINEER

Drainage Basin No. 17 *page* 22I

Fees

State Printing 96151

STATE OF OREGON

COUNTY OF COOS

ORDER APPROVING AN ADDITIONAL POINT OF DIVERSION

Pursuant to ORS 537.211, after notice was given and no objections were filed, and finding that no injury to existing water rights would result, this order approves, as conditioned or limited herein, PERMIT AMENDMENT 8195 submitted by

CITY OF BANDON
P.O. 67
BANDON, OREGON 97411.

The first permit to be modified is Permit 3011 with a date of priority of JUNE 19, 1916. The permit allows the use of GEIGER CREEK AND GEIGER CREEK RESERVOIR CONSTRUCTED UNDER APPLICATION 5017, PERMIT R-368, a tributary of FERRY CREEK, for DOMESTIC SUPPLY. The amount of water to which this permit is entitled is limited to an amount actually beneficially used and shall not exceed 5.0 cubic feet per second, if available at the authorized point of diversion: NE¼ NE¼ SW¼, SECTION 4, T 29 S, R 14 W, W.M.; S 27°14'E 3431.4 FEET FROM THE CORNER COMMON TO SECTIONS 32, 33, 4, AND 5, T 28 AND 29 S, R 14 W, W.M., or its equivalent in case of rotation, measured at the point of diversion from the source.

This is an order in other than a contested case. This order is subject to judicial review under ORS 183.484. Any petition for judicial review must be filed within the 60 day time period specified by ORS 183.484(2).

Pursuant to ORS 536.075 and OAR 137-004-080 and OAR 690-01-005 you may either petition for judicial review or petition the Director for reconsideration of this order.

The second permit to be modified is Permit 27232 with a date of priority of MARCH 7, 1961. The permit allows the use of GEIGER CREEK, a tributary of FERRY CREEK, for MUNICIPAL USE. The amount of water to which this permit is entitled is limited to an amount actually beneficially used and shall not exceed 3.0 cubic feet per second, if available at the authorized point of diversion: SW¼ SE¼, SECTION 28, T 28 S, R 14 W, W.M.; 1544.54 FEET SOUTH AND 218.9 FEET EAST FROM THE CENTER OF SECTION 29, T 28 S, R 14 W, W.M., or its equivalent in case of rotation, measured at the point of diversion from the source.

The third permit to be modified is Permit 27233 with a date of priority of MARCH 7, 1961. The permit allows the use of FERRY CREEK, a tributary of the COQUILLE RIVER, for MUNICIPAL USE. The amount of water to which this permit is entitled is limited to an amount actually beneficially used and shall not exceed 3.0 cubic feet per second, if available at the authorized point of diversion: SW¼ SE¼, SECTION 29, T 28 S, R 14 W, W.M.; 1374.4 FEET SOUTH AND 1263.01 FEET EAST FROM THE CENTER OF SECTION 29, or its equivalent in case of rotation, measured at the point of diversion from the source.

The use shall conform to any reasonable rotation system ordered by the proper state officer.

The authorized place of use is located as follows:

PERMITS 3011, 27232, 27233

ALL SECTIONS 19, 20, 29, 30 AND 31	W½ SECTION 32

TOWNSHIP 28 SOUTH, RANGE 14 WEST, W.M.

ALL
SECTIONS 24, 25, AND 36

TOWNSHIP 28 SOUTH, RANGE 15 WEST, W.M.

The right to use the water for the above purpose is restricted to beneficial use on the lands or place of use described

The applicant proposes an additional point of diversion, below the confluence of Ferry Creek and Geiger Creek, located:

SW¼ SE¼, SECTION 29, T 28 S, R 14 W, W.M.; 1193.45 FEET NORTH AND 2709.05 FEET EAST FROM THE SW CORNER OF SECTION 29.

THIS CHANGE TO AN EXISTING WATER PERMITS MAY BE MADE PROVIDED THE FOLLOWING CONDITIONS ARE MET BY THE WATER USER:

1. The quantity of water diverted at the new point of diversion, together with that diverted at the old points of diversion, shall not exceed the quantity of water lawfully available at the original points of diversion.

2. The water user shall install and maintain a headgate, an in-line flow meter, weir, or other suitable device for measuring and recording the quantity of water diverted. The type and plans of the headgate and measuring device must be approved by the Department prior to beginning construction and shall be installed under the general supervision of the Department.

3. Water shall be acquired from the same surface water source as the original point of diversion.

4. All other terms and conditions of the permit remain the same.

5. The water user shall install and maintain a fish screen or fish by-pass device. The type and plans of the screen or by-pass device must be approved by the Oregon Department of Fish and Wildlife prior to beginning of construction and shall be installed under the supervision of the Department of Fish and Wildlife.

Permits 3011, 27232, and 27233, all in the name of CITY OF BANDON, are amended as described herein.

WITNESS the signature of the Water Resources Director, affixed MAR 29 2000.

for Martha O. Pagel, Director

368

*Reservoir Permit No. 368

APPLICATION FOR A PERMIT TO CONSTRUCT A RESERVOIR AND TO STORE FOR BENEFICIAL USE THE UNAPPROPRIATED WATERS OF THE STATE OF OREGON

We, ~~I,~~ City of Bandon (Name of Applicant)

of Bandon (Postoffice), *County of* Coos

State of Oregon, *do hereby make application for a permit to construct the following described reservoir and to store the unappropriated waters of the State of Oregon, subject to existing rights.*

If the applicant is a corporation, give date and place of incorporation Bandon, Oregon, Feb. 18, 1891

1. *The name of the proposed reservoir is* Giger Creek Reservoir

2. *The name of the stream from which the reservoir is to be filled and the appropriation made is* Giger Creek Tributary of Ferry Creek (Coquille River)

3. *The amount of water to be stored is* 90 *acre feet.*

4. *The use to be made of the impounded water is* Domestic Supply to be appropriated (Irrigation, power, domestic supply, etc.) under secondary Application No. 4982, Permit No. 3011

5. *The location of the proposed reservoir will be in Sec.* 4 Twp. 29 S R 14 W.W.M. (Give sections or townships to be submerged)

(a) *State whether situated in channel of running stream and give character of material at outlet* Res. is situated in channel of running stream. Material at outlet is earth.

(b) *If not in channel of running stream, state how it is to be filled. If through a feed canal, give name and dimensions*

6. *The dam will be located in* NW¼ NE¼ SW¼ (Smallest legal subdivision), *Sec.* 4, Tp 29 S R 14 W

---

*A different form of application should be used for the appropriation of stored water to beneficial use. Such forms can be secured without charge, together with instructions, by addressing the State Engineer, Salem, Oregon.

~~Tp.~~ ...., ~~R.~~ ...., ~~W. M.~~ It will be 30 feet in height, having a length
(No. N. or S.) (No. E. or W.)
on top of 140 feet; length on bottom 10 feet; width on top 14 feet;
slope of front or water side 3 : 1 ;
(Feet horizontal to 1 vertical)
slope on back 2 : 1 ; height of dam above water
(Feet horizontal to 1 vertical)
line when full 5 feet.

7. The construction of dam, the material of which it is to be built, and method of protection from waves are as follows: Earth fill with concrete core wall. ~~small and reservoir is~~ (No paving to protect front face from wave action; water area is /entirely surrounded by hills on three sides.)

8. The location of wasteway with dimensions are as follows: Concrete waste way 5 ft. by 14 ft. around east end of dam.
(State whether over or around the dam)

9. The location of outlet from the proposed reservoir, with character of construction and dimensions, are as follows: 2 16" cast iron pipes through dam and core wall
(State whether through or around the proposed dam)

10. The area submerged by the proposed reservoir, when full, will be 7.28 *acres, with a maximum depth of water of* 20 *feet, and approximate mean depth of water* 12 *feet.*

11. The estimated cost of the proposed work is $ 40,000 (Including pipe lines and rights of way)

12. Construction work will begin on or before July 1, 1917

13. Construction work will be completed on or before July 1, 1918

Duplicate maps of the proposed reservoir and storage works, prepared in accordance with the rules of the State Water */Board ~~of Control~~, accompany this application.*

City of Bandon, Coos County, Oregon
(Name of applicant)
By Geo. C Topping, Mayor,
E B Kansrud, Recorder.

(CORPORATE SEAL)

Signed in the presence of us as witnesses:

(1) J S Sawyer (Name), Bandon, Oregon (Address of witness)

(2) T Manciet (Name), Bandon, Oregon (Address of witness)

Remarks: ....

STATE OF OREGON,
County of Marion } ss.

This is to certify that I have examined the foregoing application, together with the accompanying maps and data, and return the same for correction or completion, as follows: ....

In order to retain its priority, this application must be returned to the State Engineer, with corrections, on or before .... *19*......

WITNESS my hand this..............................*day of*.............................., *19*......

....
State Engineer.

STATE OF OREGON,
County of Marion } ss.

This is to certify that I have examined the foregoing application and do hereby grant the same, subject to the following limitations and conditions: The right under this permit shall be limited to the storage of water for domestic supply to be diverted under secondary Application No. 4982, Permit No. 3011

The right hereunder shall be limited to the storage of 90 acre feet.

~~The priority date of this permit is July 5, 1916.~~

Actual construction work shall begin on or before July 24, 1917

and shall thereafter be prosecuted with reasonable diligence and be completed on or before June 1, 1921 EXTENDED TO 6/1/23 6/1/25 9/1/31

Extended to Oct. 1, 1942
Extended to Oct. 1, 1947
Extended to Oct. 1, 1952
Extended to Oct. 1, 1957
Extended to Oct. 1, 1960
Extended to Oct. 1, 1963
Extended to October 1, 1966

WITNESS my hand this 24th *day of* July, *19*16

John H Lewis
State Engineer.

B Extended to 10-1-95
B & C to 10-1-2000

17

Application No. 5017

Reservoir Permit No. 368

PERMIT

TO CONSTRUCT A RESERVOIR AND STORE FOR BENEFICIAL USE THE UNAPPROPRIATED WATERS OF THE STATE OF OREGON

Division No. 1 District No.

This instrument was first received in the office of the State Engineer at Salem, Oregon, on the 5 *day of* July 1916, *at* 8:30 *o'clock* A M.

Returned to applicant for correction

Corrected application received

Approved

Jul 24 1916

Recorded in Book No. 2 *of Reservoirs on Page* 368

John H Lewis

State Engineer.

1 map RS $8.00

State Water

This form approved by the Board ~~of Control~~ March 11, 1909

Oregon Water Resources Department
Water Rights Division

Water Rights Application
Number R-5017

Final Order
Extension of Time for Permit Number R-368

Appeal Rights

This is a final order in other than contested case. This order is subject to judicial review under ORS 183.484. Any petition for judicial review must be filed within the 60 day time period specified by ORS 183.484(2). Pursuant to ORS 536.075 and OAR 137-004-0080 you may either petition for judicial review or petition the Director for reconsideration of this order. A petition for reconsideration may be granted or denied by the Director, and if no action is taken within 60 days following the date the petition was filed, the petition shall be deemed denied.

Application History

The Department issued Permit R-368 on July 24, 1916. The permit called for completion of construction by October 1, 1918 and complete application of water to beneficial use by October 1, 1921. On December 7, 2006, City of Bandon submitted to the Department an Application for Extension of Time for Permit R-368. In accordance with OAR 690-315-0050(2), on July 17, 2007, the Department issued a Proposed Final Order proposing to extend the time to complete construction to October 1, 2026 and the time to fully apply water to beneficial use to October 1, 2026. The protest period closed August 31, 2007, in accordance with OAR 690-315-0060(1). No protest was filed.

At time of issuance of the Proposed Final Order the Department concluded that, based on the factors demonstrated by the applicant, the permit may be extended subject to the following conditions:

CONDITIONS

1. Water Use Reporting Condition

The permit holder shall keep a complete record of the amount of water used each month and shall submit a report which includes the recorded water use measurement to the Department annually beginning in **2008**.

2. **Checkpoint Condition**

The permit holder must submit a completed Diligence Progress Report to the Department by **October 1, in the years 2007, 2012, 2019 and 2024.** ***A form for each year is enclosed for your use.***

(a) At each checkpoint, the permit holder shall submit and the Department shall review evidence of the permit holder's diligence towards completion of the project and compliance with terms and conditions of the permit and extension. If, after this review, the Department determines the permit holder has not been diligent in developing and perfecting the water use permit, or complied with all terms and conditions, the Department shall modify or further condition the permit or extension to ensure future compliance, or begin cancellation proceedings on the undeveloped portion of the permit pursuant to ORS 537.260 or 537.410, or require submission of a final proof survey pursuant to ORS 537.250;

(b) The Department shall provide notice of receipt of progress reports in its weekly notice and shall allow a 30 day comment period for each report. The Department shall provide notice of its determination to anyone who submitted comments.

The applicant has demonstrated good cause for the permit extension pursuant to ORS 537.230, 539.010(5) and OAR 690-315-0040(2).

Order

The extension of time for Application R-5017, Permit R-368, therefore, is approved subject to conditions contained herein. The deadline for completing construction is extended to October 1, 2026. The deadline for applying water to full beneficial use is extended to October 1, 2026.

DATED: September 13, 2007

Dwight French

Dwight French, Administrator of
Water Rights and Adjudications
for
Phillip C. Ward, Director

- If you have any questions about statements contained in this document, please contact Kim French at (503) 986-0813.
- If you have other questions about the Department or any of its programs, please contact our Water Resources Customer Service Group at (503) 986-0900

36011

AMENDED by special order
v. 54 **pg.** 199

* Permit No. 3011

APPLICATION FOR A PERMIT

To Appropriate the Public Waters of the State of Oregon

I, City of Bandon, Coos County, Oregon (Name of Applicant)

of Bandon (Postoffice), *County of* Coos

State of Oregon, *do hereby make application for a permit to appropriate the following described public waters of the State of Oregon, subject to existing rights:*

If the applicant is a corporation, give date and place of incorporation Incorporated Feb. 18th, 1891, at Bandon, Oregon.

1\. *The source of the proposed appropriation is* Giger Creek and the water stored in the Giger Creek Reservoir to be constructed under Application No. 5017, Permit No. R 368 (Name of stream), *tributary of* Coquille River

2\. *The amount of water which the applicant intends to apply to beneficial use is* Five *cubic feet per second.*

3\. *The use to which the water is to be applied is* Domestic supplies (Irrigation, power, mining, manufacturing, domestic supplies, etc.)

4\. *The point of diversion is located* S 27° 14' E 3431.4 feet from the cor. to Secs. 32 - 33 - 4 & 5 Twp. 28 & 29 S R 14 W.W.M. (Give distance and bearing to section corner)

being within the NE$\frac{1}{4}$ NE$\frac{1}{4}$ SW$\frac{1}{4}$ (Give smallest legal subdivision) *of Sec.* 4, *Tp.* 29 S (No. N. or S.)

R. 14 W (No. E. or W.), *W. M., in the county of* Coos

5\. *The* pipe line (Main ditch, canal or pipe line) *to be* 2.4 *miles in length, terminating* ~~in the~~ at the $\frac{1}{4}$ cor. bet. (Smallest legal subdivision) ~~of~~ *Sec*s. 30 & 31, *Tp.* 28 S (No. N. or S.), *R.* 14 (No. E. or W.) *W. M., the proposed location being shown throughout on the accompanying map.*

6\. *The name of the ditch, canal or other works is* Giger Creek Intake Pipe Line

DESCRIPTION OF WORKS

DIVERSION WORKS—

7\. (a) *Height of dam* 30 *feet, length on top* 140 *feet, length at bottom* 15 *feet; material to be used and character of construction* Earth fill with concrete core wall. Concrete wasteway around East end of dam. (Loose rock, concrete, masonry, rock and brush, timber crib, etc., wasteway over or around dam)

(b) *Description of headgate* 16 inch Gate Valve. (Timber, concrete, etc., number and size of openings)

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* A different form of application is provided where storage works are contemplated. These forms can be secured, without charge, together with instructions, by addressing the State Engineer, Salem, Oregon.

V54 p199
T-8195

CANAL SYSTEM—

8. (a) *Give ~~dimensions~~ at each point of canal where materially changed in size, stating miles from headgate. At headgate: Width on top (at water line)..........feet; width on bottom..........feet; depth of water..........feet; grade..........feet fall per one thousand feet.*

(b) At..........miles from headgate. Width on top (at water line)..........feet; width on bottom..........feet; depth of water..........feet; grade..........feet fall per one thousand feet.

....

....

....

FILL IN THE FOLLOWING INFORMATION WHERE THE WATER IS USED FOR:

IRRIGATION—

9. *The land to be irrigated has a total area of..........acres, located in each smallest legal subdivision, as follows:* ....

(Give area of land in each smallest legal subdivision which you intend to irrigate)

....

....

....

....

....

....

....

....

....

(If more space is required, attach separate sheet)

POWER, MINING, MANUFACTURING, OR TRANSPORTATION PURPOSES—

10. (a) *Total amount of power to be developed..........theoretical horsepower.*

(b) Total fall to be utilized..........feet.
(Head)

(c) The nature of the works by means of which the power is to be developed..........

....

(d) Such works to be located in..........of Sec..........
(Legal subdivision)

Tp.........., (No. N. or S.) *R..........,* (No. E. or W.) *W. M.*

(e) Is water to be returned to any stream?.......... (Yes or No)

(f) If so, name stream and locate point of return..........

.........., Sec.........., Tp.........., (No. N. or S.) *R..........,* (No. E. or W.) *W. M.*

(g) The use to which power is to be applied is..........

....

(h) The nature of the mines to be served..........

....

MUNICIPAL SUPPLY—

11. To supply the city of Bandon

Coos (Name of) *County, having a present population of* 2500*, and an estimated population of* 10,000 *in* 1930

(Answer questions 12, 13, 14, and 15 in all cases)

12. Estimated cost of proposed works, $ 40,000

13. Construction work will begin on or before July 1, 1917

14. Construction work will be completed on or before July 1, 1918

15. The water will be completely applied to the proposed use on or before July 1, 1920

Duplicate maps of the proposed ditch or other works, prepared in accordance with the rules of the State Water Board, accompany this application.

(Corporate Seal)

City of Bandon, Coos Co., Ore.
(Name of applicant)
by Geo. P Topping, Mayor
E B Kansrud,
Recorder of the City of Bandon.

Signed in the presence of us as witnesses:

(1) J S Sawyer, (Name) — Bandon, Oregon (Address of witness)

(2) T Manciet (Name) — Bandon, Oregon (Address of witness)

Remarks: $40,000 Bonds have been voted by the people for this work, but the issue has not been sold.

STATE OF OREGON,
County of Marion } *ss.*

This is to certify that I have examined the foregoing application, together with the accompanying maps and data, and return the same for correction or completion, as follows:

In order to retain its priority, this application must be returned to the State Engineer, with corrections, on or before ...., 191...

WITNESS my hand this .... day of ...., 191...

....
State Engineer.

3011(c)

17

Application No. 4982

Permit No. 3011

PERMIT

TO APPROPRIATE
THE PUBLIC WATERS OF
THE STATE OF OREGON

Division No. 1 *District No.*

This instrument was first received in the office of the State Engineer at Salem, Oregon, on the 19 *day of* June *, 191*6*, at* 8:30 *o'clock* a *m.*

Returned to applicant for correction

Corrected application received

Approved:
Jul 24 1916

Recorded in Book No. 11 *of Permits, on Page* 3011

John H Lewis
State Engineer.

1 map RS
$8.00

STATE OF OREGON,
County of Marion } *ss.*

This is to certify that I have examined the foregoing application and do hereby grant the same, subject to the following limitations and conditions: ~~*If for irrigation, this appropriation shall be limited to one eightieth of one cubic foot per second, or its equivalent, for each acre irrigated, and shall be subject to such reasonable rotation system as may be ordered by the proper State officer.*~~

The use of the water under this permit shall be limited to water for domestic supply ~~and to the waters of Giger Creek,~~ and to the water stored in the Giger Creek reservoir to be constructed under Application No. 5017, Permit No. R 368.

The amount of water appropriated shall be limited to the amount which can be applied to beneficial use and not to exceed 5.0 *cubic feet per second, or its equivalent in case of rotation. The priority date of this permit is* June 19, 1916

Actual construction work shall begin on or before July 24, 1917

and shall thereafter be prosecuted with reasonable diligence and be completed on or before June 1, 1921

Extended to 4/1/23 4/1/26 (4/1/31)
10-1-42
Extended to Oct. 1, 1947
Extended to Oct. 1, 1952
Extended to Oct. 1, 1957
Extended to Oct. 1, 1960
Extended to Oct. 1, 1961
Extended to Oct. 1, 1963
BC Extended to Oct. 1, 1968
Extended to Oct. 1, 1968
Extended to Oct. 1 1973
Extended to Oct. 1978

Complete application of the water to the proposed use shall be made on or before October 1, 1924

10/1/26 (10/1/31)
10-1-42
Extended to Oct. 1, 1948
Extended to Oct. 1, 1952
Extended to Oct. 1, 1957
Extended to Oct. 1, 1960
Extended to Oct. 1, 1961
Extended to Oct. 1, 1963
BC Extended to Oct. 1, 1963
Extended to Oct. 1, 1968
Extended to Oct. 1 1973
Extended to Oct. 1978

WITNESS my hand this 24th *day of* July, 1916

John H Lewis
State Engineer.

~~Permits for power development are subject to the limitation of franchise as provided in Sec. 6622, Lord's Oregon Laws, and the payment of annual fees as provided in Chapter 310, Laws of 1915.~~

This form approved by the State Water Board, March 11, 1909.

BC 1988, BC extended to 10-1-95, 10-1-2000

APPENDIX C: COST ESTIMATES

Priority I

Project 1A - Water Treatment Plant Building

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$33,894	$33,894
2	Demolition and Site Prep	LS	1	$22,596	$22,596
3	***Flow Measurement Equipment***				***$91,100***
3a	Meter Vault	EA	3	$8,800	$26,400
3b	Magnetic Flow Meter	EA	3	$8,800	$26,400
3c	Recording Units	EA	3	$8,800	$26,400
3d	Signal & Power	LS	1	$5,600	$5,600
3e	Misc. Fittings and Appurtenances	LS	1	$6,300	$6,300
4	Filter Sun Shade Roof Structure	SF	2280	$100	$228,000
5	Sample Island in Laboratory	EA	1	$12,500	$12,500
6	Tile Flooring in Front Office	SF	2000	$15	$30,000
7	PLC Modifications	EA	1	$15,000	$15,000

Project Subtotal	**$433,090**
Contingency	**$65,000**
Engineering	**$86,600**
Legal Admin.	**$13,000**
Project Total	**$598,000**

Project 1B – Backup Generator System

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$76,000	$76,000
2	Demolition and Site Prep	LS	1	$50,700	$50,700
3	Generator & Transfer Switch	LS	1	$675,000	$675,000
4	Roof Structure	SF	480	$125	$60,000
5	Mis Electrical Gear & Conduit	LS	1	$50,000	$50,000
6	Concrete Pad	CY	20	$500	$10,000
7	Installation	LS	1	$50,000	$50,000

Project Subtotal	**$971,700**
Contingency	**$145,800**
Engineering	**$145,800**
Legal Admin.	**$38,900**
Project Total	**$1,302,000**

Project 1C – Existing Clarifier Replacement

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$194,100	$194,100
2	Demolition and Site Prep	LS	1	$145,500	$145,500
3	Excavation	CY	140	$25	$3,500
4	Engineered Fill	CY	135	$50	$6,750
5	Concrete Tank	LS	1	$1,100,000	$1,100,000
6	Clarifier Mechanism	LS	1	$577,500	$577,500
7	Tube Settlers	LS	1	$66,000	$66,000
8	Painting	LS	1	$60,000	$60,000
9	Miscellaneous Metals	LS	1	$42,200	$42,200
10	Site Piping	LS	1	$42,200	$42,200
11	Appurtenances	LS	1	$34,000	$34,000
12	Landscaping	LS	1	$8,500	$8,500

Project Subtotal	**$2,280,300**
Contingency	**$342,000**
Engineering	**$410,500**
Legal Admin.	**$15,000**
Project Total	**$3,047,800**

Project 2 - 2 MG Treated Water Storage Tank Improvements

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$122,700	$122,700
2	Demolition and Site Prep	LS	1	$68,200	$68,200
3	Seismic Upgrades	LS	1	$250,000	$250,000
4	Interior Surface Preparation	LS	1	$166,800	$166,800
5	Interior Coatings	LS	1	$442,488	$442,488
6	Exterior Surface Preparation	LS	1	$81,140	$81,140
7	Exterior Surface Coatings	LS	1	$421,900	$421,900

Project Subtotal	**$1,553,228**
Contingency	**$232,972**
Engineering	**$279,600**
NACE Inspection	**$18,000**
Legal Admin.	**$46,600**
Project Total	**$2,130,400**

Project 3 - 1MG Treated Water Storage Tank Rehabilitation

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$55,700	$55,700
2	Demolition and Site Prep	LS	1	$31,000	$31,000
3	Seismic Upgrades	LS	1	$325,000	$325,000
4	Interior Surface Preparation	LS	1	$87,750	$87,750
5	Interior Coatings	LS	1	$205,750	$205,750

Project Subtotal	**$705,200**
Contingency	**$105,800**
Engineering	**$141,100**
NACE Inspection	**$12,000**
Legal Admin.	**$21,200**
Project Total	**$985,300**

Project 4 - Middle Pond Pump Station

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$20,200	$20,200
2	Demolition and Site Prep	LS	1	$10,100	$10,100
3	Pump and Volute (700 gpm)	EA	2	$97,500	$195,000
4	Exhaust Fan	EA	1	$3,800	$3,800
5	Floating Dock-Pre-Fabricated	EA	1	$2,500	$2,500

Project Subtotal	**$231,600**
Contingency	**$34,800**
Engineering	**$46,400**
Legal Admin.	**$9,300**
Project Total	**$322,100**

Project 5 - Lower Pump Station

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$19,900	$19,900
2	Demolition and Site Prep	LS	1	$10,000	$10,000
3	Pump (700 gpm)	EA	2	$97,500	$195,000
4	Exhaust Fan	EA	1	$3,800	$3,800

Project Subtotal	**$228,700**
Contingency	**$34,400**
Engineering	**$45,800**
Legal Admin.	**$9,200**
Project Total	**$318,100**

Project 6 – Groundwater Supply, See Supplemental Ground Water Feasibility Study in Appendix E

Priority II

Project 7A – Raw Water Supply

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Construction Facilities and Temp. Controls	1	LS	$637,700.00	$ 637,700
2	Site Preparation	1	LS	$7,500.00	$ 7,500
3	Access Road Construction	1	LS	$1,300.00	$ 1,300
4	Dike Road Surfacing	1	LS	$12,500.00	$ 12,500
5	Geotextile Fabric	3,500	SY	$2.00	$ 7,000
6	Aggregate Base	1,000	Ton	$26.00	$ 26,000
7	Perimeter Drainage Ditch	2,550	LF	$2.00	$ 5,100
8	Foundation Stabilization	375	CY	$40.00	$ 15,000
9	Stripping - Removal	74,200	CY	$3.75	$ 278,250
10	Stripping - Reinstallation	74,200	CY	$3.25	$ 241,150
11	Excavation - used for sediment & overflow basins	26,100	CY	$3.50	$ 91,350
12	Excavation/Embankment - used for berm	52,200	CY	$4.00	$ 208,800
13	Cement Amendment for slope stabilization	15,600	CY	$6.00	$ 93,600
14	Pond Surface Fine Grading	1	LS	$10,000.00	$ 10,000
15	Pond Anchor Trench	1,500	LF	$5.00	$ 7,500
16	Pond Underdrains	1	LS	$25,000.00	$ 25,000
17	Pond Liner Underlainment	700,000	SF	$0.60	$ 420,000
18	Pond Lining (includes leakage testing)	700,000	SF	$1.00	$ 700,000
19	Floating Algae Control Cover	275,000	SF	$3.00	$ 825,000
20	Mixer / Aerator Unit	3	EA	$57,000.00	$ 171,000
21	Johnson Fish Screen w/ Air Scour System	1	LS	$25,000.00	$ 25,000
22	12" Misc. Fittings	8	EA	$1,100.00	$ 8,800
23	12" Gate Valve	1	EA	$2,100.00	$ 2,100
24	12" Check Valve	2	EA	$6,000.00	$ 12,000
25	8" Check Valve	1	EA	$4,000.00	$ 4,000
26	12" Float Valve	1	EA	$20,000.00	$ 20,000
27	Emergency Spillway Structure	2	EA	$3,000.00	$ 6,000
28	Safety Equipment (for maintenance)	1	LS	$10,000.00	$ 10,000
29	Creek Crossing	1	LS	$20,000.00	$ 20,000
30	Pipe Inlet & Outfall Structures (Manifold System)	2	EA	$20,000.00	$ 40,000
31	Pump Station Connection	1	LS	$25,000.00	$ 25,000
32	Pump Station Improvements	1	LS	$75,000.00	$ 75,000
33	12" DIP Restrained Joint Waterline - Class C	150	LF	$110.00	$ 16,500
34	12" DIP Restrained Joint Waterline - Class B	400	LF	$85.00	$ 34,000
35	12" DIP Waterline - Class B	1,750	LF	$70.00	$ 122,500

Item	Description	Units	No. Units	Unit Cost	Subtotal
36	12" C900 PVC Waterline - Class C	1,600	LF	$65.00	$ 104,000
37	8" C900 PVC Waterline - Class C	150	LF	$45.00	$ 6,750
38	Concrete Anchor Wall	2	EA	$1,500.00	$ 3,000
39	Combination Air Release Valve w/vault	1	EA	$2,100.00	$ 2,100
40	Standard Blowoff Assembly	1	EA	$1,150.00	$ 1,150
41	SCADA	1	LS	$25,000.00	$ 25,000
42	Electrical to site by Bandon Electric	1	LS	$50,000.00	$ 50,000
43	Electrical Site Service	1	LS	$6,000.00	$ 6,000
44	HP Generator System	1	LS	$50,000.00	$ 50,000
45	10HP duplex pump station	1	LS	$75,000.00	$ 75,000
46	Pre-sedimentation Basin System Exc/Emb	2,800	CY	$4.00	$ 11,200
47	Pre-sedimentation Basin Liner/Underlainment	9,600	SF	$1.30	$ 12,480
48	Safety Equipment (for maintenance)	1	LS	$2,500.00	$ 2,500
49	Energy Dissipator Basin	1	LS	$7,500.00	$ 7,500
50	Overflow Bioswale Exc/Emb	4,500	CY	$3.50	$ 15,750
51	Security Fence	3,600	LF	$75.00	$ 270,000
52	Security Gate	1	EA	$10,000.00	$ 10,000
53	Erosion & Sediment Control	1	LS	$7,000.00	$ 7,000
54	Landscaping	1	LS	$25,000.00	$ 25,000

Project Subtotal	**$4,889,000**
Contingency	**$1,222,000**
Engineering	**$831,000**
Permitting	**$90,000**
Geotechnical	**$55,000**
Water Rights	**$20,000**
Planning	**$147,000**
Administration	**$7,254,000**
Inflation Factor	**$1,088,000**
Project Total	**$8,342,000**

Project 7B – Groundwater Supply , See Supplemental Ground Water Feasibility Study in Appendix E

Priority III

Project 8 - 8TH ST SW - Oregon AVE to Franklin AVE SW

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$32,300	$32,300
2	Demolition	LS	1	$21,500	$21,500
3	New 8-inch Waterline	LF	1650	$130	$214,500
4	Fire Hydrant Assembly	EA	2	$6,300	$12,600
5	Connections to Exist 6-inch	EA	1	$2,500	$2,500
6	Connections to Exist 8-inch	EA	1	$2,900	$2,900
7	Misc. Fittings and Appurtenances	LS	1	$26,600	$26,600
8	AC Patch	LF	1650	$60	$99,000
9	Service Lateral	EA	12	$1,800	$21,600

Project Subtotal	**$433,500**
Contingency	**$65,100**
Engineering	**$86,700**
Legal Admin.	**$17,400**
Project Total	**$602,700**

Project 9 - Beach Loop DR - Seabird DR to Best Western

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$29,100	$29,100
2	Demolition	LS	1	$19,400	$19,400
3	New 10-inch Waterline	LF	1300	$150	$195,000
4	Fire Hydrant Assembly	EA	3	$6,300	$18,900
5	Connections to Exist 6-inch	EA	1	$2,500	$2,500
6	Connections to Exist 12-inch	EA	1	$4,800	$4,800
7	Misc. Fittings and Appurtenances	LS	1	$24,000	$24,000
8	AC Patch	LF	1300	$60	$78,000
9	Service Lateral	EA	21	$1,800	$37,800

Project Subtotal	**$409,500**
Contingency	**$61,500**
Engineering	**$81,900**
Legal Admin.	**$16,400**
Project Total	**$569,300**

Project 10 - 13TH ST SW - Franklin AVE SW to Allegheny AVE SW to Allegheny RD

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$39,600	$39,600
2	Demolition	LS	1	$26,400	$26,400
3	New 8-inch Waterline	LF	2150	$130	$279,500
4	Fire Hydrant Assembly	EA	2	$6,300	$12,600
5	Connections to Exist 4-inch	EA	1	$1,900	$1,900
6	Connections to Exist 8-inch	EA	1	$2,900	$2,900
7	Misc. Fittings and Appurtenances	LS	1	$32,600	$32,600
8	AC Patch	LF	1830	$60	$109,800

Project Subtotal	**$505,300**
Contingency	**$75,800**
Engineering	**$101,100**
Legal Admin.	**$20,300**
Project Total	**$702,500**

Project 11 - Ohio AVE NE - Highway 42S to 10TH ST NE

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$88,200	$88,200
2	Demolition	LS	1	$58,800	$58,800
3	New 12-inch Waterline	LF	3910	$180	$703,800
4	Fire Hydrant Assembly	EA	2	$6,300	$12,600
5	Connections to Exist 4-inch	EA	6	$1,900	$11,400
6	Connections to Exist 8-inch	EA	1	$2,900	$2,900
7	Connections to Exist 12-inch	EA	2	$4,800	$9,600
8	Misc. Fittings and Appurtenances	LS	1	$72,600	$72,600
9	AC Patch	LF	2770	$60	$166,200

Project Subtotal	**$1,126,100**
Contingency	**$169,000**
Engineering	**$225,300**
Legal Admin.	**$45,100**
Project Total	**$1,565,500**

Project 12 - 10TH ST NE - Michigan AVE - Ohio AVE

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$30,100	$30,100
2	Demolition	LS	1	$20,100	$20,100
3	New 12-inch Waterline	LF	1193	$180	$214,740
4	Fire Hydrant Assembly	EA	1	$6,300	$6,300
5	Connections to Exist 12-inch	EA	2	$4,800	$9,600
6	Misc. Fittings and Appurtenances	LS	1	$24,100	$24,100
7	AC Patch	LF	730	$60	$43,800
8	Boring under Roadway	LF	85	$310	$26,350
9	Service Lateral	EA	5	$1,800	$9,000

Project Subtotal	**$384,100**
Contingency	**$57,700**
Engineering	**$76,900**
Legal Admin.	**$15,400**
Project Total	**$534,100**

Project 13 - Jackson AVE SW 12TH ST SW to Face Rock DR

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$34,000	$34,000
2	Demolition	LS	1	$22,700	$22,700
3	New 8-inch Waterline	LF	2200	$130	$286,000
4	AC Patch	LF	600	$60.00	$36,000
5	Fire Hydrant Assembly	EA	4	$6,300	$25,200
6	Connections to Exist 4-inch	EA	1	$1,900	$1,900
7	Misc. Fittings and Appurtenances	LS	1	$28,000	$28,000
8	Service Lateral	EA	5	$1,800	$9,000

Project Subtotal	**$442,800**
Contingency	**$66,500**
Engineering	**$88,600**
Legal Admin.	**$17,800**
Project Total	**$615,700**

Project 14 - Michigan AVE - 10TH ST NE to 4TH ST NE to Lexington AVE NE to 2ND ST NE to June AVE NE to 1ST ST NE to Harlem ST to Caroline ST SE

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$85,600	$85,600
2	Demolition	LS	1	$57,100	$57,100
3	New 8-inch Waterline	LF	4030	$130	$523,900
4	Fire Hydrant Assembly	EA	6	$6,300	$37,800
5	Connections to Exist 6-inch	EA	6	$2,500	$15,000
6	Connections to Exist 12-inch	EA	2	$4,800	$9,600
7	Misc. Fittings and Appurtenances	LS	1	$66,300	$66,300
8	AC Patch	LF	4030	$60	$241,800
9	Service Lateral	EA	31	$1,800	$55,800

Project Subtotal	**$1,092,900**
Contingency	**$164,000**
Engineering	**$218,600**
Legal Admin.	**$43,800**
Project Total	**$1,519,300**

Project 15 – 13TH ST SE – Highway 101 to Delaware AVE SE

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$19,700	$19,700
2	Demolition	LS	1	$13,100	$13,100
3	New 6-inch Waterline	LF	1090	$110	$119,900
4	Fire Hydrant Assembly	EA	6	$6,300	$37,800
5	Connections to Exist 6-inch	EA	2	$2,500	$5,000
6	Connections to Exist 4-inch	EA	2	$1,900	$3,800
7	Misc. Fittings and Appurtenances	LS	1	$16,200	$16,200
8	AC Patch	LF	590	$60	$35,400
9	Service Lateral	EA	7	$1,800	$12,600

Project Subtotal	**$263,500**
Contingency	**$39,600**
Engineering	**$52,700**
Legal Admin.	**$10,600**
Project Total	**$366,400**

Project 16 - System-Wide Water Meter Replacement

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	2245	$32	$72,500
2	Demolition and Site Prep	LS	2245	$26	$58,000
3	Install New Water Meters	EA	2245	$323	$724,700
4	New AMR Equipment	LS	1	$10,700	$10,700

Project Subtotal	**$865,900**
Contingency	**$129,900**
Engineering	**$173,200**
Legal Admin.	**$34,700**
Project Total	**$1,203,700**

Project 17 – Chicago AVE SE – 9TH ST SE to 10TH ST SW

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$4,500	$4,500
2	Demolition	LS	1	$3,000	$3,000
3	New 6-inch Waterline	LF	300	$110	$33,000
4	Fire Hydrant Assembly	EA	1	$6,300	$6,300
5	Connections to Exist 4-inch	EA	1	$1,900	$1,900
6	Connections to Exist 6-inch	EA	1	$2,500	$2,500
7	Misc. Fittings and Appurtenances	LS	1	$3,700	$3,700
8	AC Patch	LF	40	$60	$2,400
9	Service Lateral	EA	4	$1,800	$7,200

Project Subtotal	**$64,500**
Contingency	**$9,700**
Engineering	**$12,900**
Legal Admin.	**$2,600**
Project Total	**$89,700**

Project 18 - North AVE SE, 3RD ST SE to 4TH ST SE & June AVE SE, Klamath AVE SE, Lexington AVE SE

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$18,000	$18,000
2	Demolition	LS	1	$12,000	$12,000
3	New 6-inch Waterline	LF	973	$110	$107,030
4	Fire Hydrant Assembly	EA	1	$6,300	$6,300
5	Connections to Exist 4-inch	EA	3	$1,900	$5,700
6	Connections to Exist 6-inch	EA	3	$2,500	$7,500
7	Misc. Fittings and Appurtenances	LS	1	$14,800	$14,800
8	AC Patch	LF	973	$60	$58,380

Project Subtotal	**$229,700**
Contingency	**$34,500**
Engineering	**$46,000**
Legal Admin.	**$9,200**
Project Total	**$319,400**

Project 19 – 9TH ST SW to Jackson AVE SW

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$4,200	$4,200
2	Demolition	LS	1	$2,800	$2,800
3	New 6-inch Waterline	LF	260	$110	$28,600
4	Fire Hydrant Assembly	EA	1	$6,300	$6,300
5	Connections to Exist 4-inch	EA	1	$1,900	$1,900
6	Connections to Exist 10-inch	EA	1	$3,800	$3,800
7	Misc. Fittings and Appurtenances	LS	1	$3,300	$3,300
8	AC Patch	LF	30	$60	$1,800

Project Subtotal	**$52,700**
Contingency	**$8,000**
Engineering	**$10,600**
Legal Admin.	**$2,200**
Project Total	**$73,500**

Project 20 – 2ND W ST – Douglas AVE SW to Edison AVE SW

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$5,300	$5,300
2	Demolition	LS	1	$3,600	$3,600
3	New 6-inch Waterline	LF	320	$110	$35,200
4	Fire Hydrant Assembly	EA	1	$6,300	$6,300
5	Connections to Exist 4-inch	EA	1	$1,900	$1,900
6	Connections to Exist 10-inch	EA	1	$3,800	$3,800
7	Misc. Fittings and Appurtenances	LS	1	$9,000	$9,000
8	AC Patch	LF	40	$60	$2,400
9	Service Lateral	EA	3	$1,800	$5,400

Project Subtotal	**$72,900**
Contingency	**$11,000**
Engineering	**$14,600**
Legal Admin.	**$3,000**
Project Total	**$101,500**

Project 21 – 9TH ST – Jackson AVE SW to Beach Loop DR

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$37,300	$37,300
2	Demolition	LS	1	$24,900	$24,900
3	New 10-inch Waterline	LF	2000	$150	$300,000
4	Fire Hydrant Assembly	EA	4	$6,300	$25,200
5	Connections to Exist 10-inch	EA	2	$3,800	$7,600
6	Connections to Exist 6-inch	EA	1	$2,500	$2,500
7	Misc. Fittings and Appurtenances	LS	1	$30,500	$30,500
8	AC Patch	LF	800	$60	$48,000

Project Subtotal	**$476,000**
Contingency	**$71,400**
Engineering	**$95,200**
Legal Admin.	**$19,100**
Project Total	**$661,700**

Project 22 - Highway 101 - 15TH ST SE to 17TH ST SE down 17TH

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$16,900	$16,900
2	Demolition	LS	1	$11,300	$11,300
3	New 6-inch Waterline	LF	770	$110	$84,700
4	Fire Hydrant Assembly	EA	1	$6,300	$6,300
5	Connections to Exist 6-inch	EA	3	$2,500	$7,500
6	Misc. Fittings and Appurtenances	LS	1	$32	$31,600
7	AC Patch	LF	770	$60	$46,200
8	Service Lateral	EA	6	$1,800	$10,800

Project Subtotal	**$215,300**
Contingency	**$32,300**
Engineering	**$43,100**
Legal Admin.	**$8,700**
Project Total	**$299,400**

Project 23 - Baltimore AVE SE – 17TH ST SE to 20TH ST SE

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$13,000	$13,000
2	Demolition	LS	1	$8,700	$8,700
3	New 8-inch Waterline	LF	800	$130	$104,000
4	Fire Hydrant Assembly	EA	2	$6,300	$12,600
5	Connections to Exist 6-inch	EA	1	$2,500	$2,500
6	Misc. Fittings and Appurtenances	LS	1	$22,900	$22,900
7	AC Patch	LF	30	$60	$1,800

Project Subtotal	**$165,500**
Contingency	**$24,900**
Engineering	**$33,100**
Legal Admin.	**$6,700**
Project Total	**$230,200**

Project 24 - Franklin AVE SW - 11TH ST SW to 13TH ST SW

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$16,000	$16,000
2	Demolition	LS	1	$10,700	$10,700
3	New 8-inch Waterline	LF	780	$130	$101,400
4	Fire Hydrant Assembly	EA	2	$6,300	$12,600
5	Connections to Exist 4-inch	EA	2	$1,900	$3,800
6	Connections to Exist 8-inch	EA	1	$2,900	$2,900
7	Misc. Fittings and Appurtenances	LS	1	$9,700	$9,700
8	AC Patch	LF	780	$60	$46,800
9	Service Lateral	EA	8	$1,800	$14,400

Project Subtotal	**$218,300**
Contingency	**$32,800**
Engineering	**$43,700**
Legal Admin.	**$8,800**
Project Total	**$303,600**

Project 25 - South Bandon 0.25 Million Gallon Reservoir & Pump Station

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$121,100	$121,100
2	Demolition and Site Prep	LS	1	$80,800	$80,800
3	.27-MG Bolted Steel Tank	EA	1	$552,600	$552,600
4	Site Work and Fencing	LS	1	$77,500	$77,500
5	Access Road	EA	1	$38,700	$38,700
6	Misc. Fittings and Appurtenances	LS	1	$129,100	$100,000
7	8" line connection to Existing	LF	800	$130	$104,000
8	New Pump Station	EA	1	$472,600	$472,600
9	Seismic Valving	EA	1	$232,400	$232,400
10	Electrical-On-Site and Service	EA	1	$45,200	$45,200
11	Telemetry	EA	1	$32,300	$32,300
12	Exterior Liquid Level Indicator	EA	1	$6,500	$6,500

Project Subtotal	**$1,863,700**
Contingency	**$279,600**
Engineering	**$372,800**
Legal Admin.	**$74,600**
Environmental Review	**$30,000**
Land Acquisition	**$110,300**
Project Total	**$2,731,000**

Project 26 - Franklin AVE SW 15TH ST SE to 24TH ST SE

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$35,700	$35,700
2	Demolition	LS	1	$23,800	$23,800
3	New 8-inch Waterline	LF	2450	$130	$318,500
4	AC Patch	LF	250	$ 60.00	$15,000
5	Fire Hydrant Assembly	EA	4	$6,300	$25,200
6	Connections to Exist 8-inch	EA	1	$2,900	$2,900
7	Connections to Exist 12-inch	EA	1	$4,800	$4,800
8	Misc. Fittings and Appurtenances	LS	1	$29,400	$29,400
9	Service Lateral	EA	5	$1,800	$9,000

Project Subtotal	**$464,300**
Contingency	**$69,700**
Engineering	**$92,900**
Legal Admin.	**$18,600**
Project Total	**$645,500**

Project 27 – Franklin AVE SW to 24TH ST SW to Seabird DR

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$32,200	$32,200
2	Demolition	LS	1	$21,500	$21,500
3	New 8-inch Waterline	LF	1900	$130	$247,000
4	AC Patch	LF	600	$60.00	$36,000
5	Fire Hydrant Assembly	EA	6	$6,300	$37,800
6	Connections to Exist 12-inch	EA	2	$4,800	$9,600
7	Misc. Fittings and Appurtenances	LS	1	$26,500	$26,500
8	Service Lateral	EA	4	$1,800	$7,200

Project Subtotal	**$417,800**
Contingency	**$62,700**
Engineering	**$83,600**
Legal Admin.	**$16,800**
Project Total	**$580,900**

Project 28 - Face Rock DR to Jackson AVE SW

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$35,700	$35,700
2	Demolition	LS	1	$23,800	$23,800
3	New 12-inch Waterline	LF	1280	$180	$230,400
4	AC Patch	LF	810	$60.00	$48,600
5	Fire Hydrant Assembly	EA	13	$6,300	$81,900
6	Connections to Exist 8-inch	EA	2	$2,900	$5,800
7	Misc. Fittings and Appurtenances	LS	1	$29,400	$29,400

Project Subtotal	**$455,600**
Contingency	**$68,400**
Engineering	**$91,200**
Legal Admin.	**$18,300**
Project Total	**$633,500**

Project 29 - Jackson AVE SW - Face Rock DR to New South Tank Line

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$21,600	$21,600
2	Demolition	LS	1	$14,400	$14,400
3	New 8-inch Waterline	LF	1500	$130	$195,000
4	Fire Hydrant Assembly	EA	3	$6,300	$18,900
5	Connections to Exist 8-inch	EA	1	$2,900	$2,900
6	Connections to Exist 12-inch	EA	1	$4,800	$4,800
7	Misc. Fittings and Appurtenances	LS	1	$17,800	$17,800

Project Subtotal	**$275,400**
Contingency	**$41,400**
Engineering	**$55,100**
Legal Admin.	**$11,100**
Project Total	**$383,000**

Project 30 - Polaris ST to Beach Loop DR

Item	Description	Units	No. Units	Unit Cost	Subtotal
1	Const. Fac. & Temp. Controls	LS	1	$7,100	$7,100
2	Demolition	LS	1	$5,000	$5,000
3	New 8-inch Waterline	LF	430	$130	$55,900
4	Fire Hydrant Assembly	EA	1	$6,300	$6,300
5	Connections to Exist 6-inch	EA	1	$2,500	$2,500
6	Connections to Exist 8-inch	EA	1	$2,900	$2,900
7	Misc. Fittings and Appurtenances	LS	1	$5,800	$5,800
8	AC Patch	LF	75	$60	$4,500
9	Service Lateral	EA	3	$1,800	$5,400

Project Subtotal	**$95,400**
Contingency	**$14,400**
Engineering	**$19,100**
Legal Admin.	**$3,900**
Project Total	**$132,800**

APPENDIX D: WATER TREATMENT PLANT DATA

Pumped to City (gal)

Month	2015	2016	2017	2018	2019	2020	2021	Average
January	11,091,797	8,402,712	13,005,926	11,738,685	14,152,597	11,835,541	12,116,579	11,763,405
February	9,410,938	9,607,599	10,696,268	10,791,306	12,472,871	11,515,025	12,184,553	10,954,080
March	11,002,676	12,255,603	13,407,293	12,358,857	14,082,671	15,561,375	12,732,398	13,057,268
April	13,742,158	12,562,750	12,657,557	12,752,472	16,257,338	11,621,500	15,097,749	13,527,361
May	12,596,462	13,772,754	14,220,398	15,738,216	5,077,088	13,003,107	18,400,051	13,258,297
June	14,891,561	17,593,898	17,257,483	16,983,727	20,723,758	15,116,808	20,041,040	17,515,468
July	17,664,347	20,695,494	21,573,307	17,908,718	22,665,767	21,505,731	22,601,463	20,659,261
August	15,685,285	20,246,074	21,651,084	17,956,509	20,787,790	22,388,703	22,069,441	20,112,127
September	13,478,919	15,127,138	15,114,996	17,663,071	16,699,467	19,386,817	18,995,125	16,637,933
October	12,124,284	12,439,545	12,648,143	18,486,376	14,821,684	18,168,208	16,143,861	14,976,014
November	8,979,922	9,885,085	9,885,085	16,237,262	13,175,982	13,902,786	13,555,697	12,231,688
December	8,829,998	12,450,929	9,633,145	14,457,902	12,218,825	12,835,442	12,889,078	11,902,188
Total	149,498,347	165,039,582	171,750,685	183,073,101	183,135,838	186,841,043	196,827,035	176,595,090

Totalized Treated Water (gal)

Month	2015	2016	2017	2018	2019	2020	2021	Average
January	10,037,933	9,437,047	10,385,405	10,617,637	12,176,591	12,166,982	11,795,854	10,945,350
February	10,389,175	8,332,837	8,124,537	9,428,274	10,853,290	12,549,872	12,266,644	10,277,804
March	11,287,161	11,008,274	10,386,129	10,786,097	11,570,467	13,342,346	11,844,494	11,460,710
April	12,418,422	10,491,886	9,926,936	10,968,340	14,085,902	12,881,391	14,624,322	12,199,600
May	14,129,995	15,251,919	11,197,571	14,750,151	4,338,391	14,339,976	16,960,296	12,995,471
June	16,700,037	16,354,611	14,426,996	17,298,038	18,189,831	15,979,755	18,292,474	16,748,820
July	20,223,091	19,327,410	19,313,055	21,271,481	22,007,286	19,848,762	20,632,626	20,374,816
August	18,828,868	18,915,206	19,985,410	20,941,829	20,851,156	20,251,817	16,781,594	19,507,983
September	15,077,211	16,474,680	16,481,367	19,012,519	16,381,309	17,953,175	13,955,361	16,476,517
October	13,857,640	13,273,656	15,578,711	17,229,008	14,361,529	17,240,310	12,834,165	14,910,717
November	9,992,095	11,004,266	11,862,592	15,219,599	12,896,996	13,374,215	13,473,081	12,546,121
December	10,112,003	10,677,165	10,752,348	12,851,181	11,767,130	12,410,913	12,460,812	11,575,936
Total	163,053,629	160,548,956	158,421,059	180,374,155	169,479,878	182,339,514	175,921,723	170,019,845

WTP Backwash (gal)

Month	2015	2016	2017	2018	2019	2020	2021	Average
January	680,791	751,668	905,851	902,345	1,198,759	978,961	748,894	881,038
February	754,474	677,988	753,839	827,400	1,046,495	823,714	599,440	783,336
March	680,595	770,307	902,741	901,982	746,119	597,105	748,651	763,929
April	831,733	752,459	754,073	828,699	819,810	598,549	896,204	783,075
May	1,056,907	902,505	903,996	1,472,816	295,738	747,636	1,352,003	961,657
June	904,669	904,859	902,329	1,583,092	1,046,193	601,482	973,478	988,015
July	1,055,292	980,977	1,506,820	1,201,788	1,122,453	898,524	899,531	1,095,055
August	904,480	979,707	1,204,936	1,052,606	1,045,770	747,030	823,103	965,376
September	909,185	827,299	1,053,594	1,125,044	827,700	974,222	824,829	934,553
October	831,779	753,861	904,420	899,622	752,959	1,199,741	601,352	849,105
November	678,944	981,757	828,948	900,076	600,119	600,469	601,161	741,639
December	677,362	906,076	829,248	899,637	809,101	755,070	753,278	804,253
Total	9,966,213	10,189,463	11,450,794	12,595,108	10,311,216	9,522,503	9,821,924	10,551,032

WTP % Backwash

Month	2015	2016	2017	2018	2019	2020	2021	Average
January	6.78%	7.97%	8.72%	8.50%	9.84%	8.05%	6.35%	8.03%
February	7.26%	8.14%	9.28%	8.78%	9.64%	6.56%	4.89%	7.79%
March	6.03%	7.00%	8.69%	8.36%	6.45%	4.48%	6.32%	6.76%
April	6.70%	7.17%	7.60%	7.56%	5.82%	4.65%	6.13%	6.52%
May	7.48%	5.92%	8.07%	9.99%	6.82%	5.21%	7.97%	7.35%
June	5.42%	5.53%	6.25%	9.15%	5.75%	3.76%	5.32%	5.88%
July	5.22%	5.08%	7.80%	5.65%	5.10%	4.53%	4.36%	5.39%
August	4.80%	5.18%	6.03%	5.03%	5.02%	3.69%	4.90%	4.95%
September	6.03%	5.02%	6.39%	5.92%	5.05%	5.43%	5.91%	5.68%
October	6.00%	5.68%	5.81%	5.22%	5.24%	6.96%	4.69%	5.66%
November	6.79%	8.92%	6.99%	5.91%	4.65%	4.49%	4.46%	6.03%
December	6.70%	8.49%	7.71%	7.00%	6.88%	6.08%	6.05%	6.99%
Total	6.27%	6.67%	7.45%	7.25%	6.36%	5.32%	5.61%	6.42%

City Usage Data-Based on Billing

Year	Month	Residential (IC)	Commercial (IC)	Residential (OC)	Commercial (OC)	City Use No Charge	City Use Charge	Total	Residential Total	Commercial Total	City Total	Annual Total Metered
2015	1	4,368,000	2,797,000	335,000	278,000	20,000	321,000	8,119,000	4,703,000	3,075,000	341,000	
	2	3,781,000	2,488,000	303,000	340,000	20,000	206,000	7,138,000	4,084,000	2,828,000	226,000	
	3	4,262,000	3,034,000	320,000	432,000	31,000	343,000	8,422,000	4,582,000	3,466,000	374,000	
	4	3,967,000	2,832,000	301,000	370,000	29,000	326,000	7,825,000	4,268,000	3,202,000	355,000	
	5	4,604,000	3,047,000	331,000	400,000	33,000	431,000	8,846,000	4,935,000	3,447,000	464,000	
	6	6,022,000	4,432,000	458,000	484,000	40,000	390,000	11,826,000	6,480,000	4,916,000	430,000	
	7	8,098,000	6,593,000	668,000	698,000	80,000	370,000	16,507,000	8,766,000	7,291,000	450,000	
	8	7,414,000	6,391,000	692,000	522,000	88,000	441,000	15,548,000	8,106,000	6,913,000	529,000	
	9	7,239,000	6,869,000	626,000	579,000	102,000	525,000	15,940,000	7,865,000	7,448,000	627,000	
	10	6,157,000	5,243,000	506,000	850,000	69,000	489,000	13,314,000	6,663,000	6,093,000	558,000	
	11	4,841,000	3,856,000	400,000	1,748,000	41,000	358,000	11,244,000	5,241,000	5,604,000	399,000	
	12	5,210,000	35,000	409,000	864,000	28,000	553,000	7,099,000	5,619,000	899,000	581,000	131,828,000
2016	1	4,394,000	3,809,000	335,000	224,000	23,000	587,000	9,372,000	4,729,000	4,033,000	610,000	
	2	3,247,000	2,056,000	263,000	185,000	14,000	707,000	6,472,000	3,510,000	2,241,000	721,000	
	3	4,159,000	2,839,667	318,000	296,000	27,333	631,333	8,271,333	4,477,000	3,135,667	658,667	
	4	4,416,000	3,647,000	391,000	250,000	43,000	446,000	9,193,000	4,807,000	3,897,000	489,000	
	5	4,196,000	2,970,000	323,000	322,000	59,000	440,000	8,310,000	4,519,000	3,292,000	499,000	
	6	6,462,000	4,780,000	515,000	516,000	178,000	577,000	13,028,000	6,977,000	5,296,000	755,000	
	7	7,613,000	6,552,000	681,000	710,000	75,000	562,000	16,193,000	8,294,000	7,262,000	637,000	
	8	6,017,000	5,241,000	506,000	485,000	78,000	494,000	12,821,000	6,523,000	5,726,000	572,000	
	9	8,158,000	7,295,000	685,000	721,000	108,000	671,000	17,638,000	8,843,000	8,016,000	779,000	
	10	6,616,000	5,448,000	562,000	858,000	68,000	475,000	14,027,000	7,178,000	6,306,000	543,000	
	11	4,544,000	3,736,000	341,000	1,313,000	32,000	808,000	10,774,000	4,885,000	5,049,000	840,000	
	12	4,996,000	3,439,000	370,000	471,000	29,000	542,000	9,847,000	5,366,000	3,910,000	571,000	135,946,333

City Usage Data-Based on Billing

Year	Month	Residential (IC)	Commercial (IC)	Residential (OC)	Commercial (OC)	City Use No Charge	City Use Charge	Total	Residential Total	Commercial Total	City Total	Annual Total Metered
2017	1	4,221,000	2,925,000	307,000	225,000	25,000	433,000	8,136,000	4,528,000	3,150,000	458,000	
	2	3,960,000	2,529,000	315,000	155,000	21,000	976,000	7,956,000	4,275,000	2,684,000	997,000	
	3	4,260,000	2,794,000	312,000	192,000	26,000	1,000,000	8,584,000	4,572,000	2,986,000	1,026,000	
	4	3,803,000	2,897,000	539,000	191,000	34,000	631,000	8,095,000	4,342,000	3,088,000	665,000	
	5	3,921,000	2,978,000	390,000	244,000	35,000	817,000	8,385,000	4,311,000	3,222,000	852,000	
	6	4,824,000	3,684,000	367,000	458,000	24,000	1,075,000	10,432,000	5,191,000	4,142,000	1,099,000	
	7	5,904,000	5,226,000	500,000	397,000	80,000	825,000	12,932,000	6,404,000	5,623,000	905,000	
	8	6,892,000	5,403,000	593,000	436,000	79,000	633,000	14,036,000	7,485,000	5,839,000	712,000	
	9	8,532,000	7,682,000	732,000	770,000	118,000	938,000	18,772,000	9,264,000	8,452,000	1,056,000	
	10	5,926,000	4,924,000	542,000	700,000	68,000	826,000	12,986,000	6,468,000	5,624,000	894,000	
	11	5,426,003	4,677,000	417,000	1,624,000	47,000	1,008,000	13,199,003	5,843,003	6,301,000	1,055,000	
	12	4,689,001	3,347,000	410,000	497,000	26,000	758,000	9,727,001	5,099,001	3,844,000	784,000	**133,240,004**
2018	1	4,359,002	3,803,000	377,000	187,000	33,000	742,000	9,501,002	4,736,002	3,990,000	775,000	
	2	4,170,000	2,730,000	342,000	158,000	28,000	897,000	8,325,000	4,512,000	2,888,000	925,000	
	3	3,955,000	2,691,000	322,000	264,000	25,000	551,000	7,808,000	4,277,000	2,955,000	576,000	
	4	3,978,000	3,114,000	338,000	151,000	39,000	769,000	8,389,000	4,316,000	3,265,000	808,000	
	5	4,500,000	3,132,000	400,000	250,000	40,000	1,090,000	9,412,000	4,900,000	3,382,000	1,130,000	
	6	6,296,000	4,450,000	538,000	357,000	60,000	1,319,000	13,020,000	6,834,000	4,807,000	1,379,000	
	7	6,966,000	5,637,000	581,000	463,000	78,000	1,003,000	14,728,000	7,547,000	6,100,000	1,081,000	
	8	7,833,000	6,061,000	670,000	617,000	111,000	1,183,000	16,475,000	8,503,000	6,678,000	1,294,000	
	9	7,753,000	6,307,000	662,000	472,000	212,000	2,324,000	17,730,000	8,415,000	6,779,000	2,536,000	
	10	6,799,000	5,690,000	612,000	840,000	75,000	3,051,000	17,067,000	7,411,000	6,530,000	3,126,000	
	11	5,133,502	3,341,000	387,000	1,784,000	44,000	3,158,000	13,847,502	5,520,502	5,125,000	3,202,000	
	12	4,430,000	2,978,000	351,000	922,000	32,000	4,061,000	12,774,000	4,781,000	3,900,000	4,093,000	**149,076,504**

City Usage Data-Based on Billing

Year	Month	Residential (IC)	Commercial (IC)	Residential (OC)	Commercial (OC)	City Use No Charge	City Use Charge	Total	Residential Total	Commercial Total	City Total	Annual Total Metered
2019	1	3,810,000	2,490,000	291,000	337,000	27,000	1,984,000	8,939,000	4,101,000	2,827,000	2,011,000	
	2	4,044,000	2,667,000	334,000	237,000	21,000	2,161,000	9,464,000	4,378,000	2,904,000	2,182,000	
	3	3,784,000	2,814,000	288,000	242,000	38,000	1,963,000	9,129,000	4,072,000	3,056,000	2,001,000	
	4	5,675,000	4,175,000	507,000	350,000	51,000	3,498,000	14,256,000	6,182,000	4,525,000	3,549,000	
	5	4,997,000	4,032,000	446,000	420,000	49,000	2,455,000	12,399,000	5,443,000	4,452,000	2,504,000	
	6	7,201,000	5,816,000	634,000	582,000	68,000	2,652,000	16,953,000	7,835,000	6,398,000	2,720,000	
	7	8,330,000	7,231,000	692,000	588,000	81,000	2,918,000	19,840,000	9,022,000	7,819,000	2,999,000	
	8	7,493,000	6,114,000	660,000	559,000	67,000	1,968,000	16,861,000	8,153,000	6,673,000	2,035,000	
	9	6,363,000	5,759,000	628,000	744,000	56,000	2,445,000	15,995,000	6,991,000	6,503,000	2,501,000	
	10	4,528,000	3,488,000	395,000	1,356,000	31,000	1,748,000	11,546,000	4,923,000	4,844,000	1,779,000	
	11	5,139,000	3,601,000	476,000	694,000	29,000	1,796,000	11,735,000	5,615,000	4,295,000	1,825,000	
	12	3,581,784	2,430,000	347,000	225,000	17,000	1,347,000	7,947,784	3,928,784	2,655,000	1,364,000	**155,064,784**
2020	1	3,581,784	2,430,000	347,000	225,000	17,000	1,347,000	7,947,784	3,928,784	2,655,000	1,364,000	
	2	4,434,679	2,743,000	34,000	181,000	20,000	1,869,000	9,281,679	4,468,679	2,924,000	1,889,000	
	3	4,140,163	2,727,000	320,000	233,000	20,000	1,953,000	9,393,163	4,460,163	2,960,000	1,973,000	
	4	4,402,633	2,699,000	426,000	284,000	18,000	2,387,000	10,216,633	4,828,633	2,983,000	2,405,000	
	5	5,204,697	2,495,095	484,000	320,000	10,000	2,018,000	10,531,792	5,688,697	2,815,095	2,028,000	
	6	5,247,093	2,952,268	559,103	279,000	24,000	1,713,000	10,774,464	5,806,196	3,231,268	1,737,000	
	7	6,651,024	490,058	643,175	433,000	81,000	2,009,000	10,307,257	7,294,199	923,058	2,090,000	
	8	8,121,408	6,020,751	830,928	460,000	55,272	1,796,000	17,284,359	8,952,336	6,480,751	1,851,272	
	9	8,373,371	6,133,586	804,714	441,000	57,320	2,107,000	17,916,991	9,178,085	6,574,586	2,164,320	
	10	8,119,192	5,951,745	792,834	626,000	45,007	2,564,000	18,098,778	8,912,026	6,577,745	2,609,007	
	11	5,141,951	3,977,808	500,245	1,528,000	40,596	1,314,000	12,502,600	5,642,196	5,505,808	1,354,596	
	12	5,696,966	3,416,662	447,433	1,032,000	24,200	4,382,000	14,999,261	6,144,399	4,448,662	4,406,200	149,254,761

City Usage Data-Based on Billing

Year	Month	Residential (IC)	Commercial (IC)	Residential (OC)	Commercial (OC)	City Use No Charge	City Use Charge	Total	Residential Total	Commercial Total	City Total	Annual Total Metered
2021	1	4,185,967	2,565,999	341,036	216,000	17,295	2,389,000	9,715,297	4,527,003	2,781,999	2,406,295	
	2	3,806,310	2,478,872	293,142	197,000	18,141	2,685,000	9,478,465	4,099,452	2,675,872	2,703,141	
	3	4,810,469	3,116,674	392,274	230,000	24,874	1,891,000	10,465,291	5,202,743	3,346,674	1,915,874	
	4	4,382,181	2,983,773	372,220	241,000	31,584	2,601,000	10,611,758	4,754,401	3,224,773	2,632,584	
	5	5,085,604	3,421,886	413,664	382,000	31,262	1,814,000	11,148,416	5,499,268	3,803,886	1,845,262	
	6	6,000,573	4,198,206	508,403	398,000	46,784	1,954,000	13,105,966	6,508,976	4,596,206	2,000,784	
	7	8,590,999	7,201,195	693,361	516,000	66,925	2,487,000	19,555,480	9,284,360	7,717,195	2,553,925	
	8	7,506,437	5,834,666	646,700	445,000	62,598	1,964,000	16,459,401	8,153,137	6,279,666	2,026,598	
	9	8,709,578	6,643,190	751,075	501,000	62,334	2,240,000	18,907,177	9,460,653	7,144,190	2,302,334	
	10	7,797,783	6,065,170	594,630	638,000	58,732	2,201,000	17,355,315	8,392,413	6,703,170	2,259,732	
	11	4,670,607	3,310,494	381,269	1,426,000	29,120	2,215,000	12,032,490	5,051,876	4,736,494	2,244,120	
	12	5,700,914	3,566,905	501,714	816,000	28,029	2,836,000	13,449,562	6,202,628	4,382,905	2,864,029	**162,284,618**

APPENDIX E: FEASIBILITY EVALUATION

Water Solutions, Inc.

TECHNICAL MEMORANDUM - FINAL

City of Bandon – Supplemental Groundwater Supply Feasibility Evaluation

To:	Dan Chandler, JD, ICMA-CM / City of Bandon
CC:	Steve Major, PE / The Dyer Partnership Engineers & Planners, Inc.
From:	Ryan Dougherty, PE, RG / GSI Water Solutions, Inc.[1] Kim Grigsby / GSI Water Solutions, Inc. Ted Ressler, RG, CWRE / GSI Water Solutions, Inc.[1] Ronan Igloria, PE / GSI Water Solutions, Inc.
Date:	June 10, 2022

1. Introduction

This technical memorandum was prepared by GSI Water Solutions, Inc. (GSI) for the City of Bandon (City) to document the results of an evaluation of the feasibility of developing a municipal groundwater supply for supplemental/emergency use.

The City is evaluating alternatives to supplement their existing source water supplies from Ferry and Geiger Creek, which are vulnerable to low flow conditions induced by droughts, climate change, harmful algal blooms, and earthquake hazards. The City has identified off-channel reservoir storage and/or development of a groundwater supply as potential alternatives to supplement source water supplies on an emergency or seasonal basis. Based on the City's 2020 Water System Master Plan and discussions with the City, GSI understands that a supplemental source water supply should be capable of providing approximately 300-500 gallons per minute (gpm) for 30 days to be feasible.

The objective of this evaluation was to perform a reconnaissance-level study to assess the feasibility of developing a supplemental/emergency municipal groundwater supply capable of meeting the City's target capacity of approximately 300-500 gpm for 30 days.

The remainder of this technical memorandum is organized as follows:

- <u>Section 2 – Hydrogeology:</u> Evaluates the local hydrogeologic setting and summarizes the characteristics of the local hydrogeologic units.
- <u>Section 3 – Water Rights:</u> Summarizes alternatives to obtain water use authorization for a new municipal groundwater supply source.
- <u>Section 4 – Well Siting, Preliminary Test Well Design, and Planning Level Costs:</u> Evaluates locations for new wells, develops a preliminary test well design, and provides planning level cost estimates for exploratory drilling/testing and a full-scale wellfield.

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[1] Ryan Dougherty and Ted Ressler led the analysis and documentation for Sections 2 and 4 of the technical memorandum while at GSI Water Solutions, Inc. but have since departed the firm. in the time since the draft of the technical memo was submitted in January 2022. GSI finalized the technical memorandum based on review comments from City of Bandon, which did not affect Sections 2, 4 and 5.

- Section 5 – Results and Recommendations: Summarizes the results of this preliminary feasibility evaluation and provides GSI's recommendations regarding the sequencing of activities to further evaluate site-specific feasibility of a supplemental/emergency municipal groundwater supply system.

2. Hydrogeology

This section describes the local hydrogeologic setting and summarizes the characteristics of the local hydrogeologic units. Geologically, the City of Bandon is located in southern portion of the Coast Range geologic province, which generally consists of benches of wave-cut marine terraces and accreted/uplifted marine sediments to the east which form the topographic highs of the Coast Range (Orr, 1999).

2.1 Hydrogeologic Setting Overview

To evaluate the hydrogeologic setting in the vicinity of the City, GSI reviewed available geologic reports[2], geologic spatial data[3], and well logs[4] to develop a conceptual model of the local hydrogeologic system. Following review of available geologic information, GSI developed a map of surficial geology (Figure 2) and two cross sections (Figures 3 and 4) to further characterize the occurrence, extent, and thickness of hydrogeologic units in the vicinity of the City. A summary of the major hydrogeologic units in the vicinity of the City is provided below, from youngest to oldest (from the ground surface downward, if present):

- Alluvial Deposits (Aa, Ha): This hydrogeologic unit primarily consists of unconsolidated sand, gravel, and silt deposited along active stream channels and floodplains (see Figure 2). The thickness of this unit is generally less than 20 feet, with thicknesses decreasing with distance away from active stream channels. When present, groundwater within this unit exists under unconfined conditions and is typically hydraulically connected to nearby surface waters. Overall, the alluvial deposits are not considered to be a suitable hydrogeologic unit (aquifer) for a supplemental groundwater supply due to their limited extent and thickness.
- Coastal Dune Deposits (Abs, Qds): This hydrogeologic unit primarily consists of unconsolidated sand deposited by wave and wind processes in active near-shore and back-beach settings. In the vicinity of the City, the extent of this unit is limited to the west of Highway 101 (see Figure 2). The thickness of this unit is typically less than 30 feet, with thicknesses decreasing inland (to the east). When present, groundwater within this unit exists under unconfined conditions and is typically hydraulically connected to nearby surface waters. Overall, the coastal dune deposits are not considered to be a suitable hydrogeologic unit (aquifer) for a supplemental groundwater supply due to their limited extent and thickness which in turn can produce issues related to long-term sustainability (see discussion of Pacific Dunes Golf Course Well in BCWCD, 2004).
- Marine Terrace Deposits (Qmtw, Qmtp, Qmtd): This hydrogeologic unit primarily consists of unconsolidated sand and gravel interbedded with clay and silt that were deposited in ancestral nearshore marine environments. This unit is regionally extensive and is present throughout the local area, with thicknesses commonly between 50-100 feet. Groundwater within this unit exists under unconfined conditions and is likely hydraulically connected to nearby surface waters in many locations. The majority of local wells are completed in the marine terrace deposits due to the unit's relative thickness and abundance of permeable material, which in turn produces relatively moderate well yields (~15-75 gpm). Overall, the marine terrace deposits may be a suitable hydrogeologic unit (aquifer) for a supplemental groundwater supply.

  The marine terrace deposits is a collection of various subunits including the Whiskey Run (Qmtw), Pioneer Terrace (Qmtp), and Seven Devils (Qmtd) subunits. These three subunits are the most extensive subunits in the vicinity of the City (see Figure 2). Of these three subunits, the Pioneer

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[2] See BCWCD, 2004; Orr, 1999

[3] See DOGAMI, 2014 and DOGAMI, 2021

[4] OWRD, 2019

Terrace subunit is anticipated to the have the largest saturated thickness, highest potential well yield, and greatest sustainability. Within the City's watershed, the Pioneer Terrace subunit is estimated to have thickness of 35-100 feet, with thicknesses increasing to the east (upland) and away from Ferry and Geiger Creek (see Figures 3 and 4).

A hydrogeologic study prepared for the Bandon Cranberry Water Control District (BCWCD, 2004) in cooperation with the Oregon Water Resources Department (OWRD) estimated the following hydraulic properties for the marine terrace deposits at a site approximately 0.25-miles north of the City's watershed[5]. These hydraulic parameters provide the basis for evaluating the feasibility of a supplemental groundwater supply and also developing a preliminary well design and wellfield layout.

Table 1. Reported Hydraulic Properties of the Marine Terrace Deposits

Parameter	Symbol	Units	Reported Value
Hydraulic Gradient	i	dimensionless	0.02
Transmissivity	T	gpm/ft	3,740
Horizontal Hydraulic Conductivity	K_h	feet/day	10
Vertical Hydraulic Conductivity	K_v	feet/day	0.042
Specific Yield / Storativity	s	dimensionless	0.0002

Based on review of these hydraulic parameters, GSI anticipates that a new properly-designed water supply well could achieve a sustainable yield of 75-100 gpm, assuming that at least 50 feet of saturated and screenable aquifer material (relatively clean sand and gravel) is present at potential well sites.

- Consolidated Marine Rocks (KJs, Tefm): This hydrogeologic unit primarily consists of clay, siltstone, and claystone deposited in ancient marine environments. This unit generally represents the oldest and deepest geologic unit in the local area, and is also considered to be part of Oregon's oldest geologic terrane. The thickness of this unit is estimated to be over 1,000 feet. Groundwater within this unit is commonly saline and well yields are low (<20 gpm). Overall, the consolidated marine rocks are not considered to be a suitable hydrogeologic unit (aquifer) for a supplemental groundwater supply due to their low well yields and water quality issues (saline).

2.2 Hydrogeologic Feasibility Results

Based on GSI's review available information describing the local and regional hydrogeologic setting, one geologic unit (marine terrace deposits) appears favorable for the development of a supplemental groundwater supply with a 30-day capacity of 300-500 gpm. GSI anticipates that a single new properly designed water supply well could potentially achieve a yield of 75-100 gpm, assuming that at least 50 feet of saturated and screenable aquifer material is present at specific well sites. Based on these assumptions, a total of three to six wells may be necessary to meet the target capacity of 300-500 gpm. Within the City's watershed, the thickness of the marine terrace deposits appears to range from approximately 35-100 feet, with thickness generally increasing to the east (upland) and away from Ferry and Geiger Creek (see Figures 3 and 4).

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[5] See Gardner Site in Table 5.4 of BCWCD, 2004; located approximately 0.25-miles northwest of the City's watershed

3. Water Rights

The use of groundwater for municipal water supply requires a water right from OWRD. This section summarizes two options the City could potentially pursue to obtain authorization to use groundwater for municipal water supply. A detailed discussion of each option is included in Attachment A.

3.1 Groundwater Permit Application

GSI conducted an evaluation of the opportunity for the City to obtain a new groundwater permit based on OWRD's review criteria. As detailed in Attachment A, it is likely that OWRD would find the following with respect to the department's review criteria for new groundwater permits:

1. <u>Whether Water is Available</u>: Although groundwater is available for the proposed use, the use would have the potential to cause substantial interference (PSI) with surface water[6], and additional surface water use is not available any month of the year. A map showing areas in the vicinity of the City that would trigger PSI is shown on Figure 5. Accordingly, OWRD is expected to find that water is not available for the proposed use.
2. <u>Basin Program Rules</u>: The use of groundwater for municipal use is consistent with the basin program rules.
3. <u>Injury to Existing Water Rights</u>: There is uncertainty as to whether the proposed use would cause injury to existing water users. These uncertainties can only be resolved after an application has been submitted and OWRD's groundwater section has completed its review. Based on GSI's estimations of pumping interference from a new full-scale wellfield, two existing water users would be impacted, which are discussed below:
   - *ODFW Fish Hatchery*: The Oregon Department of Fish and Wildlife's (ODFW's) hatchery has a water right certificate for non-consumptive use of water from Ferry Creek. ODFW's water right certificate (7904) has a priority date of 7/20/1925, which is junior to some of the City's existing water rights (including Certificate 9754, see Section 3.3). It is possible that OWRD would determine that a full-scale wellfield would cause injury to ODFW's fish hatchery, even though a groundwater system by nature would result in less direct stream depletion than the City's existing surface water intakes on Ferry Creek.
   - *Exempt (Domestic) Wells*: There are existing exempt (domestic) wells located a few hundred feet north of the City's water treatment plant (along Houston Lane, Melton Road). These wells are exempt from needing a water right to use groundwater. Some of these wells are shallow (<50 feet) and therefore pumping interference from a full-scale wellfield could preclude the exempt wells from obtaining groundwater. It is possible that OWRD would determine that there may be injury to existing exempt (domestic) wells from a full-scale wellfield depending on where the wells are located. New wells located near the City's water treatment plant would likely cause injury to the exempt wells while new wells located south of Ferry Creek would not likely result in injury to the exempt wells.
4. <u>Consistency with OWRD Administrative Rules</u>: As part of their evaluation under the Division 33 rules, ODFW and the Department of Environmental Quality (DEQ) would be expected to recommend either denial of the application or require that the City provide mitigation to address impacts to listed fish species in the affected surface water source.

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[6] A proposed groundwater use that has a hydraulic connection to local surface water sources may be classified as PSI if several criteria are met relating to the distance of the well from local surface waters, the proposed pumping rate, and minimum perennial streamflows. If OWRD finds PSI with a surface water, then the use of groundwater is subject to regulatory limitations that are applicable to the surface water source.

Based on the expected finding that water is not available for the proposed use, and expected recommendations from ODFW and DEQ, OWRD would likely deny an application for a new municipal groundwater permit from wells in the area of the City.

Potential to Mitigate for Surface Water Impacts

To obtain a new groundwater permit, the City would likely need to resolve the concerns described above regarding PSI, surface water not being available, and impacts to listed fish species. Historically, the method to resolve these issues has typically been to provide mitigation. Mitigation has been provided in the form of transferring a surface water right instream in the affected surface water source, or possibly cancelling a water right certificate that authorizes use from the affected surface water source. However, OWRD has recently announced that it will generally not accept mitigation when water is not available. OWRD would be unlikely to accept mitigation from the City due to water not being available from Ferry Creek.

3.2 Surface Water to Groundwater Transfer

Since it appears unlikely that the City would obtain OWRD approval of an application for a new groundwater permit, GSI evaluated the opportunity for the City to change a portion of one of the City's existing surface water rights to allow the appropriation of the water from a new well. This change is referred to as a surface water to groundwater transfer. (This process allows only a <u>change</u> from a surface water point of diversion to a groundwater point of appropriation [well]; i.e., the original surface water point of diversion could not be retained as an additional or supplemental point of diversion for the portion of the water right included in the transfer. The surface water to groundwater transfer process is more streamlined than the permit application process, and consequently may pose less of a challenge than obtaining a new groundwater permit.

As detailed in Attachment A, it is likely that OWRD would find the following with respect to the department's review criteria for surface water to groundwater transfers:

1. <u>Injury to Existing Water Rights</u>: There is uncertainty as to whether the proposed use would cause injury to existing water users. In its evaluation of injury, OWRD considers the potential for injury at the point on the stream nearest to the proposed well(s). The nearest point of the proposed wells to Ferry Creek is in the same general location as the current point of diversion with a junior instream water right (79554). If this point was determined to be upstream from the current point of diversion, OWRD could find injury to the instream water right. These uncertainties can only be resolved after an application has been submitted and OWRD's groundwater section has completed its review. The existing water users that would potentially be impacted are identical to those discussed in Section 3.1 (ODFW Fish Hatchery and Exempt Domestic Wells).
2. <u>No Enlargement of Water Right</u>: The surface water to groundwater transfer would not propose to enlarge the City's water right selected for transfer.
3. <u>Hydraulic Connection with the Authorized Surface Water Source</u>: The proposed aquifer (marine terrace deposits) is hydraulically connected to local surface water based on GSI's review of hydrogeologic information (Section 2).
4. <u>Proposed Change will affect the Authorized Surface Water Source "Similarly":</u> The proposed groundwater use must affect the authorized surface water source "similarly"[7]. GSI used the Jenkins (1970) and Hunt (1999) streamflow depletion models to evaluate the furthest distance that new wells could be located from surface waterbodies to meet OWRD's "similarly" conditions. Input parameters for these stream depletion models were based on hydraulic properties for the marine terrace deposits (see Table 1, based on BCWCD, 2004). Results of the stream depletion modeling

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[7] OWRD defines "similarly" to mean that the use of groundwater at the new wells affects the surface water source specified in the subject water rights and would result in stream depletion of at least 50 percent of the rate of appropriation within 10 days of continuous pumping.

suggest that new wells could be located over 3,000 feet from surface waterbodies (or anywhere within the City's watershed).

5. Well(s) Located within Appropriate Distance of Authorized Surface Water Source: The proposed well locations must be within 500 feet of the surface water source and within 1,000 feet upstream or downstream of the original point of diversion; or a licensed geologist must prepare a report demonstrating that the "similarly' criteria are met.

   As described in bullet number four above, results of the stream depletion modeling suggest that new wells could be located over 3,000 feet from surface waterbodies (or anywhere within the City's watershed). Although preliminary and not utilizing site-specific hydrogeologic information, since the input parameters for the stream depletion model analysis presented here are based on hydraulic properties that OWRD co-authored (BCWCD, 2004), we have reasonable confidence that a surface water to groundwater transfer to wells completed in the marine terrace deposits may be possible anywhere within the City's watershed.

Based on the evaluation of OWRD's review criteria for surface water to groundwater transfers, GSI concluded that the agency would likely approve such a transfer application; however, the City should be aware that the approval order may include multiple conditions. First, in order to preclude enlargement of the right being transferred OWRD would limit the City's use of groundwater to the amount of water legally available at the original point of diversion (on the surface water source). In some cases OWRD has required a measuring device at both the original point of diversion and the well to ensure compliance with this requirement. If OWRD limits appropriation from the well to the amount of water available at the original point of diversion and requires a measuring device to document that amount, there may be little benefit derived from a surface water to groundwater transfer. . OWRD is expected to include a general condition precluding enlargement; however, the specific condition requirements cannot be determined without going through the application process. Second, the transfer approval order would likely also note that all restrictions that existed at the original surface water point of diversion shall apply to the proposed well(s). Finally, as part of the surface water to groundwater transfer process, the right would be conditioned to allow OWRD to subordinate the right to any existing groundwater rights that are injured as the result of the transfer.

3.3 Water Rights Next Steps

It should be noted that GSI's water rights evaluation focused on technical criteria and processes of each water rights alternative; a deeper understanding of the City's water rights portfolio by GSI (status, development to date, infrastructure capacity, etc.) would be needed to further assess feasibility and to develop a potential implementation strategy.

As a next step the City should evaluate its surface water rights, shown below on Table 2, to consider its options for a surface water to groundwater transfer. There are several water right attributes to consider in making this evaluation, including status (permit vs. certificate), development deadline and need for a permit extension or certificate request, amounts of water developed to date, and available streamflow as compared to water right authorization.

Table 2. City's Existing Surface Water Rights

Water Right	Source	Maximum Authorized Rate (cfs)	(mgd)	Priority Date	Status
Certificate 9754	Mill Cr., Ferry Cr., and stored water from 2 reservoirs	2.0	1.3	1/24/1910	Certificate right
Permit S-27233	Ferry Cr.	3.0	1.9	3/7/1961	Permit, 10/1/2000 development deadline
Permit S-27232	Geiger Cr.	3.0	1.9	3/7/1961	Permit, 10/1/2000 development deadline
Permit S-3011	Geiger Cr. and Geiger Cr. Reservoir	3.4	2.2	6/19/1916	Extended domestic use permit, 10/30/2050 development deadline
Transfer T-12632	Geiger Cr. and Geiger Cr. Reservoir	1.6	1.0	6/19/1916	Transfer to change from domestic to municipal, 10/1/2022 deadline

Given the expected outcome of each water right alternative, we recommend that the City complete a water rights review to further evaluate a surface water to groundwater transfer. If further evaluation suggests that a surface water to groundwater transfer is feasible, we recommend submitting a transfer application. As the application is processed and more information about the agencies' evaluations are obtained, the preferred course of action will become clearer. OWRD's processing of a surface water to groundwater transfer would likely require 18 to 24 months to complete. To expedite OWRD's review, the Reimbursement Authority process could be used, which would likely reduce the timeline to 8 to 12 months.

4. Well Siting, Preliminary Well Design, and Planning Level Costs

This section identifies potential well locations, develops a preliminary well design, and provides planning level cost estimates for a single test well and also for a full-scale wellfield.

4.1 Well Siting Evaluation

4.1.1 Well Siting Methods

Potential well locations were identified based on the following five criteria: regulatory setbacks for water supply wells, proximity to existing water system infrastructure, hydrogeology/potential yield, pumping interference, and water right considerations. A discussion of the methods and results for each of the five criteria is provided below. Given the reconnaissance scale nature of this assessment, other criteria such as cultural/social impacts, proximity to power, and general site improvements necessary to install a new water supply well (grading, tree removal, etc.) were not considered in the well siting evaluation.

Regulatory Setbacks

The Drinking Water Services section of the Oregon Health Authority (OHA)[8] and OWRD[9] promulgate standards for the siting of water supply wells in the form of setback requirements. While some setback requirements can be negotiated and waived if certain construction measures are implemented or if certain hydrogeologic conditions are demonstrated, this well siting evaluation attempted to identify and delineate potential locations for new water supply wells that can meet regulatory setbacks outright without a waiver. Key setback requirements for the siting of a new water supply wells include the following:

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[8] See OAR 333-061-0050 (2)(a)(A-F) and 333-061-0032(7)(a) for OHA setback requirements

[9] See OAR 690-210-0030 for OWRD setback requirements

Table 3. Key Regulatory Setbacks for Potable Water Supply Wells

Setback Distance (feet)	Setback Description	Regulatory Authority
5	Any permanent structure not including pump houses	OWRD
50	Septic tanks, gravity feed sewer lines (sanitary or stormwater)	OWRD, OHA
100	Chemical or fuel storage, long-term parking lots/structures, septic systems	OWRD, OHA
100	Area within 100 feet of well shall be owned/controlled by the water supplier	OHA
500	Hazardous waste storage, disposal, or treatment (including UICs)	OWRD
*	*Shall not be located in floodplains or within 100 feet of public or private roads	OHA

Notes
UIC = underground injection control facility (drywell)
* these setbacks are automatically waived by OHA if the wellhead is completed at least two feet above the 100-year flood level (or two feet above ground surface for the setback from roads) and is secured (locked pump house, fencing, etc.)

To determine appropriate locations for new water supply wells based on regulatory setbacks, GSI obtained and reviewed geospatial data[10] for features with an associated regulatory setback. These features were imported into ArcMap 10.6.1 and a processing tool was used to create buffers from each feature for its associated regulatory setback to identify and delineate areas within which new water supply wells can meet all applicable regulatory setbacks outright.

Results of this analysis are presented on Figure 6; the green shaded areas of Figure 6 are areas that are able to meet all applicable regulatory setbacks outright.

Proximity to Existing Water System Infrastructure

Well locations that are closer to existing water system conveyance piping will require less installation of new piping, saving on project costs. This well siting evaluation attempted to 1) identify well locations that are close to existing water system conveyance piping and 2) avoid well locations that would require stream crossings for conveyance.

Hydrogeology / Potential Yield

Based on GSI's understanding of the hydrogeologic setting (Section 2), a minimum thickness of 50 feet of screenable saturated aquifer material is anticipated to be necessary to meet the target sustainable capacity of a single new well (75-100 gpm). This well siting evaluation attempted to identify potential well locations with over 50 feet of saturated aquifer material.

Additionally, GSI anticipates that a minimum of three to six water supply wells may be necessary to meet the target capacity for a supplemental groundwater supply (300-500 gpm for 30-days). Therefore, this well siting evaluation attempted to identify at least six potential well locations.

Pumping Interference

Pumping interference occurs when the pumping operations of one well reduce the available drawdown and production capacity of a neighboring well. This phenomenon is commonly observed when wells are in close proximity and draw groundwater from the same aquifer system.

GSI estimated pumping interference for various well spacings[11] to determine a minimum separation distance that should be maintained between new wells. Based on this exercise a target separation distance

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[10] Utilities and building footprints obtained from AWS in July 2021; Groundwater Administrative Areas from OWRD; Potential Contaminant Sources from DEQ Facility Profiler, 2021

[11] Well interference (drawdown) was calculated using the Cooper-Jacob method for the following pumping scenario: unconfined aquifer conditions; individual well pumping rates of 75-100 gpm, pumping duration of 30 days, hydraulic parameters for the marine terrace deposits (see Table 1)

of at least 400 feet should be maintained between wells to minimize interference effects, to the extent possible.

Water Right Considerations

As discussed in Section 3.2, to obtain authorization for a supplemental groundwater system via a surface water to groundwater transfer, the proposed well locations must be within 500 feet of the surface waterbody and also within 1,000 feet upstream/downstream of the original point of diversion unless evidence is provided that demonstrates that use of groundwater from a well at a greater distance will affect the surface water similarly[12] to use from the original point of diversion.

Based on stream depletion modeling (see Section 3.2), GSI believes it is likely that OWRD would grant approval for new wells located anywhere within the City's watershed because the input parameters for the stream depletion models are based on hydraulic properties that OWRD co-authored. However, as a contingency plan this well siting evaluation also identified backup well locations within the prescriptive delineations (within 500 feet by 1,000 feet of original point of diversion) in the event that OWRD does not agree with the stream depletion model results.

Further, OWRD will only approve of well locations that do not cause injury to existing water users. Based on GSI's estimations of pumping interference, two existing local water users would be impacted, which are discussed in Section 3.1 and summarized below:

- ODFW Fish Hatchery: The Oregon Department of Fish and Wildlife's (ODFW's) hatchery has a water right certificate for non-consumptive use of water from Ferry Creek. It is possible that OWRD would determine that the proposed well locations would cause injury to ODFW's fish hatchery, despite the fact that a groundwater system by nature would result in less direct stream depletion than the City's existing surface water intakes.
- Exempt (Domestic) Wells: There are existing exempt (domestic) wells a few hundred feet north of the City's water treatment plant (along Houston Lane, Melton Road). Pumping interference from a full-scale wellfield could preclude the exempt wells from obtaining groundwater. GSI believes it is possible that OWRD would determine injury to existing exempt (domestic) wells from a full-scale wellfield located near the City's water treatment plant.

Due to the possibility that OWRD may determine injury to existing exempt (domestic) wells from a full-scale wellfield located near the City's water treatment plant, backup well locations that are far from existing exempt wells were identified as a contingency plan. These backup well locations are identified on Figure 6.

4.1.2 Well Siting Results

Results of the well siting evaluation are presented on Figure 6. A preferred group and two backup group well locations were identified, with six well locations per group (total of eighteen well locations). Key results for each group are summarized below:

- Preferred Well Locations: The preferred well locations are able to meet all applicable regulatory setbacks outright and are close to existing water system infrastructure. The thickness of the marine terrace deposits at these locations is estimated to be between 80-100 feet, which exceeds the minimum thickness of 50 feet of screenable saturated aquifer material anticipated to be necessary to produce a sustainable well yield of 75-100 gpm. With respect to pumping interference, all six of the preferred well locations maintain a separation distance of at least 400 feet from one another. In terms of water right considerations, the preferred well locations would require evidence of similar stream depletion to facilitate a surface water to groundwater transfer. GSI believes it is likely that

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[12] OWRD defines "similarly" to mean that the use of groundwater at the new wells affects the surface water source specified in the subject water rights and would result in stream depletion of at least 50 percent of the rate of appropriation within 10 days of continuous pumping.

OWRD would be in agreement that the similar stream depletion conditions are satisfied by the preferred well locations, however OWRD may determine that the preferred well locations cause injury to existing exempt (domestic) wells north of the City's water treatment plant. Overall, development of a supplemental groundwater supply at the preferred well locations appears most favorable although there are some uncertainties that cannot be resolved until a water right transaction is submitted and reviewed by OWRD.

- Backup Well Locations: The backup well locations represent contingency locations in the event that OWRD does not agree with the stream depletion modeling results or determines that a full-scale wellfield near the City's water treatment plant will cause injury to existing exempt (domestic) wells. Two additional series of backup well locations were identified, which are discussed below:
  - *B Series Backup Wells*: This series of backup well locations were sited on the north side of Ferry Creek to prioritize proximity to the City's water treatment plant. Two of the backup well locations are unable to meet all applicable regulatory setbacks outright and would require a waiver from OWRD/OHA (locations 5b and 6b on Figure 6, within 500 feet of HAZWASTE site). The thickness of the marine terrace deposits at these locations is estimated to be 30-50 feet, which could be insufficient to produce a sustainable well yield of 75-100 gpm/well. With respect to pumping interference, a majority of the backup well locations are unable to maintain a separation distance of at least 400 feet. Overall, development of a supplemental groundwater supply at the B Series backup well locations is less favorable than the C Series and may not be feasible due to the limited aquifer thickness.
  - *C Series Backup Wells*: This series of backup well locations were sited on the south side of Ferry Creek to prioritize hydrogeologic feasibility (thickness of marine terrace deposits). All six of the backup well locations are able to meet all applicable regulatory setbacks outright. The thickness of the marine terrace deposits at these locations is estimated to be 60-90 feet, which could be sufficient to produce a sustainable well yield of 75-100 gpm/well. With respect to pumping interference, a majority of the backup well locations are able to maintain a separation distance of at least 400 feet and the potential for injury to existing groundwater users is low. Overall, development of a supplemental groundwater supply at the C Series backup well locations is more favorable than the B Series and appears feasible, but may be more expensive due to the additional conveyance that would be required.

4.2 Preliminary Well Design

To develop a preliminary well design, the anticipated hydrogeologic setting of the preferred well locations (thickness of the marine terrace deposits) was considered in conjunction with the following criteria to develop a preliminary design for a new water supply well:

- The well design should conform to regulatory standards[13] for the construction of water supply wells.
- Selecting a casing and screen diameter that maximizes yield without incurring unnecessarily large construction costs.
- Maximizing the design screen capacity and minimizing well losses (inefficiencies) and resultant drawdown.

The resulting preliminary well design is presented on Figure 7 and includes the following key construction features: a total depth of 110 feet; a casing diameter of 12-inches; a sump/pump chamber length of ten feet; a screen length of 50 feet with an accompanying filter pack; and a seal depth of 20 feet. The location and slot-size of the screen is conceptual and would be dependent on encountered subsurface conditions.

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[13] See OAR 690-210 for minimum well construction standards for water supply wells

Based on an assumed seasonal low static water level of 20 feet below ground surface (bgs), GSI estimated the 30-day pumping water level of the well to be 75 feet bgs, which includes allowances for pumping interference between a full-scale wellfield. The expected pumping water level would result in a portion of the well screen being dewatered, which is generally not recommended as dewatering of the screen can result in conditions that can enhance biological growth in the well (biofouling) which in turn can require more frequent well maintenance/rehabilitation. While screen dewatering is not ideal, it is common practice for water systems with shallow alluvial wells and usually manifests in the form of additional maintenance costs rather than a fatal flaw. The City's intended use of a groundwater supply (supplemental rather than primary) would help to mitigate the potential screen dewatering problems as the screen would be dewatered and rewetted less frequently.

4.3 Planning Level Cost Estimates

A planning level cost estimate for a new supplemental groundwater system was developed in cooperation with the Dyer Partnership Engineers & Planners, Inc. (Dyer) using recent contractor costs (including prevailing wage rates) and equipment/material costs. The planning level cost estimate includes general allowances for design, permitting, construction oversight, and contingencies and is provided as a range to account for differences between potential well locations and the number of wells that may be required to meet the target capacity of 300-500 gpm for 30 days. The planning level cost is further divided by the following project phases:

1. Phase I – Exploratory Drilling and Testing Program: The scope of this phase involves water rights transactions, exploratory drilling to confirm the geologic setting (thickness of marine sediments), and the installation of one test well and one observation well. The purpose of this phase is to confirm the feasibility of a groundwater system, and if favorable, finalize the design of a full-scale wellfield.
2. Phase II – Full-Scale Wellfield: The scope of this phase involves drilling, constructing, and testing the total number of wells necessary to meet the target capacity of 300-500 gpm for 30 days. GSI anticipates that a total of two to five additional wells (beyond the initial test well) will be necessary to meet the target capacity.
3. Phase III – Water System Integration: The scope of this phase involves the design, permitting, and construction of above-ground facilities necessary to integrate the full-scale wellfield with the City's existing water system (well houses, permanent pumping systems, conveyance, etc.).

The resulting planning level cost estimates for each phase are provided below on Table 4. These cost estimates should be refined once well locations are finalized (after obtaining OWRD's approval of well locations through water rights transactions).

Table 4. Groundwater System Planning Level Cost Estimates

Item	Cost Estimate	
	Low	High
Phase I: Exploratory Drilling and Testing Program		
Well Drilling, Construction, and Testing	$140,000	$250,000
Construction Support (20%)	$28,000	$50,000
Water Rights Permitting (10%)	$14,000	$25,000
Final Wellfield Design (5%)	$7,000	$12,500
Phase I Subtotal	**$189,000**	**$337,500**
Phase II: Full-Scale Wellfield	**2 Wells**	**5 Wells**
Well Drilling, Construction, and Testing	$315,000	$850,000
Construction Support (20%)	$63,000	$170,000
OHA Plan Review Permitting (5%)	$15,750	$42,500
Phase II Subtotal	**$393,750**	**$1,062,500**
Phase III: Water System Integration		
Site Prep Work (Grading, Clearing, Power)	$251,000	$509,000
Wellhead Completions, Pumping Systems	$235,700	$471,500
Conveyance	$140,600	$276,200
Design and Construction Support (20%)	$125,500	$251,300
Permitting (10%)	$62,750	$125,650
Phase III Subtotal	**$815,550**	**$1,633,650**
New Groundwater System Subtotal	**$1,398,300**	**$3,033,650**
Project Contingency (30%)	**$419,490**	**$910,095**
New Groundwater System Total	**$1,817,980**	**$3,943,745**

Notes

- The Phase I program includes drilling one exploratory sonic borehole with completion as an observation well and drilling, constructing, and testing one test well
- The Phase I and Phase II planning level cost estimates do not account for tree clearing, grading, or access limitations
- While contingencies are built into the individual cost estimates for each phase of work, and additional 30% planning level contingency has been applied to the project subtotal to further account for variations in final quantities, market conditions, construction conditions, etc.

5. Results and Recommendations

GSI completed a reconnaissance-level study to assess the feasibility of developing a supplemental municipal groundwater supply capable of meeting the City's target capacity of approximately 300-500 gpm for 30 days. Overall, development of a supplemental groundwater system capable of meeting the City's target capacity appears feasible in terms of hydrogeology and water rights, although the following uncertainties must be resolved to confirm the project's feasibility:

- The two identified water rights alternatives (new groundwater permit application with instream mitigation and/or surface water to groundwater transfer) each have uncertainties and risks that cannot be resolved until OWRD has reviewed the submitted applications. The uncertainties, risks, and benefits associated with each alternative are summarized below:
  - New Groundwater Permit Application: Uncertainties associated with this alternative include: 1) whether OWRD would accept mitigation to resolve impacts to stream flows and listed fish species from a new use of groundwater, and 2) whether OWRD would determine that some or all of the identified well locations will cause injury to existing water users. The primary benefits of this alternative are that: 1) use of groundwater would typically not be subject to curtailment if OWRD were to regulate surface water (due to low flow), and 2) groundwater pumping would not be limited to the amount of streamflow (the City could pump groundwater at rates above the rate of available surface water).
  - Surface Water to Groundwater Transfer: Uncertainties associated with this alternative include: 1) whether OWRD would agree with GSI's stream depletion modeling, and 2) whether OWRD would determine that some or all of the identified well locations will cause injury to existing water users. Risks associated with this alternative include: 1) the City's use of groundwater would be limited to the amount of water lawfully available at the original point of diversion (on the surface water source) and 2) the right would be conditioned to allow OWRD to subordinate the right to any existing groundwater rights that are injured as the result of the transfer. The primary benefit of this alternative is that the transfer could be reverted if a groundwater system is determined to be unfeasible after drilling/testing.
- Based on GSI's understanding of the hydrogeologic setting, a minimum thickness of 50 feet of screenable saturated aquifer material is anticipated to be necessary to meet the target sustainable capacity of a single new well (75-100 gpm). Within the City's watershed, the thickness of the marine terrace deposits is estimated to range from 35-100 feet, with thicknesses increasing to the east (upland) and away from Ferry and Geiger Creek (see Figures 3 and 4). The actual thickness of screenable material and productivity of the aquifer must be verified with an exploratory drilling and testing program to confirm the feasibility of a supplemental groundwater supply.

Based on the preliminary feasibility results, GSI performed a well siting evaluation to identify potential well locations. Results of the well siting evaluation are presented on Figure 6, which identified six preferential well locations near the City's water treatment plant and twelve backup well locations as a contingency plan to account for the uncertainties associated with each water right alternative.

Following the identification of potential well locations a preliminary well design and planning level cost estimates for a new supplemental groundwater system were developed with the support of Dyer. The resulting preliminary well design is presented on Figure 7 and consists of a 110-foot deep, 12-inch diameter well with 50 feet of screen and accompanying filter pack. The planning level cost estimates include general allowances for design, permitting, construction oversight, and contingencies and were provided as a range to account for differences between potential well locations and the number of wells that may be required to meet the target capacity of 300-500 gpm for 30 days. The resulting planning level costs of a new supplemental groundwater system are provided on Table 4 and are estimated to range from approximately

$1.8 million to $3.9 million depending on the location and number of wells necessary to meet the City's target capacity.

If the City wishes to further pursue development of supplemental groundwater supply, the following sequence and schedule of activities is recommended:

1. Water Rights Transactions: Based on the expected outcome of each water rights alternative, GSI recommends further evaluating a surface water to groundwater transfer. GSI estimates that water rights permitting may cost between $14,000 -$25,000 (see Table 4) and take up to 3 months for preparation of the water right application plus up to 24 months for OWRD's review (or potentially 8-12 months if OWRD's Reimbursement Authority process is used). GSI does not recommend proceeding with exploratory drilling/testing until OWRD has reviewed the applications and issued preliminary decisions (a proposed final order and/or a draft preliminary determination) confirming the agency can approve the application, including the proposed well locations. GSI only recommends proceeding with the exploratory drilling and testing program if the Preferred or C Series Backup Well locations are approved by OWRD.
2. Exploratory Drilling and Testing Program: Develop bid documents for public procurement of a contractor to drill, construct, and test one test well and one observation well. GSI estimates that the exploratory drilling and testing program may cost between $189,000 - $337,500 (see Table 4) and take 4 months to develop contract documents and solicit/procure a contractor and another 3 months to drill, construct, and test the test well and observation well (subject to the availability of drilling contractors). If results of the exploratory drilling and testing program are favorable, GSI recommends finalizing the full-scale wellfield design and revising the planning level costs and schedule to construct and integrate a full-scale wellfield.

6. References

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ATTACHMENT A

Water Rights Feasibility Details

Water Solutions, Inc.

DRAFT ATTACHMENT A

City of Bandon – Water Rights Feasibility Details

To: Dan Chandler, JD, ICMA-CM / City of Bandon

CC: Steve Major, PE / The Dyer Partnership Engineers & Planners, Inc.

From: Ryan Dougherty, PE, RG / GSI Water Solutions, Inc.
Kim Grigsby / GSI Water Solutions, Inc.
Ted Ressler, RG, CWRE / GSI Water Solutions, Inc.

Date: December 27, 2021

1. Introduction

The use of groundwater for municipal water supply requires a water right from the Oregon Water Resources Department (OWRD). This attachment provides details associated with two options the City of Bandon (City) could potentially pursue to obtain authorization to use groundwater for municipal water supply.

1.1 Groundwater Permit Application

GSI conducted an evaluation of the opportunity for the City to obtain a new groundwater right that would authorize the use of groundwater for municipal purposes. As further described below, seeking a new groundwater permit would be challenging and it is likely OWRD would deny such a request.

1.1.1 Groundwater Permit Application Review Criteria

GSI's evaluation considered each of the review criteria that OWRD would consider when processing an application for a new groundwater permit. OWRD will review a permit application according to the following criteria:

1. Whether water is available
2. Whether the proposed use is consistent with its basin program rules
3. Whether the proposed use would cause injury to an existing water right
4. Whether the proposed use is consistent with other rules of the Water Resources Commission

The methods and likely outcome for each of these four criteria are discussed in further detail in the following subsections.

Whether Water is Available

Groundwater Availability

When reviewing a groundwater permit application, OWRD will first consider whether groundwater is available. Generally, OWRD will review local groundwater level hydrographs to determine whether groundwater is available for further development (i.e. groundwater levels are stable). In this case, GSI anticipates that OWRD would find that groundwater is available for the proposed use from the marine terrace deposits as multiple local wells with recent (post-2010) water level data suggest that water levels are relatively stable[1].

Potential for Substantial Interference with Surface Water

In addition to groundwater availability, OWRD will determine if the proposed use of groundwater would have the potential for substantial interference (PSI) with surface water. If OWRD finds PSI with surface water, then it subjects the groundwater use to regulatory limitations that are applicable to the adjacent surface water source, such as surface water availability. In making a PSI determination, OWRD will first consider whether a well is developing water from a confined or unconfined aquifer. Next, OWRD will determine whether the aquifer is hydraulically connected to surface water. In making this determination, OWRD will assume that a well less than one-quarter mile from a surface water source that produces water from an unconfined aquifer is hydraulically connected to the surface water. Finally, if the well is determined to produce water from an aquifer that is hydraulically connected to surface water, OWRD will determine whether it has the potential to cause substantial interference (PSI) with surface water. OWRD will assume that use of hydraulically connected groundwater will have PSI with surface water if it meets any of the four criteria:

1. The well is less than one-quarter mile from the surface water
2. The well is less than one mile from the surface water and groundwater would be pumped at a rate greater than five cubic feet per second (cfs)
3. The well is less than one mile from the surface water and groundwater would be pumped at a rate greater than one percent of the pertinent minimum perennial streamflow, senior instream water right, or the natural stream flow that is expected 80 percent of the time
4. The well is less than one mile from the surface water and groundwater pumped for a period of 30 days would cause stream depletion greater than 25 percent of the rate of appropriation.

To determine whether the City's proposed use of groundwater would have PSI with surface water, GSI first concluded that the City would develop groundwater from an unconfined aquifer that would be hydraulically connected to surface water (marine terrace deposits). GSI then created buffers from surface water sources in the City's watershed to assess how far from surface water new wells could be located. Although GSI determined that wells could be located more than one-quarter mile from surface water, GSI concluded there are essentially no locations near the City that exceed one mile from surface water. Thus, as shown in Figure 5, any proposed well included in a permit application would be less than one mile from surface water.

In the next step of a PSI evaluation for wells within one mile of surface water, OWRD will consider whether the proposed pumping rate would be more than one percent of specified flows rates for surface water sources within one mile from the proposed new well. In evaluating this criteria, GSI calculated one percent of the specified flow rates for surface water sources near the City (based on relevant minimum perennial streamflow, instream water right, or natural stream flow expected 80 percent of the time). The resulting pumping rates that would trigger PSI are provided below on Table 1.

Table 1. Pumping Rates Triggering PSI

Surface Water Source	Pumping Rate Limit (gpm)
Ferry Creek	1.3
Geiger Creek	1.8
Johnson Creek	0.09
Crooked Creek	4.5

As shown in Table 1, these flows are significantly lower than the City's target capacity for a supplemental groundwater supply (300-500 gpm). Therefore, a groundwater permit application for approximately 300-500 gpm would trigger PSI.

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[1] See water levels of COOS-3902, COOS-51116, and COOS-5117

Surface Water Availability

When OWRD concludes that a proposed use of groundwater would have PSI with surface water, the agency then considers whether surface water is available for the proposed use. OWRD would consider its Water Availability Analysis at 80 percent exceedance to make this determination. GSI reviewed OWRD's Water Availability Analysis for Ferry Creek, Johnson Creek, and Crooked Creek, and found that surface water is not available for new appropriation during any month of the year from these sources (OWRD's Water Availability Analysis does not have a report for Geiger Creek, so the agency would use the report for Ferry Creek, to which Geiger Creek is a tributary). Since surface water is not available, OWRD would conclude that water was not available for the City's proposed use of groundwater.

Basin Program Rules

OWRD will also consider whether the proposed use is consistent with the rules in the relevant basin program. The City and surrounding area is within OWRD's South Coast Basin. The basin program rules for that basin "classify" (allow) the use of groundwater for municipal use in the area near the City. Accordingly, OWRD should find that the use of groundwater for municipal purposes is consistent with the basin program rules.

Injury to Existing Water Rights

Next, OWRD will evaluate whether the proposed use will cause "injury" (excessive pumping interference) to existing water users. Injury can occur when the pumping operations of one well preclude an existing water user from obtaining their authorized/customary quantity of water. This phenomenon is commonly observed when wells are in close proximity and draw groundwater from the same aquifer system.

GSI evaluated the potential for injury (excessive pumping interference) from new wells located in the City's watershed[2]. Based on GSI's estimations of pumping interference, two existing water users would be impacted, which are discussed below:

- ODFW Fish Hatchery: The Oregon Department of Fish and Wildlife's (ODFW's) hatchery has a water right certificate for non-consumptive use of water from Ferry Creek. ODFW's water right certificate (7904) has a priority date of 7/20/1925, which is junior to some of the City's existing water rights (including Certificate 9754, see subsequent section). GSI believes it is unlikely that OWRD would determine that a full-scale wellfield would cause injury to ODFW's fish hatchery because a groundwater system by nature will result in less direct stream depletion than the City's existing surface water intakes.
- Exempt (Domestic) Wells: There are existing exempt (domestic) wells a few hundred feet north of the City's water treatment plant (along Houston Lane, Melton Road). These wells are exempt from needing a water right to use groundwater. Some of these wells are shallow (<50 feet) and therefore pumping interference from a full-scale wellfield could preclude the exempt wells from obtaining groundwater. GSI believes it is possible that OWRD would determine injury to existing exempt (domestic) wells from a full-scale wellfield depending on where the wells are located. New wells located near the City's water treatment plant would likely cause injury to the exempt wells while new wells located south of Ferry Creek would not likely result in injury to the exempt wells.

Overall, there is uncertainty as to whether OWRD would determine that the proposed use would cause injury to existing water users. As described above, the probability of causing injury (particularly to exempt wells) largely depends on where the new wells will be located. The identification and evaluation of potential well locations is discussed in the main body of the technical memorandum in Section 4.1.1. The uncertainties

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[2] Well interference (drawdown) was calculated using the Cooper-Jacob method for the following pumping scenario: unconfined aquifer conditions; individual well pumping rates of 75-100 gpm, pumping duration of 30 days, hydraulic parameters for the marine terrace deposits (see Table 1)

associated with causing injury to existing water users can only be resolved after an application has been submitted and OWRD's groundwater section has completed their review.

Consistency with OWRD Administrative Rules

Finally, OWRD will evaluate whether the proposed use of water is consistent with other OWRD administrative rules. Generally, the rules that OWRD considers for a groundwater application determined to have PSI would be those related to well construction and additional public interest review for impacts to fish listed under the state and federal Endangered Species Act. First, new wells should be constructed to comply with the relevant rules. Second, the Oregon Department of Fish and Wildlife (ODFW) and the Department of Environmental Quality (DEQ) would review the application for impacts to listed fish species. Since listed fish species are present and surface water is not available during any month, both agencies would likely recommend that OWRD either deny the application, or that the City provide mitigation to offset impacts to the affected surface water source.

1.1.2 Groundwater Permit Application Summary

GSI evaluated OWRD's review criteria for a new groundwater permit to determine the expected outcome of OWRD's review of a permit application filed by the City requesting the use of groundwater for municipal purposes. GSI concluded that OWRD would likely find the following with respect to the four review criteria:

1. Whether Water is Available: Although groundwater is available for the proposed use, the use would have PSI with surface water, and surface water is not available any month of the year. Accordingly, OWRD is expected to find that water is not available for the proposed use.
2. Basin Program Rules: The use of groundwater for municipal use is consistent with the basin program rules.
3. Injury to Existing Water Rights: There is uncertainty as to whether the proposed use would cause injury to existing water users. These uncertainties can only be resolved after an application has been submitted and OWRD's groundwater section has completed their review.
4. Consistency with OWRD Administrative Rules: ODFW and DEQ would be expected to recommend either denial of the application or require that the City provide mitigation to address impacts to listed fish species in the affected surface water source.

Based on the expected finding that water is not available for the proposed use, and recommendations from ODFW and DEQ, OWRD would likely deny an application for a new municipal groundwater permit from wells in the area of the City. Historically, one option to potentially change this outcome could be to provide mitigation to offset the impacts to surface water, as described below.

Potential to Mitigate for Surface Water Impacts

To obtain a new groundwater permit, the City would likely need to resolve the concerns described above regarding PSI, surface water not being available, and impacts to listed fish species. The method to resolve these issues has historically been to provide mitigation. However, OWRD has recently announced that it intends to stop allowing applicants to provide mitigation when water is not available for a proposed use. Further discussions with OWRD will be required to determine if OWRD will be implementing this new policy.

1.2 Surface Water to Groundwater Transfer

Since it appears unlikely that the City would obtain OWRD approval of an application for a new groundwater permit, GSI evaluated the opportunity for the City to change a portion of one of the City's existing surface water rights to allow the appropriation of the water from a new well. This change is referred to as a surface water to groundwater transfer. As described below, the surface water to groundwater transfer process is much more streamlined than the permit application process and is limited to an evaluation of injury to existing rights, enlargement of the right being modified, and "similar source" criteria. Consequently, this process may pose less of a challenge than obtaining a new groundwater right. It should also be noted that this evaluation is focused on the technical criteria and process; a deeper understanding of the City's water rights portfolio by GSI (status, development to date, infrastructure capacity, etc.) would be needed to further assess feasibility and to develop a potential implementation strategy.

OWRD can approve a surface water to groundwater transfer, if all of the following criteria are met:

1. The change would not cause injury to other existing water rights
2. The proposed change would not enlarge the right to be changed
3. The aquifer is hydraulically connected to the authorized surface water source
4. The proposed change would affect the surface water source similarly[3]
5. The well is located within 500 feet of the surface water source and within 1,000 feet upstream or downstream of the original point of diversion; or a licensed geologist prepares a report demonstrating that the above criteria are met.

GSI evaluated these review criteria to assess the expected outcome of OWRD's review of a transfer application requesting to change one of the City's surface water rights to allow the use of groundwater from one or more wells. GSI's review assumed that the City would develop groundwater from an unconfined aquifer that would be hydraulically connected to surface water (marine terrace deposits); therefore, the expected outcomes of the first three criteria would be the same as that of the groundwater permit application (see Section 3.1.2 for summary of expected outcomes). The remaining two criteria (criteria numbers four and five above) are evaluated below through a stream depletion analysis.

To evaluate the effect of a proposed transfer on surface water, GSI completed a preliminary analysis similar to that used by OWRD in their review of a surface water to groundwater transfer. Specifically, the Jenkins (1970) and Hunt (1999) streamflow depletion models were used to evaluate the furthest distance that new wells could be located from surface waterbodies to meet the conditions for a surface water to groundwater transfer (affecting the surface water source similarly[7]). Input parameters for these stream depletion models were based on hydraulic properties for the marine terrace deposits (see Table 1, based on BCWCD, 2004). Results of the stream depletion modeling suggests that new wells could be located over 3,000 feet from surface waterbodies (or anywhere within the City's watershed). Although preliminary and not utilizing site-specific hydrogeologic information, since the input parameters for the stream depletion model analysis presented here are based on hydraulic properties that OWRD co-authored , we have reasonable confidence that a surface water to groundwater transfer to wells completed in the marine terrace deposits may be possible anywhere within the City's watershed.

Based on the evaluation of OWRD's review criteria, GSI concluded that the agency would likely approve such a transfer application; however, the City should be aware that the approval order may include multiple conditions. First, in order to preclude enlargement of the right being transferred OWRD would limit the City's use of groundwater to the amount of water lawfully available at the original point of diversion (on the surface water source). In some cases OWRD has required a measuring device at the original point of diversion and the well to ensure compliance with this requirement. Second, the transfer approval order would likely also note that all restrictions that existed at the original surface water point of diversion shall apply to the proposed well(s). Finally, as part of the surface water to groundwater transfer process the right would be conditioned to allow OWRD to subordinate the right to any existing groundwater rights that are injured as the result of the transfer.

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[3] OWRD defines "similarly" to mean that the use of groundwater at the new wells affects the surface water source specified in the subject water rights and would result in stream depletion of at least 50 percent of the rate of appropriation within 10 days of continuous pumping.

APPENDIX F: COMMENTS

CITY OF BANDON

OFF-CHANNEL RESERVOIR FEASIBILITY STUDY 2016

Prepared By:

The Dyer Partnership

Engineers & Planners, Inc.

Engineers, Planners, Surveyors,
Water, Wastewater, Transportation

Project 101.92 August 2016

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SECTION 1:
INTRODUCTION

SECTION 1: INTRODUCTION

This feasibility study is being prepared to evaluate the Off-Channel Reservoir project in Bandon, Oregon in detail and outlines the steps taken and methods used for completion of the evaluation. This study has been prepared under a grant from the Water Conservation, Reuse and Storage Grant (Grant GA-0101-17) administered by the Oregon Water Resources Department. The objective of the proposed Off-Channel Reservoir project is to establish off-channel storage to insure municipal water supply during low flow or drought conditions from water diverted from Ferry Creek and so that instream flows can be better managed to meet the needs of irrigators and improve late summer fish passage conditions.

The proposed reservoir would be located off Cardinal Lane, approximately 0.3 miles southwest of the diversion on Ferry Creek and 0.2 miles west of Geiger Creek Reservoir. The reservoir site would be located entirely on property owned by the City of Bandon. Figure 1.1 shows a vicinity map of Bandon.

The proposed reservoir would be designed to store up to a maximum of 100 acre-feet of water diverted from Ferry Creek utilizing the City's existing point of diversion and pump station. Water would be piped to the reservoir in a new 12-inch diameter pipe that would use the existing utility easement and parallel the City's treated water main. Water would be diverted from the Ferry Creek during the peak runoff season for raw water storage. The stored raw water would be used to supply municipal needs during tourist season and to directly supplement late summer flows in Ferry and Geiger Creeks.

The proposed Off-Channel Reservoir project is expected to benefit multiple uses such as instream flow, water supply, instream and riparian habitat and water quality. The proposed project should allow for water management that would better meet both instream and out-of-stream needs.

Climate models suggest that the state's average summer precipitation will decline in the future and that the wildfire threat is projected to increase. The proposed Off-Channel Reservoir would provide the City resiliency and security for the predicted climate change and the resulting increased wildfire threat.

Study Description

The following includes a brief description of the scope of work and purpose of the feasibility study. In general, the feasibility study was prepared to identify deficiencies or challenges that would prevent implementation of the project and to more clearly define the benefits and costs associated with implementation and long-term operation of the project.

Panoramic view of Lot 2400 after brush was cleared in May 2014.

Scope of Work

The scope of work approved by Oregon Water Resources Department for development of this feasibility study included the following tasks:

Task 1. Complete Water Rights Analysis – This task included determining the means by which surface water will be diverted to fill the proposed reservoir. This task assessed the feasibility of the following options: water right permit amendment; water right transfer; new storage water right permit and new surface water right from reservoir; or use of existing surface water rights. This task included coordinating with Oregon Water Resources Department on how to successfully navigate the administrative issues associated with providing permitted water for the project.

Task 2. Complete Biological Assessment, Wetlands Delineation, Environmental Resources Review, Analysis of Permitting Issues – This task included the preparation of a Biological Assessment, following the outline and format of RUS Bulletin 1794-602, Section "3.5.1 Biological Resources Information: Threatened and Endangered Species; Fish and Wildlife: Vegetation". The assessment included a review of state and federal lists of threatened or endangered species and candidate species that may be affected by the project. The fish, wildlife and vegetation resources within the project area are described and the short term and long term affects to these resources is discussed. A wetland investigation was conducted to determine whether there were any wetlands present in the project area. A plant survey was conducted in mid-July 2016 to determine if the Western lily, *Lilium occidentale* was present in the vicinity of the project site.

Task 3. Assess Environmental and Archaeological Impacts -This task conducted a wetland delineation to determine if wetlands are present in the area, using online and regulatory sources. The site was examined on foot for the presence of hydrophytic vegetation, wetland hydrology, and hydric soils. This task also included a complete assessment with Oregon Department of Fish and Wildlife (ODFW), U.S. Fish and Wildlife Service, Oregon State Historic Preservation Office (SHPO), Coquille Indian Tribe of environmental or archaeological impacts to the site.

Task 4. Assess Impact To Other Water Users And To The Fish Hatchery - This task assessed the impact of the proposed off-channel reservoir to other water users in the drainage and to ODFW's Bandon Fish Hatchery, including the development of a recommended operating scheme that would maximize the use of the reservoir to benefit instream flow resources and supply municipal needs.

Task 5. Identify Permits and Prepare Permit Applications -This task analyzed the permitting issues and requirements for the proposed project. Necessary permits were identified and the applications were prepared and submitted.

Task 6. Hydrological Investigation – This task included field gathering of flow data on Ferry and Geiger Creeks to determine natural inflow and hydrologic conditions of the basin tributary to the proposed reservoir.

Task 7. Geotechnical Exploration – This task included subsurface soil sampling, testing, and preparation of a report to address the geotechnical suitability of the site for reservoir construction and provide recommendations for design of the reservoir embankment.

Task 8. Cost Estimate – This task included development of a total estimate of reservoir construction costs and long-term operation and maintenance costs.

Task 9. Identify Financing Opportunities and Rate Impact Analysis – This task identified funding options and investigated impacts of construction and O&M costs to water rates.

Task 10. OAR 690-600-0050 (2) Planning Study Criteria – This task identified planning study criteria additional obligations as required by OAR 690-600-0050(2)

a. Analyses of by-pass, optimum peak, flushing and other ecological flows of the affected stream and the impact of the storage project on those flows;

b. Comparative analyses of alternative means of supplying water, including but not limited to the costs and benefits of conservation and efficiency alternatives and the extent to which long-term water supply needs may be met using those alternatives;

c. Analyses of environmental harm or impacts from the proposed storage project; and

d. Evaluation of the need for and feasibility of using stored water to augment in-stream flows to conserve, maintain and enhance aquatic life, fish life and any other ecological values;

e. In addition, if the storage project is for municipal use, the grant agreement will require an analysis of local and regional water demand and the proposed storage project's relationship to existing and planned water supply projects.

Feasibility Study Purpose

The purpose of this feasibility study is to identify and address the necessary requirements and the costs of implementing the project so that the City can make informed decisions on how to fund and construct the project. The feasibility study is also intended to identify and evaluate weaknesses or barriers that could prevent implementation of the project.

Based on the available data collected, this site has been determined to be suitable for reservoir construction. Detailed reservoir design analysis will be completed when the rest of the site has been cleared and is accessible.

Proposed Schedule for Off-Channel Reservoir Construction

The proposed schedule for the Off-Channel Reservoir is dependent upon funding opportunities becoming available. The City plans to apply for funding as soon as the feasibility study is complete and is in the process of developing plans to take a bond issue to the voters.

SECTION 2:
BACKGROUND

SECTION 2: BACKGROUND

The City of Bandon owns two reservoirs in which raw water is stored. One reservoir is on Ferry Creek and the other is on Geiger Creek. Ferry Creek Reservoir can store no more than a maximum of 5 acre-feet of its 20-5/8 acre-feet permitted water right and Geiger Creek Reservoir can store a maximum 3 acre-feet of its 90 acre-feet of permitted water right, if they were dredged. However, a survey conducted in 2014 determined that total existing capacity for both reservoirs was only 3.38 acre-feet. Expanding storage for these two reservoirs would be very expensive, problematic due to permitting issues, difficult to get through the dam safety approval process, and challenging because both dams are owned Oregon Department of Fish and Wildlife (ODFW).

The proposed reservoir site is situated on two parcels located on Cardinal Lane outside Bandon city limits. Lot 2300 was logged sometime prior to 1994 and doesn't appear to have been reforested. Lot 2400 is currently timberland. The site is fairly flat with a slope ranging from 0.5% to a maximum of 5.0%. This topography is favorable for constructing a reservoir that would be approximately 11.5 acres in size, 6 to 8 feet higher than the average base elevation, and approximately 16 feet deep, total. Figure 2.1 shows the vicinity map and Figure 2.2 shows a contour map of the site.

This site is close to the City's Water Treatment Plant. There is an easement that follows the boundary of the adjacent property that allows for the installation of a transmission line. This transmission line would supply the reservoir with water from the City's existing point of diversion on Ferry Creek and allow transportation of water from the reservoir to the treatment plant. In addition, the average base elevation of the site is 123 feet, which is close to the elevation of the water treatment plant and would allow utilization of the same pump station currently used. Access to the proposed reservoir is via a private road for which the City has both utility and access easements. There is existing electrical access available from Bandon Electric.

The water stored in the reservoir will be procured from the City's existing point of diversion on Ferry Creek in accordance with Oregon Water Resources Department's requirements. Water right applications for a new storage right and the right to withdraw from the reservoir are in the process of being completed for submission to Oregon Water Resources Department.

The proposed reservoir would be surrounded by a vegetative buffer, a minimum of 50 feet wide, and would be enclosed by a six (6) foot tall security fence. The proposed reservoir would be lined to prevent water loss and intrusion from nearby surface and groundwater sources and it would be covered to prevent evaporation loss, reduce water temperature, and to prevent waterfowl and mosquito use.

The proposed site is not located within a flood hazard area. Construction of a reservoir at this site will not alter any water courses. The proposed use will not force a significant change in, or significantly increase the cost of, accepted farming or forest practices on agriculture or forest lands in the surrounding area.

Prior to construction activities, timber and brush will be cleared from the site and this activity will subject property owners in the nearby area to noise and smoke for a limited time. Cardinal Lane will be impacted by the log trucks transporting timber offsite. It is anticipated that most of the on-site material will be suitable for use in the construction of the reservoir and upland storage site, so Cardinal Lane will be minimally impacted. Property owners will be notified prior to these activities being conducted and Cardinal Lane will be maintained during this work and returned to as good or better condition.

Once constructed, the reservoir will not emit any sound. No dwellings or other buildings shall be constructed on this site. A 50-foot vegetated buffer will be constructed around the perimeter so the reservoir will not be visible from adjacent properties. Trees within this buffer will be removed as needed to prevent wind-thrown trees from damaging the reservoir. A security fence will be constructed around the perimeter of the reservoir to prevent wildlife from entering the reservoir. The reservoir will need little regular maintenance, so use of the access road will be limited to annual reservoir cleaning and brushing and mowing.

SECTION 3:
BIOLOGICAL ASSESSMENT

SECTION 3: BIOLOGICAL ASSESSMENT

A complete Biological Assessment (BA) was prepared by an environmental consultant, Land And Environmental Services, Inc. The BA follows the outline and format of RUS Bulletin 1794A-602, Section "3.5.1 Biological Resources Information: Threatened and Endangered Species; Fish and Wildlife; Vegetation". The assessment includes a review of state and federal lists of threatened or endangered species and candidate species, and identification of any listed species or critical habitat that may be affected by the project. The fish, wildlife and vegetation resources within the project area are described and the short term and long term affects to the resources are discussed. The BA includes a plant survey to determine if the endangered Western lily, *Lilium occidentale* is present in the vicinity of the project.

BIOLOGICAL ASSESSMENT
CITY OF BANDON
OFF-CHANNEL RAW WATER RESERVOIR
BANDON, COOS COUNTY, OREGON
T28S R14W Section 29, TL 2400, 2300, 900, 2200

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July 2016

ACRONYMS

BA – Biological Assessment
CH – Critical Habitat
COE – U.S. Army Corps of Engineers
DPS – Distinct Population Segment
DSL – Oregon Department of State Lands
EFH – Essential Fish Habitat
ESU – Evolutionary Significant Unit
ER – Environmental Report
LAWESI – Land And Water Environmental Services, Inc.
OC – Oregon Coast
ODA – Oregon Department of Agriculture
ODFW – Oregon Department of Fish and Wildlife
ORBIC – Oregon Biodiversity Information Center
OWRD – Oregon Water Resources Department
MSA – Magnuson-Stevens Fishery Conservation Management Act
NOAA – National Oceanographic and Atmospheric Administration
NMFS – National Marine Fisheries Service
NRCS – Natural Resources Conservation Service
USDA – U.S. Department of Agriculture
USFWS – U.S. Fish and Wildlife Service

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APPENDICES

EXECUTIVE SUMMARY

This document is the Biological Assessment (BA) for the City of Bandon Off-Channel Raw Water Reservoir project. The purpose of the project is providing the community with adequate water during periods of drought and low water flow. The action site location is east of Bandon (See Vicinity Map, Appendix A), found on Coos County Tax Assessor Map#28S14W29C. The reservoir will be located on tax lot numbers 2400 and 2300, and a pipe line will be installed in the utility easement of lots 900 and 2200. The new pipeline will be routed under Ferry Creek to the pump station on the east side of Ferry Creek, and will parallel the existing treated water line in the existing utility right-of-way to the reservoir. (See Site Plan, Appendix D.)

This BA was prepared by Land And Water Environmental Services, Inc. for The Dyer Partnership Engineers and Planners, Inc. The Oregon Water Resources Department (OWRD) is the funding agency.

The action site is located in the Lower Coquille hydrological unit (HUC 1710030507), near the confluence of Geiger Creek and Ferry Creek. Ferry Creek enters the Coquille River estuary approximately 1.25 straight line miles from the point of diversion for this project. (See Portion of USGS Map, Appendix B.)

The soil type of the proposed reservoir site is Bullards sandy loam, 7-12% slopes, which is a non-hydric soil but can have inclusions of Blacklock fine sandy loam which is hydric. (See Soil Map and Legends, Appendix E.) No wetlands were found on the action site.

The potential reservoir site is approximately 300 feet west of Geiger Creek, but at a higher elevation than the stream. The reservoir site location is 118-127 feet above mean sea level. Geiger Creek is at approximately 80 feet above mean sea level, flowing north toward its confluence with Ferry Creek.

Comments and guidance were sought from the resource Agencies and others with knowledge pertinent to the conditions of the habitat, and the likelihood of cultural resources on the action site. (See Responses to Requests for Comments, Appendix G.)

The species considered in this biological assessment occur, or historically occurred, in Coos County as recorded by the Oregon Biodiversity Information Center (ORBIC).

A two mile radius data search of species records was obtained from ORBIC. Ten of the species which will be considered in this BA have records of being present within the two mile radius of the project site. These species are: *Arborimus albipes* (White-footed vole), *Bassariscus astutus* (Ringtail), *Charadrius nivosus nivosus* (Western snowy plover), *Lilium occidentale* (Western lily), *Oncorhynchus kisutch* (OC coho), *Oncorhynchus mykiss* (Steelhead), *Oncorhynchus tshawytscha* (Chinook), *Phacelia argentea* (Silvery phacelia), *Plebejus saepiolus littoralis* (Coastal greenish blue butterfly), and *Progne subis* (Purple martin).

The anadramous fish, the white-footed vole, and the Western lily are those species most suited to the available habitat in the vicinity of the action site.

The white-footed vole is likely to be located in Section 19, but would be found near the streams, living in alders, on which they feed. Best management construction practices, especially in the riverine zone must be utilized.

Western lily habitat was not found on the action site. A survey was preformed during this species flowering period on 15 July 2016 to make sure they were not missed in the thick scrub/shrub habitat. The shrub/scrub vegetation was removed in late January, and although during the April site visit it appeared that new growth was returning, the July site visit revealed that the rebound grown had been limited. The site was surveyed by Madeleine Vander Hayden of USFWS, LAWESI and Dyer Partnership personnel.

The streams near the action site are Essential Salmonid Habitat (ESH). The National Marine Fisheries Service has requested that the City apply through the Habitat Conservation Planning process for an incidental take permit. If federal money is sought for this project in the future then full consultation would be required.

Concurrently with the biological assessment, the likelihood of cultural resources on the action site was researched by contacting the archaeologist of the Coquille Tribe and the State Historic Preservation Office. There are no records of cultural resources on the site, but if artifacts or remains are found during construction, activity should stop and the Coquille Tribe and the State Historic Preservation Office should be contacted.

INTRODUCTION

Proposed Action

The City of Bandon, Oregon is proposing to build an off channel raw water reservoir to prevent future water shortfalls. This document is the biological assessment for the proposed site. Issues evaluated during the writing of this document include the possible impacts on or near the project site to biological resources.

Land And Water Environmental Services, Inc. (LAWESI) of Oakland, Oregon preformed this biological assessment for The Dyer Partnership Engineers and Planners of Coos Bay, Oregon.

The proposed site where the reservoir would be located is found at T28S R14W Sec. 29 on the Bandon 7.5 minute Quadrangle, 1970, and has the Coos County Tax Lot numbers 2400 and 2300 on Map# 28S14W29C. There will be a pipe line installed across lot 900 and lot 2200, within an existing utility easement where there are currently other utilities. A pump station in Ferry Creek will divert water from the creek to the reservoir during high flow conditions in Ferry Creek. Water from the reservoir will be pumped to the water treatment plant to provide water for the City during low flows in the summer, and a portion will be returned to Ferry Creek to supplement stream flow. The point of diversion is on the east side of Ferry Creek at the Bandon Fish Hatchery. Approximately 10 acres of scrub/shrub habitat and 10 acres of coniferous woodland habitat would be converted to a water storage reservoir.

Alternative Actions Considered

Dredging and repair of the reservoirs on Ferry and Geiger Creeks was one of the alternatives considered to expand water storage. Expanding the storage capacity of the current reservoirs is problematic due to expense, permitting issues, the dam safety approval process, and ownership of the dams, only one of which is owned by the City.

Another option considered was installing a new 1.0 or 2.0 million gallon treated water tank. This option is far more expensive per gallon of water than a raw water storage reservoir.

The City owns an alternate parcel similar to the proposed site, which was considered, but which does not at this time have utilities.

The no action alternative would mean that the City remains vulnerable to periods of drought and low stream flows.

The proposed action would provide water storage for the City of Bandon against times of drought and low water flow, and supplement Ferry Creek during low flows. An off channel reservoir is less of an environmental risk during construction than repairing the in channel reservoirs.

BIOLOGICAL RESOURCES

The purpose of this biological assessment is to consider the effects this project may have on the biological resources in the area of the site being considered for the City of Bandon raw water storage reservoir. Approximately 10 acres of scrub/shrub habit and 10 acres of coniferous woodland habitat would be converted to a water storage reservoir.

The site is located in the Lower Coquille hydrological unit (HUC 1710030507), near the confluence of Geiger Creek and Ferry Creek. Ferry Creek enters the Coquille River approximately 1.25 miles from the point of diversion for this project. The point of confluence of Ferry Creek with the River is at the Coquille River Estuary near the boat basin, approximately river mile one.

The site of the proposed reservoir is approximately 300 feet west of Geiger Creek, but at a higher elevation than the stream. The reservoir site location is 118-127 feet above mean sea level. Geiger Creek is at approximately 80 feet above mean sea level, flowing north toward its confluence with Ferry Creek.

The project site is located in the coastal lowlands of the Coast Range Ecoregion. The soil is Bullards sandy loam, 7 to 12 percent slopes which is a non-hydric soil, but can have inclusions of Blacklock fine sandy loam which is hydric.

The species considered in this biological assessment occur, or historically occurred, in Coos County as recorded by the Oregon Biodiversity Information Center (ORBIC).

Mammals: Threatened or Endangered Species

In addition to the species considered in this document there are seven whale species listed by National Marine Fisheries Service (NMFS) and Oregon Department of Fish and Wildlife (ODFW) which may occur off the coast of Coos County, but have no habitat on this site and are not enumerated in this document.

Canis Lupus (Gray wolf) is listed by United Sates Fish and Wildlife Service (USFWS) and by ODFW as endangered. Grey wolves can survive in a variety of habitats. At the present time in western Oregon, wolves are only found in the Cascades. During the course of this biological assessment the gray wolf was delisted by the state of Oregon. At this point in time there are believed to be 110 wolves in residence in Oregon. Wolves west of Hwys. 395-78-95 remained protected by USFWS.

Enhydra lutris (Sea otter) is listed by ODFW as threatened. Sea otter are found in the Marine and Estuarine Ecoregion. The project site is in the Coastal Ecoregion.

Eumetopias jubatus (Stellar sea lion, aka Northern sea lion) is listed by NMFS as threatened. Northern sea lion are found in the Marine and Estuarine Ecoregion. The project site is in the Coastal Ecoregion.

Ursus arctos (brown bear) is listed by USFWS as threatened. This species is considered extirpated from the state of Oregon.

Mammals: Proposed, Candidate, Species of Concern, and Sensitive Species

Arborimus albipes, aka *Phencomys albipes* (White-footed vole) is designated by USFWS as a species of concern. White-footed vole are found in wooded riverine habitat with thick shrub undergrowth where red alder and hazel are available. There are ORBIC data records of white-footed vole occurring near the project site. The wooded areas along Geiger and Ferry Creeks may be habitat for the white-footed vole. The construction plans for this project should include management practices that will minimize disturbance to the riverine zone during construction.

Arborimus longicuadus (Red tree vole), north coast DPS, is designated by USFWS as a candidate species and by ODFW as a sensitive (vulnerable) species. Red tree voles are mostly arboreal and found in mature conifers where they eat the new growth tips. This species is more likely to be found at locations moderately higher in elevation than the project site, in the Coast Range with mature conifer forest.

Bassariscus astutus (Ringtail) is designated by ODFW as a sensitive (vulnerable) species. Ringtails are nocturnal, and though seldom seen sometimes live in buildings, though their natural preference is for rocky areas near water. There is an ORBIC data record of this species in the City of Bandon. There may be ringtail in the area, but the thick shrub/scrub of the project site is not the rocky habitat ringtails prefer.

Corynorhinus townsendii townsendii (Townsend's western big-eared bat) is designated by USFWS as a species of concern and by ODFW as a sensitive (critical) species. This species prefers cavern like structures such caves and mines, but will roost and hibernate in buildings. There are no caves, mines, or buildings on the project site.

Lasionycteris noctivagans (Silver-haired bats) is designated by USFWS as a species of concern and by ODFW as a sensitive (vulnerable) species. This bat is found in the fissures of tree bark, buildings, rocks, and wood piles. The trees remaining on the project site are not mature enough to have fissured bark for bats to roost.

Martes caurina (Pacific marten), Coastal population, is designated by ODFW as a sensitive (vulnerable) species. Pacific marten are omnivores, and the many species of berries found in the project area rate highly in their diet. The project area was in the historical the range of this species, but the fragmentation of the forest so near a coastal town has decreased the range value for this species.

Myotis californicus (California myotis) is designated by ODFW as a sensitive (vulnerable) species. In the winter this bat roosts in caves, mines, and buildings. In the summer it can be found in a wider range of places including trees and shrubs. It is likely that there are bats in the area. The trees remaining on the project site are not mature enough to have fissured bark for bats to roost.

Myotis evotis (Long-eared bat) is designated by USFWS as a species of concern. This species is found in a variety of areas and roosts in tree bark, caves, and buildings. In the Pacific Northwest this bat prefers tall snags reaching into or above the forest canopy. There are likely bats found in the area, but this project will not impact any likely bat roosting habitat.

Myotis thysanodes (Fringed myotis) is designated by USFWS as a species of concern and by ODFW as a sensitive (vulnerable) species. This bat is found in oak, pinion, juniper; desert scrub habitat. The fringed myotis breeds in large colonies and roosts in caves, mines, and buildings. There is no likely roosting habitat for this species on the project site.

Myotis volans (Long-legged myotis) is designated bu USFWS as a species of concern and by ODFW as a sensitive (vulnerable) species. This bat roosts in trees, crevices, and buildings. There are likely bats found in the area, but this project will not impact any likely bat roosting habitat.

Myotis yumanensis (Yuma myotis) is designated by USFWS as a species of concern. Found near forests and water where they feed on associated insects, this bat species roosts in a variety of places but nurseries are usually in tree cavities. The remaining trees in this location are not mature enough to provide nursery habitat.

Pekania pennanti aka *Marte pennanti* (Fisher) USFWS has proposed threatened status for the west coast DPS, and ODFW has designated fisher as a sensitive (critical) species. This species prefers closed canopy forests, and at this point in time is not found in the Coast Range.

Birds: Threatened or Endangered Species

Brachyramphus marmoratus (Marbled murrelet) is listed by USFWS and ODFW as threatened, and critical habitat has been designated. Marbled murrelet is a seabird that seeks mature conifers to lay their eggs since they do not build nests but instead lay their eggs directly on broad limbs. The eastern portion of the project site has coniferous woods, but with inadequate limbs for nest platforms.

Charadrius nivosus nivosus (Western snowy plover) is listed by USFWS and ODFW as threatened, and critical habitat has been designated. There are ORBIC records of Western snowy plover on beaches within a 2 mile radius of the project site. This ocean shore bird nests on sand beaches. The project site does not contain habitat for this species.

Pelecanus occidentalis californicus (California brown pelican) has been delisted by USFWS, but is listed by ODFW as endangered. Brown pelican is an ocean bird that may be found on the coast and estuary from April through October. The project site does not contain habitat for this species.

Strix occidentalis caurina (Northern spotted owl) is listed by USFWS and ODFW as threatened, and critical habitat has been designated. Spotted owls nest in mature dense coniferous forest. The woodland habitat remaining on the project site is not adequate for this species.

Phoebastria albatrus (Short-tailed albatross) though not found in ORBIC, this species is listed by USFWS and ODFW as endangered. There is no habitat for this ocean bird on the project site.

Birds: Species of Concern, and Sensitive Species

Accipiter gentilis (Northern goshawk) is designated by USFWS as a species of concern and by ODFW as a sensitive (vulnerable) species. This raptor prefers closed canopy forest in remote settings at elevations between 1,900 and 6,100 feet for summer breeding, may be present in Coast Range in the winter. The woodland habitat remaining on the project site is not adequate for this species.

Athene cunicularia hypugaea (Western burrowing owl) is designated by USFWS as a species of concern and by ODFW as a sensitive (critical) species. This bird nests in vacated burrows and culverts, and prefers grassland, shrub steppes, and savannah. Burrowing owl is more likely to be found in eastern Oregon.

Cerorhinca monocerata (Rhinoceros auklet) is designated by ODFW as a sensitive (vulnerable) species. This seabird nests in colonies, creating burrows in coastal headland areas. There is no habitat for this species on the project site.

Contopus cooperi (Olive-sided flycatcher) is designated by USFWS as a species of concern and by ODFW as a sensitive (vulnerable) species. Preferred habitat is forest edges and riparian zones. Could be in the area May through August near streams.

Empidonax traillii brewsteri (Little willow flycatcher) is designated by ODFW as a sensitive (vulnerable) species. This bird breeds in heavy shrub habitat, preferring willows and riparian area. Cow bird parasitism is a serious problem for this species. May be found in the area near streams.

Falco peregrinus anatum (American peregrine falcon) is designated by ODFW as a sensitive (vulnerable) species. In the Pacific Northwest peregrine falcons are known to hunt for birds on beaches and dunes especially during the winter. This species may be in the vicinity but probably not on the project site.

Fratercula cirrhata (Tufted puffin) ODFW sensitive (vulnerable) species. This bird is an ocean cliff dweller. There is no habit on the project site for this species.

Haematopus bachmani (Black oystercatcher) is designated by USFWS as a species of concern and by ODFW as a sensitive (vulnerable) species. This bird is found along rocky shores, and gravel beaches along the coast. There is no habit on the project site for this species.

Haliaeetus leucocephalus (Bald eagle) is designated by ODFW as a sensitive (vulnerable) species. Though delisted by USFWS this species remains protected under the Bald and Golden Eagle Protection Act (Eagle Act). Prefers to nest in trees near large bodies of water. No nesting trees for were found on the action site.

Histrionicus histrionicus (Harlequin duck) is designated by ODFW as a sensitive (vulnerable)species. This bird nests near mountain streams in the summer, then returns to rocky coastal areas during the winter. There is no habit on the project site for this species.

Icteria virens (Yellow-breasted chat) is designated by USFWS as a species of concern. This bird's preferred habitat is dense scrub/shrub near a riparian zone. The yellow-breasted chat is a rare summer visitor to the Oregon coast north of Curry County.

Melanerpes formicivorus (Acorn woodpecker) is designated by USFWS as a species of concern. Acorn woodpeckers prefers open oak and mixed woodland. Likely extirpated from Coos County since the 1990's.

Melanerpes lewis (Lewis's woodpecker) is designated by USFWS as a species of concern and by ODFW as a sensitive (critical) species. The Lewis' woodpecker prefers pine-oak forest, riparian woodland, and orchards. Rarely found on the coast.

Oreortyx pictus (Mountain quail) is designated by USFWS as a species of concern. Preferred habitat of the mountain quail is brushy mountain areas, but is occasionally in the winter found on the coast in the transitional areas between beachgrass and forest, and sometimes at feeders.

Patagioenas fasciata aka *Columba fasciata* (Band-tailed pigeon) is designated by USFWS as a species of concern. This bird's preferred habitat is coniferous forest, and riparian areas. Usually found at higher elevations that the project area, but is adapting to city life.

Podiceps grisegena (Red-necked grebe) the breeding population is considered by ODFW a sensitive (critical) species. This grebe winters on the coast in protected saltwater. The breeding population is found in summer at Upper Klamath Lake.

Pooecetes gramineus affinis (Oregon vesper sparrow) is designated by USFWS as a species of concern. This sparrow's preferred habitat is grassland and farmland where it nests under low shrubs. Rare on the coastal slopes of Coos County.

Progne subis (Purple martin) USFWS species of concern, ODFW sensitive (critical) species. There is an ORBIC record of purple martin nesting in boxes in Bandon. Purple martin nest in summer months in western Oregon in a variety of open land from clear cuts to parks. The scrub-shrub habitat present before the site was cleared, and the forest habitat are too dense for this bird.

Ptychoramphus aleuticus (Cassin's auklet) is designated by ODFW as a sensitive (vulnerable) species. Cassin's auklet is a seabird that feeds in the ocean and nests colonially, burrowing on cliffs and islands along the coast. There is no habitat on site for this species.

Sialia mexicana (Western bluebird) is designated by ODFW as a sensitive (vulnerable) species. Blue bird's preferred habitats include open conifer forest, oak woodland, and farmland. The habitat available on the project site is thick shrub and woodland with heavy undergrowth, not the preference of this specie.

Reptiles: Threatened or Endangered Species

There are four species of marine turtles listed by NMFS and ODWF as endangered or threatened which may occur in the Marine and Estuarine Ecoregion along the coast of Coos County. There is no habitat for these marine turtles on the project site, and they are not enumerated in this document.

Reptiles: Species of Concern, and Sensitive Species

Actinemys marmorata (Western pond turtle) is designated by ODFW as a sensitive (critical) species. The subspecies *Actinemys marmorata marmorata* (Northern Pacific pond turtle) is designated by USFWS as a species of concern. The pond turtle's preferred habitat is near ponds and small streams. This species may be present in the nearby streams, Geiger and Ferry Creeks. The construction plans for this project should include management practices that will minimize disturbance to the stream areas during construction.

Amphibians: Species of Concern, and Sensitive Species

Anaxyrus boreas aka *Bufo boreas* (Western toad) is designated by ODFW as sensitive (vulnerable) species, but is recorded in ORBIC with a question mark for Coos County. The preferred breeding habitat of this species is marsh or shallow lakes, near woodland. There maybe areas near, but not on the project site where this species could lay eggs.

Aneides ferreus, (Clouded salamander) is designated by ODFW as sensitive (vulnerable) species. The clouded salamander is found in moist forests, clear cuts, and burns where it lives in the decaying wood of large conifers and feeds on invertebrates; also found sheltering in rock crevices. The project site lacks the type of woody debris on which this species depends.

Ascaphus truei (Coastal tailed frog) is designated by USFWS as a species of concern and by ODFW as a sensitive (vulnerable) species. This species is found in cool coastal streams in the Coast Range and Cascades. The tailed frog may be in streams near the site, but are not likely to be found on the project site. The construction plans for this project should include management practices that will minimize disturbance to the stream areas during construction.

Plethodon elongatus (Del Norte salamander) is designated by USFWS as a species of concern and by ODFW as a sensitive (vulnerable) species. Found in rocky outcrops of forests. This species' range extends from southern Coos County south to Humboldt and Trinity Counties in California. Not found in the project area.

Rana boylii (Foothill yellow-legged frog) is designated by USFWS species of concern and by ODFW as a sensitive (vulnerable) species. This frog species is found near permanent streams and may be found at the streams near this project. The construction plans for this project should include management practices that will minimize disturbance to the stream areas during construction.

Rhyacotriton variegatus (Southern torrent salamander) is designated by USFWS as a species of concern and by ODFW as a sensitive (vulnerable) species. This species is found in cool streams near coniferous forest in the Coast Range, and might be found at the streams near this project. The construction plans for this project should include management practices that will minimize disturbance to the stream areas during construction.

Fish: Threatened or Endangered Species

Acipenser medirostris, Green sturgeon (Southern DPS) is listed by NMFS as threatened and critical habitat has been designated. Sturgeon spend much of there life in the ocean but enter major rivers along the Pacific coast to spawn. The rivers and estuaries where the southern distinct population segment of *Acipenser medirostris* run are the Sacramento River and rivers south of the Sacramento. The small streams nearest the project site are not habitat for sturgeon.

Oncorhynchus kisutch, Coho salmon aka OC coho (Oregon Coast ESU) is listed by NMFS as threatened and freshwater streams along the Oregon Coast are designated critical habitat under section 305 of the Magnuson-Stevens Fishery Conservation and Management Act (MSA). Under MSA, Essential Fish Habitat (EFH) is designated if the stream is or was historically accessible to coho and Chinook salmon. Although OC coho is not listed by ODFW, Essential Salmonid Habitat (ESH) has been designated for OC coho based on the OC coho Evolutionary Significant Unit (ESU), and is designated a sensitive (vulnerable) species. There are ORBIC records of coho salmon (pop. 3) within a 2 mile radius of the project site, and this species is known to be in Ferry Creek. The construction plans for this project should include management practices that will minimize disturbance to the stream areas during construction.

Thaleichthys pacificus, Eulachon aka smelt (Southern DPS) is listed by NMFS as threatened and critical habitat has been designated. The Umpqua River to the north and the Klamath River to the south are included in the critical habitat. Smelt run in larger rivers than the small streams near the project site.

Fish: Species of Concern, and Sensitive Species

Acipenser medirostris, Green sturgeon (Northern DPS) is designated by NMFS as a species of concern and by ODFW as a species of concern. Sturgeon spend much of there life in the ocean but enter major rivers along the Pacific coast to spawn. The rivers and estuaries where the northern distinct population segment of *Acipenser medirostris* run are the Klamath River and rivers north of the Klamath. The small streams nearest the project site are not habitat for sturgeon.

Entosphenus tridentatus, Pacific lamprey is designated by USFWS as a species of concern and by ODFW as a sensitive (vulnerable) species. Lamprey spend the majority of their life (3-7 years) living in a larval stage as filter feeders in the sand. As adults they migrate to the ocean where they are parasitic on marine fish for up to three years, then return to fresh water for about a year before spawning in gravel bottomed streams. The construction plans for this project should include management practices that will minimize disturbance to the stream areas during construction.

Lampetra ayresii, River lamprey is designated by USFWS as a species of concern. The larval stage (ammocoete) live as filter feeders in sandy back waters of streams. The adults live in streams, estuaries, and near shore sea until returning to streams to spawn in graveled riffles. The construction plans for this project should include management practices that will minimize disturbance to the stream areas during construction.

Oncorhynchus clarkii, Coastal cutthroat trout (Oregon Coast ESU) is designated by USFWS as a species of concern. This trout prefers the reaches of streams and rivers within a hundred miles of the Pacific. The construction plans for this project should include management practices that will minimize disturbance to the stream areas during construction.

Oncorhynchus mykiss, Steelhead (Oregon Coast ESU, summer run) is designated by NMFS as a species of concern. The summer run of steelhead return to freshwater from the ocean, May through August, and mature before spawning. The construction plans for this project should include management practices that will minimize disturbance to the stream areas during construction.

Oncorhynchus mykiss, Steelhead (Oregon Coast ESU, winter run), is designated by NMFS as a species of concern and by ODFW as sensitive (vulnerable) species in the Coquille drainage. The winter run of steelhead return to freshwater already mature, November through April, and spawn. There are ORBIC records of winter run steelhead (pop. 31) within a 2 mile radius of the project site, and this species is known to be in Ferry Creek. The construction plans for this project should include management practices that will minimize disturbance to the stream areas during construction.

Oncorhynchus tshawytscha, Chinook salmon (Oregon Coast ESU, spring run) in designated by ODFW as sensitive (critical) species. Chinook are the largest salmon species and use the largest gravel when spawning. There are ORBIC records of spring run Chinook (pop. 27) within a 2 mile radius of the project site. The construction plans for this project should include management practices that will minimize disturbance to the stream areas during construction.

Invertebrates: ORBIC List 1 & 2 Species

ORBIC List 1 contains species that are threatened with extinction or presumed to be extinct throughout their range. ORBIC List 2 contains species that are threatened with extirpation or presumed to be extirpated from the state of Oregon.

Anodonta californiensis (California floater mussel) is an ORBIC list 2 species, and considered by USFWS a species of concern. This species is listed in ORBIC as occurring in Coos County with a question mark. The question mark in ORBIC listings can mean that the species is rarely collected as opposed to truly rare. There is considerable debate amongst taxonomists with regard to the species divisions in *Anodonta.* This freshwater mussel is found in lakes and lake like streams. There may be freshwater mussels in nearby streams. The construction plans for this project should include management practices that will minimize disturbance to the stream areas during construction.

Bombus occidentalis (Western bumblebee) is an ORBIC list 2 species. The Western bumblebee has suffered a serious decline in western Oregon in recent decades, at this time it is rare and unlikely to be found in the area. Insect foraging habitat will be decreased by this project, but this project is unlikely to adversely affect any western bumblebee.

Callophrys johnsoni (Johnson's hairstreak butterfly) is an ORBIC list 2 species. Found in coniferous forest, often old growth, where it lives on pine dwarf mistletoe. Not usually found on the coast of Oregon. There is no habitat on the project site for this butterfly.

Cicindela hirticollis siuslawensis (Siuslaw sand tiger beetle) is an ORBIC list 2 species. A now rare species of beetle found on beaches at the mouth of rivers along the coast, occurs in the Bandon area. There is no habitat for this beetle on the project site.

Gonidea angulata (Western ridged mussel) is an ORBIC list 2 species. This freshwater mussel is found in cool streams at low to mid elevations. The construction plans for this project should include management practices that will minimize disturbance to the stream areas during construction.

Littorina subrotundata (Newcomb's littorine snail) is an ORBIC list 2 species, and considered by USFWS a species of concern. This species is a marine snail. There is no habitat on the project site for this species.

Monadenia fidelis beryllica aka *flava* (Green sideband snail aka Pacific sideband) is an ORBIC list 1 species. This rare subspecies is found in southwestern Oregon on the western slope of Coast range in forest and riverine habitat. The majority records for the occurrence of this subspecies are for Curry County.

Plebejus saepiolus littoralis (Coastal greenish blue butterfly) is an ORBIC list 1 species, and is considered by USFWS as a species of concern. There is an ORBIC record of this butterfly on beach habitat within a two mile radius of the project area. There is no habitat on the project site for this species.

Pomatiopsis californica (Pacific walker snail) is an ORBIC list 1 species. The Pacific walker is a semiaquatic species found in moist leaf litter near streams. The species range is in the fog zone along southern Oregon and northern California coast. The construction plans for this project should include management practices that will minimize disturbance to the stream areas during construction.

Invertebrates: Species of Concern, and ORBIC List 3 & 4 Species

ORBIC List 3 contains species for which more information is needed before status can be determined, but which may be threatened or endangered in Oregon or throughout their range. ORBIC List 4 contains species which are of conservation concern, but are not currently threatened or endangered.

Anodonta oregonensis (Oregon floater mussel) is an ORBIC list 4 species. There is considerable debate amongst taxonomists with regard to the species divisions in *Anodonta*. *Anodonta* are more tolerant of poor water quality than other freshwater mussels. There may be freshwater mussels in nearby streams. The construction plans for this project should include management practices that will minimize disturbance to the stream areas during construction.

Bembidion tigrinum (Cryptic beach carabid beetle) is an ORBIC list 3 species. Species habitat is coastal beaches. There is no habitat on the project site for this species.

Margaritifera falcata (Western pearlshell mussel) is an ORBIC list 4 species. This long lived freshwater mussel once widely distributed in the Pacific drainage has become extirpated from some large rivers due to sedimentation, and the decrease in host fish. There may be freshwater mussels in nearby streams. The construction plans for this project should include management practices that will minimize disturbance to the stream areas during construction

Megomphix hemphilli (Oregon megomphix snail) is an ORBIC list 4 species. This terrestrial snail is found in mid elevations (500-1500 ft.), in association with big leaf maple, under moist rotting logs. The project site lacks likely habitat for this species.

Nabicula propinqua (Marsh damsel bug aka marsh nabid) is an ORBIC list 3 species. A carnivorous bug found in marsh habitat. There is no habitat on the project site for this species.

Platylygus pseudotsugae (Douglas-fir plant bug aka Douglas-fir platylyngus) is an ORBIC list 3 species. Found in association with Douglas-fir host, more likely at higher elevation. There is no habitat on the project site for this species.

Saldula villosa (Hairy shore bug) is an ORBIC list 3 species. Rare species found in salt marsh habitat. Known from only one specimen in Coos County. There is no habitat on the project site for this species.

Teratocoris paludum (Pale plant bug aka pale teratocoris sedge bug) is an ORBIC list 3 species. Found in intertidal zone. There is no habitat on the project site for this species.

Plants: Threatened or Endangered Species

Abronia umbellata ssp. *breviflora* (Pink sandverbena) is designated by USFWS as a species of concern, and is listed by Oregon Department of Agriculture (ODA) as endangered. This plant lives on sand beaches. There is no habit for this species on the project site.

Chloropyron maritimum ssp. *palustre,* formerly *Cordylanthus maritimus p.,* (Pt. Reyes bird's beak) is designated by USFWS as a species of concern, and is listed by ODA as endangered. This plant grows in saltwater marsh. There is no habitat for this species on the project site.

Lilium occidentale (Western lily) is listed by USFWS and ODA as endangered. There are ORBIC records of western lily in a 2 mile radius of the project site. This lily grows on the edge of bogs within the fog zone of the coast. Both the shrub/scrub and the wooded area of the project site are too shaded for western lily to bloom. No bogs were located on site. The main standing water on site appears to be where septic test pits were dug.

Phacelia argentea (Silvery phacelia) is designated by USFWS as a species of concern, and is listed by ODA as threatened. There are ORBIC records of silvery phacelia within a 2 mile radius of the project site. This species grows on beaches, dunes, and coastal bluffs. There is no habitat for this species on the project site.

Plants: Species of Concern, and Candidate Species

Bensoniella oregana (Bensonia) is designated by USFWS as a species of concern and by ODA as a candidate species. This plant is found in transitional zones between forest and meadow at higher elevation (2000-5000 feet) than the project site. There is no habitat for this species on the project site.

Limbella fryei (Limbella moss) is designated by USFWS as a species of concern and by ODA as a candidate species. This moss is is found in tall shrub marsh growing on the lower trunks of shrubs such as willow and the surrounding leaf litter. There is no habitat for this species on the project site.

Sidalcea malviflora ssp. *patula* (Coast checker bloom or mallow) is designated by USFWS as a species of concern and by ODA as a candidate species. Often found along roadsides in the Coast Range in southern Oregon and northern California. Habitat is open coastal forests and bluffs. This species may be along roads in the area of the site.

Triteleia hendersonii var. *leachiae* (Leach's brodiaea aka Blue-striped brodiaea) is designated by USFWS as a species of concern and by ODA as a candidate species. Found on well drained slopes, and has been observed in the Coquille watershed. The project site lacks hillsides.

SITE CONDITIONS

At the time of LAWESI biologist's first site visit, in January 2016, the scrub/shrub habitat contained *Gaultheria shallon* (salal) 30%, *Vaccinium ovatum* (Evergreen huckleberry) 25%, *Arctostaphylos columbiana* (Hairy manzanita), *Pinus contorta* (Shore pine), *Chamaecyparis lawsoniana* (Port Orford cedar); *Arbutus menziesii* (Pacific madrone). There were no wetlands present, though there was water retained in places that had reportedly in the past been dug for septic test pits. The vegetation was dense, and appeared to be transitioning to mixed forest habitat by the number of young trees colonizing.

The forest habitat overstory included *Pinus contorta* (Shore pine), *Tsuga heterophylla* (Western hemlock), and *Pseudotsuga menziesii* spp. *menziesii* (Douglas fir). The understory included *Gaultheria shallon* (salal), *Vaccinium ovatum* (Evergreen huckleberry), *Rubus parviflorus* (Thimble berry), and *Rhododendron macrophyllum* (Pacific rhododendron).

At the time of the second site visit, in April 2016, the scrub/shrub vegetation had been bladed off and test borings had been drilled. The forest habitat was unaltered from the January 2016 site visit. (See photo report in Appendix F.)

CUMULATIVE AND INDIRECT EFFECTS

This project will permanently impact ten acres of mixed forest (mostly coniferous) and ten acres of shrub/scrub habitat. No wetlands will be impacted. No threatened or endangered species will be adversely affected.

MITIGATION

The construction plans for this project should include management practices that will minimize disturbance to the stream areas during construction. Best management construction practices to prevent erosion during a storm event would be followed.

INFORMATION SOURCES

Responses to Request for Comments (See Appendix G.)

April 4, 2016:
Rippee, Kassandra, Archaeologist, Tribal Historic Preservation Officer, Coquille Indian Tribe

April 13, 2016:
Vander Hayden, Madeleine, Fish and Wildlife Biologist, Coordinator, Oregon Coastal Program, USFWS

April 15, 2016 (includes request for comments):
Amsberry, Kelly, Native Plant Conservation Program, Oregon State University

April 26, 2016:
Curtis, Ross, SHPO Archaeologist, State Historic Preservation Office

May 3, 2016:
Phippen, Kenneth W., Oregon Coast Branch Chief, National Marine Fisheries Service

Other Sources

Hansen, Glenn L., Douglas County Librarian, research assistance

Negherbon, Barbara, PE, CWRE, Dyer Partnership Engineers & Planners

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ORBIC two mile radius data search at Lat. 43.112372 N, Long. -124.387882

Agency Lists (See Appendix H):

Oregon Department Fish and Wildlife, revised October 2014, "Threatened, Endangered, and Candidate Fish and Wildlife Species in Oregon"

Oregon Department Fish and Wildlife, 2008 "Sensitive Species List"

U.S. Fish and Wildlife Service, updated 9/22/2015, "Federally Listed, Proposed, Candidate, Delisted Species and Species of Concern"

Oregon Department of Agriculture, 4/6/2009, "Oregon Listed Plants"

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National Marine Fisheries Service (NMFS), updated map 10/31/2012, "Status of ESA Listings & Critical Habitat Designations for West Coast Salmon & Steelhead"

NMFS
http://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/salmon_and_steelhead_listings/salmon_and_steelhead_listings.html

Mammals

Bats
http://www.dfw.state.or.us/species/mammals/bats.asp#Top

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M. evotis
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M. thysanodes
http://www.iucnredlist.org/details/14206/0

M. volans
http://www.iucnredlist.org/details/14210/0

M.yumanensis
http://www.iucnredlist.org/details/14213/0

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http://www.fws.gov/oregonfwo/articles.cfm?id=149489430

Gray wolf
http://www.fws.gov/oregonfwo/articles.cfm?id=149489434

http://www.dfw.state.or.us/Wolves/management_plan.asp

Pacific marten
http://www.fws.gov/oregonfwo/ExternalAffairs/News/2015/Coastal_Marten_Final_Species_Report_April_2015%20%281%29.pdf

Birds

Burrows, Roger, and Gilligan, Jeff 2003, *Birds of Oregon*, Lone Pine Publishing International, Auburn, WA

Herlyn, Hendrik G., and Contreras, Alan L. 2009, *Handbook of Oregon Birds,* Oregon State University Press, Corvallis, OR

Udvardy, Miklos D. F., editor, revised by Farrand, John, Jr. 1994, *National Aububon Society, Field Guide to Birds,* Alferd A. Knopf, New York

American Peregrine falcon
http://www.fs.fed.us/database/feis/animals/bird/fape/all.html#PacificNorthwest

Marbled murrelet
http://www.fs.fed.us/database/feis/animals/bird/brma/all.html

Northern goshawk
http://www.fs.fed.us/database/feis/animals/bird/acge/all.html

Reptiles & Amphibians

Behler, John L., and King, F. Wayne 1979, *The Audubon Society Field Guide to North American Reptiles & Amphibians,* Alfred A. Knopf, New York

Leonard, William P., et al. 1993, *Amphibians of Washington and Oregon,* Seattle Audubon Society, Seattle, WA

Getubig, Lawrence, "A brief life history of the Tailed Frog, *Ascaphus truei*", http://blogs.uoregon.edu/bi468titus/student-projects/a-brief-life-history-of-the-tailed-frog-ascaphus-truei-lawrence-getubig/

Clouded salamander
http://www.iucnredlist.org/details/59115/0

Coastal tailed frog
http://www.iucnredlist.org/details/54414/0

Yellow-legged frog
http://www.iucnredlist.org/details/19175/0

Southern torrent salamander
http://www.iucnredlist.org/details/59438/0

Fish

Coho
http://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/salmon_and_steelhead_listings/coho/oregon_coast_coho.html

Green sturgeon
http://www.iucnredlist.org/details/233/0

http://www.westcoast.fisheries.noaa.gov/protected_species/green_sturgeon/green_sturgeon_pg.html

Eulachon
http://www.westcoast.fisheries.noaa.gov/protected_species/eulachon/pacific_eulachon.html

Pacific lamprey
http://www.fws.gov/oregonfwo/articles.cfm?id=149489457

http://oregonstate.edu/ua/ncs/archives/2015/feb/study-finds-lamprey-decline-continues-loss-habitat-oregon

Steelhead
http://www.westcoast.fisheries.noaa.gov/publications/SOC/steelhead_detailed.pdf

Invertebrates

BLM, 2009, *Field Guide to Survey and manage Terrestrial Mollusk Species from the Northwest Forest Plan*

Opler, Paul A, and illustrated by Wright, Amy Bartlett, 1999, *A Field Guide to Western Butterflies*

(Peterson Field Guides) Houghton Mifflin Company, NY

Nedeau, Ethan Jay, et al, 2009, *Freshwater Mussels of the Pacific Northwest,* The Xerces Society

California floater mussel
http://www.iucnredlist.org/details/1311/0

Western bumblebee
http://www.xerces.org/western-bumble-bee/
http://www.iucnredlist.org/details/44937492/0

Johnson's hairstreak
http://www.xerces.org/johnsons-hairstreak/

http://www.butterfliesandmoths.org/species/callophrys-johnsoni

Tiger beetle
http://www.xerces.org/siuslaw-hairy-neck-tiger-beetle/

http://www.fs.fed.us/r6/sfpnw/issssp/documents/inventories/inv-iico-cihis-field-id-2009.pdf

Western ridged mussel
http://www.xerces.org/western-ridged-mussel/

Green sideband snail
Stone, Theresa, USDA Forest Service Fact Sheet, *Monadenia fidelis beryllica,* 2009, and 2015 update

Pacific walker snail
http://www.iucnredlist.org/details/189665/0

US Forest Service Fact Sheet, *Pomatiopsis californica*

Oregon floater mussel
http://www.iucnredlist.org/details/189487/0

http://www.xerces.org/oregon-floater/

Western pearl shell mussel
http://www.xerces.org/western-pearlshell/

Oregon megomphix snail
Jordan, Sarah Foltz, 2013, US Forest Service Species Fact Sheet

http://academic.evergreen.edu/projects/ants/TESCBiota/mollusc/key/meg_hem/meg_hem.htm

Hairy shore bug
http://www.xerces.org/hairy-shore-bug/

Douglas-fir plant bug
Equihua-Martinez, Armando, 1995, "Revision of the genus Platylygus" Ph.D. thesis Oregon State University

Plants

Hitchcock, C. Leo,1973 *Flora of the Pacific Northwest*, University of Washington Press, Seattle and London

Pink sand verbena
http://www.oregon.gov/ODA/shared/Documents/Publications/PlantConservation/AbroniaUmbellataBrevifloraProfile.pdf

Pt. Reyes bird's beak
http://www.oregon.gov/ODA/shared/Documents/Publications/PlantConservation/CordylanthusMaritimusPalustrisProfile.pdf

Silvery phacelia
http://www.oregon.gov/ODA/shared/Documents/Publications/PlantConservation/PhaceliaArgenteaProfile.pdf

Bensonia
http://www.blm.gov/or/plans/surveyandmanage/MR/VascularPlants/section3.htm

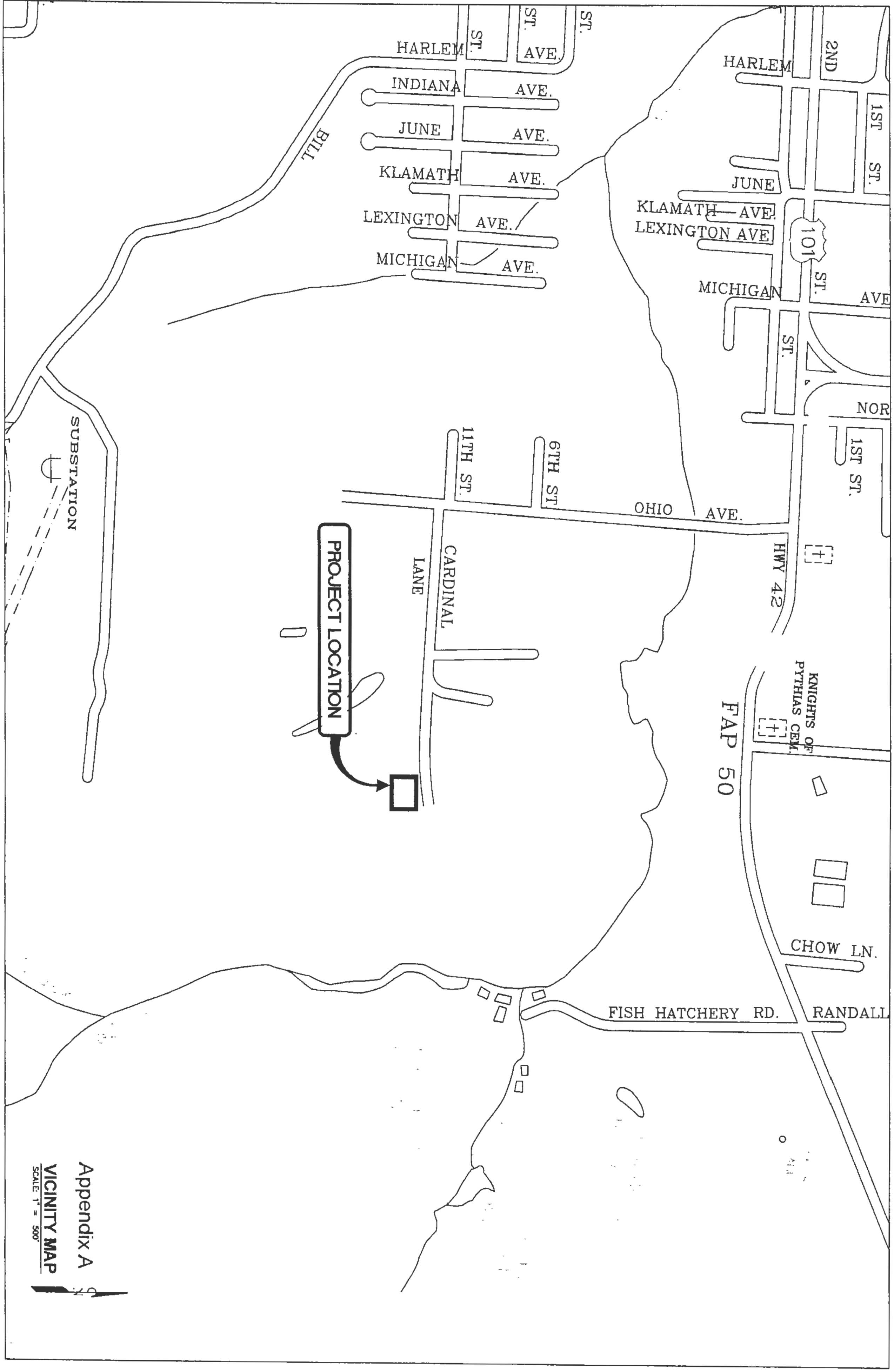
Coast checker bloom
http://ucjeps.berkeley.edu/eflora/eflora_display.php?tid=52989

Leach's brodiaea
http://explorer.natureserve.org/servlet/NatureServe?searchName=Triteleia+hendersonii+var.+leachiae

Document Preparation

Dayl Waldron
Land And Water Environmental Services, Inc.
2016

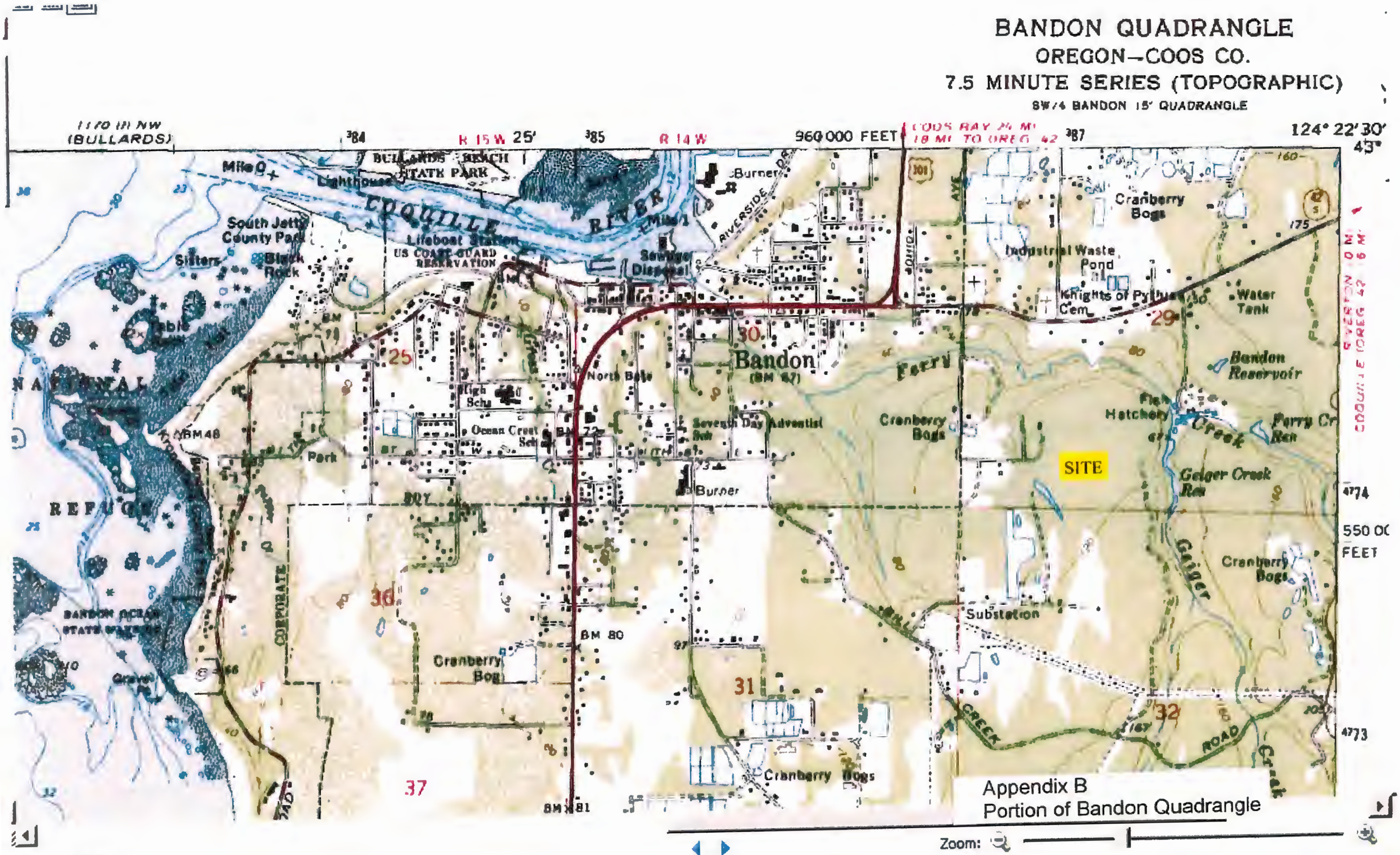
\\Dyer\projects\01Active\101.78A\dwg\101.84—Off-Channel Storage.dwg 7/21/2014 9:35:48 AM PST



Appendix A

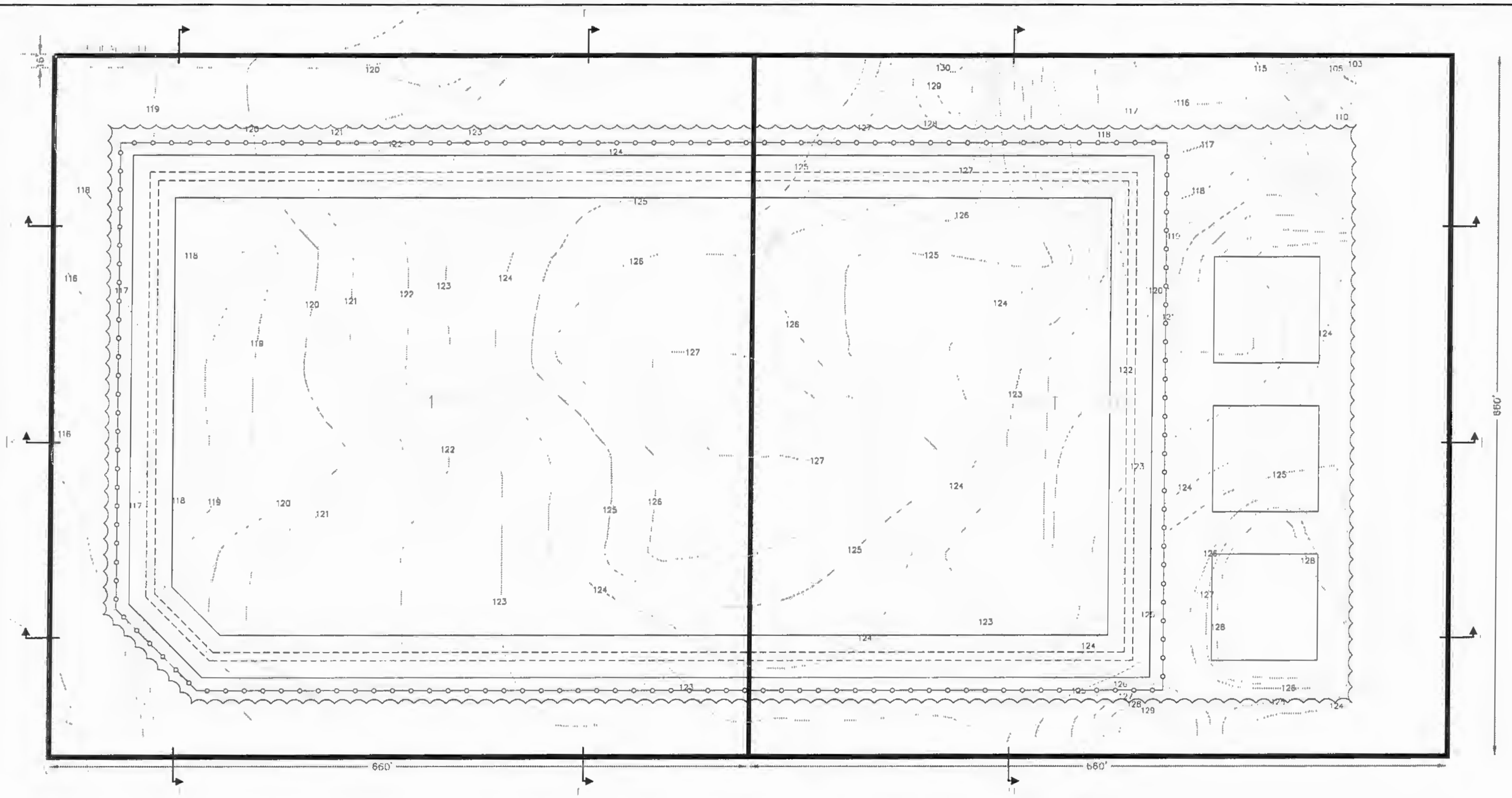
VICINITY MAP

SCALE: 1" = 500'



Appendix B
Portion of Bandon Quadrangle

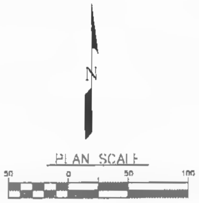
o43124a4



LEGEND

▬	PROPERTY LINE
—	PROPOSED [illegible]
- - -	[illegible]
—o—o—o—	[illegible] HAIR [illegible]
—	BREAK LINE [illegible]
	[illegible] CONTOUR LINE
	MAJOR [illegible]
124	ELEVATION
—	PROPOSED [illegible] UPLAND [illegible] FACILITY

BANDON, OREGON [illegible]
(541) [illegible]
14W
14W



PRELIMINARY – NOT FOR CONSTRUCTION

NOTE:
PRELIMINARY DESIGN ONLY
ALL SLOPES AND DIMENSIONS ARE APPROXIMATE
ELEVATIONS BASED OFF OF GOOGLE EARTH

Appendix C, page 1 of 2

SUBMITTED BY
B
DATE

RE[illegible]

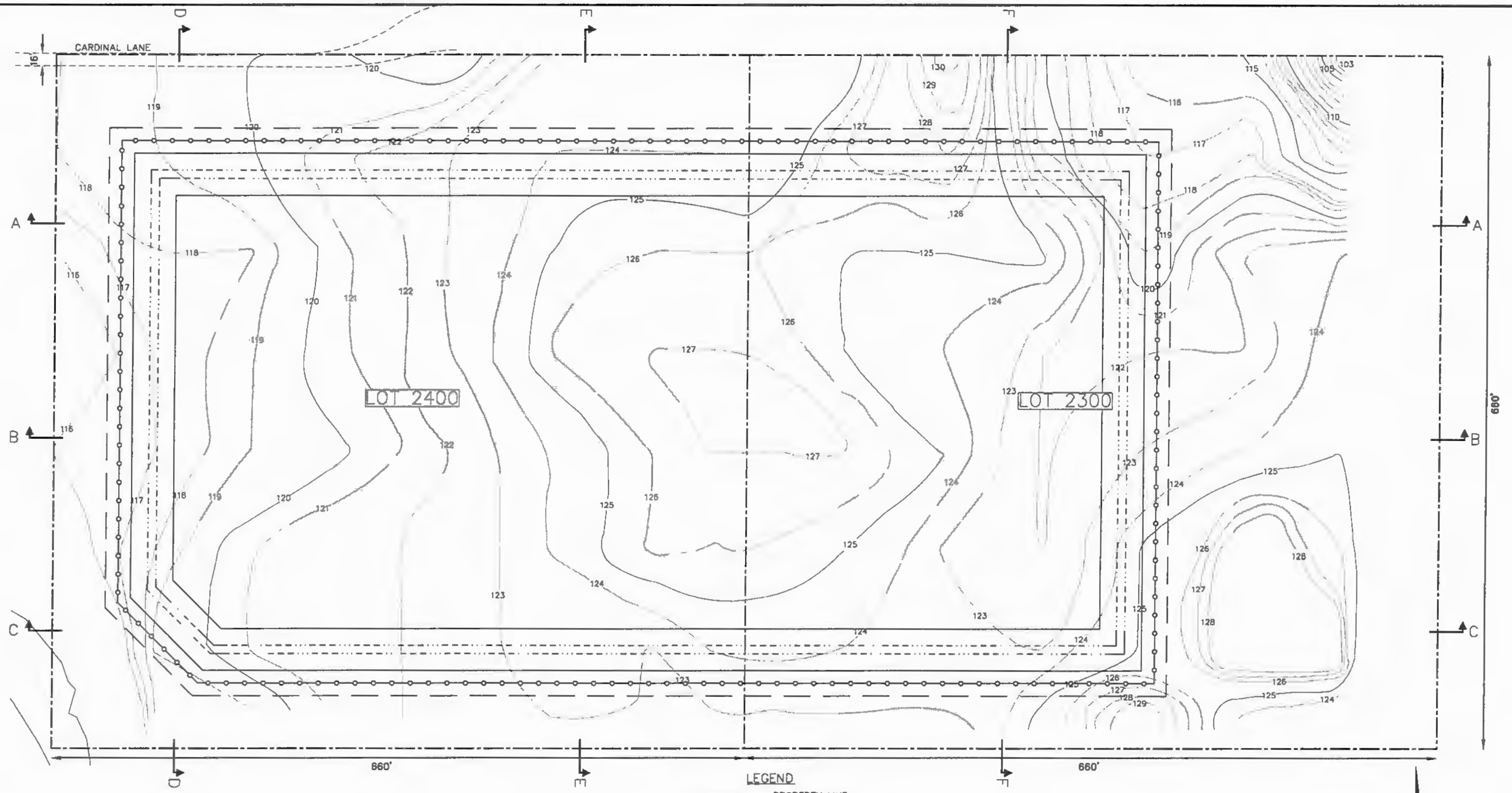
THE [illegible] PARTNERSHIP
ENGINEERS & PLANNERS
330 [illegible] AVE
COOS BAY, [illegible]
TELEPHONE, [illegible]
www.dy[illegible]

LINE IS 1 INCH
AT FULL SCALE
IF NOT 1-INCH - SCALE ACCORDINGLY

OFF-CHANNEL RAW WATER RESERVOIR
CITY OF BANDON

PRELIMINARY CONTOUR MAP

PROJECT NO.	DRAWING NO.
101.84	
DATE	SHEET NO.
SEPT, 2014	1 OF 2



LEGEND

- PROPERTY LINE
- PROPOSED TOE DIKE
- PROPOSED TOB DIKE
- PROPOSED CHAIN LINK FENCE
- BRUSH LINE PROPOSED
- MINOR CONTOUR LINES
- MAJOR CONTOUR LINES
- 124 ELEVATION

N

PLAN SCALE
50 0 50 100

CITY OF BANDON
P.O. BOX 57
BANDON, OREGON 97411
(541) 347-2437

28S 14W 29C 2300

28S 14W 29C 2400

NOTE:
PRELIMINARY DESIGN ONLY
ALL SLOPES AND DIMENSIONS ARE APPROXIMATE
ELEVATIONS BASED OFF OF GOOGLE EARTH

PRELIMINARY – NOT FOR CONSTRUCTION

Appendix C, page 2 of 2

SUBMITTED BY: ____________________ DATE: __________

APPROVED BY: ____________________ DATE: __________

REVISIONS

REVISED	DESCRIPTION	SUBMIT	APPR'D.	DATE

DESIGNED: -
DRAWN: -
CHECKED -
APPROVED: -

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.
1330 TEAKWOOD AVENUE
COOS BAY, OREGON 97420
TELEPHONE: (541) 269-0732
www.dyerpart.com

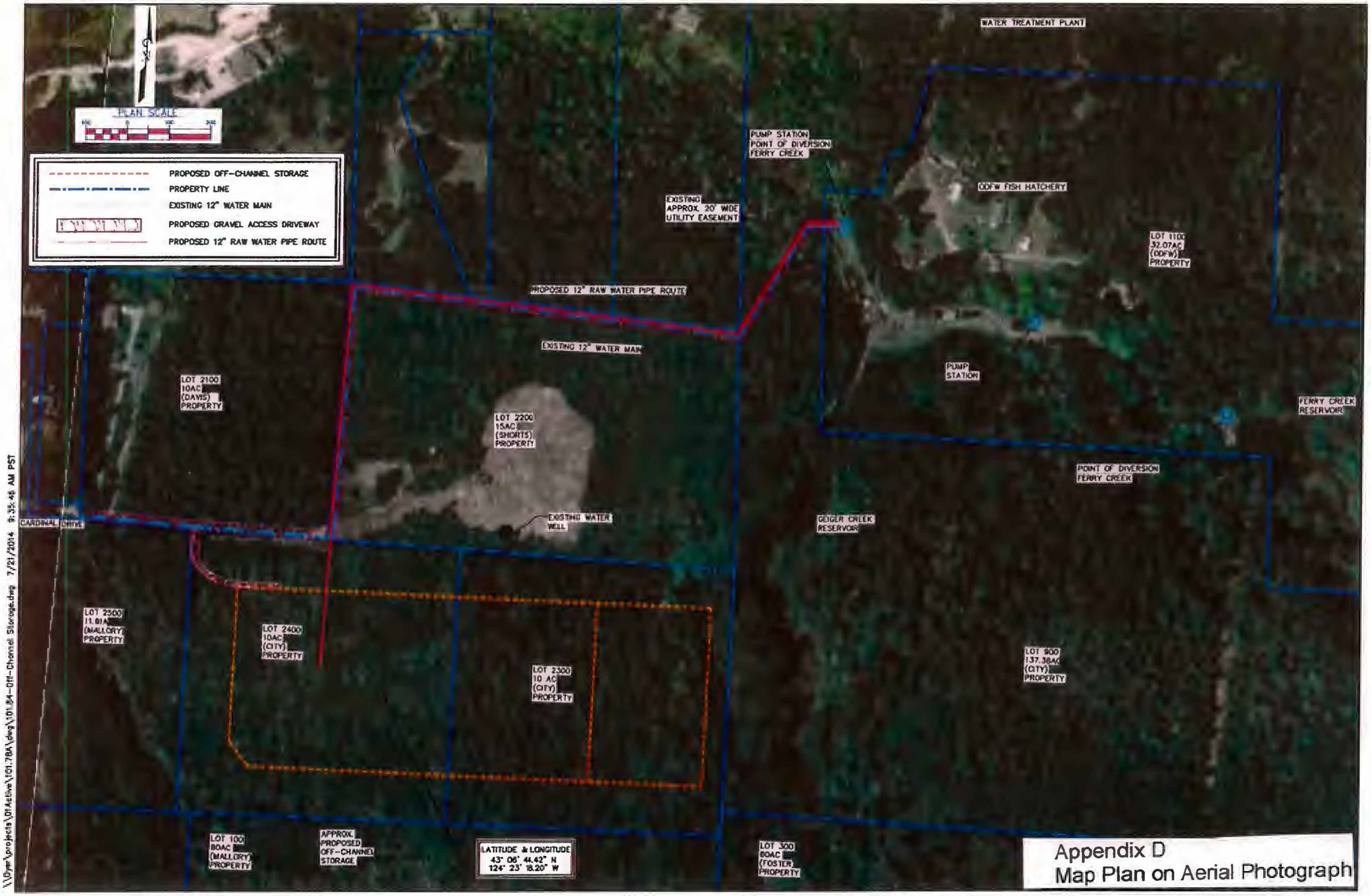
LINE IS 1 INCH
AT FULL SCALE
IF NOT 1-INCH - SCALE ACCORDINGLY

OFF-CHANNEL RAW WATER RESERVOIR
CITY OF BANDON

PRELIMINARY CONTOUR MAP

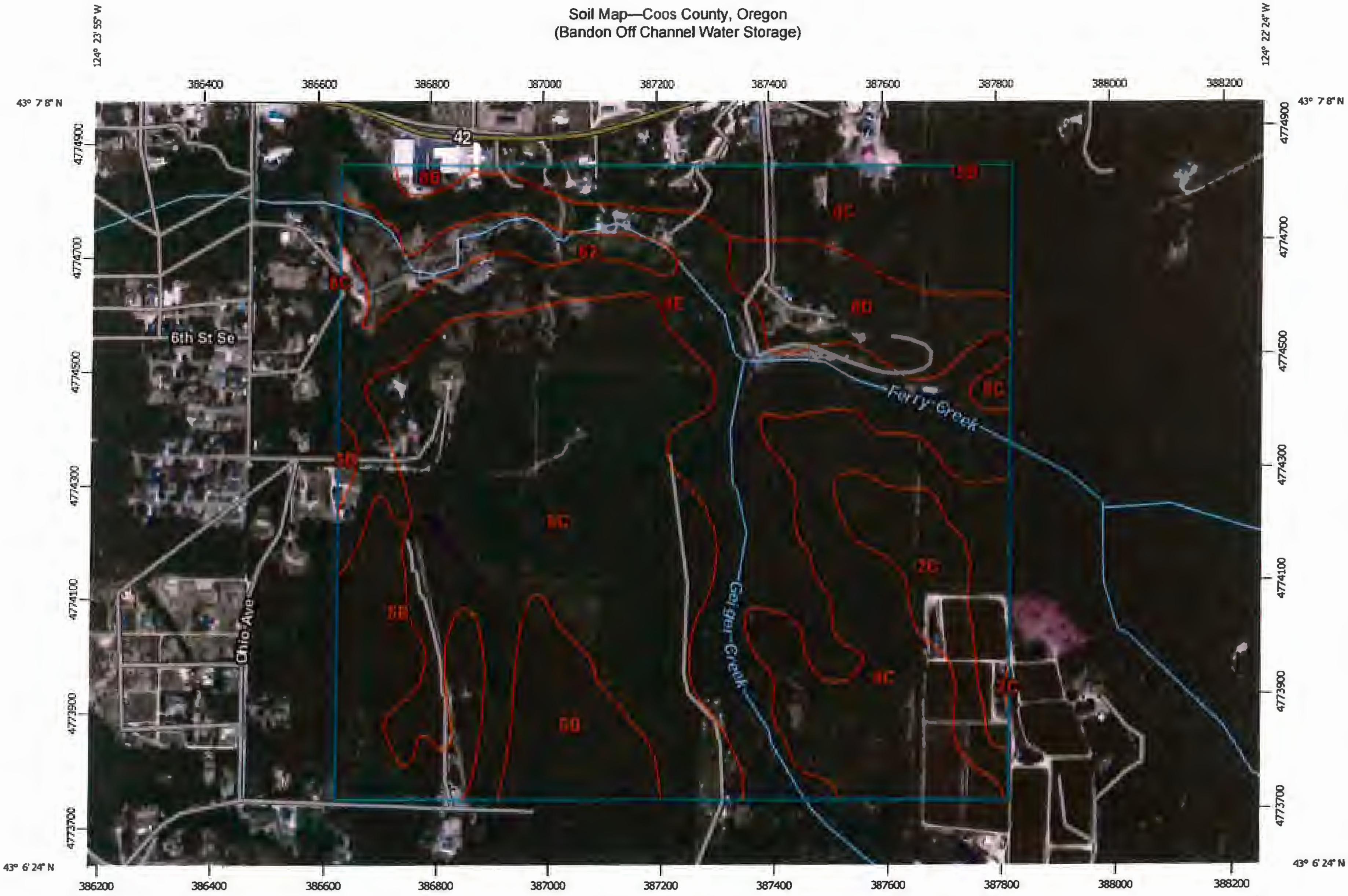
PROJECT NO.	DRAWING NO.
101.84	
DATE	SHEET NO.
SEPT, 2014	1 OF 2

\\Dyer\projects\01Active\101.78A\dwg\101.84-Off-Channel Storage.dwg 7/21/2014 9:35:46 AM PST



Appendix D
Map Plan on Aerial Photograph

Soil Map—Coos County, Oregon
(Bandon Off Channel Water Storage)



124° 23' 55" W

124° 22' 24" W

Appendix E
Soil Map and Legends, page 1 fo 3

Map Scale: 1:9,430 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0, 100, 200, 400, 600

Feet: 0, 450, 900, 1800, 2700

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

- ☐ Area of Interest (AOI)

Soils

- ☐ Soil Map Unit Polygons
- ~ Soil Map Unit Lines
- ■ Soil Map Unit Points

Special Point Features

- Blowout
- ☒ Borrow Pit
- Clay Spot
- ◇ Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- ◎ Miscellaneous Water
- ○ Perennial Water
- Rock Outcrop
- + Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- +++ Rails
- ~ Interstate Highways
- ~ US Routes
- Major Roads
- Local Roads

Background

- ■ Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Coos County, Oregon
Survey Area Data: Version 10, Sep 18, 2015

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jul 6, 2010—Jul 13, 2010

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Appendix E
Soil Map and Legends, page 2 fo 3

Map Unit Legend

Coos County, Oregon (OR011)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
2C	Bandon-Blacklock complex, 0 to 12 percent slopes	13.4	4.1%
5B	Blacklock fine sandy loam, 3 to 7 percent slopes	37.6	11.4%
8B	Bullards sandy loam, 0 to 7 percent slopes	1.3	0.4%
8C	Bullards sandy loam, 7 to 12 percent slopes	167.9	51.0%
8D	Bullards sandy loam, 12 to 30 percent slopes	17.5	5.3%
8E	Bullards sandy loam, 30 to 50 percent slopes	80.0	24.3%
62	Willanch fine sandy loam	11.7	3.6%
Totals for Area of Interest		**329.5**	**100.0%**

Appendix E
Soil Map and Legends, page 3 of 3

APPENDIX F

SITE PHOTOGRAPHS:

January 2016

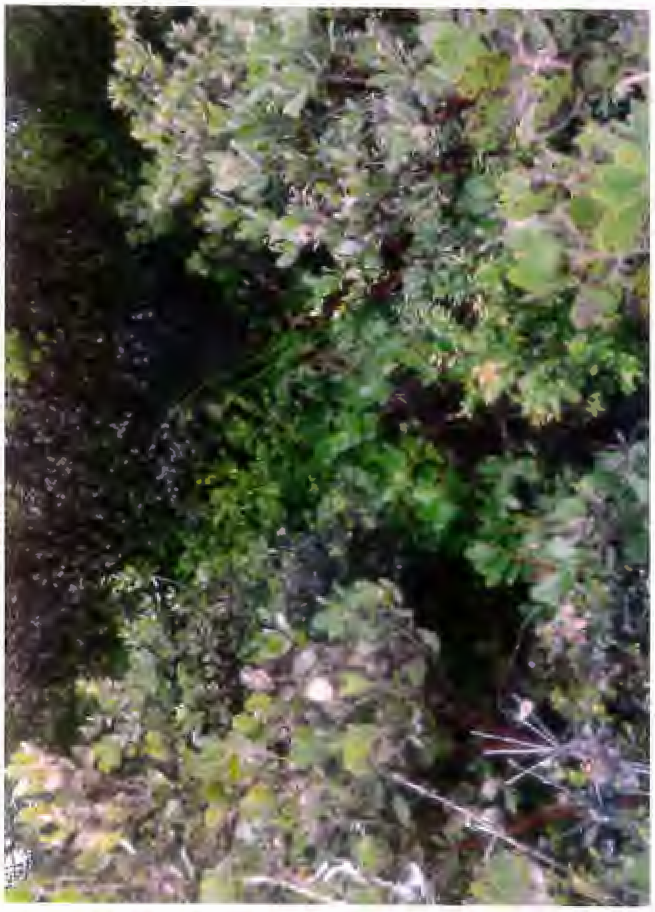
April 2016

1. January 2016, scrub/shrub habitat. Shore pine, evergreen huckleberry.

2. Hairy manzanita, salal, western hemlock, Douglas fir.

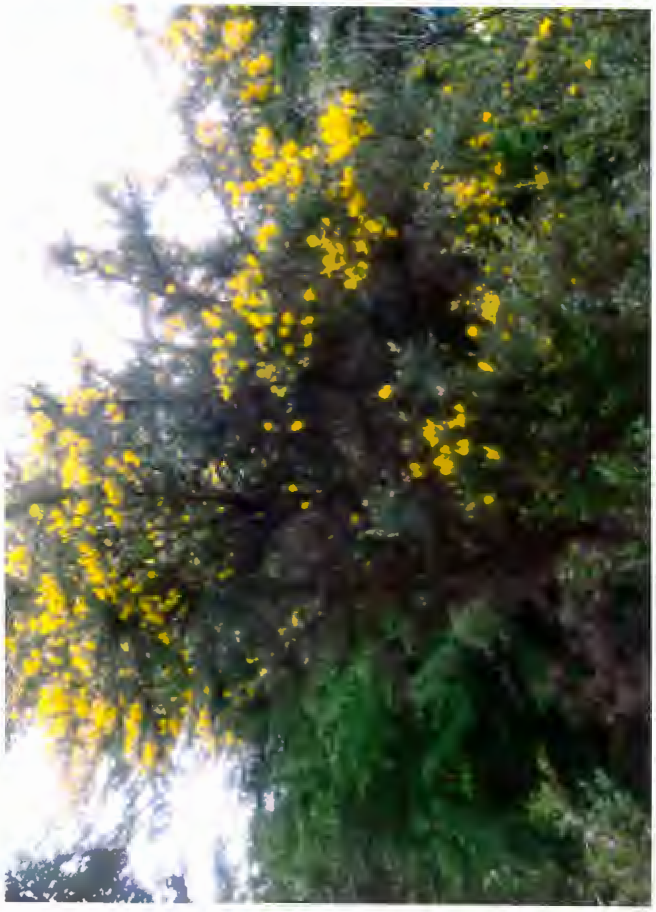
3. Hairy manzanita, Pacific madrone, evergreen huckleberry, salal, broom

4. Pacific rhododendron center of photo.



5.

6. Manzanita



7. Broom

8. Gorse

9. Water standing in reported septic test pit.

10.

11. Young trees colonizing .

12. Utility right-of-way leading to Ferry Creek.

1. April 22, 2016, area that was scrub/shrub has been cleared.

2. Looking east toward forested area.

3. Sandy patch where test pit was dug.

4. Forested area and under growth of salal, and evergreen huckleberry.

5. Understory of thimbleberry, evergreen huckleberry, salal, rhododendron, coastal willow

6. Dense under growth

7. Western hemlock, Douglas fir, Pacific rhododendron

8. Shore pine, coastal willow

APPENDIX G

RESPONSES TO REQUEST FOR COMMENTS:

April 4, 2016:
Rippee, Kassandra, Archaeologist, Tribal Historic Preservation Officer, Coquille Indian Tribe

April 13, 2016:
Vander Hayden, Madeleine, Fish and Wildlife Biologist, Coordinator, Oregon Coastal Program, USFWS

April 15, 2016 (includes request for comments):
Amsberry, Kelly, Native Plant Conservation Program, Oregon State University

April 26, 2016:
Curtis, Ross, SHPO Archaeologist, State Historic Preservation Office

May 3, 2016:
Phippen, Kenneth W., Oregon Coast Branch Chief, National Marine Fisheries Service

COQUILLE INDIAN TRIBE
3050 Tremont Ave. North Bend, OR 97459
Telephone: (541) 756-0904 ~ Fax: (541) 756-0847
www.coquilletribe.org

April 4, 2016

Land and Water Environmental Services, Inc.
PO Box 448
119 NE 2nd Street, Suite B
Oakland, OR 97462

Re: City of Bandon Off-Channel Raw Water Storage Reservoir Project

Thank you for the opportunity to comment on the proposal to site an off-channel reservoir located near the confluence of Geiger Creek and Ferry Creek, Oregon. The Coquille Indian Tribe concurs with the anticipatory finding of no historic properties/cultural resources effected. We request that we be contacted immediately if any known or suspected cultural resources are encountered during the work.

Extreme caution is recommended during project related groundbreaking activities. If archaeological materials are discovered, uncovered, or disturbed, on the property, we will discuss the appropriate actions with all necessary parties. ORS 97.745 prohibits the willful removal, mutilation, defacing, injury, or destruction of any cairn, burial, human remains, funerary objects, or objects of cultural patrimony of a Native Indian. ORS 358.920 prohibits excavation, injury, destruction, or alteration of an archaeological site or object, or removal of an archaeological object from public or private lands.

Thank you again and feel free to contact me at (541) 808-5554 if you have any questions.

Best,

Kassandra Rippee, MA
Archaeologist
Tribal Historic Preservation Officer
Coquille Indian Tribe

CRT15540

Print | Close Window

Subject: **Request for comments on city of Bandon off-channel raw water storage**
From: **Madeleine Vander Heyden <madeleine_vanderheyden@fws.gov>**
Date: **Wed, Apr 13, 2016 3:53 pm**
To: **<dwaldron@landandwater.biz>**

Ms. Waldron,

I was forwarded your request for comments on the subject line project. I'm the US Fish and Wildlife Service lead for the Federally endangered western lily. There are indeed a few populations in the Bandon area, and a few individuals were found in the city's watershed several years ago.

The western lily occurs on two types of soils, decomposed peat or muck substrate, or soils that are poorly drained due to a shallow iron pan (e.g., Blacklock, Bandon, or Bullard series in Oregon), or clay layer (e.g., Joeney series in Oregon). It requires a habitat that maintains a delicate balance between maintaining adequate moisture to avoid desiccation during the growing season, and avoiding prolonged inundation when it needs to grow; thus, the close association with soils that either "perch" water near the surface and stay relatively moist, or where the water table drops seasonally to expose the bulbs.

The 23 extant principle populations (including CA occurrences) range in size from less than 0.1 acre to more than 6 acres, totaling about 40 acres of occupied habitat. Due to the rarity of this species, any potential impacts to potentially suitable but unsurveyed sites are a concern. Occasionally a new population is discovered, and I have hopes to find others.

I am requesting a site visit to determine whether the proposed development may contain western lilies. July would be ideal for detecting flowering individuals; would this be possible? Also, would you please send me a map of proposed activities?

Thank you for considering the western lily.

Madeleine

Madeleine Vander Heyden
Fish and Wildlife Biologist
Coordinator, Oregon Coastal Program
U. S. Fish and Wildlife Service, Newport Field Office
83673 North Bank Lane
Bandon, Oregon 97411
541-347-1470 ext. 4

Print | Close Window

Subject: RE: Request for Comments on the City of Bandon
From: "Amsberry, Kelly" <amsberrk@science.oregonstate.edu>
Date: Fri, Apr 15, 2016 5:14 pm
To: <dwaldron@landandwater.biz>
Cc: "Robert Meinke" <meinker@science.oregonstate.edu>

Hi Dayl!

As required by OAR 603-073, the City of Bandon and/or OWRD will need to request a consultation by ODA prior to initiating ground breaking activities that may impact T/E species. The consultation request must originate from the land management agency – more information is available on our website. http://www.oregon.gov/ODA/programs/PlantConservation/PermitsConsultations/Pages/AboutPermitsConsultations.aspx

Only T/E plant species listed by ODA are protected by the OAR , not "all T&E listed, proposed, candidate, species of concern, and sensitive species that may occur in the area as established by Oregon Biodiversity Information Center (ORBIC) records"). A survey for plants likely to occur will be required - we usually start with the plant species found in the county where the project occurs, which are *Lilium occidentale*, *Phacelia argentea*, *Abronia umbellata* var. *breviflora*, and *Cordylanthys maritimus* ssp. *palustris*. It sounds from the description below like the site may have suitable habitat for *Lilium occidentale*, but probably not for *Phacelia argentea*, unless the site contains sandy areas not mentioned. And it looks like it's too far from the coast for the other two. A survey will be required for *Lilium occidentale* (and for the *Phacelia* if there are sandy areas) – our website has information on survey timing, surveyor qualifications, etc., as well as a template to use for survey results. (Is using the survey template what you mean by "the biological assessment of this site will follow the Department of Agriculture format"? ODA does not require a biological assessment, nor provide a format). A lily survey would probably best be done in late June-July, and most any time in the summer for the *Phacelia*. http://www.oregon.gov/ODA/programs/PlantConservation/PermitsConsultations/Pages/ConsultationProcess.aspx

Bob Meinke is currently handling consultations for our agency; please contact him at 541 737-2317 or meinker@science.oregonstate.edu

Feel free to contact me too, if you have additional questions! We have been working on lily recovery for the last few years, so would be interested to know if there are more publically owned lily populations out there.

Kelly Amsberry
Native Plant Conservation Program
Oregon Department of Agriculture
2082 Cordley Hall, Dept. of Botany and Plant Pathology

Oregon State University
Corvallis, OR 97331
(541) 737-4333
(541) 602-1729

From: dwaldron@landandwater.biz [mailto:dwaldron@landandwater.biz]
Sent: Friday, April 15, 2016 1:54 PM
To: kamsberry@oda.state.or.us
Subject: Request for Comments on the City of Bandon

Off-Channel Raw Water Storage Reservoir Project
Lat. 43.112372, Long. -124.387882

The City of Bandon and the Oregon Water Resources Department (OWRD) are in the initial planning stage of a project to store raw water in an off channel reservoir. This is a first of its kind funding by OWRD, with a view to begin addressing future water shortfalls in our communities. A first step in this process will be examining potential sites for their suitability. Amongst the issues to be evaluated are the possible impacts to the biological and cultural resources on or near the project site.

The Dyer Partnership Engineers and Planners has assisted the City in choosing a reservoir site that fits the community's needs and the geophysical requirements. They will be designing the project plans. Land And Water Environmental Services will be writing a biological assessment for the project.

The proposed location where the reservoir would be located is found at T28S R14W Sec. 29 on the Bandon 7.5 minute Quadrangle, 1970, and has the Coos County Tax Lot numbers 2400 and 2300 on Map# 28S14W29C. There will be a pipe line installed across lot 900 and lot 2200, within an existing utility easement where there are currently other utilities. A pump station in Ferry Creek will divert water from the creek to the pond during high flow conditions in Ferry Creek. The point of diversion is on the west side of Ferry Creek opposite the Bandon Fish Hatchery. Approximately 10 acres of land that is now scrub/shrub habit and 10 acres of coniferous woodland habitat would be converted to a water storage reservoir.

The site is located in the Lower Coquille hydrological unit (HUC 1710030507), near the confluence of Geiger Creek and Ferry Creek. Ferry Creek enters the Coquille River approximately 1.25 miles from the point of diversion for this project. The soil type of the reservoir site is Bullards sandy loam, which is a non-hydric soil but can have inclusions of Blacklock fine sandy loam which is hydric.

The reservoir site is approximately 300 feet west of Geiger Creek, but at a higher elevation than the stream. The reservoir site location is 118-127 feet above mean sea level. Geiger Creek is at approximately 80 feet above mean sea level, flowing north toward its confluence with Ferry Creek.

The biological assessment of this site will follow the Department of Agriculture format and consider all T&E listed, proposed, candidate, species of concern, and sensitive species that may occur in the area as established by Oregon Biodiversity Information Center (ORBIC) records.

A two mile radius data search of species records has been obtained from ORBIC. Ten of the species which will be considered in the biological assessment have records of being present within the two mile radius of the project site. These species are: *Arborimus albipes* (White-footed vole), *Bassariscus astutus* (Ringtail), *Charadrius nivosus nivosus* (Western snowy plover), *Lilium occidentale* (Western lily), *Oncorhynchus kisutch* (OC coho), *Oncorhynchus mykiss* (Steelhead), *Oncorhynchus tshawytscha* (Chinook), *Phacelia argentea* (Silvery phacelia), *Plebejus saepiolus littoralis* (Coastal greenish blue butterfly), and *Progne subis* (Purple martin).

We would appreciate your assistance with information you may have specific to this site concerning cultural resources, rare species or critical habitat in the area.

Sincerely:

Ms Dayl Waldron
Land And Water Environmental Services, Inc.
PO Box 448
Oakland, OR 97462
dwaldron@landandwater.biz
(541-459-4141)

Oregon
Kate Brown, Governor

Parks and Recreation Department
State Historic Preservation Office
725 Summer St NE Ste C
Salem OR 97301-1266
Phone (503) 986-0690
Fax (503) 986-0793
www.oregonheritage.org

April 26, 2016

Mr. Dayl Waldron
Land & Water Enviro Services Inc
PO Box 448
Oakland, OR 97462

RE: SHPO Case No. 16-0574
City of Bandon, Off-Channel Raw Water Storage Reservoir Project
Reservoir creation, intaling pipe, pump station
28S 14W 29 Taxlot 2400 and 2300, Bandon, Coos County

Dear Mr. Waldron:

Our office recently received a request to review your application for the project referenced above. In checking our statewide archaeological database, it appears that there have been no previous surveys completed near the proposed project area. However, the project area lies within an area generally perceived to have a high probability for possessing archaeological sites and/or buried human remains. In the absence of sufficient knowledge to predict the location of cultural resources within the project area, extreme caution is recommended during project related ground disturbing activities. Under state law (ORS 358.905 and ORS 97.74) archaeological sites, objects and human remains are protected on both state public and private lands in Oregon. If archaeological objects or sites are discovered during construction, all activities should cease immediately until a professional archaeologist can evaluate the discovery. If you have not already done so, be sure to consult with all appropriate Indian tribes regarding your proposed project. If the project has a federal nexus (i.e., federal funding, permitting, or oversight) please coordinate with the appropriate lead federal agency representative regarding compliance with Section 106 of the National Historic Preservation Act (NHPA). If you have any questions about the above comments or would like additional information, please feel free to contact our office at your convenience. In order to help us track your project accurately, please reference the SHPO case number above in all correspondence.

Sincerely,

Ross Curtis
SHPO Archaeologist
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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
Oregon Coast Branch
2900 Stewart Parkway
ROSEBURG, OREGON 97471

May 3, 2016

Dayl Waldron
Land and Water Environmental Services, Inc.
P.O. Box 448
Oakland, Oregon 97462

Re: Comments on the City of Bandon Off-Channel Raw Water Storage Reservoir, Ferry Creek, Bandon, Coos County, Oregon

Dear Ms. Waldron:

The National Marine Fisheries Service (NMFS) received your March 30, 2016 letter requesting comments on the City of Bandon off-channel raw water storage reservoir. This letter regards the potential impacts to any Endangered Species Act (ESA) listed species, critical habitat, or essential fish habitat (EFH) designated under the Magnuson-Stevens Fishery Conservation and Management Act (MSA) that may be found in the vicinity of the proposed reservoir. This letter does not satisfy consultation under the ESA nor the MSA, instead it communicates the presence of NMFS trust resources associated with both of those acts. The City of Bandon and Oregon Water Resources Department are in the planning phases of this project and are evaluating the possible impacts to biological resources near the site. Information on ESA-listed species' distribution, copies of Federal Register documents designating listed species status, and links to various ESA and EFH consultation policies and tools may be found on our website at: http://www.westcoast.fisheries.noaa.gov/.

Based on the information you provided, three species listed as threatened under the ESA occur in the proposed action area, which extends into the Coquille River estuary because the amount of water discharged from Ferry Creek will be reduced. Oregon Coast (OC) coho salmon (*Oncorhynchus kisutch*) are present in Ferry Creek which is also designated critical habitat for them. North American green sturgeon (*Acipenser medirostris*) (green sturgeon) and Pacific eulachon (*Thaleichthys pacificus*) (eulachon) are present in the Coquille River estuary, but it is not designated critical habitat for either species.

The proposed action will divert water from Ferry Creek during winter high flow conditions. Any changing of winter high flows will have resultant changes in the dynamic balance between water and sediment which forms and maintains stream channels. Those channel changes will adversely affect fishery resources that rely on them. Furthermore, winter water withdrawal will occur during OC coho salmon spawning and incubation, two life stages sensitive to stream flow.

If this project has a Federal nexus, section 7 of the ESA requires Federal agencies to consult with us for projects that may affect listed species. For this proposed action, formal consultation is warranted because we expect this project is likely to adversely affect our ESA trust resources. Please refer to section 7 of the ESA and its implementing regulations (50 CFR Part 402) for information on interagency consultation. A biological assessment will be required and you indicate that one will be written according to Department of Agriculture format. We are not familiar with this format, but it is unlikely to meet current standards for NMFS. We suggest you look at the U.S. Fish and Wildlife Service's (FWS) template found here: http://www.fws.gov/midwest/endangered/section7/ba_guide.html, then call us at the number below to discuss.

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. Ferry Creek is designated EFH under the MSA for species of Pacific Coast salmon (Chinook salmon and coho salmon).

If this project does not have a Federal nexus, Section 10(a)(1)(B) allows NMFS and FWS to issue non-Federal proposed actions a permit through the Habitat Conservation Planning process. For more information see here: http://www.fws.gov/endangered/what-we-do/hcp-overview.html.

This letter constitutes the required notification of the presence of a Federally-listed threatened or endangered species or critical habitat under NMFS' jurisdiction in the area that may be affected by the proposed project (Appendix A to Part 330, section C. 13(5)(I)).

We thank you for the opportunity to provide you a list of ESA-listed species, designated critical habitat, and EFH that may be affected by your proposed action. We would like to take this opportunity to recommend that as you continue to develop your project, early coordination with the appropriate state and Federal agencies that have a regulatory interest in your project or jurisdiction over resources within your project area will likely improve the efficiency of the regulatory review of your project, and may result in a more timely outcome.

Please direct any questions regarding this letter to Chuck Wheeler, fisheries biologist in the Oregon Coast Branch of the Oregon Washington Coastal Area Office at 541.957.3379 or chuck.wheeler@noaa.gov.

Sincerely,

Kenneth W. Phippen
Oregon Coast Branch Chief
Oregon Washington Coastal Area Office
West Coast Region – NOAA Fisheries

cc: Jon Unger, OWRD
Matt Winkel, City of Bandon

APPENDIX H

AGENCY LISTS:

Oregon Department Fish and Wildlife, revised October 2014, “Threatened, Endangered, and Candidate Fish and Wildlife Species in Oregon”

Oregon Department Fish and Wildlife, 2008 “Sensitive Species List”

U.S. Fish and Wildlife Service, updated 9/22/2015, “Federally Listed, Proposed, Candidate, Delisted Species and Species of Concern”

Oregon Department of Agriculture, 4/6/2009, “Oregon Listed Plants”

US Department of Agriculture, Threatened & Endangered (Plants), downloaded 1/21/2016

National Marine Fisheries Service (NMFS), updated map 10/31/2012, “Status of ESA Listings & Critical Habitat Designations for West Coast Salmon & Steelhead”

NMFS
http://www.westcoast.fisheries.noaa.gov/protected_species/salmon_steelhead/salmon_and_steelhead_listings/salmon_and_steelhead_listings.html

Threatened, Endangered, and Candidate Fish and Wildlife Species in Oregon

Common Name	Scientific Name	State status*	Federal status
FISH			
Borax Lake Chub	*Gila boraxobius*	E	E
Bull Trout (Range-wide)	*Salvelinus confluentus*		T
Columbia River Chum Salmon	*Oncorhynchus keta*		T
Foskett Speckled Dace	*Rhinichthys osculus* ssp	T	T
Green sturgeon (Southern DPS)	*Acipenser medirostris*		T
Hutton Spring Tui Chub	*Gila bicolor* ssp.	T	T
Lahontan Cutthroat Trout	*Oncorhynchus clarki henshawi*	T	T
Lost River Sucker	*Deltistes luxatus*	E	E
Lower Columbia River Chinook Salmon	*Oncorhynchus tshawytscha*		T
Lower Columbia River Coho Salmon	*Oncorhynchus kisutch*	E	T
Lower Columbia River Steelhead	*Oncorhynchus mykiss*		T
Middle Columbia River Steelhead	*Oncorhynchus mykiss*		T
Modoc sucker	*Catostomus microps*		E
Oregon Chub	*Oregonichthys crameri*		T
Oregon Coast Coho Salmon	*Oncorhynchus kisutch*		T
Pacific Eulachon/Smelt (Southern DPS)	*Thaleichthys pacificus*		T
Shortnose Sucker	*Chasmistes brevirostris*	E	E
Snake River Chinook Salmon (Fall)	*Oncorhynchus tshawytscha*	T	T
Snake River Chinook Salmon (Spring/Summer)	*Oncorhynchus tshawytscha*	T	T
Snake River Sockeye Salmon	*Oncorhynchus nerka*		E
Snake River Steelhead	*Oncorhynchus mykiss*		T
Southern Oregon Coho Salmon	*Oncorhynchus kisutch*		T
Upper Columbia River Spring Chinook Salmon	*Oncorhynchus tshawytscha*		E
Upper Columbia River Steelhead	*Oncorhynchus mykiss*		E
Upper Willamette River Chinook Salmon	*Oncorhynchus tshawytscha*		T
Upper Willamette River Steelhead	*Oncorhynchus mykiss*		T
Warner Sucker	*Catostomus warnerensis*	T	T
AMPHIBIANS AND REPTILES			
Columbia spotted frog ✓	*Rana luteiventris*		C
Green Sea Turtle	*Chelonia mydas*	E	T
Leatherback Sea Turtle	*Dermochelys coriacea*	E	E
Loggerhead Sea Turtle	*Caretta caretta*	T	E
Oregon spotted frog ✓	*Rana pretiosa*		T
Pacific Ridley Sea Turtle	*Lepidochelys olivacea*	T	T
BIRDS			
Brown Pelican	*Pelecanus occidentalis*	E	
California Least Tern	*Sterna antillarum browni*	E	E
Marbled Murrelet	*Brachyramphus marmoratus*	T	T
Northern Spotted Owl	*Strix occidentalis caurina*	T	T
Short-tailed Albatross	*Diomedea albatrus*	E	E
Streaked horned lark	*Eremophila alpestris strigata*		T
Western Snowy Plover	*Charadrius alexandrinus nivosus*	T	T (Coastal population only)
Yellow-billed cuckoo	*Coccyzus americanus*		PT

Common Name	Scientific Name	State status*	Federal status
MAMMALS			
Blue Whale	*Balaenoptera musculus*	E	E
Canada lynx	*Lynx canadensis*		T
Columbian White-tailed Deer (Lower Columbia River population only)	*Odocolieus virginianus leucurus*		E
Fin Whale	*Balaenoptera physalus*	E	E
Fisher	*Martes pennanti*		C
Gray Whale	*Eschrichtius robustus*	E	
Gray Wolf	*Canis lupus*	E	E[1]
Humpback Whale	*Megaptera novaeangliae*	E	E
Kit Fox	*Vulpes macrotis*	T	
North Pacific Right Whale	*Eubalaena japonica*	E	E
Northern (Steller) Sea Lion	*Eumetopias jubatus*		T
Red tree vole	*Arborimus longicaudus*		C
Sea Otter	*Enhydra lutris*	T	T
Sei Whale	*Balaenoptera borealis*	E	E
Sperm Whale	*Physeter macrocephalus*	E	E
Washington Ground Squirrel	*Urocitellus [Spermophilus] washingtoni*	E	C
Wolverine	*Gulo gulo*	T	

Threatened, Endangered, and Candidate Fish and Wildlife Species in Oregon
(T=threatened, E=endangered, C=candidate, DPS=Distinct Population Segment, P=Proposed)

* listed under the Oregon Endangered Species Act (ORS 496.171 through192)

1: The gray wolf is protected as endangered under the authority of the Federal ESA in Oregon west of Highways 395, 78, and 95.

Revised October 2014

Oregon Department of Fish and Wildlife
SENSITIVE SPECIES LIST
Organized by Category

An asterisk (*) indicates that the species, Distinct Population Segment (DPS) or Evolutionarily Significant Unit (ESU) is federally listed as threatened or endangered by either NOAA's National Marine Fisheries Service or the U.S. Fish and Wildlife Service. Parenthetical scientific names are proposed taxonomic changes not yet adopted by the American Fisheries Society Committee on Names of Fishes.

Sensitive Species: Fish. USGS Hydrologic Unit (HU) distribution is based on current known distribution as described in the ODFW Native Fish Status Report, literature review, or expert information. A species or Species Management Unit (SMU) may be distributed in all or a portion of the HU where appropriate habitat exists. For anadromous species, the distribution does not include migration corridors. Figure 2 displays the location of the hydrologic units in Oregon.

SENSITIVE – CRITICAL

Common Name	Scientific Name	USGS HU distribution (current)
FISH		
Modoc Sucker*	*Catostomus microps*	Goose Lake (18020001)
Westslope Cutthroat Trout	*Oncorhynchus clarki lewisi* (Behnke 2002)	Upper John Day (17070201)
Chum Salmon (Columbia River ESU)*	*Oncorhynchus keta*	Lower Columbia (17080006), Lower Columbia-Clatskanie (17080003), Lower Willamette (17090012), Lower Columbia-Sandy (17080001)
Chum Salmon (Coastal Chum Salmon SMU/Pacific Coast ESU)	*Oncorhynchus keta*	Nehalem (17100202), Necanicum (17100201), Wilson-Trask-Nestucca (17100203), Yamhill (17090008), Siletz-Yaquina (17100204)
Steelhead (Klamath Mountains Province ESU, Klamath Summer Steelhead SMU)	*Oncorhynchus mykiss*	Upper Klamath River (18010206)
Steelhead (Lower Columbia River ESU/SMU, winter run)*	*Oncorhynchus mykiss*	Lower Columbia (17080006), Lower Columbia-Clatskanie (17080003), Lower Willamette (17090012), Lower Columbia-Sandy (17080001), Clackamas (17090011), Middle Columbia-Hood (17070105)
Steelhead (Lower Columbia River ESU/SMU, summer run)*	*Oncorhynchus mykiss*	Middle Columbia-Hood (17070105)
Steelhead (Middle Columbia River ESU, summer run)*	*Oncorhynchus mykiss*	Lower Deschutes (17070306), Trout (17070307), Upper Deschutes (17070301), Lower Crooked (17070305), Upper John Day (17070201), North Fork John Day (17070202), Middle Fork John Day (17070203), Lower John Day (17070204), Umatilla (17070103), Walla Walla (17070102)
Great Basin Redband Trout (Catlow Valley Redband Trout SMU)	*Oncorhynchus mykiss newberrii* (Behnke 2002)	Guano (17120008)
Great Basin Redband Trout (Goose Lake Redband Trout SMU)	*Oncorhynchus mykiss newberrii* (Behnke 2002)	Goose Lake (18020001)

Common Name	Scientific Name	USGS HU distribution (current)
Great Basin Redband Trout (Warner Lakes Redband Trout SMU)	*Oncorhynchus mykiss newberrii* (Behnke 2002)	Warner Lake (17120007)
Great Basin Redband Trout (Fort Rock Redband Trout SMU)	*Oncorhynchus mykiss newberrii* (Behnke 2002)	Summer Lake (17120005)
Chinook Salmon (Upper Willamette River ESU, spring run/Willamette Spring Chinook SMU)*	*Oncorhynchus tshawytscha*	Molalla-Pudding (17090009), North Santiam (17090005), South Santiam (17090006), Mckenzie (17090004), Middle Fork Willamette (17090001), Coast Fork Willamette (17090002), Upper Willamette (17090003)
Chinook Salmon (Coastal Spring Chinook SMU)	*Oncorhynchus tshawytscha*	Wilson-Trask-Nestucca (17100203), Siletz-Yaquina (17100204), Alsea (17100205), Coquille (17100305), North Umpqua (17100301), South Umpqua (17100302)
Chinook Salmon (Lower Columbia River Chinook ESU/SMU, fall run)*	*Oncorhynchus tshawytscha*	Lower Columbia (17080006), Lower Columbia-Clatskanie (17080003), Lower Columbia-Sandy (17080001), Clackamas (17090011), Middle Columbia-Hood (17070105), Lower Willamette (17090012)
Chinook Salmon (Lower Columbia River Chinook ESU/SMU, spring run)*	*Oncorhynchus tshawytscha*	Lower Columbia-Sandy (17080001), Clackamas (17090011)
Oregon Chub*	*Oregonichthys crameri*	North Santiam (17090005), Upper Willamette (17090003), South Santiam (17090006), Mckenzie (17090004), Middle Fork Willamette (17090001), Coast Fork Willamette (17090002)
Umpqua Chub	*Oregonichthys kalawatseti*	Umpqua (17100303), North Umpqua (17100301), South Umpqua (17100302)
Bull Trout (Willamette Bull Trout SMU)*	*Salvelinus confluentus*	Mckenzie (17090004), Middle Fork Willamette (17090001)
Bull Trout (John Day Bull Trout SMU)*	*Salvelinus confluentus*	North Fork John Day (17070202), Middle Fork John Day (17070203), Upper John Day (17070201)
Bull Trout (Umatilla Bull Trout SMU)*	*Salvelinus confluentus*	Umatilla (17070103)
Bull Trout (Grande Ronde Bull Trout SMU)*	*Salvelinus confluentus*	Upper Grande Ronde River (17060104), Wallowa River (17060105), Lower Grande Ronde (17060106)
Bull Trout (Imnaha Bull Trout SMU)*	*Salvelinus confluentus*	Imnaha River (17060102)
Bull Trout (Hells Canyon Bull Trout SMU)*	*Salvelinus confluentus*	Brownlee Reservoir (17050201), Powder River (17050203)
Bull Trout (Hood River Bull Trout SMU)*	*Salvelinus confluentus*	Middle Columbia-Hood (17070105)
Bull Trout (Malheur River Bull Trout SMU)*	*Salvelinus confluentus*	Upper Malheur (17050116)
Bull Trout (Odell Lake Bull Trout SMU)*	*Salvelinus confluentus*	Upper Deschutes (17070301)
Bull Trout (Klamath Lake Bull Trout SMU)*	*Salvelinus confluentus*	Upper Klamath Lake (18010203), Sprague (18010202)

SENSITIVE - CRITICAL

Common Name	Scientific Name	Ecoregion
AMPHIBIANS		
Columbia Spotted Frog	*Rana luteiventris*	Columbia Plateau, Northern Basin and Range
Oregon Spotted Frog	*Rana pretiosa*	
Foothill Yellow-legged Frog	*Rana boylii*	Willamette Valley
Northern Leopard Frog	*Lithobates pipiens*	
REPTILES		
Western Painted Turtle	*Chrysemys picta bellii*	
Western Pond Turtle	*Actinemys marmorata*	
Western Rattlesnake	*Crotalus oreganus*	Willamette Valley
BIRDS		
Columbian Sharp-tailed Grouse	*Tympanuchus phasianellus columbianus*	
Red-necked Grebe	*Podiceps grisegena*	Breeding Population
Ferruginous Hawk	*Buteo regalis*	Columbia Plateau
Yellow Rail	*Coturnicops noveboracensis*	
Upland Sandpiper	*Bartramia longicauda*	
Yellow-billed Cuckoo	*Coccyzus americanus*	
Burrowing Owl	*Athene cunicularia*	Blue Mountains, Columbia Plateau, Eastern Cascades Slopes and Foothills, Klamath Mountains, Willamette Valley
Common Nighthawk	*Chordeiles minor*	Willamette Valley
Lewis's Woodpecker	*Melanerpes lewis*	
White-headed Woodpecker	*Picoides albolarvatus*	
Streaked Horned Lark	*Eremophila alpestris strigata*	Coast Range, Klamath Mountains, Willamette Valley
Purple Martin	*Progne subis*	
Yellow-breasted Chat	*Icteria virens*	Willamette Valley
Oregon Vesper Sparrow	*Pooecetes gramineus affinis*	Klamath Mountains, Willamette Valley
Sage Sparrow	*Amphispiza belli*	Columbia Plateau
Western Meadowlark	*Sturnella neglecta*	Willamette Valley
MAMMALS		
Townsend's Big-eared Bat	*Corynorhinus townsendii*	
Fisher	*Martes pennanti*	

SENSITIVE – VULNERABLE

Common Name	Scientific Name	USGS HU distribution (current)
FISH		
Goose Lake Sucker	*Catostomus occidentalis lacusanserinus* (Moyle 2002)	Goose Lake (18020001)
Alvord Chub	*Gila alvordensis* (*Siphateles alvordensis*)	Alvord Lake (17120009)
Miller Lake Lamprey	*Lampetra minima* (*Entosphenus minimus*)	Williamson (18010201), Sprague (18010202)
Western Brook Lamprey	*Lampetra richardsoni*	Columbia River system and coastal streams including the Rogue
Pacific Lamprey	*Lampetra tridentate* (*Entosphenus tridentata*)	Columbia River system and coastal streams including the Rogue
Coastal Cutthroat Trout (Lower Columbia Coastal Cutthroat Trout SMU/ Southwestern Washington/Columbia River ESU)	*Oncorhynchus clarkii clarkii*	Lower Columbia-Clatskanie (17080003), Lower Columbia (17080006), Lower Willamette (17090012), Middle Columbia-Hood (17070105), Lower Columbia-Sandy (17080001), Clackamas (17090011)
Coho Salmon (Coastal Coho Salmon SMU/Oregon Coast ESU)*	*Oncorhynchus kisutch*	Nehalem (17100202), Necanicum (17100201), Wilson-Trask-Nestucca (17100203), Siletz-Yaquina (17100204), Alsea (17100205), Siuslaw (17100206), Siltcoos (17100207), Umpqua (17100303), Coos (17100304), South Umpqua (17100302), Coquille (17100305), Sixes (17100306), North Umpqua (17100301)
Coho Salmon (Southern Oregon/Northern California Coasts ESU/Rogue (and Klamath) Coho SMU)*	*Oncorhynchus kisutch*	Middle Rogue (17100308), Lower Rogue (17100310), Illinois (17100311), Upper Rogue (17100307), Applegate (17100309)
Inland Columbia Redband Trout	*Oncorhynchus mykiss gairdneri*	Lower Owyhee (17050110), Jordan (17050108), Middle Owyhee (17050107), South Fork Owyhee (17050105), East Little Owyhee (17050106), Lower Malheur (17050117), Upper Malheur (17050116), Bully (17050118), Willow (17050119), Burnt River (17050202), Lower Snake-Asotin (17060103), Walla Walla (17070102), , Lower Grande Ronde (17060106), Middle Fork John Day (17070203), Lower John Day (17070204), Brownlee Reservoir (17050201), Powder River (17050203), Imnaha River (17060102), North Fork John Day (17070202), Upper Grande Ronde River (17060104), Wallowa River (17060105), Willow (17070104), Umatilla (17070103), South Fork Crooked (17070303), Upper Crooked (17070304), Upper John Day (17070201), Little Deschutes (17070302), , Lower Crooked (17070305), Upper Deschutes (17070301), Trout (17070307), Middle Columbia-Hood (17070105), Lower Deschutes (17070306)
Great Basin Redband Trout (Malheur Lakes Redband SMU)	*Oncorhynchus mykiss newberrii* (Behnke 2002)	Silvies (17120002), Harney-Malheur Lakes (17120001), Silver (17120004), Donner Und Blitzen (17120003),
Great Basin Redband Trout (Chewaucan Redband Trout SMU)	*Oncorhynchus mykiss newberrii* (Behnke 2002)	Lake Abert (17120006)
Great Basin Redband Trout (Upper Klamath Basin Redband Trout SMU)	*Oncorhynchus mykiss newberrii* (Behnke 2002)	Sprague (18010202), Upper Klamath Lake (18010203), Williamson (18010201), Lost River (18010204), Upper Klamath River (18010206)

Common Name	Scientific Name	USGS HU distribution (current)
Steelhead (Upper Willamette River ESU, winter run/Willamette Winter Steelhead SMU)*	*Oncorhynchus mykiss*	Tualatin (17090010), Yamhill (17090008), Molalla-Pudding (17090009), North Santiam (17090005), South Santiam (17090006), Upper Willamette (17090003), Middle Willamette (17090007)
Steelhead (Oregon Coast ESU, summer run/Coastal Summer Steelhead SMU)	*Oncorhynchus mykiss*	Siletz-Yaquina (17100204), North Umpqua (17100301)
Steelhead (Oregon Coast ESU, winter run/Coastal Winter Steelhead SMU)	*Oncorhynchus mykiss*	Nehalem (17100202), Necanicum (17100201), Wilson-Trask-Nestucca (17100203), Siletz-Yaquina (17100204), Alsea (17100205), Siuslaw (17100206), Umpqua (17100303), Coos (17100304), North Umpqua (17100301), South Umpqua (17100302), Coquille (17100305), Sixes (17100306)
Steelhead (Klamath Mountains Province ESU, summer run/Rogue Summer Steelhead SMU)	*Oncorhynchus mykiss*	Upper Rogue (17100307), Middle Rogue (17100308), Applegate (17100309), Lower Rogue (17100310)
Steelhead (Snake River Basin ESU/Snake Summer Steelhead SMU)*	*Oncorhynchus mykiss*	Imnaha River (17060102), Upper Grande Ronde River (17060104), Wallowa River (17060105), Lower Grande Ronde River (17060106)
Chinook Salmon (Mid-Columbia River ESU/SMU, fall run)	*Oncorhynchus tshawytscha*	Lower Deschutes (17070306)
Chinook Salmon (Rogue Spring Chinook SMU)	*Oncorhynchus tshawytscha*	Upper Rogue (17100307), Middle Rogue (17100308)
Chinook Salmon (Middle Columbia Spring Chinook SMU	*Oncorhynchus tshawytscha*	Lower Deschutes (17070306), Upper Deschutes (17070301), Lower Crooked (17070305), Upper John Day (17070201), North Fork John Day (17070202), Middle Fork John Day (17070203)
Chinook Salmon (Southern Oregon/Northern California Coast ESU, fall run/Rogue Fall Chinook SMU)	*Oncorhynchus tshawytscha*	Lower Rogue (17100310), Illinois (17100311), Chetco (17100312), Upper Rogue (17100307), Middle Rogue (17100308), Applegate (17100309), Sixes (17100306)
Millicoma Dace	*Rhinichthys cataractae* ssp.	Coos (17100304)
Bull Trout (Deschutes Bull Trout SMU)*	*Salvelinus confluentus*	Lower Deschutes (17070306), Upper Deschutes (17070301)

SENSITIVE - VULNERABLE

	Common Name	Scientific Name	Ecoregion
	AMPHIBIANS		
	Cope's Giant Salamander	*Dicamptodon copei*	
	Columbia Torrent Salamander	*Rhyacotriton kezeri*	
5	Southern Torrent Salamander	*Rhyacotriton variegatus*	
	Cascade Torrent Salamander	*Rhyacotriton cascadae*	
	Larch Mountain Salamander	*Plethodon larselli*	
005	Del Norte Salamander	*Plethodon elongatus*	
	Siskiyou Mountains Salamander	*Plethodon stormi*	
[illegible]	Clouded Salamander	*Aneides ferreus*	
	Black Salamander	*Aneides flavipunctatus*	
	Oregon Slender Salamander	*Batrachoseps wrightorum*	
	Rocky Mountain Tailed Frog	*Ascaphus montanus*	
2005	Coastal Tailed Frog	*Ascaphus truei*	
005	Western Toad	*Anaxyrus boreas*	
	Northern Red-legged Frog	*Rana aurora*	Klamath Mountains, Willamette Valley
	Cascades Frog	*Rana cascadae*	
	Columbia Spotted Frog	*Rana luteiventris*	Blue Mountains, Eastern Cascades Slopes and Foothills
	Foothill Yellow-legged Frog	*Rana boylii*	Coast Range, Klamath Mountains, West Cascades
	REPTILES		
	Northern Sagebrush Lizard	*Sceloporus graciosus graciosus*	Columbia Plateau
	Common Kingsnake	*Lampropeltis getula*	
	California Mountain Kingsnake	*Lampropeltis zonata*	
	BIRDS		
	Greater Sage-Grouse	*Centrocercus urophasianus*	Blue Mountains, Columbia Plateau, Eastern Cascades Slopes and Foothills
	Spruce Grouse	*Falcipennis canadensis*	
	Mountain Quail	*Oreortyx pictus*	Northern Basin and Range
	American White Pelican	*Pelecanus erythrorhynchos*	Breeding Population
	Snowy Egret	*Egretta thula*	Breeding Population
	Northern Goshawk	*Accipiter gentilis*	
	Swainson's Hawk	*Buteo swainsoni*	
	Ferruginous Hawk	*Buteo regalis*	Blue Mountains, Eastern Cascades Slopes and Foothills
	American Peregrine Falcon	*Falco peregrinus anatum*	
	Arctic Peregrine Falcon	*Falco peregrinus tundrius*	
	Greater Sandhill Crane	*Grus canadensis tabida*	Central Valley Population (Oregon Breeding Population)
	Black Oystercatcher	*Haematopus bachmani*	
	Long-billed Curlew	*Numenius americanus*	Blue Mountains, Columbia Plateau, Eastern Cascades Slopes and Foothills

SENSITIVE - VULNERABLE

Common Name	Scientific Name	Ecoregion
BIRDS continued		
Franklin's Gull	*Larus pipixcan*	
Cassin's Auklet	*Ptychoramphus aleuticus*	
Rhinocerous Auklet	*Cerorhinca monocerata*	
Tufted Puffin	*Fratercula cirrhata*	
Flammulated Owl	*Otus flammeolus*	
Burrowing Owl	*Athene cunicularia*	Northern Basin and Range
Great Gray Owl	*Strix nebulosa*	
Acorn Woodpecker	*Melanerpes formicivorus*	Willamette Valley
American Three-toed Woodpecker	*Picoides dorsalis*	
Black-backed Woodpecker	*Picoides arcticus*	
Pileated Woodpecker	*Dryocopus pileatus*	Blue Mountains, Eastern Cascades Slopes and Foothills, Klamath Mountains
Olive-sided Flycatcher	*Contopus cooperi*	
Willow Flycatcher	*Empidonax traillii adastus*	Blue Mountains, Columbia Plateau, Eastern Cascades Slopes and Foothills, Northern Basin and Range
Little Willow Flycatcher	*Empidonax traillii brewsteri*	Coast Range, Klamath Mountains, West Cascades, Willamette Valley
Loggerhead Shrike	*Lanius ludovicianus*	Blue Mountains, Columbia Plateau, Eastern Cascades Slopes and Foothills
White-breasted Nuthatch (=Slender-billed Nuthatch)	*Sitta carolinensis aculeata*	Coast Range, Klamath Mountains, West Cascades, Willamette Valley
Western Bluebird	*Sialia mexicana*	Coast Range, Klamath Mountains, West Cascades, Willamette Valley
Grasshopper Sparrow	*Ammodramus savannarum*	
Bobolink	*Dolichonyx oryzivorus*	
MAMMALS		
California Myotis	*Myotis californicus*	
Fringed Myotis	*Myotis thysanodes*	
Long-legged Myotis	*Myotis volans*	
Hoary Bat	*Lasiurus cinereus*	
Silver-haired Bat	*Lasionycteris noctivagans*	
Spotted Bat	*Euderma maculatum*	
Pallid Bat	*Antrozous pallidus*	
Pygmy Rabbit	*Brachylagus idahoensis*	
Black-tailed Jackrabbit	*Lepus californicus*	Willamette Valley
White-tailed Jackrabbit	*Lepus townsendii*	
Western Gray Squirrel	*Sciurus griseus*	Willamette Valley
Red Tree Vole	*Arborimus longicaudus*	Coast Range
Ringtail	*Bassariscus astutus*	
American Marten	*Martes americana*	Blue Mountains, Coast Range
Columbian White-tailed Deer*	*Odocoileus virginianus leucurus*	Coast Range (Columbia River Population)

— Coos

FEDERALLY LISTED, PROPOSED, CANDIDATE, DELISTED SPECIES AND SPECIES OF CONCERN UNDER THE JURISDICTION OF THE FISH AND WILDLIFE SERVICE WHICH MAY OCCUR WITHIN OREGON

LISTED SPECIES

Mammals

Gray wolf (Conterminous USA, lower 48 states, except where otherwise designated)	*Canis lupus*	E
Canada lynx	*Lynx canadensis*	CH T
Columbian white-tailed deer (Columbia River population)	*Odocoileus virginianus leucurus*	E

Birds

Marbled murrelet (Washington, Oregon and California population)	*Brachyramphus marmoratus*	CH T
Western snowy (coastal) plover (Pacific coast population)	*Charadrius alexandrinus nivosus*	CH T
Yellow-billed cuckoo (Western population)	*Coccyzus americanus*	T
Streaked horned lark	*Eremophila alpestris strigata*	CH T
Short-tailed albatross	*Phoebastria albatrus* — Not in OR BIC	E
Northern spotted owl	*Strix occidentalis caurina*	CH T

Reptiles and Amphibians

Inland:

Oregon spotted frog	*Rana pretiosa*	PCH T

Marine:

Loggerhead sea turtle	*Caretta caretta*	E
Green sea turtle	*Chelonia mydas*	T
Leatherback sea turtle	*Dermochelys coriacea*	E
Olive (=Pacific) ridley sea turtle	*Lepidochelys olivacea*	T

Fish

Inland:

Modoc sucker	*Catostomus microps*	CH E
Warner sucker	*Catostomus warnerensis*	CH T
Shortnose sucker	*Chasmistes brevirostris*	PCH E
Lost River sucker	*Deltistes luxatus*	PCH E
Hutton tui chub	*Gila bicolor ssp.*	T
Borax Lake chub	*Gila boraxobius*	CH E
Lahontan cutthroat trout	*Oncorhynchus clarki henshawi*	T
Foskett speckled dace	*Rhinichthys osculus ssp.*	T
Bull trout (Conterminous USA, lower 48 states)	*Salvelinus confluentus*	CH T

Invertebrates

FEDERALLY LISTED, PROPOSED, CANDIDATE, DELISTED SPECIES AND SPECIES OF CONCERN UNDER THE JURISDICTION OF THE FISH AND WILDLIFE SERVICE WHICH MAY OCCUR WITHIN OREGON

Crustaceans:

Vernal pool fairy shrimp	*Branchinecta lynchi*	CH T

Insects:

Taylor's checkerspot butterfly	✓*Euphydryas editha taylori*	CH E
Fender's blue butterfly	Plebejus ✓*Icaricia icarioides fenderi*	CH E
Oregon silverspot butterfly	✓*Speyeria zerene hippolyta*	CH T

Plants

McDonald's rockcress	*Arabis macdonaldiana*	E
Applegate's milk-vetch	*Astragalus applegatei*	E
Golden paintbrush	*Castilleja levisecta*	T
Willamette daisy	*Erigeron decumbens var. decumbens*	CH E
Gentner's fritillary	*Fritillaria gentneri*	E
Water howellia	*Howellia aquatilis*	T
→ Western lily	*Lilium occidentale*	E — [illegible]
Large-flowered woolly meadowfoam	*Limnanthes pumila spp. grandiflora*	CH E
Bradshaw's desert parsley	*Lomatium bradshawii*	E
Cook's lomatium	*Lomatium cookii*	CH E
Kincaid's lupine	*Lupinus sulphureus spp. kincaidii*	CH T
MacFarlane's four o'clock	*Mirabilis macfarlanei*	T
Rough popcornflower	*Plagiobothrys hirtus*	E
Nelson's checker-mallow	*Sidalcea nelsoniana*	T
Spalding's catchfly	*Silene spaldingii*	T
Malheur wire-lettuce	*Stephanomeria malheurensis*	CH E
Howell's spectacular thelypody	*Thelypodium howellii spp. spectabilis*	T

PROPOSED SPECIES

No Proposed Endangered Species	PE
No Proposed Threatened Species	PT

Mammals

→ Fisher (West Coast population)	*Martes pennanti*	PT

CANDIDATE SPECIES

Mammals

→ Red tree vole (North Oregon Coast population)	*Arborimus longicaudus*
Washington ground squirrel	*Urocitellus washingtoni*

[illegible]

FEDERALLY LISTED, PROPOSED, CANDIDATE, DELISTED SPECIES AND SPECIES OF CONCERN UNDER THE JURISDICTION OF THE FISH AND WILDLIFE SERVICE WHICH MAY OCCUR WITHIN OREGON

Birds

Xantus's murrelet	*Synthliboramphus hypoleucus*

Reptiles and Amphibians

***Inland*:**

Columbia spotted frog (Great Basin population)	*Rana luteiventris*

Plants

Northern wormwood	*Artemisia campestris var. wormskioldii*
Siskiyou mariposa lily	*Calochortus persistens*
Whitebark Pine	*Pinus albicaulis*

DELISTED SPECIES

Mammals

Gray wolf (Rocky Mountain population)	*Canis lupus*
Columbian white-tailed deer (Douglas County population)	*Odocoileus virginianus leucurus*

Birds

Aleutian Canada goose	*Branta canadensis leucopareia*
American Peregrine falcon	*Falco peregrinus anatum*
Bald eagle (USA, lower 48 states)	*Haliaeetus leucocephalus*
Brown pelican (Entire, except U.S. Atlantic coast, FL, AL)	*Pelecanus occidentalis*

Fish

***Inland*:**

Oregon chub	*Oregonichthys crameri*

SPECIES OF CONCERN

Mammals

Pallid bat	✓ *Antrozous pallidus pacificus* – Coos Co
→ White-footed vole	*Arborimus albipes*
Pale western big-eared bat	*Corynorhinus townsendii pallescens*
→ Townsend's western big-eared bat	*Corynorhinus townsendii townsendii* – Coos Co.
Spotted bat	✓ *Euderma maculatum*
→ Silver-haired bat	*Lasionycteris noctivagans* – Coos Co.

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Hoary bat	*Lasiurus cinereus*
Small-footed myotis bat	*Myotis ciliolabrum*
→ Long-eared myotis bat	*Myotis evotis* — Coos Co
→ Fringed myotis bat	*Myotis thysanodes* — Coos Co
→ Long-legged myotis bat	*Myotis volans* — Coos
→ Yuma myotis bat	*Myotis yumanensis* — Coos
Preble's shrew	*Sorex preblei*
Camas pocket gopher	*Thomomys bulbivorus*
Goldbeach western pocket gopher	*Thomomys mazama helleri*
Pistol River pocket gopher	*Thomomys umbrinus detumidus*
***Terrestrial*:**	
Pygmy rabbit	*Brachylagus idahoensis*

Birds

Northern goshawk	*Accipiter gentilis* — Coos
Tricolored blackbird	*Agelaius tricolor*
Western burrowing owl	*Athene cunicularia hypugaea* — Coos
Upland sandpiper	*Bartramia longicauda*
Ferruginous hawk	*Buteo regalis*
Greater sage-grouse	*Centrocercus urophasianus*
Black tern	*Chlidonias niger*
Olive-sided flycatcher	*Contopus cooperi* — Coos
Yellow rail	*Coturnicops noveboracensis*
Willow flycatcher	*Empidonax traillii adastus*
Black oystercatcher	*Haematopus bachmani* — Coos
Harlequin duck	*Histrionicus histrionicus* — Coos
Yellow-breasted chat	*Icteria virens* — Coos
Acorn woodpecker	*Melanerpes formicivorus* — [illegible]
Lewis' woodpecker	*Melanerpes lewis*
Mountain quail	*Oreortyx pictus*
Band-tailed pigeon	*Patagioenas fasciata* — Coos
White-headed woodpecker	*Plcoides albolarvatus*
White-faced ibis	*Plegadis chihi*
Oregon vesper sparrow	*Pooecetes gramineus affinis* — Coos
Purple martin	*Progne subis* — Coos
Columbian sharp-tailed grouse	*Tympanuchus phasianellus columbianus*

Reptiles and Amphibians

→ Northern Pacific pond turtle	*Actinemys marmorata marmorata*
Rocky Mountain tailed frog	*Ascaphus montanus*
→ Coastal tailed frog	*Ascaphus truei*
Oregon slender salamander	*Batrachoseps wrighti*
Common kingsnake	*Lampropeltis getula*
California mountain kingsnake	*Lampropeltis zonata*

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Del Norte salamander	*Plethodon elongatus*
Larch Mountain salamander	*Plethodon larselli*
Siskiyou Mountains salamander	*Plethodon stormi*
Northern red-legged frog	*Rana aurora aurora*
Foothill yellow-legged frog	*Rana boylii*
Cascades frog	*Rana cascadae*
Southern torrent (seep) salamander	*Rhyacotriton variegatus*
Northern sagebrush lizard	*Sceloporus graciosus graciosus*

Fish

Goose Lake sucker	*Catostomus occidentalis lacusanserinus*
Jenny Creek sucker	*Catostomus rimiculus ssp.*
Klamath largescale sucker	*Catostomus snyderi*
Malheur mottled sculpin	*Cottus bairdi ssp.*
Margined sculpin	*Cottus marginatus*
Slender sculpin	*Cottus tenuis*
Alvord chub	*Gila alvordensis*
Sheldon tui chub	*Gila bicolor eurysoma*
Oregon Lakes tui chub	*Gila bicolor oregonensis*
Summer Basin tui chub	*Gila bicolor ssp.*
Catlow tui chub	*Gila bicolor ssp.*
River lamprey	*Lampetra ayresi*
Pacific lamprey	*Lampetra tridentata*
Goose Lake lamprey	*Lampetra tridentata ssp.*
Pit roach	*Lavinia symmetricus mitrulus*
Westslope cutthroat trout	*Oncorhynchus clarki lewisi*
Coastal cutthroat trout	*Oncorhynchus clarki ssp*
Great Basin redband trout	*Oncorhynchus mykiss gibbsi*
Catlow Valley redband trout	*Oncorhynchus mykiss ssp.*
Umpqua chub	*Oregonichthys kalawatseti*
Millicoma dace	*Rhinichthys cataractae ssp.*

Invertebrates

Annelid Worms:	
Oregon giant earthworm	*Megascolides macelfreshi*
Arachnids:	
Malheur pseudoscorpion	*Apochtonius malheuri*
Clams:	
California floater mussel	*Anodonta californiensis*
Peaclam.	*Pisidium ultramontanum*
Crustaceans:	
Malheur Cave amphipod	*Stygobromus hubbsi*
Flatworms and Roundworms:	
Planarian	*Kenkia rhynchida*

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Insects:

American acetropis grass bug	*Acetropis americana*
Denning's agapetus caddisfly	✓*Agapetus denningi*
Beller's ground beetle	✓*Agonum belleri*
Scott's apatanian caddisfly	✓*Allomyia scotti*
Cascades apatanian caddisfly	✓*Apatania tavala*
Franklin's bumblebee	*Bombus franklini*
Siskiyou chloealtis grasshopper	*Chloaeltis aspasma*
Blue Mountains cryptochian caddisfly	*Cryptochia neosa*
Mt. Hood primitive brachycentrid caddisfly	*Eobrachycentrus gelidae*
Green Springs Mountain farulan caddisfly	*Farula davisi*
Mt. Hood farulan caddisfly	*Farula jewetti*
Tombstone Prairie farulan caddisfly	*Farula reaperi*
Sagehen Creek goeracean caddisfly	*Goeracea oregona*
Lynn's clubtail dragonfly	✓*Gomphus lynnae*
Schuh's homoplectran caddisfly	*Homoplectra schuhi*
Goeden's lepidostoman caddisfly	✓*Lepidostoma goedeni*
Siskiyou carabid beetle	*Nebria gebleri siskiyouensis*
Columbia Gorge neothremman caddisfly	✓*Neothremma andersoni*
Tombstone Prairie oligophlebodes caddisfly	✓*Oligophlebodes mostbento*
Insular blue butterfly	*Plebejus saepiolus insulanus* [illegible] = ?
Roth's blind ground beetle	✓*Pterostichus rothi*
Obrien rhyacophilan caddisfly	*Rhyacophila colonus*
Haddock's rhyacophilan caddisfly	*Rhyacophila haddocki*
One-spot rhyacophilan caddisfly	✓*Rhyacophila unipunctata*
Wahkeena Falls flightless stonefly	*Zapada wahkeena*

Snails:

Newcomb's littorine snail	*Algamorda newcombiana*
Columbia pebblesnail	*Fluminicola fuscus (= columbianus)*
Minor Pacific sideband snail	*Monadenia fidelis minor*

Plants

Pink sand-verbena	*Abronia umbellata spp. breviflora* — [illegible]
Henderson ricegrass	✓ *Achnatherum hendersonii*
Wallowa ricegrass	✓ *Achnatherum wallowaensis*
Henderson's bentgrass	✓ *Agrostis hendersonii*
Howell's bentgrass	✓ *Agrostis howellii*
Blue Mountain onion	✓ *Allium dictuon*
Robinson's onion	✓ *Allium robinsonii*
Malheur Valley fiddleneck	✓ *Amsinckia carinata*
Bog anemone	✓ *Anemone oregana var. felix*
Hell's Canyon rock-cress	*Arabis hastatula*
Koehler's rock-cress	✓ *Arabis koehleri var. koehleri*
Rogue canyon rock cress	✓ *Arabis modesta*

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Crater Lake rock-cress	Boechera ✓ *Arabis suffrutescens var. horizontalis*
Gasquet manzanita	✓ *Arctostaphylos hispidula*
Estes' artemisia	✓ *Artemisia ludoviciana spp. estesii*
Laurence's milk-vetch	✓ *Astragalus collinus var. laurentii*
Mulford's milk-vetch	✓ *Astragalus mulfordiae*
Bastard kentrophyta	✓ *Astragalus tegetarioides*
— Bensoniella	*Bensoniella oregona*
Upward-lobed moonwort	✓ *Botrychium ascendens*
Prairie moonwart	✓ *Botrychium campestre*
Crenulate grape fern	✓ *Botrychium crenulatum*
Mountain grape fern	✓ *Botrychium montanum*
Twin-spike moonwort	✓ *Botrychium paradoxum*
Stalked moonwort	✓ *Botrychium pedunculosum*
Cox's mariposa lily	✓ *Calochortus coxii*
Greene's mariposa lily	✓ *Calochortus greenei*
Howell's mariposa lily	✓ *Calochortus howellii*
Peck's mariposa lily	✓ *Calochortus longebarbatus var. peckii*
Green-band mariposa lily	✓ *Calochortus macrocarpus var. maculosus*
Broad-fruit mariposa lily	✓ *Calochortus nitidus*
Umpqua mariposa-lily	✓ *Calochortus umpquaensis*
Howell's camassia	✓ *Camassia howellii*
Dwarf evening-primrose	✓ ~~*Camissonia*~~ *pygmaea* Eremothera
Saddle Mountain bittercress	✓ *Cardamine pattersonii*
Idaho sedge	*Carex idahoa*
Chamber's paintbrush	✓ *Castilleja chambersii*
Fraternal paintbrush	✓ *Castilleja fraterna*
Mendocino coast indian paintbrush	✓ *Castilleja mendocinensis*
Purple alpine paintbrush	✓ *Castilleja rubida*
Cliff paintbrush	✓ *Castilleja rupicola*
Slender wild cabbage	✓ *Caulanthus major var. nevadensis*
Barren valley collomia	✓ *Collomia renacta*
— Pt. Reyes bird's-beak	*Cordylanthus maritimus spp. palustris* — Coos Co.
Cold-water corydalis	✓ *Corydalis aquae-gelidae*
Baker's cypress	✓ ~~*Cupressa*~~ bakeri Hesperocyparis
Greeley's springparsley	✓ *Cymopterus acaulis var. greeleyorum*
Clustered lady's-slipper	✓ *Cypripedium fasciculatum*
Pale larkspur	✓ *Delphinium leucophaeum*
Willamette Valley larkspur	✓ *Delphinium oreganum*
Peacock larkspur	✓ *Delphinium pavonaceum*
Few-flowered bleedingheart	✓ *Dicentra pauciflora*
Frigid shootingstar	✓ *Dodecatheon austrofrigidum*
Oregon fireweed	✓ *Epilobium oreganum*
Siskiyou willow-herb	✓ *Epilobium siskiyouense*
Siskiyou daisy	✓ *Erigeron cervinus*

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Englemann's daisy	✓ *Erigeron engelmannii var. davisii*
Howell's daisy	✓ *Erigeron howellii*
Oregon fleabane	✓ *Erigeron oreganus*
Golden buckwheat	✓ *Eriogonum chrysops*
Crosby's buckwheat	✓ *Eriogonum crosbyae*
Cusick's buckwheat	✓ *Eriogonum cusickii*
Prostrate buckwheat	✓ *Eriogonum prociduum*
Green buckwheat	✓ *Eriogonum umbellatum var. glaberrimum*
Pacific wallflower	✓ *Erysimum menziesii spp. concinnum*
Coast Range fawn lily	✓ *Erythronium elegans*
Wayside aster	✓ *Eucephalus vialis*
Queen-of-the-forest	✓ *Filipendula occidentalis*
Purdy's fritillary	✓ *Fritillaria purdyi*
Warner Mountain bedstraw	✓ *Galium serpenticum spp. warnerense*
Bristly gentian	✓ *Gentiana plurisetosa*
Waldo gentian	✓ *Gentiana setigera*
Seaside gilia	✓ *Gilia millefoliata*
Boggs Lake hedge-hyssop	*Gratiola heterosepala*
Cronquist's stickseed	*Hackelia cronquistii*
Purple-flowered rush lily	*Hastingsia bracteosa var. atropurpurea*
Large-flowered rush lily	✓ *Hastingsia bracteosa var. bracteosa*
Shaggy horkelia	✓ *Horkelia congesta spp. congesta*
Henderson's horkelia	✓ *Horkelia hendersonii*
Cooper's goldflower	✓ *Hymenoxys ~~lemmonii~~* [illegible]
Grimy ivesia	✓ *Ivesia rhypara var. rhypara*
Shelly's ivesia	✓ *Ivesia rhypara var. shellyi*
Fragrant kalmiopsis	✓ *Kalmiopsis fragrans*
Large-flowered goldfields	✓ *Lasthenia ornduffii*
Thin-leaved peavine	✓ *Lathyrus holochlorus*
Davis' peppergrass	✓ *Lepidium davisii*
Hazel's prickly-phlox	*Leptodactylon pungens spp. hazeliae* [illegible]
Kellogg's lily	✓ *Lilium kelloggii*
Frye's Limbella	*Limbella fryei*
Bellinger's meadowfoam	✓ *Limnanthes floccosa spp. bellingerana*
Dwarf woolly meadowfoam	✓ *Limnanthes floccosa spp. pumila*
Red-fruited desert parsley	*Lomatium erythrocarpum*
Greenman's desert parsley	✓ *Lomatium greenmani*
Ochoco lomatium	✓ *Lomatium ochocense*
Suksdorf's desert parsley	✓ *Lomatium suksdorfii*
Colonial luina	*Luina serpentina*
Mt. Ashland lupine	✓ *Lupinus ~~aridus~~ spp. ashlandensis* lepidus
Cusick's lupine	✓ *Lupinus cusickii* [illegible]
White meconella	✓ *Meconella oregana*
Smooth stickleaf	✓ *Mentzelia mollis*

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Packard's stickleaf	✓	*Mentzelia packardiae*	
Detling's microseris	✓	*Microseris laciniata spp. detlingii*	
Disappearing monkeyflower	✓	*Mimulus evanescens*	
Membrane-leaved monkeyflower	✓	*Mimulus hymenophyllus*	
Siskiyou monardella	✓	*Monardella purpurea*	
Sessile mousetail	✓	*Myosurus sessilis*	
Wolf's evening-primrose	✓	*Oenothera wolfii*	
Barrett's penstemon	✓	*Penstemon barrettiae*	
Blue-leaved penstemon	✓	*Penstemon glaucinus*	
Peck's penstemon	✓	*Penstemon peckii*	
Red-root yampah	✓	*Perideridia erythrorhiza*	
— Silvery phacelia		*Phacelia argentea*	— Coos Co.
Playa phacelia	✓	*Phacelia inundata*	
Siskiyou phacelia	✓	*Phacelia leonis*	
Mackenzie's phacelia	✓	*Phacelia lutea var. mackenzieorum*	
Least phacelia	✓	*Phacelia minutissima*	
Coral seeded allocarya	✓	*Plagiobothrys figuratus var. corallicarpus*	
Desert allocarya	✓	*Plagiobothrys salsus*	
Oregon semaphore grass	✓	*Pleuropogon oregonus*	
San Francisco bluegrass	✓	*Poa unilateralis*	
Profuse-flowered mesa mint	✓	*Pogogyne floribunda*	
Williams combleaf	✓	*Polyctenium williamsiae*	
Snake River goldenweed	✓	*Pyrrocoma radiata*	
Dalles Mt. buttercup	✓	*Ranunculus triternatus*	
Bartonberry	✓	*Rubus bartonianus*	
Saddle Mountain saxifrage	✓	*Saxifraga hitchcockiana*	Micranthes
Ertter's ragwort	✓	*Senecio ertterae*	
Western senecio	✓	*~~Senecio~~ hesperius*	Packera
Whitetop aster	✓	*Sericocarpus rigidus*	
Henderson's checker-mallow	✓	*Sidalcea hendersonii*	
Bristly-stemmed sidalcea	✓	*Sidalcea hirtipes*	
Maple-leaved checker-mallow	✓	*Sidalcea malachroides*	
— Coast checkermallow		*Sidalcea malviflora spp. patula*	— Coos Co.
Cascade Head catchfly	✓	*Silene douglasii var. oraria*	
Hitchcock's blue-eyed grass	✓	*Sisyrinchium hitchcockii*	
Pale blue-eyed grass	✓	*Sisyrinchium sarmentosum*	
Western necklace	✓	*Sophora leachiana*	
Biennial stanleya	✓	*Stanleya confertiflora*	
Oregon sullivantia	✓	*Sullivantia oregana*	
Howell's tauschia	✓	*Tauschia howellii*	
Woven-spored Lichen	✓	*Texosporium sancti-jacobi*	
Short-podded thelypody	✓	*Thelypodium brachycarpum*	
Arrow-leaf thelypody	✓	*Thelypodium eucosmum*	
Howell's thelypody	✓	*Thelypodium howellii spp. howellii*	

FEDERALLY LISTED, PROPOSED, CANDIDATE, DELISTED SPECIES AND SPECIES OF CONCERN UNDER THE JURISDICTION OF THE FISH AND WILDLIFE SERVICE WHICH MAY OCCUR WITHIN OREGON

Douglas' clover	✓ *Trifolium douglasii*
Leiberg's clover	✓ *Trifolium leibergii*
Owyhee clover	✓ *Trifolium owyheense*
Leach's brodiaea	*Triteleia hendersonii var. leachiae* — [illegible]
Western bog violet	✓ *Viola primulifolia spp. occidentalis*
Small-flowered deathcamas	✓ *Zigadenus fontanus*

Definitions:

Listed Species: An endangered species is one that is in danger of extinction throughout all or a significant portion of its range. A threatened species is one that is likely to become endangered in the foreseeable future.

Proposed Species: Taxa for which the Fish and Wildlife Service or National Marine Fisheries Service has published a proposal to list as endangered or threatened in the Federal Register.

Candidate Species: Taxa for which the Fish and Wildlife Service has sufficient biological information to support a proposal to list as endangered or threatened.

Delisted Species: A species that has been removed from the Federal list of endangered and threatened wildlife and plants.

Species of Concern: Taxa whose conservation status is of concern to the U.S. Fish and Wildlife Service
(many previously known as Category 2 candidates), but for which further information is still needed. Such species receive no legal protection and use of the term does not necessarily imply that a species will eventually be proposed for listing.

Key:

E	Endangered
T	Threatened
CH	Critical Habitat has been designated for this species
PE	Proposed Endangered
PT	Proposed Threatened
PCH	Critical Habitat has been proposed for this species

Notes:

Marine & Anadromous Species: Please consult the National Marine Fisheries Service (NMFS) (http://www.nmfs.noaa.gov/pr/species/) for marine and anadromous species. The National Marine Fisheries Service (NMFS) manages mostly marine and anadromous species, while the U.S. Fish and Wildlife Service manages the remainder of the listed species, mostly terrestrial and freshwater species.

Marine Turtle Conservation and Management: All six species of sea turtles occurring in the U.S. are protected under the Endangered Species Act of 1973. In 1977, NOAA Fisheries and the U.S. Fish and Wildlife Service signed a Memorandum of Understanding to jointly administer the Endangered Species Act with respect to marine turtles. NOAA Fisheries has the lead responsibility for the conservation and recovery of sea turtles in the marine environment and the U.S. Fish and Wildlife Service has the lead for the conservation and recovery of sea turtles on nesting beaches. For more information, see the NOAA Fisheries webpage on sea turtles http://www.nmfs.noaa.gov/pr/species/turtles/.

Gray Wolf: In 2008, the Service published a final rule that established a distinct population segment of the gray wolf (Canis lupis) in the northern Rocky Mountains (which includes a portion of Eastern Oregon, east of the centerline of Highway 395 and Highway 78 north of Burns Junction and that portion of Oregon east of the centerline of Highway 95 south of Burns Junction). Any wolves found west of this line in Oregon belong to the conterminous USA population [see 73 FR 10514]. On May 5, 2011, the Fish and Wildlife Service published a final rule – as directed by legislative language in the Fiscal Year 2011 appropriations bill – reinstating the Service's 2009 decision to delist biologically recovered gray wolf populations in the Northern Rocky Mountains. Gray wolves in Oregon are State-listed as endangered, regardless of location.

ODA Plant Division, Plant Conservation

Oregon Department of Agriculture

Oregon listed plants

Overview

Endangered plant species

Threatened plant species

Candidate plant species

Threatened and endangered plant definitions

Overview

Currently, there are 60 plant species that are administratively protected in the State of Oregon. Of these 60 species, 30 are listed as endangered and 28 are listed as threatened. Two species, *Arabis macdonaldiana* (pdf, 399 KB) and *Howellia aquatilis*, have been federally listed, but the Oregon Administrative Rules (OAR 603-073) have not been updated to reflect the state protection that is conferred by federal listing. All federally listed plant species occurring in Oregon are administratively protected by the Oregon Department of Agriculture. In addition, Oregon has 76 candidate species.

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Endangered plant species

Scientific Name	**Common Names**
Abronia umbellata ssp. *breviflora*	Pink sandverbena Coos Co.
*Arabis macdonaldiana**	Red Mountain rockcress
Artemisia campestris ssp. borealis var. wormskioldii	Northern wormwood
Astragalus applegatei	Applegate's milkvetch
Astragalus mulfordiae	Mulford's milkvetch
Calochortus coxii	Crinite mariposa lily
Calochortus indecorus	Sexton Mountain mariposa lily
Calochortus umpquaensis	Umpqua mariposa lily
Castilleja levisecta	Golden paintbrush
Cordylanthus maritimus ssp. *palustris*	Point Reyes bird's-beak Coos Co.
Delphinium leucophaeum	White rock larkspur
Delphinium pavonaceum	Peacock larkspur
Erigeron decumbens	Willamette daisy
Fritillaria gentneri	Gentner's fritillary

Haplopappus radiatus	Snake River goldenweed
Ivesia rhypara var. rhypara	Grimy ivesia
Lilium occidentale	Western lily Coos Co.
Limnanthes floccosa ssp. grandiflora	Big-flowered wooly meadowfoam
Lomatium bradshawii	Bradshaw's desert parsley
Lomatium cookii	Cook's desert parsley
Lomatium erythrocarpum	Red-fruited lomatium
Lupinus cusickii	Cusick's lupine
Mentzelia mollis	Smooth mentzelia
Mirabilis macfarlanei	Macfarlane's four o'clock
Plagiobothrys hirtus	Rough popcornflower, rough allocarya
Plagiobothrys lamprocarpus	Shiny-fruited allocarya
Ranunculus reconditus	Dalles Mountain buttercup
Silene spaldingii	Spalding's campion
Stephanomeria malheurensis	Malheur wire-lettuce
Thelypodium howellii ssp. spectabilis	Howell's spectacular thelypody
Trifolium owyheense	Owyhee clover

* Species has been listed federally, but the Oregon Administrative Rules (OAR 603-073) have not yet been updated. All federally listed plant species occurring in Oregon are administratively protected by the State of Oregon.

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Threatened plant species

Scientific Name	**Common Name**
Amsinckia carinata	Malheur Valley fiddleneck
Aster curtus	White-topped aster
Aster vialis	Wayside aster
Astragalus collinus var. *laurentii*	Laurent's milkvetch
Astragalus diaphanus var. *diurnus*	South Fork John Day milkvetch
Astragalus peckii	Peck's milkvetch
Astragalus sterilis	Sterile milkvetch
Astragalus tyghensis	Tygh Valley milkvetch
Botrychium pumicola	Pumice grape-fern
Calochortus howellii	Howell's mariposa lily

Eriogonum chrysops	Golden buckwheat
Eriogonum crosbyae	Crosby's buckwheat
Erythronium elegans	Coast Range fawn lily
Gratiola heterosepala	Boggs Lake hedge hyssop
Hackelia cronquistii	Cronquist's stickseed
Hastingsia bracteosa	Large-flowered rush lily
*Howellia aquatilis**	Howellia
Lepidium davisii	Davis' peppergrass
Limnanthes floccosa ssp. pumila	Dwarf meadowfoam
Lomatium greenmanii	Greenman's desert parsley
Lupinus sulphureus ssp. *kincaidii*	Kincaid's lupine
Mentzelia packardiae	Packard's mentzelia
Microseris howellii	Howell's microseris
Oenothera wolfii	Wolf's evening-primrose
Phacelia argentea	Silvery phacelia Coos Co.
Pleuropogon oregonus	Oregon semaphore grass
Sidalcea nelsoniana	Nelson's checkermallow
Silene douglasii var. *oraria*	Cascade Head catchfly
Thelypodium eucosmum	Arrow-leaf thelypody

* Species has been listed federally, but the Oregon Administrative Rules (OAR 603-073) have not yet been updated. All federally listed plant species occurring in Oregon are administratively protected by the State of Oregon.

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Candidate plant species

Scientific Name	**Common Name**
Achnatherum hendersonii	Henderson ricegrass
Agrostis howellii	Howell's bentgrass
Arabis koehleri var. *koehleri*	Koehler's rockcress, shrubby rockcress
Arabis suffrutescens var. *horizontalis*	Crater Lake rockcress
Asarum wagneri	Green-flowered wild ginger
Astragalus tegetarioides	Deschutes milkvetch, bastard kentrophyta
Bensoniella oregana	Bensoniella Coos Co.
Bolandra oregana	Oregon bolandra
Botrychium ascendens	Upswept moonwort, upward-lobed moonwort

Botrychium crenulatum	Dainty moonwort, crenulate grape-fern
Botrychium paradoxum	Paradox moonwort, twin-spike moonwort
Botrychium pedunculosum	Stalked moonwort
Calochortus greenei	Greene's mariposa lily
Calochortus longebarbatus var. *peckii*	Peck's mariposa lily
Calochortus persistens	Siskiyou mariposa lily
Camassia howellii	Howell's camassia
Camissonia pygmaea	Pygmy evening primrose, dwarf evening primrose
Cardamine nuttallii var. *gemmata*	Purple dentaria, purple toothwort
Cardamine pattersonii	Saddle Mountain bittercress
Carex constanceana	Constance's sedge
Caulanthus major var. *nevadensis*	Nevada wild cabbage, slender wild cabbage
Cimicifuga elata	Tall bugbane
Collomia renacta	Barren Valley collomia
Corydalis aquae-gelidae	Clackamas corydalis, cold water corydalis
Cypripedium fasciculatum	Clustered lady slipper
Delphinium oreganum	Willamette Valley larkspur
Draba howellii	Howell's whitlow grass
Epilobium oreganum	Oregon willowherb
Epilobium siskiyouense	Siskiyou willowherb
Erigeron howellii	Howell's daisy, Howell's fleabane
Erigeron oreganus	Oregon daisy, Oregon fleabane
Eriogonum cusickii	Cusick's buckwheat, Cusick's eriogonum
Eriogonum prociduum	Prostrate buckwheat
Filipendula occidentalis	Queen of the forest
Frasera umpquaensis	Umpqua frasera, Umpqua swertia
Gentiana setigera	Elegant gentian, Waldo gentian
Hackelia diffusa var. *diffusa*	Diffuse stickseed
Horkelia congesta ssp. *congesta*	Shaggy horkelia
Lasthenia macrantha ssp. *prisca*	Large flowered goldfields, perennial lasthenia
Leptodactylon pungens ssp. *hazeliae*	Snake River prickly phlox, Hazel's prickly phlox
Limbella fryei	Frye's limbella moss
Limnanthes floccosa ssp. *bellingeriana*	Bellinger's meadowfoam
Limnanthes gracilis var. *gracilis*	Slender meadowfoam

Lomatium suksdorfii	Suksdorf's lomatium
*Luina serpentina**	Colonial luina
Lupinus lepidus var. *ashlandensis*	Ashland lupine, Mount Ashland lupine
Meconella oregana	White meconella
Mimulus evanescens	Disappearing monkeyflower
Mimulus hymenophyllus	Thinsepal monkeyflower, membrane-leaved monkeyflower
Mimulus jungermannioides	Jungermann's monkeyflower, hepatic monkeyflower
*Mimulus patulus**	Stalk leaved monkeyflower
Montia howellii	Howell's montia
Myosurus sessilis	Sessile mousetail
Penstamon barrettiae	Barrett's penstemon
Perideridia erythrorhiza	Red root yampah
Phacelia minutissima	Least phacelia
Plagiobothrys figuratus ssp. *corallicarpus*	Coral seeded allocarya
Ranunculus austrooreganus	Southern Oregon buttercup
Rorippa columbiae	Columbia cress
Rubus bartonianus	Bartonberry
Saxifraga hitchcockiana	Saddle Mountain saxifrage
Sedum moranii	Rogue River stonecrop
Sedum oblanceolatum	Applegate stonecrop
*Senecio ertterae**	Ertter's senecio
Senecio hesperius	Western senecio
Sidalcea campestris	Meadow sidalcea, meadow checkermallow
Sidalcea hirtipes	Hairy stemmed checkermallow, bristly-stemmed sidalcea
Sidalcea malviflora ssp. *patula*	Mallow sidalcea, coast checker bloom Coos Co.
Sisyrinchium sarmentosum	Pale blue eyed grass
Sophora leachiana	Western sophora, western necklace
Streptanthus howellii	Howell's streptanthus
Sullivantia oregana	Oregon sullivantia, sullivantia
Tauschia howellii	Howell's tauschia
Trifolium leibergii	Leiberg's clover
Triteleia hendersonii var. *leachiae*	Leach's brodiaea, blue-striped brodiaea Coos Co
Viola primulifolia ssp. *occidentalis*	Western bog violet

* Species was previously listed as threatened or endangered by the Oregon Department of Agriculture, but has since been delisted.

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Threatened and endangered plant definitions

Endangered species

(a) Any native plant species determined by the director to be in danger of extinction throughout all or any significant portion of its range; or

(b) Any plant species listed as an endangered species pursuant to the federal Endangered Species Act of 1973 (PL 93-205, 16 USC § 1531), as amended.

Threatened species

(a) Any native plant species the director determines is likely to become endangered within the foreseeable future throughout all or any significant portion of its range; or

(b) Any plant species listed as a threatened species pursuant to the federal Endangered Species Act of 1973 (PL 93-205, 16 U.S.C. § 1531), as amended.

Candiate species

Any plant species designated for study by the director (of the Oregon Department of Agriculture) whose numbers are believed low or declining, or whose habitat is sufficiently threatened and declining in quantity and quality, so as to potentially qualify for listing as a threatened or endangered species in the foreseeable future.

Delisted species

Any plant species, previously listed as threatened or endangered by the Oregon Department of Agriculture, which has been removed from list. All delisted species are placed on the candidate species list.

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USDA United States Department of Agriculture
Natural Resources Conservation Service

NRCS | PLANTS

Threatened & Endangered

Protected Plants for All Scientific Names

Jurisdiction = Federal and State
State Distribution = U.S. States (Oregon)
73 records returned

Protected plants that are synonyms retain their protected status, and are indented beneath the current PLANTS accepted name; common names are from PLANTS.

United States	USFWS Endangered Species Program. 2014. *All plants (January 2014)* (http://ecos.fws.gov/tess_public/pub/listedPlants.jsp). US Fish and Wildlife Service, Washington, DC.
Oregon	Oregon Natural Heritage Information Center. 2004. *Rare, threatened and endangered species of Oregon* (http://orbic.pdx.edu/plants/view_plants2.php, 5 May 2006). Oregon Natural Heritage Information Center, Oregon.

Symbol	**Scientific Name**	**Common Name**	**Federal Protected Status†**	**State Protected Status†**	Coos Co.
ABUMB	*Abronia umbellata* Lam. ssp. *breviflora* (Standl.) Munz	pink sand verbena		OR (E)	— yes
AMCA8	*Amsinckia carinata* A. Nelson & J.F. Macbr.	Malheur Valley fiddleneck		OR (T)	
ARMA33	*Arabis macdonaldiana* Eastw.	MacDonald rockcress	E		
ARPA7	*Arenaria paludicola* B.L. Rob.	marsh sandwort	E		
ARCAW	*Artemisia campestris* L. ssp. *borealis* (Pall.) H.M. Hall & Clem. var. *wormskioldii* (Besser ex Hook.) Cronquist	field sagewort		OR (E)	
ASAP	*Astragalus applegatei* M. Peck	Applegate's milkvetch	E	OR (E)	
ASCOL	*Astragalus collinus* Douglas ex G. Don var. *laurentii* (Rydb.) Barneby	Laurent's milkvetch		OR (T)	
ASCUS2	*Astragalus cusickii* A. Gray var. *sterilis* (Barneby) Barneby	barren milkvetch		OR (T)	
ASDI2	*Astragalus diaphanus* Douglas ex Hook.	transparent milkvetch			
ASDID4	*Astragalus diaphanus* Douglas ex Hook. var. *diurnus* (S. Watson) Barneby ex M. Peck			OR (T)	
ASER4	*Astragalus eremiticus* Sheldon	hermit milkvetch			
ASAM14	*Astragalus ampullarioides* (S.L. Welsh) S.L. Welsh		E		
ASMU	*Astragalus mulfordiae* M.E. Jones	Mulford's milkvetch		OR (E)	
ASPE4	*Astragalus peckii* Piper	Peck's milkvetch		OR (T)	
ASTY	*Astragalus tyghensis* M. Peck	Tygh Valley milkvetch		OR (T)	
BOPU2	*Botrychium pumicola* Coville ex Underw.	Crater Lake grapefern		OR (T)	
CACO41	*Calochortus coxii* M. Godfrey & F. Callahan	Cox's mariposa lily		OR (E)	
CAHO11	*Calochortus howellii* S. Watson	Howell's mariposa lily		OR (T)	

Coos Co

CAIN18	*Calochortus indecorus* Ownbey & M. Peck	Sexton Mountain mariposa lily		OR (E)	
CAUM5	*Calochortus umpquaensis* N.A. Fredricks	Umpqua mariposa lily		OR (E)	
CALE27	*Castilleja levisecta* Greenm.	golden Indian paintbrush	T	OR (E)	
COMAP	*Cordylanthus maritimus* Nutt. ex Benth. ssp. *palustris* (Behr) T.I. Chuang & Heckard	Pt. Reyes bird's-beak		OR (E)	— yes
DENUO	*Delphinium nuttallii* A. Gray ssp. *ochroleucum* (Nutt.) Warnock	upland larkspur			
DELE	*Delphinium leucophaeum* Greene			OR (E)	
DEPA4	*Delphinium ×pavonaceum* Ewan (pro sp.) [*menziesii* × *trolliifolium*]	peacock larkspur		OR (E)	
ERDED	*Erigeron decumbens* Nutt. var. *decumbens*	Willamette fleabane	E	OR (E)	
ERCH6	*Eriogonum chrysops* Rydb.	bitterroot buckwheat		OR (T)	
ERCR10	*Eriogonum crosbyae* Reveal	Crosby's buckwheat		OR (T)	
ERME5	*Erysimum menziesii* (Hook.) Wettst.	Menzies' wallflower	E		
EREL13	*Erythronium elegans* Hammond & K.L. Chambers	Coast Range fawnlily		OR (T)	
EUVI8	*Eucephalus vialis* Bradshaw	wayside aster			
ASVI4	*Aster vialis* (Bradshaw) S.F. Blake			OR (T)	
FRGE	*Fritillaria gentneri* Gilkey	Gentner's fritillary	E	OR (E)	
GRHE	*Gratiola heterosepala* H. Mason & Bacig.	Boggs Lake hedgehyssop		OR (T)	
HACR4	*Hackelia cronquistii* J.L. Gentry	Cronquist's stickseed		OR (T)	
HABRB	*Hastingsia bracteosa* S. Watson var. *bracteosa*	largeflower rushlily		OR (T)	
HOAQ	*Howellia aquatilis* A. Gray	water howellia	T		
ILRIR	*Iliamna rivularis* (Douglas ex Hook.) Greene var. *rivularis*	streambank wild hollyhock			
ILCO4	*Iliamna corei* Sherff		E		
IVRHR	*Ivesia rhypara* Ertter & Reveal var. *rhypara*	grimy mousetail		OR (E)	
LEDA2	*Lepidium davisii* Rollins	Davis' pepperweed		OR (T)	
LIOC2	*Lilium occidentale* Purdy	western lily	E	OR (E)	— yes
LIPU8	*Limnanthes pumila* Howell	woolly meadowfoam			
LIFLP2	*Limnanthes floccosa* Howell ssp. *pumila* (Howell) Arroyo	woolly meadowfoam		OR (T)	
LIPUG	*Limnanthes pumila* Howell ssp. *grandiflora* (Arroyo) S.C. Meyers & K.L. Chambers	woolly meadowfoam			
LIFLG	*Limnanthes floccosa* Howell ssp. *grandiflora* Arroyo	woolly meadowfoam	E	OR (E)	
LOBR	*Lomatium bradshawii* (Rose ex Mathias) Mathias & Constance	Bradshaw's desertparsley	E	OR (E)	
LOCO8	*Lomatium cookii* J.S. Kagan	agate desertparsley	E	OR (E)	
LOER2	*Lomatium erythrocarpum* R.J. Meinke & Constance	redfruit desertparsley		OR (E)	
LOGR2	*Lomatium greenmanii* Mathias	Greenman's biscuitroot		OR (T)	
LUORK	*Lupinus oreganus* A. Heller var. *kincaidii* C.P. Sm.	Kincaid's lupine	T		
LUSUK	*Lupinus sulphureus* Douglas ex Hook. ssp. *kincaidii* (C.P. Sm.) L. Phillips			OR (T)	

Coos Co.

MEMO2	*Mentzelia mollis* M. Peck	soft blazingstar		OR (E)
MEPA5	*Mentzelia packardiae* Glad.	Packard's blazingstar		OR (T)
MIHO2	*Microseris howellii* A. Gray	Howell's silverpuffs		OR (T)
MIMA2	*Mirabilis macfarlanei* Constance & Rollins	MacFarlane's four o'clock	T	OR (E)
OEWO	*Oenothera wolfii* (Munz) P.H. Raven, W. Dietr. & Stubbe	Wolf's evening primrose		OR (T)
PHAR	*Phacelia argentea* A. Nelson & J.F. Macbr.	sanddune phacelia (Silky p.)		OR (T) — yes
PLHI6	*Plagiobothrys hirtus* (Greene) I.M. Johnst.	rough popcornflower	E	OR (E)
PLLA3	*Plagiobothrys lamprocarpus* (Piper) I.M. Johnst.	shinyfruit popcornflower		OR (E)
PLOR3	*Pleuropogon oregonus* Chase	Oregon semaphoregrass		OR (T)
PYRA2	*Pyrrocoma radiata* Nutt.	ray goldenweed		OR (E)
RATR6	*Ranunculus triternatus* A. Gray	obscure buttercup		
RARE5	*Ranunculus reconditus* A. Nelson & J.F. Macbr., nom. illeg.			OR (E)
SERI4	*Sericocarpus rigidus* Lindl.	Columbian whitetop aster		
ASCU2	*Aster curtus* Cronquist			OR (T)
SINE2	*Sidalcea nelsoniana* Piper	Nelson's checkerbloom	T	OR (T)
SIDOO	*Silene douglasii* Hook. var. *oraria* (M. Peck) C.L. Hitchc. & Maguire	seabluff catchfly		OR (T)
SISP2	*Silene spaldingii* S. Watson	Spalding's silene	T	OR (E)
STMA5	*Stephanomeria malheurensis* Gottlieb	Malheur wirelettuce	E	OR (E)
THHOS2	*Thelypodium howellii* S. Watson ssp. *spectabilis* (M. Peck) Al-Shehbaz	Howell's thelypody		OR (E)
THHOS	*Thelypodium howellii* S. Watson var. *spectabilis* M. Peck		T	
TROW	*Trifolium owyheense* Gilkey	Owyhee clover		OR (E)

†Code	Protected Status
E	Endangered
T	Threatened

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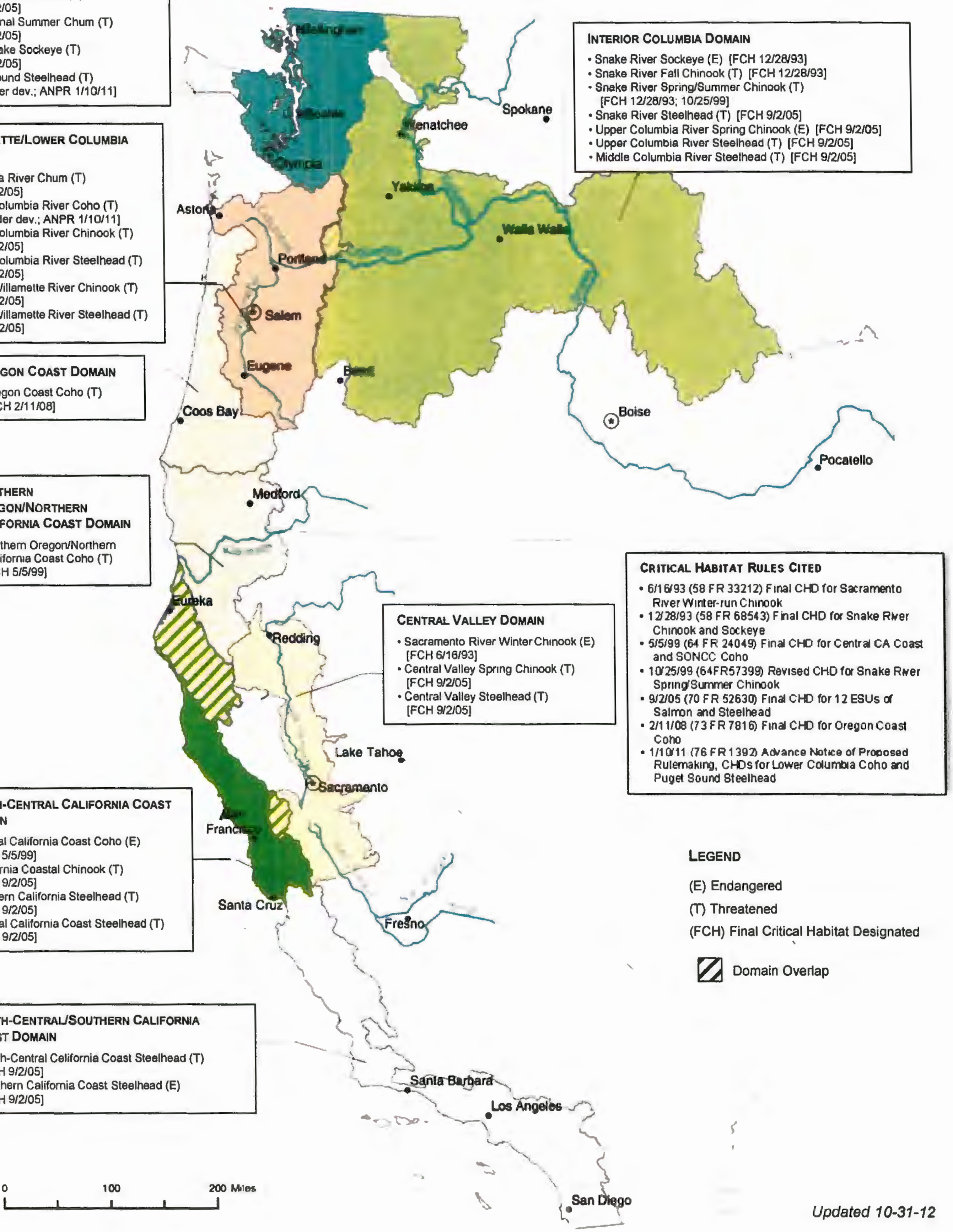
Status of ESA Listings & Critical Habitat Designations for West Coast Salmon & Steelhead



PUGET SOUND DOMAIN

- Puget Sound Chinook (T) [FCH 9/2/05]
- Hood Canal Summer Chum (T) [FCH 9/2/05]
- Ozette Lake Sockeye (T) [FCH 9/2/05]
- Puget Sound Steelhead (T) [CH under dev.; ANPR 1/10/11]

WILLAMETTE/LOWER COLUMBIA DOMAIN

- Columbia River Chum (T) [FCH 9/2/05]
- Lower Columbia River Coho (T) [CH Under dev.; ANPR 1/10/11]
- Lower Columbia River Chinook (T) [FCH 9/2/05]
- Lower Columbia River Steelhead (T) [FCH 9/2/05]
- Upper Willamette River Chinook (T) [FCH 9/2/05]
- Upper Willamette River Steelhead (T) [FCH 9/2/05]

OREGON COAST DOMAIN

- Oregon Coast Coho (T) [FCH 2/11/08]

SOUTHERN OREGON/NORTHERN CALIFORNIA COAST DOMAIN

- Southern Oregon/Northern California Coast Coho (T) [FCH 5/5/99]

NORTH-CENTRAL CALIFORNIA COAST DOMAIN

- Central California Coast Coho (E) [FCH 5/5/99]
- California Coastal Chinook (T) [FCH 9/2/05]
- Northern California Steelhead (T) [FCH 9/2/05]
- Central California Coast Steelhead (T) [FCH 9/2/05]

SOUTH-CENTRAL/SOUTHERN CALIFORNIA COAST DOMAIN

- South-Central California Coast Steelhead (T) [FCH 9/2/05]
- Southern California Coast Steelhead (E) [FCH 9/2/05]

INTERIOR COLUMBIA DOMAIN

- Snake River Sockeye (E) [FCH 12/28/93]
- Snake River Fall Chinook (T) [FCH 12/28/93]
- Snake River Spring/Summer Chinook (T) [FCH 12/28/93; 10/25/99]
- Snake River Steelhead (T) [FCH 9/2/05]
- Upper Columbia River Spring Chinook (E) [FCH 9/2/05]
- Upper Columbia River Steelhead (T) [FCH 9/2/05]
- Middle Columbia River Steelhead (T) [FCH 9/2/05]

CENTRAL VALLEY DOMAIN

- Sacramento River Winter Chinook (E) [FCH 6/16/93]
- Central Valley Spring Chinook (T) [FCH 9/2/05]
- Central Valley Steelhead (T) [FCH 9/2/05]

CRITICAL HABITAT RULES CITED

- 6/16/93 (58 FR 33212) Final CHD for Sacramento River Winter-run Chinook
- 12/28/93 (58 FR 68543) Final CHD for Snake River Chinook and Sockeye
- 5/5/99 (64 FR 24049) Final CHD for Central CA Coast and SONCC Coho
- 10/25/99 (64FR57399) Revised CHD for Snake River Spring/Summer Chinook
- 9/2/05 (70 FR 52630) Final CHD for 12 ESUs of Salmon and Steelhead
- 2/11/08 (73 FR 7816) Final CHD for Oregon Coast Coho
- 1/10/11 (76 FR 1392) Advance Notice of Proposed Rulemaking, CHDs for Lower Columbia Coho and Puget Sound Steelhead

LEGEND

(E) Endangered

(T) Threatened

(FCH) Final Critical Habitat Designated

▨ Domain Overlap

Updated 10-31-12

SECTION 4:

WATER RIGHTS

SECTION 4: WATER RIGHTS

This study will consider the options of providing storage water rights for the proposed off-channel reservoir using the existing surface water rights as the water supply.

Background

The City has 11.0 cfs of surface water rights from both Ferry and Geiger Creeks, but only diverts a maximum of 1.6 cfs. Based on projected population growth and need, the City will need to increase their maximum diversion to approximately 4.5 cfs by the year 2040. See Table 4.1.

Table 4.1
Projected Population Growth and Water Need

Year	Residents Inside City Limits Full Time	Residents Outside City Limits Full Time	Residents Inside City Limits Peak Additional	Residents Outside City Limits Peak Additional	Transient Off Peak	Transient Peak Additional	Total	Use Max. Raw Diverted, cfs
2015	3104	203	288	9	263	486	4353	1.26
2020	3114	206	292	10	266	493	4381	2.87
2030	3198	209	297	10	270	501	4485	2.88
2035	3196	209	296	10	270	501	4482	2.88
2040	3185	208	295	10	269	499	4466	4.48

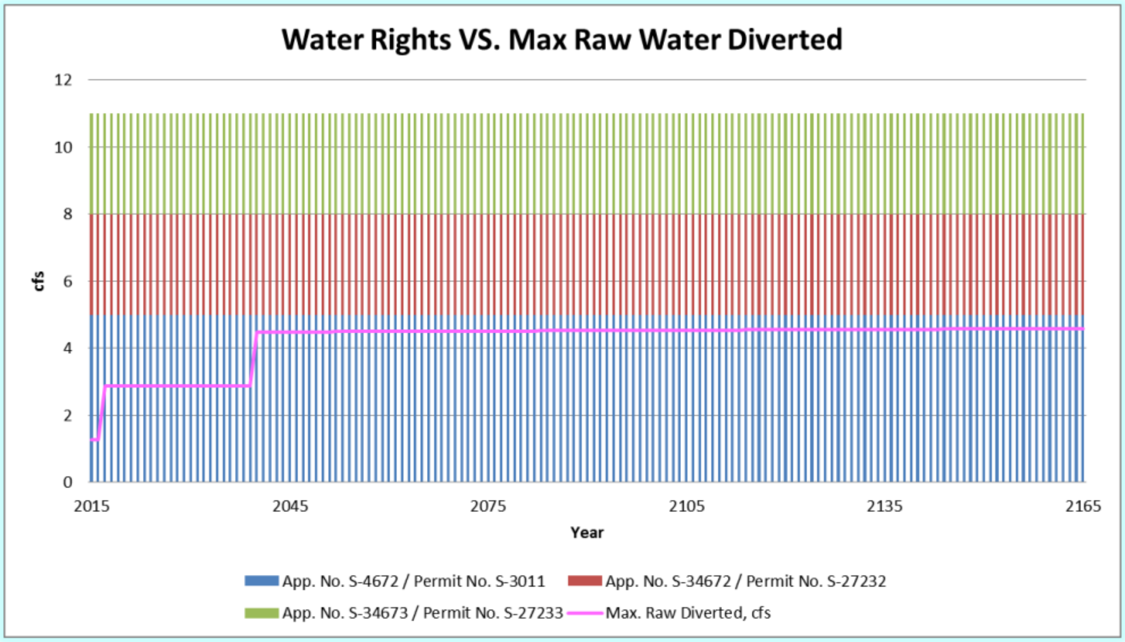
The City's water rights are listed in Table 4.2:

Table 4.2
Existing Water Rights

App. No.	Permit No.	Cert. No.	Trans. No.	P-date	Stream/Reservoir	Magnitude
S-4982	S-3011	N/A	T-8195	6/19/1916	Geiger Creek	5.0 cfs
S34672	S-27232	N/A	T-8195	3/7/1961	Geiger Creek	3.0 cfs
S-34673	S-27233	N/A	T-8195	3/7/1961	Ferry Creek	3.0 cfs
E-481	E-27	9754	N/A	1/24/1910	Ferry Creek	2.0 cfs
R-5017	R-368	N/A	N/A	7/5/1916	Geiger Crk. Res.	90.0 ac-ft
R-501	R-28	9755	N/A	1/24/1910	Ferry Creek Res.	20-5/8 ac-ft

The City has adequate surface water rights from both Ferry and Geiger Creeks for future needs as shown in Table 4.1.

Figure 4.1



The City has two raw water intakes, one located below Ferry Creek Reservoir and the other below the fish hatchery, at the confluence of Ferry and Geiger Creeks. Bandon Hatchery is a non-consumptive water user and has water intakes and rights on both Ferry and Geiger Creeks. Water diverted by the fish hatchery flows through the fish tanks and then returns to Ferry Creek.

Stream flows in Ferry and Geiger Creek varies seasonally. Both creeks have upstream agriculture use, which is generally higher during late August through October. This is also the period when streamflows drop due to low precipitation. The lowest recorded flow in Ferry Creek (above the confluence with Geiger Creek) was 1.3 cfs, as reported in the 1992 Water Master Plan (date unknown). In addition, the 1992 Water Master Plan states that, according to information provided by the Oregon State University, Agricultural Experimental Station, 1992 was the driest precipitation year in over 30 years of records. This 1.3 cfs flow was considered to be a 1/100 low flow value for Ferry Creek. The total water supply available at the confluence of Ferry and Geiger Creeks could fall to as low as 1.7 cfs during a dry month. According to the City's Water Management and Conservation Plan (WCMP), October 2013, the maximum daily demand (MDD) is 1.70 cfs. The projected MDD for the year 2040 is 1.74 cfs. This means there is the potential for demand to exceed water supply during dry months.

Currently there is no way of verifying streamflows in the main confluence of Ferry Creek. A stream gauge, located just downstream from the confluence of Ferry and Geiger Creeks, had been abandoned, but the City, in cooperation with the local Watermaster and Oregon Water Resources Department, is in the process of reinstating it. The stream gauge is predicted to be transmitting data as soon August 2016.

The City has insufficient capacity to store raw water in their existing in-channel reservoirs. Ferry Creek Reservoir can only store approximately 1.61 acre-feet of it 20-5/8 acre-feet certificated water right and Geiger Creek Reservoir can only store approximately 1.78 acre-feet of its 90 acre-feet permitted water right. There is an approximate total of 3.39 acre-feet of raw water storage, however, both reservoirs need dredging and the current capacities of the reservoirs, based on surveys conducted in 2014 are shown in Figure 4.2:

Figure 4.2
Reservoir Capabilities

Reservoir	Acre-Feet	Gallons
Ferry Creek	1.61	541,000
Geiger Creek	1.78	580,015
Total	3.39	1,121,015

The dams that impound the water for both of these reservoirs are owned by Oregon Department of Fish and Wildlife, which owns and operates the Bandon Hatchery. Ferry Creek Reservoir, which is located on property owned by Oregon Department of Fish and Wildlife, was originally constructed to store 20-5/8 acre-feet of water. Geiger Creek Reservoir is located on property owned by the City of Bandon. It was originally constructed to store a maximum of 2.73 acre-feet and, according to the 1992 Water Master Plan, was intend primarily to aid in the diversion of water from the creek.

The City investigated dredging both reservoirs to increase storage. Because of the condition of the dam and the period of time that Ferry has been silted in, dredging could not be as extensive as needed. The estimated storage if the proposed dredging was completed would be less than 4 acre-feet. It was determined that dredging the main body of Geiger Reservoir would not significantly increase storage.

Expanding storage to the full amount of the listed water right for these two instream reservoirs would provide adequate storage for the City, but it would be very expensive. The estimated cost to repair the dam and dredge Ferry Creek Reservoir to increase its capacity to 3.59 acre-feet was $3,307,000. The estimated cost to dredge Geiger Creek Reservoir was $274,000. Reservoir expansion would be problematic due to permitting issues, difficult to get through the dam safety approval process, and challenging because both dams are not owned by the City.

Proposed Changes to Water Rights

The City has investigated a number of ways to change or transfer their existing water rights to the proposed off-channel reservoir and / or obtaining a new storage water right using the existing surface water rights to supply water to the proposed off-channel reservoir.

A. “Move”, by manner of Water Right Permit Amendment, the place of storage for 85 ac-ft of 90 acre-feet from Geiger Creek Reservoir to off-channel reservoir. (ORS 537.211) (4) The holder of a water right permit may change the point of diversion, change the point of appropriation, change the point of diversion to allow the appropriation of ground water or use the water on land to which the right is not appurtenant).The application was prepared and this option was discussed at a phone conference held November 3, 2014 with the City, Oregon Water Resources Department (OWRD), and Oregon Department of Fish and Wildlife attending. The Permit Amendment option was rejected by OWRD due to another case being decided by the Oregon Department of Justice. The City hired Martha Pagel, water rights attorney, to assist with the process, however, this alternative is not considered likely to be approved by OWRD.

B. “Move”, by Water Right Transfer, 15 acre-feet of 20-5/8 ac-ft of storage from Ferry Creek Reservoir to off-channel reservoir. The application was prepared, however, OWRD are putting applications to “move” reservoir locations on hold pending litigation and rule making related to that. (OAR 690-380)

C. Develop a “bulge in the system” that would be used as an in-system storage facility, some what like the City’s Middle Pond. This option is more commonly used for irrigation uses, where the water held in the pond are used on a rotational basis, but not stored for use outside the irrigation season. According to the OWRD field manual, water can be kept in a bulge in the system pond for up to 72 hours for non-agricultural use. Municipal use is year round, however the purpose of this reservoir, is to divert water during the rainy season for use during the dry season, so water would be held far longer than 72 hours. Some use of the stored water may be necessary during the rainy season when the Fish Hatchery is treating their fish, however, this use would be minor. This alternative would likely not be approved by OWRD.

D. Apply for incremental perfection of claim of beneficial use (partial perfection) for 1.6 cfs of 5.0 cfs of Application No. S-4982 / Application No. S-3011, Geiger Creek, domestic use. This alternative certificates a portion of a permitted surface water that is currently in use and that has a 1916 priority date. Certificating a portion of this permit secures the rights to the use of water. Martha Pagel, water rights attorney, is assisting the City through this process.

E. Apply for a Transfer for the type of use for Application No. S-4982 / Application No. S-3011, Geiger Creek, from domestic use to municipal use after Patial Perfection is approved by OWRD. Martha Pagel, water rights attorney, is assisting with this process.

F. Apply for a new water right to store water and for a new water right to withdraw water from the the new reservoir. Martha Pagel, water rights attorney, is assisting with this process.

SECTION 5:

ARCHAEOLOGICAL AND ENVIRONMENTAL IMPACTS

SECTION 5: ARCHAEOLOGICAL AND ENVIRONMENTAL IMPACTS

This section will consider archaeological impacts, environmental impacts and analyses of environmental harm to reservoir area and streams from the proposed project.

Madeleine Vander Heyden, Fish and Wildlife Biologist Coordinator, Oregon Coastal Program with U.S. Fish and Wildlife Service, was contacted in 2014 regarding any listed bird species around the project area. She said that marbled murrelets and spotted owls are the listed birds in this region, but she wasn't aware of any in the area. She said that she would check on the possibility of eagles in the area.

Madeleine was also involved with the plant survey to look for the endangered Western lily, *Lilium occidentale*.

Kassandra Rippee, Tribal Archaeologist with the Coquille Tribe of Indians made a site visit on February 22, 2016 to specifically look at the organic material found during the geotechnical excavations. She said that she didn't see anything, such as shell fragments, that might be a cultural resource. She said that tsunami was the most likely explanation for the organic material found near the bottom of the one of the test pits. She had visited the project site prior to the site brushing, however the vegetation made it impossible to access the site. She will return to examine the timbered parcel when it is logged. It, too, is inaccessible due to brushy conditions.

No wetlands were identified in the cleared parcel. Verification of whether any wetlands are within the timbered parcel will be conducted once the logging is complete. A 401 Water Quality Certificate will be obtained as part of the process. See Section 9 for additional information regarding permitting.

SECTION 6:

IMPACTS TO OTHER WATER USERS AND FISH HATCHERY

SECTION 6: IMPACTS TO OTHER WATER USERS AND FISH HATCHERY

This section will consider impacts to other water users and the Fish Hatchery from the proposed project.

The City holds water rights on the Ferry and Geiger Creek systems with the oldest priority dates. The Ferry Creek reservoir is certificated with a priority date of 1910 and the Geiger Creek reservoir is permitted with a priority date of 1916. The City's surface water right, Application No. S-4982/Permit No. S-3011/Transfer No. 8195, is permitted with a priority date of 1916. Because Oregon's water laws are based on the principle of prior appropriation, the user with first water right or earliest priority is the last to be shut off during times of low stream flows. That means the City should be the last to be denied water from Ferry Creek.

The City currently diverts water from their existing Backup or Lower Pump Station located at the same point of diversion intended to be used to supply the off-channel reservoir. Application No. S-4982/Permit No. S-3011/Transfer No. 8195 is currently in the process of being submitted to OWRD for an incremental Claim of Beneficial Use (Partial Perfection) of 1.6 cfs of the 5.0 cfs surface water right total. Utilizing this point of diversion will not lessen stream flow.

The City does not intend to increase the maximum diversion rate to supply the proposed reservoir, however, if the size of the City increases, as forecast to, within the next 25 years, then the diversion rate may be increased to a maximum of 3.2 cfs. Raising the diversion rate, by installing an additional 50 HP pump at the existing point of diversion, would allow the water treatment plant to increase in size to keep up with water demand. This could, also, allow more flexibility in the diversion schedule for filling the reservoir in regard to flows for fish runs and stream turbidity.

Oregon Department of Fish and Wildlife (ODFW) have a certificated surface water right for 3.0 cfs with a priority date of 1925. This right is for "flow through" water and is designated for fish propagation at the Bandon Fish Hatchery. The right diverts water from Ferry and South Fork Ferry (Geiger) Creeks from the existing reservoirs on each of the creeks. This water is diverted and returned to Ferry Creek above the existing point of diversion that is proposed to be used for the off-channel reservoir. Water diverted for the off-channel reservoir would not impact the Fish Hatchery in terms of lessening creek flows. Having the off-channel reservoir would mean there would be water available to supply municipal needs during periods when the Fish Hatchery is doctoring their fish and allow flexibility when stream flows are low.

Another surface water right with a priority date of 1929 is Bandon Trout Farm, Inc. This another "flow through" right that allows for 3.5 cfs to be diverted from Ferry Creek through a series of fish ponds and returned to Ferry Creek downstream. The point of diversion for this water right is downstream from the existing point of diversion proposed to be used for the off-channel reservoir. It is unknown at this time whether Bandon Trout Farm is still in business or whether this water is being used as per the permitted use.

Downstream from the existing point of diversion that is intended to supply the proposed off-channel reservoir are Oregon Water Resources Department's (OWRD) instream water rights for anadromous and resident fish rearing purposes. These rights vary with month and diversion times at rates would have to be coordinated with upstream migrations of fish. See Section 7 Hydrological Analysis for further information.

Upstream from the Ferry and Geiger Creek Reservoirs are several surface water rights that are, in general, intended for agricultural use. Approximately nine of these rights, totaling approximately 5.5 cfs have priority dates that range from 1925 through 1947. At present these rights should be impacted by low flows because the City has a more senior right. If the off-channel reservoir were to be built, the reservoir would lessen the impact of low stream flows, by allowing the agricultural users to continue to use water during the late summer / early fall period when their water use is higher.

All water rights on the Ferry and Geiger Creek basins are listed on a chart at the end of this section.

Ferry Creek is considered to be over allocated, meaning there is insufficient streamflow to meet the demands of the surface water rights currently issued. OWRD has stated that no new surface water rights will be granted to divert water from the Ferry and Geiger Creek system. The City has sufficient surface water rights to supply the reservoir without seeking additional water rights from Ferry Creek or Gieger Creek.

Ferry Creek is reported to have dropped to 1.3 cfs during the period between 1977 and 1996 when the stream gauge, located just downstream of the point of diversion, was in operation. This amounts to little more than a trickle of stream flow and would greatly impact the City's ability to withdraw sufficient amounts of water for municipal use.

At present, Ferry Creek does not have an operating stream gauge. The City is coordinating with OWRD to reinstate this stream gauge and data should be available by August or September of this year.

Climate change tends to increase the frequency of droughts. The drought that has persisted through the summer months, from 2014 water year to present, puts additional pressure on the Ferry and Geiger Creek system. The trend of hotter and drier summers presents an escalated risk of wildfires. Bandon has had a history of devastating wildfires within the city. The City is located in an area that is infested with gorse, a highly flammable bush. This reservoir would provide necessary water storage to combat potential wildfires in the City.

Augmenting low flows during dry months would benefit the water quality for aquatic organisms by increasing flow depth and reducing river temperature. The need for augmenting stream flows has become more apparent with the change in climate and agricultural diversion for summer and fall crops. The majority of agricultural water use coincides with the historical low flow periods. Climate change has shown a tendency to increase the frequency of drought years which exacerbates the depletion of stream flows. During extreme low flows in Ferry Creek there is barely enough water to sustain the municipal diversion rate. Augmenting low flows may be required by some funding agencies.

Diverting raw water during the wet winter months and storing it for use during the dry summer months in an off-channel reservoir will benefit other water users and the environment. During the wet months the primary users are the Fish Hatchery and ODFW for fish migrating to spawning grounds, however, it must be noted that there is no existing fish passage past either Ferry or Geiger Creek dams. During the dry summer months the stream is used by almost all of the water right holders, primarily for agricultural use, but also for municipal use.

SECTION 7:
HYDROLOGICAL ANALYSIS

SECTION 7: HYDROLOGICAL ANALYSIS

The proposed off channel reservoir will divert raw water from Ferry Creek just downstream of the confluence with Geiger Creek at an existing point of diversion. The diverted raw water will be used for municipal treatment supply and could be used for streamflow augmentation. This section will provide insight to the physical and hydrological characteristics of the watershed and the associated impacts of the off channel reservoir. The information produced in this section will be used to address the hydraulic and hydrologic feasibility of implementing the proposed off channel reservoir. To better understand the hydraulic and hydrologic relationships within the watershed, the following major tasks were undertaken:

A. Identify the physical characteristics of the watershed

B. Identify environmental constraints and regulations

C. Identify a relationship between streamflow and meteorological events

D. Verify the feasibility of diverting raw water to the off channel reservoir

E. Verify the feasibility of releasing raw water for municipal use and streamflow augmentation

F. Address future changes

Definitions:

EPA – U.S. Environmental Protection Agency
OHW – Ordinary High Water Line
MHHW – Mean Higher High Water
MSL – Mean Sea Level
DEQ – Oregon Department of Environmental Quality
ODFW – Oregon Department of Fish and Wildlife
cfs – cubic feet per second
ac-ft – acre-feet

Watershed

The contributing watershed is comprised of the Ferry Creek basin which has an area of 1189.5 acres (1.86 square miles) and the Geiger Creek basin which has an area of 1524.5 acres (2.4 square miles). The lower reaches of Ferry Creek are near sea level and the upper reaches of Geiger Creek are near 400-feet above sea level. The contributing watershed begins at the point of diversion which has an approximate elevation of 50 feet above sea level. The highest point in the watershed is around 400 feet above sea level. The watershed has an average slope of 1.8% with a shallower slope of 0.5% near the lower reaches and the point of diversion. Ferry Creek is a third order perennial stream with 3 second order tributaries. Geiger Creek is a third order perennial stream with 2 second order tributaries. Geiger and Ferry Creek basins are adjacent to each other and form a larger contributing basin that comprises the watershed for the point of diversion. The point of diversion is located on the lower reach of Ferry Creek adjacent to the confluence with Geiger Creek. Appendix A shows the watershed delineation. The upper portions of the watershed consist mainly of agricultural and forested lands. The agriculture in the watershed is dominated by cranberry bogs. The forested portion of the watershed consist of shore pine, Sitka spruce, western hemlock, and Douglas-fir. The lower portions of the watershed consist of mainly low density urban developments with sporadic forestland. The proposed off channel reservoir has a relatively small footprint of 7.3 acres when compared to the contributing watershed 2,714 acres. The addition of the proposed off-channel reservoir will only have a minor impact on the overall hydrological function of the watershed. Table 7.1 is a summary of the watershed characteristics and these values will be used as basepoint data for the hydrologic analysis.

Table 7.1
Physical Characteristics of the Watershed

DESCRIPTION	VALUE
Ferry Creek Basin Area	1,189.5 Acres
Geiger Creek Basin Area	1,524.5 Acres
Watershed Area	2,714 Acres
Watershed Average Slope	1.8%
Number of Second Order Tributaries to Ferry Creek	3
Number of Second Order Tributaries to Geiger Creek	2
Lowest Point in Watershed	50 feet above MSL
Highest Point in Watershed	400 feet above MSL
Ferry Creek Gauge Station	STA# 14327120

The only river gauging station in the watershed is Ferry Creek Station No. 14327120 which is located downstream of the confluence of Geiger Creek and Ferry Creek. The gauging station is also located near the planned point of diversion for the off channel reservoir. The flow data can be assumed realistic and accurate because of the close proximity of the gauging station to the point of diversion. The gauging station is currently out of service but historic flow data is available from the Oregon Water Resources Department (OWRD). Published flow data is available from 1977 to 1982 and 1994 to 1996. Table 7.2 is a summary of the flow data from the Ferry Creek gauging station.

Table 7.2
Ferry Creek Streamflow Data

Month	Average Ferry Creek Flow (cfs)	Minimum Ferry Creek Flow (cfs)	Maximum Ferry Creek Flow (cfs)	STDV Ferry Creek Flow (cfs)
January	14.7	3.0	125.0	15.9
February	16.7	2.2	80.0	14.5
March	12.2	3.0	58.0	8.8
April	6.8	0.3	100.0	7.5
May	9.0	3.7	56.0	7.8
June	5.2	1.5	11.0	1.8
July	3.7	0.9	6.3	1.3
August	3.2	0.8	18.0	1.5
September	4.2	1.4	13.0	2.3
October	3.8	0.3	24.0	2.7
November	9.0	2.4	45.0	7.3
December	12.8	2.2	100.0	14.1

During the drier months the flow rate in Ferry Creek has a low standard deviation and is consistently around 4 cfs which is attributed to groundwater base flow. In the winter months the flow rate is highly variable and depends on the precipitation which is attributed to surface water runoff. This watershed is very responsive to precipitation and drought which cause large fluctuations in flowrate. During the drier months the flows in Ferry Creek are at the lowest which also correspond to the highest water demand period for agricultural diversion. The primary agricultural use in the watershed is from cranberry growers. These growers divert raw water to their cranberry bogs for irrigation and as part of their harvesting techniques. The combination of drought and agricultural diversion causes stress on the watershed which impacts the municipal water source and environmental flows. During wet weather the watershed experiences an abundance of streamflow in Ferry Creek. Raw water diverted to the off channel reservoir during high flows in Ferry Creek would have a minimal impact on the overall streamflow. Wet weather flow conditions are the ideal period for raw water diversion to the off channel reservoir.

Climate

The watershed has a Marine West Coast-Mediterranean climate (Köppen classification Csb), which is common to most of the Oregon coast. Climate data for this section is based on published daily meteorological observations from the Western Regional Climate Center Station ID: Bandon 2 NNE, Oregon (350471). In the winter months rain and overcast conditions are common and the summers are mostly dry. Below freezing temperatures and snow can occur during the winter; however, this is not very common and usually occurs on average less than once a year. Extreme temperatures of 20 °F or lower are extremely rare, usually happening about once every five years. Summers are dry and cool with an average July high temperature of about 68 °F while lows are generally in the 50s °F. Bandon's highest reading of 100 °F occurred on September 21, 1990 and the lowest reading of 8 °F was observed only three months later on December 21, 1990. The moderate climate is beneficial to off channel raw water storage because the stored water temperature will stay fairly consistent. Water quality is predictable and easier to control with consistent water temperatures. Table 7.3 below is a summary of the temperature and precipitation for the watershed.

Table 7.3
30-Year Average Climate Data

Month	Mean Max. Temperature (F)	Mean Temperature (F)	Mean Min. Temperature (F)	Mean Precipitation (in)
Jan	55	47.2	39.4	9.46
Feb	56	47.6	39.2	7.23
Mar	56.9	48.7	40.5	7.01
Apr	58.4	50.2	41.9	4.51
May	61.8	53.6	45.4	3.22
Jun	64.9	57	49.2	1.77
Jul	67.5	59.6	51.7	0.39
Aug	68.1	59.7	51.3	0.61
Sep	67.4	57.9	48.5	1.32
Oct	63.6	54.2	44.8	3.99
Nov	57.7	49.9	42	8.88
Dec	54.3	46.6	38.8	10.32
Annual	61	52.7	44.4	58.71

Environmental

The Geiger Creek and Ferry Creek watersheds play host to a delicate ecosystem and the Oregon Coast coho salmon (*Oncorhynchus kisutch*) which is considered threatened. Ferry Creek downstream of the Ferry Creek dam is considered essential salmon habitat which restricts certain construction activities and riparian zone development. The off channel reservoir will be constructed outside of any riparian zones and will have no construction impacts to Ferry Creek. It is unlikely that the construction of the off channel reservoir will trigger a regulatory consultation. Appendix B shows the extent to which Ferry Creek is considered essential salmon habitat. Under most circumstances, both National Marine Fisheries Service and Oregon Department of Fish and Wildlife require a minimum water depth of 1 foot and streamflow temperature deviation of less than one degree Fahrenheit for fish passage. Low flow conditions in Ferry Creek downstream of the confluence with Geiger Creek occur for most of the summer dry period (June – October). Table 7.4 lists environmental data. Augmenting streamflow by diverting twenty-five percent of all water diverted to the off channel reservoir would help maintain the minimum depth in lower Ferry Creek during low flow conditions. The temperature in Ferry Creek will be monitored upstream and downstream of the streamflow augmentation discharge point. If the temperature deviation between upstream and downstream exceeds one degree Fahrenheit, then streamflow augmentation will be reduced or stopped entirely until adequate temperature differentials are achieved. Currently OWRD, in cooperation with the City of Bandon, is installing a new stream gauge station at the location of a presently inoperable existing stream gauge. The new gauge station will allow the City to monitor and control raw water diversion and streamflow augmentation based on real time data.

Table 7.4
Environmental Data

Description	Value
Migratory Salmonid Species Present	Yes, Salmon & Steelhead
Threatened Species Present	Yes, Oregon Coast coho salmon
Minimum Fish Passage Water Depth	1 Foot
Maximum Change in Water Temperature	1 Degree Fahrenheit
Temperature and DO Monitoring Station	Yes, Located at Bandon Fish Hatchery
Downstream Gauge Station	Yes, Located Adjacent to Point of Diversion

Hydrology and Hydraulics

Ferry Creek and Geiger Creek convey surface and base flow to two small existing dams that impound raw water within the watershed. One dam is on Ferry Creek and the other dam is on Geiger Creek. A capacity survey in 2014 indicated that together they store approximately 3.38 acre-feet of raw water. These two dams are considered balancing reservoirs and are capable of supplying the raw water demand for approximately 2.5 days during normal conditions. Balancing reservoirs are intended to supply immediate fluctuations in water demand and do not impound water as a long term supply source. Both balancing reservoirs pump raw water to a small settling pond called Middle Pond. Raw water is pumped from Middle Pond to the Bandon water treatment plant for municipal use. The off channel reservoir will be considered an impounding or storage reservoir. Storage reservoirs are intended to divert and store raw water during high flow conditions and then use the stored raw water during low flow conditions. The proposed 100 acre-feet off channel reservoir will utilize the City's existing 12-inch intake pipe and pump station.

The intent of the hydrological analysis is to verify the feasibility of diverting enough raw water to adequately supply municipal needs and streamflow augmentation. To verify feasibility it is necessary to identify the quantity and timing of raw water diversion to the off channel reservoir. The feasibility analysis of diverting raw water to the off channel reservoir includes the following major tasks:

A. Produce a relationship between streamflow records and precipitation data.

B. Produce a unit hydrograph of the watershed using streamflow records and precipitation data.

C. Produce a rating curve for an idealized section of Ferry Creek to identify a streamflow threshold that would cause water depths below the 1-foot minimum.

D. Analysis of rating curve with the streamflow records to identify ideal periods for raw water diversion and streamflow augmentation.

E. Produce a typical diversion and streamflow augmentation schedule. Compare diversion and streamflow augmentation schedule with municipal demand to verify raw water availability.

F. Compare raw water availability with future demand projections to verify adequate future supply.

Streamflow and Precipitation Relationship

Historic flow data between 1977 to 1982 and 1994 to 1996 from the Oregon Water Resources Department was used along with published daily meteorological observations from the Western Regional Climate Center Station ID: Bandon 2 NNE, Oregon (350471) to produce a relationship between streamflow and precipitation. Individual isolated rainfall events and the corresponding streamflow response for each month of the year were analyzed to identify a relationship between precipitation and streamflow. It is apparent form the data that the Ferry Creek watershed is highly responsive to any amount of precipitation. Saturated antecedent soil conditions allow for higher streamflow during wet periods of the year. During dry antecedent soil conditions the initial quantity of precipitation is consumed through groundwater infiltration and evapotranspiration which causes a lag in the streamflow response. Results of the monthly streamflow and precipitation relationship are summarized in Table 7.5 and flow precipitation relationships are in Appendix C.

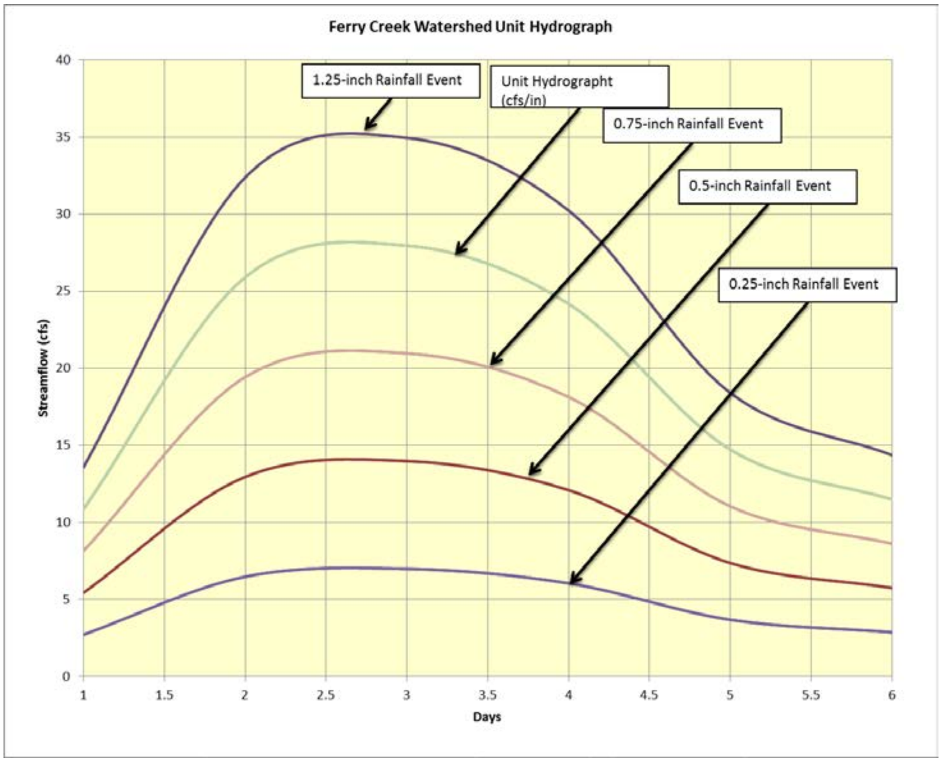
Table 7.5
Average Monthly Streamflow

Month	Average Streamflow (cfs)	Average Precipitation (in)
January	12.8	9.5
February	14.5	7.2
March	10.7	7.0
April	10.6	4.5
May	9.0	3.2
June	5.2	1.8
July	3.7	0.4
August	3.2	0.6
September	4.2	1.3
October	3.8	4.0
November	9.0	8.9
December	12.7	10.3

Unit Hydrograph

The unit hydrograph is used to approximate the streamflow response for any given rainfall event. Knowing the streamflow response to rainfall events is used to identify ideal times for raw water diversion. The unit hydrograph is developed by dividing every point on a streamflow response hydrograph by the average excess precipitation. The unit hydrograph for the watershed was developed by averaging 10 separate isolated rainfall events and their corresponding streamflow response hydrographs. Figure 1 shows the anticipated streamflow response for several rainfall events. Unit hydrograph development calculations are included in Appendix D.

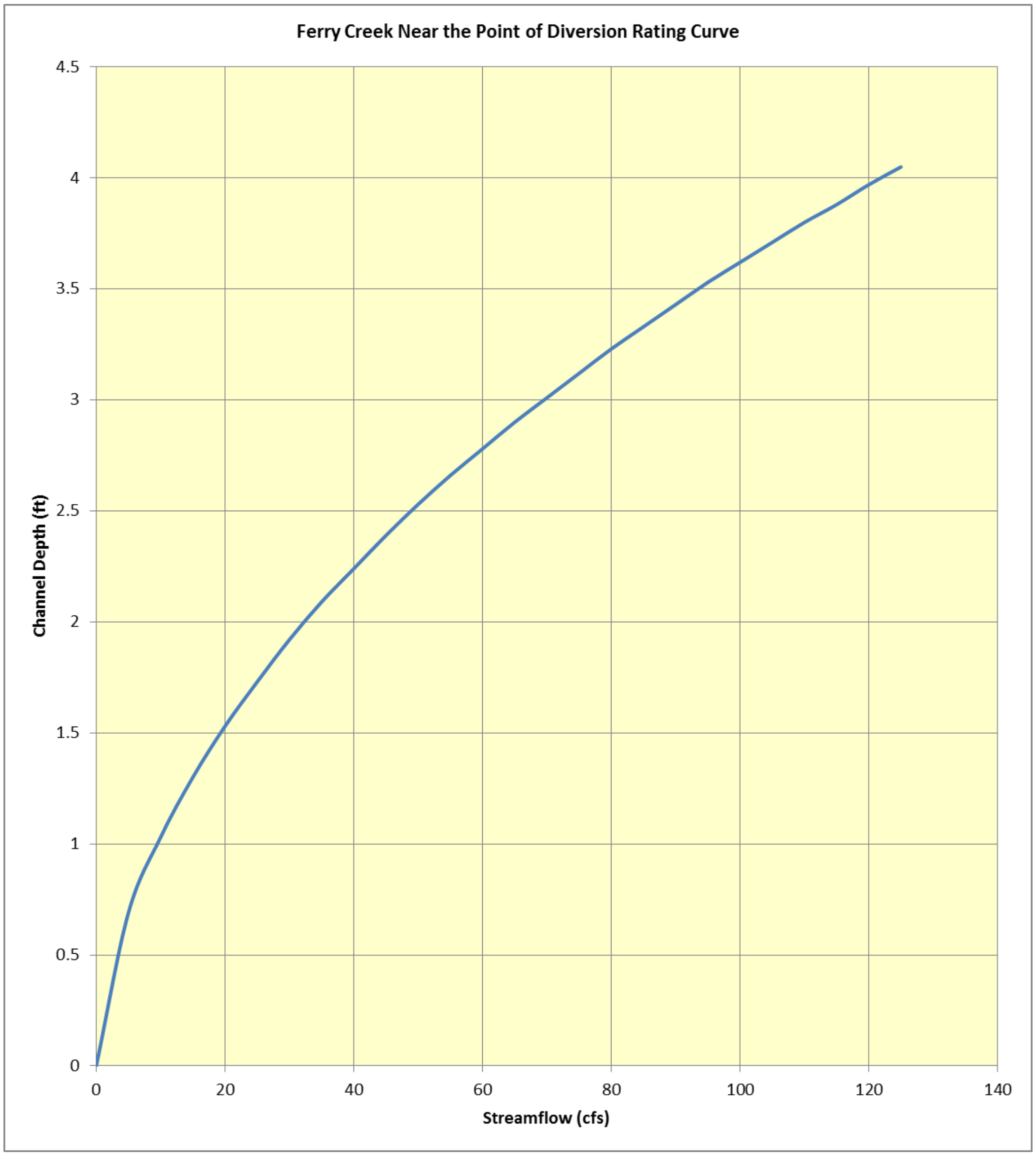
Figure 7.1
Streamflow Response



Ferry Creek Rating Curve

A rating curve of a typical section of Ferry Creek near the point of diversion will identify the relationship between streamflow and channel depth. The rating curve is developed by using the Manning's equation for open channel flow. The normal channel depth was calculated for various flowrates in Ferry Creek near the point of diversion. The channel geometry of Ferry Creek changes depending on the location in the watershed. The reach near the point of diversion is narrow with steep channel side slopes. For this analysis the channel geometry was approximated. Rating curve development calculations are included in Appendix E. The minimum streamflow to provide a channel depth of 1 foot is approximately 10 cubic feet per second. Figure 7.2 shows the approximate rating curve for Ferry Creek near the point of diversion.

Figure 7.2
Ferry Creek Rating Curve



Analysis

From approximately May to October the average water depth in Ferry Creek is at or below the minimum depth required for fish passage. From approximately November to April the average water depth in Ferry Creek exceeds the minimum depth required for fish passage. The ideal period for raw water diversion to the off channel reservoir is between November and April, when streamflow exceeds 10 cfs. See Table 7.6.

Table 7.6
Ferry Creek Streamflow

Description	Value
Streamflow in Exceedance of 10 cfs per Year (days)	108
Streamflow Below 10 cfs per Year (days)	257

Raw Water Diversion and Streamflow Augmentation Schedule

The intent of creating a raw water diversion and streamflow augmentation schedule is to model the typical operation of the off channel reservoir. Modeling the typical operation of the off channel reservoir will give insight to the diversion and augmentation timing and verify the feasibility of a sustainable operation. The diversion and streamflow augmentation schedule was created using historic streamflow and municipal demand averages. The daily streamflow in Ferry Creek near the point of diversion was approximated by taking the individual daily average for each day throughout the year. The municipal daily averages were developed from the City of Bandon water treatment plant records from 2009 to 2013. Table 7.7 shows the average daily raw water demand and raw water availability for off channel storage based on the City of Bandon's 1.6 cfs water right. The average daily raw water available for diversion to the off channel reservoir is equivalent to the water right (1.6 cfs) minus the average daily raw water demand. The off channel reservoir will be lined to prevent water loss from infiltration and will have a semi-rigid cover to reduce water loss to evaporation. For this analysis water loss to infiltration and evaporation are assumed to be negligible.

Table 7.7
Raw Water Demand

Month	Average Daily Raw Water Demand (gpd)	Average Daily Raw Water Demand (cfs)	Average Daily Raw Water Available for Diversion to the Off Channel Reservoir (cfs)
Jan	431,289	0.667	0.933
Feb	412,685	0.639	0.961
Mar	472,563	0.731	0.869
Apr	460,540	0.713	0.887
May	558,964	0.865	0.735
Jun	691,863	1.071	0.529
Jul	845,348	1.308	0.292
Aug	820,530	1.270	0.330
Sep	675,555	1.045	0.555
Oct	552,744	0.855	0.745
Nov	412,668	0.639	0.961
Dec	426,986	0.661	0.939

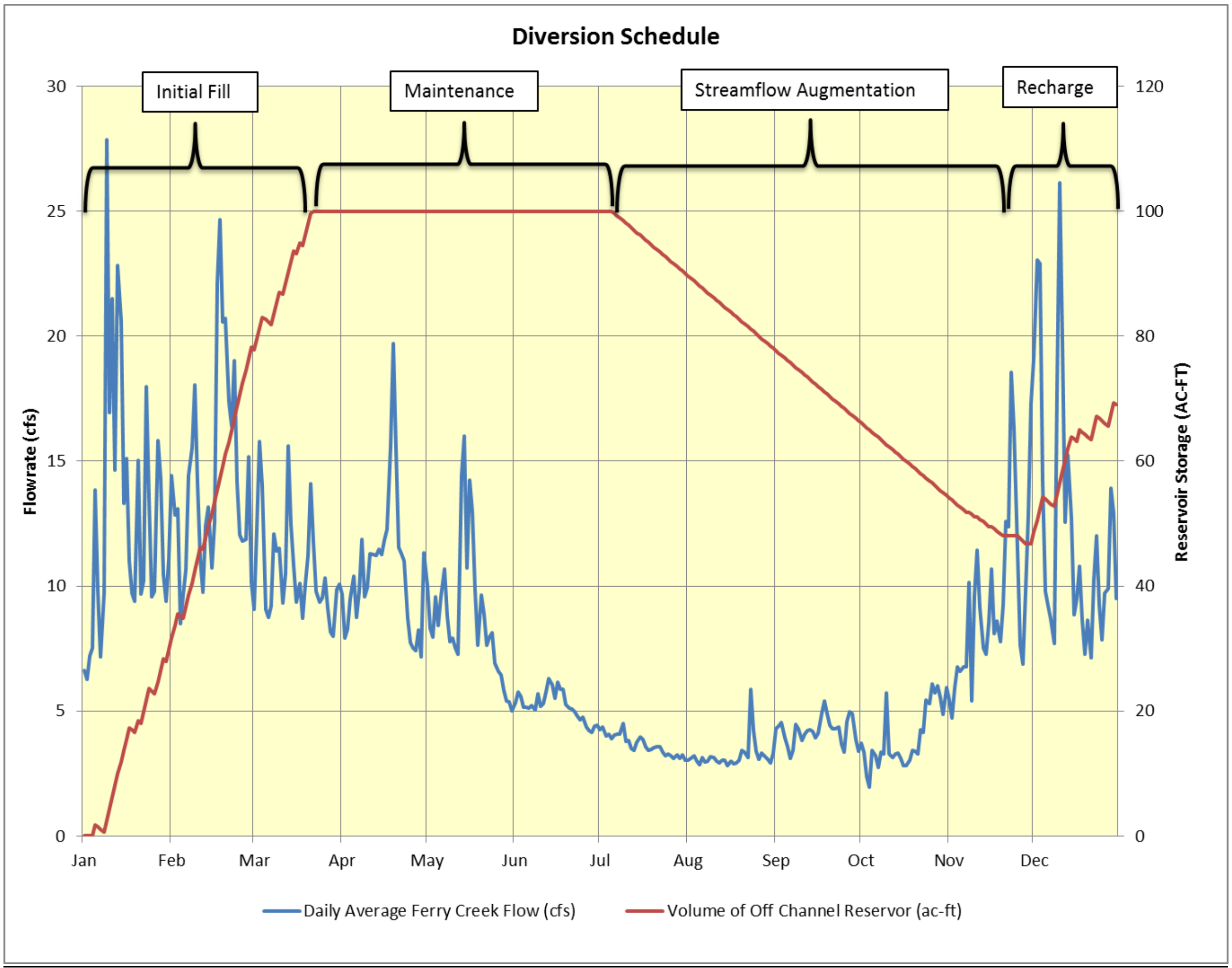
Raw water diversion to the off channel reservoir and to the City of Bandon water treatment plant combined will not exceed the 1.6 cfs water right threshold. Raw water diversion to the off channel reservoir is dependent on the depth in the active stream channel. When streamflow exceeds 10 cfs then there is enough water depth in the active channel to provide fish passage and raw water will be diverted to the off channel reservoir for storage. On average there are 108 days a year that the streamflow exceeds 10 cfs. Streamflow augmentation will occur from July to November when streamflow in the active channel is below 10 cfs. On average there are 143 days a year between July and November that the streamflow is below 10 cfs and raw water will be released back into Ferry Creek. The quantity of raw water released for streamflow augmentation will be twenty-five percent of the raw water diverted for storage. Table 8 is a summary of the off channel reservoir diversion parameters.

Table 7.8
Raw Water Diversion and Streamflow Augmentation

Description	Value
Total Raw Water Diverted per Year (ac-ft)	166.5
Streamflow in Exceedance of 10 cfs per Year (days)	108
Streamflow Augmentation per year (July to November, days)	143
Minimum Reservoir Volume during Normal Operation (ac-ft)	45
Time for Initial Fill (days)	82

The off channel reservoir is assumed to begin diversion on January 1st and will achieve 100 acre-feet of storage in approximately 82 days. During the spring months of March through June the off channel reservoir will operate in a “maintenance” mode. While in maintenance mode raw water will be diverted to the off channel reservoir then released to the Bandon water treatment plant which will allow for raw water storage cycling. The reservoir will be near capacity during the spring months. During the months of July through November raw water will most likely not be diverted to the off channel reservoir due to low flows in Ferry Creek. The off channel reservoir will operate in a “streamflow augmentation” mode. By the end of summer the off channel reservoir raw water storage volume will be reduced to approximately 45 acre-feet. Beginning in November the streamflow depth in Ferry Creek exceeds the threshold for fish passage and raw water will begin to be diverted to the off channel reservoir. During the winter months the off channel reservoir is anticipated to fill at a rate of 1.8 acre-feet per day. The off channel reservoir will reach capacity in mid to late January. The raw water diversion and streamflow augmentation schedule is illustrated in Figure 7.3 and Appendix F for tabulated values.

Figure 7.3
Raw Water Diversion and Streamflow Augmentation Schedule



Future

The intent of the off channel reservoir is to provide the City of Bandon with a sustainable and secure raw water source now and for future demands. Future water demands are dependent on population growth, industrial uses, and impacts from climate change. Population growth is directly correlated with growth in water demand. The City of Bandon has a relatively low permanent population growth rate which has only a small impact on the water demand increase. To meet the current water demands the off channel reservoir would need to receive raw water for approximately 40 days per year. On average there are a 108 days per year that raw water could be diverted to the off channel reservoir without impacting environmental streamflow. If water demand increases then the duration of raw water diversion to the off channel reservoir would also increase. Under these assumptions the off channel reservoir has the capacity to support a significant increase in water demand or a significant decrease in raw water availability. Raw water availability in Ferry Creek will most likely decrease due to increased agricultural demands and climate change. The overall decrease in raw water availability is uncertain and unpredictable but it is unlikely that raw water availability in Ferry Creek would become insufficient for future demands. The off channel reservoir will protect the City of Bandon from the impacts of increased water demand and decreased water availability.

SECTION 8:
GEOTECHNICAL INVESTIGATION

SECTION 8: GEOTECHNICAL INVESTIGATION

A preliminary geotechnical investigation was prepared by Foundation Engineering, Inc. in March/April 2016. The investigation only considered the cleared parcel, Lot 2400. Lot 2300 is currently covered in mature timber and dense, impenetrable brush.

The study concludes the site is suitable for reservoir construction. The Preliminary Geotechnical Investigation follows.

Preliminary Geotechnical Investigation

Bandon Off-Channel Reservoir

Bandon, Oregon

Prepared for:

Dyer Partnership Engineers & Planners, Inc.
Coos Bay, Oregon

April 11, 2016

Professional
Geotechnical
Services

Foundation Engineering, Inc.

Foundation Engineering, Inc.
Professional Geotechnical Services

Barbara Negherbon, P.E., CWRE
Dyer Partnership Engineers & Planners, Inc.
1330 Teakwood Avenue
Coos Bay, OR 97420

April 11, 2016

Bandon Off-Channel Reservoir
Preliminary Geotechnical Investigation
Bandon, Oregon

Project 2161003

Dear Ms. Negherbon:

We have completed the requested geotechnical investigation for the above-referenced project. Our report includes a description of our work, a discussion of site conditions, a summary of field and laboratory testing and conclusions concerning the suitability of the site for the planned reservoir.

Based on the work completed to date, we have concluded the site is suitable for reservoir construction. Key geotechnical issues pertaining to site grading and reservoir design and construction are also discussed. Detailed geotechnical design recommendations will be provided in a future geotechnical investigation.

It has been a pleasure assisting you with this phase of your project. Please do not hesitate to contact us if you have any questions or if you require further assistance.

Sincerely,

FOUNDATION ENGINEERING, INC.

Erin J. Gillaspie, P.E.
Staff Engineer

James K. Maitland, P.E., G.E.
Principal Engineer

REGISTERED PROFESSIONAL ENGINEER
10701
OREGON
July 18, 1980
JAMES K. MAITLAND
EXPIRES: 12/31/16

EJG/JKM/wg
enclosure

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PRELIMINARY GEOTECHNICAL INVESTIGATION
BANDON OFF-CHANNEL RESERVOIR
BANDON, OREGON

BACKGROUND

The City of Bandon is conducting a feasibility study to develop an off-channel raw water reservoir as a means to store a maximum of 100 acre-feet of water. The City currently utilizes storage in Ferry and Geiger Creek Reservoirs; however, neither reservoir is capable of storing its permitted water storage rights of 20 5/8 acre-feet and 90 acre-feet, respectively. The City owns both reservoirs, however, both Ferry and Geiger Creek dams are owned by the Oregon Department of Fish and Wildlife (ODFW). Construction of the new reservoir is currently planned for 2018, pending resolution of water rights issues and fund raising.

The Dyer Partnership Engineers & Planners, Inc. (Dyer) was selected as the project's lead designer. Dyer retained Foundation Engineering, Inc. as the geotechnical consultation for the project. Our scope of work was outlined in a proposal dated January 13, 2015, and authorized by a signed service agreement dated January 15, 2016. The scope of work was subsequently modified to include supplemental exploratory drilling.

LOCATION, PROJECT DESCRIPTION AND RESERVOIR OPERATION

Location

The project is located ±1,500 feet east of the Bandon city limits, ±700 feet southeast of the terminus of Cardinal Lane. The site location is shown in Figure 1A (Appendix A). The proposed reservoir site will encompass Parcels 2300 and 2400. However, only Parcel 2400, which was recently cleared of brush, was investigated during the current phase. Parcel 2300 is currently forested with dense undergrowth and is essentially inaccessible. Investigation of this parcel will be delayed until the suitability of Parcel 2400 for reservoir construction has been established.

Project Description

Only conceptual drawings were available at the time this report was prepared. We understand a nominal berm width of 8 feet is anticipated and balanced cut-and-fill construction is planned.

The two parcels comprising the proposed reservoir site have a combined plan dimension of ±660x1320 feet. The new raw water reservoir will have a minimum capacity of 50 acre-feet, although a capacity of up to 100 acre-feet is desired. The conceptual plans show a rectangular reservoir occupying most of the site, along with three settling pond at the east end of the property. We estimated the reservoir will occupy a plan area of ±410x840 feet (measured from the center of the berms). An access road will extend into the facility from the northwest corner. Conceptual plans indicate the site will also have a ±50-foot wide perimeter buffer zone and access area for vegetation maintenance (e.g., mower and brush hog). The top of the berms will provide equipment access for pond cleaning.

Reservoir Operation

Water will be pumped from the City's existing pump station downstream of the ODFW Fish Hatchery. The new 12-inch diameter waterline will parallel the existing 14-inch diameter treated water main, using the City's existing utility easement. Water will be pumped into the three settling ponds, where turbidity will be allowed to settle out. The water will then be pumped into the reservoir. The settling ponds allow easier cleaning and should lower annual operating and maintenance costs. There will be a minimum of three inflow/outflow points and water will be gravity-piped back to the pump station where it will be pumped to the middle pond and onto the water treatment plant. The reservoir will have mixers and/or aerators for water quality.

The reservoir will be lined and covered to reduce evaporation and bird use. Approximately 25% of the diverted water will be used to augment stream flows. However, due to potential fish health issues, it is not currently known if the water from the reservoir will be returned to Geiger Creek or Ferry Creek.

LITERATURE REVIEW

Available geologic and seismic publications, maps and web sites were reviewed to characterize the local and regional geology and evaluate relative seismic hazards at the site. Local water well logs available from the Oregon Water Resources Department (OWRD) website were also reviewed, along with information from other geotechnical and seismic hazard investigations previously completed by Foundation Engineering and others in the area.

SITE RECONNAISSANCE

We conducted a site reconnaissance on February 9, 2016, to observe site and surface features. Our reconnaissance included a traverse of Parcel 2400 and photographs were taken of the cleared terrain. We looked for evidence of slope instability, concentrated surface runoff, surface erosion and natural drainages. The underbrush within Parcel 2300 and the terrain south and west of Parcel 2400 was too dense for access.

FIELD EXPLORATION

We completed six test pits and four borings at the site. The explorations were continuously logged by an experienced engineer. The final logs (Appendix B) were prepared based on a review of the field logs, the laboratory test results, and an examination of the soil and rock samples in our office. The approximate test pit and boring locations are shown in Figure 2A, (Appendix A). These locations were established by pacing and are approximate. The elevation contours shown on the figure were estimated by Dyer and are approximate. We assume the exploration locations will be surveyed prior to issuance of our final report. Therefore, that report will include ground surface elevations at individual exploration locations.

Test Pits

The original scope of work included only exploratory test pits. Six test pits were dug within Parcel 2400 on February 11, 2016, using a Kobelco K210 tracked excavator provided by the City. Repeated caving of the test pit sidewalls in all test pits limited the depth of exploration to a maximum depth of ±18 feet. Soil samples representing each soil unit encountered were retained for possible laboratory testing and observation in our office. The soil profiles and sampling depths are summarized on the test pit logs (Appendix B).

We encountered a stratum of concentrated wood debris in the bottom of TP-6. This layer extends from ±15 to at least 18 feet. TP-6 terminated at ±18 feet, but we could not determine how deep the organics extended because of repeated sidewall caving. Our scope of work was subsequently expanded to included exploratory drilling to investigate the extent of the organic material.

Borings

Four supplemental exploratory borings were completed between March 21 and 23, 2016, to evaluate the thickness, composition and lateral extent of the organics found in TP-6 (discussed below). The borings were completed using a CME-850, track-mounted drill rig with mud-rotary drilling techniques. The borings extended to maximum depths ranging from ±35 to 50 feet.

Disturbed soil samples were typically obtained in the borings at 2.5-foot intervals to ±20 feet, and at ±5-foot intervals thereafter. Sampling was completed using a split-spoon sampler in conjunction with the Standard Penetration Test (SPT). The SPT, which is run each time the split-spoon is driven, provides an indication of the relative stiffness or density of the soils. The sampling depths and SPT data for each boring are summarized on the logs (Appendix B).

A 1-inch diameter, PVC standpipe piezometer was installed in BH-3. The slotted screen was installed from ±10 to 20 feet. Ground water levels within the piezometer will be measured periodically to monitor seasonal fluctuations. BH-1 was backfilled with bentonite grout and BH-2 and BH-4 were backfilled with bentonite chips.

LOCAL GEOLOGY

The City of Bandon and the project site are located west of the Coast Range foothills on the Southern Oregon Coast. Bandon is at the transition from the Coast Range to the Klamath Mountains geographic province. Much of the bedrock is geologically and structurally complex.

Local geologic mapping indicates the site is underlain by Pioneer terrace deposits, followed by siltstone and mudstone of the Melange of Sixes River (Wiley et al., 2014). Our explorations encountered terrace deposits primarily consisting of loose to very dense sand followed by close jointed siltstone at depths ranging from ±28 to 40 feet below the existing grades. However, BH-3 did not encounter bedrock above the maximum depth of 46 feet. The subsurface conditions encountered in our explorations are consistent with the mapped local geology. Additional details are provided in the Subsurface Conditions section of this report and on the exploration logs found in Appendix B.

DISCUSSION OF POTENTIAL GEOLOGIC AND SEISMIC HAZARDS

Erosion

The ground surface was disturbed by recent brushing activities. However, no evidence of active surface erosion was observed within the cleared site or the surrounding terrain.

The predominant site material is sand, which is subject to erosion by wind or water if not covered with topsoil and vegetation. During construction it will be important to keep disturbance of site vegetation to the adjacent terrain to a minimum. We understand a ±50-foot wide buffer will be maintained around the perimeter of the planned facility. It will be important to maintain vegetation in the buffer zone throughout and following construction. It is assumed the new perimeter berm will be built using predominantly sand. Most of the inside slope will be covered with a liner. However, it will be critical to develop and maintain a vegetative cover on all exposed soil surfaces at the top and exterior slope of the new berm.

Seismic Hazards

Faults and Earthquakes. No mapped faults cross the site; however, the site is located between two mapped north-trending faults (Beaulieu and Hughes, 1975; Wiley et al., 2014). These faults are not considered active in the Quaternary (USGS, 2006). The US Geologic Survey (USGS) does recognize the northwest-trending Coquille anticline, which is located ± ½ mile south of the site, as a potentially active structure. Its most recent deformation is estimated to be less than 15,000 years (USGS, 2006). No historic earthquake epicenters are located within ±5 miles of the site since 2008 (DOGAMI, 2016b).

The site is located ±45 miles east of the CSZ. Therefore, the site would experience severe shaking from a large magnitude earthquake along the subduction zone (DOGAMI, 2016b).

Ground Motion Amplification. The existing subsurface conditions at this site and adjacent sites indicates relatively shallow bedrock (siltstone of the Melange of Sixes River). Therefore, we estimate the potential for ground motion amplification is low.

Liquefaction. Relative high SPT N-values were recorded in the borings, suggesting the sand underlying the planned reservoir is typically medium dense to dense. As a result, the liquefaction hazard is low due to the relative density of the sand.

Landslides and Earthquake-Induced Landslides. The site is relatively flat, there are no mapped or historic landsides at the site (DOGAMI, 2016b; DOGAMI, 2016a), and we did not observe any landslides or surface features during our site reconnaissance and exploration that would suggest slope instability. Therefore, the risk of landslides or earthquake-induced slope instability is low.

During our site reconnaissance, we noted a break in the pavement on Ohio Street SE between SE 5th and SE 6th Streets. The break, shown in Photo 1 (Appendix A), extends across the entire width of the road. The break suggests creep or slope movement to the north. This soil movement is located ±1500 feet northwest of Parcel 2300, and does not appear to represent a hazard to the planned reservoir project.

Earthquake-Induced Instability of Engineered Fills. Man-made fills supporting structures or other infrastructure will be engineered to remain stable during an earthquake. Therefore, the risk of instability should be low if the fills are constructed in accordance with appropriate geotechnical guidelines for material type, placement and compaction.

Tsunami Inundation. The site is at ±El. 115 to 125 feet and is well above the tsunami inundation zone for all the earthquake scenarios for either a local (CSZ) or distal (Alaskan) sources (DOGAMI, 2012).

A more detailed seismic hazard review and analysis will be completed to fulfill the requirements of a site-specific seismic hazard study as defined in the current Oregon Structural Specialty Code (OSSC).

SITE CONDITIONS

Site Topography and Vegetation

A topographic site map was provided by Dyer. However, it is our understanding the topographic contours were estimated based on satellite imagery and are approximate. Uneven terrain at the time of our field work appeared to confirmed a relatively high variance between the current topography and that shown on the site plan. We assume a topographic survey of the site will be completed prior to issuance of our final report.

Parcel 2400 was originally covered by thick brush including salal and small fir trees typically ±1 to 3 inches in diameter (Photo 2, Appendix A). We also noted scattered stumps of larger, previously logged trees. The parcel was recently cleared. Photos 3 and 4 show the appearance of the parcel after clearing, at the time of our initial field exploration. Parcel 2300 is heavily wooded with numerous fir trees up to ±2 to 3 feet in diameter and thick underbrush. Photo 5 shows a partial view of Parcel 2300 from Parcel 2400.

The terrain west of Parcel 2400 slopes down at ±5%, to an elongated pond. Satellite imagery indicates the water surface at this pond lies at ±El. 107 to 108. We understand a ±50-foot wide vegetated buffer is planned between the new reservoir and the existing pond. There are no significant slopes to the north and south of Parcel 2400.

SUBSURFACE CONDITIONS

Test Pits

Approximately 3 to 12 inches of surficial organics (duff) currently covers the site. The duff consists of primarily roots, plant and wood debris generated from recent clearing activities.

The duff is underlain by sand of the Pioneer terrace deposits. The upper ±3 to 6 feet of the terrace deposits consist of brown to red-brown, moist, fine, silty sand. Some fine roots extend to a depth of ±2 feet. At TP-5 and TP-6, the darker colored sand was weakly to moderately cemented. At the other test pits, the cementation was very weak or absent.

The sand changes to grey with trace silt below ±3 to 6 feet. This unit extends to the bottom of TP-1 through TP-5 (i.e., ±13 to 16 feet). However, at TP-6 the grey sand was silty and underlain by a layer of concentrated organics in a matrix of dark grey to dark brown, silty sand. The organics extend from ±15 to at least 18 feet (the limits TP-6).

At all locations, the depths of the test pits were limited by repeated caving of the sidewalls.

Borings

BH-1. BH-1 was drilled near TP-6, along the eastern edge of Parcel 2400. At BH-1, loose, silty fine sand was encountered to ±4.5 feet, followed by medium dense to dense, fine sand with trace silt to ±15 feet.

Silty fine sand with scattered to some organics (wood) was encountered from ±15 to 17 feet and scattered wood debris was encountered from ±19 to 20 feet. This approximately corresponds to the organics found at TP-6. However, the organic matter is less concentrated. N-values of 6 and 36 were recorded in this layer, suggesting a loose to dense consistency. The lower value likely reflects the presence of softer organic matter, but may be due in part to higher silt content.

Fine sand with trace to some silt was encountered from ±17 to 25 feet. N-values of 22 and 31 were recorded in this unit, indicating the sand is predominantly medium dense to dense. Fine to coarse sand with some silt follows to ±40 feet. N-values of 38 to 62 indicate this unit is dense to very dense.

Dark grey, slightly weathered to moderately weathered, close-jointed, very weak (R1) siltstone was encountered at ±40.0 feet (Melange of Sixes River). The siltstone grades with depth to a grey, slightly weathered to fresh, weak (R2) sandstone. The sandstone extends to at least ±50.3 feet, the limits of our exploration. N-values in the bedrock ranged from 83 to practical sampling refusal (i.e., 50 blows for less than 6 inches of penetration).

BH-2. BH-2 was drilled near the south edge of the parcel. The soil profile at BH-2 consisted of predominantly fine sand with trace silt to ±17 feet and some silt from ±17 to 20 feet. N-values in this layer ranged from 26 to 40, suggesting the sand is medium dense to dense. Dense, fine to coarse sand with some silt was encountered from ±20 to 27 feet. The organics encountered in TP-6 and BH-1 were absent at BH-2.

The sand is underlain by very dense, sandy gravel with some silt ±27 to 34.5 feet. Practical refusal was recorded in this layer.

Extremely weak (R0) highly weathered to decomposed siltstone was encountered from ±34.5 to 36.5 feet, the limits of our exploration. An N-value of 44 was recorded in this formation.

BH-3. BH-3 was located along the north edge of the parcel. Predominantly fine sand with trace silt was encountered to ±23.5 feet. N-values ranged from 26 to 69, suggesting the sand is medium dense near the ground surface, becoming dense with depth. The sand contained trace to some silt below ±20 feet and an N-value of 47 indicates the sand at this depth is dense.

Medium dense sandy gravel with silty sand interbeds was noted from ±23.5 feet to ±30 feet. An N-value of 24 was recorded in this layer at 25 feet.

A layer of stiff clayey silt with scattered to some organics was encountered from ±30 to 35 feet. An N-value of 14 was recorded in the clayey silt.

The clayey silt was underlain by silty, fine sand to a depth of 46.5 feet, the limits of exploration. N-values of 29 near the top of the layer, 80 at ±40 feet, and practical refusal at 45 feet indicate the sand grades from medium dense to very dense.

BH-4. BH-4 was drilled along the west side of the site. At this location, silty, fine sand extends to ±5 feet, followed by fine sand with trace silt to ±17.0 feet. N-values ranged from 13 to 55, suggesting the sand is predominantly medium dense, grading with depth to dense to very dense.

Medium dense to very dense gravelly sand with silty sand interbeds was encountered from ±17 to 28 feet. N-values in this stratum ranged from 22 to practical refusal.

Extremely weak (R0), highly weathered to decomposed siltstone was encountered from ±28 feet to 43 feet. Weak (R2), slightly weathered sandstone was encountered from ±43.0 to 45.5 feet, the limits BH-4.

Water Wells and Ground Water Levels

Water Wells. We located several logs for water wells near the subject property from the OWRD website. They include, among others, wells located on the property north of Cardinal Lane (Tax Lot 2200), an undeveloped lot to the north of the (Tax Lot 804) and a residence on Ohio Street SE (Tax Lot 1900). For reference, these logs have been included in Appendix B.

The nearest well to the proposed reservoir was located on Tax Lot 2200 (north of Parcel 2400). That log reported brown, cemented sand from 0 to 9 feet, followed by grey, cemented sand to 16 feet. Grey, cemented sand and gravel was encountered from 16 to 40 feet, the limits of the well. A static water level of 21 feet was recorded on June 6, 2014.

The well on Tax Lot 804 reported 1 foot of topsoil followed by alternating layers of sand. Some gravel was reported mixed with the sand from 18 to 24 feet. Gravel mixed with sand and sandy clay was encountered between 24 and 33 feet, followed by sandy clay (33 to 35 feet) and brown siltstone to 43 feet (the bottom of the well). A static water level of 26 feet was reported on August 6, 2014.

The log from the well on Ohio Street reports brown sand mixed with clay to a depth of 12 feet, followed by brown sand to 23 feet and brown, coarse sand to 44 feet. Blue metamorphic rock was encountered from 44 to 53 feet (the limits of the well). A static water level at 23 feet was reported on February 8, 1993.

Ground Water. We observed slow to rapid ground water infiltration in the exploratory test pits at depths of ±1 to 6.5 feet. Ground water typically accumulated in the test pits during exploration to a depth of ±5 to 7.5 feet (see Photo 6, Appendix A). Where active seepage was not observed, the sands appeared to be wet below ±5 feet.

The use of drilling mud in the borings precluded direct observation of any ground water in the borings at the time of drilling. A piezometer was installed at BH-3 and an initial water level of ±2 feet was observed on March 22. We repeatedly attempted to bail the water out of the piezometer, but were able to lower the water level to only ±4 feet. The water level quickly rebounded from ±4 feet to 2 feet. Therefore, the measured ground water level of 2 feet below the existing ground surface appears representative of the current ground water level at BH-3. We will continue to monitor the piezometer for seasonal fluctuations.

FIELD AND LABORATORY TESTING

Laboratory Testing

The laboratory work included natural water content and percent fines tests to help classify the soils and estimate their overall engineering properties. Results of the classification tests are summarized in Table 1C (Appendix C). The water contents are also included on the boring logs.

A moisture density curve (ASTM D698) was completed on a sample of sand from TP-1 to establish compaction characteristics of the sandy soil. A single moisture-density point was also run on a sample from TP-4. Both samples were taken with the upper portion of the soil profile to reflect the likely source of fill generated by the reservoir excavation. The results of these tests are summarized in Figure 1C (Appendix C).

The laboratory tests indicate the sands at TP-1 have a maximum dry density of ±103.7 pcf at an optimum water content of ±16.8%. These values are for the relatively clean sand (i.e., less than 2% fines). Sample S-4-1 had ±24.4% fines and the single moisture-density point suggests the maximum dry density is probably 2 to 3 pcf higher and the optimum water content is likely 2 to 4% wetter than that for TP-1.

Natural water contents of the sand within ±10 feet of the ground surface typically ranged from ±15% to ±25%. Several high water contents recorded near the ground surface were associated with the presence of organic matter. The test results indicate the water contents are currently ±5 to 10% above the optimum water content for compaction.

We completed gradation analysis on sample S-1-2 from TP-1 at ±4 to 5.0 feet, and sample S-6-2 from TP-6 at ±3 to 3.5 feet. The analyses indicate S-1-2 consists of ±3.8% medium sand (i.e., between No. 10 and No. 40 sieve), ±94.6% fine sand (i.e., between No. 40 and No. 200 sieve) and 1.6% fines (i.e., passing the No. 200 sieve). Therefore, the soil sample consists of predominantly uniform, fine sand. Sample S-6-2 consisted of 0.9% coarse sand, 2.1% medium sand, 93.6% fine sand, and 2.1% fines. Therefore, its gradation is very similar to S-1-2. Based on the results of the two tests and the appearance of samples from other test pits and borings, we expect the soil underlying the expected limits of reservoir construction will consist of predominantly fine sand with trace to some fines.

pH and Resistivity Testing

pH and resistivity tests were completed to evaluate the corrosivity of the soil. The pH test results were run on samples of the sand and silty sand from the upper ±10 feet of the site. The results, summarized in Table 2C (Appendix C), indicate moderately acidic soils with pH values ranging from 5.6 to 5.8.

In-situ resistivity testing (ASTM G57) was completed near the center of Parcel 2400. The approximate test location (designated R-1) is shown on Figure 2A (Appendix A). The resistivity test was completed using a Nilsson 400, 4-pin, soil resistance meter. The 4–pin resistance meter provides an estimate of the average resistivity of a soil profile extending to a depth equal to the spacing between the pins. The test was performed with the pins spaced at 5, 10 and 20-foot intervals. The recorded resistivities, summarized in Table 3C (Appendix C), ranged from ±80,000 to 85,000, which is not uncommon for sandy soils. The relatively high resistivities suggest the soils are not significantly corrosive.

PRELIMINARY CONCLUSIONS

Based on the work completed to date, we have concluded the following:

1. The soils at the site are suitable for construction of the planned water storage reservoir. This assumes the subsurface conditions within Parcel 2300 are similar to those encountered within Parcel 2400. This assumption should be confirmed by future exploration.
2. There are no known natural hazards (e.g., faulting, liquefaction, or slope instability) that would preclude using the site for the planned project.
3. The predominant soil within the anticipated limits of the earthwork for the new reservoir consists of silty sand to sand with trace silt. Where concentrated organics are present relatively close to the base of berms and reservoir, the organics should be removed during construction. Concentrated organics were encountered at ±13 feet at only TP-6. Based on currently assumed limits of reservoir excavation, we anticipate these organics will extend below the bottom of the reservoir.
4. The site is underlain by siltstone and sandstone of the Melange of Sixes River at depths ranging from ±28 to 40 feet. Bedrock is not expected to impact reservoir construction.
5. Ground water rises to very shallow depths (±1 to 5 feet) during the winter. The drop in the ground water level during dry weather should be determined with future piezometer readings. The presence of shallow ground water may pose a significant construction challenge if ground water levels do not drop significantly during the summer, and would require a significant dewatering effort. Elevated ground water could also adversely impact operations once the reservoir is in operation.
6. Based on preliminary design assumptions, the floor of the planned reservoir and perimeter berms will be built using predominantly silty sand. The excavated soil will be suitable for construction of the perimeter berms. It should be assumed the upper ±1 foot of soil will not be suitable for berm construction, but may reused as landscaping material on the exterior surfaces of the embankment and surrounding terrain.

DISCUSSION

Reservoir Dimensions and Earthwork Volumes

The conceptual site layout provided by Dyer shows the reservoir floor with dimensions of ±375x805 feet (measured from the anticipated inside toe to inside toe of the berms). A total capacity in the range of 50 to 100 acre-feet is planned. This capacity equates to a water depth of ±7 to 14 feet for the assumed reservoir dimensions. Assuming 3 feet of freeboard, the resulting total berm height is ±10 to 17 feet (measured from the top of the berm to the bottom of the reservoir). It should be noted that a total embankment height in excess of 10 feet results in a statutory dam classification.

A balanced cut and fill is planned. That is, the soil generated by the reservoir excavation will be used to construct the perimeter berms. Approximately 1 foot of site stripping will be required to remove surface duff, vegetation, and most roots. Deeper stripping may be required in some areas to remove tree roots. For the plan dimensions described above, each additional foot of excavation within the reservoir floor would generate ±11,000 yd^3 of fill. To estimate excavation depths, we assumed a nominal berm with a top width of 8 feet, a berm height of 10 feet and 3:1 interior and exterior slopes. This represents the estimated berm height for the minimum desired reservoir capacity (50 acre-feet). We estimate a gross excavation depth of ±4 feet (including 1 foot of site stripping) would generate enough material to construct the perimeter berm. A taller berm would require proportionally deeper cuts and fills.

For purposes of discussing soils conditions, we assumed nominal excavation depths in the range of ±4 to 9 feet. It should be understood that all assumed dimensions and volumes are approximate and are intended for discussion and planning purposes only.

Shallow Ground Water

The water surface in the pond to the east of the site lies at ±El. 107 to 108. Static water levels of the nearest water wells to the north ranged from depths of 21 to 26 feet. The reason for the large discrepancy in water levels in not currently known, but the seepage noted in the test pits and in the water level observed in the piezometer suggest ground water during the winter and early spring lies at ±1 to 5 feet. It is possible the water observed in the test pits and piezometer represent a perched condition that develops during the winter. In that case, the true water table may be deeper and closer to the levels reported in nearby wells. If so, this condition may improve significantly during the summer when rains cease and the sandy soils drain.

Key Geotechnical Issues

Planning for design and construction of the new reservoir should consider the following key geotechnical issues:

1. Sandy soils are typically relatively highly permeable. Therefore, a membrane liner should be planned for the new reservoir.
2. Extensive earthwork will be required for reservoir construction and the native sand will be highly sensitive to disturbance. We anticipate the soil will easily pump or rut under construction equipment when moist of the optimum water content and tend to loosen easily under foot or equipment traffic when dry, even if compacted.

   One possible option to help maintain grades during construction and expedite the subsequent installation of the membrane liners would be to amend the soil. The sand in the bottom of the reservoir and the interior slopes could be amended with cement to create a soil-cement surface that would help resist erosion and disturbance, and expedite liner installation.

3. Ground water will be a construction issue if shallow ground water persists into the summer. Future piezometer readings will help establish seasonal fluctuations and summer levels. Final design, including the maximum depth of excavation, may be predicated on the future piezometer readings. If shallow ground water persists into the summer or fall, it should be assumed a significant dewatering effort will be required prior to and during the earthwork. Furthermore, an underdrain system will be required to prevent the liner from floating in the event the reservoir is drained.
4. Site grading work should be planned for dry weather (typically between late June to mid-October) when aeration and compaction of the silty sand is feasible. Even during the dry summer and fall months, soils excavated from several feet below the current ground surface are will likely be wet of the optimum moisture for compaction. However, the clean (relatively fines-free) sand will typically drain and dry quickly. Therefore, contractors should plan for a site grading schedule that permits aeration and drying of the soils prior to compaction.
5. For preliminary design, we recommend assuming a 3:1 slope for both interior and interior sides of the berm. If soil amendment is planned, a 3.5:1 interior slope should be considered to expedite the work.
6. The sandy soils are expected to be highly erodible once the vegetation is removed. Therefore, once the bulk of the earthwork is completed, all exposed soil surfaces should be seeded so a mature cover of vegetation is in place before the onset of the winter rains. This recommendation may require staggered landscaping and/or maintenance of seeding during dry summer months in the event the site grading extends into the fall.
7. We expect very modest settlement of the perimeter berms based on the observed density of the underlying sand. It is assumed the berm fill will be engineered (i.e., well-compacted) and should not undergo significant settlement due to self-weight. Any organic matter exposed at or near the bottom of the reservoir should be excavated. Deeper organic matter can be left in place. Some localized compression of the organics may occur. However, the resulting settlement is expected to be modest since the added weight of the water will be partially off-set by the weight of the excavated soil.

FUTURE GEOTECHNICAL WORK

Development of design and construction documents will require a more detailed geotechnical investigation. Future geotechnical work should include the following key elements:

1. Field exploration for Parcel 2300 to investigate subsurface conditions. The exploration should include test pits and borings similar to that completed for Parcel 2400. We also recommend installing additional piezometers in selected borings and periodic monitoring to establish seasonal fluctuations in ground water levels.

2. Additional laboratory testing to provide strength parameters for slope stability analysis of the berms and compaction characteristics of the on-site soils.
3. Engineering analysis to establish the interior and exterior berm slopes and evaluate berm stability. Although the reservoir will not function as a dam, the planned embankment height may exceed the 10-foot limit of the OWRD definition of a small dam. Therefore, the analysis and design of the embankments may have to meet the OWRD requirements for "statutory" dams.
4. Development of detailed geotechnical recommendations for site grading and reservoir design and construction.
5. A site-specific seismic hazard study meeting the requirements for essential facilities, according to the current Oregon Structural Specialty Code (OSSC) and OWRD requirements. The seismic hazard study should include:
    - review of the local and regional geologic, tectonic and seismic setting
    - review of regional seismic and earthquake history
    - selection of seismic sources and recommended design earthquakes
    - evaluation of site-specific seismic hazards (e.g., liquefaction, fault rupture, and slope instability risks)
    - recommended Site Class and parameters for seismic design
    - appropriate OSSC response spectra

Based on the proximity of the planned reservoir to adjacent residences, we anticipated the design of the new facility will require a breach analysis (by others) to quantify the potential impact on residences.

VARIATION OF SUBSURFACE CONDITIONS, USE OF THIS REPORT AND WARRANTY

The analysis, conclusions and preliminary recommendations contained herein are based on the assumption that the soil profiles and the ground water levels encountered in the test pits and borings completed within Parcel 2400 and the information reported in nearby water well logs are representative of overall site conditions. It is assumed future geotechnical work will include exploration of Parcel 2300.

This report was prepared for the exclusive use of the Dyer Partnership Engineers & Planners, Inc., the City of Bandon, and other design consultants for the Bandon Off-Channel Reservoir project in Bandon, Oregon. Information contained herein should not be used for other sites or for unanticipated construction without our written consent. This report is intended for preliminary planning only. It is assumed a design-level geotechnical investigation will be completed to develop recommendations for site grading and reservoir design and construction. Anyone using the information to estimate construction quantities or costs should understand the preliminary nature of the information and should do so at their own risk.

Our services do not include any survey or assessment of potential surface contamination or contamination of the soil or ground water by hazardous or toxic materials. We assume that those services, if needed, have been completed by others.

Our work was done in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

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Appendix A

Figures and Photos

Professional
Geotechnical
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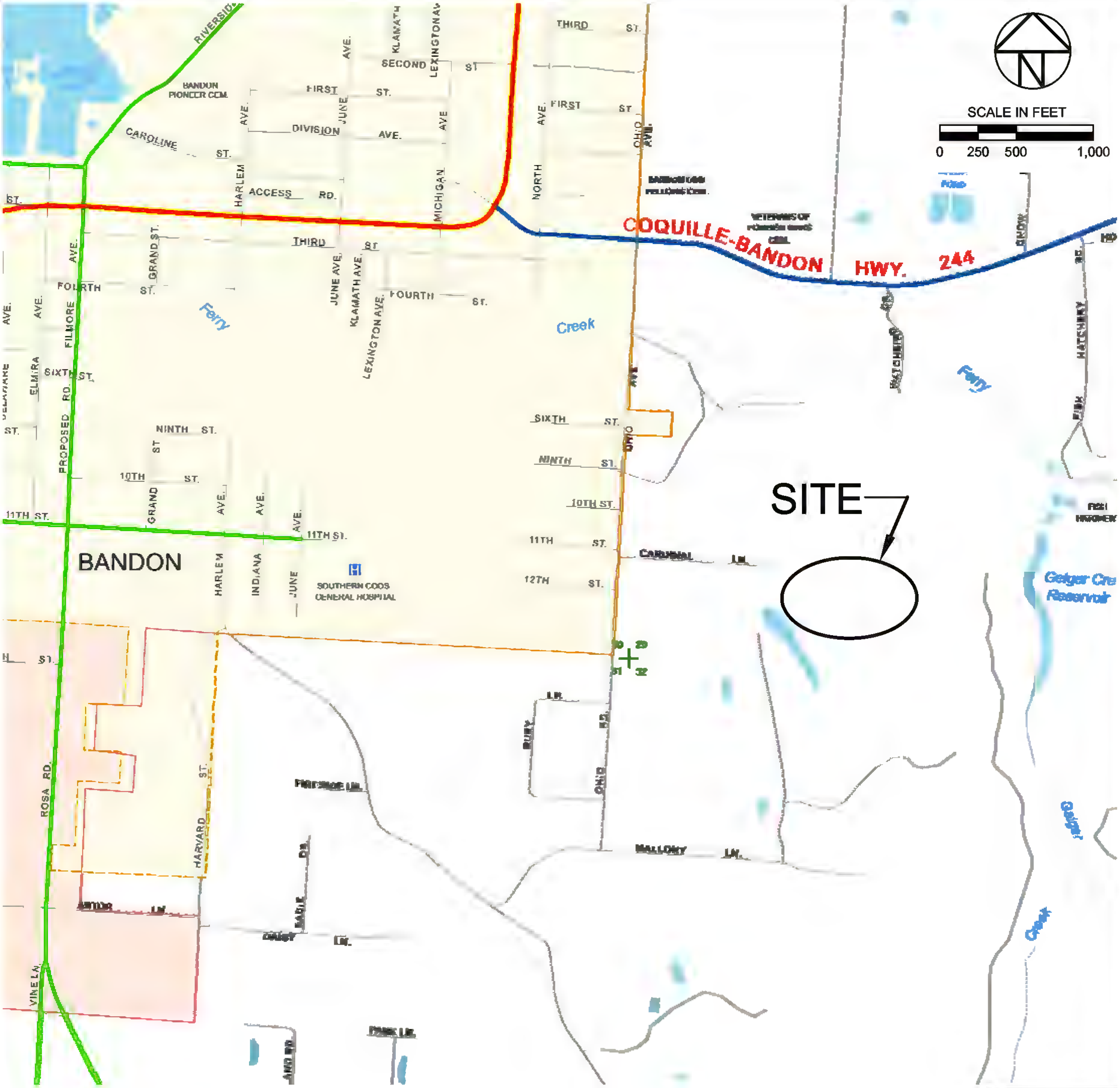
Foundation Engineering, Inc.



DATE JAN 2016
DWN. EJG
APPR.
REVIS.
PROJECT NO.
2161003

FOUNDATION ENGINEERING INC.
PROFESSIONAL GEOTECHNICAL SERVICES
820 NW CORNELL AVENUE
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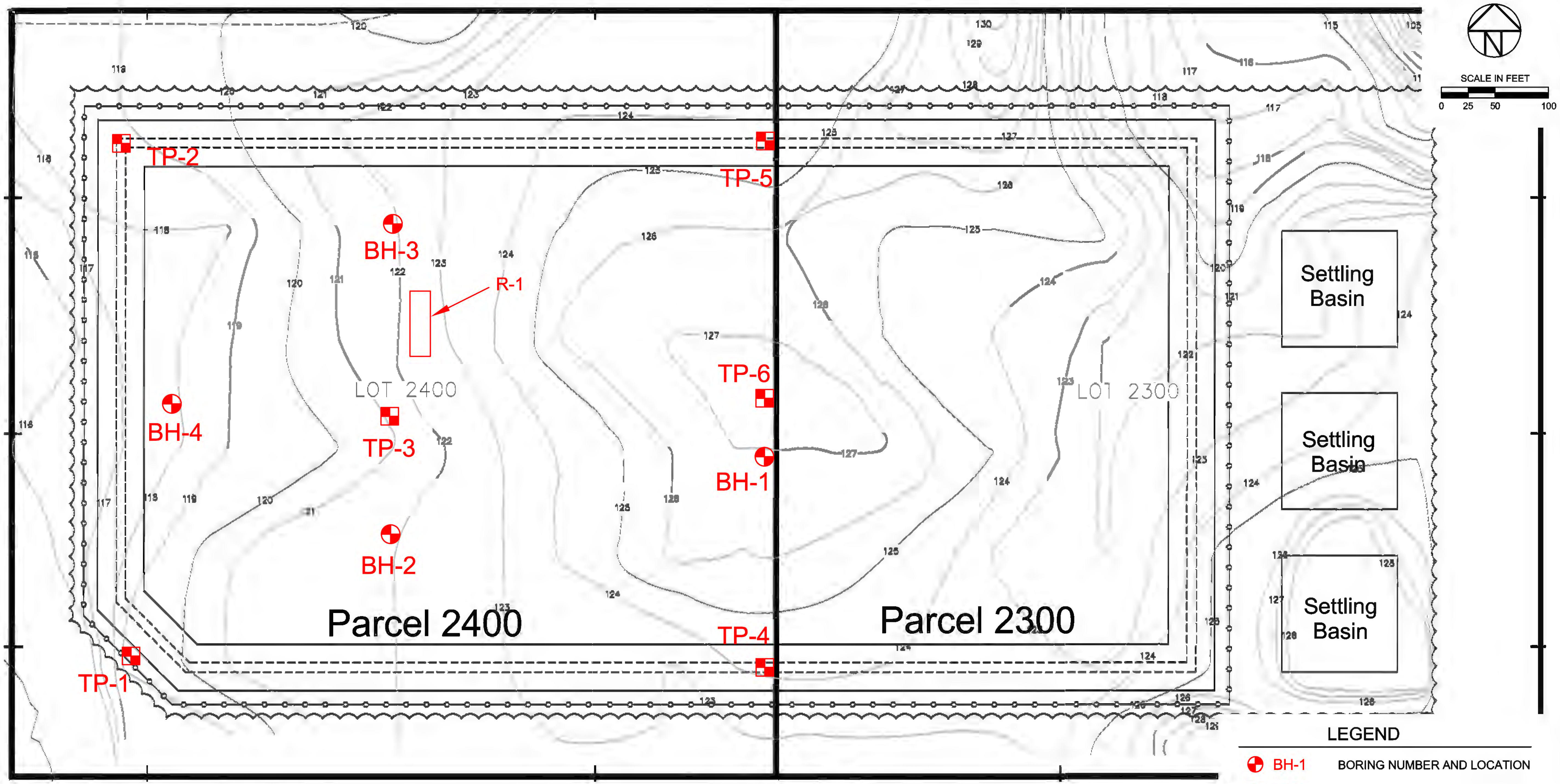
VICINITY MAP

BANDON OFF-CHANNEL RESERVOIR
BANDON, OREGON

FIGURE NO.
1A

FILE NAME: FIG 1A



LEGEND

●	BH-1	BORING NUMBER AND LOCATION
▨	TP-1	TEST PIT NUMBER AND LOCATION
▯	R-1	RESISTIVITY TEST LOCATION

NOTES:
1. BORING LOCATIONS WERE ESTABLISHED BY PACING AND ARE APPROXIMATE.
2. SEE REPORT FOR A DISCUSSION OF SUBSURFACE CONDITIONS.
3. BASE MAP PROVIDED BY THE DYER PARTNERSHIP ENGINEERING.
4. ELEVATION CONTOURS BASED ON SATELLITE IMAGES AND SHOULD BE CONSIDERED APPROXIMATE.

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SITE LAYOUT AND TEST PIT LOCATIONS

BANDON OFF-CHANNEL RESERVOIR
BANDON, OREGON

FIGURE NO.
2A

FILE NAME:FIG 2A

Photo 1. Offset on road pavement

Photo 2. Typical underbrush

Photo 3. View of site after brush clearing

Photo 4. View of site after brush clearing

Photo 5. View of Parcel 2300

Photo 6. Typical water in test pits

Appendix B

Boring and Test Pit Logs

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Services

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DISTINCTION BETWEEN FIELD LOGS AND FINAL LOGS

A field log is prepared for each boring or test pit by our field representative. The log contains information concerning sampling depths and the presence of various materials such as gravel, cobbles, and fill, and observations of ground water. It also contains our interpretation of the soil conditions between samples. The final logs presented in this report represent our interpretation of the contents of the field logs and the results of the sample examinations and laboratory test results. Our recommendations are based on the contents of the final logs and the information contained therein and not on the field logs.

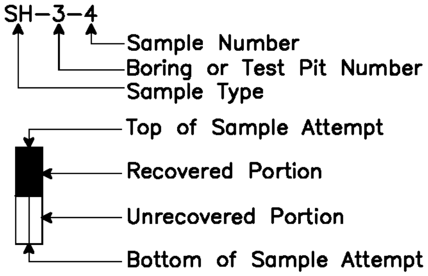
VARIATION IN SOILS BETWEEN TEST PITS AND BORINGS

The final log and related information depict subsurface conditions only at the specific location and on the date indicated. Those using the information contained herein should be aware that soil conditions at other locations or on other dates may differ. Actual foundation or subgrade conditions should be confirmed by us during construction.

TRANSITION BETWEEN SOIL OR ROCK TYPES

The lines designating the interface between soil, fill or rock on the final logs and on subsurface profiles presented in the report are determined by interpolation and are therefore approximate. The transition between the materials may be abrupt or gradual. Only at boring or test pit locations should profiles be considered as reasonably accurate and then only to the degree implied by the notes thereon.

SAMPLE OR TEST SYMBOLS



S – Grab Sample
SS – Standard Penetration Test Sample (split–spoon)
SH – Thin–walled Shelby Tube Sample
C – Pavement Core Sample
CS – Rock Core Sample

▲ Standard Penetration Test Resistance equals the number of blows a 140 lb. weight falling 30 in. is required to drive a standard split–spoon sampler 1 ft. Practical refusal is equal to 50 or more blows per 6 in. of sampler penetration.

● Water Content (%).

UNIFIED SOIL CLASSIFICATION SYMBOLS

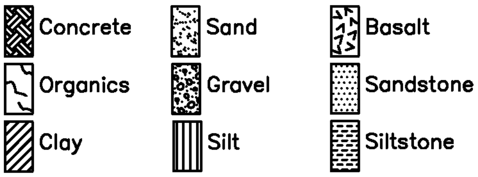
G – Gravel
S – Sand
M – Silt
C – Clay
Pt – Peat

W – Well Graded
P – Poorly Graded
L – Low Plasticity
H – High Plasticity
O – Organic

FIELD SHEAR STRENGTH TEST

Shear strength measurements on test pit side walls, blocks of soil or Shelby tube samples are typically made with Torvane or Field Vane shear devices.

TYPICAL SOIL/ROCK SYMBOLS



WATER TABLE

▼ Water Table Location

(1/31/16) Date of Measurement

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SYMBOL KEY

BORING AND TEST PIT LOGS

Explanation of Common Terms Used in Soil Descriptions

Field Identification	Cohesive Soils			Granular Soils	
	SPT*	S_u** (tsf)	Term	SPT*	Term
Easily penetrated several inches by fist.	0 – 2	< 0.125	Very Soft	0 – 4	Very Loose
Easily penetrated several inches by thumb.	2 – 4	0.125–0.25	Soft	4 – 10	Loose
Can be penetrated several inches by thumb with moderate effort.	4 – 8	0.25 – 0.50	Medium Stiff	10 – 30	Medium Dense
Readily indented by thumb but penetrated only with great effort.	8 – 15	0.50 – 1.0	Stiff	30 – 50	Dense
Readily indented by thumbnail.	15 – 30	1.0 – 2.0	Very Stiff	> 50	Very Dense
Indented with difficulty by thumbnail.	>30	> 2.0	Hard		

* SPT N–value in blows per foot (bpf)
** Undrained shear strength

Term	Soil Moisture Field Description
Dry	Absence of moisture. Dusty. Dry to the touch.
Damp	Soil has moisture. Cohesive soils are below plastic limit and usually moldable.
Moist	Grains appear darkened, but no visible water. Silt/clay will clump. Sand will bulk. Soils are often at or near plastic limit.
Wet	Visible water on larger grain surfaces. Sand and cohesionless silt exhibit dilatancy. Cohesive soil can be readily remolded. Soil leaves wetness on the hand when squeezed. Soil is wetter than the optimum moisture content and above the plastic limit.

Term	PI	Plasticity Field Test
Non–plastic	0 – 3	Cannot be rolled into a thread at any moisture.
Low Plasticity	3 – 15	Can be rolled into a thread with some difficulty.
Medium Plasticity	15 – 30	Easily rolled into thread.
High Plasticity	> 30	Easily rolled and re–rolled into thread.

Term	Soil Structure Criteria
Stratified	Alternating layers at least ¼ inch thick.
Laminated	Alternating layers less than ¼ inch thick.
Fissured	Contains shears and partings along planes of weakness.
Slickensided	Partings appear glossy or striated.
Blocky	Breaks into small lumps that resist further breakdown.
Lensed	Contains pockets of different soils.

Term	Soil Cementation Criteria
Weak	Breaks under light finger pressure.
Moderate	Breaks under hard finger pressure.
Strong	Will not break with finger pressure.

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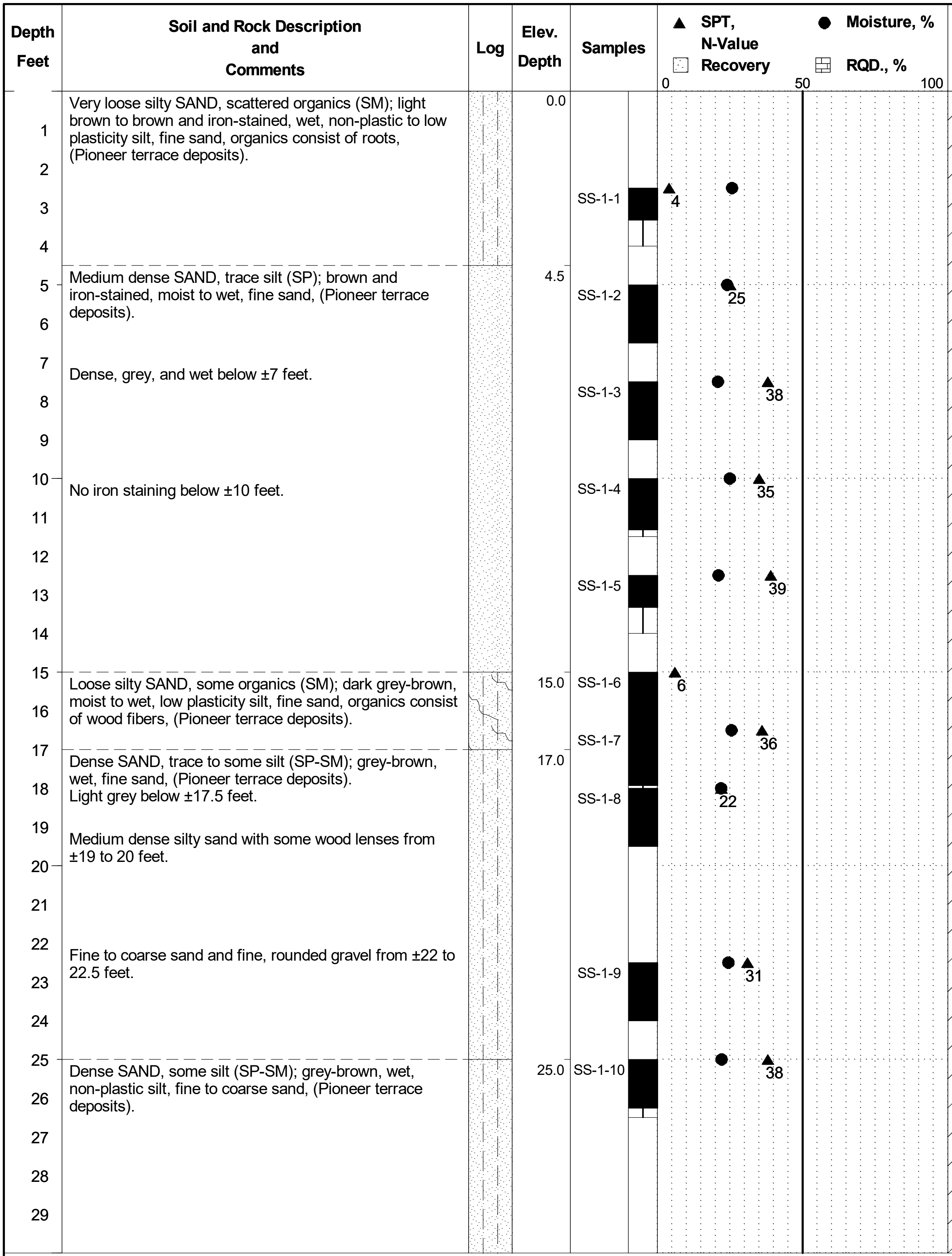
COMMON TERMS

SOIL DESCRIPTIONS

Elev. Depth	Soil and Rock Description and Comments	Samples	Installations/ Water Table
0.0	Very loose silty SAND, scattered organics (SM); light brown to brown and iron-stained, wet, non-plastic to low plasticity silt, fine sand, organics consist of roots, (Pioneer terrace deposits).	SS-1-1	Backfilled with bentonite grout
4.5	Medium dense SAND, trace silt (SP); brown and iron-stained, moist to wet, fine sand, (Pioneer terrace deposits).	SS-1-2	
	Dense, grey, and wet below ±7 feet.	SS-1-3	
	No iron staining below ±10 feet.	SS-1-4 SS-1-5	
15.0	Loose silty SAND, some organics (SM); dark grey-brown, moist to wet, low plasticity silt, fine sand, organics consist of wood fibers, (Pioneer terrace deposits).	SS-1-6 SS-1-7	
17.0	Dense SAND, trace to some silt (SP-SM); grey-brown, wet, fine sand, (Pioneer terrace deposits). Light grey below ±17.5 feet.	SS-1-8	
	Medium dense silty sand with some wood lenses from ±19 to 20 feet.		
	Fine to coarse sand and fine, rounded gravel from ±22 to 22.5 feet.	SS-1-9	
25.0	Dense SAND, some silt (SP-SM); grey-brown, wet, non-plastic silt, fine to coarse sand, (Pioneer terrace deposits).	SS-1-10	



Project No.: 2161003

Surface Elevation: N/A

Date of Boring: March 21, 2016

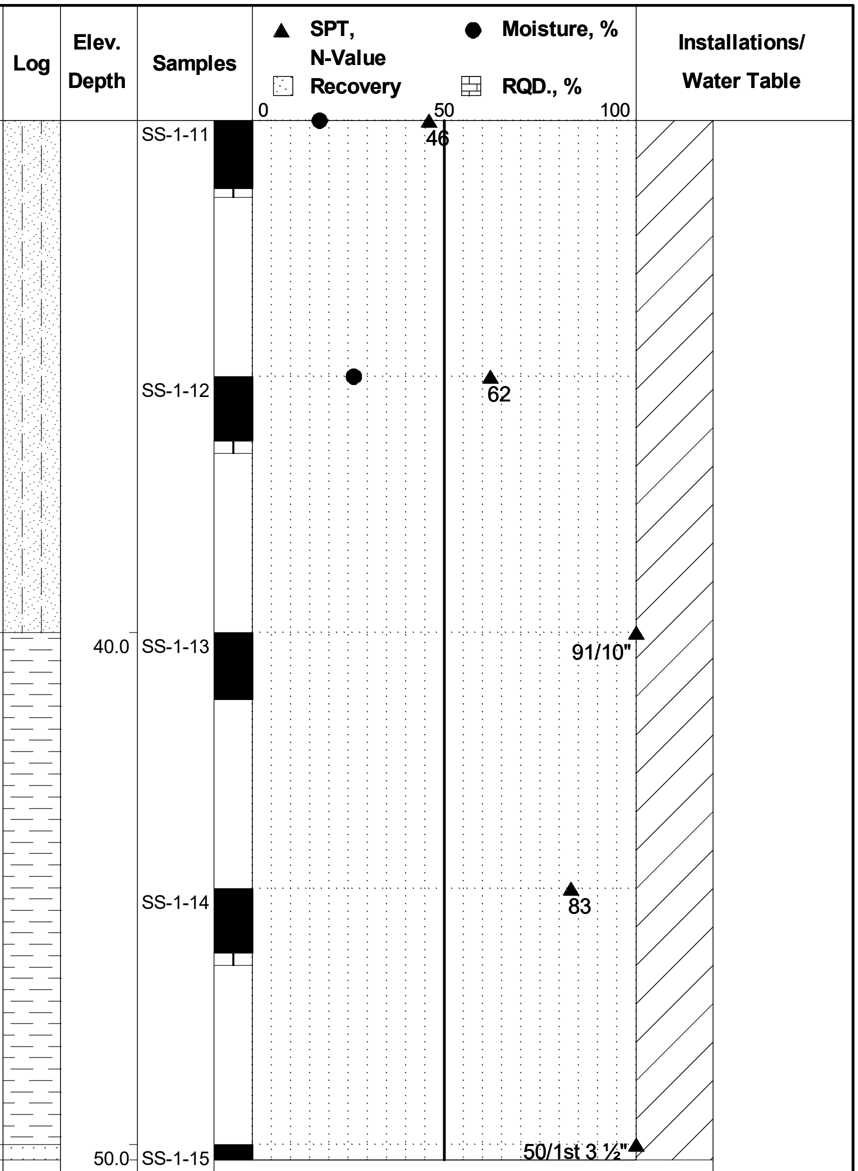
Foundation Engineering, Inc.

Boring Log: BH-1

Bandon Off-Channel Reservoir

Coos County, Oregon

Depth Feet	Soil and Rock Description and Comments	Elev. Depth	Samples	▲ SPT, N-Value
			SS-1-11	46
31				
32				
33				
34				
35	Fine sand below ±35 feet.		SS-1-12	62
36	Silty with scattered wood and weak to moderate cementation below ±36 feet.			
37				
38				
39				
40	Very weak (R1) SILTSTONE; dark grey, slightly to moderately weathered, sheared, calcite veining, (Melange of Sixes River).	40.0	SS-1-13	91/10"
41				
42				
43				
44				
45			SS-1-14	83
46				
47				
48				
49				
50	Weak (R2) SANDSTONE; grey, slightly weathered to fresh, fine sand, (Melange of Sixes River).	50.0	SS-1-15	50/1st 3 ½"
	BOTTOM OF BORING	50.3		



Project No.: 2161003

Surface Elevation: N/A

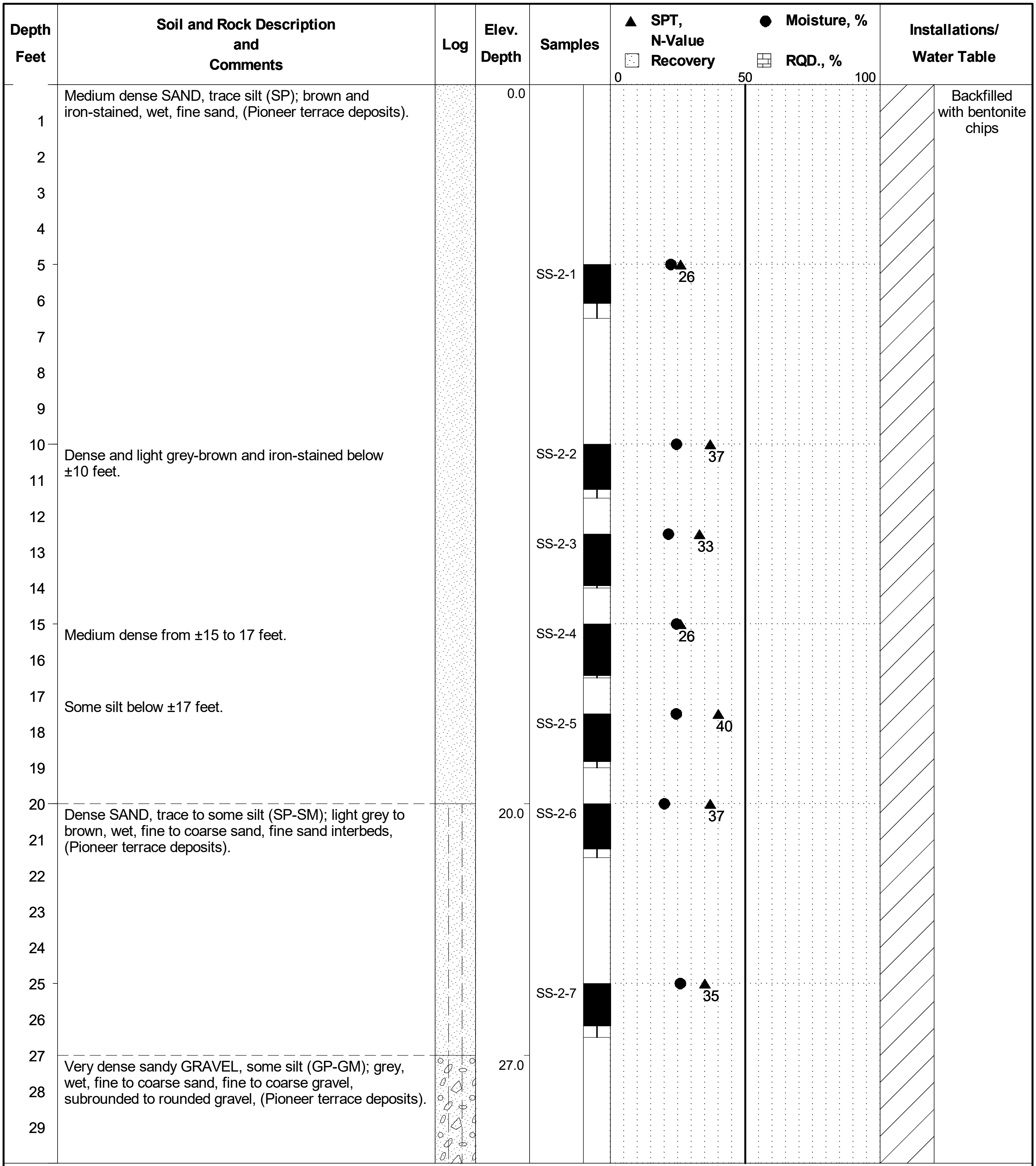
Date of Boring: March 21, 2016

Boring Log: BH-1

Bandon Off-Channel Reservoir

Coos County, Oregon

Foundation Engineering, Inc.



Soil and Rock Description and Comments	Elev. Depth	Samples	SPT, N-Value	Installations/ Water Table
Medium dense SAND, trace silt (SP); brown and iron-stained, wet, fine sand, (Pioneer terrace deposits).	0.0			Backfilled with bentonite chips
		SS-2-1	26	
Dense and light grey-brown and iron-stained below ±10 feet.		SS-2-2	37	
		SS-2-3	33	
Medium dense from ±15 to 17 feet.		SS-2-4	26	
Some silt below ±17 feet.		SS-2-5	40	
Dense SAND, trace to some silt (SP-SM); light grey to brown, wet, fine to coarse sand, fine sand interbeds, (Pioneer terrace deposits).	20.0	SS-2-6	37	
		SS-2-7	35	
Very dense sandy GRAVEL, some silt (GP-GM); grey, wet, fine to coarse sand, fine to coarse gravel, subrounded to rounded gravel, (Pioneer terrace deposits).	27.0			

Project No.: 2161003

Surface Elevation: N/A

Date of Boring: March 22, 2016

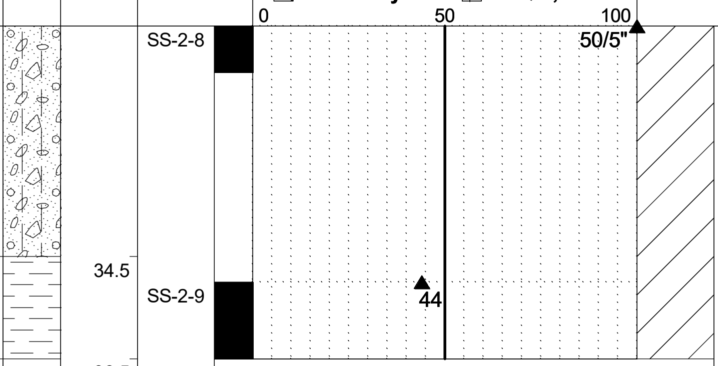
Foundation Engineering, Inc.

Boring Log: BH-2

Bandon Off-Channel Reservoir

Coos County, Oregon

Depth Feet	Soil and Rock Description and Comments	Log	Elev. Depth	Samples	▲ SPT, N-Value ⬚ Recovery ● Moisture, % ⊞ RQD., %	Installations/ Water Table
31 32 33 34				SS-2-8	50/5"	
35 36	Extremely weak (R0) SILTSTONE; dark grey, highly weathered to decomposed, sheared (Melange of Sixes River).		34.5	SS-2-9	44	
	BOTTOM OF BORING		36.5			



Project No.: 2161003

Surface Elevation: N/A

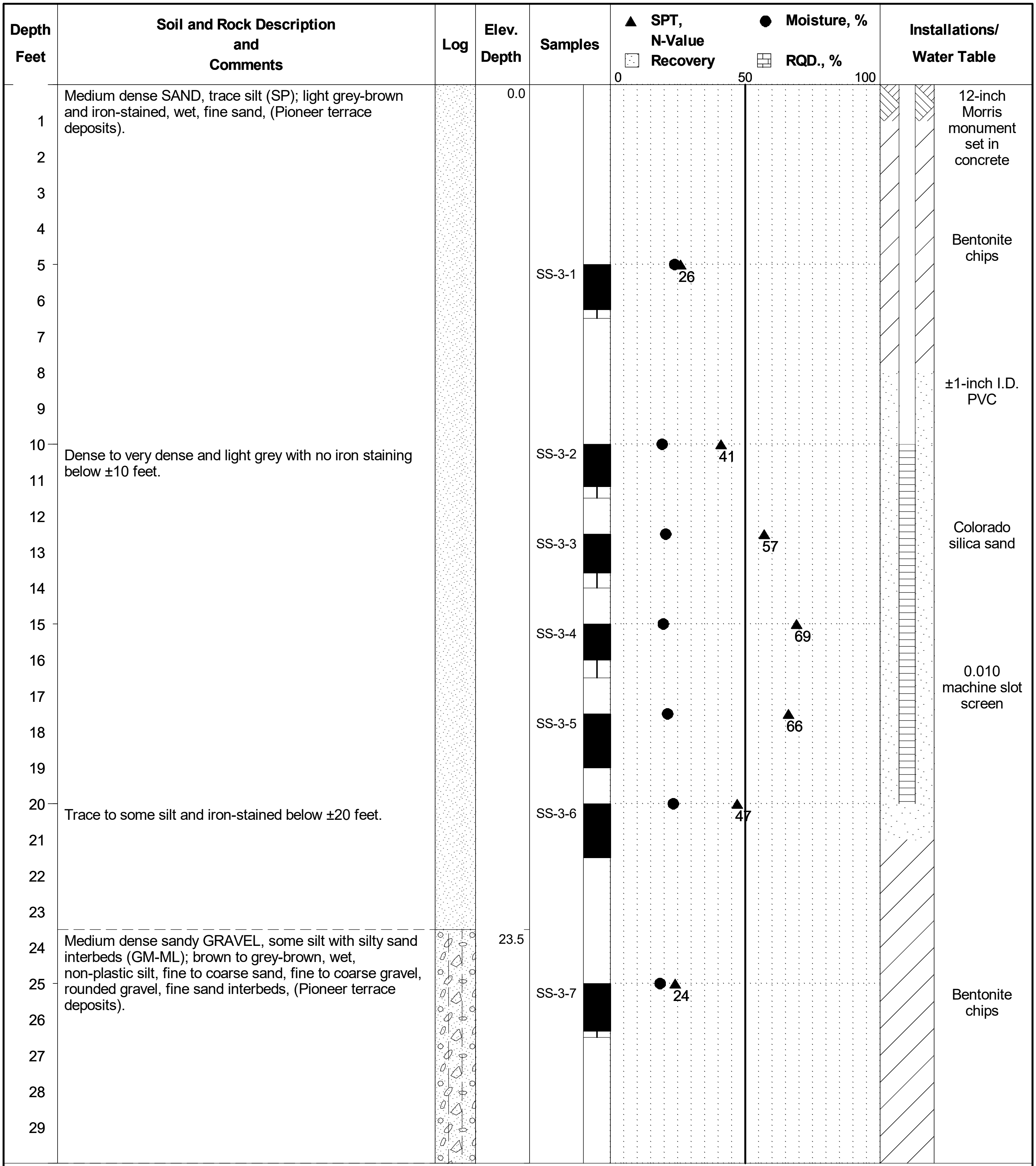
Date of Boring: March 22, 2016

Boring Log: BH-2

Bandon Off-Channel Reservoir

Coos County, Oregon

Foundation Engineering, Inc.



Depth Feet	Soil and Rock Description and Comments	Elev. Depth	Samples	SPT, N-Value	Installations/ Water Table
0	Medium dense SAND, trace silt (SP); light grey-brown and iron-stained, wet, fine sand, (Pioneer terrace deposits).	0.0			12-inch Morris monument set in concrete
4					Bentonite chips
5			SS-3-1	26	
8					±1-inch I.D. PVC
10	Dense to very dense and light grey with no iron staining below ±10 feet.		SS-3-2	41	
12.5			SS-3-3	57	Colorado silica sand
15			SS-3-4	69	
16.5					0.010 machine slot screen
17.5			SS-3-5	66	
20	Trace to some silt and iron-stained below ±20 feet.		SS-3-6	47	
23.5	Medium dense sandy GRAVEL, some silt with silty sand interbeds (GM-ML); brown to grey-brown, wet, non-plastic silt, fine to coarse sand, fine to coarse gravel, rounded gravel, fine sand interbeds, (Pioneer terrace deposits).	23.5			
25			SS-3-7	24	Bentonite chips

Project No.: 2161003

Surface Elevation: N/A

Date of Boring: March 22, 2016

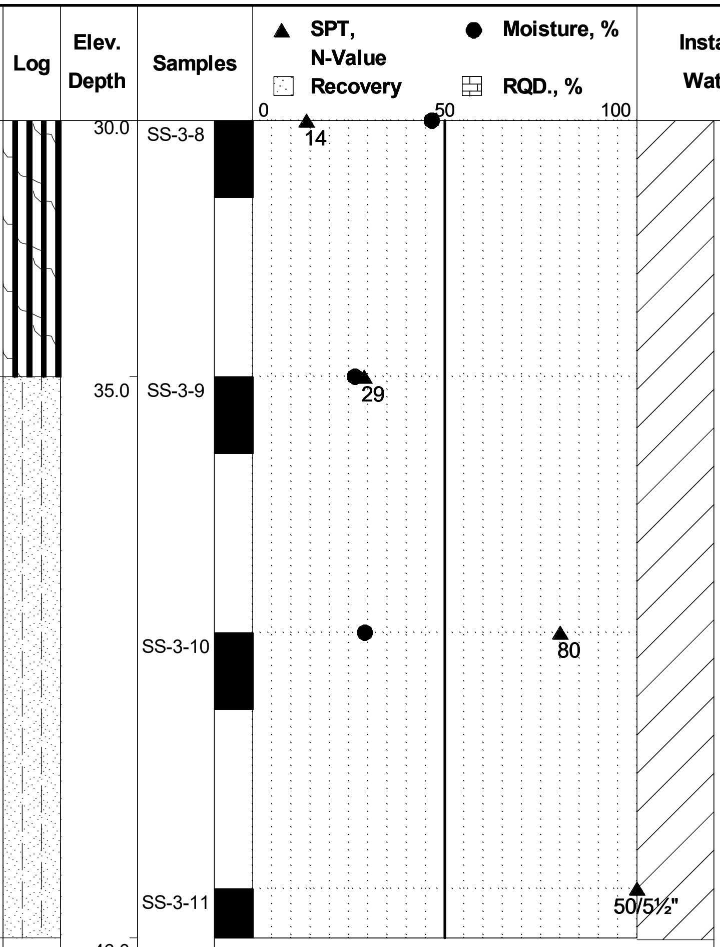
Foundation Engineering, Inc.

Boring Log: BH-3

Bandon Off-Channel Reservoir

Coos County, Oregon

Depth Feet	Soil and Rock Description and Comments	Elev. Depth	Samples
31 32 33 34	Stiff clayey SILT, scattered to some organics (MH); grey and dark brown, moist, high plasticity, organics consist of wood fibers, (Pioneer terrace deposits).	30.0	SS-3-8
35 36 37 38 39	Medium dense silty SAND (SM); grey, moist to wet, low plasticity silt, fine sand, (Pioneer terrace deposits).	35.0	SS-3-9
40 41 42 43 44	Very dense below ±40 feet.		SS-3-10
45	Weak cementation below ±45 feet.		SS-3-11
	BOTTOM OF BORING	46.0	



Project No.: 2161003

Surface Elevation: N/A

Date of Boring: March 22, 2016

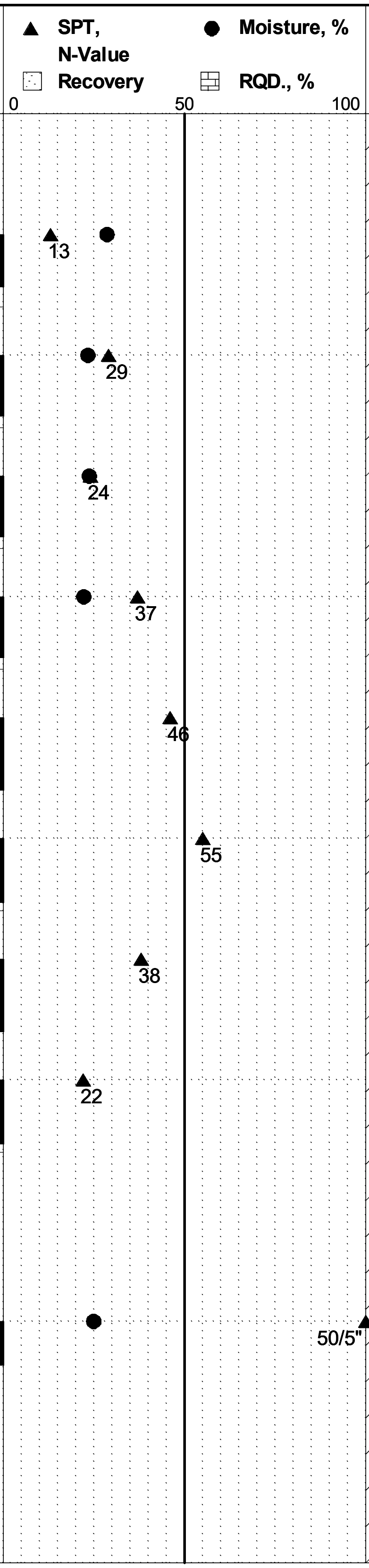
Foundation Engineering, Inc.

Boring Log: BH-3

Bandon Off-Channel Reservoir

Coos County, Oregon

Depth Feet	Soil and Rock Description and Comments	Elev. Depth	Samples	Installations/ Water Table
	Medium dense silty SAND, scattered organics (SM); light grey-brown and iron-stained, wet, non-plastic to low plasticity silt, fine sand, organics consist of roots, (Pioneer terrace deposits).	0.0		Backfilled with bentonite chips
3			SS-4-1	
5	Medium dense SAND, trace to some silt (SP-SM); grey, wet, fine sand, (Pioneer terrace deposits).	5.0	SS-4-2	
8			SS-4-3	
10	Dense below ±10 feet.		SS-4-4	
12	Grey-brown and iron-stained below ±12 feet.			
13			SS-4-5	
15	Very dense below ±15 feet.		SS-4-6	
17	Medium dense to dense gravelly SAND, some silty sand interbeds (SW interbedded with SM); grey-brown to brown and iron-stained, wet, fine to coarse sand, fine to coarse gravel, subrounded to rounded gravel, non-plastic silt and fine sand interbeds, (Pioneer terrace deposits).	17.0	SS-4-7	
20			SS-4-8	
25	Very dense below ±25 feet.		SS-4-9	
28	Extremely weak (R0) SILTSTONE; dark grey, highly weathered to decomposed, sheared, calcite veining, (Melange of Sixes River).	28.0		



Project No.: 2161003

Surface Elevation: N/A

Date of Boring: March 23, 2016

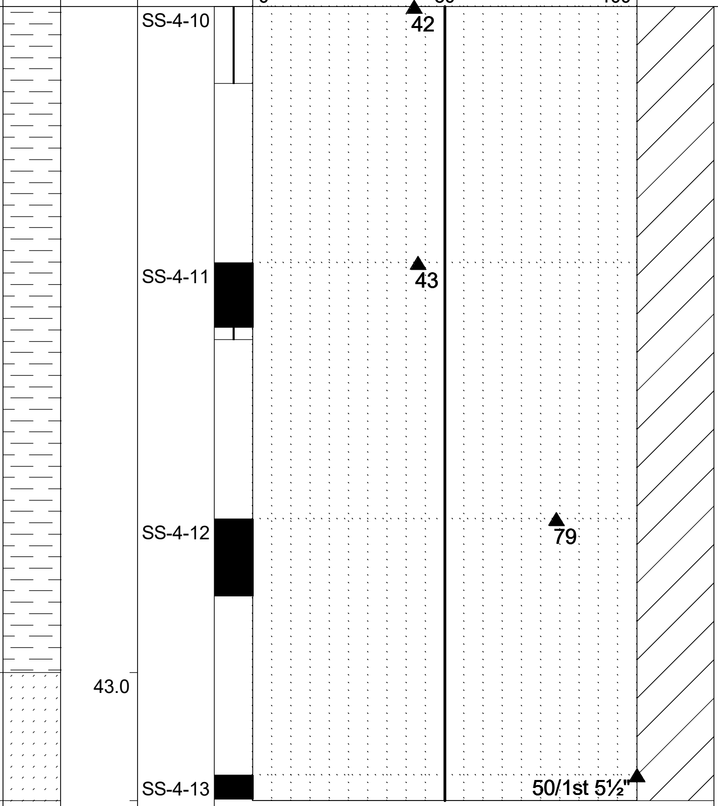
Boring Log: BH-4

Bandon Off-Channel Reservoir

Coos County, Oregon

Foundation Engineering, Inc.

Depth Feet	Soil and Rock Description and Comments	Log	Elev. Depth	Samples	▲ SPT, N-Value ⬚ Recovery ● Moisture, % ⊞ RQD., % (0 50 100)	Installations/ Water Table
				SS-4-10	42	
31						
32						
33						
34						
35				SS-4-11	43	
36						
37						
38						
39						
40	Slightly weathered below ±40 feet.			SS-4-12	79	
41						
42						
43	Weak (R2) SANDSTONE; grey, slightly weathered, fine sand, calcite veining, (Melange of Sixes River).		43.0			
44						
45				SS-4-13	50/1st 5½"	
	BOTTOM OF BORING		45.5			



Project No.: 2161003

Surface Elevation: N/A

Date of Boring: March 23, 2016

Foundation Engineering, Inc.

Boring Log: BH-4

Bandon Off-Channel Reservoir

Coos County, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Surface: Organics (duff) consisting of plant and woody debris.	1							Dense silty SAND, scattered organics (SM); brown to grey and iron-stained, wet, non-plastic to low plasticity silt, fine sand, (Pioneer terrace deposits).
	2							
Roots extend to ±3 feet.	3	S-1-1	■					Very dense SAND, trace silt (SP); light grey to grey, wet, fine sand, (Pioneer terrace deposits). Sandy gravel lens with fine to coarse, subrounded gravel at ±3 feet.
Slow seepage at ±3.5 feet.	4	S-1-2	■					
	5							
	6							
	7							
Ground water filled test pit to ±7.5 feet.	8							
	9							
	10	S-1-3	■					
	11							
	12							
	13							
	14							BOTTOM OF TEST PIT
	15							
	16							
	17							
	18							
	19							

Project No.: 2161003

Surface Elevation: N/A (Approx.)

Date of Test Pit: February 11, 2016

Test Pit Log: TP-1

Bandon Off-Channel Reservoir

Coos County, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Surface: Organics (duff) consisting of plant and woody debris.	1							Dense silty SAND, some organics (SM); brown and iron-stained, wet, non-plastic silt, fine sand, organics consist of roots, (Pioneer terrace deposits).
Rapid seepage at ±1 foot.	2							
Roots extend to ±3 feet.	3							Very dense SAND, trace silt (SP); light grey to grey and iron-stained, wet, fine sand, (Pioneer terrace deposits).
	4	S-2-1	■					
Ground water filled test pit to ±5 feet.	5							
	6							
	7	S-2-2	■					
	8							
	9	S-2-3	■					
	10							
	11							
	12							
	13							
	14							BOTTOM OF TEST PIT
	15							
	16							
	17							
	18							
	19							

Project No.: 2161003

Surface Elevation: N/A (Approx.)

Date of Test Pit: February 11, 2016

Test Pit Log: TP-2

Bandon Off-Channel Reservoir

Coos County, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Surface: Organics (duff) consisting of plant and woody debris.		S-3-1	■					Dense silty SAND, some gravel (SM); brown, moist, low plasticity silt, fine to coarse sand, fine gravel, subrounded gravel, (Pioneer terrace deposits).
	1	S-3-2	■					
	2							
Moderate seepage at ±2.5 feet.	3	S-3-3	■					Dense to very dense silty SAND to SAND, some silt (SM); brown and iron-stained, wet, non-plastic silt, fine sand, (Pioneer terrace deposits). Some weak cementation at ±2.5 to 3.5 feet.
Roots extend to ±2.5 feet.	4							
	5	S-3-4	■					
	6							Very dense SAND, trace silt (SP); light grey to grey, wet, fine sand, (Pioneer terrace deposits).
	7							
	8							
	9	S-3-5	■					
	10							
	11							
	12							Light grey below ±12 feet.
	13	S-3-6	■					
	14							
	15							
	16							BOTTOM OF TEST PIT
	17							
	18							
	19							

Project No.: 2161003

Surface Elevation: N/A (Approx.)

Date of Test Pit: February 11, 2016

Test Pit Log: TP-3

Bandon Off-Channel Reservoir

Coos County, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Surface: Organics (duff) consisting of plant and woody debris.								Medium dense silty SAND, scattered organics (SM); brown, wet, low plasticity silt, fine sand, (Pioneer terrace deposits).
	1	S-4-1	■					
	2							Medium dense to dense SAND, some silt (SP-SM); brown, wet, non-plastic silt, fine sand, (Pioneer terrace deposits).
Slow seepage at ±3 feet.	3	S-4-2	■					
Roots extend to ±4 feet.	4							
	5							Very dense SAND, trace silt (SP); grey, wet, fine sand, (Pioneer terrace deposits).
Ground water filled test pit to ±6 feet.	6	S-4-3	■					
	7							
	8							
	9							
	10							
	11	S-4-4	■					
	12							
	13							BOTTOM OF TEST PIT
	14							
	15							
	16							
	17							
	18							
	19							

Project No.: 2161003

Surface Elevation: N/A (Approx.)

Date of Test Pit: February 11, 2016

Test Pit Log: TP-4

Bandon Off-Channel Reservoir

Coos County, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Surface: Organics consisting of plant and woody debris.		S-5-1	■					Medium dense to dense silty SAND, some to scattered organics (SM); red-brown, moist, low plasticity silt, fine to coarse sand, organics consist of roots, (Pioneer terrace deposits).
	1							
	2	S-5-2	■					
Roots extend to ±3 feet.	3							Very dense SAND, trace silt (SP); brown and iron-stained, moist, fine sand, weak to moderate cementation, (Pioneer terrace deposits). Wet below ±5 feet.
	4	S-5-3	■					
	5							
	6							
	7	S-5-4	■					Very dense SAND, trace silt (SP); grey, wet, fine sand, weak cementation, (Pioneer terrace deposits).
	8							
	9	S-5-5	■					
	10	S-5-6	■					
	11							
	12	S-5-7	■					
	13	S-5-8	■					
No seepage or groundwater to the limit of excavation.	14							BOTTOM OF TEST PIT
	15							
	16							
	17							
	18							
	19							

Project No.: 2161003

Surface Elevation: N/A (Approx.)

Date of Test Pit: February 11, 2016

Test Pit Log: TP-5

Bandon Off-Channel Reservoir

Coos County, Oregon

Comments	Depth, Feet	Sample #	Location	Class Symbol	Water Table	C, TSF	Symbol	Soil and Rock Description
Surface: Organics (duff) consisting of plant and woody debris.	1							Stiff SILT, some sand (ML); grey-brown, wet, low plasticity, fine to coarse sand, (topsoil).
	2	S-6-1	■					Dense to very dense SAND, trace silt (SP); brown and iron-stained, wet, non-plastic silt, fine sand, weak to moderate cementation, (Pioneer terrace deposits).
	3	S-6-2	■					
	4							
	5							
	6	S-6-3	■					Very dense silty SAND (SM); grey and iron-stained, wet, low plasticity silt, fine sand, weak cementation, (Pioneer terrace deposits).
Rapid seepage at ±6.5 feet.	7	S-6-4	■					
	8							
	9							
	10	S-6-5	■					
	11							
	12							
	13							
	14							
	15							ORGANICS, in silty SAND matrix (OL); dark brown to dark grey, wet, low plasticity silt, fine sand, organics consist of wood and decomposed organic material (Pioneer terrace deposits).
	16	S-6-6	■					
	17							
	18							BOTTOM OF TEST PIT
	19							

Project No.: 2161003

Surface Elevation: N/A (Approx.)

Date of Test Pit: February 11, 2016

Test Pit Log: TP-6

Bandon Off-Channel Reservoir

Coos County, Oregon

Appendix C

Laboratory Test Results

Professional
Geotechnical
Services

Foundation Engineering, Inc.

Table 1C. Natural Water Contents and Percent Fines

Sample Number	Sample Depth (ft)	Natural Water Content (percent)	Percent Fines
S-1-1	3.0 – 3.5	22.3	
S-1-2	4.0 – 5.0	20.3	1.6
S-1-3	10.0 – 11.0	25.3	
S-2-1	4.0 – 4.5	17.1	
S-2-2	7.0 – 8.0	19.8	
S-2-3	9.0 – 10.0	20.5	
S-3-1	0.0 – 0.5	53.7	
S-3-2	1.0 – 1.5	36.6	
S-3-3	2.5 – 3.5	21.3	
S-3-4	4.5 – 5.0	25.5	
S-3-5	9.0 – 10.0	17.6	
S-3-6	13.0 – 14.0	22.2	
S-4-1	0.5 – 1.5	25.7	24.4
S-4-2	3.0 – 3.5	27.7	
S-4-3	6.0 – 7.0	18.1	
S-4-4	11.0 – 12.0	16.8	
S-5-1	0.0 – 0.5	56.1	
S-5-2	1.5 – 2.0	26.9	
S-5-3	4.0 – 4.5	8.2	
S-5-4	6.5 – 7.0	15.8	
S-5-5	8.5 – 9.0	19.1	
S-5-6	9.5 – 10.0	16.5	
S-5-7	11.5 – 12.0	14.7	
S-5-8	12.5 – 13.0	16.4	
S-6-1	1.0 – 1.5	38.7	

Table 1C. Natural Water Contents and Percent Fines

Sample Number	Sample Depth (ft)	Natural Water Content (percent)	Percent Fines
S-6-2	3.0 – 3.5	19.6	3.4
S-6-3	6.0 – 6.5	18.1	
S-6-4	7.0 – 7.5	19.4	
S-6-5	9.5 – 10.0	33.7	12.7
SS-1-1	2.5 – 4.0	25.7	
SS-1-2	5.0 – 6.5	24.0	
SS-1-3	7.5 – 9.0	20.8	
SS-1-4	10.0 – 11.5	24.9	
SS-1-5	12.5 – 14.0	21.0	
SS-1-6	15.0 – 16.5	49.2	6.8
SS-1-7	16.5 – 18.0	25.5	
SS-1-8	18.0 – 19.5	21.9	
SS-1-9	22.5 – 24.0	24.4	
SS-1-10	25.0 – 26.5	22.1	
SS-1-11	30.0 – 31.5	17.5	
SS-1-12	35.0 – 36.5	26.4	
SS-2-1	2.5 – 4.0	22.9	
SS-2-2	5.0 – 6.5	22.4	
SS-2-3	7.5 – 9.0	21.5	
SS-2-4	10.0 – 11.5	24.5	
SS-2-5	17.5 – 19.0	24.4	
SS-2-6	20.0 – 21.5	20.0	
SS-2-7	25.0 – 26.5	25.9	
SS-2-8	30.0 – 30.8	11.9	
SS-3-1	5.0 – 6.5	23.8	2.9
SS-3-2	10.0 – 11.5	19.2	
SS-3-3	12.5 – 14.0	20.5	

Table 1C. Natural Water Contents and Percent Fines

Sample Number	Sample Depth (ft)	Natural Water Content (percent)	Percent Fines
SS-3-4	15.0 – 16.5	19.6	
SS-3-5	17.5 – 19.0	21.2	
SS-3-6	20.0 – 21.5	23.3	
SS-3-7	25.0 – 26.5	18.4	
SS-3-8	30.0 – 31.5	46.6	
SS-3-9	35.0 – 36.5	26.6	
SS-3-10	40.0 – 41.5	29.2	
SS-4-1	2.5 – 4.0	28.6	17.7
SS-4-2	5.0 – 6.5	23.3	
SS-4-3	7.5 – 9.0	23.7	5.8
SS-4-4	10.0 – 11.5	22.2	
SS-4-9	25.0 – 25.9	24.9	

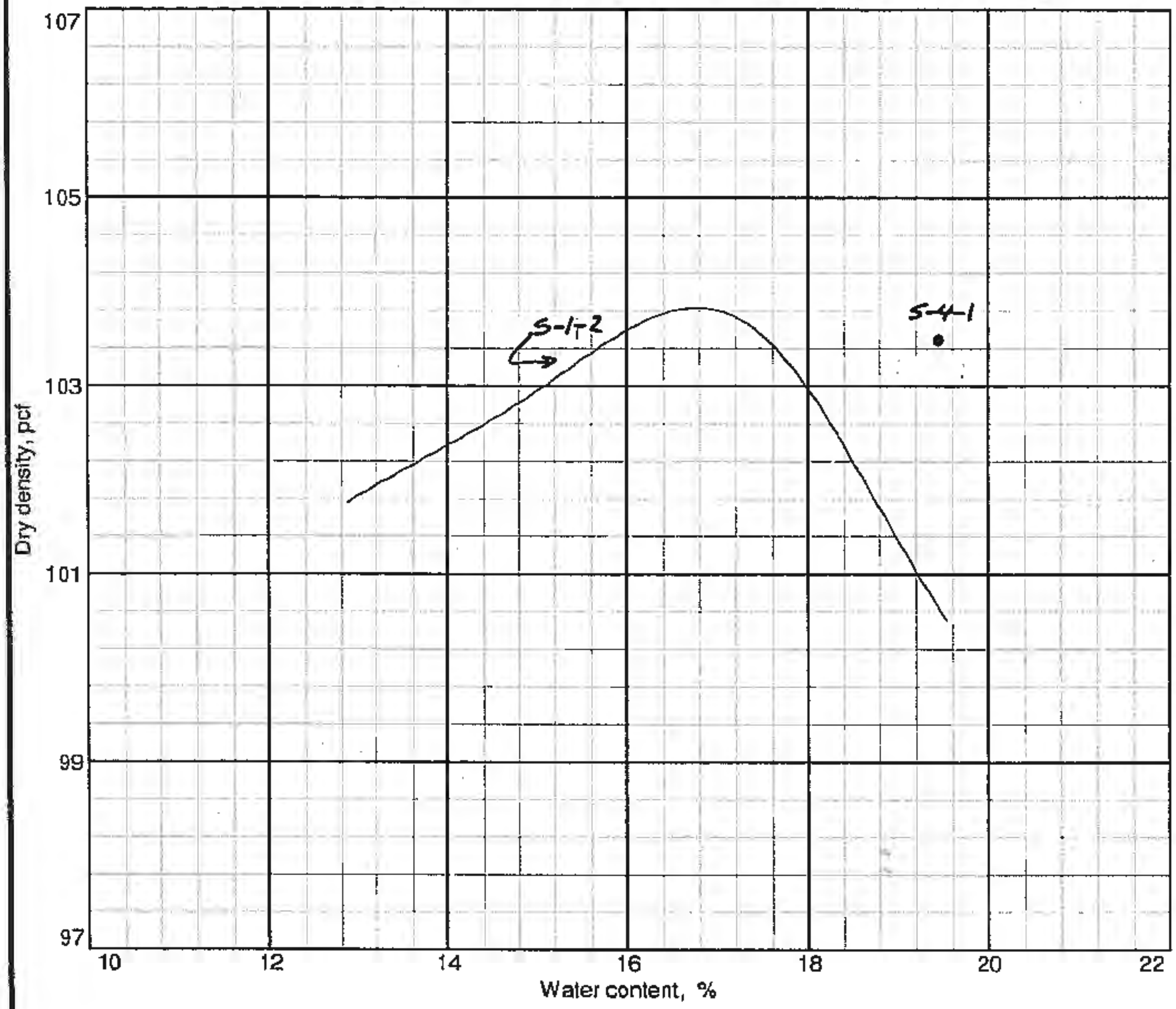
Table 2C. pH Test Results (ASTM G51)

Sample Number	Sample Depth (ft)	Sample Description	pH
SS-1-1	2.5 – 4.0	silty SAND	5.8
SS-3-1	5.0 – 6.5	fine SAND	5.6
SS-4-3	7.5 – 9.0	fine SAND	5.8
SS-2-2	10.0 – 11.5	fine SAND	5.7

Table 3C. Summary of Resistivity Testing

Location	Pin Spacing (ft.)	Resistivity (Ω-cm)
R-1 (near center of Parcel 2400)	5	84,260
	10	85,218
	20	80,430

MOISTURE - DENSITY RELATIONSHIP TEST



Test specification: ASTM D 698-00a Method A Standard

Elev/ Depth	Classification		Nat. Moist.	Sp.G.	LL	PI	% > No.4	% < No.200
	USCS	AASHTO						

TEST RESULTS	MATERIAL DESCRIPTION
Dry density = 103.5 pcf Moisture 19.4 %	brown silty SAND

Project No. 2166001-602 **Client:** Foundation Engineering, Inc.; project #2161003
Project: Bandon Off - Channel Reservoir

● **Source:** 5986 **Sample No.:** S-4-1 **Elev./Depth:** 0.5-1.5'

Remarks:
Check Point applied to S-1-2 curve

MOISTURE - DENSITY RELATIONSHIP TEST
FEI Testing & Inspection, Inc.
Corvallis, OR

Figure 1C

SECTION 9:

PERMITTING

SECTION 9: PERMITTING

This task identifies the required permits and applications that must be prepared and submitted for approval. The following agencies were contacted and respective permitting needs are listed as follows:

A. SHPO & Tribes – prehistoric and historic – no permit necessary

  1. Coquille Tribe of Indians – Kassandra Rippee, tribal archaeologist made preliminary site visit. She will make another site visit when second parcel has been cleared enough to view.

  2. Confederated Tribes of the Siletz Indians – made calls to Robert Kentta, but no return calls from him.

B. United States Army Corps of Engineers (USACE) & Department of State Lands (DSL) - no permits necessary.

C. Section 401 Water Quality Certification is in the process of being obtained.

D. Department of Environmental Quality (DEQ) National Pollutant Discharge Elimination System (NPDES) 1200C Permit – erosion control - obtained approval for site clearing and preliminary geotechnical investigation 10/27/14 File No. 123948 Permit No. 30432.

E. A permit for reservoir construction will be obtained during the design process.

F. Section 10 of the Rivers and Harbors Appropriation Act of 1899 – no obstructions, or excavations and fills shall be constructed in any navigable waterways as part of this project.

G. Section 404 Clean Water Act – No disposal dredging or fill material discharged into navigable water, shellfish beds, and fishery areas is anticipated.

H. Conditional Use Permit from Coos County – obtained approval March 17, 2015 Final Decision and Order for AP-15-05 City of Bandon.

I. A new water right permit for storage and the withdrawal from the new reservoir are in the process of being obtained from Oregon Water Resources Department (OWRD).

J. Consulting with the following:

  1. Oregon State Historic Preservation Office – no permits necessary because of no potential issues.

  2. Coquille Tribe – no permits necessary but Tribal Archaeologist made site visit will visit again once site is cleared of vegetation.

  3. Confederated Tribes of Siletz Indians – no permits necessary but Tribe contacted and there was no response

4. US Fish & Wildlife Service – no permits necessary, contacted regarding bird concerns.

5. National Marine and Fisheries Service – contacted, responded to concerns about impacts to fish in main Ferry Creek. If federal funding is sought, then full consultation with NMFS will be required.

6. Oregon Department of Fish & Wildlife – contacted, responded to concerns about water quality issues.

SECTION 10:

FEASIBILITY LEVEL COST ESTIMATE

SECTION 10: FEASIBILITY LEVEL COST ESTIMATE

This section addresses the cost estimate at the feasibility study level. It is intended to serve as a budgetary guide and to support evaluations of project feasibility or funding requirements in support of planning and to establish a budget.

Purpose

The City of Bandon lacks both, a sufficient surface water supply, during the dry season, and raw water storage, necessary to provide the city with water when water supply is low and demand is high.

Background information

The City studied options to expanding the City's water storage prior to proceeding with pursuing the raw water storage facility option. The following options were considered:

- Dredging Ferry and Geiger Creek Reservoirs to expand raw water storage
- Repairing Ferry Creek Dam, so that water levels could be raised, to increase raw water storage.
- Installing a new 1.0 MG or new 2.0 MG treated water tank.

The study concluded the cost per gallon of water for constructing a raw water storage facility was far lower than any of the other options and offers the most storage volume.

Scope

The City purchased a ten-acre parcel in 2014 for the purpose of constructing an off-channel reservoir, so no property will have to be purchased for this project. This parcel is contiguous another ten-acre parcel and will provide an adequately sized site to construct the reservoir, settling ponds, and overflow basin. Both these parcels are contiguous to the property that the City water treatment plant is located. This property is not within the city, but is in close proximity. It has access to electric service and there is a utility easement that runs from the property to the Backup Pump Station. The property is approximately the same elevation as Middle Pond, so the same pumps at the Backup Pump Station can be used to pump water to the proposed off-channel reservoir.

The raw water storage facility will consist of the 100-acre-foot off-channel reservoir that will occupy approximately a 20-acre site. A sedimentation basin will allow lower O&M costs by allowing sediment settle out before entering the raw storage facility. This basin can be cleaned much easier than the larger raw water storage basin. Emergency overflow will be directed to an energy-dissipator basin and bioswale. The site will be enclosed by a 50-foot wide buffer of natural vegetation (brush) and will be security-fenced and gated.

The reservoir will be constructed of native materials, as determined by the geotechnical study, to be appropriate for reservoir construction. Materials excavated for the reservoir will be used to construct the berm. This will minimize trucking of materials in and out of the site.

The raw water storage basin will be lined to eliminate leakage and so nearby wells are not adversely impacted by water from the local water table migrating into the storage basin. The raw water storage basin will be covered to eliminate evaporation. The combination of the liner and cover will serve as significant water conservation measures.

The cover will be insulated and will keep water cool and minimize algae growth. Mixers and aerators will keep the water from stratifying. Stratification of stored water results in difficulty in treating this water, the possibility of algal blooms, and adverse impacts to fish if this water is released into the stream.

Water for the reservoir will be pumped from the existing Backup Pump Station, located downstream from the Fish Hatchery, through a new 12-inch diameter pipe, located in an existing utility easement. An existing 14-inch treated water main and electrical lines already utilize the easement. Water will be diverted from the reservoir by gravity to the Backup Pump Station, where it will be pumped to the treatment plant.

Water may be released for stream augmentation at the Backup Pump Station, if determined necessary by funding or regulatory agencies.

A fish screen will be provided at the intake in the raw water storage basin if required by regulatory agencies.

A SCADA system will be installed to provide telemetry control of valves and pumps.

Basis for Cost Estimate

The costs for construction and associated engineering have be developed and summarized on the feasibility level cost estimate.

The following assumptions were used to determine construction costs:

- The project will receive funding for the entire project.
- Environmental regulations will not change.
- The construction costs are in today’s dollars and should be adjusted to reflect inflation at the time of design.
- The geotechnical properties of the timbered site (Lot 2300) will be the same as the cleared area (Lot 2400) that was examined during the feasibility study.
- The materials and equipment used in the cost estimate will still be available.
- Preliminary and final design will not change significantly.

The estimated construction costs are based on a preliminary design and costs derived from similar projects and input from material and equipment suppliers. These costs are shown in Table 10.1.

Table 10.1
Total Project Cost Estimate

No.	Item	Quantity	Unit	Unit Price	Total Price
1	Construction Facilities and Temp. Controls	1	LS	$637,700.00	$ 637,700
2	Site Preparation	1	LS	$7,500.00	$ 7,500
3	Access Road Construction	1	LS	$1,300.00	$ 1,300
4	Dike Road Surfacing	1	LS	$12,500.00	$ 12,500
5	Geotextile Fabric	3,500	SY	$2.00	$ 7,000
6	Aggregate Base	1,000	Ton	$26.00	$ 26,000
7	Perimeter Drainage Ditch	2,550	LF	$2.00	$ 5,100
8	Foundation Stabilization	375	CY	$40.00	$ 15,000
9	Stripping - Removal	74,200	CY	$3.75	$ 278,250
10	Stripping - Reinstallation	74,200	CY	$3.25	$ 241,150
11	Excavation - used for sediment & overflow basins	26,100	CY	$3.50	$ 91,350
12	Excavation/Embankment - used for berm	52,200	CY	$4.00	$ 208,800
13	Cement Amendment for slope stabilization	15,600	CY	$6.00	$ 93,600
14	Pond Surface Fine Grading	1	LS	$10,000.00	$ 10,000
15	Pond Anchor Trench	1,500	LF	$5.00	$ 7,500
16	Pond Underdrains	1	LS	$25,000.00	$ 25,000
17	Pond Liner Underlainment	700,000	SF	$0.60	$ 420,000
18	Pond Lining (includes leakage testing)	700,000	SF	$1.00	$ 700,000
19	Floating Algae Control Cover	275,000	SF	$3.00	$ 825,000
20	Mixer / Aerator Unit	3	EA	$57,000.00	$ 171,000
21	Johnson Fish Screen w/ Air Scour System	1	LS	$25,000.00	$ 25,000
22	12" Misc. Fittings	8	EA	$1,100.00	$ 8,800
23	12" Gate Valve	1	EA	$2,100.00	$ 2,100
24	12" Check Valve	2	EA	$6,000.00	$ 12,000
25	8" Check Valve	1	EA	$4,000.00	$ 4,000
26	12" Float Valve	1	EA	$20,000.00	$ 20,000
27	Emergency Spillway Structure	2	EA	$3,000.00	$ 6,000
28	Safety Equipment (for maintenance)	1	LS	$10,000.00	$ 10,000
29	Creek Crossing	1	LS	$20,000.00	$ 20,000
30	Pipe Inlet & Outfall Structures (Manifold Systen	2	EA	$20,000.00	$ 40,000
31	Pump Station Connection	1	LS	$25,000.00	$ 25,000
32	Pump Station Improvements	1	LS	$75,000.00	$ 75,000
33	12" DIP Restrained Joint Waterline - Class C	150	LF	$110.00	$ 16,500
34	12" DIP Restrained Joint Waterline - Class B	400	LF	$85.00	$ 34,000
35	12" DIP Waterline - Class B	1,750	LF	$70.00	$ 122,500
36	12" C900 PVC Waterline - Class C	1,600	LF	$65.00	$ 104,000
37	8" C900 PVC Waterline - Class C	150	LF	$45.00	$ 6,750
38	Concrete Anchor Wall	2	EA	$1,500.00	$ 3,000
39	Combination Air Release Valve w/vault	1	EA	$2,100.00	$ 2,100
40	Standard Blowoff Assembly	1	EA	$1,150.00	$ 1,150

No.	Item	Quantity	Unit	Unit Price	Total Price
41	SCADA	1	LS	$25,000.00	$ 25,000
42	Electrical to site by Bandon Electric	1	LS	$50,000.00	$ 50,000
43	Electrical Site Service	1	LS	$6,000.00	$ 6,000
44	HP Generator System	1	LS	$50,000.00	$ 50,000
45	10HP duplex pump station	1	LS	$75,000.00	$ 75,000
46	Pre-sedimentation Basin System Exc/Emb	2,800	CY	$4.00	$ 11,200
47	Pre-sedimentation Basin Liner/Underlainment	9,600	SF	$1.30	$ 12,480
48	Safety Equipment (for maintenance)	1	LS	$2,500.00	$ 2,500
49	Energy Dissipator Basin	1	LS	$7,500.00	$ 7,500
50	Overflow Bioswale Exc/Emb	4,500	CY	$3.50	$ 15,750
51	Security Fence	3,600	LF	$75.00	$ 270,000
52	Security Gate	1	EA	$10,000.00	$ 10,000
53	Erosion & Sediment Control	1	LS	$7,000.00	$ 7,000
54	Landscaping	1	LS	$25,000.00	$ 25,000
				Construction Total	**$ 4,889,000**
				Contingency	**$ 1,222,000**
				Engineering	**$ 733,000**
				Permitting	**$ 61,000**
				Geotechnical	**$ 55,000**
				Water Rights	**$ 20,000**
				Planning	**$ 93,000**
				Administration	**$ 147,000**
				Project Total	**$ 7,220,000**

The cost per acre-foot is $72,220 and the cost per gallon is $0.22.

Annual Operating and Maintenance Costs

Annual maintenance activities were identified with input from City staff. Preventative maintenance consists of tasks considered necessary to keep the reservoir in good working order. Monitoring and inspection are items that should be regular maintenance duties and may be conditions of the reservoir permit. Replacement, maintenance, and calibration items include the costs to replace and maintain items that require substantial costs that may not occur annually but will require budgeting for. Table 10.2 lists the annual operating and maintenance costs for the off-channel reservoir.

Table 10.2
Annual O&M Costs

No.	Item	Quantity	Unit	Unit Price	Total Price
Preventive Maintenance					
1	Vegetation Mowing	1	EA	$227.16	$ 227
2	Brush Removal	2	EA	$494.20	$ 988
3	Maintain/grade embankment & access roads	1	EA	$483.51	$ 484
4	Maintain/repair embankment	1	EA	$98.18	$ 98
5	Remove and repair rodent damage	1	EA	$84.00	$ 84
6	Maintain/Repair security fence	1	EA	$100.00	$ 100
7	Cleaning (algea & dirt)	1	EA	$500.00	$ 500
8	Cleaning basin & spillway (sediment removal)	1	EA	$3,000.00	$ 3,000
9	Repair & verify calibration of measurement equip.	1	EA	$650.00	$ 650
10	Dredge settling pond(s) (once every 5 years)	0.2	EA	$10,000.00	$ 2,000
Monitoring/Inspection					
11	Monitoring - visual	12	EA	$50.00	$ 600
12	Inspection - after storm/disaster events	3	EA	$150.00	$ 450
13	Inspection - all with Engineer	1	EA	$1,000.00	$ 1,000
	(SHORT LIVED ASSETS) TOTAL MAINT. AND MONITORING/INSPECTION COSTS				$ 10,181
Replacement/Calibration, maintenance					
14	Valves (maintain all valves once every 7 years)	0.05	EA	$7,750.00	$ 400
15	Valves (replace 2 valves once every 20 years)	0.05	EA	$8,000.00	$ 400
16	10 HP Pump (replace 2 pumps once every 20 years)	0.05	EA	$50,000.00	$ 2,500
17	SCADA (calibration once a year)	1	EA	$500.00	$ 500
18	Mixer/aerators (replace all once every 10 years)	0.10	EA	$171,000	$ 17,100
19	Floating Algae Control Cover (rep. 25% every 20 years)	3,438	EA	$3.00	$ 10,313
	TOTAL REPLACEMENT AND CALIBRATION COSTS				$ 31,213
	Note: based total current unit price costs *0.1 equals 1 of 20 years*				
	TOTAL YEARLY OPERATING & MAINTENANCE COSTS				**$ 41,394**

SECTION 11:

FUNDING AND RATE ANALYSIS

SECTION 11: FUNDING AND RATE ANALYSIS

The City of Bandon is unable to finance this project without some form of governmental funding assistance, such as low-interest loans or grants. This section summarizes the funding needed to construct and operate the proposed off-channel reservoir.

Income – Water Rates

The City's rate structure consists of a base rate, which includes the first 2,000 gallons and a price per each 1,000 gallons used thereafter. The City of Bandon's average water bill cost for 4,000 gallons is $16.10. Bandon's water bill for 7,500 gallons is $21.30. The authority to raise water rates must be approved by the voters of the City. Currently the City's Utility Commission is working on a water rate ballot measure. In addition, the City will be commissioning a water rate study July 2016.

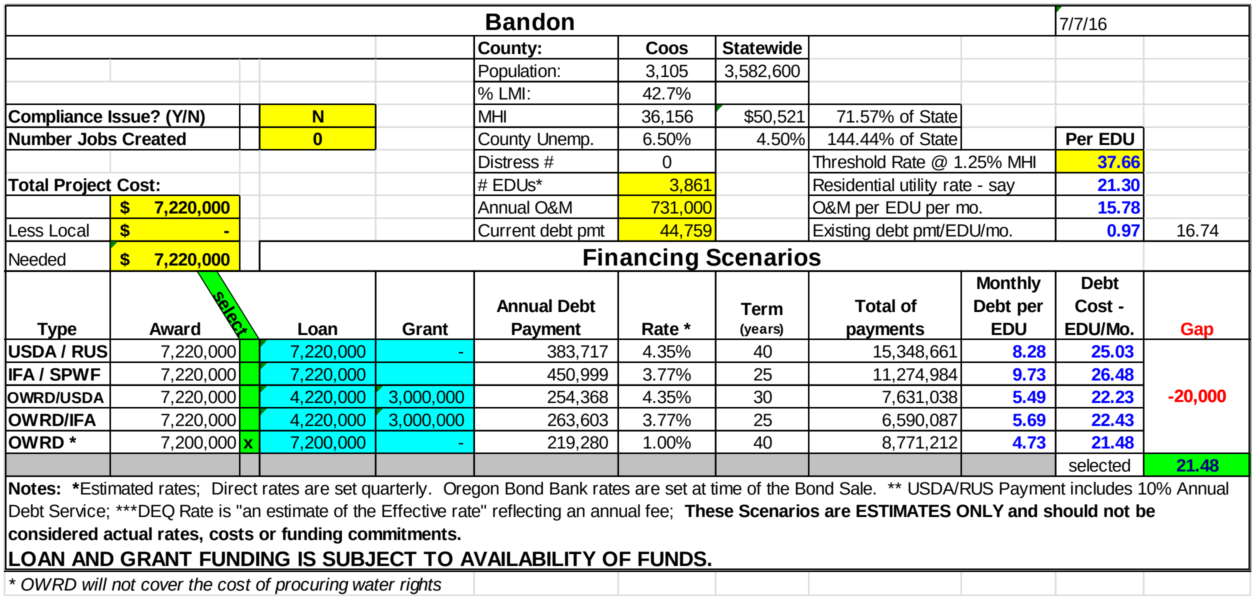
Construction of the proposed off-channel reservoir may require ratepayers in the City of Bandon to pay higher rates for water service.

There appears to be two viable funding options for this project: funding from OWRD or a combination of funding from USDA and OWRD.

Impact to Ratepayers

The following financial scenarios are based on a total project cost of $7,220,000 as seen in Figure 11.1.

Figure 11.1
One Stop Financial Summary



Bandon										7/7/16	
					County:	**Coos**	**Statewide**				
					Population:	3,105	3,582,600				
					% LMI:	42.7%					
Compliance Issue? (Y/N)			**N**		MHI	36,156	$50,521	71.57% of State			
Number Jobs Created			**0**		County Unemp.	6.50%	4.50%	144.44% of State		**Per EDU**	
					Distress #	0		Threshold Rate @ 1.25% MHI		**37.66**	
Total Project Cost:					# EDUs*	3,861		Residential utility rate - say		**21.30**	
	$ 7,220,000				Annual O&M	731,000		O&M per EDU per mo.		**15.78**	
Less Local	**$ -**				Current debt pmt	44,759		Existing debt pmt/EDU/mo.		**0.97**	16.74
Needed	**$ 7,220,000**		**Financing Scenarios**								

Type	Award	select	Loan	Grant	Annual Debt Payment	Rate *	Term (years)	Total of payments	Monthly Debt per EDU	Debt Cost - EDU/Mo.	Gap
USDA / RUS	7,220,000		7,220,000	-	383,717	4.35%	40	15,348,661	**8.28**	**25.03**	
IFA / SPWF	7,220,000		7,220,000		450,999	3.77%	25	11,274,984	**9.73**	**26.48**	
OWRD/USDA	7,220,000		4,220,000	3,000,000	254,368	4.35%	30	7,631,038	**5.49**	**22.23**	**-20,000**
OWRD/IFA	7,220,000		4,220,000	3,000,000	263,603	3.77%	25	6,590,087	**5.69**	**22.43**	
OWRD *	7,200,000	x	7,200,000	-	219,280	1.00%	40	8,771,212	**4.73**	**21.48**	
										selected	**21.48**

Notes: *Estimated rates; Direct rates are set quarterly. Oregon Bond Bank rates are set at time of the Bond Sale. ** USDA/RUS Payment includes 10% Annual Debt Service; ***DEQ Rate is "an estimate of the Effective rate" reflecting an annual fee; **These Scenarios are ESTIMATES ONLY and should not be considered actual rates, costs or funding commitments.**

LOAN AND GRANT FUNDING IS SUBJECT TO AVAILABILITY OF FUNDS.

** OWRD will not cover the cost of procuring water rights*

Former City Manager, Chris Good, attended a Developmental One Stop Finance Meeting on October 19, 2015. The meeting was attended by USDA/RUS, IFA/SPWF, and OWRD/OWRD. A variety of loan and grant opportunities were considered from the three funding sources.

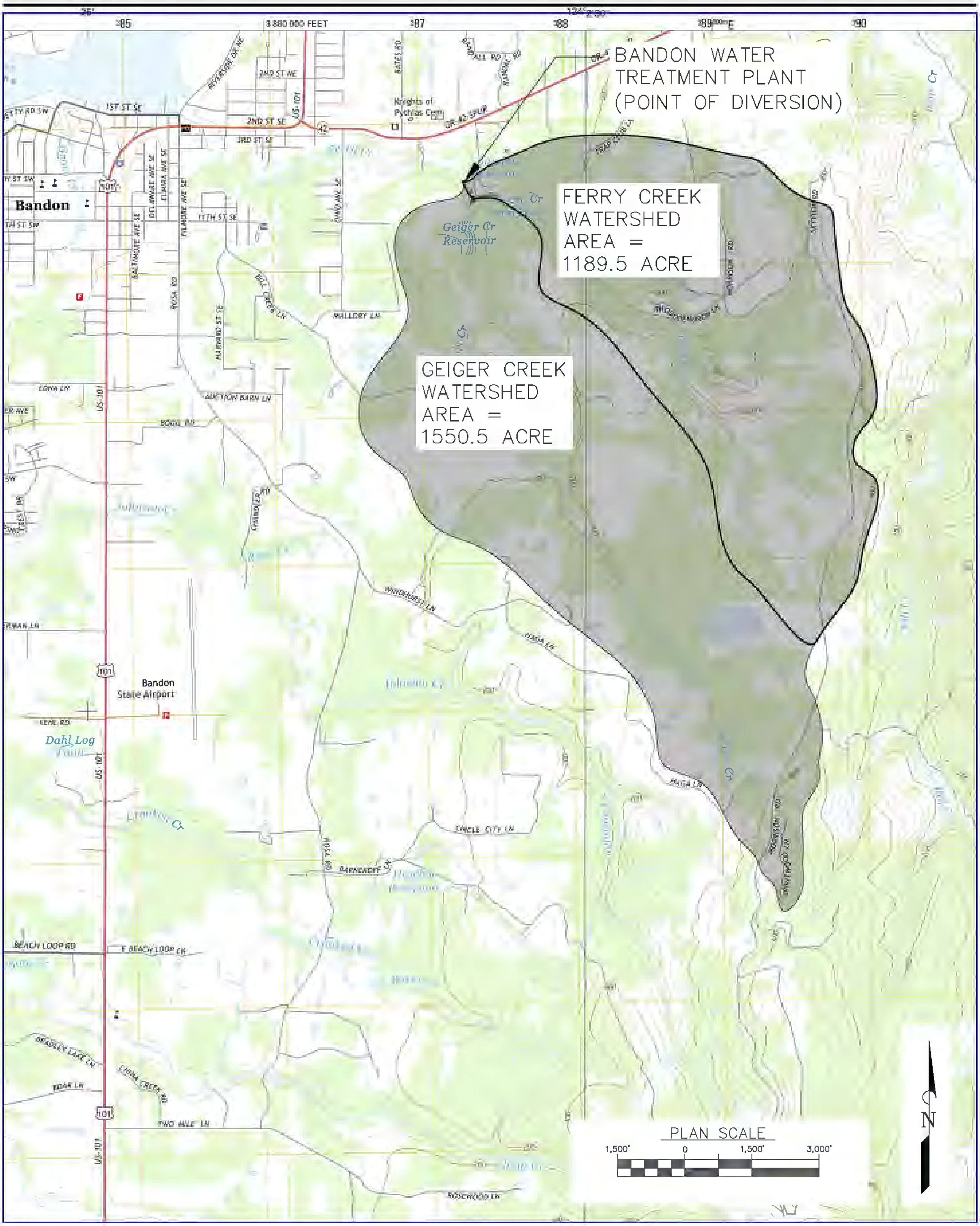
The City is considering a General Obligation bond to fund loan repayments.

The City's current annual operating budget is $690,000 and their current debt service payment is $44,759. The estimated annual O & M cost for the raw water storage facility is approximately $41,000.

The selected alternative is the loan funded by OWRD. OWRD stated that they do reimburse costs for procuring the water rights, however if the City pays the estimated $20,000 cost to cover the water rights, the total cost, including interest, will be the most economical.

APPENDICES

APPENDIX A: **WATERSHED DELINEATION**



THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

DATE: JUNE 2016
PROJECT NO.: 101.92

CITY OF BANDON
OFF CHANNEL RESERVOIR FEASIBILITY STUDY

WATERSHED DELINEATION MAP

FIGURE NO.
1

APPENDIX B: **ESSENTIAL SALMON HABITAT**

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

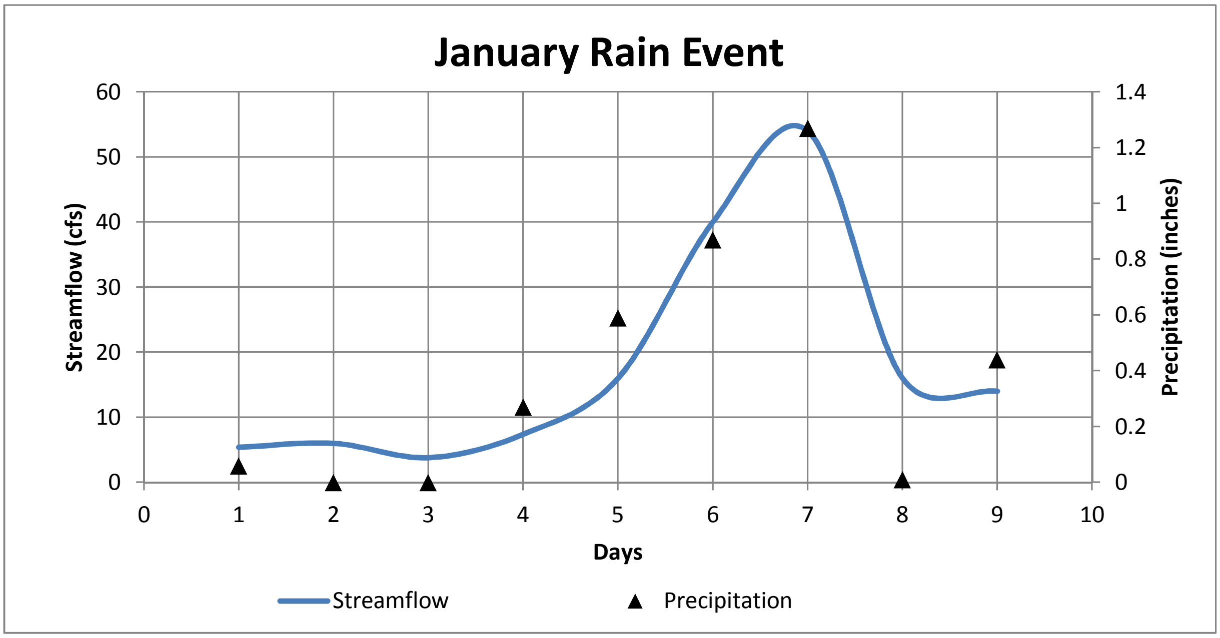
DATE: JUNE 2016
PROJECT NO.: 101.92

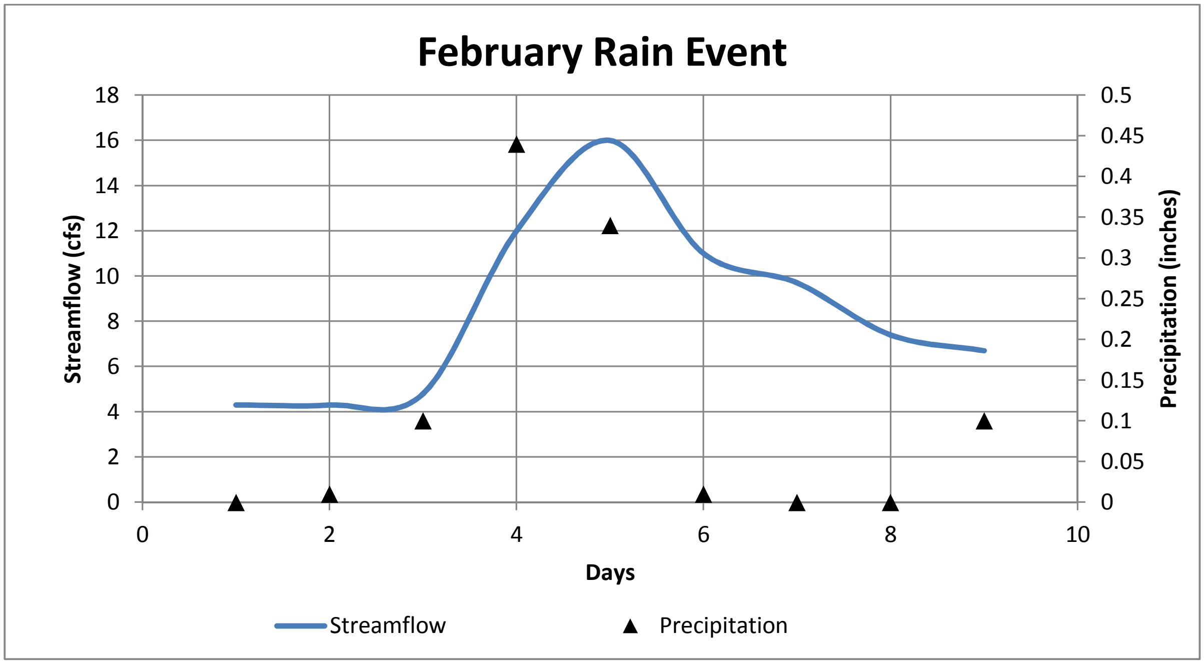
CITY OF BANDON
OFF CHANNEL RESERVOIR FEASIBILITY STUDT

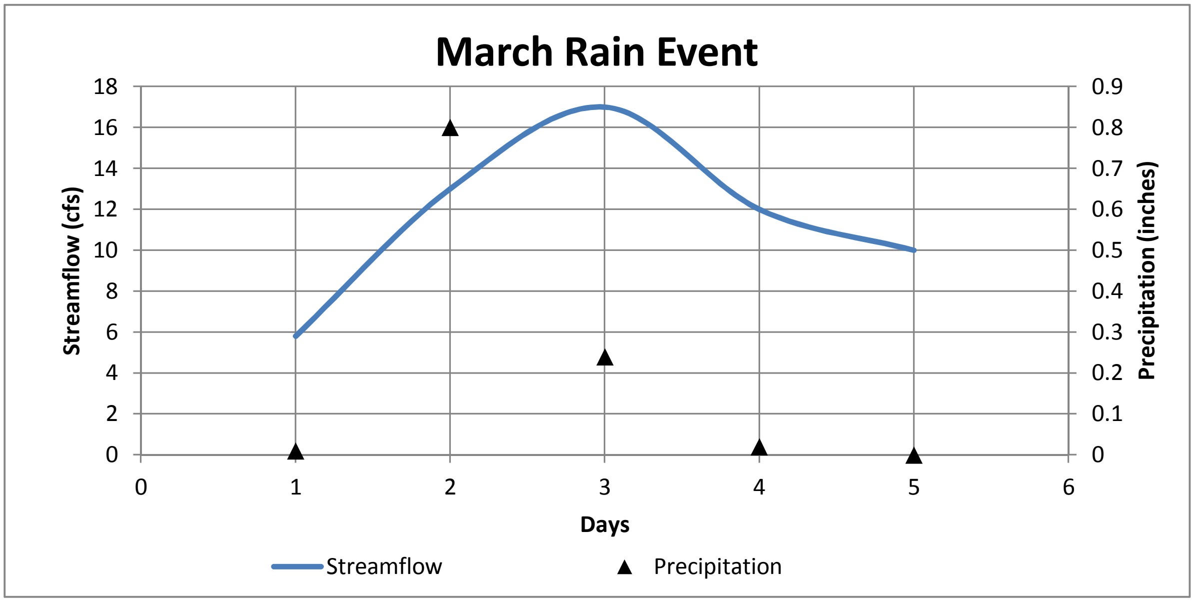
ESSENTIAL SALMON HABITAT

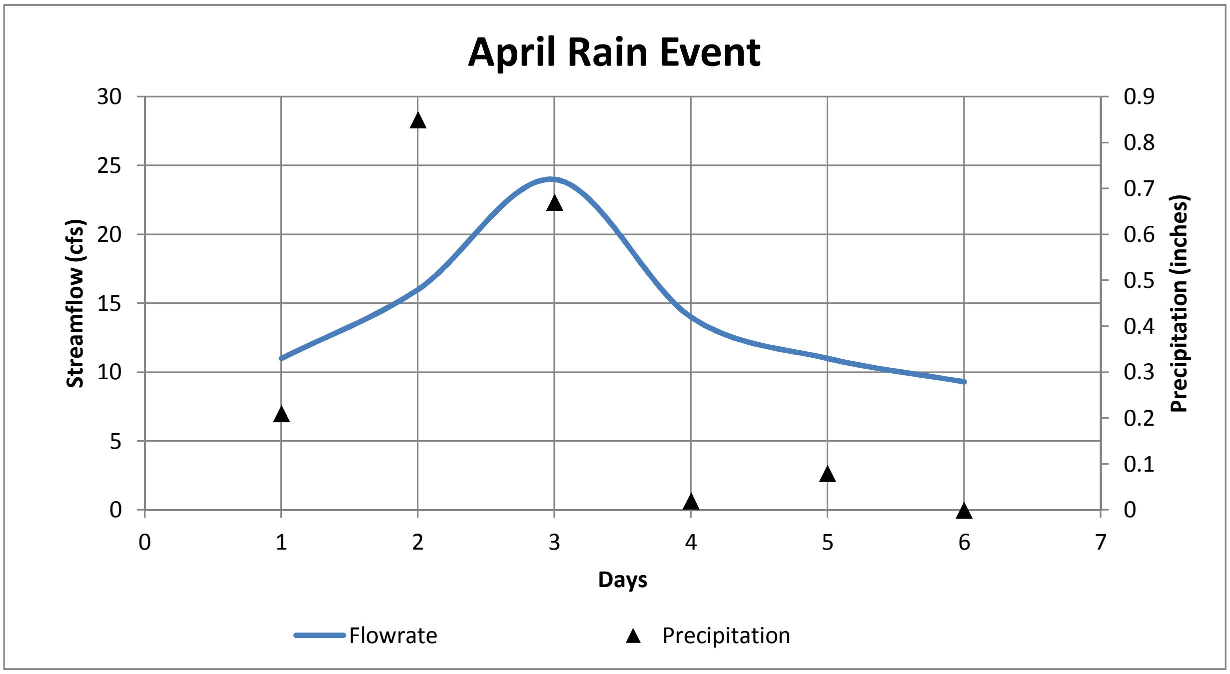
FIGURE NO.
2

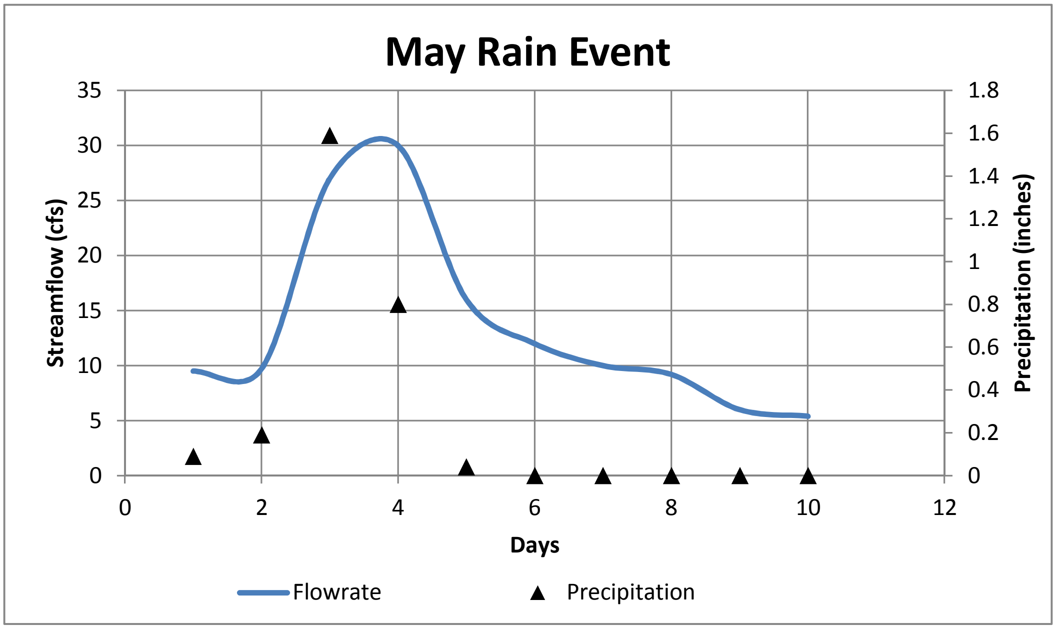
APPENDIX C: **FLOW PRECIPITATION RELATIONSHIP**

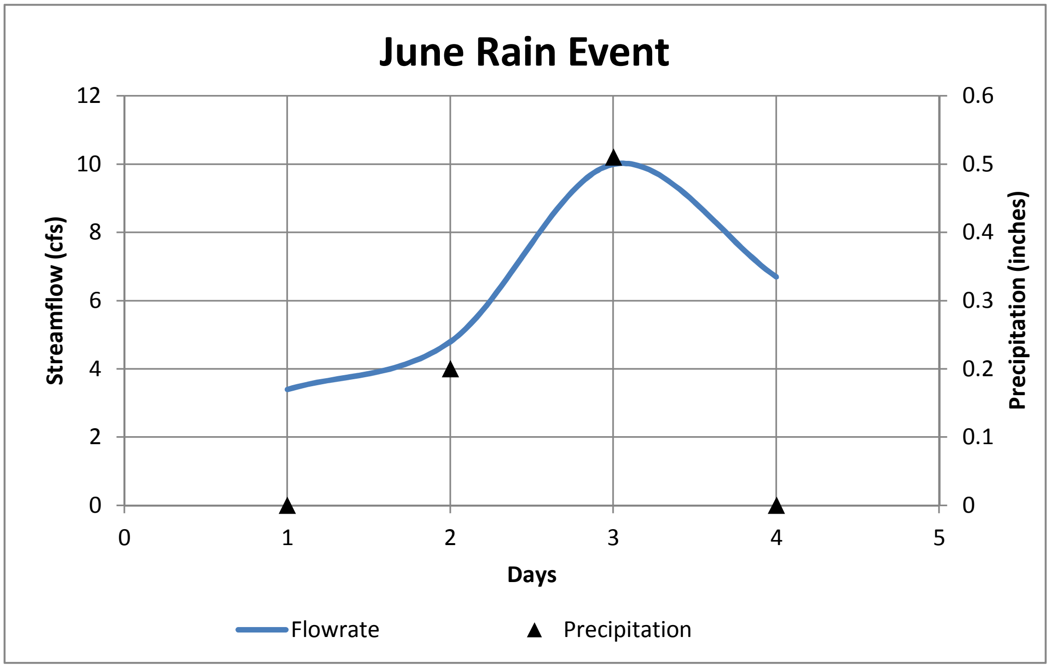

January Rain Event
Streamflow (cfs)
0
10
20
30
40
50
60
Precipitation (inches)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
Days
0
1
2
3
4
5
6
7
8
9
10
Streamflow
Precipitation

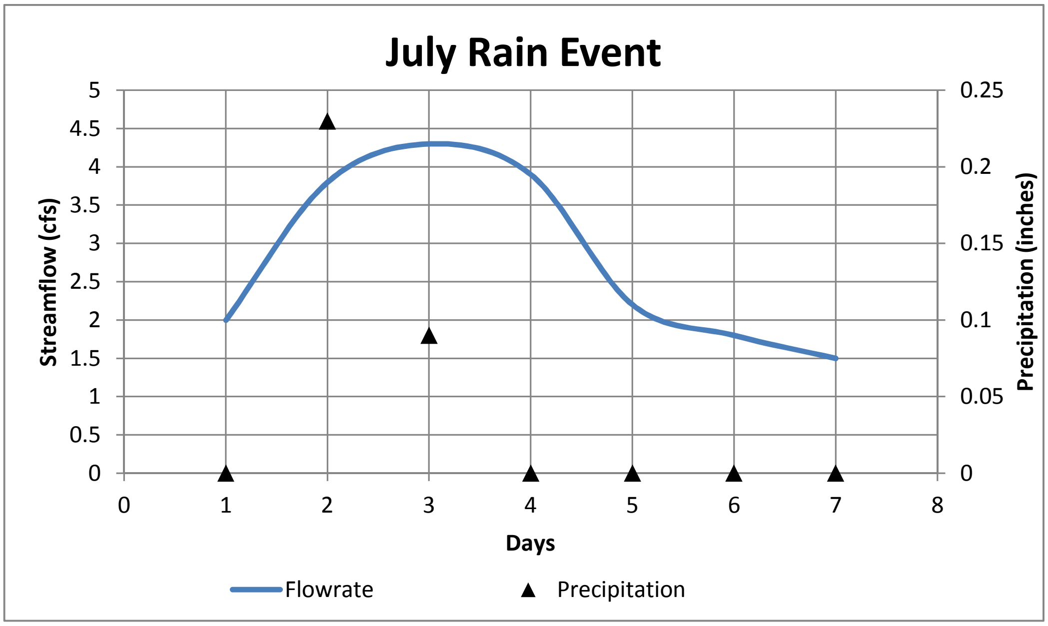

February Rain Event
Streamflow (cfs)
0
2
4
6
8
10
12
14
16
18
Precipitation (inches)
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
Days
0
2
4
6
8
10
Streamflow
Precipitation

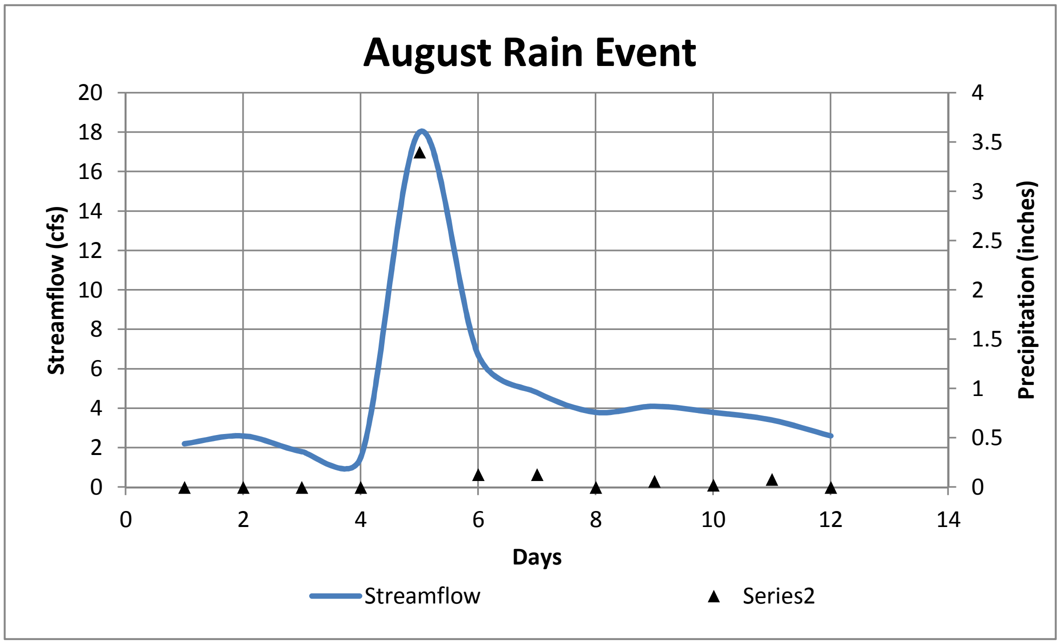

March Rain Event
Streamflow (cfs)
18
16
14
12
10
8
6
4
2
0
Precipitation (inches)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
1
2
3
4
5
6
Days
Streamflow
Precipitation

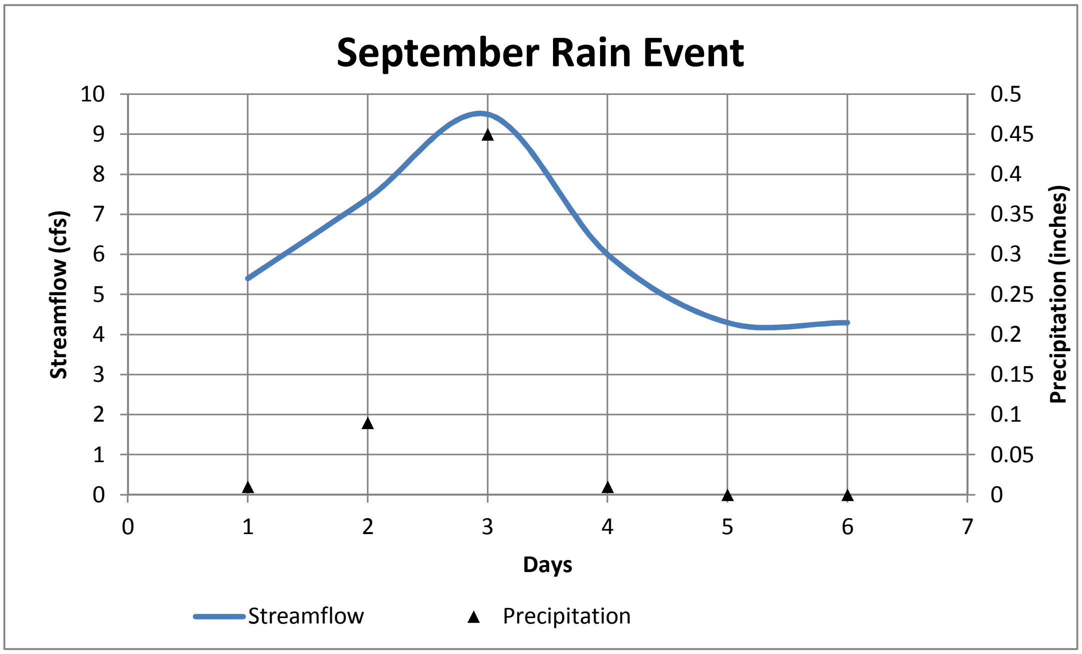

April Rain Event
Streamflow (cfs)
30
25
20
15
10
5
0
Precipitation (inches)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
1
2
3
4
5
6
7
Days
Flowrate
Precipitation

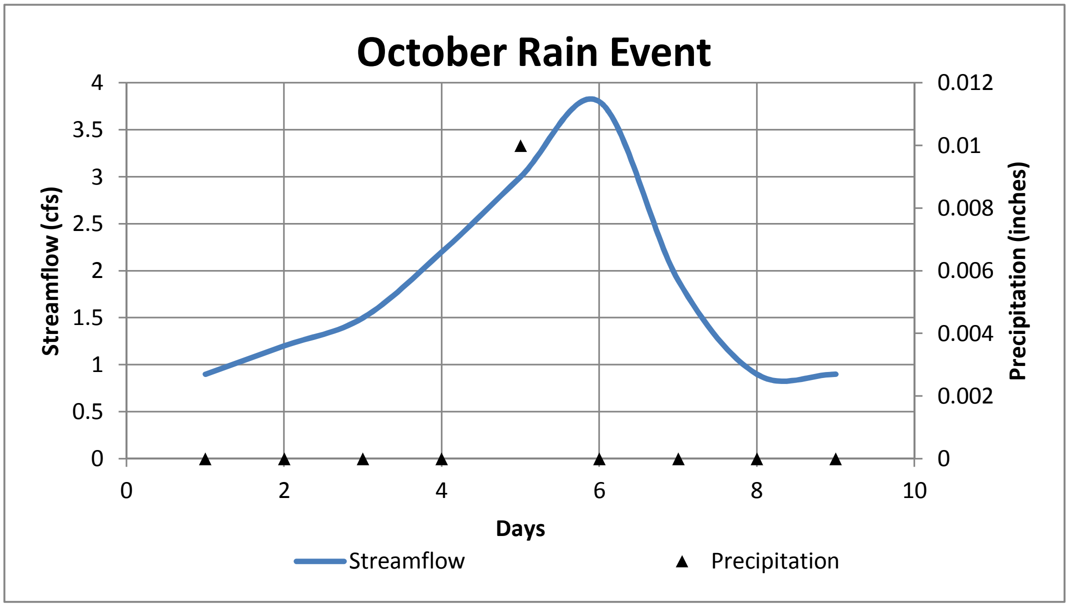

May Rain Event
Streamflow (cfs)
35
30
25
20
15
10
5
0
Precipitation (inches)
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
2
4
6
8
10
12
Days
Flowrate
Precipitation

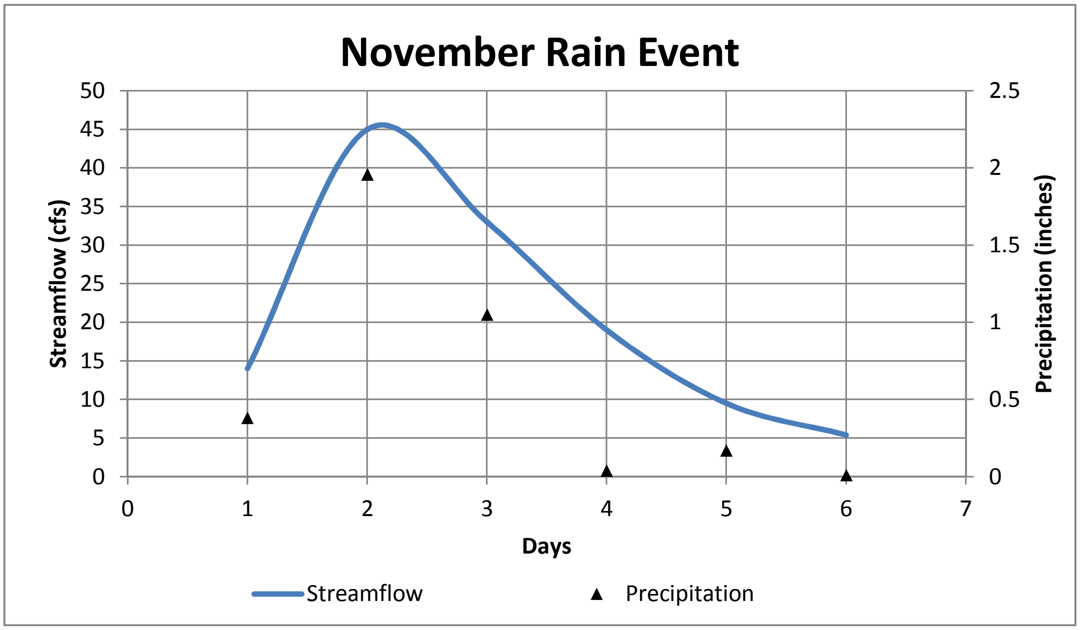

June Rain Event
Streamflow (cfs)
12
10
8
6
4
2
0
Precipitation (inches)
0.6
0.5
0.4
0.3
0.2
0.1
0
0
1
2
3
4
5
Days
Flowrate
Precipitation

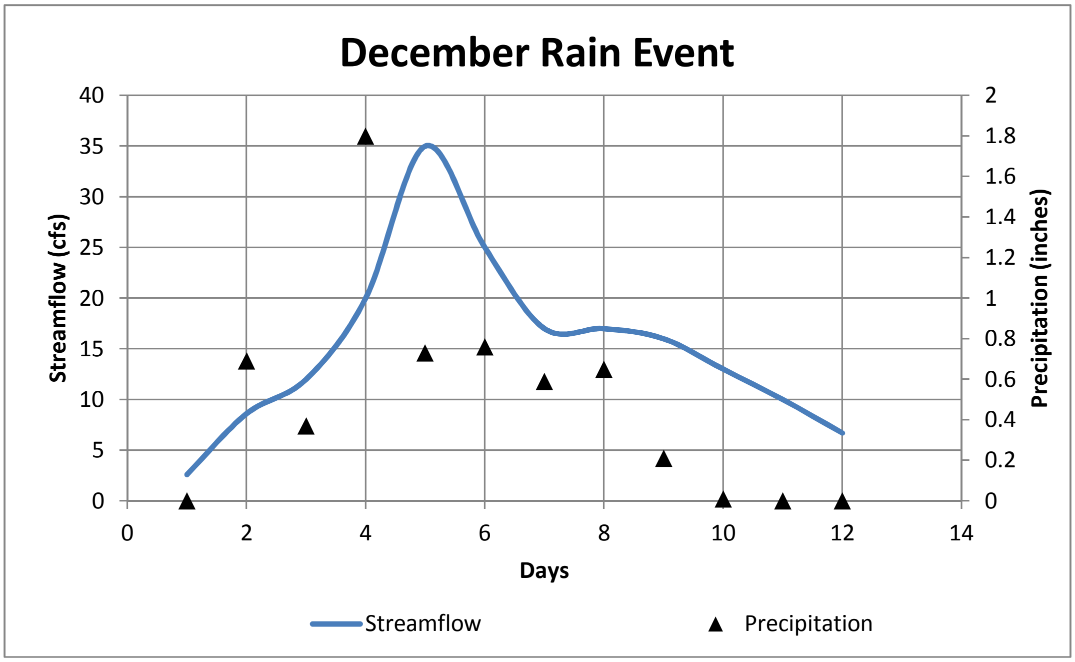

July Rain Event
Streamflow (cfs)
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
Precipitation (inches)
0
0.05
0.1
0.15
0.2
0.25
Days
0
1
2
3
4
5
6
7
8
Flowrate
Precipitation


August Rain Event
Streamflow (cfs)
0
2
4
6
8
10
12
14
16
18
20
Precipitation (inches)
0
0.5
1
1.5
2
2.5
3
3.5
4
Days
0
2
4
6
8
10
12
14
Streamflow
Series2


September Rain Event
Streamflow (cfs)
10
9
8
7
6
5
4
3
2
1
0
Precipitation (inches)
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
1
2
3
4
5
6
7
Days
Streamflow
Precipitation


October Rain Event
Streamflow (cfs)
4
3.5
3
2.5
2
1.5
1
0.5
0
Precipitation (inches)
0.012
0.01
0.008
0.006
0.004
0.002
0
0
2
4
6
8
10
Days
Streamflow
Precipitation


November Rain Event
Streamflow (cfs)
50
45
40
35
30
25
20
15
10
5
0
Precipitation (inches)
2.5
2
1.5
1
0.5
0
0
1
2
3
4
5
6
7
Days
Streamflow
Precipitation

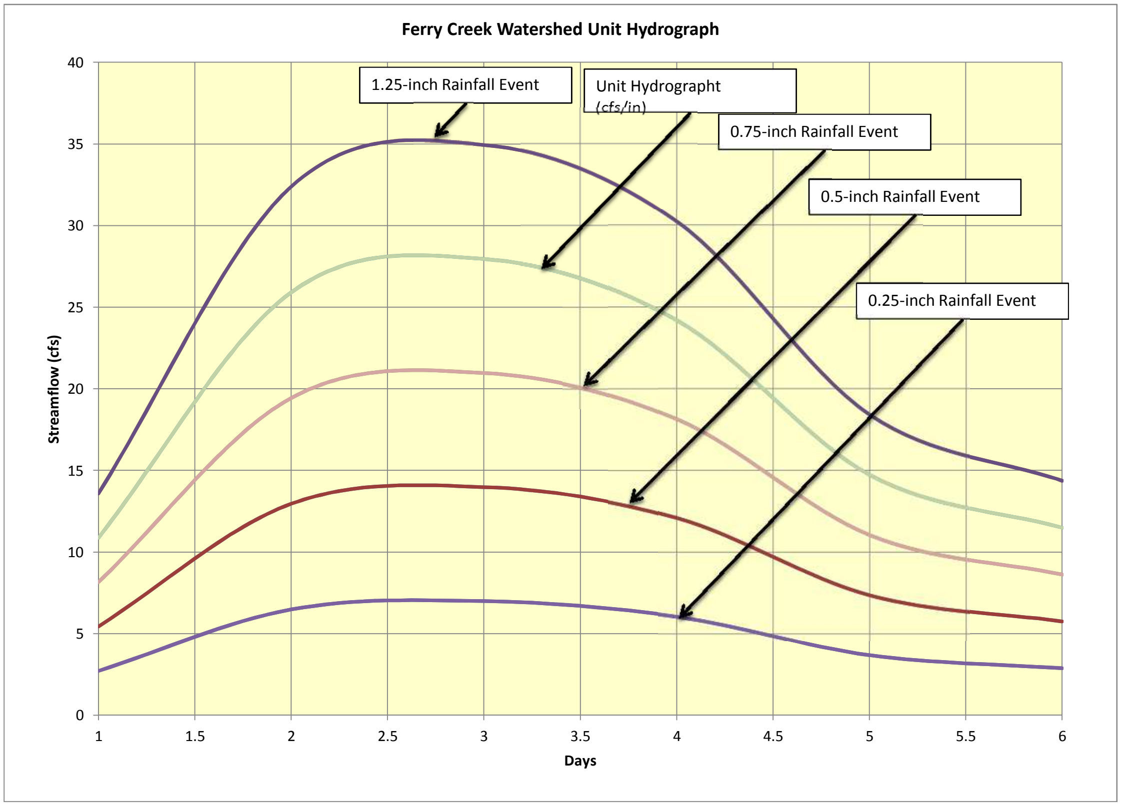

December Rain Event
Streamflow (cfs)
40
35
30
25
20
15
10
5
0
Precipitation (inches)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
2
4
6
8
10
12
14
Days
Streamflow
Precipitation

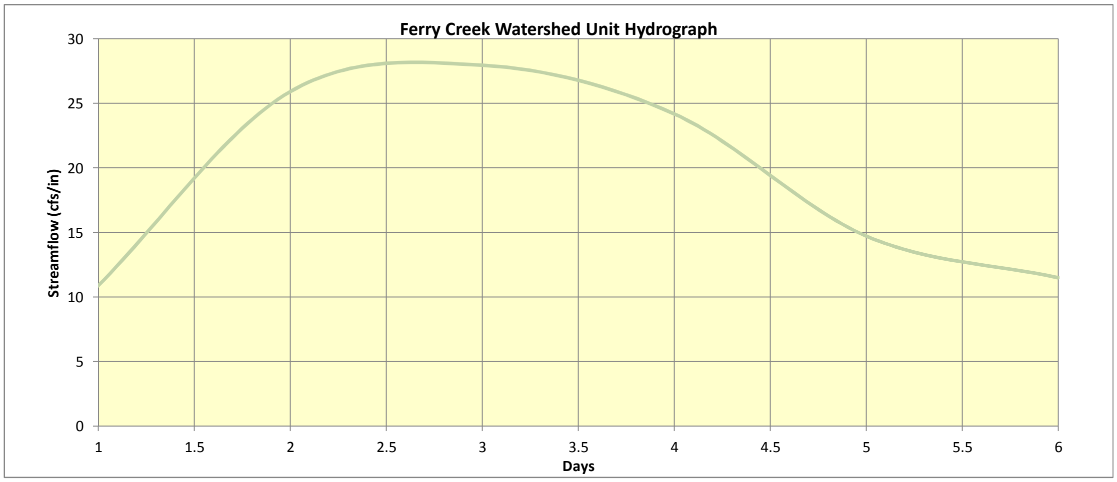
APPENDIX D: **UNIT HYDROGRAPH**

	Average Daily Flow (cfs)	# Days	Volume of excess runoff (cuft)	Unit Hydrograph (cfs/in)
STORM # 1	1.5	1	129600	4.438999572
	18	2	1555200	53.26799486
	6.7	3	578880	19.82753142
	4.8	4	414720	14.20479863
Pave (in)	3.8	5	328320	11.24546558
0.337913977	4.1	6	354240	12.1332655
STORM # 2	5.4	1	466560	16.84654472
	7.4	2	639360	23.08600572
	9.5	3	820800	29.63743978
	6	4	518400	18.71838302
Pave (in)	4.3	5	371520	13.41484116
0.320540508	4.3	6	371520	13.41484116
STORM # 3	1.5	1	129600	12.98323935
	2.2	2	190080	19.04208438
	3	3	259200	25.9664787
	3.8	4	328320	32.89087302
Pave (in)	1.9	5	164160	16.44543651
0.115533571	0.9	6	77760	7.789943609
STORM # 4	14	1	1209600	12.80105463
	45	2	3888000	41.14624702
	33	3	2851200	30.17391448
	19	4	1641600	17.37285985
Pave (in)	9.5	5	820800	8.686429927
1.09365989	5.4	6	466560	4.937549643
STORM # 5	8.6	1	743040	8.41849726
	12	2	1036800	11.74674036
	20	3	1728000	19.5779006
	35	4	3024000	34.26132606
Pave (in)	25	5	2160000	24.47237576
1.021559993	17	6	1468800	16.64121551
STORM # 6	7.4	1	639360	5.779332504
	16	2	1382400	12.49585406
	40	3	3456000	31.23963516
	54	4	4665600	42.17350746
Pave (in)	16	5	1382400	12.49585406
1.280424685	14	6	1209600	10.93387231
STORM # 7	4.8	1	414720	9.07334428
	12	2	1036800	22.6833607
	16	3	1382400	30.24448093
	11	4	950400	20.79308064
Pave (in)	9.7	5	838080	18.33571657
0.529022139	7.4	6	639360	13.98807243
STORM # 8	11	1	950400	14.84523577
	16	2	1382400	21.59307021
	24	3	2073600	32.38960531
	14	4	1209600	18.89393643
Pave (in)	11	5	950400	14.84523577
0.740978464	9.3	6	803520	12.55097206
STORM # 9	9.7	1	838080	10.66518757
	27	2	2332800	29.68660458
	30	3	2592000	32.98511621
	16	4	1382400	17.59206198
Pave (in)	12	5	1036800	13.19404648
0.909501116	10	6	864000	10.99503874
STORM # 10	2	1	172800	12.79089506
	3.8	2	328320	24.30270062
	4.3	3	371520	27.50042438
	3.9	4	336960	24.94224537
Pave (in)	2.2	5	190080	14.06998457
0.156361223	1.8	6	155520	11.51180556

Watershed Area	
2740	ac
1.19E+08	sqft

# Days	Unit Hydrograph (cfs/in)	0.25 Inch Rainfall Eve (cfs)	0.5 Inch Event Hydrograph (cfs)	0.75 Inch Event Hydrograph (cfs)	1.25 Inch Event Hydrograph (cfs)
1	10.9	2.7	5.4	8.1	13.6
2	25.9	6.5	13.0	19.4	32.4
3	28.0	7.0	14.0	21.0	34.9
4	24.2	6.0	12.1	18.1	30.2
5	14.7	3.7	7.4	11.0	18.4
6	11.5	2.9	5.7	8.6	14.4





APPENDIX E: **RATING CURVE**

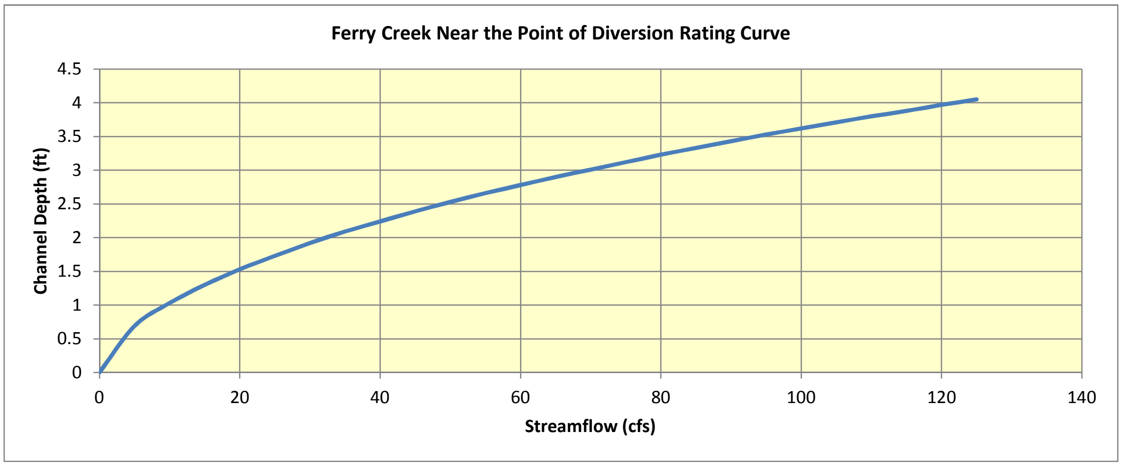
Description - The Mannings equation for trapazoidal open channel flow was used for this analysi

INPUT

Description	Value
Roughness Coefficient	0.02
Left Side Slope (H:V)	1.0
Right Side Slope (H:V)	1.0
Bottom Width (H:V) ft	4.0
Channel Slope (ft/ft)	0.005

OUTPUT

Streamflow (cfs)	Normal Depth (ft)	Velocity (ft/sec)	Flow Area (sqft)	Wetted Perimeter (ft)	Top Width (ft)
0	0	0	0	0	0
5	0.69	1.6	3.22	5.9	5.4
10	1.03	1.9	5.19	6.9	6.1
15	1.30	2.2	6.9	7.7	6.6
20	1.53	2.4	8.47	8.3	7.1
25	1.73	2.5	9.94	8.9	7.5
30	1.92	2.6	11.35	9.4	7.8
35	2.09	2.8	12.7	9.9	8.2
40	2.24	2.9	14	10.3	8.5
45	2.39	3.0	15.26	10.8	8.8
50	2.53	3.0	16.49	11.2	9.1
55	2.66	3.1	17.69	11.5	9.3
60	2.78	3.2	18.87	11.9	9.6
65	2.90	3.3	20.02	12.2	9.8
70	3.01	3.3	21.15	12.5	10.0
75	3.12	3.4	22.26	12.8	10.3
80	3.23	3.4	23.35	13.1	10.5
85	3.33	3.5	24.42	13.4	10.7
90	3.43	3.5	25.48	13.7	10.9
95	3.53	3.6	26.53	14.0	11.1
100	3.62	3.6	27.57	14.2	11.2
105	3.71	3.7	28.59	14.5	11.4
110	3.80	3.7	29.6	14.7	11.6
115	3.88	3.8	30.6	15.0	11.8
120	3.97	3.8	31.58	15.2	11.9
125	4.05	3.8	32.56	15.5	12.1


Ferry Creek Near the Point of Diversion Rating Curve

APPENDIX F: **DIVERSION SCHEDULE**

Date	Daily Average Ferry Creek Flow (cfs)	Daily Average Municipal Demand Flow (cfs)	Daily Diversion Off Channel Reservoir Flow (cfs)	Streamflow Augmentation Raw Water Release Flow (cfs)	Volume of Off Channel Reservor (ac-ft)
1-Jan	6.6375	0.66735	0.00000	0.08167	0.00000
2-Jan	6.275	0.66735	0.00000	0.19434	0.00000
3-Jan	7.2	0.66735	0.00000	0.19434	0.00000
4-Jan	7.5375	0.66735	0.00000	0.19434	0.00000
5-Jan	13.8375	0.66735	0.93265	0.00000	1.84989
6-Jan	9.8125	0.66735	0.00000	0.19434	1.46442
7-Jan	7.15	0.66735	0.00000	0.19434	1.07895
8-Jan	9.725	0.66735	0.00000	0.19434	0.69348
9-Jan	27.875	0.66735	0.93265	0.00000	2.54337
10-Jan	16.925	0.66735	0.93265	0.00000	4.39325
11-Jan	21.4875	0.66735	0.93265	0.00000	6.24314
12-Jan	14.625	0.66735	0.93265	0.00000	8.09303
13-Jan	22.825	0.66735	0.93265	0.00000	9.94291
14-Jan	20.5875	0.66735	0.93265	0.00000	11.79280
15-Jan	13.3125	0.66735	0.93265	0.00000	13.64269
16-Jan	15.1125	0.66735	0.93265	0.00000	15.49257
17-Jan	11.025	0.66735	0.93265	0.00000	17.34246
18-Jan	9.725	0.66735	0.00000	0.19434	16.95699
19-Jan	9.3875	0.66735	0.00000	0.19434	16.57152
20-Jan	15.05	0.66735	0.93265	0.00000	18.42141
21-Jan	9.6875	0.66735	0.00000	0.19434	18.03594
22-Jan	10.225	0.66735	0.93265	0.00000	19.88583
23-Jan	17.9875	0.66735	0.93265	0.00000	21.73571
24-Jan	13.5375	0.66735	0.93265	0.00000	23.58560
25-Jan	9.5875	0.66735	0.00000	0.19434	23.20013
26-Jan	9.7875	0.66735	0.00000	0.19434	22.81466
27-Jan	15.825	0.66735	0.93265	0.00000	24.66455
28-Jan	14.3125	0.66735	0.93265	0.00000	26.51443
29-Jan	10.4625	0.66735	0.93265	0.00000	28.36432
30-Jan	9.4	0.66735	0.00000	0.19434	27.97885
31-Jan	11.0875	0.66735	0.93265	0.00000	29.82874
1-Feb	14.4375	0.63856	0.96144	0.00000	31.73572
2-Feb	12.825	0.63856	0.96144	0.00000	33.64271
3-Feb	13.0875	0.63856	0.96144	0.00000	35.54969
4-Feb	8.4875	0.63856	0.00000	0.19434	35.16422
5-Feb	9.65	0.63856	0.00000	0.19434	34.77875
6-Feb	10.65	0.63856	0.96144	0.00000	36.68574
7-Feb	14.425	0.63856	0.96144	0.00000	38.59272
8-Feb	15.5375	0.63856	0.96144	0.00000	40.49970
9-Feb	18.0375	0.63856	0.96144	0.00000	42.40669
10-Feb	14.15	0.63856	0.96144	0.00000	44.31367
11-Feb	11.1	0.63856	0.96144	0.00000	46.22066
12-Feb	9.7375	0.63856	0.00000	0.19434	45.83519
13-Feb	12.4	0.63856	0.96144	0.00000	47.74217
14-Feb	13.15	0.63856	0.96144	0.00000	49.64916
15-Feb	10.7375	0.63856	0.96144	0.00000	51.55614
16-Feb	12.5375	0.63856	0.96144	0.00000	53.46312
17-Feb	22.125	0.63856	0.96144	0.00000	55.37011
18-Feb	24.675	0.63856	0.96144	0.00000	57.27709
19-Feb	20.55	0.63856	0.96144	0.00000	59.18407
20-Feb	20.7	0.63856	0.96144	0.00000	61.09106
21-Feb	17.375	0.63856	0.96144	0.00000	62.99804
22-Feb	16.4125	0.63856	0.96144	0.00000	64.90502
23-Feb	19.0125	0.63856	0.96144	0.00000	66.81201
24-Feb	14.1625	0.63856	0.96144	0.00000	68.71899
25-Feb	12.0375	0.63856	0.96144	0.00000	70.62598
26-Feb	11.8125	0.63856	0.96144	0.00000	72.53296
27-Feb	11.8875	0.63856	0.96144	0.00000	74.43994
28-Feb	15.175	0.63856	0.96144	0.00000	76.34693
29-Feb	10.15	0.63856	0.96144	0.00000	78.25391
1-Mar	9.0625	0.73121	0.00000	0.19434	77.86844
2-Mar	12.2625	0.73121	0.86879	0.00000	79.59165
3-Mar	15.8	0.73121	0.86879	0.00000	81.31487
4-Mar	14.0375	0.73121	0.86879	0.00000	83.03808
5-Mar	9.0625	0.73121	0.00000	0.19434	82.65261

Date	Daily Average Ferry Creek Flow (cfs)	Daily Average Municipal Demand Flow (cfs)	Daily Diversion Off Channel Reservoir Flow (cfs)	Streamflow Augmentation Raw Water Release Flow (cfs)	Volume of Off Channel Reservor (ac-ft)
6-Mar	8.7375	0.73121	0.00000	0.19434	82.26714
7-Mar	9.2	0.73121	0.00000	0.19434	81.88167
8-Mar	12.1	0.73121	0.86879	0.00000	83.60489
9-Mar	11.3875	0.73121	0.86879	0.00000	85.32810
10-Mar	11.5125	0.73121	0.86879	0.00000	87.05131
11-Mar	9.325	0.73121	0.00000	0.19434	86.66584
12-Mar	10.5	0.73121	0.86879	0.00000	88.38906
13-Mar	15.625	0.73121	0.86879	0.00000	90.11227
14-Mar	12.475	0.73121	0.86879	0.00000	91.83548
15-Mar	10.8125	0.73121	0.86879	0.00000	93.55869
16-Mar	9.3625	0.73121	0.00000	0.19434	93.17322
17-Mar	10.125	0.73121	0.86879	0.00000	94.89644
18-Mar	8.725	0.73121	0.00000	0.19434	94.51097
19-Mar	10.0875	0.73121	0.86879	0.00000	96.23418
20-Mar	11.2375	0.73121	0.86879	0.00000	97.95739
21-Mar	14.1	0.73121	0.86879	0.00000	99.68061
22-Mar	11.7625	0.73121	0.86879	0.00000	100.00000
23-Mar	9.8	0.73121	0.00000	0.19434	100.00000
24-Mar	9.35	0.73121	0.00000	0.19434	100.00000
25-Mar	9.5375	0.73121	0.00000	0.19434	100.00000
26-Mar	10.325	0.73121	0.86879	0.00000	100.00000
27-Mar	9.0875	0.73121	0.00000	0.19434	100.00000
28-Mar	8.1875	0.73121	0.00000	0.19434	100.00000
29-Mar	8	0.73121	0.00000	0.19434	100.00000
30-Mar	9.8625	0.73121	0.00000	0.19434	100.00000
31-Mar	10.0875	0.73121	0.86879	0.00000	100.00000
1-Apr	9.675	0.71261	0.00000	0.19434	100.00000
2-Apr	7.925	0.71261	0.00000	0.19434	100.00000
3-Apr	8.275	0.71261	0.00000	0.19434	100.00000
4-Apr	9.5125	0.71261	0.00000	0.19434	100.00000
5-Apr	10.4	0.71261	0.88739	0.00000	100.00000
6-Apr	8.7625	0.71261	0.00000	0.19434	100.00000
7-Apr	9.8	0.71261	0.00000	0.19434	100.00000
8-Apr	11.875	0.71261	0.00000	0.00000	100.00000
9-Apr	9.575	0.71261	0.00000	0.19434	100.00000
10-Apr	9.9125	0.71261	0.00000	0.19434	100.00000
11-Apr	11.3125	0.71261	0.88739	0.00000	100.00000
12-Apr	11.25	0.71261	0.88739	0.00000	100.00000
13-Apr	11.2125	0.71261	0.88739	0.00000	100.00000
14-Apr	11.4625	0.71261	0.88739	0.00000	100.00000
15-Apr	11.25	0.71261	0.88739	0.00000	100.00000
16-Apr	11.825	0.71261	0.88739	0.00000	100.00000
17-Apr	12.2625	0.71261	0.88739	0.00000	100.00000
18-Apr	15.5875	0.71261	0.88739	0.00000	100.00000
19-Apr	19.6875	0.71261	0.88739	0.00000	100.00000
20-Apr	15.4875	0.71261	0.88739	0.00000	100.00000
21-Apr	11.5625	0.71261	0.88739	0.00000	100.00000
22-Apr	11.2875	0.71261	0.88739	0.00000	100.00000
23-Apr	11.025	0.71261	0.88739	0.00000	100.00000
24-Apr	8.725	0.71261	0.00000	0.19434	100.00000
25-Apr	7.75	0.71261	0.00000	0.19434	100.00000
26-Apr	7.5125	0.71261	0.00000	0.19434	100.00000
27-Apr	7.4	0.71261	0.00000	0.19434	100.00000
28-Apr	8.2375	0.71261	0.00000	0.19434	100.00000
29-Apr	7.15	0.71261	0.00000	0.19434	100.00000
30-Apr	11.31428571	0.71261	0.88739	0.00000	100.00000
1-May	9.985714286	0.86491	0.00000	0.19434	100.00000
2-May	8.3	0.86491	0.00000	0.19434	100.00000
3-May	7.971428571	0.86491	0.00000	0.19434	100.00000
4-May	9.571428571	0.86491	0.00000	0.19434	100.00000
5-May	8.428571429	0.86491	0.00000	0.19434	100.00000
6-May	9.585714286	0.86491	0.00000	0.19434	100.00000
7-May	10.67142857	0.86491	0.00000	0.00000	100.00000
8-May	8.8	0.86491	0.00000	0.19434	100.00000
9-May	7.785714286	0.86491	0.00000	0.19434	100.00000
10-May	7.928571429	0.86491	0.00000	0.19434	100.00000
11-May	7.514285714	0.86491	0.00000	0.19434	100.00000

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12-May	7.271428571	0.86491	0.00000	0.19434	100.00000
13-May	14.41428571	0.86491	0.00000	0.00000	100.00000
14-May	16.01428571	0.86491	0.00000	0.00000	100.00000
15-May	10.71428571	0.86491	0.00000	0.00000	100.00000
16-May	14.22857143	0.86491	0.00000	0.00000	100.00000
17-May	12.95714286	0.86491	0.00000	0.00000	100.00000
18-May	9.857142857	0.86491	0.00000	0.19434	100.00000
19-May	7.614285714	0.86491	0.00000	0.19434	100.00000
20-May	9.642857143	0.86491	0.00000	0.19434	100.00000
21-May	8.9	0.86491	0.00000	0.19434	100.00000
22-May	7.642857143	0.86491	0.00000	0.19434	100.00000
23-May	7.942857143	0.86491	0.00000	0.19434	100.00000
24-May	8.142857143	0.86491	0.00000	0.19434	100.00000
25-May	6.928571429	0.86491	0.00000	0.19434	100.00000
26-May	6.6	0.86491	0.00000	0.19434	100.00000
27-May	6.428571429	0.86491	0.00000	0.19434	100.00000
28-May	5.842857143	0.86491	0.00000	0.19434	100.00000
29-May	5.385714286	0.86491	0.00000	0.19434	100.00000
30-May	5.357142857	0.86491	0.00000	0.19434	100.00000
31-May	5.025	0.86491	0.00000	0.19434	100.00000
1-Jun	5.325	1.07054	0.00000	0.19434	100.00000
2-Jun	5.75	1.07054	0.00000	0.19434	100.00000
3-Jun	5.5875	1.07054	0.00000	0.19434	100.00000
4-Jun	5.1625	1.07054	0.00000	0.19434	100.00000
5-Jun	5.15	1.07054	0.00000	0.19434	100.00000
6-Jun	5.125	1.07054	0.00000	0.19434	100.00000
7-Jun	5.2125	1.07054	0.00000	0.19434	100.00000
8-Jun	5.05	1.07054	0.00000	0.19434	100.00000
9-Jun	5.7	1.07054	0.00000	0.19434	100.00000
10-Jun	5.1875	1.07054	0.00000	0.19434	100.00000
11-Jun	5.2875	1.07054	0.00000	0.19434	100.00000
12-Jun	5.7625	1.07054	0.00000	0.19434	100.00000
13-Jun	6.3125	1.07054	0.00000	0.19434	100.00000
14-Jun	6.0625	1.07054	0.00000	0.19434	100.00000
15-Jun	5.5125	1.07054	0.00000	0.19434	100.00000
16-Jun	6.15	1.07054	0.00000	0.19434	100.00000
17-Jun	5.8625	1.07054	0.00000	0.19434	100.00000
18-Jun	5.8875	1.07054	0.00000	0.19434	100.00000
19-Jun	5.25	1.07054	0.00000	0.19434	100.00000
20-Jun	5.1125	1.07054	0.00000	0.19434	100.00000
21-Jun	5.075	1.07054	0.00000	0.19434	100.00000
22-Jun	4.975	1.07054	0.00000	0.19434	100.00000
23-Jun	4.7875	1.07054	0.00000	0.19434	100.00000
24-Jun	4.6375	1.07054	0.00000	0.19434	100.00000
25-Jun	4.7625	1.07054	0.00000	0.19434	100.00000
26-Jun	4.35	1.07054	0.00000	0.19434	100.00000
27-Jun	4.2	1.07054	0.00000	0.19434	100.00000
28-Jun	4.1625	1.07054	0.00000	0.19434	100.00000
29-Jun	4.3875	1.07054	0.00000	0.19434	100.00000
30-Jun	4.45	1.07054	0.00000	0.19434	100.00000
1-Jul	4.25	1.30804	0.00000	0.19434	100.00000
2-Jul	4.3625	1.30804	0.00000	0.19434	100.00000
3-Jul	4	1.30804	0.00000	0.19434	100.00000
4-Jul	4.0875	1.30804	0.00000	0.19434	100.00000
5-Jul	3.9	1.30804	0.00000	0.19434	100.00000
6-Jul	4.05	1.30804	0.00000	0.19434	99.64354
7-Jul	4.0875	1.30804	0.00000	0.19434	99.25807
8-Jul	4.075	1.30804	0.00000	0.19434	98.87261
9-Jul	4.5	1.30804	0.00000	0.19434	98.48714
10-Jul	3.8	1.30804	0.00000	0.19434	98.10167
11-Jul	3.8125	1.30804	0.00000	0.19434	97.71620
12-Jul	3.5	1.30804	0.00000	0.19434	97.33073
13-Jul	3.425	1.30804	0.00000	0.19434	96.94527
14-Jul	3.7375	1.30804	0.00000	0.19434	96.55980
15-Jul	3.9625	1.30804	0.00000	0.19434	96.17433
16-Jul	3.875	1.30804	0.00000	0.19434	95.78886
17-Jul	3.575	1.30804	0.00000	0.19434	95.40339

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18-Jul	3.4125	1.30804	0.00000	0.19434	95.01793
19-Jul	3.45	1.30804	0.00000	0.19434	94.63246
20-Jul	3.5375	1.30804	0.00000	0.19434	94.24699
21-Jul	3.5625	1.30804	0.00000	0.19434	93.86152
22-Jul	3.5625	1.30804	0.00000	0.19434	93.47605
23-Jul	3.35	1.30804	0.00000	0.19434	93.09059
24-Jul	3.225	1.30804	0.00000	0.19434	92.70512
25-Jul	3.275	1.30804	0.00000	0.19434	92.31965
26-Jul	3.2125	1.30804	0.00000	0.19434	91.93418
27-Jul	3.1125	1.30804	0.00000	0.19434	91.54871
28-Jul	3.2375	1.30804	0.00000	0.19434	91.16324
29-Jul	3.1	1.30804	0.00000	0.19434	90.77778
30-Jul	3.25	1.30804	0.00000	0.19434	90.39231
31-Jul	3.0375	1.30804	0.00000	0.19434	90.00684
1-Aug	3.05	1.26964	0.00000	0.19434	89.62137
2-Aug	3.1125	1.26964	0.00000	0.19434	89.23590
3-Aug	3.225	1.26964	0.00000	0.19434	88.85044
4-Aug	2.9875	1.26964	0.00000	0.19434	88.46497
5-Aug	2.8625	1.26964	0.00000	0.19434	88.07950
6-Aug	3.125	1.26964	0.00000	0.19434	87.69403
7-Aug	2.95	1.26964	0.00000	0.19434	87.30856
8-Aug	3.0125	1.26964	0.00000	0.19434	86.92310
9-Aug	3.1625	1.26964	0.00000	0.19434	86.53763
10-Aug	3.15	1.26964	0.00000	0.19434	86.15216
11-Aug	2.9875	1.26964	0.00000	0.19434	85.76669
12-Aug	2.925	1.26964	0.00000	0.19434	85.38122
13-Aug	3.05	1.26964	0.00000	0.19434	84.99576
14-Aug	3.05	1.26964	0.00000	0.19434	84.61029
15-Aug	2.8125	1.26964	0.00000	0.19434	84.22482
16-Aug	2.9875	1.26964	0.00000	0.19434	83.83935
17-Aug	2.875	1.26964	0.00000	0.19434	83.45388
18-Aug	2.9375	1.26964	0.00000	0.19434	83.06842
19-Aug	3.05	1.26964	0.00000	0.19434	82.68295
20-Aug	3.425	1.26964	0.00000	0.19434	82.29748
21-Aug	3.35	1.26964	0.00000	0.19434	81.91201
22-Aug	3.1375	1.26964	0.00000	0.19434	81.52654
23-Aug	5.875	1.26964	0.00000	0.19434	81.14108
24-Aug	4.2125	1.26964	0.00000	0.19434	80.75561
25-Aug	3.4	1.26964	0.00000	0.19434	80.37014
26-Aug	3.0625	1.26964	0.00000	0.19434	79.98467
27-Aug	3.325	1.26964	0.00000	0.19434	79.59920
28-Aug	3.225	1.26964	0.00000	0.19434	79.21373
29-Aug	3.0625	1.26964	0.00000	0.19434	78.82827
30-Aug	2.9125	1.26964	0.00000	0.19434	78.44280
31-Aug	3.325	1.26964	0.00000	0.19434	78.05733
1-Sep	4.2875	1.04531	0.00000	0.19434	77.67186
2-Sep	4.3875	1.04531	0.00000	0.19434	77.28639
3-Sep	4.55	1.04531	0.00000	0.19434	76.90093
4-Sep	3.925	1.04531	0.00000	0.19434	76.51546
5-Sep	3.5625	1.04531	0.00000	0.19434	76.12999
6-Sep	3.1125	1.04531	0.00000	0.19434	75.74452
7-Sep	3.4375	1.04531	0.00000	0.19434	75.35905
8-Sep	4.4625	1.04531	0.00000	0.19434	74.97359
9-Sep	4.275	1.04531	0.00000	0.19434	74.58812
10-Sep	3.8375	1.04531	0.00000	0.19434	74.20265
11-Sep	4.075	1.04531	0.00000	0.19434	73.81718
12-Sep	4.2125	1.04531	0.00000	0.19434	73.43171
13-Sep	4.25	1.04531	0.00000	0.19434	73.04625
14-Sep	4.175	1.04531	0.00000	0.19434	72.66078
15-Sep	3.925	1.04531	0.00000	0.19434	72.27531
16-Sep	4.1125	1.04531	0.00000	0.19434	71.88984
17-Sep	4.9	1.04531	0.00000	0.19434	71.50437
18-Sep	5.4125	1.04531	0.00000	0.19434	71.11891
19-Sep	4.8875	1.04531	0.00000	0.19434	70.73344
20-Sep	4.45	1.04531	0.00000	0.19434	70.34797
21-Sep	4.3	1.04531	0.00000	0.19434	69.96250
22-Sep	4.275	1.04531	0.00000	0.19434	69.57703

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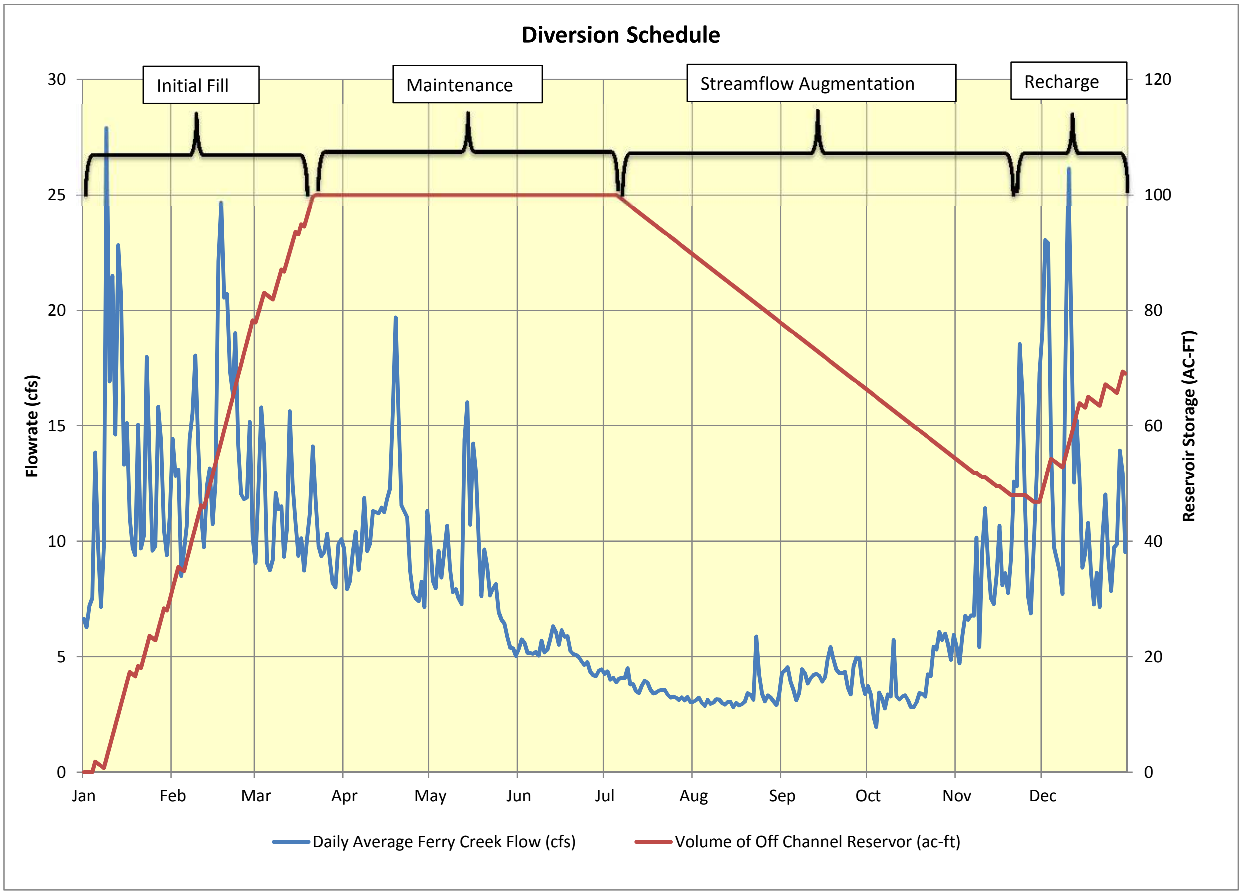
23-Sep	4.35	1.04531	0.00000	0.19434	69.19157
24-Sep	3.675	1.04531	0.00000	0.19434	68.80610
25-Sep	3.3625	1.04531	0.00000	0.19434	68.42063
26-Sep	4.5875	1.04531	0.00000	0.19434	68.03516
27-Sep	4.9625	1.04531	0.00000	0.19434	67.64969
28-Sep	4.9125	1.04531	0.00000	0.19434	67.26422
29-Sep	3.8625	1.04531	0.00000	0.19434	66.87876
30-Sep	3.385714286	1.04531	0.00000	0.19434	66.49329
1-Oct	3.728571429	0.85528	0.00000	0.19434	66.10782
2-Oct	3.357142857	0.85528	0.00000	0.19434	65.72235
3-Oct	2.374285714	0.85528	0.00000	0.19434	65.33688
4-Oct	1.96	0.85528	0.00000	0.19434	64.95142
5-Oct	3.442857143	0.85528	0.00000	0.19434	64.56595
6-Oct	3.2	0.85528	0.00000	0.19434	64.18048
7-Oct	2.757142857	0.85528	0.00000	0.19434	63.79501
8-Oct	3.371428571	0.85528	0.00000	0.19434	63.40954
9-Oct	3.271428571	0.85528	0.00000	0.19434	63.02408
10-Oct	5.728571429	0.85528	0.00000	0.19434	62.63861
11-Oct	3.285714286	0.85528	0.00000	0.19434	62.25314
12-Oct	3.142857143	0.85528	0.00000	0.19434	61.86767
13-Oct	3.271428571	0.85528	0.00000	0.19434	61.48220
14-Oct	3.328571429	0.85528	0.00000	0.19434	61.09674
15-Oct	3.114285714	0.85528	0.00000	0.19434	60.71127
16-Oct	2.814285714	0.85528	0.00000	0.19434	60.32580
17-Oct	2.814285714	0.85528	0.00000	0.19434	59.94033
18-Oct	3.028571429	0.85528	0.00000	0.19434	59.55486
19-Oct	3.428571429	0.85528	0.00000	0.19434	59.16940
20-Oct	3.4	0.85528	0.00000	0.19434	58.78393
21-Oct	3.271428571	0.85528	0.00000	0.19434	58.39846
22-Oct	4.242857143	0.85528	0.00000	0.19434	58.01299
23-Oct	4.157142857	0.85528	0.00000	0.19434	57.62752
24-Oct	5.428571429	0.85528	0.00000	0.19434	57.24205
25-Oct	5.3	0.85528	0.00000	0.19434	56.85659
26-Oct	6.071428571	0.85528	0.00000	0.19434	56.47112
27-Oct	5.728571429	0.85528	0.00000	0.19434	56.08565
28-Oct	6	0.85528	0.00000	0.19434	55.70018
29-Oct	5.542857143	0.85528	0.00000	0.19434	55.31471
30-Oct	4.857142857	0.85528	0.00000	0.19434	54.92925

Date	Daily Average Ferry Creek Flow (cfs)	Daily Average Municipal Demand Flow (cfs)	Daily Diversion Off Channel Reservoir Flow (cfs)	Streamflow Augmentation Raw Water Release Flow (cfs)	Volume of Off Channel Reservor (ac-ft)
31-Oct	5.942857143	0.85528	0.00000	0.19434	54.54378
1-Nov	5.428571429	0.63854	0.00000	0.19434	54.15831
2-Nov	4.714285714	0.63854	0.00000	0.19434	53.77284
3-Nov	5.914285714	0.63854	0.00000	0.19434	53.38737
4-Nov	6.771428571	0.63854	0.00000	0.19434	53.00191
5-Nov	6.6	0.63854	0.00000	0.19434	52.61644
6-Nov	6.785714286	0.63854	0.00000	0.19434	52.23097
7-Nov	6.771428571	0.63854	0.00000	0.19434	51.84550
8-Nov	10.15714286	0.63854	0.00000	0.00000	51.84550
9-Nov	5.414285714	0.63854	0.00000	0.19434	51.46003
10-Nov	9.6	0.63854	0.00000	0.19434	51.07457
11-Nov	11.42857143	0.63854	0.00000	0.00000	51.07457
12-Nov	9.128571429	0.63854	0.00000	0.19434	50.68910
13-Nov	7.528571429	0.63854	0.00000	0.19434	50.30363
14-Nov	7.271428571	0.63854	0.00000	0.19434	49.91816
15-Nov	8.528571429	0.63854	0.00000	0.19434	49.53269
16-Nov	10.67142857	0.63854	0.00000	0.00000	49.53269
17-Nov	8.085714286	0.63854	0.00000	0.19434	49.14723
18-Nov	8.614285714	0.63854	0.00000	0.19434	48.76176
19-Nov	7.757142857	0.63854	0.00000	0.19434	48.37629
20-Nov	9.257142857	0.63854	0.00000	0.19434	47.99082
21-Nov	12.58571429	0.63854	0.00000	0.00000	47.99082
22-Nov	12.37142857	0.63854	0.00000	0.00000	47.99082
23-Nov	18.54285714	0.63854	0.00000	0.00000	47.99082
24-Nov	16.34285714	0.63854	0.00000	0.00000	47.99082
25-Nov	11.44285714	0.63854	0.00000	0.00000	47.99082
26-Nov	7.614285714	0.63854	0.00000	0.19434	47.60535
27-Nov	6.871428571	0.63854	0.00000	0.19434	47.21989
28-Nov	9.785714286	0.63854	0.00000	0.19434	46.83442
29-Nov	12.81428571	0.63854	0.00000	0.00000	46.83442
30-Nov	17.2875	0.63854	0.00000	0.00000	46.83442
1-Dec	19.075	0.66069	0.93931	0.00000	48.69751
2-Dec	23.0375	0.66069	0.93931	0.00000	50.56060
3-Dec	22.9125	0.66069	0.93931	0.00000	52.42369
4-Dec	14.18571429	0.66069	0.93931	0.00000	54.28679
5-Dec	9.771428571	0.66069	0.00000	0.19434	53.90132
6-Dec	9.228571429	0.66069	0.00000	0.19434	53.51585
7-Dec	8.685714286	0.66069	0.00000	0.19434	53.13038
8-Dec	7.714285714	0.66069	0.00000	0.19434	52.74491
9-Dec	17.81428571	0.66069	0.93931	0.00000	54.60801
10-Dec	26.12857143	0.66069	0.93931	0.00000	56.47110
11-Dec	19.77142857	0.66069	0.93931	0.00000	58.33419
12-Dec	12.54285714	0.66069	0.93931	0.00000	60.19729
13-Dec	15.24285714	0.66069	0.93931	0.00000	62.06038
14-Dec	12.7	0.66069	0.93931	0.00000	63.92347
15-Dec	8.857142857	0.66069	0.00000	0.19434	63.53800
16-Dec	9.5	0.66069	0.00000	0.19434	63.15253
17-Dec	10.8	0.66069	0.93931	0.00000	65.01563
18-Dec	8.628571429	0.66069	0.00000	0.19434	64.63016
19-Dec	7.257142857	0.66069	0.00000	0.19434	64.24469
20-Dec	8.628571429	0.66069	0.00000	0.19434	63.85922
21-Dec	7.142857143	0.66069	0.00000	0.19434	63.47375
22-Dec	10.25714286	0.66069	0.93931	0.00000	65.33685
23-Dec	12.02857143	0.66069	0.93931	0.00000	67.19994

Date	Daily Average Ferry Creek Flow (cfs)	Daily Average Municipal Demand Flow (cfs)	Daily Diversion Off Channel Reservoir Flow (cfs)	Streamflow Augmentation Raw Water Release Flow (cfs)	Volume of Off Channel Reservor (ac-ft)
24-Dec	9.257142857	0.66069	0.00000	0.19434	66.81447
25-Dec	7.842857143	0.66069	0.00000	0.19434	66.42900
26-Dec	9.728571429	0.66069	0.00000	0.19434	66.04354
27-Dec	9.885714286	0.66069	0.00000	0.19434	65.65807
28-Dec	13.92857143	0.66069	0.93931	0.00000	67.52116
29-Dec	12.92857143	0.66069	0.93931	0.00000	69.38425
30-Dec	9.514285714	0.66069	0.00000	0.19434	68.99878



CITY OF BANDON
COOS COUNTY, OREGON

Wastewater System Master Plan

JUNE 2002
PROJECT NO. 4501.35

The Dyer Partnership
Engineers & Planners, Inc.

275 Market Avenue
Coos Bay, Oregon 97420
541/269-0732 ▫ Fax 541/269-2044

City of Bandon

Coos County, Oregon

Wastewater System Master Plan

17231
JULY 19, 1994
JANETTE L. KERBO
EXPIRES 6/30/03

11,809
JULY 16, 1982
STEVE B. MAJOR
EXPIRES 12/31/02

June, 2002

Project No. 4501.35

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Executive Summary

ES

Executive Summary

ES.1 Background and Purpose

The City of Bandon has operated a public wastewater collection system since before 1936 and a wastewater treatment plant (WWTP) since 1970. The City's most recent improvement to its system, a major expansion of the wastewater treatment plant (WWTP), was completed in 1993, increasing the peak capacity to 3.2 million gallons per day. The most recent (December 2001) infiltration and inflow (I/I) study identified several areas of deteriorated piping and recommended remediation. Soils in the City and Urban Growth Boundary (UGB) are of limited suitability for on-site septic tank systems, restricting urban growth to areas adjacent the public sewer system. The gravity flow collection system has been expanded to the practical limit, leaving several areas of the City without access to the public system.

This plan addresses additional I/I reduction efforts needed, along with the ability of the existing wastewater system to effectively convey and treat additional wastewater generated by the projected population growth in the 20-year study period. In addition, potential collection system expansions are developed for five areas inside the City or UGB that currently do not have sewer service. An analysis is also included on the ability of the treatment facility to treat increased flows after I/I reductions have been achieved.

ES.2 Population and Flow Projections

Population

The current population of Bandon is estimated at 2,940 within the city limits and 3,120 within the UGB. Census data indicates that there is an average of 2.1 people per household (per EDU). Census data for 2000 lists 1,535 residential housing units; adjusting for units on septic tanks, unoccupied units, transient housing, and commercial use gives a total of 1,734 EDUs.

The City has selected a 1.76% per year growth rate in the study area over the next 20 years for use in this Master Plan. The 20-year projected populations in the city limits and UGB are 4,241 and 4,500 respectively. Projected EDUs are 2,631. Population and EDU growth is discussed in more detail in Section 2 of this Plan.

Flows

Unit wastewater flows are used along with population projections to estimate future wastewater flows. Existing users have higher per capita flows due to the higher infiltration present in the existing system. An allowance of 57 gallons per person per day (gpcd) is used for infiltration in new systems to ensure capacity exists when the constructed improvements are 20 years old and I/I may exist.

Current flows are within the WWTP design capacity. Projected flows based on current conditions exceed the capacity of the facility by the year 2021. A successful I/I rehabilitation program, based on projects identified in the 2001 I/I study, is expected to reduce I/I flows at the project sites by about 30%. Projected flows for the year 2021 with I/I projects complete are within WWTP design capacities.

ES.3 System Condition

A comparison of wastewater flows at the treatment plant to local rain data showed that the system currently has both excessive inflow and infiltration. The December 2001 I/I study identified eight projects to reduce I/I in the system. One project, at Ocean Drive and 4th has been completed. The remaining projects include pipe lining and replacement and manhole rehabilitation at various sites. See Section 3.2 for a further discussion of these projects. Additional potential I/I was discovered in January 2002 during system flow measurement of Basin 6. Television inspection of target areas in Basin 6 is discussed in Section 3.2.

From computer modeling of the collection system, two areas, on Edison Avenue and Oregon Avenue, were found to be at or over the hydraulic capacity of the pipe. Manholes upstream of both locations have been observed to surcharge during heavy rains.

Fillmore Avenue and the South Jetty Pump Stations were found to be in general good condition, pumping at rated capacity, with minor repairs needed at each. North Avenue Pump Station was found to be operating at 25% of rated flow. This station has a number of limitations, including equipment that has exceeded its rated life, discontinued parts for the pumps, and operational and maintenance hazards to City workers. Johnson Creek Pump Station is operating at capacity, but showing wear in the structure and equipment. This station periodically floods, putting it out of service and damaging the equipment. Electrical and ventilation equipment at Johnson Creek Pump Station are not in compliance with NFPA 820, the standard regulating wastewater facilities.

The wastewater treatment plant was found to be in good general condition. A pilot project, sponsored by Bonneville Power Administration, assessing the energy savings of computer controlling the aeration systems, based on dissolved oxygen levels in the aeration basins, is currently underway. A pump control system, utilizing the sensors installed as part of the pilot project, could vary the rate of return activated sludge at the plant, increasing system efficiency. The original 1970 and 1993 flow monitoring equipment is in marginal condition, with effluent flows reading higher than influent flows. Based on the daily plant monitoring records, the system is operating well within design limits and no effluent permit violations were noted. Projected 20-year loads for the plant are within design criteria, providing an I/I remediation program is successfully completed.

ES.4 Recommendations and Costs

The City of Bandon currently does not have public sewers available in all areas of the City limits. City policy is to require developers to extend sewer services as a permit condition prior to construction. Services are only extended to properties within the City limits. Several areas within the City and developed areas in the UGB are served by private septic tanks. While these projects are not recommended for inclusion in the project budget, it is in the interest of the City to have a planned sewer layout to guide future sewer extensions as areas annex into the City. The total estimated cost for extending public sewers into five areas of the City and UGB is $8,600,000. Descriptions of each area and the proposed improvements are included in Section 6.1.

The recommended projects for improving the City's existing collection system and WWTP are summarized in Table ES.4.1.

- Projects # A, B, & R are low cost projects to remedy deficiencies noted at pump stations that should be addressed before the next wet weather season.
- Projects # C and G-L are pipe and manhole repairs identified in the December 2001 I/I study.
- Projects # D & P are pipe size upgrades recommended to alleviate capacity deficiencies.
- Projects # E & O are pump station replacements, recommended to address major deficiencies.
- Projects # F, M, & N are measures to improve recording, monitoring and control at the wastewater treatment plant.
- Project #Q is to television inspect areas in Basin 6 where large amounts of inflow were noted during a January 2002 site visit.

Project financing was estimated based on the assumption that all measures would be grouped together as a package. Financing is based on obtaining a loan for 100% of the project. SDC funds collected would be used to pay that portion of the loan. To finance these measures and improvements the City will likely need to raise monthly user fees by $3.82 to $5.44 per EDU per month.

Table ES.4.1

Capital Costs of Recommended Projects

#	Priority	Project Description	City O&M	SDC* Eligible	Loan	Project Total
A	1	Filmore Avenue Pump Station Tide Gate	$2,400			$2,400
B	1	North Avenue Pump Station Impellors	$4,000			$4,000
C	2	I/I Project # 2		$49,500	$164,920	$164,920
D	2	Oregon Avenue Line Upsize		$133,420	$133,420	$133,420
E	3	Johnson Creek Pump Station Replacement			$265,000	$265,000
F	4	New Metering Recording System			$25,000	$25,000
G	5	I/I Project # 3		$70,000	$233,635	$233,635
H	6	I/I Project # 4		$14,500	$48,390	$48,390
I	6	I/I Project # 5		$12,000	$39,735	$39,735
J	6	I/I Project # 6		$20,000	$64,775	$64,775
K	6	I/I Project # 7		$20,000	$68,620	$68,620
L	6	I/I Project # 8		$7,350	$24,500	$24,500
M	7	New Influent Meter			$21,000	$21,000
N	7	Automatic RAS Control			$12,000	$12,000
O	8	North Avenue Pump Station Replacement			$126,000	$126,000
P	9	Edison Avenue Line Upsize		$56,500	$56,500	$56,500
Q	10	Basin 6 Television Inspection	$1,500			$1,500
R	Complete	Jetty Pump Station Generator Timer	$500			$500
		Total	$8,400	$383,270	$1,283,495	$1,291,895

* SDC eligible costs are also included in loans

Recommendations for implementation of the recommendations include the following.

- Submit Plan to Council for approval.
- Implement immediate measures and improvements (#A, B, Q, & R).
- Complete environmental assessment
- Request & secure financial assistance from funding agencies to finance the improvements.
- Development and implementation of system development charges.
- Secure authority to issue bonds needed to finance improvements.
- Authorize design and construction of improvements.
- Construct improvements.

The following is a tentative schedule identifying the key activities and approximate implementation date for the improvements.

• Council Approval of Plan	August 2002
• Submit letter to Rural Development and DEQ for financing availability	October 2002
• Start environmental assessment	October 2002
• Completion of low cost improvements	October 2002
• Submit application requesting financing to Rural Development and DEQ	October 2002
• Bond Authorization	April 2003
• Design of Project	April - September 2003
• DEQ Approval of Plans & Specifications	November, 2003
• Advertise for & Receive Construction Bids	January – February 2004
• Construction	March – October 2004
• Performance Evaluation	October – December 2004

Section 1

Introduction

Section

1

Introduction

1.1 Background

The City of Bandon has operated a public wastewater collection system since prior to 1936 and a wastewater treatment plant (WWTP) since 1970. Rapid growth in the 1980's and excessive infiltration and inflow (I/I) in the older parts of the system exceeded the capacity of the WWTP and a new, larger plant was built in 1994. The new plant is sized to meet the population needs, but I/I flows continue to present an operations challenge to properly treating the City's wastewater.

About half of the collection system in Bandon was built prior to 1977. 10% of the piping is terra cotta, laid without mortar. Much of this older piping has shifted or cracked, allowing groundwater to enter the system, increasing the load on the treatment plant. The City's Public Works Department has pursued an aggressive program to replace deteriorated mains and neighborhood service lines, but I/I levels are still excessive. An I/I study completed in December 2001 found 11,000 feet of piping in need of upgrading or repair. Service connections to pre-1970 buildings are a potential source of large amounts of I/I, especially in low-lying Old Town.

Development in Bandon has roughly followed the extension of the sewer lines, as soils in the area are of limited suitability for septic tank drainfields. Areas that are easily served by gravity sewers were generally built out by the 1970's. Lack of access to public sewers has limited development of areas within the urban growth boundary (UGB) and of some areas within the City limits. City policy limits sewer services to within the City limits and requires property owners within the City wishing new sewer service to pay for extending sewer service lines to their property. Sewer extension plans need to allow for areas within the UGB eventually incorporating into the City.

Bandon commissioned Wastewater Facilities Plans in 1978 and in 1991. The 1978 plan addressed concerns with high I/I rates and with failing septic systems in the Beach Loop/Johnson Creek area. This plan led to sewer rehabilitation projects and the construction of the Johnson Creek Pump Station and collection system. The 1991 plan addressed the failing treatment system and proposed the facility plan for construction of a new WWTP.

This Plan will address the ability of the City's existing wastewater system to effectively convey and treat the existing wastewater load as well as expansions necessary to serve additional wastewater generated by projected development. System upgrades to improve the capacity and condition of older pipe sections are covered. Recommendations are included to improve the operational efficiency of the system.

1.2 Objectives

The overall objectives of this Plan include the following:

- Evaluate the existing collection system condition and capacity and identify deficiencies.
- Evaluate the WWTP's hydraulic and treatment capacity.
- Estimate current and projected wastewater flows within the current City Limits.
- Estimate current and projected wastewater flows within the current UGB.
- Develop potential wastewater collection improvements to serve the projected development needs in the City limits and UGB.
- Recommend improvements for the existing collection and treatment system to improve the operating efficiency of the systems.
- Provide cost estimates and phasing recommendations for the recommended improvements.

1.3 Scope of Study

The scope of the Bandon Wastewater System Master Plan is intended to comply with the applicable requirements of State of Oregon's Department of Environmental Quality (DEQ).

Study area characteristics were identified and included both physical and socioeconomic conditions. City population and land use are addressed and projected in the future.

The **existing wastewater facilities** are investigated in detail. Data was collected on the existing wastewater collection and treatment systems from such sources as operating records, conversations with City staff, on-site investigation, maps, as-built records and other pertinent documentation. Existing facilities were evaluated in terms of location, sizing, capacity, condition, limitations, and performance. Consideration was given to the manner in which existing facilities could be utilized in the future. The infiltration and inflow (I/I) contribution to the wastewater flow was evaluated based on past and recent I/I investigations and historic plant operating data.

Wastewater characteristics were identified in terms of loads, flows, and strength during various times of the year. Future characteristics were projected to establish capacity requirements. Flows were addressed for both dry period and wet period conditions, and unit design values were established. Future wastewater characteristics were projected.

The basis for planning was established. Applicable regulatory requirements were identified and addressed, including management plans, current and future treatment criteria, and discharge standards. The present design capacity of the City's conveyance system and treatment plant was estimated to assess the present and future operation of wastewater facilities.
Alternatives were identified for conveyance and treatment. Nonviable options were screened out,

and a limited number of selected alternatives were established and evaluated in detail.

Finally, a **recommended plan** was identified which will enable the City to meet the present and future demands and requirements of their wastewater facilities. This plan includes preliminary design data, capital improvement and operational costs, recommended staging of improvements, a project schedule, and a financing strategy.

1.4 Previous Studies and Information

The following studies, reports and other sources of information have been used in the compilation of this Master Plan:

- City of Bandon 2010 Comprehensive Plan, Draft
  2000, The City of Bandon.
- City of Bandon Infiltration/Inflow Study
  December. 2001, Dyer Partnership, Inc.
- Comprehensive Sewerage Facilities Plan
  July 1978, HGE Engineers and Planners
- Storm Drain Master Plan
  June, 1999, Dyer Partnership, Inc.
- Comprehensive Water System Master Plan
  December 1992, HGE Engineers and Planners
- South Bandon Refinement Plan, Infrastructure Element
  June 1997, Dyer Partnership, Inc.
- Wastewater System Facilities Plan
  February 1991, Brown and Caldwell Consultants
- Bandon Wastewater Treatment Plan Construction Drawings
  January 1992, Brown and Caldwell Consultants

The information in this Plan is for preliminary planning and budgeting purposes. Detailed surveys and elevation information must precede design and some changes from this Plan are anticipated.

1.5 Authorization

The City of Bandon authorized the Dyer Partnership, Engineers & Planners, Inc. to proceed with this Wastewater System Master Plan on March 1, 2001. Services are provided in accordance with a Professional Services Agreement dated March 20, 2000.

1.6 Acknowledgments

This plan is the result of contributions made by a number of individuals and agencies. We wish to acknowledge the efforts of Richard Anderson, Public Works Director, Bill Nielson, Wastewater Treatment Plant Supervisor, Jason Locke, Planning Director, and the staff of the Coos Bay DEQ office.

Section

2

Study Area Characteristics

Study Area Characteristics

Section

2

2.1 Study Area

The City of Bandon is located on the southern Oregon Coast on the south bank of the Coquille River. Bandon is situated on Highway 101 approximately 23 miles south of Coos Bay. The Study Area for this facilities plan encompasses the City of Bandon and surrounding areas within the Urban Growth Boundary (UGB). The Bandon City Limits encompasses approximately 1,980 acres and the current UGB covers approximately 2,900 acres. Situated on a marine terrace, Bandon is bounded on the north by the Coquille River and on the west by the Pacific Ocean. A bluff, on the west and part of the north side, slopes steeply to sandy beach areas. A location map is shown as Figure 2.1.1. Figure 2.1.2 illustrates the Study Area. The area is divided into the following neighborhoods by geographic and historical association as described below.

Downtown/Woodland Heights - Old Town Bandon forms the core of the downtown area, catering to tourists and waterfront activities. This area has most of the restaurants and specialty retail shops in town. Commercial development serving the year-round residents tends to follow the Highway 101 corridor, which curves through this neighborhood on the north and west sides. The Filmore Street Pump Station is located adjacent to Old Town, serving the entire Bandon system, and pumping directly to the WWTP. This area is fully developed, although there are some vacant lots and oversized lots with homes are subject to subdivision. The main concerns for this area are the pre 1936 terra cotta sewer lines and service laterals, which are sources of a high rate of infiltration in the system.

West Bandon - Bounded on the north and west by the bluff, on the south by 13th Street and on the east by Oregon and Allegheny Avenues, West Bandon is one of the oldest residential neighborhoods in the City. While mostly developed, a number of empty lots are currently on the market in this area. The community center, a large public park and schools serving the Bandon Area are located in this neighborhood. Concerns for this area are the pre 1936 terra cotta sewer lines and service laterals, which are sources of a high rate of infiltration in the system. Also of concern is the sizing of the interceptor line serving this neighborhood and areas to the south.

Bandon Heights - Bandon Heights is the area between Ohio Street and Riverside Drive from the north city limits south to Highways 101 and 42S. This area is a mix of residential and commercial, with the city's sole strip mall located on Highway 101. The area is partially developed with a mix of urban and rural lot sizes. Entirely within the city limits, the area is served by sewers except for Riverside Drive and the area north of 6th Street. The North Avenue Pump Station and the Wastewater Treatment Plant (WWTP) are located in this neighborhood. This area is of concern because the existing homes on Riverside Drive have septic systems close to the water table. When drain fields fail, these homes are required to install specialized systems to handle the effluent from their septic tanks.

Beach Loop - This area is bounded on the north by Tupper Creek, on the west by the Pacific Ocean, on the south by Polaris Avenue and the city limits, and on all other sides by the city limits. This area is characterized by bluffs and sandy, vegetation covered dunes along the ocean and sandy hillocks with Gorse, Scotch Broom and scrub pine on the east side of Beach Loop Road and the floodplain of Johnson Creek. The area is a combination of residential and commercial, with most of Bandon's hotels located in this area. Restaurants, a golf course and nursing homes make up the bulk of other commercial development in this area, with additional scattered commercial development along Highway 101. The construction of the Johnson Creek Pump Station and extension of city sewers to the area in 1980 has made this scenic loop some of the most desired retail property in Bandon. This area has experienced about 70% of the total growth in the city over the last 10 years. This area is of concern because the pump station equipment is approaching the end of its rated life, and the rapid growth in the area will require extending the existing sewer mains.

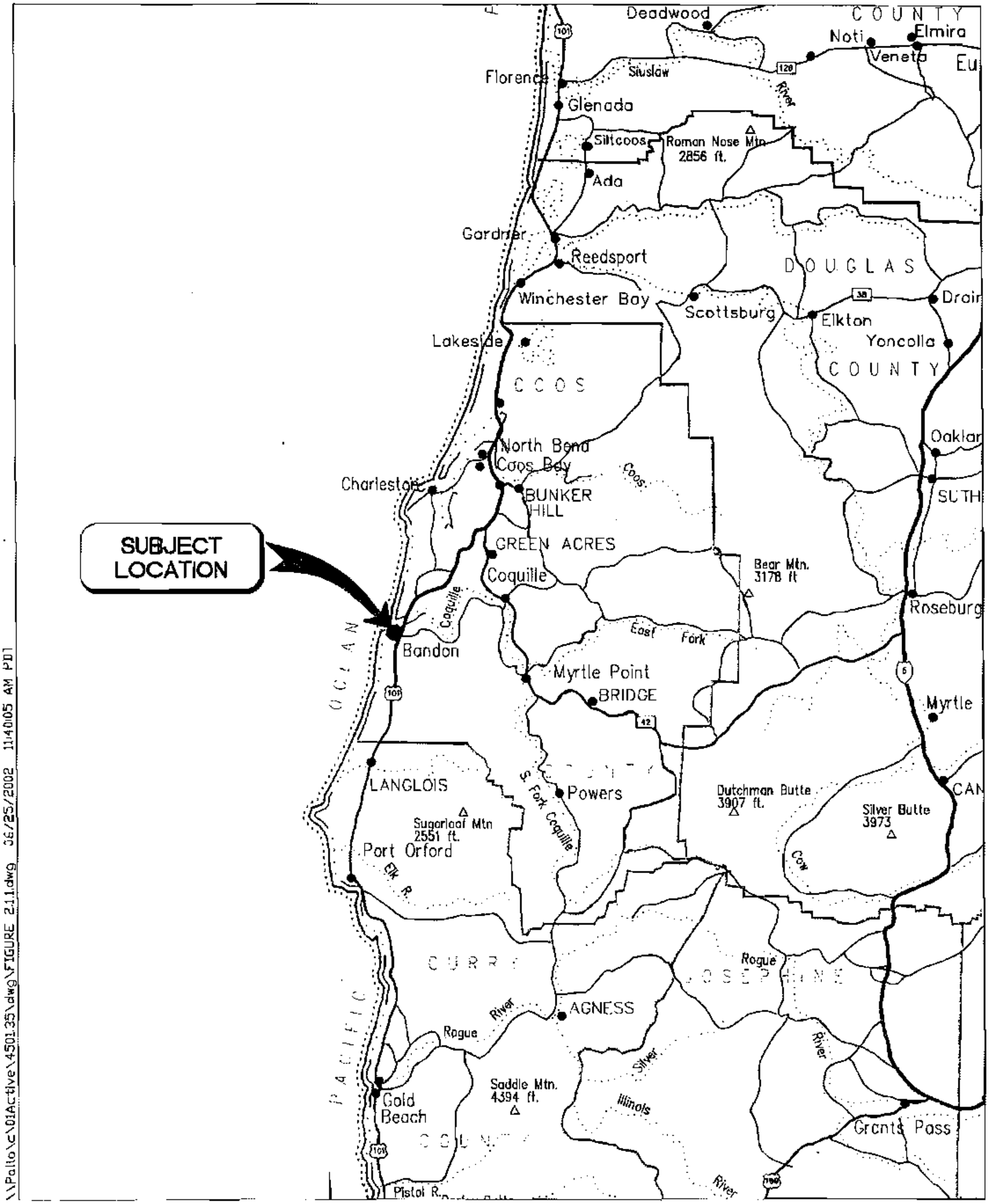
South Jetty - Tucked in between the Pacific Ocean and the bluff, with the Coquille River on the north and Tupper Creek on the south, is the South Jetty area. This area consists of low-lying grounds that have been built up with fill from dredging and construction projects. This area is mainly residential with a public park area providing access to the south jetty and Bandon Beach, and one restaurant. A new assisted living facility has recently opened in this area. The South Jetty Pump Station, built in 1995, serves this area. While some of the homes in this area are on septic systems, DEQ requires connection to the public sewer when existing systems fail. This system is the newest is Bandon, and capacity should exceed the needs of this area through the study period.

South Bandon - The Old Town area of the City of Bandon is built on the south bank of the Coquille River. As the city grew, residential development spread south along the oceanfront to Johnson Creek and commercial development spread south along Highway 101, leaving an undeveloped swath of land between the highway and the beach. Current residential development is moving east along Johnson Creek toward Highway 101, completing a circle around the undeveloped area. The area between Highway 101 and the developed shoreline is South Bandon, known locally as the Donut-Hole. The Donut-Hole is within the UGB but outside the city limits. This area is surrounded by the city on three and a half sides, which makes it a prime candidate for annexation into the city, and sections of the area are ideally situated for a future public park. It is characterized by sandy hillocks covered with Gorse, Scotch Broom and scrub pine interspersed with wetlands. The soils are not conducive to septic drain fields and city sewers do not extend outside the city limits. A 1997 study examined the development potential and recommended infrastructure to insure sound development progression. This area is of concern because it is under county jurisdiction and currently allowed development may conflict with bringing in city infrastructure in the future.

Sunset City – South of Polaris Street and bounded by the UGB, Sunset City is an area currently undergoing rapid development. Sewers serve the portion of the neighborhood inside the city limits. The area has many ocean view lots and architect-designed homes. Concerns for this area are due to rapid development without city infrastructure in place.

Southeast Bandon – South of Highway 101 and east of Harlem Street, in the city limits, is the area of Southeast Bandon. The two branches of Ferry Creek flow through this area, cutting it into three segments. This area is mainly residential with some commercial development along Highways 101 and 42S. Southern Coos Hospital and Health Center is located in the western segment of this area. Patches of second growth forest and the Ferry Creek waterway characterize the area. City sewer services are available along Highways 101 and 42S and in the southwest corner of this area. Most lot sizes in this area are too small to support a septic drain field and concerns in this area include extending sewers cost effectively to the remaining properties.

Airport – East of Highway 101 and west of Bandon Airport a zone reserved for the airport and supporting services and for industrial use. The area is sparsely developed at this time. This area is outside of the city limits, and is of concern because it is under county jurisdiction and currently allowed development may conflict with bringing in city infrastructure in the future



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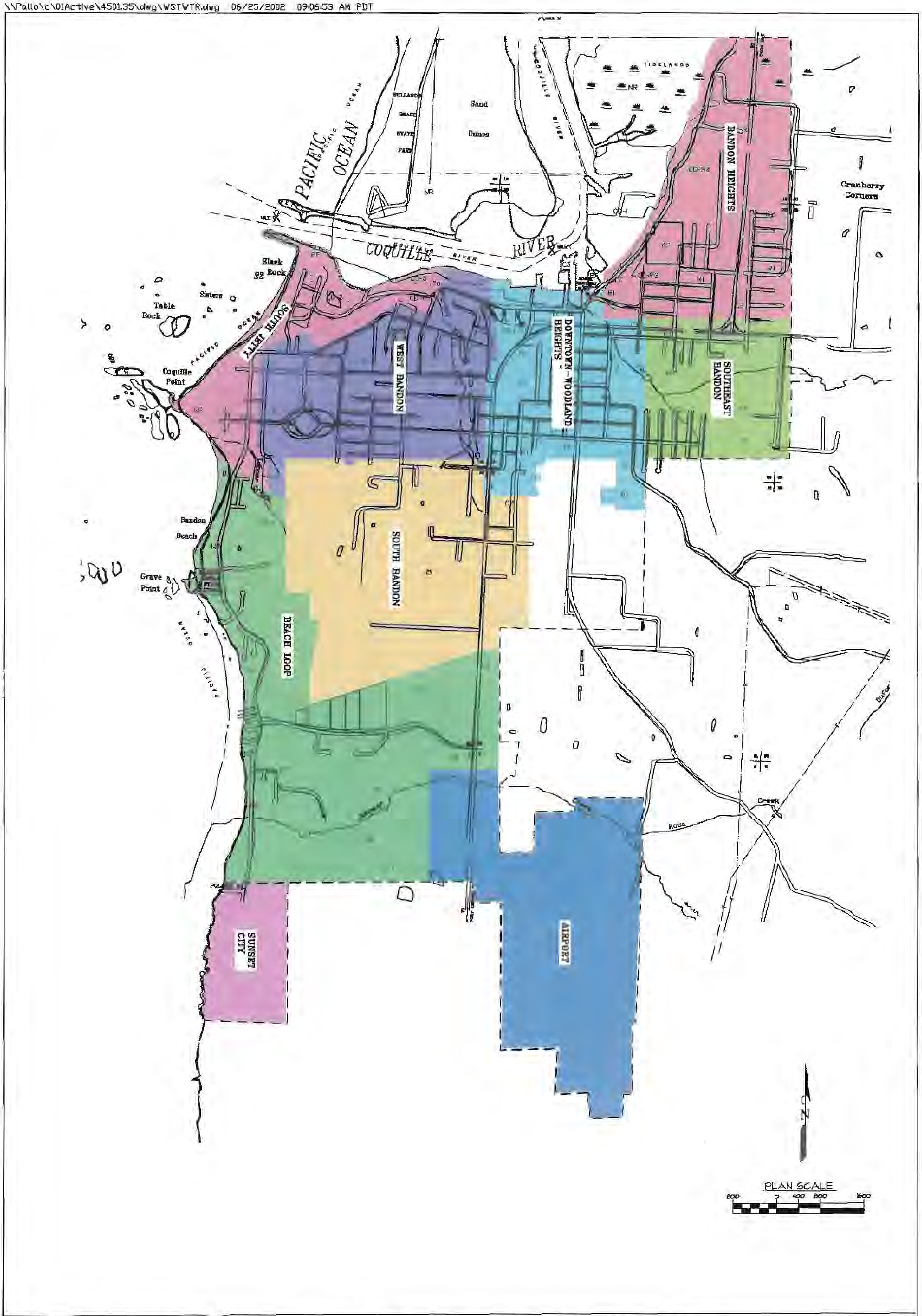
THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

DATE: JUNE, 2002
PROJECT NO.: 4501.35

CITY OF BANDON
WASTEWATER MASTER PLAN

VICINITY MAP

FIGURE NO.
2.1.1



THE DYER PARTNERSHIP
ENGINEERS & PLANNERS

DATE: JUNE, 2002

PROJECT NO.: 4501.35

CITY OF BANDON - WASTEWATER MASTER PLAN

STUDY AREA MAP

FIGURE NO.
2.1.2

2.2 Physical Environment

The following is a discussion of the physical environment in and around the City of Bandon.

Climate

Bandon has a mild marine climate. The monthly average low temperature is 38° F and the average monthly high is 67° F. Annual average rainfall is about 60 inches with July being the driest month and December the wettest. Record annual precipitation was 91 inches in 1996 with 6.25 inches falling on one day. Prevailing winds in the summer are from the northwest with winter storms predominantly from the southwest. Table 2.2.1 summarizes the precipitation and temperature data for Bandon.

Table 2.2.1

Bandon Climate Summary

	Precipitation, inches		Temperature °F,
Month	Mean	Highest Daily	Mean
January	10.07	4.00	45.8
February	7.73	4.99	47.3
March	7.38	3.87	47.6
April	4.37	3.3	49.2
May	3.09	2.56	52.5
June	1.47	1.8	56.0
July	.4	1.14	58.2
August	.79	3.4	58.6
September	1.63	1.91	57.4
October	4.54	3.18	53.7
November	8.62	6.25	49.7
December	9.63	5.61	46.4
Total	59.71		
Average			51.9

1948-2000 data from Western Regional Climate Center

Soils

There are six general classifications of surficial geologic formations found in the local Bandon area. A map showing these formations is included in the Appendix. The formations are described as follows:

- **Quaternary Alluvium (Qal)** - These soils are unconsolidated alluvial floodplain deposits, generally composed of silts, sand, mud and gravels. These soils are found along the south shorelands of the Coquille River and the lower reaches of Ferry Creek.

- **Marsh and Peat (Mpt)** – These soils are organic silt, clay and sand in wetland areas, characterized by abundant vegetation, ponding and high groundwater. These soils are found on the eastern shore of the Coquille River in north Bandon and upstream to Bullards Bridge.

- **Quaternary Marine Terrace Deposits (Qmt)** – These soils are flat-lying marine terrace deposits, typically fine to medium grained friable sandstone of beach origin with thin interbeds of siltstone. Thicknesses range from 10 to 50 feet. Qmt soils are predominant in Bandon, except along the Coquille River.

- **Unstable Dune Sand (Su)** – These soils are unconsolidated fine to medium-grained sands or large dunes not protected from wind erosion by vegetation. Found across the Coquille River from Bandon at Bullards Beach, Su soils cover the area between the river and the Pacific Ocean.

- **Stable Sand (SS)** –These soils consist of fine to medium grained dune sand, protected from wind erosion by vegetation. SS soils are found within the south jetty area of Bandon.

- **Deflation Plain and Beach Sand (Sdpb)** – These soils consist of unconsolidated fine to medium grain sand found along ocean beaches and the dunes area north of Bandon.

Geologic Hazards

There are several areas within Bandon that are susceptible to geologic hazards. These hazards include coastal and river flooding, high groundwater, landslides, earthquakes associated with fault zones, tsunamis, and coastal and river erosion. A discussion of each hazard and expected locations are discussed below. A hazard map is included in the appendix.

- **Coastal and River Flooding** - Major flooding in Bandon usually occurs from November through February. Winter rains increase the flow of the Coquille River and combined with high tides and wind driven seas cause extensive flooding in the Coquille tidal basin. Low lying areas frequently flood annually, with major floods occurring in 1890, 1955, 1964 and 1996. Extreme high water conditions in the Coquille River cause Ferry Creek to back up, flooding the area around the Bandon Cheese Factory and turning Filmore Avenue into an alternate outlet for the creek. The 100-year floodplain for the Coquille River, as shown on FEMA flood insurance maps, roughly follows Jetty Road to 2nd Avenue and continues along Riverside Drive to the Bandon Marsh.

  Ocean flooding is caused by storm driven high seas or earthquake generated tsunamis. The south jetty area, the mouth of Johnson Creek and property west of Seabird Lane have historically been subject to erosion and flooding from winter storms. The Old Town area was flooded by a 1964 tsunami generated by the Good Friday Earthquake in Alaska. The floodplain of the Coquille River, Johnson and Ferry Creeks are shown in Figure 2.2.1.

- **Earthquakes** - Earthquakes are the products of deep-seated faulting and the subsequent release of large amounts of energy. The Coquille Fault comes onshore just north of Bandon. No known earthquakes have originated in Coos County in the last 100-years, but five earthquakes registering above magnitude 5.7 occurred off the Oregon Coast between 1980 and 1990. Research has indicated that an earthquake produced Tsunami reaches the Oregon Coast every 500 to 700 years.

- **High Groundwater.** The areas know as South Bandon and the Beach Loop have perched water tables and contain large areas of wetlands. These areas are not suitable for septic tank systems and may not be easily developed without public sewers.

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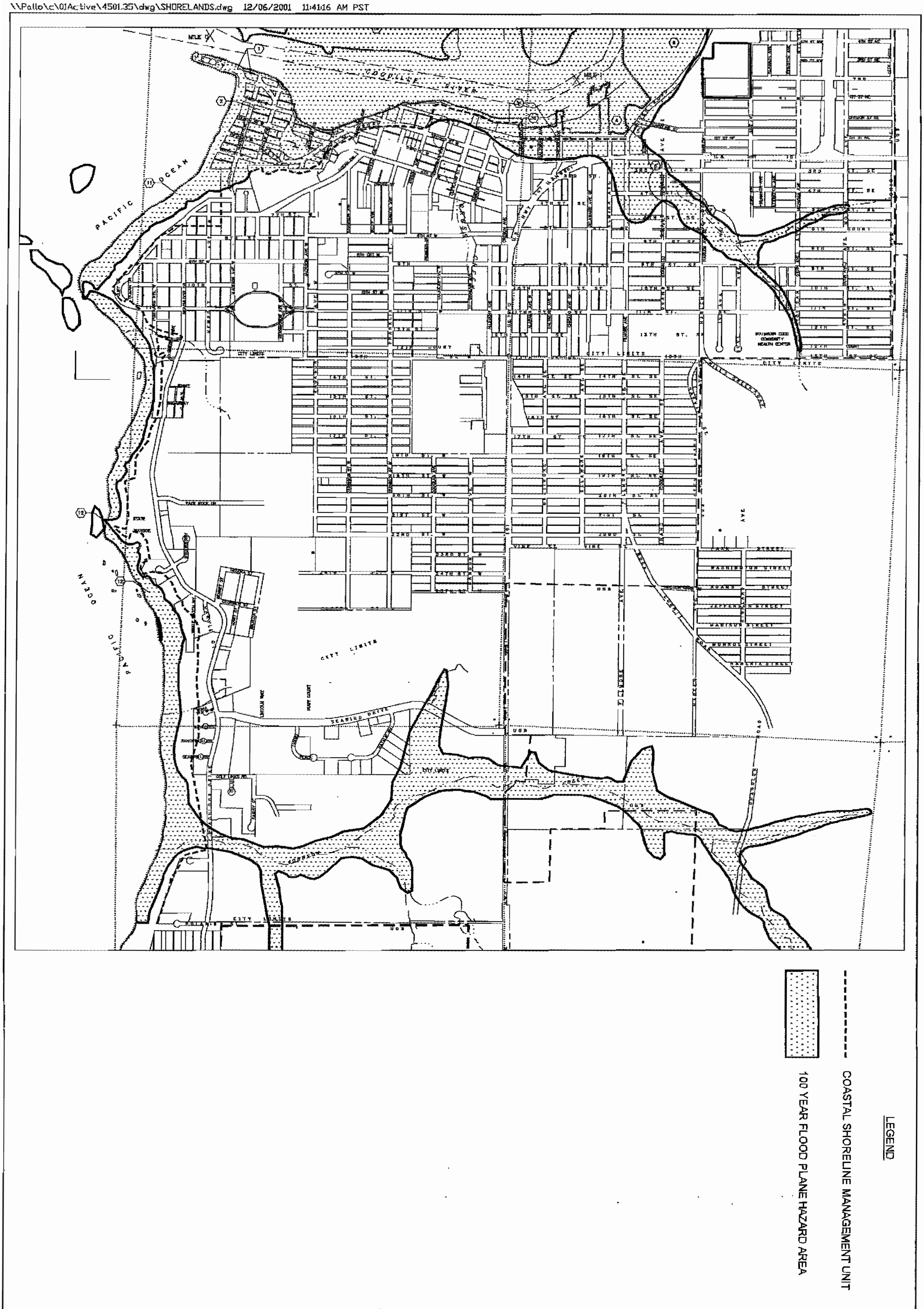


THE DYER PARTNERSHIP ENGINEERS & PLANNERS	CITY OF BANDON - WASTEWATER MASTER PLAN	FIGURE NO.
DATE: April, 2002 PROJECT NO.: 4501.35	FLOOD ZONE & COASTAL SHORELANDS BOUNDARY	2.2.1

- **Coastal Erosion.** Bandon's city limits border thousands of feet of shoreline along the Pacific Ocean. These areas are susceptible to extensive erosion by waves and the elements of weather. The bluff fronting the ocean for most of Bandon's west boundary is composed of heterogeneous, pre-tertiary bedrock, which is slow to erode. Individual areas have experienced noticeable erosion and slides.

Public Health Hazards

Known public health hazards within the Bandon area consist of failing on-site septic systems. The area north of the wastewater treatment plant on Riverside drive has a number of older homes with existing on-site septic systems. This area is below the Coquille River flood zone and has a high ground water table. The area between Harlem Avenue and Highway 101 south of 17th contains older homes on small lots with on-site septic systems and city water. Irrigation use of older wells that are contaminated due to proximity to septic drain fields is a concern. Well drawdowns also move contaminated groundwater deeper into the water table and could spread the contamination.

This Master Plan investigates alternatives for providing City sewer service to these problem areas.

Water Resources

The west boundary of Bandon is the Pacific Ocean and the north boundary is the Coquille River. This location allows year-round salt and fresh water recreation for local residents and seasonal visitors. Crabbing, fishing and boating and beachcombing are popular activities.

The Coquille River drains a 1,032 square mile sub-basin with four main tributaries, the North Fork, East Fork, Middle Fork and South Fork. Average annual flow at the river mouth is 3,020 cubic feet per second (cfs) with median flows ranging from 7,600 cfs in January to 130 cfs in September. There are 21 permitted National Pollution Discharge Elimination Sites (NPDES) on the Coquille River, including Bandon's wastewater treatment plant discharge. Oregon Department of Environmental Quality (DEQ) has found the water quality of the Coquille River upstream of Bandon to be "poor". The discharge from Bandon's outfall does not produce detectable river quality problems, possibly due to mixing action from tidal forces.

Bandon Marsh National Wildlife Refuge established in 1983 contains undisturbed salt marsh and mud flats, partly within the city limits. The marsh is considered a premier site for birding, and also is accessible for hunting, fishing and clamming.

The City's municipal water supply comes from Ferry Creek and it's upper tributary, Geiger Creek. The City has reservoirs on Ferry Creek and Geiger Creek that gravity feed water into the treatment plant.

Flora and Fauna

Vegetation in the Bandon area is typical of coastal regions in Oregon. The sandy soils encourage growths of Beach Grass, Scotch Broom, shrub trees and Gorse. The oily Gorse plant has taken over undeveloped areas invasively and is blamed for fueling the 1936 fire that devastated much of Bandon. Forestlands are predominant to the east and south of Bandon with Douglas Fir, Port Orford Cedar, Sitka Spruce, Western Hemlock and Red Alder trees. Forest shrubs include Scotch Broom, Salmonberry, Thimbleberry, Blackberry, Mountain Ash, Vine and Bid Leaf Maple, Pacific Rhododendron, Kinnikinnick, Manzanita, and Sword and Bracken Ferns.

The tidal zone along the Pacific Coast and Coquille Estuary are the habitat of Marine Bass, Rock Fish, and Ocean Perch. Other types of marine life include Clams, Mussels, Chitons, Limpets, Dungeness and Rock Crab, Shrimp, Starfish, Sea Anemone, and Urchins. Runs of Chinook and Coho salmon and Steelhead trout enter the Coquille Estuary each year for their seasonal upstream migration.

Bandon Marsh is one of the most important bird wintering areas in Coos County. Several rare species inhabit the intertidal zone, including Peregrine Falcon, Bar-tailed Godwit, and Hudsonian Godwit. Other bird species in the study area include Bald Eagles, Cormorants, Pigeon Guillemots and the Common Murre.

Sea mammals living in the ocean off the coast of Bandon include Harbor Seals, Great Elephant Seals and Northern Sea Lions. Other mammals native to the region include Shrew, Mole, Raccoon, River Otter, Muskrat, Beaver, Skunk, Squirrel, Elk, and Blacktail Deer.

Threatened or Endangered Species

Coho Salmon are currently listed by the federal government as threatened, although angling is allowed in a limited season for hatchery raised Coho. Winter Steelhead and Green Sturgeon are proposed to be added to the federal endangered list. The State of Oregon lists Cut-throat Trout and Pacific Lamprey status as sensitive. Federally listed bird species in Coos County include the Aleutian Canada Goose, Marbled Murrelet, Western Snowy Plover, Northern Spotted Owl and Bald Eagle, all listed as threatened and the Northern Pygmy Owl and Brown Pelican listed as threatened. Protected mammal species include the Northern Sea Lion and Grizzly Bear with a listing of threatened and the Gray Wolf listed as endangered. Few of these actually reside in the UBG, but may be found in the undeveloped areas surrounding Bandon.

Environmentally Sensitive Areas

The Coquille River is considered a Shallow Draft Development estuary under the Oregon Estuary Plan. While this designation allows dredging and development in the vicinity of the Bandon waterfront and the shipping channel, other areas of the estuary may be protected. The Coquille Estuary is divided into three Estuarine Management Units. The management intent of these units is described below. The estuary is further divided into subunits, each uniquely defined by natural boundaries. These boundaries may be geographic or habitat limiting. Each subunit is explicitly defined in terms of permitted uses and activities by means of a permitted matrix.

Development Estuarine Management Units are designated to provide for navigation and other identified needs for public, commercial, and industrial water dependant uses. Such areas include deep-water areas adjacent to or near the shoreline, navigation channels, subtidal areas for in-water disposal of dredged material, and areas of minimal biological significance needed for uses requiring alteration of the estuary not included in Natural or Conservation Estuarine Management Units. The Coquille Channel and Bandon Waterfront are in development management units.
Natural Estuarine Management Units are designated to assure the protection of fish and wildlife habitats, to promote the continued biological production within the estuary, and to provide for scientific research and educational needs. These units are managed to preserve natural resources in

recognition of the dynamic, geological, and evolutionary processes. Areas include all major tracts of salt marsh, tideflats, and seagrass and algae beds. The Bandon Marsh National Wildlife Refuge (NWR) is one such area. The original 304-acre NWR was expanded in 1999 by 577 acres. The City of Bandon has since opened channels in the marsh to restore tidal flows and improve habitat. Other significant wetland areas within the UBG are located in the mostly undeveloped area known as "South Bandon".

Conservation Estuarine Management Units are designed for long term uses of renewable resources that, except for restoration, do not require major alteration of the estuary. These areas are managed to conserve the natural resources and benefits. Areas include those needed for maintenance and enhancement of biological productivity, recreational and aesthetic uses, and aquaculture. They include tracts of habitat smaller or of less biological importance within Natural Units, and recreational or commercial oyster and clam beds not included in Natural Units. The existing wastewater treatment plant is within a conservation unit.

Several areas outside of the Coquille Estuary system have been identified as wetlands. Small Palustrine (marsh) wetlands are scattered throughout the study area, particularly in South Bandon. Bandon is in the process of completing a comprehensive wetlands inventory.

The Oregon Department of Fish and Wildlife (ODFW) maintains a fish hatchery on Ferry Creek. This is located below the water intake for the city and there are currently adequate water flows for both uses.

The City of Bandon has identified lands that limit, control, or are affected by the hydraulic action of coastal waters. These lands are indicated on Federal Flood Insurance Program maps and on the map included in the comprehensive plan as the Coastal Shoreland Inventory map. The boundary of the Coastal Shoreline Management Unit is shown in Figure 2.2.1.

Air Quality and Noise

Air quality within the Bandon area is excellent. Favorable prevailing winds, low population with corresponding low auto emissions, and absence of heavy industrial development result in few air quality problems. Noise is also not a nuisance. Automobile and truck traffic along Highway 101 would likely be the source of any future air quality or noise problems in Bandon.

Energy Production and Consumption

No major energy resources have been identified in the Study Area. There is some potential for individual small-scale wind generation projects, with PacifiCorp maintaining the permit for the dismantled wind farm just north of Bandon. Energy consumption is expected to increase within the Study Area due to population growth during the planning period. The City of Bandon Electric Utility serves the Study Area with electrical power. There is no natural gas service available, although a bond was passed in 1999 to install a pipeline connecting Coos County with Northwest Natural Gas service from Roseburg. Construction of the pipeline is scheduled for June 2002, although the line will not extend to Bandon.

Wild and Scenic River System

There are no Wild and Scenic Rivers within the Study Area.

2.3 Socioeconomic Environment

Population

Since 1990 Bandon has experienced a growth rate higher than most other communities in Oregon. Economic conditions were difficult in the early 1980's due to the decline of the forest products industry, and the population slightly decreased. Bandon's livability characteristics, however, especially for retired persons and those enjoying outdoor recreation, have attracted a long term growing populace to the Oregon Coast regardless of the local economic climate.

Based on Portland State University's (PSU) Center for Population Research census data, the City of Bandon's population increased from 2,224 to 2,940 between 1990 and 2000. This equates to an average annual growth rate of 2.83%. During this same period, the average Coos County growth rate was 0.4%.

Growth in Bandon is expected to continue at a rate higher to that experienced in the county during the last decade. A growth rate of 1.76% per year has been selected for projections used in this Master Plan over the next 20 years (to the year 2021), as suggested by the Revised Coos County Population Report for 1997. Growth occurs through infill of existing land in the City limits or through annexation of property in the UGB. The most recent population projections are shown in Table 2.3.1.

Table 2.3.1

Coos County Population Growth Rates

	Year						
Item	1990	1995	2000	2005*	2010*	2015*	2021*
Coos County Population	60,273	62,100	62,779	64,950	66,338	67,870	69,846
Annual Growth Rate %	N/A	.60	.40	.42	.42	.48	.48
City of Bandon Population	2,224	2,610	2,940	3,208	3,500	3,819	4,241
Growth Rate %	N/A	3.25	2.41	1.76	1.76	1.76	1.76

2.20 1535 248

The 1990 population census for the City of Bandon was 2,224. Housing units totaled 1,195 with 160 units listed as vacant. This results in an occupancy rate of about 2.15 persons per occupied housing unit. The 2000 Census data shows 1,535 housing units with 248 vacant for an occupied rate of 2.1 persons per occupied housing unit, fairly consistent with 1990. About 25 building permits are issued annually. At 2.1 persons per unit this would give a city population of 3,202 in 2005, a number that matches well with projections.

The population in this community has been aging, with the median age in 2000 of 49.3 years. The lower occupancy rate in 2000 is likely due to the increase in retired households. Flow projections will be based on equivalent dwelling units (EDU) with a population equivalent of 2.1 persons per EDU. 120 housing units that are listed as vacant are actually vacation or seasonal use units. For the purposes of sizing the sanitary sewers, these units will be counted as occupied.

The City's records indicated that there are five residential and one commercial sewer connections outside the city limits but within the UBG. Other households outside the city limits in the UGB rely on septic systems. Approximately 86 households representing 180 people are outside the city limits and inside the urban growth boundary. Table 2.3.2 lists the dwelling units used for this plan. 242 housing units listed are multi-family housing.

Table 2.3.2

Bandon Dwelling Unit Counts

Dwelling Use *	# of Units
Total Housing Units in the City	1,535
Additional Units outside City, Inside UGB	86
Total Units City & UGB	1,621
Vacant Units	248
Vacant Units that are Vacation or Seasonally Used	120
Units Considered Vacant for Master Plan	128

*2000 Census

Sewered Population

Not all residents in the City are currently connected to the sewer system. City records show a total of 1,259 residential water accounts inside the city limits versus 1,126 sewer accounts. (Multi-family housing is not included in this count.) A count of houses in the unsewered area of the city limits showed 130 homes, mostly on Riverside Drive and in Southeast Bandon. This Master Plan proposes improvements that will allow 100% of the population inside the UGB to be sewered. A breakdown of current residential sewage disposal is shown in Table 2.3.3.

Table 2.3.3

Sewered Dwelling Units

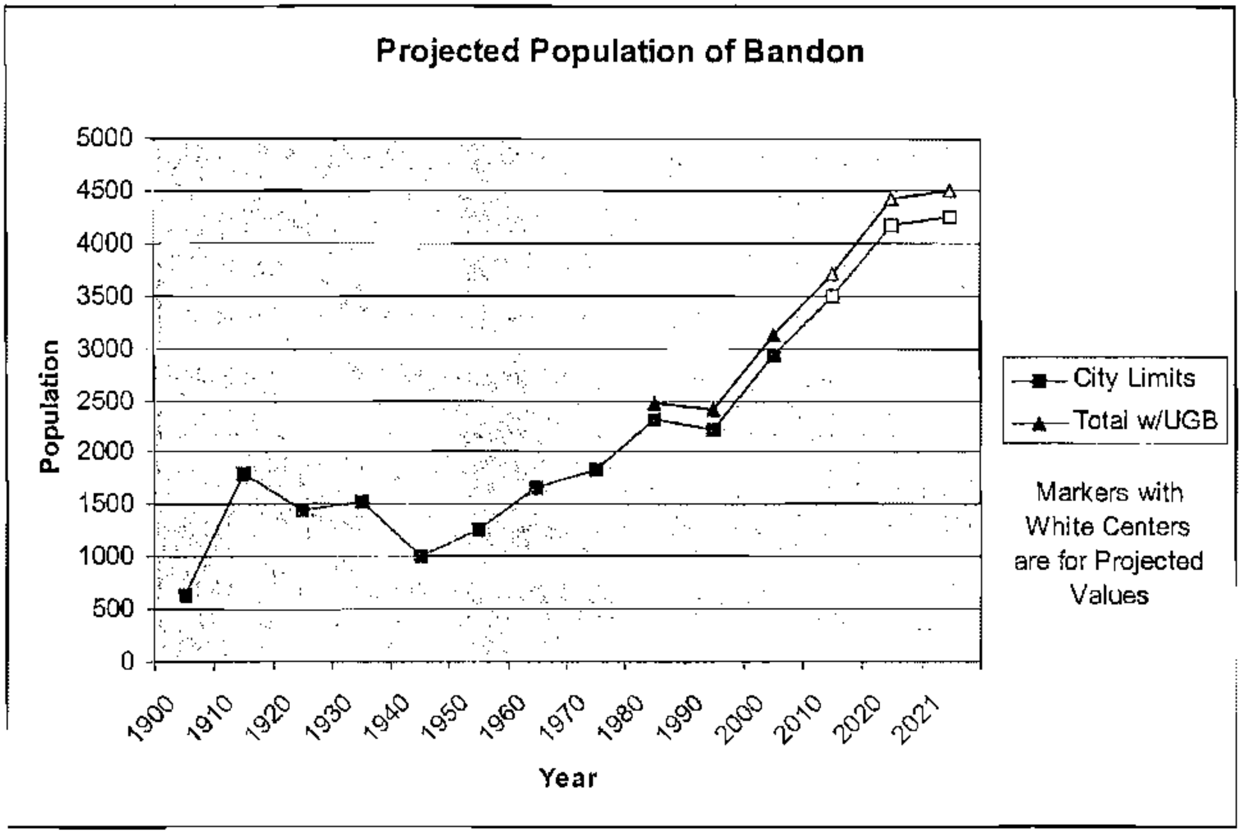
Sewer and Septic Use	Dwelling Units	Per Cent of Total
Inside City Limits on Sewers	1,405	86.7 %
Inside City Limits on Septics	130	8.0 %
Inside UGB, Outside City on Sewers	5	.3 %
Inside UGB, Outside City on Septics	81	5.0 %
Total dwelling units in City and UGB	1,621	
Total dwelling units on Sewers	1,410	
Total occupied dwelling units on Sewers	1,282	
Population on Sewer @ 2.1 per EDU	2,692	

Using a 1.76% average annual growth rate, the projected population inside the City Limits will increase from the current 2,940 persons to a total of 4,241 persons in the year 2021. The current estimated population within the current UGB would increase from 180 up to 260 persons over this 20-year period. These projections assume no annexations into the city and no extensions of city services into the UGB. The total population within the UGB is projected as 4,500 for 2021.

This projected growth trend, along with the historic growth in the City over the last 20 years is shown below in Figure 2.3.1. The projected population numbers shown in Figure 2.3.1 do not include the potential population that would be added if the UGB were expanded. Currently the City does not offer sewer service outside the city limits (with the exception of five existing connections). A large amount of land in the UGB is difficult to develop without sewers. If sewer service is extended into areas that are currently not served, the population in those areas could rise dramatically.

Figure 2.3.1

Historic and Projected Growth, City Limits and Current UGB



Bandon attracts a considerable tourist population. Sixteen motels with about 385 rooms and two RV parks with 22 spaces serve the transient population. A survey sent to motel owners generated returns from about 50% of the facilities. The occupancy rates for those returning surveys were extrapolated onto the total number of rooms available to generate the following population levels.

Table 2.3.4

Transient Population Levels

Projected Population	Hotels/Motels	RV Parks	Total
Summer Daily	703	14	717
Winter Daily	245	7	252
Annual Daily Average	410	10	420
EDU per Space or Room	.3	.33	-
EDUs	116	7	123

There are 244 businesses and government facilities that account for an additional 452 EDUs of metered water use. Larger users include three schools, three parks, two supermarkets, 24 restaurants, two retirement communities, Southern Coos Hospital, Bandon Cheese Factory, Hardin Optical plant, and Bandon Fisheries and the motels and RV parks discussed above. Table 2.3.4 summarizes the current and projected EDUs for the 20-year planning period. Projected numbers assume that commercial and industrial growth is at roughly the same rate as residential.

Table 2.3.5

Projected Sewered EDUs and Population

Projected EDUs	2000	2021
Residential	1,282	1,979*
Commercial/Industrial	452	652
Total EDUs	1,734	2,631
Equivalent Population	3,641	5,525

Includes growth plus extending sewers to all homes currently within the city limits

Bandon's industrial customers are Bandon Cheese Factory, Hardin Optical and Bandon Fisheries. Bandon Cheese Factory disposes of its industrial waste by trucking off site, leaving only domestic waste and clean up water to discharge into the sewer system. About 425 gallons per day of whey are trucked to an agricultural site where they are applied as fertilizer. Hardin Optical, which makes precision optical equipment, discharges all wastes to the sewer system. Bandon Fisheries discharges processing wastes directly to the Coquille River under an NPDES 900J permit, leaving only domestic waste to discharge into the sewer.

Public Facilities

In addition to the City's sewer system, public facilities within the Study Area and relevant to this facilities plan are the water system, storm drainage system, street system, solid waste disposal, and related federal and state facilities. The City's comprehensive plan addresses public facilities and services. Their goal is to provide adequate public facilities and services consistent with the planned level of development within the UGB.

- **Water System** - Bandon obtains its water supply from Ferry Creek and its upper tributary, Geiger Creek. Two dams impound a five-day supply of water. Water is treated physically and chemically at the treatment plant on Ferry Creek where two reservoirs with a total capacity of three million gallons store treated water. The creek flows are adequate for the needs of the City, even in drought years. Competing water rights needs from the state fish hatchery and cranberry growers may not be met during drought years as the City has senior water rights. There are approximately 1,690 water services connected to the City water system, of which 1,345 are residential accounts.

- **Street System** - The arterials include state highways, Highway 101 and Highway 42S. Collector streets are Riverside Drive, North Avenue, 11th Street, Elmira Avenue, Filmore Avenue, 1st Street, Franklin Avenue, Ocean Drive, Beach Loop Road and Seabird Avenue. Arterial and collector streets are paved, but most residential streets are not. Many paved collector streets have traffic exceeding their structural capacity. City policy is to require paved streets and drainage as a condition of new development. Storm water drains are in place in several areas, but most drainage is through ditches to natural drainage points.

- **Transportation** – Intercity bus service is available on a regularly scheduled basis. The Bandon State Airport runway is 3,600 feet by 60 feet, suitable for private aircraft. Local charter service is available.

- **Solid Waste Disposal** – Solid waste collection is a franchised operation. Waste is transported to the Coos County Beaver Hill Solid Waste Disposal Site, where it is incinerated. Some waste is transported to a landfill in Corvallis. Curbside recycling is available with solid waste service and a recycling drop off station is located at the Beaver Hill facility.

- **Electric Utility** - The City of Bandon Electric Utility serves the Study Area with electrical power. Power is purchased from Bonneville Power Administration. Electric service extends from just east of the city, south to Denmark.

- **Communication** – Telephone service is provided by Verizon. Cable television service is franchised to a private company. Radio stations broadcast mainly from Coos Bay, with a local translator station for National Public Radio out of Ashland. The Bandon Western World weekly newspaper is distributed on Wednesdays, with the daily World newspaper available from Coos Bay.

Land Use

Land use within Bandon is categorized into five general uses: residential, commercial, industrial, public facilities, and natural resource areas. There are an estimated 1,980 acres within the City Limits, and 2,900 acres within the current UGB. The Bandon zoning map is shown as Figure 2.3.1. The five general land use classifications are briefly discussed below:

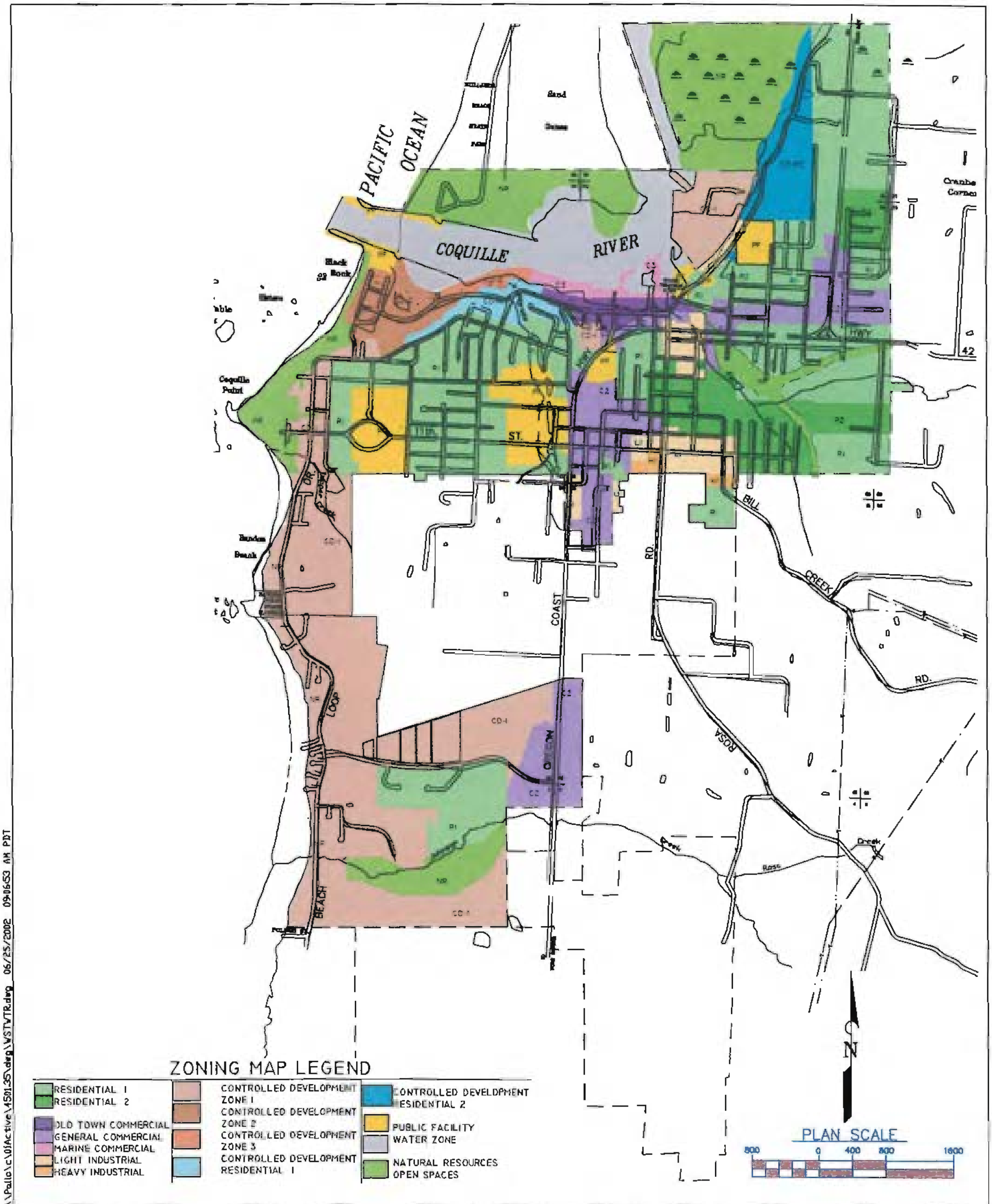
- **Residential Areas** - Bandon's residential areas are divided into two categories, Residential and Controlled Development. Most residential areas have existing or easy access to city sewers and water service. The areas are in proximity to schools and commercial centers. Controlled Development areas are primarily residential in nature, but may have commercial components, usually motels and restaurants related to tourism.

- **Commercial Areas** - Bandon's commercial areas are divided into Old Town, General and Marine Commercial. Old Town is located along the waterfront south of 1st Street and is characterized by gift shops, restaurants and specialty shops that attract substantial tourist trade. The General Commercial area is located along Highway 101 and serves the bulk of the daily local retail and service activity. The Marine Commercial area, located north of 1st Street along the waterfront, contains most of the Port of Bandon facilities, water-related activities, recreational activities, and tourist services.

- **Industrial Areas** - Industrial areas are divided into Light and Heavy Industrial. Light industrial use is for facilities producing minimal levels of noise, odors and smoke, with minimal traffic generation. The area south of Highway 101, between Grand and Elmira Avenues, currently houses this type of use, including the Bandon Cheese Factory and the City Public Works shops. Heavy Industrial areas are for facilities that could conflict with the quality of life in residential areas and are generally of a more intensive activity. The area south of 11th Street at Rosa Road is zoned for Heavy Industrial uses.

- **Public Facilities** - These are areas that are generally utilized by public agencies such as the City of Bandon and the Bandon School District, and contain structures and uses related to schools, parks, City Offices, and wastewater treatment.

- **Natural Resource Areas** - Natural Resource areas are very limited in the types of development that can occur, and include such areas as the Bandon Marsh, Bullards Beach State Park, Coquille Point, and riparian zones including Ferry Creek and Johnson Creek.



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THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	CITY OF BANDON WASTEWATER MASTER PLAN	FIGURE NO.
DATE: JUNE, 2002 PROJECT NO.: 4501.35	BANDON ZONING MAP	2.3.1

Section
3

Existing Wastewater Facilities

Existing Wastewater Facilities

Section

3

3.1 System History

Bandon built the original wastewater collection system in the early 1900's. The gravity system was constructed of terra cotta pipes and conveyed sanitary sewer and some storm water directly to the Coquille River without treatment. Part of this system is still in use in the Old Town, Woodland Heights and West Bandon neighborhoods, but now discharges to the WWTP. Many of the old mains have been replaced, while retaining the terra cotta service laterals. The original outfall locations were at Carolina Avenue, Bandon Avenue, Baltimore Avenue and Edison Avenue. Records of the early system were destroyed in the 1936 fire that devastated Bandon, and field measurements are the main information available now.

A 1950 engineering report provided the basis on which sewer expansions were laid out for the next 15 years. A recommended sewer along Oregon Avenue and Highway 101, south of 1st Street, was started in 1954. Other sewers were built to meet development needs, roughly following the recommendations in the report. The report addressed the need for future wastewater treatment, as the system still discharged all raw sewage to the river.

As neighborhoods developed and on-site septic systems became impractical, the sewer collection system was extended. Bandon Heights and Southeast Bandon received sewers in 1961 with the installation of about 13,000 feet of concrete pipe. West Bandon had been partly served by the original system and between 1964 and 1973 an additional 2,000 feet of concrete pipe were added to bring service to the rest of the neighborhood. The area between Elmira and Highway 101 was sewered in 1973 with asbestos cement pipe. A 1978 engineering report recommended the installation of a pump station at Johnson Creek and the installation of a sewer system along Beach Loop Road to provide service to homes with failing septic tanks. The 1980 Beach Loop system was expanded in 2000 to include the area surrounding Seabird Lane. The South Jetty Pump Station was built in 1994, connecting that neighborhood to the sanitary sewer system. As septic systems fail in this area, DEQ requires homes to connect to the public system.

A sewer interceptor line was installed from the residential neighborhoods on top of the bluff, along 1st Street through Old Town in 1969 to combine the flow from three of the existing raw sewage outfall pipelines. The sewage discharged into a manhole at 1st and Filmore, future site of the Filmore Street Pump Station, and from there into the river. With the completion of the wastewater treatment plant (WWTP) at Caroline and Riverside Drive, and the Filmore Street Pump station in February 1971, the City was ready to fully treat the public wastewater.

The original activated sludge WWTP was designed based on a population of 4,500 and an average daily flow of 0.45 MGD. The system was designed to handle 610 pounds per day each of BOD and TSS. Clarified effluent was chlorinated and discharged to the river. The system met the needs of Bandon well for the first ten years of operation. Over time additional connections to the system, including Beach Loop Drive, and leakage into the system due to older deteriorating pipes and manholes appear to have exceeded the treatment capacity of the plant. A lack of sludge disposal sites led to holding too much sludge in the system, causing sludge to washout into the effluent and creating odor problems. High levels of inflow and infiltration in the conveyance system contributed to a loss of quality in the discharge effluent. DEQ required a moratorium on new connections to the system from 1990 until a new plant could be brought on-line.

The current WWTP was built in 1994. An activated sludge plant, this facility incorporated much of the existing system into the new plant. Designed for a future population of 5,070, the basic capacity of this plant should meet the needs of the residential population through 2021. The plant was designed with provisions for expansion, should the population exceed the rated capacity. Treated effluent from this plant is disinfected with ultra-violet (UV) lights and discharged directly to the Coquille River. The sludge is used for agricultural enhancement. Details of the current plant are discussed in Section 3.3.

Infiltration and inflow (I/I) has been a significant problem in Bandon since the first WWTP was built. The original conveyance system was a combined sewer/storm water system built of terra cotta pipes laid with no mortar. Over time pipe sections have shifted and root penetrations have damaged sections. Original manholes built of brick allow excess water into the system. Later sewer additions were of concrete pipe, which tends to be in better condition, but many sections have suffered erosion and deterioration due to hydrogen sulfide. The City has addressed these issues on an ongoing basis, removing most of the storm water catch basins from the system in the 1970's after the original WWTP was built. Sewer lines are regularly upgraded when street projects provide access to the lines, and individual line replacement projects have been completed, including a major upgrade of the service laterals to Old Town in the early 1980s. An I/I study was completed in December 2001, that included smoke testing and flow mapping of major sections of the piping system and video inspection of areas where excessive flow was noted. The results of this study are discussed in Section 3.2.

3.2 Wastewater Conveyance System

Pipe System Description

The Bandon wastewater conveyance system currently consists of approximately 111,100 feet of mainline gravity pipe, 466 manholes, and 8,940 feet of pressure piping. The system also has four lift stations. The conveyance system pipe inventory is presented in Table 3.2.1.

As part of the Facilities Plan, the collection system was separated into sub-basins based upon areas of gravity drainage. Figure 3.2.1 illustrates the existing collection system. The main sewer interceptor for Bandon runs from the Filmore Street Pump Station at Filmore and Riverside Drive, along First Street to Edison Avenue. Basins 1, 2 and 3 tie into the interceptor just before the pump station. A secondary interceptor runs from Bills Creek Road, along 11th and Filmore Streets jogging over to Elmira, where it ties into the main sewer line on 1st. This interceptor conveys waste from Basins 4 and 5, and is sized for future expansion. Basins 6 and 7 tie directly into the main interceptor at Bandon Avenue. Basin 8 is the original old town sewer system and service lines tie directly into the sewer main. Basin 9 is served by the Jetty pump station, which connects to the main interceptor at Edison and Jetty Road. A secondary interceptor runs along Beach Loop Road, starting just north of Face Rock Road and running north, jogging over to Newport at 11th and then following 8th Avenue to Edison and continuing down the hill on Edison, where it meets the main interceptor at Jetty Road. This secondary interceptor picks up waste from Basins 10, 11 and 12. The sewered area south of

Face Rock Road (Basin 13) drains to the Johnson Creek Pump Station, which ties into this interceptor.

Table 3.2.1

Existing Conveyance System Pipe Inventory

Basin	Gravity Sewers (Linear feet of pipe)								
Pipe Diameter	20"	18"	15"	14"	12"		10"		
Pipe Type	C	C	C	C	C	AC	C	TC	PVC
Sub-basin 1									
Sub-basin 2							280		
Sub-basin 3							1,040		
Sub-basin 4						3,580	500		
Sub-basin 5				350		450			
Sub-basin 6									
Sub-basin 7									
Sub-basin 8	60	240	1,610		800			600	
Sub-basin 9									
Sub-basin 10					2,750				
Sub-basin 11					2,680				
Sub-basin 12									
Sub-basin 13					1,800		3,270		1,800
TOTALS	60	240	1,610	350	8,030	4,030	5,090	600	1,800

Basin	Gravity Sewers (Linear feet of pipe)						
Pipe Diameter	8"				6"		MH
Pipe Type	C	AC	TC	PVC	C	PVC	Quantity
Sub-basin 1	6,650						25
Sub-basin 2	7,670	1,490	630				46
Sub-basin 3	4,340	690					19
Sub-basin 4	2,800	4,580		2,300		1,000	64
Sub-basin 5	350	9,140					34
Sub-basin 6	4,720	3,120	1,250				37
Sub-basin 7	1,950	1,650					26
Sub-basin 8			1,250				16
Sub-basin 9				4,890			26
Sub-basin 10	5,330	450	2,850		650		37
Sub-basin 11	4,390	240					39
Sub-basin 12	2,770	2,890	2,325			175	25
Sub-basin 13	5,780			4,590			72
TOTALS	46,750	24,250	8,305	11,780	650	1,175	466

C = Concrete Pipe AC = Asbestos Concrete Pipe PVC = Polyvinyl-chloride pipe
TC = Terra Cotta (some Vitrified Clay pipe included in this category)

Pipe figures taken from Infrastructure drawings. Concrete was assumed where pipe type was not noted on drawing. Service laterals are not included in inventory. Pressure sewers are listed on Table 3.2.4.

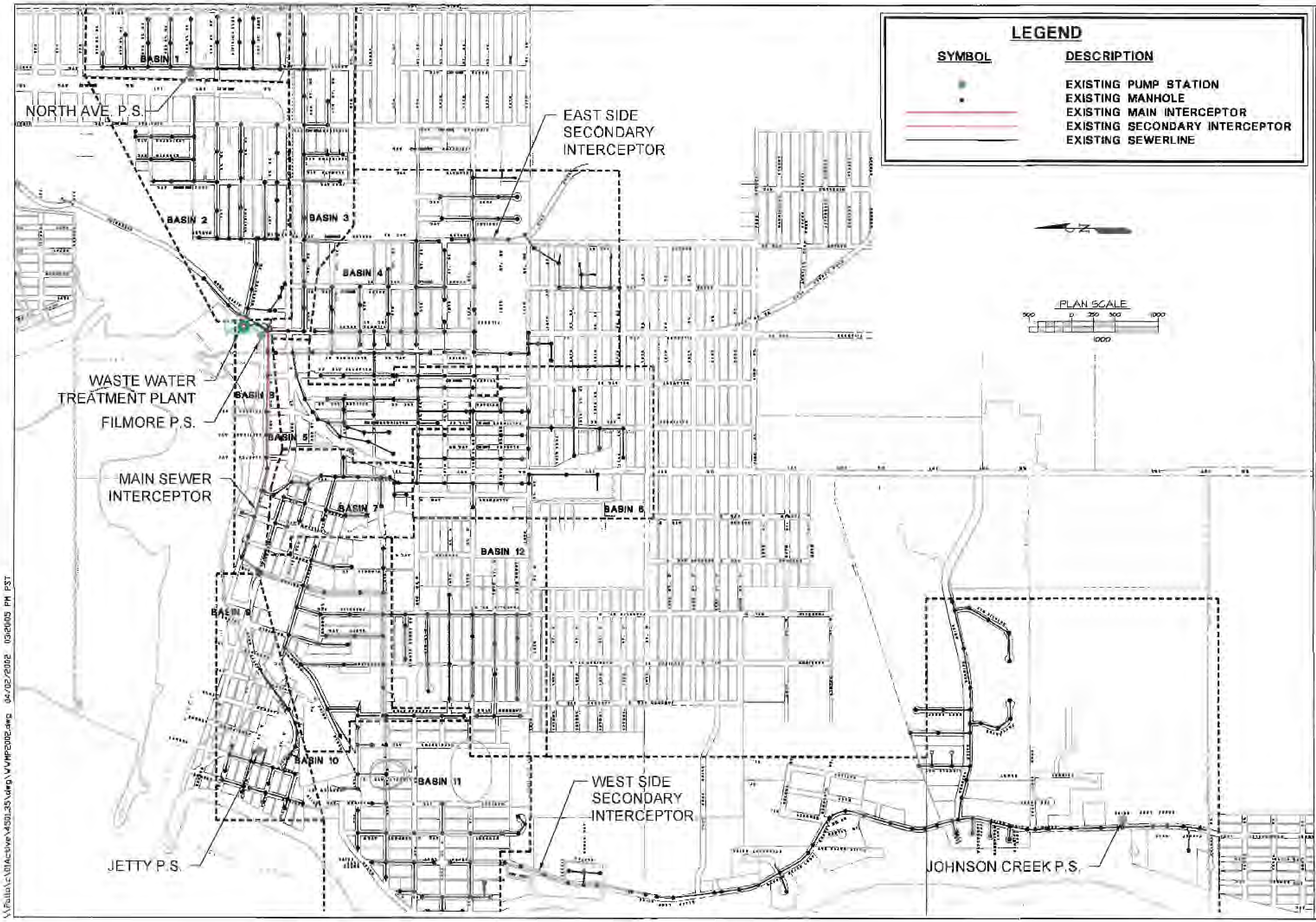

FIGURE NO.
3.21

CITY OF BANDON
WASTEWATER MASTER PLAN

EXISTING WASTEWATER FACILITIES

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

DATE: JUNE, 2002
PROJECT NO.: 4501.35

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Pipe Condition

Recent television inspection of the collection system found many problem areas with structural line failures. Pipe in Basins 2 and 12 is primarily terra cotta, installed prior to 1936. This pipe has shifted causing misaligned pipe segments, allowing infiltration and reducing pipe capacity. Tree roots have intruded into the gaps, causing blockages and dams with the pipeline. Several projects

Bandon has experienced recurring problems with grease accumulations in the collection system. A sewer line was fully plugged by grease in 1998 resulting in a raw sewage spill. Televising in 2000 showed large accumulations of grease throughout the collection system. Problem areas include the sewer trunk line on 1st Street, the Old Town area, and the eight-inch line serving Basins 1 and 3. A severe rat infestation at the WWTP was traced to accumulations of grease in a channel of the headworks in 1999. Lines and pump stations are cleaned at a cost of about $6,400 per year to remove grease and City workers spend an additional 150 hours removing grease from pump stations and the WWTP by hand. Bandon has an active grease ordinance, requiring installation and maintenance of grease traps for restaurants, cafeterias and other food processing facilities, but lacks the manpower to effectively enforce the ordinance.

Two areas were discovered to have flows exceeding capacity. The eight-inch pipe on Edison Avenue, between Jetty Road and 1st Street (Manholes No.8-15 and 8-16) is part of the West Side Interceptor and is undersized for current flows causing Manhole No. 8-16 to surcharge during wet weather. The eight-inch pipe on Oregon Avenue between 4th and 8th Streets currently surcharges during wet weather. Additional loads on this system from development south along Highway 101 would require upsizing this conduit. Recommendations for these pipe sections are presented in Section 6.

Infiltration and Inflow

Infiltration and inflow (I/I) is the leakage of ground or surface water into a sewer system. The Dyer Partnership conducted an I/I Study for the City of Bandon between September 1999 and September 2001. A full analysis of the results was presented under separate cover to the City of Bandon in December 2001. A brief discussion of the study findings is included below.

I/I Study

In September of 1999, smoke testing was conducted. Over 100 potential sources of inflow were identified. Most sources detected by smoke testing were downspouts connected to the sewer, open cleanouts and deteriorated service laterals. The City is has been working with property owners to correct these problem areas.

Flow mapping is done to identify localized areas of I/I. Wet-weather flow mapping was conducted in January 2000 and estimated a total I/I quantity of 600 gpm in the system. Dry-weather flow mapping in March 1999 found 311 gpm of groundwater infiltration in the system. Approximately 11,000 feet of suspect piping was identified during flow mapping as having I/I rates above 10 GPM. The flow mapping data for each basin is summarized in Table 3.2.2.

Table 3.2.2

Infiltration and Inflow Summary for Bandon

Basin #	Wet Weather GPM	Dry Weather GPM	Notes
1	36	2	Inflow due to car wash & pump station
2	30	10	New manholes & pipe lining recommended
3	-	23	Pipe lining recommended
4	30	12	
5	11	5	
6	140	14	Recommended for televising (mapped 1/7/02)
7	80	48	New pipe and lining recommended
8	-	-	Main interceptor, pipe too large to test
9	0	0	
10	113	68	New lines, manholes & lining recommended
11	-	34	Pipe lining recommended
12	0	80	Pipe lining and new manholes recommended
13	-	15	
Total	440	311	

Extensive video investigation of identified problem areas was performed in February and March 2001. About 11,000 feet of pipe was televised and cleaned, with detailed assessments made of system defects and deficiencies. Eight projects, as summarized in Table 3.2.3, were identified to improve I/I rates and address maintenance and capacity concerns.

Table 3.2.3

Recommended I/I Improvements Project Cost Summary

Project Priority	Basin	Description	Total Project Cost
No. 1	10	Line Replacement-Ocean Drive & 4th Street	$ 233,510
No. 2	7	Lining/Line Replacement-Oregon Avenue	$ 164,920
No. 3	12	Lining-9th Street W, 11th Street W & Franklin Avenue	$ 233,635
No. 4	2	Lining-Harlem Avenue	$ 48,390
No. 5	11	Lining-Newport Avenue	$ 39,735
No. 6	10	Lining-Jackson Avenue	$ 64,775
No. 7	3	Lining-3rd Street SE	$ 68,620
No. 8	All	Manhole Grouting, Spot Repairs, Lateral Reconstruction	$ 24,500
-	-	**Overall Total**	**$ 878,085**

Basin 6 was flow mapped again on January 7, 2002. During this period of rain I/I totaling 140 GPM was detected and isolated to two stretches of pipe. The probable sources were in the vicinity of Manhole No. 6-15 and Manhole No. 6-16. Video mapping of the adjacent pipe sections is recommended. See Appendix B for the location of I/I flows in Basin 6.

DEQ I/I Methodology

Oregon Department of Environmental Quality (DEQ) utilizes the previously developed regulations and guidelines of EPA's Construction Grant Program for determination of excessive and non-excessive I/I. For this determination, infiltration and inflow are evaluated separately as discussed below.

Infiltration

- If the flow rate at an existing treatment facility is less than or equal to 120 gpcd during periods of high groundwater (i.e. a 7-14 day average measured during periods of seasonal high groundwater), then the infiltration is considered <u>non-excessive</u>.
- If the flow rate at an existing facility is greater than 120 gpcd during periods of high groundwater, then a study of the sewer system shall be performed to determine the quantity of excessive infiltration and to propose a rehabilitation program to eliminate excessive infiltration.

Inflow

- If the rainfall induced peak inflow rate does not or will not result in chronic operational problems during a storm event, or the highest daily flow recorded during storm events is less than or equal to 275 gpcd, then the inflow is considered <u>non-excessive</u>.
- If the rainfall induced peak inflow rate results or will result in chronic operational problems or the rainfall induced total flow rate exceeds 275 gpcd during storm events, then a study of the sewer system shall be performed. The purpose of this study is to determine the quantity of excessive inflow and propose a rehabilitation program to eliminate the excessive inflow. Facilities planned for specific storage and treatment of inflow shall be subject to a cost-effective analysis.

Bandon System I/I

Infiltration and inflow contributions to the City's sewage flow were evaluated by analyzing historic WWTP influent flow data in relation to the above guidelines. Using the DEQ criteria of flows during high groundwater and low rainfall, the WWTP flows average 175 gpdc. System flows exceeded 120 gpcd 91% of the time during high groundwater, low rain intervals between 1996 and 2001. Bandon flows exceed the EPA level for excessive infiltration.

EPA guidelines suggest that inflow be determined from periods when rainfall levels create ponding and runoff. For this study daily WWTP data was used for any day that rainfall in the previous 48 hour period was 1.5 inches or greater. A 48-hour period was used to account for the effect of surface soil absorption, filling of surface water catchments and the subsequent delayed effect on the treatment plant flows. Use of the 48-hour period runs the risk of including flows caused by rain-induced infiltration, flows caused by temporary rain induced high ground water. A check was made by comparing data for days of one inch or greater rainfall in a 24-hour period.

For 48-hour periods with precipitation exceeding 1.5 inches, Bandon flows averaged 322 gpcd and were higher than the EPA guideline of 275 gpcd 68% of the time. For 24-hour rains exceeding one inch, Bandon flows exceeded EPA's level 54% of the time. Both flows exceed the EPA flow rate guidelines for excessive inflow. See Appendix B for a compilation of the data used for this determination.

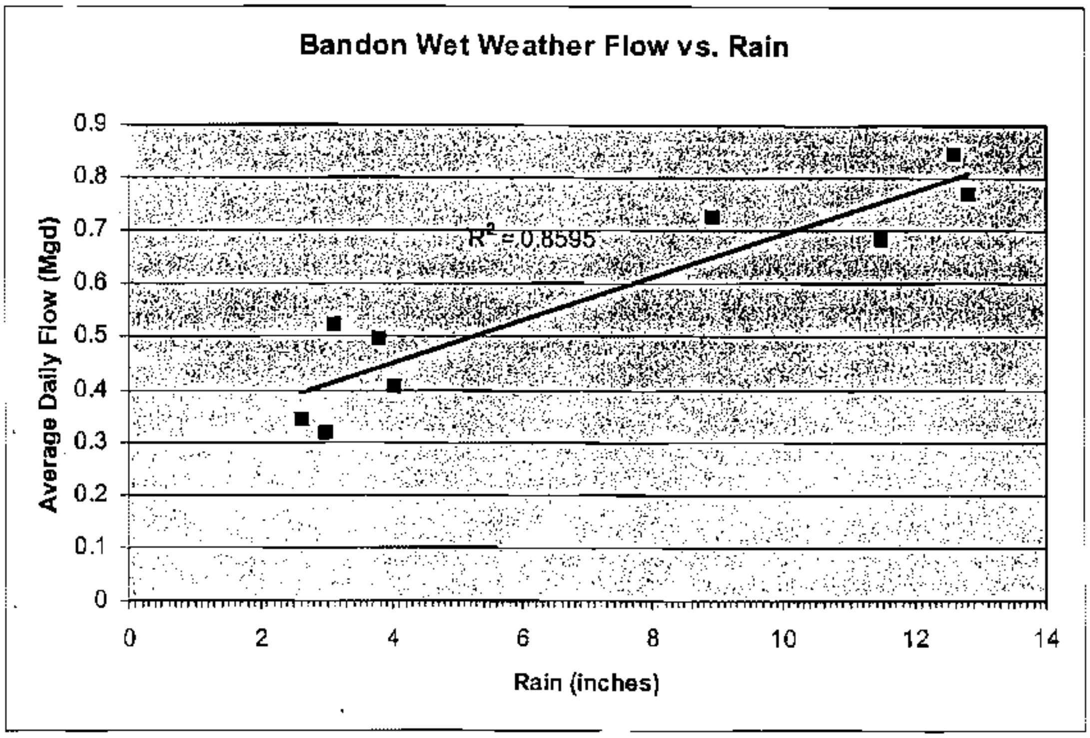
Another way of checking the amount of system I/I is to compare water consumption from the municipal treatment plant to wastewater flows. Water use in Bandon is about equally split between residential use and commercial/industrial use. Accounting for the residential use on septic tanks and city water, about 97% of the metered water accounts are on the sewer system. Accepted numbers for sewer usage are 70% to 80% of metered water use; 80% is used for this study. Correcting the metered winter-time 2000 through 2001 water use for Bandon give an average daily discharge to the sewer system of 0.227 MGD from water system customers. Wet weather WWTP flows for Bandon for the same time period are 0.369 MGD. Approximately 38% of the wet weather flows to the WWTP for this time period came from non-metered sources, most likely I/I.

Some factors need to be considered when comparing current water use to WWTP flows. The data used was the most current available, but it should be recognized that 2000/2001 was a drought period and most likely under represents normal WWTP flows. Comparing current water use with 1999 (a year with average rainfall) WWTP flow data projects 59% of wastewater flows from non-metered sources. The City of Bandon has been engaged in an active program to curtail inflow in response to smoke testing the sewer system in 1999. Almost 100 direct inflow sources were detected and corrected as a result of this program. This would account for an undetermined amount of the reduction in WWTP flows since 1999. A conservative range to use for this facility's I/I would be 40% to 50% of the wet weather flows are due to non-metered sources.

Figure 3.2.2 is a graph of monthly rainfall and the average daily plant flows for the month for wet weather months in 1999 and 2000. The strong correlation between rainfall and plant flows demonstrates the effects of I/I on the system.

Figure 3.2.2

Bandon Wet Weather Flow 1999/2000



Lift Stations

The Bandon wastewater system includes four raw sewage lift stations.

The public works staff monitors each station's performance by visiting the stations every other day. Each station is duplex, with a redundant pump at each station. Design parameters for the pump stations are summarized in Table 3.2.4.

Table 3.2.4

Pump Station Design Data

Pump Station	Filmore Street	North Avenue	Johnson Creek	South Jetty	101
Date Built	1970	1977	1980	1994	2005
Last Upgrade	1994	-	1995	-	–
Level Control	Bubbler	Mercury Switch	Float Switch	Mercury Switch	
Sulfide Control	None	None	None	Air Injection	Bioxide
Force Main Length (feet)	370	80	6,200	2,470	
Force Main Diameter (inches)	12	4	6	6	
Generator kW	N/A	N/A	72	35	yrs
Pump Size (HP)	50	2	20	5	10
Rated Flow (Per Pump GPM)	2,222	150	135	310	
Head (FT)	64	16	115	37.5	

Filmore Street Pump Station - This station, originally built in 1970, receives all incoming flow from the Bandon sewer system and discharges through a 12-inch diameter force main, approximately 370 feet into the headworks of the WWTP. The station was upgraded in 1994, during construction of the WWTP. The original wet-well/dry-well configuration was converted to a wet-well, with the old dry-well used for additional wet storage capacity. The facility is rated as an EPA Class 1 system. The overflow point is a 12-inch line to Ferry Creek. The flapper valve backflow prevention on the overflow is showing signs of leakage and it is recommended that it be replaced with a duckbill valve.

The station now has two Fairbanks Morse 50-Hp variable speed non-clog vertical column turbine pumps, installed in 1994 when the WWTP was upgraded. Capacity of a single pump is 2,222 gpm at 64 feet TDH. One pump was removed and rebuilt in 2001, and the second is scheduled for rebuild in summer 2002. Design flow for this station is 3.2 Mgd. A wood frame building serves to house the controls and electrical equipment. The wet-well level is controlled by a bubbler system. Alarm controls consist of an autodialer and alarm messages recorded at the main control panel of the WWTP. There is no back-up power for this station, although redundant electric feeds from two different local power grids insure against local disruptions.

Bonneville Power Administration, as part of an energy efficiency test project, set the pump controls in 2001 to vary the pump speed to maintain a static wet-well level. With this configuration, the pumps ran too slow to effectively remove solids from the wet-well, resulting in an accumulation of floating grease and rags on top of the wet-well and a build up of sand and gravel on the wet-well floor. The pumps have been returned to a start/stop control strategy.

Figure 3.2.3

Filmore Influent Pump Station

North Street Pump Station - This station is a factory-built, internally wired pumping station manufactured by Hydronix, Inc. Rated capacity is 150 gpm at 16 feet for each of the two horsepower pumps. The lift station is housed within a fiberglass enclosure, mounted over a five-feet diameter by five-feet deep concrete wet well, with two Hydr-o-matic Model 40 MPC self-priming pumps. Serving the north portion of Basin 1, this station discharges into a manhole about 50 feet from the station. The station is equipped with an autodialer and local alarm bell and flashing red alarm lights.

This station is difficult to maintain, as it meets the OSHA definition of a confined space, requiring two operators for entry. The only way in to the wet well is a port in the bottom of the fiberglass enclosure, which is difficult to access for wet well cleaning or inspection. Operators cleaning the wet well use a long handled net to collect floating grease balls and solids and must hand the dripping net over their head to another operator for emptying.

The station was installed in 1977, and the equipment is near the end of its rated life. A pump down flow test on the station showed each pump running at about 35 gpm, well under the design flow. This station serves a small area and no overflows have been recorded, so the combined pump output appears to handle the current flows. The low pump flows could indicate worn out impellors or restrictions in the system downstream of the pump; further investigation is warranted. The remaining expected life of this station is less than the study period and it is recommended that funds be budgeted to replace this pump station in the next ten years.

Figure 3.2.4

North Street Pump Station

Johnson Creek Pump Station - This station was built in 1980 on Beach Loop Road, in the floodplain of Johnson Creek. It serves the Beach Loop and Seabird Drive area south of Face Rock Drive. The system consists of a 6-foot diameter by 15.5 foot deep concrete wet-well with two 20 Hp vertical vacuum prime pumps with float switch level controls. The single pump capacity is 135 GPM at 115 feet of total dynamic head. The 6,200-foot pressure main discharges into a manhole on Beach Loop Drive, just north of Face Rock Drive. The overflow discharges directly into adjacent Johnson Creek. An autodialer and exterior flashing light provide alarm notification. A 72 kW diesel generator with an automatic transfer switch provides auxiliary power.

This station is showing deterioration in both the equipment and structure. At a minimum the structure requires minor siding repair, exterior paint and corrosion sealants for exterior metal fittings and panels. The pumps have exceeded their rated life and parts are difficult to obtain. The auxiliary equipment shows extensive corrosion from flooding. The generator cannot be run during periods of flooding due to safety concerns. The generator has nonfunctioning meters, and is subject to repeated seal leaks. Rodent damage caused generator and control wiring to need replacement recently.

Of greater concern is the fact that the station is located about ten feet below the historic flood level. The pump station has been inundated by surface water during past flood events causing service outages. It is recommended that this station be raised above the floodplain, the generator refurbished, and submersible pumps be installed to replace the existing vacuum prime pumps.

Figure 3.2.5

Johnson Creek Pump Station

South Jetty Pump Station - The station was constructed in 1994 to serve the area below the bluff and south of the jetty. The station is sized to serve the entire neighborhood (Basin 9), although a number of homes have not connected. Homes are allowed to remain on existing septic systems until the leach fields fail, and then are required by DEQ to connect to the public system.

The system has a seven-foot diameter by 12.5-foot deep pre-cast concrete wet-well with duplex submersible constant speed five-HP pumps controlled by a mercury switch. The pumps are each rated at 310 gpm at 37.5-feet of dynamic head. The elevation of the pump station is located just above local flood stage for a hundred year flood event. A 35 HP diesel generator located in the control building provides emergency power via an automatic transfer switch. An autodialer provides alarm notification functions.

The 2,470-foot, 6-inch diameter PVC force main discharges into a manhole at Edison and Jetty Roads, and gravity feeds from there to the Filmore Street Pump Station. The overflow is across a private lawn, 100 feet east of the pump station. This station is in excellent condition.

Figure 3.2.6

South Jetty Pump Station

3.3 Wastewater Treatment Facility

The treatment facility, constructed in 1994, is located east of Old Town, at the intersection of Caroline Avenue and Riverside Drive. The WWTP is a conventional activated sludge plant. The plant includes head works, two aeration tanks, two secondary clarifier tanks, one aerobic digester, a UV disinfection system, a sludge thickening screw press and sludge drying beds. Bandon recently acquired a truck for spreading sludge on agricultural lands. Figures 3.3.1 through 3.3.5 are photos of the main components of the WWTP. Figure 3.3.6 is a plan view of the WWTP. Figure 3.3.7 is a flow chart detailing the processing of the raw sewage.

A copy of the original Brown and Caldwell design data is included in the appendix.

Plant Design

The plant was designed for a population equivalent of 5,068 persons. Actual flows for 2001 are shown in Table 3.3.1. Design flows and loadings are shown below in Table 3.3.2. Rainfall for 2001 was only two-thirds normal, so flows for this year are not typical.

Table 3.3.1

WWTP 2001 Actual Flows and Loading

2001 Flow Data				Influent				Effluent			
Month	Avg. Flow	Max Flow	Rain	BOD	BOD	TSS	TSS	BOD	BOD	TSS	TSS
	Mgd	Mgd	Inches	mg/l	ppd	mg/l	ppd	Mg/l	ppd	mg/l	ppd
Jan-01	0.284	0.342	3.51	247	459	240	459	8	18	10	24
Feb-01	0.280	0.360	3.81	354	650	244	456	6	14	9	19
Mar-01	0.283	0.350	3.01	240	423	259	478	8	17	7	17
Apr-01	0.308	0.385	4.57	289	612	220	456	8	22	7	18
May-01	0.282	0.346	2.04	321	578	258	471	8	18	10	24
Jun-01	0.277	0.367	2.62	373	693	271	491	8	17	11	25
Jul-01	0.300	0.336	0.36	394	804	287	594	8	19	12	30
Aug-01	0.330	0.553	1.14	441	1013	255	569	9	23	12	33
Sep-01	0.303	0.357	0.27	467	918	265	523	9	23	10	26
Oct-01	0.266	0.296	3.21	384	669	207	360	6	13	9	20
Nov-01	0.295	0.545	6.79	296	569	218	426	5	11	12	30
Dec-01	0.379	0.586	11.11	256	712	183	474	8	28	11	34
Max	0.379	0.586	11.11	467	1013	287	594	9	28	12	34
Min	0.266	0.296	0.27	240	423	183	360	5	11	7	17
Avg.	0.299	0.402	3.54	339	675	242	480	8	19	10	25
Annual Total*	109	-	42.44	-	246,358	-	175,203	-	6,798	-	9,144

* Total flow in units of million gallons, total BOD and TSS in units of pounds.

The plant has two aeration basins. Basin 1 holds 157,000 gallons and Basin 2 holds 141,000 gallons. During normal operations, Basin 1 is operated and Basin 2 is held in reserve with just enough liquid to cover the air nozzles. Basin 2 is brought on-line during wet weather high flow days, or when Basin 1 is emptied for cleaning and maintenance. A 1,500-scfm blower with variable frequency drive (VFD) provides air to the basins through a membrane diffuser.

After treatment in the aeration basins, the wastewater flows to the secondary clarifiers for settling. Within the clarifiers the well-fed microorganisms or biomass settle out, while the clarified effluent is drawn from the top. Skimmers remove any non-biodegradable solids that float to the top of the tank. The clarified wastewater flows through an ultraviolet (UV) light disinfection chamber and then is discharged to the Coquille River. Each clarifier has a rotating sludge collector to scrape accumulated sludge from the bottom of the clarifier to the return activated sludge (RAS) pumps for return to the aeration basins or removal to the aerobic digesters.

The plant has two equally sized 45 feet diameter secondary clarifiers. Design overflow for each clarifier is 1000 gallons per square foot for a total capacity of 3.2 MGD.

The UV disinfection system consists of two flow channels, each containing three vertical low-pressure mercury vapor UV disinfection units with 28 lamps per unit. Flow can be directed to each or both channels, and each UV unit can be brought on as needed to meet flow and turbidity conditions. Design exposure time is 12.5 seconds at peak wet weather flow. Minimum exposure time for disinfection is 9.5 seconds.

Sludge from the RAS pumps flows either back into the aeration basins as needed or to the aerobic digesters. Sludge is aerated in the digesters to promote the digestion of biomass. Periodically the aeration is discontinued and the solids are allowed to settle. The liquid layer, or supernatant, is pumped back to the aeration basins for further treatment. The aerobic digesters typically produce sludge at about 2% to 3% solids. The biosolid product is a Class B with a minimum volatile solids reduction of 38%.

The aerobic digester has three basins with a total capacity of about 368,000 gallons. Each basin is a separate digester and may be operated independently or sequentially. The current operation is to operate sequentially. Average design solids retention time is 55 days and average liquid retention time is 20 days. The digested sludge or biosolids may either be pumped directly to a tank truck for spreading on approved agricultural sites for soil enhancement or run through a screw press for further thickening prior to agricultural application. Bandon has recently purchased a spreading tank truck for more efficient biosolids application.

Bandon has two screw presses, one with a 15-gpm capacity and the other with a 35-gpm capacity. The presses are capable of reducing the biosolids to 10% solids with a 2.5% solid feed. The screw presses have not been used in the last eight years, but are currently being rehabilitated for a trial run and possible future use.

The facility has sludge sand drying beds with a surface area of 4,213 square feet. Don Pierce, former City public works director, stated (2002) that the beds were used one time only in the 1970s. The first application of biosolids dewatered well. A second application over the dewatered biosolids was unable to drain due to an impervious seal formed by the first layer. The biosolids turned septic, creating an odor problem. The odiferous product was too thick to drain and not stable enough to remove with a front loader, and was eventually manually removed by City workers.

Operations Changes

A number of operational changes have been instituted at the WWTP in the last three years. A summary of changes is discussed below.

DEQ limits the land application of treated sludge to the dry weather months of June through October. The WWTP was designed to have sludge decanted on a year-round basis. The sludge capacity of the digester is exceeded by June, requiring the sludge to be hauled to alternative sites at a higher expense than land application.

The WWTP has two aeration basins. Past operations utilized both basins full time, although flow levels are low enough most of the year for one basin to have adequate capacity. Operating both basins requires more aeration, which increases energy and maintenance costs. Current operation is to run the larger of the two aeration basins, Basin 1, and maintain a minimum fluid level in Basin 2. When a basin is effectively empty, power consumption is reduced as the blowers for that basin may be reduced to minimum output. Taking Basin 2 out of service allowed it to be thoroughly cleaned and repaired and allows it to be used as a backup digester in the winter when digester space is at a premium. Reliance on the aeration basin as a digester reduces the capacity of the WWTP to handle high flows, and should be seen as a temporary measure.

Similar operation changes have been made in the secondary clarifiers. The second clarifier is now operated only during high flow periods. The reduced operating hours have lowered maintenance and power consumption at the plant, while preserving full treatment and back up abilities.

Bonneville Power Administration (BPA) has implemented an energy efficiency pilot program at the Bandon WWTP. The program includes the installation of a Programmable Logic Center (PLC) and a personal computer to control the speed of the blowers in the aeration basin. Sensors in the aeration basin measure the dissolved oxygen levels in the basin and the blowers are controlled to maintain a set level.

The Filmore Street Pump Station is also part of the pilot program. BPA originally set a control strategy to control the pump speed to maintain a static level in the wet well. Under this control sequence, the pumps ran too slow to effectively remove grit from the wet well, and solids settled out in the wet well and in the channel leading to the headworks auger. The pumps have been reset to allow a fill and pump down run sequence.

3.4 Effluent Disposal

Design anticipated plant effluent quality is 10-20 mg/L dry weather BOD and TSS, and 10-30 mg/L wet weather BOD and TSS. The current annual average BOD is eight mg/L and the TSS is 12 mg/L. The effluent load levels for 2001 are displayed in Table 3.4.1.

Treated effluent from the plant is discharged through a 12-inch outfall line approximately 500 feet to the Coquille River. The discharge point is directly north of the wastewater treatment facility at Filmore and Riverside Drive. The submerged diffuser is ten feet long with ten 4-inch ports. Design outfall capacity is 2.6 mgd at high tide.

The plant has two overflow outfalls, one at the WWTP UV disinfection channel discharging into the river, and one at the influent pump station discharging into Ferry Creek. The only recorded overflow from the WWTP was in November 1996 when 7.5 inches of rain in 24-hours caused flows exceeding the hydraulic capacity of the plant. The plant was able to process 2.25 MGD on November 19, 1996, 0.15 MGD more than the design maximum daily capacity.

Table 3.4.1

Bandon WWTP 2001 Effluent Daily Averages

Month	BOD Mg/l	BOD PPD	TSS Mg/l	TSS PPD
Jan-01	8	18	10	24
Feb-01	6	14	9	19
Mar-01	8	17	7	17
Apr-01	8	22	7	18
May-01	8	18	10	24
Jun-01	8	17	11	25
Jul-01	8	19	12	30
Aug-01	9	23	12	33
Sep-01	9	23	10	26
Oct-01	6	13	9	20
Nov-01	5	11	12	30
Dec-01	8	28	11	34
Max	9	28	12	34
Min	5	11	7	17
Avg	8	19	10	25

3.5 Sludge Disposal

The sludge generated at Bandon WWTP is a Class B biosolid with a minimum volatile reduction of 38%. The solids content normally runs from 1.5% to 2.5%. Treated biosolids from the plant are decanted into a City owned spray tank truck and spread for beneficial use on 30 acres of agricultural land. Part of the land is used for growing trees and part for growing rye grass hay. About 18 acres of the site is actually in use for application at any one time. Bandon has obtained permits for other beneficial use sites to assure adequate disposal sites for future growth. Current DEQ site restrictions limit spreading biosolids to June through October.

The design solids retention time in the digester is 55 days. The dry weather restriction on spreading has caused sludge to be held up to eight months in the digester, over four times the design period. This causes the digester to be overloaded, with the potential to reduce effluent quality. Careful plant management, the use of one aeration basin for a temporary digester and low rain levels have enabled the plant to maintain high effluent quality, but alternative biosolids disposal and wet weather holding capacity remain high priorities.

Figure 3.3.1

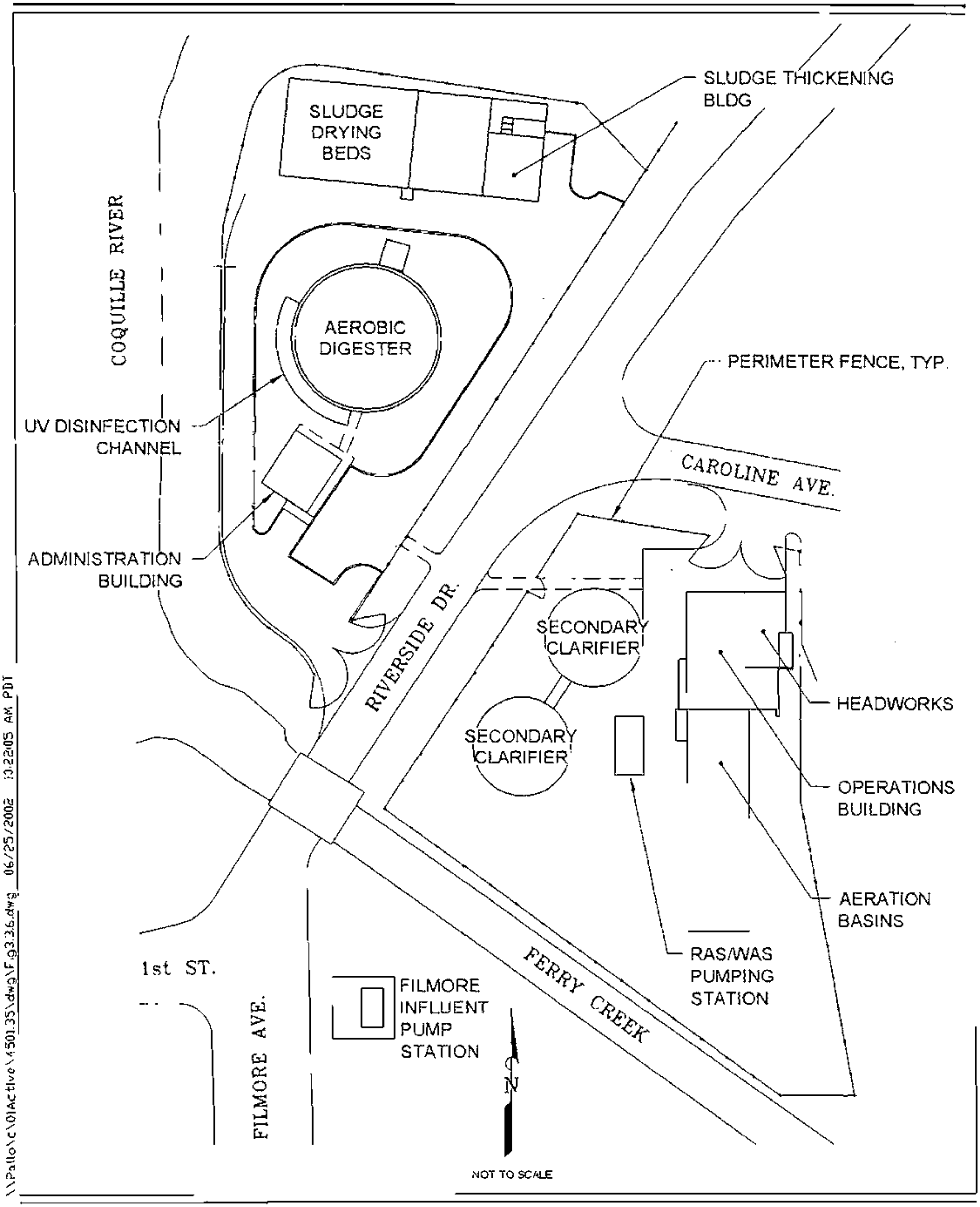
South View of Bandon WWTP

Figure 3.3.2

Headworks of Bandon WWTP

Figure 3.3.5

Bandon WWTP Digester



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THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

DATE: JUNE, 2002
PROJECT NO.: 4501.35

CITY OF BANDON
WASTEWATER MASTER PLAN

WASTEWATER TREATMENT PLANT

FIGURE NO.
3.3.6

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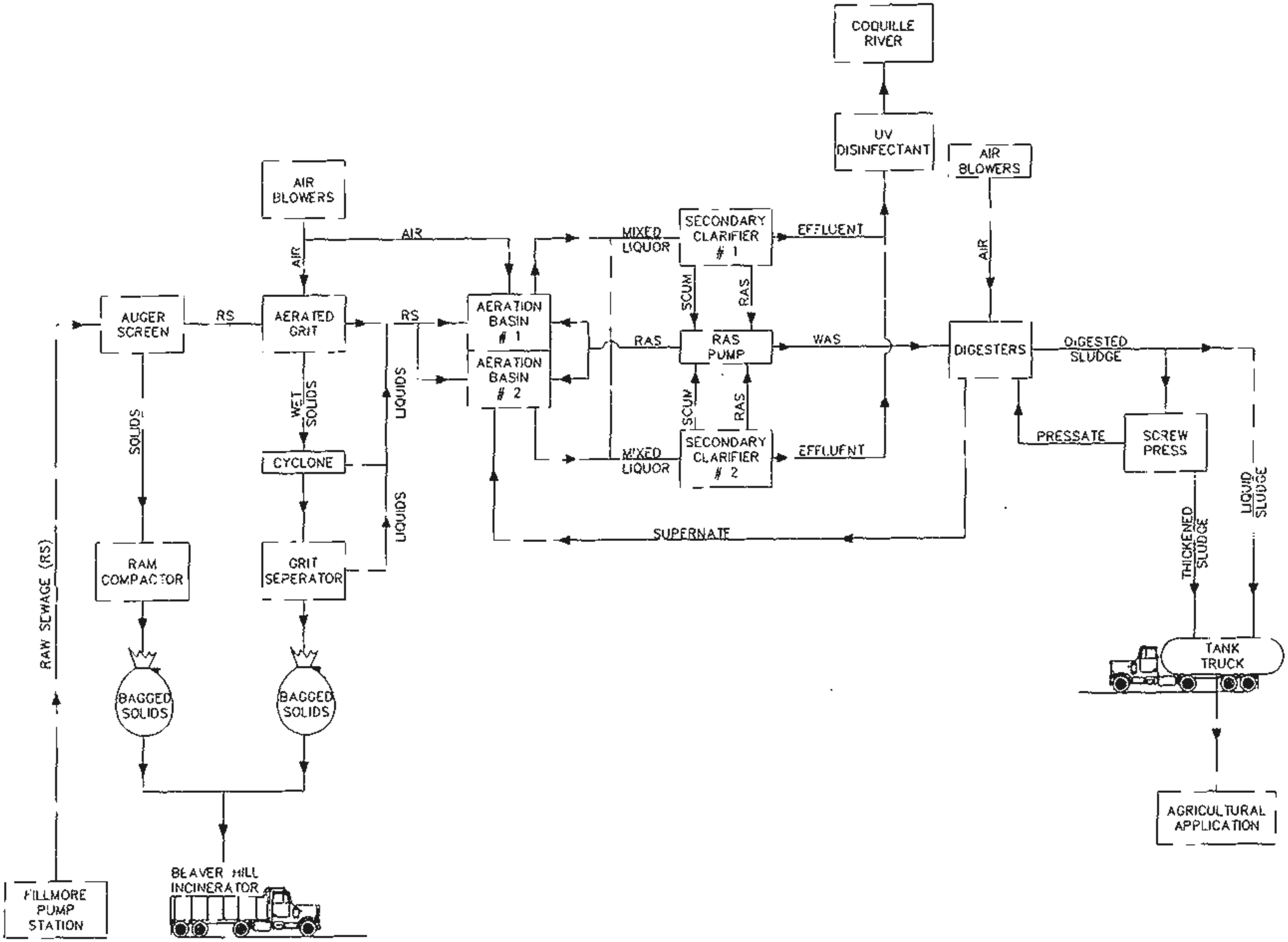
THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.
DATE: JUNE, 2002
PROJECT NO.: 4501.35

CITY OF BANDON
WASTEWATER MASTER PLAN
WASTEWATER TREATMENT PLANT FLOW DIAGRAM

FIGURE NO.
3.3.7



Section

4

Wastewater Characteristics

Wastewater Flowrates and Characteristics

Section

4

4.1 Definition Of Terms

As a preface to the review and discussion of wastewater characteristics, the terms used in this study are defined below.

Wastewater - total fluid flow in a sewerage system. Wastewater may include sanitary sewage, industrial wastes, and infiltration and inflow (I/I).

Sanitary Sewage - waterborne wastes principally derived from the sanitary conveniences of residences, business establishments, and institutions.

Industrial Wastes - waterborne wastes produced as the result of manufacturing or processing operations.

Infiltration - water that enters the sewage system from the surrounding soil. Common points of entry include broken pipe and defective joints in pipe and manhole walls. Although generally limited to sewers laid below the normal groundwater level, infiltration also occurs as a result of rain or irrigation water soaking into the ground and entering mains, manholes, and even shallow house sewer laterals with defective joints or other faults.

Base Infiltration - water that enters the sewage system from the surrounding soil during periods of low groundwater levels.

Inflow - water that enters the sewage system from surface runoff. Inflow may enter the sewer system through manhole covers, exposed broken pipes and defective pipe joints, cross connections between storm sewers and sanitary sewers, and illegal connections of roof and area drains.

Excessive Infiltration and Inflow (I/I) - portion of infiltration and/or inflow which can be removed from the sewage system through rehabilitation at less cost than continuing to transport or treat that portion of I/I.

Average Dry Weather Flow (ADWF) - the average flow measured during a dry weather season, usually May 1 to October 31, and during low groundwater levels that occur on a daily basis. During periods of little or no precipitation, wastewater flow is composed primarily of sanitary sewage, commercial and/or industrial wastes. Base infiltration may be present.

Maximum Monthly Dry Weather Flow (MMDWF) - is the monthly average flow which has only twenty-percent probability of being experienced during May to October in any given year. In other words, this flow represents the wettest dry weather season monthly average flow that is anticipated to have a five-year recurrence interval. For western Oregon, May is usually the month that has the highest dry weather flow.

Average Wet Weather Flow (AWWF) – the average flow measured during the wet season, usually November 1st to April 30th. This value may be utilized as a basis for higher winter mass load limits.

Maximum Monthly Wet Weather Flow (MMWWF) - is the monthly average flow which has only twenty-percent probability of being experienced during November to April in any given year. This flow represents the wettest wet season monthly average flow that is anticipated to have a five-year recurrence interval. For western Oregon, January is usually the month that has the highest wet weather flow.

Peak Instantaneous Flow (PIF) - is the highest hourly flow measured during wet weather. The addition of increased I/I during periods of high groundwater levels and rainfall may produce flows several times greater than the ADWF. This value determines the hydraulic capacity of major process units, sewers, channels, and pumps.

Biochemical Oxygen Demand (BOD) - is a measure of wastewater strength in terms of the quantity of oxygen required for biological oxidation of the organic matter contained in wastewater. The BOD loading imposed on a treatment plant influences both the type and degree of treatment, which must be provided to produce the required effluent quality. All references to BOD in this report are with respect to five-day BOD and 20° Celsius.

Total Suspended Solids (TSS) - is a measure of the quantity of suspended material contained in the wastewater. The quantity of TSS removed during treatment influences the sizing of sludge handling and disposal processes, as well as the effectiveness of disinfection with chlorine.

Sludge – the biomass in the digesters of a wastewater treatment plant.

Biosolids – the biomass that has been removed from the digesters of a wastewater treatment plant.

4.2 Wastewater Flowrates

Dry weather and wet weather flows and infiltration and inflow (I/I) are important in the design of wastewater collection, treatment and disposal facilities. The MMDWF usually determines the maximum organic loading of the major treatment process units. The MMWWF determines the size and capacity of the major process units necessary to provide the desired degree of treatment. The PIF determines the hydraulic capacity of pipelines, pumps, channels, and inlet structures and the reserve capacity of units such as clarifiers and disinfection facilities. The flows used for this study are based on flows recorded by the effluent flow meter, which is calibrated annually. This facility does not have an influent flow meter.

WWTP Dry Weather Flow

The average dry weather flow (ADWF) was determined to be 0.34 MGD from analysis of treatment facility flow records for the months of May through October beginning in January 1997 and ending in December 2001. The ADWF can be divided into two components: base sewage flow and base infiltration. The base sewage flow is the portion of the treatment plant flow attributed to sanitary sewage and was estimated based on the City's water consumption records. The average water consumption for Bandon residents is estimated to be 84 gpcd based on usage from November 2000 to May 2001 (time period of minimal irrigation and other non-consumptive uses). The base domestic sewage flow to the treatment plant is estimated to be 0.23 MGD. In determining projected flows, allowance must be made for unavoidable infiltration that is dependent upon such factors as the quality of material and workmanship in the sewers and building connections, the character of maintenance, and elevation of the surrounding groundwater in relation to that of the sewers. The base infiltration is found by comparing the difference of the ADWF and the base sewage flow. The base infiltration is calculated to be approximately 0.11 MGD or 40 gpcd.

The Maximum Monthly Dry Weather Flow (MMDWF) was determined, following DEQ guidelines, by graphing 2000 and 2001 dry weather (June – October) flow for the average daily flow for each month versus the total monthly rainfall. Linear regression was used to fit a line to the data. The May 90% rainfall figure of 5.39 inches per month was obtained from the US Weather Bureau Climatological Summary No. 20. This number was plotted against the regression line to obtain the 10-year high dry weather flow of 0.46 MGD. This number is exceeded on a daily basis about once a year during the dry weather months, possibly due to the high number of tourists vacationing during the summer, which can inflate the population by as much as 700 people based on hotel occupancy rates.

WWTP Wet Weather Flow

The average wet weather flow (AWWF) was determined from analysis of treatment facility flow records for the months of November through April beginning in January 1996 and ending in April 2000. The year 2000 is considered a drought year, with only 50% of the normal rainfall, and so was excluded from calculations. The AWWF for Bandon is calculated to be 0.44 MGD or approximately 162 gpcd.

The maximum month wet weather flow (MMWWF) was determined in a manner similar to that employed for determination of the MMDWF. A five-year January rainfall of 14.74 inches was utilized. For this calculation, flow and rainfall data for the months of January through May (1996 to 1999) was utilized. With linear regression analysis of average monthly flow versus rainfall, a MMWWF of 0.89 MGD or 331 gpcd was calculated.

The peak daily average flow associated with a five-year storm ($PDAF_5$) was calculated from a linear regression of daily flows and associated rainfall from January through April, 1996-2000. The five-year, 24-hour rainfall of 5.5 inches was taken from NOAA Atlas 2, Volume X, Figure 26. (No date available) The PDAF was calculated using rainfall data for rain exceeding one inch per day. The PDAF was calculated using the November 19, 1996 data for the record rainfall of 7.5 inches for a PDAF of 1.74 MGD. If this value was dropped from the data set, the calculated PDAF would be 1.7 MGD. These numbers are so close that the November 1996 data was left in the data set, even though it was well above the other rainfall days. The recorded plant flow on November 19, 1996 was 2.25 MGD, well above the design peak day of 2.1 MGD. This is the only recorded incident of the WWTP overflowing raw sewage into the Coquille River due to flows exceeding capacity.

The average flow, maximum daily flow and PDAF were used to calculate the Peak Instantaneous Flow (PIF) based on the probability of occurrence, using logarithmic probability paper, as outlined by DEQ (1996). Such a projection is based on the principle that an average monthly flow is likely to occur 6/12 of the time or 50%, and a peak monthly flow occurs 1/12 of the time or 8.3%. Likewise, peak weekly flow will take place 1/52 of the time or 1.9%; peak daily flow occurs once in 365 days or 0.27%, a peak hour flow happens once in 8,760 hours or .011%. Plotting these numbers against probability gives a current PIF of 2.6 MGD. The peak I/I flow is calculated to be 2.37 MGD based on peak flow minus base sewage. A summary of flow parameters for the WWTP is included in Table 4.2.1.

Table 4.2.1

Bandon WWTP Existing Flow Rates

Parameter	Design	Current 2001	
Population	5,086	2,692*	
EDUs	2,526	1,734	
MMDWF	-	.46 MGD	171 gpcd
MMWWF	-	.89 MGD	331 gpcd
ADWF	.54 MGD	.34 MGD	125 gpcd
AWWF	.82 MGD	.44 MGD	162 gpcd
Base Sewage	-	.23 MGD	84 gpcd
Base Infiltration	-	.11 MGD	40 gpcd
Peak Month	1.2 MGD	1.13 MGD	420 gpcd
Peak Week	1.5 MGD	1.4 MGD	520 gpcd
Peak Day	2.1 MGD	1.74 MGD	646 gpcd
PIF	3.2 MGD	2.60 MGD	966 gpcd
BOD Avg. Day	1,150 ppd	675 ppd	339 mg/l
BOD Max. Month	1,550 ppd	1,013 ppd	467 mg/l
TSS Avg. Day	1,350 ppd	480 ppd	242 mg/l
TSS Max. Month	2,350 ppd	594 ppd	287 mg/l

* Sewered population only.

4.3 Wastewater Composition

Wastewater is generated by residential, commercial and industrial sources. The wastewater composition and load from these sources cannot be ascertained since they are not separately monitored for flows and composition. Monitoring results of the influent wastewater represent the combined wastewater from these sources. The typical composition of untreated domestic wastewater consists of 110 to 400 mg/l BOD and 100 to 350 mg/l TSS. Both BOD and TSS concentrations in Bandon's influent wastewater are within the typical characteristics of raw sewage.

The values from the last five years of plant records are summarized below in Table 4.3.1.

Table 4.3.1

Bandon Influent Characteristics

Parameter	Wet Weather			Dry Weather		
BOD	Average	Low	High	Average	Low	High
mg/l	185	94	354	266	134	467
ppd	566	406	1063	579	299	1580
ppcd	0.21	0.15	0.39	0.22	0.11	0.59
TSS						
mg/l	168	94	292	214	145	287
ppd	526	426	673	469	360	1177
ppcd	0.20	0.16	0.25	0.17	0.13	0.44
Population	2692			2976*		

ppcd = pound per capita per day
* 710 estimated tourists @ 0.4 equivalent use factor =284 additional summer population

There is relatively little variation in total pounds of BOD and TSS in plant influent throughout the year. TSS is stable at about 500 ppd for an average month. 75% of average monthly TSS readings are between 400 and 550 ppd for 1996 through 2001. BOD is more volatile with an average of about 575 ppd and only 55% of the monthly averages within the 500 ppd to 650 ppd range. Changing the drum screen at the headworks out for the auger screen in 2001 has allowed more organics to pass to the secondary treatment process. BOD pounds per day have increased an average of 18% since the installation of the auger screen. BOD and TSS levels for 2001 are used as the baseline in calculating future levels to reflect this substantial change in operation.

4.4 Unit Design Factors

Unit design values for wastewater flow and loads must be established for future planning and design purposes. These values must have enough flexibility to allow for changes in the characteristics of the service area. The analysis of wastewater volume and composition from current WWTP records provided the foundation for unit design values discussed below.

Wastewater Flows

As previously discussed, various flow parameters were determined which characterize the wastewater flow from the City. Base sewage and infiltration, MMDWF, MMWWF, peak daily, weekly and monthly flows were all calculated based on existing flow records. A summary of the unit design flows, both total and on a per capita basis, was previously presented in Section 4.2.

Only base sewage and infiltration flows can be projected on a per capita basis. The projected population to be served by the City in the years 2021 is summarized in Section 2.3.

Wastewater Composition

Fluctuations in loading rates may have a significant effect on the design and process control of a wastewater treatment plant. Data was reviewed to determine representative peaking factors for BOD and TSS loading. Estimated peaking factors for maximum day, maximum month, along with a summary of unit design values, are presented in Table 4.4.1. Supporting calculations are presented in Appendix C.

Table 4.4.1

Unit Design Values - Wastewater Composition

Parameter	BOD	TSS
Average load, ppcd	0.21	0.18
Peaking Factors		
Maximum Month	1.8	1.4
Maximum Day	2.8	3.2

4.5 Projected Flowrates

Bandon's population is projected to increase by 57% by 2021. This does not mean that the sewer system in terms of area served or lineal feet of pipeline will increase by the same amount. There are several subdivisions within the city limits that have not built out, particularly along Beach Loop Drive and Seabird Lane. There are also several areas within the city limits with homes on septic tanks that may be served by line extensions or alternative individual systems. The City of Bandon has established the policy of providing sewer service only to homes within the city limits. Developers are required to pay for line extensions when building in an area not currently served by the public collection system. These requirements have the effect of encouraging infill along existing service lines, with rapid growth along areas of new line extensions. Annexation requires a formal process and agreement of the City and involved property owners, which means that growth into the UGB tends to be slower than within the City. The size of the collection system will grow at a lower rate than the population. This will not affect the base sewage generated by the population, but it does limit the amount of pipe available for infiltration.

While the collection system does not expand proportionately to the population, base sewage will. Unit values calculated in Section 4.2 for the current population will be used to forecast these flows. Base sewage was calculated as 84 gpcd.

Infiltration

Peak I/I is projected to grow to 2.88 MGD by 2021 based on current flow data. The projects identified in the December 2001 I/I study are estimated to reduce I/I flow for those areas about 30% or 0.13 MGD for an average day. That translates into a reduction in the peak I/I flow rate to 2.51 MGD. With these projects and a vigilant I/I reduction program to maintain the integrity of the existing collection system, the capacity of the existing treatment plant is estimated to be adequate through 2021. Without the I/I remediation work, the WWTP is expected to reach capacity when the population reaches about 3,500 people on the sewer system in the year 2010.

For existing developments, flowrate data can be obtained by direct measurement. For areas of future development, methods for estimating flowrates must be utilized. For planning purposes with the potential new development and existing unsewered conditions within the UGB, estimates of wastewater flowrates must be used. It is expected that I/I quantities in new system expansions will be less than the I/I measured in the existing system.

The method proposed by Metcalf and Eddy calculates infiltration for sewers based on different peak infiltration curves for old and new sewers. The curve represents declining peak infiltration per acre as the service area increases. A chart showing the relationship between service area and peak infiltration is included in Appendix C. For Bandon, the existing sewered area is about 1,650 acres. A value of 1,185 gallons per acre-day puts Bandon between the curves for old and new sewers. The existing system is a combination of old and new sewer types, so this finding is reasonable.

The service area is not likely to greatly exceed 2,000 acres in the planning period. Using the new sewer curve and 2,000 acres gives a peak infiltration rate of 600 gallons per acre-day. Dividing this by five homes per acre, the current zoning on undeveloped land, and 2.1 persons per home from the population analysis in Section 2, gives 57 gallons per capita per day for new sewer infiltration. This figure is used in calculating the wet weather infiltration rates for future population growth.

Dry weather infiltration was calculated as the existing base infiltration plus 20 gpcd times the projected increase in population. Using the current 40 gpcd for the existing population, averages a projected base infiltration rate of 33 gpcd in 2021.

Flowrate Calculation

The increase in base sewage, base dry weather infiltration and wet weather infiltration were calculated using the projected population increase (4,241-2,692 = 1,549) multiplied by the factors discussed above. These were added onto the existing ADWF, AWWF, MMDWF, and MMWWF to project the flows for 2021.

4.6 Projected Wastewater Composition

It is estimated that the current sewered equivalent population is around 2,692. By the year 2021, the estimated equivalent population inside the city limits is 4,241. This includes extending sewers to the existing 130 homes that are within the existing city limits, infill development within the existing city limits and annexation of a portion of the land within the UGB. The future wastewater loads to the treatment plant were estimated using the unit wastewater strength values from Section 4.3.

The WWTP treats mostly domestic waste, with only one industrial customer discharging into the collection system, Hardin Optical. Bandon Pacific Fishery discharges directly into the Coquille River and Bandon Cheese Factory trucks their process waste to a farm site for beneficial land application. The assumption is made that industrial use will remain at approximately the current proportion of the load. Loads have been calculated on a per capita basis, without breaking industrial use out as a separate factor. Table 4.6.1 details the current and projected BOD and TSS loads.

Table 4.6.1

Projected Wastewater Loads to Plant (lbs/day)

	Current	Projected 2021
BOD		
Avg. Day	675	902
Max. Month	1,013	1,596
Max. Day	1,580	2,489
TSS		
Avg. Day	480	783
Max. Month	594	1,060
Max. Day	1,249	2,488

The design, current, and projected loads for the WWTP are summarized in Table 4.6.2. The projected 2021 load for the system is well under the daily average design load for the existing treatment plant for both BOD and TSS. TSS levels appear to currently be less than was anticipated in the 1992 facilities plan, (0.18 ppcd currently as opposed to 0.25 ppcd in 1992.) and projected levels remain well under design values for the facility. BOD levels appear to have held steady at 0.21 ppcd, but the peaking factor has increased from a daily peaking factor of 2.0 in 1992 to a current value of 2.8. The highest BOD days are in the summer months. Bandon's successful program to increase tourism, longer retention times for wastewater in the collection system due to lower summer flows, and warmer temperatures are all factors that contribute to high summer BOD levels. Projected 2021 BOD loads are slightly above treatment plant design loads for the maximum month.

Table 4.6.2

Summary of Bandon WWTP Loads

Parameter	Design	Current 2001		Projected 2021**		Projected 2021 With I/I work done	
Population	5,086	2,692*		4,241		4,241	
EDUs	2,526	1,734		2,631		2,631	
MMDWF	-	.46 MGD	171 gpcd	0.62 MGD	146 gpcd	0.57 MGD	134 gpcd
MMWWF	-	.89 MGD	331 gpcd	1.11 MGD	262 gpcd	0.94 MGD	222 gpcd
ADWF	.54 MGD	.336 MGD	125 gpcd	0.5 MGD	118 gpcd	0.5 MGD	118 gpcd
AWWF	.82 MGD	.436 MGD	162 gpcd	0.65 MGD	153 gpcd	0.65 MGD	153 gpcd
Base Sewage	-	.227 MGD	84 gpcd	0.36 MGD	85 gpcd	0.36 MGD	85 gpcd
Base Infiltration	-	.109 MGD	40 gpcd	0.14 MGD	33 gpcd	0.14 MGD	33 gpcd
Peak Month	1.2 MGD	1.13 MGD	420 gpcd	1.41 MGD	332 gpcd	1.2 MGD	283 gpcd
Peak Week	1.5 MGD	1.4 MGD	520 gpcd	1.74 MGD	410 gpcd	1.56 MGD	368 gpcd
Peak Day	2.1 MGD	1.74 MGD	646 gpcd	2.17 MGD	512 gpcd	2.03 MGD	479 gpcd
PIF	3.2 MGD	2.60 MGD	966 gpcd	3.24 MGD	764 gpcd	2.87 MGD	677 gpcd
BOD Avg. Day	1,150 ppd	675 ppd	339 mg/l	902 ppd	.21 ppcd	902 ppd	.21 ppcd
BOD Max. Month	1,550 ppd	1,013 ppd	467 mg/l	1596 ppd	.38 ppcd	1596 ppd	.38 ppcd
TSS Avg. Day	1,350 ppd	480 ppd	242 mg/l	783 ppd	.18 ppcd	783 ppd	.18 ppcd
TSS Max. Month	2,350 ppd	594 ppd	287 mg/l	1060 ppd	.25 ppcd	1060 ppd	.25 ppcd

**Projected is based on current flows and does not include an allowance for I/I reduction anticipated in current remediation projects.

Section

5

Basis of Planning

Section

5

Basis of Planning

5.1 Basis for Design

The basis for design includes regulatory requirements and design criteria. These subjects are discussed in detail below.

Present Regulatory Requirements

The City of Bandon owns and operates its wastewater system under the jurisdiction of National Pollutant Discharge Elimination System (NPDES) waste discharge permit, No. 101546. The Oregon Department of Environmental Quality (DEQ) pursuant to ORS 468B.050 issued this permit. A copy of the City's NPDES permit, with an expiration date of December 31, 2001, is included in Appendix A. An application for extension is currently under DEQ review. A summary of regulatory requirements within the NPDES permit is provided below.

The NPDES permit is divided into five separate schedules: Schedule A - waste discharge limitations not to be exceeded. Schedule B - minimum monitoring and reporting requirements, Schedule C - compliance conditions and schedules, Schedule D - special conditions, and Schedule F – General Conditions. The City is required to collect and analyze, and report on the items or parameters pertaining to the WWTP's influent and effluent. A summary table of these monitoring requirements is provided in the City's NPDES permit, which is in Appendix D. The City is also required to provide notification of cause and estimation of flow associated with any sewage bypasses, record all applicable equipment breakdowns, and report method of sludge disposal.

The requirements pertaining to the City's WWTP effluent discharge to the Coquille River are given in Tables 5.1.1. Mass load limits specified in the City's permit are based on an average dry weather design flow (ADWF) of 0.45 MGD.

Table 5.1.1

Waste Discharge Limitations

	May 1-Oct 31		Nov 1-Apr 30		Year-round
Parameter	BOD	TSS	BOD	TSS	Fecal Coliform/pH
Monthly Average (mg/l)	20	20	30	30	-
Weekly Average (mg/l	30	30	45	45	-
Monthly Average (ppd)	75	75	110	110	-
Weekly Average (ppd)	110	110	170	170	-
Daily Maximum (ppd)	150	150	230	230	-
Minimum Removal (%)	85	85	85	85	-
Monthly Log Mean Ave. (# org/100 ml)	-			-	14
PH	-			-	6<pH<9

Fecal Counts for wastes discharged to estuaries must be below 14 outside of the mixing zone as defined in OAR 340-41-325. Bandon has a 200 foot mixing zone.

In addition to the above requirements, the water quality standards, as defined in OAR 340-41-285, shall not be exceeded except in the following defined mixing zone: 200 feet beyond the point of discharge.

Under Schedule C (Compliance Schedules and Conditions) of the permit, the City was required to submit the following.

- Submit a handling and disposal plan for rags, grit, scum and screenings, a public notification plan for untreated discharges, and a sludge management plan.
- Submit a request to retain the existing mass load limits or an engineering evaluation of the wet weather flow to substantiate a need to raise the existing limit.
- Submit an industrial waste survey.

The City has complied with the submission of the plans and reports.

Oregon Administrative Rules regulate the disposal of biosolids from public sewer facilities. Under OAR 340-050-0070, biosolids may not be land applied during flooding or periods where the groundwater is closer to the surface than one-foot. The existing WWTP was designed for biosolids to be decanted throughout the year. Under the current regulations, biosolids may be decanted for agricultural application only from June through October.

Wastewater treatment facilities, including pump stations, are also required to meet the standards set forth in the National Fire Protection Association (NFPA) 820, Fire Protection in Wastewater Treatment and Collection Facilities. This standard is applicable to all new construction and remodels and is the guide used for risk evaluation of existing facilities. NFPA 820 requires that pump houses with direct access to the wet-well have wiring that meets National Electrical Code Class I, Group D, Division 1 or 2 standards as listed in NFPA 70. NFPA also lists acceptable construction materials for pump stations.

OSHA Permit Required Confined Spaces Standard 29-CFR 1910.146 limits individual access to spaces that might trap a person or contain noxious atmospheres. The North Avenue pump station qualifies as a Permit Required Confined Space and requires special equipment and multiple personnel present for entry.

Oregon building codes require structures built in a floodplain to have the finished floor at least one foot above the 100-year floodplain. Johnson Creek Pump Station is built below the floodplain and has experienced severe water damage.

Future Regulatory Requirements

OAR 340-41-026 (2) requires that, unless otherwise approved by the Environmental Quality Commission, growth and development shall be accommodated within the existing permitted loads by the application of increased treatment and control efficiency. Records indicate that the plant operates within the permit mass load limits. While the WWTP normally operates below the average dry weather flow permit level of 0.45 MGD, high levels of I/I regularly cause plant winter effluent flows to exceed 1.0 MGD.

OAR 340-041-0034 (3) sets forth the following policy guidelines for future sewer planning:

- Each sewer utility is to develop a financing plan for new or modified sewer works.
- The financing plan should assure ability to construct facilities in a timely fashion with locally derived funds.
- Sewer utilities are not to assume grant assistance in addressing planning and construction needs.

The Coquille river is considered water quality limited upstream of Bandon. Tidal action and local marshlands improve the water quality at Bandon to the point that calculating the Total Maximum Daily Load is not required at Bandon.

Design criteria for future conveyance and treatment system expansions are based on topography and the estimated future flows discussed in Section 4. Treatment planning must take into account existing and projected loadings and flows, and regulatory requirements as presented above. General design considerations incorporated in the development and evaluation of alternatives in Section 6 are discussed below.

Design Period

The design period must be long enough to ensure the new facilities will be adequate for future needs, but short enough to ensure effective use within their economic life. The improvement plan for serving the existing UGB will be based on a design period of twenty years for pump stations. Gravity collection line sizing will be based on ultimate build-out. Treatment facility recommendations will be based on a 20-year planning period.

Collection System

Gravity Sewers

Collection systems must be designed considering natural ground slope, subsurface conditions, capacity requirements, minimum slope considerations, minimum flow velocities required to maintain solids suspension, and potential sulfide and odor generation.

Collection sewers should be designed for ultimate development of areas. The minimum diameter of sewers should be eight-inches for maintenance purposes. Short, non-extendable six-inch sections up to 250 feet are permissible. Pipe sizing above eight-inches should be based on anticipated flows and master planning, not minimum slope considerations. Manholes should be spaced no more than 500 feet apart for sewers up to 24-inches in diameter. Manholes should also be used where sewer alignment, slope, or pipe size changes. To facilitate self-cleaning, a drop should be incorporated in the manhole base. Flow channels in manholes should be designed with a 0.1-foot drop from inlet to outlet. The minimum drop for an outlet at right angles to an inlet of the same diameter should be 0.2 feet. Manholes should have a minimum inside diameter of 48-inches at the bottom and have a 23-inch minimum opening. Flattop manholes should be used when the depth to the invert is six feet or less; otherwise standard eccentric cone type manholes should be used. Pipe inverts over two feet from the bottom of the manhole should have a drop elbow and pipe.

Minimum pipe slopes are established to ensure flow velocities high enough for self-cleaning of the pipe. Slope is the key criterion in designing a wastewater collection system to avoid sulfide problems. Sewers designed with long runs at minimum slope are prone to sulfide generation due to long residence times, poor oxygen transfer, and deposition of solids. Current conventional design practice recommends that a minimum velocity of two feet per second (fps) be achieved regardless of pipe size to maintain a self-cleaning action in sewers. It is desirable to have a velocity of three fps or more whenever practical. Minimum slope for service laterals should be 2% (¼-inch drop per foot).

Standard methods of determining the slope for self-cleaning velocities are based on pipes flowing at least half-full. Where flows are expected to be less than half-full on a regular basis and adequate grade exists, a slope should be used that will provide velocities of three fps for full or half-full pipes. In general, minimum slopes should be established based on this information, which is summarized below in Table 5.1.2.

Table 5.1.2

Slopes for Sewers (based on Manning's n = 0.013)

Nominal Pipe Diameter (in)	Minimum Slope (2 fps)	Recommended Slope (3 fps)
4	0.02	0.02
6	0.0060	0.0110
8	0.0040	0.0075
10	0.0028	0.0056
12	0.0022	0.0044
15	0.0015	0.0033
18	0.0012	0.0026

Force Mains

Most force mains should have a nominal diameter of at least four-inches to pass larger solids. In general, velocities of at least 3.5 fps are desirable in small force mains to help maintain self-cleaning action. Larger force mains should convey higher velocities periodically. In no case should the velocity in a force main be less than 2.5 fps. Very high velocities in force mains will result in high friction losses and larger pump motors being required thus design must address maximum velocities. Velocities above eight fps are usually considered excessive. The design should also address transient or pressure surges due to sudden velocity changes, especially in long force mains. Minimum flows required to obtain recommended force main velocities are shown in Table 5.1.3.

Table 5.1.3

Minimum Force Main Flows (gpm)

Force Main Inside Diameter (in)	Flow for Velocity of 2.5 fps	Flow for Velocity of 3.5 fps	Flow for Velocity of 5.0 fps
3	55	77	110
4	98	137	196
6	220	308	441
8	392	548	783
10	612	857	1,224
12	881	1,234	1,762
14	1,200	1,679	2,399

The number of high points in a force main should be kept to a minimum. Air and other gases can become trapped at high points reducing the pipes capacity. A means of releasing air or gases trapped at high points is usually required. Sewage air relief valves are commonly used to release trapped air and gases at high points that are not at the end of the force main. Sewage air relief valves may not be required if the force main is small in diameter or length, or velocities are sufficient to move trapped air and gases.

Pump Stations

Design of pump (lift) stations is a critical element of sanitary sewer collection systems. The pump station installation must be able to handle the peak flows in the system without bypassing and designed so as not to increase the total sulfide generation potential of the collection system. Contemporary design practice requires some wet-well storage of wastewater plus retention in the force main, both of which tend to increase the potential sulfide generation when supplemental aeration is not provided. To minimize sulfide generation, wet-wells should be as small as possible while still allowing for future growth. Wet-well detention times of 30 minutes or less are recommended to avoid sulfide generation[1]. When detention times in the pump station force main exceed 25 to 30 minutes, a system to control hydrogen sulfide generation, and the accompanying odor and corrosion problems, is recommended.

Pump stations should have redundant pump equipment and provisions for emergency generator operation. Power outage frequency and duration must be considered in pump station design to ensure that overflows do not occur due to power loss. In some cases, a portable generator connected to the pump station with a manual transfer switch will suffice. In larger pump stations, a permanent standby generator may be required. Level controls should include a redundant high wet-well level sensor.

Pressure Sewers

Pressure sewers use individual pumps on each property with either a grinder pump (GP) or a septic tank effluent pump (STEP) used. The major difference between the two systems is in the onsite equipment and layout. GP systems have a small pump and basin. STEP systems typically have a 1,000-gallon septic tank with a pump conveying the supernatant into the system. Pressure sewers generally use smaller diameter pipe and are installed shallower than conventional gravity sewers and usually result in lower construction costs in less populated areas. Pressure sewers are considerably independent of slope. Because the mains are pressurized there is no infiltration.

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[1] EPA/625/1-85/018 "Odor and Corrosion Control in Sanitary Sewer Systems and Treatment Plants"

Service connections in pressure sewer systems are typically 1.25-inch diameter. Cleanouts are used to provide access for flushing. Automatic air release valves are required at and slightly downstream of summits in the sewer profile. GP systems should be designed so that a pipe velocity of three to five fps is achieved at least once every day. GP effluent is generally about twice the strength of conventional wastewater (e.g., BOD and TSS of 350 mg/L). STEP effluent is pretreated and has a BOD_5 of 100 to 150 mg/L and SS of 50 to 70 mg/L. Both can be assumed to be anaerobic and potentially odorous if subjected to turbulence.

STEP systems require pumpout of interceptor tanks at three to five year intervals. Owing to their tendency to accumulate grease in their tankage, GP units are often pumped as part of the annual preventative maintenance check. Energy costs are borne by the homeowner and range from $1.00 to $2.50 per month depending on the horsepower of the unit. Total O&M costs are estimated at $100 to $200 per year per unit for tank pump out and equipment repair.

Wastewater Treatment Facility

Primary consideration will be the degree of treatment required to meet the discharge requirements and sufficient sizing of the facility to handle future projected peak hydraulic and organic loads.

Flexibility

Conveyance and treatment design should allow for flexibility in operation and maintenance. The treatment plant operator must have the ability to alter plant flows around the major process units without significantly degrading effluent quality. This goal can be achieved by providing redundant units and multiple interconnections between units when appropriate. Conveyance and treatment equipment design should also be such that maintenance, both routine and emergency, can be performed without excessively loading other components. Flexibility is also needed to ensure discharge requirements can be met during changing influent conditions and also allow construction and connection of new process units as needed.

Reliability

Reliability of treatment processes depends on proper application of unit loading factors and conservative selection of equipment to ensure long life and minimum maintenance costs. Each unit process should be selected based on its capabilities to effectively treat the waste characteristics for the specific application. Capabilities of the treatment plant operator and the community should also be considered. Processes that require high degree of manual labor and specialized instrumentation should be avoided in most cases. Electrical equipment should be above the local flood zone and back-up power generation provided. Redundancy is also a key factor in reliability.

The Environmental Protection Agency (EPA) has developed system design criteria for minimum standards of reliability for wastewater treatment works (1974). The minimum standards are defined into three classes of reliability. The following is a description of these three classes (Ibid 1974).

- Reliability Class I - Works that discharge into navigable waters that could be permanently or unacceptably damaged by degraded quality effluent for only a few hours. Examples of this class include discharges near drinking water reservoirs, into shellfish waters, or in close proximity to areas used for water contact sports.

- Reliability Class II – Works that discharge into navigable waters that would not be permanently or unacceptably damaged by short-term effluent quality degradations, but could be damaged by continued (on the order of several days) effluent quality degradation. An example of this class is a discharge into recreational waters.

- Reliability Class III – Works not otherwise classified as Reliability Class I or II.

Bandon's WWTP discharges into shellfish waters, which requires Class I Reliability

The system design criteria for Reliability Class I works includes backup requirements for the main wastewater treatment system components. In general, unit operations in the main wastewater treatment system shall be designed such that, with the largest flow capacity unit out of service, the hydraulic capacity of the remaining units shall be sufficient to handle 75 percent of the design wastewater flow to that unit operation for Class I. In addition, there should be system flexibility to enable the wastewater flow to any unit out of service to be distributed to the remaining units in service. The Bandon WWTP meets these criteria.

Operability

Operation of wastewater systems entails considerable responsibility and cost while providing public health benefits. For these reasons, personnel assigned to operate and maintain a treatment facility must be trained appropriately. The more sophisticated the process or equipment, the greater the level of expertise that is needed. Qualified individuals are usually available in metropolitan areas, as is financial support for their employment. However, small communities often have a problem in finding the personnel and the money with which to pay them. Consequently, the selection of a treatment process or equipment should reflect the regional and local level of training of operations and maintenance.

Durability

Conveyance and treatment systems should consist of materials and equipment that are capable of satisfactory performance over the entire design life/period of the wastewater system components. The selection of durable wastewater system components is a matter of judgment based on a number of factors including type/intensity of use, type/quality of materials used in construction, quality of workmanship during the initial installation, and expected maintenance to be performed during life of the component. For Bandon, direct exposure to salt sea-air needs to be an additional consideration in selecting suitable materials.

Capacity

Individual treatment components must be capable of handling the hydraulic flow through the plant during peak wet weather rainfalls and be sized to treat the mass loads projected for the facility. Jon Gasik of Oregon DEQ (2002) suggests the following guidelines:

- All units should be able to handle the peak hourly flows without overflowing or damaging equipment.
- The headworks should be sized for peak hourly flows.
- Primary clarifiers, when present, should be sized for peak daily flows.
- Aeration basins should be sized using modeling to generate desired treatment. Typically, 10 mg/L at MMDWF (Summer) and 30 mg/L at MMWWF (Winter).

- The secondary clarifiers should be sized for either the peak day with both clarifiers operational or the MMDWF with the largest clarifier off line, whichever results in the greater treatment capacity. Overflow rates for the separate seasons should be used. (e.g. 1200 for winter and 800 for summer)
- The disinfection system should be sized for peak hour flow. The contact chamber should be sized for at least 15 minutes of contact time at the peak hour flow, 20 minutes at peak day, or 60 minutes at ADWF, whichever results in the largest basin.

Sizing of the digester is based on the suspended solids level of the incoming mixed liquor and the exiting biosolids in addition to the holding time in the digester and the amount of plant influent. The assumption is made that sludge is held for 60 days, to meet DEQ pathogen reduction requirements, and that biosolids are removed at 2% solids. The plant is designed for a 55 day holding period, but use of the 60 day period is justified by Bandon's mild winter temperatures.

Miscellaneous

Consideration of site location, daily operational tasks, public perception, health and safety concerns, noise, access to equipment, human factors, and hazardous area all have to be analyzed when assessing the conveyance and treatment alternatives. Plant operations should make efficient use of public resources, while maximizing public safety.

Biosolids Disposal

Biosolids originate as leftover waste materials, domestic septage and sewage sludge, which are generated from sewage treatment. Presently biosolids produced at the WWTP are aerobically digested and land applied on a DEQ approved site. In this section, the most viable biosolids stabilization processes and disposal methods for the WWTP will be identified, evaluated, and recommended.

An important consideration in biosolids management is compliance with applicable regulatory requirements and regulations. The use and disposal of biosolids derived from sewage sludge are regulated under 40 CFR Part 503. Biosolids cannot be applied to land or placed on a surface disposal site unless it has met the two basic types of requirements in Subpart D of the Part 503 regulations: pathogen reduction and vector attraction reduction. These requirements are discussed in detail below.

The pathogen reduction requirements for biosolids are divided into two categories: Class A and Class B. Class A requirements for biosolids are more stringent than for Class B and require pathogens to be reduced to below detectable levels. Biosolids that are sold or given away in a bag or other container for application to land or in bulk applied to a lawn or home garden must meet Class A requirements. In addition, there are no site restrictions for the land application of Class A biosolids. Treatment processes capable of meeting the Class A requirements under specified operating conditions includes composting, heat drying, heat treatment, thermophilic aerobic digestion, beta ray irradiation, gamma ray irradiation, and pasteurization.

Class B requirements are imposed to ensure that pathogens in the biosolids have been reduced to levels that are unlikely to pose a threat to public health and the environment under the specific use conditions. For the application of Class B solids to land, site restrictions are imposed to minimize the potential for human and animal contact with the biosolids until environmental factors have further reduced pathogens. Class B solids cannot be sold or given away in bags or other containers for land application. Processes capable of meeting Class B requirements under specified operating conditions include aerobic digestion, air drying, anaerobic digestion, composting and lime stabilization.

In addition to pathogen reduction requirements, Part 503 regulations specify vector reduction requirements. These requirements are aimed to reducing transport of pathogens via vector transmission. Vectors are any living organisms (e.g. insects, birds, rodents) capable of transmitting a pathogen from one organism to another either mechanically or biologically. Options for vector reduction described in the Part 503 regulations are designed to either reduce the attractiveness of biosolids to vectors or prevent the vectors from coming into contact with the biosolids. One option that is commonly used by small communities for vector attraction regulations is minimum 38 percent reduction in volatile solids content during biosolids treatment (e.g. aerobic and anaerobic digestion).

5.2 Basis For Cost Estimate

The cost estimates presented in this Plan will include four components, each of which is discussed in this section. The estimates presented herein are preliminary and are based on the level and detail of planning presented in this Study. As projects proceed and as site specific information becomes available, the estimates may require updating.

Construction Costs

The estimated construction costs in this Plan are based on actual construction bidding results from similar work, published cost guides, and other construction cost experience. Reference was made to the drawings of the existing facilities to determine construction quantities, elevations of the major components, and treatment of wastewater during construction. Estimates will be based on preliminary layouts of the proposed improvements.

Future changes in the cost of labor, equipment, and materials may justify comparable changes in the cost estimates presented herein. For this reason, common engineering practices usually tie the cost estimates to a particular index, which varies in proportion to long-term changes in the national economy. The Engineering News Record (ENR) construction cost index is most commonly used. This index is based on the value of 100 for the year 1913. Average yearly values for the past twelve years have been summarized in Table 5.2.1.

Estimates in this Plan are based on year 2002 costs. Future yearly ENR indices can be used to calculate the cost of projects for their construction year based on the annual growth in the ENR index. Without using the future ENR Index, costs for construction performed in latter years should be projected on an increase of three percent per year.

Contingencies

A contingency factor equal to 15% of the estimated construction cost has been added. In recognition that the cost estimates presented are based on conceptual design, allowances must be made for variations in final quantities, bidding market conditions, adverse construction conditions, unanticipated specialized investigation and studies, and other difficulties which cannot be foreseen at this time but may tend to increase final costs.

Table 5.2.1

ENR Index - 1990 To 2001

Year	Index	% Change
1990	4732	2.54
1991	4835	2.18
1992	4985	3.10
1993	5210	4.51
1994	5408	3.80
1995	5471	1.16
1996	5620	2.72
1997	5825	3.65
1998	5920	1.63
1999	6060	2.36
2000	6222	2.67
2001	6342	1.93
	Average Annual Change =	2.62%

Engineering

The cost of engineering services for major projects typically include special investigations, a predesign report, surveying, foundation exploration, preparation of contract drawings and specifications, bidding services, construction management, inspection, construction staking, start-up services, and the preparation of operation and maintenance manuals. Depending on the size and type of project, engineering costs may range from 15 to 25% of the contract cost when all of the above services are provided. The lower percentage applies to large projects without complicated mechanical systems. The higher percentage applies to small, complicated projects. The engineering costs for design and construction of this project will average about 20% of the construction cost.

Legal and Administrative

An allowance of 5 % of construction cost has been added for legal and administrative services. This allowance is intended to include internal project planning and budgeting, grant administration, liaison, interest on interim loan financing, legal services, review fees, legal advertising, and other related expenses associated with the project.

Operation and Maintenance Costs

O&M costs are difficult to predict since they depend on many things including the owner's policies, varying costs of labor and materials, specific maintenance required, and repair crew time required. In addition, future power costs are usually unknown. For the estimates used in this Plan, annual pump station operation and maintenance costs are taken as 5% of the construction cost (excluding power costs). STEP system O&M costs are $145/year per tank plus $500 per mile of piping. Grinder pump system O&M costs are taken as $225/year per tank plus $500 per mile of piping. Power costs are estimated using a cost of 7 cents per kW-hr. Gravity sewers are anticipated to be cleaned/flushed once every five years at a cost of 65 to 85 cents per foot. Additionally, annual O&M funds include an allowance to TV inspect 25% of the sewer length in 20 years at cost of $1.50 per foot.

Annual O&M costs listed for STEP systems include power consumption costs equal to $15 per year per tank. STEP tanks will require pumping about every three to six years. Grinder pump basins should be cleaned every one to three years to remove accumulated grease. Grinder pump power costs are about $30 per year per pump.

5.3 Sewer System Analysis Methodology

For development and implementation of a successful I/I reduction program, it is necessary to identify the following features or conditions of the existing conveyance system.

- Key components within the conveyance system.
- Impact of high groundwater and rainfall on the conveyance system.
- System areas with limited hydraulic capacity and/or frequent blockage problems.
- Sources of extraneous flows.

Several analyses and investigations were performed to identify the above information. Analyses included conducting preliminary field investigations, performing flow mapping and analysis, and smoke testing. The analysis methods are discussed below. The City of Bandon Infiltration/Inflow Study was presented to the City under separate cover in December 2001. Results of that study are summarized in Section 4.

Smoke Testing

Smoke testing was performed to detect inflow and shallow infiltration sources. This technique utilizes a non-toxic "smoke" that is forced into sections of the sewer lines with a blower. The smoke then surfaces at deficient locations, such as open cleanouts, roof drains, catch basins, and broken or leaking pipes. The location and type of deficiency (e.g. open cleanout) are noted and documented.

I/I Flow Mapping & Analysis

Flow mapping studies are performed to determine the quantity and sources of extraneous water that enters a sewer collection system. In order to differentiate the I/I from sanitary flows, flow-mapping studies are typically conducted at night between midnight and five a.m. It is presumed that during these hours most residential users will be sleeping and the domestic flow component will be negligible.

Sewer inspections and measurements of I/I flows are performed during the high groundwater months. Investigations are typically made at selected manholes within a system both during a storm event and during a winter dry period to establish, respectively, the total I/I and to establish the infiltration component alone.

For flow mapping, two crews, three persons each, including one man from City staff, move from manhole to manhole as expeditiously as possible during the middle of the night. The term mapping refers to the sequential order of obtaining instantaneous flow readings between each manhole section.

Flow measurements were conducted by opening mainline manholes, visually assessing flows from the side laterals and the main, inserting a flow measuring device to obtain an instantaneous flow reading before proceeding to the next manhole upstream. Instantaneous flow measurements were made by inserting an Isco® Flow Poke™ into the incoming pipe segments. This flow device utilizes an open channel measuring technique (manometer attached to an open channel V-notch weir insert). During the flow mapping, general observations concerning the condition of the manholes were noted and documented.

Television Inspection

Approximately 11,000 lineal feet of gravity sewer lines were inspected by video camera. The City of North Bend Wastewater Department conducted the inspection and has provided Bandon with two videotapes and detailed reports. Inspection of the sewer lines with a TV camera permits specific identification of clogging and I/I sources and more specific recommendations as to correction of any problems/defects. These recommendations are discussed in the Bandon I/I Study, bound separately.

5.4 Evaluation of Conveyance System and WWTP

The design capacity of the City's conveyance system and wastewater treatment plant was estimated to assess the present and future operation of Bandon's wastewater facilities. This analysis and evaluation was limited to the main components of the City's system. DEQ's minimum design flows for the basis of planning were utilized to assist in this evaluation.

Conveyance System

The conveyance system was computer modeled using the XP-SWMM2000 Stormwater and Wastewater Management Program, 50-node edition. Gravity flows were modeled in hydraulic mode, using the Manning formula for open channel flow. The existing conveyance system was split into two portions, East and West Bandon along the east and west interceptor lines. While the total length of pipe in the system was modeled, manholes and cleanouts were reduced to simplify the model and stay within the capacity of the program. Key manholes were selected for modeling, representing typical areas, areas of converging branch lines, and changes in slope and pipe direction. All flows were modeled as entering the system at the manholes and pump stations.

Current flows were based on existing connections as copied directly from the City of Bandon Public Works Department infrastructure drawings. Future flows were based on 5,400 square foot lots in areas with platted lots and streets and at five housing units per acre, in the currently undeveloped areas of the city limits and UGB without platted streets. The undeveloped areas are not anticipated to reach full build out within the study period, however future flows were modeled at full build out for sizing piping.

Slopes, inverts, sizing and lengths of piping were taken from original construction drawings, the City infrastructure maps or field observations where available. Where no drawings were available, manhole elevations were taken from topographic maps and piping was assumed to follow the slope of the land surface. Manning's numbers were assumed to be 0.014 for concrete pipe and 0.011 for PVC pipe and pipe lining.

Flows were based on 2.1 occupants per household as developed in Section 3 and flows of 124 gpcd base sewage and 177 gpcd for I/I. I/I for new sewers was calculated at 57 gpcd in Section 4, bringing the total flow to 301 gpcd for existing sewers and 181 gpcd for areas with new sewers. Basin 13 has mainly PVC pipe and was modeled using the I/I rate for new sewers. Base sewage was profiled to follow the hourly use curve recommended by Metcalf and Eddy. (See Appendix C) Daily I/I was profiled to match a five-year 24-hour storm, with the peak of the storm occurring during peak sanitary sewer flows. This presents a worst-case scenario for pipe sizing.

Pump station capacities were checked by performing pump down tests. The fluid levels in the wet-wells were monitored while the pumps were in manual off position and the flow rate was calculated. The pumps were then run for a set time and the wet-well level measured before and after. This provided the information needed to calculate the pump flow rates. Filmore Avenue was not tested due to lack of access to the wet-well and the VFDs on the pumps. Both pumps have been recently rebuilt and should be operating at rated capacity.

WWTP Facilities

The main components of the WWTP examined include the headworks, secondary treatment, ultraviolet (UV) disinfection chamber, and effluent outfall line. The 2021 projected flow rates for the plant do not exceed the construction design as detailed in the Brown and Caldwell construction drawings from 1993 and the 1992 facilities plan.

Headworks

The headworks consist of two main components: screening and grit removal. The design flow for the auger screen is 3.2 MGD. The screenings compactor is designed to handle 12 cubic feet per hour of solids, with current solids generation at 95 cubic feet per month. The headworks appear capable of handling the PIF of 3.2 MGD expected in the year 2021.

Secondary Treatment

Secondary treatment consists of two aeration basins, two clarifiers and three digesters. Digester capacity is discussed under sludge handling. The two aeration basins are divided into seven cells. Basins may be operated in plug flow, step flow or contact stabilization (reaeration) mode. The recommended flow for high rain periods is contact stabilization with the RAS reaerated in cells number one, two and three before being fed raw wastewater. This shifts solids from the clarifiers and helps prevent solids washout. In this mode, the construction design rate for the aeration basins is six hours of contact time for peak month average flows of 1.2 MGD.

The aeration basins have a total liquid capacity of 40,000 cubic feet. At 75 pounds of BOD per 1000 ft^3 per day, the plant has an approximate BOD capacity of 3,000 pounds per day in contact stabilization mode. This capacity exceeds the projected load of 1,596 maximum month load projected for 2021.

The secondary clarifiers have a design PIF overflow rate of 1,000 gallons/day/sf. The 45-foot clarifier diameter gives a total capacity of 3.2 MGD. Each clarifier is designed to handle 2.4 MGD at an overflow rate of 1,500 gpd/sf, which meets the DEQ requirement of each clarifier sized for 75% of the PIF. The clarifier hydraulic capacity appears to meet the projected flow rates for 2021 based on the original construction data and providing the I/I projects are instituted and maintained.

The average and maximum monthly BOD loading to the WWTP during the study period are 573 ppd and 1,013 ppd, respectively. Construction specifications for the facility list the design plant load as 1,150 ppd average and 1,550 ppd maximum month. Projected load for 2021 is 902 ppd average and 1,596 maximum. The projected maximum month BOD slightly exceeds the plant design. Permit levels require an 85% reduction in BOD and TSS. The allowed mass load limits and effluent concentrations are shown in Table 5.4.1.

Table 5.4.1

Permit Mass Limits For Bandon WWTP

Parameter	**Average Effluent Concentrations**		**Mass Load Limitations**		
	Monthly	Weekly	Month Avg. Pounds	Weekly Avg. Pounds	Daily Max. Pounds
BOD Summer	20 mg/l	30 mg/l	75	110	150
TSS Summer	20 mg/l	30 mg/l	75	110	150
BOD Winter	30 mg/l	45 mg/l	110	170	230
TSS Winter	30 mg/l	45 mg/l	110	170	230

Summer = May 1 – October 31 Winter = November 1 – April 30

Based on the permit concentration limits, Bandon is eligible to apply for a mass load limit increase for wet weather flows. If approved, this increase would raise the winter limit to as much as 200 ppd for the monthly average, 300 ppd for the weekly average and 400 ppd for the daily maximum. Documentation for the limit increase is included in Appendix C. DEQ requires an active I/I reduction program for limit increases. Bandon has recently completed an I/I study and addressed the identified inflow sources, a major component of the DEQ requirements. It is recommended that Bandon apply for the mass load increase to meet the growing population demands on the facility.

Current operation of the facility meets the DEQ permit limits.

Conclusions. The headworks and secondary treatment systems appear to have adequate capacity to meet the projected load for the study period.

Ultraviolet Disinfection and Contact Chamber

The existing ultraviolet treatment system consists of two flow channels, each with three UV modules. The original design calls for the modules to be flow controlled, with one channel handling flow up to 1.6 MGD and one module on at all times. Additional modules are brought on line at 0.7 MGD and 1.4 MGD. The system utilizes two-channel operation for flows above 1.6 MGD with one module active in each channel. When effluent flows exceed 1.4 MGD a second module activates in each channel, with a third set of modules activating when the flow exceeds 2.8 MGD.

The system is designed for 12.5 seconds of exposure with both channels operating and 3.2 MGD of flow. Minimum required exposure time is 9.5 seconds with the effluent TSS at 30 mg/l, UV intensity at 70% of initial lamp intensity and 65% transmittance. The projected PIF of 3.2 MGD is within the design parameters for the UV treatment system.

Current practice is to run both UV channels continuously with all six modules activated. With the current high effluent quality and effective plant management, it is recommended that the UV system be operated with flow-paced control. This will reduce energy consumption at the facility as well as extending average lamp life to over four times the current installed time. Extending lamp life reduces hazardous waste, as UV lamps contain a small but significant amount of mercury. Running only one channel will reduces maintenance time for lamp cleaning and lamp changing by 50%.

Effluent Outfall Line

The existing main effluent outfall line was evaluated to determine its ability to convey the existing and future PIF. The existing main discharge line, Outfall No.1, consists of approximately 500 lineal feet of 12-inch diameter line. The emergency outfall line, Outfall No.2, consists of approximately 170 feet of 12-inch diameter pipe. The capacity of Outfall No.1 was determined for gravity flow, assuming a slope of 3.5%, a high tide of 7.93 feet and a mean water level of zero feet. With gravity flow, the 12-inch gravity line, flowing full with n=0.011, has a capacity of approximately 4.5 MGD at low tide conditions and 2.6 MGD at high tide conditions. Outfall No. 2 capacity is equivalent that of Outlet No.1.

The maximum registered daily effluent flow at the plant was 2.25 MGD on November 19, 1996. The rainfall that day was 7.5-inches, the equivalent for Bandon of a 25-year, 24-hour storm and the Coquille River was at the 100-year flood stage of 12 feet. This is the only recorded instance of Outfall No.2 for the plant being utilized.

Biosolids Treatment, Storage & Disposal

Biosolids treatment at the WWTP was reviewed in terms of actual and required digester capacity to comply with 40 CFR Part 503 regulations on control of pathogens and vector attraction. Control of pathogens for WWTP biosolids was evaluated using Class B Alternative 2: Use of Processes to Significantly Reduce Pathogens, PSRP (EPA 1995). For aerobic digestion, the mean cell residence time and temperature shall be between 40 days at 20°C and 60 days at 15°C. Vector attraction reduction was analyzed using Option 1, which is at least 38 percent reduction in volatile solids during treatment (EPA 1995). With the current WWTP operating parameters and assuming a mean cell residence time of 60 days, the required tank capacity to comply with the pathogen and vector attraction requirements is estimated to be from 175,000 to 185,000 gallons (see Appendix D). Projections for 2021 show a requirement for digester capacity of between 300,000 and 315,000 gallons. The existing three digesters have a combined capacity of 368,000 gallons. The existing digester space is adequate for the projected flows, provided adequate winter biosolids disposal methods and sites are available.

The City currently disposes of its biosolids by land application in the dry weather months. Two farm sites are currently utilized with City personnel spraying the biosolids with the facility tank truck. Additional sites are being negotiated for future use.

Approved sites for beneficial application of biosolids are currently available for use under DEQ permit only between late June and October. This means that sludge is held in the digester for as long as possible in the winter. The existing digester is oversized for the current population and careful management has enabled sludge to be held for over 150 days. Usually the digester reaches capacity by April, and biosolids are trucked to another facility for disposal. Bandon currently trucks between 50,000 and 100,000 gallons of biosolids each April to the City of North Bend WWTP for disposal at an annual cost of between $7,500 and $14,000. (See Appendix C for cost breakdown.) North Bend will soon need the full capacity of its lagoon, and anticipates closing the facility to outside biosolids disposal in less than five years.

The Dew Valley beneficial use site is an upland beach terrace and portions of the site could be approved for conditional applications as early as April of each year. Use of the site in spring would depend on soil and air temperatures, soil moisture content and a prediction for a period of dry weather.

The WWTP is capable of producing biosolids at 2.2% solids. At this concentration, anticipated biosolids generation in the Year 2021 is approximately 3,000 gallons per day or 540,000 gallons for a six-month period. The existing sludge drying beds hold about 65,000 gallons, but no longer have a roof. This is only 12 % of the storage capacity needed for long term planning, although the beds could be tarped and used for temporary storage. A storage tank with adequate freeboard would require a capacity of 700,000 gallons. There is room for a storage tank or additional digester at the current drying bed location.

Disposal of the WWTP biosolids was evaluated with respect to regulatory requirements pollutant limits (i.e. 40 CFR Part 503, Subpart B) and to agronomic rate for the on-site vegetation (i.e. nitrogen). The Part 503 rule requires that biosolids be land applied at a rate that is equal to or less than the agronomic rate for nitrogen at the application site. Additional Part 503 requirements include the following (EPA 1995).

- Biosolids cannot be land applied unless trace element concentrations in the sludge are below ceiling concentrations specified in Part 503.
- Biosolids must meet either (1) the pollutant concentration limits specified in Table 3 of Part 503 or (2) the Part 503 cumulative pollutant-loading rate (CPLR) limits for bulk biosolids.

The amount of plant available nitrogen (PAN) currently applied to the City's biosolids reuse sites was first calculated and then compared with the nitrogen requirements of the site. The PAN provided at the reuse site from 1999 to 2001 was calculated using procedures outlined in EPA's *Process Design Manual - Land Application of Sewage Sludge and Domestic Septage* (1995). For the PAN calculation, measured nitrogen concentrations (e.g. TKN, nitrate, etc.) and solids concentrations from 1999 to 2001 biosolids analysis were utilized. Application rates for each site was based on the recorded gallons delivered to the site, and assumed to be surface spread evenly. Volatilization of applied ammonia was assumed to be negligible. A summary of the PAN calculations is presented in Appendix C. Based on this analysis, the PAN applied to the Dew Valley site was 33 lb/acre in 2000 and 76 lb/acre in 2001. The PAN applied to the Nelson Ranch site ranged from 50 lb/acre to 132 kg/ha.

The reported nitrogen uptake for biosolids application to a rye grass hay crop is 200 pounds per acre per year (EPA 1995). Paul Kennedy of DEQ suggested using an uptake rate of 100 lbs/acre based on the Oregon State University Extension Service Fertilizer Guide and the soils report for the site, and this is the rate that the WWTP currently uses. At the current biosolids application rate, the applied nitrogen is below the calculated agronomic rate for Dew Valley, but has exceeded the calculated agronomic rate for Nelson Ranch. Test samples were taken in October 2000 at Dew Valley and Nelson Ranch sites to verify soil nitrogen levels. The sample results for both sites came back with no detectable nitrogen found. It appears that the past application rates have not exceeded the actual uptake rate of the rye grass. Using the current nitrogen and solids concentrations for Bandon's biosolids and the mineralized organic nitrogen available, the Dew Valley site should have limit of 360,000 gallons of biosolids applied and the Nelson site a limit of 290,000 gallons.

To assess future applications, it was assumed that the amount of biosolids generated at the end of the planning period is proportional to the estimated increase of average daily BOD from the Year 2000 to the Year 2021. Assuming that future biosolids will contain nitrogen at the current levels, the estimated gallons of biosolids applied to the site in the year 2021 were calculated as follows.

Gallons Applied (2025)
= (Ave. BOD (2025)/ Ave. BOD, (2000)) * Gallons Applied, (2000)
= (902 lb BOD/day)/(675 lb BOD/day) * 601,900 gallons
= 1.34 * 601,900 gallons/year
= 804,300 gallons/year.

The current sites have an allowed application rate of about 35,000 gallons per acre. At this rate Bandon will require a total of about 23 acres of beneficial application site to meet the WWTP needs in 2021. Bandon currently applies to 17.9 acres and holds a permit to apply to another 4-acre site. An additional 30 acres are available for future use. The sites allocated for beneficial use appear to be sufficient for the study period, under current regulations and limits. These sites are only available seasonally due to groundwater and crop harvest restrictions. An upland site, such as a private forest, would be a good addition to the application site inventory for winter disposal.

The historical trace element concentrations in the WWTP biosolids was compared with the regulatory concentration limits for pollutants given in CFR 40 Part 503, Part B. Based on this comparison, none of the trace elements in the WWTP biosolids were above the ceiling and pollutant concentration limits given in the Part 503 rule. Since the biosolids quality is such that it is in compliance with the pollutant concentration limits, compliance with the cumulative pollutant loading rate (CPLR) limits is also achieved. This fact was confirmed as the calculated CPLRs were all well below the Part 503 limits (see Appendix C). Assuming the trace element concentrations in the WWTP biosolids remain at or below current levels, it appears that compliance with Part 503 regulations for trace elements will not be an issue within the planning period.

Section
6

Development of Alternatives

Development and Evaluation of Alternatives

Section 6

6.1 Conveyance System

The alternatives for the City's conveyance system are affected by such factors as the existing pump and pipeline capacity, projected flowrates, operating and maintenance issues with the existing pumps stations, and potential/observed I/I sources in the collection system.

Collection System Rehabilitation

From the flow mapping study completed in December 2001, about 100 inflow sources were identified. The City has aggressively pursued removing these sources from the sanitary system. A number of deteriorated lines and manholes were discovered and recommended for repair including the following:

1. Line Replacement-Ocean Drive & 4th Street
2. Lining/Line Replacement-Ocean Avenue
3. Lining-9th Street W, 11th Street W & Franklin Avenue
4. Lining-Harlem Avenue
5. Lining-Newport Avenue
6. Lining-Jackson Avenue
7. Lining-3rd Street SE
8. Manhole Grouting, Spot Repairs, Lateral Reconstruction

The estimated cost of the system rehabilitation work is a total of $ 878,085. Costs for each project are presented in Section 3.2. Detailed cost breakdowns and project descriptions are presented under separate cover in the City of Bandon Infiltration/Inflow Study and are not repeated here. Work has started on replacing the line on Ocean Drive and 4th, and the other projects are being scheduled as funds become available. The repair methods for existing pipe systems vary, with the recommended techniques for the Bandon projects briefly discussed below.

Basin 6 was flow mapped again on January 7, 2002. During this period of rain I/I totaling 140 GPM was detected and isolated to two stretches of pipe. The probable sources were in the vicinity of Manhole # 6-15 and Manhole 6-16. Video mapping of the adjacent pipe sections is recommended at an estimated cost of $1,500. See Figure 3.2.2 for the location of I/I flows in Basin 6.

Complete Pipe Replacement

Pipeline replacement by conventional excavation and backfill means is normally required when the existing pipeline is deteriorated so badly that other methods of rehabilitation are not feasible. The obvious advantage of pipe replacement is that the service life gained with modern materials and methods is generally considered to be more than 50 years. Replacement also provides the opportunity to correct any misalignments, increase the hydraulic capacity of the line, repair service connections, or eliminate storm water entry points such as catch basins. The cost of replacement, though, is generally high, and creates inconveniences to local residents due to temporary street closures and service outages.

Cured in Place Pipe

Cured in place pipe (CIPP) is best described as "manufacturing a new pipe within an existing pipe". A CIPP installation uses a plastic lined felt bag that has been impregnated with resins. The bag is lifted over an existing manhole and inverted (turned inside out) allowing the plastic exterior to be turned inward. The inner space is then filled with water, as the inverted bag is oriented into the existing pipe. The weight of water drives the bag's inversion until the entire section of liner has been turned inside out and the end has been retrieved at the downstream manhole. Once the liner is in place the water is then heated which causes the resins in the bag to cure and harden.

The use of CIPP lining is appropriate for pipelines requiring minor structural repair, sealing holes, leaky joints, leaky misalignments, and for correcting corrosion problems. Because this method of rehabilitation does not require excavations, it may be used under highways, railroads, and buildings. Service lateral connections are typically made with special cutters and sealers from inside the pipe. The entire process typically requires less than 24 hours to complete. In larger sewer lines, this time frame requires the use of bypass pumping equipment to convey flows around the work area. If properly completed, the life of an inversion-lined pipe has been claimed by several lining manufacturers to be 50 years.

Chemical Grouting

Chemical grouting is commonly used to seal leaking joints in structurally sound pipe, laterals, and manholes experiencing infiltration. Chemical grouts used for rehabilitation of sewers include acrylamide, acrylate, or urethane gels. Typical applications consist of two separate chemicals that form a gel or foam when mixed together that expands out through the defect and into the surrounding earth. Typical applications include one tank to mix and dispense the grout and another tank to mix and dispense a catalyst. Depending upon the amount of catalyst utilized, the time required to form the grout can be adjusted to a few seconds or several minutes.

The equipment used for chemical grouting includes a joint or lateral packer and television (TV) camera. The entire assembly is pulled inside the sewer pipe with cables and winches. Chemical feed lines are extended from the supply tanks to the packer unit. Chemical injection is performed internally, using robotic equipment without requiring man entry or excavations unless unique problems develop.

Since manholes are a major component of the collection system, it is often desirable to enhance the grout rehabilitation method by applying an interior coating. This coating increases the effectiveness of a grout repair by providing an interior seal that will last beyond the expected grout life. Successful manhole coatings include cementitious linings, polyethylene linings, epoxy coatings, and cured-in-place fiberglass lining systems.

Chemical grouting does not improve the structural strength of a pipeline, therefore this method of rehabilitation should not be used on pipes that are badly broken or deteriorated. If the groundwater table drops below the level of the pipe, the chemical grout may become dehydrated and its useful life shortened. Also, many chemical grouts do not have shear strength and will tear or fracture if a load is applied to the surrounding earth. When used appropriately, rehabilitation by chemical grouting should serve a useful life of ten years.

Internal Spot Repairs

There are two highly effective methods for performing internal spot repairs without requiring excavations. The two methods are Link-Pipe and ambient cured soft liners. Link-Pipe is a stainless steel grouting sleeve that is used to accomplish small spot repairs within a sewer line; these sleeves come in a variety of lengths up to three feet long and three-foot diameter. Link-Pipe can be used to restore partially collapsed pipes, replace collapsed pipes, close holes created by material loss in pipe walls, and seal infiltrating cracked pipes and pipe joints. The grouting sleeve is of stainless steel construction and is surrounded by a grout-absorbing gasket. The sleeve is remotely moved into position using a video camera to monitor the position. Once in place, compressed air is used to inflate a positioning plug, which in turn compresses the gasket against the walls of the sewer line. The repair is completed when the flow through plug is fully inflated, the gasket has adhered to the wall, and the Link-Pipe's internal locks have engaged. This method of rehabilitation creates a smooth stainless steel channel that supports damaged pipe and may actually improve the hydraulic properties of the existing line

The second method of performing a spot repair is to install an ambient cure soft-liner. This type of liner is very similar to CIPP except that the liner does not require an inversion system and the resin does not require an external heat source to harden. Spot repair liners are especially applicable when a section of pipe requires a repair over a few feet in length. Another advantage of an ambient cure liner is that it can be used to repair laterals with or without having to excavate at the mainline connection. A special feature of an ambient cure lateral liner was the invention of a "top hat" which can be inserted and used to seal the lateral connection at the main.

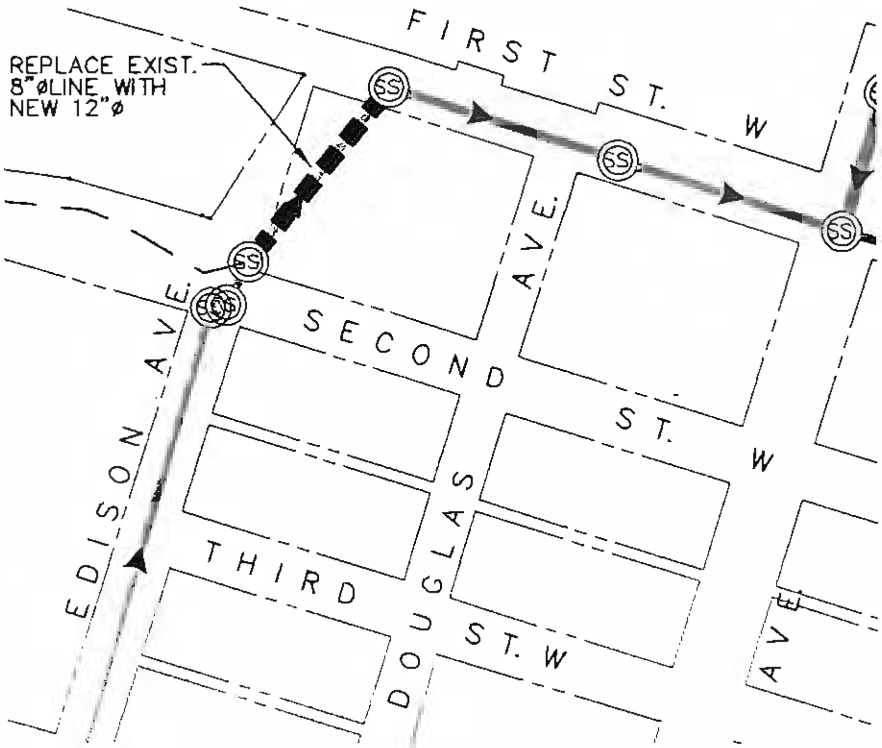
Cost Estimates for Collection System Repairs

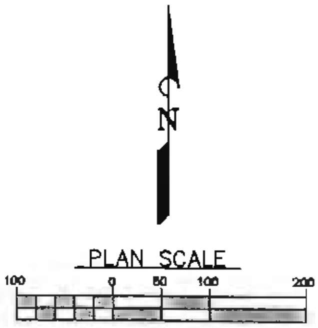
The estimated construction costs in this Plan are based on actual construction bidding results from similar work, published cost guides, and other construction cost experience. Reference was made to the available drawings of the existing facilities to determine construction quantities. Where required, estimates were based on preliminary layouts of the proposed improvements. Construction costs are based on the anticipation of construction starting during late spring of the year 2003.

Conveyance System Capacity

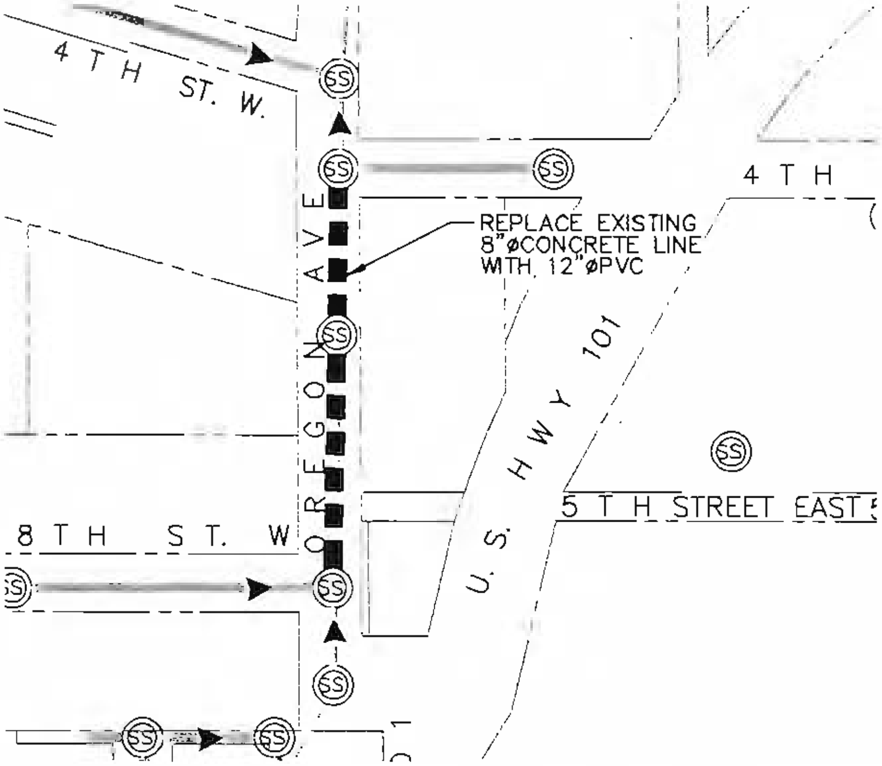
The existing conveyance system was modeled using XP-SWMM software to determine areas where the system was at or near current capacity. Two critical areas were discovered; one section of pipe was determined to be at capacity for existing wet weather conditions and another appears to be near capacity. Both pipe sections are capable of carrying current flows but are located in the system where development will create higher loads. Figure 6.1.1 shows the location of each pipe section. Construction cost estimate details are included in Appendix E.

The first section is on Edison Avenue, between Jetty Road and First Street. This section of the west side interceptor is approximately 220 feet of eight-inch concrete pipe laid at a slope of 0.7%. Currently the pipe runs full during high rain periods and the upstream manhole surcharges. New development in the South Jetty, Beach Loop, South Bandon and part of West Bandon neighborhoods would connect to the collection system upstream of this section, increasing flows and potentially causing a sewer overflow.





EDISON AVE. LINE REPLACEMENT



OREGON AVE. LINE REPLACEMENT

LEGEND

ⓢ EXISTING SEWER MH

■ ■ ■ ■ REPLACED SEWER LINE

▬ EXSITING SEWER LINE

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

DATE: JUNE, 2002
PROJECT NO.: 4501.35

CITY OF BANDON
WASTEWATER MASTER PLAN

PROPOSED SEWER LINE CAPACITY IMPROVEMENTS

FIGURE NO.
6.1.1

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The recommendation is to replace this line with a section of 12-inch PVC using open trench construction. The estimated cost for replacing this line is $56,500.

The second section of pipe runs along Oregon Avenue, between Fourth Street West and Eighth Street West. This line handles all flows from Basin 6 along Highway 101 south of Old Town. Approximately 520 feet of eight-inch concrete pipe is laid at a slope of just less than 0.4%. Currently the model shows this pipe running 75% full during peak wet weather conditions. The manholes in this section of line were surcharged during the 2001 I/I flow mapping. Line restrictions due to grease accumulations, root intrusions and pipe settlement have reduced the capacity of the line to below the 75% flow shown in the computer model. Lining was recommended for this section of line in the I/I study. The further development in Basin 6 or the addition of a pump station on Highway 101 south of this area would produce flows that exceed the capacity of the repaired line. The recommendation is increase the capacity of this line by replacing it with a section of 12-inch PVC using open trench construction.

The estimated cost to replace the 520 feet of eight-inch pipe is $133,420. The I/I study has a cost of $164,920 for Project #2, which includes lining this section of pipe in addition to lining and replacing adjacent pipe sections on Oregon Avenue. If this line is replaced then the lining portion of I/I Project #2 will not need to be done. If this pipe replacement is combined with the rest of the Oregon Avenue I/I work, a cost savings in engineering and construction set up time is anticipated. The estimated cost for the combined project on Oregon Avenue is $240,750.

Conveyance System Expansion

The City of Bandon currently does not have public sewers available in all areas of the City limits. City policy is to require developers to extend sewer services as a permit condition prior to construction. Services are only extended to properties within the City limits. An exception is made where the property is located on a street that forms the City boundary and sewer lines are already installed. Several areas within the City and most developed areas in the UGB are served by private septic tanks. The soils in Bandon are of limited suitability for septic systems and Del Cline with the Coos Bay DEQ office has expressed concerns about groundwater migration of septic effluent in several areas. Specific areas of concern are Southeast Bandon east of Ferry Creek, South Bandon, Bandon Heights along Riverside Drive and the area along Rosa Road inside the UGB. While several of these areas are outside the City Limits, it is in the interest of the City to have a planned sewer layout to guide future sewer extensions as areas annex into the City. See Figure 6.1.8 (located at the end of this section) for an overall layout of the suggested sewer routing.

Area # 1, Ohio Avenue Sewers

Several developers have expressed interest in building within the City Limits in Southeast Bandon, between Ohio Avenue and Ferry Creek. DEQ has concerns about development without sewers, as the terrain is steep and very close to Ferry Creek. Individual grinder pumps were considered for this area, but are not practical due to the high elevation of the discharge manholes on the south side of Ferry Creek. Conventional gravity sewers were selected for this area with a pump station and pressure main running under Ferry Creek to reach the existing gravity sewer system. This area has about 90 acres in the City Limits, but due to floodplain and terrain concerns, only about 70 acres are buildable. Full build out of 270 homes is not anticipated during the study period. Peak flow at full build out is estimated at 80 gpm. See Figure 6.1.2 for the proposed sewer layout. The estimated cost to install this system is $1.1 million, about $4,000 per future home site or $15,300 per developable acre. The slopes south and east of the City Limits are suitable for gravity flow extensions to this system. With the pump station in place, the cost for additional homes drops to about $12,000 per acre, but would require annexation into the City under current policies.

Area # 2, Riverside Drive

Riverside Drive follows the Coquille River east of Old Town and connects to Highway 101 north of Bandon. A high water table and proximity to the river make this area unsuitable for septic leach fields and DEQ requires special on-site treatment systems when existing leach fields fail. There are 16 homes in this area that receive City water, but are on septic tanks. Approximately 4,500 feet of Riverside Drive extends beyond the reach of the public sewers within the City Limits. See Figure 6.1.3 for proposed sewer layout.

There is inadequate slope for gravity sewers to this neighborhood and restricted development zoning, due to the adjacent wildlife refuge, will prevent the housing density from reaching the point where a pump station would be economically feasible. Individual grinder pumps and STEP systems are possibilities for this area, but the City does not allow STEP systems to connect to the public system. This leaves individual grinder pumps as the probable alternative. The estimated cost to provide a two-inch force main from the last manhole on the gravity system to the City Limits on Riverside Drive and fully connect with a grinder system the existing 16 homes is $320,050, about $19,400 per existing home. On-site sand or gravel filters generally may be installed for under $12,000, so the grinder pump option is not cost effective.

Full build out for Riverside Drive and the North end of Michigan Avenue (between Cody Avenue and the City Limits) is about 50 EDUs. Assuming 40 homes on the Riverside Drive line and extension of the line up Michigan Avenue brings the construction cost for servicing these homes with grinder pumps to $577,000. This lowers the cost per home to about $14,000, still not cost effective for installation.

Area # 3, Highway 101 South Sewers

This area is west of Highway 101 between Seabird Lane and 22nd Street. This area is currently partially developed, with a mixture of residential and commercial properties. A pump station will be required to serve this area with sanitary sewers. About half of the projected service area is currently within the City Limits, with the other half within the UGB. The majority of the properties along the east side of Highway 101 in this area are outside of the UGB. Construction of a pump station and public sewer system along Highway 101 would create an economic incentive for those property owners east of the highway to annex into the City, increasing the proposed service area. The drainage basin for this system includes about 50 acres in the current City Limits, 60 acres in the UGB, and 35 acres outside the UGB adjacent to Highway 101. Full build out for this area is estimated at about 270 EDUs.

The estimated cost to serve this entire area is $1.4 million, or about $10,000 per acre. To install just the pump station, force main, and piping serving within the City Limits, the estimated cost is $0.8 million or about $15,000 per acre. See Figure 6.1.4 for a proposed sewer and pump station layout for this area.

Area # 4, Allegany Avenue Sewers

This area is currently partially developed, with a mixture of residential and commercial properties. Bounded by Delaware Avenue on the east, Douglas Avenue on the west, 21st Street on the south, and 13th Street on the north, this area is totally outside of, but adjacent to the City Limits and considered part of the South Bandon neighborhood. Due to the flat topography of the land, a pump station will be required to connect this area with existing gravity sewers. See Figure 6.1.5 for the proposed sewer layout. The estimated cost to install a pump station and sewers to serve this area is $1.2 million, about $14,500 per acre.

Area # 5, South Bandon Sewers

South Bandon is an unincorporated area surrounded on three sides by the City of Bandon. Extensive wetland areas, dense gorse thickets and lack of infrastructure have kept this area from developing. The City commissioned a study in 1997 to investigate providing infrastructure to South Bandon. Figure 6.1.6 is an updated look at the street and sewer layout recommended in the South Bandon Refinement Plan. Parts of the area covered in the 1997 report have been included in Areas # 3 and # 4 above, and will not be included as part of Area #5. Sewers were installed on Seabird Drive in 1999. The remaining area covers about 350 acres and runs from 13th Street south to Seabird Drive and from Douglas Avenue west to the Bandon City Limits. A pump station will be required to serve part of this area and the rest will gravity drain to the existing Johnson Creek Pump Station. The estimated construction cost to serve this area with sewers is about $3.8 million, close to $11,000 per undeveloped acre.

Area # 6, Rosa Road Sewers

This area, totally outside of the City Limits, has been identified by DEQ as an area of concern due to migration of septic tank effluent in ground water. Residents have access to City water services, but wells are still used for landscape irrigation, and are a potential source of contact with the groundwater contamination. The layout in Figure 6.1.7 is presented to show the feasibility of gravity sewers for this area, and as a guideline for future requirements as sewers are extended. Slope requirements dictate the invert elevations of pipelines in this area, and additions at too shallow of a depth could prevent future extension of the gravity flow service area. Full build out is estimated at 370 EDUs. The estimated cost for construction of this system is about $1.1 million. The estimated construction cost comes to about $3,000 per home or $14,000 per undeveloped acre.

Conclusions

Developers are likely to look for the low cost route and line depth to serve their property. Lines may be installed at too shallow a level to allow service beyond this property. The alternatives discussed above were developed after examination of existing topographic maps and sewer design drawings. The recommendation is that these alternatives be used as a guideline when extending sanitary sewer lines to achieve gravity service to the largest possible service territory. The City may wish to include the cost for installing pump stations in areas of rapid growth such as Highway 101 South and Ohio Avenue in the future capital improvements budget.

Pump Station Improvement Alternatives

A number of deficiencies were noted at the pump stations. NFPA 820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities, requires pump stations to use explosion proof electrical equipment unless the wet-well is physically separated from the dry-well. Filmore Avenue and the South Jetty Pump Stations are physically separated from the wet-well, but North Avenue and Johnson Creek Pump Stations access the wet-well from inside the pump station. Johnson Creek Pump Station is subject to flooding by surface water, and has sustained service outages and equipment damage in past floods. All of the stations have equipment deficiencies, which are detailed below.

Filmore Avenue Pump Station

Filmore Avenue Pump Station overflow is subject to tidal backflow at tides over 6.9 feet. The existing tide gate leaks and was found stuck open during the study. Salty estuary water interferes with the biological treatment process of the WWTP and imposes a hydraulic load on the equipment. The recommendation is to replace the existing tide gate with a "duck-bill" back flow valve. The estimated cost to remove the old valve and install the new one is $2,450.

One pump was rebuilt last year and the second pump was being rebuilt at the time of this study as part of the regular preventative maintenance program. The estimated cost for each pump rebuild is $5,500.

South Jetty Pump Station

South Jetty Pump Station is the newest pump station and is in good overall condition. A pump test showed that the pump flow is about 185 gpm, lower than the pump rating of 310 gpm. Recommend checking the pumps for plugging from rags. If pumps are clear then the balance on the check valves need to be reset to provide proper flow. Estimated time to check pumps and adjust check valves is 16 man-hours.

The generator timer no longer functions. Estimated cost to replace timer is $500.

North Avenue Pump Station

North Avenue Pump Station is a fiberglass factory-built packaged unit installed below grade over a concrete wet-well. The unit does not meet NFPA 820, is near the end of its service life and is difficult to operate. The pumps are operating at less than 25% of their rated capacity, probably due to worn impellors. The manufacturer has discontinued this pump line, and estimates that parts will be unavailable in about five years. The alternatives examined for this station are:

- No Action, operate the station as-is.
- Refurbish the existing station and continue to operate it
- Build a new pump station

No Action, Operate the Existing Station As-Is – The existing station is operating at about 25% of its rated capacity. With both pumps operating it is capable of handling the MMWWF for this zone, but not the peak daily flow or the peak hourly flow. Operating this station as-is is not a viable option.

Refurbish the Existing Station – Installing new impellors and seals on the existing pumps should restore the station to design capacity. Pump rehabilitation will allow the station to handle the peak daily and hourly flows expected for this basin. The risk of overflow is high enough that this station should not go through another winter below design capacity. Given the lengthy timeline for financing, design, and construction of a major upgrade, this station should be refurbished before next winter, even if a decision is made to replace the station. Refurbishing the station will provide the necessary capacity, but does not address the operational and safety concerns or the failure to meet NFPA 820. The estimated cost for parts to refurbish this station is $3,000. Adding staff labor, shipping, and contingency results in a budget of $4,000.

Build a New Pump Station – The existing pump station has exceeded its rated life. The manufacturer is no longer supporting parts and maintenance for the pumps. In five to ten years, the City will be faced with the need to replace this station. Installing a new station now would offer the opportunity to improve worker safety and avoid the increased maintenance that will be required to keep this station on-line over the next few years. The options for a new pump station are as follows:

Install an Above Grade Packaged Pump Station – Removing the existing pump station and installing concrete rings to extend the existing wet-well to surface level would enable a surface mount packaged pump station with submersible pumps to be installed on the existing wet-well. A packaged pump station would solve the code and operational problems.

The advantages of a packaged pump station include a lower initial cost as compared to a contractor built station, shorter construction time and less construction disruption to the neighborhood, and single point responsibility for parts and manufacturer's support. Disadvantages include shorter average equipment life, minimal security against vandalism, and lack of storage space for on-site equipment.

Estimated construction cost for an above ground packaged pump station on the existing wet-well is $126,000.

Build a New Above Ground Pump Station with Standby Power – This alternative would involve building a new above-grade structure next to the existing pump station, which could be designed to resemble a small residential garage to blend in with the residential neighborhood. The new building would house the controls, electric service, valves, and generator for the pump station. The old fiberglass dry well would be removed and disposed of. The existing wet-well would be refurbished as necessary, extended to ground level and capped with an access port. The proposed design would include two five-HP submersible pumps.

The advantages of an above ground building include easier access for maintenance, space for a permanent generator, increased worker safety due to separation of the electric components from possible flammable vapors, elimination of confined space concerns for daily maintenance chores, availability of parts, and an aesthetically pleasing station exterior. Disadvantages include the cost, lengthy construction period and associated City related administration time, placement of a larger structure in the street right of way, and possible objections by the property owner abutting the new station. (The station would be near the existing station, within 50 feet of the front of their house, but much larger.)

Estimated construction cost is $215,000 with standby power

Build a New Above Ground Pump Station with Portable Generator Connection – This option is the same as Option #4 and has much the same advantages and disadvantages, except it utilizes a transfer switch and receptacle for portable generator connection instead of a permanent generator. North Avenue has low flows for the size of the wet–well, and of all the City's pump stations, is the best candidate for use of a portable generator. If permanent standby power is not installed, then the City will need to demonstrate the availability of a working portable generator of sufficient capacity to run the station.

The advantages of using a portable generator are a reduction in the initial construction cost and lower maintenance costs. Permanent generators need to be exercised (run for a brief period of time) weekly, which could cause add to the noise level in this residential neighborhood. A portable generator would only run during power outages, reducing the amount of time the neighborhood is exposed to generator noise. The disadvantage is that City workers will need to monitor the wet-well level manually during power outages and deliver and run the portable generator as needed. Estimated construction cost is $170,000.

Conclusions – The recommended alternative for North Avenue Pump Station is to rebuild the pumps now and budget to install a new packaged pump station in the next five years. The portable generator easily serves this station, and low flows make it a minimal risk for overflow, so a permanent generator is not recommended.

Johnson Creek Pump Station

Johnson Creek Pump Station is a wood framed structure sited in the flood plane of Johnson Creek directly over the wet-well. The station has adequate capacity for current and future flows. The floodwaters of Johnson Creek have left a watermark inside the pump station 36 inches above the floor. The station is inoperable and creates an electrical and physical hazard for City workers when the creek floods. The location of the wet-well inside of the structure is not in accordance with NFPA 820, which requires all equipment to be explosion proof when the wet-well is accessible from the structure. NFPA 820 also requires that the pump house structure be of low flame spread construction, a condition not met by the cedar shakes at Johnson Creek. The exterior siding and metal surfaces are deteriorating and need paint and minor repairs. The existing pumps have reached the end of their useful life and parts are difficult to obtain and maintain. The options explored for this station include the following:

- No action, operate the station as-is
- Refurbish the equipment
- Install a floodwall around pump station
- Replace Johnson Creek Pump Station

No Action, Operate the Station As-Is - When Johnson Creek reaches flood stage the station is unable to operate and poses a hazard to workers. The structure is in violation of NFPA 820. Operating the station as-is is not a recommended option.

Refurbish the Existing Equipment – The pumps are currently operating at rated capacity. City operators have been diligent in keeping the pumps operational. The structure needs exterior and interior painting on all surfaces, minor siding repair and sheet metal repair. The generator is corroded due to flood exposure and needs the engine section to be cleaned and the generator section to be refinished. The control panel is corroded and components do not stay tight in their slots.

As this option will not solve any of the deficiencies noted above, it is not a recommended alternative. Restoring finishes on the structure and equipment and replacing the control panel to extend the life of this facility is estimated to cost $14,000.

Install a Floodwall Around Pump Station– Construction of a concrete wall with a floodgate around the pump station would protect it from future floodwaters. City crews could use its existing portable pump if necessary as a sump pump to keep the enclosure dry. National Flood Insurance Program rate maps do not designate the 100-year flood elevation at the station but the historic watermark in the building is 36-inches above the station floor. The finished floor of the pump station is at 19.5 feet (based on the 1978 as-built drawings), with the ground sloping down to Johnson Creek and the adjacent golf course. A floodwall approximately five-feet tall would be needed to provide protection from a 100-year flood. A ten-foot opening with floodgate sections that could be manually dropped into place would provide access to the station.

The advantage of a flood wall would be that the equipment would be protected from damage, the station could continue to operate during a flood, and flood waters would be prevented from draining into the wet-well, adding to the treatment plant load. The disadvantage would be that City workers would need to install the floodgate whenever flood warnings were issued, maintenance access would be restricted, and the aesthetics of the station would be diminished. This option would not address deficiencies associated with NFPA or the age of the pumps. The estimated cost of installing a floodwall around Johnson Creek Pump Station is $50,000.

Replace Johnson Creek Pump Station – This option involves building a new pump station adjacent to the existing pump station, reusing the existing wet-well with modifications. The floor of the new station would be at 23.5 feet of elevation, one foot above the floodplain. The existing generator would be reused, but all pumps, valves and control components would be replaced.

The advantage of this option is that the City would have new equipment with an expected life span of 20 years. Code, flooding, and life safety issues would be addressed in the design of the new station. The disadvantage is the capital construction cost and a lengthy construction period, with the associated traffic, noise, and administration problems. Estimated cost of a new Johnson Creek Pump Station is $265,000.

Conclusions – The recommendation is to replace Johnson Creek Pump Station with a new station; raised above the floodplain. Until a new station is brought on-line, running the exhaust fan system 24 hours in the pump house should help minimize fume accumulations.

Pump Station Recommendation Summary

The recommended pump station projects are summarized in Table 6.1.1.

Table 6.1.1

Pump Station Recommendation Summary

Pump Station	Project Description	Cost Estimate ($)
Filmore Avenue	Install tide gate	2,450
South Jetty	Generator timer	500
North Avenue	Rebuild pumps & replace station	130,000
Johnson Creek	Replace station	265,000
Total		397,950

6.2 WWTP Improvements

The Bandon WWTP has the capacity to handle flows and mass loads projected through the study period, providing that the recommended I/I projects are successfully implemented. The facility is well maintained and operated, with only relatively minor deficiencies found.

Headworks

The headworks were upgraded in 2000 and are operating efficiently. One minor operation change is recommended for the headworks. The grease baffles in the channel located prior to the aeration basins should be scheduled for regular cleaning. Removing the grease by ladling or pumping is preferable to allowing it to flow into the treatment portion of the plant.

The major concern for the headworks is accurate measurement of flows. Influent flow for the headworks is not measured directly, but calculated based on effluent flow. Mass loads for the plant are based on effluent and influent flows and inaccurate influent flows could cause these calculations to appear to be erroneously out of compliance. Also the mass load balance for the treatment process is based on influent flows; inaccurate readings could lead to inefficient operation of the plant, and the perception of reduced treatment capacity. The calculated reading at the chart recorder consistently shows the effluent flow to be higher than the influent flow. The staff has had the effluent meter recalibrated, but still records erroneous influent flows. The existing flow recording system was installed in 1970 and has reached the end of its rated life. Parts are difficult to obtain and require installation and calibration by technicians trained to work on older systems.

Options to remedy the problem are as follows:

- No action, operate as-is.
- Recalibrate the existing system.
- Replace the existing system.
- Install new influent meter.

No Action, Operate As-Is

This option is to continue to operate the plant with the effluent reading higher than the influent. DEQ staff has noted the meter discrepancy in their files and has expressed concerns about the accuracy of metering at the plant. Under its NPDES Permit, the City is required to monitor effluent flow by meter and total flow by calculation. An obviously inaccurate flow record would not be in conformance with the City's permit.

Recalibrate the Existing System

The original plant design shows the influent flow level calculated by adding the effluent meter, water reuse meter, and the sludge waste meter reading together. Turning off the reuse water and sludge waste and comparing the influent and effluent readings have shown the effluent still reads higher than the influent. Review of the electrical diagrams and an inspection by a technician lead to the conclusion that components in the metering system are wired incorrectly or summation modules in the system have failed or need calibration. A budget figure of $5,000 is recommended for troubleshooting and repairing these components. The WWTP Operator has the effluent meter calibrated annually. Calibrating the water reuse meter and the sludge waste meter are estimated to cost about $2,000. The water reuse meter and sludge waste meter are recommended for calibration, even if another option is chosen.

Calibrating and repair of the existing system has the advantage of lower initial cost and less disruption to the existing system. The disadvantage is that it might not work, and the plant would still show inaccurate flow readings. Even if the system is operating correctly, actual influent flows vary with the speed and run times of the Filmore station pumps while effluent flows tend to represent the average of the day's flow due to holding capacity of the treatment process. Another disadvantage is that even if the system is restored to original installation standards, it failed once and likely would fail again. The total estimated cost for calibrating and troubleshooting the metering system is $7,000.

Replace the Existing System

Replacing the existing chart recording system with a new graphical recording system would provide greater confidence in recorded levels and assurance of service support availability. The estimated cost for replacing the chart recorder and modules and connecting them to the existing flow meters is $25,000.

Install New Influent Meter

This option is to install a new mag-meter in the vertical influent line just before the headworks. A remote readout panel would be installed in the motor control center at the operations building and a data wire would feed under Riverside Drive to the administration building through an existing conduit. The data wire would connect to the existing chart recorder, replacing the components that currently calculate the influent flow.

The advantages of a new mag-meter would be a direct influent measurement with a more accurate meter type. Independent meters for influent and effluent act as an accuracy check for each other. The disadvantage is the initial capital cost. Estimated cost for installing a new influent meter is $21,000.

Treatment

The aeration basins and secondary clarifiers have adequate treatment capacity for projected mass loads based on the original construction design drawings. The hydraulic capacity is also considered adequate if the I/I reduction program is completed successfully. WWTP operating staff have identified no deficiencies in the treatment process. The current energy control system installed through Bonneville Power Administration (BPA) creates an opportunity to improve plant performance. BPA installed sensors that measure dissolved oxygen and suspended solids in the aeration basins. Currently, the staff controls the RAS pumps manually, setting them based on a suspended solids level from a grab sample of the aeration basins. Installing a system to control the RAS pumps based on the sensor reading of suspended solids in the aeration basins could effectively increase the treatment capacity of the plant by maintaining a more exact food to mass ratio. The estimated cost to add automatic RAS control to the WWTP is $12,000.

6.3 Disinfection

The disinfection system at the WWTP is an ultraviolet (UV) radiation system with two flow channels and six units of vertical lamps. The system was designed to be flow paced by the effluent meter with one unit and one channel used at low flows and additional units brought on at preset flow values. The current mode of operation is to run both disinfection channels full time with all six units energized. It is the understanding of the current staff that the flow pacing controls have never operated correctly. The plant has no history of problems with excessive fecal counts in the effluent.

Running all six units consumes excessive energy and increases maintenance costs by requiring frequent replacement of lamps and ballasts. Return to flow pacing the UV system is recommended, Frequent fecal tests during the first month should be made to develop confidence in the efficacy of the disinfection process.

Estimated savings in energy, lamp and ballast replacement, and disposal costs is about $10,000 per year. The estimated cost for troubleshooting the flow pacing system, repairing, and calibrating the controls is $5,000.

6.4 Biosolids Management

Biosolids originate as leftover waste materials, domestic septage and sewage sludge, which are generated from sewage treatment. Presently biosolids produced at the WWTP are aerobically digested and land applied on a DEQ approved site. Selection of the most viable biosolids stabilization alternative is depended upon the selected ultimate use and disposal of the biosolids. The following is a discussion of the biosolids stabilization and ultimate use/disposal alternatives.

Biosolids Stabilization

Biosolids stabilization is a treatment process, which converts sludge generated in the liquid stream treatment process to a stable product for ultimate disposal or use. This process reduces pathogens and vector attraction in the sludge and produces a less odorous product. The most common biosolids stabilization processes used in small communities are stabilization lagoons, facultative sludge lagoons, aerobic digestion, anaerobic digestion, and lime stabilization. While not typically utilized in small communities, composting is considered a potential stabilization alternative. The use of stabilization and/or facultative sludge lagoons were not considered viable options for biosolids stabilization since these facilities require relatively large amounts of land, which is at a premium in the vicinity of the WWTP. Available undeveloped parcels are below the 100-year floodplain of the Coquille River, and thus of limited use.

The Bandon WWTP currently uses aerobic digestion for sludge stabilization, followed by land application of the majority of the treated biosolids. When land application sites are not available, biosolids are transferred to the sludge lagoons owned and operated by the City of North Bend. The digester capacity of the Bandon WWTP is projected to be adequate through the study period, based on a 60 day holding time, 2% minimum sludge solids, and projected wastewater flows.

Although the WWTP has adequate digestion space, biosolids disposal is a major operational limitation for the WWTP. DEQ requirements for the currently permitted sites prohibit land application during high groundwater periods. The City owned spreading truck is unable to safely drive on the fields during periods of high soil moisture. The land used for soil enhancement is used for producing hay and is unavailable during the growing season. These conditions restrict the available spreading season to the months of July through October. The retention time for the digester runs up to eight months under this spreading schedule. Consequently, the digesters reach storage capacity by March or April each spring. Currently about 100,000 gallons of biosolids must be removed to prevent negative effects on the treatment process.

The aerobic digesters in Bandon currently meet or exceed the DEQ limits for vector attraction based on a 38% reduction in volatile solids, according the plant DMRs. Operators report that the plant consistently has produced an acceptable Class B biosolid. Based on the projection of adequate future capacity, the recommendation is that Bandon continue to stabilize the sludge with aerobic digestion.

Basic Ultimate Use and Disposal of Biosolids Alternatives

The ultimate use or disposal of biosolids is perhaps the area of greatest uncertainty in sludge handling because of its dependency on solids marketability, land availability, and regulatory requirements. Another important consideration of an ultimate utilization or disposal option is public acceptance. The reluctance of the public to accept a biosolids disposal or processing facility in their area generally stems from concerns about odors and adverse health impacts. A public education and outreach may be necessary for successful biosolids use or disposal. Potential viable options for use and disposal of biosolids include disposal of biosolids at a landfill, land application of biosolids, and distribution and marketing of biosolids.

Land Application

Land application refers to any beneficial use project that applies biosolids to the land. Such land sites include primary agricultural land, pastures, tree farms, and old mines

Any biosolids to be land applied must be classified as nonhazardous and meet criteria for maximum concentrations of trace metals (e.g. cadmium, copper, lead, nickel and zinc). For application to agricultural lands, all biosolids must undergo treatment by a process which to significantly reduce pathogens. In addition to evaluating a biosolid with respect to its environmental suitability, a land application program will depend on the nutrient content of the biosolids, the land to which it will be applied, and the crops to be grown on the land. For most biosolids produced and land applied, the limiting factor is the nutrient content of the biosolids when it is applied as a fertilizer for a particular crop.

A land application program operating year-round cannot function without adequate permitted acreage available during all but the most inclement periods of weather. The farming practices and crops in a given area determine site availability. As a rule, it is advisable to hold permitted acreage equal to three times the amount actually needed in any given year to accommodate all the biosolids for a particular project. Usually, storage of biosolids will also be necessary at some time during the year. Paul Kennedy of DEQ is currently working with City personnel to obtain permits for winter application sites (2002). Additional acreage on the currently permitted sites could be eligible.

The key advantages of land application are the ability to utilize wastewater biosolids for a beneficial use and the low capital outlay costs. The key disadvantages of land application are securing DEQ approved sites and providing sufficient capacity to store biosolids during the wet season.

Landfill Disposal

Landfill disposal is generally less desirable alternative than land application for beneficial use. If a suitable site is convenient, a sanitary landfill may be used for the disposal of biosolids if landfill and regulatory officials permit this practice. The economics of hauling biosolids usually indicate that the dewatering for volume reduction will result in justifiable savings. While this process is more expensive and does not take advantage of the beneficial uses of biosolids, disposal at a landfill is a viable option when weather conditions or regulatory requirements limit land application.

The City currently has no access to a local landfill site for biosolids. Coffin Butte Landfill (Corvallis), Short Mountain Landfill (Eugene) and Heard Farms (Roseburg) are the three landfills in closest proximity that accept municipal biosolids. DEQ regulations discourage biosolids disposal at a landfill if other viable alternatives exist. In addition to the lack of landfill access, the cost of hauling and disposing of biosolids at a landfill would be substantial.

Hauling to Another Municipal Facility

DEQ requires WWTP facilities to be built with capacity to meet projected growth for 20 years from the date of construction. This means that new facilities tend to have surplus capacity for a few years. Bandon has been able to utilize that surplus in the past by hauling biosolids to the City of North Bend's sludge lagoons. North Bend has indicated that they will run out of surplus capacity in less than five years, and will not commit to accepting biosolids from other communities in the future. The City of Florence also has surplus capacity, but only will take biosolids on an emergency basis.

A multi-community group headed by Charleston Sanitary District recently commissioned a feasibility study for a regional biosolids disposal center. The study found that a regional disposal method is cost effective for Coos County and surrounding communities, but further research is needed to determine methods and costs (John Waddill 2002).

Private Sector Services

Heard Farms - Heard Farms in Roseburg operates a sludge lagoon where municipal and private biosolids may be disposed of for a fee. They also own a tanker truck and will pick up municipal sludge directly from the WWTP. Liquid effluent from the lagoon is held in tanks and used for irrigation of farm crops in the summer. Solids are stabilized in the lagoon and used for soil amendment.

Roto-Rooter - The local Roto-Rooter franchise has been working on a pilot program to dewater biosolids at local wastewater facilities and dispose of the residue in a privately owned landfill in Port Orford. The company delivers a portable press that dewaters the biosolids to approximately 20% solids, with the pressate returned to the headworks of the WWTP.

The advantage of a private service is that the disposal of the biosolids becomes somebody else's headache. Staff time would not be spent dealing with trucking, locating and permitting application sites, or processing biosolids. The disadvantages are the return of the pressate, which requires treatment and reduces the capacity of the WWTP, loss of control over the process and disposal, and the need to administer an outside services contract.

Distribution and Marketing of Biosolids

Compost and heat-dried (Class A) biosolids may be distributed and marketed to end-users such as the agricultural and horticultural industries, landscape contractors, and homeowners. Each municipality must develop its particular distribution and marketing strategy based on surveys of potential users and competing products. Some municipalities have chosen to market the product through a broker or distributor. Such items such as product quality, selling price, storage, responsibility for unsold product, and other risk-sharing decisions should be included in any contracts. Promotional and demonstration programs are usually required to promote public attention and acceptance, and inform potential users of the product's potential use and availability.

The distribution and marketing of processed wastewater biosolids is usually done by rather large municipalities (e.g. Portland, Newberg) that produce considerable amounts of biosolids. These municipalities usually have the resources to successfully develop a product market. Bandon currently produces a Class B biosolid and would need to further process the waste to achieve a Class A. A Class A material could be used directly by the City for fertilizing plantings in parks, at City Hall and at the local schools. Surplus could be given away to the public or farmers. Methods of producing a Class A biosolid are discussed below.

Composting - Composting is a process in which organic material undergoes biological degradation to a stable end product. Biosolids that have been composted properly is a sanitary, nuisance-free, humus-like material that is an excellent low-grade fertilizer and soil conditioner. With composting, approximately 20 to 30 % of the volatile solids are converted to carbon dioxide, water and heat. Although higher temperatures can be achieved, optimum microbial activity occurs between 45 to 60 °C (113 to 140 °F). To be considered a process that significantly reduce pathogens, the temperature of the composted material must be raised to and remain at 40°C or higher for five days. In addition, the temperature of the composted material must exceed 55°C for at least four hours during the 5-day period.

Biosolids to be composted must have a porous structure and a moisture content of 40 to 60 % to be compostable. Biosolids are mixed with a bulking agent such as wood chips, sawdust, or compost to obtain the required structure, porosity and moisture. To reduce the amount of bulking agent used in composting, the biosolids are typically dewatered to a minimum solids content of 12 %.

There are several methods of composting, including static pile, windrow, mechanical "in vessel" and container composting. Of these methods, container composting appears to be better suited for small communities.

Container composting is similar to the in-vessel process in that composting is conducted in a closed reactor or container under controlled conditions. However, instead of a using continuous process, the container system composts material in batches. For each batch, dewatered biosolids are mixed with an amount of bulking agent and then conveyed into a stainless steel lined container. Air is introduced into the containers using variable speed blowers. A computer program that monitors temperatures within the container determines the amount of air needed for composting. Once composting is completed, container is lifted and the material in the container is emptied onto a concrete slab for cooling and distribution. To control odors, exhaust air is sent through a biofilter consisting of wood chips and compost.

The advantages of composting are the elimination of the need for digestion, relatively low capital cost, reduction of land application if marketed, and production of a useful product. The disadvantages of this process include significant land area, possibility of odor generation, relatively high operation costs, and the need of a market for the compost. Composting is not an option at the current WWTP due to lack of available land and concerns about odors.

Reed Bed Dewatering - Reed bed dewatering is used in Europe and in about 50 sites in the U.S., most in New England. The system consists of marsh plants growing in a sand lined concrete bed with walls about three feet high. A drain system is installed and pea gravel and sand layers are built up over the drains. Marsh plants, usually reeds, are planted in the sand. The reeds are heavily watered with treated effluent to establish them in the sand bed. The established plants are then flooded with digested biosolids with 3 to 4 percent solids, about four inches every 20 days. The penetration of the vegetation root system maintains pathways for drainage and delivers oxygen to the bottom layers of the sand bed to promote aerobic stabilization of the biosolids. The roots also absorb water that is transported to the leaves and evaporated.

Harvesting the above ground vegetation annually maintains the treatment capacity of the beds. Beds that are not harvested have their capacity reduced by the organic load contributed by the decomposing plant material. Harvested material may be composted, burned, or chipped and used for mulch. Beds are typically run on a ten-year cycle. At the end of the cycle, the beds are allowed to rest for a six-month period and then a front-end loader scoops out the organic layer that has accumulated. The sand layer is left intact. The beds are then flooded with treated effluent to encourage new growth from the existing rootstock. The biosolids removed from the beds are about 90% solids and have aged long enough to remove pathogens. DEQ would require sampling and testing of the removed biosolids prior to classifying them as a Class A.

The existing drying beds in Bandon could be converted into reed dewatering beds by raising the sides of the beds by about two feet. The beds would have a capacity of treating between 200,000 to 300,000 gallons of biosolids annually. This is not enough to handle the full output of the digesters, but could provide storage while waiting for agricultural land spreading in the summer.

There are no municipal reed beds in Oregon. Bandon Dunes has a form of reed bed system that was used to treat the effluent from their system, but was discontinued in the recent treatment system upgrade. Due to the lack of data on local reed beds, this alternative is most attractive as a pilot project, possibly with the cooperation of a graduate student.

Positives for this alternative are that Bandon already has sludge drying beds, making the capital of this alternative very low. A reed bed could showcase the local ecological sentiments and promote environmental awareness. Maintenance is minimal, and the beds only need to be scraped once every ten-years. The negative aspects are that a reed bed could not handle the full output of the digesters and should be considered experimental in Oregon. DEQ would likely require a high level of testing with a resulting high administrative cost. The reeds should be harvested annually with the resultant disposal cost of the cut reeds. There is a chance of odors from the beds, which are in close proximity to the tourist district.

Biosolid Storage

Bandon currently has the digester capacity necessary to meet the projected sludge load during the study period. The agricultural application sites have a calculated life exceeding the expected life of the treatment plant, and capacity to handle the projected nitrogen loading under existing regulations. What Bandon lacks is storage capacity to hold digested biosolids during wet weather and crop growing periods.

Biosolids can be stored within the wastewater treatment process units, biosolids treatment process units, or in separate specially designed tanks. Wastewater treatment units can store biosolids for short-term storage (few hours to 24 hours). For longer detention times, biosolids treatment units, such as aerobic or anaerobic digesters, facultative sludge lagoons, are used for storage. Separate tanks are usually used for obtaining longer detention times than biosolids treatment units. These separate holding tanks often use mixing and/or aeration to prevent septicity, odors, and solids suspension. Mixing may be accomplished using diffused air, and top-entry or submersible mechanical mixers. Other odor control measures include either chemical addition of chlorine, hydrogen peroxide, or iron salts, and maintenance of an aerobic surface layer (e.g. facultative sludge lagoon).

Facultative Sludge Lagoons

Typically in small communities, facultative sludge lagoons have been recommended and implemented for biosolids storage. However, the use of a facultative sludge lagoon in Bandon for biosolids is not considered viable due to lack of appropriate sites.

Drying Beds

Drying beds are contained structures with the floor sloping to a drain system. A layer of gravel is built up over the drains, and a layer of sand applied over the gravel and the surfaces of the beds are flooded with digested biosolids. The liquid content of the biosolids drains through the sand and gravel and is returned to the headworks of the plant. Dewatered biosolids are scraped off after each application, along with the top layer of the sand, using a small front-end loader. The biosolids are then disposed of by land application with a manure spreader or by landfill. The solids content of the finished biosolids may vary from 15% to 70%, with 50% used as an estimate for study purposes.

Bandon has approximately 4,300 square feet of sludge drying beds that were built with the original 1970 treatment plant. The drying beds have not been used within the memory of current staff, but were used once after the original WWTP was built in 1970, with unsatisfactory results. Similar beds are in use in North Bend with no operational problems. Uncovered beds are not practical in areas with over 40 inches of annual rainfall so installation of a roof structure is suggested.

One advantage is that the City already owns drying beds, so no capital outlay or construction is necessary. Another advantage includes a reduced volume of material, with the associated reduction in trucking miles and time. Disadvantages include odor concerns and multiple handling of the material; it must be spread, scraped up, loaded into a truck and then tilled in at the application site.

Tank

Tanks for holding biosolids need to be large enough to get through the period between land application seasons and make provisions for odor prevention. Bandon would need a tank capacity of approximately 600,000 gallons to hold a six-month production of biosolids. Odor control is done by use of aeration or by covering the tank and filtering the exhaust air. A recent study for the City of Lakeside found that a similar tank would cost about $1 million for construction, engineering, and administration of the project (Lakeside 2002).

The advantages of a tank are that there is minimal labor involved in the use of a storage tank and an aerated tank would continue a certain amount of aerobic digestion. The disadvantages of a tank are the high capital construction cost and the large space a tank would occupy. A 600,000-gallon storage tank would have a diameter of 80 feet. With the possibility of a regional disposal center being developed, a large capital investment in storage is not recommended at this time.

Screw Press Thickening

Bandon WWTP has two screw presses, one installed in 1970 with the original WWTP, and one installed in 1993 with the plant upgrade; neither have been operated since 1993. Digested sludge is treated with polymer to allow flocculation and easier dewatering. The screw press produces liquid pressate, which is pumped back to the headworks for further treatment and a dewatered sludge with a solids content of approximately 10% solids. The sludge drying beds may be used as a storage area for the thickened biosolids or the biosolids may be spread over a layer of sand in the beds to further reduce the moisture content. A trial run of the screw presses is scheduled for late summer 2002. At that time, depending on the results of the trial, it will be determined if the sludge beds would require a roof if they are to be used for storing thickened sludge.

The screw press reduces the sludge volume by about 75%, which lowers the storage volume required to hold the biosolids and the number of trips eventually necessary to haul biosolids off site. However, the biosolids will no longer be in a liquid state that can be pumped or sprayed. Removal of the thickened sludge will require a front loader or other mechanical means of loading and spreading, increasing the handling labor.

Selection of Biosolids Disposal Alternative

Sludge at Bandon is currently aerobically digested and land applied to local farms. Anticipated capital and O&M costs were compiled for biosolids hauling, holding, dewatering and land application. The present worth costs for these alternatives are summarized in Table 6.4.1. Additional details are included in Appendix "C".

Table 6.4.1

Present Worth Costs For Biosolids Disposal Alternatives (1)

#	Option	Disposal Site	Solids %	Hauler	Disposal Method	Present Value Cost per Gallon
1	Use reed beds (2)	City Projects	75%	Bandon	Fertilize City Parks	$0.05
2	Apply digester material to local farms	Local Farms	2%	Bandon	Beneficial Land Application	$0.05
3	Use sludge drying bed and apply to local farms (2)	Local Farms	50%	Bandon	Beneficial Land Application	$0.07
4	Thicken, store, then apply to local farms	Local Farms	10%	Bandon	Beneficial Land Application	$0.08
5	Thicken & have Heard Farms pick up at WWTP	Heard Farms	10%	Heard Farms	Sludge Lagoon	$0.09
6	Have Roto-Rooter press at plant and haul solids	Roto-Rooter	2%	Roto-Rooter	Dryer/Compost	$0.11
7	Haul to City of North Bend (3)	North Bend	2%	Bandon	Sludge Lagoon	$0.13
8	Have Heard Farms pick up at WWTP	Heard Farms	2%	Heard Farms	Sludge Lagoon	$0.14
9	Build storage tank and farm apply in summer	Local Farms	2%	Bandon	Beneficial Land Application	$0.15
10	Thicken and haul to City of North Bend (3)	North Bend	10%	Bandon	Sludge Lagoon	$0.15
11	Thicken and haul to Heard Farms	Heard Farms	10%	Bandon	Sludge Lagoon	$0.17
12	Haul to Heard Farms	Heard Farms	2%	Bandon	Sludge Lagoon	$0.24
13	Thicken and haul to Short Mountain Landfill	Short Mountain	10%	Bandon	Landfill	$0.25
14	Thicken and haul to Coffin Butte Landfill	Coffin Butte	10%	Bandon	Landfill	$0.25
15	Haul to Coffin Butte Landfill	Coffin Butte	2%	Bandon	Landfill	$0.43
16	Haul to Short Mountain Landfill	Short Mountain	2%	Bandon	Landfill	$0.45

1) – Present worth costs were based on 6 percent interest over 20 years.
2) – These methods will handle only part of the total plant output.
3) – North Bend will only take sludge on an emergency basis and will discontinue this service in the near future.

Land application, the lowest cost method that would handle the full biosolids production of the WWTP, combined with the four lowest cost storage and dewatering methods were chosen for further discussion. Problems are encountered in land application due weather related restrictions. Therefore, the analysis of biosolids will focus on methods of storage or alternate disposal during wet weather periods. Bandon currently needs wet weather disposal for about 100,000 gallons of biosolids, usually in March or April. By the year 2001, the wet weather surplus is projected at about 600,000 gallons and the plant will need to start removing excess sludge by December.

All detailed alternatives are based on the City continuing to land apply biosolids removed from the digesters without further treatment during dry weather months. Each alternative looks at different methods of disposing of surplus sludge that must be removed from the digesters during wet weather. Biosolids are assumed to increase by equal increments each year to reach the 1.2 million gallon level projected for 2021. Present Value costs are for disposal of all biosolids from the WWTP, assuming that all biosolids produced in dry weather are land applied.

Land Application with Reed Bed Dewatering

The existing drying beds, used for reed bed dewatering, have an estimated capacity of about 200,000 gallons of sludge per year. This is adequate capacity to handle the wet weather surplus for the next ten years, but not through the study period. There is the possibility of obtaining donated plants and labor to set up the reed bed, which would lower the first cost, but the experimental nature of establishing a reed bed in Oregon will drive up the administrative costs in dealing with the regulatory authorities. The estimated costs for setting up and running a reed bed system are listed in Table 6.4.2. The capital costs include $20,000 for setting up a pilot project to test the feasibility of the concept.

Table 6.4.2

Costs for Establishing and Maintaining a Reed Bed

Item	Cost ($)
Capital Costs	$56,750
Annual O&M Costs	$3,600
Ten Year Clean Out Cost	$6,200
Cost to Land Apply Remaining Biosolids	$26,150
Present Worth Cost	$474,000

Land Application with Winter Sites

Bandon currently land applies liquid biosolids directly out of the digesters to farm fields, using a City owned tank truck. This was found to be the most cost effective method of application with a proven history. City staff is currently working with DEQ to obtain permits for sites that would allow year around application of biosolids. The City already owns the tank truck, so no additional capital is needed. However, administrative time will be required for obtaining and maintaining the permits, which are estimated to run over 400 hours per year.

Table 6.4.3

Costs for Wet Weather Land applying Biosolids Directly From the Digester

Item	Cost ($)
Capital Costs	$0
Annual O&M Costs	$30,500
Present Worth Cost	$480,000

Land Application with Winter Storage of Thickened Sludge

Bandon already has two screw presses that were designed to thicken digester biosolids to a minimum of 10% solids. Running the biosolids through the presses should reduce the volume by about 75%. The existing sludge drying beds have a flat storage volume of about 50,000 gallons, the equivalent of 200,000 gallons of biosolids before pressing. This is adequate capacity to handle the wet weather surplus for the next ten years, but not through the study period. The biosolids laid in the drying beds would dewater further through drainage, increasing the total capacity of the beds. The cost of running the screw presses is about $0.03 per gallon.

The solids would be too thick for the City tank truck and would need to be loaded into a lined dump truck for delivery to farm application sites, and spread at the site with a manure spreader. It is assumed that the farmer provides the spreader, and that no additional City labor is required after delivery of the biosolids to the farm. A biosolid with 10% solids content has a consistency similar to Jell-O and the assumption is made that only 8 yards are hauled per load in a ten-yard dump truck, to prevent spills.

With this option, there would be no additional capital costs involved, as the City already owns both the presses and the drying beds. The WWTP would need the use of a dump truck, which could be provided through the City public works department. The costs of running a dump truck were assumed to be similar to the tank truck currently operated by the WWTP personnel at $3.13 per mile. This figure includes maintenance and depreciation, which would need to be reimbursed to the Public Works Department from the sewer budget. Costs for thickening sludge and storing it during the winter before land application are included in Table 6.4.4.

Table 6.4.4

Costs for Thickening, Storing and Land Applying Biosolids

Item	Cost ($)
Capital Costs	$0
Annual O&M Costs	$26,400
Cost to Land Apply Remaining Biosolids	$26,150
Present Worth Cost	$543,000

Land Application with Sludge Bed Dewatering

The existing drying beds may be used as is with no cover. The City of North Bend operates similar uncovered drying beds with good results. However, Bandon has the greatest need for storage during the wettest part of the year, a time when drying beds are least effective. With a cover, the drying beds are estimated to be capable of dewatering about 350,000 gallons of biosolids annually. This is adequate capacity to handle the wet weather surplus for the next twelve years, but not through the study period. Estimated costs to cover and operate the existing sludge drying beds are included in Table 6.4.5.

Table 6.4.5

Costs for Sludge Bed Dewatering and Land Applying Biosolids

Item	Cost ($)
Capital Costs	$60,000
Annual O&M Costs	$6,630
Cost to Land Apply Remaining Biosolids	$23,000
Present Worth Cost	$592,000

Land Application with Private Hauler Removing Surplus Thickened Sludge

Heard Farms in Roseburg offers a service where they will provide use their company tank trucks to haul biosolids from the WWTP. The quoted rate for digested sludge (2% solids) is currently $0.13 per gallon, but they estimate it would be $.20 per gallon for biosolids thickened to 10%. It would cost the City of Bandon an estimated $0.03 per gallon to run the screw press, which reduces the volume to 25% of the original. Each thickened gallon costs $0.12 to press (4 gallons x $0.03) for a total cost to Bandon of $0.32 per gallon to have thickened biosolids hauled off. Since each gallon started out as four gallons of digested biosolids, this equals a cost of $0.08 for each gallon of original biosolids.

Bandon already has the screw presses, so there would be no new capital costs. Costs for operating the screw presses and having Heard Farms haul the thickened material are included in Table 6.4.6.

Table 6.4.6

Costs for Thickening Biosolids & Contracting with Private Hauler for Disposal

Item	Cost ($)
Capital Costs	$0
Annual O&M Costs (1)	$29,130
Cost to Land Apply Remaining Biosolids	$25,800
Present Worth Cost	$630,000

(1) O&M costs for this measure would be very low the first year and increase each year. Figure given here is the average amount based on total biosolids for the 20-year study period.

Matrix Evaluation

Based on this cost analysis, reed beds would be the choice for treating sludge during wet weather. However other factors, play a role in deciding which system is best suited for the needs of the community. A matrix evaluation was performed on each alternative with respect to present worth value, flexibility, capacity, reliability, operability, ability to construct, environmental factors, and community impact. The following is a discussion of this evaluation.

Present Worth Value

The present worth value of each alternative was calculated based on the estimated construction and O&M costs. A comparison of total present worth costs, based on six percent over 20 years, for the alternatives is summarized in Table 6.4.7. Additional information on the cost estimates for these alternatives is given in Appendix C.

Capital costs for the proposed alternatives range from approximately $0 to $60,000. Bandon already owns equipment to implement wet weather application, thickening and storing, and using a private hauler. Reed bed construction and installing a cover on the sludge drying beds both are estimated at about $60,000 initial cost.

Table 6.4.7

Alternatives for Biosolids Disposal

Number	Alternative	Present Value Cost ($)
1	Reed Bed Dewatering	$474,000
2	Wet Weather Land Application	$480,000
3	Thicken & Store for Summer Land Application	$543,000
4	Sludge Bed Dewatering	$592,000
5	Thicken & Contract with Private Hauler	$630,000

Flexibility

Wet weather land application offers the least flexibility due to site access restraints and permit conditions followed by reed bed dewatering. After a reed bed is set up, it must be fed a minimum amount of fluid to keep the plants healthy. Use of the screw press and sludge drying beds offer a large degree of flexibility, as they can batch process varying amounts of biosolids, depending on the needs of the plant. Using a private hauler offers the highest degree of flexibility, providing advance notice is not required for hauling.

Capacity

The capacity of wet weather application is limited by nitrogen uptake and by metals accumulations for each acre of land. Calculations based on the analysis of the previous three years biosolids production from the WWTP demonstrate that about 17 acres of land would be needed for beneficial application of the wet weather production of biosolids in the study period. At this time, the two private haulers contacted have no restriction on capacity for removal of biosolids.

The screw press had adequate capacity to thicken the projected output for the WWTP. However, the existing sludge drying beds have a storage capacity of only 50,000 gallons. Additional storage sites would be needed, or modifications made to the existing beds to increase storage by the end of the study period. Use of the existing drying beds for a reed bed would have a maximum capacity of about 200,000 gallons per year. Use of the existing sludge drying beds as a drying bed would have a maximum capacity of about 350,000 gallons per year.

Reliability

Use of a private hauler is the only option that is independent of the weather. Wet weather application is fairly reliable, but extremely rainy weather, bad road conditions or equipment failure could disrupt this alternative. Wet weather could also cause problems with storage of thickened sludge in open beds. While a roof over the drying beds would greatly improve their performance, the drying process is still reliant of low humidity, warm temperature and wind evaporation. Reed beds are considered experimental in Oregon, and cannot be assigned a high reliability until the pilot project has proven successful.

Operability

All alternatives use equipment and processes that are familiar to the plant operators. Thickened biosolids would require use of a dump truck, front loader, and manure spreader, equipment that is currently not used at the WWTP. Some training would be required in operation of the screw press, drying beds or reed bed.

Ability to Construct

None of the alternatives require extensive construction. Installation of a sludge bed roof or reed bed could be accomplished without disruption of the WWTP operations.

Environmental Factors

Reed beds are the only alternative that potentially produces a Class A biosolid. The standard reed used to establish a reed bed is Phragmites, a plant considered invasive to native wetlands. Native local wetland plants are recommended to avoid possible contamination of the Bandon Marsh. The other environmental concern is disposal of the annual reed harvest. If the crop is composted or chipped for mulch, then the environmental impact is minimal. Wet weather land application sites would be carefully screened to avoid runoff due to rain or ground water contamination. Use of the sludge drying beds, screw press or a private hauler would have negligible environmental impacts under normal operation.

Community Impact

Use of wet weather sites would have no community impact greater than the current method. The number of trucks leaving the plant would be the same. The distance to the application sites is shorter than the trip to North Bend, reducing the chance of a spill. Use of reed beds could be used to raise community awareness of sewage treatment concerns and showcase the community's support for the environment. However, there is a possibility of odor problems in the old town area. Use of the screw presses poses no community impact, but storage of the thickened sludge or use of the sludge drying beds might cause an odor problem in Old Town. Thickened sludge would require fewer trips for disposal, reducing the number of trips from the WWTP by 25%. Use of the screw press and pick up by a private hauler would result in about 25% fewer trips than the current system.

Summary

For the matrix evaluation, a rating system was employed to compare the alternatives. This rating system consisted of a three point scale - three being the best and one, the worst. Two or more alternatives may have the same rating for a particular parameter. The ratings for the matrix evaluation are summarized in Table 6.4.8.

Table 6.4.8

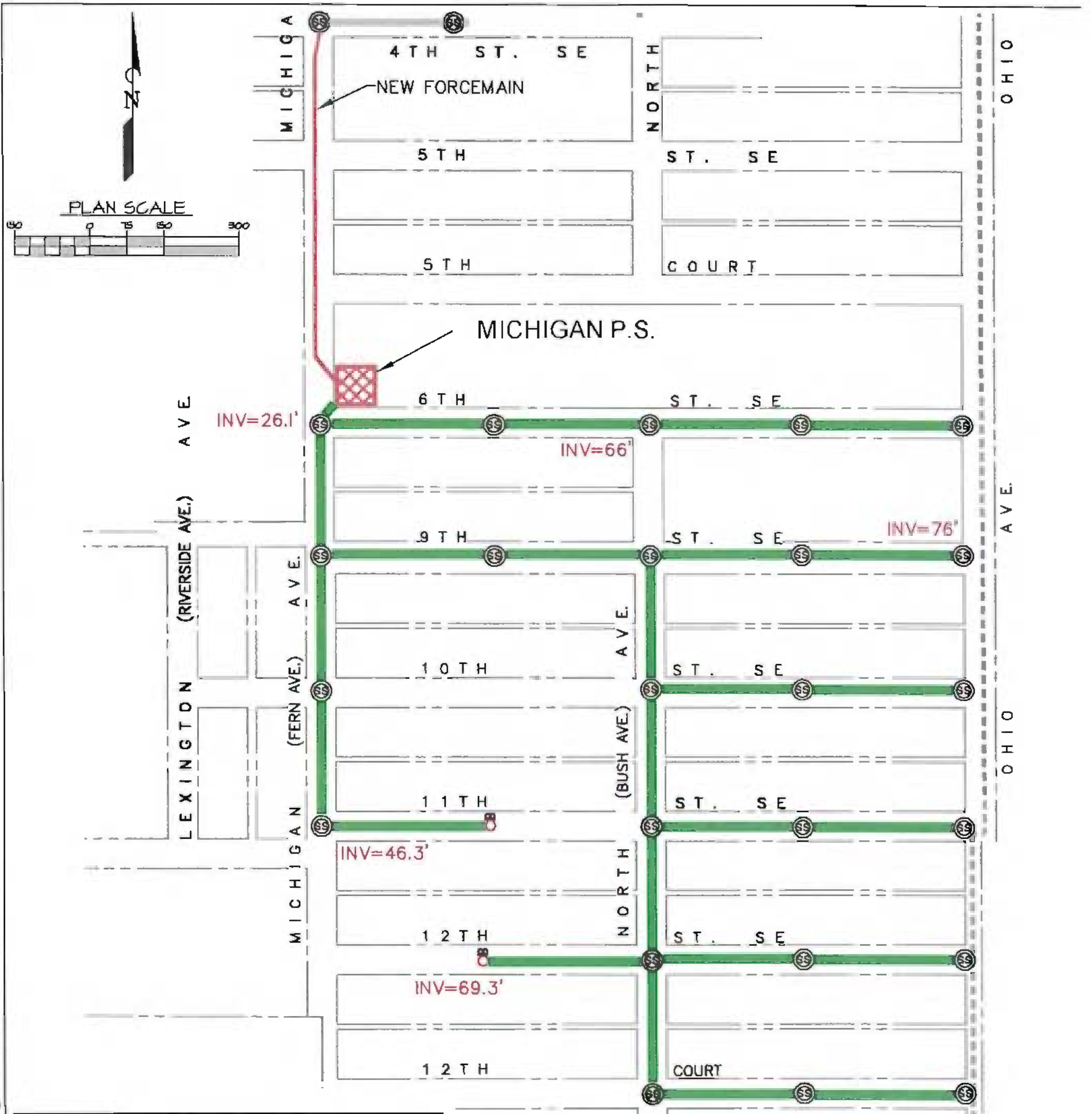
Matrix Evaluation

	Alternative				
Parameter	No. 1	No. 2	No. 3	No. 4	No. 5
Present Worth Cost	3	3	2	2	1
Flexibility	2	2	2	3	3
Capacity	1	3	1	2	3
Reliability	1	2	2	2	3
Operability	2	3	2	2	2
Ability to Construct	2	3	3	2	3
Environmental Factors	3	2	2	2	2
Community Impact	3	3	2	2	3
Total	17	21	16	17	20

Based on the above analysis, Alternatives No. 2 and 5 are considered the highest-ranking alternatives. Alternatives Number 1, 3 and 4 all share the use of the WWTP site for storage, a factor that introduces both the possibility of odor concerns in adjacent neighborhoods and restrictions on capacity. On-site alternatives would require a small-scale test project to see if the process could be conducted without causing odor problems. Capacity issues would not be a concern with any option for at least ten-years, but there is little room for future expansion at the WWTP site.

For the planning period of this Wastewater Master Plan, Alternative No. 2, wet weather land application, is considered the most viable alternative for the City of Bandon's biosolids disposal needs.

Biosolids disposal for the south coast is in a state of flux. A stricter regulatory climate limits disposal options, and the growth in small communities has increased the total volume of biosolids needing disposal sites. Larger communities, that have been able to take biosolids from outside their jurisdiction in the past, are now turning away outside users. Both private haulers and community groups are investigating regional centers for biosolids disposal. These factors could cause major changes in the options available for biosolids disposal in the next five to ten years. The City should plan on reevaluating disposal options within the next five years. It is recommended that the annual operating budget for the WWTP include $5,000 set aside for staff time and outside services for developing biosolids disposal options.



LEGEND

○	SANITARY CLEAN OUT
●	PROPOSED SANITARY MH
INV=69'	PROPOSED INVERT ELEVATION
🟩	PROPOSED SANITARY SEWER
—	PROPOSED PRESSURE MAIN
▨	PROPOSED PUMP STSTION

NOTE:

1. ALL LINES ARE 8" PIPE UNLESS OTHERWISE NOTED.
2. INVERT ELEVATIONS ARE BASED ON 1929 DATUM.

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CITY OF BANDON
WASTEWATER MASTER PLAN

OHIO AVE. PROPOSED SEWER LAYOUT

FIGURE NO.
6.1.2

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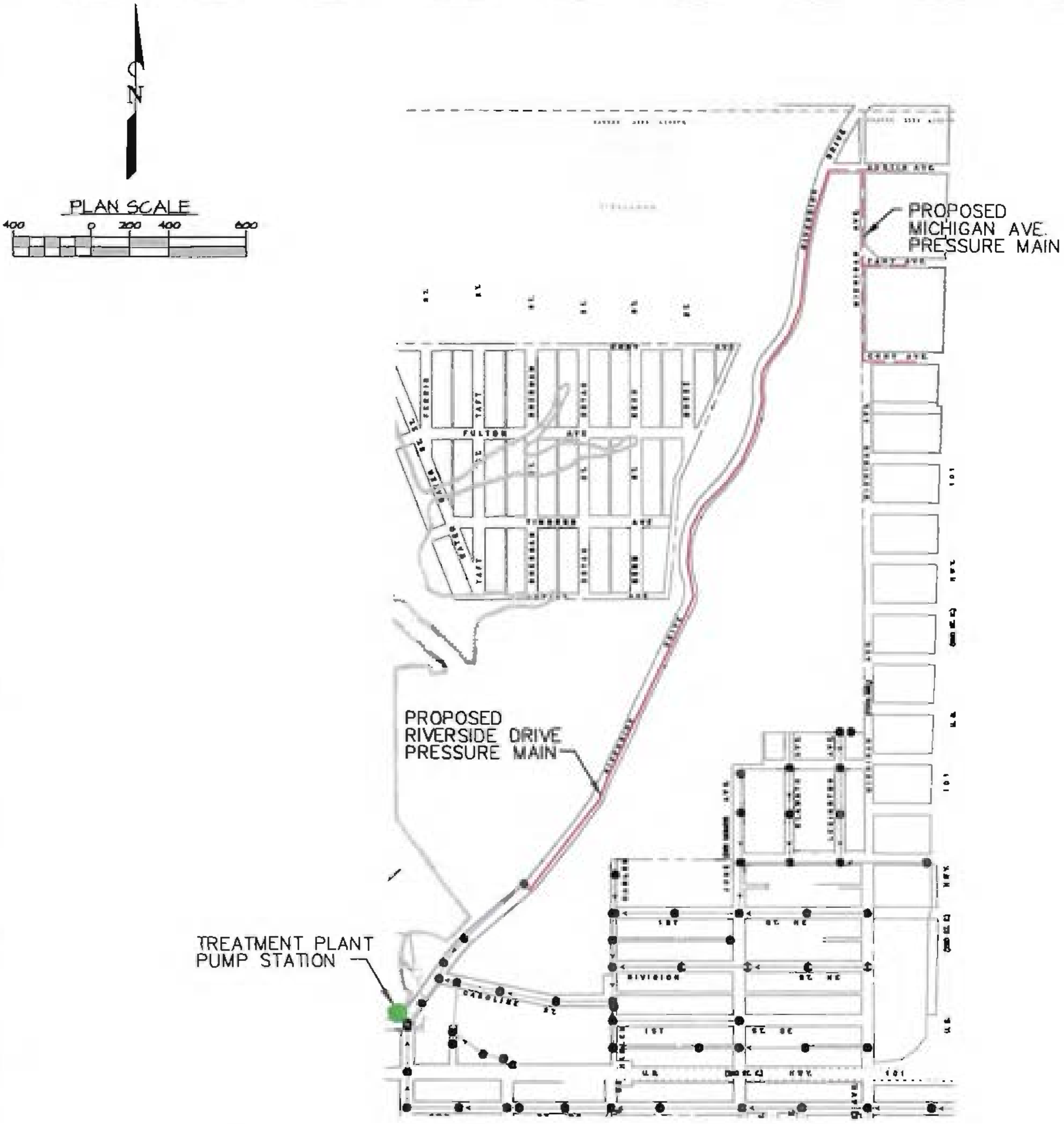

LEGEND

- Ⓢ PROPOSED SANITARY MH
- ▬ EXISTING SANITARY SEWER
- 🟩 PROPOSED SANITARY SEWER
- ▬ RIVERSIDE DRIVE PRESSURE MAIN
- – – – MICHIGAN AVE. PRESSURE MAIN

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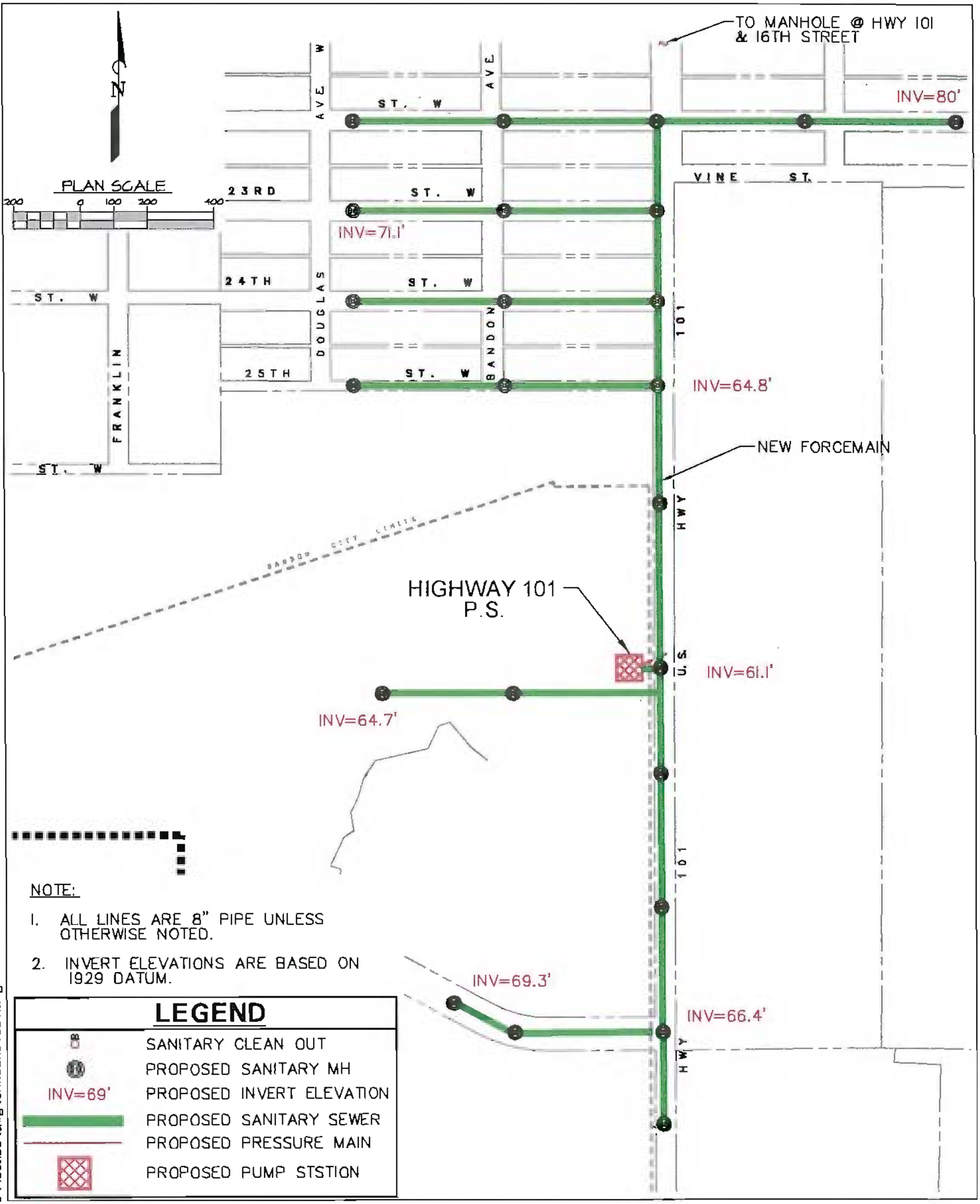
PROJECT NO.: 4501.35

CITY OF BANDON
WASTEWATER MASTER PLAN

PROPOSED RIVERSIDE DRIVE PRESSURE MAIN

FIGURE NO.

6.1.3



NOTE:

1. ALL LINES ARE 8" PIPE UNLESS OTHERWISE NOTED.
2. INVERT ELEVATIONS ARE BASED ON 1929 DATUM.

LEGEND

⊙	SANITARY CLEAN OUT
●	PROPOSED SANITARY MH
INV=69'	PROPOSED INVERT ELEVATION
🟩	PROPOSED SANITARY SEWER
—	PROPOSED PRESSURE MAIN
▨	PROPOSED PUMP STSTION

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DATE: JUNE, 2002
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CITY OF BANDON
WASTEWATER MASTER PLAN

PROPOSED HIGHWAY 101 SOUTH PUMP STATION

FIGURE NO.
6.1.4

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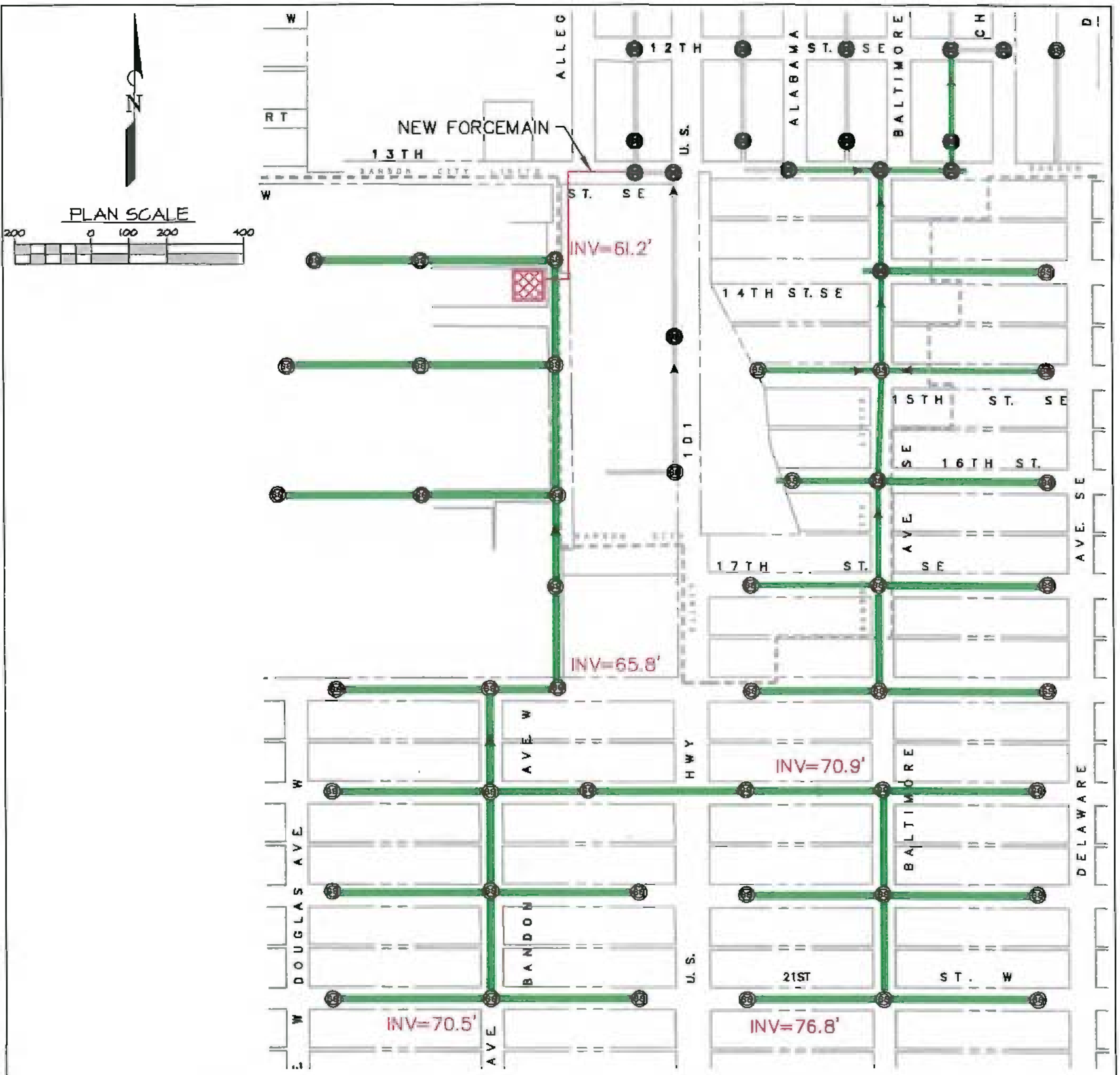

LEGEND

8	SANITARY CLEAN OUT
▬	EXISTING SANITARY SEWER
●	PROPOSED SANITARY MH
INV=69'	PROPOSED INVERT ELEVATION
🟩	PROPOSED SANITARY SEWER
―	PROPOSED PRESSURE MAIN
▨	PROPOSED PUMP STSTION

NOTE:

1. ALL LINES ARE 8" PIPE UNLESS OTHERWISE NOTED.
2. INVERT ELEVATIONS ARE BASED ON 1929 DATUM.

THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF BANDON*** ***WASTEWATER MASTER PLAN***	**FIGURE NO.**
DATE: JUNE, 2002 PROJECT NO.: 4501.35	***PROPOSED ALLEGHENY PUMP STATION & SEWERS***	***6.1.5***

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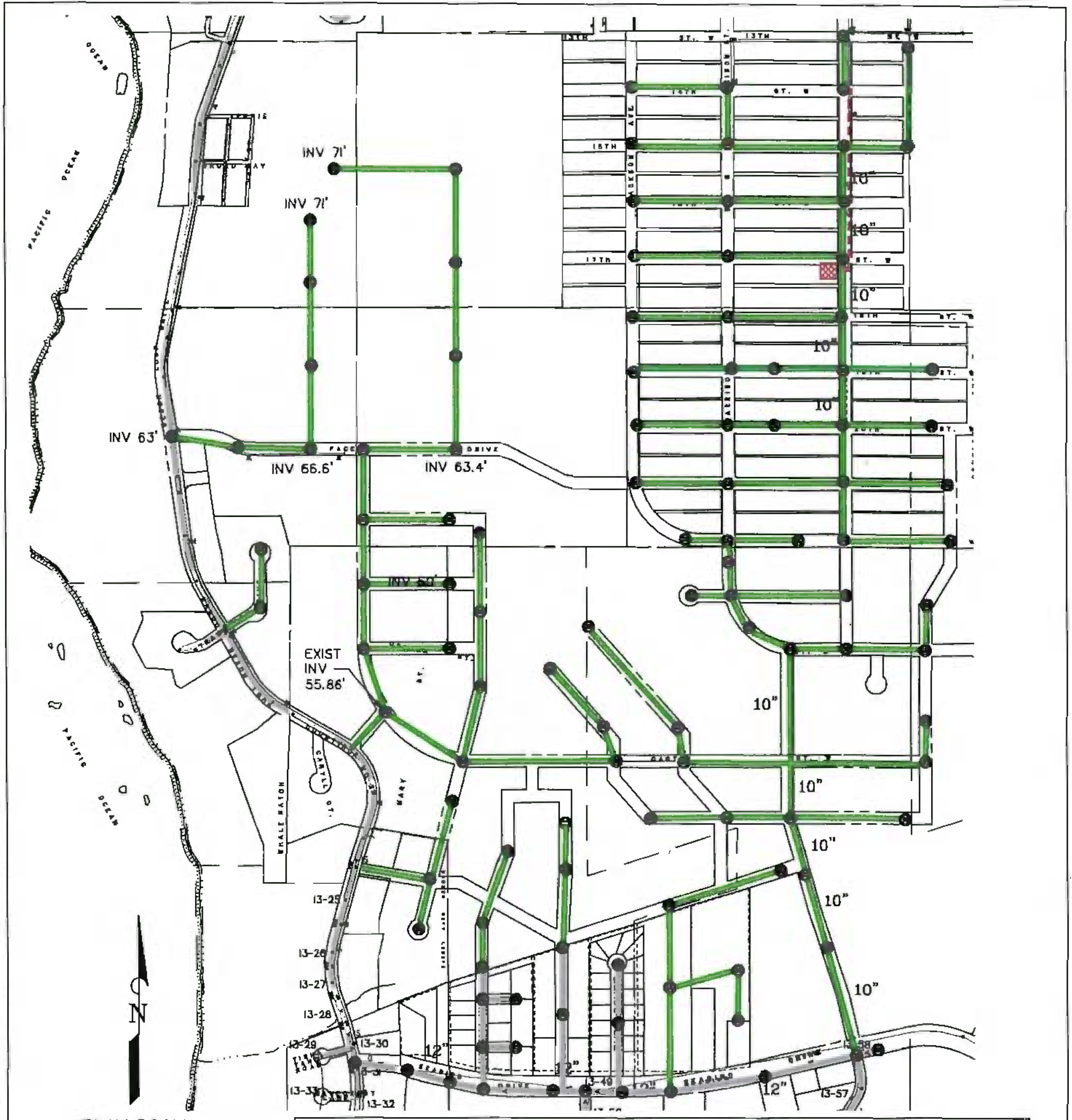

PLAN SCALE

SCALE: 1"=700'

NOTE:
1. ALL LINE ARE 8" PIPE UNLESS OTHERWISE NOTED.

LEGEND

——— AREA BOUNDARY

········· SHORELINE

14TH — ST. SE STREET RIGHT OF WAY

——— EXISTING SEWER

———● PROPOSED SEWER

▨ PROPOSED PUMP STATION

- - - - PROPOSED PRESSURE LINE

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CITY OF BANDON
WASTEWATER MASTER PLAN

SOUTH BANDON PROPOSED SEWERS

FIGURE NO.
6.1.6

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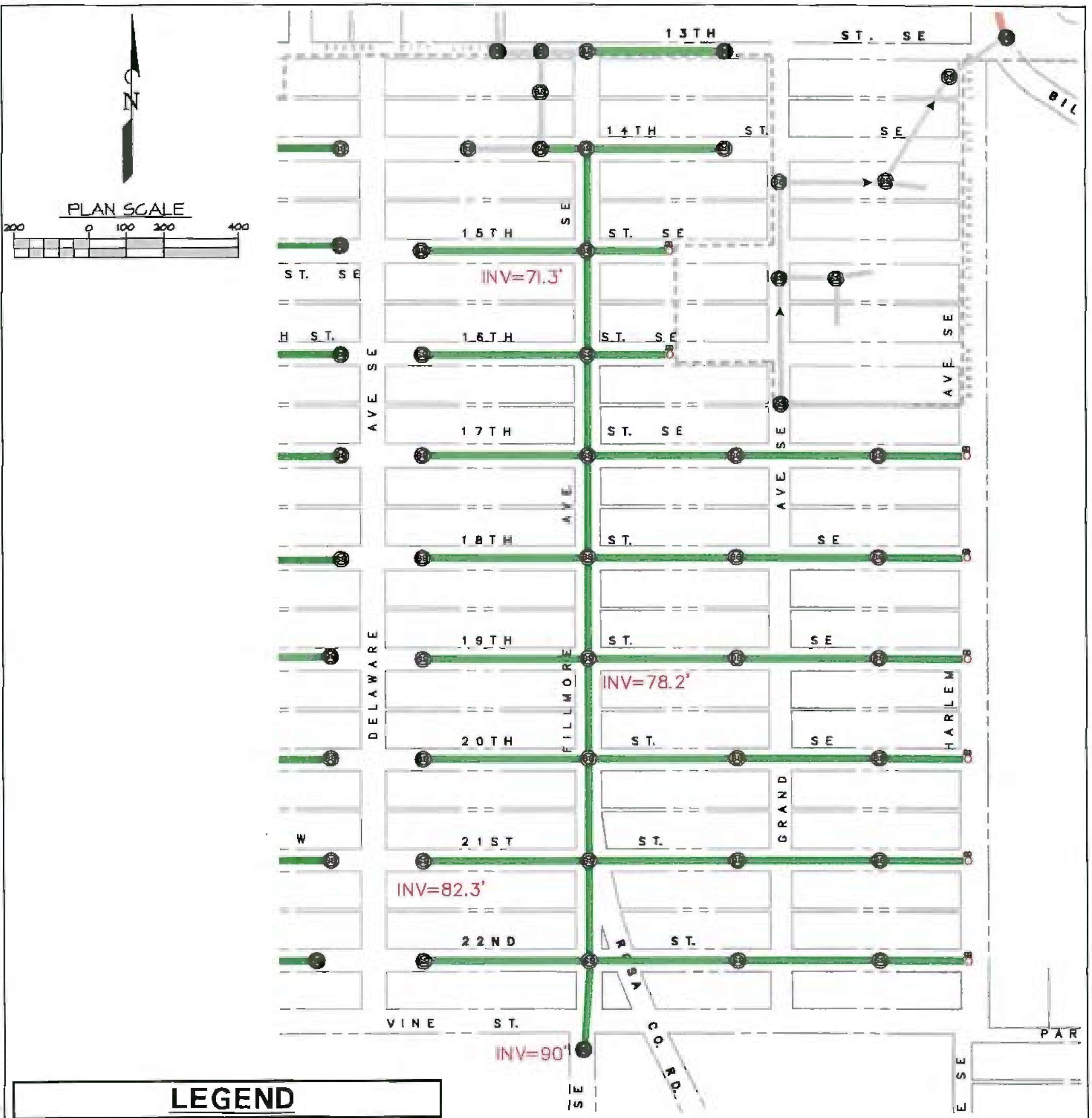

LEGEND

8 SANITARY CLEAN OUT
⊗ PROPOSED SANITARY MH
▬ EXIST. SANITARY SEWER
🟩 PROPOSED SANITARY SEWER
INV=91' PROPOSED INVERT ELEVATION

NOTE:

1. ALL LINES ARE 8" PIPE UNLESS OTHERWISE NOTED.
2. INVERT ELEVATIONS ARE BASED ON 1929 DATUM.

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CITY OF BANDON
WASTEWATER MASTER PLAN

ROSA ROAD PROPOSED SEWER LAYOUT

FIGURE NO.
6.1.7

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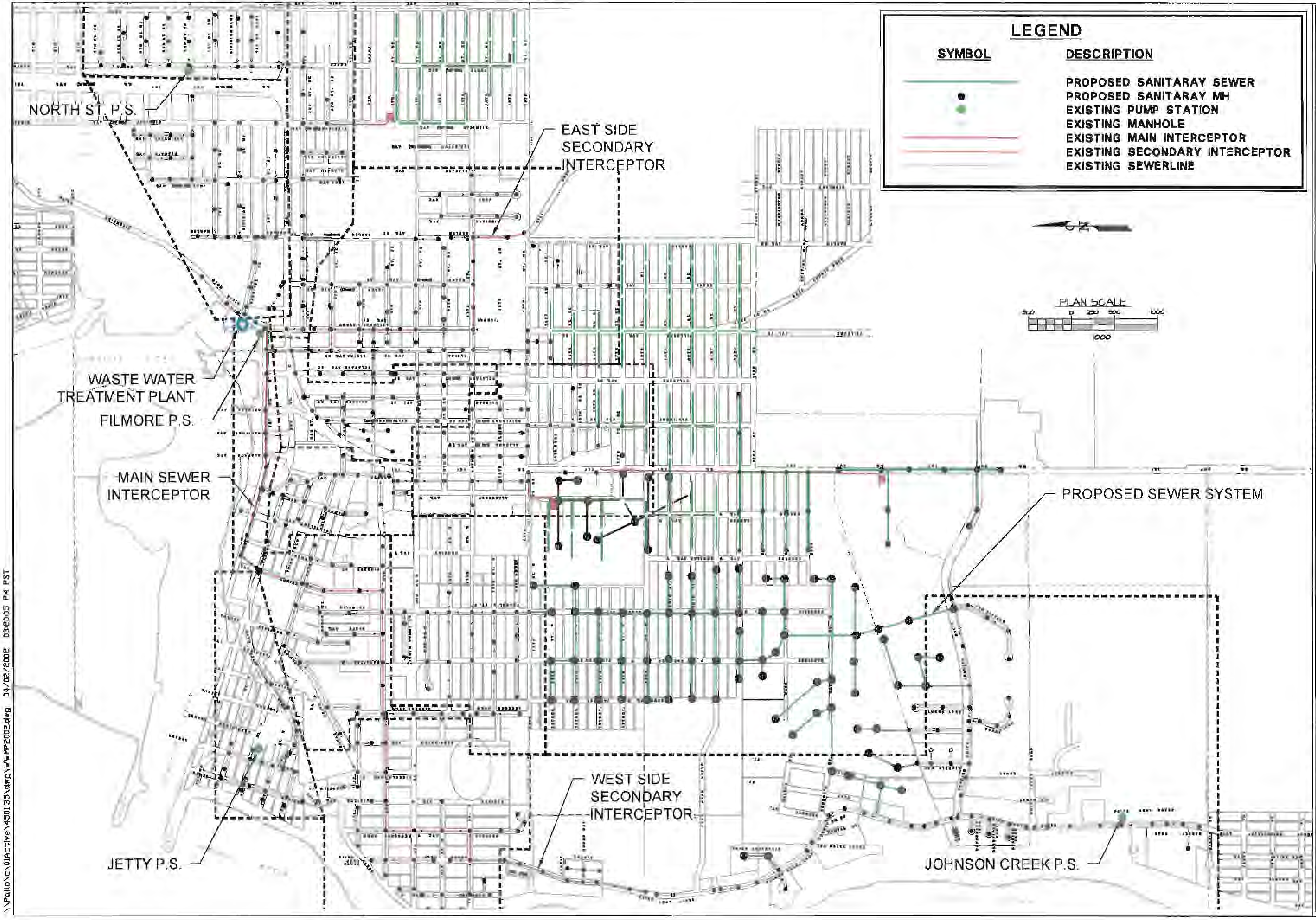

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FIGURE NO.
6.18

CITY OF BANDON
WASTEWATER MASTER PLAN

PROPOSED SEWER LAYOUT

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DATE: JUNE, 2002
PROJECT NO.: 4501.35

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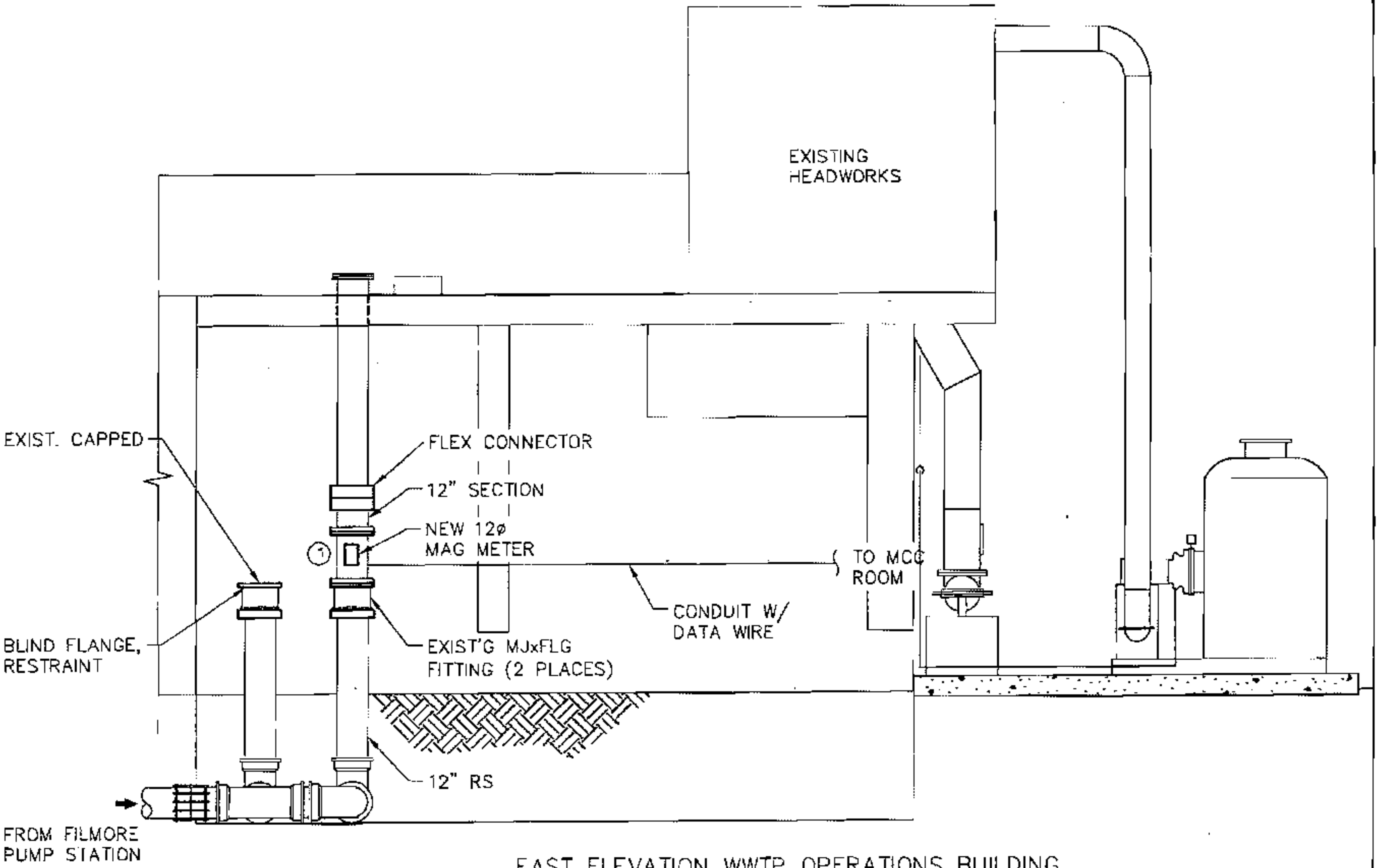

EAST ELEVATION WWTP OPERATIONS BUILDING

① PROVIDE ADDITIONAL SECTION OF PIPE W/ MJxFLG ON ONE END, SIZED TO REPLACE METER PLUS 12" FOR TEMPORARY DUTY DURING METER SERVICING.

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DATE: JUNE, 2002
PROJECT NO.: 4501.35

CITY OF BANDON
WASTEWATER MASTER PLAN
PROPOSED INFLUENT METER

FIGURE NO.
6.2.1

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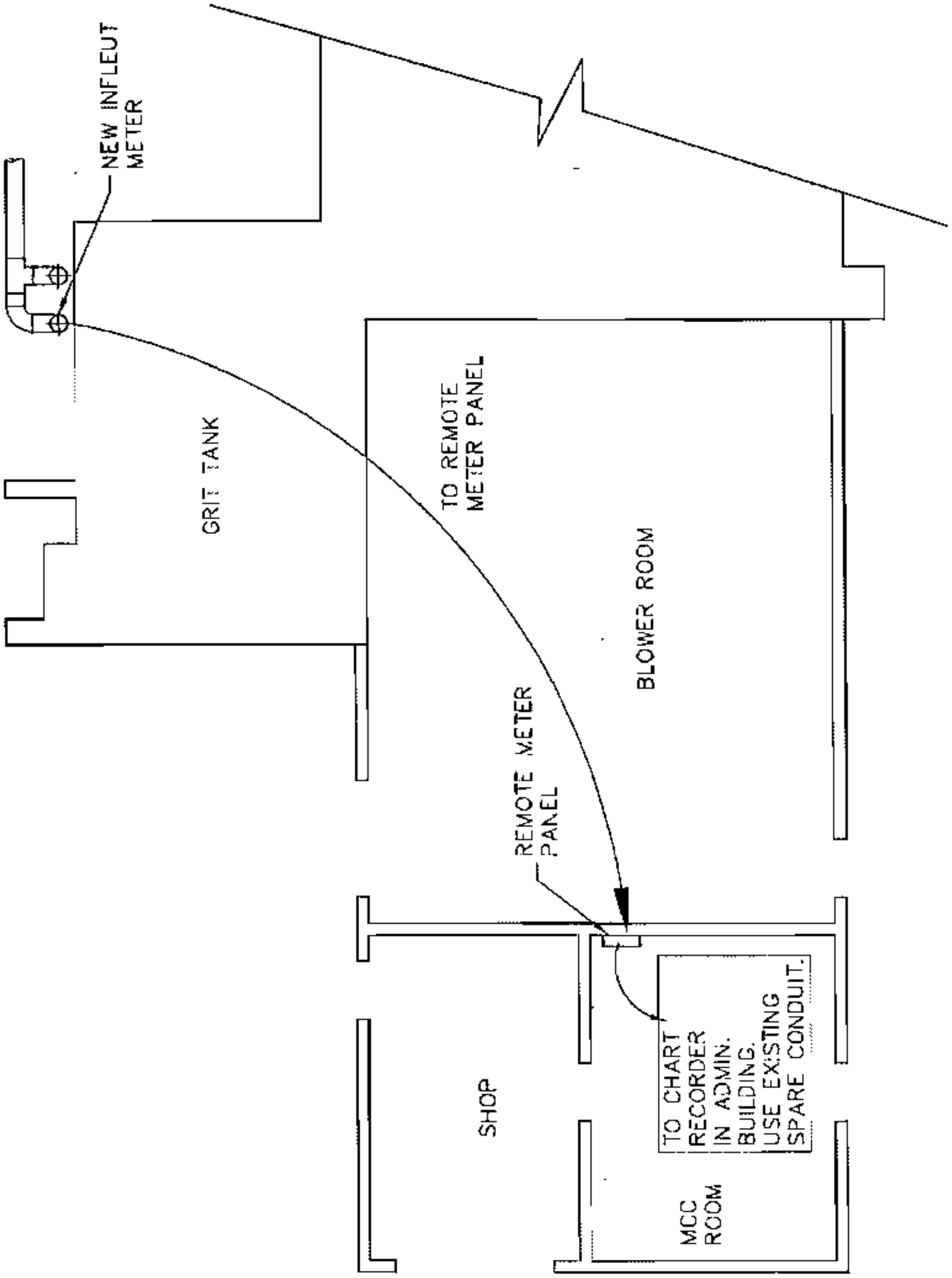

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DATE: JUNE, 2002
PROJECT NO.: 4501.35

CITY OF BANDON
PLAN VIEW PROPOSED INFLUENT. METER CONNECTIONS

BANDON WWTP

FIGURE NO.
6.2.2

Section 7

Recommended Plan

Section

7

Recommended Plan

7.1 Existing Conveyance System Improvements

Improvements proposed for the collection system are directed to correct sources of I/I and system deficiencies identified in Section 6.1 and the December 2001 I/I Study. Proposed improvements include pipeline lining and replacement, manhole rehabilitation, and pump station repairs and replacements.

I/I work

It is recommended that work continue to identify and correct I/I in the existing system. Eight projects were identified in the 2001 Bandon I/I Study to correct I/I problems with an associated cost estimate of $878,085. The first project, Line Replacement of Ocean Drive & 4th Street Sewers, was completed in July 2002. This leaves $644,575 to be budgeted to complete the projects recommended in the I/I study as listed in Table 7.1.1.

Table 7.1.1

Remaining Recommended I/I Improvements Projects (1)

(From December 2001 I/I Study)

Project Number	I/I Study Number	Basin	Description	Total Project Cost
C	No. 2	7	Lining/Line Replacement-Oregon Avenue	$ 164,920
G	No. 3	12	Lining-9th Street W, 11th Street W & Franklin Avenue	$ 233,635
H	No. 4	2	Lining-Harlem Avenue	$ 48,390
I	No. 5	11	Lining-Newport Avenue	$ 39,735
J	No. 6	10	Lining-Jackson Avenue	$ 64,775
K	No. 7	3	Lining-3rd Street SE	$ 68,620
L	No. 8	All	Manhole Grouting, Spot Repairs, Lateral Reconstruction	$ 24,500
-	-	-	**Overall Total**	**$ 644,575**

(1) Note: Project No. 1 from the I/I study has been completed.

Basin 6 was flow mapped in January 2002 and found to have potential I/I problems. It is recommended that $1,500 be budgeted for television inspection of the areas identified in Figure 3.2.2.

Pipe Capacity

Two sections of existing pipeline were found to be undersized for current flows. The sections recommended for replacement are identified in Figure 6.1.1 and are located on Edison Avenue and on Oregon Avenue.

Estimated cost for replacing the existing eight-inch pipe on Edison Avenue with 12-inch, using open trench construction is $56,500.
Estimated cost for replacing the existing eight-inch pipe on Oregon Avenue with 12-inch, using open trench construction is $133,420.

Pump Stations

Deficiencies were found at all four pump stations, some fairly minor. Recommended improvements are as follows:

Filmore Avenue Pump Station

Install a new tide gate to prevent river water from back flowing into the pump station at high tide. Estimated construction cost is $2,400.

South Jetty Pump Station

Replace the generator timer. Estimated construction cost is $500.

North Avenue Pump Station

Rebuild the pumps this year and budget to install a new above ground packaged pump station in the next five years. Estimated cost to replace the pump impellors and seals using in-house labor is $4,000. The estimated cost to install an above ground pump station is $126,000.

Johnson Creek Pump Station

Build a new pump station located above the floodplain. Reuse the existing generator and wet-well. Locate the wet-well outside of the pump station. Estimated construction cost is $265,000.

7.2 Collection System Expansions

The service areas for expansion have been divided into five separate areas all of which can be served with either conventional gravity systems, pressure sewer systems, or a combination of the two. Riverside Drive was evaluated, but is not recommended for connection to the sanitary sewer system due to the high cost per EDU. DEQ requires special on-site treatment systems in the Riverside Drive area as replacement systems when existing conventional septic drain fields fail. As regulatory requirements and prices for special systems increase, residents in this area may chose to form a local utility district and connect to the public system.

The proposed collection system expansions are presented as guidelines for future expansion, and are not directly recommended for construction. Current City policy is to allow connections only to properties within the City limits and to require developers to pay for line extensions to serve their development. An exception is made where the property is located on a street that forms the City boundary and sewer lines are already installed. The Ohio Avenue and Highway 101 South areas are within the City limits, the other projects are in the UGB. Projects in the Ohio Avenue, Highway 101 South, Allegany Avenue and South Bandon areas will require pump stations and pressure mains to be installed before service may be extended. These projects are detailed in Section 6.1. The estimated construction costs for each area are summarized in Table 7.2.1.

Table 7.2.1

Collection System Expansion Costs Summary (EDUs at Build-out)

Area	Estimated Cost (millions)	EDUs	Cost Per EDU
Ohio Avenue	$1.1	270	$4,000
Highway 101 South	$1.4	270	$5,200
Allegany Avenue	$1.2	340	$3,500
South Bandon	$3.8	900	$4,200
Rosa Road	$1.1	370	$3,000

The costs per EDU can be used as an estimate for the assessments required if each of the five areas forms a local improvement district (LID). If each EDU pays this cost, the collection system can be installed. Costs for any required treatment plant expansion would be in addition to the LID costs. Plant expansion is not necessary to meet the projected load for the year 2021, but will be necessary before full build-out is reached in the UGB.

The improvements and costs discussed in the Plan assume that the selected growth rate occurs relatively evenly throughout the study area. Some improvements may be phased differently than assumed if different growth patterns occur. It is anticipated that a spurt of rapid development would occur directly adjacent any new line extension. With a specific service area selected, a predesign report should be completed with a more accurate determination of LID assessments included.

7.3 Treatment Facility Improvements

The WWTP has adequate capacity to meet the projected load for the anticipated 20-year population growth, based on the original construction design data. One project is recommended to improve treatment efficiency and two measures to correct deficiencies in metering and recording plant flows.

Installation of a RAS monitoring and control system would enable the operators to maintain a more accurate food to mass ratio and optimize the secondary treatment process. Estimated construction cost is $12,000.

Replacing the existing chart recorder and recording modules would improve the accuracy of the WWTP flow records. The existing equipment is out-dated and is not recording flows accurately. The estimated replacement cost, including calibration, training and engineering is $25,000.

Installation of a new influent mag-meter at the headworks of the WWTP would provide accurate information for calculating mass loads, by passes and hydraulic loads, thereby improving the operating efficiency of the plant. Estimated installation cost is $21,000.

7.4 Biosolids Disposal

One of the largest concerns facing the WWTP operating staff is the timely removal and disposal of biosolids from the WWTP digesters. The recommended biosolids measure for dealing with disposal is to develop wet weather application sites. While this measure involves minimal capital outlay, there will be a considerable investment in staff time to obtain and maintain permits for these sites.

The City should continue to pursue opportunities to increase the flexibility for biosolids disposal. Options involving the existing sludge drying beds received a lower rating in Section 6.4 due to lack of capacity and concerns involving the possibility of odor generation. However, small-scale test projects could be run at minimal cost to assess the viability of these alternatives to handle a portion of the digesters' output. The WWTP staff is currently preparing to run the existing screw presses and will use the sludge drying beds to test the feasibility of storing and drying dewatered biosolids. In addition to this test, it is recommended that one sludge drying bed be used to run a dewatering test on digester biosolids during dry weather. A recommended annual budget for staff time and incidental costs associated with pursuing additional permit sites and on-site biosolids storage options is $3,500.

The City participated in Phase I of the regional biosolids study. Phase II of this study will identify the preferred option for a regional disposal center and is in the process of fund acquisition. As a regional disposal center may provide small municipalities an option for biosolids disposal, it is recommended that the City continue its participation in the project. The Phase II contribution solicited for participation by small municipalities is $1,700.

7.5 Project Cost Summary

Capital costs for the recommended projects are summarized in Table 7.5.1. The estimated project cost total, including construction, engineering, contingency and administration is $1,291,895. Projects are listed in priority order.

Table 7.5.1

Capital Costs of Recommended Projects

#	Project Description	Project
A	Filmore Avenue Pump Station Tide Gate	$2,400
B	North Avenue Pump Station Impellors	$4,000
C	I/I Project # 2	$164,920
D	Oregon Avenue Line Upsize	$133,420
E	Johnson Creek Pump Station Replacement	$265,000
F	New Metering Recording System	$25,000
G	I/I Project # 3	$233,635
H	I/I Project # 4	$48,390
I	I/I Project # 5	$39,735
J	I/I Project # 6	$64,775
K	I/I Project # 7	$68,620
L	I/I Project # 8	$24,500
M	New Influent Meter	$21,000
N	Automatic RAS Control	$12,000
O	North Avenue Pump Station Replacement	$126,000
P	Edison Avenue Line Upsize	$56,500
Q	Basin 6 Television Inspection	$1,500
R	Jetty Pump Station Generator Timer	$500
	Total	$1,291,895

A break down of project capital costs, including expansion projects, to show funding responsibility under current City policy is included in Table 7.5.2.

Table 7.5.2

Associated City, Private and SDC Improvement Costs

#	Priority	Project Description	City Project	SDC Eligible	Private Project	Total Cost
A	1	Filmore Avenue PS Tide Gate	$2,400	$0	$0	$2,400
B	1	North Avenue PS Impellors	$4,000	$0	$0	$4,000
C	2	I/I Project # 2	$115,420	$49,500	$0	$164,920
D	2	Oregon Avenue Line Upsize	$0	$133,420	$0	$133,420
E	3	Johnson Creek PS Replacement	$265,000	$0	$0	$265,000
F	4	New Metering Recording System	$25,000	$0	$0	$25,000
G	5	I/I Project # 3	$163,635	$70,000	$0	$233,635
H	6	I/I Project # 4	$33,890	$14,500	$0	$48,390
I	6	I/I Project # 5	$27,735	$12,000	$0	$39,735
J	6	I/I Project # 6	$44,775	$20,000	$0	$64,775
K	6	I/I Project # 7	$48,620	$20,000	$0	$68,620
L	6	I/I Project # 8	$17,150	$7,350	$0	$24,500
M	7	New Influent Meter	$21,000	$0	$0	$21,000
N	7	North Avenue PS Replacement	$126,000	$0	$0	$126,000
O	8	Automatic RAS Control	$12,000	$0	$0	$12,000
P	9	Edison Avenue Line Upsize	$0	$56,500	$0	$56,500
Q	10	Basin 6 Television Inspection	$1,500	$0	$0	$1,500
R	Done	Jetty PS Generator Timer	$500	$0	$0	$500
		Recommended Project Subtotal	**$908,625**	**$383,270**	$0	**$1,291,895**
S	-	Ohio Avenue Sewer Expansion	$0	$420,000	$680,000	$1,100,000
T	-	Highway 101 South Sewer Expansion	$0	$483,200	$916,800	$1,400,000
U	-	Allegany Avenue Sewer Expansion	$0	$0	$1,200,000	$1,200,000
V	-	South Bandon Sewer Expansion	$0	$0	$3,800,000	$3,800,000
W	-	Rosa Road Sewer Expansion	$0	$0	$1,100,000	$1,100,000
		Expansion Project Subtotal	**$0**	**$903,200**	**$7,696,800**	**$8,600,000**
		Total	**$908,625**	**$1,286,470**	**$7,696,800**	**$9,891,895**

7.6 Project Summary

A brief description of each project is included below.

Projects A, B, & R

Pump Station Improvements: Repairs necessary to maintain proper operation of existing pump stations.

- Filmore Pump Station: Replace leaking tide gate.
- Jetty Pump Station: Replace generator timer.
- North Avenue Pump Station: Replace impellors.

Cost is estimated at **$6,900.**

Projects C & G-L

Infiltration and Inflow Rehabilitation: Lining and replacement of sewer lines as identified in the February I/I Study. This work is required for the WWTP to have adequate capacity for the next 20 years. Cost is estimated at **$644,575**.

Projects D & P

Sewer Line Capacity Improvements: Upsize of existing sewer lines that are currently at or over capacity. Includes replacement of approximately 220 feet of pipe on Edison Avenue between Jetty Road and First Street and 520 feet of pipe on Oregon Avenue between Fourth and Eighth Street West. Cost is estimated at **$189,920**.

Projects E & N

Pump Station Replacements: Replacement of pump stations that have operational and safety problems due to their age and construction.

- North Avenue Pump Station: Confined space requirements, failure to meet NFPA 820 and the discontinuation of support by the manufacturer are concerns for this facility. Replace with an above ground packaged station.
- Johnson Creek Pump Station: Failure to meet NFPA 820, damage due to previous flooding, deterioration due to age, maintenance difficulties due to lack of parts and type of equipment, and loss of service during high water conditions are concerns for this facility. Replace with a conventional pump station raised above the floodplain.

Cost is estimated at **$391,000**.

Projects F, M, & O

Wastewater Treatment Plant Controls & Metering: Installation of new monitoring and metering equipment. Includes installation of a new influent meter, replacement of the outdated and/or nonfunctioning recording system, and installation of automatic RAS control. Cost is estimated at **$58,000**.

Project Q

Television Inspection of Basin 6: Inspect existing sewer lines with a video camera to determine the source of excess I/I detected during winter rains. Cost estimated at **$1,500.**

Total recommended project cost is estimated at **$1,291,895**.

Projects S-W are expansion projects and are not recommended at this time.

Section

8

Financing Options

Section 8

Financing

Most communities are unable to finance major infrastructure improvements without some form of governmental funding assistance, such as low interest loans or grants. In this Section, a number of major Federal/State funding programs and local funding mechanisms that are appropriate for the recommended improvements are discussed. A recommended financing strategy for the proposed infrastructure system improvements is also presented along with a discussion of the potential impact to rate payers.

8.1 Grant and Loan Programs

Some level of outside funding assistance in the form of grants or low interest loans may be necessary to make the proposed improvement projects affordable for the City of Bandon and it's citizens. The amount and types of outside funding will dictate the amount of local funding that the City must secure. In evaluating grant and local programs, the major objective is to select a program, or a combination of programs, which are most applicable and available for the intended project.

A brief description of the major Federal and State funding programs that are typically utilized to assist qualifying communities in the financing of infrastructure improvement programs is given below. Each of the government assistance programs has particular prerequisites and requirements. These assistance programs promote such goals as aiding economic development, benefiting areas of low to moderate-income families, and providing for specific community improvement projects. With each program having its specific requirements, not all communities or projects may qualify for each of these programs.

Economic Development Administration (EDA) Public Works Grant Program

The EDA Public Works Grant Program, administered by the U.S. Department of Commerce, is aimed at projects which directly create permanent jobs or remove impediments to job creation in the project area. Thus, to be eligible for this grant, a community must be able to demonstrate the potential to create jobs from the project. Potential job creation is assessed with a survey of businesses to demonstrate the prospective number of jobs that might be created if the proposed project was completed.

Proposed projects must be located within an EDA-designated Economic Development District. Priority consideration is given to projects that improve opportunities for the establishment or expansion of industry and that create or retain private sector jobs in both the near-term and long-term. Communities, which can demonstrate that the existing system is at capacity (i.e. moratorium on new connections), have a greater chance of being awarded this type of grant. EDA grants are usually in the range of the 50 to 80 percent of the project cost; therefore some type of local funding is also required. Grants typically do not exceed 1 million dollars.

Water and Waste Disposal Loans and Grants (Rural Development)

The Rural Development Administration (Rural Development) manages the loans and grants for wastewater programs that used to be overseen by the Farmers Home Administration. While these programs are administered by a new agency, the program requirements are essentially the same. The Rural Utilities Service (RUS) is one of three entities that comprise the USDA's Rural Development mission area. The RUS supports various programs that provide financial and technical assistance for development and operation of safe and affordable water supply systems and sewer and other forms of waste disposal facilities.

Rural Development has the authority to make loans to public bodies and non-profit corporations to construct or improve essential community facilities. Grants are also available to applicants who meet the median household income (MHI) requirements. Eligible applicants must have a population less than 10,000. Priority is given to public entities in areas smaller than 5,500 people to restore a deteriorating water supply, or to improve, enlarge, or modify a water facility and/or inadequate waste facility. Preference is given to requests that involve the merging of small facilities and those serving low-income communities.

In addition, borrowers must meet the following stipulations:

- Be unable to obtain needed funds from other sources at reasonable rates and terms.
- Legal capacity to borrow and repay loans, to pledge security for loans, and to operate and maintain the facilities or services.
- Financially sound and able to manage the facility effectively.
- Financially sound facility based on taxes, assessments, revenues, fees, or other satisfactory sources of income to pay all facility costs including operation and maintenance, and to retire the indebtedness and maintain a reserve.
- Water and waste disposal systems must be consistent with any development plans of State, multi-jurisdictional area, counties, or municipalities in which the proposed project is located. All facilities must comply with Federal, State, and local laws including those concerned with zoning regulations, health and sanitation standards, and the control of water pollution.

Loan and grant funds may be used for the following types of improvements:

- Construct, repair, improve, expand, or otherwise modify waste collection, pumping, treatment, or other disposal facilities. Facilities to be financed may include such items as sewer lines, treatment plants, including stabilization ponds, storm sewer facilities, sanitary landfills, incinerators, and necessary equipment.
- Legal and engineering costs connected with the development of facilities.
- Other costs related to the development of the facility including the acquisition of right-of-way and easements, and the relocation of roads and utilities.
- Finance facilities in conjunction with funds from other agencies or those provided by the applicant.

Interim commercial financing will normally be used during construction and Rural Development funds will be available when the project is completed. If interim financing is not available or if the project cost is less than $50,000, multiple advances of Rural Development funds may be made as construction progresses.

The maximum term on all loans is 40 years. However, no repayment period will exceed any statutory limitation on the organization's borrowing authority, nor the useful life of the improvement of the facility to be financed. Interest rates are set quarterly and are based on current market yields for municipal obligations. Current interest rates may be obtained from any Rural Development office.

The following rates currently apply for the Rural Development program:

> ***Market rate.*** Those applicants pay the market rate whose median household income (MHI) of the service area is more than the $27,756 (Oregon non-metropolitan MHI). The market rate is currently 5.00%.
>
> ***Intermediate rate.*** The intermediate rate is paid by those applicants whose MHI of the service area is less than $27,756 but greater than $22,205. The intermediate rate is currently 4.75%.
>
> ***Poverty line rate.*** Those applicants whose MHI of the service area is below $22,205 (80% of the non-metropolitan MHI) pay the lowest rate. Improvements must also be to correct a regulatory violation or health risk issue to qualify for this lowest rate. The current poverty line rate is 4.50%.

Maximum grant amounts, based on MHI, are provided in Table 8.1.1. The grants are calculated on the basis of eligible costs that do not include the costs attributable to reserve capacity or interim financing. In addition, grant funds cannot be used to reduce total user costs below that of comparable communities funded by RUS.

Table 8.1.1
Maximum Rural Development Grant Funds Based On Median Household Income

Median Household Income (MHI)	Maximum Grant [a]	Interest Rate [b]
<$22,205	45%	4.5%
$22,205 - $27,756	45%	4.75%
>$27,756	0%	5.00%

[a] MHI<22,205 may be considered for a grant up to 75% of eligible project cost if the project is needed to alleviate a health or sanitary problem.

[b] Rates apply for quarter ending June 30, 2002.

Eligibility for the Rural Water and Waste Disposal grants and loans are currently based on 1990 Census data. The MHI in the City of Bandon, based on 1990 Census data, is $17,708. At this MHI, the City could be eligible for a maximum grant of up to 75% of the total project cost. The City may also eligible for a Rural Development loan at the intermediate rate of 4.75%.

There are other restrictions and requirements associated with these loans and grants. If the City becomes eligible for grant assistance, the grant will apply only to eligible project costs. Additionally, grant funds are only available after the City has incurred long-term debt resulting in an annual debt service obligation equal to 0.5% of the MHI. In addition, an annual funding allocation limits the Rural Development funds. To receive a Rural Development loan, the City must secure bonding authority, usually in the form of general obligation or revenue bonds.

Rural Utilities Service funds, for use in Oregon, are limited by an annual funding allocation. Because of the success of the Rural Utilities Service Grant and Loans and tightening of the Federal budget, it is becoming increasingly difficult to obtain sole funding from Rural Development for a large project. Rural Development staff believes the maximum amount of grant funding would consist of a 50 percent split between grant and loan funds. Unless Rural Utilities Service receives an increase in funding, the amount of loan and grant funds for any given project is likely to be limited to approximately $3.5 million and $1.0 million, respectively.

Applications for financial assistance are made at area offices of the Rural Development. For additional information on Rural Development loans and grant programs call 1-541-673-0136 or visit the RUS website at http://www.usda.gov/rus/water/. The Oregon Rural Development website is http://www.rurdev.usda.gov/or/.

Technical Assistance and Training Grants (TAT)

Available through the USDA Rural Utilities Service (RUS) as part of the Water and Waste Disposal programs, TAT grants are intended to provide technical assistance and training to associations on a wide range of issues relating to the delivery of water and waste disposal services.

Rural communities with populations of less than 10,000 persons are eligible along with private, nonprofit organizations that have been granted tax-exempt status by the IRS.

TAT funds may be used for the following activities:

- Identify and evaluate solutions to water and/or waste related problems of associations in rural areas.
- Assist entities with preparation of applications for Water and Waste Disposal loans and grants.
- Provide training to association personnel in order to improve the management, operation and maintenance of water and/or waste disposal facilities.
- Pay expenses related to providing the technical assistance and/or training.

Grants may be made for up to 100% of the eligible project costs. Applications are filed with any USDA Rural Development office. For additional information on Rural Development loans and grant programs call 1-541-673-0136 or visit the RUS website at http://www.usda.gov/rus/water/.

Oregon Community Development Block Grant (OCDBG) Program

The Community Development Program section of the Oregon Economic and Community Development Department (OECDD) administers the OCDBG Program. Funds for the program come from the U.S. Department of Housing and Urban Development. OCDBG funds under the Public Works category are targeted to water and wastewater systems. Oregon has approximately six million dollars targeted for public works projects in 2002.

To receive a grant the applicant must meet the following criteria:

- Be a City or County located in a non-metropolitan area of rural Oregon.
- Have over 51% of population considered low and moderate income in target area based on census data or a local survey.
- Have received less than $750,000 in grants from this program in the previous five years for wastewater projects.
- Have drinking water/waste disposal rates at or above 1.75% of the median annual household income for the target area.
- Have a local match of a minimum of 15% local funding.
- List the project on their top ten Needs and Issues Priority List.
- Use the funds to benefit current residents in a primarily residential area.

Eligible activities include the following categories:

- Public Works Water and Sewer Improvements
- Public Works Infrastructure for New Low/Moderate Income Housing
- Emergency Projects
- Projects which are necessary to bring municipal water and sewer systems into compliance with the requirements of the Safe Drinking Water Act or the Clean Water Act administered by the Oregon Health Division (OHD) or the requirements of water quality statutes, rules or permits administered by the Oregon Department of Environmental Quality (DEQ) or the Environmental Quality Commission (EQC)
- Projects where the municipal system has been issued a notice of non-compliance from the Oregon Health Division or the Department of Environmental Quality or it is determined that there is a high probability that within two years the system will be notified of non-compliance.

Public works project grants are limited to $750,000 for the combined total of all phases. Applications may be submitted year-round for Public Works grants under the OCDBG Program. Based on a local survey, 56.70% of residents in Bandon are Low/Moderate Income, so the City qualifies to apply for grants under this program. The 2000 census data will be released in July 2002 and will supercede previous census and survey data. Income levels for Bandon may no longer meet the eligibility guidelines.

For additional information on the OCDBG programs, call 1-800-233-3306 or visit the OECDD website at http://www.econ.state.or.us/cdbg.htm.

Oregon Special Public Works Fund

The Special Public Works Fund (SPWF) program provides financing to local governments to construct, improve, and repair infrastructure in order to support local economic development and create new jobs locally, especially family wage jobs. In order to be eligible, the following conditions must be satisfied.

- The existing infrastructure must be insufficient to support current or future industrial or eligible commercial development; and
- There must be a high probability that family wage jobs will be created or retained within: 1) the boundary to be served by the proposed infrastructure project or 2) industrial or eligible commercial development of the properties served by the proposed infrastructure project.

The SPWF program is capitalized by the Oregon State Legislature through biennial appropriations from the Oregon Lottery Economic Development Fund, through bond sales for dedicated project funds, through loan repayments and other interest earnings. The Oregon Economic and Community Development Department (OECDD) administers the fund.

Eligible activities include wastewater treatment facilities and all facilities necessary for collecting, pumping, treatment and disposal of sanitary sewage and storm drainage. The following criteria are used to determine project eligibility.

- *Firm Business Commitment.* In addition to creating or retaining of permanent jobs as a result of the project, there must be private and/or public investment in the project equal to at least twice the SPWF funding.
- *Capacity Building.* The applicant is required to document: 1) recent interest benefited by the project, 2) there are ongoing efforts to market the area, and 3) the project will promote future economic development and creation of jobs.

All projects must principally benefit industrial or eligible commercial users.

The Department will structure a financing package that may include loans and/or grants. Final amount of financing and the loan/grant/bond mix is determined by such factors as the financial feasibility of the project, applicant's credit strength, the ability to assess specially benefited property owners, applicant's ability to afford annual loan payments, and future beneficiaries of the project.

Maximum SPWF loan per project is $10 million, if funded from SPWF revenue bond proceeds. Projects financed directly from the SPWF may receive up to $1 million. Interest rates are no less than 6.5 percent and are set quarterly by the Department; loan terms cannot exceed 25 years. The maximum SPWF grant is $500,000 for a construction project and is not to exceed 85 percent of the total project cost. Grants are made only when loans are not feasible.

For additional information on the OCDBG and other OECDD programs, call 1-800-233-3306 or visit the OECDD website at http://www.econ.state.or.us/spwf.htm.

Water/Wastewater Financing Program

The Water/Wastewater Financing Program was designed for communities that must meet Federal and State mandates to provide safe drinking water and adequate treatment and disposal of wastewater. The legislation was intended to assist local governments meet the Safe Drinking Water Act and the Clean Water Act. The Oregon State Legislature capitalizes the funding for this program through a biennial appropriation from the Oregon Lottery Economic Development Fund. The program is administered by OECDD, Community Development Programs Section. Program eligibility is limited to projects necessary to ensure compliance with the applicable State regulatory agency standards or rules.

While loans and grants may be awarded, grant funding must be accompanied by loans from the Community Development Program. Loans are based on a municipality's ability to repay. Grant funding is available only if a loan is not feasible. OECDD will structure a financing package that may include direct loans, bond loans, and/or grants and may include funds from other Community Development programs for which the project is eligible. The mix of loan/grant/bond financing will depend on the financial feasibility of the project and will consider utility rates, per capita income, existing debt, and other factors. Financing limits are as follows:

Table 8.1.2

Project Financing Limitations

	Maximum	
Project Financing	Loan	Grant
With Bond Funds	$10 million	$500,000
With SPWF Funds	$500,00	$500,000
Technical Assistance [(a)]	$20,000	$10,000

[(a)] For eligible applicants under 5,000 population.

Interested applicants should contact OECDD prior to submitting an application. Applications are accepted year-round. For additional information on this and other OECDD programs, call 1-800-233-3306 or visit the OECDD website at http://www.econ.state.or.us/wtrww.htm.

Department of Environmental Quality, Clean Water State Revolving Fund (SRF)

The SRF Program is administered by the DEQ and was developed to replace the EPA Construction Grants Program. The SRF is a loan program that provides low interest rate loans, instead of grants, for the planning, design, and construction of water pollution control facilities.

Interest rates on all design and/or construction loans are two-thirds of the current municipal bond rate during the quarter that the loan agreement is signed. Estimated loan rates are currently 3.55 percent. In addition, an initiation fee (1.5 percent of the loan amount) and a servicing fee (0.5 percent of the outstanding balance) are also assessed to cover program administration by DEQ. Loans can be in the form of general obligation bonds or other rated debt obligations, revenue secured loan, or a discretionary loan.

SRF funds are allocated based on a prioritization process. Based on the preliminary applications, projects are assigned points and ranked in priority order based on 1) severity of water quality/health hazard problem; 2) receiving water body sensitivity; and 3) population served by the project.

The Intended Use Plan is one part of Oregon's annual SRF capitalization grant application. This plan includes lists of eligible projects ranked in priority order. Projects allocated funds are placed on the Funded List. Unfunded projects are on the Planning List to receive funds if any of the Funded List projects do not complete the loan process. Projects identified on the Funded List from prior years, which have not been initiated, are placed on a Supplemental List.

For additional information on this and other DEQ programs, call 1-800-452-4011 or visit the DEQ website at http://waterquality.deq.state.or.us.

Oregon Department of Energy, Small Scale Energy Loan Program (SELP)

The SELP program offers loans to projects whose purpose is to promote energy conservation and renewable energy resource development. Eligible applicants include cities, counties, special districts, individuals, and non-profit groups. Loans will cover up to 100% of construction costs, including engineering, fees, and studies. The finished project must at least break even in power costs.

The program offers low-interest loans for projects that:

- conserve natural gas, electricity, oil, or other source of energy
- produce energy from renewable resources such as water, wind, geothermal, solar, biomass, waste materials or waste heat
- use recycled materials to create products.

Interested parties should contact the Oregon Office of Energy for details. For additional information on the Office of Energy programs, call 1-503-378-4040 or visit the Office of Energy website at http://www.energy.state.or.us.

Oregon Department of Energy, Business Energy Tax Credit

The Business Energy Tax Credit was revamped in 2001 to allow public entities to participate. The State of Oregon Department of Energy offers a tax credit of 35% of project costs, taken over a five-year period, for qualifying capital improvements that reduce energy use. Requirements for projects are similar to that of the SELP program. Public entities do not pay taxes and so are not eligible for a direct tax credit, but may sell their credit to private businesses at a discounted rate, usually about 28%. Lighting retrofits, VFDs, efficient motors, and controls are typical projects that qualify for funding.

8.2 Local Funding Sources

The amount and type of local funding obligations for infrastructure improvements will depend, in part, on the amount of grant funding anticipated and the requirements of potential loan funding. Local revenue sources for capital expenditures include *ad valorem* taxes, various types of bonds, wastewater service charges, connection fees, and system development charges. Local revenue sources for operating costs include *ad valorem* taxes and wastewater service charges. The following sections identify those local funding sources and financing mechanisms that are most common and appropriate for the improvements identified in this study.

General Obligation Bonds

A general obligation (G.O.) bond is backed by the full faith and credit of the issuer. For payment of the principal and interest on the bond, the issuer may levy ad valorem general property taxes. Such taxes are not needed if revenue from assessments, user charges or other sources are sufficient to cover debt service.

Oregon Revised Statutes limit the maximum term to 40 years for cities. Except in the event that Rural Development Administration will purchase the bonds, the realistic term for which general obligation bonds should be issued is 15 to 20 years. Under the present economic climate, the lower interest rates will be associated with the shorter terms.

Financing of wastewater system improvements by general obligation bonds is usually accomplished by the following procedure:

- Determination of the capital costs required for the improvement.
- An election authorizing the sale of general obligation bonds.
- Following voter approval, the bonds are offered for sale.
- The revenue from the bond sale is used to pay the capital costs associated with the projects.

From a fund raising viewpoint, general obligation bonds are preferable to revenue bonds in matters of simplicity and cost of issuance. Since the bonds are secured by the power to tax, these bonds usually command a lower interest rate than other types of bonds. General obligation bonds lend themselves readily to competitive public sale at a reasonable interest rate because of their high degree of security, their tax-exempt status, and their general acceptance.

These bonds can be revenue-supported wherein a portion of the user fee is pledged toward payment of the debt service. Using this method, the need to collect additional property taxes to retire the obligated bonds is eliminated. Such revenue-supported general obligation bonds have most of the advantages of revenue bonds, but also maintain the lower interest rate and ready marketability of general obligation bonds. Because the users of the water system pay their share of the debt load based on their water usage rates, the share of that debt is distributed in a fare and equitable manner.

Advantages of general obligation bonds over other types of bonds include:

- The laws authorizing general obligation bonds are less restrictive than those governing other types of bonds.
- By the levying of taxes, the debt is repaid by all property benefited and not just the system users.
- Taxes paid in the retirement of these bonds are IRS deductible.

- General obligation bonds offer flexibility to retire the bonds by tax levy and/or user charge revenue.

The disadvantage of general obligation bond debt is that it is often added to the debt ratios of the underlying municipality, thereby restricting the flexibility of the municipality to issue debt for other purposes. Furthermore, general obligation bonds are normally associated with the financing of facilities that benefit an entire community and must be approved by a majority vote and often necessitate extensive public information programs. A majority vote often requires waiting for a general election in order to obtain an adequate voter turnout. Waiting for a general election may take years, and too often a project needs to be undertaken in a much shorter amount of time.

Revenue Bonds

Revenue bonds offer some advantages to general obligation bonds and are becoming a more frequently used option. Revenue bonds are payable solely from charges made for the services provided. These bonds cannot be paid from tax levies or special assessments; their only security is the borrower's promise to operate the system in a way that will provide sufficient net revenue to meet the debt service and other obligations of the bond issue.

Many communities prefer revenue bonding, as opposed to general obligation bonding because it insures that no tax will be levied. In addition, debt obligation will be limited to system users since repayment is derived from user fees. Another advantage of revenue bonds is that they do not count against a municipality's direct debt, but instead are considered "overlapping debt." This feature can be a crucial advantage for a municipality near its debt limit or for the rating agencies, which consider very closely the amount of direct debt when assigning credit ratings. Revenue bonds also may be used in financing projects extending beyond normal municipal boundaries. These bonds may be supported by a pledge of revenues received in any legitimate and ongoing area of operation, within or outside the geographical boundaries of the issuer.

Successful issuance of revenue bonds depends on the bond market evaluation of the revenue pledged. Revenue bonds are most commonly retired with revenue from user fees. Recent legislation has eliminated the requirement that the revenues pledged to bond payment have a direct relationship to the services financed by revenue bonds. Revenue bonds may be paid with all or any portion of revenues derived by a public body or any other legally available monies. In addition, if additional security to finance revenue bonds was needed, a public body may mortgage grant security and interests in facilities, projects, utilities or systems owned or operated by a public body.

Normally, there are no legal limitations on the amount of revenue bonds to be issued, but excessive issue amounts are generally unattractive to bond buyers because they represent high investment risks. In rating revenue bonds, buyers consider the economic justification for the project, reputation of the borrower, methods and effectiveness for billing and collecting, rate structures, provision for rate increases as needed to meet debt service requirements, track record in obtaining rate increases historically, adequacy of reserve funds provided in the bond documents, supporting covenants to protect projected revenues, and the degree to which forecasts of net revenues are considered sound and economical.

Municipalities may elect to issue revenue bonds for revenue producing facilities without a vote of the electorate (ORS 288.805-288.945). In this case, certain notice and posting requirements must be met and a 60-day waiting period is mandatory. A petition signed by 5% of the municipality's registered voters may cause the issue to be referred to an election.

Improvement Bonds

Improvement (Bancroft) bonds can be issued under an Oregon law called the Bancroft Act. These bonds are an intermediate form of financing that is less than full-fledged general obligation or revenue bonds. This type of bond is quite useful, especially for smaller issuers or for limited purposes.

An improvement bond is payable only from the receipts of special benefit assessments, not from general tax revenues. Such bonds are issued only where certain properties are recipients of special benefits not accruing to other properties. For a specific improvement, all property within the improvement area is assessed on an equal basis, regardless of whether it is developed or undeveloped. The assessment is designed to apportion the cost of improvements, approximately in proportion to the afforded direct or indirect benefits, among the benefited property owners. This assessment becomes a direct lien against the property, and owners have the option of either paying the assessment in cash or applying for improvement bonds. If the improvement bond option is taken, the City sells Bancroft improvement bonds to finance the construction, and the assessment is paid over 20 years in 40 semi-annual installments with interest. Cities and special districts are limited to improvement bonds not exceeding 3% of true cash value.

With improvement bond financing, an improvement district is formed, the boundaries are established, and the benefited properties and property owners are determined. The engineer usually determines an approximate assessment, either on a square foot or a front-foot basis. Property owners are then given an opportunity to object to the project assessments. The assessments against the properties are usually not levied until the actual cost of the project is determined. Since this determination is normally not possible until the project is completed, funds are not available from assessments for the purpose of making monthly payments to the contractor. Therefore, some method of interim financing must be arranged, or a preassessment program, based on the estimated total costs, must be adopted. Commonly, warrants are issued to cover debts, with the warrants to be paid when the project is complete.

The primary disadvantage to this source of revenue is that the property to be assessed must have a true cash value at least equal to 50% of the total assessments to be levied. As a result, owners of undeveloped property usually require a substantial cash payment. In addition, the development of an assessment district is very cumbersome and expensive when facilities for an entire community are contemplated. In comparison, general obligation bonds can be issued in lieu of improvement bonds, and are usually more favorable.

Capital Construction (Sinking) Fund

Sinking funds are often established by budgeting for a particular construction purpose. Budgeted amounts from each annual budget are carried in a sinking fund until sufficient revenues are available for the needed project. Such funds can also be developed with revenue derived from system development charges or serial levies.

The disadvantage of a sinking fund is that it is usually too small to undertake any significant projects. Also, setting aside money generated from user fees without a designated and specified need is not generally accepted in a municipal budgeting process.

Connection Fees

Most cities charge connection fees to cover the cost of connecting new development to water and wastewater systems. Based on recent legislation, connection fees can no longer be programmed to cover a portion of capital improvement costs.

System Development Charges

A system development charge (SDC) is essentially a fee collected as each piece of property is developed, and which is used to finance the necessary capital improvements and municipal services required by the development. Such a fee can only be used to recover the capital costs of infrastructure. Operating, maintenance, and replacement costs cannot be financed through system development charges.

Two types of charges are permitted under the Oregon Systems Development Charges Act: improvement fees, and reimbursement fees. SDCs charged before construction are considered improvement fees and are used to finance capital improvements to be constructed. After construction, SDCs are considered reimbursement fees and are collected to recapture the costs associated with capital improvements already constructed or under construction. A reimbursement fee represents a charge for utilizing excess capacity in an existing facility paid for by others. The revenue generated by this fee is typically used to pay back existing loans for improvements.

Under the Oregon SDC Act, methodologies for deriving improvement and reimbursement fees must be documented and available for review by the public. A capital improvement plan must also be prepared which lists the capital improvements that may be funded with improvement fee revenues, and the estimated cost and timing of each improvement. Thus, revenue from the collection of SDCs can only be used to finance specific items listed in a capital improvement plan. In addition, SDCs cannot be assessed on portions of the project paid for with grant funding.

Local Improvement District (LID)

Improvement bonds issued for local improvement districts (LIDs) are used to administer special assessments for financing local improvements in cities, counties, and some special districts. Common improvements financed through a LID include storm and sanitary sewers, street paving, curbs, sidewalls, water mains, recreational facilities, street lighting, and off-street parking. The basic principle of special assessment is that it is a charge imposed upon property owners who receive special benefits from an improvement beyond the general benefits received by all citizens in the community. A public agency should consider three "principles of benefit" when deciding to use special assessment: 1) direct service, 2) obligation to others, and 3) equal sharing/basis. Cities are limited to improvement bonds not exceeding three percent of true cash value.

The Oregon Legislature has provided cities with a procedure for special assessment financing (ORS 223.387-399), which applies when city charter or ordinance provisions do not specify otherwise. To establish a LID, an improvement district is formed, the boundaries are established, and the benefited properties and property owners are determined. An approximate assessment to each property is determined based on the above three principles of benefit and is documented in a written report. Property owners are then given an opportunity to object to the project assessments. The assessments against the properties are usually not levied until the actual cost of the project is determined. Since this determination is normally not possible until the project is completed, funds are not available from assessments for the purpose of making monthly payments to the contractor. Therefore, some method of interim financing must be arranged based on the estimated total costs.

The primary disadvantage to this source of revenue is that the property to be assessed must have a true cash value at least equal to 50 percent of the total assessments to be levied. As a result, owners of undeveloped property usually require a substantial cash payment. In addition, the development of an assessment district is very cumbersome and expensive.

Ad Valorem Taxes

Ad valorem property taxes are often used as revenue source for utility improvements. Property taxes may be levied on real estate, personal property or both. Historically, *ad valorem* taxes were the traditional means of obtaining revenue to support all local governmental functions.

A marked advantage of these taxes is the simplicity of the system; it requires no monitoring program for developing charges, additional accounting and billing work is minimal, and default on payments is rare. In addition, ad valorem taxation provides a means of financing that reaches all property owners that benefit from a water system, whether a property is developed or not. The construction costs for the project are shared proportionally among all property owners based on the assessed value of each property.

Ad valorem taxation, however, is less likely to result in individual users paying their proportionate share of the costs as compared to their benefits. Public hearings an election with voter approval would be required to implement *ad valorem* taxation.

User Fee

User fees can be used to retire general obligation bonds, and are commonly the sole source of revenue to retire revenue bonds and to finance operation and maintenance. User fees represent monthly charges of all residences, businesses, and other users that are connected to the wastewater system. These fees are established by resolution and may be modified, as needed, to account for increased or decreased operating and maintenance costs. User fees may be based on a metered volume of water consumption and/or on the type of user (e.g. residential, commercial, schools etc.). .

Assessments

Under special circumstances, the beneficiary of a public works improvement may be assessed for the cost of a project. For example, the City may provide some improvements or services that directly benefit a particular development. The City may choose to assess the industrial or commercial developer to provide up-front capital to pay for the administered improvements.

8.3 Financing Strategy

A financing strategy or plan must provide a mechanism to generate capital funds in sufficient amounts to pay for the proposed improvements over the relatively short duration in design and construction, generally two years. The financing strategy must also identify the manner in which annual revenue will be generated to cover the expense for long-term debt repayment and the on-going operation and maintenance of the system.

The objectives of a financial strategy include the following:

- Identify the capital improvement cost for the project and the estimated expense for operation and maintenance.
- Evaluate the potential funding sources and select the most viable program.
- Determine the availability of outside funding sources and identify the local cost share.
- Determine the cost to system users to finance the local share and the annual cost for operation and maintenance.

Project Expenses

A total of $1,291,895 in recommended capital improvement project costs were identified in Section 7.5. (Additional costs for expansion projects are assumed to be born by the developers and are not considered in this section.) The identified projects replace or repair existing equipment and facilities and are not expected to increase the operations and maintenance costs to the City.

Funding Sources

With any of the proposed funding sources within the financial strategy, the City is advised to confirm specific funding amounts with the appropriate funding agencies prior to making local financing arrangements.

Most of the grant programs require that the project address a DEQ issue violation or order before the project is eligible for funding. Rural Development will issue grants for projects without this requirement, but for a reduced amount and the project must pass strict scrutiny. Most agencies are currently relying on 1990 Census data for calculating household income, but the 2000 data is being circulated and will soon be adopted by funding agencies. Bandon median income is expected to rise in comparison with the state average over the last ten years. Any applications for grants or loans should be submitted as soon as possible to take advantage of the 1990 income data for interest rates and program eligibility.

It is recommended that the City undertake efforts to secure funding in the form of grants and loans. Rural Development looks closely at sewer user rates and expects local rates to be at or above that of similar communities before the project becomes eligible for grants. Typical sewer user rates for communities the size of Bandon are in the range of $40 to $45 per month. Sewer revenue per EDU currently runs $19.48 for user fees and $4.86 for the sewer construction bond (paid through property taxes) for a total monthly average cost of $24.34. The actual cost to provide sewer service, based on the operating budget for 2002, is $36.98 per EDU per month, much more in line with other communities.

The City Council voted to raise sewer user rates by 10%, effective in July 2002, and also referred a ballot measure to the voters requesting approval to raise rates 10% per year until user fees match the operations budget. To be considered for grant funds, the City must demonstrate that it is working to reach parity between user fees and operating costs.

Rural Development currently expects a municipality to have a sewer rate of at least $43.00 per month per EDU before it will be considered for grant funding. Without a DEQ violation or order, the City is most likely not eligible for a grant. Projects number 1, 11, 12 and 13 would likely be funded out of operations funds, leaving $1,283,500 to be financed with a loan. Current Rural Development interest rates are 4.75% for a 40-year loan.

The Department of Environmental Quality (DEQ) State Revolving Fund (SRF) Loan program provides low interest loans for planning, design, and construction of all water pollution control facilities. SRF loans are currently at 3.55% for a 20-year loan.

Table 8.3.1

Funding Alternatives

Funding Source	Loan Amount(1)	Effective Interest, %	Loan Duration, yrs	Est. Monthly Rate Increase
Private Funding	$1,283,500	5.00	20	$4.95
Rural Develop.	$1,283,500	4.75	40	$3.47
SRF (2)	$1,302,750	4.05	20	$4.73

(1) – Amount based on current dollars
(2) – Effective interest rate for SRF funding is based on 3.55% annual interest, 0.5% servicing fee. Loan includes 1.5% loan fee.

The recommended funding path is to apply for private loan funding. The overall project construction and administration costs are likely to be lower with private financing than with Rural Development or DEQ funding, which could offset part of the higher private interest rate. The overall cost for operating the system and meeting the debt service, estimated at $41.93, is still below the Rural Development rate minimum.

Local Cost Share

There are several items that should be addressed this year and are small enough to fund from the current operating budget. Television inspection of Basin 6, the tide gate replacement for Filmore Avenue Pump Station, the Jetty Pump Station Timer, and new impellors for North Avenue Pump Station have a combined estimated project cost of $8,400. These projects are recommended for completion before the next wet weather season.

The projects identified in the I/I study will increase capacity of the collection system and effectively increase the capacity of the WWTP by removing flow that would use capacity and prevent future connections. While these projects are also being done to improve pipe conditions, an estimated 30% of the cost is attributable to capacity issues. The line size increase for Edison Avenue and Oregon Avenue will increase capacity to allow for future connections. Projects that increase system capacity are eligible to be considered for SDCs. An estimated $383,270 of the construction costs for these projects could be funded using an SDC.

System User Costs

If the worse case was considered and the City was not successful in obtaining grant funds and all of the projects were completed one at a time, there would have to be an increase in user fees. Based on 1,734 EDUs, for a twenty-year loan, as detailed above, monthly individual user fee increase would be between $3.47 and $4.73 per month.

Once the City has determined what funding may be available, the current rate structure should be reviewed and analyzed to determine the actual impact to ratepayers. The City's collection system is in need of repairs and requires a significant rehabilitation project. Since a project of this nature will likely result in higher sewer rates, all grants, loans, existing debts and reserves, and surpluses should be taken into account when calculating the final impact to rate payers.

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Appendix

A

Wastewater Treatment Plant Permits

Oregon
John A. Kitzhaber, M.D., Governor

Department of Environmental Quality
Western Region
Salem Office
750 Front St NE
Suite 120
Salem, OR 97310
(503) 378-8240
(503) 378-3684 TTY

February 13, 1998

FEB 17 1998

Mr. Matt Winkel
City of Bandon
PO Box 67
Bandon, OR 97411

CERTIFIED MAIL
RETURN RECEIPT REQUESTED

Re: NPDES Permit
File No. 5664
Facility: Bandon STP, Riverside Drive & Caroline Street, Bandon
Coos County

Dear Mr. Winkel

We have completed our review of your application for a National Pollutant Discharge Elimination System (NPDES) Permit and the comments received regarding the preliminary draft permit. Your NPDES Permit has been issued and is enclosed.

Please note that two changes were made in the permit following public comment. These are:

1. The bacteria effluent limit and bacteria monitoring were corrected to fecal coliform bacteria, from e.coli bacteria. We had inadvertently included the fresh water bacteria standard.
2. The office to be called in case of malfunction of the treatment plant was changed from the Coos Bay DEQ office, to the state-wide Oregon Accident Response System office. The second office is staffed 24 hours per day and on weekends, and also have "call lists" for other state agencies to be notified including the Department of Agriculture shellfish protection program.

This permit will be considered the final action on permit application number 997367.

You are urged to carefully read the permit and take all possible steps to comply with conditions established to help protect Oregon's environment against pollution.

If you are dissatisfied with the conditions or limitations of this permit, you have 20 days to request a hearing before the Environmental Quality Commission or its authorized representative. Any such request shall be made in writing to the Director and shall clearly state the grounds for the request.

If you have any questions, please contact Ruben Kretzxchmar, Western Region - Coos Bay Office, at (541) 269-2721 extension 23.

Sincerely,

Steve Greenwood
Administrator
Western Region

SG:sms
Enclosure
cc: Ruben Kretzschmar, Western Region - Coos Bay Office, DEQ

Expiration Date: 12/31/01
Permit Number 101546
File Number: 5664
Page 1 of 18 Pages

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM WASTE DISCHARGE PERMIT

Department of Environmental Quality
Western Region - Eugene Office
1102 Lincoln St., Suite 210, Eugene, OR 97401
Telephone: (541) 686-7838

Issued pursuant to ORS 468B.050 and The Federal Clean Water Act

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ISSUED TO:

City of Bandon
PO Box 67
Bandon OR 97330

SOURCES COVERED BY THIS PERMIT:

Type of Waste	Outfall Number	Outfall Location
Domestic	001	RM 1.1 Coquille River
Domestic High Flows	002	RM 0.1 Ferry Creek
Emergency Overflow	003	RM 0.5 Ferry Creek

PLANT TYPE AND LOCATION:

Activated Sludge Plant
Interst. of Riverside Dr
and Caroline Street
Bandon OR

RECEIVING SYSTEM INFORMATION:

Basin: South Coast
Sub-basin: Coquille
Stream: Coquille River
Hydro Code: 14B-COQU 1.1 D
Hydro Code: 14B-FERR 0.1 D
County: Coos

Treatment System Class: III
Collection System Class: II

EPA REFERENCE NO: OR-002020-6

Issued in response to Application No. 997367 received 05-27-92.

This permit is issued based on the land use findings in the permit record.

Steve Greenwood, Administrator
Western Region

February 13, 1998
Date

PERMITTED ACTIVITIES

Until this permit expires or is modified or revoked, the permittee is authorized to construct, install, modify, or operate a wastewater collection, treatment, control and disposal system and discharge to public waters adequately treated wastewaters only from the authorized discharge point or points established in Schedule A and only in conformance with all the requirements, limitations, and conditions set forth in the attached schedules as follows:

Unless authorized by another NPDES permit, each other direct and indirect discharge to public waters is prohibited.

SCHEDULE A

I. **Waste Discharge Limitations not to be Exceeded Upon Permit Issuance:**

a. Outfall Numbers 001 and 002 (Wastewater Treatment Plant Discharge)
b.

(1) May 1 - October 31:

Parameter	Average Effluent Concentrations		Mass Load Limitations (See Note 1/)		
	Monthly	Weekly	Monthly Average lb/day	Weekly Average lb/day	Daily Maximum lbs
BOD$_5$	20 mg/l	30 mg/l	75	110	150
TSS	20 mg/l	30 mg/l	75	110	150

(2) November 1 - April 30:

Parameter	Average Effluent Concentrations		Mass Load Limitations (See Note 2/)		
	Monthly	Weekly	Monthly Average lb/day	Weekly Average lb/day	Daily Maximum lbs
BOD$_5$	30 mg/l	45 mg/l	110	170	230
TSS	30 mg/l	45 mg/l	110	170	230

(3) Other Parameters (year-round):

Parameter	Limitations
pH	Shall be within the range 6.0 - 9.0.
Fecal Coliform Bacteria	Shall not exceed a 30 day log mean of 14 organisms per 100 ml, with not more than 10 percent of the samples exceeding 43 organisms per 100 ml.
BOD$_5$ and TSS	Shall not be less than 85% monthly average concentration.

b. Outfall Number 002 (When Discharging)

Outfall Number 002 shall be limited to those conditions when flows through the treatment facility exceed 2.6 MGD combined with a high tidal event where all the effluent is unable to be discharged from outfall 001.

c. Outfall Number 003 (When Discharging)

Unless the cause is the result of an exceptional event beyond the reasonable control of the permittee:

No wastes shall be discharged from Outfall Number 003 and no activities shall be conducted which violate Water Quality Standards as adopted in OAR 340-41-325, unless the cause is an upset as defined in Conditions B4 and B6 of the attached General Conditions.

Events caused by operational error, improperly designed facilities, or lack of preventative maintenance are not beyond the reasonable control of the permittee.

d. Notwithstanding the effluent limitations established by this permit, no wastes shall be discharged and no activities shall be conducted which will violate Water Quality Standards as adopted in OAR 340-41-325, except in the following defined mixing zones:

Outfall 001

The allowable mixing zone for Outfall Number 001 shall not exceed that segment of Coquille River within a radius of 200 feet from the point of discharge.

Outfall 002

The allowable mixing zone for Outfall Number 002 shall not exceed that segment of Ferry Creek within a radius of 50 feet from the point of discharge.

e. Raw sewage discharges are prohibited to waters of the State from May 22 through October 31, except during a storm event greater than the one-in-ten-year, 24-hour duration storm. If an overflow occurs between May 21 and June 1, and if the permittee demonstrates to the Department's satisfaction that no increase in risk to beneficial uses occurred because of the overflow, no violation shall be triggered if the storm associated with the overflow was greater than the one-in-five-year, 24-hour duration storm.

f. No chlorine or chlorine compounds shall be used for effluent disinfection purposes.

Notes:

1/ Mass load limitations for BOD_5 and TSS are based on an original average dry weather design flow to the facility equaling 0.45MGD. Upon expansion to 0.50 MGD design, the permittee was required to retain the existing summer mass load limits.

2/ Mass load limits based upon average dry weather design flow of 0.45 MGD. Schedule C, Condition 5 requires the permittee to select the basis for calculating winter time mass load limits. Upon review and approval of the engineering study to determine the design average wet weather flow, pursuant to OAR 340-41-120(9), and upon request of the permittee, the Department intends to modify this permit and include revised mass load limits.

SCHEDULE B

1. Minimum Monitoring and Reporting Requirements to be Met Upon Permit Issuance:
(unless otherwise approved in writing by the Department)

The permittee shall monitor the parameters as specified below at the locations indicated. The laboratory used by the permittee to analyze samples shall have a quality assurance/quality control (QA/QC) program to verify the accuracy of sample analysis. If QA/QC requirements are not met for any analysis, the results shall be included in the report, but not used in calculations required by this permit. When possible, the permittee shall re-sample in a timely manner for parameters failing the QA/QC requirements, analyze the samples, and report the results.

a. Influent

Item or Parameter	Minimum Frequency	Type of Sample
Total Flow (MGD)	Daily	Calculation
BOD_5	2/Week	24-Hr Composite
TSS	2/Week	24-Hr Composite
pH	2/Week	Grab

b. Outfall Number 001 (Sewage Treatment Plant Discharge) (See Note 4/)

Item or Parameter	Minimum Frequency	Type of Sample
Total Flow (MGD)	Daily	Flow meter
Flow Meter Calibration	Annually	Verification
BOD_5	2/Week	24-Hr Composite
TSS	2/Week	24-Hr Composite
Pounds Discharged (BOD and TSS)	2/Week	Calculation
pH	2/Week	Grab
Fecal Coliform Bacteria	1/Week	Grab
Turbidity	1/Week	Grab
Average Percent Removed (BOD/TSS)	Monthly	Calculation
U-V Radiation Percent Intensity	Daily	Reading (See Note 5/)

c. Outfall 003 - When Discharging (See Note 6/)

Item or Parameter	Minimum Frequency	Type of Sample
Total Flow (MGD)	Daily (During each occurrence)	Estimation

d. Sludge Management

Item or Parameter	Minimum Frequency	Type of Sample
Volume biosolids removed	Each occurrence	Measurement
Biosolids analysis including: Total Solids (% dry wt.) Volatile Solids (% dry wt.) Volatile Suspended Solids (% dry wt.) Biosolids Nitrogen: NH_3-N; NO_3-N; & TKN (% dry wt.) Biosolids Metals: As, Cd, Cu, Pb, Hg, Mo, Ni, Se, & Zn (mg/kg) Phosphorus (% dry wt.) Potassium (% dry wt.) pH (standard units)	Annually	Composite samples to be representative of the product to be land applied from the digester and/or sludge drying beds. (See Note 7/)
Record of % volatile solids reduction accomplished through digestion	Monthly	Calculation (See Note 8/)
Quantity and type of lime product used to stabilize sludge [when required to meet federal Process to Significantly Reduce Pathogens (PSRP) regulations]	Each Occurrence	Pounds/gallon of sludge land applied.
Record of locations where sludge is applied on land (Site location map to b maintained at treatment facility for review upon request by DEQ)	Each Occurrence	Date, volume & locations where sludges were applied recorded on site location map.

Notes:

4/ For compliance purposes, effluent samples collected for Outfall Number 001 shall be obtained prior to the point where the effluent flow splits. When sampled above the point where the effluent flow splits, only one set of samples shall be collected. These samples shall be deemed representative of the total effluent discharged through Outfall Number 001 and/or Outfall Number 002.

5/ The intensity of radiation emitted by a bank of U-V lamps will decrease over time. As intensity decreases, its ability to kill organisms will also decrease. To track the reduction in intensity, the U-V disinfection system should include a U-V intensity transmittance meter. This meter will measure the relative intensity of a bank of U-V lamps as compared to a baseline. The baseline should be established after the first 100 hours of burn-in time on the lamps. At 100 hours, the meter should be set at 99.9%. The daily percent U-V transmittance would then be determined by reading the meter each day.

6/ This parameter shall be measured during any discharge or overflow event, but no more frequently than as specified under this Condition, unless otherwise requested by the Department.

7/ Composite samples of the sludge shall consist of representative samples collected from either the digester withdrawal line and/or the sludge drying beds as follows:

Digester withdrawal line: Composite samples from each digester withdrawal line shall consist of at least 4 aliquots of equal volume collected over an 8-hour period and combined. The samples shall be representative of the product being removed from the digester and transferred to a sludge hauling truck. A sufficient number of composite samples shall be obtained to adequately represent the contents of each truck load leaving the facility site.

Inorganic pollutant monitoring must be conducted according to **Test Methods for Evaluating Solid Waste, Physical/Chemical Methods**, Second Edition (1982) with Updates I and II and third Edition (1986) with Revision I

Sludge drying beds: Composite samples from the drying beds shall be taken from reference areas in the bed pursuant to **Test Methods for Evaluating Solid Waste, Volume 2; Field Manual, Physical/Chemical Methods, November 1986, Third Edition, Chapter 9.**

Inorganic pollutant monitoring must be conducted according to Test Methods for Evaluating Solid Waste, Physical. Chemical Methods, Second Edition (1982) with Updates I and II and third Edition (1986) with Revision I.

8/ Calculation of the % volatile solids reduction is to be based on comparison of a representative monthly grab sample of total and volatile solids entering the digester (secondary solids) and a representative composite sample of sludge solids collected during sludge removal (as defined in Note 6/ above).

2. Reporting Procedures

a) Monitoring results shall be reported on approved forms. The reporting period is the calendar month. Reports must be submitted to the Department by the 15th day of the following month.

b) State monitoring reports shall identify the name, certificate classification and grade level of each principal operator designated by the permittee as responsible for supervising the wastewater collection and treatment systems during the reporting period. Monitoring reports shall also identify each system classification as found on page one of this permit.

c) Monitoring reports shall also include a record of the quantity and method of use of all sludge removed from the treatment facility and a record of all applicable equipment breakdowns and bypassing.

3. Report Submittals

a. An annual solids report shall be submitted to the Department by February 19 of each year that describes solids handling activities for the previous year and includes, but is not limited to, the required information outlined in OAR 340-50-035(6)(a)-(e).

b. The permittee shall have in place a program to identify and reduce inflow and infiltration into the sewage collection system. An annual report shall be submitted to the Department by August 1 of each year which details sewer collection maintenance activities that have been done in the previous year and outlines those activities planned for the following year.

SCHEDULE C

Compliance Conditions and Schedules

1. Within 60 days of permit issuance, the permittee shall submit to the Department for review and approval, a report that describes procedures for handling, transporting, and disposal of rags, grit, scum and screenings generated at the treatment facility. Upon written approval by the Department, the permittee shall conform with the approved procedures. Modified procedures may be followed upon prior approval in writing by the Department.

2. By no later than ninety (90) days after issuance of this permit, the permittee shall submit to the Department a biosolids management plan in accordance with OAR 340-50, "Land Application of Domestic Wastewater Treatment Facility Biosolids, Biosolids Derived Products, and Domestic Septage." Upon approval of the plan by the Department, the plan shall be implemented by the permittee.

3. Public Notification Plan

   Within six (6) months of permit issuance, the Respondent shall submit a Public Notification Plan to the Department for approval for notifying the public during periods of discharge of untreated sewage. The Plan shall include procedures to be followed by the Respondent during periods of discharge of untreated sewage, including stream sampling, posting of warning signs and other public notification steps. In addition, the Plan shall include contingency plans for minimizing the flow of raw or partially treated sewage.

4. By no later than twelve (12) months after permit issuance, the permittee shall submit either an engineering evaluation which demonstrates the design average wet weather flow, or a request to retain the existing mass load limits. The design average wet weather flow is defined as the average flow between November 1 and April 30 when the sewage treatment facility is projected to be at design capacity for that portion of the year. Upon acceptance by the Department of the design average wet weather flow determination, the permittee may request a permit modification to include higher winter mass loads based on the design average wet weather flow.

5. Within 180 days of permit modification to include higher winter mass load limits as specified in Condition 4 of this Schedule, the permittee shall submit to the Department for review and approval a proposed program and time schedule for identifying and reducing inflow within 60 days of receiving written Department comments, the permittee shall submit a final approvable program and time schedule. The program shall consist of the following:

   a. Identification of all overflow points and verification that sewer system overflows are not occurring up to a 24-hour, 5-year storm event or equivalent;

   b. Monitoring of all pump station overflow points;

   c. A program for identifying and removing all inflow sources into the permittee's sewer system over which the permittee has legal control; and,

   d. If the permittee does not have the necessary legal authority for all portions of the sewer system or treatment facility, a program and schedule for gaining legal authority to require inflow reduction and a program and schedule for removing inflow sources.

6. The permittee is expected to meet the compliance dates which have been established in this schedule. Either prior to or no later than 14 days following any lapsed compliance date, the permittee shall submit to the Department a notice of compliance or noncompliance with the established schedule. The Director, or his authorized representative, may revise a schedule of compliance if he determines good and valid cause resulting from events over which the permittee has little or no control.

7. Industrial Waste Survey/Pretreatment Program

By no later than six (6) months from permit issuance date, the permittee shall submit an industrial waste survey as described in 40 CFR 403.8(f)(2)(i-iii) suitable to make a determination as to the need and type of pretreatment program to be developed.

Should the Department determine that a pretreatment program is required, the permit shall be reopened and modified in accordance with 40 CFR 403.8(e)(1) to incorporate a compliance schedule to require schedule requiring program development shall be developed in accordance with the provisions of 40 CFR 403.12(k), and shall not exceed twelve (12) months.

SCHEDULE D

Special Conditions

1. The permittee shall comply with Oregon Administrative Rules (OAR), Chapter 340, Division 49, "Regulations Pertaining To Certification of Wastewater System Operator Personnel" and accordingly:

   a. The permittee shall have its wastewater system supervised by one or more operators who are certified in a classification and grade level (equal to or greater) that corresponds with the classification (collection and /or treatment) of the system to be supervised as specified on page one of this permit.

Note: A "supervisor" is defined as the person exercising authority for establishing and executing the specific practice and procedures of operating the system in accordance with the policies of the permittee and requirements of the waste discharge permit. "Supervise" means responsible for the technical operation of a system, which may affect its performance or the quality of the effluent produced. Supervisors are not required to be on-site at all times. .

   b. The permittee's wastewater system may not be without supervision(as required by Special Condition 1a. above) for more than thirty (30) days. During this period, and at any time that the supervisor is not available to respond on-site (i.e. vacation, sick leave or off-call), the permittee must make available another person who is certified at no less than one grade lower than the system classification.

   c. If the wastewater system has more than one daily shift, the permittee shall have the shift supervisor, if any, certified at no less than one grade lower than the system classification.

   d. The permittee is responsible for ensuring the wastewater system has a properly certified supervisor available at all times to respond on-site at the request of the permittee and to any other operator.

   e. The permittee shall notify the Department of Environmental Quality in writing within thirty (30) days of replacement or redesignation of certified operators responsible for supervising wastewater system operation. The notice shall be filed with the Water Quality Division, Operator Certification Program, 811 SW Sixth Ave., Portland, OR 97204. This requirement is in addition to the reporting requirements contained under Schedule B of this permit.

   f. Upon written request, the Department may grant the permittee reasonable time, not to exceed 120 days, to obtain the services of a qualified person to supervise the wastewater system. The written request must include justification for the time needed, a schedule for recruiting and hiring, the date the system supervisor availability ceased and the name of the alternate system supervisor(s) as required by 1.b. above.

2. a. All biosolids shall be managed in accordance with the current biosolids management plan approved by the Department and the site authorization letters issued by the Department. The biosolids management plan shall be kept current and remain on file with the permit. No substantial changes shall be made in solids management activities which significantly differ from operations specified under the approved plan without the prior written approval of the Department.

b. This permit may be modified to incorporate any applicable standard for sewage sludge use of disposal promulgated under section 405(d) of the Clean Water Act, if the standard for sewage sludge use or disposal is more stringent than any requirements for sludge use or disposal in the permit, or controls a pollutant or practice not limited in this permit.

3. The permittee shall report any noncompliance or spills which may endanger the health or the environment. This report shall be made immediately (within one hour) from the time the permittee becomes aware of the circumstances. The Department shall be notified through the Oregon Accident Response System at 1-800-452-0311. Submission of a written report shall also be provided to the Department within 5 days of the occurrence. This report should detail all aspects of noncompliance and steps taken to prevent a recurrence.

SCHEDULE F

GENERAL CONDITIONS

SECTION A. STANDARD CONDITIONS

1. Duty to Comply

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of Oregon Revised Statutes (ORS) 468B.025 and is grounds for enforcement action; for permit termination, suspension, or modification; or for denial of a permit renewal application.

2. Penalties for Water Pollution and Permit Condition Violations

Oregon Law (ORS 468.140) allows the Director to impose civil penalties up to $10,000 per day for violation of a term, condition, or requirement of a permit.

Under ORS 468.943, unlawful water pollution, if committed by a person with criminal negligence, is punishable by a fine of up to $25,000 or by imprisonment for not more than one year, or by both. Each day on which a violation occurs or continues is a separately punishable offense.

Under ORS 468.946, a person who knowingly discharges, places or causes to be placed any waste into the waters of the state or in a location where the waste is likely to escape into the waters of the state, is subject to a Class B felony punishable by a fine not to exceed $200,000 and up to 10 years in prison.

3. Duty to Mitigate

The permittee shall take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment. In addition, upon request of the Department, the permittee shall correct any adverse impact on the environment or human health resulting from noncompliance with this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

4. Duty to Reapply

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and have the permit renewed. The application shall be submitted at least 180 days before the expiration date of this permit.

The Director may grant permission to submit an application less than 180 days in advance but no later than the permit expiration date.

5. Permit Actions

This permit may be modified, suspended, revoked and reissued, or terminated for cause including, but not limited to, the following:

a. Violation of any term, condition, or requirement of this permit, a rule, or a statute;

b. Obtaining this permit by misrepresentation or failure to disclose fully all material facts; or

c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

The filing of a request by the permittee for a permit modification or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

6. Toxic Pollutants

The permittee shall comply with any applicable effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

7. Property Rights

The issuance of this permit does not convey any property rights of any sort, or any exclusive privilege.

8. Permit References

Except for effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants and standards for sewage sludge use or disposal established under Section 405(d) of the Clean Water Act, all rules and statutes referred to in this permit are those in effect on the date this permit is issued.

SECTION B. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

1. Proper Operation and Maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls, and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

2. Duty to Halt or Reduce Activity

For industrial or commercial facilities, upon reduction, loss, or failure of the treatment facility, the permittee shall, to the extent necessary to maintain compliance with its permit, control production or all discharges or both until the facility is restored or an alternative method of treatment is provided. This requirement applies, for example, when the primary source of power of the treatment facility fails or is reduced or lost. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

3. Bypass of Treatment Facilities

a. Definitions

(1) "Bypass" means intentional diversion of waste streams from any portion of the treatment facility. The term "bypass" does not include nonuse of singular or multiple units or processes of a treatment works when the nonuse is insignificant to the quality and/or quantity of the effluent produced by the treatment works. The term "bypass" does not apply if the diversion does not cause effluent limitations to be exceeded, provided the diversion is to allow essential maintenance to assure efficient operation.

(2) "Severe property damage" means substantial physical damage to property, damage to the treatment facilities or treatment processes which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

b. Prohibition of bypass.

(1) Bypass is prohibited unless:

(a) Bypass was necessary to prevent loss of life, personal injury, or severe property damage;

(b) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventative maintenance; and

(c) The permittee submitted notices and requests as required under General Condition B.3.c.

(2) The Director may approve an anticipated bypass, after considering its adverse effects and any alternatives to bypassing, when the Director determines that it will meet the three conditions listed above in General Condition B.3.b.(1).

c. Notice and request for bypass.

(1) Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior written notice, if possible at least ten days before the date of the bypass.

(2) Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in General Condition D.5.

4. Upset

a. Definition. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operation error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventative maintenance, or careless or improper operation.

b. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology based permit effluent limitations if the requirements of General Condition B.4.c are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

c. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

(1) An upset occurred and that the permittee can identify the causes(s) of the upset;

(2) The permitted facility was at the time being properly operated;

(3) The permittee submitted notice of the upset as required in General Condition D.5, hereof (24-hour notice); and

(4) The permittee complied with any remedial measures required under General Condition A.3 hereof.

d. Burden of proof. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

5. Treatment of Single Operational Event

For purposes of this permit, A Single Operational Event which leads to simultaneous violations of more than one pollutant parameter shall be treated as a single violation. A single operational event is an exceptional incident which causes simultaneous, unintentional, unknowing (not the result of a knowing act or omission), temporary noncompliance with more than one Clean Water Act effluent discharge pollutant parameter. A single operational event does not include Clean Water Act violations involving discharge without a NPDES permit or noncompliance to the extent caused by improperly designed or inadequate treatment facilities. Each day of a single operational event is a violation.

6. Overflows from Wastewater Conveyance Systems and Associated Pump Stations

a. Definitions

(1) "Overflow" means the diversion and discharge of waste streams from any portion of the wastewater conveyance system including pump stations, through a designed overflow device or structure, other than discharges to the wastewater treatment facility.

(2) "Severe property damage" means substantial physical damage to property, damage to the conveyance system or pump station which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of an overflow.

(3) "Uncontrolled overflow" means the diversion of waste streams other than through a designed overflow device or structure, for example to overflowing manholes or overflowing into residences, commercial establishments, or industries that may be connected to a conveyance system.

b. Prohibition of overflows. Overflows are prohibited unless:

(1) Overflows were unavoidable to prevent an uncontrolled overflow, loss of life, personal injury, or severe property damage;

(2) There were no feasible alternatives to the overflows, such as the use of auxiliary pumping or conveyance systems, or maximization of conveyance system storage; and

(3) The overflows are the result of an upset as defined in General Condition B.4. and meeting all requirements of this condition.

c. Uncontrolled overflows are prohibited where wastewater is likely to escape or be carried into the waters of the State by any means.

d. Reporting required. Unless otherwise specified in writing by the Department, all overflows and uncontrolled overflows must be reported orally to the Department within 24 hours from the time the permittee becomes aware of the overflow. Reporting procedures are described in more detail in General Condition D.5.

7. Public Notification of Effluent Violation or Overflow

If effluent limitations specified in this permit are exceeded or an overflow occurs, upon request by the Department, the permittee shall take such steps as are necessary to alert the public about the extent and nature of the discharge. Such steps may include, but are not limited to, posting of the river at access points and other places, news releases, and paid announcements on radio and television.

8. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in such a manner as to prevent any pollutant from such materials from entering public waters, causing nuisance conditions, or creating a public health hazard.

SECTION C. MONITORING AND RECORDS

1. Representative Sampling

Sampling and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge. All samples shall be taken at the monitoring points specified in this permit and shall be taken, unless otherwise specified, before the effluent joins or is diluted by any other waste stream, body of water, or substance.. Monitoring points shall not be changed without notification to and the approval of the Director.

2. Flow Measurements

Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be selected and used to ensure the accuracy and reliability of measurements of the volume of monitored discharges. The devices shall be installed, calibrated and maintained to insure that the accuracy of the measurements is consistent with the accepted capability of that type of device. Devices selected shall be capable of measuring flows with a maximum deviation of less than ± 10 percent from true discharge rates throughout the range of expected discharge volumes.

3. Monitoring Procedures

Monitoring must be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in this permit.

4. Penalties of Tampering

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate, any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than two years, or by both. If a conviction of a person is for a violation committed after a first conviction of such person, punishment is a fine not more than $20,000 per day of violation, or by imprisonment of not more than four years or both.

5. Reporting of Monitoring Results

Monitoring results shall be summarized each month on a Discharge Monitoring Report form approved by the Department. The reports shall be submitted monthly and are to be mailed, delivered or otherwise transmitted by the 15th day of the following month unless specifically approved otherwise in Schedule B of this permit.

6. Additional Monitoring by the Permittee

If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR 136 or as specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the Discharge Monitoring Report. Such increased frequency shall also be indicated. For a pollutant parameter that may be sampled more than once per day (e.g., Total Chlorine Residual), only the average daily value shall be recorded unless otherwise specified in this permit.

7. Averaging of Measurements

Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean, except for bacteria which shall be averaged as specified in this permit.

8. Retention of Records

Except for records of monitoring information required by this permit related to the permittee's sewage sludge use and disposal activities, which shall be retained for a period of at least five years (or longer as required by 40 CFR part 503), the permittee shall retain records of all monitoring information, including all calibration and maintenance records of all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of the sample, measurement, report or application. This period may be extended by request of the Director at any time.

9. Records Contents

Records of monitoring information shall include:

a. The date, exact place, time and methods of sampling or measurements;

b. The individual(s) who performed the sampling or measurements;

c. The date(s) analyses were performed;

d. The individual(s) who performed the analyses;

e. The analytical techniques or methods used; and

f. The results of such analyses.

10. Inspection and Entry

The permittee shall allow the Director, or an authorized representative upon the presentation of credentials to:

a. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit, and

d. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by state law, any substances or parameters at any location.

SECTION D. REPORTING REQUIREMENTS

1. Planned Changes

The permittee shall comply with Oregon Administrative Rules (OAR) 340, Division 52, "Review of Plans and Specifications". Except where exempted under OAR 340-52, no construction, installation, or modification involving disposal systems, treatment works, sewerage systems, or common sewers shall be commenced until the plans and specifications are submitted to and approved by the Department. The permittee shall give notice to the Department as soon as possible of any planned physical alternations or additions to the permitted facility.

2. Anticipated Noncompliance

The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

3. Transfers

This permit may be transferred to a new permittee provided the transferee acquires a property interest in the permitted activity and agrees in writing to fully comply with all the terms and conditions of the permit and the rules of the Commission. No permit shall be transferred to a third party without prior written approval from the Director. The permittee shall notify the Department when a transfer of property interest takes place.

4. Compliance Schedule

Reports of compliance or noncompliance with, or any progress reports on interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date. Any reports of noncompliance shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirements.

5. Twenty-Four Hour Reporting

The permittee shall report any noncompliance which may endanger health or the environment. Any information shall be provided orally (by telephone) within 24 hours, unless otherwise specified in this permit, from the time the permittee becomes aware of the circumstances. During normal business hours, the Department's Regional office shall be called. Outside of normal business hours, the Department shall be contacted at 1-800-452-0311 (Oregon Emergency Response System).

A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. If the permittee is establishing an affirmative defense of upset or bypass to any offense under ORS 468.922 to 468.946, and in which case if the original reporting notice was oral, delivered written notice must be made to the Department or other agency with regulatory jurisdiction within 4 (four) calendar days. The written submission shall contain:

a. A description of the noncompliance and its cause;

b. The period of noncompliance, including exact dates and times;

c. The estimated time noncompliance is expected to continue if it has not been corrected;

d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance; and

e. Public notification steps taken, pursuant to General Condition B.7.

The following shall be included as information which must be reported within 24 hours under this paragraph:

a. Any unanticipated bypass which exceeds any effluent limitation in this permit.

b. Any upset which exceeds any effluent limitation in this permit.

c. Violation of maximum daily discharge limitation for any of the pollutants listed by the Director in this permit.

The Department may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

6. Other Noncompliance

The permittee shall report all instances of noncompliance not reported under General Condition D.4 or D.5, at the time monitoring reports are submitted. The reports shall contain:

a. A description of the noncompliance and its cause;

b. The period of noncompliance, including exact dates and times;

c. The estimated time noncompliance is expected to continue if it has not been corrected; and

d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

7. Duty to Provide Information

The permittee shall furnish to the Department, within a reasonable time, any information which the Department may request to determine compliance with this permit. The permittee shall also furnish to the Department, upon request, copies of records required to be kept by this permit.

Other Information: When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or any report to the Department, it shall promptly submit such facts or information.

8. Signatory Requirements

All applications, reports or information submitted to the Department shall be signed and certified in accordance with 40 CFR 122.22.

9. Falsification of Reports

Under ORS 468.953, any person who knowingly makes any false statement, representation, or certification in any record or other document submitted or required to be maintained under this permit, including monitoring reports or reports of compliance or noncompliance, is subject to a Class C felony punishable by a fine not to exceed $100,000 per violation and up to 5 years in prison.

10. Changes to Indirect Dischargers - **[Applicable to Publicly Owned Treatment Works (POTW) only]**

The permittee must provide adequate notice to the Department of the following:

a. Any new introduction of pollutants into the POTW from an indirect discharger which would be subject to section 301 or 306 of the Clean Water Act if it were directly discharging those pollutants and;

b. Any substantial change in the volume or character of pollutants being introduced into the POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.

c. For the purposes of this paragraph, adequate notice shall include information on (i) the quality and quantity of effluent introduced into the POTW, and (ii) any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.

11. Changes to Discharges of Toxic Pollutant - **[Applicable to existing manufacturing, commercial, mining, and silvicultural dischargers only]**

The permittee must notify the Department as soon as they know or have reason to believe of the following:

a. That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels:

(1) One hundred micrograms per liter (100 mg/l);

(2) Two hundred micrograms per liter (200 mg/l) for acrolein and acrylonitrile; five hundred micrograms per liter (500 mg/l) for 2,4-dinitrophenol and for 2-methyl-4,6-dinitrophenol; and one milligram per liter (1 mg/l) for antimony;

(3) Five (5) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7); or

(4) The level established by the Department in accordance with 40 CFR 122.44(f).

b. That any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

(1) Five hundred micrograms per liter (500 mg/l);

(2) One milligram per liter (1 mg/l) for antimony;

(3) Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7); or

(4) The level established by the Department in accordance with 40 CFR 122.44(f).

SECTION E. DEFINITIONS

1. BOD means five-day biochemical oxygen demand.

2. TSS means total suspended solids.

3. mg/l means milligrams per liter.

4. kg means kilograms.

5. m^3/d means cubic meters per day.

6. MGD means million gallons per day.

7. Composite sample means a sample formed by collecting and mixing discrete samples taken periodically and based on time or flow.

8. FC means fecal coliform bacteria.

9. Technology based permit effluent limitations means technology-based treatment requirements as defined in 40 CFR 125.3, and concentration and mass load effluent limitations that are based on minimum design criteria specified in OAR 340-41.

10. CBOD means five day carbonaceous biochemical oxygen demand.

11. Grab sample means an individual discrete sample collected over a period of time not to exceed 15 minutes.

12. Quarter means January through March, April through June, July through September, or October through December.

13. Month means calendar month.

14. Week means a calendar week of Sunday through Saturday.

15. Total residual chlorine means combined chlorine forms plus free residual chlorine.

16. The term "bacteria" includes but is not limited to fecal coliform bacteria, total coliform bacteria, and E. coli bacteria.

17. POTW means a publicly owned treatment works.

Oregon
John A. Kitzhaber, M.D., Governor

Department of Environmental Quality
Western Region Roseburg Office
725 SE Main
Roseburg, OR 97470
(541) 440-3338
FAX (541) 440-3396

State of Oregon
Department of Environmental Quality
RECEIVED
OCT 12 2000
COOS BAY OFFICE

October 11, 2000

Bill Nielson
Bandon Wastewater Treatment Plant
PO Box 67
Bandon OR 97411

Re: File number 5664
Authorization to Land Apply Biosolids
David Leff Property
87432 Cranberry Creek Lane
Bandon OR
Twp. 29S S, R. 15W W. Sec. 24 and 25

Bill:

This letter represents approval of your request to apply aerobic biosolids the above referenced property. Approval is subject to criteria detailed in the Oregon Administrative Rules, Chapter 340, Division 50 and the following conditions:

Responsibility:
It is the responsibility of Bandon Wastewater Treatment Facility (BWTF) to insure the proper handling and application of all biosolids generated. Transportation of the biosolids to the application site shall be done in such a manner as to prevent leaking or spilling the biosolids onto the highways, streets, roads, waterways or other land surfaces not approved for biosolids application.

Site Description:
The site has approximately 30 acres of hay pasture and trees, which can be used for biosolid land application. The site is on the West Side of Highway 101 just south of Bandon, Oregon. The land application of biosolids on this ranch is to help to remediate and stabilize the farm's sandy loam-loamy sand soils. This authorization is good for two years at which time another site visit is required to review the farm practices and crop response to land applied biosolids over the previous two years. This authorization can be renewed in two years as an on going remedial land application practice to help reestablish the soil organic horizon on this farm. This biosolids application site is only that portion of this parcel that is shaded on the enclosed map.

Based upon an evaluation of this property the Department is pleased to grant you authorization to land apply stabilized biosolids subject to the conditions under your National Pollutant Discharge Elimination (NPDES) permit and the following stipulations:

1. This site is approved <u>for summer application (June 1 through Oct. 31)</u> of biosolids. During biosolid land application, care should be taken to avoid wet soil conditions, which may have occurred as a result of precipitation, especially in low and concave areas of sites. Application is authorized when the temporary water table is at least 12 inches below the ground surface.

2. Biosolids shall be applied evenly and in a manner to prevent ponding or runoff.

3. Biosolids shall not be applied closer than 50 feet to any drainage ditch, channel, pond or waterway or within 200 feet of any well or domestic water source.

4. Biosolids application rate shall not exceed approximately <u>32,000 gallons/acre/years.</u> Changes in biosolids characteristics or crops management may necessitate appropriate adjustments in the application rate to maintain proper agronomic nitrogen loading (75 to 100 lb. Total N/acre depending upon digester-solids analysis).

5. If other sources of nitrogen are used, the biosolids application rate must be reduced so that commercial nitrogen in combination with biosolids nitrogen does not exceed agronomic loading rate of this site (100 lb. Total N/acre-year).

<u>Site Use Limitations:</u>

1. Controlled access to the biosolids site must be maintained for a period of 12 months following biosolids application.

2. Grazing animals should not be allowed on pasture within 30 days following biosolids application and 90 days for lactating animals.

<u>Accidental Spillage:</u>

The permittee shall immediately clean up any spillage of biosolids and notify the DEQ Roseburg office at 440-3338 of any such occurrences. Spillage which cannot be completely cleaned up shall be covered with hydrated lime (calcium Hydroxide) or lime (calcium oxide). A 50-lb. bag of liming material shall remain available during transportation of the biosolids.

<u>Monitoring:</u>

1. BWTF shall maintain daily records of accumulated biosolids application. Daily land application shall be kept on a field grid map or other easily readable system. BWTF is responsible for tracking the land application of biosolids on daily basis (number of dry pounds Nitrogen land applied per acre).

2. A copy of this authorization letter and the biosolids certification statements shall be carried with all biosolids s that are to be land applied. The responsible parties who apply biosolids shall review these documents prior to land applying biosolids to this site.

3. BWTF shall provide the DEQ with monthly summaries of biosolids land application activities along with a current BWTF biosolids analysis in BWTF's annual report due February 19 of each year.

4. A copy of this site authorization letter and a signed biosolid pathogen and vector attraction reduction certification statement shall accompany all biosolids land applied at this site.

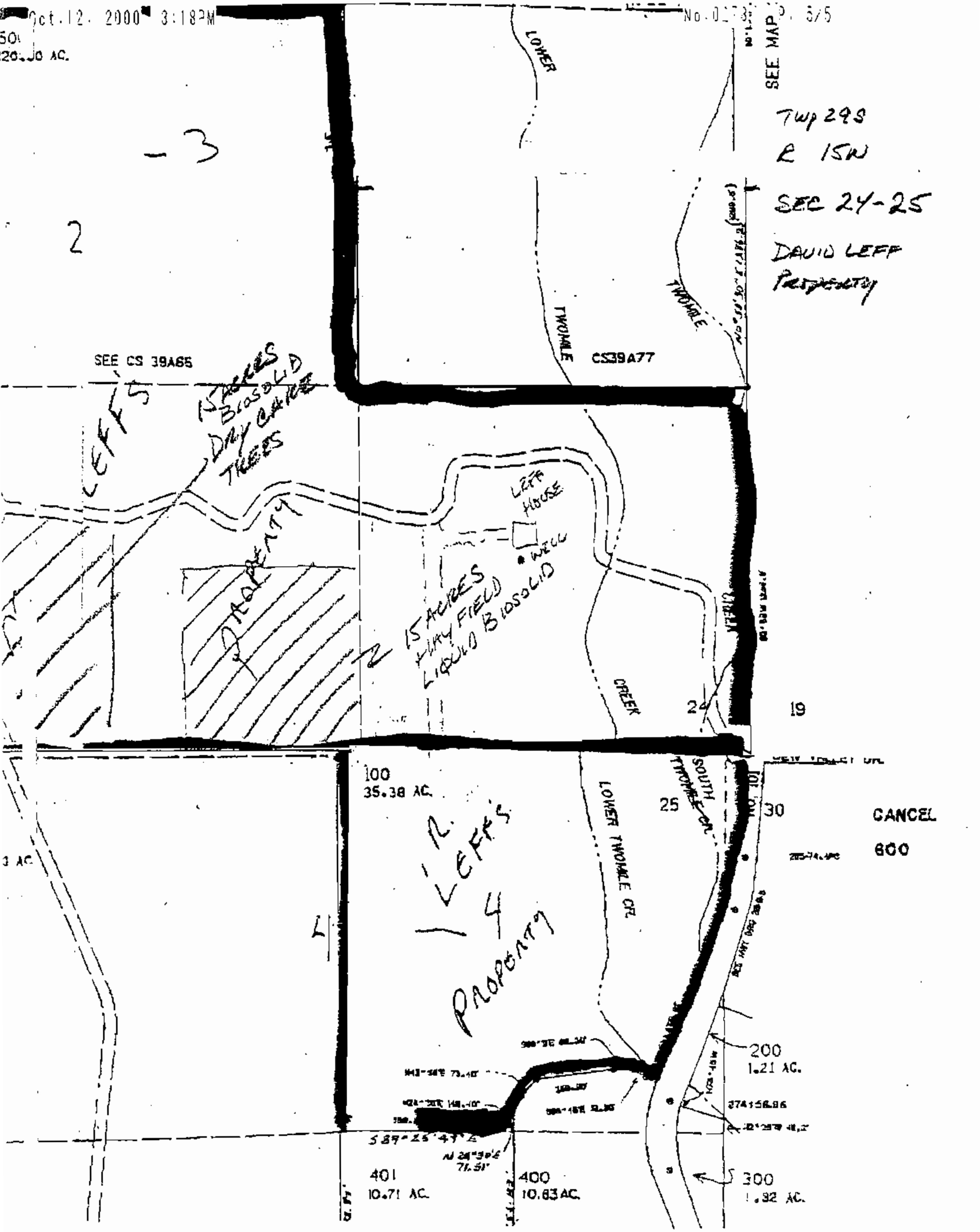
If you have any questions regarding this approval please call me at 440-3338.

Sincerely,

Paul Kennedy

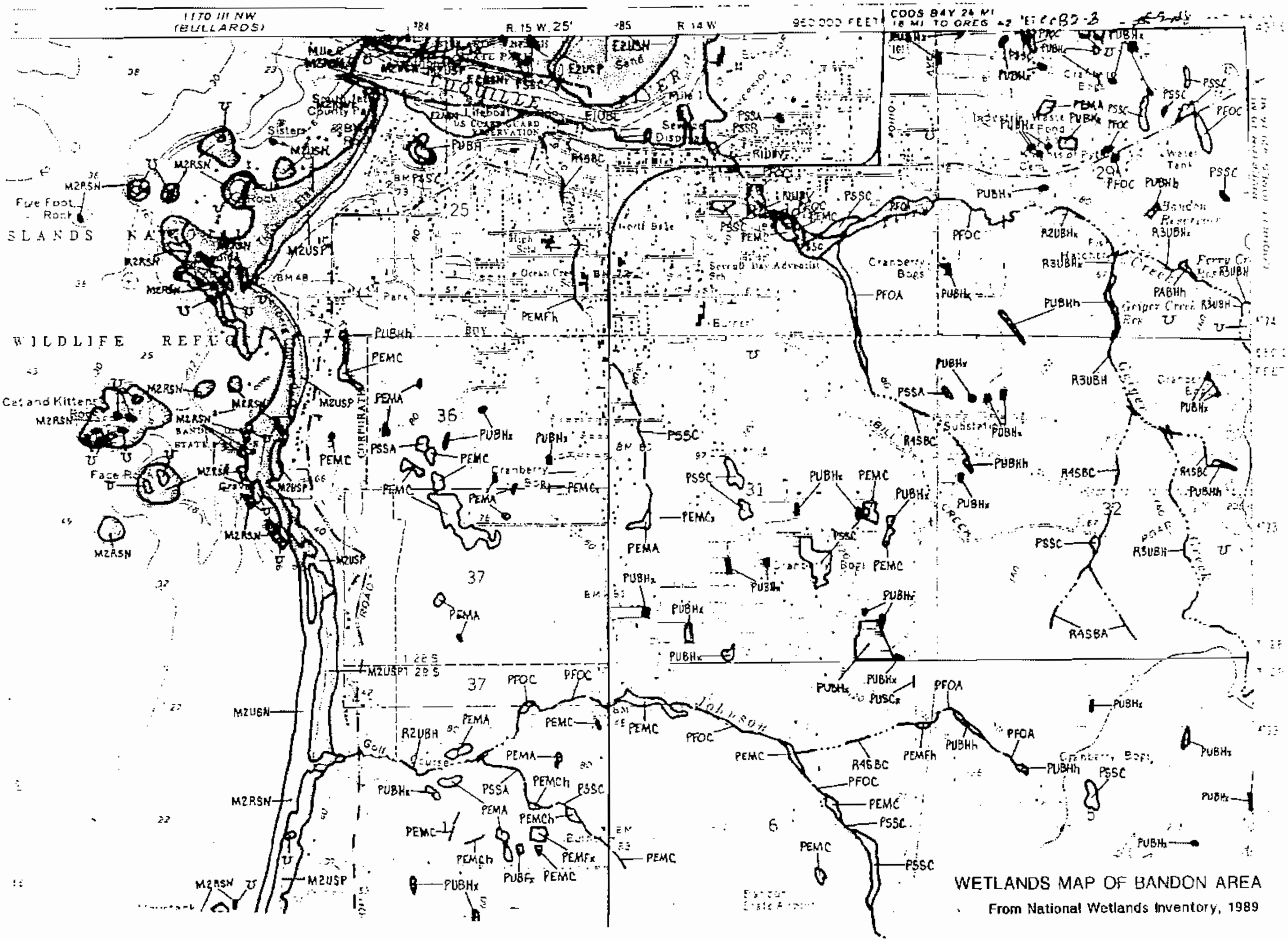
Paul Kennedy, RS
Environmental Specialist

cc: Biosolids Program, DEQ-Portland


500
20.00 AC.
SEE MAP
Twp 29S
R 15W
SEC 24-25
DAVID LEFF
Property
-3
2
LOWER
TWOMBLE
TWOMBLE
CS39A77
SEE CS 39A65
LEFF'S
15 ACRES
BIOSOLID
DRY CAKE
TREES
PROPERTY
LEFF
HOUSE
• WELL
15 ACRES
HAY FIELD
LIQUID BIOSOLID
CREEK
24
19
25
30
100
35.38 AC.
R. LEFF'S
4
PROPERTY
LOWER TWOMBLE CR.
SOUTH TWOMBLE CR.
CANCEL
600
3 AC.
L
200
1.21 AC.
274156.86
S 89° 25' 47" E
N 24°39'E
71.51'
401
10.71 AC.
400
10.63 AC.
300
1.32 AC.

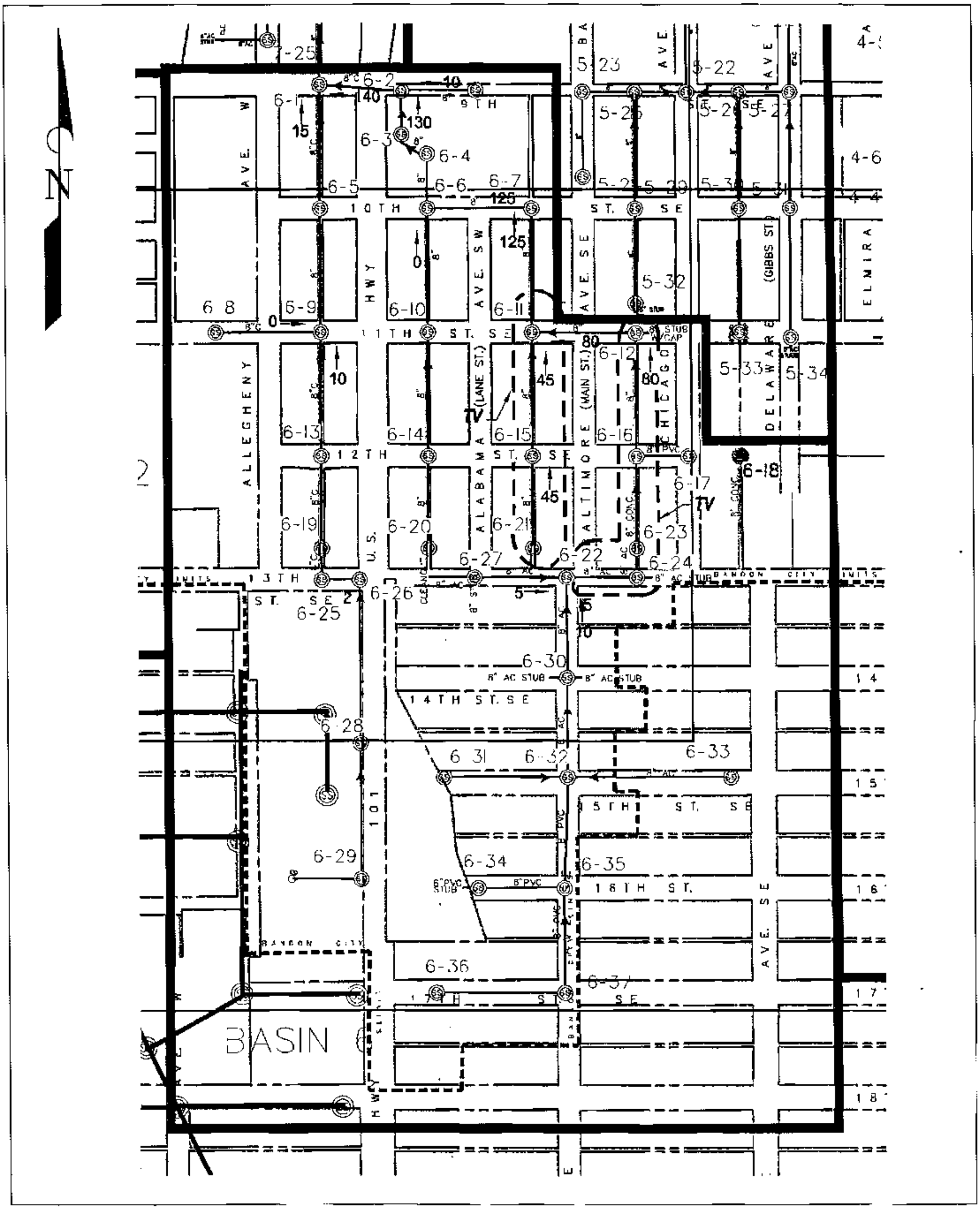
Appendix B

Figures and Maps



WETLANDS MAP OF BANDON AREA

From National Wetlands Inventory, 1989



THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	CITY OF BANDON BASIN 6	FIGURE NO.
DATE: JAN., 2002 PROJECT NO.: 4501.35	I/I ANALYSIS	1

D E S I G N   D A T A

ITEM	VALUE DESIGN	VALUE FUTURE
PLANT FLOW		
AVERAGE DRY WEATHER, MGD	0.5	0.75
PEAK MONTHLY AVERAGE, MGD	1.2	1.8
PEAK DAILY AVERAGE, MGD	2.1	3.2
PEAK WET WEATHER, MGD	3.2	4.8
PLANT LOAD		
BOD AVERAGE, PPD	1,150	1,730
BOD MAXIMUM MONTH, PPD	1,550	2,320
SS AVERAGE, PPD	1,350	2,020
SS MAXIMUM MONTH, PPD	2,350	3,520
FILLMORE AVENUE PUMPING STATION		
TYPE OF PUMPS: NON-CLOG VERTICAL TURBINE, VARIABLE SPEED		
NUMBER OF PUMPS	2	2
CAPACITY, EACH, MGD	0.678–3.2	4.8
HORSEPOWER, EACH	50	
OVERFLOW TO FERRY CREEK, DIAMETER, INCHES	12	12
WET WELL STORAGE BEFORE OVERFLOW AT 1.2 MGD, MINUTES	10	10
HEADWORKS		
ROTATING DRUM SCREEN		
NUMBER	1	1
DIAMETER, INCHES	36	60
LENGTH OF DRUM, INCHES	72	80
SPACING BETWEEN WEDGEWIRES, INCHES	0.1	0.1
CAPACITY, MGD, AT SS CONCENTRATION OF 250 mg/l	3.2	4.8
HAND RAKED BAR SCREEN		
NUMBER	1	1
SPACING BETWEEN BARS, INCHES	1.0	1.0
CAPACITY, MGD	4.8	4.8
SCREENINGS COMPACTOR		
TYPE: PLUNGER OR AUGER		
NUMBER	1	1
WET SCREENINGS CAPACITY, CU FT/HR	12	12
GRIT REMOVAL		
AERATED GRIT TANK		
NUMBER OF BASINS	1	1
LENGTH, FEET	17.33	17.33
WIDTH, FEET	13	13
AVERAGE DEPTH, FEET	5	8
VOLUME, GALLONS	13,400	13,400
DETENTION TIME AT PWWF, MINUTES	6	4
AIRFLOW, SCFM	70	70
GRIT PUMPING		
TYPE: RECESSED IMPELLER		
NUMBER OF PUMPS	1	1
CAPACITY, GPM AT 30 FEET TDH	100	100
HORSEPOWER	7.5	7.5
GRIT SEPARATION		
CYCLONE SEPARATOR		
NUMBER	1	1
CAPACITY, GPM AT 8 PSI	270	270
GRIT WASHER		
TYPE: SCREW CLASSIFIER		
NUMBER	1	1
SCREW DIAMETER, INCHES	12	12
CAPACITY, POUNDS PER HOUR	1,500	1,500

ITEM	VALUE DESIGN	VALUE FUTURE
SECONDARY TREATMENT		
AERATION BASINS		
NUMBER	2	3
WIDTH, FEET	12.87	12.87
WATER DEPTH, FEET	15.8	15.8
BASIN 1		
TYPE: 3-CELL ANOXIC SELECTOR WITH 1 AEROBIC CELL		
LENGTH, FEET	105	105
VOLUME, 1000 GALLONS	157	157
VOLUME ANOXIC CELLS, 1000 GALLONS		
CELL 1	18	18
CELL 2	19	19
CELL 3	42	42
VOLUME, AEROBIC CELL, 1000 GALLONS	78	78
ANOXIC CELL MIXERS		
TYPE: SUBMERSIBLE PROPELLER		
NUMBER	4	8
HORSEPOWER, EACH	3.2	3.2
BASIN 2		
TYPE: 2-CELL AEROBIC		
LENGTH, FEET	84.5	84.5
VOLUME, 1000 GALLONS	141	141
BASIN 3		
TYPE: 2-CELL AEROBIC		
LENGTH, FEET	–	105
VOLUME, 1000 GALLONS	–	157
DIFFUSER TYPE: FINE BUBBLE FLEXIBLE MEMBRANE		
SECONDARY PROCESS PERFORMANCE, MAXIMUM MONTH LOAD		
MLSS IN AERATION BASIN, mg/l	2,000	2,000
RAS SUSPENDED SOLIDS, mg/l	8,000	8,000
F/M, LB BOD/LB MLVSS/DAY	0.37	0.37
SLUDGE AGE, DAYS	6	6
HYDRAULIC DETENTION TIME AT PEAK MONTH AVERAGE FLOW, HOURS	8	8
BLOWERS, AERATION AND DIGESTION		
TYPE: POSITIVE DISPLACEMENT		
NUMBER, STANDBY	2	
NUMBER AND CAPACITY, EACH, SCFM/HORSEPOWER		
AERATION (NEW, VARIABLE SPEED)	1–1,500/75	2–1,500/75
DIGESTION (EXISTING 2-SPEED)	1–880/50 HI SPD 510/30 LO SPD	1–1,300/75 (NEW)
STANDBY (EXISTING)	2–800/40	1–800/40
AIR REQUIRED FOR AERATION, SCFM		
AVERAGE	380	800
MAXIMUM DAY	1,250	1,900
SECONDARY CLARIFIERS		
TYPE: INBOARD WEIR, FLOCCULATOR		
NUMBER	2	3
DIAMETER, FEET	45	45
SIDE WATER DEPTH, FEET	16	16
OVERFLOW RATE AT PWWF, GPD/SQ FT	1,000	1,000
OVERFLOW RATE AT PEAK DAILY FLOW, GPD/SQ FT	880	660
OVERFLOW RATE AT 75% PWWF WITH ONE CLARIFIER OUT OF SERVICE, GPD/SQ FT	1,800	1,100
NUMBER OF SLUDGE LEVEL SIGHT PORTS PER CLARIFIER	3	3

ITEM	VALUE DESIGN	VALUE FUTURE
RETURN SLUDGE PUMPS		
TYPE: NON-CLOG HORIZONTAL CENTRIFUGAL, VARIABLE-SPEED		
NUMBER	3	4
CAPACITY, EACH, GPM	50–270	50–270
HORSEPOWER, EACH	5	5
SLUDGE WASTING CAPACITY, GPM	15–40	15–40
WAS FLOW METER		
TYPE: MAGNETIC		
CAPACITY, GPM	40	40
ULTRAVIOLET DISINFECTION—OPEN CHANNEL VERTICAL TYPE		
UV DISINFECTION CHANNELS		
NUMBER	2	2
LENGTH, INCHES	224	224
WIDTH, INCHES	18.25	18.25
DEPTH, INCHES	65.5	65.5
CAPACITY, EACH, MGD	1.6	2.4
LAMPS		
NUMBER PER MODULE	28	28
TOTAL NUMBER OF MODULES/CHANNEL	3	4
FLOW CAPACITY, PER MODULE, MGD	0.54	0.60
POWER CONSUMPTION, PER MODULE, KW	2.38	2.36
UV DOSE AT PWWF, 70% OUTPUT, 65% TRANSMISSION, MICROWATT-SEC/SQ CM	35,870	34,850
EXPOSURE AT PWWF, SECONDS	12.5	11.1
AEROBIC DIGESTION		
DIGESTER BASIN (3-CELL SERIES TYPE)		
VOLUME, EACH CELL, GALLONS	2–125,000 1–118,000	2–125,000 1–118,000
FUTURE DIGESTER BASIN, VOLUME, GALLONS		121,600
MAXIMUM MONTH SLUDGE LOADING, GPD AT 0.8% SOLIDS	18,600	27,900
HYDRAULIC DETENTION TIME, DAYS	20	20
SOLIDS RETENTION TIME, DAYS	55	55
PEAK MONTH AIR REQUIREMENT, SCFM	850	1,300
DIGESTED SLUDGE FLOWMETER		
TYPE: MAGNETIC		
CAPACITY, GPM	350	350
LIQUID SLUDGE LOADING SYSTEM		
EXISTING		
FEED PUMP		
TYPE: CENTRIFUGAL		
CAPACITY, GPM	350	350
HORSEPOWER	3	3
AIR LIFT SLUDGE PUMPS		
TYPE: AIR LIFT		
NUMBER	3	3
DIAMETER, INCHES	4	4
CAPACITY AT 3 FEET LIFT AND 82% SUBMERGENCE, EACH, GPM	175	175
AIR REQUIREMENT, EACH, SCFM	30	30
SLUDGE THICKENING		
SCREW PRESS FEED PUMP		
EXISTING		
TYPE: PROGRESSIVE CAVITY, VARIABLE SPEED		
NUMBER	1	1
CAPACITY, GPM	8–57	8–57
HORSEPOWER	5	5
AVERAGE SLUDGE FEED RATE, GPD, AT 2.5% SOLIDS	5,350	8,025

ITEM	VALUE DESIGN	VALUE FUTURE
SCREW PRESS FEED FLOW METERS		
TYPE: MAGNETIC		
NUMBER	2	2
CAPACITY, GPM	15/35	15/35
SCREW PRESSES		
EXISTING		
NUMBER	1	1
CAPACITY, DRY SOLIDS, LB/HR	150	150
CAPACITY, GPM	15	15
PERCENT CAPTURE, MIN	82.5	82.5
NEW		
NUMBER	1	1
CAPACITY, DRY SOLIDS, LB/HR	350	350
CAPACITY, GPM	35	35
PERCENT CAPTURE, MIN	82.5	82.5
POLYMER FEED SYSTEM		
POLYMER DOSE, LBS/TON DRY SOLIDS	8–15	8–15
EXISTING		
NEAT POLYMER FEED PUMP		
TYPE: MECHANICAL DIAPHRAGM, VARIABLE SPEED		
NUMBER	1	1
CAPACITY, GPH	5–104	5–104
HORSEPOWER	0.5	0.5
POLYMER MIXING TANK, VOLUME, GALLONS	500	500
POLYMER SOLUTION MIXER, HORSEPOWER	0.5	0.5
NEW		
NEAT POLYMER DRUM MIXER, HORSEPOWER	0.5	0.5
POLYMER SOLUTION FEED PUMP		
TYPE: PROGRESSIVE CAVITY, VARIABLE SPEED		
NUMBER	1	1
CAPACITY, GPM	1–10	1–10
HORSEPOWER	3	3
SLUDGE STORAGE		
EXISTING		
AIR DRYING BEDS		
NUMBER	2	2
TOTAL AREA, SQ FT	4,213	4,213
PLANT WATER		
PUMPS		
TYPE: VERTICAL TURBINE		
NUMBER	2	2
CAPACITY, EACH, GPM	60	60
HORSEPOWER	5	5
HYDROPNEUMATIC TANK, VOLUME, GALLONS	158	158
SERVICE AIR COMPRESSOR		
TYPE: AIR COOLED RECIPROCATING		
CAPACITY, ACFM AT 100 PSIG	15	15
HORSEPOWER	5	5
EFFLUENT FLOW METER		
TYPE: IN-LINE SONIC		
RANGE, MGD	0.072–4.8	0.072–4.8
AVERAGE MONTHLY PLANT EFFLUENT REQUIREMENTS*		
BOD AND SS, PPD JUNE–OCTOBER	75	75
BOD AND SS, PPD NOVEMBER–MAY	113	113
* MASS LOAD GOVERNS CONCENTRATION AT ALL DESIGN FLOWS		
ANTICIPATED EFFLUENT QUALITY		
BOD AND SS, mg/l JUNE–OCTOBER	10–20	10–20
BOD AND SS, mg/l NOVEMBER–MAY	10–30	10–30

Brown and Caldwell
Consultants
Eugene, Oregon

SUBMITTED: Tom R. Nevins DATE: 1-20-92
APPROVED: PROJECT MANAGER DATE: 1-20-92
BROWN AND CALDWELL
APPROVED: DATE:

LINE IS 2 INCHES AT FULL SIZE
(IF NOT 2"-SCALE ACCORDINGLY)

FILE 6151
DRAWN GTM
DESIGNED WMH,JDB
CHECKED BKP
CHECKED

REGISTERED PROFESSIONAL ENGINEER
10,947
OREGON
DEC. 16, 1990
THOMAS RICHARD NEVINS

REVISIONS					
ZONE	REV.	DESCRIPTION	BY	DATE	APP.

CITY OF BANDON, OREGON

WASTEWATER TREATMENT
PLANT IMPROVEMENTS

DESIGN DATA

SCALE
NONE

DRAWING NUMBER
G5

SHEET NUMBER
5

Appendix

C

Calculations

TABLE 4.4
EQUIVALENT DWELLING UNITS

Land Use	EDU
Single family dwelling = 1 EDU	
Camp	
Day (no meals)	0.05/person
Resort	0.17/person
Church	0.17/seat
Country Club	0.33/member
Hotel	0.4/room
Industrial (excl. industrial use)	
Without showers	0.05/person/shift
With showers	0.12/person/shift
Institutions	
Hospital	0.83/bed
Rest Home	0.42/bed
Laundries, self-serve	1.67/machine
Mobile home parks	0.83/space
Motels	
With kitchens	0.33/bedroom
Without kitchens	0.27/bedroom
Office building	0.05/worker/shift
Picnic parks	
Toilet only	0.017/user
Showers included	0.033/user
Residential	
Boarding houses	0.5/bedroom
Rooming houses	0.27/person
Condominiums	0.68/unit
Multi-family	0.55/unit
Single family, 3 bedrooms or less	1.0/unit
Each additional bedroom	0.25/bedroom
Restaurant	0.13/seat
Single - service	0.007/customer
With bar/lounge	0.17/seat

Table 4.4, continued

Land Use	EDU
Schools	
Boarding	0.33/person
Day (cafeteria & showers)	0.083/person
Day (cafeteria only)	0.067/person
Day	0.05/person
Service or gas station	1.25/per pump station
Swimming pool	0.033/person
Shopping center	0.53/1000 SF
Tavern	0.07/seat
Theater	0.017/seat
Trailer park	
Without hookup	0.17/space
With hookup	0.33/space

Bandon WWTP Loads 1996-2001

		Average				Daily Max	
Month	Avg flow	BOD	BOD	TSS	TSS	BOD	TSS
	MGD	mg/L	PPD	mg/L	PPD	PPD	PPD
Jan-96	0.491	194	651	148	500	782	889
Feb-96	0.725	94	503	95	487	689	953
Mar-96	0.518	173	626	166	614	924	1050
Apr-96	0.493	189	675	155	533	913	687
May-96	0.499	210	757	145	488	1297	888
Jun-96	0.327	277	635	162	373	712	594
Jul-96	0.293	291	602	226	460	719	933
Aug-96	0.281	297	650	228	504	786	844
Sep-96	0.263	282	590	204	436	711	689
Oct-96	0.257	295	595	189	390	696	598
Nov-96	0.482	265	701	171	500	984	697
Dec-96	0.771	109	644	99	549	1063	1100
Jan-97	0.677	104	508	138	617	692	1579
Feb-97	0.571	142	522	127	479	677	852
Mar-97	0.527	140	578	150	620	740	810
Apr-97	0.291	325	766	216	516		
May-97	0.407	217	523	167	459	1026	951
Jun-97	0.287	271	661	184	435	781	718
Jul-97	0.283	248	578	186	434	772	1064
Aug-97	0.284	286	635	186	404	823	677
Sep-97	0.277	311	636	186	368	835	624
Oct-97	0.298	271	544	202	426	733	710
Nov-97	0.309	233	495	203	455	594	759
Dec-97	0.349	187	481	184	469	642	819
Jan-98	0.586	124	488	123	525	760	1238
Feb-98	0.727	103	540	94	503	719	791
Mar-98	0.541	141	544	151	607	666	914
Apr-98	0.475	169	595	152	534	923	797
May-98	0.393	177	496	175	500	542	746
Jun-98	0.345	205	517	181	457	617	740
Jul-98	0.313	251	577	207	482	728	612
Aug-98	0.309	264	596	203	454	684	599
Sep-98	0.275	257	552	220	481	835	915
Oct-98	0.291	257	539	202	425	666	627
Nov-98	0.407	217	523	167	459	898	1005
Dec-98	0.752	112	541	113	583	837	
Jan-99	0.687	145	593	120	524	689	802
Feb-99	0.848	94	583	97	568	853	932
Mar-99	0.726	113	554	103	495	653	721
Apr-99	0.526	134	446	144	494	615	674
May-99	0.406	134	354	163	428	502	807
Jun-99	0.347	174	375	204	444	548	809
Jul-99	0.378	177	434	185	448	634	938
Aug-99	0.354	184	393	205	457	699	918
Sep-99	0.336	164	332	240	504	472	696
Oct-99	0.326	153	299	230	462	419	674
Nov-99	0.341	183	406	292	625	966	1259
Dec-99	0.378	194	474	213	501	586	874

Bandon WWTP Loads 1996-2001

		Average				Daily Max	
Month	Avg flow	BOD	BOD	TSS	TSS	BOD	TSS
	MGD	mg/L	PPD	mg/L	PPD	PPD	PPD
Jan-00	0.56	172	641	177	631	1061	1245
Feb-00	0.77	129	646	132	673	867	1119
Mar-00	0.498	159	515	181	569	681	1172
Apr-00	0.344	266	565	237	511	743	1004
May-00	0.317	244	471	248	483	628	735
Jun-00	0.342	261	551	224	475	759	900
Jul-00	0.374	255	605	256	618	687	1177
Aug-00	0.354	301	685	231	521	861	1006
Sep-00	0.335	236	484	235	492	641	927
Oct-00	0.333	258	515	277	564	621	815
Nov-00							
Dec-00							
Jan-01	0.284	247	459	240	459	565	815
Feb-01	0.28	354	650	244	456	746	1249
Mar-01	0.283	240	423	259	478	623	931
Apr-01	0.308	289	612	220	456	797	760
May-01	0.282	321	578	258	471	751	875
Jun-01	0.277	373	693	271	491	859	679
Jul-01	0.3	394	804	287	594	1034	773
Aug-01	0.33	441	1013	255	569	1580	1046
Sep-01	0.303	467	918	265	523		777
Oct-01	0.266	384	669	207	360	829	434
Nov-01	0.295	296	569	218	426	730	840
Dec-01	0.379	256	712	183	474	991	1065
Max	0.848	467	1013	292	673	1580	1579
Avg	0.412	227	573	192	497	767	866
Peak factor		2.1	1.8	1.5	1.4	2.1	1.8
PCL		0.08	0.21	0.07	0.18	0.28	0.32

2001 averages	
339	BOD mg/l
675	BOD lbs
242	TSS mg/l
480	TSS lbs

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

MEMORANDUM

To: Bill Nielson, City of Bandon
From: John Waddill
Date: June 18, 2001

Subject: City of Bandon Miscellaneous Services
Wastewater Treatment Plant
Design Average Wet Weather Flow
Project No. 4501.00E

Schedule C, Condition 4 of the city's National Pollutant Discharge Elimination System (NPDES) permit for the wastewater treatment facility allows the city to request an increase in wet weather mass loading based on wet weather flows. The information in this memorandum provides an evaluation of the design average wet weather flow.

The evaluation utilizes the flow analysis by Brown and Caldwell Consulting Engineers in 1991. That information is summarized below:

Design Flow	Flow(1)	Probability of Exceeding (2)
Peak Wet Weather	3.2 Mgd	0.011%
Peak Daily	2.1 Mgd	0.27%
Peak Weekly	1.5 Mgd	1.9%
Peak Monthly	1.2 Mgd	8.3%

These probabilities are illustrated on the attached graph (Exhibit 1). The flow vs. probability line was extrapolated to the 50% probability intersection. This suggests an average annual flow of 0.68 Mgd.

The average dry weather flow used in the 1992 design is 0.54 Mgd(1). Average annual flow is the mean of the average dry weather flow and the average dry weather flow(2). That is,

$$\text{Annual Flow}_{\text{AVERAGE}} = (\text{Dry Weather Flow}_{\text{AVERAGE}} + \text{Wet Weather Flow}_{\text{AVERAGE}})/2$$

or

$$\begin{aligned}\text{Wet Weather Flow}_{\text{AVERAGE}} &= (2 \times \text{Annual Flow}_{\text{AVERAGE}}) - \text{Dry Weather Flow}_{\text{AVERAGE}}\\ &= (2 \times 0.68\text{ Mgd}) - 0.54\text{ Mgd}\\ &= 0.82\text{ Mgd}\end{aligned}$$

275 MARKET AVE.
COOS BAY, OREGON 97420
TELEPHONE: (541) 269-0732
FAX: (541) 269-2044

The design data table(3) in the construction drawings for the facility shows the following information about the main process equipment and flow:

Process Equipment	Design Parameter		
Influent Pump Station	Flow	3.2 Mgd	Peak Wet Weather
Rotating Drum Screen(4)	Flow	3.2 Mgd	Peak Wet Weather
Hand Raked Bar Screen	Flow	3.2 Mgd	Peak Wet Weather
Aeration Basin	Hydraulic Retention	6 hours	Peak Wet Weather
Secondary Clarifier	Overflow	1000 sf/gal/day	Peak Wet Weather
	Overflow	660 sf/gal/day	Peak Daily

The overflow rate of the secondary clarifier is the only variable process in the design for the average wet weather flow. Attached Exhibit 2 shows daily influent flow rates, secondary clarifier overflow rates, and the calculated mass load(5).

For clarifiers in general, the preferred average overflow for average flow conditions is about 560 gallons per day per square foot(6). Using this rate, the calculated average wet weather flow is consistent with the 1992 design scheme.

From this analysis, design average wet weather flow is approximately 0.82 million gallons per day. Using a BOD_5 concentration of 30 mg per liter, the average monthly load is calculated(5) as approximately 200 pounds. Similarly, the not-to-exceed weekly load is approximately 300 pounds and the not-to-exceed daily load is 400 pounds.

Footnotes

(1) Brown and Caldwell, City of Bandon Wastewater Facilities Plan, February 1991

(2) Oregon Department of Environmental Quality, Guidelines for Making Wet-Weather and Peak Flow Projections for Sewage Treatment in Western Oregon, 1996

(3) Brown and Caldwell, Bandon Wastewater Treatment Plant Improvement, Volume 3 of 3, Part C: Drawings, January, 1992

(4) This unit was replaced in 1998 with equipment of the same capacity.

(5) OAR 340-41-120(9).

(6) American Society of Civil Engineers, Design of Municipal Wastewater Treatment Plants, Volume I, Chapters 1-12, 1991

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COMPARISION OF MASS LOAD WITH SECONDARY CLARIFIER OVERFLOW RATE

Diameter	45 feet
Area	1590 square feet
Depth	16 feet

		Using Wet Weather Permit Concentration Monthly BOD5 of 30 mg/l				Using Dry Weather Permit Concentration Monthly BOD5 of 20 mg/l		
Plant Flow Mgd	SCL Overflow (gal/sf/day)	Monthly Average BOD_5 Mass Load (lbs)	Weekly Average BOD_5 Mass Load (lbs)	Daily Average BOD_5 Mass Load (lbs)	Design Flow	Monthly Average BOD_5 Mass Load (lbs)	Weekly Average BOD_5 Mass Load (lbs)	Daily Average BOD_5 Mass Load (lbs)
0.0	0	0	0	0		0	0	0
0.1	31	25	38	50		17	25	33
0.2	63	50	75	100		33	50	67
0.3	94	75	113	150		50	75	100
0.4	126	100	150	200		67	100	133
		110	**170**	**230**	**Mass Load Permit Parameters**	**75**	**110**	**150**
0.45	141	113	169	225	Average Dry Weather Flow	75	113	150
0.5	157	125	188	250				
0.6	189	150	225	300				
0.7	220	175	263	350				
0.8	**252**	**200**	**300**	**400**	**Average Wet Weather Flow**			
0.9	283							
1.0	314							
1.1	346							
1.2	377				Peak Monthly Flow			
1.3	409							
1.4	440							
1.5	472							
1.6	503							
1.7	534							
1.8	566							
1.9	597							
2.0	629							
2.1	660				Peak Daily Average Flow			
2.2	692							
2.3	723							
2.4	755							
2.5	786							
2.6	817							
2.7	849							
2.8	880							
2.9	912							
3.0	943							
3.1	975							
3.2	1006				Peak Wet Weather Flow			

EXHIBIT 2

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

June 19, 2001

Mr. Bill Nielson
City of Bandon
P.O. Box 67
Bandon, OR 97411

Subject: City of Bandon Miscellaneous Services
Wastewater Treatment Plant
Design Average Wet Weather Flow
Project No. 4501.00E

Dear Bill:

As requested by the city, our office evaluated the design average wet weather flow (DAWWF) for the city's wastewater treatment plant. Schedule C, Condition 4 of the city's National Pollutant Discharge Elimination System (NPDES) permit for the facility allows the city to request an increase in wet weather mass loading. The information in the attached memorandum to the city dated June 18, 2001 provides an evaluation of the design average wet weather flow.

The conclusion that was reached in the document is that the DAWWF is approximately 0.82 million gallons per day (Mgd). The current wet weather mass load is based on the average dry weather flow, that is, 0.45 Mgd. The current mass load parameters are about one half of what could be requested. This is shown in the table below:

BOD_5 Mass Load Permit Parameter	**Current Permit**	**Potential Modification**
Average Monthly Load	110 lbs	200 lbs
Not-to-exceed Weekly Load	170 lbs	300 lbs
Not-to-exceed Daily Load	230 lbs	400 lbs

The request for modification has attached conditions. The conditions, which are abstracted from OAR 340-41-120(9)(a), are listed below:

> *(G) Within 180 days after permit renewal or modification, permittees receiving higher mass loads under this rule and having a separate sanitary sewer system shall submit to the Department for review and*

approval a proposed program and time schedule for identifying and reducing inflow. The program shall consist of the following:

- *(i) Identification of all overflow points and verification that sewer system overflows are not occurring up to a 24-hour, five-year storm event or equivalent;*
- *(ii) Monitoring of all pump station overflow points; and*
- *(iii) A program for identifying and removing all inflow sources into the permittees sewer system over which the permittee has legal control; and*
- *(iv). For those permittees not having the necessary legal authority for all portions of the sewer system discharging into the permittee's sewer system or treatment facility, a program and schedule for gaining legal authority to require inflow reduction and a program and schedule for removing inflow sources.*

(H) Within one year after the Department's approval of the program, the permittee shall begin implementation of the program.

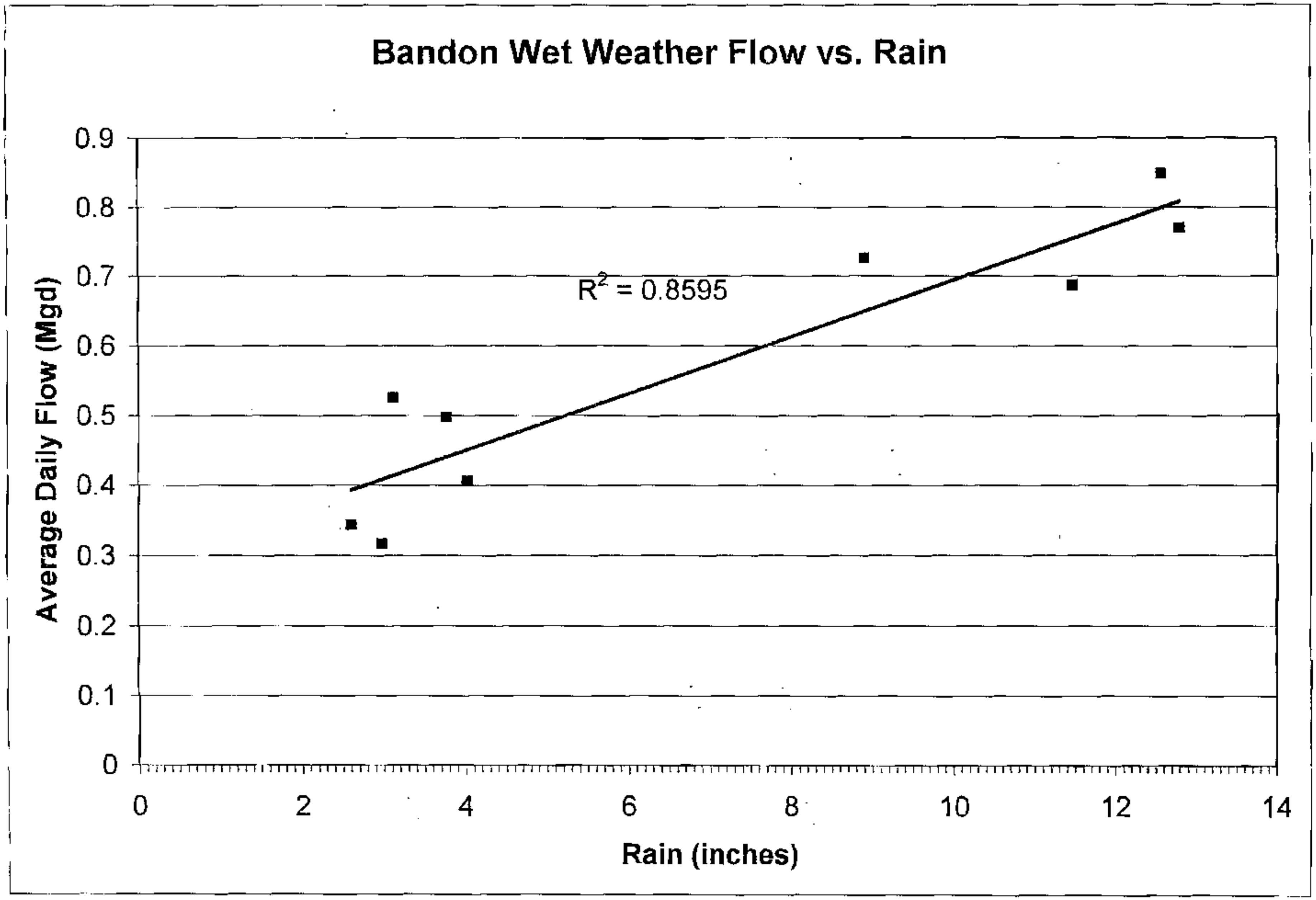
As you can see, the price of increased loading is diligent and monitored pursuit of inflow and infiltration (I/I). While what is demanded in this section of the Oregon Administrative Rules is certainly reasonable and part of a well operated collection system, the specific involvement of the regulator may be carry more labor and care than needed.

Our recommendation in the analysis so far, is that the city should pursue the mass load increase to the next level. That is, request an increase, define the specifics, and evaluate the cost and benefits. While it is obvious that the mass load in the winter should be higher than that in the summer, the regulator may not allow the entire increase that is suggested by the evaluation. The marginal increase must be weighed against the cost of the provisions that are generally described above. In other words, the benefit of increased mass load in the winter is clear. The cost is not clear because the specifics are not yet definite.

Please call if you have any questions.

Respectfully,
THE DYER PARTNERSHIP ENGINEERS AND PLANNERS, INC.

John M. Waddill, P.E., P.L.S.
(signed in two counterparts)


Bandon Wet Weather Flow vs. Rain
Average Daily Flow (Mgd)
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
$R^2 = 0.8595$
0
2
4
6
8
10
12
14
Rain (inches)

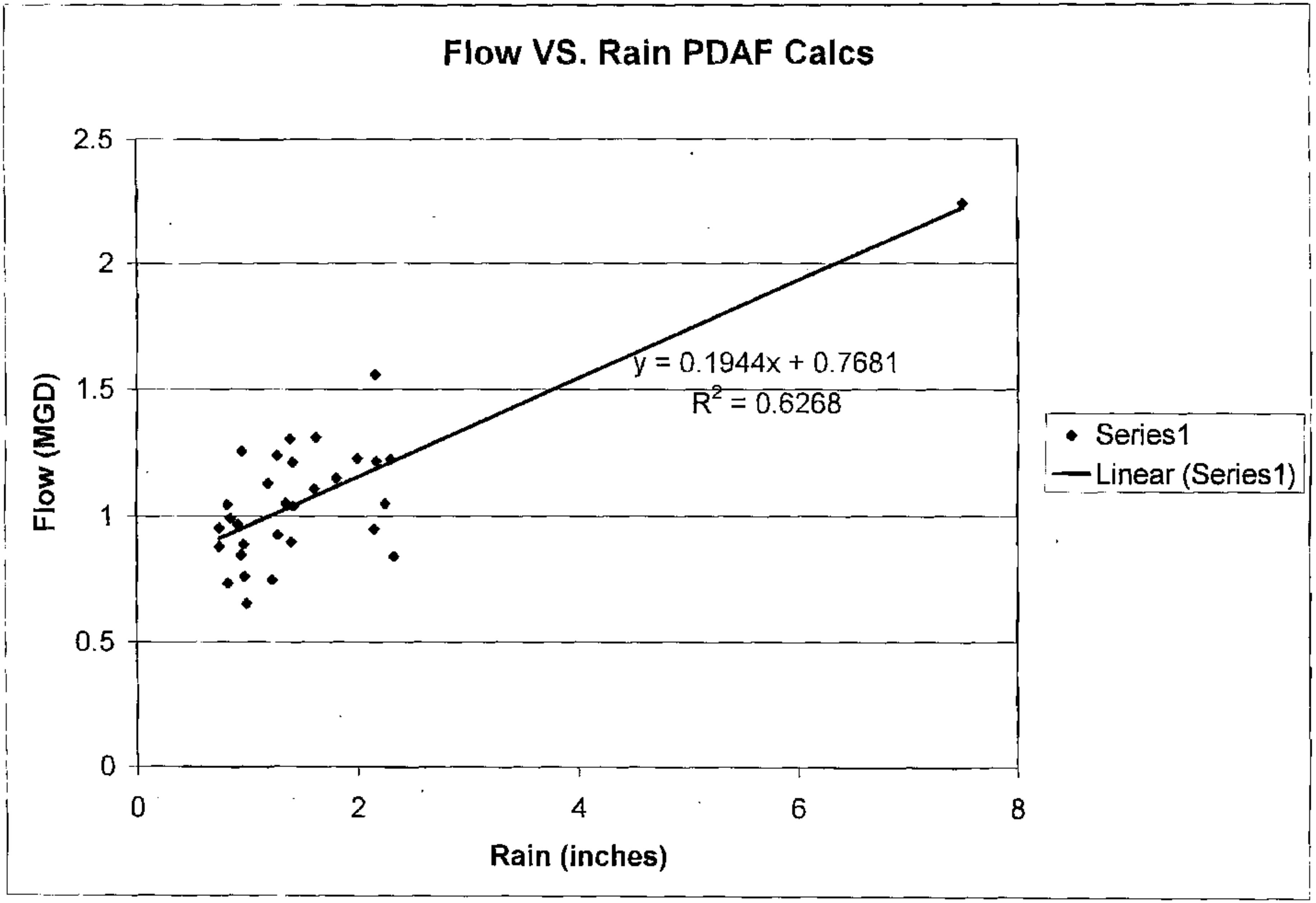
INFILTRATION					INFLOW				
Date	Efluent (MGD)	rain (in./day)	Average (MGD)	Per Capita Use (gpcd)	Date	Efluent (MGD)	Rain (in./day)	Rain 48 hr	Per Capita Use (gpcd)
2/10/96	0.981	0			1/9/96	0.547	1.77	2.1	185
2/11/96	0.676	0			1/10/96	0.571	0.09	1.88	193
2/12/96	0.59	0			1/20/96	0.47	1.3	1.89	159
2/13/96	0.586	0			1/21/96	0.763	0.98	2.28	258
2/14/96	0.567	0			1/24/96	0.735	0.83	1.58	248
2/15/96	0.526	0			1/27/96	0.749	1.23	1.56	253
2/16/96	0.526	0.05	0.579	195	1/28/96	0.954	0.75	1.98	322
3/12/96	0.547	0.15			2/9/96	1.218	2.17	2.81	411
3/13/96	0.507	0.1			2/10/96	0.981	0	2.17	331
3/14/96	0.482	0			2/18/96	0.723	1.47	1.71	244
3/15/96	0.487	0.02			2/19/96	1.152	1.81	3.28	389
3/16/96	0.467	0.03			2/20/96	0.993	0.85	2.66	335
3/17/96	0.458	0			2/21/96	1.216	1.41	2.26	411
3/18/96	0.447	0			2/22/96	0.984	0.47	1.88	332
3/19/96	0.419	0			2/29/96	0.908	1.4	1.92	307
3/20/96	0.43	0			3/5/96	0.969	0.92	2.04	327
3/21/96	0.424	0	0.467	158	11/18/96	0.385	2.2	2.98	130
1/4/97	0.791	0.03			11/19/96	2.243	7.5	9.7	758
1/5/97	0.715	0.07			11/20/96	1.514	1.2	8.7	511
1/6/97	0.571	0			11/21/96	0.712	0.3	1.5	240
1/7/97	0.591	0.01			11/22/96	0.95	2.15	2.45	321
1/8/97	0.555	0			11/23/96	0.842	0.02	2.17	284
1/9/97	0.531	0			12/5/96	1.051	2.25	2.32	355
1/10/97	0.506	0.07			12/6/96	0.882	0.75	3	298
1/11/97	0.575	0			12/8/96	1.226	2.3	2.88	414
1/12/97	0.474	0			12/9/96	1.151	0.13	2.43	389
1/13/97	0.441	0			12/11/96	1.131	0.73	1.55	382
1/14/97	0.469	0			12/29/96	0.928	1.23	1.47	313
1/15/97	0.446	0			12/30/96	1.023	0.5	1.73	345
1/16/97	0.405	0.03	0.544	184	12/31/96	1.242	1.27	1.77	419
3/21/97	0.626	0			1/1/97	1.512	1.03	2.3	511
3/22/97	0.577	0			1/26/97	1.557	2.16	3.24	526
3/23/97	0.475	0			1/27/97	0.843	0	2.16	285
3/24/97	0.451	0			1/31/97	1.109	2.81	2.81	375
3/25/97	0.526	0			2/1/97	1.756	0.62	3.43	593
3/26/97	0.478	0.1			3/2/97	0.843	2.33	2.33	285
3/27/97	0.47	0.11	0.515	174	3/3/97	0.613	0.31	2.64	207
12/15/98	0.688	0			11/18/98	0.317	0.66	1.54	107
12/16/98	0.626	0			11/21/98	0.708	3.53	3.96	239
12/17/98	0.595	0			11/22/98	0.865	0.99	4.52	292
12/18/98	0.546	0			11/26/98	0.777	1.74	2.2	262
12/19/98	0.545	0			11/27/98	0.611	0.5	2.24	206
12/20/98	0.538	0			11/30/98	0.883	2.7	3.59	298
12/21/98	0.533	0			12/1/98	1.797	0.75	3.45	607
12/22/98	0.571	0			12/2/98	1.229	2	2.75	415
12/23/98	0.544	0			12/3/98	1.335	0.42	2.42	451
12/24/98	0.53	0	0.572	193	12/28/98	0.835	2.3	2.3	282
1/1/99	0.687	0.05			12/29/98	1.287	0.66	2.96	435

INFILTRATION				
Date	Efluent (MGD)	rain (in./day)	Average (MGD)	Per Capita Use (gpcd)
1/2/99	0.652	0		
1/3/99	0.606	0		
1/4/99	0.561	0		
1/5/99	0.525	0		
1/6/99	0.482	0		
1/7/99	0.481	0.08		
1/8/99	0.459	0		
1/9/99	0.474	0		
1/10/99	0.461	0		
1/11/99	0.452	0	0.531	179
3/15/99	0.747	0.04		
3/16/99	0.686	0.08		
3/17/99	0.646	0		
3/18/99	0.63	0.07		
3/19/99	0.592	0.02		
3/20/99	0.578	0		
3/21/99	0.581	0.02		
3/22/99	0.552	0.06	0.627	212
4/12/99	0.615	0.02		
4/13/99	0.59	0		
4/14/99	0.507	0		
4/15/99	0.426	0		
4/16/99	0.487	0		
4/17/99	0.493	0		
4/18/99	0.479	0		
4/19/99	0.554	0		
4/20/99	0.458	0.05		
4/21/99	0.462	0		
4/22/99	0.439	0.02		
4/23/99	0.433	0		
4/24/99	0.443	0		
4/25/99	0.441	0		
4/26/99	0.438	0.17		
4/27/99	0.43	0.08		
4/28/99	0.409	0.09		
4/29/99	0.379	0		
4/30/99	0.388	0	0.467	158
12/20/99	0.347	0		
12/21/99	0.354	0		
12/22/99	0.335	0		
12/23/99	0.369	0		
12/24/99	0.348	0		
12/25/99	0.325	0		
12/26/99	0.311	0		
12/27/99	0.301	0		
12/28/99	0.331	0		
12/29/99	0.335	0		
12/30/99	0.319	0		

INFLOW				
Date	Efluent (MGD)	Rain (in./day)	Rain 48 hr	Per Capita Use (gpcd)
1/16/99	0.673	0.75	2.05	227
1/18/99	1.041	1.42	1.91	352
1/19/99	0.784	0.43	1.85	265
1/21/99	0.999	0.85	1.8	337
1/30/99	0.936	2.44	2.62	316
1/31/99	1.47	0.39	2.83	496
2/7/99	1.12	0.67	1.52	378
2/9/99	1.307	1.39	1.56	441
2/10/99	0.968	0.3	1.69	327
2/18/99	0.726	1.35	1.71	245
2/19/99	0.991	0.45	1.8	335
2/23/99	0.99	1.6	2	334
2/24/99	1.279	0.45	2.05	432
2/28/99	1.131	1.19	1.52	382
3/4/99	0.99	0.28	1.63	334
3/30/99	0.717	0.53	1.5	242
3/31/99	0.891	0.97	1.5	301
11/26/99	0.464	1.15	1.55	157
12/10/99	0.582	0.75	1.89	197
1/11/00	0.674	1.61	2.33	228
1/12/00	0.564	0.43	2.04	190
1/13/00	0.899	2.9	3.33	304
1/14/00	1	0.77	3.67	338
1/24/00	0.743	1.67	1.7	251
1/25/00	0.954	0.78	2.45	322
2/9/00	0.849	0.48	1.55	287
1/13/00	0.879	0.58	1.56	297
1/14/00	1.109	1.61	2.19	375
1/15/00	1.134	0.7	2.31	383
1/26/00	0.885	1.6	2.3	299
1/27/00	1.312	1.62	3.22	443
1/28/00	1.012	0.04	1.64	342
5/16/00	0.346	0.35	1.54	117
12/14/00	0.515	1.36	1.57	174
12/15/00	0.436	0.18	1.54	147
Average	0.96	1.20	2.40	323
Median				321
EPA Criterion for Inflow				275
Percent > EPA Criteria				69%

INFILTRATION				
Date	Efluent (MGD)	rain (in./day)	Average (MGD)	Per Capita Use (gpcd)
12/31/99	0.326	0	0.333	113
2/16/00	0.963	0		
2/17/00	0.778	0		
2/18/00	0.704	0		
2/19/00	0.703	0		
2/20/00	0.614	0.03		
2/21/00	0.667	0.31	0.693	234
3/24/00	0.437	0		
3/25/00	0.427	0		
3/26/00	0.424	0		
3/27/00	0.4	0		
3/28/00	0.395	0.23		
3/29/00	0.402	0		
3/30/00	0.404	0		
3/31/00	0.358	0		
4/1/00	0.393	0		
4/2/00	0.377	0		
4/3/00	0.361	0		
4/4/00	0.353	0		
4/5/00	0.363	0		
4/6/00	0.365	0		
4/7/00	0.35	0		
4/8/00	0.338	0		
4/9/00	0.347	0		
4/10/00	0.34	0		
4/11/00	0.331	0		
4/12/00	0.346	0	0.376	127
Average			0.518	175
Median				179
EPA Criteria for infiltration				120
Percentage > EPA Criteria				91%

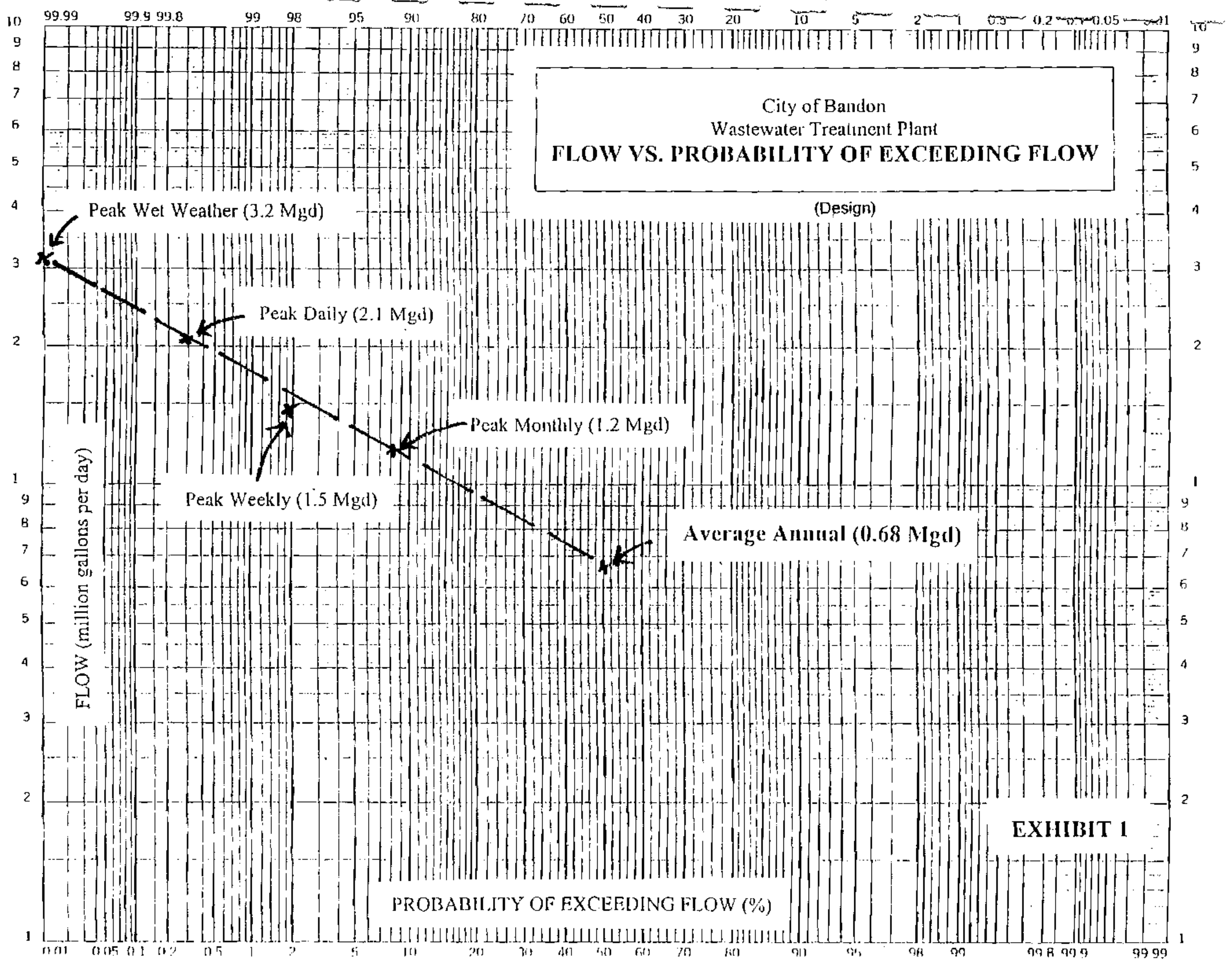
INFLOW				
Date	Efluent (MGD)	Rain (in./day)	Rain 48 hr	Per Capita Use (gpcd)


Flow VS. Rain PDAF Calcs
Flow (MGD)
2.5
2
1.5
1
0.5
0
0
2
4
6
8
Rain (inches)
y = 0.1944x + 0.7681
R² = 0.6268
Series1
Linear (Series1)

Storm calcs for PDAF

	MGD	Rain
1/21/1996	0.763	0.98
1/24/1996	0.735	0.83
1/27/1996	0.749	1.23
1/28/1996	0.954	0.75
2/9/1996	1.218	2.17
2/19/1996	1.152	1.81
2/20/1996	0.993	0.85
2/21/1996	1.216	1.41
2/29/1996	0.9	1.4
3/5/1996	0.969	0.92
11/22/1996	0.95	2.15
12/4/1996	0.656	1
12/5/1996	1.051	2.25
12/6/1996	0.882	0.75
12/8/1996	1.226	2.3
12/10/1996	1.046	0.82
12/29/1996	0.928	1.28
12/31/1996	1.242	1.27
1/26/1997	1.557	2.16
3/2/1997	0.843	2.33
12/2/1998	1.229	2
1/18/1999	1.041	1.42
2/9/1999	1.307	1.39
2/25/1999	1.259	0.95
2/28/1999	1.131	1.19
3/3/1999	1.054	1.35
3/9/1999	0.848	0.95
3/31/1999	0.891	0.97
2/14/2000	1.109	1.61
2/27/2000	1.312	1.62
11/19/1996	2.243	7.5
PDAF		1.74

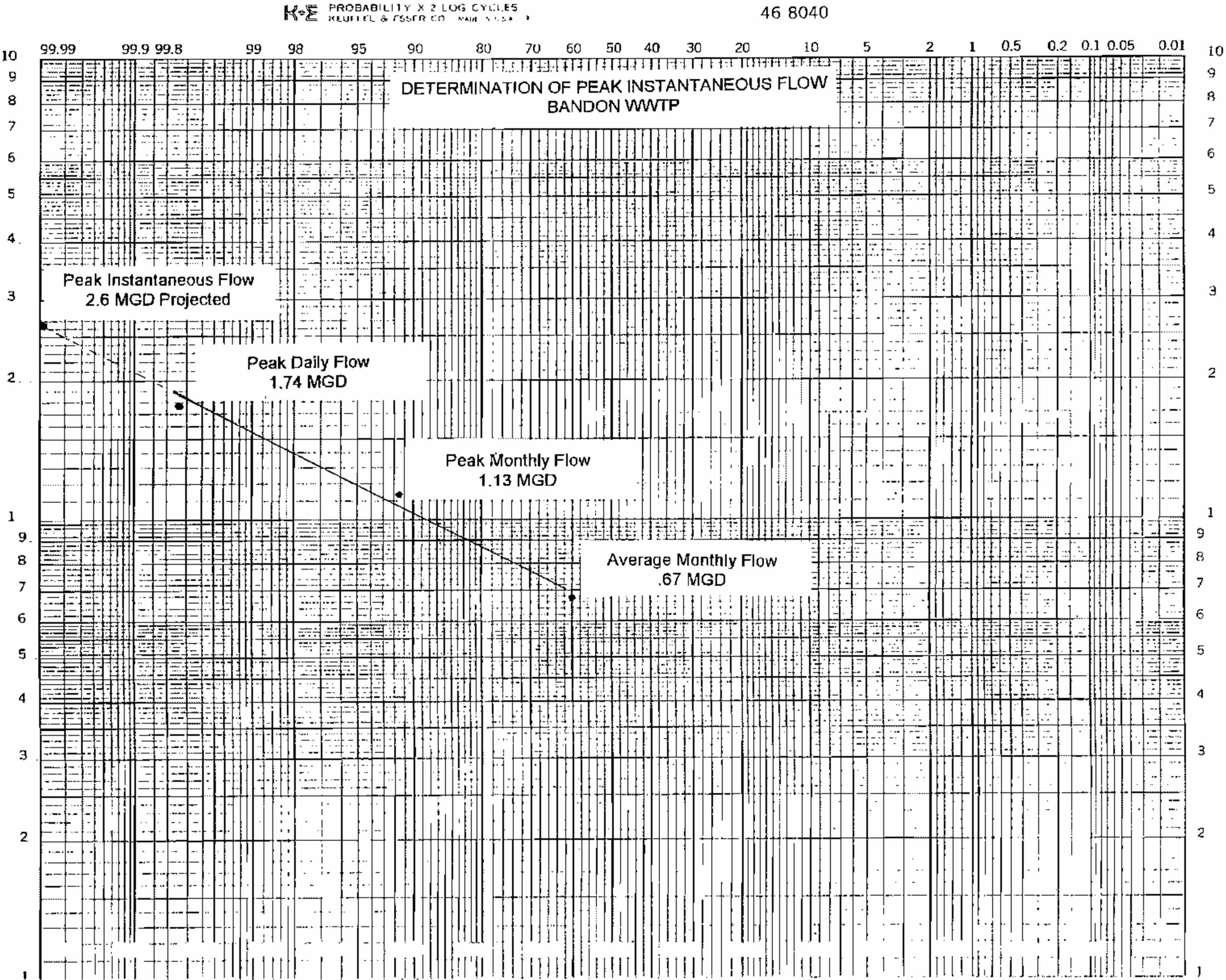
Note: PDAF without 11/96 storm is 1.70



City of Bandon
Wastewater Treatment Plant
FLOW VS. PROBABILITY OF EXCEEDING FLOW

(Design)

EXHIBIT 1



DETERMINATION OF PEAK INSTANTANEOUS FLOW
BANDON WWTP

Peak Instantaneous Flow
2.6 MGD Projected

Peak Daily Flow
1.74 MGD

Peak Monthly Flow
1.13 MGD

Average Monthly Flow
.67 MGD

Design Flows for Bandon WWTP			24-Apr-02
Summary of Existing Influent Flows at the Bandon WWTP			
Flow Parameter	gpcd	MGD	Basis
Population - Dry Season	2692		2001 Equivalent Population
Population - Wet Season	2692		2001 Equivalent Population
ADWF	125	0.34	May-Oct 10/97 - 10/00
Base Sewage dry	84	0.23	Based on review of Bandon's Water Consumption Data
Base Sewage wet		0.23	
Base Infiltration		0.11	
AWWF		0.44	Nov-Apr 1/97 - 12/00
MMDWF		0.46	
MMWWF		0.89	
Peak Month		1.13	
Peak Week		1.4	Estimated from probability plot
Peak Day		1.74	Based on 5.0", 5-year, 24-hour storm
PIF		2.6	Estimated from probability plot
MMWW I/I		0.66	MMWWF - Base Sewage
PI I/I		2.37	PIF - Base Sewage
Density people/acre		10.5	5 homes per acre x 2.1 occupancy
Peak I/I gallons/acre/day		600	Metcalf & Eddy new sewer I/I chart (2,000 acres)
Peak I/I gallons/person/day		57	
Flow Projections for the years 2021.		MGD	Basis
Year	2021		
Population - Dry Total	4241		
Population - Wet Total	4241		
Population - Dry Increase	1549		
Population - Wet Increase	1549		
Flow Parameter			
increase in base sewage	A	**0.13**	Base sewage gpcd x population increase
increase in dry weather I/I	B	**0.03**	20 gpcd x population increase
increase in wet weather I/I	C	**0.09**	57 gpcd x population increase
Base Sewage - Dry		0.36	Existing base sewage dry + A
Base Infiltration - Dry		0.14	Existing base infiltration + B
ADWF		0.50	Existing ADFW + A+ B
MMDWF		0.62	Existing MMDFW + A + B
Base Sewage - Wet		0.36	Existing base sewage wet + A
Base Infiltration - Wet		0.20	Existing base infiltration + C
AWWF		0.65	Existing AWWF + A +C
MMWWF		1.11	Existing MMWWF + A + C
Peak Month		1.41	(Exist. Peak Month/Exist MMWWF) * New MMWWF
Peak Week		1.74	(Exist. Peak Week/Exist MMWWF) * New MMWWF
Peak Day		2.17	(Exist. Peak Day/Exist MMWWF) * New MMWWF
PIF		3.24	(Exist. PIF/Exist MMWWF) * New MMWWF
MMWW I/I		0.75	MMWWF - New Base Sewage (wet)
PI I/I		2.88	PIF - New Base Sewage (wet)

BOD & TSS design

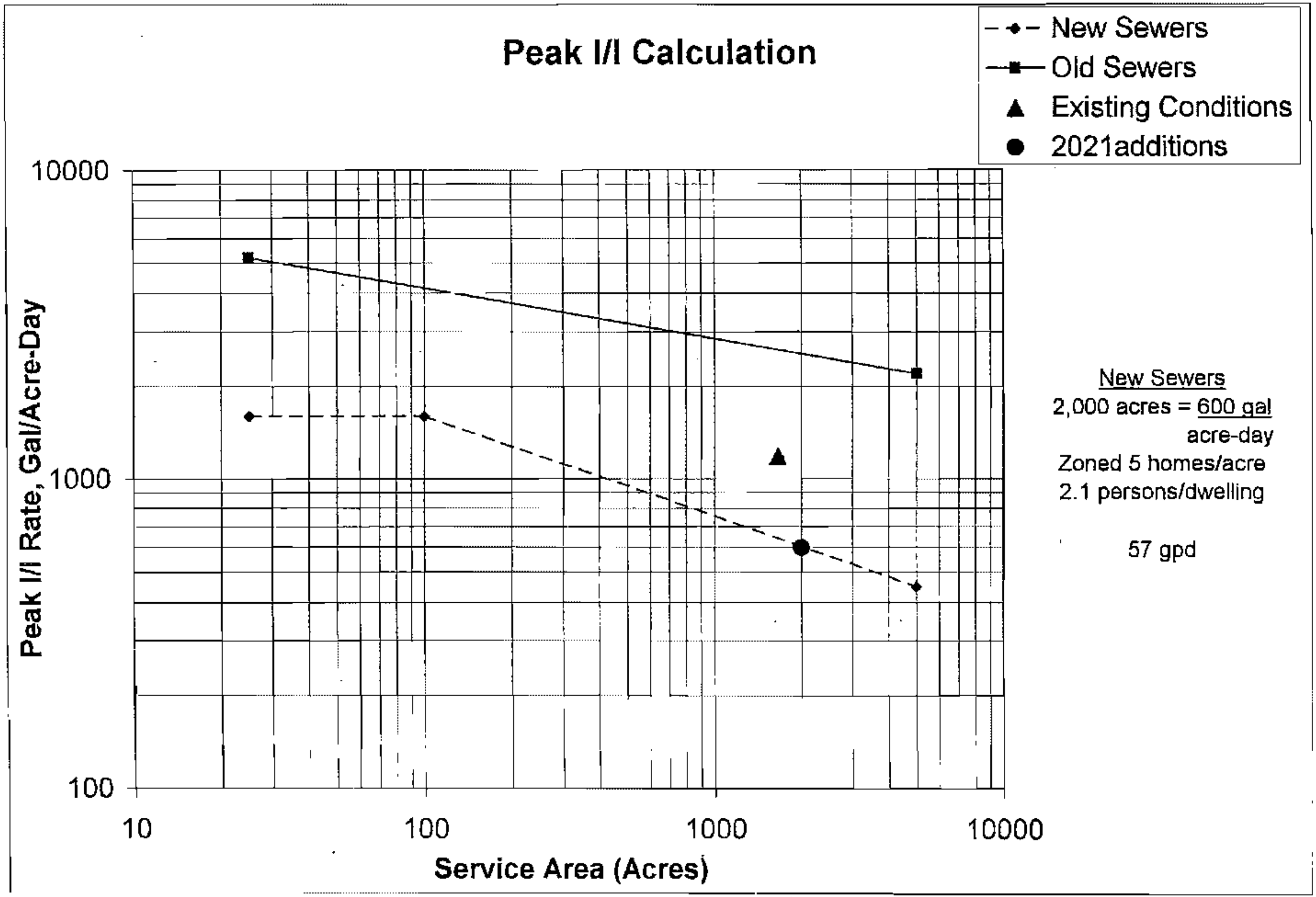
Design Loads for Bandon WWTP

6 year data			1996-2001
Existing Peaking Factors			
BOD	ppd	Peak Factor	
Max Day	1580	2.76	Represents 99.5% of all data
Max Week	1312	2.29	August 8-13, 2001
Max. Month	1013	1.77	Maximum month - August 2001
Average Day	573		
Per Capita Load	0.21		
TSS			
Max Day	1579	3.18	Represents 99.5% of all data
Max Week	943	1.90	January 13-17, 2000
Max. Month	673	1.35	Max. Month - February 2000
Average Day	497		
Per Capita Load	0.18		

Parameter	2001	2021	Basis
Sewered Population	2692	4241	Sewered population in the city limits
Wastewater Loads, ppd			
BOD, ppd			
Per Capita Load	0.25	0.21	
Average Day	675	902	
Maximum Month	1013	1596	
Maximum Day	1580	2489	
TSS, ppd			
Per Capita Load	0.18	0.18	
Average Day	480	783	
Maximum Month	594	1060	
Maximum Day	1249	2488	

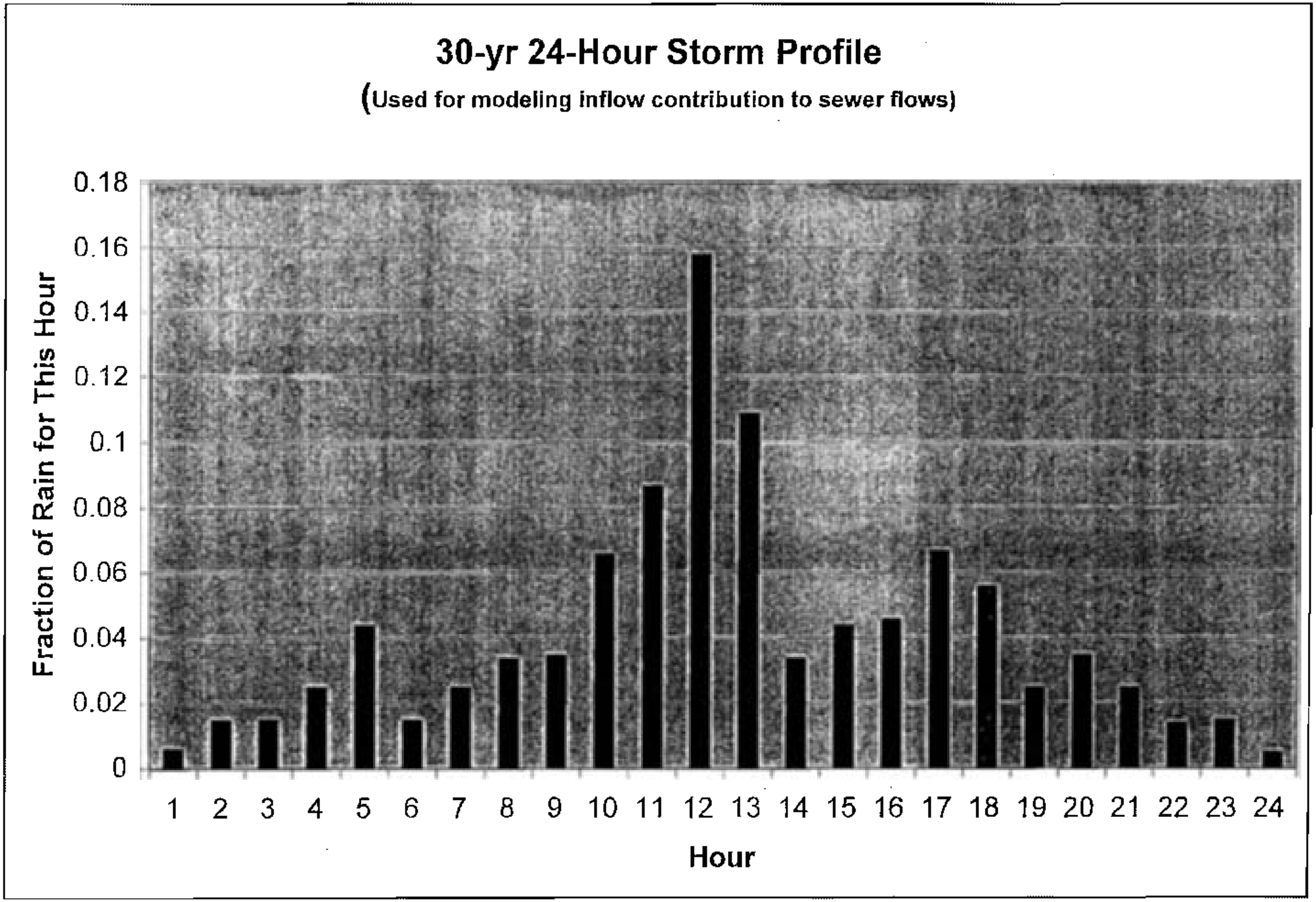
Discarded 9/2001 BOD Maximum as not matching surrounding data

Discarded 12/1998 TSS Maximum as not matching surrounding data


Peak I/I Calculation

New Sewers
2,000 acres = 600 gal
acre-day
Zoned 5 homes/acre
2.1 persons/dwelling

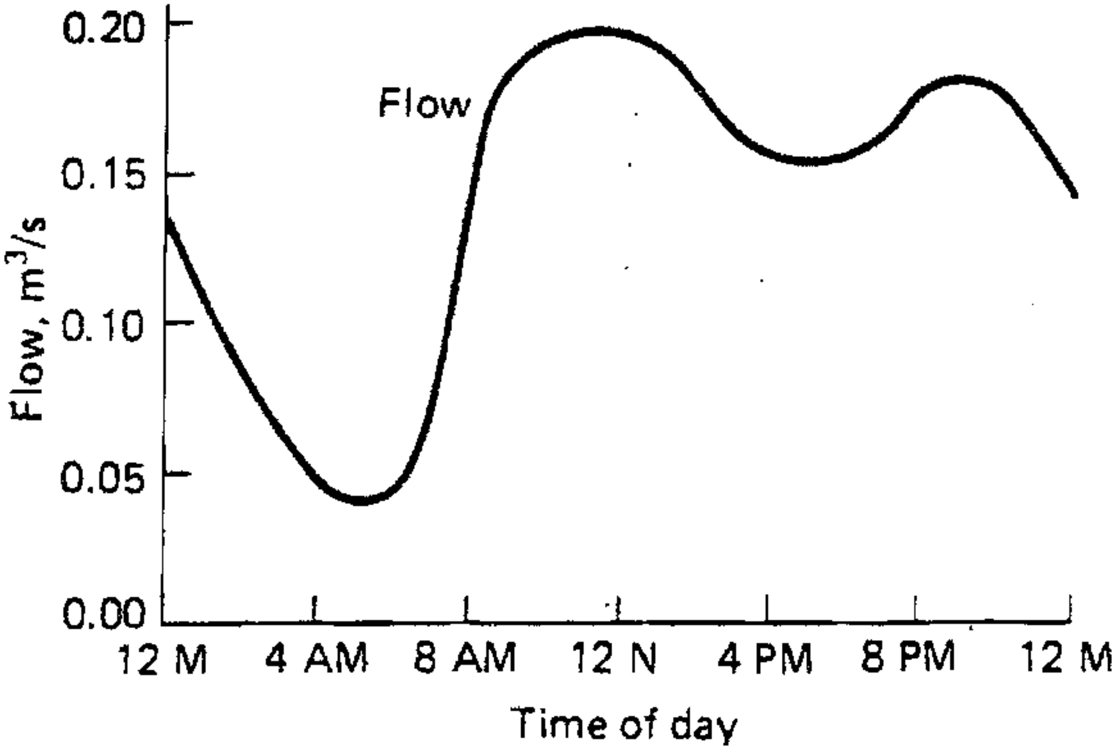
57 gpd



30-yr 24-Hour Storm Profile

(Used for modeling inflow contribution to sewer flows)

Typical Residential Sewer Use Profile



This profile was used to calculate the percent of total sewer flow for each hour of the day. That percentage was multiplied by the base sewer flow per person for Bandon to create the estimated flows for the computer modeling.

Source: Metcalf & Eddy

Bandon WWTP Sludge Disposal 2001

Date	Gallons	MLSS	Pounds	% Solids
4/4/2001	8800	17560	1289	1.8%
4/5/2001	8700	17750	1288	1.9%
4/6/2001	11600	17060	1650	1.8%
4/11/2001	7400	17630	1088	1.8%
4/19/2001	5100	21920	932	2.3%
4/23/2001	6300	19390	1019	2.0%
4/25/2001	6100	18900	962	2.0%
7/2/2001	10800	22280	2007	2.3%
7/6/2001	7900	20930	1379	2.2%
7/7/2001	13300	21740	2411	2.3%
7/8/2001	20300	22250	3767	2.3%
7/9/2001	11900	20950	2079	2.2%
7/19/2001	15900	19900	2639	2.1%
7/20/2001	16300	19810	2693	2.1%
7/22/2001	20500	18730	3202	2.0%
7/24/2001	12300	18630	1911	1.9%
7/25/2001	24600	18530	3802	1.9%
7/26/2001	23500	18690	3663	1.9%
8/2/2001	23600	17540	3452	1.8%
8/3/2001	11900	17940	1780	1.9%
8/9/2001	11800	16830	1656	1.8%
8/10/2001	23700	16460	3253	1.7%
8/27/2001	7700	13790	886	1.4%
8/28/2001	15700	14350	1879	1.5%
8/29/2001	15800	14290	1883	1.5%
8/30/2001	15600	14070	1831	1.5%
8/31/2001	15600	13580	1767	1.4%
9/5/2001	19700	13020	2139	1.4%
9/6/2001	15800	12600	1660	1.3%
9/8/2001	7800	13100	852	1.4%
9/11/2001	15700	13240	1734	1.4%
9/12/2001	15800	13570	1788	1.4%
9/13/2001	19700	12660	2080	1.3%
9/14/2001	7800	13640	887	1.4%
9/15/2001	11700	13420	1309	1.4%
9/16/2001	15800	12280	1618	1.3%
9/17/2001	7900	12450	820	1.3%
9/18/2001	7900	12100	797	1.3%
9/24/2001	11800	11850	1166	1.2%
9/26/2001	7800	11450	745	1.2%
9/27/2001	15700	11460	1501	1.2%
9/28/2001	19700	11520	1893	1.2%
10/2/2001	19600	10610	1734	1.1%
10/3/2001	19700	10530	1730	1.1%
10/15/2001	15700	10410	1363	1.1%
10/17/2001	7800	9190	598	1.0%
10/26/2001	11800	8870	873	0.9%
Total	647900		83457	1.6%
Daily Average	1775		228.649	

Calculation of Required Digester Space
Bandon Wastewater Master Plan

Parameter	Current Operation		Basis
Year	2001	2021	
AWWF, MGD	0.436	0.65	
ADWF, MGD	0.336	0.5	
Average Flow, MGD	0.386	0.575	
Ave. Month BOD Loading, ppd	675	902	
Max. Month BOD Loading, ppd	1013	1596	Design BOD - max. month
Design Month BOD Loading, ppd	675	1150	
Effluent BOD, mg/l	8	8	
Sludge Yield	0.75	0.75	Assumed yield
Amount of Sludge Produced, ppd	486.9	833.7	
Solids Fraction	0.015	0.015	
Volume of Sludge Produced, gpd	3892	6664	
% Volatile Solids	75	75	Based on current average
Volatile Solids Loading	365.2	625.3	
Residence Time	55	55	
Temperature, oC	15	15	
% Volatile Solids Reduction	45	45	
Fraction of Solids Not Destroyed	0.66	0.66	
Influent SS, mg/l	15000	15000	
Thickened SS, mg/l	19000	19000	
SS in Supernatant	0	0	
Average SS in Digester	13300	13300	70% of thickened solids
Material Retained in Digester	0.52	0.52	
Material Leaving as Supernatant	0.48	0.48	
Required Tank Volume, MG	0.1600	0.2739	
Required Tank Volume, gallons	159956	273876	
Required Tank Volume, ft3	21385	36615	
Mass of Digester Sludge, lb/d	323	552	
Volume of Digester Sludge, gpd	2036	3486	
Separate Calculation of Required Tankage			
Thickened SS, mg/l	19000	19000	
Required Tank Volume, ft3	22595	38687	
Required Tank Volume, gallons	169010	289379	

Calculation of Nitrogen Loading From Application of WWTP Sludge

City of Bandon Wastewater Master Plan

Summary of Analysis of Nitrogen in Dig. #3 Sludge WWTP Sludge Concentrations, % of dry weight

Pollutant	2002	10/11/2001	4/24/2001	4/18/2000	4/1/1999	Average
Ammonium Nitrogen	NA	1.3	0.22	0.56	0.25	0.70
Nitrate Nitrogen	NA	0.017	0.156	0.003	0.870	0.297
TKN	NA	5.77	3.58	3.32	1.16	3.42
Net Organic Nitrogen	NA	4.47	3.36	2.76	0.91	2.71
Volatile Solids	NA	71.9	69.6	63.5	70.8	68.7

Dew Valley Site				
Year	2002	2001	2000	1999
Acres	9.5	9.5	9.5	9.5
Ha	3.8	3.8	3.8	3.8
Sludge Gallons	NA	273,200	234,400	0
% solids	1.5%	1.7%	1.5%	2.0%
Dry solids, lb/yr		38,620	28,541	-
Crop	Rye Grass	Rye Grass	Rye Grass	Rye Grass
Agronomic Load Rate lb/acre/yr	100	100	100	100
Agronomic Load Rate kg/ha/yr	112	112	112	112
Application factor (surface)	0.5	0.5	0.5	0.5
Aerobically digested sludge factor	0.3	0.3	0.3	0.3
Total Organic Nitrogen, kg		688	358	0
Ammonium Nitrogen, kg	NA	67	36	0
Nitrate Nitrogen, kg	NA	15.2	0.4	0
Organic Nitrogen Available, kg	NA	206	107	0
Prior available organic Nitrogen, kg	69	38	0	0
Total available nitrogen, kg		326	144	0
Nitrogen available per kg/ha		85	38	0
Average gallons of sludge per year this site can handle				**358,692**

Nelson Site #1				
Year	2002	2001	2000	1999
Acres	8.4	8.4	8.4	8.4
ha	3.4	3.4	3.4	3.4
Sludge Gallons	NA	328,700	252,900	475,000
% solids	1.5%	1.7%	1.5%	2.0%
Dry solids, lb/yr	NA	46,466	30,794	77,645
Crop	Rye Grass	Rye Grass	Rye Grass	Rye Grass
Agronomic Load Rate lb/acre/yr	100	100	100	100
Agronomic Load Rate kg/ha/yr	112	112	112	112
Application factor (surface)	0.5	0.5	0.5	0.5
Aerobically digested sludge factor	0.3	0.3	0.3	0.3
Total Organic Nitrogen, kg		827	386	321
Ammonium Nitrogen, kg	NA	80	39	44
Nitrate Nitrogen, kg	NA	18	0	307
Organic Nitrogen Available, kg	NA	248	116	96
Prior available organic Nitrogen, kg	104	56	34	0
Total available nitrogen, kg		402	189	448
Nitrogen available per kg/ha		118	56	132
Average gallons of sludge per year this site can handle				**290,760**

Calculation of Pollutant Loading From Application of WWTP Sludge
City of Bandon Wastewater Master Plan

Summary of Analysis of Pollutants in Digester #3 Sludge

	Part 503.13 Concentration Limits, mg/kg dry		WWTP Sludge Concentrations, mg/kg dry					
Pollutant	Ceiling	Monthly Ave.	10/11/2001	4/24/2001	4/18/2000	4/1/1999	9/12/1994	Average
Arsenic, As	75	41	ND	ND	0.39	ND	1.15	<3.2
Cadmium, Cd	85	39	2.55	2.5	3.76	0	3.83	2.5
Copper, Cu	4,300	1,500	222	372	401	10.3	465	294.1
Lead, Pb	840	300	58	35.3	35.3	0.3	74	40.6
Mercury, Hg	57	17	10.8	2.42	2.88	0	3.05	3.8
Molybdenum, Mo	75	NA	4.45	4.06	4.07	ND	ND	<10.5
Nickel, Ni	420	420	28.5	22.6	21.7	0	28.3	20.2
Selenium, Se	100	100	8.3	3.07	5.27	0	1.97	3.7
Zinc, Zn	7,500	2,800	1070	1340	0	22.9	1848	856.2

Dew Valley Site							
Year	2001	2000	1999	Cumulative	Avg.		
Acres	9.5	9.5	9.5	9.5	9.5		
ha	3.8	3.8	3.8	3.8	3.8		
Sludge Gallons	273,200	234,400		507,600	253,800		
% solids	1.5%	1.5%	1.5%		0.01460	EPA	
Dry solids, lb/yr	33,266	28,541	-	61,807	20,602	Limit	Site Life
Pollutant \ units	kg/ha/yr	kg/ha/yr	kg/ha/yr	kg/ha/yr	kg/ha/yr	kg/ha	Years
Arsenic, As	0.00004	0.00132	-	0.001355	0.00068	41	60,500
Cadmium, Cd	0.01003	0.01269	-	0.022717	0.01136	39	3,434
Copper, Cu	0.87313	1.35315	-	2.226285	1.11314	1500	1,348
Lead, Pb	0.22812	0.11912	-	0.347233	0.17362	300	1,728
Mercury, Hg	0.04248	0.00972	-	0.052195	0.02610	17	651
Molybdenum, Mo	0.01750	0.01373	-	0.031236	0.01562	NA	NA
Nickel, Ni	0.11209	0.07323	-	0.185317	0.09266	420	4,533
Selenium, Se	0.03264	0.01778	-	0.050427	0.02521	100	3,966
Zinc, Zn	4.20833	0.00023	-	4.208562	2.10428	2800	1,331

Nelson Site #1							
Year	2001	2000	1999	Cumulative	Avg.		
Acres	8.4	8.4	8.4	8.4	8.4		
ha	3.4	3.4	3.4	3.4	3.4		
Sludge Gallons	328700	252,900	475000	1,056,600	352,200		
% solids	1.5%	1.5%	2.0%	-	0.01627	EPA	
Dry solids, lb/yr	40,024	30,794	77,645	148,463	49,488	Limit	Site Life
Pollutant \ units	kg/ha/yr	kg/ha/yr	kg/ha/yr	kg/ha/yr	kg/ha/yr	kg/ha	Years
Arsenic, As	0.00005	0.00161	0.00010	0.001763	0.00059	41	69,760
Cadmium, Cd	0.01365	0.01548	0.00001	0.029134	0.00971	39	4,016
Copper, Cu	1.18807	1.65114	0.10694	2.946143	0.98205	1500	1,527
Lead, Pb	0.31040	0.14535	0.00311	0.458861	0.15295	300	1,961
Mercury, Hg	0.05780	0.01186	0.00208	0.071733	0.02391	17	711
Molybdenum, Mo	0.02381	0.01676	0.00519	0.045764	0.01525	NA	NA
Nickel, Ni	0.15252	0.08935	0.00017	0.242039	0.08068	420	5,206
Selenium, Se	0.04442	0.02170	0.00033	0.066451	0.02215	100	4,515
Zinc, Zn	5.72629	0.00028	0.23775	5.964321	1.98811	2800	1,408

Costs for self hauling & disposing of digested 2% bio-solids

Item	North Bend *	Coffin Butte	Short Mountain	Heard Farms	Farm Spread
Sludge Gallons	647,000	647,000	647,000	647,000	647,000
Round Trip Miles	54	318	280	170	12
Cost Per Mile	3.13	3.13	3.13	3.13	3.13
Disposal Rate	0.07	0.13	0.18	0.07	0
Trip Hours	3	8.3	7.5	5.3	2.2
Annual Admin Hours	40	40	40	40	500
Annual Misc. Costs	0	0	0	0	400
Sludge Testing Costs	500	500	500	500	1000
Total Annual Cost	$ 85,962	$ 279,756	$ 290,907	$ 154,625	$ 30,511
Total Cost/Gallon	$ 0.13	$ 0.43	$ 0.45	$ 0.24	$ 0.05

Assumes 3,900 gallon truck, 1.5 hour load/unload time

Alternative Haulers 2%	Roto-Rooter	Heard Farms
Cost Per Gallon	0.10	0.13
Loading Hours/Trip	1	1
Annual Admin Hours	32.0	32.0
Total Annual Cost	$ 69,310	$ 88,720
Total Cost/Gallon	$ 0.11	$ 0.14

Costs for self hauling & disposing of digested 10% bio-solids

Item	North Bend *	Coffin Butte	Short Mountain	Heard Farms	Farm Spread
Original Sludge Gallons	647,000	647,000	647,000	647,000	647,000
Pessed Sludge Gallons	162,000	162,000	162,000	162,000	162,000
Round Trip Miles	54	318	280	170	12
Cost Per Mile	3.13	3.13	3.13	3.13	3.13
Disposal Rate	$ 0.28	$ 0.13	$ 0.18	$ 0.14	$ -
Trip Hours	4	9.3	8.5	6.3	3.2
Annual Admin Hours	40	40	40	40	500
Annual Misc. Costs**	0	0	0	0	400
Sludge Testing Costs	500	500	500	500	1000
Sludge Pressing Costs	$ 21,538	$ 21,538	$ 21,538	$ 21,538	$ 21,538
Total Annual Cost	$ 94,299	$164,232	$ 159,056	$ 113,206	$ 48,677
Total Cost/Orignal Gallon	$ 0.15	$ 0.25	$ 0.25	$ 0.17	$ 0.08

Assumes 10yd truck with 8 yds of bio-solid, 2.5 hour load/unload time

Alternative Haulers 10%	Heard Farms
Cost Per Gallon	0.20
Sludge Pressing Costs	$ 21,538
Additonal Loading Hours/Trip	1
Annual Admin Hours	32.0
Total Annual Cost	$ 55,812
Total Cost/Gallon	$ 0.09

* North Bend will only take bio-solids on an emergency basis and will discontinue emergency service in the next five years.

** Farm road & sign improvments

Bandon Sludge Trucking & Disposal Costs	Annual Cost
Insurance	500
Maintenance	700
Fuel	643
Equipment Depriciation	7800
Total	9643
Cost per mile	3.13
North Bend Vehicle Costs per trip	169
North Bend Fuel costs per trip	11
North Bend non fuel costs per trip	158
Farm Costs per trip	38
Farm Fuel Costs per trip	2.5
Farm Non-fuel costs per trip	35

Bandon Sludge disposal costs

North Bend Disposal	Unit cost	Quantity	Extension
Charge by NB per gallon	0.07	100,000	7000
Trip cost salary (Assume 3 hr roundtrip)	66	26	1692
Trip cost fuel (7 mpg @ $1.46/gallon, 54 miles)	11	26	289
Non Fuel Trip Costs (Insur, maint. deprec.)	158	26	4042
Total			$ 13,023
Cost per gallon			$ 0.13

Farm spreading	Unit cost	Quantity	Extension
Charge for application	0	547,000	$ -
Sludge & soils testing	1000	1	$ 1,000
Permit costs	0	1	$ -
Labor for site inspection, management & paperwork	30	500	$ 15,000
Site maintenance costs	400	1	$ 400
Site maintenance labor	22	40	$ 880
Trip cost Salary	22	140	$ 3,086
Trip Cost Fuel	2.5	140	$ 351
Non Fuel Trip Costs	35	140	$ 4,914
Total			$ 25,630
Cost per gallon			$ 0.05

Non-fuel costs apportioned on a per mile basis	
Gallons of sludge hauled	647000
Trips	166
Total miles	3083
fuel gallons	440
fuel cost	643

Fuel calculated at 7mpg, $1.46/gallon

Costs to operate the Bandon Screw Press

	HP
Polymer Mixing Motor	0.5
Polymer Feed Pump	2
Screw Press 2	3
Pressate Pump	0.5
Screw Press Feed Pump	5
Total	11

Press GPM		30
Estimated gallons/year		647,000
Hours to Process		359
operator hours		539
Energy kWh		2,946
Energy cost @ $.07/kWh	$	206
Labor Cost	$	11,862
Polymer Costs	$	6,470
Maintenance Costs	$	3,000
Total Annual Cost	$	21,538
Cost per Gallon	$	0.03

Reed Bed Analysis

	1 Year	10 Year
Bed Area (SF)	4,300	
Depth of Flood (FT)	0.33	
Gallons per flood	10,614	
Days between floods	21	
Gallons per year	184,484	1,844,835
Gallons of end product	4,100	40,996
Yards of end Product	20	203

Capital Cost	Material	Hours Labor	Labor Rate	Extension
Pea Gravel at Drains	66	6	22	$ 198
Sand at Drains	398	12	22	$ 662
Plant Material (Reeds)	8600	358	22	$ 16,483
Pilot Study Cost				$ 20,000
Raise bed walls	6300			$ 6,300
Subtotal				$ 43,643
Engineering				6,546.52
Contingency				4,364.35
Administration				2,182.17
Total				$ 56,736

Annual Operations Cost	Material	Hours Labor	Labor Rate	Annual Cost
Flooding Labor		35	22	$ 765
Harvesting Labor		16	22	$ 352
DEQ Testing				$ 1,500
Reed Disposal	280	32	22	$ 984
				$ 3,601

10 Year Operations Cost	Material	Hours Labor	Labor Rate	Annual Cost
Cleaning Labor		48	22	$ 1,056
Equipment Cost	1200			$ 1,200
New Sand	398	16	22	$ 750
DEQ Testing				$ 2,500
Material Handling		32	22	$ 704
Total				$ 6,210

Sludge Drying Bed Analysis				
Bed Area (SF)	4,300			
Depth of Flood (FT)	0.75			
Gallons per flood	24,123			
Days between floods	25			
Gallons per year	352,196			
Gallons of end product	44,024			
Yards of end Product	218			
Operations Cost	Material	Hours Labor	Labor Rate	Annual Cost
Pea Gravel at Drains	66	6	22	$ 198
Sand at Drains	53	12	22	$ 317
Flooding Labor		29	22	$ 642
Cleaning Labor		117	22	$ 2,570
Equipment Cost	2900			$ 2,900
Total				$ 6,627

Costs for self hauling & disposing of digested 16% bio-solids from Sludge Drying Beds				
Item	Coffin Butte	Short Mountain	Heard Farms	Farm Spread
Original Sludge Gallons	350,000	350,000	350,000	350,000
Pessed Sludge Gallons	43,750	43,750	43,750	43,750
Round Trip Miles	318	280	170	12
Cost Per Mile	3.13	3.13	3.13	3.13
Disposal Rate	$ 0.13	$ 0.18	$ 0.14	$ -
Trip Hours	9.3	8.5	6.3	3.2
Annual Admin Hours	40	40	40	500
Annual Misc. Costs**	0	0	0	400
Sludge Testing Costs	500	500	500	1000
Sludge Drying Costs	$ -	$ -	$ -	$ -
Total Annual Cost	$ 33,284	$ 32,621	$ 22,364	$ 18,739
Total Cost/Orignal Gallon	$ 0.10	$ 0.09	$ 0.06	$ 0.05

N = 20
A = $ 6,627
i = 0.06
P/A= 11.47
AT = 6,627
P = 76,008

4,014,472	Present Value in Gallons of Sludge
$ 214,931	Present Value including spreading
$ 60,000	Construction Cost
$ 274,931	Total Present Value
$ 0.068	Present value per gallon

Bandon Basic Sewer Rate		
Base monthly rate	$	13.31
Add per H2O unit	$	2.21
Gpcd H2O use		75
People/edu		2.1
Total EDUs		1,734
Annual tax debt service	$	101,090
Direct cost to consumer		
Monthly water use per EDU (gal)		4,791
Average monthly bill	$	19.48
Tax payment for dept per EDU	$	4.86
Sewer revenue per month per EDU	**$**	**24.34**
Total cost to City per EDU		
Operating Budget	$	668,306
Sewer Cost per EDU	$	32.12
Tax based debt service	$	4.86
Total cost of sewer service	**$**	**36.98**

CITY OF BANDON UTILITY RATES

SEWER RATES

6/2001

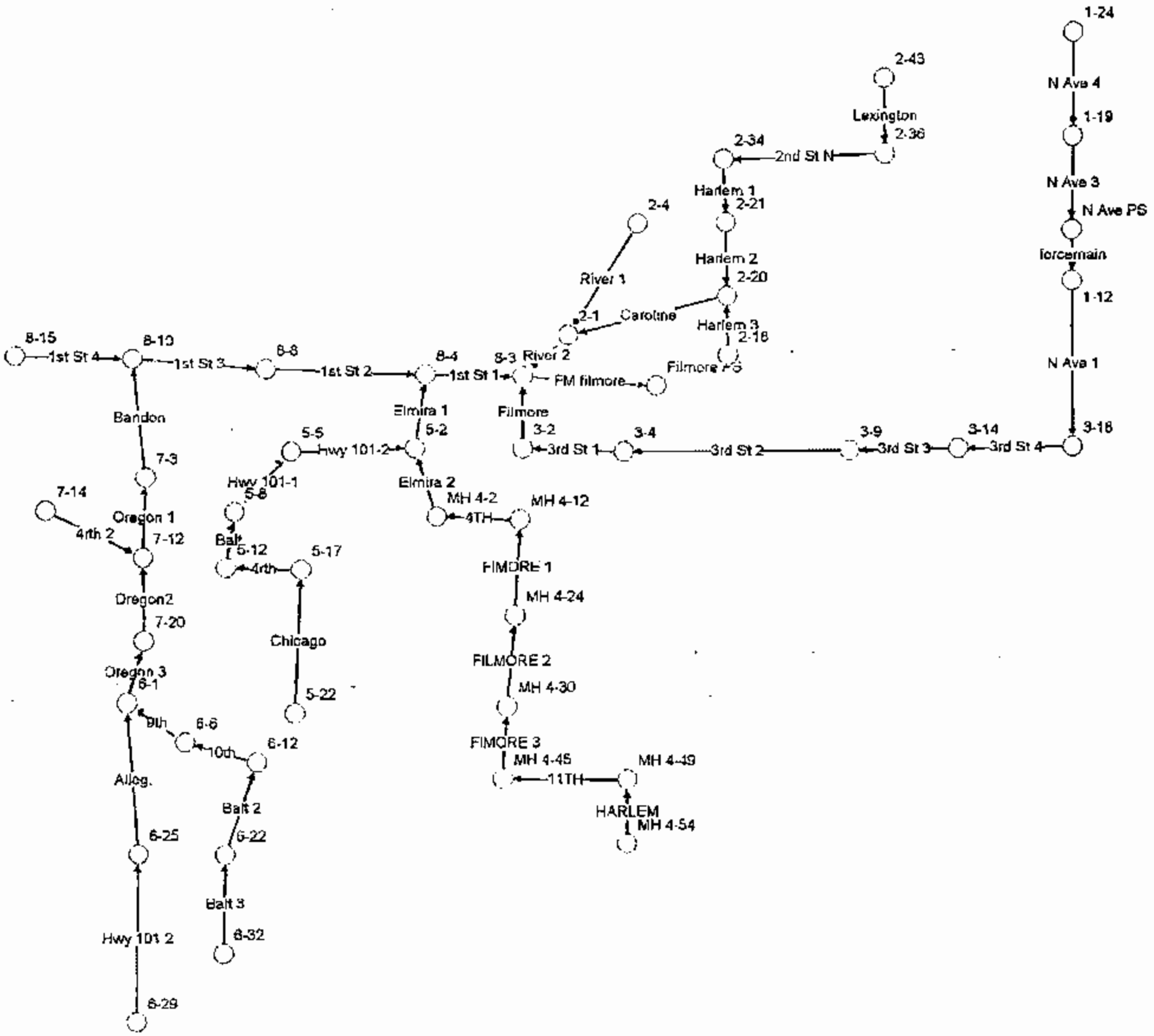
SW 01 Residential, inside city	13.31/2.21
SW 02 Commercial/Industrial, inside city	13.31/2.21
SW 03 Residential, outside city	20.98/3.30
SW 04 Commercial/Industrial, outside city	20.98/3.30
SW 05 Residential fixed--No water, inside city	26.59
SW 06 Residential fixed--No water, outside city	36.90
SW 07 Additional unit rate-inside city-attached/detached residence (Duplex, Triplex, etc.), apartment (plus per washer in a common Laundry facility), commercial business, commercial office building, industry	5.46
SW 08 Additional unit rate-inside city-mobile home park (plus per washer In a common laundry facility)	5.46
SW 09 Additional unit rate-inside city-motel, bed & breakfast (plus per washer in a common laundry facility)	2.68
SW 10 Additional unit rate-inside city-RV park (plus per washer in a common laundry facility)	3.44
SW 11 Additional unit rate-inside city-health/elderly care facility	4.44
SW 20 Commercial/special strength customer-inside city (restaurant, Laundromat, other individually negotiated)	8.88/2.66
SW 21 Commercial/special strength customer-inside city Cheese Factory	1,410.00
SW 68 City use only --no charge	
SW 69 City use only--Charge--inside/outside city	13.31/2.21
TX 01 10% CITY TAX	
SUMMER RATE (6/15-10/15)	13.31/1.44

Sewer Rates: SW01, SW02, SW03, SW04 & SW69
Basic Charge includes 1st 2,000 gallons consumpt

Sewer additional Unit Rates - per unit (1st unit is includ
in basic charge)

Appendix D

Computer Model Results



XP-SWMM2000

Version 7.50

Bandon East

Licenced To: Dyer Partnership [42-750-0181]

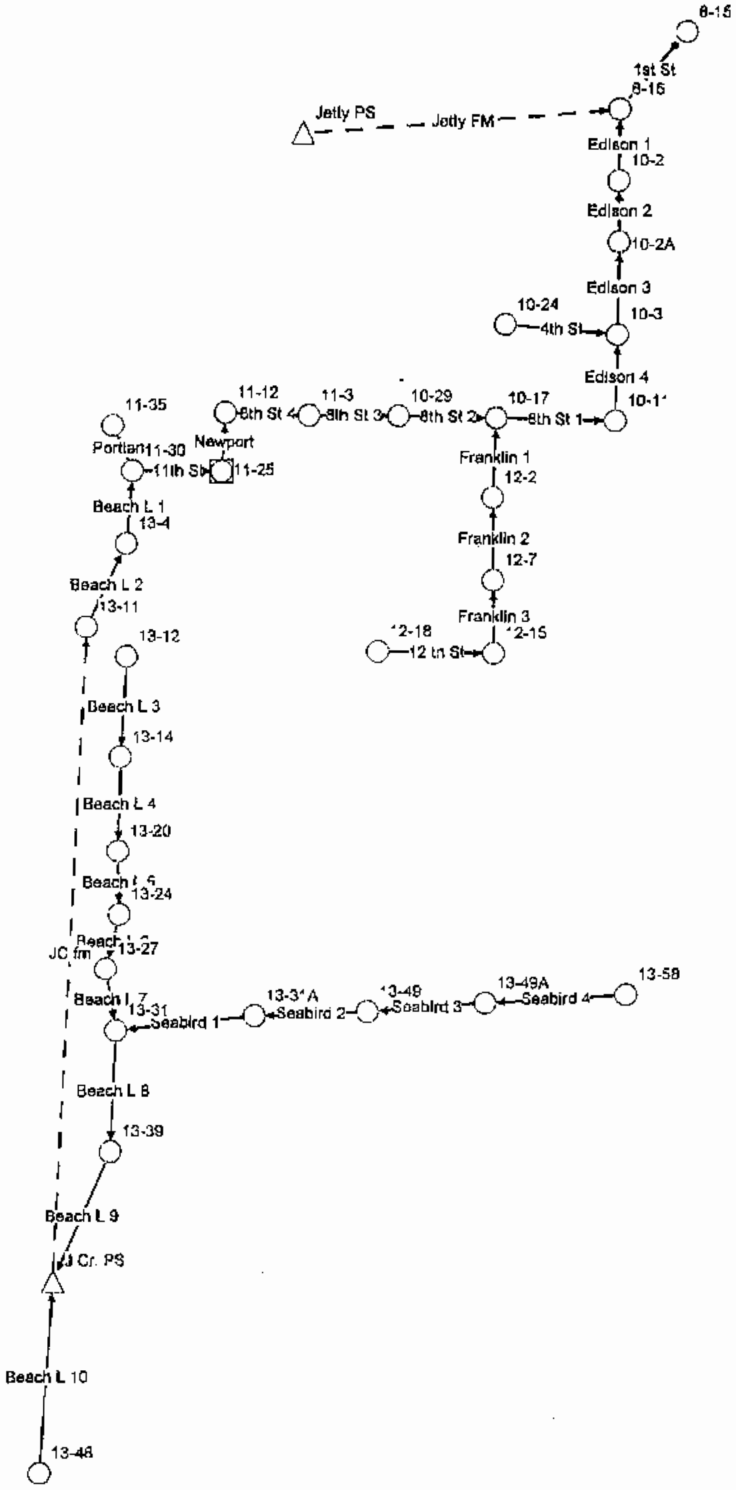
03/20/02

Bandon East 2001	Link Name	Length (feet, metres) [Single]	Conduit Slope (%) [Single]	HDR:Max Flow (ft^3/s, m^3/s) [Single]	HDR:Max Velocity (ft/s, m/s) [Single]	HDR:Design Full Flow (ft^3/s, m^3/s) [Single]	HDR:Max Flow/Design Flow (fraction) [Single]	Diameter/Depth (feet, metres) [Single]
Hwy 101 2	Hwy 101 2	880.	.56818	.006527743	.475892937	.857137378	.007615857	.67
Alleg.	Alleg.	1300.	.53846	.028124509	.330416307	.834418860	.033709030	.67
Balt 3	Balt 3	550.	.36364	.109775925	1.42936934	.685709902	.160383369	.67
Balt 2	Balt 2	650.	1.25538	.135509831	1.61349717	1.27407551	.106359374	.67
10th	10th	870.	.28966	.187408141	1.31100040	.611994349	.306226263	.67
9th	9th	600.	.38667	.318466189	1.95244805	.707090716	.450454323	.67
Oregon 3	Oregon 3	350.	.86571	.455345167	2.39331024	1.05802044	.430380277	.67
Oregon2	Oregon2	540.	.38704	.500196240	2.01937947	.707429280	.707066695	.67
4rth 2	4rth 2	400.	1.715	0	0	1.48915131	0	.67
Oregon 1	Oregon 1	350.	.82286	.566314089	2.99133249	1.03149942	.549020267	.67
Bandon	Bandon	600.	7.95	.633669302	2.99977432	3.20619795	.197638858	.67
1st St 4	1st St 4	800.	.89125	.627966999	1.58789982	5.66283328	.110892722	1.25
1st St 3	1st St 3	400.	.1675	1.29356798	2.18109628	2.45494298	.527141803	1.25
1st St 2	1st St 2	1200.	.42667	1.30993933	2.18202315	3.91812567	.334526127	1.25
HARLEM	HARLEM	605.	.49587	.216598934	1.85177715	2.32964764	.092976216	1.
11TH	11TH	1055.	.25592	.435815911	1.79470324	1.67364348	.260399490	1.
FIMORE 3	FIMORE 3	665.	4.84211	.562050651	5.03223062	7.27988323	.077206926	1.
FILMORE 2	FILMORE 2	325.	4.92308	.734850489	4.25262936	7.34049945	.100110846	1.
FIMORE 1	FIMORE 1	650.	.96769	.800641231	2.47483041	3.25443756	.246015750	1.
4TH	4TH	245.	.28571	.948540241	2.33455859	1.76837056	.536400844	1.
Elmira 2	Elmira 2	450.	.62444	1.08563332	3.17869589	2.61429265	.415276126	1.
Chicago	Chicago	860.	.47558	.165566045	1.75907704	.784186202	.211131776	.67
4rth	4rth	270.	7.8037	.220083061	5.15003640	3.17656066	.069283443	.67
Balt.	Balt.	180.	11.28889	.232753464	3.42276589	3.82060700	.060920665	.67
Hwy 101-1	Hwy 101-1	420.	.84524	.237253600	2.40256795	1.04543322	.226943853	.67
Hwy 101-2	Hwy 101-2	400.	1.6575	.237805451	1.64652994	1.46397458	.162438725	.67
Elmira 1	Elmira 1	290.	1.03103	1.34083963	2.62217436	5.07106892	.264410060	1.167
1st St 1	1st St 1	240.	.3	2.81549884	3.17191732	5.34250114	.568782051	1.5
N Ave 4	N Ave 4	520.	.43846	.018193515	.889115139	.752961065	.024276393	.67
N Ave 3	N Ave 3	494.	.4413	.271296397	1.10479123	.755390537	.444868766	.67
forcemain	forcemain							
N Ave 1	N Ave 1	1250.	.4216	.350544367	2.06263033	.736341142	.474965405	.67

Brandon East 2001	Link Name	Length (feet, metres) [Single]	Conduit Slope (%) [Single]	HDR:Max Flow (ft^3/s, m^3/s) [Single]	HDR:Max Velocity (ft/s, m/s) [Single]	HDR:Design Full Flow (ft^3/s, m^3/s) [Single]	HDR:Max Flow/Design Flow (fraction) [Single]	Diameter/Depth (feet, metres) [Single]
3rd St 4	3rd St 4	500.	.512	.417888921	2.02825847	.813657718	.513630447	.67
3rd St 3	3rd St 3	620.	.41613	.456708644	2.17521961	.733534891	.622613388	.67
3rd St 2	3rd St 2	1200.	4.44667	.535789548	3.03682456	2.39786128	.223974271	.67
3rd St 1	3rd St 1	500.	.538	.565066881	2.54270850	.834061175	.678296445	.67
Filmore	Filmore	400.	1.5525	4	0	0	0	.833
River 1	River 1	670.	.42239	.010902190	.271709781	.739030878	.014752013	.67
Lexington	Lexington	500.	.568	.013066232	.369547539	.857000225	.015246475	.67
2nd St N	2nd St N	500.	.224	.063164119	.887173703	.538183993	.117365497	.67
Harlem 1	Harlem 1	1000.	.73	.139377122	1.95208138	.971556805	.143457512	.67
Harlem 2	Harlem 2	200.	4.155	.241751705	4.04824031	2.31788712	.104298943	.67
Harlem 3	Harlem 3	100.	.89	.061005932	1.36509082	1.07275802	.056878074	.67
Caroline	Caroline	900.	4.82222	.312990269	4.61909680	2.49706805	.128044303	.67
River 2	River 2	300.	2.24333	.486952003	4.05878436	1.70315303	.444509603	.67
FM filmore	FM filmore							

East future	Length (feet, metres) [Single]	Conduit Slope (%) [Single]	HDR:Max Flow (ft^3/s, m^3/s) [Single]	HDR:Max Velocity (ft/s, m/s) [Single]	HDR:Design Full Flow (ft^3/s, m^3/s) [Single]
105					
Hwy 101 2	880.	.56818	.362827384	2.32168799	.857137378
Alleg.	1300.	.53846	.288619827	1.98978916	.834418860
Balt 3	550.	.36364	.109775927	1.42936935	.685709902
Balt 2	650.	1.25538	.135509831	1.61342899	1.27407551
10th	870.	.28966	.187408249	1.33146681	.611994349
9th	600.	.38667	.317998994	1.94346622	.707090716
Oregon 3	350.	.86571	.602162939	2.64179476	1.05802044
Oregon2	540.	.38704	.634009685	2.23328006	.707429280
4rth 2	400.	1.715	0	0	1.48915131
Oregon 1	350.	.82286	.671958861	3.08969594	1.03149942
Bandon	600.	7.95	.739949737	3.35813773	3.20619795
1st St 4	800.	.89125	.645206999	1.58801078	5.66283328
1st St 3	400.	.1675	1.41547185	2.24170556	2.45494298
1st St 2	1200.	.42667	1.42831793	2.28402953	3.91812567
HARLEM	605.	.49587	.216598934	1.85177715	2.32964764
11TH	1055.	.25592	.435820672	1.79361333	1.67364348
FIMORE 3	665.	4.84211	.537630587	4.94831041	7.27988323
FILMORE 2	325.	4.92308	.710434464	4.20709630	7.34049945
FIMORE 1	650.	.96769	.776222976	2.44982792	3.25443756
4TH	245.	.28571	.924121138	2.31824447	1.76837056
Elmira 2	450.	.62444	1.06121328	3.15904045	2.61429265
Chicago	860.	.47558	.165566045	1.75907704	.784186202
4rth	270.	7.8037	.220083061	5.15003640	3.17656066
Balt.	180.	11.28889	.232753464	3.42278568	3.82060700
Hwy 101-1	420.	.84524	.237253600	2.40256795	1.04543322
Hwy 101-2	400.	1.6575	.237805452	1.65986262	1.46397458
Elmira 1	290.	1.03103	1.31641993	2.55124142	5.07106892
1st St 1	240.	.3	2.83835939	3.21031867	5.34250114
N Ave 4	520.	.43846	.017034718	.822740978	.752961065
N Ave 3	494.	.4413	.283228726	1.05294441	.755390537
forcemain					
N Ave 1	1250.	.4216	.347192566	2.06065989	.738341142
3rd St 4	500.	.512	.426075116	1.98110557	.813657718
3rd St 3	620.	.41613	.460804903	2.17866485	.733534891
3rd St 2	1200.	4.44667	.544162448	3.06721661	2.39786128
3rd St 1	500.	.538	.573476257	2.55008443	.834061175
Filmore	400.	1.5525	4	0	0
River 1	670.	.42239	.010902228	.493870320	.739030878
Lexington	500.	.568	.013066232	.369547539	.857000225
2nd St N	500.	.224	.063164119	.887173703	.538183993
Harlem 1	1000.	.73	.139377051	1.95208109	.971556805
Harlem 2	200.	4.155	.241752882	4.04739067	2.31788712
Harlem 3	100.	.89	.061005932	1.36509100	1.07275802
Caroline	900.	4.82222	.316699344	4.37966102	2.49706805
River 2	300.	2.24333	.585154633	3.95388364	1.70315303
FM filmore					

East Future	HDR:Max Flow/Design Flow (fraction) [Single]	Diameter/Depth (feet, metres) [Single]
105		
Hwy 101 2	.443472050	.67
Alleg.	.345893220	.67
Balt 3	.160383371	.67
Balt 2	.106359374	.67
10th	.306226436	.67
9th	.449729097	.67
Oregon 3	.569612413	.67
Oregon2	.896216347	.67
4rth 2	0	.67
Oregon 1	.653710430	.67
Bandon	.231264296	.67
1st St 4	.113937134	1.25
1st St 3	.576800716	1.25
1st St 2	.364786989	1.25
HARLEM	.092976216	1.
11TH	.260402335	1.
FIMORE 3	.073852633	1.
FILMORE 2	.096784435	1.
FIMORE 1	.238512867	1.
4TH	.522591894	1.
Elmira 2	.405935517	1.
Chicago	.211131776	.67
4rth	.069283443	.67
Balt.	.060920665	.67
Hwy 101-1	.226943853	.67
Hwy 101-2	.162438726	.67
Elmira 1	.259594510	1.167
1st St 1	.593814678	1.5
N Ave 4	.024074720	.67
N Ave 3	.455532720	.67
forcemain		
N Ave 1	.473411902	.67
3rd St 4	.523838148	.67
3rd St 3	.633120821	.67
3rd St 2	.227246410	.67
3rd St 1	.688187080	.67
Filmore	0	.833
River 1	.014752064	.67
Lexington	.015246475	.67
2nd St N	.117365497	.67
Harlem 1	.143457438	.67
Harlem 2	.104298870	.67
Harlem 3	.056878074	.67
Caroline	.141939145	.67
River 2	.440896988	.67
FM filmore		



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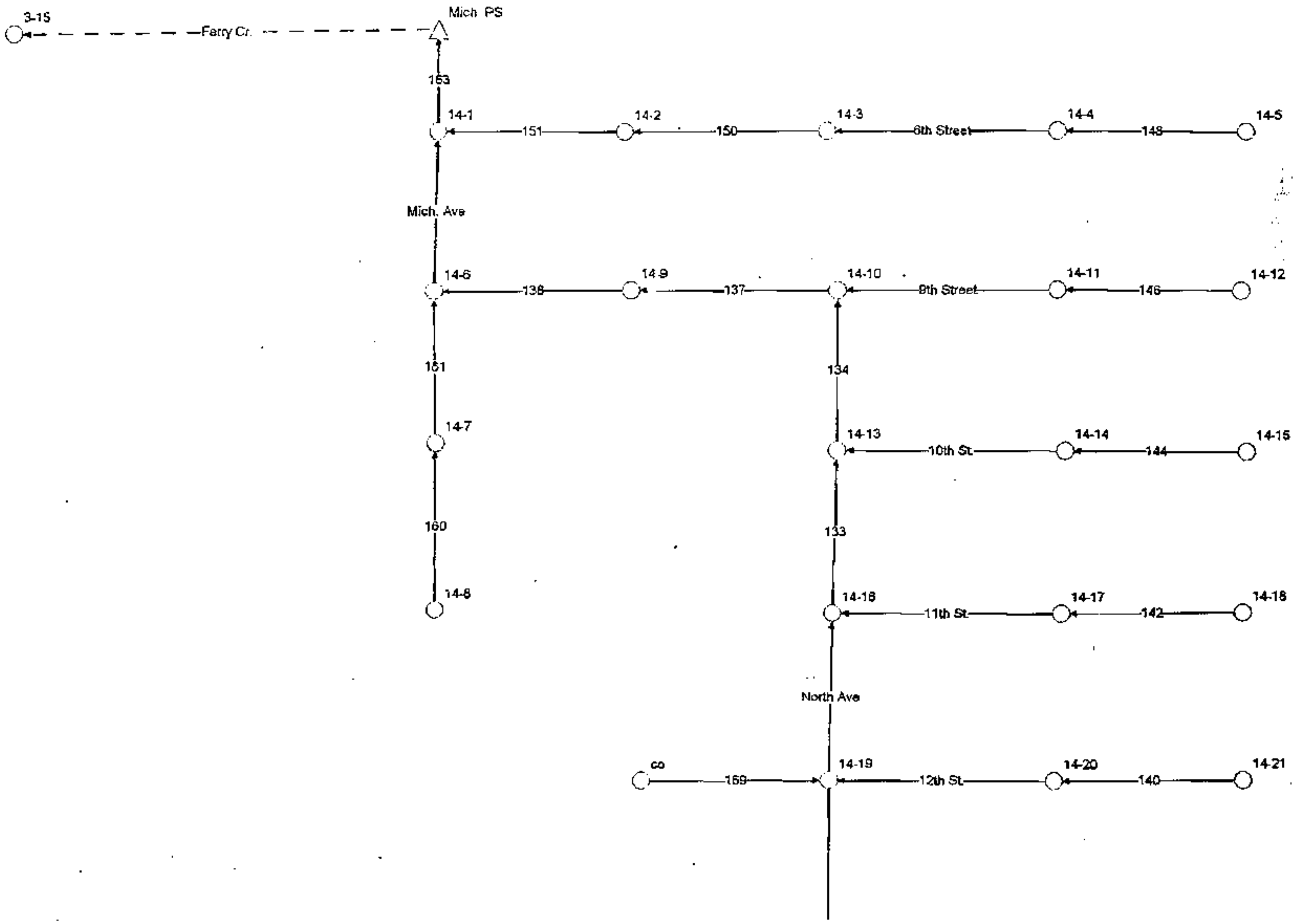
Bandon West 2001	HDR:Max Flow (ft^3/s, m^3/s) [Single]	HDR:Max Velocity (ft/s, m/s) [Single]	HDR:Design Full Flow (ft^3/s, m^3/s) [Single]	HDR:Max Flow/Design Flow (fraction) [Single]	Length (feet, metres) [Single]	Conduit Slope (%) [Single]	Diameter/Depth (feet, metres) [Single]
12 th St	.034845318	.623533923	.832429778	.041859790	1170.	.5359	.67
Franklin 3	.148105163	1.32601741	.773624568	.191443356	525.	.46286	.67
Franklin 2	.211220671	1.83562927	.750236461	281538797	510.	.43529	.67
Franklin 1	.250410690	1.35697653	1.40500826	.178227200	300.	1.52667	.67
Portland	.034850486	.489746560	.750514173	.046435480	730.	.43562	.67
Beach L 3	.012532173	.827760576	2.02854508	.006177912	770.	.51818	.83
Beach L 4	.024281741	.858279994	1.49660647	.016224534	1170.	.28205	.83
Beach L 5	.047029869	1.62473368	2.17682139	.021604836	910.	.5967	.83
Beach L 6	.056533092	1.93106913	3.65899217	.015450848	710.	1.68592	.83
Beach L 7	.065982473	1.17564201	2.15130877	.030672347	544.	.57169	.833
Seabird 4	.023205958	.998467296	1.48545034	.015630890	565.	.27257	.833
Seabird 3	.025107570	.966457399	1.55630065	.016133672	800.	.305	.83
Seabird 2	.047904213	1.90683430	2.72152781	.017616436	520.	.93269	.83
Seabird 1	.063384488	1.95108564	4.77817997	.013265404	600.	2.875	.83
Beach L 8	.139324883	2.13546925	2.03661726	.068414249	890.	.51236	.833
Beach L 9	.172726156	3.63097449	3.97056113	.043503587	1008.	1.94742	.833
Beach L 10	.001444217	.871532927	4.76008108	3.03565E-4	895.	2.79888	.833
JC fm							
Beach L 2	.305550430	1.34124344	1.27273549	.242069875	1000.	.148	1.
Beach L 1	.312335825	1.38917459	1.52432392	.205143673	1220.	.2123	1.
11th St	.438130833	1.64535947	1.55257833	.282203802	336.	.22024	1.
Newport	.493517869	1.63264462	1.55833736	.316715286	960.	.22188	1.
8th St 4	.617443917	1.80686482	1.54732424	.399082204	672.	.21875	1.
8th St 3	.702779242	1.89844855	1.60696266	.437333920	640.	.23594	1.
8th St 2	.757925637	1.65307103	1.52631988	.496597044	1245.	.21285	1.
8th St 1	1.06552430	2.18487543	1.47952496	(.720216813)	250.	.2	1.
Edison 4	1.07900185	3.24601729	2.69547723	.400407994	940.	.66383	1.
4th St	.067538943	1.07901304	1.07796853	.062653909	750.	.89867	.67
Edison 3	1.36597480	7.48988261	4.83069186	.294003707	217.	5.64977	.833
Edison 2	1.73329037	9.93091707	6.40320328	.282294861	273.	9.92674	.833
Edison 1	1.80190266	5.24145619	4.42526127	.437089553	60.	4.83333	.83
Jetty FM							

Bandon West 2/2	HDR:Max Flow (ft^3/s, m^3/s) [Single]	HDR:Max Velocity (ft/s, m/s) [Single]	HDR:Design Full Flow (ft^3/s, m^3/s) [Single]	HDR:Max Flow/Design Flow (fraction) [Single]	Length (feet, metres) [Single]	Conduit Slope (%) [Single]	Diameter/Depth (feet, metres) [Single]
1st St	1.68783521	6.17057639	.960605909	(1.75845790)	220.	.71364	.67

West Bandon Future	HDR:Max Flow (ft^3/s, m^3/s) [Single]	HDR:Max Velocity (ft/s, m/s) [Single]	HDR:Design Full Flow (ft^3/s, m^3/s) [Single]	HDR:Max Flow/Design Flow (fraction) [Single]	Length (feet, metres) [Single]	Conduit Slope (%) [Single]	Diameter/Depth (feet, metres) [Single]
12 th St	.034845298	.623533165	.832429778	.041859744	1170.	.5359	.67
Franklin 3	.148104905	1.32601547	.773624568	.191442867	525.	.46286	.67
Franklin 2	.211221668	1.83563311	.750236461	.281540126	510.	.43529	.67
Franklin 1	.250413485	1.37092200	1.40500826	.178229189	300.	1.52667	.67
Portland	.034850461	.489746560	.750514173	.046435448	730.	.43562	.67
Beach L 3	.012532173	.827760576	2.02854508	.006177912	770.	.51818	.83
Beach L 4	.024281880	.858289364	1.49660647	.016224687	1170.	.28205	.83
Beach L 5	.047029212	1.62472357	2.17682139	.021604884	910.	.5967	.83
Beach L 6	.056533796	1.93107348	3.65899217	.015450774	710.	1.68592	.83
Beach L 7	.065984769	1.17449820	2.15130877	.030672638	544.	.57169	.833
Seabird 4	.023067777	.996814090	1.48545034	.015532041	565.	.27257	.833
Seabird 3	.025059504	.966800277	1.55630065	.016101969	800.	.305	.83
Seabird 2	.047906061	1.90685237	2.72152761	.017602635	520.	.93269	.83
Seabird 1	.063383081	1.95108561	4.77817997	.013265109	600.	2.875	.83
Beach L 8	.138882429	2.13309850	2.03661726	.068199144	890.	.51236	.833
Beach L 9	.174156725	3.62375741	3.97056113	.043896354	1008.	1.94742	.833
Beach L 10	.002197545	.847408322	4.76008108	4.61661E-4	895.	2.79888	.833
JC fm							
Beach L 2	.498145035	1.55164617	1.27273549	.391412973	1000.	.148	1.
Beach L 1	.518254067	1.73980270	1.52432392	.340360500	1220.	.2123	1.
11th St	.646600125	1.86888506	1.55257833	.416490588	336.	.22024	1.
Newport	.693797240	1.84964233	1.55833736	.445216462	960.	.22188	1.
8th St 4	.804207238	1.97347011	1.54732424	.519830468	672.	.21875	1.
8th St 3	.879872746	2.06371449	1.60696266	.547553887	640.	.23594	1.
8th St 2	.916396565	1.78372938	1.52631988	.600396151	1245.	.21285	1.
8th St 1	1.22268065	2.26300852	1.47952496	.826441561	250.	.2	1.
Edison 4	1.23129329	3.35900374	2.69547723	.456807080	940.	.66383	1.
4th St	.067538943	1.07004005	1.07796853	.062653909	750.	.89867	.67
Edison 3	1.41622136	7.67901722	4.83069186	.293206310	217.	5.64977	.833
Edison 2	1.62674790	9.66182385	6.40320328	.275980124	273.	9.92674	.833
Edison 1	1.73293631	5.12790256	4.42526127	.436886082	60.	4.83333	.83
Jetty FM							

WEST BANDON FUTURE	HDR:Max Flow (ft^3/s, m^3/s) [Single]	HDR:Max Velocity (ft/s, m/s) [Single]	HDR:Design Full Flow (ft^3/s, m^3/s) [Single]	HDR:Max Flow/Design Flow (fraction) [Single]	Length (feet, metres) [Single]	Conduit Slope (%) [Single]	Diameter/Depth (feet, metres) [Single]
1st St	1.70421871	6.31852736	.960605909	1.77410809	220.	.71364	.67



XP-SWMM2000

Version 7.50

Ohio Ave. Proposed Sewers

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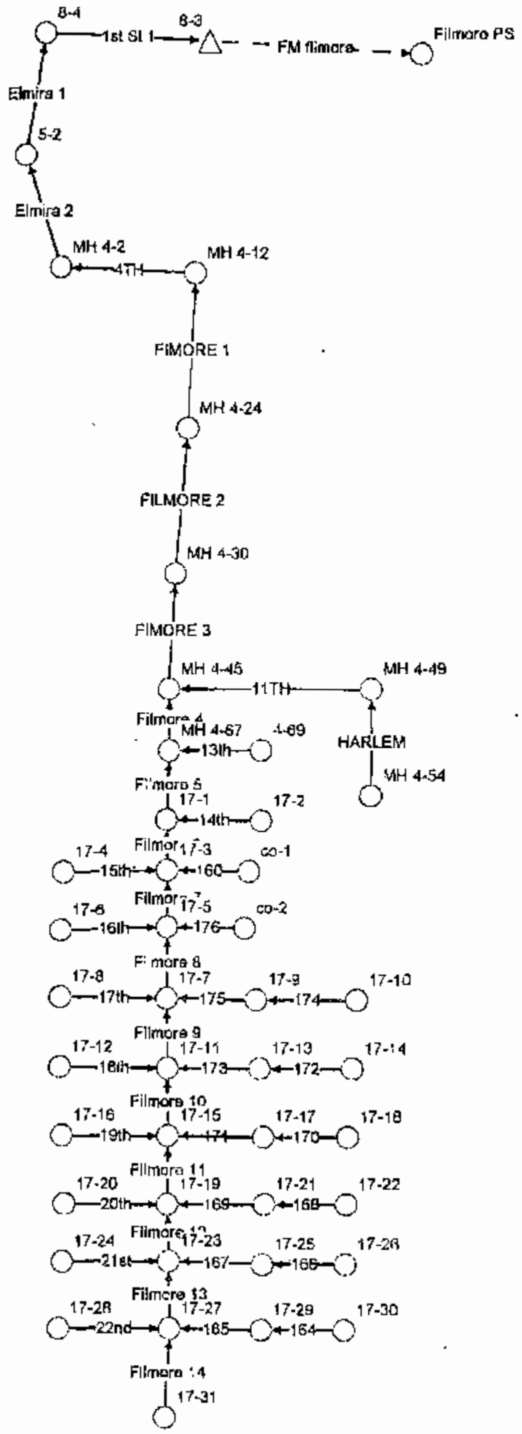
03/29/02

OHIO AVE.	Ground Elevation (feet, metres)	Invert Elevation (feet, metres)	HDR DWF Flow Rate
14-24	100.	96.	0.
14-23	92.	85.	.14
14-22	80.	75.9	.14
14-21	97.	92.3	0.
14-20	92.	85.3	.14
co	73.	69.3	0.
14-19	80.	67.9	.28
14-18	93.	88.	0.
14-17	92.	82.3	.14
14-16	80.	66.76	.14
14-15	75.	70.42	0.
14-14	75.	68.07	.14
14-13	70.	65.62	.14
14-12	80.	76.	0.
14-11	80.	72.4	.14
14-10	65.	61.1	.14
14-9	58.	54.1	.14
14-8	50.	46.3	0.
14-7	50.	45.16	.14
14-6	52.	45.02	.14
14-5	80.	76.3	0.
14-4	80.	71.05	.14
14-3	70.	66.	.14
14-2	50.	46.1	.14
14-1	30.	26.1	.14
Mich. PS	15.	2.	0.
3-15	74.	62.	0.

OHIO SEWERS	Link Name	Length (feet, metres) [Single]	Conduit Slope (%) [Single]	HDR:Max Flow (ft^3/s, m^3/s) [Single]	HDR:Max Velocity (ft/s, m/s) [Single]	HDR:Design Full Flow (ft^3/s, m^3/s) [Single]	HDR:Max Flow/Design Flow (fraction) [Single]	Diameter/Depth (feet, metres) [Single]
129	129	300.	3.	0	0	2.50670222	0	.67
12th Ct.	12th Ct.	300.	3.	.009701999	1.69339316	2.50670222	.003870423	.67
131	131	260.	3.	.019403999	2.08208573	2.50670222	.007740847	.67
140	140	300.	2.3	0	0	2.19485602	0	.67
12th St.	12th St.	300.	3.	.009701999	1.69339316	2.50670222	.003870423	.67
169	169	300.	.4	0	0	.915318234	0	.67
North Ave	North Ave	260.	.4	.048509999	1.37358787	.915318234	.052997960	.67
142	142	300.	2.2	0	0	2.14661153	0	.67
11th St.	11th St.	300.	2.1	.009701999	1.48993837	2.09725754	.004626041	.67
133	133	260.	.4	.067913999	1.51809548	.915318234	.074197144	.67
144	144	300.	.75	0	0	1.25335111	0	.67
10th St.	10th St.	300.	.75	.009701999	1.04125333	1.25335111	.007740846	.67
134	134	260.	1.66154	.087317998	2.69696115	1.86550886	.046806530	.67
146	146	300.	1.16667	0	0	1.56320348	0	.67
9th Street	9th Street	300.	3.7	.009701999	1.82792092	2.78383173	.003485124	.67
137	137	300.	2.3	.106721997	3.21057483	2.19485602	.048623689	.67
138	138	300.	2.37	.116423995	3.33169242	2.22643830	.052291588	.67
160	160	260.	.4	0	0	.915318234	0	.67
161	161	260.	.4	.009701987	.844299638	.915318234	.010599579	.67
Mich. Ave	Mich. Ave	260.	7.2	.135827980	5.14592716	3.88336638	.034976864	.67
148	148	300.	1.65	0	0	1.85902012	0	.67
6th Street	6th Street	300.	1.65	.009701999	1.36813300	1.85902012	.005218878	.67
150	150	300.	6.6	.019403999	2.73585701	3.71804024	.005218878	.67
151	151	300.	6.6	.029105999	3.09900397	3.71804024	.007828317	.67
163	163	130.	11.61538	.174635978	6.55913513	4.93240712	.035405832	.67
Ferry Cr.	Ferry Cr.							



XP-SWMM2000

Version 7.50

Rosa Road Sewers

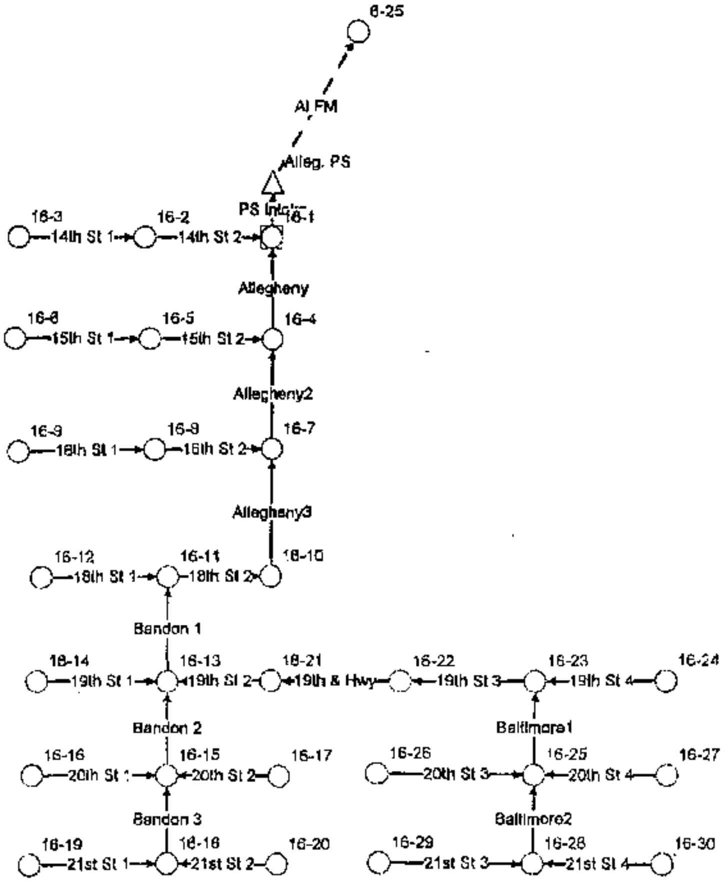
Licenced To: Dyer Partnership [42-750-0181]

04/23/02

Rosa Road	Length (feet, metres) [Single]	Conduit Slope (%) [Single]	HDR:Max Flow (ft^3/s, m^3/s) [Single]	HDR:Max Velocity (ft/s, m/s) [Single]	HDR:Design Full Flow (ft^3/s, m^3/s) [Single]
170	400.	1.4	.010595968	1.32649844	1.71240361
171	400.	1.46	.029861364	1.86256590	1.74871303
Filmore 14	270.	3.	0	0	2.50670222
22nd	400.	.4	0	0	.915318234
164	400.	1.5	.010595968	1.35867225	1.77250613
165	400.	2.	.029861366	2.08418649	2.04671379
Filmore 13	270.	.4	.066465621	1.50818990	.915318234
21st	400.	.4	0	0	.915318234
166	400.	1.5	.010595968	1.35867225	1.77250613
167	400.	2.	.029861366	2.08418649	2.04671379
Filmore 12	270.	.4	.133894505	1.85249477	.915318234
20th	400.	.4	0	0	.915318234
168	400.	2.	.010595969	1.50257065	2.04671379
169	400.	.75	.029861366	1.47624390	1.25335111
Filmore 11	270.	.4	.204213148	2.09010791	.915318234
19th	400.	.4	0	0	.926689083
Filmore 10	270.	.4	.274531477	2.27118999	.915318234
18th	400.	.4	0	0	.915318234
172	400.	1.4	.010595968	1.32649844	1.71240361
173	400.	1.4	.029861364	1.83510253	1.71240361
Filmore 9	270.	.4	.344848334	2.41779755	.915318234
17th	400.	.4	0	0	.915318234
174	400.	1.4	.010595968	1.32649844	1.71240361
175	400.	1.4	.029861364	1.83510253	1.71240361
Filmore 8	270.	.75	.415164936	3.18868998	1.25180280
16th	400.	.4	0	0	.921021207
176	220.	.5	0	0	1.03261823
Filmore 7	270.	.85	.445020927	3.40680035	1.33574683
15th	400.	.47	0	0	.992181323
160	220.	.53	0	0	1.05089608
Filmore 6	270.	.4	.474817224	2.63092841	.915318234
14th	400.	.43	0	0	.949022144
Filmore 5	120.	.5	.494071411	2.46206120	.804066133
13th	400.	.4	0	0	.915318234
Filmore 4	1250.	.928	.512466602	3.05476643	1.09542022
HARLEM	605.	.49587	.216597888	1.85176977	2.32964764
11TH	1055.	.25592	.391964436	1.75026278	1.67364348
FIMORE 3	665.	4.84211	1.02951157	6.24131331	7.27988323
FILMORE 2	325.	4.92308	1.20216531	4.95102725	7.34049945
FIMORE 1	650.	.96769	1.26772269	2.88743377	3.25443756
4TH	245.	.28571	1.41507073	2.55171831	1.76837056
Elmira 2	450.	.62444	1.55168349	3.50815182	2.61429265
Elmira 1	290.	1.03103	1.56879085	3.47593338	5.07106892
1st St 1	240.	.3	1.61143506	2.71555249	5.34250114
FM filmore					

Rosa Road	HDR:Max Flow/Design Flow (fraction) [Single]	Diameter/Depth (feet, metres) [Single]
170	.006187775	.67
171	.017076194	.67
Filmore 14	0	.67
22nd	0	.67
164	.005977958	.67
165	.014589908	.67
Filmore 13	.072614768	.67
21st	0	.67
166	.005977958	.67
167	.014589908	.67
Filmore 12	.146281916	.67
20th	0	.67
168	.005177064	.67
169	.023825220	.67
Filmore 11	.223106172	.67
19th	0	.67
Filmore 10	.299930086	.67
18th	0	.67
172	.006187775	.67
173	.017438274	.67
Filmore 9	.376752392	.67
17th	0	.67
174	.006187775	.67
175	.017438274	.67
Filmore 8	.331653623	.67
16th	0	.67
176	0	.67
Filmore 7	.333162628	.67
15th	0	.67
160	0	.67
Filmore 6	.518745538	.67
14th	0	.67
Filmore 5	.614469380	.67
13th	0	.67
Filmore 4	.467928932	.67
HARLEM	.092975597	1.
11TH	.234216959	1.
FIMORE 3	.141418692	1.
FILMORE 2	.163771595	1.
FIMORE 1	.389540958	1.
4TH	.800216887	1.
Elmira 2	.593538559	1.
Elmira 1	.309379996	1.167
1st St 1	.352810896	1.5
FM filmore		

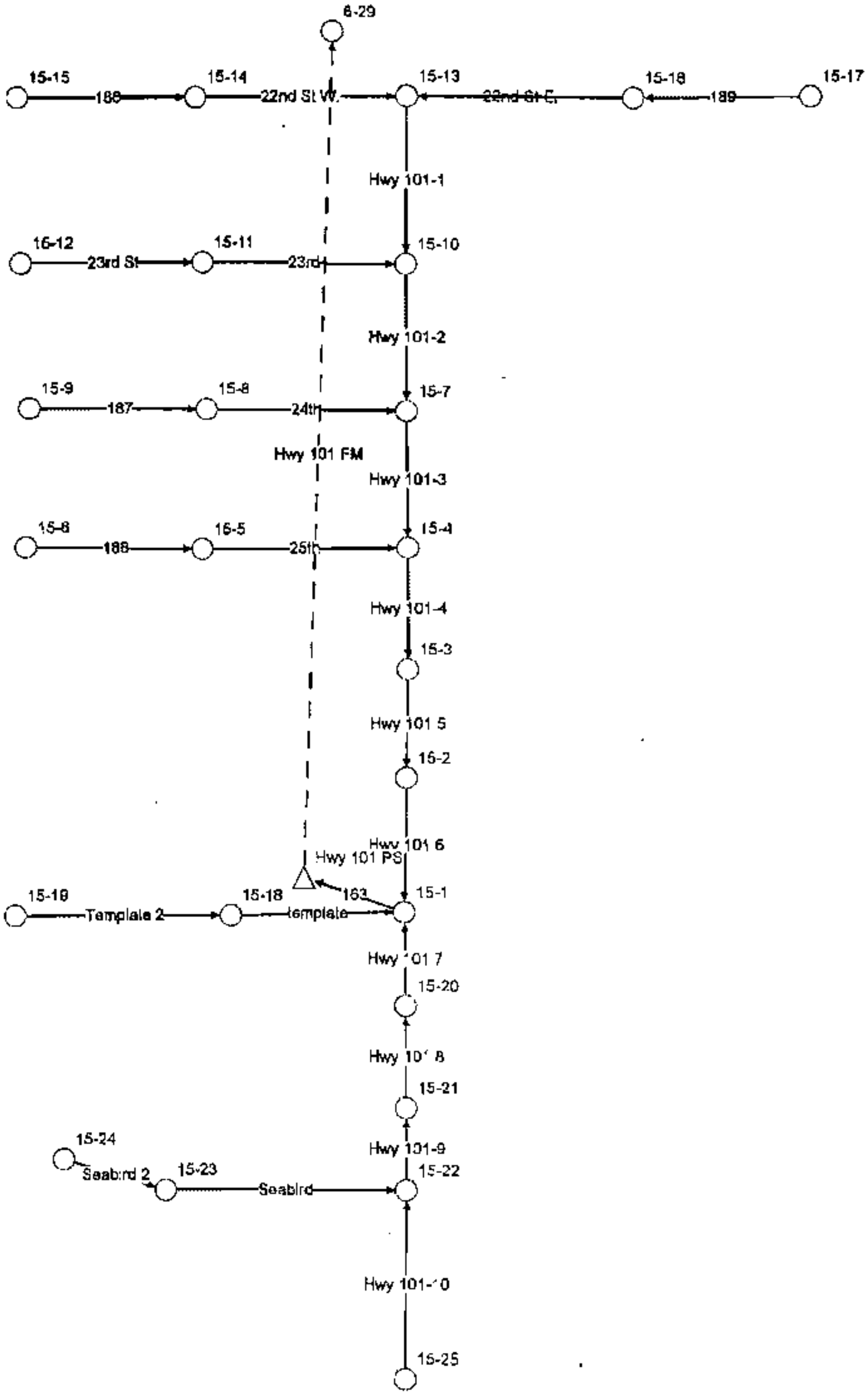
Rosa Road	Ground Elevation (feet, metres)	Invert Elevation (feet, metres)	DWF Sewage Flow Rate
17-18	96.	90.	
17-17	90.	84.2	
17-31	95.	90.	
17-28	87.5	83.5	
17-30	103.	97.8	
17-29	98.	91.6	
17-27	90.	81.7	
17-24	87.5	82.32	
17-26	102.	94.82	
17-25	94.	88.72	
17-23	89.	80.52	
17-20	86.	81.14	
17-22	98.	92.	
17-21	90.	82.54	
17-19	89.	79.34	
17-16	86.	80.	
17-15	89.5	78.16	
17-12	85.	78.78	
17-14	95.	88.8	
17-13	89.	83.1	
17-11	87.5	76.98	
17-8	82.5	77.6	
17-10	92.5	87.5	
17-9	89.	81.8	
17-7	84.	75.8	
17-6	80.	75.5	
co-2	80.	75.	
17-5	79.	73.68	
17-4	77.	73.36	
co-1	77.5	72.64	
17-3	78.	71.28	
17-2	77.5	72.4	
17-1	74.	70.	
4-69	76.	71.	
MH 4-67	74.	69.3	
MH 4-54	78.4	70.	.764
MH 4-49	76.	60.2	.774
MH 4-45	65.	57.5	.445
MH 4-30	34.	25.3	.61
MH 4-24	17.	9.3	.232
MH 4-12	11.	3.01	.522
MH 4-2	13.	2.31	.484
5-2	8.8	-.5	.077
8-4	9.4	-3.49	.079
8-3	10.	-8.43	.087
Filmore PS	40.	35.	1E-4



XP-SWMM2000 Version 7.50 	**South Bandon Allegheny Sewers** Licenced To: Dyer Partnership [42-750-0181]	04/23/02 Page 1/1

Allegheny Sewers	Ground Elevation (feet, metres)	Invert Elevation (feet, metres)	HDR DWF Flow Rate
16-17	78.4	74.2	0.
16-20	81.	77.	0.
16-19	76.	72.3	0.
16-18	79.4	70.5	.45
16-16	76.	72.	0.
16-15	77.	69.22	.45
16-14	75.	71.	0.
16-30	85.	81.	0.
16-29	80.5	76.8	0.
16-28	81.	75.0	.45
16-27	86.	82.	0.
16-26	81.	77.	0.
16-25	79.	73.92	.45
16-24	85.	81.	0.
16-23	79.	72.64	.226
16-22	78.5	70.94	.226
16-21	77.5	69.54	.113
16-13	77.	68.04	.339
16-12	76.	69.86	0.
16-11	78.	66.76	.113
16-10	81.	65.8	.05
16-9	72.	68.27	0.
16-8	76.	65.77	
16-7	77.	63.62	.14
16-6	71.	67.3	0.
16-5	73.	64.7	.226
16-4	75.	62.44	.226
16-3	71.	67.3	0.
16-2	73.5	65.15	.226
16-1	74.	61.26	.226
Alleg. PS	74.	52.	0.
6-25	74.	62.	0.

Allegheny Sewers	Link Name	Length (feet, metres) [Single]	Conduit Slope (%) [Single]	HDR:Max Flow (ft^3/s, m^3/s) [Single]	HDR:Max Velocity (ft/s, m/s) [Single]	HDR:Design Full Flow (ft^3/s, m^3/s) [Single]	HDR:Max Flow/Design Flow (fraction) [Single]	Diameter/Depth (feet, metres) [Single]
20th St 2	20th St 2	400.	.75	0	0	1.25335111	0	.67
21st St 2	21st St 2	400.	.75	0	0	1.25335111	0	.67
21st St 1	21st St 1	400.	.4	0	0	.915318234	0	.67
Bandon 3	Bandon 3	270.	.4	.031185146	1.20219219	.915318234	.034070680	.67
20th St 1	20th St 1	400.	.645	0	0	1.16231000	0	.67
Bandon 2	Bandon 2	270.	.4	.062370291	1.47991159	.915318234	.068140650	.67
19th St 1	19th St 1	400.	.69	0	0	1.20217215	0	.67
21st St 4	21st St 4	400.	1.	0	0	1.44724520	0	.67
21st St 3	21st St 3	400.	.4	0	0	.915318234	0	.67
Baltimore2	Baltimore2	270.	.4	.031185192	1.20219282	.915318234	.034070874	.67
20th St 4	20th St 4	400.	1.82	0	0	1.95244052	0	.67
20th St 3	20th St 3	400.	.72	0	0	1.22802827	0	.67
Baltimore1	Baltimore1	270.	.4	.062370497	1.47991318	.915318234	.068141186	.67
19th St 4	19th St 4	400.	1.6	0	0	1.83063646	0	.67
19th St 3	19th St 3	400.	.4	.078032405	1.58096707	.915318234	.085251678	.67
19th & Hwy	19th & Hwy	325.	.4	.093694002	1.66874446	.915318234	.102362226	67
19th St 2	19th St 2	325.	.4	.101524770	1.70860724	.915318234	.110917461	.67
Bandon 1	Bandon 1	270.	.4	.187387038	2.04001209	.915318234	.204723375	.67
18th St 1	18th St 1	400.	.75	0	0	1.25335111	0	.67
18th St 2	18th St 2	190.	.4	.195214214	2.06629746	.915318234	.213274691	.67
Allegheny3	Allegheny3	520.	.4	.198664571	2.07107629	.915318234	.217044262	.67
16th St 1	16th St 1	400.	.6	0	0	1.12103131	0	.67
16th St 2	16th St 2	325.	.6	0	0	1.12103131	0	.67
Allegheny2	Allegheny2	270.	.4	.211505817	1.91841511	.915318234	.231822862	.67
15th St 1	15th St 1	400.	.6	0	0	1.12103131	0	.67
15th St 2	15th St 2	325.	.6	.015661799	1.01580009	1.12103131	.013970885	.67
Allegheny	Allegheny	270.	.4	.237808768	1.98448391	.915318234	.261561950	.67
14th St 1	14th St 1	325.	.6	0	0	1.12103131	0	.67
14th St 2	14th St 2	325.	.6	.015661845	1.12792716	1.12103131	.013970983	.67
PS Intake	PS Intake	40.	1.	.301074038	2.71433468	4.21056705	.072963706	1.



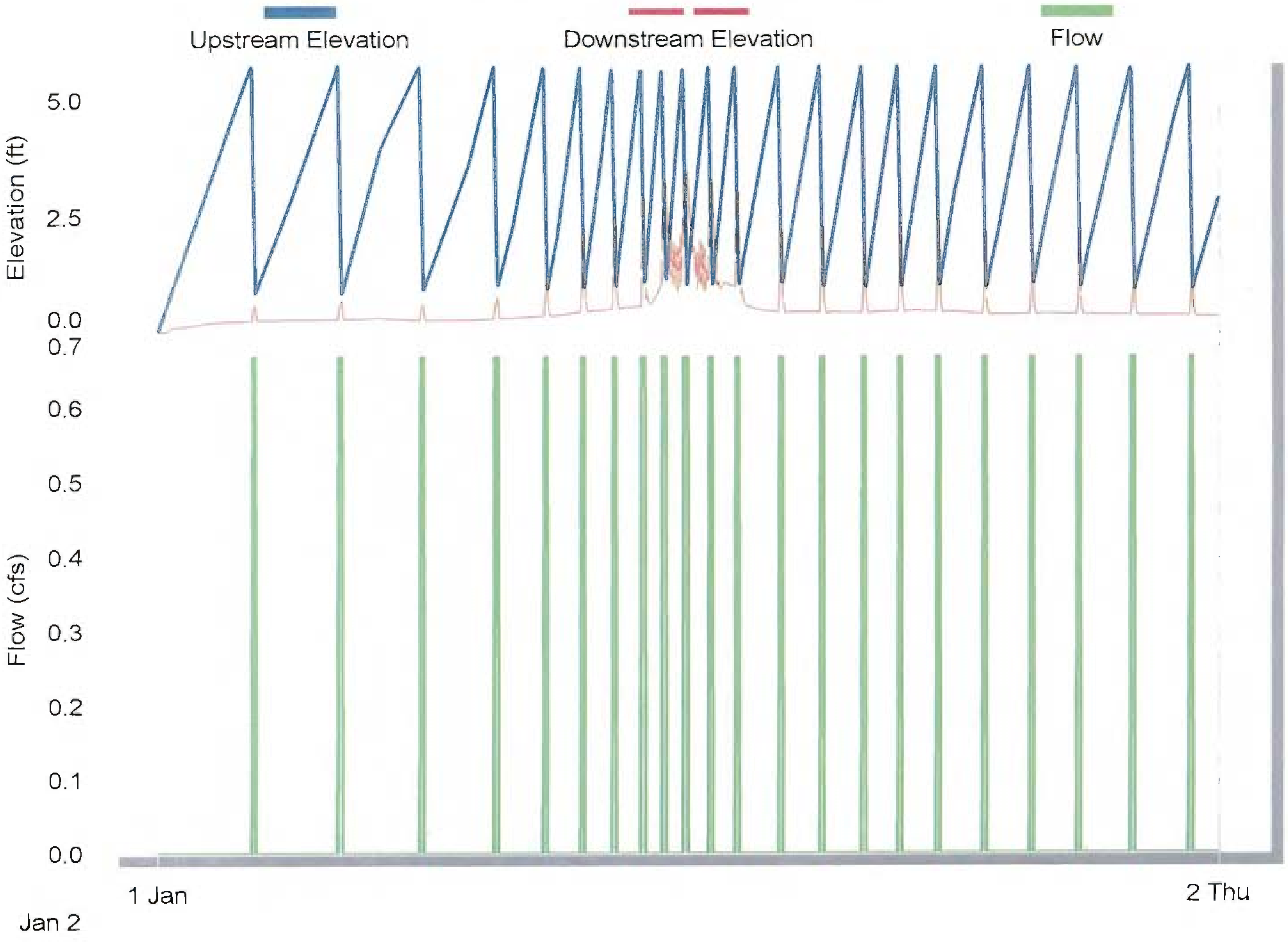
XP-SWMM2000 Version 7.50 Copyright (c) XP Software	**Highway 101 South Proposed Sewers** Licenced To: Dyer Partnership [42-750-0161]	04/23/02 Page 1/1

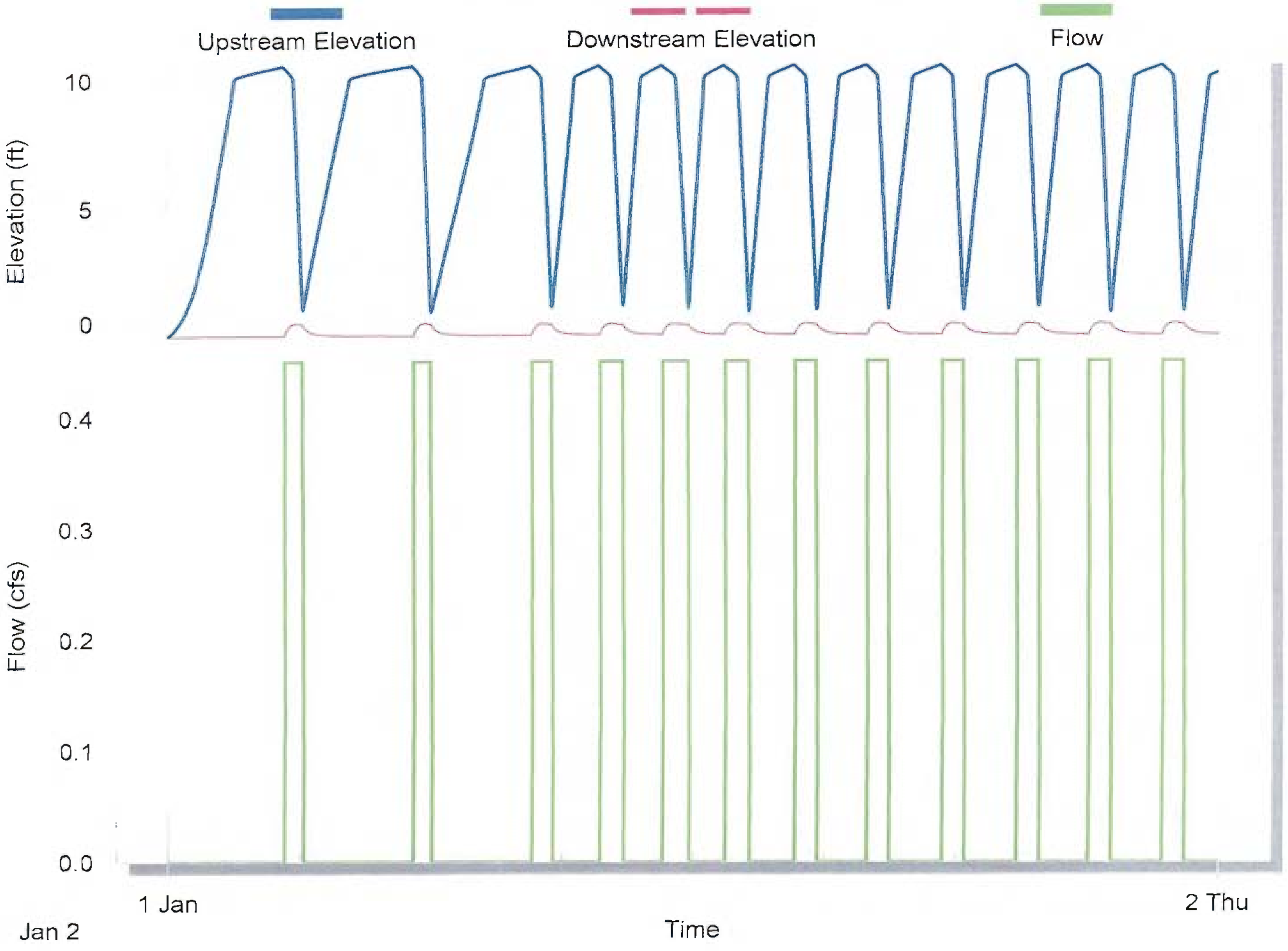
101 South	Link Name	Length (feet, metres) [Single]	Conduit Slope (%) [Single]	HDR:Max Flow (ft^3/s, m^3/s) [Single]	HDR:Max Velocity (ft/s, m/s) [Single]	HDR:Design Full Flow (ft^3/s, m^3/s) [Single]	HDR:Max Flow/Design Flow (fraction) [Single]	Diameter/Depth (feet, metres) [Single]
189	189	400.	.75	0	0	1.25335111	0	.67
22nd St E.	22nd St E.	400.	.75	.015660324	1.21957392	1.25335111	.012494762	.67
186	186	450.	.426	0	0	.945336607	0	.67
22nd St W.	22nd St W.	450.	.425	.015656551	.559466225	.942871579	.016605178	.67
Hwy 101-1	Hwy 101-1	270.	.42593	.062494719	1.51366895	.944515646	.066166051	.67
23rd St	23rd St	450.	.4	0	0	.915318234	0	.67
23rd	23rd	450.	.4	.015661032	.974513642	.915318234	.017109931	.67
Hwy 101-2	Hwy 101-2	270.	.4	.093811901	1.66996046	.915318234	.102491271	.67
187	187	400.	.75	0	0	1.25335111	0	.67
24th	24th	400.	.75	.015661798	1.21961386	1.25335111	.012495938	.67
Hwy 101-3	Hwy 101-3	270.	.4	.125128339	1.81688720	.915318234	.136705078	.67
188	188	400.	.75	0	0	1.25335111	0	.67
25th	25th	400.	.75	.015661798	1.21961386	1.25335111	.012495938	.67
Hwy 101-4	Hwy 101-4	300.	.4	.156442535	1.93695649	.915318234	.170916474	.67
Hwy 101 5	Hwy 101 5	270.	.4	.156431294	1.93740382	.915318234	.170907143	.67
Hwy 101 6	Hwy 101 6	270.	.4	.156416727	1.93735104	.915318234	.170897883	.67
Template 2	Template 2	400.	.4	0	0	.915318234	0	.67
template	template	400.	.4	.009701341	.843602078	.915318234	.010598872	.67
Hwy 101-10	Hwy 101-10	300.	.4	.009701938	.844040469	.915318234	.010599525	.67
Seabird 2	Seabird 2	250.	.4	0	0	.915318234	0	.67
Seabird	Seabird	400.	.4	.009701342	.843602103	.915318234	.010598873	.67
Hwy 101-9	Hwy 101-9	367.	.4	.029104361	1.18542209	.925240673	.031456014	.67
Hwy 101 8	Hwy 101 8	367.	.4	.029102182	1.18539494	.925240673	.031453880	.67
Hwy 101 7	Hwy 101 7	367.	.40872	.029090023	1.00553391	.726974814	.040019961	.67
163	163	40.	1.	.228470017	2.99511113	1.44724520	.157866007	.67
Hwy 101 FM	Hwy 101 FM							

Hwy 101 South	Ground Elevation (feet, metres)	Invert Elevation (feet, metres)	HDR DWF Flow Rate
15-17	84.	80.	0.
15-16	83.3	76.9	.226
15-15	77.4	72.38	0.
15-14	78.3	70.46	.226
15-13	82.7	68.55	.45
15-12	74.8	71.1	0.
15-11	77.	69.2	.226
15-10	80.2	67.2	.226
15-9	79.8	75.8	0.
15-8	77.9	71.	.226
15-7	77.6	66.02	.226
15-6	75.7	71.14	0.
15-5	77.9	68.04	.226
15-4	79.	64.84	.226
15-3	80.	63.54	0.
15-2	80.3	62.36	0.
15-19	70.	64.68	0.
15-18	75.	62.98	.14
15-25	75.	67.7	.14
15-24	73.	69.3	0.
15-23	76.	68.2	.14
15-22	78.	66.4	.14
15-21	82.4	64.8	0.
15-20	82.9	63.2	0.
15-1	80.	61.08	.48
Hwy 101 PS	72.	50.	0.
6-29	74.	62.	0.

Forcemain from Jetty PS to 8-16 (Wet Weather)

[Max Flow = 0.6700][Max Velocity = 0.00]



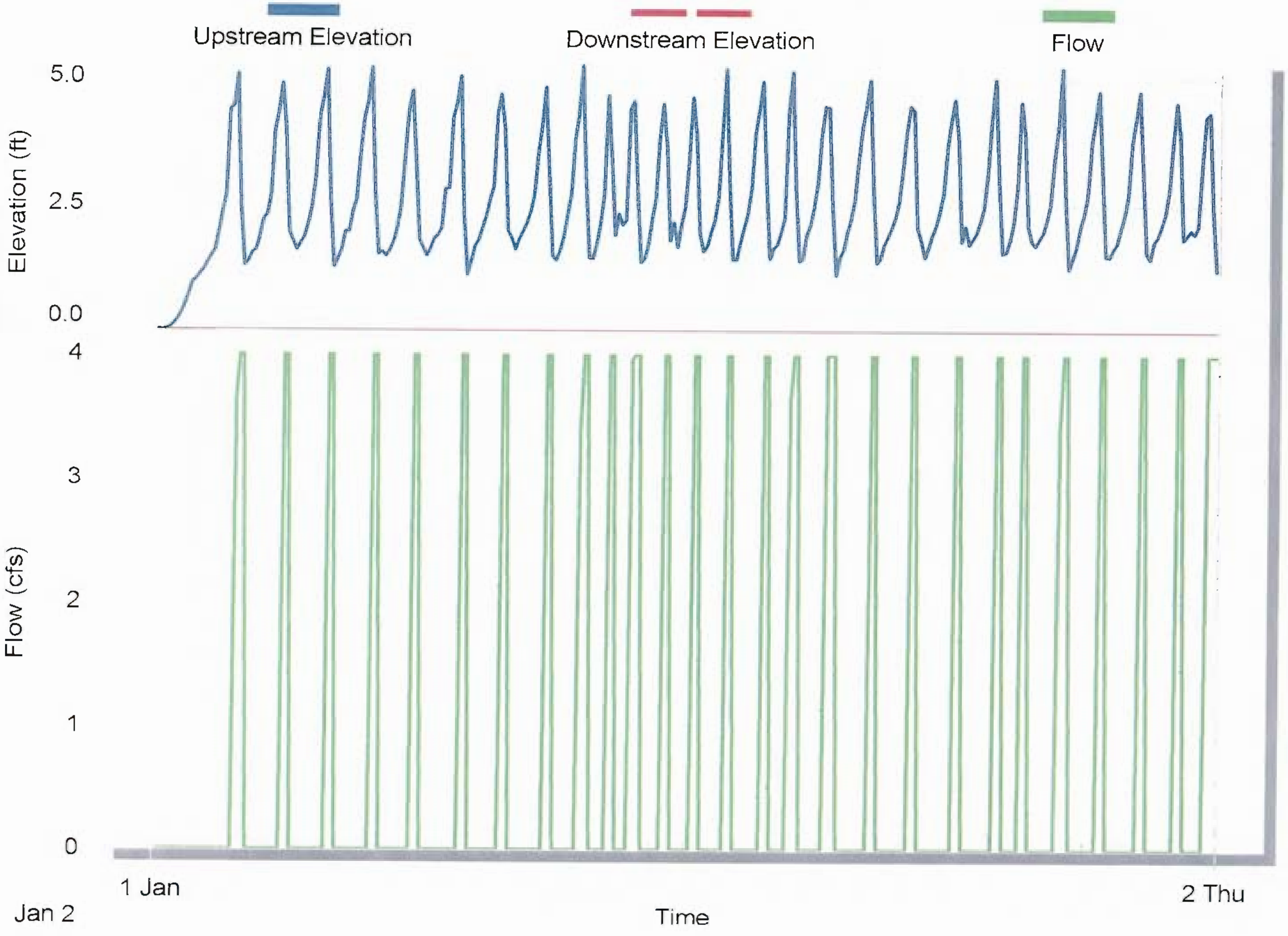


Diversion Johnson from J Cr. PS to 13-11

[Max Flow = 0.4500][Max Velocity = 0.00]

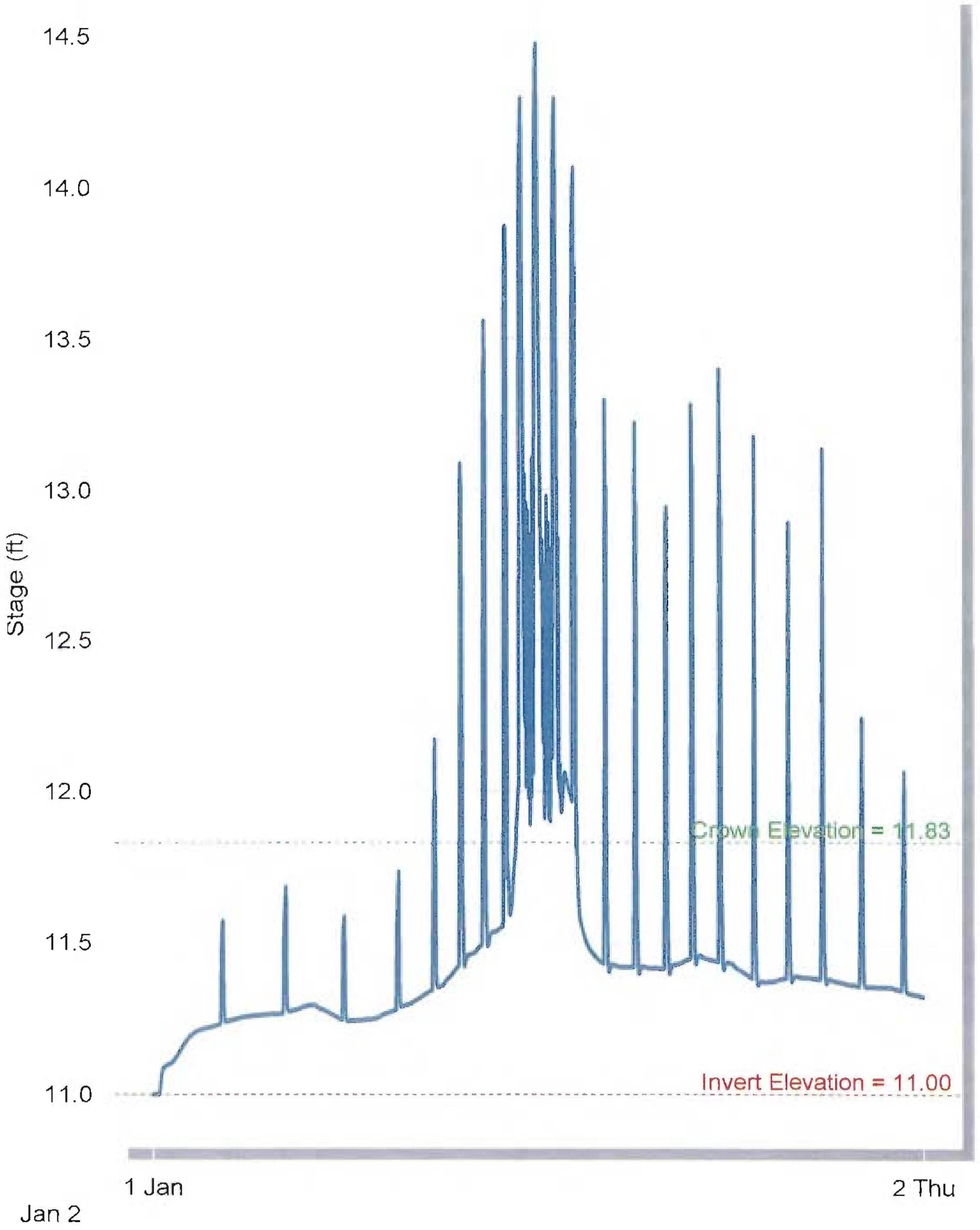
Diversion Filmore from 8-3 to Filmore PS

[Max Flow = 4.0000][Max Velocity = 0.00]



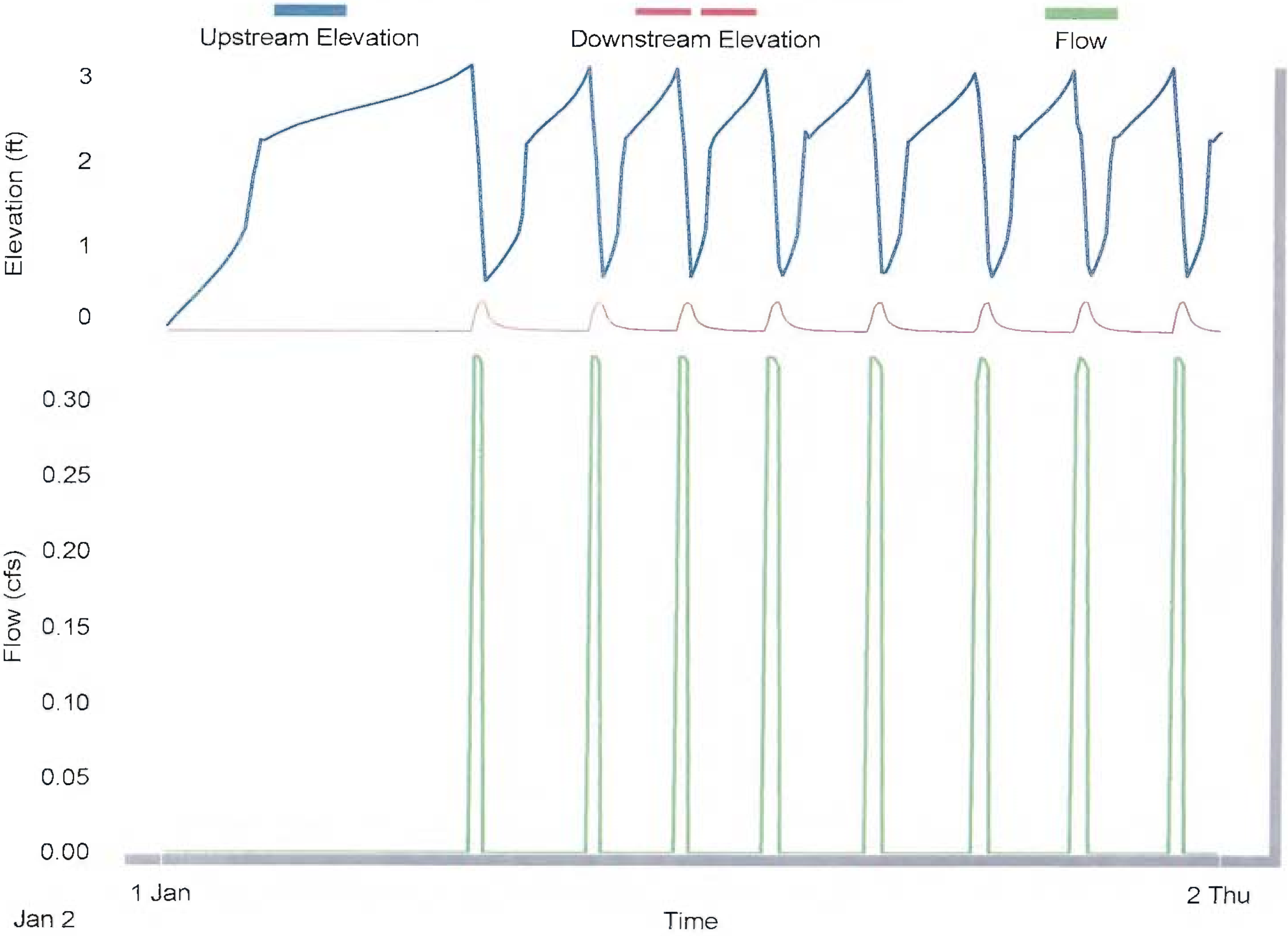
Node - 8-16

Wet Weather surcharge



Diversion North PS from N Ave PS to 1-12

[Max Flow = 0.3300][Max Velocity = 0.00]



Appendix E

Cost Estimates

City of North Bend WWTP

JOB ESTIMATE

P.O. Box B
1255 Airport Lane
North Bend Or. 97459
(541)756-6078

TO:
Jan
Dyer Partnership
275 Market Street
Coos Bay, Or 97420

269-0732

[illegible]
Tv around 600 feet of sewer lines will be setting up at 2 locations around 300 feet per section
1 hr. to get to Bandon 1 hr to get back
1 hr for total set-up and takedown
1 hr at each location for actual TV time. Will provide video and written report.

[illegible]	[illegible]
1 man @ 27.14/hr for 5 hours	$135.70
1 man @ 21.23/hr for 5 hours	106.15
TV Van @ 40/hr for 5 hours	200.00
Generator	20.00
Video tape (no charge)	-
TOTAL ESTIMATED JOB COST	$461.85

This is an estimate only, not a contract. This estimate is for completing the job described above, based on our evaluation. It does not include unforeseen price increases or additional labor and materials which may be required should problems arise.

PREPARED BY

DATE

File: Dyer partnership Job Estimate

Office In Color

Printed: 4/18/02

Edison Avenue Line Upsize

Construction Cost Estimate

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 5,000	$ 5,000
2	Demolition & Site Preparation	LS	All	$ 3,000	$ 3,000
3	By-Pass Pumping	LS	All	$ 5,000	$ 5,000
4	12" Sewerpipe Replacement	LF	230	$ 120	$ 27,600
5	AC Pavement R & R	LF	75	$ 16	$ 1,200
			Construction Subtotal		**$ 41,800**
			Contingency		$ 6,000
			Engineering		$ 7,500
			Administration		$ 850
			Permit Fees		$ 350
			Project Total		**$ 56,500**

I/I Study Project No. 2 - Basin 7 combined with Line Upsize

Construction Cost Estimate

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 10,500	$ 10,500
2	Demolition & Site Preparation	LS	All	$ 8,000	$ 8,000
3	By-Pass Pumping	LS	All	$ 12,500	$ 12,500
4	8" Sewerpipe Lining	LF	250	$ 35	$ 8,750
5	12" Sewerpipe Replacement	LF	520	$ 120	$ 62,400
6	8" Sewerpipe Replacement	LF	210	$ 70	$ 14,700
7	AC Pavement R & R	LF	730	$ 16	$ 11,680
8	Lateral Connection	EA	16	$ 1,500	$ 24,000
9	Lateral Replacement	LF	480	$ 35	$ 16,800
10	Service Laterals	EA	17	$ 150	$ 2,550
11	Lateral and Line Grout Pack	EA	7	$ 500	$ 3,500
12	Preliminary Televising Work	LF	980	$ 1.50	$ 1,470
			Construction Subtotal		**$ 176,850**
			Contingency		$ 27,000
			Engineering		$ 32,000
			Administration		$ 3,500
			Permit Fees		$ 350
			Project Total		**$ 239,700**

Oregon Avenue Line Upsize Only

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 9,000	$ 9,000
2	Demolition & Site Preparation	LS	All	$ 5,500	$ 5,500
3	By-Pass Pumping	LS	All	$ 7,000	$ 7,000
4	12" Sewerpipe Replacement >12'	LF	520	$ 120	$ 62,400
5	AC Pavement R & R	LF	520	$ 16	$ 8,320
6	Service Laterals	EA	17	$ 150	$ 2,550
			Construction Subtotal		**$ 94,770**
			Contingency		$ 14,800
			Engineering		$ 18,000
			Administration		$ 2,000
			Permit Fees		$ 350
			Project Total		**$ 129,920**

Ohio Ave Proposed Sewers

Construction Cost Estimate

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 70,000	$ 70,000
2	Demolition & Site Preparation	LS	All	$ 42,000	$ 42,000
3	8" Sewerline	LF	8,150	$ 45	$ 366,750
4	Manholes< 8'	EA	21	$ 2,000	$ 42,000
5	Manholes > 8'	EA	3	$ 2,500	$ 7,500
6	Cleanouts	EA	2	$ 500	$ 1,000
7	Pump Station	EA	1	$ 200,000	$ 200,000
8	Land acquisition	Lot	1	$ 20,000	$ 20,000
9	Stream Crossing	LF	200	$ 150	$ 30,000
10	4" Forcemain	LF	750	$ 25.00	$ 18,750

Construction Subtotal	**$ 798,000**
Contingency	$ 95,000
Engineering	$ 160,000
Administration	$ 16,000
Permit Fees	$ 1,000
Project Total	**$ 1,070,000**
Cost per projected home	$ 3,963
Cost per acre	$ 15,286

Riverside Drive Grinder Pump Cost Estimate

Riverside Drive, 16 Existing Homes Only

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 20,000	$ 20,000
2	Demolition & Site Preparation	LS	All	$ 9,000	$ 9,000
3	Backfill of old Septic	EA	16	$ 200	$ 3,200
4	Grinder Pump equipment cost	EA	16	$ 2,800	$ 44,800
5	Pump Installation and Electrical	EA	16	$ 1,500	$ 24,000
6	Concrete Anchor	EA	16	$ 300	$ 4,800
7	2" pressure main	LF	4,500	$ 15	$ 67,500
8	Lateral connection (100')	EA	16	$ 300	$ 4,800
9	Manhole Drop Connection	EA	1	$ 1,500.00	$ 1,500
10	Vacuum Release Valve	EA	1	$ 1,500.00	$ 1,500
11	Driveway Crossing	EA	8	$ 300.00	$ 2,400
12	AC cut & Restore	EA	200	$ 16.00	$ 3,200
13	Gravel Resurface	EA	4,300	$ 10.00	$ 43,000
14	Directional Drill 1-1/4" Road Crossing	EA	8	$ 500.00	$ 4,000

Construction Subtotal	**$**	**233,700**
Contingency	$	28,000
Engineering	$	43,000
Administration	$	5,000
Permit Fees	$	350
Project Total	**$**	**310,050**
Cost per Existing Home	$	19,378

Riverside Drive Grinder Pump Cost Estimate

Riverside Drive & Michigan Avenue, 40 Homes

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 37,000	$ 37,000
2	Demolition & Site Preparation	LS	All	$ 15,000	$ 15,000
3	Backfill of old Septic	EA	40	$ 200	$ 8,000
4	Grinder Pump equipment cost	EA	40	$ 2,800	$ 112,000
5	Pump Installation and Electrical	EA	40	$ 1,500	$ 60,000
6	Concrete Anchor	EA	40	$ 300	$ 12,000
7	2" pressure main	LF	6,100	$ 15	$ 91,500
8	Lateral connection (100')	EA	40	$ 300	$ 12,000
9	Manhole Connection	EA	1	$ 1,500.00	$ 1,500
10	Vacuum Release Valve	EA	1	$ 1,500.00	$ 1,500
11	Driveway Crossing	EA	8	$ 300.00	$ 2,400
12	AC cut & Restore	EA	200	$ 16.00	$ 3,200
13	Gravel Resurface	EA	5,900	$ 10.00	$ 59,000
14	Directional Drill 1-1/4" Road Crossing	EA	8	$ 500.00	$ 4,000

Construction Subtotal	**$**	**419,100**
Contingency	$	51,000
Engineering	$	78,000
Administration	$	8,500
Permit Fees	$	350
Project Total	**$**	**556,950**
Cost per Home	$	13,924

Highway 101 South Sewer Construction Cost Estimate

Entire Project

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 85,000	$ 85,000
2	Demolition & Site Preparation	LS	All	$ 35,000	$ 35,000
3	8" sewerpipe Class C	LF	9,120	$ 45	$ 410,400
4	4" Forcemain	LF	3,350	$ 25	$ 83,750
5	Manholes	EA	24	$ 2,000	$ 48,000
6	AC Restoration	LF	2,000	$ 16.00	$ 32,000
7	Gravel Restoration	LF	8,000	$ 10.00	$ 80,000
8	Pump Station	LS	1	$ 200,000	$ 200,000
			Construction Subtotal		**$ 974,150**
			Contingency		$ 117,000
			Engineering		$ 195,000
			Administration		$ 20,000
			Permit Fees		$ 1,000
			Project Total		**$ 1,307,150**
			Cost per acre		$ 9,015

Highway 101 South Sewer Construction Cost Estimate

Portion Serving Within the City Limits

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 50,000	$ 50,000
2	Demolition & Site Preparation	LS	All	$ 20,000	$ 20,000
3	8" sewerpipe Class C	LF	3,070	$ 45	$ 138,150
4	4" Forcemain	LF	3,350	$ 25	$ 83,750
5	Manholes	EA	10	$ 2,000	$ 20,000
6	AC Restoration	LF	2,000	$ 16.00	$ 32,000
7	Gravel Restoration	LF	2,350	$ 10.00	$ 23,500
8	Pump Station	LS	1	$ 200,000	$ 200,000
			Construction Subtotal		**$ 567,400**
			Contingency		$ 70,000
			Engineering		$ 115,000
			Administration		$ 11,500
			Permit Fees		$ 1,000
			Project Total		**$ 764,900**
			Cost per acre		$ 15,298

Allegheny Avenue Updated Construction Cost

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 76,000	$ 76,000
2	Demolition & Site Preparation	LS	All	$ 31,000	$ 31,000
3	8" Sewerpipe	LF	8,125	$ 45	$ 365,625
4	10" Sewerpipe	LF	1,130	$ 90	$ 101,700
5	Manholes	EA	32	$ 2,000	$ 64,000
6	Manholes >8'	EA	6	$ 2,500	$ 15,000
7	Pump Station	EA	1	$ 200,000	$ 200,000
8	4" Forcemain	LF	500	$ 25	$ 12,500

Construction Subtotal	**$ 865,825**
Contingency	$ 105,000
Engineering	$ 175,000
Administration	$ 17,500
Permit Fees	$ 1,000
Project Total	**$ 1,164,325**
	$ 14,199.09

South Bandon Updated Construction Cost

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 278,000	$ 278,000
2	Demolition & Site Preparation	LS	All	$ 166,000	$ 166,000
3	8" Sewerpipe	LF	35,000	$ 45	$ 1,575,000
4	10" Sewerpipe	LF	2,200	$ 90	$ 198,000
5	Manholes	EA	87	$ 2,000	$ 174,000
6	Manholes >8'	EA	10	$ 2,500	$ 25,000
7	Pump Station	EA	1	$ 200,000	$ 200,000
8	Pressure Sewer	EA	1,000	$ 25	$ 25,000

Construction Subtotal	**$ 2,641,000**
Contingency	$ 500,000
Engineering	$ 600,000
Administration	$ 65,000
Permit Fees	$ 350
Project Total	**$ 3,806,350**
Cost per acre	$ 10,875

Rosa Road Proposed Sewers

Construction Cost Estimate

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 70,000	$ 70,000
2	Demolition & Site Preparation	LS	All	$ 28,000	$ 28,000
3	8" Sewerline	LF	12,840	$ 45	$ 577,800
4	Manholes< 8'	EA	23	$ 2,000	$ 46,000
5	Manholes > 8'	EA	10	$ 2,500	$ 25,000
6	Cleanouts	EA	8	$ 500	$ 4,000
7	AC Remove & Replace	LF	2,900	$ 16	$ 46,400
			Construction Subtotal		**$ 797,200**
			Contingency		$ 96,000
			Engineering		$ 145,000
			Administration		$ 16,000
			Permit Fees		$ 1,000
			Project Total		**$ 1,055,200**
			Cost per projected home		$ 2,799
			Cost per acre		$ 14,069

Replace Tide Gate at Fimore PS with Red Valve

Item	Description	Unit	Quantity	Material Cost		Labor Hours		Total Cost	
1	Tideflex Valve	Each	1	$	1,950	$	4	$	2,070
2	Remove existing	Each	1	$	20	$	12	$	380
			Construction Total					**$**	**2,450**

ESTIMATE SHEET

NAME ____________________
ADDRESS ____________________
CITY ____________ STATE ____________ ZIP ____________
MR ____________ EXT. ____________ PHONE ____________
FAX ____________

Page ______ of ______
DATE 4-16-02
QUOTE # ____________
B.O.D. ____________

JOB: S/o Bandon 40 mmPC ENGR.: ____________

CONDITIONS OF SERVICE

GPM ______ TDH ______ PSI FT. SUCT ______ PSI FT. DISCH ______ PSI FT. VEL HEAD ______ FT. LIQUID ______

AVAIL NPSH ______ FT. REQ'D. NPSH ______ FT. VAPOR PRESS ______ PSIA SP. GR ______ TEMP ______ °F. VISC ______

EFF ______ % BHP ______ MAX. BPH ______ RPM ______ SIZE SOLIDS ______ % SOLIDS ______

PIT DEPTH ______ PIT DIA ______ VOLTAGE ______

ITEM NO.	QUAN.	DESCRIPTION	LIST	MULT.	COST	MULT.	NET SELL. PRICE	W
		Parts To Rebuild 1 Pump						
32	1	1088-009-2 7½" Imp.					602.10	
42	1	4025-004-2 7½" Lip plate					711.90	
31	1	891-000-2 Wearplate					156.60	
30	1	150-024-1 Case O Ring					13.50	
24	1	241-007-1 O Ring					4.50	
40	1	3296-001-1 Seal Sleeve					51.30	
41	1	920-001-1 Mech Seal					33.30	
		TOTALS					1573.20	

NOTES:

Parts for 1 pump.

SELLING PRICE ____________
SALES TAX ___ % ____________
FREIGHT COST ____________

SALES OFFICE COST ____________
SALES OFFICE COMM. ____________

Quoted by ____________

HYDRONIX

New Johnson Creek Pump Station

Construction Cost Estimate with Generator

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$24,000.00	$ 24,000
2	Demolition & Site Preparation	LS	All	$10,000.00	$ 10,000
3	Temporary controls & Pumping	LS	1	$ 10,000	$ 10,000
4	Remove old PS	EA	1	$ 10,000	$ 10,000
5	Refurbish Wet-Well	EA	1	$ 1,500	$ 1,500
6	Extend & Cap Wet Well	EA	1	$ 5,000	$ 5,000
7	5 HP submersible Pumps	EA	2	$ 9,500	$ 19,000
8	Piping & Valves	LS	1	$ 18,000	$ 18,000
9	Stucture	SF	196	$ 125	$ 24,500
10	Electrical	LS	1	$ 18,000	$ 18,000
11	Controls & Telemetry	LS	1	$ 10,000	$ 10,000
12	Hoist & Rails	EA	2	$ 1,500	$ 3,000
13	Site Landscaping	LS	1	$ 4,000	$ 4,000
14	Concrete & fill	YD	75	$ 400	$ 30,000
15	Generator Rehab & Reinstall	EA	1	$ 10,000	$ 10,000

Construction Subtotal	**$ 197,000**
Contingency	$20,000
Engineering	$36,000
Administration	$9,900
Permit Fees	$ 1,000
Project Total	**$ 263,900**

New Influent Meter

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 2,025	$ 2,025
2	By-Pass Pumping	LS	All	$ 2,000	$ 2,000
3	0-5 MGD Mag Meter	EA	1	$ 6,000	$ 6,000
4	Piping & Connections	LS	1	$ 2,000	$ 2,000
5	Wiring to control panel	LS	1	$ 3,500	$ 3,500

Construction Subtotal	**$ 15,525**
Contingency	$ 2,250
Engineering	$ 3,000
Administration	$ 300
Project Total	**$ 21,075**

Replace Metering & Recording Equipment

(Does not include new flow meters)

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$ 2,550	$ 2,550
2	By-Pass Pumping	LS	All	$ 2,000	$ 2,000
3	Replacement of the Recorder	EA	1	$ 6,000	$ 6,000
4	Calibration & Set Up	LS	1	$ 4,000	$ 4,000
5	Wiring to control panel	LS	1	$ 5,000	$ 5,000

Construction Subtotal	**$ 19,550**
Contingency	$ 2,000
Engineering	$ 3,000
Administration	$ 300
Project Total	**$ 24,850**

Automatic RAS Pump Controls

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Contractor Overhead	LS	All	$1,200.00	$ 1,200
2	Electrical	LS	1	$ 1,000	$ 1,000
3	BacGen Control Wiring	LS	1	$ 7,000	$ 7,000

Construction Subtotal	**$ 9,200**
Contingency	$900
Engineering	$1,400
Administration	$276
Permit Fees	$ -
Project Total	**$ 11,776**

UV Lamp Operating Cost

Existing

	Avg Flow	# Lamps	Watts	Hours	kWh	Lamps Replaced	Ballast Replaced	Lamp Disposal
Jan	0.284	168	8064	730	5,887			
Feb	0.28	168	8064	730	5,887			
Mar	0.283	168	8064	730	5,887			
Apr	0.308	168	8064	730	5,887			
May	0.282	168	8064	730	5,887			
Jun	0.277	168	8064	730	5,887			
Jul	0.3	168	8064	730	5,887			
Aug	0.33	168	8064	730	5,887			
Sep	0.303	168	8064	730	5,887			
Oct	0.266	168	8064	730	5,887			
Nov	0.295	168	8064	730	5,887			
Dec	0.379	168	8064	730	5,887			
Total				8760	70,641	168	16	168
Cost					$4,945	$ 6,720	$ 2,000	$ 504

Total Annual Cost Without Labor $14,169

With Flow Pacing

	Avg Flow	# Lamps	Watts	Hours	kWh	Lamps Replaced	Ballast Replaced	Lamp Disposal
Jan	0.284	56	2688	730	1,962			
Feb	0.28	56	2688	730	1,962			
Mar	0.283	28	1344	730	981			
Apr	0.308	28	1344	730	981			
May	0.282	28	1344	730	981			
Jun	0.277	28	1344	730	981			
Jul	0.3	28	1344	730	981			
Aug	0.33	28	1344	730	981			
Sep	0.303	28	1344	730	981			
Oct	0.266	28	1344	730	981			
Nov	0.295	28	1344	730	981			
Dec	0.379	56	2688	730	1,962			
Total				8760	14,717	35	3	35
Cost					$1,030	$ 1,400	$ 375	$ 105

Total Annual Cost Without Labor $ 2,910

Assume 1 year lamp life & $40 replacement cost
Assume $.07/kWh energy Cost
Assume 5 year ballast life & $125 replacement cost
Assume $3.00 lamp disposal cost

Roof for Sludge Beds

Construction Cost Estimate with Generator

Item	Description	Unit	Quantity	Unit Cost	Total Cost
1	Const. Facilities & Temporary Controls	LS	All	$5,000	$ 5,000
2	Demolition & Site Preparation	LS	All	$2,000	$ 2,000
3	Pole Building package from BJS'	LS	1	$ 25,000	$ 25,000
4	Presite investigation & core sampling	EA	1	$ 10,000	$ 10,000
	Construction Subtotal				**$ 42,000**
	Contingency				$ 5,000
	Engineering				$ 8,000
	Administration				$ 2,100
	Permit Fees				$ 1,500
	Project Total				**$ 58,600**

Pole style building with metal roof, no walls

Appendix

F

Laboratory Test Results

NEILSON RESEARCH CORPORATION

SLUDGE STUDY

NRC Number	94–9163
Date Received	9/9/94
Time Received	22:20
Date Reported	9/19/94

CLIENT MAILING ADDRESS:

City of Bandon
PO Box 67
Bandon OR 97411

Phone: (503) 347–9122

SAMPLE LOCATION:

City of Bandon
PO Box 67
Bandon OR 97411

SAMPLE COLLECTION DATA

SITE ID : Digester No # 3
MATRIX: Sludge
COMMENTS:

Time Collected: 13:30
Date Collected: 9/9/94
Collector's Name: Ed Hammond

SLUDGE STUDY

ANALYST: TD

9/12–19/94

ANALYSIS PERFORMED	METHOD	UNITS IN DRY WT	TEST RESULTS	METHOD BLANK	LCS % RECOVERY
pH	EPA 150.1	pH Units	< 4	ND	NA
Arsenic, As	EPA 7060	mg/kg	1.15	ND	116
Cadmium, Cd	EPA 7130	mg/kg	3.83	ND	94
Chromium, Cr	EPA 7190	mg/kg	30.2	ND	93
Copper, Cu	EPA 7210	mg/kg	465	ND	104
Lead, Pb	EPA 7420	mg/kg	74.0	ND	95
Mercury, Hg	EPA 7471	mg/kg	3.05	ND	108
Molybdenum, Mo	EPA 7480	mg/kg	ND@10	ND	80
Nickel, Ni	EPA 7520	mg/kg	26.3	ND	105
Selenium, Se	EPA 7740	mg/kg	1.97	ND	95
Zinc, Zn	EPA 7950	mg/kg	1648	ND	103
Ammonia Nitrogen	EPA 250.2	%	1.13	ND	97
Nitrate Nitrogen	EPA 353.3	%	1.13	ND	102
Total Kjeldahl Nitrogen	EPA 351.3	%	4.35	ND	94
Total Phosphorus	EPA 365.3	%	3.72	ND	104
Total Solids	EPA 160.3	% Wet Wt	1.39	NA	NA
Volatile Solids	EPA 160.4	%	58.1	NA	NA
Potassium	EPA 7610	%	0.625	ND	93

ND = None Detected at Level Indicated
MDL = Method Detection Limit

APPROVED Durkee

APPROVED

NEILSON RESEARCH CORPORATION

Analysis Report

Sludge Analysis

NRC Sample ID: 99-3161
Received: 4/2/99
Analyzed: 4/5-15/99
Reported: 4/15/99

CLIENT MAILING ADDRESS
City of Bandon - WWTP
Attn: Bill Nielson
PO Box 67
Bandon, OR 97411

541-347-9122

SAMPLE LOCATION

WWTP
Digester #3

Date Collected: 4/1/99
Sample Point: Digester #3
Collector's Name: Nielson/City of Bandon

Matrix: Sludge
Analyst W. Batie/J. Thompson

Sludge Analysis

Analysis	Method	Test Results As Received	PQL As Received	Units As Received	Test Results Dry Wt.	PQL Dry Wt.	Units Dry Wt.
Arsenic, As	EPA 200.7	ND	0.05	mg/L	ND	0.2	mg/kg
Cadmium, Cd	EPA 200.7	ND	0.001	mg/L	ND	0.05	mg/kg
Chromium, Cr	EPA 200.7	ND	0.001	mg/L	ND	0.05	mg/kg
Copper, Cu	EPA 200.7	0.202	0.001	mg/L	10.3	0.05	mg/kg
Lead, Pb	EPA 200.7	0.006	0.003	mg/L	0.3	0.1	mg/kg
Mercury, Hg	EPA 245.1	ND	0.05	mg/L	ND	0.2	mg/kg
Molybdenum, Mo	EPA 200.7	ND	0.01	mg/L	ND	0.5	mg/kg
Nickel, Ni	EPA 200.7	ND	0.003	mg/L	ND	0.1	mg/kg
Selenium, Se	EPA 200.7	ND	0.003	mg/L	ND	2	mg/kg
Silver, Ag	EPA 200.7	ND	0.001	mg/L	ND	0.05	mg/kg
Zinc, Zn	EPA 200.7	0.449	0.001	mg/L	22.9	0.05	mg/kg
Ammonia Nitrogen	EPA 350.2	49	—	mg/L	0.25%	—	%
Nitrate Nitrogen	SM4500NO$_3$	170.5	—	mg/L	0.87%	—	%
Total Kjeldahl Nitrogen	EPA 351.3	227	—	mg/L	1.16%	—	%
Total Phosphorus	EPA 365.3	1339	—	mg/L	6.83%	—	%
Potassium	EPA 200.7	2.96	—	mg/L	0.0151%	—	%
Total Solids	EPA 160.3	—	—	% Solids	1.96%	—	% Solids
Volatile Solids	EPA 160.4	—	—	% VS	70.8%	—	% VS
Cyanide	SM4500CN-C/E	ND	0.02	mg/L	ND @ 0.001%	—	%

Release Data Authorization
Analytical Chemist

Kay Fowler
Reviewed and Approved

ND = None Detected at PQL

Methods = 40CFR- Part 136.3

PQL = Practical Quantitation Limit

NEILSON RESEARCH CORPORATION

Analysis Report

City of Bandon		Lab Order:	**0004365**
P.O. Box 67		NRC Sample ID	**0004365-01A**
Bandon, OR 97411		Collection Date:	**4/18/00 8:45:00 AM**
Client Sample ID:	**Digester #3**	Received Date:	**4/19/00 1:45:38 PM**
Sample Location:		Reported Date:	**5/9/00 2:52:59 PM**
Project:	**WWTP**	Matrix:	**Aqueous**

ANALYTICAL RESULTS

Analyte	Result	Reporting Limit	Qual	Units	Dilution Factor	Date Analyzed
Ammonia Nitrogen as N by SM 4500-NH3 E						***Analyst: JKT***
Nitrogen, Ammonia (As N)	0.560	0.00685		% Wt-Dry	1	5/2/00
Cyanide, Total by SM 4500CN-CE						***Analyst: JKT***
Cyanide	ND	13.7		mg/Kg-dry	10	5/3/00
Trace Metals by EPA 245.1						***Analyst: WCB***
Mercury	2.38	0.274		mg/Kg-dry	1	4/27/00
Trace Metals by EPA 200.7						***Analyst: WCB***
Arsenic	0.390	0.137		mg/Kg-dry	1	4/26/00
Cadmium	3.76	0.0342		mg/Kg-dry	1	4/26/00
Chromium	26.5	0.0342		mg/Kg-dry	1	4/26/00
Copper	401	0.0342		mg/Kg-dry	1	4/26/00
Lead	35.3	0.0685		mg/Kg-dry	1	4/26/00
Molybdenum	4.07	0.342		mg/Kg-dry	1	4/26/00
Nickel	21.7	0.0685		mg/Kg-dry	1	4/26/00
Potassium	8430	1.37		mg/Kg-dry	1	4/26/00
Selenium	5.27	0.685		mg/Kg-dry	1	4/26/00
Silver	4.24	0.0342		mg/Kg-dry	1	4/26/00
Zinc	ND	0.0685		mg/Kg-dry	1	4/26/00
Nitrate Nitrogen by EPA 300.0						***Analyst: JKT***
Nitrate Nitrogen	ND	0.00342		% Wt-Dry	5	5/2/00
Total Phosphorus as P by SM 4500-P E						***Analyst: JKT***
Phosphorus, Total (As P)	3.40	0.0875		% Wt-dry	25	5/5/00
% Total Solids by EPA 160.3						***Analyst: JKT***
Total Solids	1.46	1		%	1	4/26/00
% Volatile Solids by EPA 160.4						***Analyst: JKT***
Total Volatile Solids	63.5	1		%	1	4/26/00
Total Kjeldahl Nitrogen by SM 4500-NH3 E						***Analyst: JKT***
Nitrogen, Kjeldahl, Total	3.32	0.00685		% Wt-Dry	1	5/2/00

Qualifiers:

ND - Not Detected at the Reporting Limit

J - Analyte detected below quantitation limits

B - Analyte detected in the associated Method Blank

* - Value exceeds Maximum Contaminant Level

S - Spike Recovery outside accepted recovery limits

R - RPD outside accepted recovery limits

E - Value above quantitation range

Analysis Report

City of Bandon
P.O. Box 67 80 Fillmore
Bandon, OR 97411
Client Sample ID: **Digester #3**
Sample Location: **#3**
Project: **WWTP/Dig #3**

Lab Order: **0104488**
NRC Sample ID **0104488-01A**
Collection Date: **4/24/01 11:00:00 AM**
Received Date: **4/25/01 11:20:27 AM**
Reported Date: **5/7/01 3:35:49 PM**
Matrix: **Sludge**

ANALYTICAL RESULTS

Analyte	Result	PQL	Qual	Units	Dilution Factor	Date Analyzed
Ammonia Nitrogen as N by SM 4500-NH3 E						*Analyst: JKT*
Nitrogen, Ammonia (As N)	**0.216**	0.0966		% Wt-Dry	20	4/30/01
Cyanide, Total by SM 4500CN-CE						*Analyst: JKT*
Cyanide	**ND**	0.966		mg/Kg-dry	1	4/27/01
Trace Metals by EPA 245.1						*Analyst: WCB*
Mercury	**2.42**	0.0145		mg/Kg-dry	1	4/27/01
Trace Metals by EPA 200.7						*Analyst: WCB*
Arsenic	**ND**	0.483		mg/Kg-dry	1	5/2/01
Cadmium	**2.50**	0.0242		mg/Kg-dry	1	5/2/01
Chromium	**29.6**	0.0966		mg/Kg-dry	1	5/2/01
Copper	**372**	0.773		mg/Kg-dry	1	5/2/01
Lead	**35.3**	0.483		mg/Kg-dry	1	5/2/01
Molybdenum	**4.06**	0.145		mg/Kg-dry	1	5/2/01
Nickel	**22.6**	0.773		mg/Kg-dry	1	5/2/01
Potassium	**7660**	15.5		mg/Kg-dry	10	5/4/01
Selenium	**3.07**	1.55		mg/Kg-dry	1	5/2/01
Silver	**38.3**	0.0483		mg/Kg-dry	1	5/2/01
Zinc	**1340**	0.145		mg/Kg-dry	1	5/2/01
Nitrate Nitrogen by SM 4500-NO3-E						*Analyst: JKT*
Nitrate Nitrogen	**0.156**	0.0121		% Wt-Dry	50	4/25/01
Total Phosphorus as P by SM 4500-P E						*Analyst: JKT*
Phosphorus, Total (As P)	**3.20**	0.0875		% Wt-Dry	25	4/30/01
% Total Solids by SM 2540B						*Analyst: JKT*
Total Solids	**2.07**	1		%	1	4/25/01
% Volatile Solids by SM 2540G						*Analyst: JKT*
Total Volatile Solids	**69.6**	1		%	1	4/25/01
Total Kjeldahl Nitrogen by SM 4500-NH3 E						*Analyst: JKT*
Nitrogen, Kjeldahl, Total	**3.58**	0.0966		% Wt-Dry	20	4/30/01

Qualifiers:
ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
B - Analyte detected in the associated Method Blank
* - Value exceeds Maximum Contaminant Level
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
E - Value above quantitation range

NEILSON RESEARCH CORPORATION

Analysis Report

City of Bandon
P.O. Box 67 80 Fillmore
Bandon, OR 97411
Client Sample ID: **Digester #3**
Sample Location: **Digester #3**
Project: **WWTP/Dig #3**

Lab Order: **0109477**
NRC Sample ID **0109477-01A**
Collection Date: **9/25/01 11:35:00 AM**
Received Date: **9/26/01 11:17:32 AM**
Reported Date: **10/11/01 3:08:36 PM**
Matrix: **Sludge**

ANALYTICAL RESULTS

Analyte	Result	PQL	Qual	Units	Dilution Factor	Date Analyzed
Ammonia Nitrogen as N by SM 4500-NH3 E						*Analyst: JKT*
Nitrogen, Ammonia (As N)	1.30	0.152		% Wt-Dry	20	10/8/01
Cyanide, Total by SM 4500CN-CE						*Analyst: JKT*
Cyanide	ND	15.2		mg/Kg-dry	1	10/3/01
Fecal Coliform Bacteria by SM 9221E						*Analyst: DLC*
Fecal Coliform Bacteria	378789	2		org/gmTS	1	9/28/01
Fecal Coliform Bacteria	526870	2		org/gmVS	1	9/28/01
Trace Metals by EPA 245.1						*Analyst: WCB*
Mercury	10.8	0.0227		mg/Kg-dry	1	10/5/01
Trace Metals by EPA 200.7						*Analyst: WCB*
Arsenic	ND	0.758		mg/Kg-dry	1	10/9/01
Cadmium	2.55	0.0379		mg/Kg-dry	1	10/9/01
Chromium	15.1	0.152		mg/Kg-dry	1	10/9/01
Copper	222	1.21		mg/Kg-dry	1	10/9/01
Lead	58.0	0.758		mg/Kg-dry	1	10/9/01
Molybdenum	4.45	0.227		mg/Kg-dry	1	10/9/01
Nickel	28.5	1.21		mg/Kg-dry	1	10/9/01
Potassium	1.21%	24.2		% Dry Wt.	10	10/9/01
Selenium	8.30	2.42		mg/Kg-dry	1	10/9/01
Silver	26.9	0.0758		mg/Kg-dry	1	10/9/01
Zinc	1070	0.227		mg/Kg-dry	1	10/9/01
Nitrate Nitrogen by SM 4500-NO3-E						*Analyst: JKT*
Nitrate Nitrogen	0.0173	0.00947		% Wt-Dry	25	10/8/01
Total Phosphorus as P by SM 4500-P E						*Analyst: JKT*
Phosphorus, Total (As P)	3.81	0.425		% Wt-Dry	25	10/5/01
% Total Solids by SM 2540B						*Analyst: JKT*
Total Solids	1.32	1		%	1	9/28/01
% Volatile Solids by SM 2540G						*Analyst: JKT*
Total Volatile Solids	71.9	1		%	1	9/28/01
Total Kjeldahl Nitrogen by SM 4500-NH3 E						*Analyst: JKT*

Qualifiers:
ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
B - Analyte detected in the associated Method Blank
* - Value exceeds Maximum Contaminant Level
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
E - Value above quantitation range

NEILSON RESEARCH CORPORATION

Analysis Report

City of Bandon		Lab Order:	**0109477**
P.O. Box 67 80 Fillmore		NRC Sample ID	**0109477-01A**
Bandon, OR 97411		Collection Date:	**9/25/01 11:35:00 AM**
Client Sample ID:	**Digester #3**	Received Date:	**9/26/01 11:17:32 AM**
Sample Location:	**Digester #3**	Reported Date:	**10/11/01 3:08:36 PM**
Project:	**WWTP/Dig #3**	Matrix:	**Sludge**

ANALYTICAL RESULTS

Analyte	Result	PQL	Qual	Units	Dilution Factor	Date Analyzed
Nitrogen, Kjeldahl, Total	5.77	0.152		% Wt-Dry	20	10/8/01

Qualifiers:

ND - Not Detected at the Reporting Limit	S - Spike Recovery outside accepted recovery limits
J - Analyte detected below quantitation limits	R - RPD outside accepted recovery limits
B - Analyte detected in the associated Method Blank	E - Value above quantitation range
* - Value exceeds Maximum Contaminant Level	

NEILSON RESEARCH CORPORATION

Analysis Report

City of Bandon
P.O. Box 67
Bandon, OR 97411
Client Sample ID: **Nelson Ranch #1**
Sample Location: **Nelson Ranch #1**
roject: **Nelson Ranch Site #1**

Lab Order: 0010512
NRC Sample ID 0010512-01A
Collection Date: 10/24/00 9:00:00 AM
Received Date: 10/25/00 9:06:18 AM
Reported Date: 11/2/00 4:51:34 PM
Matrix: Solid

ANALYTICAL RESULTS

Analyte	Result	PQL	Qual	Units	Dilution Factor	Date Analyzed
Nitrite Nitrogen by SM 4500-NO2-B						*Analyst: JKT*
Nitrite Nitrogen	ND	0.05		mg/Kg	5	10/26/00
Nitrate Nitrogen by SM 4500-NO3-E						*Analyst: JKT*
Nitrate Nitrogen	ND	1.25		mg/Kg	25	10/27/00

Qualifiers:
ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
B - Analyte detected in the associated Method Blank
* - Value exceeds Maximum Contaminant Level
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
E - Value above quantitation range

NEILSON RESEARCH CORPORATION

Analysis Report

City of Bandon
P.O. Box 67
Bandon, OR 97411

Client Sample ID: Dew Valley
Sample Location: Dew Valley
Project: Dew Valley

Lab Order: 0010416
NRC Sample ID: 0010416-01A
Collection Date: 10/14/00 11:00:00 AM
Received Date: 10/19/00 12:20:00 PM
Reported Date: 11/9/00 11:47:04 AM
Matrix: Solid

ANALYTICAL RESULTS

Analyte	Result	PQL	Qual	Units	Dilution Factor	Date Analyzed
Ammonia Nitrogen as N by SM 4500-NH3 E						*Analyst: JKT*
Nitrogen, Ammonia (As N)	ND	500		mg/Kg	1	11/2/00
Trace Metals by EPA 6010B						*Analyst: WCB*
Arsenic	ND	0.497		mg/Kg	1	11/1/00
Cadmium	ND	0.0497		mg/Kg	1	11/1/00
Chromium	21.3	0.497		mg/Kg	1	11/1/00
Copper	3.82	0.497		mg/Kg	1	11/1/00
Lead	4.98	0.497		mg/Kg	1	11/1/00
Molybdenum	ND	0.993		mg/Kg	1	11/1/00
Nickel	5.26	0.497		mg/Kg	1	11/1/00
Selenium	ND	0.993		mg/Kg	1	11/1/00
Silver	ND	0.0993		mg/Kg	1	11/1/00
Zinc	9.80	0.0993		mg/Kg	1	11/1/00
Nitrite Nitrogen by SM 4500-NO2-B						*Analyst: JKT*
Nitrite Nitrogen	ND	0.05		mg/Kg	5	10/19/00
pH in Soil by EPA 9045C						*Analyst: JJS*
pH	5.30	0.1		pH Units	1	10/31/00
Total Phosphorus as P by SM 4500-P E						*Analyst: JKT*
Phosphorus, Total (As P)	ND	1		mg/Kg	1	10/31/00
Total Kjeldahl Nitrogen by SM 4500-NH3 E						*Analyst: JKT*
Nitrogen, Kjeldahl, Total	ND	500		mg/Kg	1	11/2/00
Total Organic Carbon by EPA415.1						*Analyst: SUB*
Organic Carbon, Total	21400	100		mg/kg	1	11/6/00

Qualifiers:
ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
B - Analyte detected in the associated Method Blank
* - Value exceeds Maximum Contaminant Level
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
E - Value above quantitation range

CITY OF BANDON

WASTEWATER TREATMENT FACILITIES
Condition Assessment

May 2018

WATERDUDE
SOLUTIONS

Prepared by Mark Walter, Operations Specialist

Contents

Executive Summary

The City of Bandon operates and maintains a 0.50 Wastewater Treatment Plant (WWTP) that experienced its last plant wide improvement project in 1993. Since then the facility has completed several system specific upgrades including:

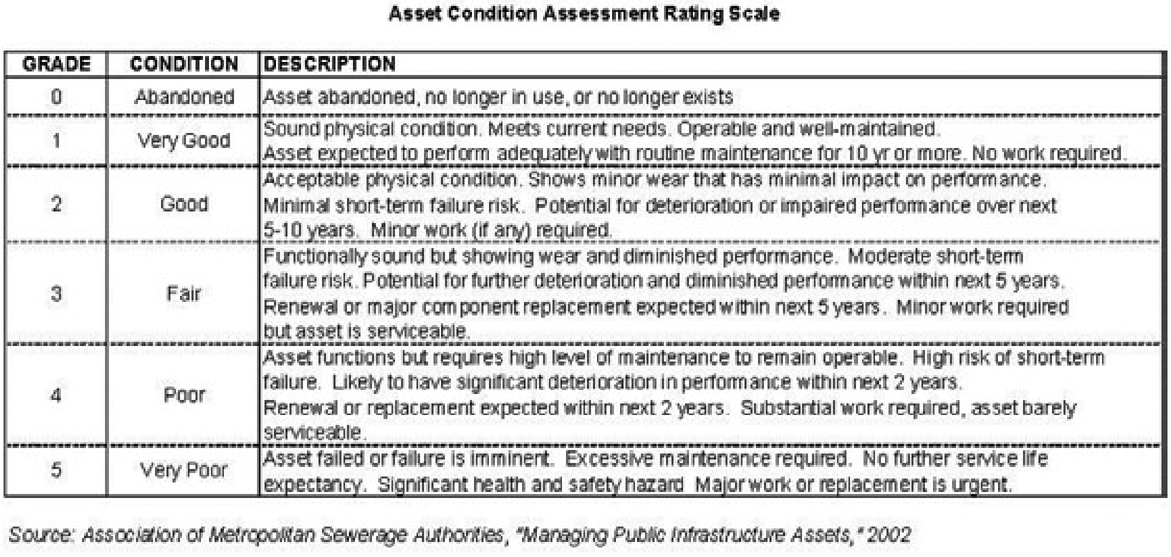
- Influent Screen system was replaced in early 2000's
- Ultraviolet Disinfection system replaced in 2009
- Standby Generator for WWTP installed in 2014
- Thickening system was replaced in 2015.

The City hired Waterdude Solutions in March of 2018 to conduct condition assessment activities and provide this report. The goal of the assessment is effort is to provide the City with current system condition information that can be used to plan repair and refurbishments. The asset data in this report can also be used to develop a Computerized Maintenance Management System (CMMS) that will schedule and track maintenance activities.

This condition assessment includes the systems within the WWTP and the Influent Pump Station. Condition assessment activities included document review, staff interviews and facility inspection. Routine maintenance and repair work is performed by operation staff. Specialty trade work including electrical, instrumentation is performed by contractors. Operations and maintenance activities are recorded in a Log Book for future reference.

Systems and components were rated using the rating system described in Table ES 1.0. This rating system is published by the Association of Metropolitan Sewerage Agencies (AMSA) in Managing Public Infrastructure Assets to Minimize Cost and Maximize Performance, 2002.

ES 1.0 Summary of Condition Rating System



Asset Condition Assessment Rating Scale

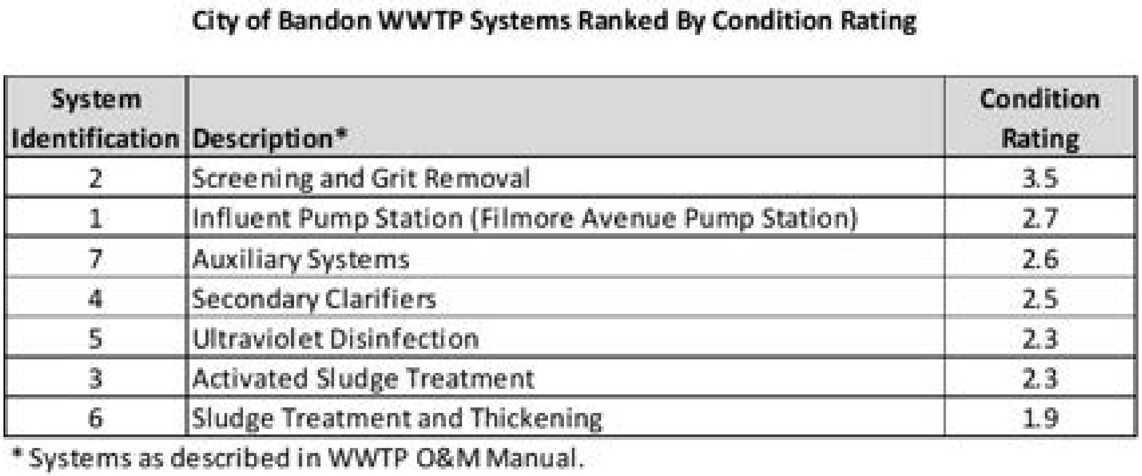
GRADE	CONDITION	DESCRIPTION
0	Abandoned	Asset abandoned, no longer in use, or no longer exists
1	Very Good	Sound physical condition. Meets current needs. Operable and well-maintained. Asset expected to perform adequately with routine maintenance for 10 yr or more. No work required.
2	Good	Acceptable physical condition. Shows minor wear that has minimal impact on performance. Minimal short-term failure risk. Potential for deterioration or impaired performance over next 5-10 years. Minor work (if any) required.
3	Fair	Functionally sound but showing wear and diminished performance. Moderate short-term failure risk. Potential for further deterioration and diminished performance within next 5 years. Renewal or major component replacement expected within next 5 years. Minor work required but asset is serviceable.
4	Poor	Asset functions but requires high level of maintenance to remain operable. High risk of short-term failure. Likely to have significant deterioration in performance within next 2 years. Renewal or replacement expected within next 2 years. Substantial work required, asset barely serviceable.
5	Very Poor	Asset failed or failure is imminent. Excessive maintenance required. No further service life expectancy. Significant health and safety hazard Major work or replacement is urgent.

Source: Association of Metropolitan Sewerage Authorities, "Managing Public Infrastructure Assets," 2002

The overall average condition rating for the seven systems assessed fell between Good and Fair. Among the seven systems, twenty-three components were rated as Poor to Very Poor condition. The Components at most risk of failure is identified in Section 4 Results. The assessment results do not include valves and pressure gauges in Poor condition because of an existing replacement plan for these assets.

Table ES 2.0 provides a summary of the System condition ratings. The Systems at most risk of component failure is listed first with improved ratings in descending order.

ES 2.0 Summary of Overall System Condition Ratings



City of Bandon WWTP Systems Ranked By Condition Rating

System Identification	Description*	Condition Rating
2	Screening and Grit Removal	3.5
1	Influent Pump Station (Filmore Avenue Pump Station)	2.7
7	Auxiliary Systems	2.6
4	Secondary Clarifiers	2.5
5	Ultraviolet Disinfection	2.3
3	Activated Sludge Treatment	2.3
6	Sludge Treatment and Thickening	1.9

* Systems as described in WWTP O&M Manual.

Section 1 Introduction

The following condition report is formatted around functional systems. Systems were derived from the Operations and Maintenance Manual for the City of Bandon Water Pollution Control Plant prepared by Brown and Caldwell in 1993 and Piping and Instrumentation (P&ID) Drawings found in the 1992 Contract Documents for the Bandon Wastewater Treatment Plant Improvements

Information for the Dewatering system was obtained from the 2015 Operations and Maintenance manual for the Bandon Dewatering and Pump Station Improvements prepared by Pacific Excavation.

Ultraviolet disinfection system information was obtained from the 2010 UV system installation booklet and 2012 operations and maintenance manual.

1.1 Purpose

The purpose of this report is to provide the City of Bandon with an assessment of the condition of assets at Wastewater Treatment Plant (WWTP) and Influent Pump Station (IPS). The information in this report is intended to be used to develop strategies for system replacement, repair or refurbishment.

1.2 Organization

In addition to the Executive Summary and this introductory section, this report includes the following sections:

Section 2 – System Description. Includes a system table and description of each of the systems.

Section 3 – Condition of Facilities. Provides a description of the condition assessment approach and individual system condition assessments.

Section 4 – Results. Lists the deficiencies at system and component level that are at the greatest risk of failure.

Section 2 System Description

The WWTP Systems have been identified utilizing Operations and Maintenance Manual for the City of Bandon Water Pollution Control Plant. The manual identifies seven systems within the WWTP including the Influent Pump Station.

The System descriptions found in the O&M manual utilize the same numbering scheme found on the field tags for the associated assets. The description and asset tag numbers are used to identify the components within each system.

Documentation used to develop the systems and component list included:

Facility Operation and Maintenance Manual prepared by Brown and Caldwell

Construction Documents prepared by Brown and Caldwell

Construction Documents prepared by Pacific Excavation

The system identification numbers are derived from the Operations and Maintenance Manual for the City of Bandon Water Pollution Control Plant. The system identification utilizes a numbering scheme that connects assets based on structure location. The following table illustrates the number series for each structure.

The Unit Process number is specific to this report and is used to sequence the systems.

Table 2.0 describes the Systems and the Structure number series associated with each.

Table 2.0 Systems

City of Bandon Wastewater Treatment Department

Unit Process Number	Description*	Structure Number
1	Influent Pump Station (Filmore Avenue Pump Station)	3000
2	Screening and Grit Removal	5000
3	Activated Sludge Treatment	5000
4	Secondary Clarifiers	6000
5	Ultraviolet Disinfection	7000
6	Sludge Treatment and Thickening	7000
7	Auxiliary Systems	8000

* Systems as described in WWTP O&M Manual.

The intent of this strategy is to maintain existing nomenclature so that the information in this report can be used to support future maintenance management implementation efforts.

2.1 System Summary

Influent Pump Station

The influent pump station provides raw sewage pumping to the WWTP screening and grit systems. Two vertical turbine pumps were installed as part of a 1992 pump station retrofit. Backup power to the pump station is provided by the WWTP standby generator.

Screening and Grit Removal

The screening and grit removal systems are designed to remove debris and grit from the incoming sewage. The original rotary screen was replaced with a grinder, screen combination unit in the early 2000’s. The original screening compactor is in operation.

The grit removal system includes an aerated grit chamber, a grit pump and grit concentrators. The original odor control system is not in service currently.

Activated Sludge Treatment

The activated sludge system includes two aerated basins with selectors, flow control gates, fine bubble aeration and rotary blowers. One aeration basin is required for current treatment conditions. Activated sludge monitoring incudes dissolved oxygen levels and solids concentration.

Secondary Clarification

Secondary clarification is provided by two circular clarifiers. Each clarifier is a center feed unit with a rotating sludge removal mechanism. The system includes flow control gates, valves and scum pumping.

Return Activated Sludge (RAS) is pumped from the clarifiers to the aeration basins. The RAS rate is automated to maintain a consistent solids concentration in the aeration basins.

Ultraviolet Disinfection

Effluent is disinfected using vertically mounted ultraviolet (UV) lamps. There are two channels, each with three modules of 16 lamps. The original UV system was replaced in 2009 to meet more stringent WWTP discharge requirements.

Sludge Treatment and Thickening

The sludge treatment system consists of three basins utilizing aerobic digestion to stabilize the sludge. Aeration is provided by the same blowers serving the aerated grit and activated sludge systems.

The original thickening system was replaced in 2015 with a self-contained Fan Press dewatering system. The system includes pressate monitoring and two conveyors.

Auxiliary Systems

Five auxiliary systems provide service to various areas of the WWTP. These auxiliary systems include: 3W Water, Service Air, Plant Drain, Telemetry and Alarms, and Electrical Distribution.

The 3W Water system includes two vertical turbine pumps that provide pressurized effluent water to various areas of the WWTP. This includes sprayers at the headworks and clarifiers, hose down water and in-plant irrigation. A hydropneumatic tank provides surge suppression for the 3W system.

Service Air is provided by an air compressor and includes pressurized air storage.

The Plant Drain pump station collects WWTP drainage. The system is manually operated when draining the grit basin, aeration basins, clarifiers or aerobic digesters.

Electrical Distribution includes the transformer, switchgear, motor control centers (MCC), and breaker panels. In 2015 a new power generator was installed to provide backup power to the WWTP and IPS.

Section 3 Condition of Facilities

3.1 Condition Assessment Approach

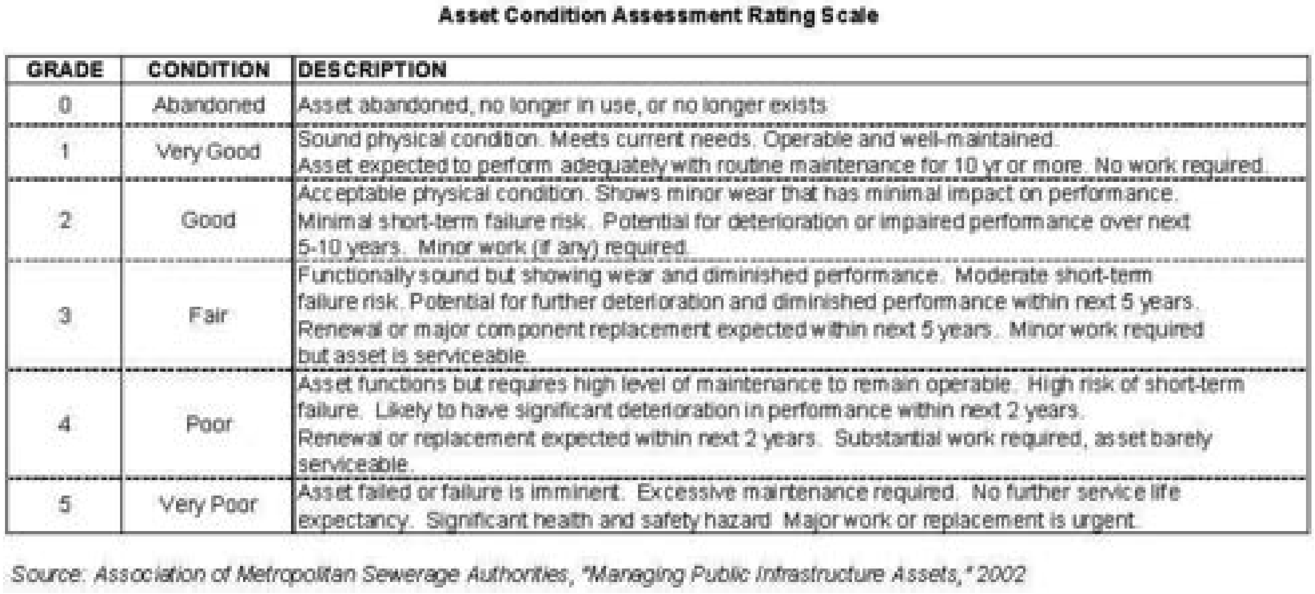
The condition assessments are based on a review of available information, staff knowledge and physical inspection of facilities. The condition assessment process included development of an asset and systems inventory. Condition assessment activities included visual inspection and observation of operation when possible. Operating staff were interviewed to obtain historical operation and performance history.

For rotating equipment, a FLUKE Model 805 FC vibration meter was used to assess bearing condition and vibration. The use of this device is intended to detect adverse mechanical conditions that require further investigation.

The wastewater treatment systems were rated on asset condition and operational function. Each system assessment includes a System Condition Summary, a Component Condition Summary, Condition Ratings Table and a System Photo Summary. System condition summaries provide information on the operational performance of the system and addresses the condition of system.

The component condition score provides a rating for the overall condition of the asset. Each asset was assigned an Asset Condition Rating based on the scale shown in Table 3.1.

Table 3.1



Asset Condition Assessment Rating Scale

GRADE	CONDITION	DESCRIPTION
0	Abandoned	Asset abandoned, no longer in use, or no longer exists
1	Very Good	Sound physical condition. Meets current needs. Operable and well-maintained. Asset expected to perform adequately with routine maintenance for 10 yr or more. No work required.
2	Good	Acceptable physical condition. Shows minor wear that has minimal impact on performance. Minimal short-term failure risk. Potential for deterioration or impaired performance over next 5-10 years. Minor work (if any) required.
3	Fair	Functionally sound but showing wear and diminished performance. Moderate short-term failure risk. Potential for further deterioration and diminished performance within next 5 years. Renewal or major component replacement expected within next 5 years. Minor work required but asset is serviceable.
4	Poor	Asset functions but requires high level of maintenance to remain operable. High risk of short-term failure. Likely to have significant deterioration in performance within next 2 years. Renewal or replacement expected within next 2 years. Substantial work required, asset barely serviceable.
5	Very Poor	Asset failed or failure is imminent. Excessive maintenance required. No further service life expectancy. Significant health and safety hazard. Major work or replacement is urgent.

Source: Association of Metropolitan Sewerage Authorities, "Managing Public Infrastructure Assets," 2002

3.2 Condition Rating by System

The System condition rating is determined by averaging the component ratings within a system. The final system condition rating is determined after considering operational impact and reliability concerns.

The overall condition ratings for the Systems assessed are summarized in Table 3.2.

Table 3.2

City of Bandon Wastewater Treatment Department

System Identification	Description*	Condition Rating
1	Influent Pump Station (Filmore Avenue Pump Station)	2.7
2	Screening and Grit Removal	3.5
3	Activated Sludge Treatment	2.3
4	Secondary Clarifiers	2.5
5	Ultraviolet Disinfection	2.3
6	Sludge Treatment and Thickening	2.0
7	Auxiliary Systems	2.6

* Systems as described in WWTP O&M Manual.

3.3 System Condition Assessments

This section includes individual System condition assessments. The electronic version of this report allows access to each of the Systems assessments by clicking the link located in the Table of Contents.

3.3.1 Influent Pump Station System

The Influent Pump Station (IPS) system consists of the following components:

- Influent Pumps
- Valves & Piping
- Controls
- Ventilation
- Grease Control

System Condition Summary

The influent pump station system is in Good to Fair condition. The pumping system is in Good condition. Pump maintenance is performed regularly in 6 to 18-month intervals. Much of the maintenance is performed during pump un-plugging and rag removal activities. Maintenance activities are recorded in a log book. Lubrication is scheduled and performed by referencing the log book. The pumping capacity of the IPS is sufficient for the flows received by the WWTP. A standby portable pump is available if one of the IPS pumps fail. This system was online and in service during the inspection due to IPS Pump 2 being out of service.

The Control system is in Fair condition because of the additional operational and maintenance activities needed to maintain reliability. A Capital Improvement project has been established to investigate the IPS pump control system. Including potential solutions for grit, rag and debris build up.

Component Condition Summary

Influent Pumps

During the assessment IPS Pump 2 was out of service for repairs. IPS Pump 1 was in operation and performing with in design. The pump motor and Variable Speed Drive (VFD) are in Good condition. Recommend nondestructive online Motor testing to confirm internal components are reliable.

Valves and Piping

The valves and piping located at the Influent Pump Station are in Fair condition. Valves are operational with some corrosion on valve handles and check valve springs.

The exterior of the piping appears to be in Good condition. The interior piping was exposed during the assessment due to IPS Pump 2 being out of service for repairs. A visual inspection of the interior of the discharge piping showed moderate corrosion in the interior of the piping.

Controls

The Control System is rated in Fair to Poor condition. The control system requires regular operator attention due to system performance issues caused by grit, grease and rags. Due to the size and configuration of the wet well grit, rags and debris build up and require regular maintenance. Operators report that there are also nuisance alarms from the bubbler system that are attributed to grease build up in the system. Operator activities include regular flushing of the bubbler and scheduling of a Vacuum truck to remove debris.

It is noted that the City’s grease trap inspection program has resulted in less grease accumulation in the wet well. Operations staff have also installed a grease control system to decrease grease accumulation in the wet well and bubbler system.

The control system is also affected by the size of the wet well. During the assessment the IPS Pump was cycling on and off about every 1-2 minutes. This start/stop cycling stresses electrical systems, specifically the pump motor and VFD. The cycling also results in flow surges to the WWTP.

Ventilation

Ventilation system shows some corrosion in the exhaust fan. Other components appeared in Good Condition.

Grease Control

An Eco-Bionics system is installed in the IPS for grease control. The system is designed to dispense live bacteria into the wastewater stream to increase the natural breakdown of organic waste, including soluble BOD, TSS, ammonia, and FOG. The system is in operation and appeared in Good condition.

Condition Rating Table

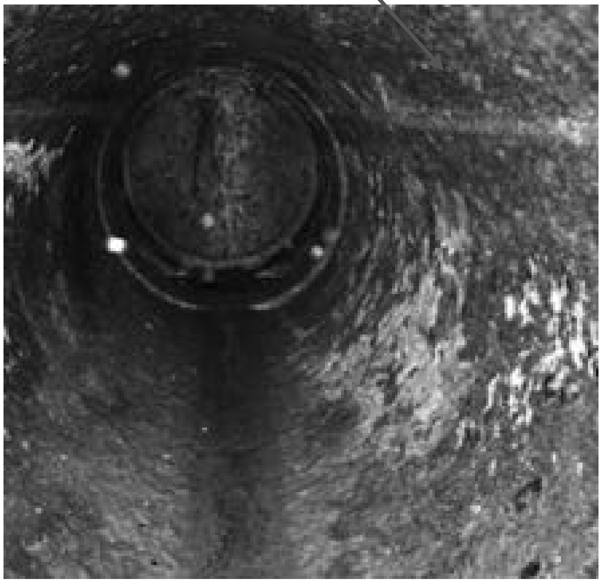
System	Process Number		
Influent Pump Station	3000		
Equipment Description	**Asset Tag Number**	**Rating**	**Comments**
Influent Pump 1	P-3110	2	Fairbanks Morse Pump; VFD Drive installed ~7 years ago; 30 HP Motor; Bearings and Vibration rated as Good.
Variable Frequency Drive	VFD-3110	2	VFD replaced approximately ~2011
Solenoid Valve	FV-3251	3	Valve in fair condition
Influent Pump 2	P-3120		Fairbanks Morse Pump; VFD Drive; Pump Out of service, being rebuilt due to unknown impact to impellor. Portable Standby pump is installed, tested and in standby mode.
Variable Frequency Drive	VFD-3120	2	VFD replaced approximately ~2011
Solenoid Valve	FV-3252	4	Solenoid valve cover corroded and cracked.
Valves		3	10" Plug and Check Valve, Pressure Gauge, Pinch Valve for pump start up all operational; Overflow has Swing Check; Plug valve moderate corrosion on operator stem. The check valve spring is corroded.
Piping		3	Piping exterior Good. Discharge piping for Pump 2 shows moderate internal piping corrosion.
Compressor	CP-3230	3	Instrument Air compressor supplies Bubbler and Pinch valve; Additional compressor is installed external to the contorl cabinet.
Wet Well Level Bubbler	LE-3115	4	Bubbler system requires blow down to prevent grease build up. Nusance alarms are occuring related to system plugging.
Controls	PNL-3300	4	Has bypass panel and VFD control ; Pump low level shut off = none.; Start stop cycles often as 2-3x per 5min.; Station has been retrofitted once. New standby generator runs IPS and WWTP.
Exhaust Fan	F-3220	4	Fan shroud is severely corroded.
Electrical Room Intake Louver	LVR-3210	2	Louver is present.
Back flow Device		2	Back flow device is tested annually.
Seal Water		2	Pressure indicator and alarm
	Overall Rating	2.7	

Influent Pump Station System Photo Summary

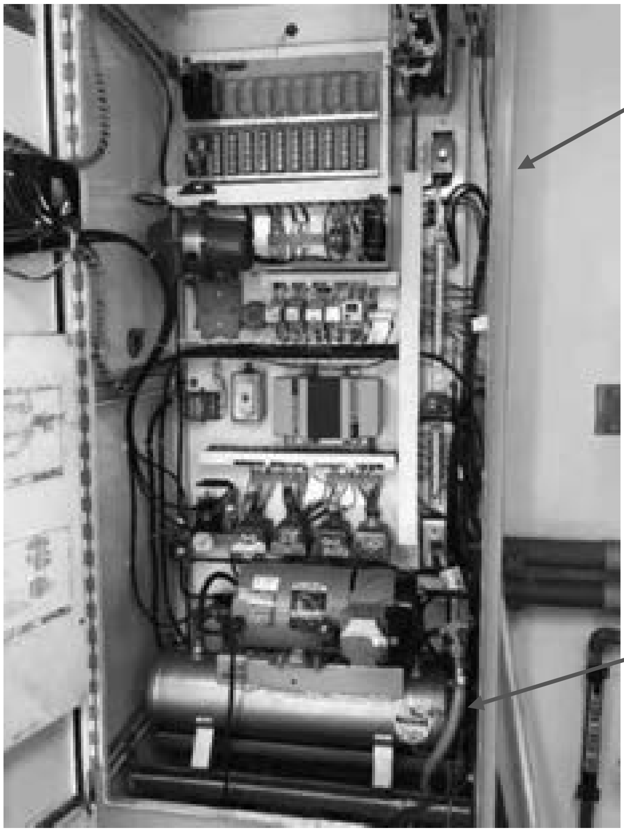
IPS Pump 1(left). Lower photo shows corrosion on handwheel stem and check valve spring.

Stand-by portable pump for IPS. Pump 2 removed for repairs.

Pump 2 discharge piping interior corrosion and pitting.



VFD Enclosure



VFD Enclosure – Internal view.

Temporary replacement compressor to supplement IPS instrument air.

IPS Control Panel. Wet well level indication, bubbler system status and lead/lag pump selection.

Bubbler system requires regular back flushing to maintain pump/wet well level control.

Eco-Bionics biological additive for grease control.

3.1.2 Screening and Grit Removal

The Screening and Grit Removal system consists of the following components:

Influent Screen

Screening Compactor

Grit Removal

Gates

Valves & Piping

Controls

Process Air

System Condition Summary

The screening and grit removal system is in Fair to Poor condition due to corrosion and operational deficiencies. Hydraulic loadings to the screening system ranges from a dry weather flow of 0.30 Million Gallons Per Day (MGD) to a peak flow of 1.2 MGD during the winter. As flows increase, headloss in the influent channel causes flow to bypass the screen. When this occurs, flow bypasses the screen at two locations, one location is through the grinder to the screen discharge channel. The second location is through the manual screen which provides coarse screening only.

The grit system is in Poor condition due to corrosion of much of the equipment. Operational deficiencies in the screening system also cause additional debris to accumulate in the Grit Removal system. Operators must use air to backflush grit pump to aerated grit chamber piping due to the debris plugging the line.

Loading to the grit removal system is decreased due to the design of the upstream influent pump station wet well. Operators report that significant grit accumulates in the wet well which requires removal via Vacuum Truck.

The Odor Control System has been removed from service and is not included in this assessment.

Component Condition Summary

Influent Screen

The mechanical condition of the screen is rated as Fair. The overall condition of the screen is Poor due to corrosion and the fact all screening is bypassed during higher flows. The bypass condition is occurring due to the excessive headloss generated by the existing screen under those conditions. This condition is worsened when the screen headloss surcharges the influent channel to the point influent flows into the manual screen channel. Under this condition both screening and grit removal is bypassed. Some of the headloss is a result of replacing the original 8mm screen with a 3mm screen. The screen was replaced due to pass through of organic matter with the 8mm screen. No overflows of the structure have been reported due to the higher headloss created by the 3mm screen.

The pre-screening grinder is in Poor condition due to excessive vibration caused by bearing wear at the motor/gearbox. The cutting assembly is in Fair condition due to it being recently replaced.

Screening Compactor

The Screenings Compactor is in Poor condition due to severe corrosion. An additional impact is that the unit can only be operated in manual due to operational concerns. The concern being that when the compacted material sits in the piping it gets stuck in the piping. This is a known issue with this type of compacted material conveyance. Operators also reported hydraulic issues with the compactor screen if the upstream rags contain a lot of water.

Production of the compacted material from the screen is minimal at one five gallon bucket per day.

Grit Removal

The Grit Removal system is in Fair condition. Corrosion of the Grit separator and Grit Cyclone reduce this rating to Poor condition. The grit pump is in Fair condition. The aerated grit chamber and associated components are in Good condition.

Gates

Hand pull gates to isolate the grit chamber are in Good condition.

Valves & Piping

Isolation valves and piping are in Good to Fair condition

Controls

Controls are operable, and the panels are servable. Level sensing probes are rated in Good to Fair condition. Controls are rated in Fair condition due to age and weathering.

Process Air

Process air for the aerated grit chamber is provided by the blowers serving the activated sludge system. Condition ratings for the blowers are included in the Activated Sludge system assessment.

Condition Rating Table

System	Process Number
Screening and Grit Removal	5000

Equipment Description	Asset Tag Number	Rating	Comments
Screen	SCN-5110	4	Original Screen replaced with existing JWC Screen/ Grinder system ~2002. Screen shaft and brushes Fair condition. Screen is in good condition. Screen runs continuously, if stops then flow goes over a weir to the manual screen. Good Vib/Bearing; Screen size reduced from 8mm to 3mm; Influent bypasses much of the screen at higher flows due to headloss.
Grinder		4	Analyzer recorded high vibration and bearing wear at motor-grinder connection. Noise is noticable and supports analyzer readings. Grinder cutter assembly was replaced about 2 years ago
Screenings Compactor	SPT-5111	4	Hydraulic press compactor; Ram has been rebuilt approximatley 10 times; Lubrication leakage and corrosion throughout operating mechanisms. Motor bearing vibe good. Operated manually due to seizing of compacted material when it sits.
Aerated Grit Tank		2	Concrete tank with aluminum hatches. Coarse air diffusers and piping are located inside the tank. Appendix B has target air flow rates; Air flow to the grit is the only one reading ~1250 scfm;
Grit Pump	P-5651	3	Operates off of timer; Good mechanical condition; Heavy lube; Motor bearing vibration good. Some vibration at drive area (Motor/Belt Pump); Some corrosion at stuffing box area. Isolation valves good.
Cyclone Separator	SEP-5212	4	Operational. Showing moderate corrosion of metal structure.
Grit Classifier	WHR-5218	4	Corrosion occurring through structure. Screwless auger showing polished edges indicating metal to metal contact in submerged area. Weir gate adjustment valve corroded in place and not operable.
Slide Gates	SG-5216	3	Aluminum hand pull slide gates
Slide Gates	SG-5217	3	Aluminum hand pull slide gates
Air Actuated Valve	FV-5101	4	Out of Sevice; Air actuated valves in place; Manually adjusted.
Air Actuated Valve	FV-5102	4	Out of Serivce; Air actuated valves in place; Manually adjusted.
Odor Reduction Tower	ORT-5150		Removed from service. Equipment abandoned in place
Fan, Odor control	F-5151		Removed from service. Equipment abandoned in place
Piping		3	No piping defects observed.
Controls		3	Control cabinet is weather tight and serviceable. Cabinet is weather worn and has a wooden cover to help keep weather out.
	Overall Rating	3.5	

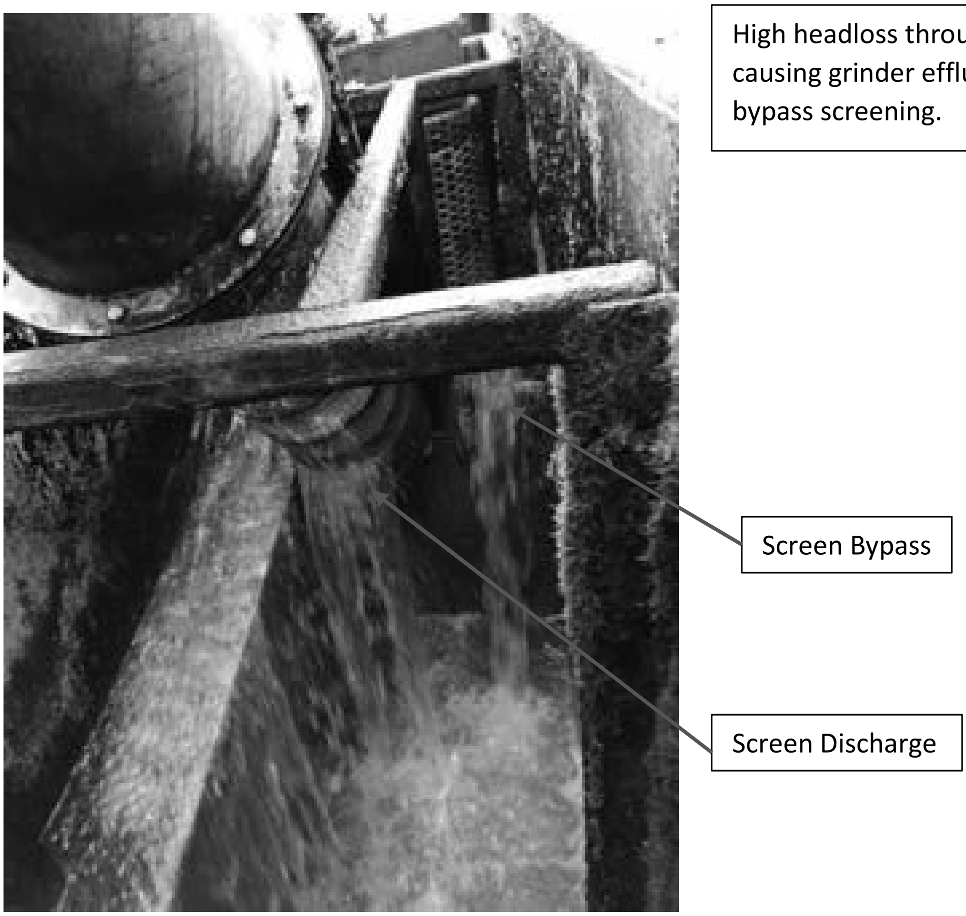
Screening and Grit Removal System Photo Summary

The original Rotary Drum Screen has been replaced. The existing influent screening system consists of a Grinder followed by a Screen.

Screening system Control Panel.

Screen support structure showing delamination of metal indicating severe corrosion.

Grinder support structure showing moderate corrosion


High headloss through screen causing grinder effluent to bypass screening.

Increased headloss through the screen during high influent flows also causes partial influent flow diversion to manual bar screen. Cycling of influent pumps creates on/off flow conditions that allow manual screen to drain periodically. Operators are diverted from other duties to clear manual screen.

Manual Screen with flow

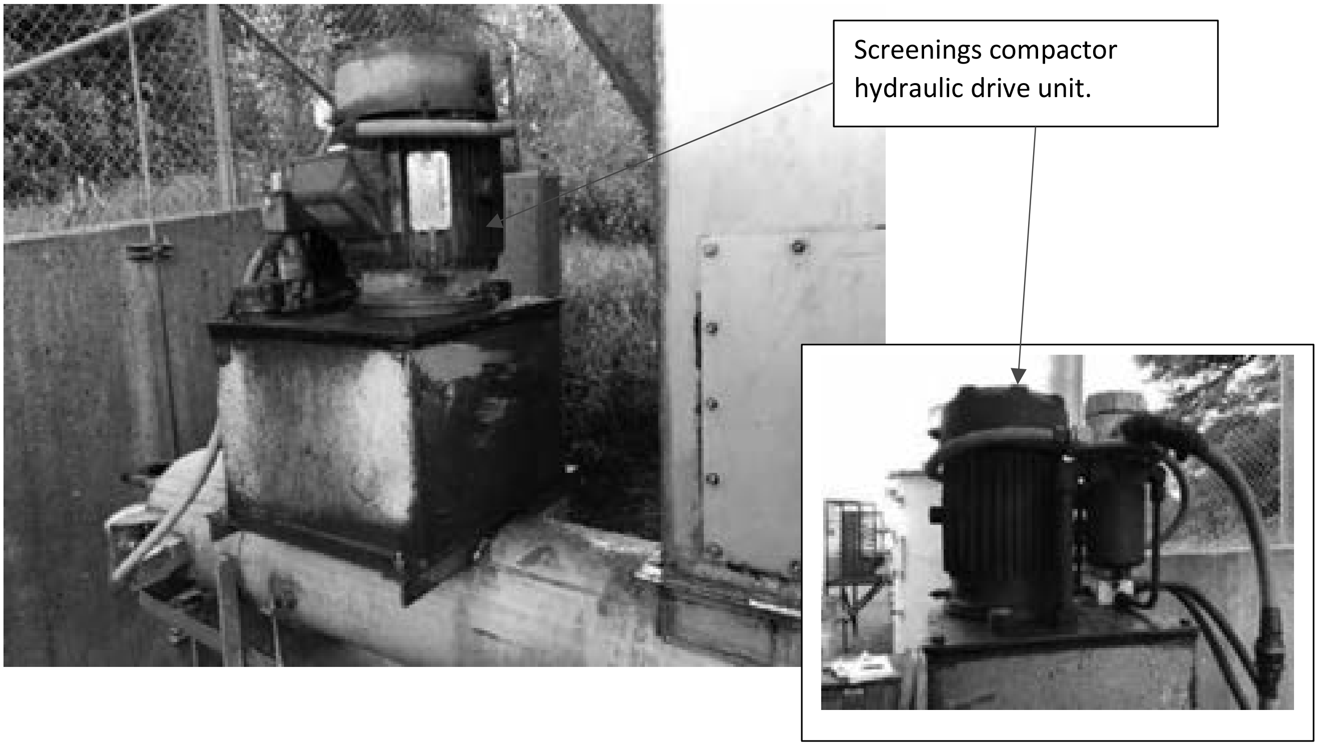
Manual Screen with no flow

Aerated Grit Chamber access hatches.

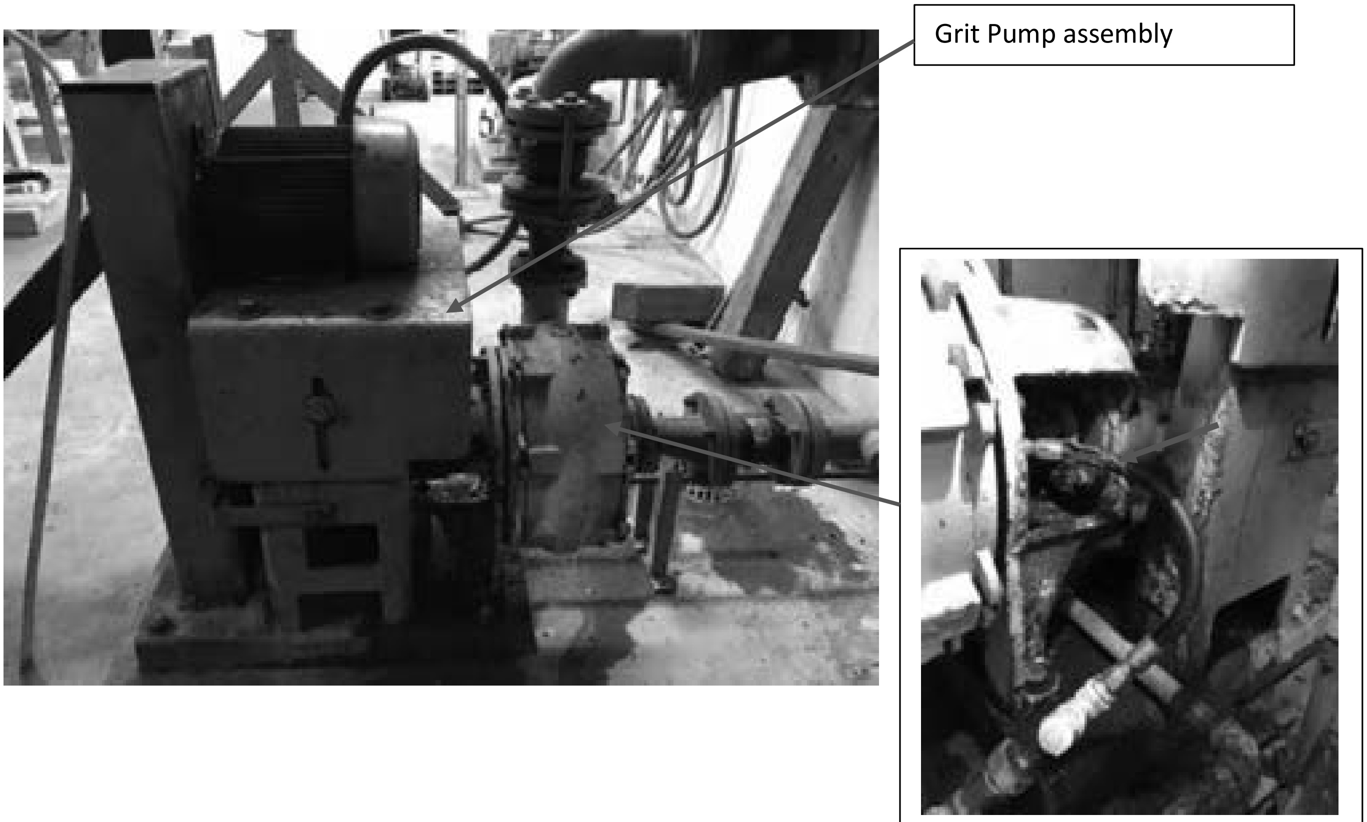
Grit Classifier and Cyclone separator assembly.

Grit Classifier shows moderate to severe corrosion throughout internal and external components. Hand operated weir is corroded in place and not operable.

Cyclone separator showing external corrosion.



Screenings compactor hydraulic drive unit.



Grit Pump assembly

Moderate corrosion in stuffing box area.

3.1.3 Activated Sludge Treatment

The Activated Sludge Treatment System consists of the following components:

Aeration Basins

Aeration Blowers

Piping

Valves and Gates

Instrumentation and Control

System Condition Summary

The Activated Sludge System is in Good condition. The system is well maintained and meeting operational goals. The facility can meet operational goals with one aeration basin in service. The off-line aeration basin is used as a flow equalization basin receiving a portion of the influent flow during high flow events.

There are fewer anoxic mixers and mixed liquor pumps that what the design documents indicate. Operators have not observed a need to have additional mixers or mixed liquor recycle pumps at this time.

Instruments controlling the process air need to be evaluated. The four process air monitors are not reliable for monitoring the air flow to three different process areas. This is a crucial parameter that enables operational adjustment of air flow to the aerated grit chamber, aeration basins and aerobic digesters.

Component Condition Summary

Aeration Basins

Aeration basins are in Good condition. Hand rails, gratings and concrete block selector walls are well maintained. The jib crane for installing/removing the Mixed Liquor Recycle pump is in Good Condition.

The fine bubble membrane air diffusers in Aeration Basin 1 were replaced in 2017 and are expected to last more than 10 years. Aeration basin mixers have been replaced to improve the reliability of the anoxic/aerobic operational mode.

The Parshall Flumes in the mixed liquor splitting structure are in good condition. The flumes are used for measuring flow to the secondary clarifiers.

Aeration Blowers

Four positive displacement blowers provide process air to the WWTP. Three blowers are single speed and one blower is powered by a VFD. The VFD blower is connected to SCADA and adjusts to meet a target dissolved oxygen level.

Two of the four blowers are rated in Good condition. One blower is rated Very Good due to being in near new condition. One blower is rated as Poor due to vibration and bearing noise being high. Operators reported that the belts were recently replaced and may need post break-in adjustment. Recommend follow up to ensure the problem has been corrected. Blowers and associated piping are in Good condition. New pressure gauges are being shipped to the WWTP to replace inoperative gauges.

Piping

Process air piping is in Good condition. Process piping at the aeration basin is stainless steel with the air manifolds made of PVC. The blower intake cover shows minor exterior corrosion.

RAS Manifold piping is in Fair condition. This is due to minor corrosion and time in service.

Valves and Gates

Blower isolation valves are rated as Fair due to exposure to heat and time in service. Fabricated slide gates are in Good condition. Some of the gate frames are beginning to show oxidation. All gates are reported as functional. Sight glasses are clear allowing clear indication of stem condition and position.

The valves for the RAS manifold are corroded and failures of the valve operators have occurred. Operations staff have a replacement plan and are in the process of replacing these valves. Aeration basin mud valve stems are corroded and in risk of failure.

Instrumentation and Control

The air flow monitoring system is rated as Poor due to erroneous readings on all monitoring devices. Air flow meters monitor process air flow to the aerated grit tank, aeration basins and aerobic digesters. None of the displays were reading accurate at the time of the assessment. Operations staff report that initiating a power reset will typically rest the displays to the correct values. This indicates a failure of the flow element or indicator. The three indicators are showing different failure codes that include “Over Range”, 1.32e3 sfcm, and low readings as with air flow to Aerated Grit displaying 28.7 scfm. The temperature readings on the indicators displaying temperature was in range. Recommend evaluation of sensors and electronics by manufacturer service representative or qualified professional.

Condition Rating Table

System	Process Number
Activated Sludge	5000

Equipment Description	Asset Tag Number	Rating	Comments
Aeration Basin 1	T-5401	2	Five Basins Labeled 1-5
Aeration Basin 2	T-5501	2	Two Basins Labeled 6-7
Channel between AB Basin 1 and 2		2	Contains Slide Gates for Flow Diversion
RAS Distribution Manifold		3	RAS piping in FAIR condition. Minor exterior corrosion. Moderate corrosion to the open piping where RAS/Piping is exposed to air.
Aeration Blower	B- 5610	2	Variable Speed; Positive Displacement; Vibration Good. Belts and bearings rated as Good.
Variable Frequency Drive	VFD-5610	2	Cutler Hammer VFD
Aeration Blower	B- 5620	1	Single Speed; Positive Displacement; Vibration Good. Motor and Blower have been replaced; Belts, bearing rated Good;
Aeration Blower	B- 5630	4	Single Speed; Positive Displacement; Vibration Satisfactory, Bearing rated as Satisfactory. Belts replaced were recently replaced.
Aeration Blower	B- 5640	2	Single Speed; Positive Displacement; Vibration Good. Belt and bearing rated as Good.
Inlet Filter	FLT-5681	3	Located on the roof some exterior corrosion.
Air Flow Indicator	FI-5401	4	Input from FE5401; Monitors air flow to Aeration Basins; Display reads "Over range"
Air Flow Indicator	FI-5201	4	Input from FE-5201; Monitors air flow to Aerated Grit Tank; Display reads 28.7 scfm
Air Flow Indicator	FI-7001	4	Input from FE-7001; Monitors air flow to Aerobic Digesters; Display reads 1.32e2
Pressure Indicator - Inlet	PI-5605	2	Filter replaced every 6 months
Pressure Indicator	PI-5670	2	Monitors process air system header pressure
Mixers	MX-5431	1	Replaced with Sulzer Mixer in late 2017-early 2018; Includes cable and winch; Coarse air available for aeration.
Mixers	MX-5432	1	Replaced with New Sulzer Mixer in late 2017-early 2018
Mixers	MX-5433		Not installed
Mixers	MX-5434		Not installed
Mixed Liquor Recirculation Pump	B-5441	2	Pump from discharge end of AB to inlet of AB
Variable Frequency Drive	VFD -5441	2	Alan Bradley VFD
Mixed Liquor Recirculation Pump	B-5620		Not installed
Mixed Liquor Recirculation Pump	B-5630		Not installed
Mixed Liquor Recirculation Pump	B-5640		Not installed
Slide Gates	SG-5411	2	Aeration Basin Flow Control
Slide Gates	SG-5412	2	Aeration Basin Flow Control
Slide Gates	SG-5413	2	Aeration Basin Flow Control
Slide Gates	SG-5414	2	Aeration Basin Flow Control
Slide Gates	SG-5415	2	Aeration Basin Flow Control
Slide Gates	SG-5416	2	Aeration Basin Flow Control
Valves		4	10" BFV along a manifold divert air flow to the Grit,AB, Aerobic Dig. FAIR; 8" RAS manifold rated POOR due to valve operator corrosion. Mud valve stems POOR.; Process air valves Fair
Process Air Piping		3	Supply air piping to each of the Grit, AB, Aerobic Dig.
Diffusers		1	Basin 1 Diffusers replaced in 2017. Diffusers rated for >10 years.
DO/TSS Meter		2	Unit is operational and meeting needs.
M.L. Flow Split Structure		2	All components operational.
	Overall Rating	2.3	

Activated Sludge Treatment System Photo Summary

Aeration Basin 1

RAS Manifold valve operator corrosion (Typ.)

Aeration Basin 2

Moderate to severe corrosion occurring to mud valve stems.

Aeration blower room.

All in operable pressure gauges are being replaced.

New blower and motor

Blower air flow monitors are not reliable. Power fluctuations cause failures of the element and/or indicator. Pictured is the aeration basin air flow monitor.

3.3.4 Secondary Clarification

The Secondary Clarification System consists of the following components:

Clarifier

Gates

Return Activated Sludge(RAS) / Waste Activated Sludge(WAS) Pumping

Valves

System Condition Summary

The secondary clarifiers are in Good to Fair condition. The clarifiers operate as designed and are mechanically stable. Corrosion of the clarifier mechanisms is moderate to severe which effects the service life of the clarifier.

Debris gets caught in the secondary clarifier trash rack and requires Operators to remove walkway grating between clarifiers. The trash rack is designed to protect the downstream UV system. It is not intended to be a location that collects debris on a regular basis. The safety and ergonomic procedures for the removal of the grating and of the debris should be evaluated.

Component Condition Summary

Clarifiers

One clarifier was in service and one was off line during the condition assessment. For purposes of this report the submerged components are considered to be in similar condition. The clarifiers are in Good operational condition. Flow flows uniformly through the clarifiers.

The submerged metal components and drive units are in Poor condition due to moderate to severe corrosion occurring. Recommend evaluation by coatings specialist to develop a refurbishment or replacement strategy.

Lack of screening during high flows has shown to plug the clarifier sludge removal systems (suction duct). These systems have small orifices that operate under suction to remove settled sludge.

Gates

Inlet and outlet flow control gates are in Good condition.

RAS/WAS Pumping

The RAS system operates from inputs from a suspended solids sensor. Pumps are in Fair condition due to time in service. Operators can obtain rebuild kits as needed.

There is no flow measurement of the RAS which limits the Operators ability to optimize WWTP operation. WAS is performed manually due to the automated WAS valve not functioning as designed.

Rags and debris plug the RAS/WAS pumps on a regular basis. Operators must take the pumps off line to dismantle and clear the pumps. This affects the secondary treatment process because lack of RAS or WAS flow can create a solids or biological imbalance.

RAS/WAS Valves are operable and in Fair condition due to time in service.

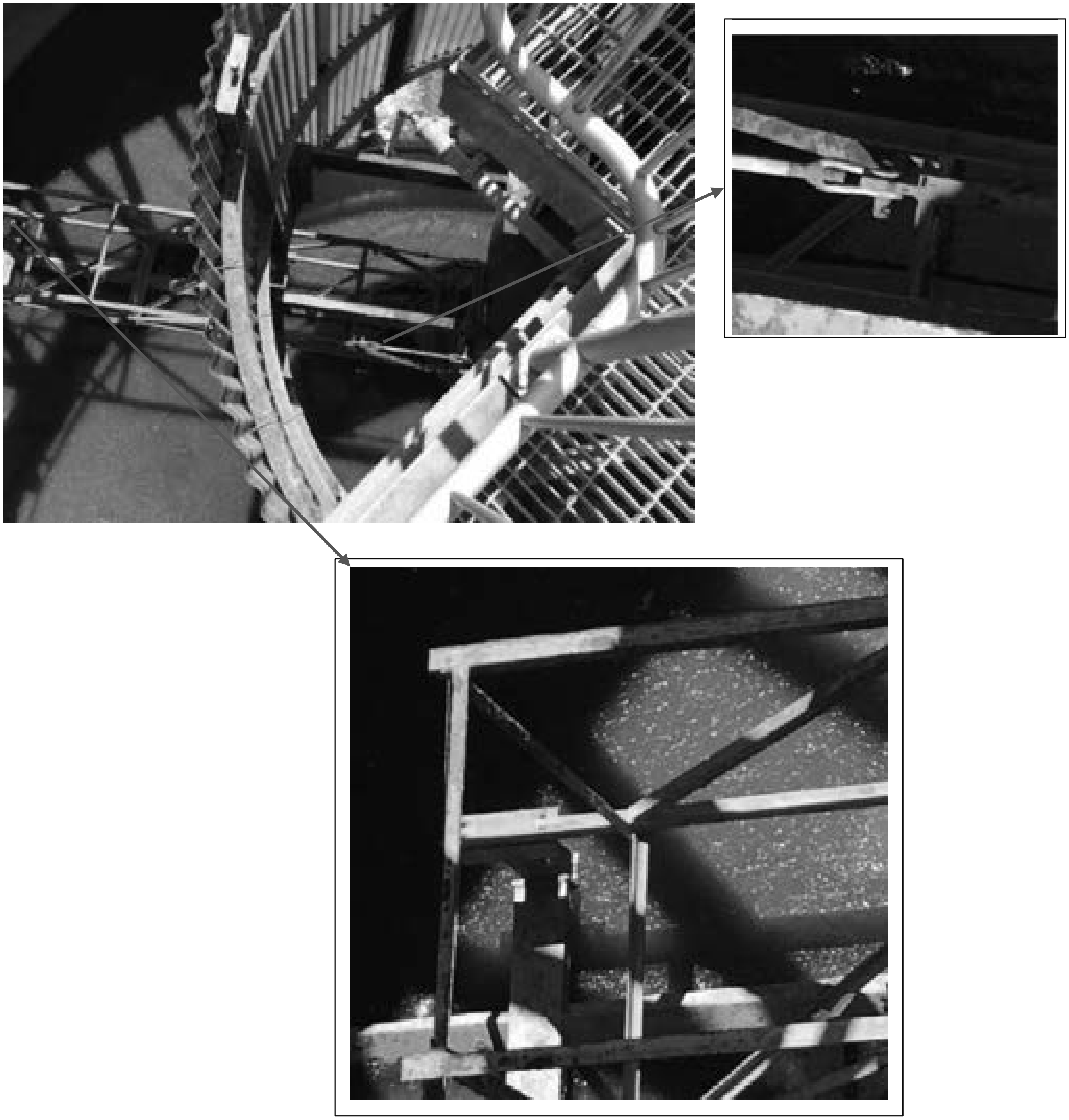
Condition Rating Table

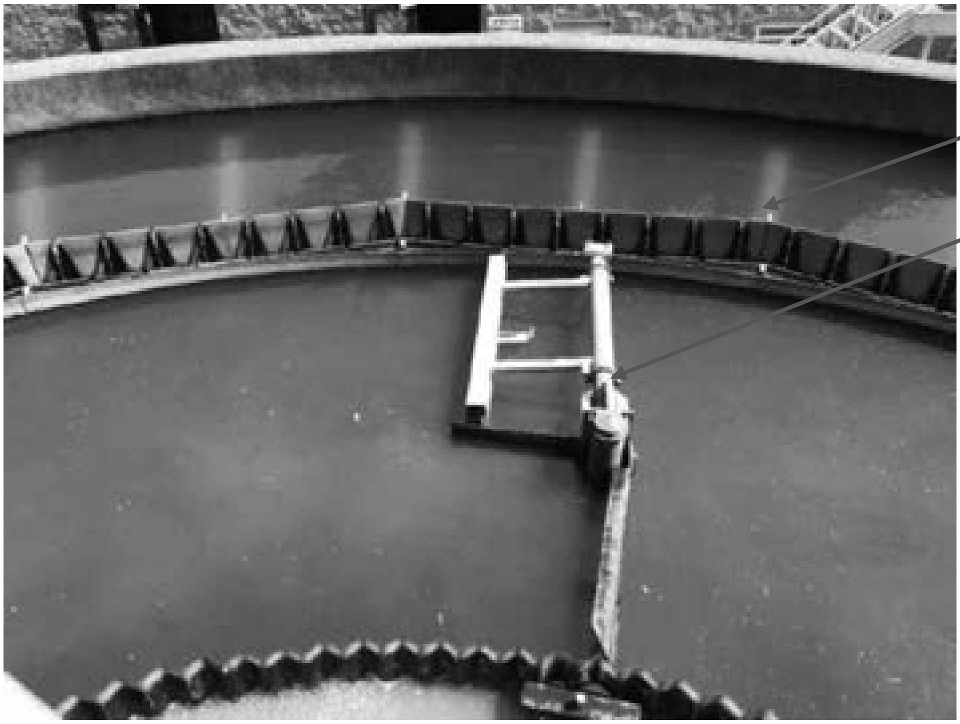
System	Process Number
Clarifiers	6000

Equipment Description	Asset Tag Number	Rating	Comments
Clarifier Tank	T-6110	2	Includes weirs, baffles, scum baffle; Handrails, Walkway grating
Clarifier Tank	T-6210	2	Includes weirs, baffles, scum baffle; Handrails, Walkway grating
Sludge Collector	COL-6111	4	Moderate corrosion throughtout submerged metal; Sludge Collector Includes Drive Unit, Torque Switch Support Structures and sludge collector manifold
Sludge Collector	COL-6211	4	Moderate corrosion throughtout submerged metal; Sludge Collector Includes Drive Unit, Torque Switch Support Structures and sludge collector manifold
Inlet Parshall Flume		2	Staff gauge measures level
Slide Gates	SG-5521	2	Serves Clarifier 1
Slide Gates	SG-5522	2	Serves Clarifier 2
Slide Gates	SG-5523	2	Future Clarifier
Slide Gates	SG-5524	2	Scum Removal Gate
Slide Gates	SG-6112	2	Clarifier Discharge
Slide Gates	SG-6212	2	Clarifier Discharge
Junction Box		3	Junction Box has screens for removing solids prior to UV; Requires manual lifting of grate to access screen.
Sluice Gate	GT-6113	2	Clarifier Drain
Sluice Gate	GT-6123	2	Clarifier Drain
RAS Pump	P-6410	3	5 HP Yoman Pump; Bearing, Vibration Good; Some corrosion; RAS Pump variable speed; All pumps require daily deragging.
RAS Pump	P-6430	3	5 HP Yoman Pump; Sludge wasting capacity 15-40gpm; RAS Pump single speed; Also used for Scum Pumping; All pumps require daily deragging.
RAS Pump	P-6440	3	WAS /Scum Pump; Sludge wasting capacity 15-40gpm; RAS Pump variable speed; Also used for Scum Pumping;All pumps require daily deragging.
Valves	6RAS - 7WAS	3	Valves are operable and in Fair condition. Includes all 6RAS and 7WAS valves
WAS Control Valve	KV-6510	4	Automatic mode not used due to hydraulic (flow) issues. Open or Closed operation only. Motorized Valve; WAS control is manual
WAS Flow Meter	FE-6510	1	New Krone magnetic flow meter
WAS Timer	KIC-6510	3	Activated Sludge WAS cycle timer
Blanket Indicators			Consist of 3 pipes at 1ft, 4ft, 6ft; Not used, Operators use Sludge Judge to monitor blankets.
Scum Box		3	Scum Box Bubbler Tube; Scum Box Air for Mixing; Bubbler inop, manual operation only; High Level float.
Water Sprayers	63W-601	2	Secondary Clarifier Scum Sprayers
Water Sprayers	63W-602	2	Secondary Clarifier Scum Sprayers
	Overall Rating	2.5	

Clarifier System Photo Summary

The following photos of Clarifier 2 illustrate a need to address corrosion throughout the clarifier mechanisms. A metal evaluation will identify if a refurbishment or replacement of the effected metal should be planned for. Clarifier 1 was on line at the time of the assessment and is assumed to be in a similar condition.

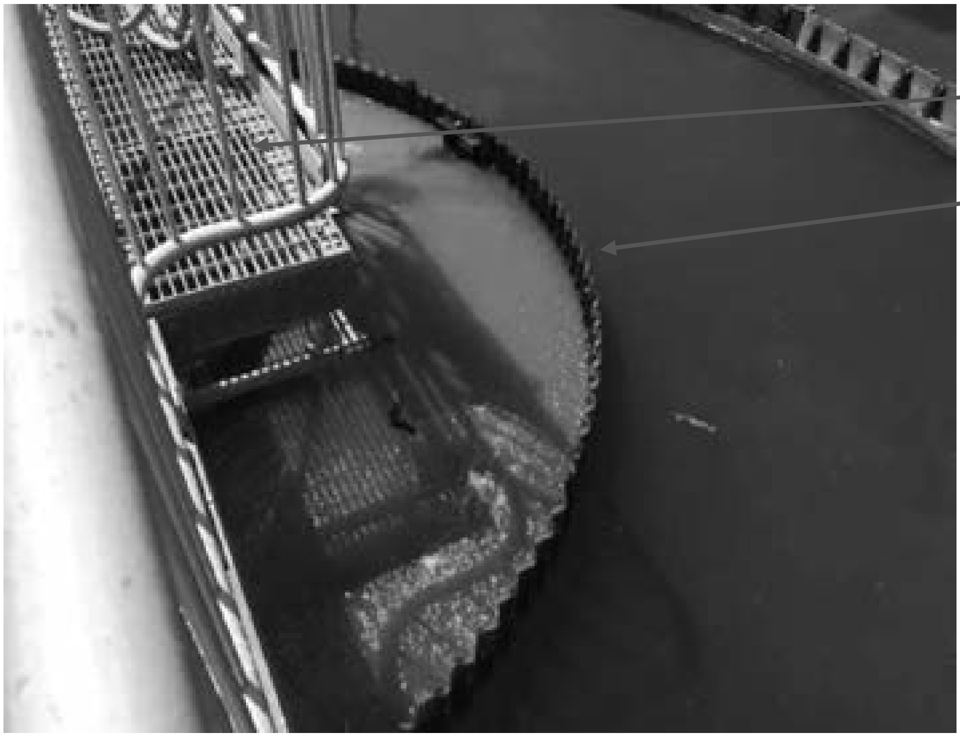




Clarifier 1 –

Uniform flow over weirs.

Scum arm in Good condition.



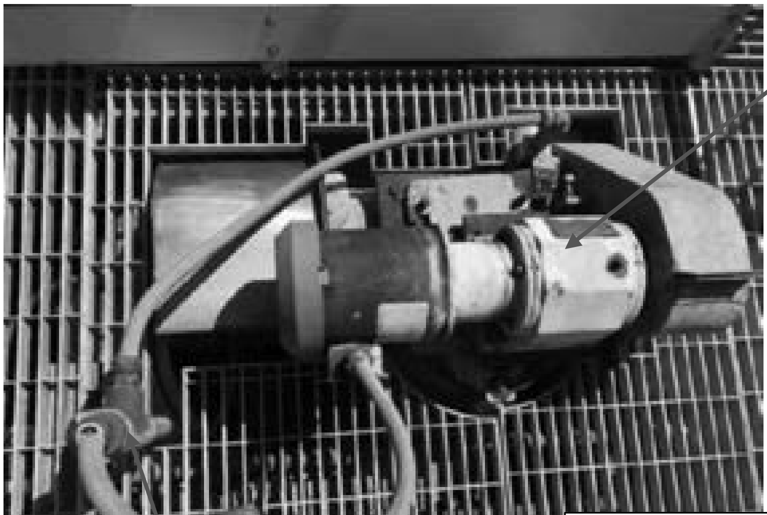
Clarifier 1 -

Grating and handrails are in Good condition.

Stilling well operational and in Good condition.

Clarifier 1 Drive

Clarifier drives are in Good operating condition.



Clarifier 2 Drive

Drive base and electrical conduits are in Poor condition.

RAS/WAS Pump Area

Automated WAS control valve. Does not function as designed resulting in manual wasting of activated sludge.

3.3.5 Ultraviolet Disinfection System

The Ultraviolet (UV) Disinfection System consists of the following components:

UV Modules

Gates

Flow metering

Controls

System Condition Summary

The UV System is in Good to Poor condition. The original UV system was replaced in a 2009 UV upgrade project to meet new permit requirements. The Poor rating within the UV system is due to the system operating in manual will all modules on line due to control and monitoring limitations. There is currently no monitoring of the UV system beyond the local control panel.

Recommend an evaluation of the UV control system to optimize control and monitoring. UV intensity indications on the UV system control panels indicate a need to replace and or clean lamps. Establishing a connection to SCADA would allow operators to trend changes in UV intensity and plan for maintenance. The UV system would also be optimized by utilizing a flow paced dosage strategy to reduce the number of modules on line.

Component Condition Summary

UV Modules

The UV modules are in Good condition. Lamps are cleaned every two months with citric acid. Replacement UV lamps are furnished by a third-party supplier and provide acceptable performance. UV Sensors are procured through the UV manufacturer.

The heat exchangers on top of the modules are in Fair condition. There is moderate corrosion on the exterior. One module had an alarm on the UV Display indicating a “TEMP TOO HI” condition which indicates a failure of the modules cooling system.

Gates

The slide gates for the UV system are used during regular maintenance and are in Good condition.

Flow Metering

Effluent flow is measured by an in pipe ultrasonic flow meter. The meter is serviced by an outside contractor.

Controls

The UV Control system is rated as Poor due to lack of system monitoring and control. Monitoring is local to control panels only. This requires operators to physically inspect the system at the control panel. There is no alarming to WWTP SCADA alarm or Dialer System. Operators report that the reason for this is that the UV system upgrade project was completed without the integration of UV alarms to the SCADA or Auto Dialer.

The UV control panels are in Very Good condition and provide local status. The local system displays indicate several maintenance related needs. The following table provides examples of display readings obtained during the assessment. The UV system manufacturer was contacted to obtain an O&M manual to determine UV alarm definitions. The call out boxes provide definition of alarm and recommended action as found in the UV system operations and maintenance manual.

UV System Example Displays

UV Module	Display
Module 1	Lamp Status 3 Off
	Lamp Status 15 Off
	Lamp Status 16 Off
	Comm Fault UV Mod 1
	CLNR-OK, TEMP TOO HI
Module 2	Lamp Status - All On
	Insufficient UV 20% OT48511 Hrs
	CLNR-OK, TEMP OK
Module 3	Lamp Status 11 Off
	Insufficient UV 19% OT48471 Hrs
	CLNR-OK, TEMP OK
Module 1	Lamp Status 5 Off
	Lamp Status 16 Off
	Insufficient UV 15% OT62086 Hrs
	CLNR-OK, TEMP OK

"Lamp Status Off" is a minor alarm condition. Change Lamp when convenient

"Comm Fault" is a minor alarm condition indicating no response from module.

"TEMP TOO HI" is a major alarm requiring verification that fans are working, and heat exchanger is functioning.

"% Insufficient UV %" is a major alarm se to equal to or greater than 80%. Indicates a need to clean sleeves or replace

Condition Rating Table

System	Process Number	
Ultraviolet Disinfection	7000	

Equipment Description	Asset Tag Number	Rating	Comments
UV Modules	A-1	2	Module structure Good; Lamp Cables Good. Internal electronics Good; Some corrosion to Heat Exchanger.; UV Sensor replaced 12-18 months ago.; Lamps replaced as needed.
UV Modules	A-2	2	Module structure Good; Lamp Cables Good. Internal electronics Good; Some corrosion to Heat Exchanger.; UV Sensor replaced 12-18 months ago.; Lamps replaced as needed.
UV Modules	A-3	2	Module structure Good; Lamp Cables Good. Internal electronics Good; Some corrosion to Heat Exchanger.; UV Sensor replaced 12-18 months ago.; Lamps replaced as needed.
UV Modules	B-1	2	Module structure Good; Lamp Cables Good. Internal electronics Good; Some corrosion to Heat Exchanger.; UV Sensor replaced 12-18 months ago.; Lamps replaced as needed.
UV Modules	B-2	2	Module structure Good; Lamp Cables Good. Internal electronics Good; Some corrosion to Heat Exchanger.; UV Sensor replaced 12-18 months ago.; Lamps replaced as needed.
UV Modules	B-3	2	Module structure Good; Lamp Cables Good. Internal electronics Good; Some corrosion to Heat Exchanger.; UV Sensor replaced 12-18 months ago.; Lamps replaced as needed.
Crane	CRN-7471		Crane not in use; Staff use portable A frame.
Effluent Flow Metering	FE-7401	3	Ultrasonic Flow Meter
Slide Gate - Inlet	SG-7481	2	Used regularly for UVSystem Maintenance
Slide Gate - Outlet	SG-7482	2	Used regularly for UVSystem Maintenance
Slide Gate- Inlet	SG-7483	2	Used regularly for UVSystem Maintenance
Slide Gate- Outlet	SG-7484	2	Used regularly for UVSystem Maintenance
Controls		4	Two control panels (A/B) Several comments on display including: Lamp Off, Insufficient UV, Comm. Fail.; No communication with SCADA and no remote alarming capability.
	Overall Rating	2.3	

Ultraviolet Disinfection System Photo Summary

UV Modules A1-A3

UV Modules B1-B3

Heat Exchanger showing wear and corrosion.

UV System Control Panels “A” and “B”

Critical UV system data is local to the control panels. No output alarm signal to SCADA or Auto Dialer.

3.3.6 Thickening System

The Thickening System consists of the following components:

Aerobic Digesters

Dewatering

Disposal

System Condition Summary

The Thickening System is in Good condition overall and meeting current operational needs. In 2015 a new dewatering and solids handling system was installed. The system is a self-contained unit that rests on a skid. The Pressate system was removed and replaced with sampling and flow monitoring for Pressate gravity flowing to the sewer

The aerobic digester tankage is the original Bandon WWTP.

Component Condition Summary

Aerobic Digesters

Aerobic digesters are meeting operational needs and are in Good operational condition. There are three aerobic digestion tanks in a concentric type configuration. One tank is drained and inspected annually. Aeration diffusers are replaced as needed during annual tank maintenance.

Process air piping is in Poor condition due to significant corrosion. Service valves show moderate corrosion and are in Fair condition.

Fabricated slide gates used for flow control are in Good condition.

Operators utilize decanting to increase solids concentrations as part of regular WWTP operation. The air lift pumps are reliable and do not plug under current conditions.

Dewatering

The dewatering system was put into service in 2015. The dewatering system is self-contained and mounted on a skid. The system is in Very Good condition. The polymer fittings are leaking onto various pieces including the air compressor.

Disposal

The Thickening system meets current disposal needs. Biosolids are dewatered during the winter months. During the summer months liquid biosolids are land applied. Operators report sufficient dewatering volume for the winter months.

The dewatering system includes conveyance from the dewatering unit to the disposal container. The horizontal screw conveyor has a audible “bump” sound that indicates a friction point that could produce a system failure. Operators report that the system was started up and accepted in that condition. Recommend inspection of the conveyor to identify the noise.

During the summer months Operators use a portable pump to fill a truck with liquid biosolids. The existing truck loading pump does not pump the volume to fill the truck in an acceptable time.

Condition Rating Table

System	Process Number		
Thickening	7000		
Equipment Description	**Asset Tag Number**	**Rating**	**Comments**
Aerobic Digester Tank	T-7100	2	Concrete tank and handrails Good
Aerobic Digester Tank	T-7200	2	Concrete tank and handrails Good
Aerobic Digester Tank	T-7300	2	Concrete tank and handrails Good
Valve	7A711	3	Butterfly valve to Dig Tank 1 moderate corrosion
Valve	7A721	3	Butterfly valve to Dig Tank 2 moderate corrosion
Valve	7A731	3	Butterfly valve to Dig Tank 3 moderate corrosion
Aeration Diffusers		2	Coarse Bubble Diffusers replaced as needed during annual tank inspection
Air Lift Pump	P-7202	2	Opeational; minor corrosion
Air Lift Pump	P-7101	2	sludge pump minor corrosion
Air Lift Pump	P-7201	2	sludge pump minor corrosion
Air Lift Pump	P-7301	2	sludge pump minor corrosion
Aerobic Digestion Piping		4	Air piping needs to be further evaluated. Significant corrosion and past repair history indicate internal deterioration.
Sludge Grinder	GRD-7520	1	New 2015
Sludge Feed Pump	P-7510	1	New 2015; Rotary Lobe Pump; Motor 3.0HP; Flow Rated 45 gpm; Used for Truck Loading, skid mounted unit has its own feed pump.
Sludge Feed Macerator	GRD-7520	1	New 2015; Operates when feed pump runs. Flow rated 110 gpm; Motor 3.0HP,
Sludge Dewatering Equipment	SP-8110		New 2015
Rotary Fan Press		1	Two Units, Skid Mounted Vertically opposed; Shared drive gearbox; Motor 3HP; Flow Rated 15 to 110 gpm
Polymer Pump and Mixing		3	Polymer system is contained within the Skid; Moderate neat polymer leak from fittings.
Air Compressor		1	Air Compressor is an upgraded version and contained within the Skid
Dewatering Feed Pump		1	Borger pump.
Pressate System			New 2015; Pressate flows by gravity to the sanitary sewer. Flow is monitored and sampled.
Flow Meter		1	4" flow meter; Flow Rated 0-100 gpm
Automatic Sampler		1	Peristaltic Pump operated. Frequency/Volume adjustable
Sludge Conveyor; Inclined		1	Gearbox/motor Good; 9 inch diameter auger; Capacity 120 Cuft/hr.; Motor 3 HP
Sludge Conveyor; Horizontal		3	Gearbox/motors Good; Conveyor has a rotating "bump" noise that has existed since start up. Includes 2 Vortex Air Actuated Slide Gates for directing Sludge into dumpster.
Tankless Water Heater		1	Small wall mounted residential tankless water heater.
Slide Gate	SG-7111	2	Fabricated slide gate between T7200 and T7100
Slide Gate	SG-7311	2	Fabricated slide gate in T7210
Truck Loading Pump	P-7510	4	Does not meet needs. Operators report low flow rate for use as Truck Loading Pump; Operators use portable pump to load truck.
	Overall Rating	1.9	

Thickening System Photo Summary

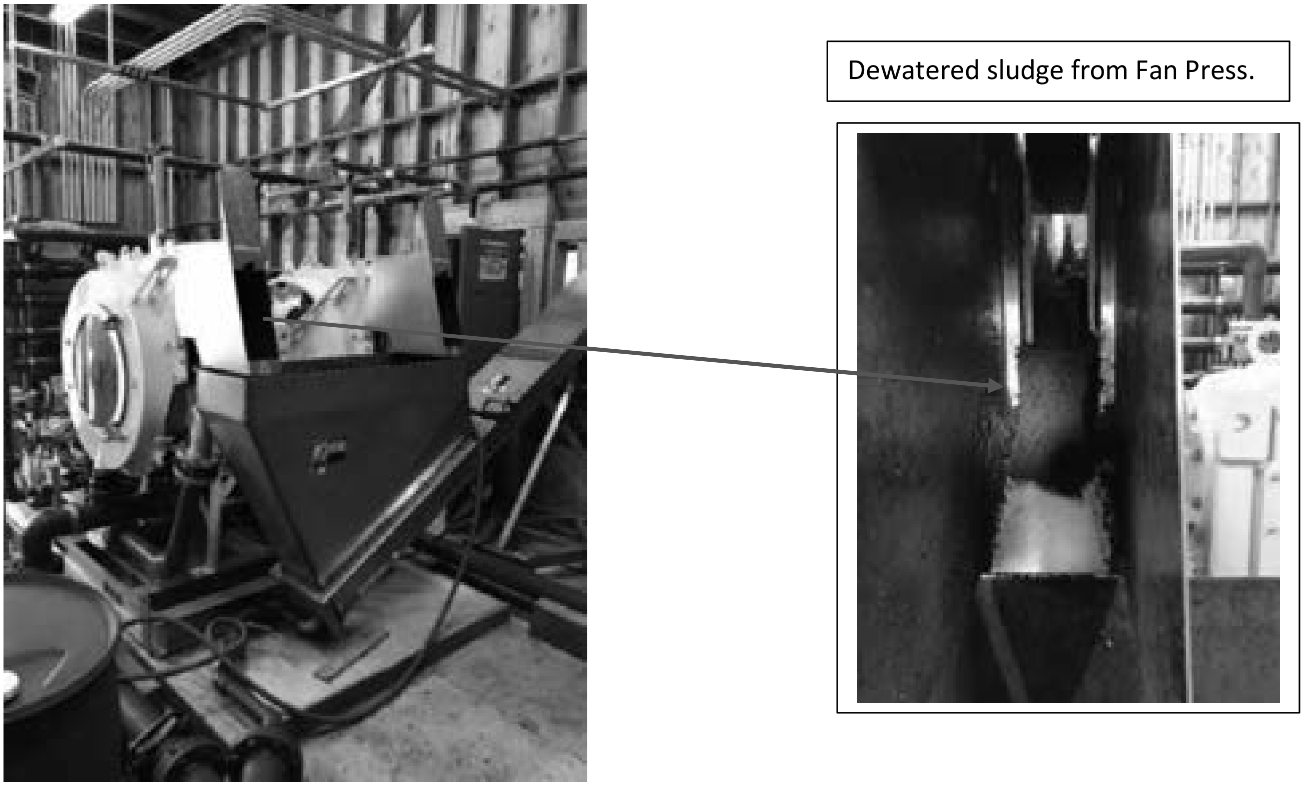
Aerobic Digester Air lift pump

Fabricated slide gates in Good condition.

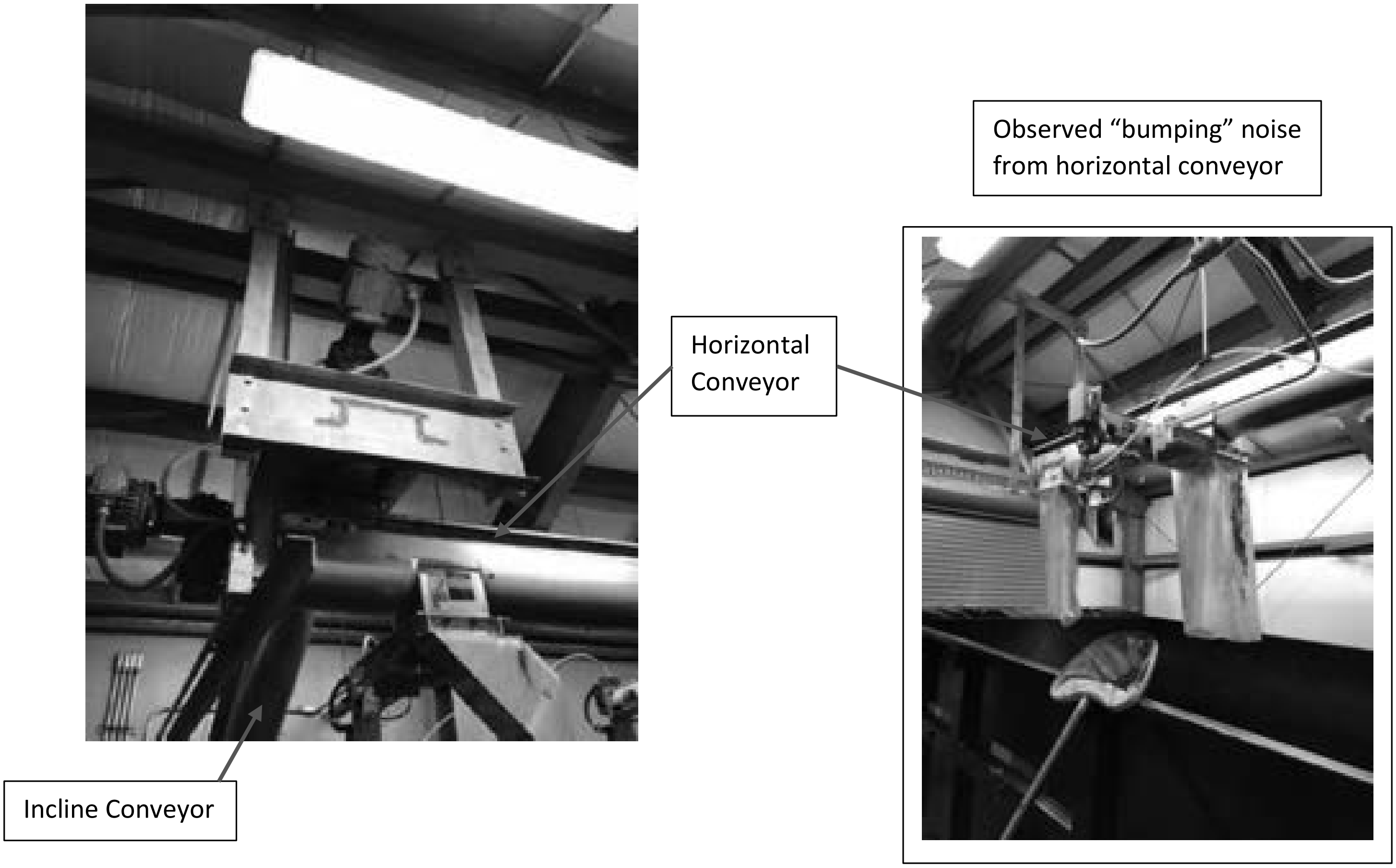
Process Air piping bends and flanges are in Poor condition showing significant exterior corrosion. Interior condition is suspect due to age and type of service.

Fan Press dewatering system installed in 2015

Polymer fittings leaking polymer onto motor,



Dewatered sludge from Fan Press.



Observed “bumping” noise from horizontal conveyor

Horizontal Conveyor

Incline Conveyor

3.3.6 Auxiliary Systems

The Auxiliary Systems consists of five systems that support the entire WWTP Facility:

3W System

Service Air

Plant Drain

Telemetry and Alarms

Electrical Distribution

System Condition Summary

3W System

The 3W system is meeting the needs of the WWTP operation currently. The pumps and motors for these systems are maintained and rebuild on a regular schedule. The controls for the 3W system are in Fair condition and should be evaluated for replacement.

Service Air

The service air system provides compressed air throughout the WWTP. The demand for WWTP service air has been reduced since the Thickening project started up.

Plant Drain

The plant drain system is functional and meeting the needs of operations. The two submersible pumps are maintained, and the piping system is in Good condition. Valve components like check valve springs should be replaced.

The automated control system is not serviceable. The bubbler system and components are corroded. The plant drain pumps are operated in manual when needed. There is a “plant drain wet well high level” alarm that notifies operators if the plant drain pumps are required to operate.

Telemetry and Alarms

The telemetry and alarm system has been maintained by an automation contractor. The current SCADA software was installed in 2005. The SCADA is limited to monitoring the activated sludge system. In 2009 a standalone flow totalizer was installed to monitor various WWTP flows. There are

Modernization of this system would reduce the number of individual components and increase reliability. Upgrading the SCADA would offer the opportunity to provide operations staff with additional monitoring information and remote viewing of conditions.

Electrical Distribution

Electrical power for the WWTP and IPS comes from a Bonneville Power Administration (BPA) step down substation. There are two power sources from the substation to the WWTP transformer. The East Circuit and Town Circuit. The WWTP Department does not have a dedicated electrician. A contract electrician provides repair and replacement services.

Electrical system condition assessment was outside of the scope of work for this project. Recommend that the electrical distribution system be evaluated due to the amount of time in service. The evaluation should include infrared analysis and ultrasonic emission testing to locate defects and potential failures within the WWTP electrical systems. Testing of electrical protective devices and switches is also recommended. Results from the analysis and testing will establish baseline condition and a maintenance frequency.

The following table was developed from the information in the 1992 Bandon WWTP Improvements contract drawings. This table is meant to illustrate the amount of equipment within the Electrical Distribution system.

Bandon WWTP Electrical Equipment Table

Equipment Description	Asset Tag Number	Location
Substation		East Circuit and Town Circuit
Transformer		Pad mounted transformer located at the WWTP
Switchboard 5A	SBD 5A	Source 1 power; RAS, WAS, Blower, MCC 5A, SBD3, MCC 2
Switchboard 5B	SBD 5B	Source 2 power; MCC 2, SBD 3, MCC 5B, MCC 8
Switchboard 3	SBD3	Located at IPS
Motor Control Center	MCC 8	Located in Sludge Thickening Bldg.; VFD power, Panel Board 8A
Motor Control Center	MCC 5B	Located in Ops Bldg.; Aeration blower, mixer, clarifier drive.
Motor Control Center	MCC 5A	Located in Ops Bldg.; Headworks equipment, clarifier drive, aeration blower, mixer, service air
Motor Control Center	MCC 2	Located in Admin Bldg.; Power for UV, Laboratory Equipment, 3W pumps.
Panelboard 2A	PBD 2A	Located in Admin. Bldg.;
Panelboard 3A	PBD 3A	Located in IPS
Panelboard 5A	PBD 5A	Located in Admin Bldg.
Panelboard 8A	PBD 8A	Located in Thickening Bldg.

Condition Rating Table

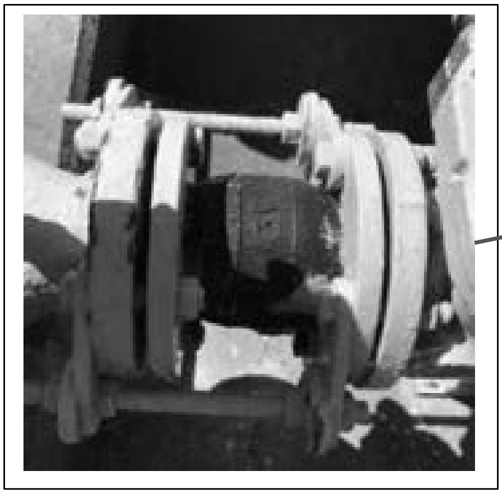
System	Process Number
Auxiliary Systems	7000

Equipment Description	Asset Tag Number	Rating	Comments
3W Pump	P-7410	3	Verticle Turbine Pump operating at 55psi; Shaft Corrosion; Bearings and Vibration Good. Pump rebuilt 8 years ago. Motor surface Corrosion; Flex Coupling at Check valve deteriorated; Discharge piping moderate corrosion
3W Pump	P-7420	3	Pressure Gauge Inop, New gauge ordered;Bearings and Vibration Good; Motor surface Corrosion; Flex Coupling at Check valve deteriorated; Discharge piping moderate corrosion.
3W Pressure Controller	PC-7415	4	Not in Use; System is operated in Hand mode
Timer	KC-7415	3	Locks out pumps until time elapse
Hydropneumatic Tank	PVL-7440	2	May require preseurized vessle permit , iunspection 70-80P psi
Valve	7SC700	3	Telescoping valve to remove scum from 3W Wet well
3W Wet Well Low Level Switch	LSL-7415	3	22.9ft starts both 3W pumps
Flow Meter	FE-7415	2	Calibrated annually
Valves	73W101	3	3W Discharge
Valves	73W202	3	3W Discharge
Valves	73W301	2	Flow meter inlet
Valves	73W302	2	Flow meter outlet
Valves	73W306	3	Flow meter bypass
Valves	73W307	2	Hydro Tank Inlet
Valves	73W308	2	Hydro Tank Drain valve
Tank Drain P.S. Bubbler Tube	LE-5555	5	Bubbler system o/s; Tank drain system is operated manually; High level float alarm. ; Controls corroded not servicable.
Tank Drain Pump	P-5551	3	Submersible pump serviced annually;
Tank Drain Pump	P-5561	3	Submersible pump serviced annually;
Valve	5TD503	3	PD Pump Check Valve
Valve	5TD502	3	PD Pump Isolation Valve
Valve	5TD602	3	PD Pump Isolation Valve
Valve	5TD603	3	PD Pump Check Valve
Service Air Compressor	CP-5661	2	Only used for WWTP utility work at this time.
Service Air Receiver	PVL-5663	2	Air Relief at 115 psi
Telemetry and Alarm System	PNL-2100	3	Includes Transmitter, Conduit, Panel Board, Annunciator, Auto Dialer; SCADA added in 2005, Flow Recorder also an add on. Many functions of the control panel are not in use. Limited Operator monitoring via SCADA; Several independent components that send outputs to Auto Dialer.
Standby Generator		1	New 2014; EC Power Sytems maintained
	Overall Rating	2.6	

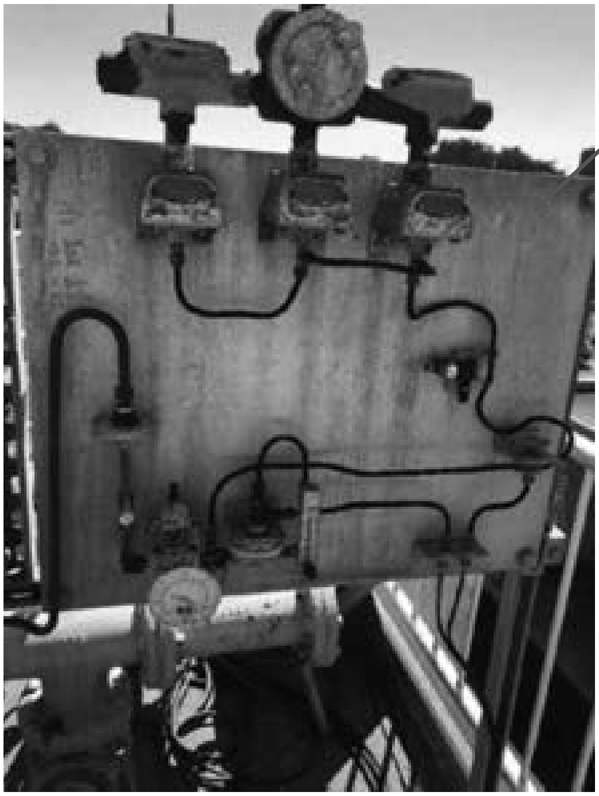
Auxiliary System Photo Summary

Moderate corrosion to pump motor

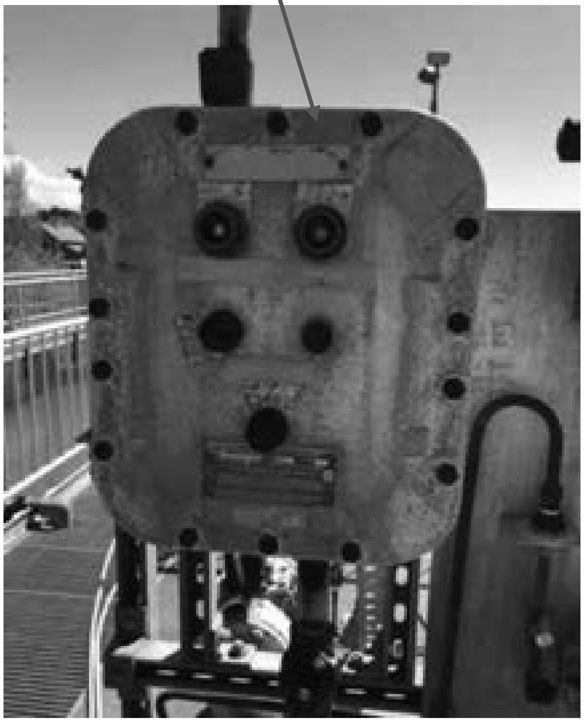
Discharge flex coupling is severely deteriorated. Common to both pumps.



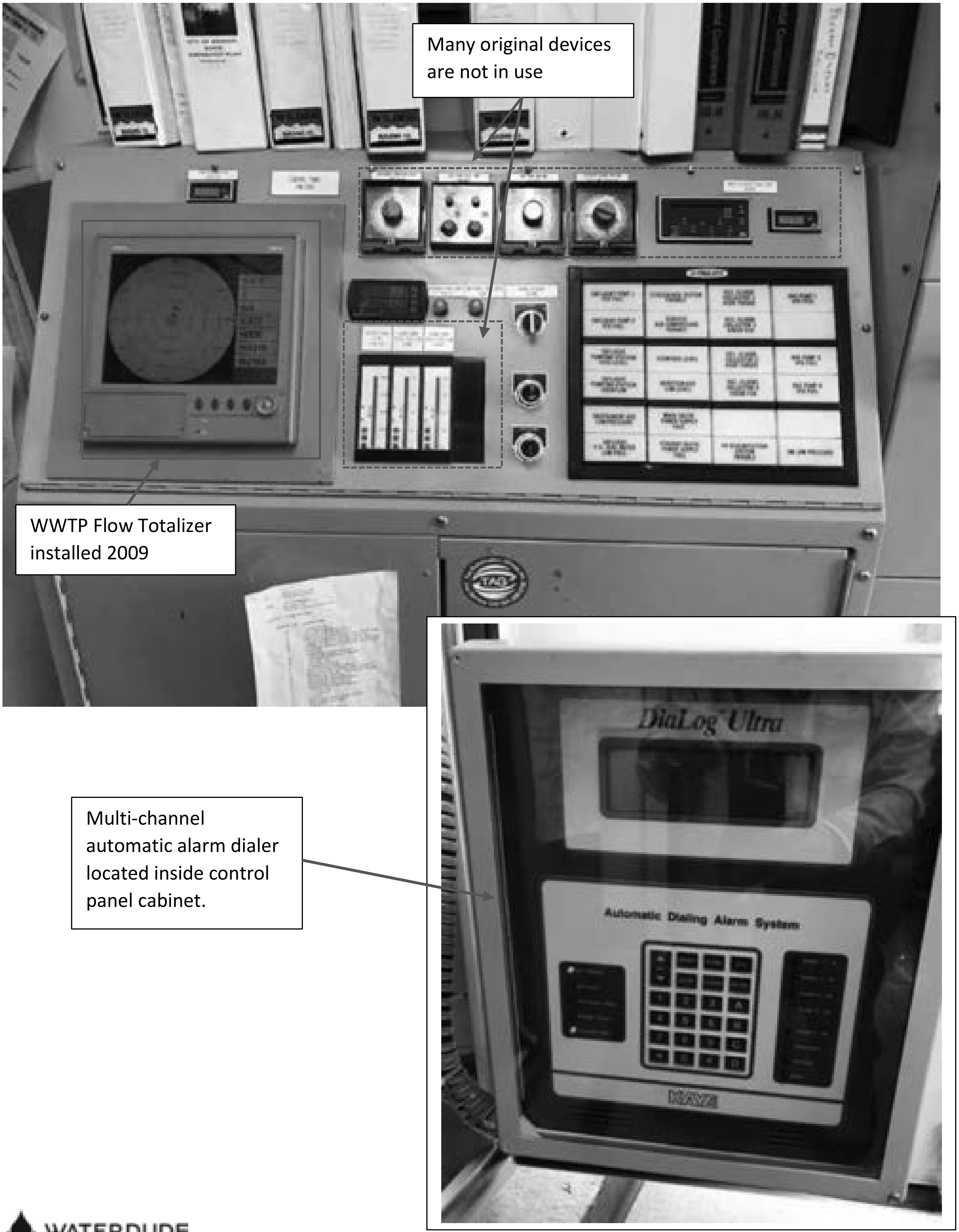
Plant drain piping manifold check valve spring severely corroded. Common to both valves.



Plant drain pump station bubbler control system inoperative. Control panel provides manual operation only.



WWTP Control Panel – Original

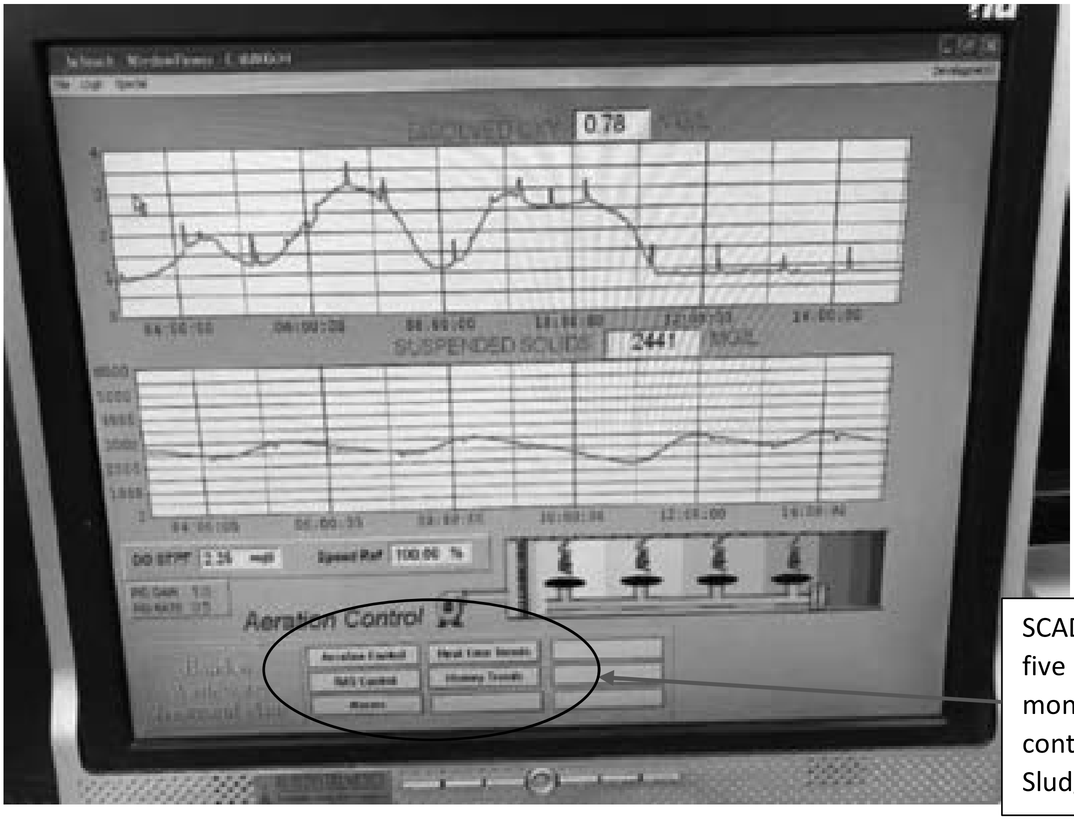


Many original devices are not in use

WWTP Flow Totalizer installed 2009

Multi-channel automatic alarm dialer located inside control panel cabinet.

SCADA monitor located in back office. Single computer replaced every five years.



SCADA consists of five pages limited to monitoring and control of Activated Sludge system.

SCADA Software: InTouch Window Viewer V9.5 2005 By Invensys Systems

Section 4 Results

The overall average WWTP systems rating is 2.5 which is equivalent to a Good to Fair condition score. Table 4.0 is organized to show Systems at most risk of failure with improved ratings following in descending order.

Table 4.0

City of Bandon WWTP Systems Ranked By Condition Rating

System Identification	Description*	Condition Rating
2	Screening and Grit Removal	3.5
1	Influent Pump Station (Filmore Avenue Pump Station)	2.7
7	Auxiliary Systems	2.6
4	Secondary Clarifiers	2.5
5	Ultraviolet Disinfection	2.3
3	Activated Sludge Treatment	2.3
6	Sludge Treatment and Thickening	1.9

* Systems as described in WWTP O&M Manual.

The Screenings and Grit Removal system is in the greatest need of refurbishment. The current system is not capable of providing screening at current WWTP flow conditions. The debris that bypasses screening obstructs process lines including grit piping and clarifier sludge collectors. Debris also obstructs the RAS and WAS pumps requiring regular operator intervention to maintain pumping. Addressing the screening bypass will improve WWTP performance and reduce Operator's corrective maintenance time.

The Influent Pump Station also has ragging and grit accumulation issues that require Operator intervention. The IPS control system is at most risk due to the reliability of the bubbler system. Recommend evaluating alternative level monitoring technology like hydrostatic pressure or ultrasonic level transmitter.

The Auxiliary systems include five individual systems; 3W Water, Plant Drain, Service Air, Telemetry and Alarms, and Electrical Distribution. Controls refurbishments are needed for the 3W Water and Plant Drain systems. The Telemetry and Alarms system should be updated and include UV system status. Recommend that an electrical evaluation of the Electrical Distribution system be conducted.

The Secondary Clarifier mechanisms are corroded and need to be evaluated to determine if the metal can be recoated.

The UV system requires improvements to monitoring to improve WWTP reliability and control.

The Activated Sludge system valves are being replaced as needed by operations staff. New mixers and aeration system diffusers have been installed.

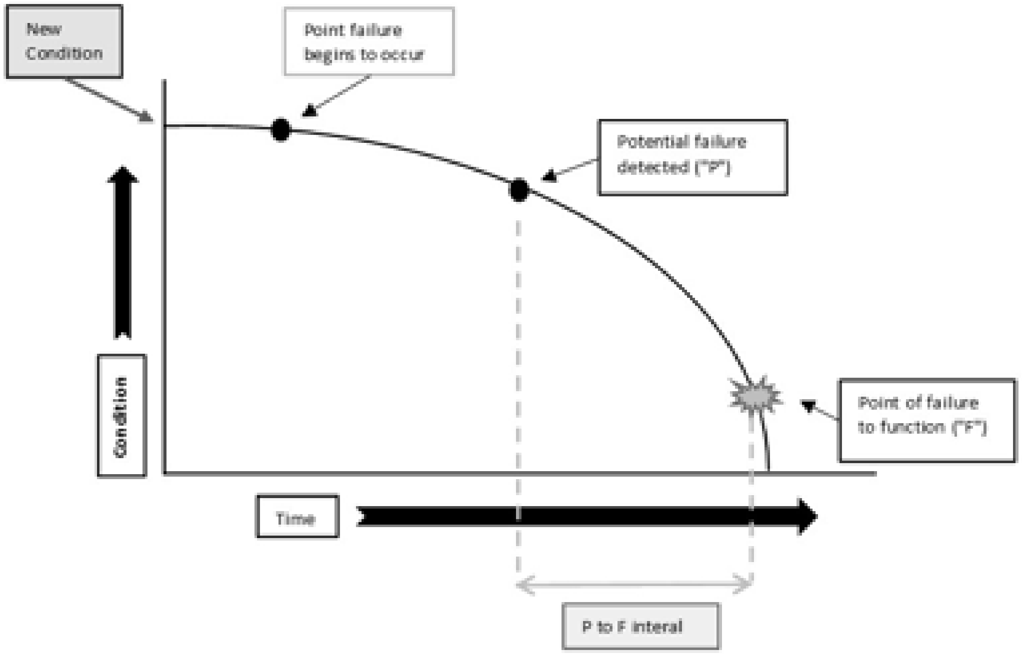
The Sludge Treatment and Thickening system is comprised of the aerobic digesters (Sludge Treatment) and the new Thickening system (Fan Press). The Thickening system is in Very Good condition. The piping and valves within the aerobic digesters are corroded and failing.

Asset Failure Curve

The P-F Curve (Figure 4.0) is a common way to represent the behavior of an asset (pump, motor), or asset component (belt, bearing) before actual functional failure has occurred. In the wastewater industry failure is a process, not an event. In most cases failures take time, which allows us to plan for repairs, refurbishment and replacement.

The P-F Curve below provides a visual picture of the decline of asset condition over time. Point “P” is the point where deterioration can be detected. At this point, it is possible to intervene and correct problems or replace components. If the deterioration is not detected and corrected, the asset continues to deteriorate until it reaches the point of functional failure (Point “F”).

Figure 4.0



In practice there are several ways to detect failures. These methods include vibration, heat, and contaminants in used oil. Developing baseline condition data will aid with creating asset specific failure curves that identify the time interval between “P” and “F”.

Each asset will have a unique “P” to “F” interval depending on the application and type of asset. To facilitate development of the “P” to “F” interval condition data is typically stored in a computerized maintenance management system (CMMS). That way both asset specific work history and condition data can be accessed and evaluated.

The components and systems listed in Table 4.1 have been identified as failed or nearing failure. Since background data is limited, corrective action on these assets should be considered urgent. At a minimum, a corrective action plan should be developed and available in the event a failure occurs.

Components with a Fair ratings are listed in the individual System rating tables. These components have moderate risk of failure and should be addressed with regular scheduled maintenance.

Table 4.1

Influent Pump Station	**Asset Tag Number**	**Rating**	**Comments**
Solenoid Valve	FV-3252	4	Solenoid valve cover corroded and cracked.
Wet Well Level Bubbler	LE-3115	4	Bubbler system requires blow down to prevent grease build up. Nusance alarms are occuring related to system plugging.
Controls	PNL-3300	4	Has bypass panel and VFD control ; Pump low level shut off = none.; Start stop cycles often as 2-3x per 5min.; Station has been retrofitted once. New standby generator runs IPS and WWTP.
Exhaust Fan	F-3220	4	Fan shroud is severely corroded.
Screening and Grit Removal	**Asset Tag Number**	**Rating**	**Comments**
Screen	SCN-5110	4	Original Screen replaced with existing JWC Screen/ Grinder system ~2002. Screen shaft and brushes Fair condition. Screen is in good condition. Screen runs continuously, if stops then flow goes over a weir to the manual screen. Good Vib/Bearing; Screen size reduced from 8mm to 3mm; Influent bypasses much of the screen at higher flows due to headloss.
Grinder		4	Analyzer recorded high vibration and bearing wear at motor-grinder connection. Noise is noticable and supports analyzer readings. Grinder cutter assembly was replaced about 2 years ago
Screenings Compactor	SPT-5111	4	Hydraulic press compactor; Ram has been rebuilt approximatley 10 times; Lubrication leakage and corrosion throughout operating mechanisms. Motor bearing vibe good. Operated manually due to seizing of compacted material when it sits.
Cyclone Separator	SEP-5212	4	Operational. Showing moderate corrosion of metal structure.
Grit Classifier	WHR-5218	4	Corrosion occurring through structure. Screwless auger showing polished edges indicating metal to metal contact in submerged area. Weir gate adjustment valve corroded in place and not operable.
Air Actuated Valve	FV-5101	4	Out of Sevice; Air actuated valves in place; Manually adjusted.
Air Actuated Valve	FV-5102	4	Out of Serivce; Air actuated valves in place; Manually adjusted.

Table 4.1 continued following page.

Table 4.1 continued.

Activated Sludge	**Asset Tag Number**	**Rating**	**Comments**
Aeration Blower	B- 5630	4	Single Speed; Positive Displacement; Vibration Satisfactory, Bearing rated as Satisfactory. Belts replaced were recently replaced.
Air Flow Indicator	FI-5401	4	Input from FE5401; Monitors air flow to Aeration Basins; Display reads "Over range"
Air Flow Indicator	FI-5201	4	Input from FE-5201; Monitors air flow to Aerated Grit Tank; Display reads 28.7 scfm
Air Flow Indicator	FI-7001	4	Input from FE-7001; Monitors air flow to Aerobic Digesters; Display reads 1.32e2
Valves		4	10" BFV along a manifold divert air flow to the Grit,AB, Aerobic Dig. FAIR; 8" RAS manifold rated POOR due to valve operator corrosion. Mud valve stems POOR.; Process air valves Fair
Clarifiers	**Asset Tag Number**	**Rating**	**Comments**
Sludge Collector	COL-6111	4	Moderate corrosion throughtout submerged metal; Sludge Collector Includes Drive Unit, Torque Switch Support Structures and sludge collector manifold
Sludge Collector	COL-6211	4	Moderate corrosion throughtout submerged metal; Sludge Collector Includes Drive Unit, Torque Switch Support Structures and sludge collector manifold
WAS Control Valve	KV-6510	4	Automatic mode not used due to hydraulic (flow) issues. Open or Closed operation only. Motorized Valve; WAS control is manual
Ultraviolet Disinfection	**Asset Tag Number**	**Rating**	**Comments**
Controls		4	Two control panels (A/B) Several comments on display including: Lamp Off, Insufficient UV, Comm. Fail.; No communication with SCADA and no remote alarming capability.
Thickening	**Asset Tag Number**	**Rating**	**Comments**
Aerobic Digestion Piping		4	Air piping needs to be further evaluated. Significant corrosion and past repair history indicate internal deterioration.
Equipment Description	**Asset Tag Number**	**Rating**	**Comments**
3W Pressure Controller	PC-7415	4	Not in Use; System is operated in Hand mode
Tank Drain P.S. Bubbler Tube	LE-5555	5	Bubbler system o/s; Tank drain system is operated manually; High level float alarm. ; Controls corroded not servicable.

End of Report.

City of Bandon

PLANNING COMMISSION AGENDA DOCUMENTATION	DATE: March 24th, 2022
PUBLIC HEARING: **Annexation of 19-Acre Parcel located in East Bandon and Portion (4334 feet) of Highway 101 (28S-14W-31BC / TL 2100, 2200, 2201, 2300, 2700, 3600, 3700, 4200, 4300, 4400) –** Request to annex property into the City of Bandon, initiated by the City of Bandon – 22-022	ITEM NO: 5.1

Potential Motion: *I move to recommend to the City Council adoption of the Annexation as proposed (and/or as amended here).*

SUBMITTED BY:

Dan Chandler, City Manager

To: Bandon Planning Commission

From: Dan Chandler, City Manager

Re: Bandon Opportunity Site Proposed Annexation

Date February 17, 2022 (Revised March 17, 2022.)

A. Introduction

This is a city-initiated annexation for an area within the Bandon Urban Growth Boundary. The annexation falls under ORS 222.170 as a triple-majority annexation.

B. Property Description

The subject property is best described in two parts.

The first part is the Highway 101 right-of-way from 18th Street to just south of the Seabird Drive/Highway 101 intersection. The second area is approximately 19 acres in an irregular shape, between Highway 101 on the west to Rosa Road on the east. The two areas abut and are connected to existing city limits. Maps of the subject property are attached as Exhibit A.

The entire area is in Bandon's Urban Growth Boundary. The area is split-zoned, with commercial zoning on the western portion and Light Industrial to the east. The City has comprehensive plan designations for the property, which are identical to the county zoning.

A significant amount of the property is likely jurisdictional wetland. The owner has obtained a draft wetland delineation that is awaiting a survey to determine wetland boundaries.

The non-highway section is vacant land with no structures or electors.

C. Consent

There is only one non-government "owner" in the area. The Oregon Department of Transportation owns the Highway 101 right-of-way, and South Coast Housing LLC owns the remaining private property. Both have consented to the annexation. There is a city-owned parcel at the corner of the 20th street right-of-way and Rosa Road. Coos County has a right-of-way interest in some of the area, but the City does not have either consent or an objection from Coos County for those areas of county right-of-way included. However, neither the city property nor the county right-of-way are considered for purposes of determining number of owners or value for an annexation under ORS 222.170(4).

D. Approval Criteria and Factors

17.118.030 Approval standards.

An annexation may be approved if the proposed request for annexation conforms, or can be made to conform through the imposition of conditions, with the following approval criteria:

A. The land is within the City's Urban Growth Boundary.

B. The proposed zoning for the annexed area is consistent with the Comprehensive Plan, and a project, if proposed concurrently with the annexation, is an allowed use within the proposed zoning.

C. The land is currently contiguous with the present City Limits.

D. Adequate City facilities can and will be provided to and through the subject property, including water, sanitary sewer, and storm drainage. Unless the City has declared a moratorium based upon a shortage of water or sewer; it is recognized that adequate capacity exists system-wide for these facilities.

E. The annexation is consistent with the annexation policies contained in the Comprehensive Plan.

E. Analysis of Code Factors

A. The land is within the City's Urban Growth Boundary.

Response: The proposed site is within Bandon's Urban Growth Boundary. This criterion is met.

B. The proposed zoning for the annexed area is consistent with the Comprehensive Plan, and a project, if proposed concurrently with the annexation, is an allowed use within the proposed zoning.

Response: The City's comprehensive plan shows the subject property as having the same comprehensive plan designations as the current Coos County designations.

The City is not changing the zoning at this time. Therefore, pursuant to ORS 215.130, the property will retain its current zoning. Once more information is gathered on the amount and configuration of buildable land, we anticipate development of an overall master plan for the property. Potential zoning changes will be considered at that time. It is important to note that under SB 8 (2021), affordable housing may be constructed on land with industrial and commercial zoning. Therefore, it may not be necessary to change the zoning on portions of the property to develop housing.

C. The land is currently contiguous with the present City Limits.

Response: The subject property is contiguous to city limits to the north and south along the Highway 101 Right-of-Way.

D. Adequate City facilities can and will be provided to and through the subject property, including water, sanitary sewer, and storm drainage. Unless the City has declared a moratorium based upon a shortage of water or sewer, it is recognized that adequate capacity exists system-wide for these facilities.

Response: There is an 8-inch water main through the property along the 20th Street right-of-way. There is a sewer line approximately 500 feet to the north of the site in Baltimore Street. Water and sewer can be effectively provided to and through the property. Storm drainage can be addressed through on-site detention.

Attached is a memorandum from Dyer Partnership analyzed wastewater capacity and concluding that there is adequate capacity to serve the system.

There has been no moratorium imposed, adequate system capacity exists for these facilities.

F. Analysis of Comprehensive Plan Factors

Preliminary Note: It is important to note that factors are different than criteria, in that factors should be considered and balanced, but are not individual pass/fail criteria.

1. Annexation Configurations - When considering the specific boundaries of an area to be annexed, the City will add or eliminate property, whenever appropriate, to ensure that the shape of the annexed area conforms to standard blocks, fractional section lines, existing and future street and utility system layouts and plans, natural features, topography, and other considerations, so that the resulting city limits configuration is efficient and sensible.

Response: The proposed annexation follows existing platted streets and rights-of-way. This factor weighs in favor of the annexation.

2. Leveraging the Annexation of Adjacent Properties - When considering a proposed annexation, the City will determine whether there are any adjacent properties which are in the City's best interest to annex at that same time. If so, those additional desirable properties will be combined with the properties in the annexation request, in a manner and configuration which will maximize the value of the annexation request to leverage the simultaneous or subsequent annexation of those adjacent properties whose owners may not necessarily be in favor of annexation.

Response: Much of the adjacent property is developed with either commercial or low-density rural residential property. The residential properties are served by wells and septic systems. It is not in the city's best interest to annex those properties at this time for several reasons. First, they would provide little benefit to meeting the city's housing or employment needs, as they are mostly developed. Second, the fiscal benefit of annexing developed property is minimal.

3. Creating County Islands - When determining the final configuration of an annexation, and to leverage the annexation of any desired adjacent properties, the City will consider the benefits of creating islands of County property, which can then be annexed at will, either immediately or in the future,

Response: The proposed annexation does create an island of county property to the west of Highway 101.. However, given the size of the island, the City has no intention of annexing the island. Under case law, the City would need to annex the entire area to qualify as an "island annexation." The City does not have the need, or the resources to annex the entire area for the foreseeable future. Annexations in that area are likely to happen only in small amounts as petitions are received, and in each case subject to a new analysis of annexation factors.

4. Fiscal Impact of Annexations - Prior to annexing an area, the specific fiscal impacts of that annexation shall be determined, to include a measurement of the effects on City tax revenues, utility revenues, cost of providing services, etc. Absent evidence to the contrary for a particular annexation, it is anticipated that the immediate fiscal impact of any annexation will be negative. However, for undeveloped areas, and areas which have development potential, the immediate negative impacts can be expected to be offset by the positive fiscal impacts of future development. The greater the ratio of undeveloped to developed property, the greater the potential for the fiscal impacts to become positive.

Response: The entire area is undeveloped. Development of the area will provide the following fiscal benefits:

Additional Property Tax Revenue

The proposed annexation area has a combined assessed value of $300,530. Considering Bandon's permanent tax rate, local option street tax, the total initial estimated net property tax impact will be a combined increase of $15.06 per year, as shown below. The land is currently vacant, which accounts for the lower assessed value for the 19 acres. As this property develops, values will increase, and taxes collected will rise. The city intends that the property remain in the Bandon Rural Fire Protection District.

Bandon Permanent Property Tax Rate ($0.4580 / $1,000 AV)	$	137.64
Local Option Street Tax ($0.8455 / $1,000 AV)	$	254.10

Net Property Tax Impact to the City (pre-development)	$	391.74

Additional Bond Rate Revenue

The annexation will bring an additional $300,530 of assessed value into City Limits, adding to the current assessed value of all property (excluding Urban Renewal Areas) of $474,433,882. The City several bonds with rates that are assessed either by a set annual number divided amongst property owners or based on debt collection that is a flat fee. The addition of additional taxpayers and assessed value will provide a modest decrease to existing payers as the burden will be spread out across these newly annexed properties. This may or may not be affected by Measure 50 limitations.

Additional Municipal Utility Revenue

The proposed property for annexation is currently vacant with no water or sewer service to the yet. Development of the property will require the extension of city water and sewer lines, which will either be covered by the developers or by using federal grant funding, with no impact to current taxpayers. The new development will yield additional utility customers, which provide the funding needed to serve the area, and cover some maintenance, staffing, and operations of the expanded service area. In addition, in-city utility customers pay a 10% tax on utilities.

System Development Charges

City services cannot be extended to these properties until they are annexed into the City. Once annexed, development may occur at the owner’s expense, and payment of System Development Charges (SDCs) will be required for connections to City water, sewer, storm drainage, and transportation systems. These numbers will vary based on the type and intensity of development proposed (taking into account equivalent dwelling units, square footage, impervious surface, water meter, etc). SDCs are meant to cover the anticipated cost of future expansion of the city’s utility systems, as well as pay “reimbursement” to systems that were installed to serve future growth. Our SDC methodology is based on master plans for each of the utilities listed above.

Conclusion

The financial impact of the proposed annexation is modest, at first, as the changes in tax collected and reduction to bond assessments is minimal. However, over time, development of the property will increase assessed value,, add utility customers, and pay for needed capital improvements through payment of SDCs.

5. Development Control Issues - While the fiscal impacts of annexation are important, they will not necessarily be the overriding factor. Consideration must also be given to the overall impact the annexation will have on the community by virtue of its being subjected to City development control, including comprehensive planning, zoning, regulating nonconforming uses and structures, and subdivision regulations. Those benefits may outweigh any projected negative fiscal impacts.

<u>Response:</u> There are significant benefits to bringing this property under city development control. First, the city can master plan the property in a fashion tailored to meet the city's need for affordable and workforce housing. There are few, if any properties currently on the market of a size and nature sufficient to have any impact on the city's affordability crisis.

If the property remains outside the city, it will likely remain undeveloped, and will thus provide no contribution to either the city housing stock or economic base. Annexation will allow the property to be served by city services and developed to meet the community's needs.

6. Sufficiency of Infrastructure Systems - When considering an annexation, the City will ensure that the existing infrastructure systems can or will meet the needs and demands of the area proposed to be annexed. An analysis of the existing street, water, sewer, storm drain, and other infrastructure systems will be undertaken to determine whether capacity exists to serve the subject area. If not, a determination will be made regarding whether anticipated system development revenues, other funding mechanisms such as a local improvement district (LID), or direct funding from the petitioner or property owners, will be necessary and sufficient to adequately finance the required infrastructure improvements. All utility and infrastructure improvements shall be consistent with the City's adopted master plans.

Streets

<u>Response:</u>

Streets: The property has frontage and a right-of-way connection to both Highway 101 and Rosa Road, which is designated as a collector in the City's Transportation System Plan (TSP). Twentieth Street is designated as a Future Collector Cross Street in the TSP (TSP, Fig,.1)

The property is adequately provided with right-of-way in its current configuration and can be efficiently served with streets.

Water: The City's water plant has existing capacity for a population of 4000 persons, and with minor additions can serve double that number. The City is in the process of working on climate and potential drought mitigation strategies for the water supply to the plant, which comes from Ferry and Geiger Creeks. However, those issues exist with or without annexation of the subject property. The city has adequate water rights to serve the city and has never had to make a "call" on junior water right holders upstream. The proposed annexation is only a 1% increase in the size of the city.

Sewer: Bandon's treatment facility "was designed for a population equivalent of 5068 persons." *City of Bandon Wastewater Master Plan, p. 3-14.* Bandon's current population is just over 3300 persons. The City's Wastewater Master Plan predicted a 2021 population of 4241 persons. *Id. P. 2-12.* Actual population is well under this figure. Adequate plant capacity is available. This factor militates in favor of the proposal.

Storm drainage: Between stormwater SDCs and the ability to incorporate on-site detention into existing wetlands, there is sufficient stormwater capacity to serve the property.

7. Street Paving - As long as a street paving tax is in effect, which will be immediately imposed on a newly annexed area, the City will pave all existing, unpaved, open streets in that annexed area, as soon as sufficient funds are available from that resource. If no such tax is in effect, the City will determine whether it is appropriate to finance that paving from another City resource, or whether the residents or property owners of the annexed area should be required to pave those streets, as a condition of annexation approval. Prior to the annexation, the City will determine whether reduced street widths, drainage, and sidewalk requirements will be allowed for those existing streets. In no case will the City annex an area containing existing, unpaved, open streets, unless some source for funding the street paving has been identified. Once an area has been annexed, all future streets will be subject to the same street opening and construction standards as would apply to any other area within the City.

<u>Response:</u> All streets will be paved by property owners and developers, possibly aided by state or federal grants and other funds. There are no unpaved open streets.

8. Timing of Annexations - Unless determined otherwise on an individual case by case basis, it can generally be assumed that annexing property sooner rather than later will minimize the negative impacts and maximize the positive impacts of that annexation.

<u>Response:</u> "Now" is sooner than later. This factor militates in in favor of the proposed annexation.

9. Sewer Connection Requirements - For any existing home, business, or other use within an annexed area at the time of the annexation, which is served by an approved, properly functioning septic or other on-site sewage disposal system, the City will waive any requirements for connecting to the municipal sanitary sewer system, as long as the on-site system continues to function properly. In the event of a failure of the on-site system, any City requirements for connection to the municipal sanitary sewer system will apply, as they would for any other property within the City limits. As a condition of this waiver, the subject property owner will be required to provide documentation to the City regarding the location of the septic or alternative sewage disposal system, and all components thereof. Annually, each property owner shall provide proof to the City that their septic or alternative sewage disposal system is properly operating in conformance with all Department of Environmental Quality (DEQ) requirements. If the City is unsure about whether it is operating properly, the DEQ will be contacted for assistance in making that determination. All costs for providing the proof of proper operation and for inspections shall be the responsibility of the property owner. This waiver applies only to City sewer connection requirements, but does not apply to any DEQ requirements, which the City has no authority to waive.

Response: Under the Bandon Municipal Code, all development will be served by City sewer.

10. Comprehensive Plan and Zoning - Annexation petitions shall be accompanied by applications for a Comprehensive Plan Amendment and a Zone Change. Those applications will be processed and considered concurrent with consideration of the annexation request, so that the provisions of the City's Comprehensive Plan and zoning regulations will immediately apply to the annexed area upon approval of the annexation.

Response: This annexation is council-initiated, rather than being initiated by petition. The factor does not apply. The property already has a city comprehensive plan designation, which is consistent with the county plan. The area will retain its current zoning designation pursuant to ORS 215.130.

11. Annexation Ordinance - The City shall adopt Annexation Regulations as part of the Bandon Municipal Code, specifying the specific requirements for preparing, submitting, and processing an application for annexation. Those regulations will reference, and ensure compliance with, these Annexation Policies, as well as State Statutes governing annexations.

Response: This is a policy to be implemented by the city, and is not a factor for approval of an individual annexation.

12. Annexation Priorities - In an effort to help ensure that future urbanization is timed and coordinated to best meet the needs and resources of the City of Bandon, the priorities for annexing areas within the UGB are as follows.

Response: The subject property is in the Second Priority Area for annexation East Bandon. The comprehensive plan says this about the area:

The Second Hiqhest Priority area for annexation is the "East Bandon" area. (This area is bounded on the north by the City limits at approximately 13th Street, on the west by Highway 101, on the east by the extended Harlem Avenue/Harvard Street, and on the south by Vine Street. County zoning is a mix of Residential, Commercial, and Industrial.) The City will look favorably upon any requests for individual annexations within this area, but will not actively pursue annexation, unless a specific benefit to the City can be identified for a particular annexation.

Response: This is a city-initiated annexation. In this instance, there is a significant specific benefit to the City from this project. Bandon has a critical housing affordability problem. This annexation provides an opportunity to provide affordable housing that simply cannot be replicated anywhere else in the City. The property owner in this instance has committed to developing the site in a manner that support housing affordability for the City. The city retains control over the provision of infrastructure and zoning in order to provide extra assurance that the area will develop as anticipated. This factor strongly weighs in favor of the proposal

G. Summary of Comprehensive Plan Factors.

It is important to recognize the difference between criteria and factors. Criteria generally need to be met individually. They generally entail a yes/no decision. Factors on the other hand, generally need to be weighed and balanced. A low “score” on a particular factor does not preclude approval of a proposal. Case law simply requires a showing that all of the factors have been weighed and considered.

Staff believe that in this case, the applicable factors balance in favor of the proposal.

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

1330 TEAKWOOD AVENUE
Coos Bay, Oregon 97420
Ph: (541) 269-0732
Fx: (541) 269-2044
www.dyerpart.com

MEMORANDUM

DATE February 22, 2022

TO Dan Chandler
City Manager
City of Bandon
P.O. Box 67
Bandon, Oregon 97411

COPY TO: Steve James
Wastewater Lead

FROM Steve Major, PE, City Engineer Sm

PROJECT NAME Wastewater System Capacity

PROJECT NO. 101.00C

The wastewater system, collection and treatment systems, were evaluated for capacity with regards to the proposed 19-acre annexation south of town near 20th Street SE between Highway 101 and Rosa Road. We assumed development would consist of residential single and multiple family units with up to a total of 200 new units. Maximum wastewater flow at build out was estimated at 75,000 gallons per day.

Collection System

Based on our preliminary investigation the proposed development can be served by a sewer line extension from the existing collection system which currently ends at the intersection 17th Street SE and Baltimore Avenue SE. An eight-inch diameter gravity line installed at minimum grade has a capacity in excess of 500,000 gallons per day. Flows from the annexation area are estimated at well below this value. Also capacity of the downstream collection system is adequate to handle the anticipated increase inflows.

Wastewater Treatment System

Daily monitoring reports were reviewed for the calendar years 2019, 2020 and 2021. Four parameters were evaluated: dry weather flow for the months of May through October, wet weather flows for the months of November through April, biochemical oxygen demand (BOD) in pounds per day and total suspended solids (TSS)in pounds per day. The following is our conclusions on capacity for each of the four parameters:

- Dry Weather Flow – None of the data points exceeded the design flows of the facility for average dry weather flow and maximum month dry weather flow. All but four of the data points were at least thirty percent below the average dry weather flow design value.
- Wet Weather Flow – Only nine days out of 540 during the three year period exceeded the average wet weather flow design value. All of the flows were well below the peak day and peak instantaneous flow design values.
- BOD – All of the data points were below the design maximum month pounds per day loading. Eighty nine percent of the data points were more than thirty five percent below the maximum month value.
- TSS – All of the data points were below the design maximum month pounds per day loading. The highest data point was approximately forty two percent below the maximum month value.

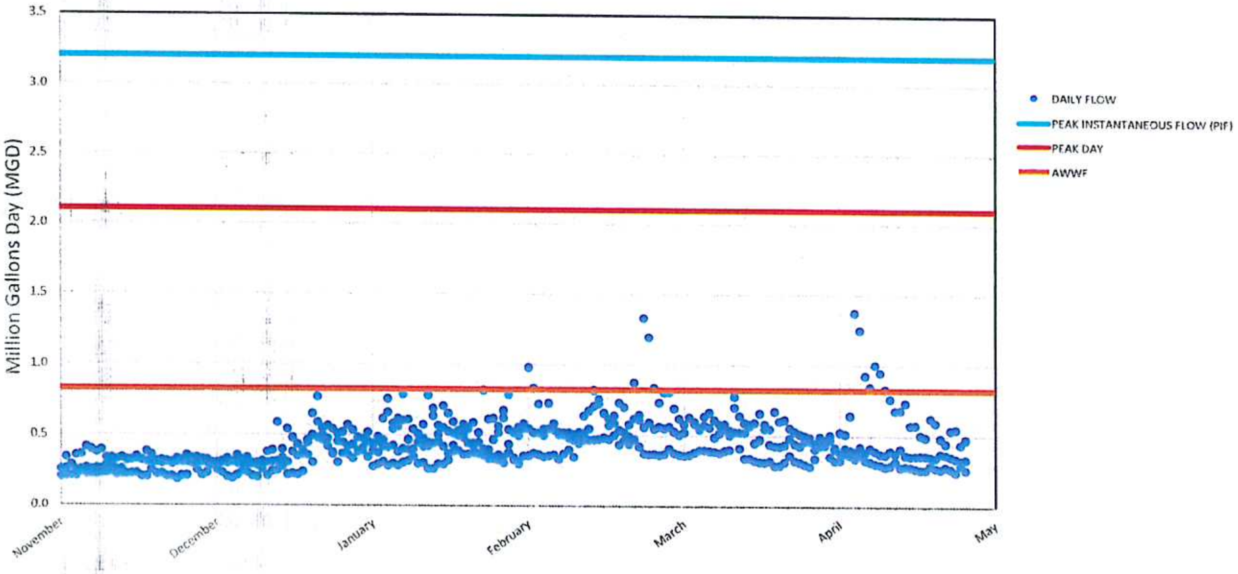
Refer to the attached graphs for the four parameters evaluated.

Based on our analysis and the items listed below the existing collection and wastewater treatment system has the capacity to serve the proposed annexation area.

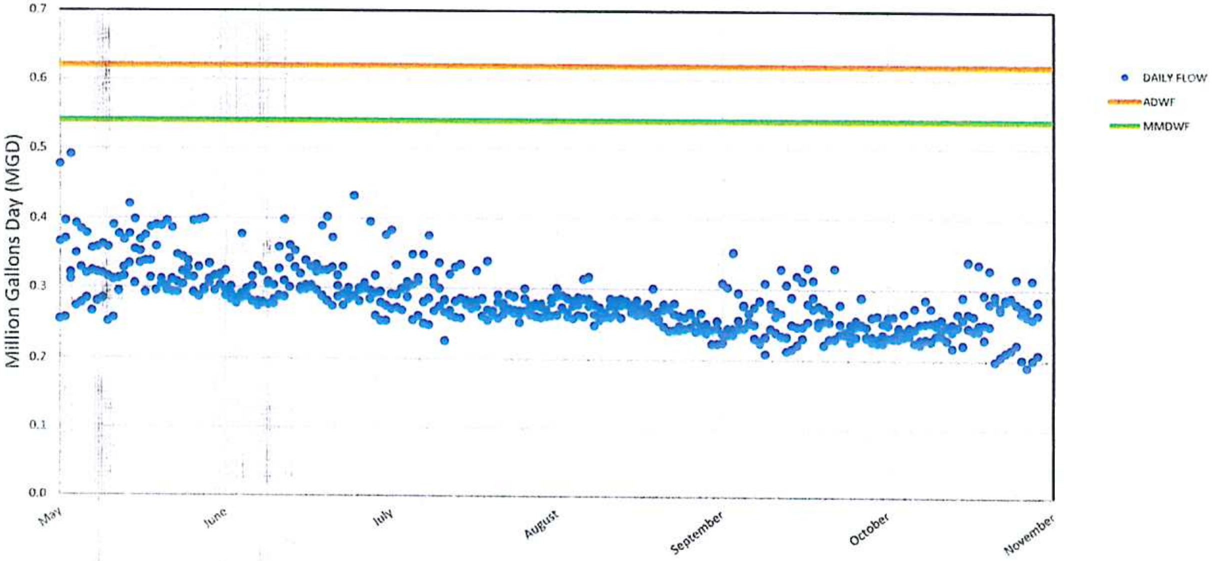
- The City is currently out to bid on a large inflow and infiltration reduction project. The estimated cost for this project $1.0M. Construction should be completed by August 2022. The project will reduce future wet weather flows and loads to the treatment facility.
- Flows and loads for the past three years are well below the design values for the wastewater treatment system.
- The wastewater treatment system has two aeration basins and secondary clarifiers. The City currently operates only one of each facility. As flows and loads increase the second aeration basin and second secondary clarifier can be put on-line.

If you have any questions please give me a call.

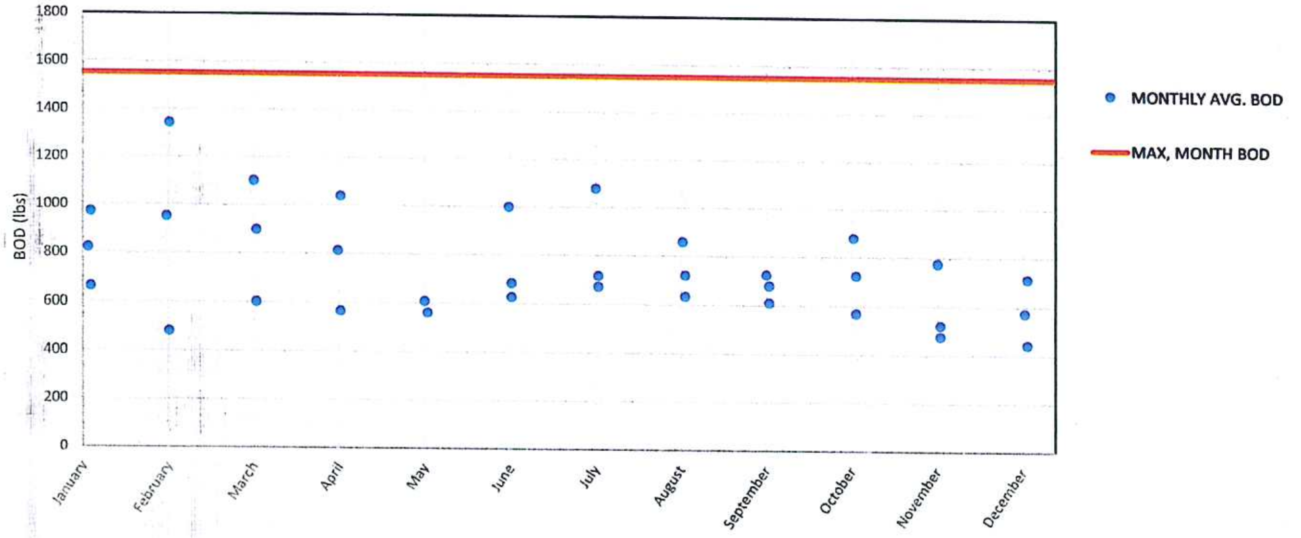
2019-2021 WET WEATHER MONTHLY - FLOW



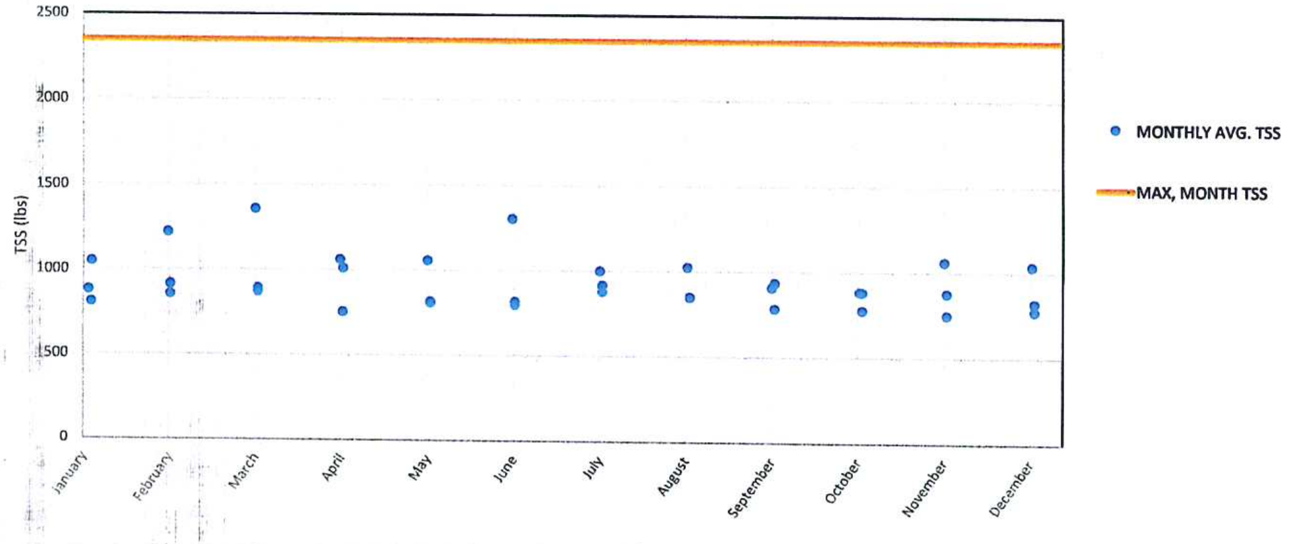
2019-2021 DRY WEATHER MONTHLY - FLOW



2019-2021 - BOD



2019-2021 - TSS



To: The Planning Department and Planning Commission, February 21, 2022

From: Sheryl Bremmer, 3221 Natalie Way, Bandon, OR 97411

Please ensure that the following is included in the public record of the Planning Commissions meeting February 24, 2022 and in the Planning Commission's packets and documents prior to the meeting.

22-020 Annexation: Annexation is often a complicated process that requires a great deal of planning, community support, financial considerations, infrastructure impacts, and thoughtful communication. Because Bandon is a Home Rule City, and because Bandon's Charter and Municipal Code do not appear to have guidelines for annexation, the Oregon Revised Statutes Chapter 222, is an important foundation to build upon when making decisions about annexation requirements.

In order to render an informed decision about 22-020 Annexation, The following questions and concerns should be answered:

1. If the legislative body (city council, CC) is initiating an annexation on its own motion, when, precisely, did it make an appropriate motion? See ORS 222.111
2. Since this annexation appears to have been discussed with agents outside the legislative body, not in public, beginning in August of 2021, Why was the public not made aware at the onset of the proposal?
3. The CM's city Facebook page included an entry somewhat describing a "Bandon Opportunity Project". Who is being given the opportunity with the "Bandon Opportunity Project"?
4. What jobs are available in Bandon that will pay enough to allow employees to live in Bandon?
5. What does the Planning Commission and CC consider monthly rent that is "affordable"?
6. Who is really paying for this project? Bandon citizens?
7. Who is developing this project? "Many people" who are not named is not an acceptable answer.
8. The City Manager states in the "Bandon Opportunity Project" description that there will be no re-zoning, yet also says that the acreage is zoned Light Industrial and Commercial. These housing projects are, presumedly, residences. How does this not require an overlay or rezoning?

9. Who is paying for opening 20th St., paving it, making it a thoroughfare to Rosa Rd., and assuring that it is up to proper street standards? Will it have curbs, gutters, sidewalks?
10. Who is paying for the gorse control/clean up in this area?
11. Has the DLCD been informed of this project? If not, why not? If so, what was their input?
12. Since this will affect the entire City of Bandon and its residents, why hasn't a Measure 56 notice been sent out?
13. Where is the detailed plan of this annexation? If there is none, how can you go forward without one and ensure that you are proceeding in a lawful manner?
14. Why is the CM presenting this annexation to the Planning Commission and later to the CC as a "fait accompli" where it appears that the only way to vote is "yes"?
15. Why hasn't there been a Town Hall Meeting about this proposal? The proposal has been around since August 2021.
16. Will this proposal be placed before the electorate for a vote? If not, will there be a true "public meeting" where the electorate can express their opinions and ask questions?
17. Since ORS 222.115 requires publication of notice of hearing in a newspaper of general circulation in the city and in four public places in the city for two successive weeks prior to the day of the hearing, what newspaper is the city using as a paper of record, since we have no newspaper of general circulation in the city? Where are the designated "public places" in the city?
18. Why are dates missing for public comment deadlines for Planning Commission and CC hearings?
19. Why does this project have the aura of secrecy around it and why is it being force fed to the public without a motion, a plan, a cost analysis, proper noticing, and time to discuss how this is an opportunity that is positive for Bandon and its residents?
20. Specifically, how is Coos County involved in this project?
21. 17 acres is not a great amount of land; how many residences are planned?

It appears that this project is an idea with no plans for completion. If true communication is to take place, specific details are imperative . How can this be a “Bandon Opportunity” when it is so opaque that we don’t know what it is?

Sheryl Bremmer

Bandon
·OREGON·
Chamber of Commerce
www.bandon.com

300 Second Street
PO Box 1515
Bandon, OR 97411
541-347-9616

DATE: February 23, 2022
TO: Bandon Planning Commission
Bandon Planning Department
FROM: Margaret Pounder MP
Bandon Chamber of Commerce
RE: Workforce Housing in Bandon

We are asking your support for workforce housing. Your support of these projects is critically needed, and we are looking to you for leadership that our community needs to help correct the current imbalance between jobs and housing. Workforce housing, which includes a myriad of housing types that will be utilized by teachers, hospitality workers, nurses, doctors, administrative staff, bank staff and more. The list is endless.

To date, the proposals we have learned of and are working with, are projects that will provide the much-needed residences affordable to local workers who have been forced to commute distances to their jobs due to the lack of local housing. After numerous years of working to get the attention of commercial developers for these type projects, we are seeing a small amount of success. There is also interest in retirement housing, which Bandon needs as well. We must solve our housing crisis, as a community.

We hope you agree, that losing a vital part of our population is a concern for the future well-being of our city, and that providing appropriate housing is the only way to ensure that we remain a healthy and thriving community.

The workforce spends actual "life energy" to make a community. If you work in a community, you ought to be able to live there! Work there – Live there!

Thank you.

To: The Planning Department and Planning Commission, February 22, 2022

From: Mary O'Dea P.O. Box 820, Bandon, Oregon 97411

Please ensure that the following is included in the public record of the Planning Commissions meeting February 24, 2022 and in the Planning Commission's packets and documents prior to the meeting. 22-020 Annexation: Annexation is often a complicated process that requires a great deal of planning, community support, financial considerations, infrastructure impacts, and thoughtful communication. Because Bandon is a Home Rule City, and because Bandon's Charter and Municipal Code do not appear to have guidelines for annexation, the Oregon Revised Statutes Chapter 222, is an important foundation to build upon when making decisions about annexation requirements. In order to render an informed decision about 22-020 Annexation, The following questions and concerns should be answered:

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20. Specifically, how is Coos County involved in this project?

21. 17 acres is not a great amount of land; how many residences are planned?

It appears that this project is an idea with no plans for execution or completion. The true costs and benefits to Bandon's rate payers must be communicated in a transparent, factual, and truthful way .

Mary O'Dea

City of Bandon
P.O. Box 67
Bandon, Oregon 97411
541-347-2437
www.cityofbandon.org

Notice of Public Hearing – Annexation (Rescheduled)

Date and Time of Hearing: ***Planning Commission:*** March 24, 2022, at 7:00 p.m.
City Council: April 11, 2022, at 7:00 p.m.

Location of Hearing: ***Via Zoom Conference - Meeting Links are below***

Planning Commission
https://us02web.zoom.us/j/2157059460 Meeting ID: 215 705 9460

City Council
https://us02web.zoom.us/j/2157059460 Meeting ID: 215 705 9460

Tax Lot(s): ***Map 28S-14W-31BC***
Tax Lots 2100, 2200, 2201, 2300 2700, 3600, 3700, 4400, 4300, 4200, 4100 and associated rights of way as shown on the attached map. Approximately 4334 feet of Highway 101 Right of Way. (See Figure A and Figure B.)

Address: ***Along 20th St. SE. Right of Way, and Highway 101***

Applicant: **City Council Initiated**

Owner: ***South Coast Housing, LLC; City of Bandon; State of Oregon by and through the Department of Transportation.***

Proposal: ***Annex approximately 17 acres of property, plus Highway Right of Way. No changes to zoning. Property to remain in all current special districts.***

Current Use: ***Vacant land with no structures, right of way***.

This notice is to inform you of a pending annexation. The property is located inside Bandon's Urban Growth Boundary and has a light industrial and commercial comprehensive plan designation, which will remain in place as it is consistent with the city plan designation for the property.
The City is also annexing a section of Highway 101 Right of Way, which is unzoned.

Testimony can be mailed to the City of Bandon, Attn: Dana Nichols, PO Box 67, Bandon, OR, 97411 or emailed to planning@cityofbandon.org. The following dates should be noted for testimony deadlines:

Planning Commission Hearing on March 24th, 2022

- **5:00 pm, March 16, 2022:** Deadline for inclusion of testimony in meeting packet.
- **5:00 pm, March 23, 2022**: Deadline for electronic (e-mail or FAX), hand delivered or US mail testimony.
- **After 5:00 pm on March 23, 2022:** Testimony must be presented at the hearing.

City Council Hearing on April 11th, 2022

- **5:00 pm, April 5, 2022:** Deadline for inclusion of testimony in meeting packet.
- **5:00 pm, April 7, 2022**: Deadline for electronic (e-mail or FAX), hand delivered or US mail testimony.
- **After 5:00 pm on April 7, 2022:** Testimony must be presented at the hearing.

A copy of the application, all documents submitted by or on behalf of the applicant, and applicable criteria are available for inspection at no cost and will be provided at a reasonable cost, upon request. A vicinity map of the subject property is included for reference on the next page.

Notice of Public Hearing – Annexation (Rescheduled)

City of Bandon • P.O. Box 67, Bandon, Oregon 97411 • 541-347-2437 • www.CityOfBandon.org

Date and Time of Hearing: *Planning Commission:* March 24, 2022 at 7:00 p.m.
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https://us02web.zoom.us/j/2157059460 Meeting ID: **215 705 9460**

City Council
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FIGURE A.

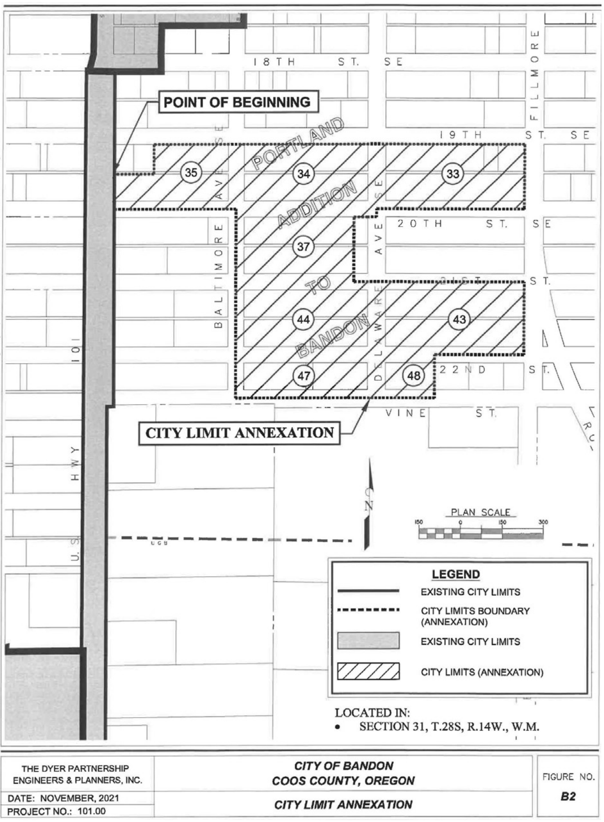
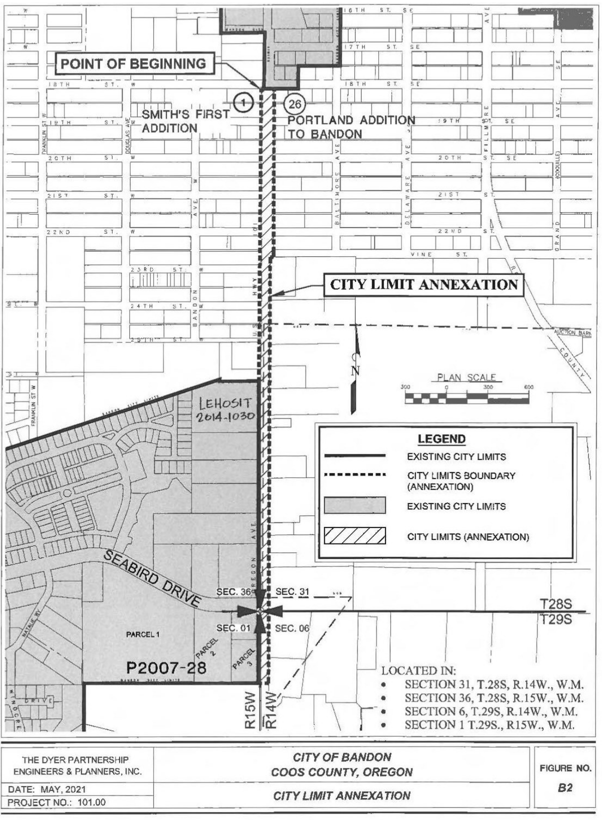


FIGURE B.



Published: March 4 and March 8, 2022 • The World & ONPA (ID: 337655)

CITY OF BANDON

CITY COUNCIL AGENDA DOCUMENTATION **DATE: April 11, 2022**

SUBJECT: Public Hearing on an annexation into the City of Bandon. **ITEM NO. 4.1**

BACKGROUND:

The City of Bandon has the opportunity to annex approximately 19 acres of land to the City of Bandon. The property is in two parts. The first part generally follows the 20th street right of way from Highway 101 to Rosa Road. The second part consists of approximately 4000 feet of Highway 101 Right of Way. The City Council formally initiated the annexation in Resolution 22-03.

The Planning Commission held a public hearing on the annexation on March 24 and voted unanimously to recommend approval of the annexation.

This will be the second public hearing on the annexation. If approved, staff will prepare an ordinance and findings for consideration at the May council meeting.

A staff report is attached hereto.

FISCAL IMPACT:

See staff memorandum attached hereto..

RECOMMENDATION:

Approve the proposed annexation to the City of Bandon of approximately 19 acres as described in the public notices and staff report.

SUBMITTED BY:

Dan Chandler City Manager

Bandon – Annexation to City
May 27, 2021
Page 1 of 1

EXHIBIT A
Annexation to City Limits

The purpose of this description is to describe a parcel of land to be annexed into the City Limits of Bandon, being located in portions of Section 31, Township 28 South, Range 14 West; Section 36, Township 28 South, Range 15 West; Section 6, Township 29 South, Range 14 West and Section 1, Township 29 South, Range 15 West of the Willamette Meridian, County of Coos, State of Oregon and is more particularly described as follows:

1. Beginning at the northeast corner of Block 1 of the Smiths First Addition to Bandon as per Plat Map filed in Book 3, Page 25, Plat Records, said point lying on the south line of the City Limits of Bandon;

2. Thence southerly 2,160 feet along the westerly right-of-way of U.S. Highway 101 to the northeast corner of a parcel of land owned by Phillip and Patricia Lehosit as described in Instrument No. 2014-01030, said point also being the northeast corner of the City Limits of Bandon;

3. Thence continuing southerly 2,179 feet along said westerly right-of-way of U.S. Highway 101 and said City Limits to the southeast corner of Parcel 3 of Partition Plat No. 2007-28;

4. Thence East 60 feet to the east right-of-way of U.S. Highway 101;

5. Thence northerly 4,334 feet along the easterly right-of-way of U.S. Highway 101 to where it intersects the existing city limits, being the northwest corner of Block 26 of Portland Addition to Bandon as per Plat Map filed in Book 3, Page 13, Plat Records;

6. Thence westerly 80 feet, more or less, to the point of beginning, all as specified on the attached Exhibits B1 and B2.

Notes
1. All subdivision plats herein referenced are records of Coos County Plat Records.
2. All deed reference numbers are records of Coos County Clerk's Office.

REGISTERED
PROFESSIONAL
LAND SURVEYOR
OREGON
JULY 26, 1988
MICHAEL W. ERICKSON
2340
EXPIRES: 12-31-21

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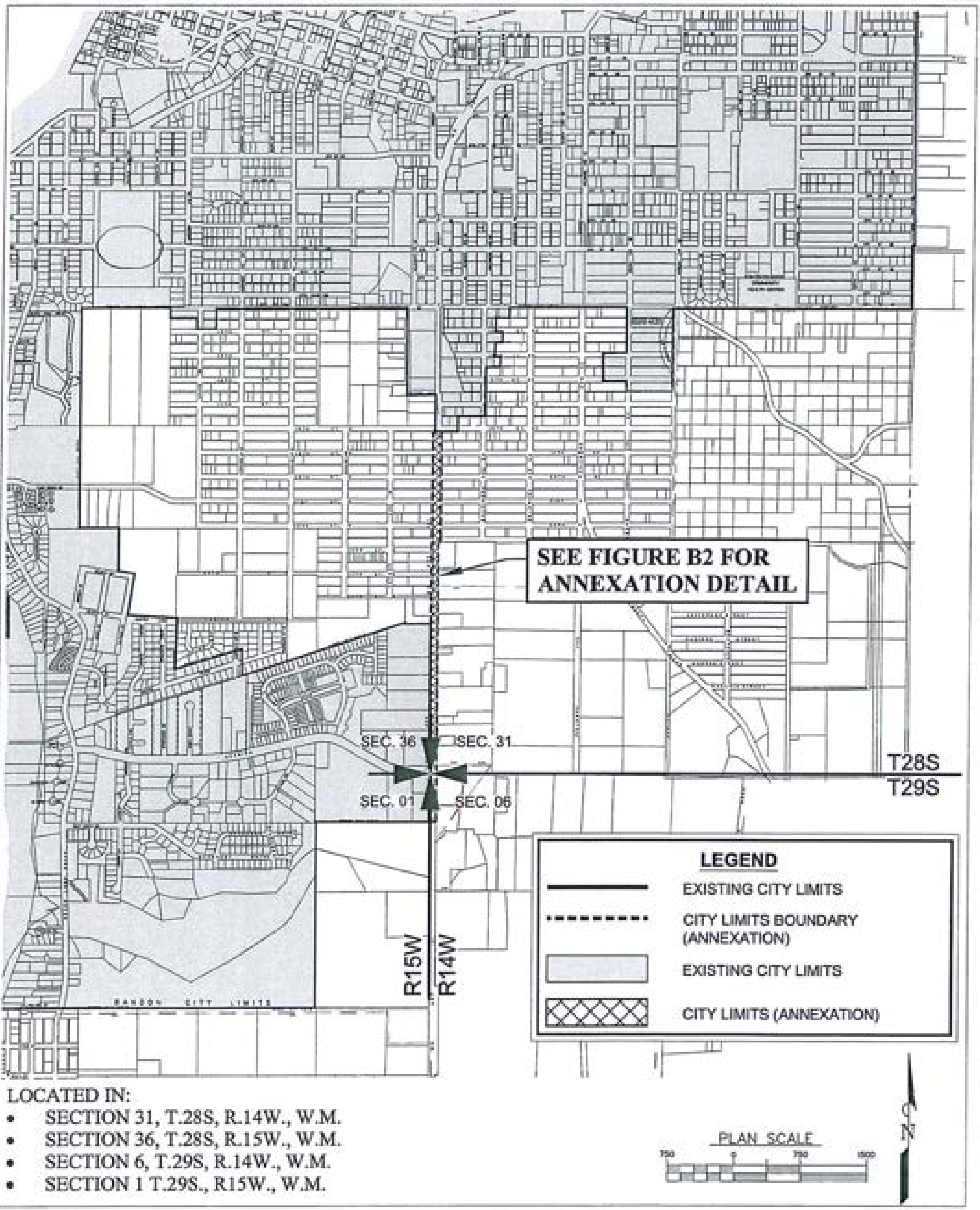


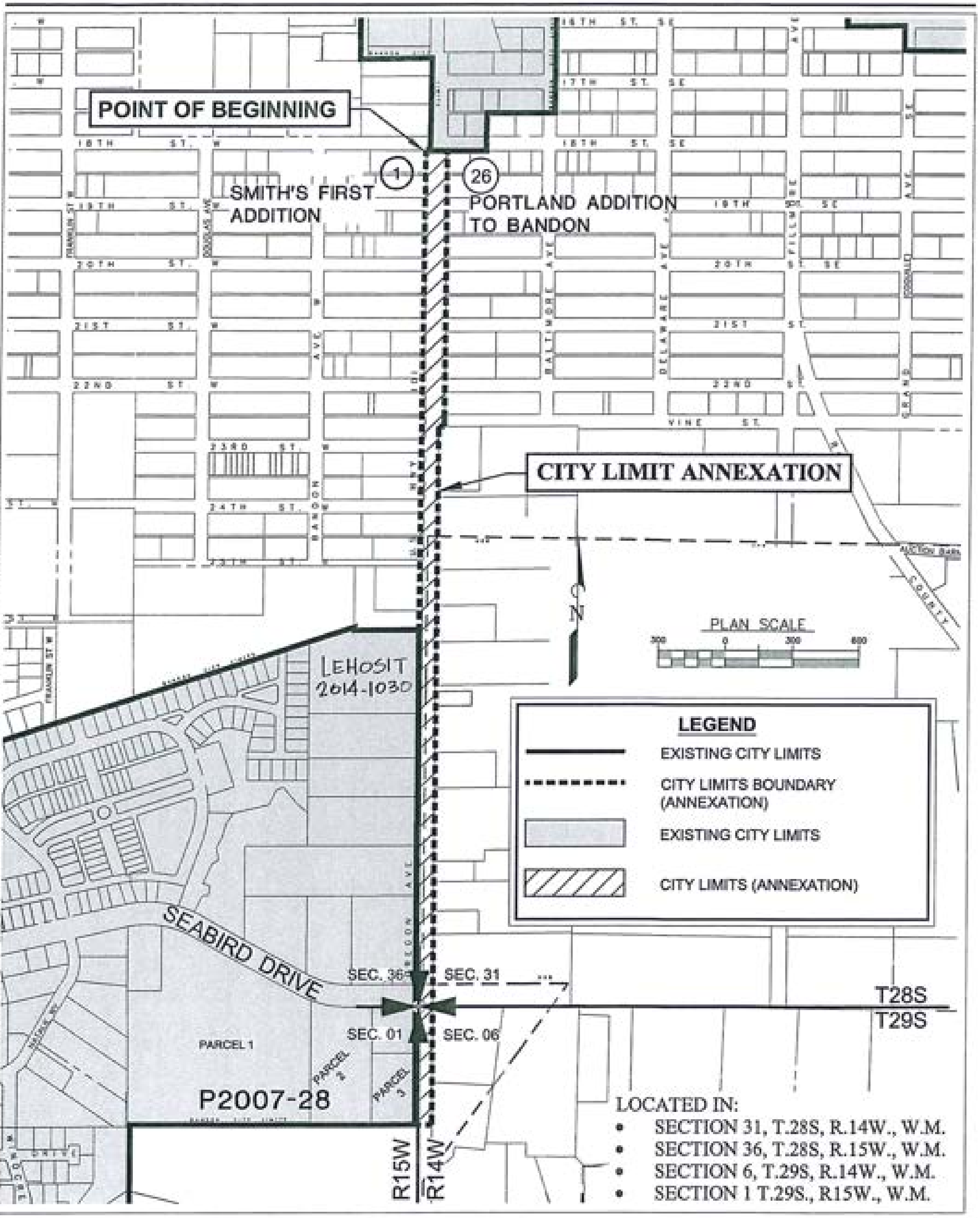
LOCATED IN:
- SECTION 31, T.28S, R.14W., W.M.
- SECTION 36, T.28S, R.15W., W.M.
- SECTION 6, T.29S, R.14W., W.M.
- SECTION 1 T.29S., R15W., W.M.

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.
DATE: MAY, 2021
PROJECT NO.: 101.00

CITY OF BANDON
COOS COUNTY, OREGON

CITY LIMIT ANNEXATION

FIGURE NO.
B1



THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

DATE: MAY, 2021
PROJECT NO.: 101.00

CITY OF BANDON
COOS COUNTY, OREGON

CITY LIMIT ANNEXATION

FIGURE NO.
B2

X:\AAprojects\101 Bandon\101.00\CITY LIMIT EXPANSION\101.00 - CITY LIMIT EXPANSION.dwg, 6/1/2021 9:29:14 AM PLOT DATE June 1, 2021

EXHIBIT A
Annexation to City Limits

The purpose of this description is to describe a parcel of land to be annexed into the City Limits of Bandon, located in a portion of Section 31, Township 28 South, Range 14 West of the Willamette Meridian, County of Coos, State of Oregon and is more particularly described as follows:

1. Beginning at the northwest corner of Lot 18 of Block 35 of the Portland Addition to Bandon as per Plat Map filed in Book 3, Page 13, Plat Records, said point lying on the easterly line of the City Limits of Bandon;

2. Thence east 150 feet to the northeast corner of Lot 23 of said Block 35;

3. Thence north 110 feet along the east line and its extension thereof of Lot 12 of said Block 35 to the northeast corner of said Lot 12;

4. Thence east 1,355 feet along the south right-of-way of 19th Street SE to the northeast corner of Block 33 of said Portland Addition to Bandon;

5. Thence south 240 feet along the west right-of-way of Fillmore Avenue SE to the centerline of 20th Street SE right-of-way;

6. Thence west 535 feet along said centerline of 20th Street SE to where it intersects with the centerline of Delaware Avenue SE;

7. Thence south 30 feet along said centerline of Delaware Avenue SE to the south right-of-way of 20th Street SE;

8. Thence west 85 feet along said south right-of-way of 20th Street SE to the northwest corner of Lot 2 of Block 37 of said Portland Addition to Bandon;

9. Thence south 240 feet along the west line of Lots 2 and 35 of said Block 37 and its extension thereof to the centerline of 21st Street SE right-of-way;

10. Thence east 620 feet along said centerline of 21st Street SE to the west right-of-way of Fillmore Avenue SE;

11. Thence south 270 feet along said west right-of-way of Fillmore Avenue SE to where it intersects with the centerline of 22nd Street SE right-of-way;

12. Thence west 325 feet along said centerline of 22nd Street SE to where it intersects with the east line and its extension thereof of Lot 14, Block 48 of said Portland Addition to Bandon;

13. Thence south 160 feet along said east line and its extension thereof of said Lot 14 to the centerline of Vine Street said centerline lying 30 feet south of said Block 48;

14. Thence west 725 feet maintaining 30 feet south of the north right-of-way of said Vine Street to the centerline intersection of Vine Street and Baltimore Avenue SE;

15. Thence north 700 feet along the centerline of Baltimore Avenue SE to where it intersects with the centerline of 20th Street SE right-of-way;

16. Thence west 455 feet along said centerline of 20th Street SE to where it intersects with the easterly right-of-way of U.S. Highway 101;

17. Thence northerly 130 feet along said easterly right-of-way of U.S. Highway 101 to the point of beginning, containing 19.8 acres, more or less, all as specified on the attached Figures B1 and B2.

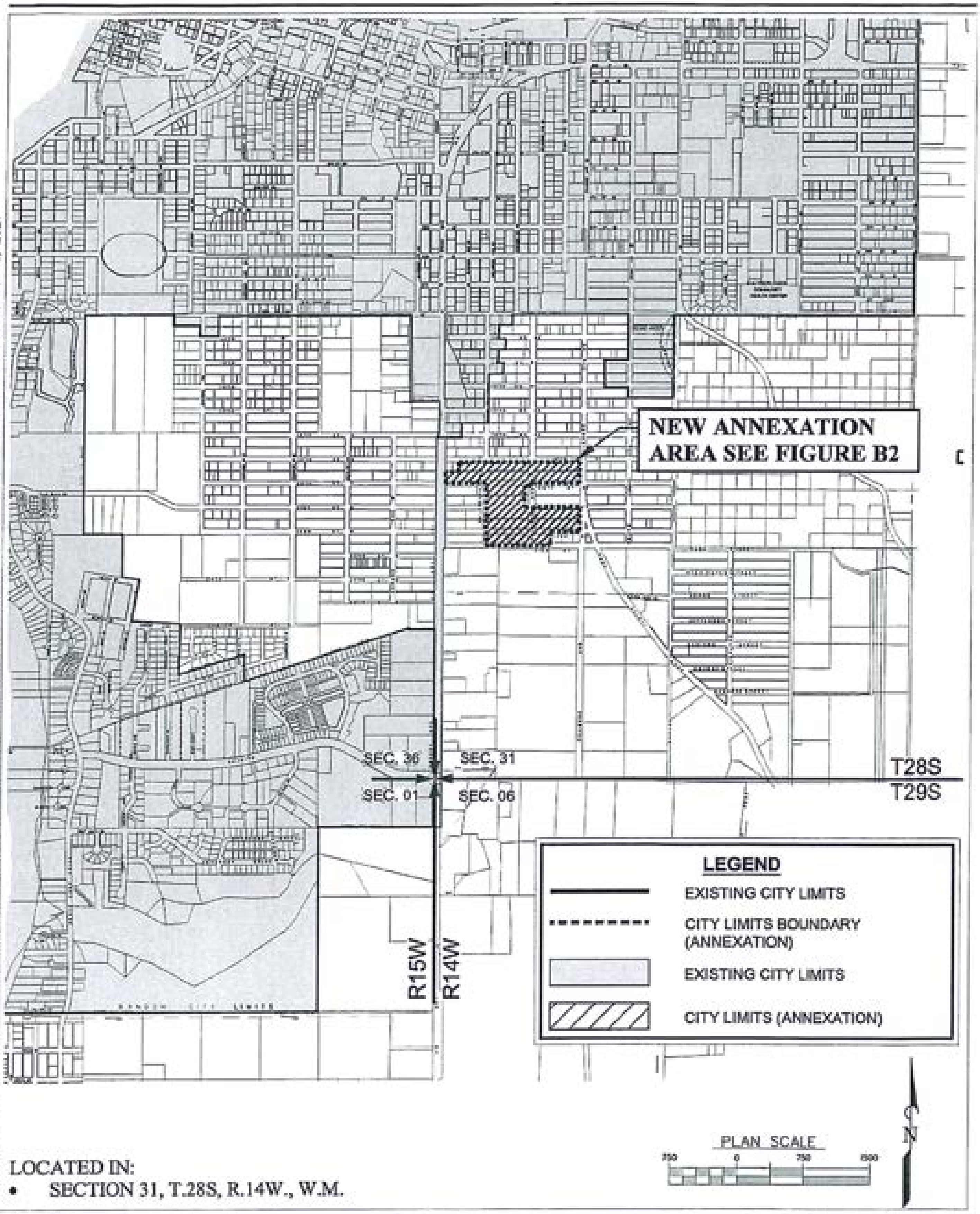
Notes

1. All subdivision plats herein referenced are records of Coos County Plat Records.

REGISTERED
PROFESSIONAL
LAND SURVEYOR

OREGON
JULY 26, 1988
MICHAEL W. ERICKSON
2340

EXPIRES: 12-31-21



LOCATED IN:
- SECTION 31, T.28S, R.14W., W.M.

THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	***CITY OF BANDON*** ***COOS COUNTY, OREGON***	FIGURE NO.
DATE: NOVEMBER, 2021 PROJECT NO.: 101.00	***CITY LIMIT ANNEXATION***	***B1***

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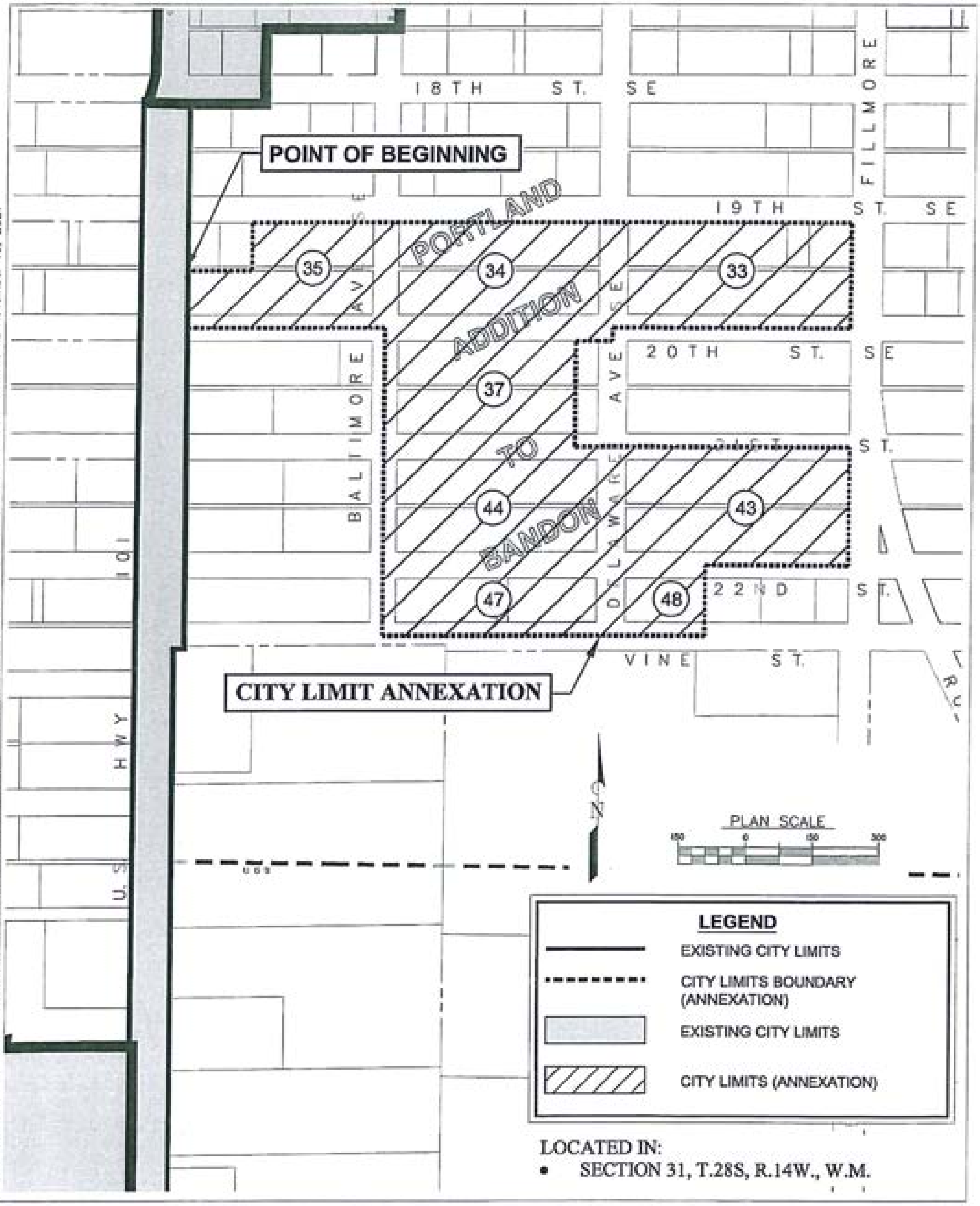

LOCATED IN:
- SECTION 31, T.28S, R.14W., W.M.

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THE DYER PARTNERSHIP ENGINEERS & PLANNERS, INC.	*CITY OF BANDON* *COOS COUNTY, OREGON*	FIGURE NO.
DATE: NOVEMBER, 2021 PROJECT NO.: 101.00	*CITY LIMIT ANNEXATION*	B2

To: Bandon City Council

From: Dan Chandler, City Manager

Re: Bandon Opportunity Site Proposed Annexation

Date February 17, 2022 (Revised March 30, 2022.)

A. Introduction

This is a city-initiated annexation for an area within the Bandon Urban Growth Boundary. The annexation falls under ORS 222.170 as a triple-majority annexation. All property owners have consented to the annexation. Coos County, which has right-of-way in the area has neither consented to opposed. County consent is not necessary.

B. Property Description

The subject property is best described in two parts.

The first part is the Highway 101 right-of-way from 18th Street to just south of the Seabird Drive/Highway 101 intersection. The second area is approximately 19 acres in an irregular shape, between Highway 101 on the west to Rosa Road on the east. The two areas abut and are connected to existing city limits. Maps of the subject property are attached as Exhibit A.

The entire area is in Bandon's Urban Growth Boundary. The area is split-zoned, with commercial zoning on the western portion and Light Industrial to the east. The City has comprehensive plan designations for the property, which are identical to the county zoning.

A significant amount of the property is likely jurisdictional wetland. The owner has obtained a draft wetland delineation that is awaiting a survey to determine wetland boundaries.

The non-highway section is vacant land with no structures or electors.

C. Consent

There is only one non-government "owner" in the area. The Oregon Department of Transportation owns the Highway 101 right-of-way, and South Coast Housing LLC owns the remaining private property. Both have consented to the annexation. There is a city-owned parcel at the corner of the 20th street right-of-way and Rosa Road. Coos County has a right-of-way interest in some of the area, but the City does not have either consent or an objection from Coos County for those areas of county right-of-way included. However, neither the city property nor the county right-of-way are considered for purposes of determining number of owners or value for an annexation under ORS 222.170(4).

D. Approval Criteria and Factors

17.118.030 Approval standards.

An annexation may be approved if the proposed request for annexation conforms, or can be made to conform through the imposition of conditions, with the following approval criteria:
A. The land is within the City's Urban Growth Boundary.

B. The proposed zoning for the annexed area is consistent with the Comprehensive Plan, and a project, if proposed concurrently with the annexation, is an allowed use within the proposed zoning.

C. The land is currently contiguous with the present City Limits.

D. Adequate City facilities can and will be provided to and through the subject property, including water, sanitary sewer, and storm drainage. Unless the City has declared a moratorium based upon a shortage of water or sewer; it is recognized that adequate capacity exists system-wide for these facilities.

E. The annexation is consistent with the annexation policies contained in the Comprehensive Plan.

E. Analysis of Code Factors

A. The land is within the City's Urban Growth Boundary.

Response: The proposed site is within Bandon's Urban Growth Boundary. This criterion is met.

B. The proposed zoning for the annexed area is consistent with the Comprehensive Plan, and a project, if proposed concurrently with the annexation, is an allowed use within the proposed zoning.

Response: The City's comprehensive plan shows the subject property as having the same comprehensive plan designations as the current Coos County designations.

The City is not changing the zoning at this time. Therefore, pursuant to ORS 215.130, the property will retain its current zoning. Once more information is gathered on the amount and configuration of buildable land, we anticipate development of an overall master plan for the property. Potential zoning changes will be considered at that time. It is important to note that under SB 8 (2021), affordable housing may be constructed on land with industrial and commercial zoning. Therefore, it may not be necessary to change the zoning on portions of the property to develop housing.

C. The land is currently contiguous with the present City Limits.

Response: The subject property is contiguous to city limits to the north and south along the Highway 101 Right-of-Way.

D. Adequate City facilities can and will be provided to and through the subject property, including water, sanitary sewer, and storm drainage. Unless the City has declared a moratorium based upon a shortage of water or sewer, it is recognized that adequate capacity exists system-wide for these facilities.

Response: There is an 8-inch water main through the property along the 20th Street right-of-way. There is a sewer line approximately 500 feet to the north of the site in Baltimore Street. Water and sewer can be effectively provided to and through the property. Storm drainage can be addressed through on-site detention.

Attached is a memorandum from Dyer Partnership analyzed wastewater capacity and concluding that there is adequate capacity to serve the system.

There has been no moratorium imposed, adequate system capacity exists for these facilities.

F. Analysis of Comprehensive Plan Factors

Preliminary Note: It is important to note that factors are different than criteria, in that factors should be considered and balanced, but are not individual pass/fail criteria.

1. Annexation Configurations - When considering the specific boundaries of an area to be annexed, the City will add or eliminate property, whenever appropriate, to ensure that the shape of the annexed area conforms to standard blocks, fractional section lines, existing and future street and utility system layouts and plans, natural features, topography, and other considerations, so that the resulting city limits configuration is efficient and sensible.

Response: The proposed annexation follows existing platted streets and rights-of-way. This factor weighs in favor of the annexation.

2. Leveraging the Annexation of Adjacent Properties - When considering a proposed annexation, the City will determine whether there are any adjacent properties which are in the City's best interest to annex at that same time. If so, those additional desirable properties will be combined with the properties in the annexation request, in a manner and configuration which will maximize the value of the annexation request to leverage the simultaneous or subsequent annexation of those adjacent properties whose owners may not necessarily be in favor of annexation.

Response: Much of the adjacent property is developed with either commercial or low-density rural residential property. The residential properties are served by wells and septic systems. It is not in the city's best interest to annex those properties at this time for several reasons. First, they would provide little benefit to meeting the city's housing or employment needs, as they are mostly developed. Second, the fiscal benefit of annexing developed property is minimal.

3. Creating County Islands - When determining the final configuration of an annexation, and to leverage the annexation of any desired adjacent properties, the City will consider the benefits of creating islands of County property, which can then be annexed at will, either immediately or in the future,

Response: The proposed annexation does create an island of county property to the west of Highway 101. However, given the size of the island, the City has no intention of annexing the island. Under case law, the City would need to annex the entire area to qualify as an "island annexation." The City does not have the need, or the resources to annex the entire area for the foreseeable future. Annexations in that area are likely to happen only in small amounts as petitions are received, and in each case subject to a new analysis of annexation factors.

4. Fiscal Impact of Annexations - Prior to annexing an area, the specific fiscal impacts of that annexation shall be determined, to include a measurement of the effects on City tax revenues, utility revenues, cost of providing services, etc. Absent evidence to the contrary for a particular annexation, it is anticipated that the immediate fiscal impact of any annexation will be negative. However, for undeveloped areas, and areas which have development potential, the immediate negative impacts can be expected to be offset by the positive fiscal impacts of future development. The greater the ratio of undeveloped to developed property, the greater the potential for the fiscal impacts to become positive.

Response: The entire area is undeveloped, other than the highway right-of-way. Development of the area will provide the following fiscal benefits:

Additional Property Tax Revenue

The proposed annexation area has a combined assessed value of $300,530. Considering Bandon's permanent tax rate, local option street tax, the total initial estimated net property tax impact will be a combined increase of $15.06 per year, as shown below. The land is currently vacant, which accounts for the lower assessed value for the 19 acres. As this property develops, values will increase, and taxes collected will rise. The city intends that the property remain in the Bandon Rural Fire Protection District.

Bandon Permanent Property Tax Rate ($0.4580 / $1,000 AV)	$	137.64
Local Option Street Tax ($0.8455 / $1,000 AV)	$	254.10

Net Property Tax Impact to the City (pre-development)	$	391.74

Additional Bond Rate Revenue

The annexation will bring an additional $300,530 of assessed value into City Limits before development, adding to the current assessed value of all property (excluding Urban Renewal Areas) of $474,433,882. The City has several bonds with rates that are assessed either by a set annual number divided amongst property owners or based on debt collection that is a flat fee. The addition of additional taxpayers and assessed value will provide a modest decrease to existing payers as the burden will be spread out across these newly annexed properties. This may or may not be affected by Measure 50 limitations.

Additional Municipal Utility Revenue

The proposed property for annexation is currently vacant with no water or sewer service to structures yet. There is a city water main running through the area along the 20th street right-of-way. Development of the property will require the extension of city sewer lines approximately 800 feet along the Baltimore Street right-of-way, which will either be covered by the developers or by using federal grant funding, with no impact to current taxpayers. The new development will yield additional utility customers, which will provide the funding needed to serve the area, and cover some maintenance, staffing, and operations of the expanded service area. In addition, in-city utility customers pay a 10% tax on utilities.

System Development Charges

City services cannot be extended to these properties until they are annexed into the City. Once annexed, development may occur at the owner's expense, and payment of System Development Charges (SDCs) will be required for connections to City water, sewer, storm drainage, and transportation systems. These numbers will vary based on the type and intensity of development proposed (taking into account equivalent dwelling units, square footage, impervious surface, water meter, etc). SDCs are meant to cover the anticipated cost of future expansion of the city's utility systems, as well as pay "reimbursement" to systems that were installed to serve future growth. Our SDC methodology is based on master plans for each of the utilities listed above.

Conclusion

The financial impact of the proposed annexation will be modest initially as the changes in tax collected and reduction to bond assessments is minimal. However, over time, development of the property will increase assessed value, add utility customers, and pay for needed capital improvements through payment of SDCs.

5. Development Control Issues - While the fiscal impacts of annexation are important, they will not necessarily be the overriding factor. Consideration must also be given to the overall impact the annexation will have on the community by virtue of its being subjected to City development control, including comprehensive planning, zoning, regulating nonconforming uses and structures, and subdivision regulations. Those benefits may outweigh any projected negative fiscal impacts.

Response: There are significant benefits to bringing this property under city development control. First, the city can master plan the property in a fashion tailored to meet the city's need for affordable and workforce housing. There are few, if any properties currently on the market of a size and nature sufficient to have any impact on the city's affordability crisis.

If the property remains outside the city, it will likely remain undeveloped, and will thus provide no contribution to either the city housing stock or economic base. Annexation will allow the property to be served by city services and developed to meet the community's needs. This factor strongly weighs in favor of the subject annexation.

6. Sufficiency of Infrastructure Systems - When considering an annexation, the City will ensure that the existing infrastructure systems can or will meet the needs and demands of the area proposed to be annexed. An analysis of the existing street, water, sewer, storm drain, and other infrastructure systems will be undertaken to determine whether capacity exists to serve the subject area. If not, a determination will be made regarding whether anticipated system development revenues, other funding mechanisms such as a local improvement district (LID), or direct funding from the petitioner or property owners, will be necessary and sufficient to adequately finance the required infrastructure improvements. All utility and infrastructure improvements shall be consistent with the City's adopted master plans.
Streets

Response:

Streets: The property has frontage and a right-of-way connection to both Highway 101 and Rosa Road, which is designated as a collector in the City's Transportation System Plan (TSP). Twentieth Street is designated as a Future Collector Cross Street in the TSP (TSP, Fig,.1)

The property is adequately provided with right-of-way in its current configuration and can be efficiently served with streets.

Water: The City's water plant has existing capacity for a population of 4000 persons, and with minor additions can serve double that number. The City is in the process of working on climate and potential drought mitigation strategies for the water supply to the plant, which comes from

Ferry and Geiger Creeks. However, those issues exist with or without annexation of the subject property. The city has adequate water rights to serve the city and has never had to make a "call" on junior water right holders upstream. The proposed annexation is only a 1% increase in the size of the city.

Sewer: Bandon's treatment facility "was designed for a population equivalent of 5068 persons." *City of Bandon Wastewater Master Plan, p. 3-14.* Bandon's current population is just over 3300 persons. The City's Wastewater Master Plan predicted a 2021 population of 4241 persons. *Id. P. 2-12.* Actual population is well under this figure. Adequate plant capacity is available. This factor militates in favor of the proposal. The City's engineers have submitted a calculation of system wastewater capacity, and conclude that adequate capacity is available.

Storm drainage: Between stormwater SDCs and the ability to incorporate on-site detention into existing wetlands, there is sufficient stormwater capacity to serve the property.

7. Street Paving - As long as a street paving tax is in effect, which will be immediately imposed on a newly annexed area, the City will pave all existing, unpaved, open streets in that annexed area, as soon as sufficient funds are available from that resource. If no such tax is in effect, the City will determine whether it is appropriate to finance that paving from another City resource, or whether the residents or property owners of the annexed area should be required to pave those streets, as a condition of annexation approval. Prior to the annexation, the City will determine whether reduced street widths, drainage, and sidewalk requirements will be allowed for those existing streets. In no case will the City annex an area containing existing, unpaved, open streets, unless some source for funding the street paving has been identified. Once an area has been annexed, all future streets will be subject to the same street opening and construction standards as would apply to any other area within the City.

Response: All streets will be paved by property owners and developers, possibly aided by state or federal grants and other funds. There are no unpaved open streets.

8. Timing of Annexations - Unless determined otherwise on an individual case by case basis, it can generally be assumed that annexing property sooner rather than later will minimize the negative impacts and maximize the positive impacts of that annexation.

Response: "Now" is sooner than later. This factor militates in in favor of the proposed annexation.

9. Sewer Connection Requirements - For any existing home, business, or other use within an annexed area at the time of the annexation, which is served by an approved, properly functioning septic or other on-site sewage disposal system, the City will waive any requirements for connecting to the municipal sanitary sewer system, as long as the on-site

system continues to function properly. In the event of a failure of the on-site system, any City requirements for connection to the municipal sanitary sewer system will apply, as they would for any other property within the City limits. As a condition of this waiver, the subject property owner will be required to provide documentation to the City regarding the location of the septic or alternative sewage disposal system, and all components thereof. Annually, each property owner shall provide proof to the City that their septic or alternative sewage disposal system is properly operating in conformance with all Department of Environmental Quality (DEQ) requirements. If the City is unsure about whether it is operating properly, the DEQ will be contacted for assistance in making that determination. All costs for providing the proof of proper operation and for inspections shall be the responsibility of the property owner. This waiver applies only to City sewer connection requirements, but does not apply to any DEQ requirements, which the City has no authority to waive.

Response: Under the Bandon Municipal Code, all development will be served by City sewer.

10. Comprehensive Plan and Zoning - Annexation petitions shall be accompanied by applications for a Comprehensive Plan Amendment and a Zone Change. Those applications will be processed and considered concurrent with consideration of the annexation request, so that the provisions of the City's Comprehensive Plan and zoning regulations will immediately apply to the annexed area upon approval of the annexation.

Response: This annexation is council-initiated, rather than being initiated by petition. The factor does not apply. The property already has a city comprehensive plan designation, which is consistent with the county plan. The area will retain its current zoning designation pursuant to ORS 215.130.

11. Annexation Ordinance - The City shall adopt Annexation Regulations as part of the Bandon Municipal Code, specifying the specific requirements for preparing, submitting, and processing an application for annexation. Those regulations will reference, and ensure compliance with, these Annexation Policies, as well as State Statutes governing annexations.

Response: This is a policy to be implemented by the city, and is not a factor for approval of an individual annexation.

12. Annexation Priorities - In an effort to help ensure that future urbanization is timed and coordinated to best meet the needs and resources of the City of Bandon, the priorities for annexing areas within the UGB are as follows.

<u>Response:</u> The subject property is in the Second Priority Area for annexation--East Bandon. The comprehensive plan says this about the area:

The Second Hiqhest Priority area for annexation is the "East Bandon" area. (This area is bounded on the north by the City limits at approximately 13th Street, on the west by Highway 101, on the east by the extended Harlem Avenue/Harvard Street, and on the south by Vine Street. County zoning is a mix of Residential, Commercial, and Industrial.) The City will look favorably upon any requests for individual annexations within this area, but will not actively pursue annexation, unless a specific benefit to the City can be identified for a particular annexation.

Response: This is a city-initiated annexation. In this instance, there is a significant specific benefit to the City from this project. Bandon has a critical housing affordability problem. This annexation provides an opportunity to provide affordable housing that simply cannot be replicated anywhere else in the City. The property owner in this instance has committed to developing the site in a manner that support housing affordability for the City. The city retains control over the provision of infrastructure and zoning in order to provide extra assurance that the area will develop as anticipated. This factor strongly weighs in favor of the proposal

G. Summary of Comprehensive Plan Factors.

It is important to recognize the difference between criteria and factors. Criteria generally need to be met individually. They generally entail a yes/no decision. Factors on the other hand, generally need to be weighed and balanced. A low "score" on a particular factor does not preclude approval of a proposal. Case law simply requires a showing that all of the applicable factors have been weighed and considered.

Staff believes that in this case, the applicable factors balance strongly in favor of the proposal.

THE DYER PARTNERSHIP
ENGINEERS & PLANNERS, INC.

1330 TEAKWOOD AVENUE
Coos Bay, Oregon 97420
Ph: (541) 269-0732
Fx: (541) 269-2044
www.dyerpart.com

MEMORANDUM

DATE February 22, 2022

TO
Dan Chandler
City Manager
City of Bandon
P.O. Box 67
Bandon, Oregon 97411

COPY TO: Steve James
Wastewater Lead

FROM Steve Major, PE, City Engineer

PROJECT NAME Wastewater System Capacity

PROJECT NO. 101.00C

The wastewater system, collection and treatment systems, were evaluated for capacity with regards to the proposed 19-acre annexation south of town near 20th Street SE between Highway 101 and Rosa Road. We assumed development would consist of residential single and multiple family units with up to a total of 200 new units. Maximum wastewater flow at build out was estimated at 75,000 gallons per day.

Collection System

Based on our preliminary investigation the proposed development can be served by a sewer line extension from the existing collection system which currently ends at the intersection 17th Street SE and Baltimore Avenue SE. An eight-inch diameter gravity line installed at minimum grade has a capacity in excess of 500,000 gallons per day. Flows from the annexation area are estimated at well below this value. Also capacity of the downstream collection system is adequate to handle the anticipated increase inflows.

Wastewater Treatment System

Daily monitoring reports were reviewed for the calendar years 2019, 2020 and 2021. Four parameters were evaluated: dry weather flow for the months of May through October, wet weather flows for the months of November through April, biochemical oxygen demand (BOD) in pounds per day and total suspended solids (TSS)in pounds per day. The following is our conclusions on capacity for each of the four parameters:

- Dry Weather Flow – None of the data points exceeded the design flows of the facility for average dry weather flow and maximum month dry weather flow. All but four of the data points were at least thirty percent below the average dry weather flow design value.
- Wet Weather Flow – Only nine days out of 540 during the three year period exceeded the average wet weather flow design value. All of the flows were well below the peak day and peak instantaneous flow design values.
- BOD – All of the data points were below the design maximum month pounds per day loading. Eighty nine percent of the data points were more than thirty five percent below the maximum month value.
- TSS – All of the data points were below the design maximum month pounds per day loading. The highest data point was approximately forty two percent below the maximum month value.

Refer to the attached graphs for the four parameters evaluated.

Based on our analysis and the items listed below the existing collection and wastewater treatment system has the capacity to serve the proposed annexation area.

- The City is currently out to bid on a large inflow and infiltration reduction project. The estimated cost for this project $1.0M. Construction should be completed by August 2022. The project will reduce future wet weather flows and loads to the treatment facility.
- Flows and loads for the past three years are well below the design values for the wastewater treatment system.
- The wastewater treatment system has two aeration basins and secondary clarifiers. The City currently operates only one of each facility. As flows and loads increase the second aeration basin and second secondary clarifier can be put on-line.

If you have any questions please give me a call.

City of Bandon

CITY COUNCIL AGENDA DOCUMENTATION	**DATE:** October 3, 2022
SUBJECT: City Council Meeting Minutes	**ITEM NO:** 6.1.1

BACKGROUND:
Meeting Minutes of the City Council as submitted by Richard Taylor, Minutes Clerks.

- August 15, 2022 – Special Meeting and Work Session
- September 12, 2022 – Regular Meeting

FISCAL IMPACT:

None

RECOMMENDATION:

Motion to approve the minutes.

SUBMITTED BY:

June Hinojosa

June Hinojosa, *City Recorder*

City Council Special Meeting and Work Session
at Bandon City Hall and via Zoom
August 15, 2022

CITY COUNCIL AND MAYOR:	STAFF:
☑ Mary Schamehorn, Mayor	☑ Dan Chandler, City Manager
☑ Peter Braun, Councilor	☑ Shala Kudlac, City Attorney
☑ Chris Powell, Councilor	☑ Paula Burris, Finance Director
☑ Geri Procetto, Councilor	☑ June Hinojosa, City Recorder
☑ Madeline Seymour, Council President	☑ Nichols, Planning Manager
☑ Geoff Smith, Councilor	☑ Kristan Liechti, Planner
☑ Brian Vick, Councilor	☑ Andrea McMahon, Assistant to the City Manager

Special Meeting

1.0 CALL TO ORDER / ROLL CALL

The Mayor and all members of the Council and City Staff were present in the Council Chambers. Schamehorn called the Special Meeting to order at 1:30 p.m. Roll Call was taken as indicated above.

2.0 PROCEEDINGS (none)

3.0 RESOLUTIONS

3.1.1 Ordinance 1645 (Move to Second Reading) Making Changes to Titles 16 and 17 of the Bandon Municipal Code and Providing an Effective Date

At its August 1, 2022, Regular Meeting, the Council passed the First Reading of Ordinance 1645. Since the full Council was not present to vote at that meeting, it was necessary to have a Second Reading at this Special Meeting. Schamehorn stated that no fiscal impact was anticipated from the adoption of the proposed ordinance.

Kudlac read Ordinance 1645 by title only.

Seymour made a motion to adopt Ordinance 1645 by roll call vote. The motion was seconded by Procetto, it passed unanimously (6:0), and the ordinance was adopted.

3.1.2 Ordinance 1649 (Move to Second Reading) Amending the City Charter to Allow the City Council to Set System Development Charges Only on New Development

The City Council passed Ordinance 1649 to a Second Reading at its August 1, 2022, Regular Meeting. Schamehorn prefaced the Second Reading and the Council's vote with this statement:

"Since 1995, the Bandon City Charter has required a public vote before any fee charge or tax is raised. However, new development in the City of Bandon creates significant demands on Bandon's water, sewer, and road systems. Oregon statutes provide a process for setting System Development Charges, which provide that new development pay for the additional infrastructure required to serve it. However, setting and maintaining System Development Charges is a very technical process under state law, which does not lend itself well to an elections process."

If approved by the voters, Ordinance 1649 would allow the City Council to set System Development Charges on new development to assure that existing ratepayers and taxpayers would not bear the cost burden of new development.

Kudlac read Ordinance 1649 by title only.

Seymour moved to adopt Ordinance 1649 by roll call vote and Procetto seconded the motion. The Council voted unanimously (6:0) to adopt the ordinance.

3.1.3 Ordinance 1651 (Move to Second Reading) Imposing a Two-year Moratorium on Psilocybin.

Prior to the Second Reading and the Council's vote, Schamehorn read the following:

"Ballot Measure 109, known as the Oregon Psilocybin Service Act, allows for the manufacture, delivery, and administration of psilocybin mushrooms at licensed facilities. The Oregon Health Authority has begun the rulemaking process to implement Measure 109 and will begin accepting applications for psilocybin licenses in January. This means local governments need to begin thinking about whether and to what extent they want to impose regulations on these types of facilities.

"The Measure 109 program for psilocybin was modeled after the state's marijuana program. As with the marijuana program, there are different types of licenses that OHA will issue under the state's psilocybin program—manufacturer, laboratory, facilitator, and service center licenses.

"This ordinance refers a two-year moratorium on certain psilocybin facilities to the November ballot. There are no foreseeable fiscal impacts. Unlike cannabis, there are no provisions for special local taxation."

Kudlac read Ordinance 1651 by title only.

Seymour offered a motion to adopt Ordinance 1651 by roll call vote. It was seconded by Procetto, and the ordinance was adopted unanimously (6:0).

4.0 OTHER: COUNCIL/MAYOR/STAFF REMARKS (none)

5.0 ADJOURN TO WORK SESSION

Schamehorn adjourned the Special Meeting at 1:34 p.m. and immediately convened the Work Session.

Work Session

1.0 CALL TO ORDER

2.0 DISCUSSION

2.1 Food Trucks

Nichols provided a Staff Report on Mobile Food Units (MFUs) for the Councilors, along with draft ordinance language developed by the Planning Commission. After multiple Work Sessions and Public Hearings on the matter, the Commission had found no problem with the code criteria recommended for food trucks but had been unable to come to a decision about where MFUs should be located. Nichols said the Commissioners heard from a number of business owners in the Old Town/Marine Commercial area "who were not thrilled by the idea of food carts.

Lacking a consensus, the Planning Commission passed the issue on to the Council without a recommendation, and that was the reason for the Council's Work Session. The draft ordinance would only allow MFUs on private property in the General Commercial and Light Industrial Zones. Nichols indicated the ordinance could be amended at a later date if there was interest in having mobile units in Old Town and along the waterfront.

Having read the documentation, Schamehorn noted that the main concern expressed by many of those who testified before the Planning Commission was that they did not want the food trucks to be located in Old Town or around the waterfront. She understood the draft ordinance to restrict MFUs to mainly along the highway and not on City property.

Nichols responded that some members of the Commission did have an interest in seeing mobile units in City Park or a mobile food cart pod on City property in the Woolen Mill District. However, she did not think the City wished to be in the position of serving as landlord to that kind of activity, and the ordinance was written to exclude MFUs from City property and City rights-of-way.

Seymour asked how many locations would be allowed to have food trucks.

Nichols did not know how many properties would be affected by the proposed ordinance, but she described the areas covered by the zones where MFUs would be permitted. The C-2 Zone (General Commercial) stretched from the area around the Bandon Shopping Center south to 18th Street SE, mainly along Highway 101, with a separate section near the Seabird Drive/101 intersection. LI Zones (Light Industrial) were mostly located around Face Rock Creamery and the Woolen Mill District and around 11th Street SE from Chicago Avenue to Harlem Avenue.

Seymour agreed with excluding food carts from City property, Old Town, and the waterfront. She wondered if MFUs around Face Rock Creamery would detract from Old Town, and she asked if the parking lot at Face Rock Creamery was a public lot.

Nichols replied that most of it was, but there were a few privately owned spaces adjacent to the Bandon Rain Taproom.

Schamehorn pointed out that the large gravel lot to the south of Face Rock Creamery was under its ownership, although it had been acquired from the City with the provision that it would be maintained for public parking.

Seymour inquired if there would still be special event uses allowed in Old Town, and Nichols answered that there were food trucks at the Farmers Market through special events permits, and those permits were also obtained by the Chamber of Commerce for events they sponsored. For such events, the City required a certificate of liability insurance and permission from the property owner where the MFU would be located.

Nichols indicated special event permits would continue to be issued, while the proposed ordinance would give the City leeway to establish standards for where MFUs could locate, how long they could be there, and how they might look. It would also set up a licensing program to enable the City to continuously review whether they were operating with valid licenses and permits required by the State and County.

Noting that pods would have to have restroom access and a trash bin, Seymour wondered what would be required of individual mobile units that could come and go.

Nichols responded that there was no language covering that in the proposed ordinance, because it was already mandated by the State, which had different classifications for various sizes of operations. She thought they generally had to be self-contained, with potable water inside the unit and other capabilities.

Chandler clarified that the draft ordinance did require each MFU to provide its own garbage receptacle.

Nichols added that State law required MFUs to be located within 500 feet of a restroom. She told the Councilors she would provide them with a State-published document detailing its requirements before they held a Public Hearing on the matter.

3.0 MANAGER ISSUES AND UPDATES (none)

4.0 AGENDA ITEMS FOR NEXT WORK SESSION (none)

5.0 ADJOURN

Schamehorn adjourned the Work Session at 1:42 p.m.

City Council Special Meeting and Work Session Minutes
Submitted by Richard Taylor, Minutes Clerk

City Council Regular Meeting
at Bandon City Hall and via Zoom
September 12, 2022

CITY COUNCIL AND MAYOR:	STAFF:
☑ Mary Schamehorn, Mayor	☑ Dan Chandler, City Manager
☑ Peter Braun, Councilor	☑ Shala Kudlac, City Attorney
☑ Chris Powell, Councilor	☐ Paula Burris, Finance Director
☑ Geri Procetto, Councilor	☑ June Hinojosa, City Recorder
☑ Madeline Seymour, Council President	☑ Dana Nichols, Planning Manager
☑ Geoff Smith, Councilor	
☑ Brian Vick, Councilor	

1.0 CALL TO ORDER / INVOCATION / PLEDGE OF ALLEGIANCE / ROLL CALL

Schamehorn called the meeting to order at 7:00 p.m. and Roll Call was taken as indicated above. Pastor Ron Harris of Pacific Community Church provided the Invocation. Seymour led the Pledge of Allegiance.

2.0 PUBLIC REQUESTS (none)

3.0 PRESENTATIONS

3.1 Volunteer of the Month – Harv Schubothe

Schubothe, the Executive Director of the Greater Bandon Association (GBA), presented the Volunteer of the Month Award to Donna Mason in recognition of her contributions to the Bandon community. "We've got one of the top notch museums in the state," he remarked, referring to the Bandon Historical Museum. Schubothe attributed the museum's quality to the efforts of its volunteers, including Mason. "When you look at the exhibits and one of the persons who really makes sure that they're top notch and stay top notch is Donna," he said, adding that she had played a major role in keeping the museum building well-kept. Schubothe praised Mason's service to the museum, ranging from greeting patrons at the front desk to stepping into a leadership role as president of the Bandon Historical Society's board of directors.

4.0 HEARINGS

4.1.1 Mobile Food Unit Ordinance

Schamehorn opened the hearing at 7:04 p.m., noting that the Public Hearing concerned a proposed code text amendment to Title 17 of the Bandon Municipal Code (BMC) to allow Mobile Food Units (MFUs) in the City of Bandon.

Nichols began the Staff Report by detailing the process that had preceded the City Council hearing: The Planning Commission had conducted several Work Sessions about MFUs, followed by two Public Hearings. The City Council had discussed MFUs at a Work Session in August. A PAPA (Post-Acknowledgment Plan Amendment) notice was submitted to the Oregon Department of Land Conservation and Development (DLCD) before the first hearing in March, Public notices were published in *The World* prior to the hearings, and notices were mailed to affected parties.

Proposed ordinance language would define a Mobile Food Unit as an individual vehicle used for preparing, processing, selling, and dispensing food. It could be permitted on approval of a Type I application, by meeting the City's clear and objective criteria. A Mobile Food Unit Pod would undergo a Type II process, allowing more discretion in determining whether zone-specific standards were met.

Nichols noted some of the requirements placed on MFUs by the proposed ordinance. They would not be allowed to impede pedestrian or vehicle traffic or occupy more than 15 percent of a required off-street parking area. An MFU would have to be fully mobile, so it could operate at a location for a period of time and then leave. Permanent connections to utilities would not be allowed.

The owner of an MFU would have to provide at least one trash receptacle and would be responsible for trash disposal and general daily site cleanup. Individual MFUs would be self-contained, without external water and sewer service. In pods, water and sewer connections could be installed with payment of System Development Charges (SDCs) and approval from the Public Works Department.

Any accessory or temporary structures accompanying an MFU would be required to meet existing requirements of its underlying zone, including vision clearance standards, floodplain regulations, and Commercial Design Standards. Signage would need to be permanently affixed to an MFU, and no sandwich boards or other portable signs would be permitted. Outdoor lighting, subject to commercial design standards, would have to be available.

Under the proposed ordinance, an MFU would be permitted specific hours of operation consistent with its host business or set by the property owner as part of the application. MFU pods could include restrooms, storage buildings, outdoor seating areas, and trash enclosures, provided they met the requirements of the underlying zone and the City's Commercial Design Standards. Pods would have to meet the parking requirements for existing commercial businesses.

The City would require an MFU to apply for an annual operating permit, with an appropriate fee to be set by the City Council. The permit process would provide an opportunity for Staff to ensure that the MFU had a Certificate of Insurance, had been inspected by Coos Health and Wellness, and had Fire Inspection documentation. An MFU permit would be issued to the operator of the MFU and would not be transferrable. It could be revoked for non-compliance.

Mobile Food Units operated as part of an approved farmers market or allowed under a special event permit would be exempt from the standard MFU approval process.

The City Council could repeal or amend the MFU chapter at any time, thereby terminating or modifying all MFU operations on private property.

Along with a copy of the Staff Report for the Mobile Food Unit Draft Ordinance, Nichols had provided copies of public comments submitted as letters and emails, the minutes of Planning Commission Public Hearings on the issue, and the Oregon Health Authority (OHA) *Mobile Food Unit Operation Guide*. She also distributed a sheet with Staff's Findings, which stated that the proposed amendment was consistent with Bandon's Comprehensive Plan (Comp Plan), would not adversely affect city development, and addressed the need for the City to "promote the health of the economy by encouraging development types that are compatible with city infrastructure, service provision capabilities, environment, and the community's high standards for quality of life."

Nichols highlighted additional language in the Comp Plan that elaborated on a City policy to "enhance the economic well-being of the residents of Bandon by encouraging the expansion and diversification of the city's economy through:

"1. Tourism: Guard the scenic appeal and character of Bandon by the careful development of tourist facilities.

"2. Meet the economic needs of Bandon in the face of a declining economic base by diversifying the city's economy wherever possible.

"3. Maintain a well-balanced social community by encouraging industry that will attract youth."

Staff found that the addition of MFUs would embrace and support those policies expressed in the City's Comp Plan and could support the seasonal influx of tourism without causing a negative impact on existing businesses in the slow season.

Prior to work by City Staff and the Planning Commission on the Mobile Food Unit issue, City Manager Chandler had conducted an online survey that received an overwhelmingly positive reaction from those who responded. However, more critical feedback from the public was heard at the Planning Commission's Public Hearing. Nichols said concerns were raised about locating MFUs in Old Town, where they would compete with "brick and mortar" businesses and existing tourism facilities along the waterfront. Concern was also voiced that MFUs should cover their fair share of the costs such as SDCs and Zoning Compliance fees that were shouldered by permanent business in the City. Nichols recalled some individuals supported food carts but wanted to see reasonable regulations to control where they were located.

The Planning Commission had recommended approval of the Draft Ordinance but could not come to a consensus about where MFUs could be permitted. Staff recommended only allowing MFUs in the C-2 (General Commercial) and LI (Light Industrial) Zones, suggesting the Council could revisit the ordinance and amend it at a later date if there was a demand or desire for locating MFUs in Old Town or along the waterfront.

Schamehorn read aloud the instructions for public testimony. No one who was present in the Council Chambers or participating remotely by Zoom chose to provide comment, and Schamehorn closed the Public Hearing at 7:14 p.m. The Councilors briefly deliberated the Draft Ordinance.

Seymour inquired if Coos Health and Wellness inspected MFUs and issued annual licenses for them to operate.

Nichols responded that Oregon law required all food service activities open to the public to be licensed prior to operation, but she was unsure about the duration of those licenses.

Powell asked if the Council should consider limiting the number of MFUs in the City.

Braun indicated the same idea had occurred to him, but he thought the market would probably take care of limiting the number of food trucks in town, through "survival of the fittest."

Chandler commented that there were few MFUs seen in similar communities which allowed them, due in part to available space. He pointed out that it would be relatively easy for Bandon to change its rules if it became overwhelmed by mobile food carts.

Vick observed that fast food companies looked at traffic counts first before establishing a drive-through restaurant in a city. He maintained that Bandon did not have the traffic counts to justify a large number of food trucks at any given time.

Seymour agreed with excluding the C-1 (Old Town Commercial) and C-3 (Marine Commercial) Zones from the MFU Ordinance, as did Schamehorn.

Braun moved to approve the land use ordinance as proposed for the zone text amendment to Chapter 17.104 Supplementary Provisions of the Bandon Municipal Code and direct Staff to prepare an Ordinance and Findings for adoption at the Council's next meeting. Procetto seconded the motion and it passed unanimously by show of hands (6:0).

5.0 PROCEEDINGS

5.1 ACTIONS (none)

5.2 DISCUSSIONS

5.2.1 Wildlife Feeding Ordinance

Chandler told the Mayor and Councilors that they had been given draft language of an amendment to BMC Section 6.24.150 for discussion purposes. In response to numerous complaints of health concerns and property damage resulting from the attraction and feeding of wildlife. The Council had previously passed a resolution defining wildlife feeding as a nuisance under BMC Chapter 8.08.

Chandler stated there had been some challenges to the specific wording of that resolution. He believed the proposed Ordinance would clarify some of the definitional issues, broadening the definitions of "feeding" and "attracting," and would limit potential loopholes in the resolution. Chandler thought an Ordinance clearly stated in the City's code as opposed to a resolution would better inform the public as to what was and was not allowed. He noted that much of the language in the proposed ordinance had come from the City of Cannon Beach's wildlife feeding ordinance, which was aimed mainly at opossums and raccoons.

There was no additional discussion of the Draft Ordinance, and it was agreed that Staff would present an ordinance for Council adoption at a future meeting.

5.3 RESOLUTIONS

5.3.1 Resolution 22-18 Authorizing Expansion of Enterprise Zone

Chandler introduced two speakers who provided background information on Enterprise Zones.

Brandi Medeiros, Community Development Director, CCD Business Development Corporation
Shaun Gibbs, Executive Director, South Coast Development Council
Medeiros explained that Enterprise Zones were a State of Oregon program designed to provide incentives to bring new eligible businesses such as manufacturing and production to a community. The Coquille Valley Enterprise Zone was designated in 1986 and CCD was appointed enterprise zone manager in 1998. Having served with CCD since 2011, Medeiros was familiar with some of the Coquille Valley Enterprise Zone's recent history. She said it had gone through a few boundary amendments and had its redesignation in 2019. By statute, an Enterprise Zone would sunset every ten years.

Medeiros indicated that every change to the zone required agreement from all of its sponsors, which was accomplished by resolution and conversations. She stated that the conversation in this instance was initiated by Gibbs and the sponsors had given their support to amending the zone and adding properties.

Through its redesignation, the Coquille Valley Enterprise Zone encompassed 9.4 square miles. It was allowed up to 15 square miles, and the additional properties being proposed for inclusion would add 1.09 square miles, bring the total square miles to 10.5 and leaving room for future development.

Medeiros emphasized that Enterprise Zones abated new structures, equipment, and heavy, fixed machinery, but did not abate land. There were eligible businesses and eligible properties that were abatable. She invited Councilors to call her if they had questions, or they could go to the Business Oregon website and look up information on Enterprise Zones. Medeiros said the Standard Enterprise Zone Exemption was the most common type, providing three to five years of tax incentives for newly authorized businesses.

Chandler offered the example of a golf course and asked if the tax abatement would not apply to the land, only to the other developments.

Medeiros confirmed that only any new structures or heavy or fixed machinery or equipment would be covered.

Schamehorn asked who initiated the increase in the size of Bandon's portion of the Enterprise Zone.

Gibbs answered, first explaining that the South Coast Development Council (SCDC) was a regional economic development organization serving the southern half of the Oregon coast, from Florence to Brookings/Harbor. SCDC frequently partnered with CCD, working to help businesses expand or be competitive, and working to bring businesses that created living wage jobs to the region.

Gibbs said SCDC initiated the boundary amendment and reached out to CCD because it was in contact with a developer who wanted to develop a property just outside the Enterprise Zone and outside Bandon's Urban Growth Boundary (UGB). It consisted of nine acres across Highway 101 from the Bandon State Airport. The individual was working on a project and was interested in what incentives might become available. Gibbs told the Mayor and Councilors that this particular property was located at Oberman Lane and the development being considered would potentially be an eligible business.

Procetto wondered if SCDC would have become involved if the developer had not contact it.

Gibbs replied that the developer had been talking to Coos County representatives and others in search of incentives.

Schamehorn asked to have it confirmed that just the small area around the Bandon Beach Hotel site was requested for addition to the Enterprise Zone in Bandon.

Gibbs verified that the hotel property was to be part of the expansion and added that there were some properties southwest of Bandon that were also included.

Schamehorn inquired about who asked to have the hotel site included.

Gibbs thought it might have been Bandon Dunes, which Schamehorn said she had assumed. He clarified that the expansion process involved conversations with the Enterprise Zone sponsors—the City of Bandon, the Port of Bandon, Coquille River, the City of Coquille, and the City of Myrtle Point. Businesses that were not in the zone but might be interested in expanding the zone were in discussions as well.

Schamehorn observed that the Oberman site was small, but she noted the larger New River Dunes expansion, where a golf course was being developed, and asked why it was being added, if a golf course would not qualify for abatement.

Gibbs answered that it was additional land owned by the Bandon Dunes Golf Resort. Although the golf course itself did not qualify for abatement, buildings would.

Braun asked if all the other Enterprise Zone sponsors had signed off on the expansion request, and Medeiros replied that all the sponsors had shown support and one of them had passed a resolution. She said Coos County had been involved from the beginning.

Schamehorn did not recall the abatement benefit being used outside of Bandon for many years.

Medeiros thought Face Rock Creamery was the last authorized business in Bandon.

Vick remembered Hardin Optical receiving an abatement many years earlier.

Medeiros offered to provide information on the businesses in Bandon that had been authorized for abatement over the years. Seymour encouraged her to do so and she moved to table the matter. Procetto seconded the motion.

Braun thought the Enterprise Zone did not dovetail with the City's Urban Renewal (UR) Districts and he understood UR-2 did not extend beyond City Park and would not encompass the Bandon Beach Hotel property.

Nichols confirmed that.

Braun asked when the clock would begin on the three-to-five-year abatement.

Medeiros responded that it would start the first year a business was placed in service, and up to two years of construction would be allowed.

Gibbs pointed out that there was a four-to-five-year Expanded Zone Program in which the sponsors had to negotiate with the project based on wages, job creation, and investment, to make sure tax revenue was not being shortchanged.

Schamehorn commented that the hotel and the golf course were going to be built whether or not the developer was given tax abatement. She said the City of Bandon had given tax abatement to Bandon Dunes and was highly criticized, but the City was betting on its success. Bandon Dunes did become the largest single taxpayer in Coos County, contributing over a million dollars a year. Schamehorn insisted, "The rest of us—the taxing bodies—we don't have a lot of money, and for us to give tax abatement to somebody who we know is going to develop anyway seems like you're slitting your own throat, and I personally am not in favor of that." She added, "But I'd like to know more about the whole purpose of expanding the zone."

By unanimous show of hands, the Council voted to table Resolution 22-18 (6:0).

5.3.2 Resolution 22-19 Water System Master Plan

Steve Major, a Principal at The Dyer Partnership Engineers & Planners in Coos Bay.
Major gave a presentation summarizing the Water Master Plan prepared by The Dyer Partnership. He noted that some concern had been expressed about the first draft of the plan, which had been completed in 2020, mainly due to the cost of the proposed raw water off-channel storage facility. New developments since the initial draft were to be covered in Major's presentation.

Major began with a map of intake facilities in the City's water system. The Ferry Creek Reservoir and the Geiger Creek Reservoir fed raw water to the Lower Pump Station, which pumped it to the Middle Pond. From there, raw water was pumped to the Water Treatment Plant. At some point in the past, a third pump was added at the Low Water Pump Station, allowing use of water that went through the Fish Hatchery, which had senior water rights. Major said the City used that water quite a bit during the summer.

Deficiencies in the intake system included the lack of storage during low-flow months, in part because the Ferry Creek and Geiger Creek Reservoirs were silted in, reducing their capacity. Major said all three pump stations needed flow monitoring capabilities, which was one of the requirements for one of the City's water rights extensions. None of the three stations had emergency power sources. The Lower and Middle Pump Stations needed ventilation and increased pump capacity to 700 gallons per minute per pump. Major noted that the Water Treatment Plant was sized for two million gallons, but it could be expanded to four million gallons with the increased pump capacity.

Major displayed an overhead photo of the Water Treatment site. He said one of the improvements that resulted from the 2019 bond issue was to replace one of the two raw water clarifiers. The older one needed to be replaced. In the control building, there was filter media in two of the four filter bays, producing two million gallons with the capacity to expand to four million. A couple of years earlier, the walls of the two filters were given an epoxy coating that made it easier for City crews to wipe off whatever might accumulate there.

Pictures of the piping gallery and chemical feed systems at the Water Treatment Plant were shown. Coagulation chemicals made particles larger so they would settle out. Soda ash controlled the pH of the water. Ultraviolet disinfection was available as backup to chlorine disinfection.

At the site there were two reservoirs—one holding a million gallons and the other with a two-million-gallon capacity.

Among the deficiencies at the Water Treatment Plant were the lack of a flow meter on the filter to waste line, so water used to unclog a filter was not accounted for. That made it appear that the City had higher water losses that it actually did. Major said the filters needed protection from sunlight to avoid algae growth. Parts were no longer available for the existing PLC, where the programs that ran all the equipment were located, so it needed to be replaced. The flooring and sample island needed updating, the secondary clarifier needed replacing, and the Water Plant had no emergency power source.

For treated water storage, the City had a one-million-gallon tank and a two-million-gallon tank, both made of welded steel.

Deficiencies noted in the two-million-gallon tank included corrosion at the inlet and outlet, a lack of seismic protection, and failing coatings on the interior and exterior. In November 2021, the City received bids for seismic valves and interior coating for that reservoir. Major said the City had a purchase order for the seismic valve and controller on December 2, 2021, but the parts had not yet been received. The project had to be cancelled, because the Fire Chief did not want the reservoirs to be offline after mid-May. The valve and controller were expected to arrive in October, shipped from England. Major commented that the City would have had the coating done at an excellent price—$440,000—but the delay in the project would mean a higher cost.

Interior coatings on the one-million-gallon reservoir were beginning to fail, there was corrosion on the ladders, supports, and rafters, and the tank lacked seismic protection.

Major reported that the City's water distribution system suffered from inadequate fire flows and almost half of the system was using aging asbestos cement pipes that had weakened over time and were prone to leak or burst with high pressures. A computer model of the City's distribution system with the current piping showed large areas of Bandon had a flow of under 1,000 gallons per minute, with a minimum of 1,500 gallons per minute recommended for residential areas. Major indicated that increasing pipe sizes and looping the pipes would improve the flow considerably.

Future water demand, based on a growth rate of 0.7 percent forecast by Portland State University, would increase slowly over the next two decades. The maximum day demand (MDD) of 993,152 gallons in 2021 was projected to grow to 1,141,840 by 2041.

Chandler noted that many of the new homes being built in Bandon were being used as second homes, and the City had to size its system based on the number of homes, whether or not someone was living there. Bandon's growth in dwelling units was higher than its increase in population. However, State law required cities to base most of their planning efforts on population growth.

Major added that the projected water usage had factored in a decrease in water loss from 13 percent down to 10 percent. He said the Oregon Water Resources Department (OWRD) wanted cities to reduce loss to 10 percent. By putting in flow meters at the Water Plant and making sure there were accurate meters at residences, Major thought that goal could be reached.

Next, Major addressed Bandon's need for raw water storage. During the period from 1977 to 1981, flows on Ferry Creek were reported to have dropped to 0.4 CFS (cubic feet per second). Between 1994 and 1996 the rate was 1.4 CFS, and between 2017 and 2021 when the stream gauge was in operation, just downstream from the point of diversion, 2.4 CFS was measured. The projected MDD flow for 2041 was 1.1 CFS.

Major noted that Ferry Creek needed a flow of 10 CFS to provide fish passage. Augmenting low flows during dry months would benefit the water quality for aquatic organisms by increasing the flow depth and reducing the river temperature. This could be achieved with development of the recommended 100 acre feet of off-channel storage. Major stated that 25 percent of any water used from the off-channel reservoir would have to go back into Ferry Creek to help the fish and aquatic life.

Chandler pointed out that it was only in the period of the late 1970s and early 1980s that Ferry Creek was at such a low level that it caused a problem. He thought a key factor at that time was that the City of Bandon, with the senior water right on Ferry Creek, "called" its water right. If that had been done, Water Resources would have shut down other water users. "Clearly we have an issue we need to plan for," Chandler emphasized. "And none of us can predict it won't happen next year," he continued. "But, if you look historically, there's enough water in the creek, particularly if we end up having to call our senior water rights. We actually now have twenty years of data we've been looking at—demand data and creek flow data. So I just want to set people's minds a little bit at ease about this situation." He felt there was a lack of knowledge as to how much water the City had.

Major admitted that in the 2020 Draft Plan he stated that there was a senior water right downstream from the City's Low Water Pump Station, but it turned out the City did not have that. However, Bandon could use the Fish Hatchery water right after the Hatchery used it. The only exception would be for a day or two after the hatchery put some chemical in the water to clean the pens, and the City would be given notice when this was happening.

Returning to his presentation, Major observed that under drought conditions there would only be 1.7 days' worth of storage in the Ferry Creek and Geiger Creek Reservoirs. He said the City had been looking at dredging those reservoirs, but Oregon Department of Fish and Wildlife (ODF&W) claimed ownership of the dams and called them unsafe, although that assessment had changed as well.

Chandler interjected, "It depends on who you ask at ODF&W, but we're talking to them on a pretty regular basis. We've actually now started a conversation with the regulatory agencies about what it would take to get the Ferry Creek impoundment dredged out." He described how the dam was not holding much water back, but the engineers, the fish biologists, and the hatchery operators were not in agreement about the dam.

Chandler underscored the huge difference the Ferry Creek Reservoir would make to Bandon. "While it's only a couple of days' worth of water," he explained, "that'll fill up overnight. If we ever have to...turn the pumps down, it will refill during the day, and what that means is we would not have to operate the plant potentially 24/7, which is obviously a cost and a staffing issue for the people of Bandon."

Major added, "To get some idea of the siltation that's in Ferry Creek and Geiger Creek, look at the latest Google pictures. It's very obvious. Ferry Creek's more affected than Geiger Creek, but it's very obvious there's not a lot of storage there."

Referring to an aerial map of the area near the Fish Hatchery, Ferry Creek and Geiger Creek Reservoirs, and the City's Pump Stations, Major described how the Off-Channel Storage option would work. Water from the Low Water Pump Station would be pumped to a 100-acre-foot storage area. During low flow conditions, water would be fed back to the Low Water Pump Station and pumped to the Middle Pond, with an additional 25 percent going back into Ferry Creek. This would provide 38.2 days added storage for over 39 total days of storage. If that storage had to be used, Major noted that the City would implement steps to reduce water usage as directed by its Water Conservation Management Plan.

Earlier in 2022, GSI Water Solutions of Portland conducted a preliminary investigation for groundwater wells, with a target capacity of 300 to 500 GPM (gallons per minute) and a potential yield of 75 to 100 GPM per water supply well. Major said up to six wells would be incorporated in this project.

Permitting concerns OWRD would take into consideration, according to Major, included the availability of water. Based on GSI's analysis of subsurface conditions, there would be enough water. OWRD Basin Program rules would have to be followed. If the wells proved to be productive, the City would have to transfer some of its water rights to the wells, and those rights could not be transferred back. Another concern would be the impact on surrounding wells of drawing 300 to 500 GPM out of the ground.

GSI generated a map that showed a set of preferred well locations that were the least expensive, with two other sets of wells that were more expensive. Dyer Engineers chose the most expensive group of wells for a cost comparison with the Off-Channel Storage project. Major told the Councilors the wells would cost significantly less, but another $360,000 would be needed to continue studying the viability of the wells. That would include drilling a test well.

Major provided an update on the City's water rights. Because water meters had not yet been installed at the pump stations, the City had been granted an extension until October 1, 2022, to submit a request for a permit to change the use of water from Geiger Creek from domestic to municipal.

The City was waiting for two final orders from OWRD to allow the off-channel storage and the usage of the off-channel storage. OWRD was waiting for comments from ODF&W.

Major went over a list labeled "Priority I Improvements" that were deemed most critical and that should be undertaken as soon as funding became available. Those projects included improvements to maintain the quality of the water system, concentrating mainly on the water treatment side.

Priority I Improvements at the Waste Treatment Plant were:

- A flow meter for the filter to waste line.
- A sun shade for the filters.
- PLC modifications.
- Replacing flooring and the sample island.

Other Priority I Improvements were:

- One backup generator to supply power to the Water Treatment Plant, Middle Pump Station, Lower Pump Station, Low Water Pump Station, and Fish Hatchery.
- Existing raw water clarifier replacement.

Vick wanted to know what regulations had been changed to cause this to project to become so expensive.

Major replied that the State Structural Code had been changed in such a way that "there is not a glass fuse to steel manufacturer that will tackle that connection where the steel comes in contact with the concrete. They're saying the only way they can meet the current code is to put a steel flooring on." Major commented, "When you put a steel floor in, that eliminates the chance of having a hopper bottom that we need for the clarifier. That means you have to go concrete." He added, "The difference between the original clarifier that was designed and built versus having that same structure as concrete is about $1.3 million."

Major said the State of Oregon changed its code without considering the effects of that change and it was one of the few entities enforcing that code. The City asked the State if the clarifier could be built to the code provisions under which the existing one was built, and that request was rejected.

"Even though we got the bonds out for it ahead of time," Vick remarked, saying, "That's ridiculous."

Major stated that plans for the clarifier would be reviewed according to the current code that required a steel floor with concrete at the bottom of supports. He believed the manufacturers would not address the issue due to liability concerns and they would not invest in solving the problem because Oregon was one of the few states with this particular structural code.

Vick wondered if there was any kind of workaround.

Chandler responded that the City was working on getting political leverage to help out. He added, "I think there's a pretty good argument for the City of Bandon to go to the State of Oregon and say, 'You guys just cost us another million bucks. You're handing out a lot of money right now for water infrastructure. Why don't you help us out?'"

Returning to his list of Priority I Improvements, Major included:

- Improvements on the two-million-gallon (2 MG) water storage tank—seismic valves and interior coating.

Powell asked if the two jobs could be done separately.

Major explained that the reservoir would have to be shut down. A hole would have to be cut in the side because the pipe coming out of the reservoir needed to come out of the side instead of the bottom. With the reservoir shut down, the painting contractor could come in and work, with only the window from March to May available to complete the project. Major said the idea was to save cost by having the two jobs done at the same time. Two different contractors would be involved.

- Improvements on the 1 MG storage tank.
- Middle Pond and Lower Pond Pump Station flow meters and standby power.
- Continuation of the groundwater supply analysis.

Major noted that Chandler had contacted ODF&W regarding the City's water rights on Simpson Creek, but the last measurement there, within the past month, showed only 0.1 CFS—not enough water to develop it as a source.

The estimated total cost of the Priority I projects was $9,041,400. At the Water Treatment Plant, improvements to the building were estimated at $598,000, the backup generator system would amount to around $1,302,000, and replacing the existing clarifier had ballooned to $3,047, 800. Improvements to the 2 MG Storage Tank were estimated at $2,130,400. The 1 MG Storage Tank rehabilitation would come to $985,300. Pump station improvements were estimated at $640,400 combined, and the groundwater study and test well would come to $337,500. "We're seeing construction costs going up 15 percent," Major observed. Of that $9 million total, the City's bond issue would cover over $3 million.

Priority II was limited to the choice between off-channel storage (estimated at $8,342,000) and a groundwater supply ($3,605,245). Major figured the groundwater cost would even be lower if the least expensive well locations were chosen, as opposed to the more expensive ones used for the estimate.

Chandler clarified that those lower-cost wells were closer to existing domestic wells. He said the next step in the groundwater project would be to meet with ODWR and discuss what would happen if studies showed the City's wells would interfere with domestic wells. "Fortunately, they're located in places where the City could mitigate by hooking those folks up to City water," Chandler stated, but he said it was unclear how ODWR would view the situation. He added that the passage of the Transient Occupancy Tax (TOT) increase measure would add more money to the City's General Fund and allow the City to move forward with some of the work.

Priority III Improvements mainly involved distribution system projects to improve fire flow, replace existing water meters, and replace aging or deficient water lines. Major shared an itemized list of project locations and costs, with an estimated total of $14,865,400. He recommended addressing the Priority III issues a little at a time.

Chandler commented that some of the projects would be demand-driven or growth-driven and would be paid for with SDCs. If the City Council were to be granted the ability to set SDC rates, the cost of some of the projects could be allocated fairly between existing residents and new development, in a district-by-district fashion. He elaborated that "If there's a particular area where fire flows are low, and it's the same area where a lot of new development is going, that new development can pay for a larger percentage of whatever local improvements need to happen."

Major added that line sizes would have to be increased to get the necessary flow for new developments. Looping the system at that time would be an improvement for existing users as well. He displayed a map showing the Priority III project locations.

Major noted that the State was not very favorable toward funding packages for communities such as Reedsport and Bandon, where the Council could not increase user fees without a vote of the people.

Seymour recalled that the City's Water Committee, when she served as a member, met in Roseburg with representatives from the federal government, the State of Oregon, and the Department of Environmental Quality (DEQ) and were told the City could not qualify for any loan or grant because it could not raise its utility rates.

"You can't guarantee that you can cover the debt," Major added. He also served as City Engineer for Reedsport, where 25 to 30 percent of the water system was metered and the rest was not. "If they're going to get any kind of funding from the State or federal government, they have to agree to meter everybody," Major contended. To do so would require voters to approve a rate increase.

Major briefly explained how Equivalent Dwelling Units (EDUs) were used to determine funding of water projects. An EDU represented the average daily water usage per residential connection. For funding considerations, Bandon's total system EDUs for all usage types came to 2,494. Based on average water consumption of 3,500 gallons per residential unit, the average rate inside the City was $36.60 per month, including a 10 percent utility fee. The average for commercial accounts was $57.62. Outside users paid a higher rate, but without the utility fee—$49.39 for residential users and $78.14 for commercial accounts.

The Dyer Partnership examined three financing options:

- The Rural Development Financing Program consisted of 25 percent grant funding with the other 75 percent being a 40-year loan at two percent interest. The grant amount would be $1.48 million and the loan amount would be $4.45 million. It would increase the cost per EDU by $5.40 per month.
- The Water/Wastewater Financing Program offered a $750,000 grant plus a 30-year, $5.1 million loan at a 2.86 percent interest rate. The rate per EDU would increase by $8.60.
- The Clean Water State Revolving Fund Loan would provide $5.9 million at one percent interest over 30 years, increasing the cost per EDU by $7.65.

Based on added debt service cost estimates, if all Priority I projects were funded, Major said the monthly residential user fee would increase to at least $53.13. He pointed out that a rate of $45.87 had been used to represent what the current monthly user fee should have been, based on the City's 2,494 EDUs.

An evaluation of the affordability of water services in Bandon, based on a median household income of $37,262, showed the current monthly rate represented 1.18 percent of a residential user's income. At a projected monthly rate of $53.13, "the affordability percentage" would increase to 1.71 percent, still below the typical two percent rate and in the range of affordability that would boost the City's chance of receiving funding packages that included grants.

Major's recommendations were:

- Adopt the Water System Master Plan.
- Secure funding for Priority I Improvements.
- Construct Priority I Improvements.
- Reevaluate Priority II Improvements based on additional groundwater supply information.
- Construct Priority II Improvements.
- Construct Priority III Improvements ("You'll have the Priority III forever," Major remarked.)

Major commented on the steep rise in construction costs and the decline in availability of materials. He told the Mayor and Councilors, "On the reservoir project, we are going out for quotes on all the pipe fittings required, so we get that ordered, get that delivered to the City before we start construction." He added, "They'll quote you a price for a day...and we've seen on projects where...we've bid the project, we've awarded the project, and then the suppliers come back and they want another 10 percent, another 15 percent, even once they've agreed to a price."

Chandler stated that the bids would probably go out in the next month on the electrical work—the backup generator system. The City's new electrical system engineers helped design a system based on a single large generator.

Major observed that it would take 16 months to get the generator.

Braun made a motion to adopt Resolution 22-19, Adopting the Water System Master Plan. Vick seconded the motion and it passed by unanimous show of hands (6:0).

6.0 CONSENT AGENDA

The Council considered the following items on the Consent Agenda:

6.1 APPROVAL OF COUNCIL MINUTES

6.1.1 City Council Meetings

- July 11, 2022 Regular Meeting
- July 18, 2022 Work Session
- August 1, 2002 Regular Meeting

6.2 REVIEWING OF COMMISSION AND COMMITTEE MINUTES

6.2.1 Planning Commission Meetings

- July 21, 2022 Regular Meeting
- August 25, 2022 Regular Meeting

6.3 INFORMATION ONLY: DEPARTMENT REPORTS

6.3.1 Accounts Payable Report for July 2022

6.3.2 Library Report for July 2022

6.3.3 Public Works Report for August 2022

6.3.4 Community Center and Sprague Theater Report for August and September 2022

6.3.5 Planning Department Report for August 2022

6.3.6 Police Department Report for August 2022

6.3.7 Finance Department Report for July 2022

6.3.8 Consolidated Municipal Utility Report

6.4 INFORMATION ONLY: OTHER ITEMS

6.4.1 Appointment to Committee for Community Involvement

- Leslie Thomas

6.5 EASEMENTS AND RIGHTS-OF-WAY (none)

6.6 COMMITTEE/COMMISSION DIRECTION AND REPORTS (none)

Schamehorn hoped to receive more of a narrative report for the monthly Community Center/Theater Report in the future, in addition to a calendar of events and activities. She noticed on the current report's calendar that there was a memorial listed on August 20, but it did not say that there was another event booked at the same time. Schamehorn attended the memorial for Larry Sabin, who served on the Bandon Rural Fire District Board for many years. It was held in one half of the meeting space and a baby shower was taking place in the other half of the space. The side where the memorial was held was posted for a maximum of 69 people, but Schamehorn said people were "wall-to-wall" on that side.

Schamehorn asked if the Library Board was meeting every two months and was now being called the Library Advisory Board.

Chandler responded that the names of some boards and commissions had been changed in 2020 to reflect that they were advisory to the City Council. The Council was the actual governing body for the Bandon Library.

Schamehorn pointed out that the Planning Department Report announced that an application for a new Grocery Outlet store had come in. She said that was good news to share with the community.

Braun moved to approve the Consent Agenda and Vick seconded the motion. By unanimous show of hands, the motion passed (6:0).

7.0 PUBLIC COMMENT

Denise Frazier, 1259 Wavecrest Lane SW, Bandon, OR 97411
Knowing that Vacation Rental Dwellings (VRDs) would be discussed at the Council's upcoming Work Session with the Planning Commission, Frazier encouraged the Councilors to amend the City's 2018 VRD Ordinance to address the unintended consequences of text changes made at that time. She specifically asked to have nonconforming VRDs included in the saturation ratio calculation when a new VRD application was being considered.

Frazier also proposed a review of the formula used to calculate VRD density, because it did not include the applicant's property, resulting at times in a ratio greater than the 30 percent allowed by the ordinance. She cited the example of two VRDs recently approved on Cleveland Avenue SW. Frazier thought two VRDs on Cleveland out of five single-family dwellings within 250 feet of those VRDs meant a saturation ratio of 40 percent. She believed the saturation ratio was intended to prevent VRD neighborhoods from forming and to minimize the impact of VRDs on existing homes in the CD (Controlled Development) Zones.

Bill Frey, 1235 Wavecrest Lane SW, Bandon, OR 97411
Frey noted the great job Bandon Police had been doing in issuing speeding citations. In a conversation with a friend in Port Orford, Frey had been told that the Council in that town had discovered that the processing of speeding tickets was not being done diligently. He said, "When they rectified that situation, they found an unintended consequence of $200,000 in revenue." Frey wondered if Bandon had a monthly or quarterly report that the public could access showing the source of the funds that go into the General Fund or if there was an audit that ensured speeding fines were being collected and processed diligently.

Chandler responded that there was a report that he reviewed every month and the overall funds were audited once a year. He also saw a large whiteboard in June Hinojosa's office where every ticket was written down and processed.

Frey added that he would appreciate a priority given to modifying the VRD ordinance as Frazier had previously recommended.

Procetto asked Schamehorn if appointees to committees such as the Committee for Community Involvement (CCI) could come to a Council meeting so the Councilors could meet them. She noted that Frey was a CCI member in attendance at the meeting.

Schamehorn thought the Councilors probably did not know most of the members of the Parks and Recreation Commission, either. She said Councilors were free to go to any of the commission or committee meetings and meet the members.

8.0 OTHER: COUNCIL/MAYOR/STAFF REMARKS

Nichols thought something could be organized to bring the Council and all the commissions together. She thought it was a nice idea.

Chandler thanked the voters for supporting the Transient Occupancy Tax increase. "We plan to put that money to good use and be very transparent about what we do with it." He said there had been a lot of requests for a trolley, and Staff was in the process of looking for used trolleys and pricing them out. There were not very many around the country and they seemed to be in places like Florida and Virginia. Staff looked for ones with aluminum bodies that would not rust in Bandon's climate and would only select a trolley that was Americans with Disabilities Act (ADA) compliant.

In the near term, Chandler said the City was dedicating some funds to the cleanup of Old Town, including curb painting, sidewalk washing, and a general cleanup of the public spaces there. He stated that making Bandon a better town for visitors "means it's a better town for all of us as well."

Vick commented that he had heard positive and negative things about the recent Cranberry Festival. He thought the festival should be split up between City Park and Old Town. "This year, the weather was exceptional, the crowds were huge, the parade was great, but I think Old Town was kind of just dead," he stated. He added, "I don't think it would really hurt to move at least part of the festival—car show, whatever—down to Old Town." Vick heard complaints that people could not get food at the festival or find a place to park.

Procetto remarked that she had attended the coronation of the Cranberry Queen, "and it was a lovely ceremony. The master of ceremonies was great and the princesses and the queen did absolutely beautifully, and I'm very proud of them and I'm sure their parents are, too."

Seymour shared that her mother, Patricia Seidler, was pleased to have been co-grand marshal of the parade but was a little disappointed that she did not get to see all of the parade. She did spend a few hours in the park and was exhausted when she got home. Seymour received a number of negative comments from people who thought the park was dirty or did not like the parking. "I thought it was a great Cranberry Festival," she said. "I wish that...somehow there could have been a few more food trucks, because the lines were so long." While at the park, Seymour had heard that the traffic jam of people going to the park on 11th Street after the parade was backed up to the hospital, and she wanted to hear from anyone who was part of that.

Seymour thanked Major for his report on the Water System Master Plan.

"I think the Festival Association, with as...few people as they have working on it, I think they did an excellent job," Schamehorn stated. She did think the parking could have been better, and she mentioned the lack of a handicapped parking area. If the City had a trolley next year, Schamehorn felt that could alleviate some of the traffic and parking issues. She did not think older people would want to walk for blocks to get to the festival and she liked Vick's suggestion of splitting up some of the activities.

"People I talked to seemed happy with it," Schamehorn summarized, although, "I did see one thread on Facebook about the political signs and the political groups that were in the parade, and they were all focused on one political party, but the other political party was in the parade, too." She added, "When you get right down to it, with Madeline and I riding, if you say, 'no politics,' then maybe we shouldn't be riding either. You don't know where to draw the line."

Seymour noted, "We purposely don't put signage on the car we're in."

Vick chimed in, saying, "Way back in the early eighties when I ran for City Council, I did the cleanup after the equestrian units and I had a sign on my wheelbarrow that said, 'Vote for Vick' on each side." He concluded, "Politics is politics. Get over it!"

Braun thanked the Volunteer of the Month and he encouraged those who had comments, criticism, and feedback about the Cranberry Festival to get involved in helping implement the festival. He emphasized, "It takes a lot of work to do that festival."

Powell agreed with Braun and noted that the festival preparation would begin in late January or early February. "If you didn't like what was happening," he urged, "get involved!"

Seymour reported that the VFW (Veterans of Foreign Wars) craft fair and bake sale was extremely successful. She said the VFW thanked everyone in town and all the tourists who came by.

Frazier asked if it helped the Old Town merchants to have the festival at the park. She drove through Bandon on the day of the festival and thought it looked pretty busy.

There was a mixed reaction to Frazier's question, but Powell responded that it was crazy at his bakery and staff was busy until the parade started. "Busiest day in the year," he proclaimed.

Procetto observed that there was no place to park when she went to Old Town that day.

Schamehorn advised anyone with concerns to talk to the Bandon Chamber of Commerce, because it was their festival.

9.0 ADJOURN

Schamehorn adjourned the City Council's Regular Meeting at 8:39 p.m.

City Council Regular Meeting Minutes
Submitted by Richard Taylor, Minutes Clerk

CITIZEN INVOLVEMENT GOAL 1

Ordinance 1501 5-05-2003

INTRODUCTION

In a desire to ensure an effective Citizen Involvement Program (CIP), the City Council appointed an ad hoc Committee to review and evaluate the existing program and make recommendations for improvement. The Committee, working with staff and the public, thoroughly reviewed and evaluated existing policies and City practices in conjunction with the Statewide Planning Goals, and made a number of recommendations that are incorporated into this chapter.

THE PLANNING PROCESS

The Planning Commission is primarily responsible for making land use decisions and recommending amendments to the Comprehensive Plan and land use regulations.

The City Council is responsible for policy decisions relating to the planning process and for adopting amendments recommended by the Planning Commission. In addition, the Council is responsible for overseeing and giving direction to the Committee for Citizen Involvement (CCI) to ensure that the goal of the citizen involvement program is being met.
Citizens are responsible for participation in the planning processes, becoming educated about land use issues, and in assisting the City in its evaluation of the planning processes and the Citizen Involvement Program.

The following sections address the Committee for Citizen Involvement, the components of Statewide Planning Goal 1, and contain policy statements and measures to implement the policies. This Chapter constitutes the Citizen Involvement Program (CIP).

COMMITTEE FOR CITIZEN INVOLVEMENT

MEMBERSHIP

The CCI shall be a Standing Committee and have 7 members. These members shall include a member of the City Council, a member of the Planning Commission, two members selected from the City's Standing Committees, and three at large members from the public. Members will be selected and serve in accordance with the Standing Committee rules.

RESPONSIBILITIES

The CCI, under the direction of the City Council, shall ensure that the Citizen Involvement program is being implemented.

The CCI shall make an annual written report to the City Council that assesses the effectiveness and overall implementation of the Citizen Involvement Program. Copies will be distributed to all Standing Committee members.

The CCI shall assist citizens and citizen groups in becoming aware of opportunities provided by the Citizen Involvement Program.

The CCI shall make recommendations to the City Council for improving the Citizen Involvement Program if necessary.

The CCI shall perform such other duties as directed by the City Council.
Meetings

The CCI shall meet at least bi-monthly in an open public meeting, and more often if the Councilor the CCI determines it is necessary.

The CCI shall conduct its proceedings in accordance with this chapter and Robert's Rules of Order.

The CCI will be staffed by the Planning Director or, in his/her absence, the City Manager.

TWO-WAY COMMUNICATION

POLICY To provide mechanisms which will promote effective two-way communication between citizens and the policy/decision makers.

IMPLEMENTATION MEASURES

All meetings shall be open to the public as required by State law, and as appropriate to the body.

All public meetings shall be scheduled at times which are conducive to citizen participation.
Appropriate notice of all public meetings shall be given, including the date and agenda of the meeting.
Notice shall be given through advertisements in local newspapers and by posting notices in public places.
In no case shall a meeting be noticed less than 24 hours before it is scheduled to occur.
The City will maintain City Bulletin Boards in public places that contain meeting agendas and other information.
The City will actively promote the City website and the City Manager's Newsletter.

The CCI will explore the feasibility of implementing a citywide questionnaire program regarding city issues. They will take into account issues such as time, cost, and overall effectiveness.
The City Council will host an annual Town Hall meeting to discuss selected topics of interest to the public.
The City will continue to develop outreach programs with service clubs, schools, and other organizations in order to provide planning information and education.

CITIZEN INFLUENCE

POLICY To provide citizens an opportunity to be involved in the planning process

IMPLEMENTATION MEASURES

A. In addition to topics scheduled for discussion, there shall be an opportunity at meetings of public bodies for the public to provide input for items which do not appear on the meeting's agenda.
B. Staff will hold informal, well-publicized educational workshops on proposed revisions to the Comprehensive Plan, Land Development Regulations and other planning topics that have potential widespread impact prior to the hearing. Workshops will be open to the public for participation and discussion. Questions and concerns will be conveyed to the decisionmaking bodies.

TECHNICAL INFORMATION

POLICY To ensure that all documents and information which will assist citizens in effectively participating in the planning process are available to the public in an understandable form subject to the requirements of state and local laws.

IMPLEMENTATION MEASURES

A. The City shall place appropriate planning documents on the website in a timely manner.
B. The City will continue to develop and implement a citywide Geographic Information System (GIS) for public use.
C. In cooperation with the Bandon Public Library, the City will ensure that planning and technical documents are available for review and checkout at the library. A list of these documents will be posted on the City website.
D. The City will continue to update planning counter materials, maps, and development pamphlets to reflect regulation and policy changes.

FEEDBACK MECHANISMS

POLICY: To ensure that the governing bodies will respond to citizens land use planning questions and concerns.

IMPLEMENTATION MEASURES:

A. The City will continue to implement established mechanisms for responding to questions at Council meetings.

B. All specific written questions from citizens will be responded to in writing in a timely fashion, with an initial response not to exceed 20 calendar days from the date of receipt.

C. The City will provide information for the public detailing how to ask questions of the Council or other decision-making body in order to ensure a response.

D. The rationale used by a governing body for making policy decisions shall be recorded and made available for review by the general public.

FINANCIAL SUPPORT

POLICY To ensure that there are adequate resources devoted to the Citizen Involvement Program.

IMPLEMENTATION MEASURES

A. The City budget shall contain a Citizen Involvement Program line item. The amount budgeted shall be recommended yearly by the CCI. The Planning Director shall include this recommendation in the Planning Department Budget.

B. City staff will assist the CCI in implementing the Citizen Involvement Program and will provide technical assistance to citizens.

Memo: Submission to the City of Bandon City Council for consideration on the subject of the February 21, 2024 Public Hearing on the Gravel Point Project.

To: Bandon City Council

Purpose: This memo is to object to the Gravel Point development because the water and wastewater utilities, as they currently stand, cannot support it or any new project for the following reasons:

1. Both the water and wastewater treatment plants are operating at or above their engineered capacity, and beyond their designed service life.
2. The long term practice of the City to not adequately budget for the water and sewer utilities' operation, maintenance, and capital improvements since FY 2011-2012 has created a backlog of expensive deferred maintenance and capital improvement projects.
3. The City has not presented any plans for increasing water or sewer utilities capacity, nor has it secured any means to fund such an expansion.
4. There is insufficient water available for fire protection. The overuse of the treated water supply has lead to significant and alarming deficiencies in the flow to fire hydrants.
5. City of Bandon is not meeting its Goal One obligations (Ordinance 1501 May 5, 2003) or its legal noticing obligations.

> Bandon has an obligation under its Municipal Code 16.12.040 (F): "*All required public facilities and services have adequate capacity to serve the proposal, and are available or can be made available by the applicant.*" Moreover, according to Municipal Code 13.04.040 (A): "*The water department will exercise reasonable diligence and care to deliver a continuous and sufficient supply of water to the customer at a reasonable pressure and to avoid, so far as reasonably possible, any shortage or interruption in delivery…*"

We are not objecting to growth, we are objecting to unplanned and insupportable growth.

1. Available Water and Sewer Services

A. Water Utility

Presently, availability of raw water is not a primary concern for the utility; however any future water needs will not be available from either Geiger or Ferry Creek according to the 2003 Water Management and Conservation Plan (Exhibit 1).

The primary concern for the water utility is the water treatment processing limitation, the deterioration of the water lines, the insufficient storage capacity of treated water, the unexpected costs associated with deferred maintenance and new regulations. Of serious concern is the fact that the facility is now operating beyond its engineered service life span with no planned replacement according to the 1992 Water Master Plan, the 2003 Water Master Plan Addendum, and the draft 2022 Revised Water Master Plan (Exhibit 2, 3, 4).

Since the deterioration of the Ferry Creek earthen dam and spillway (approx. 2014),and the State's refusal to repair it, the City Engineer put forward the necessity for an off-channel reservoir (see 2016 Off-Channel Reservoir Feasibility Study, Exhibit 5). The 2003 Water Master Plan Addendum also stated an additional need for an increase reserve of 0.5 M gallons treated water for fire suppression. The draft 2022 Revised Water Master Plan also states a need for reservoir facilities in the area near this proposed development. However to date, no planning, permitting, or funding has been secured for these projects; these improvements can't be used for consideration of any project until they are completed.

B. Sewer Utility

As with the water treatment plant, the wastewater plant is working beyond its engineered service life, and is at processing capacity as documented in the 2002 Sewer Master Plan (Exhibit 6). No plans have been created or enacted to increase its capacity.

The primary concerns for the wastewater plant are the numerous maintenance concerns documented in the Wastewater Treatment Facilities Condition Assessment May 2018 (Exhibit 7), the lack of City planning for increasing facility capacity given the City's overbuilding, and the fact that there is no room on site for any expansion. The current facility is landlocked and in the tsunami inundation zone of the marina (Figure 1). The City has not addressed the vulnerability of its only wastewater facility in the case of a tsunami, and has made no plans for its replacement if it is destroyed. The landlocked wastewater facility and its vulnerability to tsunamis complicate any capital improvement or expansion. Critical concerns include the deterioration and necessary replacement of the only influent pump, the primary recipient in the 2019 General Obligation Bond ballot initiative (6-173) approved by voters November 5, 2019. Alas, it remains unfinished as the City Manager didn't approve of the aesthetic of the planned tsunami-reinforced pump house.

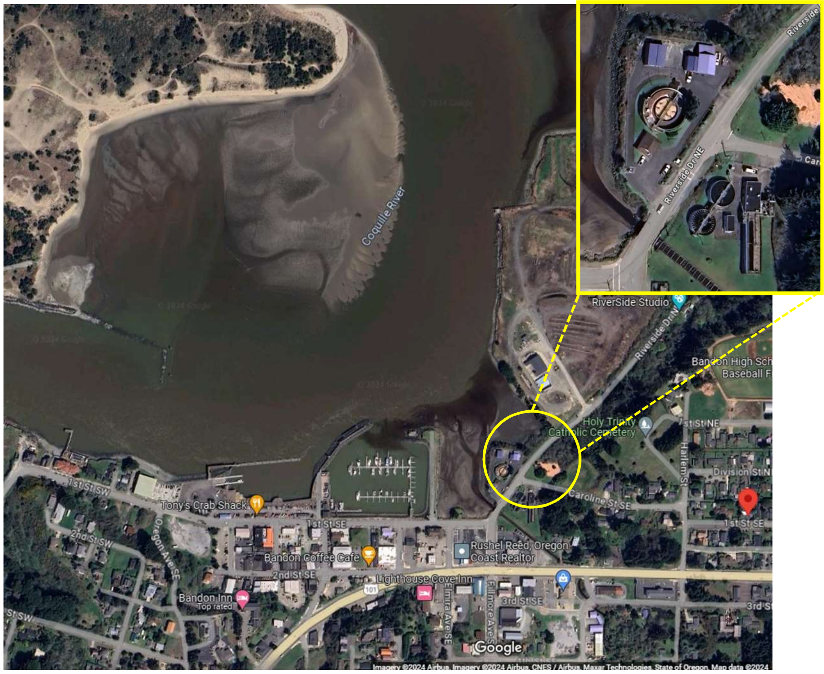


Figure 1. Illustration of landlocked and tsunami vulnerable wastewater plant.

C. Capacity

According to public hearing testimony given by the City Manager Dan Chandler in the 2022 annexation hearings for South Coast Housing LLC, the "… **City's water plant has existing capacity for a population of 4,000 persons**…" and the **wastewater treatment facility "was designed for a population equivalent of 5,068 persons**." (Exhibits 8 and 9). The systems were established to serve a certain number of people; residents, non-residents, public buildings, and commercial interests. This standard has been accepted by the City of Bandon since at least 2002. To change this standard requires State of Oregon review.

According to the City of Bandon its current population is 3, 344 people; there is therefore enough treated water for 656 users other than residents. The 2003 Water Master Plan Addendum estimated that in 2023 the transient population would be 1,034 in the summer, 362 in the winter, with an annual daily of 643 people. (Figure 2). It is reasonable to accept that as of now the water treatment facility is producing beyond its engineered capacity.

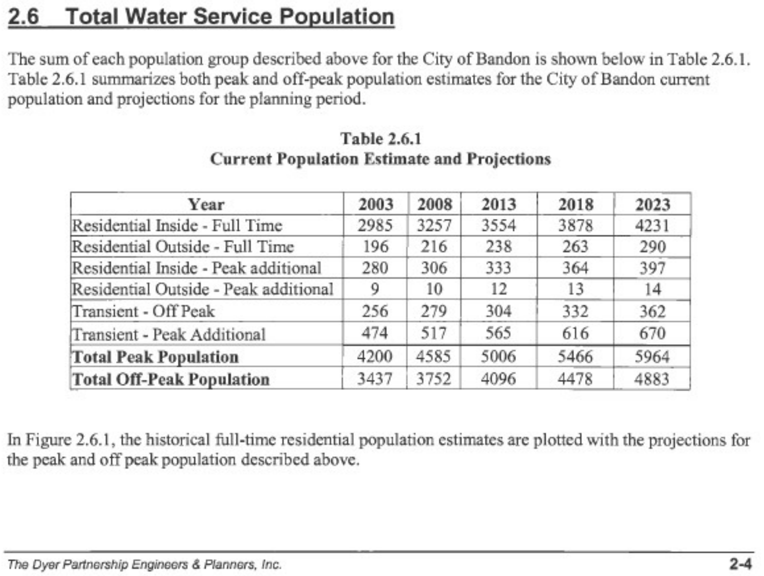
However, there are more water users that must be accounted for, including users who live outside Bandon (est. 290 users), Bandon's rural fire department, schools, hospitals and care homes, the creamery, vacation rentals, AirBnBs, and all commercial users. And of course, the City of Bandon users must also be accounted for: wastewater plant, water treatment plant, public works shop, City Hall, Sprague Theater, Barn community center, and the city library. Even by conservative estimates Bandon's water use is beyond the capacity of the water treatment plant. Using these same user numbers and applying them to the wastewater plant, the wastewater plant is also close to or beyond its processing capacity.

While there is obviously no water capacity to handle the Gravel point project we wonder, why didn't the Applicant put forward the number of users it expects for its hotels, spas, restaurants, and future golf course? The Applicant's plan gives no reasonable estimation of its water and sewer requirements; how can it argue that there is enough water? Given the level of development, it is obvious to us that the Applicant will require more than 488,414 gallons per day.

It should be noted that while the City Council unanimously voted to accept the City's draft 2022 Revised Water Master Plan on September 12, 2022, the plan has not been reviewed and accepted by the State under OAR 333-061-0060(5). It therefore does not replace the 1992 Water Master Plan and its 2003 Water Master Plan Addendum.

A review of City Council minutes for September 12, 2022 (Exhibit 10) documents there was also a long discussion with the City Engineer about the 10s of millions of dollars needed for deferred maintenance and capital improvements to keep the water system operating. There was an emphasis on increasing metering; there was no discussion of increasing capacity. They also discussed their inability to meeting funding needs due Charter restrictions, and they discussed the missed opportunities given the City Manager's handling of bond monies. There was no discussion of lack of water for fire suppression and the critical deficiencies in flows to hydrants in vital areas.

Given the obvious lack of water and sewer services, as well as the Applicants possible future development demands (i.e. additional 84 acres) within the Bandon utilities service area, how can the City reasonably provide utilities service without increasing utilities capacity?



2.6 Total Water Service Population

The sum of each population group described above for the City of Bandon is shown below in Table 2.6.1. Table 2.6.1 summarizes both peak and off-peak population estimates for the City of Bandon current population and projections for the planning period.

Table 2.6.1
Current Population Estimate and Projections

Year	2003	2008	2013	2018	2023
Residential Inside - Full Time	2985	3257	3554	3878	4231
Residential Outside - Full Time	196	216	238	263	290
Residential Inside - Peak additional	280	306	333	364	397
Residential Outside - Peak additional	9	10	12	13	14
Transient - Off Peak	256	279	304	332	362
Transient - Peak Additional	474	517	565	616	670
Total Peak Population	4200	4585	5006	5466	5964
Total Off-Peak Population	3437	3752	4096	4478	4883

In Figure 2.6.1, the historical full-time residential population estimates are plotted with the projections for the peak and off peak population described above.

The Dyer Partnership Engineers & Planners, Inc. **2-4**

Figure 2. Total water service population estimates from 2003 Amended Water Master Plan.

D. City Manager's Newsletters and the state of the utilities.

April 2020: Funding of the utilities: The General Fund had to subsidize the water and sewer utilities for over $400,000.00.

May 2020: The City Manager requests an increase for water and sewer rates to cover a City budget shortfall of $170,000 in operating costs for the water utility, and $ 200,000 for the sewer utility. However, he also praises his ability to have reduced the overall budget by $3.5 M from the previous year.

August 2020: Unexpected ($30,000.00) maintenance costs are needed to keep the wastewater plants influent pump operating. City Manager fails to disclose that the replacement of the influent pump was approved by the voters when they passed the 2019 General Obligation bond.

October 2020: Fire hazard and Bandon's history with gorse fires

November 2020: Water Treatment Facility: Bandon needs to reevaluate the City's water supply to assuage current concerns of there being inadequate fire flows during drought periods.

Gorse Removal: "The City of Bandon is at ground zero for one of the most flammable plants in the world".

March 2021: The wastewater plant continues to have recurring issues with pumps and the clarifier, these unplanned costs are not covered by the 2019 General Bond issuance for maintenance and capital improvement at the facility.

July 2021: Development is at record pace; at this point our Planning Department has received 32 applications for single-family homes as many as we normally receive in a full year. Two local hotels have been approved for minor expansion and renovation; there is a pending application for a 49 room apartment building.

August 2021: What's happening with water in Bandon?

Topic: Who pays for growth? Chandler writes that with more growth comes a demand for more infrastructure. Like Bandon, most cities and counties rely on systems development charges (SDCs) as a way to help assure that new growth pays its fairs share and that existing residents don't foot the bill.

The City Manager makes it clear that he has no knowledge of the current or future infrastructure needs of Bandon.

October 2022:The biggest needs for the water system are the replacement of failing concrete water lines, currently estimated to cost $ 10 M, with an additional $ 4M to cover water meter replacements, a new pump station, and a water storage tank for the Seabird area.

June 2023: The clarifier at the water treatment plant is leaking. And, due to floodplain and tsunami issues, the influent pump is being redesigned. However, because the aesthetics of the planned tsunami-proof structure are not to the City Manager's tastes, he has decided to put off the critical capital improvement.

September 2023: Water system update:

1. Due to unplanned costs and regulatory issues, the second clarifier at the water treatment plant has not been fixed and operational even though 2019 bond money was to be available for it.
2. The City Engineer's recommended off-channel reservoir project is not going forward, but the City Manager is pursuing a wasteful groundwater project not supported by the City's Engineer, or the water master plans.
3. City Manager makes erroneous statement regarding the City's water rights to in-channel storage and stream withdrawals. His lack of water rights knowledge leads residents to have a false sense of water security.

2. Consequence of decades of inadequate budgeting on the operating, maintenance, and capital improvements of the water and sewer utilities.

A. Budgets

The City Council and City Manager are aware that the public record (2000 to present) for the City Council, Utilities Commission, Water Resource Committee, and the Budget Committee has documented the long term effects of insufficiently budgeting for the operation, maintenance, and implementation of capital improvements for these utilities.

We remind the City Council that three of its members Madeline Seymour, Brian Vick, and Peter Braun were Council Liaisons on the Utilities Commission, at some time from 2015-2020, and were privy to all discussions regarding the utilities. Moreover, City Council was regularly updated until 2020 by the Utilities Commission at their monthly meetings, as documented in council agendas, minutes, and recordings.

All of the Master Plans have clearly documented system and facilities limitations, maintenance and capital improvement needs. We challenge the City and its Council to show us, using budgets from FY2011-2012 to present where they have adequately budgeted for the water and sewer utilities, and then actually completed the projects. Please note that shifting money from utility capital funds to cover overspending in operation costs prove our point. As the City Manager is both the Utilities Director and Budget Director, the task of adequately funding the water and sewer utilities should be straight forward.

B. Deferred Maintenance and other costly projects that must be completed before new stresses are added to the system.

According to the draft 2022 Revised Water Master Plan and the City Council Minutes of September 12, 2022 there is approximately $18,471,246.00 of necessary capital improvements for the water treatment plant. Additionally, in his January 2023 newsletter the City Manager stated that concrete water lines needed to be replaced, as well as a few smaller projects, at a cost of approximately $14,000,000.00. He was quick to state that the cost was not due to growth. He was correct it was due to neglectful management by the City Manager.

The City of Bandon Charter makes it clear that increases in utility rates (the primary source of revenue for the City) and the issuances of bonds must be granted by Bandon's voters. Without rate setting authority, Bandon cannot access low interest loans or grants (Business Oregon meeting May 2019). However, it is not in the best interest of the citizens to return authority. Issues with the utilities are decades old due to poor stewardship and the current costs are beyond the ability of the average Bandon citizen to bear. The median income of Bandon is less than $ 40,000.00 and skewed to an elderly population.

Please review previous budget documents, and ask yourself how are these expenses (approx. $36.5 M), for an aged out water system that is working without any operational slack, going to be paid? For the exorbitant costs of deferred maintenance and necessary capital improvement to be met, the City of Bandon will have to convince its residents to vote for accepting a debt burden in the 10s of millions of dollars. How does the City propose to accomplish this task?

3. The City of Bandon has an insufficient treated water supply

Figure 8.5.2 Existing Water System Fire Flows (draft 2022 Revised Water Master Plan) illustrates substantial areas of the City that do not meet the designated fire flow of 4,500 gpm for a 2 hr duration (Figure 3). A review of Table 8.5.1 (draft 2022 Revised Water Master Plan) documents fire flow parameters for vital areas (pg 8-11).

Fire hydrants that surround the area of the proposed Gravel Point site show significant deficits (Figure 4), which along with Figure 3 clearly demonstrate inadequate water supply to the area. As the water line flows are not metered, the fire flows are a good proxy to measure potable water as they both come from the water plant and stored in the 2M gallon storage tank. These figures document fire suppression deficiencies for Bandon's utilities service area are of significant concern to us.

Please note that all of Bandon's public schools (20-37 %), its only fire station (68 %), and all of the hotels (40-88%) surrounding the proposed Gravel Point site have significant hydrant flow deficits . This information from the draft 2022 Revised Water Master Plan was presented to, and accepted unanimously by the City of Bandon and its City Council on September 12, 2022. At the time of writing this memo, the City continues to approve high density building in these areas of diminished water and fire protection services.

In its October 26, 2023 letter to the City of Bandon Planning Commission (Applicant Rebuttal #1), Applicant made statements that concerned us regarding water availability for its project.

Firstly, in Section 2 it states a treated water peak (6-yr ave.) of 1, 4440.000, with a treated water capacity of 488,414 gallons. We inferred that Applicant received this information from either Tim Lakey (Public works Department supervisor) or Jim Wickstrom (Electric Department supervisor), but not the City Engineer.

While the Applicant doesn't cite the data source, we believe these numbers reflect metered water from the 2M gallon treated water storage tank, which is generally always full as it provides both potable water and water for fire suppression. Also, there is no general metering or monitoring system of water flow once it leaves plant; the City only has rate payers' meters to document water use. There is no excess water available beyond the 4,000 person capacity that the system was designed for. Moreover, Applicant's statement of a treated water capacity of 488,414 gallons makes no technical sense and is irrelevant. The fire flow deficiencies reported in the draft 2022 Revised Water Master Plan can be viewed as a proxy for insufficient water availability to the proposed Gravel Point site, and to most of the Bandon utility service area. These number in no way support Applicant's argument of there being sufficient water for its development, or any other development within the Bandon service area.

The City of Bandon has a legal obligation to provide for both potable water and fire flow, this requirement is not optional.

Secondly, in Section 2, the Applicant also cites it is in possession of the draft 2022 Revised Water Master Plan. In Section 4 Applicant stated that it had a meeting with City Staff on December 8, 2022. We question if the Applicant was given a copy of the draft 2022 plan at this meeting by City staff.

On October 19, 2023, on the Perk Development Facebook page, the Applicant announced that it was conducting the burning of gorse and other debris for three days. At this burn " we have removed approximately 95% of the gorse on about 85 acres". Given we believe that the Applicant was in possession of the draft 2022 Revised Water Master Plan, why did the Applicant allow a gorse burn on its property given there was insufficient water for fire suppression if its burn escaped containment? We are also confused why the Applicant was burning so much property given its planning application was for 24.8 acres at the time its application was submitted July 11, 2023.

We are even more concerned that the City of Bandon and the fire district allowed there to be a burning of gorse on the proposed Gravel Point site on October 19-21, 2023. The local government agencies, responsible for public safety, allowed the burning knowing that there was not sufficient water for fire suppression had the burn escaped containment. Given the gorse field to the northeast of the burn site, the inability of the City to abate gorse, as well as the large number of unprotected homes in the area, an escaped fire could easily have been catastrophic.

A reasonable person would conclude that a City that does not have enough water flow to provide fire protection is not able to provide services to a new user, not residential or commercial.

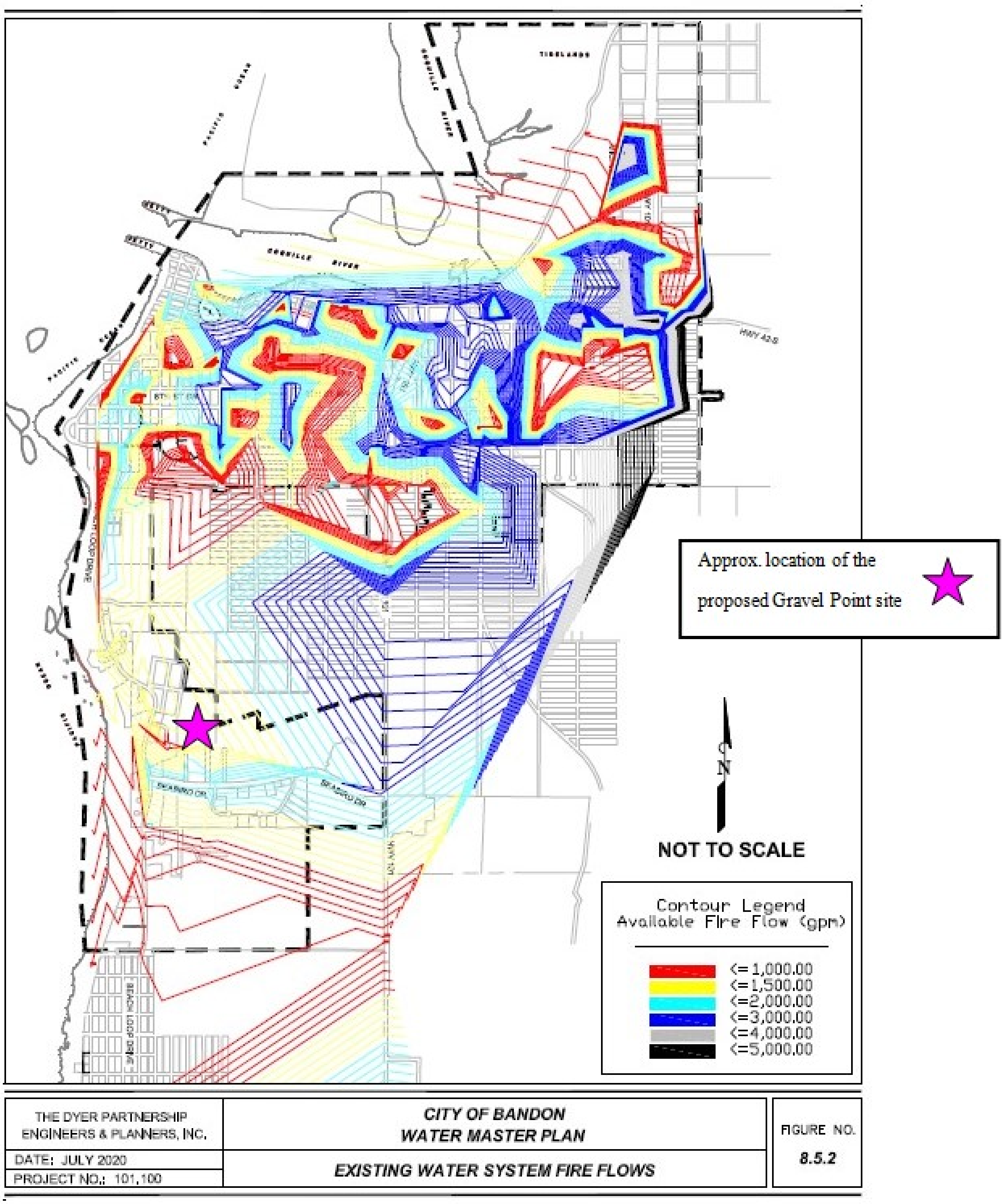
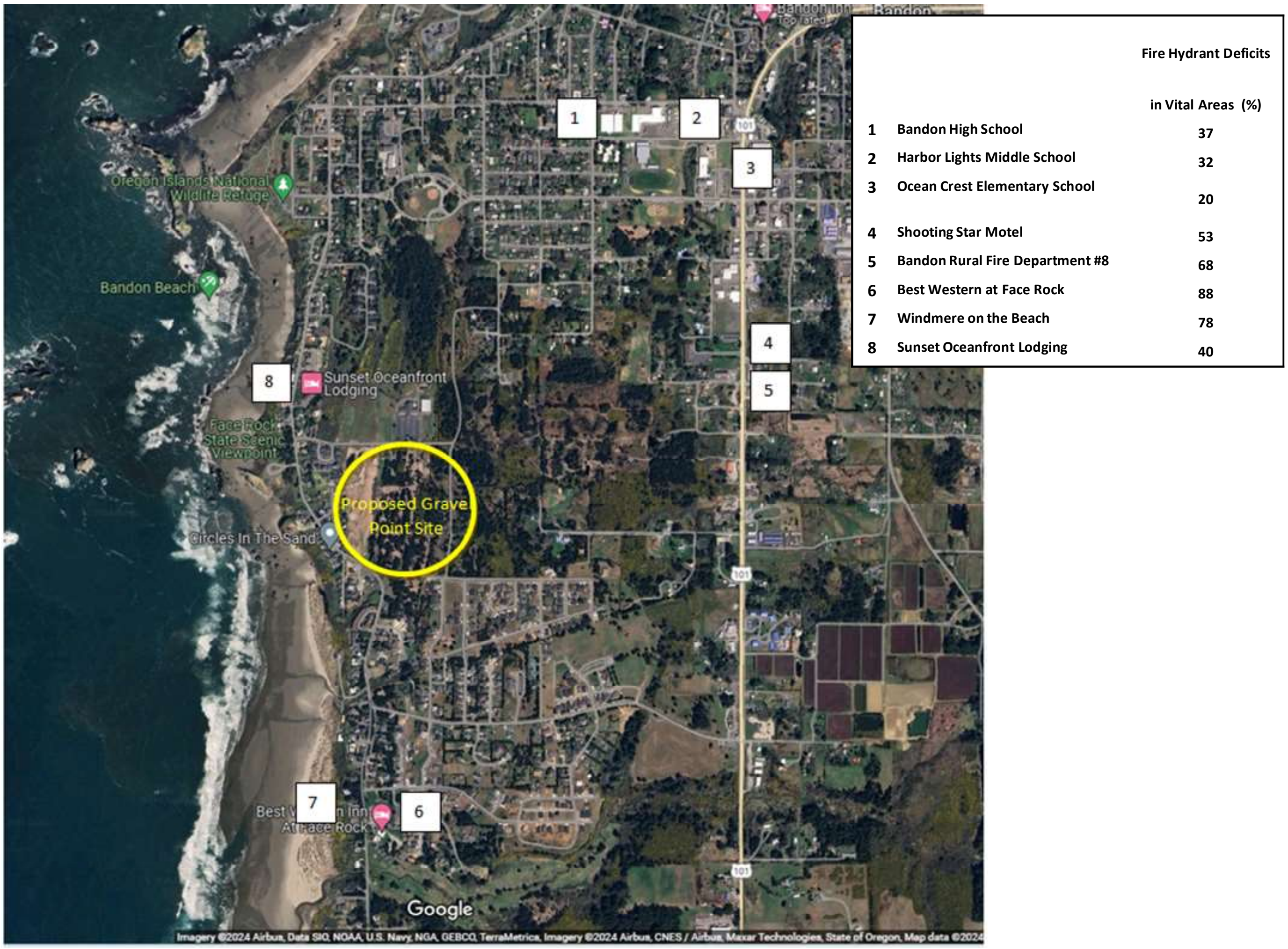


Figure 3. Existing water system fire flows presented in the draft 2022 Revised Water Master Plan.



		Fire Hydrant Deficits in Vital Areas (%)
1	Bandon High School	37
2	Harbor Lights Middle School	32
3	Ocean Crest Elementary School	20
4	Shooting Star Motel	53
5	Bandon Rural Fire Department #8	68
6	Best Western at Face Rock	88
7	Windmere on the Beach	78
8	Sunset Oceanfront Lodging	40

Figure 4. Fire hydrants in vital areas with flow deficiencies near the proposed Gravel Point project.

4. City of Bandon is not meeting its Goal One and legal noticing obligations.

Firstly, we were not noticed of the City Council Public Hearing on the Gravel Project until February 16, 2024. We object to the lack of sufficient notice for a meeting that clearly affects every property owner in Bandon's utilities service area, a Measure 56 should have been sent. We will remind the City that for the public hearings for the 2022 Annexation of South Coast Housing LLC property the City did mail notifications to all residents.

City of Bandon is not meeting its Goal One obligations as stated in its Comprehensive Plan (Ordinance 1501 May 5, 2003), and we are aggrieved:

The Planning Commission did not answer questions we submitted for their Public Hearing held September 28, 2023 on the Gravel Point Project. The routine City behavior of not meeting their Goal One obligations also occurred with our submitted questions to the Public Hearings of the Planning Commission (March 24, 2022) and the City Council (April 11, 2022) on the 2022 Annexation of property owned by South Coast Housing LLC .

We will be submitting our questions and this memo to the City Council for the Public Hearing (February 21, 2024) on the Gravel Point project. We expect the Council to answer our questions within 20 days.

To refresh the Council and City of their legal obligations we submit the following quote from the Bandon Comprehensive Plan, pg. 8-9

"CITIZEN INVOLVEMENT
Ordinance 1501 5-05-2003

FEEDBACK MECHANISMS
Policy: To ensure that the governing bodies will respond to citizens land use planning questions and concerns.
Implementation Measures

1. The City will continue to implement established mechanisms for responding to questions at Council meetings.

2. All specific written questions from citizens will be responded to in writing in a timely fashion, with an initial response not to exceed 20 calendar days from the date of receipt.

3. The City will provide information for the public detailing how to ask questions of the Council or other decision-making body in order to ensure a response.

4. The rationale used by a governing body for making policy decisions shall be recorded and made available for review by the general public. "

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Noticing of public meetings is regulated by law and is not optional for the City of Bandon. We suggest that the City review ORS Chapter 193 on what constitutes legal noticing and ORS 192.610 Definitions for ORS 192.610 to 192.705 on public meetings.

5. Conclusion

In conclusion we are asking that the Gravel Point project and all other projects not be permitted to proceed until The City of Bandon is able to remedy its deficiencies to the water and sewer utilities infrastructure as required by Bandon Municipal Code 16.12.040.

A stay on new development should be in place until Bandon conducts a serious study of the infrastructure deficiencies within its utilities service area. The City also needs to produce an impartial and professional cost of service study for all of the utilities. Without serious plans implemented to ensure that the City can handle growth pressures on its outdated and failing infrastructure, the stay should stay in effect. The City of Bandon has been aware of these issues since at least 2002. When the infrastructure is stable and updated to meet the needs of not only new development, but of all users, the stay can be lifted.

Respectfully submitted February 18, 2024

Sheryl Bremmer, resident of Bandon, Oregon

City of Bandon Planning Commissioner 2010 – 2020, Hearings Officer 2012 – 2020

Co-Chair City of Bandon Utilities Commission 2020, Commissioner 2015-2020

Mary O’Dea, PhD, resident of Bandon, Oregon.

Co –Chair 2016-2020, Chair City of Bandon Utilities Commission

List of Exhibits

Exhibit 1. City of Bandon Water, Coos County, Oregon, Water Management and Conservation Plan October 2003 (https://www.cityofbandon.org/documents)

Exhibit 2. City of Bandon Water Master Plan 1992

Exhibit 3. 2003 City of Bandon Water Master Plan Addendum

Exhibit 4. Draft 2022 Revised Water Master Item 5.3.2 (https://www.cityofbandon.org/general/page/agenda-city-council-september-12-2022)

Exhibit 5. Off-channel Reservoir Feasibility Study 2016 (https://www.cityofbandon.org/documents)

Exhibit 6.City of Bandon Sewer Master Plan 2002 (https://www.cityofbandon.org/documents)

Exhibit 7. Wastewater Treatment Facilities Condition Assessment May 2018

Exhibit 8. Staff report to Planning Commission. Planning Commission Agenda Documentation. Date:: March 24th, 2022 PUBLIC HEARING: Annexation of 19-Acre Parcel located in East Bandon and Portion (4334 feet) of Highway 101 (28S-14W-31BC / TL 2100, 2200, 2201, 2300, 2700, 3600, 3700, 4200, 4300, 4400) – Request to annex property into the City of Bandon, initiated by the City of Bandon – 22- 022, Item No: 5.1 , pgs. 6- 7 (https://www.cityofbandon.org/general/page/planning-commission-2)

Exhibit 9, Staff report to City Council: City Council Agenda Documentation. Date: April 11, 2022 Public hearing on annexation into the City of Bandon. ITEM 4.1, pgs 6-7. (https://www.cityofbandon.org/general/page/city-council-2)

Exhibit 10. Bandon City Council Minutes for September 12, 2022, City Council Agenda Documentation, October3, 2022, Item No. 6.1.1 (file name: 6.1.1_city_council_meeting_minutes_10.3.22)

Exhibit 11. City of Bandon Comprehensive Plan (Ordinance 1501 5-05-2003)

City of Bandon situation dire and systems dysfunctional

- Oct 21, 2019 Updated Aug 10, 2020

There is complex state of affairs that threatens to compromise the health and well-being of the citizens of Bandon, Oregon.

Under the existing government structure, there are loud and glaring doubts as to the managerial capacity and financial capacity of the water and wastewater systems. The jurisdictional, legal and financial inadequacies are so serious that I fear there is a good chance the drinking water system will soon not be able to maintain Oregon's drinking water requirements or meet Bandon's desired level of service and the sewer system is compromised to the point that it may not meet discharge requirements.

System administrators (aka as the City of Bandon) have been unable to acquire sufficient financial resources since 1995 when the Bandon City Charter was amended. In 1995 a city charter amendment was passed by voters that no increase in water rates, sewer rates or other fees, with few exceptions, can be made without voter consent. Since then, City administrators have been unsuccessful in making needed rate increases to properly operate and update the water and wastewater utilities.

This is unacceptable. As a recent transplant to this beautiful seaside town, the first question that came to my mind when I learned this was, "That was nearly 25 years ago. Why has this been allowed to continue for so long?"

After attending many city meetings for a year and listening to the local politics, this question quickly morphed into the idea that, just like the current decision makers, the institutional and administrative decision makers over the last 25 years were either unable or unwilling to change the existing government structure to one that was able to acquire and manage sufficient financial resources.

For instance, it would not have been difficult to apply for a special district to be formed in order to manage the systems under a board elected by the public instead of depending on a popular ballot vote for a rate change. For reasons not understood and not easily answered, this was evidently not an option?

This is why I have profound doubts about the managerial capacity of the City of Bandon to do what is required to protect public health. Public health must not be a priority in their decision making, otherwise the risk the people of Bandon now face would never have come to ligh.

The way things are now, with the water and wastewater systems being operated and managed by the City of Bandon, whose hands are tied by the city charter, the ability to acquire and manage sufficient financial resources are so limited that I would call the situation dire and the systems dysfunctional.

Some or all of the unit process have come to the end of their useful life and there is no short or long-term plan in place to replace them. Lack of financial planning puts our community at risk. The systems depend on the City Council implementing emergency rate increases to be able to cover projected revenue shortfalls. This action is now being challenged in court.

The only capital improvement plan in place is a general obligation bond (Measure 6-173) that is likely to fail in the November 5, 2019 election. What will happen then?

Karen Donaldson

Bandon

https://theworldlink.com/community/bandon/opinion/city-of-bandon-situation-dire-and-systems-dysfunctional/article_b26a46e5-8bd7-564b-ac80-242a66fb33d9.html

Water treatment plant issues outlined

- AMY MOSS STRONG Bandon Western World
- Sep 1, 2016

BANDON -- A steady stream of people trickled in to the City of Bandon's water treatment plant Saturday for a tour of the facility and to be treated with hot-dogs, lemonade and ice cream, care of Face Rock Creamery.

The open house and tours were hosted by the City of Bandon Utilities Commission. At the commission's request, the city has put a measure on November's ballot that, if approved, would increase the water base rate by $10 a month for residential customers and $20 a month for commercial and industrial customers.

The pressing need for major and minor repairs at the water plant, along with the financial condition of the city's utilities prompted the request, according to interim City Manager Matt Winkel.

Bandon’s utility rates and other fees cannot be increased without a vote of the people, based on a charter amendment passed by voters in 1995, put on the ballot by resident and longtime businessman Francis Stadelman and the Committee for Fiscal Responsibility.

In July of 2015, Mayor Mary Schamehorn asked for volunteers to form a utilities commission to investigate the physical and financial health of Bandon's three utilities, including water, electric and wastewater. Some of the same members from the former Water Resources Committee are members of the Utilities Commission.

"The city owns and operates the utilities, which means they are owned by the citizens of Bandon," said commission chairwoman Patricia Soltys in a letter to the mayor and council asking for the rate increase. "Because the Bandon utilities are publicly owned, we, the owners, are responsible to keep the utilities in good shape to continue to provide an adequate supply of clean water for drinking and fire protection, dependable electricity and a sewer system for properly collecting and treating our waste water."

Soltys said after studying the issue, the commission found that the water utility is operating at a loss and the city has not been able to put money aside for routine maintenance and replacement of parts that are in poor condition.

The Utilities Commission has been concentrating on the water utility since the commission was formed because, for the past several years, the revenue coming in to the water fund from the water rates has been less than the amount that has been spent to keep the system operating, Soltys explained. The supplemental money to make up this difference can only come from certain areas of the city budget. The major source of supplemental funding is the general fund, which is responsible for maintaining the police department, the city parks and the planning department.

"When the general fund is used to supplement the water fund to keep the water system operating, the city must reduce funds for the police department, reduce or put off city park maintenance like regular mowing and replacing worn or broken playground equipment and not replace planning department staff when someone leaves," Soltys said.

"With the current water rates, Bandon can keep city water flowing until a major catastrophe occurs, but the police department will be facing cuts, the parks will deteriorate due to less regular maintenance and the planning department may have to reduce the hours that it is open to the public because of reduced staff to do the work," she added.

The complete financial report of the cash coming in and the cash going out for the 2015-16 budget year shows that the water fund collected $543,655 from the water rates paid to the city but spent $614,696 to keep operating. This is a negative balance of $71,041. All of this deficit in the water fund was covered with money taken from the general fund.

In addition to an annual loss in the water fund for the past several years, the Utilities Commission found that the water plant currently needs the following equipment upgrades: Replacing the 16-year-old chlorine system, at a cost of $20,000; re-packing the 16-year-old filters with new filtration medium, at a cost of $120,000; ordering the spare pumps to use when the 16-year-old ones need remedial work, at a cost of $15,000; and installing a seismic valve on the 2-million-gallon water storage tank, at cost of $240,000.

According to the city, Bandon has some of the lowest utility rates along the South Coast. The last time a water rate increase was approved by the voters was in 2006 after the clarifier breakdown caused citizens to have to boil their drinking water. Because of increases in costs in the past 10 years, the amount of money collected by the 2006 water rate will no longer keep the water plant operating in the black while keeping the system in good repair and the equipment up to date, Soltys said.

The last ballot measure the city put before voters in November 2014, asking to give the council limited authority to increase water, sewer and electric rates by no more than 5 percent per year, was rejected by 57 to 42 percent.

A base rate increase would generate an estimated $308,520 per year, which would first be used to repair the walls of the water filters and replace the 16-year-old media filters, of which the city engineer and water treatment plant operator recommend immediate replacement, at a cost estimated at $120,000.

If approved by voters in the Nov. 8 election, the increase would not go into effect until Jan. 1, 2017.

https://theworldlink.com/bandon/news/water-treatment-plant-issues-outlined/article_2c82dca5-6f77-5c1b-9690-5ff3fe9bc32c.html

Editorial: Bandon's water problem solvable

May 13, 2005

Just in time for the summer construction season, the city of Bandon is requiring some builders to install sprinkler systems in new homes and duplexes. The move has angered some folks, and the city is listening.

People affected by the new rules should be encouraged. And if people keep talking rationally the way they have over the past few weeks, the situation might be resolved.

The problem is water flow. Due to a substandard water system in some areas, the city can't meet state fire codes, the city's fire chief says. State law requires sprinklers in buildings constructed in those areas. It's expensive and it's hard to imagine any people wanting sprinkler systems in their homes even it were affordable.

But one resident who complained contends the city is wrong. Fairly enough, the city has agreed to allow residents to hire a tester to prove the city wrong. If city officials erred, Bandon will cover the retesting costs.

Nobody's in the wrong here. But regardless of the outcome of new tests, there is a bigger issue here that needs to be addressed.

The inadequate sections of the water system need to be upgraded.

Should the fire department roar out into one of the problem neighborhoods, the chief fears a lawsuit should there be too little water pressure to douse a house fire.

While the city has pledged to begin work on pipelines, citizens need to closely follow this issue and work with the city to allocate money to replace water lines in any areas of town where the systems not up to code.

Quite simply, a liability against the city of Bandon is a liability against all who pay property taxes and rely upon city services.

https://theworldlink.com/news/opinion/editorial/editorial-bandons-water-problem-solvable/article_03087db9-7dad-54e5-b148-18b9b3bfe60d.html