Oregon
Kate Brown, Governor

Department of Land Conservation and Development
635 Capitol Street NE, Suite 150
Salem, Oregon 97301-2540
Phone: 503-373-0050
Fax: 503-378-5518
www.oregon.gov/LCD

NOTICE OF ADOPTED CHANGE TO A COMPREHENSIVE PLAN OR LAND USE REGULATION

Date:	August 14, 2015
Jurisdiction:	City of Grants Pass
Local file no.:	15-405-00001
DLCD file no.:	002-15

The Department of Land Conservation and Development (DLCD) received the attached notice of adopted amendment to a comprehensive plan or land use regulation on 08/12/2015. A copy of the adopted amendment is available for review at the DLCD office in Salem and the local government office.

Notice of the proposed amendment was submitted to DLCD 54 days prior to the first evidentiary hearing.

Appeal Procedures

Eligibility to appeal this amendment is governed by ORS 197.612, ORS 197.620, and ORS 197.830. Under ORS 197.830(9), a notice of intent to appeal a land use decision to LUBA must be filed no later than 21 days after the date the decision sought to be reviewed became final. If you have questions about the date the decision became final, please contact the jurisdiction that adopted the amendment.

A notice of intent to appeal must be served upon the local government and others who received written notice of the final decision from the local government. The notice of intent to appeal must be served and filed in the form and manner prescribed by LUBA, (OAR chapter 661, division 10).

If the amendment is not appealed, it will be deemed acknowledged as set forth in ORS 197.625(1)(a). Please call LUBA at 503-373-1265, if you have questions about appeal procedures.

DLCD Contact

If you have questions about this notice, please contact DLCD's Plan Amendment Specialist at 503-934-0017 or plan.amendments@state.or.us

DLCD FORM 2

NOTICE OF ADOPTED CHANGE TO A COMPREHENSIVE PLAN OR LAND USE REGULATION

FOR DLCD USE
File No.: 002-15 {23698}
Received: 8/12/2015

Local governments are required to send notice of an adopted change to a comprehensive plan or land use regulation **no more than 20 days after the adoption.** (*See* OAR 660-018-0040). The rules require that the notice include a completed copy of this form. **This notice form is not for submittal of a completed periodic review task or a plan amendment reviewed in the manner of periodic review.** Use Form 4 for an adopted urban growth boundary including over 50 acres by a city with a population greater than 2,500 within the UGB or an urban growth boundary amendment over 100 acres adopted by a metropolitan service district. Use Form 5 for an adopted urban reserve designation, or amendment to add over 50 acres, by a city with a population greater than 2,500 within the UGB. Use Form 6 with submittal of an adopted periodic review task.

Jurisdiction: City of Grants Pass

Local file no.: **15-40500001**

Date of adoption: 8/5/2015 Date sent: 8/12/2015

Was Notice of a Proposed Change (Form 1) submitted to DLCD?

☒ Yes: Date (use the date of last revision if a revised Form 1was submitted): 3/20/2015

No

Is the adopted change different from what was described in the Notice of Proposed Change? (Yes) No

If yes, describe how the adoption differs from the proposal:

Non-substantive amendment: adds map and notes referencing UGB and UR areas as part of future service area

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Local contact (name and title): Tom Schauer, AICP, Senior Planner

Phone: 541-450-6072 E-mail: tschauer@grantspassoregon.gov

Street address: 101 NW 'A' Street City: Grants Pass, OR Zip: 97526

PLEASE COMPLETE ALL OF THE FOLLOWING SECTIONS THAT APPLY

For a change to comprehensive plan text:

Identify the sections of the plan that were added or amended and which statewide planning goals those sections implement, if any:

Element 10: Public Facilities. Goal 11 and OAR Division 11.

For a change to a comprehensive plan map: N/A

Identify the former and new map designations and the area affected:

Change from to acres. A goal exception was required for this change.

Change from to acres. A goal exception was required for this change.

Change from to acres. A goal exception was required for this change.

Change from to acres. A goal exception was required for this change.

Location of affected property (T, R, Sec., TL and address): N/A

The subject property is entirely within an urban growth boundary

The subject property is partially within an urban growth boundary

If the comprehensive plan map change is a UGB amendment including less than 50 acres and/or by a city with a population less than 2,500 in the urban area, indicate the number of acres of the former rural plan designation, by type, included in the boundary. N/A

Exclusive Farm Use – Acres:	Non-resource – Acres:
Forest – Acres:	Marginal Lands – Acres:
Rural Residential – Acres:	Natural Resource/Coastal/Open Space – Acres:
Rural Commercial or Industrial – Acres:	Other: – Acres:

If the comprehensive plan map change is an urban reserve amendment including less than 50 acres, or establishment or amendment of an urban reserve by a city with a population less than 2,500 in the urban area, indicate the number of acres, by plan designation, included in the boundary. N/A.

Exclusive Farm Use – Acres:	Non-resource – Acres:
Forest – Acres:	Marginal Lands – Acres:
Rural Residential – Acres:	Natural Resource/Coastal/Open Space – Acres:
Rural Commercial or Industrial – Acres:	Other: – Acres:

For a change to the text of an ordinance or code: N/A.
Identify the sections of the ordinance or code that were added or amended by title and number:

For a change to a zoning map: N/A.
Identify the former and new base zone designations and the area affected:

Change from	to	Acres:
Change from	to	Acres:
Change from	to	Acres:
Change from	to	Acres:

Identify additions to or removal from an overlay zone designation and the area affected:

Overlay zone designation: Acres added: Acres removed:

Location of affected property (T, R, Sec., TL and address):

List affected state or federal agencies, local governments and special districts: Josephine County

Identify supplemental information that is included because it may be useful to inform DLCD or members of the public of the effect of the actual change that has been submitted with this Notice of Adopted Change, if any. If the submittal, including supplementary materials, exceeds 100 pages, include a summary of the amendment briefly describing its purpose and requirements.

Amendment to Element 10 to incorporate updates for the water treatment plant facilities plan and the water restoration plant facilities plan.

ORDINANCE NO. 15-5655

AN ORDINANCE OF THE COUNCIL OF THE CITY OF GRANTS PASS ADOPTING ADDENDUM 1 TO THE PUBLIC FACILITIES ELEMENT OF THE COMPREHENSIVE PLAN.

WHEREAS:

1. The Grants Pass and Urbanizing Area Community Comprehensive Plan was adopted December 15, 1982; and
2. The City Council adopted the Water Treatment Plant Facility Plan Update (Resolution 14-6173) and the Water Restoration Plant Facility Plan Update (Resolution 14-6205) in 2014; and
3. Statewide Planning Goal 11 (Public Facilities and Services) and Oregon Administrative Rules (OAR) 660 Division 11 address public facilities planning and specify how public facility plans are to be addressed in the Comprehensive Plan; and
4. Addendum 1 to the Public Facilities Element of the Comprehensive Plan satisfies the applicable requirements; and
5. The applicable criteria of the Comprehensive Plan are satisfied for the amendment, and approval of the proposal is recommended by the Urban Area Planning Commission to the City Council, with an additional clarifying revision recommended by staff.

NOW, THEREFORE, THE CITY OF GRANTS PASS HEREBY ORDAINS:

Section 1. Addendum 1 to the Public Facilities Element (Element 10) of the Comprehensive Plan is hereby adopted, and the Comprehensive Plan is hereby amended as described in Exhibit 'A'.

ADOPTED by the Council of the City of Grants Pass, Oregon, in regular session this 5th day of August, 2015, with the following specific roll call vote:

AYES: DeYoung, Hannum, Lindsay, Riker and Roler.

NAYS: None **ABSTAIN: Morgan** **ABSENT: Gatlin and Goodwin**

SUBMITTED to and Approved by the Mayor of the City of Grants Pass, Oregon, this 11 day of August, 2015.

Darin Fowler, Mayor

ATTEST:

David Reeves, Assistant City Manager

Date submitted to Mayor: 8/10/15

Approved as to Form, Mark Bartholomew, City Attorney MB

EXHIBIT A

TO ORDINANCE

Grants Pass and Urbanizing Area Community Comprehensive Plan
Element 10: Public Facilities

Addendum 1: 2015 Update

This addendum updates the following sections of the Public Facilities Element:

- 10.20. Water Services
- 10.30. Sanitary Sewer Services

Background

In 2008, the City Council adopted Ordinance 5460, which updated Element 10 of the Comprehensive Plan to reflect updates to several of the public facility plan documents. In 2014, the City Council adopted the following:

- **Resolution 14-6173. A resolution adopting the Water Treatment Plant Facility Plan Update.** This resolution adopted the Water Treatment Facility Plan Update prepared by Murray, Smith & Associates in association with MWH Americas, Inc. dated January 2014. It replaced the previous Water Treatment Plan Facility Plan adopted in April 2004.

- **Resolution 14-6205. A resolution adopting the Water Restoration Plant (WRP) Facility Plan.** This resolution adopted the Water Restoration Plant Facility Plan prepared by Carollo Engineers, Inc. dated May 2014. It replaced the previous Water Restoration Plant (WRP) Facility Plan completed in June 2001.

Statewide Planning Goal 11 addresses Public Facilities and Services, and Oregon Administrative Rules (OAR) Division 11 address Public Facilities Planning. OAR 660-011-0005(1) defines "Public Facilities Plan" as follows: "A public facility plan is a support document or documents to a comprehensive plan. The facility plan describes the water, sewer and transportation facilities which are to support the land uses designated in the appropriate acknowledged comprehensive plans within an urban growth boundary containing a population of greater than 2,500. Certain elements of the public facility plan shall also be adopted as part of the comprehensive plan, as specified in OAR 660-011-0045."

Consistent with OAR 660-011-0005, this addendum recognizes these 2014 updates as part of the City's Public Facilities Plan, as support documents to the Comprehensive Plan. This addendum also adopts certain elements of these plans as part of the comprehensive plan, as specified in OAR 660-011-0045.

Updates to the Water Distribution System Master Plan and the Sewer Collection Master Plan will also be completed to address future needs, including those associated with the UGB expansion and designation of Urban Reserves. Element 10 of the Comprehensive Plan will be subsequently updated to incorporate provisions of those plans at that time.

Section 1. Plans Adopted Part of the Public Facility Plan as Part of a Supporting Document to the Comprehensive Plan

The January 2014 Water Treatment Plant Facility Plan Update and the May 2014 Water Restoration Plant (WRP) Facility Plan are adopted as part of the Public Facilities Plan as a supporting document to the Comprehensive Plan.

Some of the information and provisions in the plans referenced in this addendum supersede materials in Section 10.20 pertaining to water services and Section 10.30 pertaining to sanitary sewer services.

Section 2. Sections Adopted as Part of Comprehensive Plan

1. The parts of the January 2014 Water Treatment Plant Facility Plan Update and the May 2014 Water Restoration Plant (WRP) Facility Plan identified in Table 2-1 are hereby adopted and incorporated as part of comprehensive plan.

2. In accordance with OAR 660-011-0045(2), certain public facility plan project descriptions, location, or service area designations will necessarily change as a result of subsequent design studies, capital improvement programs, environmental impact studies, and changes in potential sources of funding. It is not the intent of this section to:

   a. Either prohibit projects not included in the public facility plans for which unanticipated funding has been obtained;

   b. Preclude projects specification and location decisions made according to the National Environmental Policy Act; or

   c. Subject administrative and technical changes to the facility plan to ORS 197.610(1) and (2) or 197.835(4).

3. In accordance with OAR 660-011-0045(3), the public facility plan may allow for the following modifications to projects without amendment to the public facility plan:

   a. Administrative changes are those modifications to a public facility project which are minor in nature and do not significantly impact the project's general description, location, sizing, capacity, or other general characteristic of the project.

   b. Technical and environmental changes are those modifications to a public facility project which are made pursuant to "final engineering" on a project or those that result from the findings of an Environmental Assessment or Environmental Impact Statement conducted under regulations implementing the procedural provisions of the National Environmental Policy Act of 1969 (40 CFR Parts 1500-1508) or any federal or State of Oregon agency project development regulations consistent with the Act and its regulations.

   c. Public facility project changes made pursuant to subsection (3b) are subject to the administrative procedures and review and appeal provisions of the regulations controlling the study (40 CFR Parts 1500-1508 or similar regulations) and are not subject to the administrative procedures or review or appeal provisions of ORS Chapter 197, or OAR Chapter 660 Division 18.

4. Land use amendments are those modifications or amendments to the list, location or provider of, public facility projects, which significantly impact a public facility project identified in the comprehensive plan and which do not qualify under subsection (3)(a) or (b). Amendments made pursuant to this subsection are subject to the administrative procedures and review and appeal provisions accorded "land use decisions" in ORS Chapter 197 and those set forth in OAR Chapter 660 Division 18.

Table 2-1. Sections Adopted as Part of Comprehensive Plan

OAR 660-011-0045 Requirement	Water Treatment Plant Facility Plan Section [1, 2, 4]	Water Restoration Plant Facility Plan Section [1, 3, 4]
(1)(a) The list of public facility project titles, excluding (if the jurisdiction so chooses) the descriptions and specifications of those projects.	***See Table 2-2.*** From Executive Summary, Table ES-1	***See Table 2-3.*** From Executive Summary, Section ES.3 and Table ES.5
(1)(b) A map or written description of the public facility projects' locations or service areas as specified in Sections (2) and (3) of this rule.	Appendix E: Long Term Water Demand Projections, 'Current and Future Service Area' plus Figure 2-1	Executive Summary, Section ES.2 and Figure ES.1, 'WRP Service Area', 'Population, Flow, and Load Projections' plus Figure 2-1
(1)(c) The policy(ies) or urban growth management agreement designating the provider of each public facility system. If there is more than one provider with the authority to provide the system within the area covered by the public facility plan, then the provider of each project shall be designated.	No change from adopted policies and management agreements regarding service provider.	No change from adopted policies and management agreements regarding service provider.

[1] The facility plans for the treatment plants pertain primarily to the total demand of the service areas based on population, employment, and land use of the service areas, and demand forecasts derived from population and employment forecasts (regardless of location of growth), while the water distribution and sewer collection master plans are dependent on location of growth.

[2] In addition to the current UGB, the principal service areas for the Water Treatment Plant include approximately 105 residential and commercial acres in the Merlin/North Valley Unincorporated Community Boundary. The demand forecasts account for growth to be accommodated within the UGB expansion areas and Urban Reserves. Also, it is noted that some areas within the current UGB are served with wells and community water systems.

[3] In addition to the current UGB, the principal service areas for the Water Restoration Plant include properties located within a portion of the former Redwood Sewer District established before the Urban Growth Boundary was adopted. This is located on the west side of the city, south of the Rogue River. The demand forecasts account for growth to be accommodated within the UGB expansion areas and Urban Reserves. Also, it is noted a very limited number of developed properties within the current UGB are on septic systems and unserved by public sewer.

[4] In addition to the current service areas, the future service areas include the UGB expansion areas and Urban Reserve areas shown in Figure 2-1, and as subsequently amended, in accordance with the applicable management agreements when they are eligible for municipal water and sewer service.

Table 2-2. Water Treatment Plant CIP (Table ES-1)

Table ES-1
Recommended Capital Improvement Program Summary

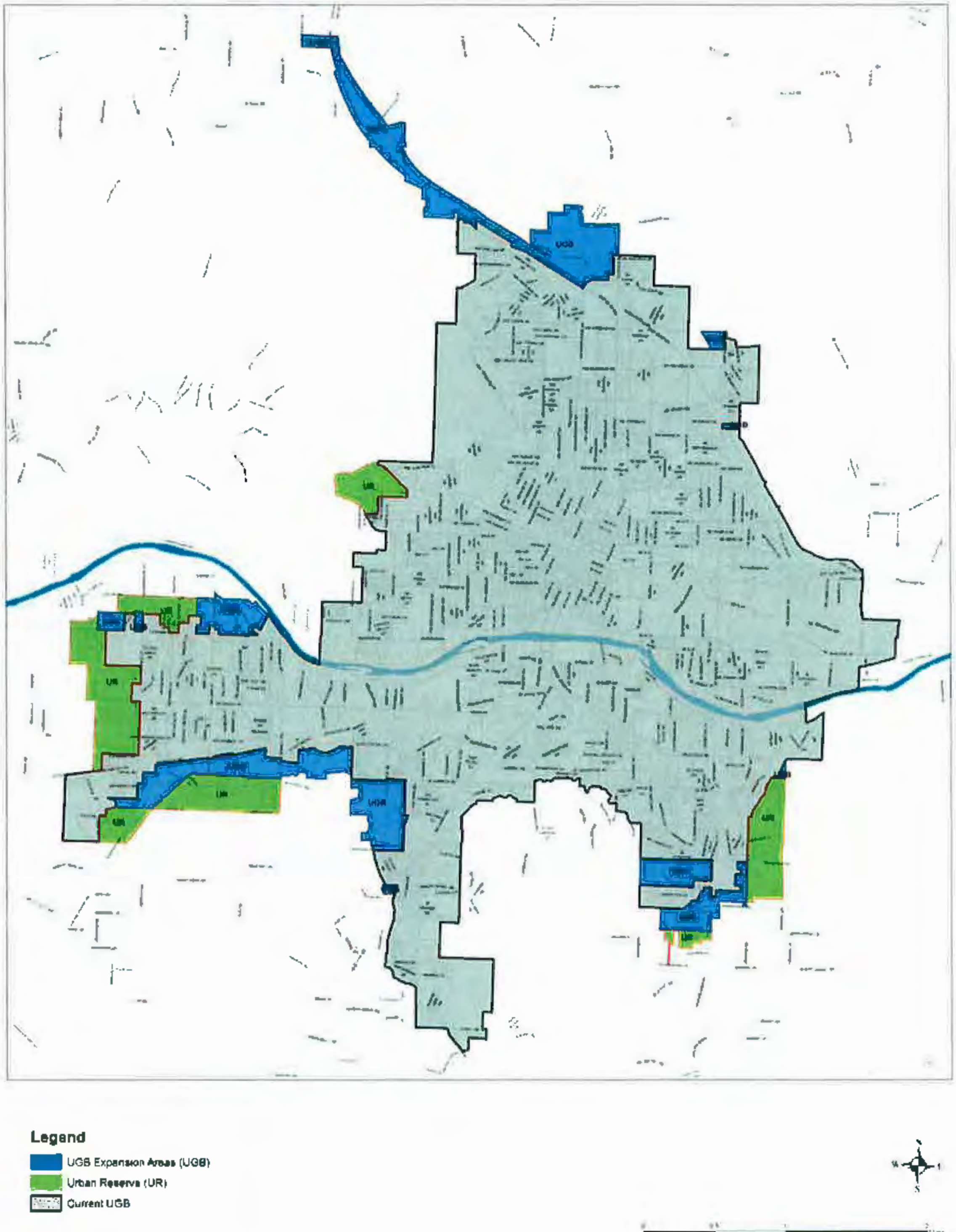
Capital Project	Capital Expenditure
New Water Treatment Plant Implementation	
Pilot Plant Study	$500,000
Siting Study and Property Acquisition	$1,300,000
Funding Study and Rate Impact Study	$200,000
Project Implementation Approach and Procurement Strategy	$50,000
Public Information/Involvement	$250,000
Permitting and Land-Use Approvals	$200,000
Preliminary Design	$1,000,000
Final Design	$4,000,000
Bidding and Award	$250,000
Construction	$47,200,000
Post-Construction and Warranty Period	$200,000
Existing Water Treatment Plant Investments	
Emergency Response Plan	$50,000
Decommission and Demolition of Existing Plant	$1,000,000
Total Anticipated Expenditures (2013 dollars)	**$56,200,000**

Table 2-3. Water Restoration Plant CIP (Table ES-3)

Table ES.3 Recommended CIP
City of Grants Pass – Executive Summary

CIP Project Phase	Cost, $	Fiscal Years
Phase 1	1,500,000	2015 – 2016
UV Disinfection	1,093,000	
Seismic Upgrades	407,000	
Phase 2	9,643,000	2016-2020
Primary Clarifier No. 3	2,703,000	
Aeration Basins No. 3 and 4	5,728,000	
Rehabilitate GT and One New GT	1,100,000	
Screening Hydraulic Improvements	112,000	
Phase 3	8,918,000	2020-2023
Primary Clarifier No. 4	2,703,000	
Secondary Clarifier No. 4	5,017,000	
WAS Diversion Pipeline and Mixing Upgrades	440,000	
Degritting Improvements	758,000	
Total CIP	20,061,000	

Figure 2-1. UGB Expansion Areas and Urban Reserve Areas



CITY OF GRANTS PASS PARKS & COMMUNITY DEVELOPMENT DEPARTMENT

CITY OF GRANTS PASS - 2015 MAP AMENDMENTS
FINDINGS OF FACT - CITY COUNCIL DECISION

Procedure Type:	Type IV-B: Planning Commission Recommendation and City Council Decision
Project Number:	15-40200002
Project Type:	Comprehensive Plan Map Amendments and Zoning Transition Overlay District Map Amendments
Applicant:	City of Grants Pass
Total Acreage:	1.34 acres
Map & Tax Lot:	36-5-21-CC-4600, 36-5-21-CD-1900, 36-6-13-AC-1800, 36-6-13-AD-2400
Address:	1550 Carnahan Drive, 1935 Rogue River Highway, 2064 Upper River Road, 2028 SW 'G' Street, ***See Exhibit 1***
Planner Assigned:	Tom Schauer
Application Received:	March 4, 2015
Application Complete:	March 13, 2015
Date of Staff Report:	May 6, 2015
Date of UAPC Hearing:	May 13, 2015
Date of UAPC Findings:	May 27, 2015
Date of City Council Staff Report:	June 19, 2015
Date of City Council Hearing:	June 17, 2015, rescheduled to July 1, 2015, and continued to July 15, 2015
Dare of City Council Findings:	August 5, 2015
Existing and Proposed Map Designations:	*See below*

Tax Lot	Address	Current Plan, Zoning, and Overlay Designations	Proposed Plan, Zoning, and Overlay Designations
36-5-21-CC-4600	1550 Carnahan Dr.	MR/ R-2/ (no overlay)	HR/ (R-2)/ R-3-2 overlay
36-5-21-CD-1900	1935 Rogue River Hwy.	North half: GC/ GC/ (no overlay) South half: LR/ R-1-10/ (no overlay)	North half: no change South half: GC/ (R-1-10)/ GC-1 overlay
36-6-13-AC-1800	2064 Upper River Rd.	North portion: LR/ R-1-8/ (no overlay) Remainder: GC/ GC/ (no overlay)	North portion: GC/ (R-1-8)/ GC-1 overlay Remainder: no change
36-6-13-AD-2400	2028 SW 'G' St.	SE portion: MR/ GC/ R-2 overlay Remainder: MR/ R-1-8/ R-2 overlay	SE portion: GC/ (GC)/ no overlay Remainder: no change

I. PROPOSAL:

Minor map corrections to the Comprehensive Plan Map and Zoning Transition Overlay District Map amendments adopted in December 2014. ***See Exhibit 1 to Planning Commission Staff Report.***

II. AUTHORITY AND CRITERIA:

The Comprehensive Plan and 1998 Intergovernmental Agreement authorize the Planning Commission to consider the request for the Comprehensive Plan map

amendments and make a recommendation to the City Council, and authorize the City Council to make the final decision. The Comprehensive Plan map may be amended provided the criteria in Section 13.5.4 of the Comprehensive Plan are met.
Section 2.020, Schedule 2-1, and Section 2.063 of the City of Grants Pass Development Code (Code), authorize the Planning Commission to consider the request for the zoning map and Zoning Transition Overlay District map amendments and make a recommendation to the City Council. Section 2.066 authorizes the City Council to make the final decision. The Zoning Map may be amended provided the Criteria in Section 4.033 of the Code are met.

III. APPEAL PROCEDURE:

Section 10.060 provides for the City Council's final decision to be appealed to the State Land Use Board of Appeals (LUBA) as provided in state statutes. A notice of intent to appeal must be filed with LUBA within 21 days of the date the notice of City Council's written decision is provided.

IV. PROCEDURE:

A. The application was received on March 4, 2015 and deemed complete on March 13, 2015. The application was processed in accordance with Section 2.060 of the Development Code.

B. Notice of the proposed amendment and the public hearings was sent to the Oregon Department of Land Conservation and Development on March 20, 2015 in accordance with ORS 197.610 and OAR Chapter 660, Division 18.

C. Notice of the proposed amendment and the public hearings was sent to Josephine County on March 20, 2015 in accordance with the 1998 Intergovernmental Agreement.

D. Notice of the proposed amendment and the public hearings was sent to the Oregon Department of Transportation and Josephine County Public Works on March 20, 2015.

E. Notice of the proposed amendment and the May 13, 2015 Planning Commission public hearing was mailed on April 22, 2015.

F. Public notice of the proposed amendment and the May 13, 2015 Planning Commission public hearing was published in the newspaper on May 6, 2015 in accordance with Sections 2.053 and 2.063 of the Development Code.

G. The Planning Commission held a public hearing on May 13, 2015 to consider the proposal and make a recommendation to the City Council.

H. Notice of the proposed amendment and the June 17, 2015 City Council public hearing was mailed on May 27, 2015.

I. The June 17, 2015 City Council public hearing was rescheduled to July 1, 2015. Public notice of the proposed amendment and the July 1, 2015 City Council public hearing was mailed on June 10, 2015 and published in the newspaper on June 24, 2015.

J. The July 1, 2015 City Council public hearing was opened and continued to a date, time, and place certain of July 15, 2015 for the staff report, public testimony, and City Council action.

K. The City Council held the continued public hearing on July 15, 2015 to consider the proposal and recommendation and to make a decision.

V. SUMMARY OF EVIDENCE:

A. The basic facts and criteria regarding this application are contained in the staff report and its exhibits attached as Exhibit "A" and incorporated herein.

1. The Planning Commission's Findings of Fact and the Attached Record are attached as Exhibit 1.

A. The basic facts and criteria regarding this application are contained in the Planning Commission staff report and its exhibits attached as Exhibit "A" and incorporated herein.

1. Project Narrative and Map of Proposed Amendments
2. Information about the Zoning Transition Overlay District

B. The minutes of the public hearing held by the Urban Area Planning Commission on May 13, 2015, which are attached as Exhibit "B", summarize the oral testimony presented and are hereby adopted and incorporated herein.

C. The PowerPoint presentation provided by staff at the May 13, 2015 Planning Commission public hearing is attached as Exhibit "C" and incorporated herein.

B. The minutes of the public hearing opened by the City Council on July 1, 2015 and continued to July 15, 2015, which are attached as Exhibit "B", summarize the oral testimony presented and are hereby adopted and incorporated herein.

C. The PowerPoint presentation provided by staff at the July 15, 2015 public hearing is attached as Exhibit "C" and incorporated herein.

VI. GENERAL FINDINGS - BACKGROUND AND DISCUSSION:

In December 2014, as part of the urban growth management planning, the city adopted numerous efficiency measures, including amendments to the comprehensive plan map and designation of a zoning transition overlay district, which affected approximately 450 acres. Some properties that had existing split map designations were not correctly addressed in the map amendments, and one property was inadvertently omitted, leaving it as an unintended, isolated spot-zoned property. The proposed amendments would correct the maps to reflect the designations that should have originally occurred. The total for all properties includes approximately 1.34 acres. ***Exhibit 2 to the Planning Commission Staff Report*** provides additional information about the Zoning Transition Overlay District.

VII. FINDINGS OF CONFORMANCE WITH APPLICABLE CRITERIA:

For comprehensive plan map amendments, the applicable criteria are provided in Section 13.5.4 of the Comprehensive Plan.

CRITERION (a): Consistency with other findings, goals and policies in the Comprehensive Plan.

Response: Satisfied. Consistent with the findings for the map amendments adopted in December 2014, these proposed map corrections are consistent with other findings, goals, and policies in the Comprehensive Plan. These corrections are consistent with the land use patterns adopted at that time, they total 1.34 acres, and they don't reflect a change in findings, goals or policies.

CRITERION (b): A change in circumstances, validated by and supported by the data base or proposed changes to the data base, which would necessitate a change in findings, goals and policies.

Response: Satisfied. Consistent with the findings for the map amendments adopted in December 2014, these proposed map corrections are validated by and supported by the changes to the database which necessitated the amendments. The update to the land needs documents reflected the map amendments, and these minor corrections are consistent with the identified change in circumstances and associated changes to the database.

CRITERION (c): Applicable planning goals and guidelines of the State of Oregon.

Response: Satisfied. Consistent with the findings for the map amendments adopted in December 2014, these proposed minor map corrections are consistent with applicable planning goals and guidelines of the State of Oregon.

CRITERION (d): Citizen review and comment.

Response: Satisfied. The major policy issues and considerations for the map amendments adopted in 2014 were considered through an extensive public process, and the public hearing process for the currently proposed minor map corrections also provides opportunity for citizen review and comment. In addition, letters with information about the proposed corrections were mailed to owners of the affected properties in advance of the formal public hearing notice.

CRITERION (e): Review and comment from affected governmental units and other agencies.

Response: Satisfied. Notice of the proposal was provided to affected governmental units and other agencies for review and comment.

CRITERION (f): A demonstration that any additional need for basic urban services (water, sewer, streets, storm drainage, parks, and fire and police protection) is adequately covered by adopted utility plans and service policies, or a proposal for the requisite changes to said utility plans and service policies as a part of the requested Comprehensive Plan amendment.

Response: Satisfied. The urban growth management planning was conducted based on the map amendments. The timing of the maps amendments provides for updates to public facilities master plans to account for these amendments together with the additional planned growth areas. The proposed map corrections are a minor adjustment to the more extensive map amendments adopted in December 2014.

CRITERION (g): Additional information as required by the review body.

Response: Satisfied. The Planning Commission had sufficient information to make a recommendation, and the City Council had sufficient information to make a decision.

CRITERION (h): In lieu of item (b) above, demonstration that the Plan as originally adopted was in error.

Response: Satisfied. One of the original amendments in December 2014 inadvertently changed the map designation for an entire parcel which previously had a split map designation. A portion of that property should have retained part of its original designation, and the proposed amendment corrects that error. For the other parcels, the errors in the 2014 amendments were of omission, where the designations for the split-zoned portions of properties should have been changed consistent with the surrounding map designations, but were inadvertently omitted.

For zoning map amendments, the criteria are provided in Section 4.033 of the Development Code. There are no additional special criteria for amendments to the Zoning Transition Overlay District.

CRITERION 1: The proposed use, if any is consistent with the proposed Zoning District.

Response: Satisfied/Not Applicable. No specific use and development is proposed at this time in conjunction with the proposal for map amendments.

CRITERION 2: The proposed Zoning District is consistent with the Comprehensive Plan Land Use Map designation.

Response: Satisfied. The proposed zoning amendments are consistent with existing Comprehensive Plan land use map designations, or the proposal includes concurrent Comprehensive Plan map amendments, and the proposed zoning is consistent with the proposed Comprehensive Plan map amendments. The two-step approach to phase in implementation of the Zoning Transition Overlay District provides for consistency between the comprehensive plan map, base zoning map, and overlay zone map designations.

CRITERION 3: A demonstration that existing or proposed levels of basic urban services can accommodate the proposed or potential development without adverse impacts upon the affected service area or without a change to adopted utility plans.

Response: Satisfied. The proposed amendments include a two-phase approach that provides for continued use under current zoning, with additional use and intensity subject to additional analysis if more intensive use is proposed in accordance with the new overlay zoning while the master plans are updated. The final zoning amendment will be effective upon adoption of the updated transportation plan, allowing the future land use to be modeled and planned for.

CRITERION 4: A demonstration that the proposed amendment is consistent with the functions, capacities, and performance standards of transportation facilities identified in the Master Transportation Plan.

Response: Satisfied. The proposed amendments include a two-phase approach that provides for continued use under current zoning, with additional use and intensity subject to additional analysis if more intensive use is proposed in accordance with the new overlay zoning while the master plans are updated. The final zoning amendment will be effective upon adoption of the updated transportation plan, allowing the future land use to be modeled and planned for.

CRITERION 5: The natural features of the site are conducive to the proposed Zoning District.

Response: Satisfied. The properties are relatively flat with gentle slope, conducive to the proposed designations.

CRITERION 6: The proposed zone is consistent with the requirements of all overlay districts that include the subject property.

Response: Satisfied. The properties are not located within the flood hazard, historic district, or medical overlay zones. The proposal would amend the designations of the zoning map and Zoning Transitions Overlay District consistent with the Comprehensive Plan map designations. The properties can be developed in accordance with the standards of the zoning and overlay district.

CRITERION 7: The timing of the zone change request is appropriate in terms of the efficient provision or upgrading of basic urban services versus the utilization of other buildable lands in similar zoning districts already provided with basic urban services.

Response: Satisfied. These are not changes from rural to urban zoning, but rather, changes from one urban zoning district to another, which are served or can be served with urban services. The timing allows for the public facilities plans updates to model and address, as needed, future land use based on the overlay zone changes. The changes have the effect of providing for efficient utilization of buildable lands within the UGB that reduces the extent for greater UGB expansion that would require further urban service extensions. Other lands in similar zoning districts can also be utilized with efficient provision of urban services.

VIII. DECISION AND SUMMARY:

Based on the above findings, the City Council found the applicable criteria were satisfied and **APPROVED** the proposed amendments to the Comprehensive Plan map and Zoning Transition Overlay map as presented.

IX. FINDINGS APPROVED AND DECISION ADOPTED BY THE GRANTS PASS CITY COUNCIL this 5th day of August, 2015.

Darin Fowler, Mayor

NOTE: *The application is not subject to the 120 day requirement per ORS 227.178.*

CITY OF GRANTS PASS PARKS & COMMUNITY DEVELOPMENT DEPARTMENT

ELEMENT 10 (PUBLIC FACILITIES) COMPREHENSIVE PLAN AMENDMENT STAFF REPORT – CITY COUNCIL

Procedure Type:	Type IV: Planning Commission Recommendation and City Council Decision
Project Number:	15-40500001
Project Type:	Comprehensive Plan Amendment
Applicant:	City of Grants Pass
Planner Assigned:	Tom Schauer
Application Received:	March 6, 2015
Application Complete:	March 13, 2015
Date of Staff Report:	May 6, 2015
Date of UAPC Hearing:	May 13, 2015
Date of UAPC Findings:	May 27, 2015
Date of City Council Staff Report:	June 19, 2015
Date of City Council Hearing:	July 1, 2015

I. PROPOSAL:

Amendment adopting Addendum 1 to Element 10 of the Comprehensive Plan (Public Facilities) to incorporate updates for the Water Treatment Plan Facilities Plan and the Water Restoration Plant Facilities Plan. ***See Exhibit 'A' to Ordinance for amendment as recommended by Planning Commission plus additional revision recommended by staff.***

II. AUTHORITY AND CRITERIA:

The Comprehensive Plan and 1998 Intergovernmental Agreement authorize the Planning Commission to consider the request for the Comprehensive Plan amendment and make a recommendation to the City Council, and authorize the City Council to make the final decision. The Comprehensive Plan may be amended provided the criteria in Section 13.5.4 of the Comprehensive Plan are met.

III. APPEAL PROCEDURE:

Section 10.060 provides for the City Council's final decision to be appealed to the State Land Use Board of Appeals (LUBA) as provided in state statutes. A notice of intent to appeal must be filed with LUBA within 21 days of the date the notice of City Council's written decision is provided.

IV. BACKGROUND AND DISCUSSION:

In 2008, the City Council adopted Ordinance 5460, which updated Element 10 of the Comprehensive Plan to reflect updates to several of the public facility plan documents. In 2014, the City Council adopted the following:

- **Resolution 14-6173. A resolution adopting the Water Treatment Plant Facility Plan Update.** This resolution adopted the Water Treatment Facility Plan Update prepared by Murray, Smith & Associates in association with MWH Americas, Inc. dated January 2014. It replaced the previous Water Treatment Plan Facility Plan adopted in April 2004.

- **Resolution 14-6205. A resolution adopting the Water Restoration Plant (WRP) Facility Plan.** This resolution adopted the Water Restoration Plant Facility Plan prepared by Carollo Engineers, Inc. dated May 2014. It replaced the previous Water Restoration Plant (WRP) Facility Plan completed in June 2001.

Statewide Planning Goal 11 addresses Public Facilities and Services, and Oregon Administrative Rules (OAR) Division 11 address Public Facilities Planning. OAR 660-011-0005(1) defines "Public Facilities Plan" as follows: "A public facility plan is a support document or documents to a comprehensive plan. The facility plan describes the water, sewer and transportation facilities which are to support the land uses designated in the appropriate acknowledged comprehensive plans within an urban growth boundary containing a population of greater than 2,500. Certain elements of the public facility plan shall also be adopted as part of the comprehensive plan, as specified in OAR 660-011-0045."

Consistent with OAR 660-011-0005, the proposed amendment, an addendum to Element 10, recognizes these 2014 updates as part of the City's Public Facilities Plan, as support documents to the Comprehensive Plan. The addendum also adopts certain elements of these plans as part of the comprehensive plan, as specified in OAR 660-011-0045.

The Planning Commission recommended approval as presented. Staff is recommending one additional revision, which is to include a map of the new UGB expansion areas and Urban Reserve areas to provide greater clarity about the service areas in addition to other data in Table 2-1 and the facility plan documents. There are also clarifying references to the map provided in Table 2-1, and the addition of Note 4 in Table 2-1. This doesn't affect the substantive provisions of the proposal or consistency with the applicable criteria.

The addendum as recommended by the Planning Commission, with the additional revision recommended by staff, is attached to the Ordinance in the City Council packet as **Exhibit 'A'**. The full facility plans are not attached to this staff report, but the full copies are available electronically on the City website.

V. CONFORMANCE WITH APPLICABLE CRITERIA:

The Planning Commission's findings of conformance with applicable criteria are provided in Section VII of their Findings of Fact (attached).

VI. RECOMMENDATION:

The Urban Area Planning Commission recommends that the City Council **APPROVE** the proposed Comprehensive Plan amendment as presented.

The vote was 7-0-0 with Commissioners Fitzgerald, Coulter, MacMillan, Arthur, McIntire, Kellenbeck, and McVay in favor. There is one vacancy on the Commission.

VII. CITY COUNCIL ACTION:

A. Positive Action: Recommend approval of the request:
   1. as submitted and recommended by the Planning Commission, with the additional revision recommended by staff
   2. as submitted and recommended by the Planning Commission
   3. as modified by the City Council (list):

B. Negative Action: Recommend denial of the request for the following reasons (list):

C. Postponement: Continue item
   1. indefinitely.
   2. to a time certain.

NOTE: The amendment is legislative and is not subject to the 120 day requirement.

VIII. INDEX TO EXHIBITS:

1. Planning Commission Findings of Fact and the Attached Record

   A. Planning Commission Staff Report and Exhibits

      1. Proposed Addendum 1 to Element 10 of the Comprehensive Plan (Public Facilities and Services)

      2. Full copies of the Water Treatment Plant Facility Plan Update (Resolution 14-6173) and the Water Restoration Plant Facility Plan (Resolution 14-6205). *Not attached. Available electronically on the City web site and at the Parks & Community Development Department.*

   B. Minutes of the May 13, 2015 Planning Commission Hearing

   C. PowerPoint Presentation from May 13, 2015 Planning Commission Hearing

CITY OF GRANTS PASS PARKS & COMMUNITY DEVELOPMENT DEPARTMENT

ELEMENT 10 (PUBLIC FACILITIES) COMPREHENSIVE PLAN AMENDMENT
FINDINGS OF FACT - URBAN AREA PLANNING COMMISSION RECOMMENDATION

Procedure Type:	Type IV: Planning Commission Recommendation and City Council Decision
Project Number:	15-40500001
Project Type:	Comprehensive Plan Amendment
Applicant:	City of Grants Pass
Planner Assigned:	Tom Schauer
Application Received:	March 6, 2015
Application Complete:	March 13, 2015
Date of UAPC Staff Report:	May 6, 2015
Date of UAPC Hearing:	May 13, 2015
Date of UAPC Findings:	May ~~20~~ 27, 2015

I. PROPOSAL:

Amendment adopting Addendum 1 to Element 10 of the Comprehensive Plan (Public Facilities) to incorporate updates for the Water Treatment Plan Facilities Plan and the Water Restoration Plant Facilities Plan. ***See Exhibit 1 to Planning Commission Staff Report.***

II. AUTHORITY AND CRITERIA:

The Comprehensive Plan and 1998 Intergovernmental Agreement authorize the Planning Commission to consider the request for the Comprehensive Plan amendment and make a recommendation to the City Council, and authorize the City Council to make the final decision. The Comprehensive Plan may be amended provided the criteria in Section 13.5.4 of the Comprehensive Plan are met.

III. APPEAL PROCEDURE:

Section 10.060 provides for the City Council's final decision to be appealed to the State Land Use Board of Appeals (LUBA) as provided in state statutes. A notice of intent to appeal must be filed with LUBA within 21 days of the date the notice of City Council's written decision is provided.

IV. PROCEDURE:

A. The application was received on March 6, 2015 and deemed complete on March 13, 2015. The application was processed in accordance with Section 2.060 of the Development Code.

B. Notice of the proposed amendment and the public hearings was sent to the Oregon Department of Land Conservation and Development on March 20, 2015 in accordance with ORS 197.610 and OAR Chapter 660, Division 18.

EXHIBIT 1
TO CC STAFF REPORT

containing a population of greater than 2,500. Certain elements of the public facility plan shall also be adopted as part of the comprehensive plan, as specified in OAR 660-011-0045."

Consistent with OAR 660-011-0005, the proposed amendment, an addendum to Element 10, recognizes these 2014 updates as part of the City's Public Facilities Plan, as support documents to the Comprehensive Plan. The addendum also adopts certain elements of these plans as part of the comprehensive plan, as specified in OAR 660-011-0045. The addendum is attached as ***Exhibit 1 to the Planning Commission Staff Report***. The full plans are referenced as ***Exhibit 2 to the Planning Commission Staff Report***; they are not attached to this staff report, but the full copies are available electronically on the City website.

VII. FINDINGS OF CONFORMANCE WITH APPLICABLE CRITERIA:

For comprehensive plan amendments, the applicable criteria are provided in Section 13.5.4 of the Comprehensive Plan.

CRITERION (a): Consistency with other findings, goals and policies in the Comprehensive Plan.

Response: Satisfied. The proposed amendments are consistent with the Water Service Policies in Section 10.2 of the Comprehensive Plan Policies and the Sewer Service Policies in Section 10.3 of the Comprehensive Plan Policies. These plans address the needs for treatment capacity and requirements for the Water Treatment Plant and the Water Restoration Plant. The water distribution system plan and sewer collection system plan are in the process of being updated, and will be adopted separately.

CRITERION (b): A change in circumstances, validated by and supported by the data base or proposed changes to the data base, which would necessitate a change in findings, goals and policies.

Response: Satisfied. In addition to structural, functional, regulatory, and other issues, the facility plan addresses future demand and capacity needs based on the adopted forecasts and future land use needs.

CRITERION (c): Applicable planning goals and guidelines of the State of Oregon.

Response: Satisfied. The proposed amendments are intended to address the applicable provisions of Statewide Planning Goal 11 (Public Facilities and Services) and specifically OAR 660-011-0005 and -0045, incorporating these facility plans as support documents to the comprehensive plan, and adopting the elements specified in OAR 660-011-0045 as part of the comprehensive plan.

CRITERION (d): Citizen review and comment.

Response: Satisfied. Resolutions 14-6173 (Water Treatment Plant Facility Plan Update) and 14-6205 (Water Restoration Plant (WRP) Facility Plan) were each adopted following their respective public hearings. In addition, the Water Treatment Plant Facility Plan was developed through a process that included a Water Facility Advisory Committee. The public hearing process for the proposed amendment to

Element 10 of the Comprehensive Plan also provides for citizen review and comment.

CRITERION (e): Review and comment from affected governmental units and other agencies.

Response: Satisfied. The Water Treatment Plant Facility Plan Update was prepared by Murray, Smith & Associates in Association with MWH Americas, Inc. and included consultation and coordination with affected agencies, including the Oregon Health Authority Drinking Water Program. The Water Restoration Plant Facility Plan was prepared by Carollo Engineers, Inc. and included consultation and coordination with affected agencies including the Oregon Department of Environmental Quality.

CRITERION (f): A demonstration that any additional need for basic urban services (water, sewer, streets, storm drainage, parks, and fire and police protection) is adequately covered by adopted utility plans and service policies, or a proposal for the requisite changes to said utility plans and service policies as a part of the requested Comprehensive Plan amendment.

Response: Satisfied. The proposed amendments provide the updates that include the comprehensive plan provisions to address adequate public facilities and provide the requisite changes for the planning horizon, the identified land use needs, and the adopted land use plans.

CRITERION (g): Additional information as required by the review body.

Response: Satisfied. The Planning Commission had sufficient information to make a recommendation.

CRITERION (h): In lieu of item (b) above, demonstration that the Plan as originally adopted was in error.

Response: Not Applicable. The proposed amendments are intended to address a change in circumstances, as addressed in Criterion (b).

VIII. RECOMMENDATION:

The Urban Area Planning Commission recommends that the City Council **APPROVE** the proposed Comprehensive Plan amendment as presented.

The vote was 7-0-0 with Commissioners Fitzgerald, Coulter, MacMillan, Arthur, McIntire, Kellenbeck, and McVay in favor. There is one vacancy on the Commission.

IX. FINDINGS APPROVED BY THE URBAN AREA PLANNING COMMISSION this ~~20th~~ 27th day of May, 2015.

Gerard Fitzgerald, Chair

NOTE: *The amendment is legislative and is not subject to the 120-day requirement.*

CITY OF GRANTS PASS PARKS & COMMUNITY DEVELOPMENT DEPARTMENT

ELEMENT 10 (PUBLIC FACILITIES) COMPREHENSIVE PLAN AMENDMENT STAFF REPORT - URBAN AREA PLANNING COMMISSION

Procedure Type:	Type IV: Planning Commission Recommendation and City Council Decision
Project Number:	15-40500001
Project Type:	Comprehensive Plan Amendment
Applicant:	City of Grants Pass
Planner Assigned:	Tom Schauer
Application Received:	March 6, 2015
Application Complete:	March 13, 2015
Date of Staff Report:	May 6, 2015
Date of UAPC Hearing:	May 13, 2015

I. PROPOSAL:

Amendment adopting Addendum 1 to Element 10 of the Comprehensive Plan (Public Facilities) to incorporate updates for the Water Treatment Plan Facilities Plan and the Water Restoration Plant Facilities Plan. ***See Exhibit 1.***

II. AUTHORITY AND CRITERIA:

The Comprehensive Plan and 1998 Intergovernmental Agreement authorize the Planning Commission to consider the request for the Comprehensive Plan amendment and make a recommendation to the City Council, and authorize the City Council to make the final decision. The Comprehensive Plan may be amended provided the criteria in Section 13.5.4 of the Comprehensive Plan are met.

III. APPEAL PROCEDURE:

Section 10.060 provides for the City Council's final decision to be appealed to the State Land Use Board of Appeals (LUBA) as provided in state statutes. A notice of intent to appeal must be filed with LUBA within 21 days of the date the notice of City Council's written decision is provided.

IV. BACKGROUND AND DISCUSSION:

In 2008, the City Council adopted Ordinance 5460, which updated Element 10 of the Comprehensive Plan to reflect updates to several of the public facility plan documents. In 2014, the City Council adopted the following:

- **Resolution 14-6173. A resolution adopting the Water Treatment Plant Facility Plan Update.** This resolution adopted the Water Treatment Facility Plan Update prepared by Murray, Smith & Associates in association with MWH Americas, Inc. dated January 2014. It replaced the previous Water Treatment Plan Facility Plan adopted in April 2004.

- **Resolution 14-6205. A resolution adopting the Water Restoration Plant (WRP) Facility Plan.** This resolution adopted the Water Restoration Plant Facility Plan prepared by Carollo Engineers, Inc. dated May 2014. It replaced the previous Water Restoration Plant (WRP) Facility Plan completed in June 2001.

Statewide Planning Goal 11 addresses Public Facilities and Services, and Oregon Administrative Rules (OAR) Division 11 address Public Facilities Planning. OAR 660-011-0005(1) defines "Public Facilities Plan" as follows: "A public facility plan is a support document or documents to a comprehensive plan. The facility plan describes the water, sewer and transportation facilities which are to support the land uses designated in the appropriate acknowledged comprehensive plans within an urban growth boundary containing a population of greater than 2,500. Certain elements of the public facility plan shall also be adopted as part of the comprehensive plan, as specified in OAR 660-011-0045."

Consistent with OAR 660-011-0005, the proposed amendment, an addendum to Element 10, recognizes these 2014 updates as part of the City's Public Facilities Plan, as support documents to the Comprehensive Plan. The addendum also adopts certain elements of these plans as part of the comprehensive plan, as specified in OAR 660-011-0045. The addendum is attached as ***Exhibit 1***. The full plans are references as ***Exhibit 2***; they are not attached to this staff report, but the full copies are available electronically on the City website.

V. CONFORMANCE WITH APPLICABLE CRITERIA:

For comprehensive plan amendments, the applicable criteria are provided in Section 13.5.4 of the Comprehensive Plan.

CRITERION (a): Consistency with other findings, goals and policies in the Comprehensive Plan.

Response: Satisfied. The proposed amendments are consistent with the Water Service Policies in Section 10.2 of the Comprehensive Plan Policies and the Sewer Service Policies in Section 10.3 of the Comprehensive Plan Policies. These plans address the needs for treatment capacity and requirements for the Water Treatment Plant and the Water Restoration Plant. The water distribution system plan and sewer collection system plan are in the process of being updated, and will be adopted separately.

CRITERION (b): A change in circumstances, validated by and supported by the data base or proposed changes to the data base, which would necessitate a change in findings, goals and policies.

Response: Satisfied. In addition to structural, functional, regulatory, and other issues, the facility plan addresses future demand and capacity needs based on the adopted forecasts and future land use needs.

CRITERION (c): Applicable planning goals and guidelines of the State of Oregon.

Response: Satisfied. The proposed amendments are intended to address the applicable provisions of Statewide Planning Goal 11 (Public Facilities and Services) and specifically OAR 660-011-0005 and -0045, incorporating these facility plans as support documents to the comprehensive plan, and adopting the elements specified in OAR 660-011-0045 as part of the comprehensive plan.

CRITERION (d): Citizen review and comment.

Response: Satisfied. Resolutions 14-6173 (Water Treatment Plant Facility Plan Update) and 14-6205 (Water Restoration Plant (WRP) Facility Plan) were each adopted following their respective public hearings. In addition, the Water Treatment Plant Facility Plan was developed through a process that included a Water Facility Advisory Committee. The public hearing process for the proposed amendment to Element 10 of the Comprehensive Plan also provides for citizen review and comment.

CRITERION (e): Review and comment from affected governmental units and other agencies.

Response: Satisfied. The Water Treatment Plant Facility Plan Update was prepared by Murray, Smith & Associates in Association with MWH Americas, Inc. and included consultation and coordination with affected agencies, including the Oregon Health Authority Drinking Water Program. The Water Restoration Plant Facility Plan was prepared by Carollo Engineers, Inc. and included consultation and coordination with affected agencies including the Oregon Department of Environmental Quality.

CRITERION (f): A demonstration that any additional need for basic urban services (water, sewer, streets, storm drainage, parks, and fire and police protection) is adequately covered by adopted utility plans and service policies, or a proposal for the requisite changes to said utility plans and service policies as a part of the requested Comprehensive Plan amendment.

Response: Satisfied. The proposed amendments provide the updates that include the comprehensive plan provisions to address adequate public facilities and provide the requisite changes for the planning horizon, the identified land use needs, and the adopted land use plans.

CRITERION (g): Additional information as required by the review body.

Response: Satisfied Contingent on Review Body Direction. Additional information can be provided if requested.

CRITERION (h): In lieu of item (b) above, demonstration that the Plan as originally adopted was in error.

Response: Not Applicable. The proposed amendments are intended to address a change in circumstances, as addressed in Criterion (b).

VI. RECOMMENDATION:

It is recommended that the Urban Area Planning Commission recommend that City Council **APPROVE** the proposed amendment to the Comprehensive Plan.

VII. PLANNING COMMISSION ACTION:

A. Positive Action: Recommend approval of the request:
   1. as submitted.
   2. as modified by the Planning Commission (list):

B. Negative Action: Recommend denial of the request for the following reasons (list):

C. Postponement: Continue item
   1. indefinitely.
   2. to a time certain.

NOTE: The amendment is legislative and is not subject to the 120 day requirement.

VIII. INDEX TO EXHIBITS:

1. Proposed Addendum 1 to Element 10 of the Comprehensive Plan (Public Facilities and Services)
2. Full copies of the Water Treatment Plant Facility Plan Update (Resolution 14-6173) and the Water Restoration Plant Facility Plan (Resolution 14-6205). *Not attached. Available electronically on the City web site and at the Parks & Community Development Department.*

Grants Pass and Urbanizing Area Community Comprehensive Plan
Element 10: Public Facilities

Addendum 1: 2015 Update

This addendum updates the following sections of the Public Facilities Element:

- 10.20. Water Services
- 10.30. Sanitary Sewer Services

Background

In 2008, the City Council adopted Ordinance 5460, which updated Element 10 of the Comprehensive Plan to reflect updates to several of the public facility plan documents. In 2014, the City Council adopted the following:

- **Resolution 14-6173. A resolution adopting the Water Treatment Plant Facility Plan Update.** This resolution adopted the Water Treatment Facility Plan Update prepared by Murray, Smith & Associates in association with MWH Americas, Inc. dated January 2014. It replaced the previous Water Treatment Plan Facility Plan adopted in April 2004.

- **Resolution 14-6205. A resolution adopting the Water Restoration Plant (WRP) Facility Plan.** This resolution adopted the Water Restoration Plant Facility Plan prepared by Carollo Engineers, Inc. dated May 2014. It replaced the previous Water Restoration Plant (WRP) Facility Plan completed in June 2001.

Statewide Planning Goal 11 addresses Public Facilities and Services, and Oregon Administrative Rules (OAR) Division 11 address Public Facilities Planning. OAR 660-011-0005(1) defines "Public Facilities Plan" as follows: "A public facility plan is a support document or documents to a comprehensive plan. The facility plan describes the water, sewer and transportation facilities which are to support the land uses designated in the appropriate acknowledged comprehensive plans within an urban growth boundary containing a population of greater than 2,500. Certain elements of the public facility plan shall also be adopted as part of the comprehensive plan, as specified in OAR 660-011-0045."

Consistent with OAR 660-011-0005, this addendum recognizes these 2014 updates as part of the City's Public Facilities Plan, as support documents to the Comprehensive Plan. This addendum also adopts certain elements of these plans as part of the comprehensive plan, as specified in OAR 660-011-0045.

Updates to the Water Distribution System Master Plan and the Sewer Collection Master Plan will also be completed to address future needs, including those associated with the UGB expansion and designation of Urban Reserves. Element 10 of the Comprehensive Plan will be subsequently updated to incorporate provisions of those plans at that time.

EXHIBIT 1
TO UAPC
STAFF REPORT

Section 1. Plans Adopted Part of the Public Facility Plan as Part of a Supporting Document to the Comprehensive Plan

The January 2014 Water Treatment Plant Facility Plan Update and the May 2014 Water Restoration Plant (WRP) Facility Plan are adopted as part of the Public Facilities Plan as a supporting document to the Comprehensive Plan.

Some of the information and provisions in the plans referenced in this addendum supersede materials in Section 10.20 pertaining to water services and Section 10.30 pertaining to sanitary sewer services.

Section 2. Sections Adopted as Part of Comprehensive Plan

1. The parts of the January 2014 Water Treatment Plant Facility Plan Update and the May 2014 Water Restoration Plant (WRP) Facility Plan identified in Figure 2-1 are hereby adopted and incorporated as part of comprehensive plan.

2. In accordance with OAR 660-011-0045(2), certain public facility plan project descriptions, location, or service area designations will necessarily change as a result of subsequent design studies, capital improvement programs, environmental impact studies, and changes in potential sources of funding. It is not the intent of this section to:

   a. Either prohibit projects not included in the public facility plans for which unanticipated funding has been obtained;

   b. Preclude projects specification and location decisions made according to the National Environmental Policy Act; or

   c. Subject administrative and technical changes to the facility plan to ORS 197.610(1) and (2) or 197.835(4).

3. In accordance with OAR 660-011-0045(3), the public facility plan may allow for the following modifications to projects without amendment to the public facility plan:

   a. Administrative changes are those modifications to a public facility project which are minor in nature and do not significantly impact the project's general description, location, sizing, capacity, or other general characteristic of the project.

   b. Technical and environmental changes are those modifications to a public facility project which are made pursuant to "final engineering" on a project or those that result from the findings of an Environmental Assessment or Environmental Impact Statement conducted under regulations implementing the procedural provisions of the National Environmental Policy Act of 1969 (40 CFR Parts 1500-1508) or any federal or State of Oregon agency project development regulations consistent with the Act and its regulations.

   c. Public facility project changes made pursuant to subsection (3b) are subject to the administrative procedures and review and appeal provisions of the regulations controlling the study (40 CFR Parts 1500-1508 or similar regulations) and are not subject to the administrative procedures or review or appeal provisions of ORS Chapter 197, or OAR Chapter 660 Division 18.

4. Land use amendments are those modifications or amendments to the list, location or provider of, public facility projects, which significantly impact a public facility project identified in the comprehensive plan and which do not qualify under subsection (3)(a) or (b). Amendments made pursuant to this subsection are subject to the administrative procedures and review and appeal provisions accorded "land use decisions" in ORS Chapter 197 and those set forth in OAR Chapter 660 Division 18.

Table 2-1. Sections Adopted as Part of Comprehensive Plan

OAR 660-011-0045 Requirement	Water Treatment Plant Facility Plan Section [1,2]	Water Restoration Plant Facility Plan Section [1,3]
(1)(a) The list of public facility project titles, excluding (if the jurisdiction so chooses) the descriptions and specifications of those projects.	***See Table 2-2.*** From Executive Summary, Table ES-1	***See Table 2-3.*** From Executive Summary, Section ES.3 and Table ES.5
(1)(b) A map or written description of the public facility projects' locations or service areas as specified in Sections (2) and (3) of this rule.	Appendix E: Long Term Water Demand Projections, 'Current and Future Service Area'	Executive Summary, Section ES.2 and Figure ES.1, 'WRP Service Area', 'Population, Flow, and Load Projections'
(1)(c) The policy(ies) or urban growth management agreement designating the provider of each public facility system. If there is more than one provider with the authority to provide the system within the area covered by the public facility plan, then the provider of each project shall be designated.	No change from adopted policies and management agreements regarding service provider.	No change from adopted policies and management agreements regarding service provider.

[1] The facility plans for the treatment plants pertain primarily to the total demand of the service areas based on population, employment, and land use of the service areas, and demand forecasts derived from population and employment forecasts (regardless of location of growth), while the water distribution and sewer collection master plans are dependent on location of growth.

[2] In addition to the current UGB, the principal service areas for the Water Treatment Plant include approximately 105 residential and commercial acres in the Merlin/North Valley Unincorporated Community Boundary. The demand forecasts account for growth to be accommodated within the UGB expansion areas and Urban Reserves. Also, it is noted that some areas within the current UGB are served with wells and community water systems.

[3] In addition to the current UGB, the principal service areas for the Water Restoration Plant include properties located within a portion of the former Redwood Sewer District established before the Urban Growth Boundary was adopted. This is located on the west side of the city, south of the Rogue River. The demand forecasts account for growth to be accommodated within the UGB expansion areas and Urban Reserves. Also, it is noted a very limited number of developed properties within the current UGB are on septic systems and unserved by public sewer.

Table 2-2. Water Treatment Plant CIP (Table ES-1)

Table ES-1
Recommended Capital Improvement Program Summary

Capital Project	Capital Expenditure
New Water Treatment Plant Implementation	
Pilot Plant Study	$500,000
Siting Study and Property Acquisition	$1,300,000
Funding Study and Rate Impact Study	$200,000
Project Implementation Approach and Procurement Strategy	$50,000
Public Information/Involvement	$250,000
Permitting and Land-Use Approvals	$200,000
Preliminary Design	$1,000,000
Final Design	$4,000,000
Bidding and Award	$250,000
Construction	$47,200,000
Post-Construction and Warranty Period	$200,000
Existing Water Treatment Plant Investments	
Emergency Response Plan	$50,000
Decommission and Demolition of Existing Plant	$1,000,000
Total Anticipated Expenditures (2013 dollars)	**$56,200,000**

Table 2-3. Water Restoration Plant CIP (Table ES-3)

Table ES.3 Recommended CIP
City of Grants Pass – Executive Summary

CIP Project Phase	Cost, $	Fiscal Years
Phase 1	1,500,000	2015 – 2016
UV Disinfection	1,093,000	
Seismic Upgrades	407,000	
Phase 2	9,643,000	2016-2020
Primary Clarifier No. 3	2,703,000	
Aeration Basins No. 3 and 4	5,728,000	
Rehabilitate GT and One New GT	1,100,000	
Screening Hydraulic Improvements	112,000	
Phase 3	8,918,000	2020-2023
Primary Clarifier No. 4	2,703,000	
Secondary Clarifier No. 4	5,017,000	
WAS Diversion Pipeline and Mixing Upgrades	440,000	
Degritting Improvements	758,000	
Total CIP	20,061,000	

Exhibit 2 to Planning Commission Staff Report

See Enclosed CD:

- Water Treatment Plant Facility Plan Update (Resolution 14-6173)
- Water Restoration Plant Facility Plan Update (Resolution 14-6205)

URBAN AREA PLANNING COMMISSION
MEETING MINUTES
May 13, 2015 – 6:00 P.M.
Council Chambers

1. **ROLL CALL:**

The Urban Area Planning Commission met in regular session on the above date with Chair Gerard Fitzgerald presiding. Vice Chair Jim Coulter and Commissioners Lois MacMillan, Loree Arthur, Blair McIntire, David Kellenbeck, and Dan McVay were present. There was one vacant position. Also present and representing the City was Parks & Community Development (hereafter: PCD) Director Lora Glover, Senior Planner Tom Schauer, Associate Planner Justin Gindlesperger, and Public Works Director Terry Haugen.

2. **ITEMS FROM THE PUBLIC:** None

3. **CONSENT AGENDA:**
   a. **MINUTES:** April 22, 2015
   b. **FINDINGS OF FACT:** 15-40200001 – Allcare Development, LLC Comprehensive Plan Map Amendment, Zoning Map Amendment, and Development Agreement.

MOTION/VOTE

Commissioner MacMillan moved and Commissioner Kellenbeck seconded the motion to approve the consent agenda as presented. The vote resulted as follows: "AYES": Chair Fitzgerald, Vice Chair Coulter and Commissioners MacMillan, Arthur, Kellenbeck, McVay, and McIntire. "NAYS": None. Abstain: None. Absent: None. The motion passed.

4. **PUBLIC HEARINGS:**
   b. **15-40500001 – Element 10 (Public Facilities) Comprehensive Plan Amendment**

Chair Fitzgerald stated, at this time I will open the public hearing to consider Application 15-40500001 the Element 10 (Public Facilities) Comprehensive Plan Amendment. We will begin the hearing with a staff report followed by a public comment and then the matter will be discussed and acted upon by the Commission. Objections to the jurisdiction - is there anyone

EXHIBIT B
TO UAPC FINDINGS

present who wishes to challenge the authority of the Commission to consider this matter? Seeing none do any Commissioners wish to abstain from participating in this hearing or declare a potential conflict of interest? I will remind you this is legislative so you do not have ex parte issues and you do not have real conflict of interest. It is clearly legislative, we are not acting upon it, we are just making a recommendation. Seeing none in this hearing the decision of the Commission will be based on specific criteria. All testimony and evidence must be directed toward that criteria. The criteria which apply in this case are noted in the staff report. It is important to remember if you fail to raise an issue with enough detail to afford the Commission and the parties an opportunity to respond to the issue you'll not be able to appeal to the Land Use Board of Appeals based on that issue. Actually that is different for this one anyway because it is going up to the City Council so there will be a chance for that to be appealed later on. The hearing will now proceed with a report from staff.

Senior Planner Schauer stated, thank you. The item before you is an amendment to Element 10 of the comprehensive plan which deals with public facilities. In 2014 in April and May the City Council adopted the new water treatment plant facility plan update by Resolution 14-6173 and the water restoration plant facility plan update by Resolution 14-6205. The second one is the wastewater plant. This is the water treatment plan and the water restoration plant facility plan. Those deal with just the treatment plants and not with the collection and distribution systems. There are links on here as well. The plans have been available on the City website for quite some time. As you noted the legislative hearing guidelines apply and the amendments based on the criteria in Section 13.54 of the comprehensive plan. Those are addressed in your staff report and this item begins on page 61 of your packet. The recommendation is for the Planning Commission to recommend approval of the amendment to City Council. Relationship to City Council goals - basically these plans were approved by resolution in 2014 so there are no 2015 goals related to the adoption of these plans. The next steps are underway but the goals from 2014 are noted in terms of the goal objectives and actions. The water treatment plant plan also had an advisory committee that provided recommendations on that work. The action before you is to incorporate those plans into the comprehensive plan in accordance with Oregon Administrative Rules. Under the Statewide Planning Goals in Administrative Rule Division 11 that deals with public facilities certain items need to be incorporated into the comprehensive plan as part of the City's public facilities plan. Some of those are incorporated as what are called supporting documents to the comprehensive plan and others need to be incorporated specifically as part of the comprehensive plan. What that primarily relates to is if you are looking at amendments to those plans there are certain things that need to be in the comprehensive plan and amendments would be afforded a land use hearing procedure like this one while other technical types of amendments can be amended subject to the applicable permitting law under Federal law for those facilities without going through the land use reviews to amend those. The proposed addendum itself starts on page 65 of your packet. That document itself summarizes the applicable administrative rules. The two documents I held up earlier would be adopted as supporting documents to the comprehensive plan. Items that are listed on page 67 and Table 2-1 are those items that would be adopted as part of the comprehensive plan and subject to the land use review procedure. That pertains to the capital improvement project lists, the map or written description of the location or service areas, and the policies that govern who is the service provider in the event that you have multiple overlapping jurisdictions providing services. The proposal incorporates the elements noted in terms of the capital project lists and the service areas by reference out of these two facility plans. There are no changes in terms of who would be providing the services. In terms of cost implications those are listed on page 68. Those are the CIPs from the respective plans and the water treatment plant plan is identified as a capital project in the budget as is the water restoration plant phases 1 and 2, currently. These plans are based on the demand and needs to meet future land use needs and to look, in the case of water planning, look much further into the future and then back off those needs. These cover our planning periods to make sure we have adequate facilities to cover future demand from our updated land use plans. Your options are to recommend approval as presented, recommend approval with modifications, or recommend denial. Staff is recommending that you recommend approval as presented and there is no 120-day requirement for the decision since this is legislative. It is incorporating those plans as required by State statute into the land use documents and the comprehensive plan. If you need any clarifications or have any questions before you open public testimony I would be happy to answer those. Otherwise, that concludes my presentation and I would be happy to answer further questions when you get to the deliberations as well, thank you.

Chair Fitzgerald asked, are there any questions for Tom?

Commissioner Arthur asked, is stormwater handled as a completely separate category?

Senior Planner Schauer stated, typically we have the treatment plants and then we have the collection and distribution systems. We are going through a number of plan updates. These two we were able to look at before we had completed some of the land use planning once we had the forecasts completed because this deals with the treatment plants themselves and the capacity of those regardless of what direction growth is occurring in. We have begun work on the collection and distribution plans that are location dependent and we will also be updating the stormwater plan and the transportation plan.

Commissioner Arthur asked, we still have the opportunity to put more controls in about the stormwater handling so it doesn't go straight to the river, right?

Senior Planner Schauer stated, that is correct.

Vice Chair Coulter stated, Tom I'm not sure if you or the Public Works director should answer this question. Is he presenting?

Senior Planner Schauer stated, no I'm presenting these. He's here to answer questions if I am not able to field those or if we need more information.

Vice Chair Coulter stated, it would seem to me the study was done and then you had the workshop that was done after the study was complete. The study shows five alternatives for the water treatment facility. The group then decided on two, alternatives 3 and 4. It looks to me like the study should have been done after we made a recommendation because it appears we are in a corner. We can't really recommend 1, 2, or 5 as a possibility going forward. Maybe I'm wrong and correct me if I am. The City already decided because on page ES4 Exhibit 2 it says "the Council directed the completion of this facility plan update with the recommendation to move forward in the planning process to construct a new water treatment plant at a site to be determined." To me that puts us in a quandary because it almost seems like we have to rubber stamp it. Am I right here? Can we consider alternatives 1, 2, or 5?

Senior Planner Schauer stated, again, this is a legislative matter. The Council did have a separate advisory committee/task force that was focused specifically on looking at those options. They have reviewed those, considered them, and adopted by resolution this plan. Ideally the processes would've gone simultaneously but through this you are making a land use decision that is within your authority to recommend as you see fit. The Council has already approved through resolution, that is true, but you are not limited in what they have done in your recommendations.

Vice Chair Coulter stated, you can see the quandary we are in from the perspective that we are not quote-unquote experts or engineers or those types of people. On one hand if we said keep alternative 1, 2, and 5 within our recommendation to you to keep those in there it is like we're coming against the experts in the workshop you already had. I think what I'm saying is we may be constrained of what we can do tonight and I think to a certain degree we are. You said simultaneous - I think that simultaneous would be that the Council could have said we are not going to have that final stamp on two alternatives before we meet. Does that make sense?

Senior Planner Schauer stated, I understand the point.

Vice Chair Coulter asked, you can see a little frustration for us?

Senior Planner Schauer stated, I do. We want to make sure that we are incorporating applicable plans as required into the comprehensive plan. I think there was probably some question about what the required action was to adopt that and we are working to reconcile it. I understand the point you're making.

Vice Chair Coulter stated, and I hope you realize I'm not questioning the merits of the study or any of those things. I'm just saying we are kind of pigeonholed in going in one direction. Obviously, if we went the other direction and changed any of what has already been in the study we would be looked down upon for doing that and for valid reasons.

Senior Planner Schauer stated, the Planning Commission has the authority granted in the development code and comprehensive plan to make recommendations to City Council. Despite that I would encourage you to make whatever recommendation you feel is appropriate as a commissioner independently.

Vice Chair Coulter stated, with legislative I know we have more latitude to some degree than quasi-judicial. However, when I look at the criteria it's stretching it if we don't recommend what's here because it seems to be the applicable criteria as far as what is in front of us. Correct?

Senior Planner Schauer stated, your charge is to make a recommendation on what is before you to the City Council. Certainly it has to meet minimum requirements of providing adequate facilities to support future land use –

Vice Chair Coulter stated, State and City goals and comprehensive plan.

Senior Planner Schauer stated, right, other than that I guess, in terms of legislative decision making, there can be more than one alternative to meet those applicable criteria whereas if you're in a quasi-judicial setting you're only reviewing the proposal submitted by an applicant. I would note that it has been through an advisory committee –

Vice Chair Coulter stated, I recognize that.

Senior Planner Schauer stated, you're free as a commissioner to make whatever independent judgment you feel is appropriate.

Vice Chair Coulter stated, and I think that is great (inaudible) advisory committee. It is just a question of the timing, the timing with the recommendation before we met. I'm beating a dead horse so I won't go any further. It is something, in the future, we might have a workshop on some of these things and iron out maybe a little of these things so it goes smoother. Sound good?

Senior Planner Schauer stated, sounds perfectly appropriate.

Chair Fitzgerald asked, are there any other questions for Tom? Are there any questions for Mr. Haugen? If there were any questions of a particular nature or more in depth in any of the exhibits you have in your packet Mr. Haugen has graciously joined us tonight. We could ask him if you have any questions.

Vice Chair Coulter stated, it is probably already a study somewhere but I'm just curious about it. The infrastructure, as far as piping and main water lines and all those things, has that been something that has already been studied and looked at? That should go hand-in-hand.

Senior Planner Schauer stated, those are in process. That again, was dependant on adoption of the urban growth boundary and urban reserve to be able to complete that work where as these facility plans could proceed in advance.

Vice Chair Coulter stated, that's all I needed to know.

Chair Fitzgerald stated, what you're talking about is that all of our infrastructure in the water is ductile iron. Will that be seismic also? Will we be checking it for when does ductile iron come apart with a seismic event?

Senior Planner Schauer stated, I can't speak to that issue. What I can tell you is the modeling is looking at the sizing to make sure if it is adequate capacity. In terms of the technical specifications and material I couldn't tell you the specifics on that. Maybe Terry could.

Chair Fitzgerald asked, Mr. Haugen wasn't it that the plant was to withstand a certain seismic event?

Public Works Director Haugen stated, Terry Haugen, Public Works director for the City. I will try to answer your questions. First of all, you were asking about the seismic capability of the pipe system. We have pipe in the ground that dates back to probably the 1920s or earlier. They did not do seismic design at that point in time. If we had a significant event it is very doubtful it would sustain. We have our doubts. Primarily the work being done on the master plan study right now for both water and wastewater is to look at the capacities within the system to carry either the water or the sewage through the system. In the case of water to distribute it to the customers or in the case of wastewater to take it back to the plant for treatment. We look at the sizing of that system and we look at what extensions need to be made to go out and reach the new areas that we are incorporating in the urban growth boundary expansion. We will also be looking at the urban reserve. Hopefully that answers that question. As far as the second part, the water treatment plant facility dates back to the 1930s. We had two primary expansions one I believe in the 50s and the other in the 80s and neither of those were designed for seismic conditions. We have concerns with both of those. Most of the concerns for the water treatment plant do not have to do with the sizing. We feel we have capacity at the plant for probably the next 15 to 20 years, however, our concerns there are whether or not that facility will stand up during an earthquake event. That is what the push is. We already have deterioration which is occurring at that facility. We have concerns the clear well underneath has deterioration and that it may fail. I don't want to say at any time but in the relative near future. We do need to proceed with plans to try to replace that facility before we do have failure.

Chair Fitzgerald asked, so the new plant that was proposed or was studied had no particular threshold of seismic event to be built into it?

Public Works Director Haugen stated, the new plant will, yes. That will be designed to current seismic standards.

Chair Fitzgerald asked, and it will withstand what? A 9, 7, 6, or what?

Public Works Director Haugen stated, that I couldn't tell you. I'm not a structural design –

Chair Fitzgerald asked, so there is no criteria being built in for the specifications of the new plant?

Public Works Director Haugen stated, not within the planning documents. That will be done during the specifications and design of the facility which hasn't started yet. This is just a planning document to determine size needs and potential type of plant that may be developed and built in the future.

Commissioner McIntire asked, on the seismic details is this a State mandate or Federal?

Public Works Director stated, I think it probably comes back to the building code which is established by the State. I don't think the Federal Government has any jurisdiction when it comes to what we're designing for earthquake capabilities. Now if we were going after Federal funds that would be a different matter. Then they would have much more say in it. At this point we do not anticipate going after Federal funds for either of these projects.

Vice Chair Coulter stated, (inaudible) Tom said the study on piping and if the pump stations are incased right and all that is ongoing. I think that is what you said. When is that planned to be finished? Obviously it would be nice to dovetail the upgrading of the water treatment plant even if it is the second or third phase. I know you get into tax dollars but –

Senior Planner Schauer stated, those are all in process but we're in the modeling stage right now. We're inputting the land use data to be able to run the model now that we have those adopted and the appeals are over that just occurred –

Vice Chair Coulter asked, so when do you think you'll bring in a firm to study that and come up to this point to –

Senior Planner Schauer stated, they are studying it. They are modeling it right now but we don't have the recommendations for the plan yet.

Vice Chair Coulter asked, will it be 5 years or 2 years?

Public Works Director Haugen stated, I can address that. The water distribution master plan is being performed by the City's master services consultant, Larry Smith and Assoc., and that work is ongoing. In fact, we've had a crew running around town today doing hydro-flow testing so we can complete the modeling effort. We anticipate the work will be complete this calendar year. On the sewer collection system our master services consultant, Carollo & Assoc., is also working on that. They are finishing up the modeling work on the collection system right now. They will probably be slightly ahead of the distribution plan because a lot of that modeling work was actually started about a year ago. I would expect probably within the next 6-8 months you will see completion of that collection system master plan. To go on further there was a question earlier about stormwater and we have been working on a stormwater master plan for a couple years now. This is to complete work that was initiated back in 2006, was not finished in 2007, and then was tabled for some time. Keller & Assoc. is doing that work for us and we are anticipating we will have that stormwater master plan available for review and comment probably early this summer.

Vice Chair Coulter stated, that is great news. Hopefully the money will follow up on both of those close together. Thank you.

Commissioner Arthur stated, on the stormwater the reason I was asking was I think we had some assumptions built in when we did the urban growth boundary planning that we would also be changing the codes to require more on-site detention of the stormwater. This would eventually affect some of your sizing at the sewer plant, right?

Public Works Director Haugen stated, actually stormwater doesn't go through a treatment process. Stormwater is a completely separate issue.

Commission Arthur asked, so it only goes if it accidentally seeps into the system?

Public Works Director Haugen stated, well hopefully we don't have that type of intrusion into our collection system. Stormwater is handled in a separate system. We are trying to go to more of a biological treatment where we are encouraging the stormwater to soak into the ground and be treated by the soil and vegetation before it actually gets to the river but –

Commissioner Arthur stated, so it is clean enough not to have to be treated?

Public Work Director Haugen stated, correct and of course when you have large storm events you have much more than what can be handled and so it will go through the pipes and make it to the creeks and rivers. At this point in time there is no mandate from either the State or Federal Government that we need to treat stormwater.

Senior Planner Schauer stated, and our system is different from some cities that historically had combined storm and sewer systems where all that run-off is going through their sewer treatment plant. We don't have that.

Chair Fitzgerald stated, Terry I noticed in Table 2-2 you state the total anticipated expenditures on 2013 dollars. Is the data that supports the accuracy of these numbers also 2013 data?

Public Works Director Haugen stated, that is correct.

Chair Fitzgerald asked, so therefore they would not reflect such as (inaudible) the costs variations?

Public Director Haugen stated, correct. These studies were based upon the data available at that time. We couldn't project out into the future. Our crystal ball doesn't work any better than anyone else's. We set a period of time which was the current time when that work was done and we completed those planning estimates. Primarily they are there for comparison to look at the different alternatives especially on the water side. To go and say that when we finally build this in probably 5-6 years, if things go properly, if we get close to that estimate of $56 million I think it will be lucky. We will see changes in technology. We don't know where construction will be. We don't know if we will be at the height of an expansion period where contractors are very busy and expensive or if we'll be in a recession and things will be cheaper. It is hard to tell. We made the estimates based on data available at that time. It is for planning and estimating purpose (inaudible) alternatives.

Chair Fitzgerald asked, are there any further questions for Terry? Thank you very much Terry. We appreciate you coming out to help in case we had any questions. Will you be around for a little while in case there are any questions from the audience?

Public Works Director Haugen stated, sure I will be here until the end of this issue.

Chair Fitzgerald stated, I appreciate it, thanks. Are there any more questions for Tom? We will now take testimony from the public. Pros or cons it makes no difference to us. Please give us your name and address for the record. Anyone have any questions you want to ask? Is there anything you'd like to clear up further Tom or Terry?

Senior Planner Schauer stated, not at this time but if you have any questions during your deliberation I will be happy to answer those.

Chair Fitzgerald stated, I will now close the public portion and turn it over to the Commissioners for deliberations and questions.

MOTION/VOTE

Commissioner Kellenbeck moved and Commissioner MacMillan seconded the motion to recommend approval of the application to City Council. The vote resulted as follows: "AYES": Chair Fitzgerald, Vice Chair Coulter and Commissioners MacMillan, Arthur, Kellenbeck, McVay, and McIntire. "NAYS": None. Abstain: None. Absent: None. The motion passed.

Comprehensive Plan Amendment

15-40500001. Element 10
Comprehensive Plan Amendment
(Public Facilities)

Urban Area Planning Commission Hearing
May 13, 2015

Parks & Community Development Department
Tom Schauer, Senior Planner

Subject and Summary

<u>Subject and Summary:</u>

Addendum to Element 10 of the Comprehensive Plan to incorporate:

- **Water Treatment Plant Facility Plan Update (Res 14-6173, 4/2014)**
- http://www.grantspassoregon.gov/374/Water-Treatment-Plant-Facility-Plan

- **Water Restoration Plant Facility Plan Update (Res 14-6205, 5/2014)**
- http://www.grantspassoregon.gov/317/Water-Restoration-Plant-Wastewater-Facil

C
TO UAPC FINDINGS

Subject and Summary

- **Procedures:**
  - Legislative Hearing Guidelines (GPDC Article 9)
- **Criteria:**
  - Section 13.5.4 of the Comprehensive Plan
- **Recommendation**
  - Recommend approval of the amendment to the City Council

Subject and Summary

- **Relationship to Council Goals (2014)**

Plans were adopted by Resolution in 2014

Goal:

- Maintain, Operate, and Expand Our Infrastructure to Meet Community Needs

Objectives:

- Plan for utility infrastructure
- Ensure water infrastructure needs are met
- Ensure sewer infrastructure needs are met

Actions:

- Complete Sewer Master Plan
- Complete Water Master Plan
- (Water Treatment Plant Advisory Committee for Recommendations)

Background

- **Council adopted these plans by Resolution in 2014**
- **This action incorporates into Comp. Plan per Oregon Admin. Rules**

- **OAR 660 Division 11: Public Facilities**
  - Adopt items as part of 'Public Facilities Plan'
  - Some items as <u>supporting document to</u> Comprehensive Plan
  - Some items as <u>part of</u> Comprehensive Plan (Table 2-1, packet page 67)

  - Some amend. not subject to 'land use decision' procedures in state law
  - Some amend. subject to 'land use decision' procedures in state law

Cost Implication

No new cost implications from Council Resolutions in 2014

<u>Water Treatment Plant (Water): $56.2 M</u>

- WA 6207. WTP Plant Upgrade: $56.2 M
  - $5.7M through FY 2016
  - $50.5M future FYs

<u>Water Restoration Plant (Sewer): $20.1 M</u>

- Phases 1&2: SE 4964. WRP Phase 2 Expansion: $12M
- Phase 3: No capital project number yet in current budget

Call to Action

Alternatives:

- Recommend approval as presented
- Recommend approval as modified by the UAPC
- Recommend denial

Decision Deadline:

- (Legislative Decision, No 120-Day Requirement)

Conclusion

- Clarifying Questions for Staff?
- Public Testimony
- Close Hearing
- Deliberation and Recommendation

City Council Meeting
July 1, 2015
6:00 pm
City Council Chambers

The Council of the City of Grants Pass met in regular session on the above date with Mayor Fowler presiding. The following Councilors were present: DeYoung, Gatlin, Goodwin, Hannum, Lindsay, Riker. Also present and representing the City were City Manager Cubic, City Attorney Bartholomew, Assistant City Manager Reeves, Finance Director Meredith, Public Safety Director Landis, Senior Planner Schauer, Public Works Director Haugen, and City Recorder Frerk. Absent: Councilor Morgan, Councilor Roler, Parks & Community Development Director Glover.

Mayor Fowler opened the meeting and Councilor Gatlin led the invocation followed by the Pledge of Allegiance.

Proclamations: Fireworks Safety Week

1. PUBLIC COMMENT:

2. PUBLIC HEARING:

Quasi-judicial Hearing

a. Ordinance amending the Comprehensive Plan Map and Zoning Transition Overlay District Map.
Councilor DeYoung moved and Councilor Hannum seconded to continue the hearing and the vote resulted as follows: "Ayes": DeYoung, Gatlin, Goodwin, Hannum, Lindsay, Riker. "Nays": None. Abstain: None. Absent: Morgan and Roler. Continued hearing to July 15, 2015.

Legislative Hearing

b. Ordinance adopting Addendum 1 to the Public Facilities Element of the Comprehensive Plan.
Councilor DeYoung moved and Councilor Hannum seconded to continue the hearing and the vote resulted as follows: "Ayes": DeYoung, Gatlin, Goodwin, Hannum, Lindsay, Riker. "Nays": None. Abstain: None. Absent: Morgan and Roler. Continued hearing to July 15, 2015.

3. CONSENT AGENDA: (Items included are of such routine nature or without controversy so that they may be approved with a single action).

a. Resolution authorizing the City Manager to enter into a contract for the Morrison/Reinhart Pedestrian Paths; Project No. LB6190.

RESOLUTION NO. 15-6337

EXHIBIT B
TO CC FINDINGS

The Council of the City of Grants Pass met in regular session on the above date with Mayor Fowler presiding. The following Councilors were present: DeYoung, Gatlin, Goodwin, Hannum, Lindsay, Riker, Roler. Also present and representing the City were City Manager Cubic, City Attorney Bartholomew, Finance Director Meredith, Public Safety Director Landis, Parks & Community Development Director Glover, Senior Planner Schauer, Public Works Director Haugen, and City Recorder Frerk. Absent: Councilor Morgan and Assistant City Manager Reeves.

Mayor Fowler opened the meeting and Councilor Gatlin led the invocation followed by the Pledge of Allegiance.

Swearing in Police Officers Jason McGinnis and Shane Corley

1. PUBLIC COMMENT:

2. PUBLIC HEARING:

Item 4a moved to beginning of hearing.

Quasi-judicial Hearing

a. <u>Ordinance amending the Comprehensive Plan Map and Zoning Transition Overlay District Map.</u>

ORDINANCE NO. 15-5651

Councilor Riker moved that the ordinance be read for the first reading, title only. The motion was seconded by Councilor Lindsay. The vote resulted as follows: "Ayes": DeYoung, Gatlin, Goodwin, Hannum, Lindsay, Riker and Roler. "Nays": None. Abstain: None. Absent: Morgan. The motion passed. The ordinance is read.

Councilor Gatlin moved that the ordinance be read by title only, second reading. The motion was seconded by Councilor Riker. The vote resulted as follows: "Ayes": DeYoung, Gatlin, Goodwin, Hannum, Lindsay, Riker and Roler. "Nays": None. Abstain: None. Absent: Morgan. The motion passed. The ordinance is read.

Councilor Lindsay moved that the ordinance be adopted. The motion was seconded by Councilor Hannum. Mayor Fowler asked if the ordinance should be adopted, signified by roll call vote as follows: DeYoung – yes, Gatlin – yes, Goodwin – yes, Hannum – yes, Lindsay – yes, Morgan – absent, Riker – yes, Roler – yes. The ordinance was adopted.

b. Ordinance adopting Addendum 1 to the Public Facilities Element of the Comprehensive Plan.

Councilor Lindsay moved that the ordinance be read for the first reading, title only. The motion was seconded by Councilor Gatlin. The vote resulted as follows: "Ayes": DeYoung, Gatlin, Goodwin, Hannum, Lindsay, Riker and Roler. "Nays": None. Abstain: None. Absent: Morgan. The motion passed. The ordinance is read.

Councilor Riker moved that the ordinance be read for the second reading, title only. The motion was seconded by Councilor DeYoung. The vote resulted as follows: "Ayes": DeYoung, Gatlin, Goodwin, Lindsay, Riker and Roler. "Nays": None. Abstain: Hannum. Absent: Morgan.

Continued hearing to August 5, 2015.

c. Ordinance vacating the common property lines between Tax Lots 1200 and 1300 of Map Number 36-06-24-DB.

ORDINANCE 15-5652

Councilor Riker moved that the ordinance be read for the first reading, title only. The motion was seconded by Councilor Hannum. The vote resulted as follows: "Ayes": DeYoung, Gatlin, Goodwin, Hannum, Lindsay, Riker and Roler. "Nays": None. Abstain: None. Absent: Morgan. The motion passed. The ordinance is read.

Councilor Lindsay moved that the ordinance be read by title only, second reading. The motion was seconded by Councilor Riker. The vote resulted as follows: "Ayes": DeYoung, Gatlin, Goodwin, Hannum, Lindsay, Riker and Roler. "Nays": None. Abstain: None. Absent: Morgan. The motion passed. The ordinance is read.

Councilor Gatlin moved that the ordinance be adopted. The motion was seconded by Councilor Lindsay. Mayor Fowler asked if the ordinance should be adopted, signified by roll call vote as follows: DeYoung – yes, Gatlin – yes, Goodwin – yes, Hannum – yes, Lindsay – yes, Morgan – absent, Riker – yes, Roler – yes. The ordinance was adopted.

d. Ordinance rescinding the vacation of the cul-de-sac bulb (Ordinance No. 5570) on Industry Drive adjacent to TL 105, Assessor's Map 36-05-21-A0.

ORDINANCE 15-5653

Councilor Lindsay moved that the ordinance be read for the first reading, title only. The motion was seconded by Councilor Hannum. The vote resulted as follows: "Ayes": DeYoung, Gatlin, Goodwin, Hannum, Lindsay, Riker and Roler. "Nays": None. Abstain: None. Absent: Morgan. The motion passed. The ordinance is read.

Councilor Lindsay moved that the ordinance be read by title only, second reading.

Comprehensive Plan Amendment

15-40500001. Element 10
Comprehensive Plan Amendment
(Public Facilities)

City Council Public Hearing
July 15, 2015

Parks & Community Development Department
Tom Schauer, Senior Planner

EXHIBIT C
TO CC FINDINGS

Subject and Summary

Subject and Summary:

Addendum to Element 10 of the Comprehensive Plan to incorporate:

- **Water Treatment Plant Facility Plan Update (Res 14-6173, 4/2014)**
- http://www.grantspassoregon.gov/374/Water-Treatment-Plant-Facility-Plan

- **Water Restoration Plant Facility Plan Update (Res 14-6205, 5/2014)**
- http://www.grantspassoregon.gov/317/Water-Restoration-Plant-Wastewater-Facil

Subject and Summary

- **Procedures:**
  - Legislative Hearing Guidelines (GPDC Article 9)
- **Criteria:**
  - Section 13.5.4 of the Comprehensive Plan
- **Recommendation**
  - Approve the amendment as recommended by the Planning Commission, with the additional map and notes recommended by staff





Subject and Summary

- <u>**Relationship to Council Goals (2014)**</u>

Plans were adopted by Resolution in 2014

Goal:

- Maintain, Operate, and Expand Our Infrastructure to Meet Community Needs

Objectives:

- Plan for utility infrastructure
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- Ensure sewer infrastructure needs are met

Actions:

- Complete Sewer Master Plan
- Complete Water Master Plan
- (Water Treatment Plant Advisory Committee for Recommendations)





Background

- **Council adopted these plans by Resolution in 2014**
- **This action incorporates into Comp. Plan per Oregon Admin. Rules**

- **OAR 660 Division 11: Public Facilities**
  - Adopt items as part of 'Public Facilities Plan'
  - Some items as supporting document to Comprehensive Plan
  - Some items as part of Comprehensive Plan (Table 2-1, packet page 67)

  - Some amend. not subject to 'land use decision' procedures in state law
  - Some amend. subject to 'land use decision' procedures in state law

Cost Implication

No new cost implications from Council Resolutions in 2014

<u>Water Treatment Plant (Water): $56.2 M</u>

- WA 6207. WTP Plant Upgrade: $56.2 M
  - $5.7M through FY 2016
  - $50.5M future FYs

<u>Water Restoration Plant (Sewer): $20.1 M</u>

- Phases 1&2: SE 4964. WRP Phase 2 Expansion: $12M
- Phase 3: No capital project number yet in current budget

Call to Action

Alternatives:

- Approve as recommended/presented in ordinance
- Approve with modifications
- Deny

Decision Deadline:

- (Legislative Decision, No 120-Day Requirement)

Conclusion

- Clarifying Questions for Staff?
- Public Testimony
- Close Hearing
- Deliberation and Recommendation

RESOLUTION NO. 14-6205

A RESOLUTION OF THE COUNCIL OF THE CITY OF GRANTS PASS ADOPTING THE WATER RESTORATION PLANT FACILITY PLAN.

WHEREAS:

1. The most recent Facility Plan for the City's Water Restoration Plant (WRP) was completed in June, 2001; and

2. In July, 2012 the City contracted with Carollo Engineers, Inc. to prepare a new Facility Plan for the WRP with the following primary objectives:
   - Provision of reliable capacity to handle additional flows and loads, including those related to expansion of the Urban Growth Boundary
   - Treatment capability to meet current and likely regulatory scenarios and effluent permit requirements
   - Unit process improvements to address significant operation and/or maintenance issues
   - Consideration for new and innovative process technologies, optimization of the existing liquid process facilities, and a review of long-range site layouts
   - Long-term approach to bio-solids treatment and disposal
   - Evaluation and recommendation of energy conservation and/or generation alternatives
   - Provide a flexible, dynamic planning tool which clearly identifies triggers for implementing improvements under varying flow, load, and regulatory scenarios; and

3. Carollo Engineers, Inc. has completed the facility plan; and

4. The conclusion of the facility plan is that the City of Grants Pass should immediately begin the process to: replace one half of the ultra-violet disinfection equipment currently used at the WRP due to its age, cost to maintain and the opportunities to greatly improve the energy efficiency of the disinfection process; and construct seismic improvements to the facilities housed at the WRP that are not planned for major repair or replacement within the scope of the facility plan. This work is proposed as Phase 1 of the recommended Capital Improvement Plan. Phases 2 and 3 of the recommended Capital Improvement Plan generally expand the plant to meet anticipated future flows and rehabilitate processes to provide reliable wastewater treatment.

NOW, THEREFORE, BE IT RESOLVED by the Council of the City of Grants Pass that the Water Restoration Plant Facility Plan prepared by Carollo Engineers, Inc. dated May, 2014 is adopted. The Water Restoration Plant Facility Plan Executive Summary is attached to and incorporated herein as Exhibit 'A'.

EFFECTIVE DATE of this Resolution shall be immediate upon the passage by the City Council and approval by the Mayor.

ADOPTED by the Council of the City of Grants Pass, Oregon, in regular session this 4th day of June, 2014.

SUBMITTED to and Approved by the Mayor of the City of Grants Pass, Oregon, this 5 day of June, 2014.

Darin Fowler, Mayor

ATTEST:

Karen Frerk, City Recorder

Date submitted to Mayor: 6/5/14

Approved as to form Mark Bartholomew, City Attorney

EXHIBIT A

CITY OF GRANTS PASS

WATER RESTORATION PLANT FACILITY PLAN

EXECUTIVE SUMMARY

FINAL

May 2014

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CITY OF GRANTS PASS

WATER RESTORATION PLANT FACILITY PLAN

EXECUTIVE SUMMARY

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ES.1 PLANNING OBJECTIVES

The Water Restoration Plant (WRP) Facilities Plan (Plan) was prepared to identify a logical path forward for the City of Grants Pass WRP for the next twenty years. The Plan aligns with the City's goal to "maintain, operate, and expand infrastructure to meet community needs." Therefore, the Plan identifies improvements needed to accommodate projected growth in the wastewater service area, maintain assets, and comply with anticipated future regulatory requirements. Projects needed during the planning period were programmed in a 20-year Capital Improvement Program (CIP). Key elements addressed in the Plan include:

- Wastewater flow and load projections from current conditions through the 20-year planning period,
- A plan for treatment facility projects that addresses current operational issues, accommodates growth, and provides flexibility to adapt to a variety of potential regulatory scenarios, including changes to the current permit requirements,
- A consideration of new and innovative process technologies for optimizing the existing liquid process facilities, and
- Recommended layout for phased WRP process expansions.

ES.2 BASIS OF PLANNING

The basis of planning establishes the foundation that provides a consistent framework for evaluating the WRP. The basis of planning includes defining the current and future WRP service area, current and future flow and loading conditions, and permitting and regulatory requirements that could impact the type and/or timeframe of needed improvements. A summary of these items follows:

WRP Service Area

The existing service area and land use for the WRP is presented in Figure ES.1.

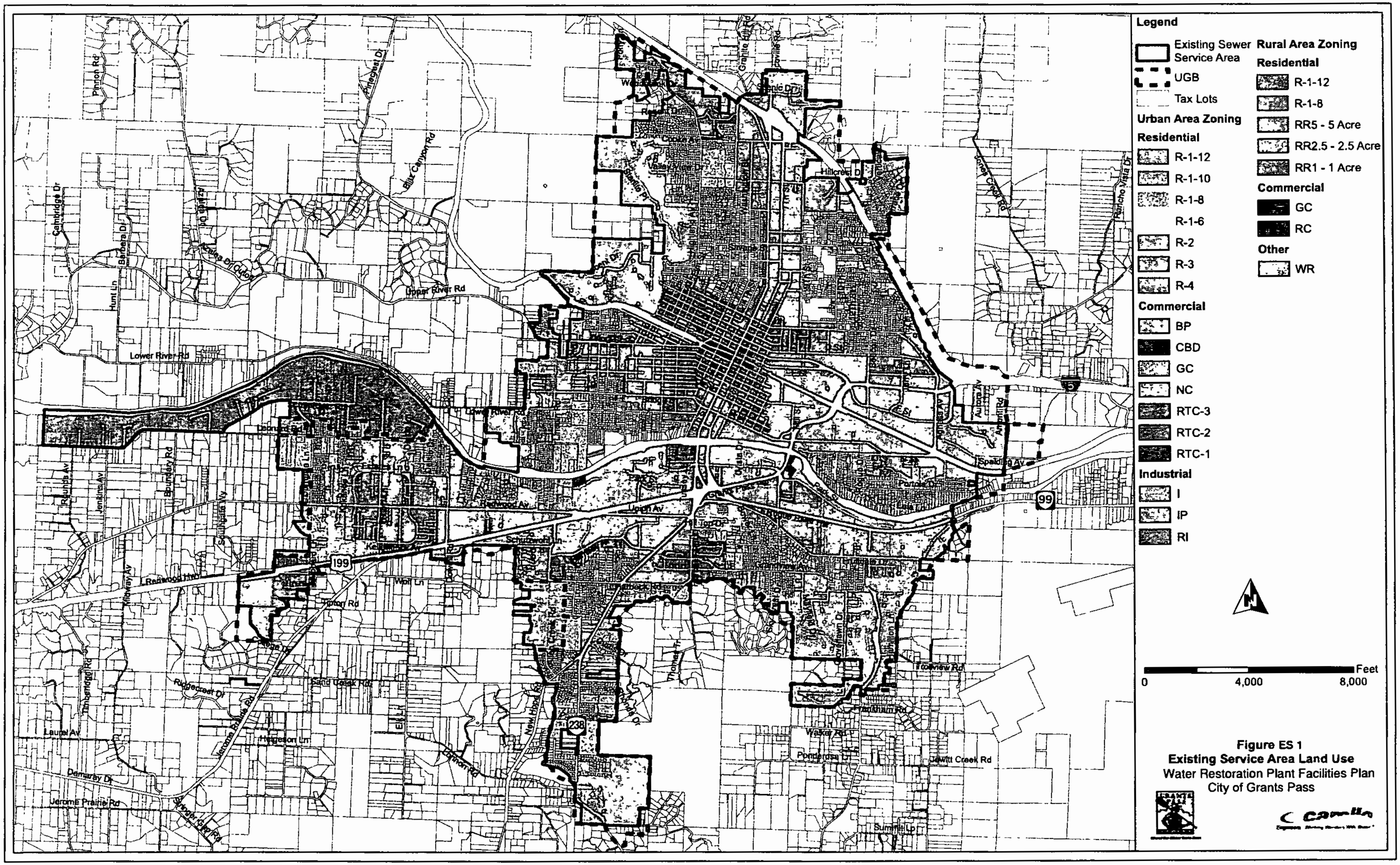

Figure ES 1
Existing Service Area Land Use
Water Restoration Plant Facilities Plan
City of Grants Pass

Population, Flow, and Load Projections

Population projections for the Facilities Plan followed the Water Master Plan and forecasts issued by the Oregon Office of Economic Analysis (OEA). A summary of the current and projected flows and loads based on the projected growth is provided in Table ES.1. The "current" data is based on the existing sewer service area; the projected 2035 data is based on growth anticipated within the current UGB as presented in Figure ES 1.

Table ES.1 Flow and Loads Projections
City of Grants Pass – Executive Summary

Description	Current	2035
Population	41,766	62,951
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Average Dry Weather Flow (ADWF), mgd	5.2	7.8
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Annual Average	920	1,390
Maximum Month	1,180	1,770
Maximum Day	1,480	2,220
Phosphorus		
Annual Average	260	390
Maximum Month	410	610
Maximum Day	570	860

Regulatory Considerations

Water quality standards and regulations continue to evolve and there are a number of new regulatory initiatives being discussed and/or implemented at the state and federal level that could significantly impact the future processes and/or operation of the Grants Pass WRP. The following are considered the most likely potential regulatory issues that could impact the Grants Pass WRP:

- Blending of wet weather flows: The Grants Pass WRP was designed to operate using "blending" mode when flow exceeds the secondary system capacity. In this mode, the City currently meets all discharge permit limits, but not all flow receives secondary treatment. In the future all flow may need to receive secondary treatment. The City has adopted a comprehensive rehabilitation/replacement program to reduce and manage infiltration/inflow (I/I) and associated peak wet-weather flows. In addition to managing I/I within the collection system, the Plan identified that the City may need to operate in contact stabilization mode during peak flow events to accommodate PHFs. If regulations change, disallowing blending, the City must reduce peak flows and/or increase secondary treatment capacity.

- Ammonia: The City's 2010 NPDES permit includes effluent quality requirements for ammonia. The current permit requirement was based on toxicity analysis for ammonia in the Rogue River. This requires the WRP to operate in a partial nitrification mode to reduce levels down to a range of 9.6 to 21 mg/L during the summer months. Currently, to increase removal of ammonia (nitrification) the activated sludge system has been operated with a higher solids residence time (SRT). This increase in SRT results in a decrease in activated sludge capacity. Additional aeration basin capacity is required to meet current and future permit requirements.

  Additionally, it is possible that nitrite could be regulated in the future. This may require the City to provide full nitrification with additional aeration basins.

- Temperature: The City currently has a thermal load based on Total Maximum Daily Load (TMDL). Northwest Environmental Advocates (NEA) challenged DEQ in federal court regarding the temperature rule and Natural Thermal Potential of streams and the federal court found in favor of NEA. For the City, this could mean new lower thermal load or temperature limits will be included in future NPDES permits.

- Mass load limitations: The City's NPDES permit does not provide an increase in mass load and requires that all existing mass load limits, as established in the City's previous NPDES permit, continue to be met, even for higher flows. This requires higher levels of treatment prior to discharge. The Plan identifies fine screening and/or enhanced primary treatment to meet limits within the planning period.

- Priority persistent toxics: In the 2007 Oregon Legislature passed Senate Bill 737, which requires DEQ to list, monitor, and eventually control priority persistent bioaccumulative toxics that have a documented effect on human health, wildlife and aquatic life. DEQ will use this list to prioritize toxic monitoring and other state water quality programs in the future. The implications of this regulatory issue for the City is increased monitoring, public education to limit toxics in the sewage, and pro-active pre-treatment program outreach within the planning period.

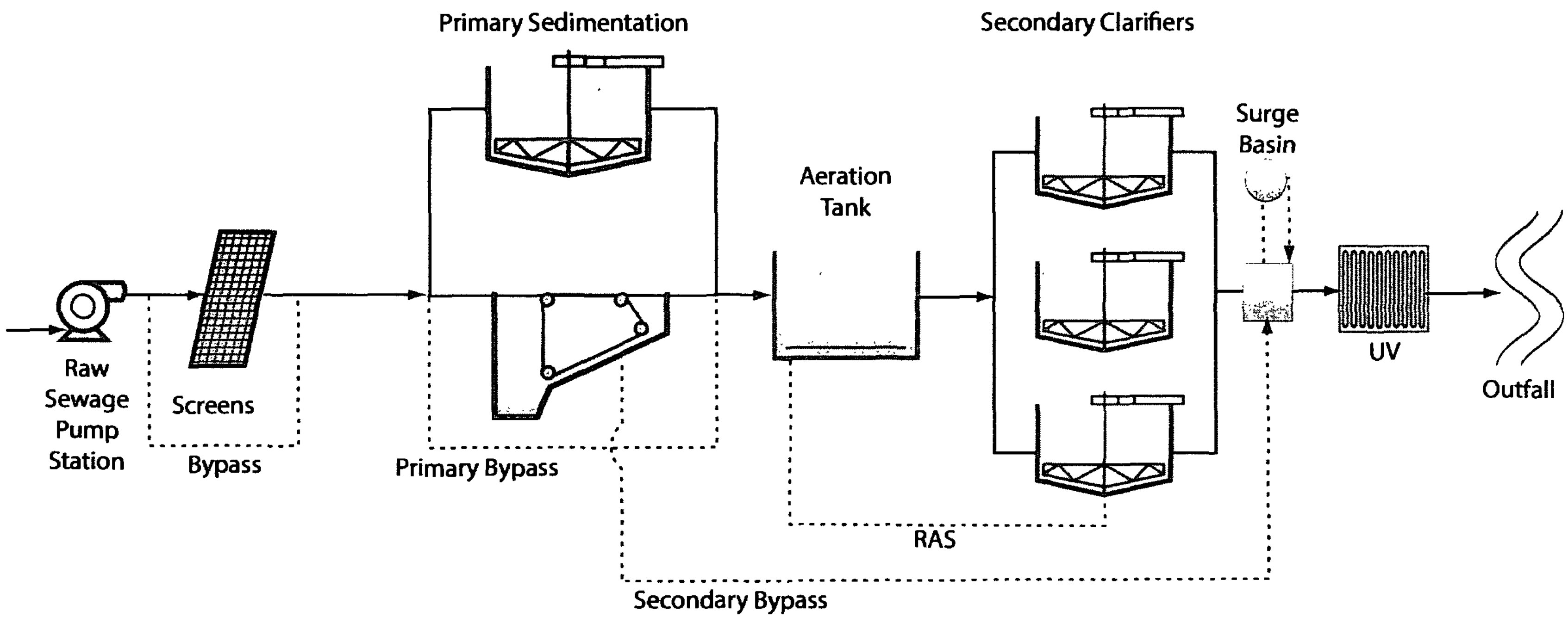
ES.3 EXISTING TREATMENT FACILITY

The Grants Pass WRP liquid stream processes includes the following major unit process - raw sewage pump station, screening, primary sedimentation, aeration, secondary sedimentation, and ultraviolet disinfection system. Figure ES.2 presents the liquids stream process schematic.

Solids from the primary process are processed in a gravity thickener (GT) prior to conveying to anaerobic digester. The secondary process solids are processed on a Gravity Belt Thickener (GBT) prior to being sent to the anaerobic digester. The digested solids are dewatered using a belt filter press and hauled to a landfill for disposal. Figure ES.3 presents the solids schematic.

An evaluation of the unit processes was conducted to form the basis for identifying expansions required to meet flows, loads, and regulatory requirements through the planning period. Analysis of historical plant operation was used to identify on-going performance deficiencies. Design capacity of each unit process was compared to the projections of future flows and loads to identify requirements to accommodate growth and potential future effluent standards, and existing facilities information was reviewed to determine how new facilities could be integrated into the facility to achieve long-term capacity and treatment objectives.

Carollo's Biotran plant process simulator was calibrated based on plant data and used to estimate performance of unit processes and capacities. The Biotran model used mass balances and biological and physical models to simulate interactions between the different processes at the WRP. Model results, in conjunction with wastewater characteristics and design criteria, were used to establish treatment capacities for the different unit processes. The capacity of each unit process is summarized in Table ES.2.



GRANTS PASS WRP LIQUID STREAM PROCESS SCHEMATIC

FIGURE ES 2

CITY OF GRANTS PASS
LIQUID STREAM PROCESS ANALYSIS

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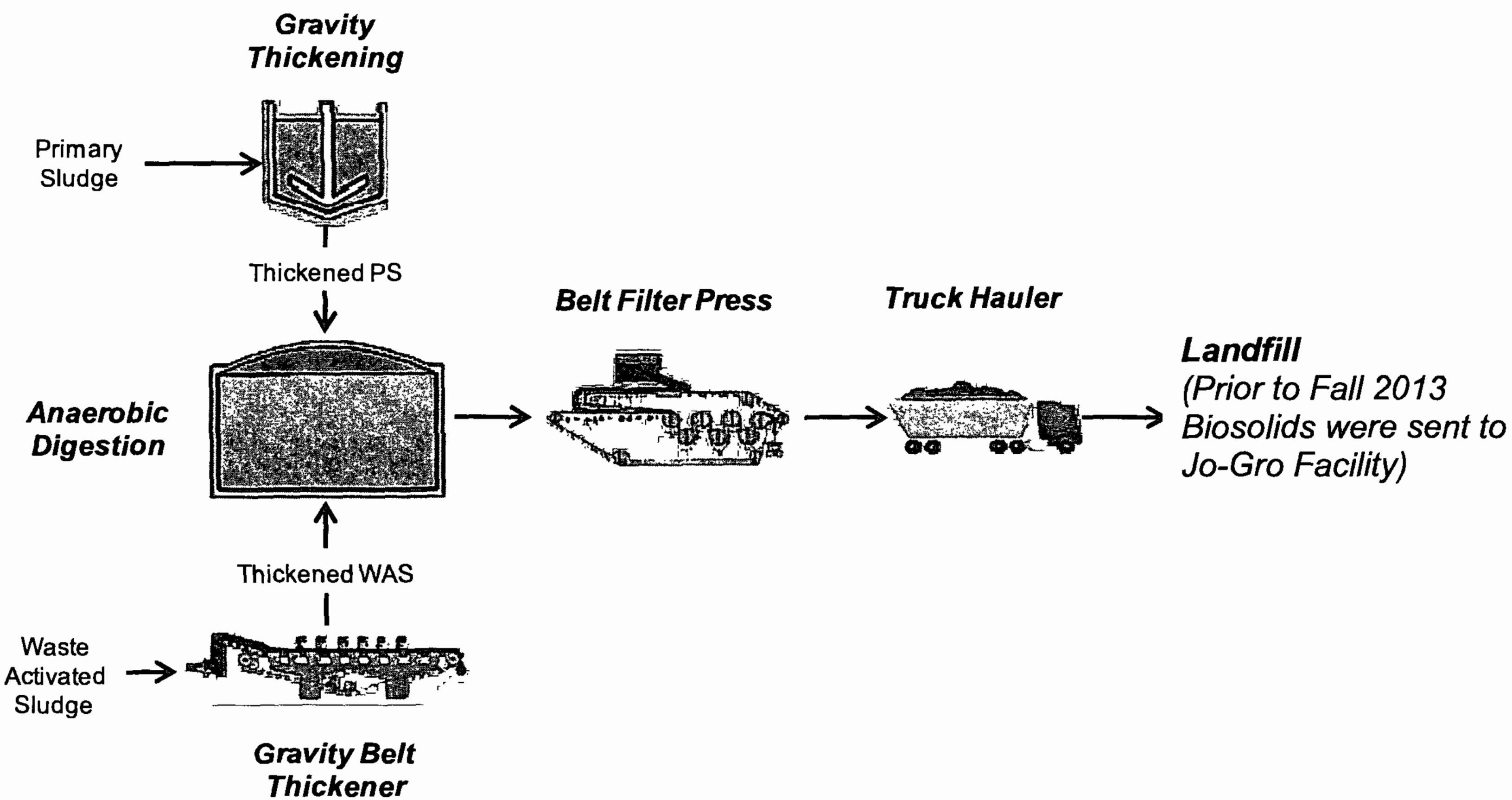

PROCESS SCHEMATIC FOR EXISTING SOLIDS TREATMENT

FIGURE ES 3

CITY OF GRANTS PASS
WATER RESTORATION PLANT FACILITY PLAN

Table ES.2 WRP Unit Process Capacity Summary *City of Grants Pass – Executive Summary*		
Unit Process	**Criteria**	**Current Rated Capacity**
Raw Sewage Pump Station	PHF with largest unit out of service	44 mgd(1)
Influent Screening Facilities	PHF all units in service with bypass	18.5 mgd
Primary Sedimentation Tanks	Overflow criterion for MMWWF @2000 gpd/sf Overflow criterion for PHF @4000 gpd/sf	20.9 mgd
Aeration Tanks	Minimum aerobic SRT = 3 days	13.5 mgd
Aeration Tanks with ML Bypass Open	Minimum aerobic SRT = 3 days	19.7 mgd
Secondary Clarifiers	PHF with all units in service	22.4 mgd
UV Disinfection	Dose 20-25 mJ/cm^2 with one log of safety at PHF conditions	47 mgd
Effluent Outfall Diffuser	Based on a Rogue River ordinary high water surface elevation of 890.00 feet	76 mgd
Gravity Thickener	Maximum month dry weather solids loading	17,900 ppd
Gravity Belt Thickeners	Maximum month dry weather flow	0.325 mgd
Anaerobic Digestion	20 days HRT 0.15 ppd VS/day	0.021 mgd 8,900 ppd
Belt Filter Press	Maximum month dry weather solids loading	9,900 ppd(2)

Notes:
(1) Firm capacity, assumes largest pump out of service.
(2) Based on 35 hours per week operation.

ES.4 RECOMMENDED WRP IMPROVEMENTS

Recommended improvements for major liquid stream unit processes are summarized below:

Raw Sewage Pump Station. The current pump station has sufficient capacity through 2035. No upgrades are needed.

Screening System. The two existing screens and screenings handling system have adequate capacity for 2035 loadings. However, channel modifications are required to allow all flow to go through the headworks under PHF conditions

Primary Sedimentation Tanks. To operate effectively with 2035 flows, two additional primary sedimentation tanks of equivalent size to the two existing rectangular units are needed. To meet the MMWWF capacity criterion, one new tank is required immediately, while the second will be needed by 2030.

Grit Removal System. The existing grit removal system has adequate capacity for 2035 loadings. However, based on the condition assessment the system should be replaced as soon as feasible.

Activated Sludge System. The activated sludge system is nearing current capacity during both the partial nitrification and winter secondary treatment seasons. Construction of two new aeration tanks with associated appurtenances is recommended. Additionally, the capacity of the existing secondary clarifiers is inadequate for current PHF loadings at the desired loading rate of 1250 gpd/sf. A new 100-foot diameter clarifier is recommended to provide treatment capacity for the majority of the planning period.

UV Disinfection. Alternatives to upgrade the existing medium pressure UV system with a more energy efficient system with an estimated lower maintenance cost were investigated. Replacement of the equipment in either one or both UV channels is recommended. These upgrades may be eligible for energy efficiency grants from Energy Trust of Oregon.

The recommended solid stream improvements are as follows:

Gravity Thickeners. Construction of one 25-ft diameter gravity thickeners with 17 ft walls and rehabilitating the existing gravity thickener is recommended. Two progressive cavity pumps for underflow pumping and scum pumps are also included in the upgrade. As the current gravity thickener is in poor condition, it is assumed the upgrades will be constructed immediately.

WAS Diversion Pipeline and Mixing Upgrades. The WAS diversion pipeline includes the installation of a pipeline to provide a thickened waste activated sludge (TWAS) bypass for the digester. This pipeline connects the GBT to the sludge holding tank. Mixer and basin upgrades are also recommended for the sludge holding tank and chlorine contact basin to allow sludge storage in the event of a catastrophic failure of the BFP. The mixer and basin upgrades include replacing the existing sludge mechanism in the sludge holding tank with a mixer, as it is in poor condition, and removing the baffle walls and installing a mixer in the chlorine contact basin. The pipeline and basin upgrades are not necessary until year 2021.

Seismic Upgrades. In addition to the liquid and solid stream processes the following seismic upgrades are recommended since several structures at the WRP do not meet the Life Safety Level performance objectives as defined by American Society of Civil Engineers Standard 31 (ASCE 31-03). These upgrades include the following:

- Operations Building: Adding straps, wall anchors, equipment anchorage, pipe bracing, roof collector element, anchor face brick, and replacing glass.
- Digester Control Building: Upgrades in the digester control building include adding wall anchors, replacing glass, adding equipment anchorage, and pipe bracing.
- Headworks Electrical Building: This project element includes replacing roofing, adding straps, adding wall anchors, equipment anchorage, bracing duct and pipes.
- Plant Drain Pump Station: Adding equipment anchorage.
- Oil Storage House: The task under this project will include adding anchorage and removing and infilling access door.

- Gravity Thickener Sludge Pump Building: Replacing damaged plywood, complete nailing, and adding wall anchorage.

ES.5 CAPITAL IMPROVEMENT PLAN

Based on basis of planning and alternative analysis, the improvements required to meet and accommodate growth, and upgrade facilities to comply with current and anticipated regulations, the Capital Improvement Plan (CIP) was organized into three phases. These phases are assembled by need, logical construction sequence, and cash flow.

Table ES.3 summarizes the estimated total project costs for the improvements recommended in the CIP. All cost estimates prepared as part of the planning effort are order-of-magnitude estimates.

As presented, in Phase 1 the older of the two aged ultraviolet (UV) disinfection units is replaced with a new, more energy efficient UV unit. This upgrade restores the reliability of the disinfection process. Additionally, seismic upgrades are made to existing facilities to address life safety issues that are not addressed in Phase 2.

Phase 2 includes projects needed to treat maximum month wet weather flows, increase peak hour capacity, and allow the existing aeration basin to be taken offline to replace diffusers and make other needed repairs. Additionally, Phase 2 includes rehabilitation of the existing gravity thickener and construction of one new gravity thickener to provide a reliable sludge thickening process.

Phase 3 expands plant capacity to accommodate growth and addresses the remainder of plant upgrades needed through the planning year 2035.

Table ES.3 Recommended CIP
City of Grants Pass – Executive Summary

CIP Project Phase	Cost, $	Fiscal Years
Phase 1	1,500,000	2015 – 2016
UV Disinfection	1,093,000	
Seismic Upgrades	407,000	
Phase 2	9,643,000	2016-2020
Primary Clarifier No. 3	2,703,000	
Aeration Basins No. 3 and 4	5,728,000	
Rehabilitate GT and One New GT	1,100,000	
Screening Hydraulic Improvements	112,000	
Phase 3	8,918,000	2020-2023
Primary Clarifier No. 4	2,703,000	
Secondary Clarifier No. 4	5,017,000	
WAS Diversion Pipeline and Mixing Upgrades	440,000	
Degritting Improvements	758,000	
Total CIP	20,061,000	

RESOLUTION NO. 14-6173

A RESOLUTION OF THE COUNCIL OF THE CITY OF GRANTS PASS ADOPTING THE WATER TREATMENT PLANT FACILITY PLAN UPDATE.

WHEREAS:

1. In April 2004, a Water Treatment Plant Facility Plan was adopted for the City of Grants Pass; and

2. In June, 2012 the City contracted with Murray, Smith & Associates, Inc (MSA) to prepare an update to the Water Treatment Plant Facility Plan with the following primary objectives.

   - Evaluate the recent performance of the Water Treatment Plant (WTP) in terms of quality and capacity
   - Update the impacts of current drinking water regulations as they affect current and future treatment requirements
   - Evaluate and document the existing condition and remaining useful life of the WTP's structural systems
   - Incorporate the recently updated water system demand projections to help identify potential WTP capacity deficiencies and the need for development of expanded capacity
   - Evaluate the alternative approaches for maintaining the existing WTP and providing expanded capacity
   - Evaluate the siting and construction of a new WTP
   - Develop an implementation plan based on community stakeholder input and triple bottom line analyses of existing and new facility improvement alternatives, and

3. MSA has completed the facility plan update with a recommendation provided by the Water Treatment Plant Advisory Committee, and

4. The conclusion of the facility plan update is that the City of Grants Pass should immediately begin the process to construct a new WTP due to the age and structural condition of the existing WTP In order to minimize the risks to the City's only drinking water supply, and to reduce continued investment in the existing plant, the City should plan to have a new WTP online in 2019 In the next fiscal year the City should budget to perform initial planning work to include site selection, a pilot plant study, and a funding analysis A public outreach program can help the City engage its citizens to help explain why these investments are important to the community

NOW, THEREFORE, BE IT RESOLVED by the Council of the City of Grants Pass that the Water Treatment Plant Facility Plan Update prepared by Murray, Smith & Associates, Inc in association with MWH Americas, Inc. dated January, 2014 is adopted

EFFECTIVE DATE of this Resolution shall be immediate upon its passage by the City Council and approval by the Mayor.

ADOPTED by the Council of the City of Grants Pass, Oregon, in regular session this 19th day of February 2014.

SUBMITTED to and Approved by the Mayor of the City of Grants Pass, Oregon, this 24 day of February 2014

Darin Fowler, Mayor

ATTEST:

Karen Frerk, City Recorder

Date submitted to Mayor: ____________

Approved as to form Mark Bartholomew, City Attorney____________

GRANTS PASS
OREGON

City of Grants Pass
Water Restoration Plant

Facilities Plan Update

June 2014

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City of Grants Pass

WATER RESTORATION PLANT FACILITY PLAN

FINAL

June 2014

Engineers...Working Wonders With Water®

REVIEWER: H. WAYNE GRESH	REVIEWER: LARA KAMMERECK
REGISTERED PROFESSIONAL ENGINEER 18350 OREGON MARCH 19, 1996 HAROLD W. GRESH	REGISTERED PROFESSIONAL ENGINEER 81417 OREGON MAY 13, 2008 LARA RAE KAMMERECK
EXPIRES: 06/30/15	EXPIRES: 06/30/15

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ACKNOWLEDGEMENTS

The Water Restoration Plant Restoration Plan was prepared through the dedication, support, and input of the City of Grants Pass Public Works Department staff and wastewater treatment plant management and operation personnel, and the dedication and hard work of Carollo project team members. Deep gratitude is expressed for the input of each individual that helped prepare the plans outlined in this document. The following individuals are acknowledged for their contributions to the Water Restoration Plant Restoration Plan:

City of Grants Pass

Terry Haugen, P.E., Director, Public Works Department
Joey Wright, CPII, PW Engineering Technician
Tim Wilson, WRP Superintendent
WRP Staff:

Gary Brelinski, Jr.
Bill Hickerson
Eric Larsen
Chris Meyer
Bill Ryan
Kevin Smith
Mary Wytcherley

Carollo Project Team

Carollo Engineers, Inc.

Wayne Gresh, P.E., Project Manager
Lara Kammereck, P.E., Collection System Planning Lead
Jeff McCormick, P.E., WWTF Planning Lead
Karen Hooge, Document Preparation
Bhargavi Maremanda, P.E., Planning and Process Evaluations
Matt Sprick, E.I.T., Planning Engineer
Randal Samstag, P.E., Process Modeling
Nitin Goel, UV System Evaluation
Mike Dadik, P.E., Structural Evaluation
Todd Jordan, Collection System Hydraulic Modeling
Margaret Dutton, Collection System Hydraulic Modeling Task Lead

CITY OF GRANTS PASS

WATER RESTORATION PLANT FACILITY PLAN

EXECUTIVE SUMMARY

FINAL

May 2014

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CITY OF GRANTS PASS

WATER RESTORATION PLANT FACILITY PLAN

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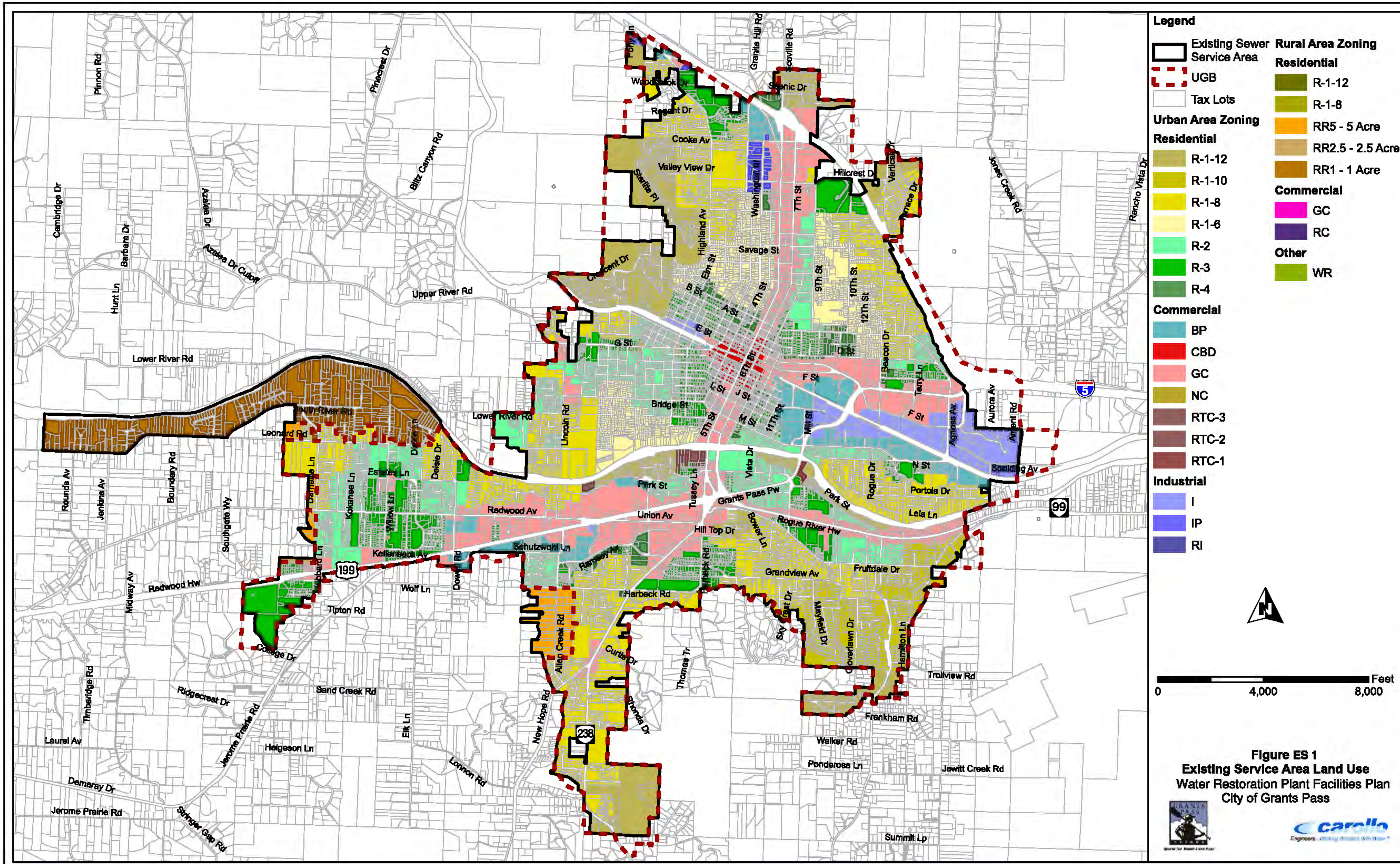

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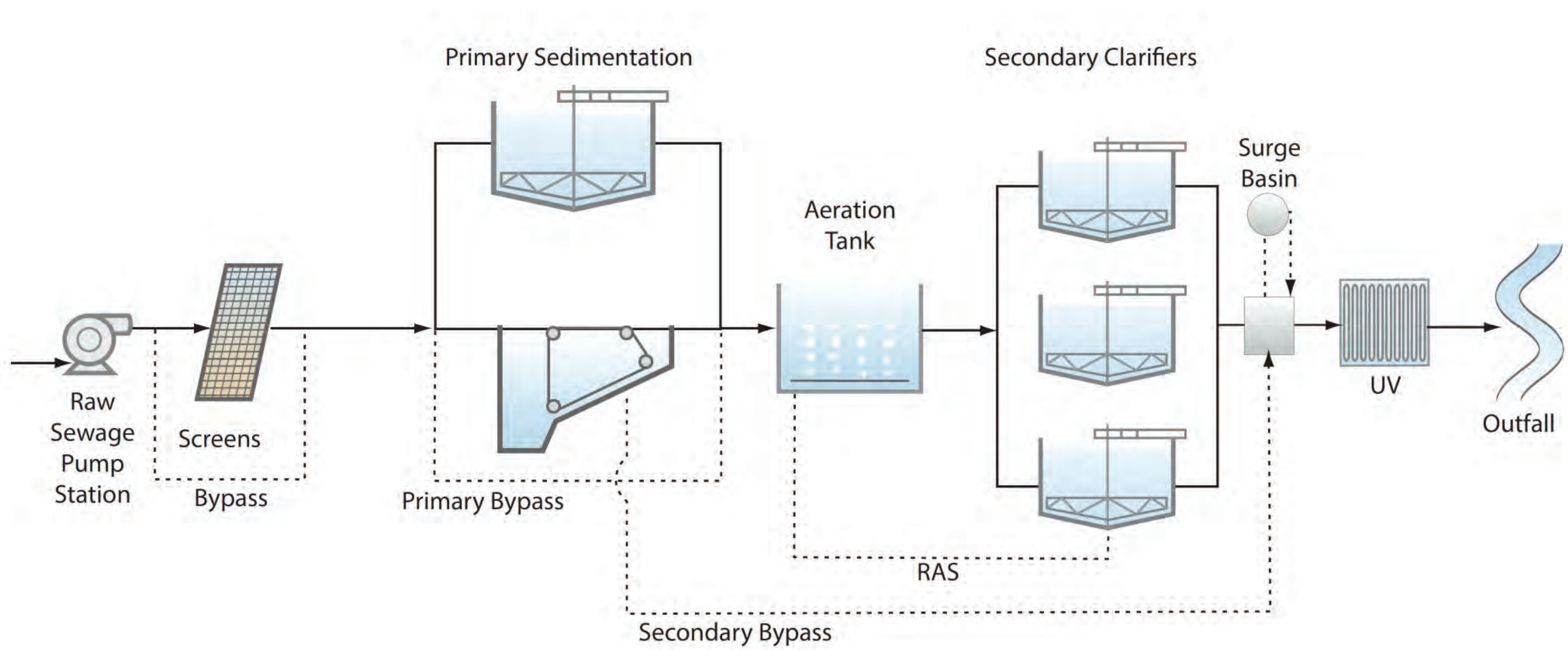
Carollo’s Biotran plant process simulator was calibrated based on plant data and used to estimate performance of unit processes and capacities. The Biotran model used mass balances and biological and physical models to simulate interactions between the different processes at the WRP. Model results, in conjunction with wastewater characteristics and design criteria, were used to establish treatment capacities for the different unit processes. The capacity of each unit process is summarized in Table ES.2.

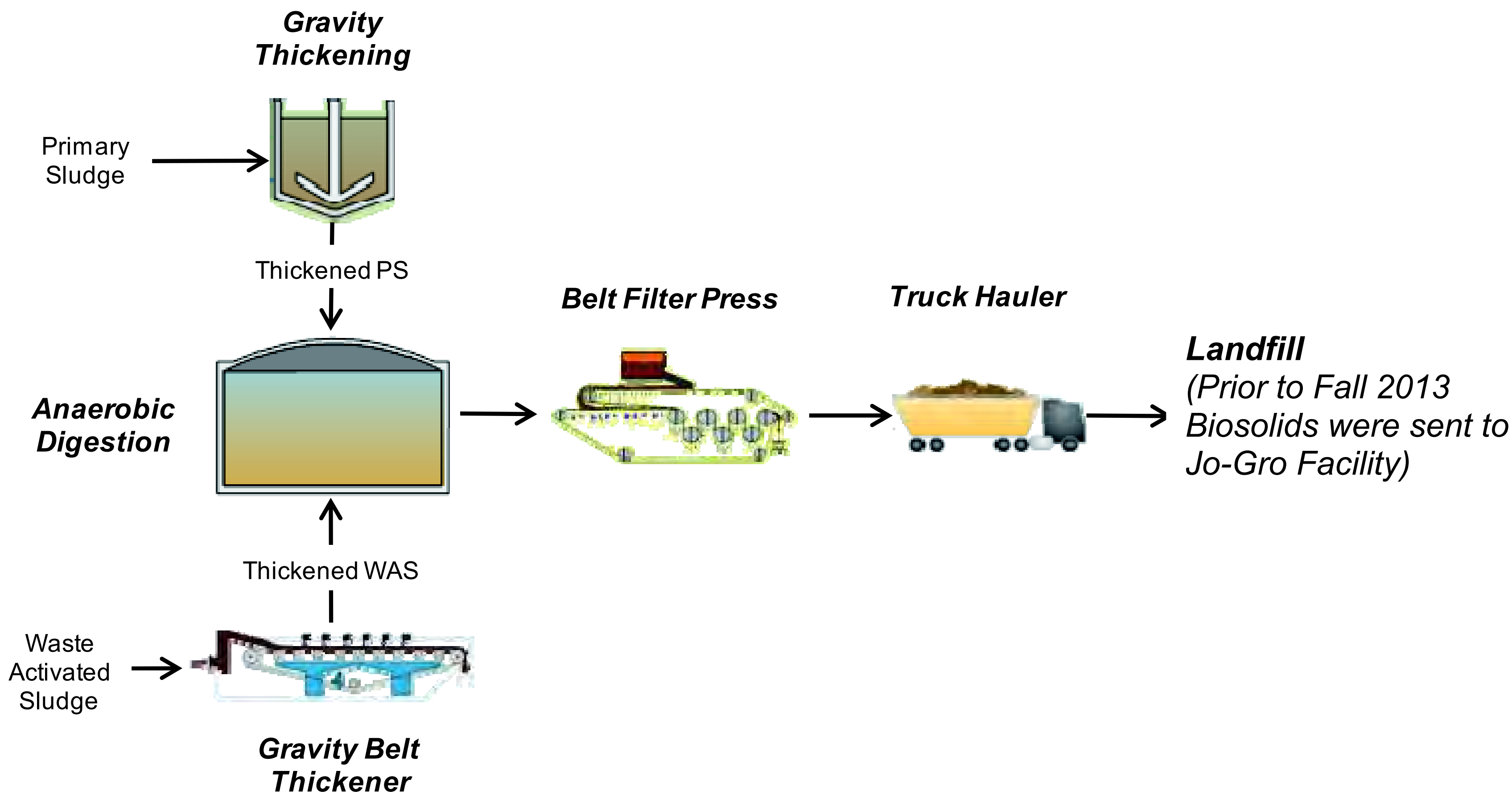
In addition to the process analysis, an assessment of the condition of WRP facilities and equipment was conducted. The complete condition and seismic assessment along with process analysis was then incorporated into the recommended plan for facility improvements through the planning period.



GRANTS PASS WRP LIQUID STREAM PROCESS SCHEMATIC

FIGURE ES 2

CITY OF GRANTS PASS
LIQUID STREAM PROCESS ANALYSIS



PROCESS SCHEMATIC FOR EXISTING SOLIDS TREATMENT

FIGURE ES 3

CITY OF GRANTS PASS
WATER RESTORATION PLANT FACILITY PLAN

Table ES.2 WRP Unit Process Capacity Summary *City of Grants Pass – Executive Summary*		
Unit Process	**Criteria**	**Current Rated Capacity**
Raw Sewage Pump Station	PHF with largest unit out of service	44 mgd(1)
Influent Screening Facilities	PHF all units in service with bypass	18.5 mgd
Primary Sedimentation Tanks	Overflow criterion for MMWWF @2000 gpd/sf Overflow criterion for PHF @4000 gpd/sf	20.9 mgd
Aeration Tanks	Minimum aerobic SRT = 3 days	13.5 mgd
Aeration Tanks with ML Bypass Open	Minimum aerobic SRT = 3 days	19.7 mgd
Secondary Clarifiers	PHF with all units in service	22.4 mgd
UV Disinfection	Dose 20-25 mJ/cm^2 with one log of safety at PHF conditions	47 mgd
Effluent Outfall Diffuser	Based on a Rogue River ordinary high water surface elevation of 890.00 feet	76 mgd
Gravity Thickener	Maximum month dry weather solids loading	17,900 ppd
Gravity Belt Thickeners	Maximum month dry weather flow	0.325 mgd
Anaerobic Digestion	20 days HRT 0.15 ppd VS/day	0.021 mgd 8,900 ppd
Belt Filter Press	Maximum month dry weather solids loading	9,900 ppd(2)

Notes:
(1) Firm capacity, assumes largest pump out of service.
(2) Based on 35 hours per week operation.

ES.4 RECOMMENDED WRP IMPROVEMENTS

Recommended improvements for major liquid stream unit processes are summarized below:

Raw Sewage Pump Station. The current pump station has sufficient capacity through 2035. No upgrades are needed.

Screening System. The two existing screens and screenings handling system have adequate capacity for 2035 loadings. However, channel modifications are required to allow all flow to go through the headworks under PHF conditions

Primary Sedimentation Tanks. To operate effectively with 2035 flows, two additional primary sedimentation tanks of equivalent size to the two existing rectangular units are needed. To meet the MMWWF capacity criterion, one new tank is required immediately, while the second will be needed by 2030.

Grit Removal System. The existing grit removal system has adequate capacity for 2035 loadings. However, based on the condition assessment the system should be replaced as soon as feasible.

Activated Sludge System. The activated sludge system is nearing current capacity during both the partial nitrification and winter secondary treatment seasons. Construction of two new aeration tanks with associated appurtenances is recommended. Additionally, the capacity of the existing secondary clarifiers is inadequate for current PHF loadings at the desired loading rate of 1250 gpd/sf. A new 100-foot diameter clarifier is recommended to provide treatment capacity for the majority of the planning period.

UV Disinfection. Alternatives to upgrade the existing medium pressure UV system with a more energy efficient system with an estimated lower maintenance cost were investigated. Replacement of the equipment in either one or both UV channels is recommended. These upgrades may be eligible for energy efficiency grants from Energy Trust of Oregon.

The recommended solid stream improvements are as follows:

Gravity Thickeners. Construction of one 25-ft diameter gravity thickeners with 17 ft walls and rehabilitating the existing gravity thickener is recommended. Two progressive cavity pumps for underflow pumping and scum pumps are also included in the upgrade. As the current gravity thickener is in poor condition, it is assumed the upgrades will be constructed immediately.

WAS Diversion Pipeline and Mixing Upgrades. The WAS diversion pipeline includes the installation of a pipeline to provide a thickened waste activated sludge (TWAS) bypass for the digester. This pipeline connects the GBT to the sludge holding tank. Mixer and basin upgrades are also recommended for the sludge holding tank and chlorine contact basin to allow sludge storage in the event of a catastrophic failure of the BFP. The mixer and basin upgrades include replacing the existing sludge mechanism in the sludge holding tank with a mixer, as it is in poor condition, and removing the baffle walls and installing a mixer in the chlorine contact basin. The pipeline and basin upgrades are not necessary until year 2021.

Seismic Upgrades. In addition to the liquid and solid stream processes the following seismic upgrades are recommended since several structures at the WRP do not meet the Life Safety Level performance objectives as defined by American Society of Civil Engineers Standard 31 (ASCE 31-03). These upgrades include the following:

- Operations Building: Adding straps, wall anchors, equipment anchorage, pipe bracing, roof collector element, anchor face brick, and replacing glass.
- Digester Control Building: Upgrades in the digester control building include adding wall anchors, replacing glass, adding equipment anchorage, and pipe bracing.
- Headworks Electrical Building: This project element includes replacing roofing, adding straps, adding wall anchors, equipment anchorage, bracing duct and pipes.
- Plant Drain Pump Station: Adding equipment anchorage.
- Oil Storage House: The task under this project will include adding anchorage and removing and infilling access door.
- Gravity Thickener Sludge Pump Building: Replacing damaged plywood, complete nailing, and adding wall anchorage.

ES.5 CAPITAL IMPROVEMENT PLAN

Based on basis of planning and alternative analysis, the improvements required to meet and accommodate growth, and upgrade facilities to comply with current and anticipated regulations, the Capital Improvement Plan (CIP) was organized into three phases. These phases are assembled by need, logical construction sequence, and cash flow.

Table ES.3 summarizes the estimated total project costs for the improvements recommended in the CIP. All cost estimates prepared as part of the planning effort are order-of-magnitude estimates.

As presented, in Phase 1 the older of the two aged ultraviolet (UV) disinfection units is replaced with a new, more energy efficient UV unit. This upgrade restores the reliability of the disinfection process. Additionally, seismic upgrades are made to existing facilities to address life safety issues that are not addressed in Phase 2.

Phase 2 includes projects needed to treat maximum month wet weather flows, increase peak hour capacity, and allow the existing aeration basin to be taken offline to replace diffusers and make other needed repairs. Additionally, Phase 2 includes rehabilitation of the existing gravity thickener and construction of one new gravity thickener to provide a reliable sludge thickening process.

Phase 3 expands plant capacity to accommodate growth and addresses the remainder of plant upgrades needed through the planning year 2035.

Table ES.3 Recommended CIP
City of Grants Pass – Executive Summary

CIP Project Phase	Cost, $	Fiscal Years
Phase 1	1,500,000	2015 – 2016
UV Disinfection	1,093,000	
Seismic Upgrades	407,000	
Phase 2	9,643,000	2016-2020
Primary Clarifier No. 3	2,703,000	
Aeration Basins No. 3 and 4	5,728,000	
Rehabilitate GT and One New GT	1,100,000	
Screening Hydraulic Improvements	112,000	
Phase 3	8,918,000	2020-2023
Primary Clarifier No. 4	2,703,000	
Secondary Clarifier No. 4	5,017,000	
WAS Diversion Pipeline and Mixing Upgrades	440,000	
Degritting Improvements	758,000	
Total CIP	20,061,000	

REGISTERED PROFESSIONAL ENGINEER
76549
OREGON
DEC. 31, 2007
BHARGAVI MAREMANDA
EXPIRES: 12/31/14

City of Grants Pass

TECHNICAL MEMORANDUM NO. 1

Water Restoration Plant Facility Plan
Core Criteria and Guidelines

FINAL

May 2014

720 SOUTHWEST WASHINGTON STREET, SUITE 550 • PORTLAND, OREGON 97205-3507 • (503) 227-1885 • FAX (503) 227-1747

City of Grants Pass

TECHNICAL MEMORANDUM NO. 1

Water Restoration Plant Facility Plan
Core Criteria and Guidelines

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CORE CRITERIA AND GUIDELINES

1.0 INTRODUCTION

The City of Grants Pass (City) prepared this Facilities Plan to document the existing condition and capacity and analyze the future needs of the Water Restoration Plant (WRP). The Plan will be used as a guide to plan for maintenance and improvements to the WRP through the planning year 2035. The planning process allows the City to meet its goal: **Maintain, Operate, and Expand Infrastructure to Meet Community Needs**.

This Technical Memorandum (TM) provides the core criteria and guidelines for infrastructure expansions and improvements for the City of Grants Pass Water Restoration Plant (WRP).

2.0 EVALUATION CRITERIA

The following criteria were used to evaluate the alternatives in the Facilities Plan.

2.1 Factors for Conducting Economic Evaluation

The economic evaluation of alternatives is based on present worth analysis, which includes initial capital cost, and operation and maintenance costs over the planning period.

2.1.1 Capital Costs

All cost estimates prepared as part of this planning effort are order-of-magnitude estimates as defined by the American Association of Cost Engineers (AACE). An order of magnitude estimate is one that is made without detailed engineering data and uses techniques such as cost curves and scaling factors applied to similar projects. The overall expected level of accuracy of the cost estimates presented is –30 percent to +50 percent. This means that bids can be expected to fall within a range of 30 percent under to 50 percent over the estimate for each project. This is consistent with the guidelines established by the AACE for planning level studies.

The costs estimates for this project are based on the perception of current conditions in the area. Costs will be prepared based on a 20 Cities *Engineering News-Record* (ENR) Construction Cost Index average of 9,308. The estimates reflect a professional opinion of costs at this time and are subject to change as the design of each project component develops. The consultant team has no control over variances in the cost of labor, materials, and equipment; services provided by others; contractor’s methods of determining process; competitive bidding or market conditions; or bidding practices or strategies; and therefore does not warrant or guarantee that proposals, bids or actual construction costs will not vary from costs presented in this report.

Preliminary cost estimates are presented for various wastewater conveyance and treatment facilities. Construction costs are costs without contingency. Estimated construction costs include the work items described for each, plus the following indirect costs:

- Contractor general conditions - 10 percent (e.g., mobilization, demobilization, permits).
- Contractor overhead and profit - 15 percent.
- Contingencies - 30 percent.

The preliminary construction cost estimates do not include the following:

- Potential cost increases due to unknown historical or cultural impacts to construction.
- Potential costs associated with identification and mitigation of hazardous waste.
- Easement or land acquisition costs.
- Engineering, legal and administration (ELA) costs.

Total project costs for the Facilities Plan alternatives will be calculated by multiplying the sum of the estimated construction costs (with general conditions and overhead and profit) by a factor to account for engineering, legal and administration costs as follows:

- Engineering, legal and administration - 25 percent.

The engineering, legal and administrative cost factor will be applied to the construction cost following the application of the contingencies factor.

2.1.2 Operation and Maintenance (O&M) Costs

O&M costs will be based on annual average flow and load conditions. Unit costs for labor, materials, and power were developed based on current City's costs.

2.1.3 Land Acquisition Costs

Land prices will be determined on a case-by-case basis. Where possible, costs will be estimated from county tax assessor appraisal records.

2.1.4 Total Present Worth Cost

The alternative economic evaluation incorporates both capital and O&M costs to give a present worth cost of each alternative. The following assumptions and procedures will be used to provide a comprehensive assessment of various alternatives:

- An evaluation period up to year 2035 with a discount rate of 6 percent.
- Total project costs include construction costs as defined above.
- Staffing costs are based on the staffing levels developed with the City.
- Project implementation was assumed to include the following:
  - Design in years 1-2.
  - Construction in years 3-7.

  However, for smaller projects design and construction may be completed in 2 years.

2.2 Factors for Conducting Non-Economic Evaluation

The non-economic evaluation criteria listed below is used when applicable for alternatives evaluation.

2.2.1 Ease of Operation

The alternative should be straightforward in its operation, requiring a reasonable amount of operator attention. Further, the alternative should be able to reliably and consistently meet treatment objectives.

2.2.2 Flexibility

The alternative should be modifiable to satisfy uncertain future regulations and meet programmatic City's objectives. The alternative should also be realistically constructible with minimal disruption to treatment plant operation.

2.2.3 Environmentally Beneficial

The alternative should improve the ability to meet effluent discharge requirements while minimizing environmental impacts. Additionally, the chosen alternative should improve sustainability by lowering energy demand and using fewer raw materials.

2.2.4 Public Acceptance

The alternative should enhance the community and improve livability while fully protecting public health and matching the public perception of health risks. The cost benefits and impact allocation should be equitable and fair.

REGISTERED PROFESSIONAL ENGINEER
76549
OREGON
DEC. 31, 2007
BHARGAVI MAREMANDA
EXPIRES: 12/31/14

City of Grants Pass

TECHNICAL MEMORANDUM NO. 2

Water Restoration Plant Facility Plan
Study Area Characteristics

FINAL

March 2014

720 SOUTHWEST WASHINGTON STREET, SUITE 550 • PORTLAND, OREGON 97205-3507 • (503) 227-1885 • FAX (503) 227-1747

City of Grants Pass

TECHNICAL MEMORANDUM NO. 2

Water Restoration Plant Facility Plan
Study Area Characteristics

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STUDY AREA CHARACTERISTICS

1.0 INTRODUCTION

This Technical Memorandum presents the characteristics of City of Grants Pass' service area relevant to the Water Restoration Plant (WRP), including population, land use, climate, soil types, and topography. Much of the information presented in this report has been developed from work conducted as part of the *Grants Pass Facilities Plan* (Parametrix, 2001). This TM presents an update to the existing and future service area conditions and shall be used to establish flows for the analysis of the WRP's wastewater.

1.1 PLANNING AREA

The service area for the WRP includes the following collection systems:

- City of Grants Pass,
- Fruitdale-Harbeck Sewer District, and
- Redwood Sanitary Sewer Service District (RSSSD).

Management of the RSSSD was transferred to the City in approximately 2000, and a petition was approved in 2010 to dissolve the Fruitdale-Harbeck system and make it a part of the City's collection system. The combined collection system discharges to the City's WRP, located centrally within the City and adjacent to the Rouge River.

The extent of planning area, including existing Urban Growth Boundary (UGB) and land use, are shown in Figure 1. The City's UGB for this study was incorporated from the Grants Pass Comprehensive Plan for Community Development as presented in Appendix A.

2.0 PHYSICAL ENVIRONMENT

The physical environment includes the topography, geology, soils, climate, and water resources of the region. This section presents a brief discussion of these items as they relate to the sewerage planning program. This information has been updated from Parametrix 2001 Facilities Plan when possible.

2.1 Topography, Geology, and Soils

The topography, geology, and soils of a region can have significant effect on the design and construction requirements of sewage works. Topography can determine the route and slope of sewer lines, as well as the need for and location of pumping stations. The geology and soil conditions in an area can affect construction costs for pipelines and determine locations for sewage works.

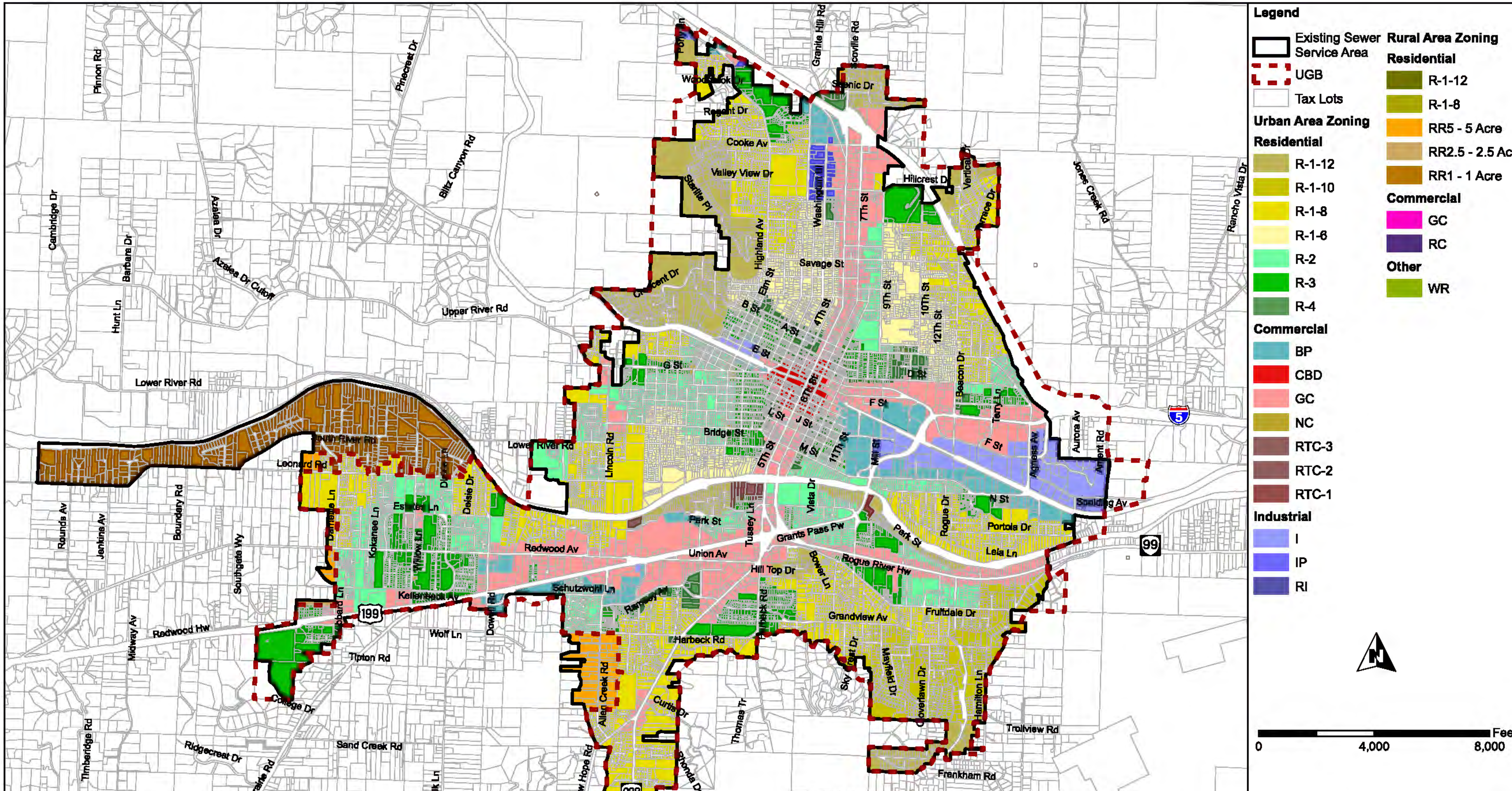


Figure 1
Existing Service Area Land Use
Water Restoration Plant Facilities Plan
City of Grants Pass

2.1.1 Topography

The City of Grants Pass lies in the Rogue River Valley in the Klamath Mountain Range of Oregon. The Siskiyou Mountains, part of the Klamaths, lie to the south and west of Grants Pass. To the northeast, a spur connects the Klamaths to the Cascade Range.

Away from the valley floor, the terrain quickly grows steep. The lava and metavolcanic rock composing Beacon Hill (elevation 2,177 feet) and Baldy Mountain (elevation 2,740 feet) to the northeast and southeast of the city does not weather easily. Its ruggedness has limited development in these areas. The softer granite of Dollar Mountain to the northwest and various hills to the south and southwest of the city shows greater weathering. Their rounded ridges and gentle slopes have generated alluvium, encouraging development in these areas.

The Rogue River Valley begins at the base of the surrounding hills and exists as a well-defined stream terrace some 10 to 15 feet above bed of the Rogue River. The valley slopes toward the river at an average gradient of 1 to 2 percent and is composed of relatively flat-lying alluvium. Elevations on the low-lying valley floor range from 880 to 1,100 feet above sea level. The Rogue River traverses the valley in a general east-west direction on an average slope of about 6 feet per mile.

2.1.2 Geology

The Klamath Mountains are composed largely of Paleozoic and Mesozoic metamorphic rocks derived from sedimentation of volcanic formations. Intrusions of granitic and ultrabasic rocks are common. The mixed assemblage is probably responsible for the distinctive mineralogy of the region. The presence of gold, copper, and mercury led to the region's history of mining. The Almeda Mine, for instance, was located a few miles to the northwest of Grants Pass.

The study area contains several major geologic units. The large deposits of alluvium, which constitute the valley floor, date from the Pleistocene epoch. At the time, uplifting of the coastal areas of the Klamath Mountains reduced the sediment-carrying capacity of the river, thus forming the valley floor. The alluvium reaches thicknesses of 100 to 150 feet in places near the river.

Diorites and granites dating from the Upper Jurassic and Lower Cretaceous occur as irregular masses throughout the study area. Dollar Mountain and Cathedral Hill Park area are two places where these granitic intrusive rocks are prominent. Many of these rocks are quite weathered.

Ultramafic intrusive rocks are less common. Small outcroppings occur northeast of the city. These serpentines, peridotites, and greenstones were formed during the Upper Jurassic epoch.

Northeast and southeast of Grants Pass lay the greenstones of the Applegate Group. These metavolcanic rocks from Baldy Mountain are present along both forks of Jones Creek. They date from the Upper Triassic.

Other members of the Applegate Group are gneisses and schists found along Fruitdale Creek and forming Beacon Hill. These occur mainly as contact metamorphic zones along intrusive granites. Along with the greenstones, they are relatively resistant to weathering.

2.1.3 Soils

Weathering of the different geologic units has given the soils of this area a wide range of characteristics.

The soils that underlie the developable portions of the Rogue River Valley are of the greatest importance to the sewerage study. A survey conducted by the US Department of Agriculture identified the soil types found in the area for agricultural purposes. A brief summary of the study with generalized engineering interpretations is presented here.

The most important soil types in the valley are Newberg fine sandy loam, Barron coarse sandy loam, and Clawson sandy loam. Newberg fine sandy loan is the principal soil type in the floodplain and terraced areas of the valley. It occupies a strip along the Rogue River that is generally about a mile in width; however, it narrows to about 2,500 feet at Grants Pass. The soil is well-drained and presents no major problems for sewage collection and treatment.

Barron coarse sandy loam occupies extensive portions for the Rogue River Valley and underlies most of Grants Pass west of Gilbert Creek. The soil generally occurs upslope from Columbia fine sandy loam and extends as valley fill material into most of the minor tributary valleys. This soil has a slightly higher clay content than the Newberg loam.

Clawson sandy loam underlies a major portion of Grants Pass east of Gilbert Park. Typically, this soil consists of about 1 foot of smooth-textured silt loam overlying a compact silty loam or clay loam subsoil. At a depth of about 30 inches, the subsoil assumes an extremely gritty texture, reflecting the presence of coarse granitic material. The subsoil terminates at shallow depths in coarse granitic rock. The soil is flat-lying and poorly drained, and because of the impervious nature of the shallow bedrock, it is waterlogged during the winter and spring months. In some areas, the water table stands at less than 3 feet below ground level well into the summer. The high groundwater conditions that accompany this soil type can be a problem when sewer pipes lying in the soil have cracks or leaks. Groundwater infiltrates into the cracks and leaks, significantly increasing the flow of liquid to the WRP.

2.2 Climate

Precipitation and temperature can significantly affect the planning and design of sewerage facilities. Grants Pass is considered to have mild climate, although temperatures below freezing and above 100 degrees F occur for short periods annually. The climate is influenced by air movement from the Pacific Ocean, located about 60 miles west of Grants Pass. However, intervening coastal mountains modify the effect of the marine air masses, causing this portion of the Rogue River Valley to receive less annual rainfall and to have fewer cloudy and rainy days than most other portions of Western Oregon.

A summary of monthly precipitation and temperatures is presented in Table 1.

Table 1	Monthly Precipitation and Temperature Summary *City of Grants Pass – Study Area Characteristics*	
Month	**Mean Precipitation, Inches**	**Mean Temperature, Degrees Fahrenheit**
January	4.96	39.3
February	4.6	43.4
March	3.66	47.0
April	2.02	50.7
May	1.21	56.8
June	0.53	63.1
July	0.37	69.2
August	0.45	69.0
September	0.87	62.9
October	2.07	53.9
November	5.12	44.0
December	5.40	38.5

Notes:
(1) Data from Climatography of United States No. 20 1971-2000.

3.0 DEVELOPMENT FORECASTS

A 20-year planning period from now until 2035 was used for this evaluation. Growth projections are based on the City's Water Master Plan and forecasts issued by the Oregon Office of Economic Analysis (OEA) as described in Appendix B. Table 2 presents the population estimates used in this analysis.

Table 2	WRP Population Estimates *City of Grants Pass – Study Area Characteristics*
Year	**Population**
Current	41,766
2015	44,584
2020	49,708
2025	55,422
2030	59,737
2035	62,951

Appendix A

COMPREHENSIVE PLAN FOR COMMUNITY DEVELOPMENT

Comprehensive Community Development Plan

The Grants Pass and Urbanizing Area Comprehensive Community Development Plan was first adopted by Ordinance 4471 on December 15, 1982. It was last amended on February 3, 2010 by Ordinance 5506.

Elements:

1. Location
   Last amended 12/15/1982
2. Citizen Involvement
   Last amended 8/1/1984
3. Scenic, Rogue River, Historic & Natural Resources
   Last amended 6/5/2002; Wetlands Resource Plan adopted as a supplement on 1/11/1998
4. Environmental Resource Quality
   Last amended 6/5/2002
5. Natural Hazards
   Last amended 11/4/2009
6. Population
   Last amended 2/20/2008
7. Recreation, Parks and Open Space
   Last amended 2/3/2010; New Comprehensive Park & Recreation Master Plan with Appendices adopted.
8. Economy
   Last amended 2/20/2008
9. Housing
   Last amended 4/2/2008
10. Public Facilities and Services
    Last amended 7/16/2008; Adopted the following documents by reference as part of the Public Facilities Element:
    - City of Grants Pass Water Distribution Systems Master Plan
    - City of Grants Pass Water Management and Conservation Plan, Final Report
    - City of Grants Pass Water Treatment Plant Facility Plan, Final Report
    - Wastewater Facilities Plan Update, City of Grants Pass Water Restoration Plant, Final Report & Appendices
    - Collection System Master Plan, City of Grants Pass
    - Redwood Sanitary Sewer Service District Engineering Report
11. Transportation
    Replaced by the Grants Pass Urban Area Master Transportation Plan, adopted December 1997 and last amended 5/21/2008.
12. Energy Conservation
    Last amended 8/1/1984
13. Land Use
    Last amended 1/17/2007; Development Code adopted as a supplement on 8/17/1983; Economic Opportunities Analysis adopted as supplement 1/17/2007 and repealed 2/20/2008
14. Urbanization
    Last amended 9-18-12 Ordinance 5500.

- Downtown River District Plan
  Adopted on July 7, 2008 by Ordinance 5459. Repealed by the City Council on August 25, 2008.
- Urban Forestry Framework Plan
  Adopted on November 19, 2008 by Ordinance 5470.
- Policies

Last amended 2/3/2010

Text Amendments

Comprehensive Plan Map and Zoning Map Amendments

Appendix B

FORECASTS ISSUED BY OEA

TO: Mayor Fowler and Members of the Grants Pass City Council

Council Memorandum No. 19

FROM: Aaron K. Cubic, City Manager

DATE: April 11, 2013

SUBJECT: Materials Regarding County Coordinated Population Forecast

****

Attached are some materials to the Josephine County Board of Commissioners regarding the County coordinated population forecast. Attachment 2 is a new memo to both the City Council and Board of Commissioners about the final forecast issued by the Oregon Office of Economic Analysis (OEA) on March 28, 2013.

Attachments

City of
Grants Pass

WHERE THE ROGUE RIVER RUNS
GRANTS PASS
OREGON

MEMO

To: Josephine County Board of Commissioners
c/o David Wechner, Josephine County Planning Director
From: Tom Schauer, City of Grants Pass Senior Planner
Re: Josephine County Coordinated Population Forecast
and Grants Pass Urban Area Planning
Date: April 9, 2013
cc: Aaron Cubic, Michael Black, Carla Angeli Paladino, Josh LeBombard

On March 20, the Grants Pass City Council provided direction necessary for staff to move forward with the Grants Pass urban area planning work. ***Some of the necessary actions resulting from their direction require concurrence and/or joint adoption by the Josephine County Board of Commissioners.*** For those items, if the Board concurs with the direction provided by the City Council, it will be necessary to vote in concurrence. If the Board does not concur, it will be necessary to work together until there is concurrence on an alternative to move forward with the planning work. ***We are offering assistance to move forward with these actions. Please let us know when your meeting is scheduled and how we can assist.*** Materials are attached to assist with some of the necessary Board actions.

First, the City Council adopted a **resolution** directing staff to proceed with planning work for the Grants Pass urban area consistent with ***Alternative 3 presented in the background sheet attached as Attachment 1A.*** This alternative directs staff to initiate an amendment to the population forecast and 'needs' documents as described in the resolution. It also directs staff to initiate planning for a resulting smaller 20-year UGB, and to plan for an Urban Reserve boundary for an additional 10-year period (30-year total). However, the infrastructure planning is limited to the 20-year UGB. It doesn't include planning for the 30-year period or the additional 10-year Urban Reserve area. The Urban Reserve planning is limited to the work to establish a boundary only.

Second, the City Council approved a **motion** providing direction to staff to develop land use alternatives for their consideration which maximize upzoning of buildable lands at reasonable locations within the current UGB. ***(Alternative 1 in the background sheet attached as Attachment 1B).*** In part, this would mean all of the additional higher density land needs for the next 20 years won't all occur at the UGB fringes.

The information and alternatives the City Council considered on March 20 are substantially the same as those presented at the March 4 City Council workshop you attended and your meeting of March 11 which city staff attended. As discussed at your March 11 meeting, the population forecast methodology was updated from the March 4 materials. The final county forecast from the Oregon Office of Economic Analysis (OEA) was issued on March 28, and the Grants Pass forecast has been updated accordingly and is attached. ***Attachment 2.***

No land use decisions are being made at this time. These actions provide direction to initiate plan amendments, which will be considered through a public hearing process with final adoption by ordinance.

The City provided courtesy notice of the March 20 City Council meeting to a 'UGB interested parties' list by mail and e-mail. In that notice, we noted that the Board would meet and deliberate on the issues separately. If you would like to provide notification of your meeting to this interested parties list, please provide advance notice so the city and county can coordinate responsibilities for this notification in advance of the meeting. The notification list includes over 400 mailings and over 200 e-mail notifications.

Attached are the following items for your consideration:

1. **Background sheets from the City Council's March 20 meeting** for the resolution and motion. (For the resolution, staff recommended Alternative 2, City Council adopted Alternative 3 described in the background sheet. For the motion, City Council adopted the recommendation as presented by staff in the background sheet).
2. **Memo** with Grants Pass Urban Area forecast and methodology based on OEA's final forecast for Josephine County.
3. **Memo** with preliminary draft of Josephine County coordinated population forecast numbers. City staff has offered to prepare the supplementary information necessary to update the County coordinated forecast (which the Board must adopt), consistent with the methodology for the Grants Pass urban area population forecast.
4. **Copy of 'UGB Interested Parties' notice** from March 20 City Council meeting.

The following items require decisions and actions by the Board of Commissioners for work to proceed consistent with the direction provided by City Council. Please let me know how I can be of assistance.

- **Concurrence with items in Resolution 6049.** (Alternative 3 presented in background sheet attached as ***Attachment 1*** – New forecast, UGB and Urban Reserve, associated scope of work, and methodologies for updated forecast and needs documents).

- **Josephine County Coordinated Forecast.** The first action would also require the County to adopt a revised Josephine County Coordinated forecast through a subsequent public hearing process. A draft proposal is attached as ***Attachment 3.*** (The City Council only voted on the methodology for the Grants Pass portion of the forecast, not the overall County coordinated forecast). However, the City Council decision for Grants Pass assumes a revised county forecast total.

- **Concurrence with motion regarding upzonings.** Tbis helps narrow the UGB and land use alternative concepts staff will prepare for subsequent consideration by the City Council and Board of Commissioners. (Alternative 1 presented in the background sheet attached as ***Attachment 2***.

(RESOLUTION 6049)

Item:	Resolution providing direction to staff on the population forecast and scope for the UGB/urban area planning work.	**Correction** Date: March 20, 2013

SUBJECT AND SUMMARY:

The City and County are in the process of expanding the Urban Growth Boundary. This agenda item presents alternatives for how to proceed with the work, giving consideration to a new population forecast for Oregon and its counties issued by the Oregon Office of Economic Analysis.

RELATIONSHIP TO COUNCIL GOALS:

This activity contributes to the Council's goal to facilitate **SUSTAINABLE, MANAGEABLE GROWTH**, Objective 1: Complete expansion of the Urban Growth Boundary.

BACKGROUND:

The Grants Pass UGB planning work with the City Council and Josephine County Board of Commissioners picked up with a March 4, 2013 workshop, the first held with new members following the November election. In January, the Oregon Office of Economic Analysis (OEA) issued a new draft 2010-2050 population forecast for Oregon and its counties. At the March 4, 2013 City Council workshop, staff presented four alternatives for the population forecast and scope of work and how to proceed with the UGB/urban area planning work. Those four alternatives are summarized below in the 'Alternatives' section.

Any of the alternatives will need concurrence between the City Council and Josephine County Board of Commissioners. The resolution provides direction to staff to prepare draft documents for submittal to DLCD that will begin the public hearing process, and to prepare draft work products based on the these decisions to bring back to the City Council and Board of Commissioners. Staff would wait until there is direction on those subsequent decisions before making a submittal to DLCD, and then submit the draft proposal to DLCD as a bundle. The City Council and Board of Commissioners must still adopt any amendments to the Comprehensive Plan by ordinance following a public hearing process and public testimony.

Please note that staff has revised the population forecast methodology as described in the attached March 13, 2013 memo, and the resulting forecast has slower growth during the planning period than was presented on March 4, which also affects the associated acreages. Updated slides excerpted from the March 4 powerpoint presentation are attached (Exhibit 1) which show the revised population figures for the alternatives.

Background (continued):

COST IMPLICATION:

The City and County currently have an adopted and acknowledged forecast and adopted 'needs documents' that provide the basis for the UGB planning work.

If any of the adopted documents are amended, reconsideration creates the potential that not all parties will agree with changes. That has the potential to create additional cost in working to resolve and reconcile issues, and/or in time and legal costs if there are appeals or objections filed. However, there is also potential that amendments could resolve some issues and reduce the potential for appeals on some issues.

If the City Council and Board of Commissioners concur with the methodology described for updating the forecast and 'needs documents', and if DLCD concurs, the necessary work to update the amendments could be done in a fairly efficient manner, independent of the potential appeals or objections. This is based on the forecast methodology and use of a proportional approach that scales the adopted needs documents to a new forecast. If there isn't concurrence with this methodology, and if the full demographic and economic analysis would need to be redone, there would be significant cost associated with that work.

ALTERNATIVES:

Alternative 1: Original Forecast, UGB

- **Forecast.** Do not initiate an amendment to adopted population forecast, and
- **Scope.** Continue planning work for a 20-year UGB based on the adopted forecast and the adopted 'needs documents' (population, housing, economy, urbanization, buildable land inventory, etc.)

Alternative 2: New Forecast, UGB + Urban Reserve (with Urban Reserve Infrastructure Planning)

- **Forecast.** Initiate an amendment to the population forecast based on new forecast from Oregon Office of Economic Analysis (OEA) for Josephine County, using the 'Alternative Forecast 2' methodology for the Grants Pass urban area described in the attached March 13, 2013 memo.
- **'Needs Documents'.** Update the 'needs documents' (population, housing, economy, urbanization, etc.) based on a proportion of the total identified needs corresponding to the new forecast. Update the buildable lands inventory by deducting acreage/properties that have since developed from the original adopted inventory.
- **Scope.** Proceed with planning to establish a 20-year UGB and an additional 10-year Urban Reserve based on a new forecast for urban area.
- Conduct infrastructure planning for the 30-year period, including the Urban Reserve area, and the necessary conceptual land use planning required for the infrastructure planning.

Alternatives (continued):

Alternative 3: New Forecast, UGB + Urban Reserve (without Urban Reserve Infrastructure Planning)

- **Forecast.** Initiate an amendment to the population forecast based on new forecast from Oregon Office of Economic Analysis (OEA) for Josephine County, using the 'Alternative Forecast 2' methodology for the Grants Pass urban area described in the attached March 13, 2013 memo.
- **'Needs Documents'.** Update the 'needs documents' (population, housing, economy, urbanization, etc.) based on a proportion of the total identified needs corresponding to the new forecast. Update the buildable lands inventory by deducting acreage/properties that have since developed from the original adopted inventory.
- **Scope.** Proceed with planning to establish a 20-year UGB and an additional 10-year Urban Reserve based on a new forecast for urban area.
- Conduct infrastructure planning for the 20-year period. Do not conduct infrastructure planning for the Urban Reserve area or the additional 10-year period. (For the Urban Reserve, only establish the Urban Reserve boundary location).

Alternative 4: New Forecast, UGB, (No Urban Reserve)

- **Forecast.** Initiate an amendment to the population forecast based on new forecast from Oregon Office of Economic Analysis (OEA) for Josephine County, using the 'Alternative Forecast 2' methodology for the Grants Pass urban area described in the attached March 13, 2013 memo, and
- **"Needs Documents'.** Update the 'needs documents' (population, housing, economy, urbanization, etc.) based on a proportion of the total identified needs corresponding to the new forecast. Update the buildable lands inventory by deducting acreage/properties that have since developed from the original adopted inventory.
- **Scope.** Proceed with planning to establish a 20-year UGB based on a new forecast for the urban area.
- Do not plan for an additional 10-year Urban Reserve. (Do not plan an Urban Reserve Boundary. Only conduct infrastructure planning for the 20-year period and the UGB. Do not conduct infrastructure planning for the Urban Reserve area or the additional 10-year period).

Other Alternatives:

- For Alternatives 2 or 3, the area within the combined 30-year UGB and Urban Reserve area is expected to be smaller than the UGB area in Alternative 1. For Alternatives 2 or 3, Council could also choose to consider a longer period for the Urban Reserve that would generally correspond to the acreage needed for the original UGB planning in Alternative 1. That would be about a 12-13 year Urban Reserve, rather than a 10 year Urban Reserve. A period for the Urban Reserve longer than 12-13 years would begin to exceed the acreage needed for the original UGB in Alternative 1.

Background (continued):

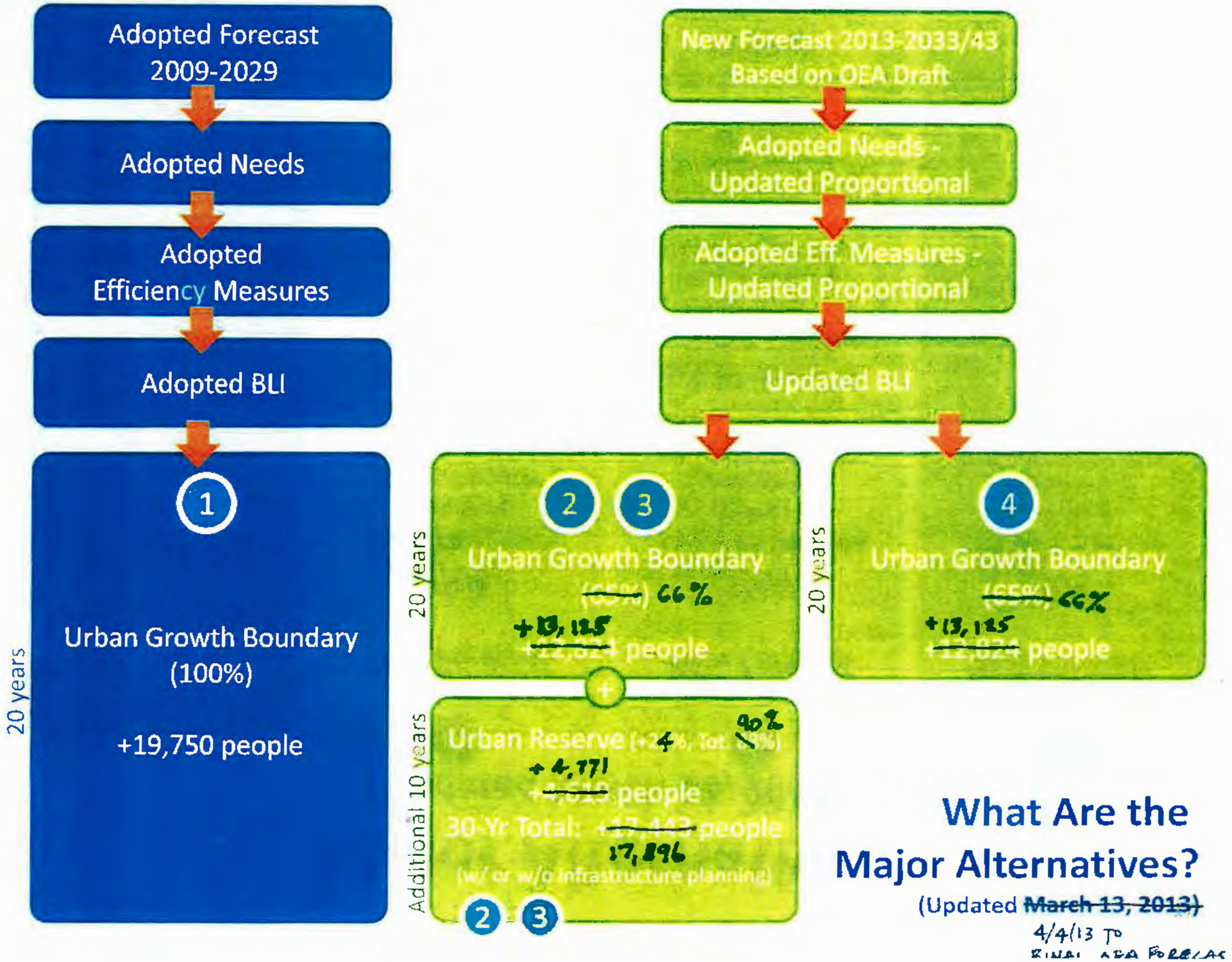
RECOMMENDED ACTION:

Staff provided a recommendation for Alternative 2.

POTENTIAL MOTION:

I move to approve the resolution for Alternative 2 directing staff to:

- initiate an amendment to the adopted population forecast and associated needs documents based on the methodology described; and
- proceed with planning to establish a 20-year Urban Growth Boundary (UGB) and an additional 10-year Urban Reserve based on a new forecast for urban area; and
- conduct infrastructure planning for the 30-year period, including the Urban Reserve area, and the necessary conceptual land use planning required for the 30-year infrastructure planning.



Adopted Forecast 2009-2029
Adopted Needs
Adopted Efficiency Measures
Adopted BLI
1
Urban Growth Boundary (100%)
+19,750 people
20 years
New Forecast 2013-2033/43 Based on OEA Draft
Adopted Needs - Updated Proportional
Adopted Eff. Measures - Updated Proportional
Updated BLI
2 3
Urban Growth Boundary
~~(65%)~~ 66%
+13,125
~~+12,824~~ people
20 years
4
Urban Growth Boundary
~~(65%)~~ 66%
+13,125
~~+12,824~~ people
20 years
+
Urban Reserve (+24%, Tot. 90%)
+4,771
~~+4,619~~ people
30-Yr Total: ~~+17,443~~ people
17,896
(w/ or w/o Infrastructure planning)
2 3
Additional 10 years
What Are the Major Alternatives?
(Updated ~~March 13, 2013)~~
4/4/13 TO
FINAL OEA FORECAST

Major Alternatives

(Updated ~~March 13, 2013~~) 4/4/13 TO FINAL OEA FORECAST w/ ADJUSTED BASE YEAR

	1	2	3	4
	Adopted Forecast	**New Forecast**	**New Forecast**	**New Forecast**
20 yr	**UGB** **+19,750 people** Land Use & Transportation & Infrastructure Planning	**UGB** **+~~12,824~~ 13,125 people** Land Use & Transportation & Infrastructure Planning	**UGB** **+~~12,824~~ 13,125 people** Land Use & Transportation & Infrastructure Planning	**UGB** **+~~12,824~~ 13,125 people** Land Use & Transportation & Infrastructure Planning
+10 yr		**Urban Reserve** **~~+4,619~~ 4,771 people** *With* Transportation & Infrastructure Planning (Conceptual Land Use Plan Required to Develop Transportation & Infrastructure Plans)	**Urban Reserve** **~~+4,619~~ 4,771 people** *Without* Transportation & Infrastructure Planning (Urban Reserve Boundary Only, Based on Land Use Allocations)	
30 yr		**= Total** **+~~17,443~~ 17,896 people**	**= Total** **+~~17,443~~ 17,896 people**	

After BLI Update, Alts 2&3 UGB + 12-13 Year UR ~= Alt 1 UGB

Summary – Some Pros and Cons of Alternatives

(Revised March 13, 2013)

1 — Adopted Forecast UGB

Land Use Planning
Can plan entire 1,200 ac area & in one phase

Infrastructure Planning
Can do infrastructure planning for entire 1,200 ac (UGB) area & in one phase

Infrastructure will be sized correctly to serve entire 1,200 ac area as it is installed incrementally

Update Frequency
Land use and/or infrastructure plans will not need to be updated as soon as with other options

2 — New Forecast UGB + UR

With UR Infra. Planning

Land Use Planning
Can plan entire ~1,000 +/- ac area, but in two phases (UGB+UR). 2nd phase is limited - only a concept plan for UR, but needed for UR infra. planning

For UR, there is substantial work to develop land use concept plan for UR infra. plans, but w/o adopting detailed UR land use plan

Significant infra. decisions based on UR land use concept rather adopted, detailed land use plan.

At time of future UGB inclusions, need to avoid deviation from UR concept on which infra. sizing and investment decisions were based

Infrastructure Planning
Can do infra. planning for entire +/- ~1,000 ac (UGB + UR) area, but in 2 phases. While phased, it ensures correct infra. sizing and extensions to serve entire UGB + UR areas.

Advance Notice
UR provides earlier notification about future UGB / growth areas

3 — New Forecast UGB + UR

Without UR Infra. Planning

Land Use Planning
Can plan entire +/- ~1,000 ac area, but in two phases (UGB+UR).

2nd phase is very limited - only a boundary for UR, but using suitability analysis already done, with same growth area decisions needed for Alternative 1 or 2

Infrastructure Planning
Infrastructure planning is only for +/- ~446-508 ac UGB area

No infrastructure plans for +/- ~495-557 ac Urban Reserve Area

Infra. sizing and extensions to serve UGB area won't consider needs for remainder of ~1,000 ac area in UR and may be undersized to later serve UR area

Update Frequency
Land use and infrastructure plans will be obsolete sooner and need updating sooner

Advance Notice
UR provides earlier notification about future UGB / growth areas

4 — New Forecast UGB (No UR)

Land Use Planning
Land use plan is only for +/- ~446-508 ac area

Land use patterns won't consider coordination and relationship to remainder of ~1,000 +/- ac area

Infrastructure Planning
Infrastructure planning is only for +/- ~446-508 ac UGB area

No infrastructure plans for ~495-557 ac Urban Reserve Area +/-

Infra. sizing and extensions to serve UGB area won't consider needs for remainder of ~1,000 ac +/- area in UR and may be undersized to later serve UR area

Update Frequency
Land use and infrastructure plans will be obsolete sooner and need updating sooner

ATTACHMENT 1B

CORRECTION

Item: Motion providing direction to staff on the extent of rezones to consider for preliminary draft UGB planning alternatives.

Date: March 20, 2013

SUBJECT AND SUMMARY:

This agenda item relates to the UGB / Urban Area planning work. To develop boundary proposals, land use allocations to areas, and land use plan concepts within areas, it is necessary to determine how many acres of each plan designation need to be allocated to different areas. This can be affected by the level of rezoning of current buildable lands within the current UGB. If Council is prepared to provide direction on that issue for staff to prepare initial draft concepts, that will help narrow the potential draft alternatives.

RELATIONSHIP TO COUNCIL GOALS:

This activity contributes to the Council's goal to facilitate **SUSTAINABLE, MANAGEABLE GROWTH**, Objective 1: Complete expansion of the Urban Growth Boundary.

BACKGROUND:

Planning for the UGB and possible Urban Reserve requires decisions about the land use pattern and what comprehensive plan map and zoning map designations are applied to properties. The land use pattern can be considered for the community as a whole, not just limited to UGB expansion areas.

The buildable land inventory shows how many buildable acres are available in each plan designation within the current UGB, and that determines how many acres for each plan designation must be assigned to expansion areas. However, if some of the current buildable land inventory is re-designated / rezoned, that affects the allocations to expansion areas.

There is the potentiel to upzone some properties within the current UGB near major transportation corridors, near commercial and service areas and nodes. This would mean a higher share of some of the lower density designations could be applied to expansion areas closer to the edges of the UGB. In addition, in the shorter-term for Alternatives 2-4, there is more land with lower density designations in the current UGB that needed for the planning period. Therefore, the initial UGB needs to be larger to meet needs for the other plan designations, unless part of the lower density surplus is rezoned to designations that are needed. In the longer term, the additional low density need would be assigned to expansion areas.

Background (continued):

Therefore, rezoning of lands in the current UGB can affect the size of the UGB (up to a certain point) which is based on a new forecast, as well as the land use pattern, by accommodating more of the higher density designations within the current UGB. See Exhibits 1 and 2 for a summary of reasons for rezones of these areas and a map illustrating an example of the potential effect of rezones on boundary size and allocations.

For each level of re-zonings considered, there are many variations of land use scenarios that staff could draft for Council's consideration. Direction on the extent of rezoning Council would like to consider can help narrow down those initial alternatives. An example of the difference was presented at the March 4 workshop.

COST IMPLICATION:

If Council can provide direction at this time to help narrow alternatives, it will reduce staff time and materials to develop alternatives and provide outreach to develop a range of alternatives for Council's consideration.

ALTERNATIVES:

1. **Maximize Rezones of Buildable Lands in Current UGB.** Motion to prepare drafts that maximize rezones in the current UGB in areas with buildable land inventory, thereby reducing the surpluses and size of the initial UGB; increasing the share of new higher density designations within the UGB; and increasing the share of new lower density designations in expansion areas. (Net changes affecting about 60-90 acres of buildable land reallocations, plus nearby acreages not all in buildable land inventory).

2. **Minimize Rezones of Buildable Lands In Current UGB.** Motion to prepare drafts that minimize rezones in the current UGB, thereby retaining the surpluses and increasing the size of the initial UGB; retaining greater share of new lower density designations within the current UGB; and retaining greater share of new higher density designation in expansion areas. (Minimal changes may be need to transition to new areas).

3. **Draft Alternatives for Full Range of Scenarios from Minimizing to Maximizing Rezones of Buildable Land in Current UGB.**

RECOMMENDED ACTION:

Staff recommends Alternative 1.

POTENTIAL MOTION:

I move to approve Alternative 1 directing staff to prepare draft concepts based on maximizing rezones in the current UGB in areas with buildable land inventory.

Rezoning Areas with Buildable Lands in UGB?

Two Major Reasons:

1. ***For All Alternatives:***
   Land Use Pattern

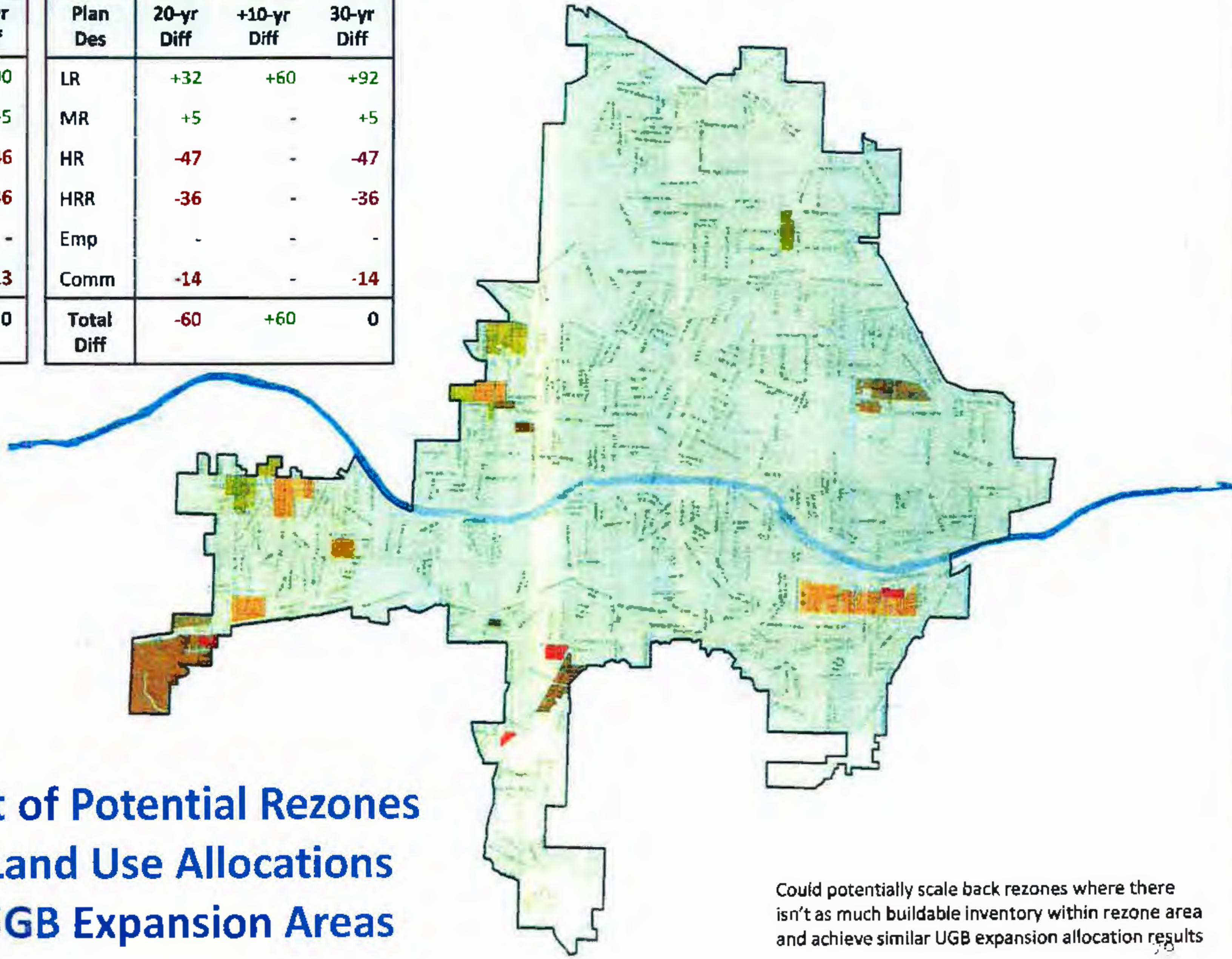
- Planning for entire community, not just expansion areas
- Adjust edges between existing zoning districts
- Disperse rather than concentrate higher-density designations
- Locate more of higher-density near commercial nodes & corridors with services
- Locate less higher-density at UGB fringes, affecting land use mix for expansion areas

2. ***For Alternatives 2-4:***
   Reduce Surpluses / UGB Size

- Reduce low-density surplus in current UGB at suitable locations, reducing size of 20-year UGB expansion
- Smaller 20-year UGB (Alts 2,3,4), bigger 10-year UR (Alts 2,3), same 30-year total UGB+UR
- When the additional low-density demand occurs in the 20-30 year timeframe, it will be met in expansion areas.
- (Doesn't change 30-year totals, but changes land-use pattern)

Alt 1	
Plan Des	20-yr Diff
LR	+90
MR	+5
HR	-46
HRR	-36
Emp	-
Comm	-13
Total Diff	0

Alternatives 2, 3, 4			
Plan Des	20-yr Diff	+10-yr Diff	30-yr Diff
LR	+32	+60	+92
MR	+5	-	+5
HR	-47	-	-47
HRR	-36	-	-36
Emp	-	-	-
Comm	-14	-	-14
Total Diff	-60	+60	0



Effect of Potential Rezones on Land Use Allocations to UGB Expansion Areas

Could potentially scale back rezones where there isn't as much buildable inventory within rezone area and achieve similar UGB expansion allocation results

ATTACHMENT 2

City of
Grants Pass

GRANTS PASS
WHERE THE ROGUE RIVER RUNS
OREGON

MEMO

To:	Mayor Fowler and Members of the Grants Pass City Council Josephine County Board of Commissioners
From:	Tom Schauer, Senior Planner
Re:	Methodology for Final Draft Grants Pass Urban Area Population Forecast
Date:	April 9, 2013
cc:	David Wechner, Michael Black, Carla Angeli Paladino, Josh LeBombard

On March 28, 2013, the Oregon Office of Economic Analysis (OEA) issued its new ***final*** population forecast for Oregon and its counties for 2010-2050. Below is a summary of the methodology used to develop the final draft population forecast for the Grants Pass urban area, based on OEA's final forecast. This methodology is consistent with Resolution 6049 approved by the City Council on March 20, 2013.

The term 'urban area' population used below refers to population forecast to be within an Urban Growth Boundary (UGB) over time. For the current planning work, it is used in the context of a 30-year period from 2013-2043, with a UGB population for the initial 20-year period from 2013-2033 and a possible Urban Reserve population for the additional 10-year period from 2033-2043. (As used here, this is entirely different than Census Bureau 'urbanized area' designations and definitions). The forecast will also be extended out to 2050 to correspond the OEA forecast period.

Final Draft Grants Pass Urban Area Population Forecast & Methodology

OEA March 28, 2013 Final Forecast for Josephine County & Modified Base Year

On March 28, 2013, the Oregon Office of Economic Analysis (OEA) issued its new ***final*** population forecast for Oregon and its counties for 2010-2050. OEA's methodology uses separate 5-year growth rates for each county for each five-year period through 2050. ***See Exhibits 1A, 1B, and 1C.*** The final forecast differed slightly from the original draft.

As with their January draft forecast, OEA's March 28, 2013 final population forecast for counties applied growth rates starting from the 2010 Census and PSU population data. For Josephine County, this exceeded PSU's subsequent 2012 population estimate.

Therefore, consistent with the methodology approved in Resolution 6049, the Grants Pass urban area forecast is based on a modification to OEA's Josephine County forecast. It adjusts the OEA forecast to begin with PSU's 2012 population estimate and then applies OEA's growth rates beginning with that base year population. This is the only difference. This doesn't significantly affect the additional population growth being planned for, but it better reflects the total population (current and future).

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'Share' Method for Grants Pass Urban Area

The OEA forecast only includes counties and the state total. It doesn't include forecasts for areas smaller than counties, such as cities and UGBs. Therefore, it is necessary to develop a forecast for the urban area. The methodology for the draft Grants Pass urban area forecast is based on a 'share' method, where the population of the urban area was calculated as a share of the total county population.

The actual Grants Pass UGB share of the Josephine County population increased from 40% in 1990 to 42% in 2000 (an increase of 1% each 5 years for the 10-year period from 1990-2000) to 46% in 2010 (an increase of 2% each 5 years for the 10-year period from 2000-2010). ***See Exhibit 2.*** This is a total increase of 6% share from 1990-2010, or an average increase of 1.5% each 5 years for the 20-year period.

For the Grants Pass urban area forecast, the assumption is the share will increase 1% each five years for the first 20 years (2013-2033), beginning from the current 46% share. For the next 10 years (2033-2043) and beyond, it assumes the increasing share slows to 0.5% every 5 years, increasing to 51% in 2043. This generally corresponds to a slower county growth rate based in demographics toward the end of the forecast period. ***See Exhibit 3.***

The 'share' methodology for the Grants Pass Urban Area described above does not directly use a growth rate, but equivalent growth rates can be calculated from the figures, and they are shown below.

Results

This methodology results in the following population growth for the Grants Pass urban area:

2013-2033 (20-year): +13,125 people (~1.48% 20-yr AAGR)
2033-2043 (10-year): +4,771 people (~0.89% 10-yr AAGR)
2013-2043 (30-year): +17,896 people (~1.29% 30-yr AAGR)

Note 1: Once the UGB is expanded, the base year UGB population will initially increase due solely to the boundary change. The amount of the increase will differ depending on which areas are included in the UGB. Rather than confuse the forecast issue with differing initial ***total population*** figures, the ***new population*** figures above can be added to the base year population that would result from the initial transfer of population from outside to inside the boundary, regardless of that initial total.

Note 2: With the 'share' methodology (and other methodologies), population is usually assumed to be assigned to mutually exclusive areas: urban areas inside a UGB and rural areas outside UGB. However, depending how a UGB and Urban Reserve are managed, some of the rural share of the growth could initially occur within a UGB or Urban Reserve before urban zoning is applied to those lands. Therefore, there could be overlapping areas where a portion of the rural share occurs in these areas initially and a portion of the urban share occurs in these areas later.

Oregon Office of Economic Analysis (OEA) March 28, 2013 Final Population Forecast - Josephine County

(Josephine County Data Excerpted from Forecast for Oregon and Counties)

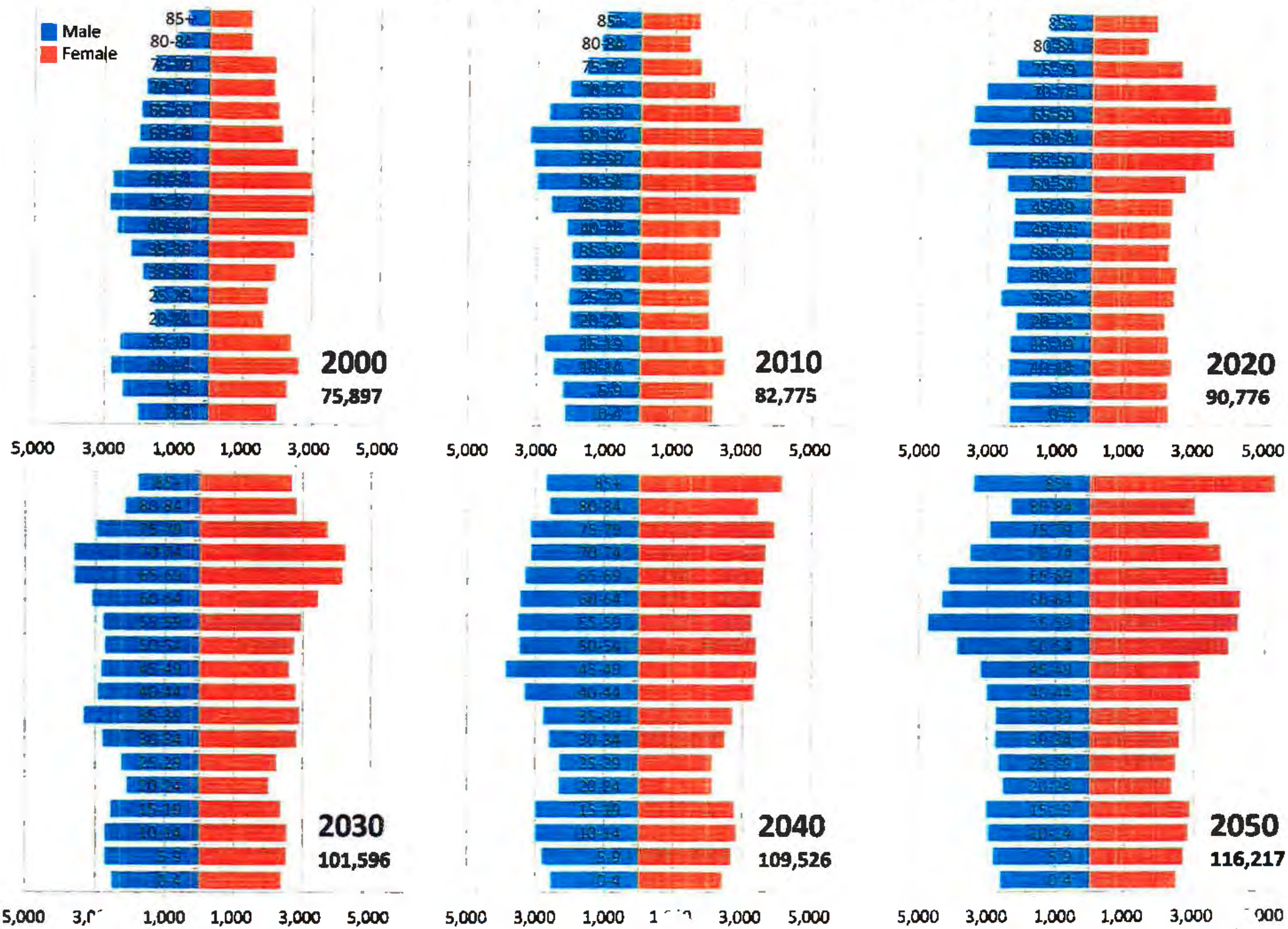
Josephine Co. Population	Area Name	1980	1985	1990	Estimate 1995	2000	2005	2010	FORECAST 2015	2020	2025	2030	2035	2040	2045	2050
Population	Josephine	58,982	60,666	62,985	71,313	75,897	79,134	82,775	85,313	90,776	96,468	101,596	105,829	109,526	112,906	116,217

Components of Change	Area Name	1980-1985	985-1990	990-1995	Estimate 995-2000	000-2005	005-2010	FORECAST 010-2015	015-2020	020-2025	2025-2030	2030-2035	2035-2040	2040-2045	2045-2050
Population Change	Josephine	1,684	2,319	8,328	4,584	3,237	3,641	2,538	5,463	5,692	5,128	4,233	3,697	3,381	3,311
Annualized Growth Rate	Josephine	0.56%	0.75%	2.48%	1.25%	0.84%	0.90%	0.60%	1.24%	1.22%	1.04%	0.82%	0.69%	0.61%	0.58%
Number of Births	Josephine	4,158	3,990	3,984	3,978	3,857	4,238	4,039	4,352	4,592	4,659	4,702	4,714	4,789	4,848
Number of Deaths	Josephine	3,107	3,626	4,109	4,739	5,100	5,429	5,605	5,973	6,556	7,295	8,209	8,747	9,130	9,252
Natural Increase (Births - Deaths)	*Josephine*	*1,051*	*364*	*-125*	*-762*	*-1,243*	*-1,191*	*-1,566*	*-1,621*	*-1,964*	*-2,636*	*-3,507*	*-4,033*	*-4,341*	*-4,404*
Death/Birth Ratio	*Josephine*	*0.75*	*0.91*	*1.03*	*1.19*	*1.32*	*1.28*	*1.39*	*1.37*	*1.43*	*1.57*	*1.75*	*1.86*	*1.91*	*1.91*
Net Migration	Josephine	634	1,955	8,453	5,499	4,480	4,832	4,103	7,084	7,656	7,763	7,740	7,730	7,723	7,714

(Calculations by City of Grants Pass in Italics)

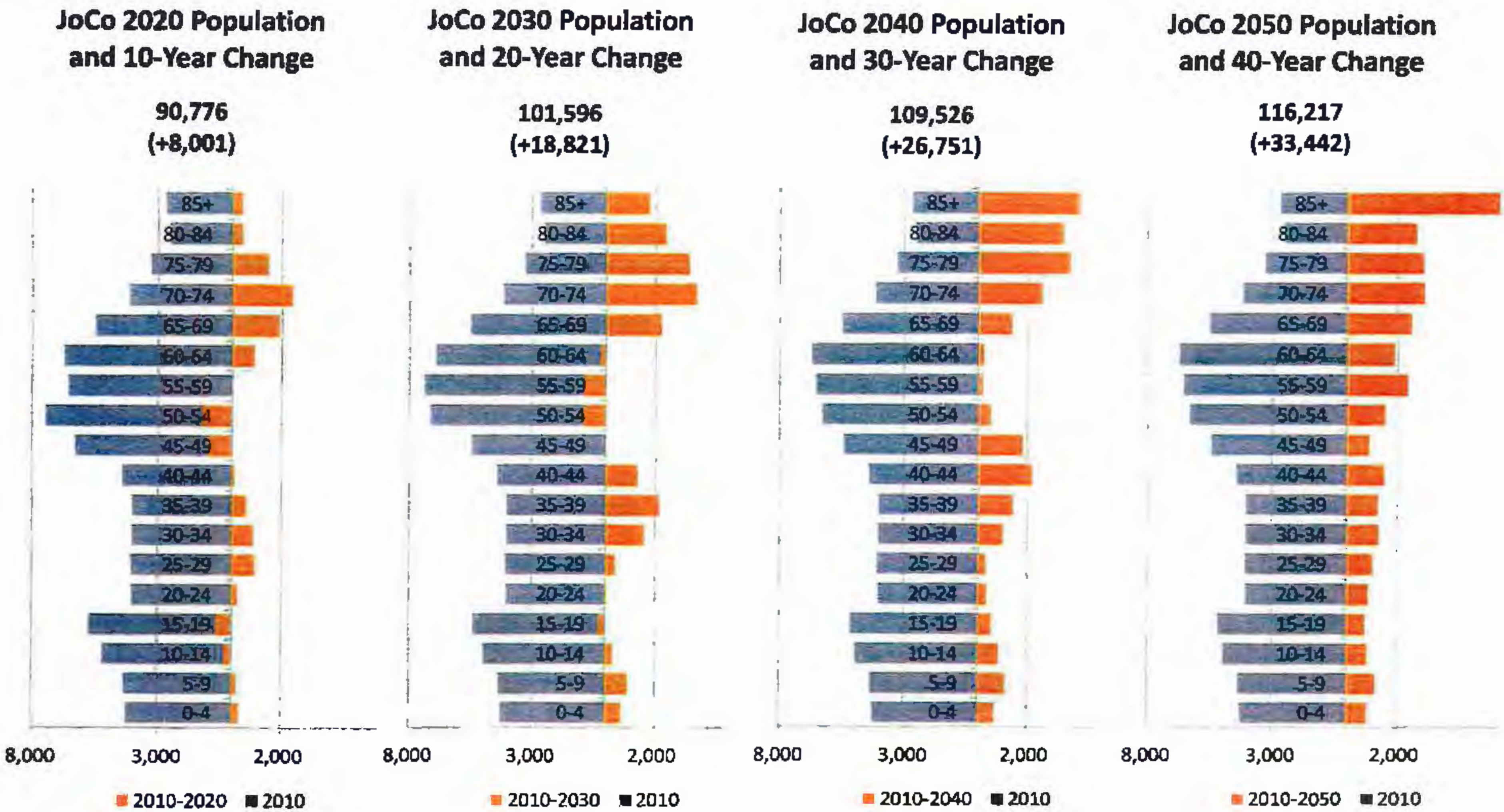
EXHIBIT 1A

Josephine County Population 2000-2050, OEA March 28, 2013 Forecast



Josephine County Population Change from 2010

OEA Final Forecast, March 28, 2013 (by 5-Year Age Group)



Population Census and Estimates

	1990	2000	2010	Difference 1990-2000	2000-2010	1990-2010
City of Grants Pass	17,488	23,003	34,533	5,515	11,530	17,045
Grants Pass UGB (est)	*25,069	32,085	37,928	7,016	5,843	12,859
Unincorporated UGB (est)	*7,581	9,082	3,395			
Josephine County	62,649	75,726	82,713	13,077	6,987	20,064
City Share of County	28%	30%	42%			
UGB Share of County	40%	42%	46%			

Census figures are for April 1

The 1990 data was taken from the previous Comprehensive Plan Population Element.
At least one PSU Table shows the April 1, 1990 population as 17,503 rather than 17,488 (possibly the July 1, 1990 estimate inadvertently referenced).
The 1990 Urbanizing Area estimate was developed using Census Tract data

2000 and 2010 UGB estimates were developed using Census Block data and aggregation
A subsequent calculation of 2000 UGB population resulted in an estimate of 32,148, a difference of 63

EXHIBIT 2

Final Grants Pass Urban Area Draft Forecast Methodology

Based on OEA March 28, 2013 Final Forecast for Josephine County, with Modified JoCo Base Year, Unmodified JoCo Growth Rates

Year	Jo Co	Share	GPUGB
2010	82,775	0.458	37,928
2011	82,820	0.459	38,055
2012	82,775	0.461	38,135
2015	84,289	0.464	39,110
2020	89,686	0.474	42,511
2025	95,310	0.484	46,130
2030	100,376	0.494	49,586
2035	104,558	0.502	52,488
2040	108,211	0.507	54,863
2045	111,550	0.512	57,114
2050	114,822	0.517	59,363
2013	83,276	0.460	38,307
2033	102,865	0.500	51,433
2043	110,202	0.510	56,203

Five-year figures for GPUA are only intended as interim figures necessary to develop figures for 2013, 2033, and 2043

Estimates for GPUA for 2011 & 2012 based on addition of PSU's 2011 & 2012 City of GP estimates and 2010 Census data for unincorporated UGB

3

ATTACHMENT 3

City of
Grants Pass

MEMO

To:	Josephine County Board of Commissioners
	c/o David Wechner, Josephine County Planning Director
From:	Tom Schauer, City of Grants Pass Senior Planner
Re:	Josephine County Coordinated Population Forecast, 2013 Update
Date:	April 9, 2013

Purpose
This memo outlines a proposed methodology and draft coordinated forecast for the Board's consideration in updating the Josephine County Coordinated Population Forecast consistent with direction and feedback provided by the cities of Grants Pass and Cave Junction.

Background
On March 19, 2008, the Josephine County Board of Commissioners adopted Ordinance 2008-001, which included a coordinated population forecast for Josephine County, including the cities of Grants Pass and Cave Junction. The ordinance included a 20-year forecast for 2007-2027, and a longer forecast through 2057. The cities of Grants Pass and Cave Junction adopted forecasts consistent with the coordinated forecast. The City of Grants Pass adopted a population forecast by Ordinance 5432 in February 2008. The City of Cave Junction adopted a population forecast by Resolution 694 in February 2007.

Update
In March 2013, the Oregon Office of Economic Analysis (OEA) issued a new long-term population forecast for Oregon and its counties through 2050. They initially issued a preliminary draft on January 2, and the final forecast on March 28. On March 20, the Grants Pass City Council adopted Resolution 6049 in support of amending the population forecast for the Grants Pass urban area using a methodology based on the new OEA forecast. The final methodology and forecast, consistent with the adopted resolution, are outlined in a separate memo dated April 3, 2013.

We contacted staff at the City of Cave Junction to determine how a proposal for a new coordinated forecast should address Cave Junction. Cave Junction staff informed us they want to retain their adopted forecast, rather than adopt a revised forecast. In a subsequent conversation with their contracted planner, it is my understanding they may be open to consideration of a revised forecast.

While the original coordinated forecast identified a 20-year 2007-2027 planning period, the methodology also covered a time period through 2057, making it possible to update the forecast to be consistent with the planning periods for the respective jurisdictions without necessitating an amendment to the coordinated forecast to extend the forecast period. The original forecast covered a 50-year period from 2007-2057, divided into two periods: 2007-2027 and 2027-2057, initially providing the greatest flexibility for optional planning scopes, corresponding to a 20-year UGB planning period, and the option of an additional 30-year Urban Reserve planning period, as outlined in state law.

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On March 20, the Grants Pass City Council voted to use a new forecast and plan for a 20-year UGB and an additional 10-year Urban Reserve boundary, so the forecast period is 2013-2043. Cave Junction has not updated their planning period, retaining a 2007-2027 planning period. Since the OEA forecast extends through 2050, the County coordinated forecast extends through the same period. It is not necessary to extend the forecast beyond the OEA period through 2057 and 2060 as with the previous forecast.

Methodology

Grants Pass. The methodology and forecast for the Grants Pass urban area is provided in a separate memo dated April 3, 2013. It is based on a share of total county population, with a gradually increasing share as has occurred historically.

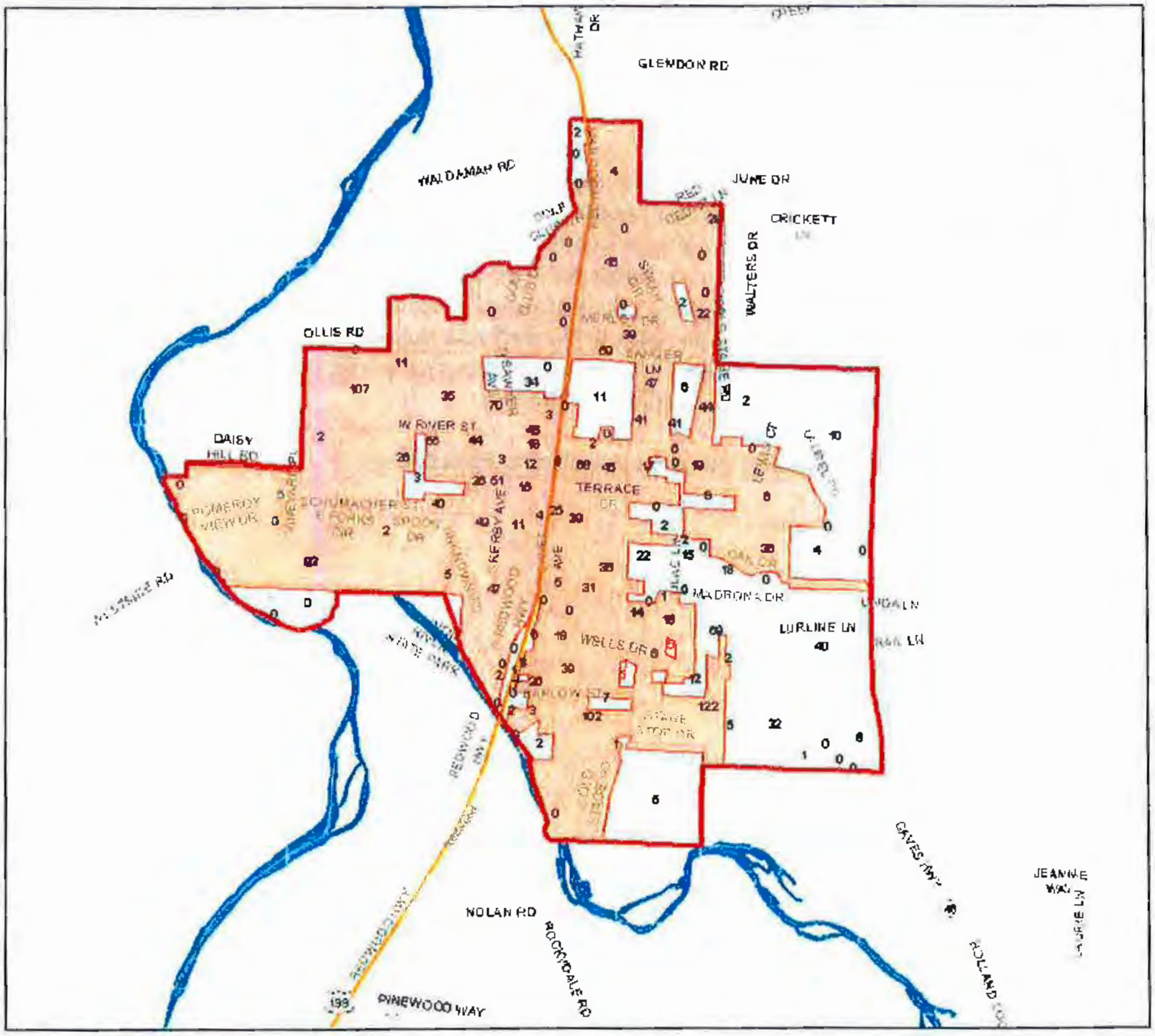
Cave Junction. The Cave Junction forecast specified growth to a population of 5,500 people in 2027. The actual growth during the originally forecast years 2007-2012 has been less than the forecast for those years. Therefore, there are a couple options for incorporating the Cave Junction forecast into the updated County coordinated forecast in a manner that doesn't amend the Cave Junction forecast, as they requested. First, the forecast could be updated by retaining the original figures and growth rates, recognizing they have differed from actual growth estimates for 2007-2012. However, that overstates their actual base year population, and is confusing when calculating totals relative to the other areas. Second, the base year population could be updated to actual estimates, and the growth rates can be adjusted to rates that would attain 5,500 people by 2027, consistent with Cave Junction's resolution. I have shown the latter in the attached draft.

Therefore, to achieve a population of 5,500 by 2027, the original growth from 2,241 people in 2007 to 5,500 people in 2027 (4.59% AAGR for 2007-2027) has been updated to reflect the 2012 population estimate of 2,204 people. The growth from 2,204 people in 2012 to 5,500 people in 2027 results in a 6.29% AAGR for 2012-2027. The growth rate after 2027 remains the same at a 1.05% AAGR.

Another potential method would be to start with the updated base year population estimate and apply the derived growth rate from original forecast through 2027, starting with the adjusted base population figure. However, this appears to be inconsistent with the original methodology for Cave Junction and would result in an amendment to their forecast without their concurrence, and inconsistent with their adopted resolution. If they choose to consider a revised forecast, this is one possible methodology.

The updated base year population for the Cave Junction Urban Area was developed using the same methodology used for Grants Pass. 2010 Census block data was aggregated to fit the Cave Junction UGB, and the sum of the Census block population figures provided the 2010 UGB population. The 2010 Census population for the City was subtracted to provide the 2010 population of the unincorporated area in the UGB. For 2011 and 2012, this same figure for the unincorporated UGB was added to the PSU population estimates for the city to estimate the total UGB population for those years.

Year	City of Cave Junction (Census and PSU)	Unincorporated UGB	Total UGB
2010	1,885	314	2,199
2011	1,885	314	2,199
2012	1,890	314	2,204



Cave Junction City Limits and Urban Growth Boundary with 2010 Census Block Boundaries and Population

Josephine County. In both their preliminary and final forecasts, OEA began forecasting from the 2010 Census year figures. There are now two years of population estimates since then. In the Grants Pass urban area methodology, staff recommended using the 2011 and 2012 PSU population estimates and applying OEA's growth rates from the 2012 estimate, and that is the methodology City Council approved in the resolution. The OEA forecast provides growth rates for each 5-year period through 2050, and those rates would be applied, starting with the updated base year. This doesn't significantly affect the new growth increment, but better reflects the total population (current and forecast).

The coordinated forecast breaks the county forecast total into the Grants Pass urban area (including the UGB and Urban Reserve areas), the Cave Junction urban area (within the UGB area), and Josephine County unincorporated area outside of the urban area population forecasts. Depending on the management policies to be decided upon by the City Council and Board of County Commissioners, some of the urban area population could initially include rural development that may occur within the Urban Reserve before those lands are included within a UGB (and possibly within the UGB if rural zoning is initially retained).

Format

The draft forecast shows the annual figures achieved by applying the described methodologies. Please recognize that this coordinated forecast is intended to identify a total population for the planning horizon. The forecast is not intended to mean the exact growth rate will be attained for each interim year. A forecast that is over or under the forecast for any given year is likely, and shouldn't be considered to invalidate the forecast. The individual years are provided only as a convenience to facilitate the use of different planning periods for different jurisdictions, and to facilitate future updates to the respective planning periods, if needed, consistent with the adopted forecast, without the need for an amendment to the coordinated forecast.

The draft coordinated forecast figures are attached as ***Exhibit 'A'***.

Table 1. Adjustments for Josephine County Coordinated Population Forecast

Year	Josephine County Growth Rate OEA	Josephine County Population OEA	Josephine County Population Updated Base Yr	Grants Pass Urban Area Share of JoCo	Grants Pass Urban Area Population	Cave Junction Urban Area Growth Rate (Original)	Cave Junction Urban Area Population (Original)	Cave Junction Urban Area Growth Rate (Updated Base Year)	Cave Junction Urban Area Population (Updated Base Year)
	✓	✗	✓	✓	✓	✗	✗	✓	✓
2007							2,241		
2008						4.591%	2,344		
2009						4.591%	2,451		
2010		82,775	82,775	0.4582	37,928	4.591%	2,564		2,199
2011	0.6058%	83,276	82,820	0.4595	38,055	4.591%	2,682		2,199
2012	0.6058%	83,781	82,775	0.4607	38,135	4.591%	2,805		2,204
2013	0.6058%	84,289	83,276	0.460	38,307	4.591%	2,934	6.286%	2,343
2014	0.6058%	84,799	83,781	0.462	38,707	4.591%	3,068	6.286%	2,490
2015	0.6058%	85,313	84,289	0.464	39,110	4.591%	3,209	6.286%	2,646
2016	1.2491%	86,379	85,341	0.466	39,769	4.591%	3,357	6.286%	2,813
2017	1.2491%	87,458	86,407	0.468	40,439	4.591%	3,511	6.286%	2,989
2018	1.2491%	88,550	87,487	0.470	41,119	4.591%	3,672	6.286%	3,177
2019	1.2491%	89,656	88,580	0.472	41,810	4.591%	3,840	6.286%	3,377
2020	1.2491%	90,776	89,686	0.474	42,511	4.591%	4,017	6.286%	3,589
2021	1.2238%	91,887	90,784	0.476	43,213	4.591%	4,201	6.286%	3,815
2022	1.2238%	93,011	91,895	0.478	43,926	4.591%	4,394	6 286%	4,055
2023	1.2238%	94,150	93,019	0.480	44,649	4.591%	4,598	6.286%	4,310
2024	1.2238%	95,302	94,157	0.482	45,384	4.591%	4,807	6.286%	4,581
2025	1.2238%	96,468	95,310	0.484	46,130	4.591%	5,027	6.286%	4,869
2026	1.0412%	97,472	96,302	0.486	46,803	4.591%		6.286%	
2027	1.0412%	98,487	97,305	0.488	47,485	4.591	5,258	6	5,175
2028	1.0412%	99,513	98,318	0.490	48,176	1.054%	5,500	1.054%	5,558
2029	1.0412%	100,549	99,342	0.492	48,876	1.054%	5,558	1.054%	5,616
2030	1.0412%	101,596	100,376	0.494	49,586	1.054%	5,675	1.054%	5,675
2031	0.8198%	102,429	101,199	0.496	50,195	1.054%	5,735	1.054%	5,735
2032	0.8198%	103,268	102,028	0.498	50,810	1.054%	5,796	1.054%	5,796
2033	0.8198%	104,115	102,865	0.500	51,431	1.054%	5,857	1.054%	5,857
2034	0.8198%	104,969	103,708	0.501	51,958	1.054%	5,918	1.054%	5,918
2035	0.8198%	105,829	104,558	0.502	52,488	1.054%	5,981	1.054%	5,981
2036	0.6891%	106,558	105,279	0.503	52,955	1.054%	6,044	1 054%	6,044
2037	0.6891%	107,293	106,004	0.504	53,426	1.054%	6,107	1.054%	6,107
2038	0.6891%	108,032	106,735	0.505	53,901	1.054%	6,172	1.054%	6,172
2039	0.6891%	108,776	107,470	0.506	54,380	1.054%	6,237	1.054%	6,237
2040	0.6891%	109,526	108,211	0.507	54,863	1.054%	6,303	1.054%	6,303
2041	0.6097%	110,194	108,871	0.508	55,306	1.054%	6,369	1.054%	6,369
2042	0.6097%	110,866	109,534	0.509	55,753	1.054%	6,436	1.054%	6,436
2043	0.6097%	111,542	110,202	0.510	56,203	1.054%	6,504	1.054%	6,504
2044	0.6097%	112,222	110,874	0.511	56,657	1.054%	6,573	1.054%	6,573
2045	0.6097%	112,906	111,550	0.512	57,114	1.054%	6,642	1.054%	6,642
2046	0.5797%	113,561	112,197	0.513	57,557	1.054%	6,712	1.054%	6,712
2047	0.5797%	114,219	112,847	0.514	58,004	1.054%	6,783	1.054%	6,783
2048	0.5797%	114,881	113,502	0.515	58,453	1.054%	6,854	1.054%	6,854
2049	0.5797%	115,547	114,160	0.516	58,906	1.054%	6,926	1.054%	6,926
2050	0.5797%	17	1	0.517	59,363	1.054%	6,999	1.054%	999
Blue =	mate	116,2	14,822						6.

Black = Forecast Census/Esti

Updated estimates for Urban Areas start with 2010 Census data

Table 2. Josephine County Coordinated Population Forecast to 2050

April 4, 2013 Update

Year	Josephine County	Grants Pass Urban Area	Cave Junction Urban Area	JoCo Outside Urban Areas
2007			2,241	
2008				
2009				
2010	82,775	37,928	2,199	42,648
2011	82,820	38,055	2,199	42,566
2012	82,775	38,135	2,204	42,436
2013	83,276	38,307	2,343	42,627
2014	83,781	38,707	2,490	42,584
2015	84,289	39,110	2,646	42,532
2016	85,341	39,769	2,813	42,760
2017	86,407	40,439	2,989	42,979
2018	87,487			43,191
2019	88,580	41,119	3,177	43,393
2020	89,686	41,810	3,377	43,585
2021	90,784	42,511	3,589	43,756
2022	91,895	43,213	3,815	43,914
2023	93,019	43,926	4,055	44,060
2024	94,157	44,649	4,310	44,193
2025	95,310	45,384	4,581	44,311
2026	96,302	46,130	4,869	44,325
2027	97,305	46,803	5,175	44,320
2028	98,318	47,485		44,585
2029	99,342	48,176	5,616	44,849
2030	100,376	48,876	5,675	45,115
2031	101,199	49,586	5,735	45,269
2032	102,028	50,195	5,796	45,423
2033	102,865	50,810	5,857	45,576
2034	103,708		5,918	45,832
2035	104,558	51,958	5,981	46,089
2036	105,279	52,488	6,044	46,280
2037	106,004	52,955	6,107	46,471
2038	106,735	53,426	6,172	46,662
2039	107,470	53,901	6,237	46,853
2040	108,211	54,380	6,303	47,045
2041	108,871	54,863	6,369	47,195
2042	109,534	55,306	6,436	47,345
2043	110,202	55,753	6,504	47,495
2044	110,874	56,657	6,573	47,645
2045	111,550	57,114	6,642	47,795
2046	112,197	57,557	6,712	47,928
2047	112,847	58,004	6,783	48,061
2048	113,502	58,453	6,854	48,194
2049	114,160	58,906	6,926	48,327
2050	114,822	59,363	6,999	48,459

Blue = Census/Estimate
Black = Forecast

UGB/UR planning periods for jurisdictions shaded orange

ATTACHMENT 4

City of
Grants Pass

WHERE THE ROGUE RIVER RUNS

March 6, 2013

**RE: Grants Pass Urban Growth Boundary (UGB) Work
Population Forecast and Scope of Work**

Dear Grants Pass UGB Interested Parties:

In January, the Oregon Office of Economic Analysis (OEA) issued a new draft Long-Term Population Forecast for Oregon and its Counties, the first they have issued since 2004. They expect to issue their final forecast in March.

On Wednesday, March 20, 2013 the Grants Pass City Council will consider a resolution to decide whether to continue the UGB planning work based on the adopted population forecast, or whether to initiate use of a new forecast based on OEA's new forecast for Josephine County. They will also decide on the scope of work to undertake if they decide to use a new forecast. The City Council will take public testimony on this issue.

If the Council decides to proceed with a new population forecast, their decision on March 20 will not adopt a new forecast, but it will initiate the work to begin the process. Therefore, their decision on March 20 will not be a land-use decision.

Any amendment to the Comprehensive Plan, including any revisions that would adopt a new forecast, will only be adopted by ordinance following a public hearing process, with separate public notice provided. Since the forecast is not property-specific, hearing notice for that item will not be mailed to individual property owners unless it occurs at the same time as property-specific decisions; however, notice for items that are not property-specific will continue to be provided to persons who have requested notification as interested parties for the UGB work.

The decision regarding the population forecast and scope must be jointly agreed upon by the Grants Pass City Council and Josephine County Board of Commissioners. The Board of Commissioners will meet and deliberate on this issue separately. They have not yet set a meeting date for this item.

What:	Grants Pass City Council Meeting Resolution to Consider Population Forecast and Scope of Work
When:	Wednesday, March 20, 6:00pm
Where:	Grants Pass City Council Chambers 101 NW 'A' Street, Grants Pass, OR 97526

If special physical or language accommodations are needed for this Public Session, please notify Karen Frerk (450-6000) at least 48 hours prior to session.

A copy of the powerpoint presentation from the March 4, 2013 workshop will be available on the City website. The agenda and packet materials for the March 20 City Council meeting will be posted on the City website the Friday before the meeting. On the City website, these materials can be found at: www.GrantsPassOregon.gov > *Your Government* > *Parks & Community Development* > *Planning Division* > *Urban Growth Boundary Evaluation* > *Latest News*

Please contact the Grants Pass Parks & Community Development Department at (541) 450-6060 if you have questions.

101 Northwest "A" Street • Grants Pass, Oregon 97526 • (541) 474-6360 • FAX (541) 479-0812 • www.grantspassoregon.gov

REGISTERED PROFESSIONAL ENGINEER
19616
OREGON
FEB. 6, 1998
JEFFREY F. McCORMICK
EXPIRES: 12/31/14

City of Grants Pass

TECHNICAL MEMORANDUM NO. 3

Water Restoration Plant Facility Plan
Influent Flows and Loads

FINAL

March 2013

720 SOUTHWEST WASHINGTON STREET, SUITE 550 • PORTLAND, OREGON 97205-3507 • (503) 227-1885 • FAX (503) 227-1747

City of Grants Pass

TECHNICAL MEMORANDUM NO. 3

Water Restoration Plant Facility Plan
Influent Flows and Loads

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INFLUENT FLOWS AND LOADS

1.0 INTRODUCTION

Wastewater flow and load analysis and projections are one of the key factors affecting wastewater facilities planning and design. This technical memorandum (TM) presents an evaluation of historical wastewater flows and loads entering the Grants Pass Water Restoration Plant (WRP), and establishes flow and load projections associated with anticipated growth. The historical flows and loads are based on the analysis of historical influent flow data from January 2007 through April 2012. Flow and load projections are based upon the population projections presented in the City's Comprehensive Plan (2007). Peak hour and day flows were determined in the Sewer System Capacity Analysis TM (Carollo, 2013).

1.1 Regulatory Seasons

The Department of Environmental Quality (DEQ) typically structures National Pollutant Discharge Elimination System (NPDES) permit limitations so that there is a seasonal distinction between treatment requirements. The DEQ defines the dry weather season as May through October and the wet weather season as November through April. For the purpose of this analysis, the wet weather seasons were analyzed under each *water year* as opposed to calendar year. For example, the 2007 wet weather flows were determined by using data from November 2007 through April 2008 instead of utilizing January 2007 through April 2007 and November 2007 through December 2007.

1.2 Definitions

The flow parameters of primary interest for planning purposes are defined as follows:

- **Average Dry Weather Flow (ADWF)**. The average of daily flows over the six-month dry weather season, May 1 through October 31.
- **Average Wet Weather Flow (AWWF)**. The average flow at the plant during the wet weather season (November 1 through April 30) during a year with average rainfall.
- **Average Annual Flow (AAF)**. The average daily influent flow that is anticipated at the treatment plant.
- **Maximum Month Dry Weather Flow (MMDWF)**. The monthly average flow corresponding to the wettest dry weather month of high groundwater with a 10 percent probability of occurrence in any given year. The recurrence interval of this flow is ten years.
- **Maximum Month Wet Weather Flow (MMWWF)**. The anticipated monthly average flow corresponding to the wettest wet weather month of high groundwater with a 20 percent probability of occurrence in any given year. The recurrence interval of this flow is five years.

- **Peak Day Flow (PDF)**. The anticipated daily flow resulting from a 24-hour storm with a 1-in-5 year recurrence interval during a period of high groundwater and saturated soils.
- **Peak Hour Flow (PHF)**. The peak flow sustained for one hour during the 24-hour, five-year return frequency storm at a time when groundwater levels are high and soils are already saturated by previous storms.

1.3 Rainfall Records

Rainfall has a large effect on flow rates and, therefore, DEQ flow analysis guidelines incorporate rainfall records into the recommended statistical analysis. Daily rainfall data collected at the Grants Pass WRP have been used for this analysis. Statistical summaries of climatological data prepared by National Oceanic and Atmospheric Administration (NOAA) were also used in the analysis.

1.4 Raw Sewage Flows and Loads

The Grants Pass WRP primarily serves residential, commercial, and light industrial flow from the Grants Pass WRP service area. A description of the service area is provided in the Sewer System Capacity Analysis TM. The WRP provides liquid stream treatment, including primary and secondary treatment in addition to solids stream treatment.

1.5 Base Flow and Load Projections

Population and ADWF projections are presented in the Sewer System Capacity Analysis TM. Base loading projections are based on historical loadings and population estimates. Table 1 presents a summary of the population and flow estimates in the Grants Pass WRP service area.

Table 1 City of Grants Pass WRP Service Area Population and Flow Estimates
City of Grants Pass – Influent Flows and Loads

Year	Population Projections	ADWF Projections, mgd
Current	41,766	5.2
2027	57,888	7.2
2035	62,951	7.8
Build-out(1)	64,961	8.1

Notes:
(1) Projected build-out for the currently adopted urban growth boundary occurs in 2038.

2.0 HISTORICAL FLOW ANALYSIS

The current residential and commercial/light industrial flows for the WRP were established through analysis of historical influent flow records from January 2007 to April 2012. Figure 1 presents the average dry weather influent flows from January 2007 to April 2012. As illustrated in Figure 1, the average dry weather flow in the service area remained constant during the period of analysis, although the population was projected to increase.

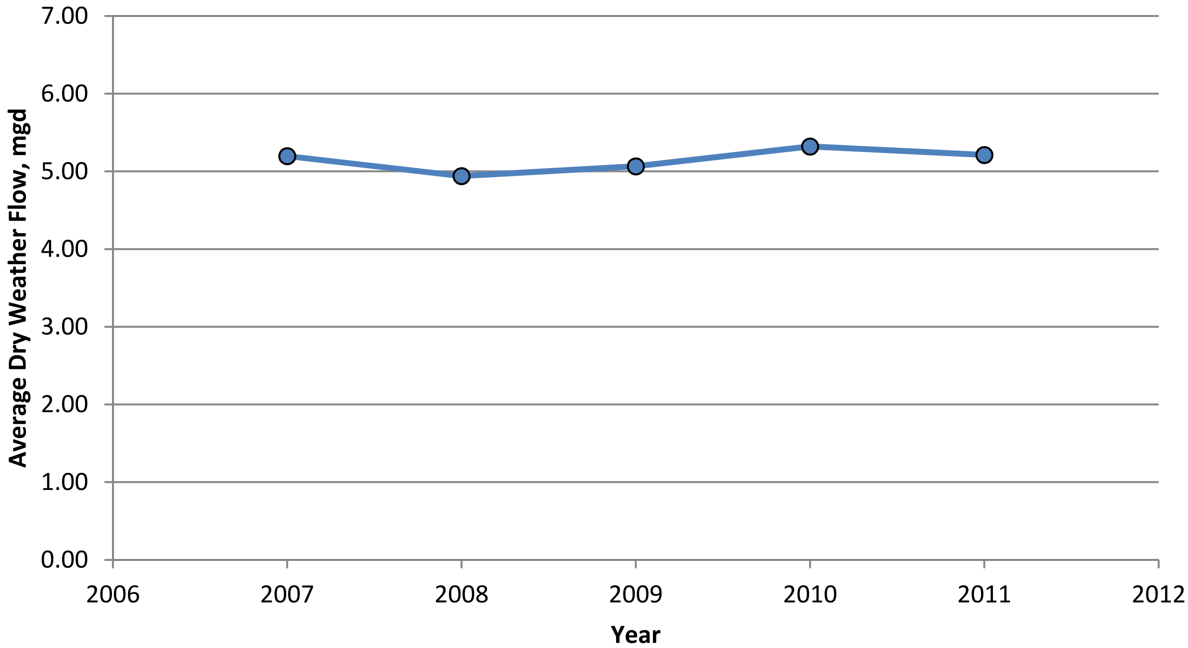

Figure 1 Average Monthly Influent Flows

2.1 Average Dry Weather/Wet Weather Flows

Table 2 presents the seasonal summary of rainfall and influent plant flows for the period January 2007 through April 2012. Seasonal values shown in the table indicate that the influent flows are highly dependent upon rainfall. This rainfall dependence indicates that infiltration and inflow (I/I) sources significantly contribute to the total wastewater flow. Therefore, in order to accurately estimate average plant flows, it is necessary to use flow periods that are in the range of mean climatological conditions experienced in the treatment plant's service area. The NOAA climatological data summaries indicate that the dry weather season (May through October), and wet weather season (November though April) mean rainfalls for the Grants Pass area are 5.58 inches and 25.88 inches, respectively.

Table 2	Summary of Wet and Dry Season Rainfall and Influent Flow *City of Grants Pass – Influent Flows and Loads*		
Season	**Year**(1)	**Total Rainfall** ***(inches)***	**Average Plant Influent Flow** ***(mgd)***
Dry Season	2007	6.2	5.20
(May through October)	2008	2.4	4.94
	2009	7.2	5.07
	2010	8.8	5.32
	2011	6.4	5.21
Average Dry Season		**6.2**(2)	**5.15**
Wet Season	2007	21.9	6.52
(November through April)	2008	17.4	5.35
	2009	21.1	6.35
	2010	30.4	8.00
	2011	24.9	6.45
Average Wet Season		**23.1**(2)	**6.53**

Notes:
(1) For wet weather, water year is used instead of calendar year. For example, 2007 consists of flow data from November 2007 to April 2008.
(2) Long-term average dry weather (May - October) rainfall = 5.58 inches. Long-term average wet weather (November - April) rainfall = 25.88 inches.

As shown in Figure 2, the ADWF is determined based on the relationship developed between total rainfall and average influent flow for the dry season. Based on the average rainfall conditions, the ADWF for Grants Pass WRP is estimated at 5.1 mgd (million gallons per day).

Similarly, the AWWF is determined based on the relationship developed between total rainfall and average influent flow for the wet season. As shown in Figure 3, the current AWWF is determined by the intersection of the average long-term wet weather precipitation (25.88 inches) with a system response curve based on regression analysis of the historical data. Using this data, the AWWF is 7.1 mgd.

Simple averages are calculated for each season from 2007 to 2011 and presented in Table 2. The ADWF average corresponds well with DEQ methodology. However, the AWWF is not as close. This is primarily due to the lower-than-average rainfall during the wet season, as compared to the long-term historical average.

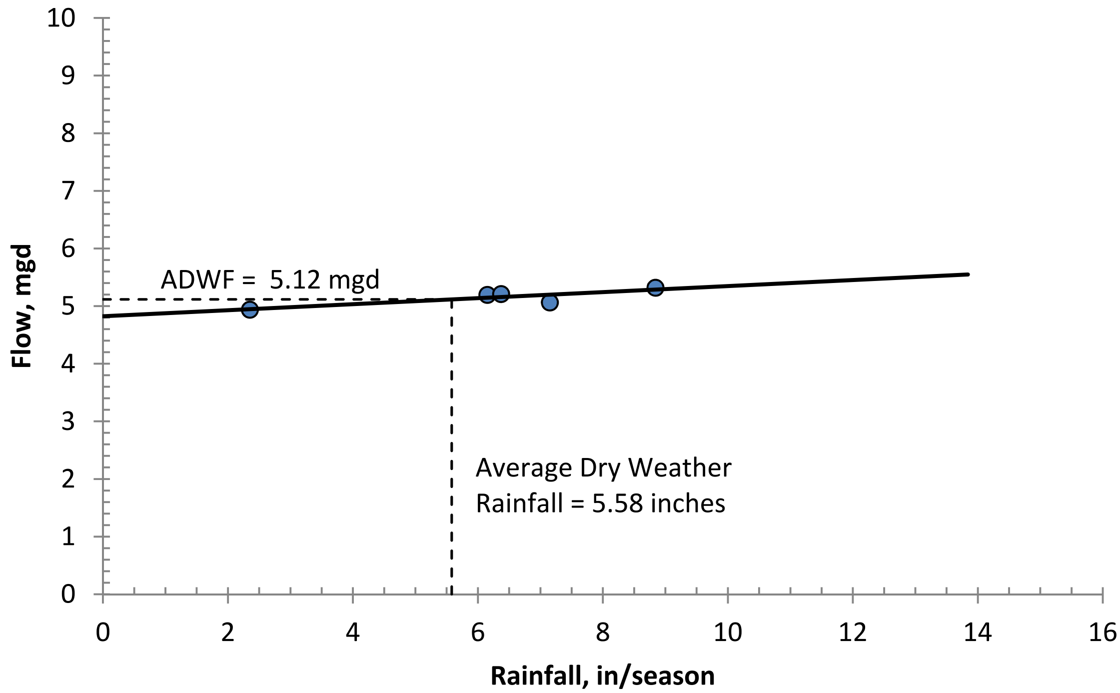

Figure 2 Average Dry Weather Flow

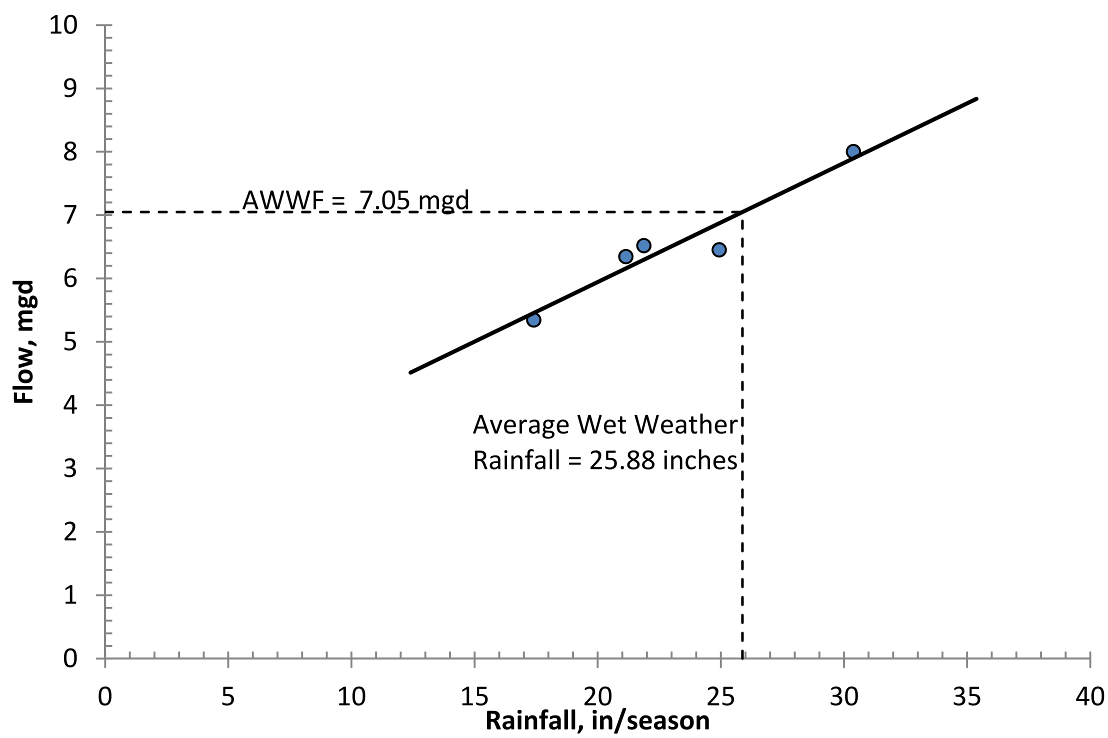

Figure 3 Average Wet Weather Flow

2.2 Maximum Month Flows

The DEQ methodology for estimating maximum month flows consists of plotting monthly average plant flow for the months of January through May against the corresponding monthly rainfall, and developing a linear relationship between flow and rainfall.

The maximum month dry weather flow (MMDWF) is defined as the flow that is expected to occur with a rainfall with a 1-in-10 year probability for the wettest month of the dry weather season. October is the wettest dry weather month for the area, but the average May rainfall is used for this analysis because groundwater levels are higher in the spring. For Grants Pass, the 1-in-10 year May rainfall is 2.65 inches. By approximating a linear relationship between the influent flow and rainfall, as illustrated in Figure 4, the MMDWF is estimated at 6.3 mgd.

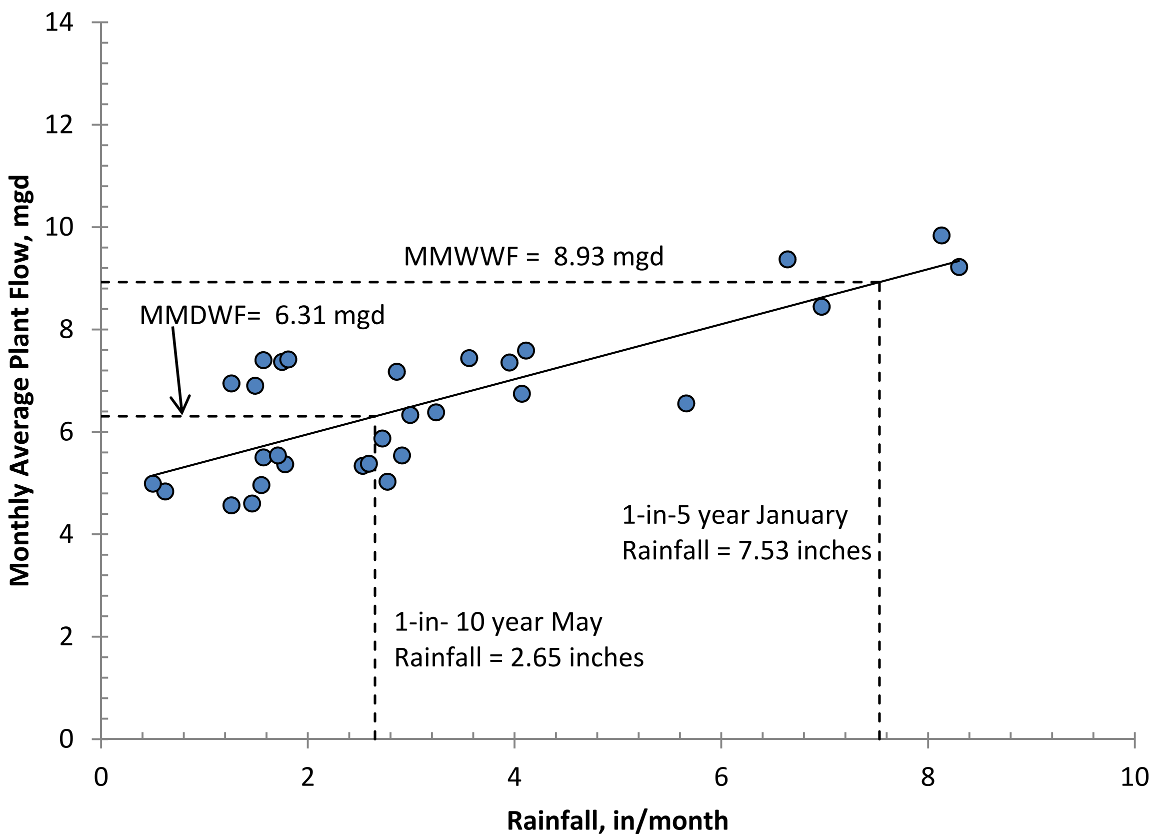

Figure 4 Maximum Month Flows

Similarly, the maximum month wet weather flow (MMWWF) is defined as the flow expected to occur when rainfall is at the 1-in-5 year high rainfall (7.53 inches). For the Grants Pass WRP service area, January is the wettest month of the year. From Figure 4, the MMWWF is estimated at 8.9 mgd.

The range of MMWWFs observed between 2007 and 2011 is 6.4 to 10.3 mgd, while the range of MMDWFs observed during the same period is 5.3 to 5.5 mgd (Table 3). MMWWF calculated using the DEQ method is less than the maximum month flows observed during the last 5 years (excluding 2009). The DEQ method produces a lower MMWWF than what is derived from historical data, because it is based solely on the months of January through May. December is a consistently wet month in Grants Pass; therefore, not including that month results in lower projected flows. Furthermore, with the exception of 2010 the average wet weather rainfall during the past five years was well below the long-term average. Therefore, the recommended MMWWF is 10.3 mgd because it corresponds well to the year 2010 where rainfall was similar to the long-term average for the season and accounts for the high flows that can occur in December.

Table 3 Historical Maximum Month Dry and Wet Weather Flows
City of Grants Pass – Influent Flows and Loads

Year[(1)]	MMDWF, mgd	MMWWF, mgd
2007	5.5	9.4
2008	5.3	6.4
2009	5.3	7.6
2010	5.5	10.3
2011	5.4	9.2
Max	**5.5**	**10.3**

Notes:
(1) For wet weather, water year is used instead of calendar year. For example, 2007 consists of flow data from November 2007 to April 2008.

MMDWF calculated using the DEQ method is greater than the maximum month flows observed during the last 5 years. This is in spite of dry season rainfall averages greater than the long-term average for each year (except 2008). From November 2010 to November 2011, the average rainfall for both seasons is above average, and the May rainfall was above the DEQ 1-in-10 year level. During this time, the MMDWF was 5.5 mgd, significantly below that predicted by the DEQ methodology. However, in order to provide a more conservative design basis, the value of 6.3 mgd shown in Figure 4 is recommended for planning purposes.

2.3 Peak Day and Peak Hour Flows

The peak day flow (PDF) is defined as the daily average plant flow rate that occurs during the 1-in-5 year, 24-hour storm event. According to DEQ's methodology, PDF is estimated based on the linear relationship that exists between the daily average plant influent flow data during significant wet season storm events and daily rainfall.

A PDF of 19.6 mgd was estimated using the DEQ methodology. However, PDF was determined to be 21.7 mgd in the Sewer System Capacity Analysis TM. The 21.7 mgd flow from the Sewer System Capacity TM is recommended over the DEQ method, because its higher value results in a more conservative design criterion. Furthermore, its development with a calibrated sewer model provides a more accurate value.

The PHF was calculated as 27.2 mgd in the Sewer System Capacity Analysis TM.

2.4 Influent Flow Summary

Table 4 provides a summary of the current influent flows from the City of Grants Pass' service area, along with their associated peaking factors. The peaking factor is calculated based on the ADWF. As an example, the peaking factor for MMWWF will be the computed MMWWF of 10.1 mgd divided by the ADWF (5.2 mgd), or 1.94.

Table 4 Current Wastewater Flows
City of Grants Pass – Influent Flows and Loads

Flow Parameter	Flow, mgd	Peaking Factor[(1)]
Average Dry Weather Flow (ADWF)	5.2	1.00
Average Annual Flow (AAF)	6.2	1.19
Average Wet Weather Flow (AWWF)	7.1	1.36
Maximum Month Dry Weather Flow (MMDWF)	6.3	1.21
Maximum Month Wet Weather Flow (MMWWF)	10.3	1.98
Peak Day Flow (PDF)	21.7	4.17
Peak Hour Flow (PHF)	27.2	5.23

Notes:
(1) Peaking factor based upon ADWF.

Table 5 presents a comparison of the current peaking factors to the 2001 Facilities Plan. The current peaking factors compare reasonably well with the updated values, with the exception of MMDWF and PDF. The increase in the peaking factors may be associated with the general upward trend in the observed flows associated with the aging of the pipes in the collection system.

Table 5 Comparison of Peaking Factors to 2001 Facilities Plan
City of Grants Pass – Influent Flows and Loads

Flow Parameter	Recommended Peaking Factor	2001 Facilities Plan Peaking Factor
Average Dry Weather Flow (ADWF)	1.00	–
Average Annual Flow (AAF)	1.19	1.13
Average Wet Weather Flow (AWWF)	1.36	1.27
Maximum Month Dry Weather Flow (MMDWF)	1.21	1.49
Maximum Month Wet Weather Flow (MMWWF)	1.98	2.00
Peak Day Flow (PDF)	4.17	3.20
Peak Hour Flow (PHF)	5.23	5.00

2.5 Current Per-Capita Flows

The current estimated ADWF of 5.2 mgd includes residential, commercial, and industrial flow components. The per capita flow has remained approximately stagnant since 2008, and averaged 132 gallons per capita/day (gpcd) for the period of 2007 to 2011 (Table 6). Although 132 gpcd is higher than typical, it is similar to the 120 gpcd determined in the 2001 Facilities Plan.

Table 6 Per Capita Flows
City of Grants Pass – Influent Flows and Loads

Year	ADWF (mgd)	Population[(1)]	Flow per Capita (gpcd)
2007	5.2	37,460	139
2008	4.9	38,284	129
2009	5.1	39,126	130
2010	5.3	39,987	133
2011	5.2	40,867	128
Average			**132**

Notes:
(1) Population estimates from Comprehensive Plan.

3.0 HISTORICAL WASTEWATER LOADS ANALYSIS

Wastewater loading data are important for determining the sizing of certain treatment processes. The wastewater loading components of principal interest are the five-day biochemical oxygen demand (BOD_5), total suspended solids (TSS), ammonia, and phosphorus. BOD_5 is a measure of the amount of oxygen required to biologically oxidize the organic material in the wastewater over a specific time period. TSS is a measure of the particulate material suspended in the wastewater. The main parameters of interest are the annual average loading, maximum month loading, maximum week loading, and peak day loading.

3.1 BOD_5 and TSS Loading Analysis

Daily BOD_5 and TSS loads for the period of January 2007 to December 2011 are presented in Figures 5 and 6, respectively. Data points for both daily BOD_5 and TSS that showed large influent loads but did not correlate with elevated primary effluent concentrations were considered outliers, and removed in order to prevent the selection of unrepresentative peaking factors. The monthly influent BOD_5 and TSS loading are presented in Figure 7 and 8, respectively. As illustrated in Figure 5, the BOD_5 loading has decreased since 2007 before increasing in a step-like manner during late 2009. After the step-increase, the BOD_5 loading continues the moderate decrease over time as seen from 2007 to early 2009. Similarly, TSS shows a moderate decrease over time from 2007 through 2011. Based on this data, the average annual wastewater loading was 7,300 ppd of BOD_5 and 7,900 ppd of TSS.

Because of the relatively static BOD and TSS loads, average annual load was determined by averaging the daily loads over the entire five-year period. Historical peaking factors for max month, week, and peak day loads were determined by dividing the annual maximum with the average annual load for each year. The maximum of these historical peaking factors were then applied to the average annual load to arrive at the representative historical max month, max week, and peak day loads. Table 7 summarizes the representative historical influent BOD_5 and TSS loads and peaking factors.

Table 7 BOD_5 and TSS Loading Summary
City of Grants Pass – Influent Flows and Loads

Parameter	BOD_5 Load *(ppd)*	Peaking Factor	TSS Load *(ppd)*	Peaking Factor
Average Annual	7,300	1.00	7,900	1.00
Max Month	9,100	1.24	11,000	1.40
Max Week	11,800	1.62	12,400	1.57
Peak Day	16,100	2.20	20,500	2.60

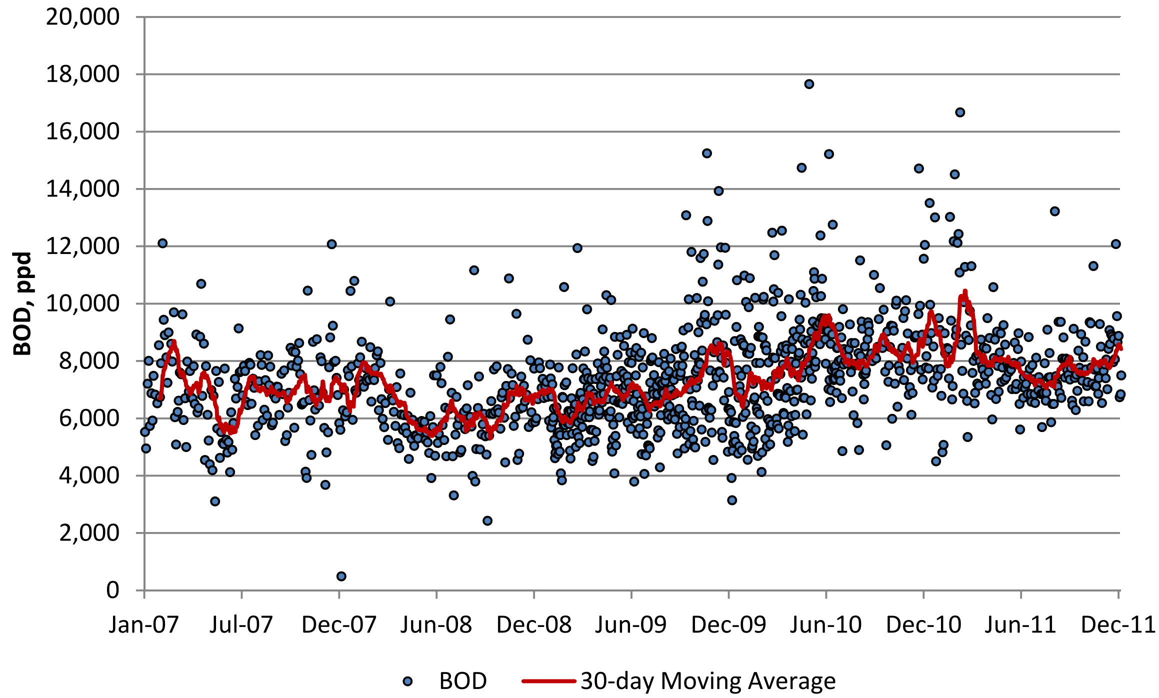

Figure 5 **Daily BOD_5 Loading 2007-2011**

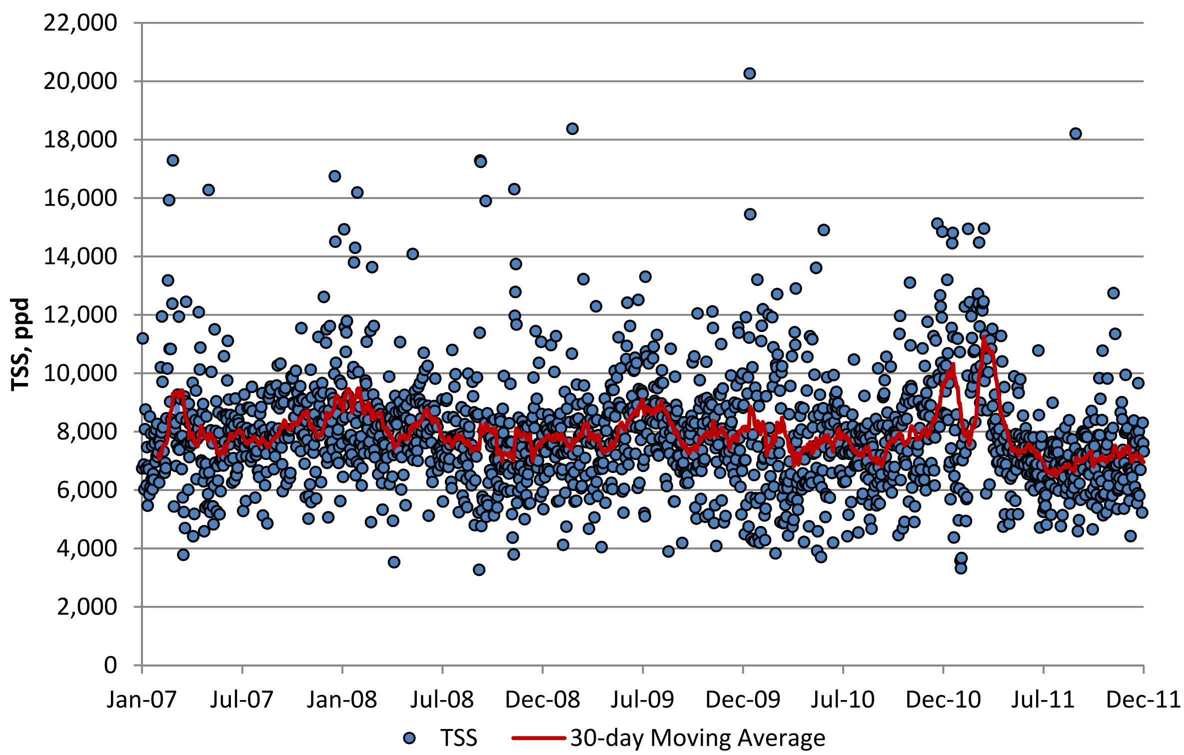

Figure 6 **Daily TSS Loading 2007-2011**

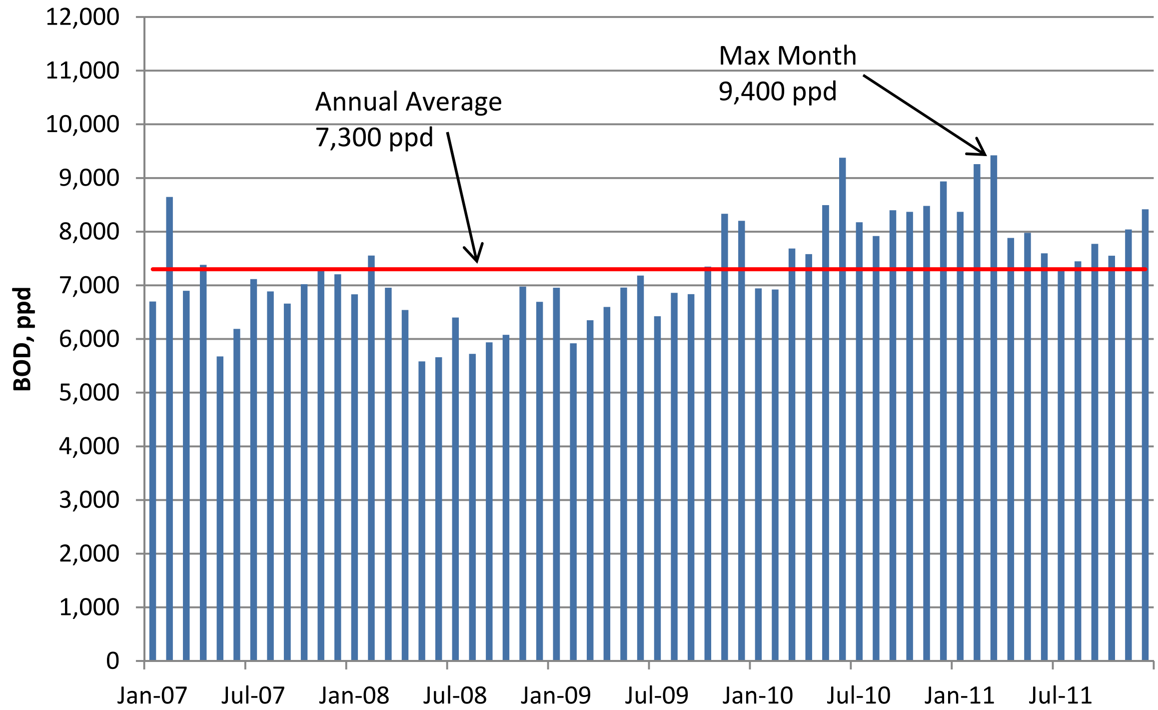

Figure 7 Monthly BOD_5 Loading 2007-2011

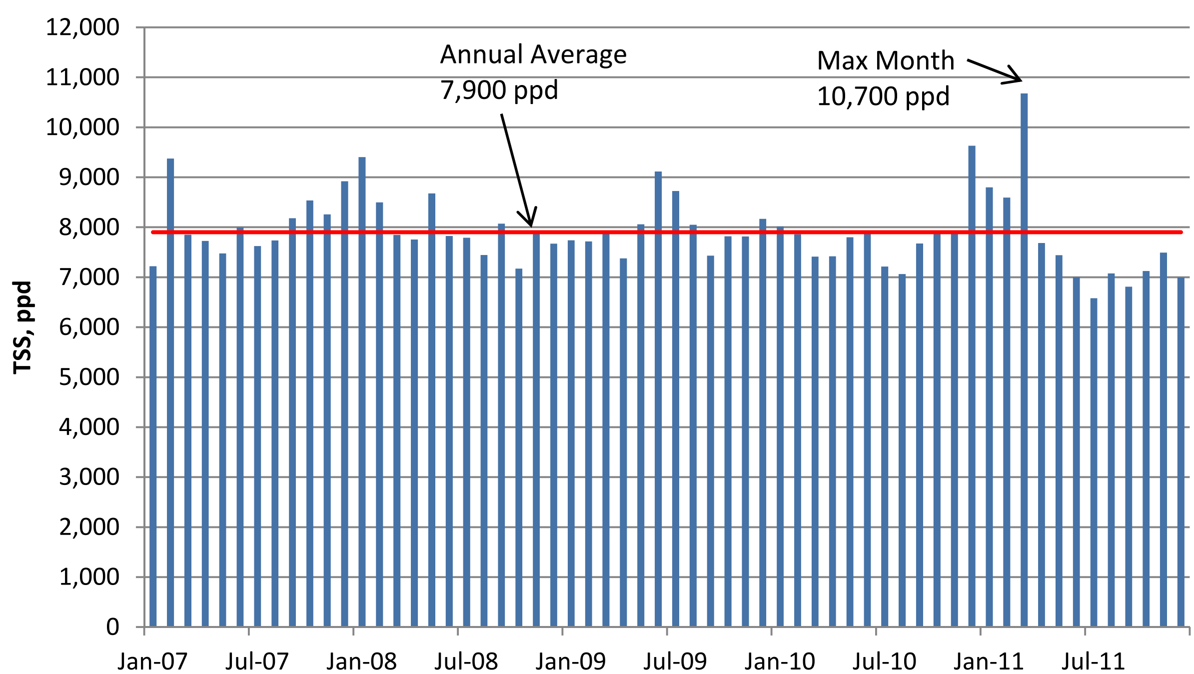

Figure 8 Monthly TSS Loading 2007-2011

3.2 Ammonia Loading Analysis

Similar to the BOD_5 and TSS analysis, weekly and monthly ammonia loading for the period January 2007 to December 2011 are presented in Figures 9 and 10, respectively. Representative historical values were calculated identical to the values derived for BOD_5 and TSS. A summary of ammonia loading is presented in Table 8.

Table 8	**Ammonia Loading Summary** ***City of Grants Pass – Influent Flows and Loads***	
Parameter	**Ammonia Load *(ppd)***	**Peaking Factor**
Average Annual	810	1.0
Max Month	1,070	1.3
Peak Day	1,300	1.6

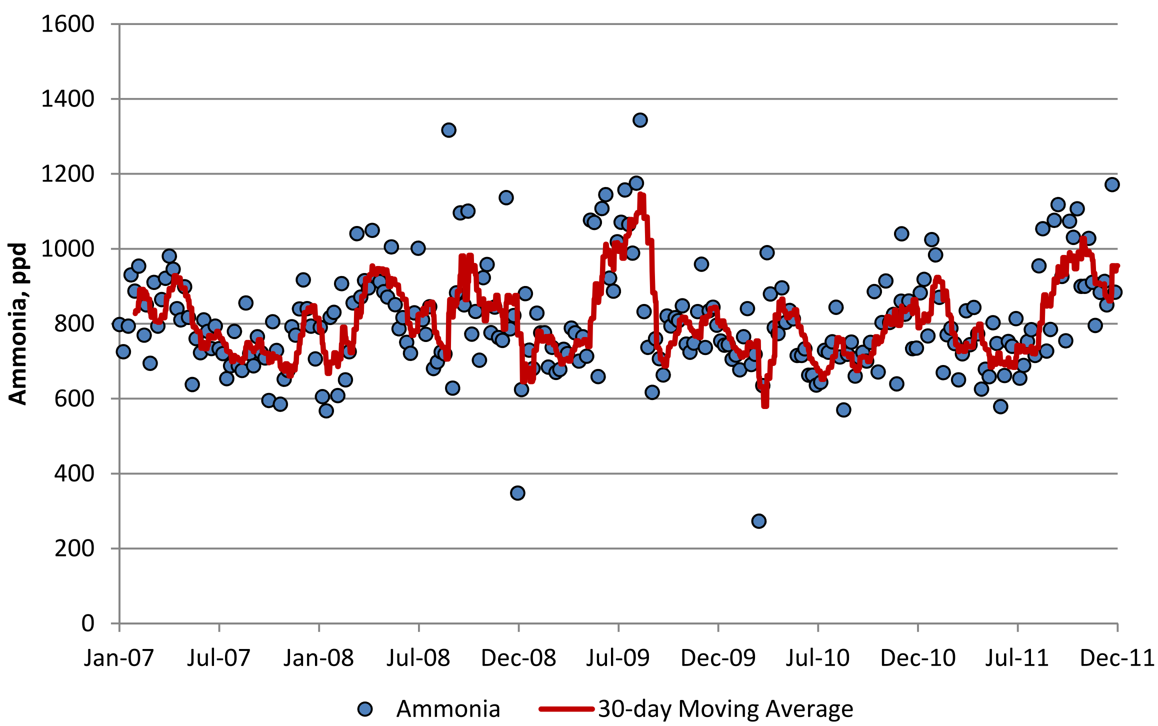

Figure 9 Weekly Ammonia Loading

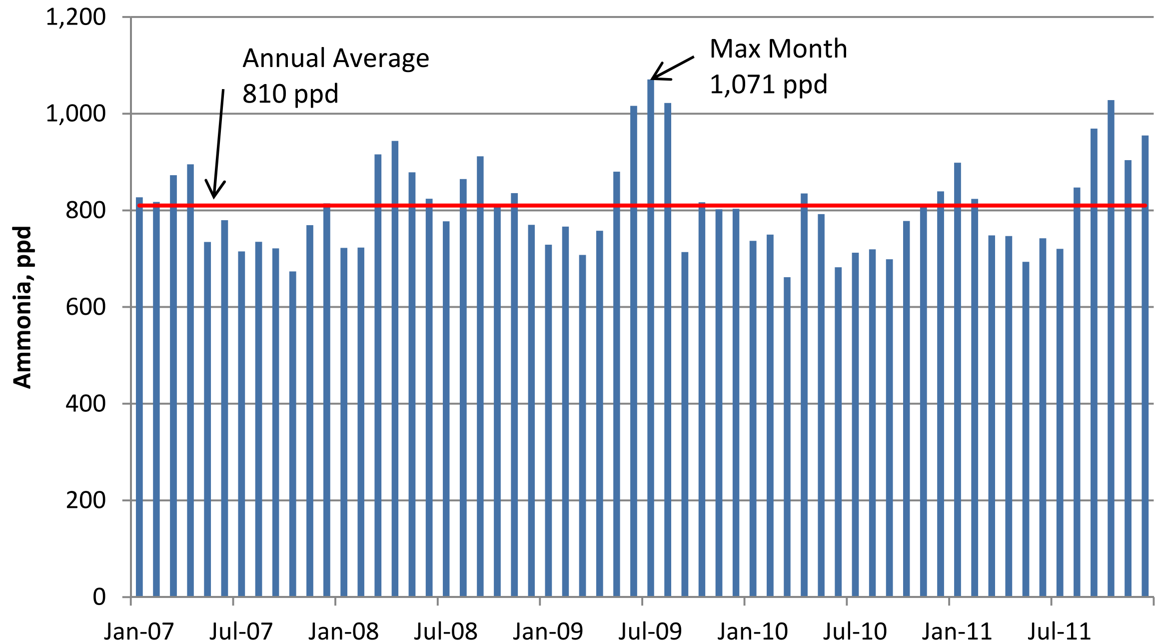

Figure 10 Monthly Ammonia Loading

3.3 Phosphorus Loading Analysis

Similar to the ammonia analysis, weekly and monthly ammonia loading for the period January 2007 to December 2011 are presented in Figures 11 and 12, respectively. Figure 11 shows some significant and sporadic spikes. Further testing and analysis is required to determine the cause of these high values. However, since phosphorus is not a near term constituent of concern, this investigation will be conducted as part of the plant's on-going sampling program. Representative historical values were calculated identical to the values derived for BOD_5 and TSS. A summary of phosphorus loads are presented in Table 9.

Table 9 Phosphorus Loading Summary
City of Grants Pass – Influent Flows and Loads

Parameter	Phosphorus Load *(ppd)*	Peaking Factor
Average Annual	200	1.0
Max Month	310	1.6
Peak Day	440	2.2

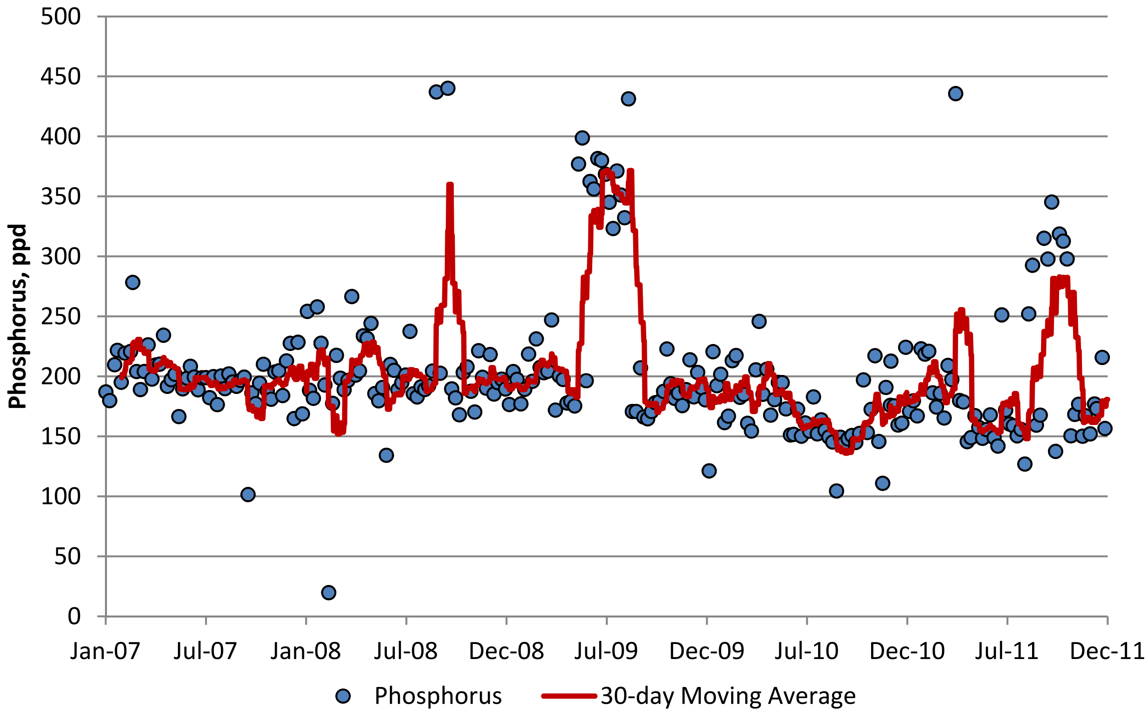

Figure 11 Weekly Phosphorus Loading

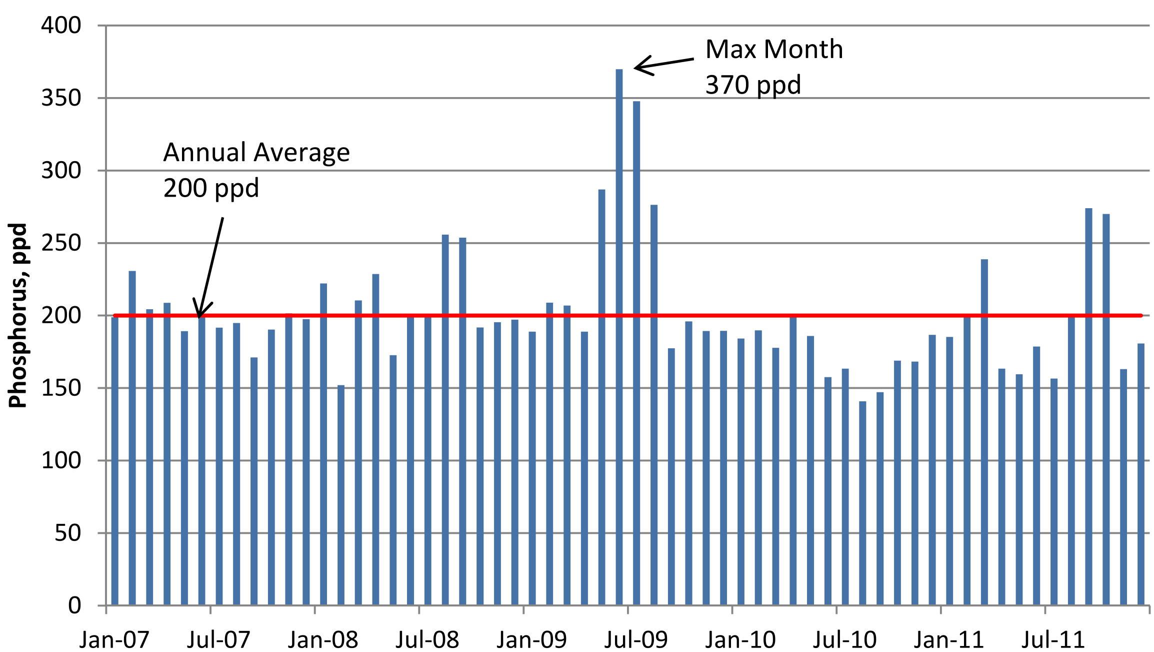

Figure 12 Monthly Phosphorus Loading

3.4 Current Per Capita Loads

The current per capita loading is determined by dividing the current influent loads by the population, as shown in Table 10. The per capita loading will be used to project future average dry weather loads by multiplying the population projections and the per capita unit loads. The recommended BOD_5 and TSS per capita loads from 2007 - 2011 are 0.19 and 0.20 pounds per capita per day (pcd), respectively.

Table 10 Per Capita Loading
City of Grants Pass – Influent Flows and Loads

Year	Population	BOD_5, pcd	TSS, pcd	Ammonia, pcd	Phosphorus, pcd
2007	37,460	0.18	0.21	0.019	0.005
2008	38,284	0.15	0.20	0.022	0.006
2009	39,126	0.18	0.21	0.023	0.007
2010	39,987	0.21	0.19	0.018	0.004
2011	40,867	0.19	0.17	0.020	0.005
Selected		**0.19**	**0.20**	**0.022**	**0.006**

4.0 FLOW AND LOAD PROJECTIONS

Flow and load projections are developed using current per capita flows & loads, peaking factors, and anticipated community growth. As shown in Table 11, the population of the Grants Pass WRP service area is expected to grow from its current level of 41,766 to 62,951 in year 2035, and 64,961 at build-out (estimated 2038).

4.1 Flow Projections

The average dry weather wastewater flows are expected to grow at approximately the same rate as the overall population. The future average dry weather wastewater flows are projected by applying the anticipated population growth rate to the estimated per capita flow.

Projection of the future peak wet weather flows requires additional consideration due to the variability of I/I rates among the existing and future developments. Sewers installed to serve new houses, businesses and commercial units will contribute less I/I compared to existing sewers. This is due to improved construction materials and techniques available. Therefore, future PHF was estimated using current wet weather I/I rates for existing portions of the collection system, while using lower rates in areas of new and rehabilitated developments. These values serve as an estimate of the potential peak flow to the WRP. Actual peak flows will depend on the type and extent of development in Grants Pass in 2035.

Table 11 Wastewater Flow Projections
City of Grants Pass – Influent Flows and Loads

Parameter	Current	2035	Build-out[(1)]
Population	41,766	62,951	64,961
ADWF, mgd	5.2	7.8	8.1
MMDWF, mgd	6.3	9.4	9.7
MMWWF, mgd	10.3	15.5	15.9
PDF, mgd	21.7	27.7	27.9
PHF, mgd	27.2	33.9	34.2

Notes:
(1) Urban growth boundary build-out; estimated year 2038.

4.2 Load Projections

The future annual average influent load projections are also based on unit loads, which are summarized in Table 10. The AA loads are expected to grow at the same rate as population. Therefore, the projected AA loads are developed by multiplying the anticipated population and the estimated per capita loads. The future maximum month, maximum week, and peak day loading is then calculated based on their respective peaking factors. A summary of load projections is presented in Table 12.

Table 12	**Load Projections** ***City of Grants Pass – Influent Flows and Loads***						
Load Parameter	**Current**	**2015**	**2020**	**2025**	**2030**	**2035**	**2038**(1)
Population	41,766	44,584	49,708	55,422	59,737	62,951	64,961
BOD_5							
Average Annual	7,500	8,500	9,400	10,500	11,300	12,000	12,300
Max Month	9,300	10,500	11,700	13,100	14,100	14,800	15,300
Max Week	12,200	13,700	15,300	17,100	18,400	19,400	20,000
Peak Day	16,500	18,600	20,800	23,200	25,000	26,300	27,200
TSS							
Average Annual	8,400	8,900	9,900	11,100	11,900	12,600	13,000
Max Month	11,600	12,400	13,800	15,400	16,600	17,500	18,100
Max Week	13,600	14,500	16,200	18,000	19,400	20,500	21,100
Peak Day	21,700	23,200	25,800	28,800	31,000	32,700	33,700
Ammonia							
Average Annual	920	980	1,100	1,220	1,320	1,390	1,430
Max Month	1,180	1,250	1,400	1,560	1,680	1,770	1,830
Peak Day	1,480	1,570	1,760	1,960	2,110	2,220	2,290
Phosphorus							
Average Annual	260	280	310	340	370	390	400
Max Month	410	430	480	540	580	610	630
Peak Day	570	610	680	760	820	860	890

Notes:
(1) Urban growth boundary build-out.

5.0 WASTEWATER CHARACTERISTICS SUMMARY

Table 13 summarizes the flow and load projections developed in previous sections.

Table 13 Wastewater Characteristics Summary
City of Grants Pass – Influent Flows and Loads

Description	Current	2035	2038[1]
Flows			
Average Dry Weather Flow (ADWF), mgd	5.2	7.8	8.0
Average Annual Flow (AAF), mgd	6.2	9.3	9.5
Average Wet Weather Flow (AWWF), mgd	7.1	10.6	10.8
Maximum Month Dry Weather Flow (MMDWF), mgd	6.3	9.4	9.7
Maximum Month Wet Weather Flow (MMWWF), mgd	10.3	15.5	15.9
Peak Day Flow (PDF), mgd	21.7	27.7	27.9
Peak Hour Flow (PHF), mgd	27.2	33.9	34.2
Loads			
BOD_5 Loads			
Average annual loading, ppd	7,500	12,000	12,300
Maximum month, ppd	9,300	14,800	15,300
Maximum week, ppd	12,200	19,400	20,000
Maximum day, ppd	16,500	26,300	27,200
TSS Loads			
Average annual loading, ppd	8,400	12,600	13,000
Maximum month, ppd	11,600	17,500	18,100
Maximum week, ppd	13,600	20,500	21,100
Maximum day, ppd	21,700	32,700	33,700
Ammonia Loads			
Average annual loading, ppd	920	1,390	1,430
Maximum month, ppd	1,180	1,770	1,830
Maximum day, ppd	1,480	2,220	2,290
Phosphorus Loads			
Average annual loading, ppd	260	390	400
Maximum month, ppd	410	610	630
Maximum day, ppd	570	860	890

Notes:
(1) Urban growth boundary build-out.

City of Grants Pass

TECHNICAL MEMORANDUM NO. 4

Water Restoration Plant Facility Plan
Permitting and Regulatory Considerations

FINAL

February 2014

REGISTERED PROFESSIONAL ENGINEER
76549
OREGON
DEC. 31, 2007
BHARGAVI MAREMANDA
EXPIRES: 12/31/14

720 SOUTHWEST WASHINGTON STREET, SUITE 550 • PORTLAND, OREGON 97205-3507 • (503) 227-1885 • FAX (503) 227-1747

City of Grants Pass

TECHNICAL MEMORANDUM NO. 4

Water Restoration Plant Facility Plan
Permitting and Regulatory Considerations

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PERMITTING AND REGULATORY CONSIDERATIONS

1.0 INTRODUCTION

This technical memorandum (TM) focuses on a review of current and potential permitting and regulatory issues relating to water quality or treatment associated with the City of Grants Pass's Water Restoration Plant (WRP), and assesses how those issues may impact the development of the facilities plan. The TM addresses the following:

- Current water quality criteria applicable to the City of Grants Pass,
- Current permit requirements, and
- Potential future regulatory issues that may affect the City's planning and operation.

The above considerations establish the basis of planning for the analysis conducted to evaluate the adequacy of the system to provide existing service and serve projected growth.

2.0 CURRENT DISCHARGE PERMIT REQUIREMENTS

Discharges from wastewater treatment plants to surface waters must be permitted by a National Pollutant Discharge Elimination System (NPDES) Permit as required by the federal Clean Water Act and the promulgated federal and state regulations implementing the requirements of the Clean Water Act.

NPDES permit limitations on discharges are established so that in-stream water quality criteria are met, and for compliance with other water quality standards and regulations. The City's current NPDES permit for the WRP was issued on October 20, 2010, and the current effluent limitations are summarized in Table 1 below. A copy of the current discharge permit is attached as Appendix A.

Table 1 Current Discharge Permit Requirements: $CBOD_5$ and TSS
City of Grants Pass – Permitting and Regulatory Considerations

Parameter	Average Effluent Concentrations		Monthly Average, Lbs/day	Weekly Average, Lbs/day	Daily Maximum, Lbs/day
	Monthly, mg/L	Weekly, mg/L			
May 1 - October 31					
$CBOD_5$	10	15	500	750	1,000
TSS	10	15	670	1,000	1,300
November 1 – April 30					
BOD_5	30	45	1,600	2,400	3,200
TSS	30	45	1,600	2,400	3,200
Other Parameters (Year Round)					
E. coli Bacteria	Shall not exceed 126 organisms per 100 mL monthly geometric mean. No single sample shall exceed 406 organisms per 100 mL.				

Table 1 Current Discharge Permit Requirements: $CBOD_5$ and TSS *City of Grants Pass – Permitting and Regulatory Considerations*					
Parameter	**Average Effluent Concentrations** Monthly, mg/L	Weekly, mg/L	**Monthly Average, Lbs/day**	**Weekly Average, Lbs/day**	**Daily Maximum, Lbs/day**
pH (year round)	6.0 - 9.0				
BOD_5 and TSS Removal Efficiency	Shall not be less than 85 percent monthly average				
Ammonia-N (June 1-30)	Shall not exceed a monthly average concentration of 21 mg/L and a daily maximum concentration of 34.7 mg/L.				
Ammonia-N (July 1-31)	Shall not exceed a monthly average concentration of 10.4 mg/L and a daily maximum concentration of 21.7 mg/L.				
Ammonia-N (August 1-31)	Shall not exceed a monthly average concentration of 16.8 mg/L and a daily maximum concentration of 36 mg/L.				
Ammonia-N (September 1-30)	Shall not exceed a monthly average concentration of 9.6 mg/L and a daily maximum concentration of 21.3 mg/L.				

3.0 WATER QUALITY STANDARDS

Water quality standards in Oregon are adopted by the Environmental Quality Commission and enforced by the Oregon Department of Environmental Quality. Oregon's water quality standards are found in Oregon Administrative Rules (OAR 340-041). Statewide standards and a brief summation of their relevance to The Dalles are presented herein. It should be noted that the summations are not complete and the actual standards have considerable additional detail and complexity. The specific section of the OAR should be consulted for further information.

3.1 Statewide Standards Criteria

3.1.1 Antidegradation Policy (OAR 340-041-0004)

The purpose of the Antidegradation Policy is to guide decisions that affect water quality such that unnecessary further degradation from new or increased point and nonpoint sources of pollution is prevented, and to protect, maintain, and enhance existing surface water quality to ensure the full protection of all existing beneficial uses.

The policy recognizes that the assimilative capacity of Oregon's streams is finite, but the potential uses of this capacity are virtually unlimited. Thus, it is important that priority be given to those beneficial uses that promise the greatest return (beneficial use) relative to the unused assimilative capacity that might be utilized. In-stream uses that will benefit from reserve assimilative capacity, as well as potential future beneficial use, will be weighed against the economic benefit associated with increased loading.

The Antidegradation Policy may limit increases in mass load in discharges from the Grants Pass WRP. Implementation of this policy will be more restrictive for waters that currently do not meet water quality standards.

3.1.2 Statewide Narrative Criteria (OAR 340-041-0007)

These criteria establish aesthetic limitations such as prohibition of oily sheens, sludge, development of fungi in the receiving water, offensive odors, and discoloration. Because other, more specific, and more restrictive standards are in place, these narrative criteria typically have few implications for current facility planning.

3.1.3 Bacteria (OAR 340-041-0009)

Effluent discharges to freshwaters, and estuarine waters other than shellfish growing waters may not exceed a monthly log mean of 126 *E. coli* organisms per 100 milliliters (ml). No single sample may exceed 406 *E. coli* organisms per 100 ml. However, no violation will be found for exceedances if the permittee takes at least five consecutive re-samples at 4-hour intervals beginning as soon as practical (preferably within 28 hours) after the original sample was taken and the log mean of the 5 re-samples is less than or equal to 126 *E. coli* organisms/100 ml.

3.1.4 Biocriteria (OAR 340-041-0011)

Waters of the State must be of sufficient quality to support aquatic species without detrimental changes in the resident biological communities.

3.1.5 Dissolved Oxygen (OAR 340-041-0016)

Adequate dissolved oxygen is critical for successful reproduction and survival of salmonids and other aquatic species. Where there are salmonid spawning activities, the dissolved oxygen should be greater than 11.0 mg/l. For water bodies identified by the Department as providing cold-water aquatic life, the dissolved oxygen may not be less than 8.0 mg/l as an absolute minimum.

For water bodies identified by the Department as providing cool-water aquatic life, the dissolved oxygen may not be less than 6.5 mg/l as an absolute minimum.

3.1.6 Nuisance Phytoplankton (OAR 340-041-0019)

Average Chlorophyll a values must be less than 0.015 mg/l where phytoplankton may impair the recognized beneficial uses.

3.1.7 pH (OAR 340-041-0021)

Limits for pH are basin specific and are discussed in detail in Section 4.2.1.

3.1.8 Temperature (OAR 340-041-0028)

Water temperatures affect the biological cycles of aquatic species and are a critical factor in maintaining and restoring healthy salmonid populations throughout the State. Water temperatures are influenced by solar radiation, stream shade, ambient air temperatures, channel morphology, groundwater inflows, and stream velocity, volume, and flow. Surface water temperatures may also be warmed by anthropogenic activities such as discharging heated water, changing stream width or depth, reducing stream shading, and water withdrawals. The temperature standard was developed to protect aquatic ecosystems from adverse warming and cooling caused by anthropogenic activities.

Temperature criteria are dependent upon spatial and temporal fish activities in the receiving water. Fish activities are defined by maps and tables that identify the timing and location of fish activities in each water body.

The Rogue River near the City is a salmonid migration corridor. Therefore, the seven-day-average maximum temperature may not exceed 20.0 degrees Celsius (68.0 degrees Fahrenheit). In addition, migration corridors must have coldwater refugia that are sufficiently distributed so as to allow salmon and steelhead migration without significant adverse effects from higher water temperatures elsewhere in the water body. Finally, the seasonal thermal pattern in the Rogue River must reflect the natural seasonal thermal pattern.

3.1.9 Total Dissolved Gas (OAR 340-041-0031)

Waters will be free from dissolved gases, such as carbon dioxide, hydrogen sulfide, or other gases, in sufficient quantities to cause objectionable odors or to be deleterious to fish or other aquatic life, navigation, recreation, or other reasonable uses made of such waters.

3.1.10 Total Dissolved Solids (OAR 340-041-0031)

Limits for total dissolved solids are basin specific and are discussed in detail in Section 2.3.2.2.

3.1.11 Toxics (OAR 340-041-0033)

Toxic substances may not be introduced above natural background levels in waters of the state in amounts, concentrations, or combinations that may be harmful, may chemically change to harmful forms in the environment, or may accumulate in sediments or bioaccumulate in aquatic life or wildlife to levels that adversely affect public health, safety, or welfare or aquatic life, wildlife, or other designated beneficial uses.

3.1.12 Turbidity (OAR 340-041-0036)

No more than a 10 percent cumulative increase in natural stream turbidities may be allowed, as measured relative to a control point immediately upstream of the turbidity causing activity, including wastewater treatment plant discharges.

3.1.13 Other Standards

In addition, there are water quality standards pertaining to mixing zones, domestic wastewater treatment plant performance standards, and water quality limited waters.

3.2 Rogue River Basin Specific Water Quality Standards

In addition to the statewide water quality standards and criteria, the Environmental Quality Commission has adopted basin specific water quality standards for the Rogue River Mainstem. This task is the responsibility of the Oregon Water Resources Department (OWRD), and includes both designated beneficial uses for the basin and water quality criteria to protect those designated uses. A water body's beneficial uses depend on characteristics such as its size and location. The following are the designated beneficial uses for the Rogue River.

3.2.1.1 Designated Beneficial Uses

The designated beneficial uses for the Rogue River at River Mile 100.5 (Oregon Administrative Rules -OAR 340-041-0101) are:

- Public domestic water supply.
- Private domestic water supply.
- Industrial water supply.
- Irrigation.
- Livestock watering.
- Fish & aquatic life.
- Wildlife and hunting.
- Fishing.
- Boating.
- Water contact recreation.
- Aesthetic quality.

3.2.1.2 Basin Specific Criteria

In addition to the statewide criteria and standards, basin specific criteria have been developed and adopted to protect these designated beneficial uses in the Rogue River. They include:

1. pH (hydrogen ion concentration). pH values may not fall outside 6.5 – 8.5 range.
2. Total Dissolved Solids. At the Grants Pass WRP, the water quality criteria for Total Dissolved Solids is 500 mg/l. This limit must not be exceeded unless otherwise specifically authorized by DEQ upon such conditions, as it may deem necessary to carry out the general intent of this plan and to protect the beneficial uses set forth in OAR 340-041-0101.
3. Minimum Design Criteria for Treatment and Control of Sewage Wastes:
    a. During periods of low stream flows: Treatment resulting in monthly average effluent concentrations not to exceed 10 mg/l of BOD and 10 mg/l of SS or equivalent control. The period of low flow at the Grants Pass is approximately May 1 to October 31.
    b. During periods of high stream flows: By federal law, a minimum of secondary treatment (30-day average concentrations of 30 mg/L BOD and 30 mg/L TSS) or equivalent control and unless otherwise specifically authorized by the Department, operation of all waste treatment and control facilities at maximum practicable efficiency and effectiveness so as to minimize waste discharges to public waters.

4.0 POTENTIAL REGULATORY ISSUES

Water quality standards and regulations continue to evolve and there are a number of new regulatory initiatives being discussed and/or implemented at the state and federal level that could significantly impact the design and operation of the Grants Pass WRP. Since one of the goals of this facility planning is to develop long-term treatment scenarios for phased implementation of improvements at the WRP, considerations for these potential future permit requirements have been made as part of the planning-level layout of facilities. This section outlines parameters that are likely to be included in subsequent NPDES permits written for the City, and presents probable future permit limits. These include:

- Blending of wet weather flows,
- Ammonia,
- Temperature,
- Mass load limitations, and
- Priority persistent toxics

A detailed discussion of each of these issues is included in this section. The alternatives for addressing new regulations are presented in detail in TMs 5 and 7.

4.1 Blending

Blending, also known as “split flow” or “select treatment,” refers to the practice of diverting flow around a treatment component (usually secondary treatment) during high wet weather flows. The Grants Pass WRP was designed to operate using blending when flow exceeds the secondary system capacity. The practice is not specifically authorized in the NPDES permit.

EPA has been trying to adopt a wet weather flow management policy for separated sanitary sewer systems and treatment facilities since the early 1990s. Although several proposals have been made by EPA and others, no wet weather flow management policy or regulations, including those related to blending, have been finalized. EPA views blending as a bypass as defined and prohibited by federal regulations (CFR 122.41(m)(4)(i) and recently has taken a more aggressive regulatory approach towards blending. Although the future of blending remains uncertain, alternatives for improvements to the treatment plant should include the possibility that blending will not be permitted in the future and that all flows must receive secondary treatment prior to discharge.

The City has already adopted a comprehensive rehabilitation/replacement program to reduce and manage infiltration/inflow (I/I) and associated wet-weather flows. In addition to managing I/I within the collection system, the City may need to operate in step-feed mode during peak flow events to accommodate PHFs. The capacity of the existing system when operated in this mode is 30 mgd. If the practice of blending is determined to be illegal, wet weather capacity improvements to meet year 2035 flows are recommended. For the City, this would include adding a secondary clarifier. TM 5 – Liquid Stream Process discusses the capacity in contact stabilization mode in further detail.

4.2 Ammonia

Since un-ionized ammonia is toxic to fish and other aquatic species, water quality criteria have been developed by USEPA to protect these organisms. Acute and chronic toxicity limits for ammonia are dependant upon temperature and pH. Generally, as pH increases and temperature decreases, total ammonia becomes more toxic. The acute and chronic limits must be met at the edge of Zone of Immediate Dilution (ZID) and mixing zone, respectively.

Two potential scenarios for ammonia that affect the City's WRP regulatory compliance as presented below.

4.2.1 pH

Ammonia toxicity is sensitive to temperature and pH of the water. DEQ has developed an Internal Management Directive "Reasonable Potential Analysis for Toxic Pollutants" (September 2005). This directive outlines the procedures to be used by permit writers to establish if there is a reasonable potential for a discharge to cause or contribute to an exceedances of water quality criteria in the receiving stream, and if so, how to establish effluent limitations for that pollutant.

DEQ performed a Reasonable Potential Analysis (RPA) analysis for the City and results of RPA showed potential toxicity for ammonia during June through September. The City's 2010 NPDES permit includes effluent quality requirements for ammonia. The current permit requirement was based on toxicity analysis for ammonia in the Rogue River. This requires partial nitrification down to a level of 9.6 to 21 mg/L during the summer months.

4.2.2 Freshwater Mussels Criteria

It is likely that the State of Oregon will adopt the proposed water quality criteria for ammonia presented in Table 2 for protection of freshwater mussels in the Rogue River. It is anticipated that this change will affect the City within the next 5 to 10 years.

Table 2 Freshwater Criteria for Ammonia at pH 8 and 25 Degrees Celsius
City of Grants Pass – Permitting and Regulatory Considerations

	Anticipated Ammonia Limit
Acute	3.2 mg/L
Chronic	0.28 mg/L

Implementation of freshwater mussels criteria would impose more stringent water quality limits for ammonia concentrations in the WRP effluent. Based on the existing dilution achieved at the zone of initial dilution (ZID), the ammonia concentration in the WRP would need to be less than 7.5 mg/l, with the limit at the perimeter of the ZID the controlling condition. Additionally, it is anticipated that the City could receive nitrite limit in the future. This would imply that the City should completely nitrify seasonally or even year-round in the event that fresh water mussels criteria is implemented.

If full nitrification is required, the City will need to add the current aeration tank volume by a factor of three in order to meet permit requirements. A detailed full nitrification treatment capacity is presented in TM 5 – Liquids Stream Process.

4.3 Temperature

The Rogue River is water quality limited for temperature. High water temperatures adversely affects cold-water fish. In stream temperatures below 15.5 degrees Celsius are optimal for salmonoid fish such as salmon and other cold-water aquatic species. Temperatures above 21 degrees Celsius limit growth and reproduction and those above 24 degrees Celsius are potentially lethal. In addition, in stream temperature regulation is also important because it controls the solubility of dissolved oxygen (DO) in water. As the stream water temperature increases, the DO saturation concentration decreases and it becomes more difficult to maintain adequate DO levels necessary for fish health.

The City currently has thermal load based on Total Maximum Daily Load allocation (TMDL). Northwest Environmental Advocates (NEA) challenged DEQ in federal court regarding the temperature rule and Natural Thermal Potential of streams and the federal court found in favor of NEA. For the City, this could mean new lower thermal load or temperature limits will be included in future NPDES permits.

Discharge to natural treatment systems such as poplar plantations or engineered wetlands; indirect or nighttime discharge; better dilution of effluent in the river discharge; reuse water programs; and water quality trading are strategies the City should consider employing to meet more stringent temperature limits. The City meets to monitor his issue and begin review strategies for meeting more stringent temperature limits during the planning period. Layout of facilities on the WRP site allows space for a future tertiary treatment process if needed for water reuse.

4.4 Mass Load Limitations

The City's new 2010 NPDES permit does not provide an increase in mass load and requires that all existing mass load limits, as established in the City's previous NPDES permit, continue to be met, even if higher flows would require higher levels of treatment prior to discharge. This is consistent with the State's Antidegradation Policy.

Figure 1 presents a plot of required effluent BOD concentrations to meet no mass load increase scenario. As illustrated in the figure, the plant's current performance does not meet the required treatment during the later part of the planning period. The plant may need to provide fine screening and/or enhanced primary treatment to meet limits within the planning period.

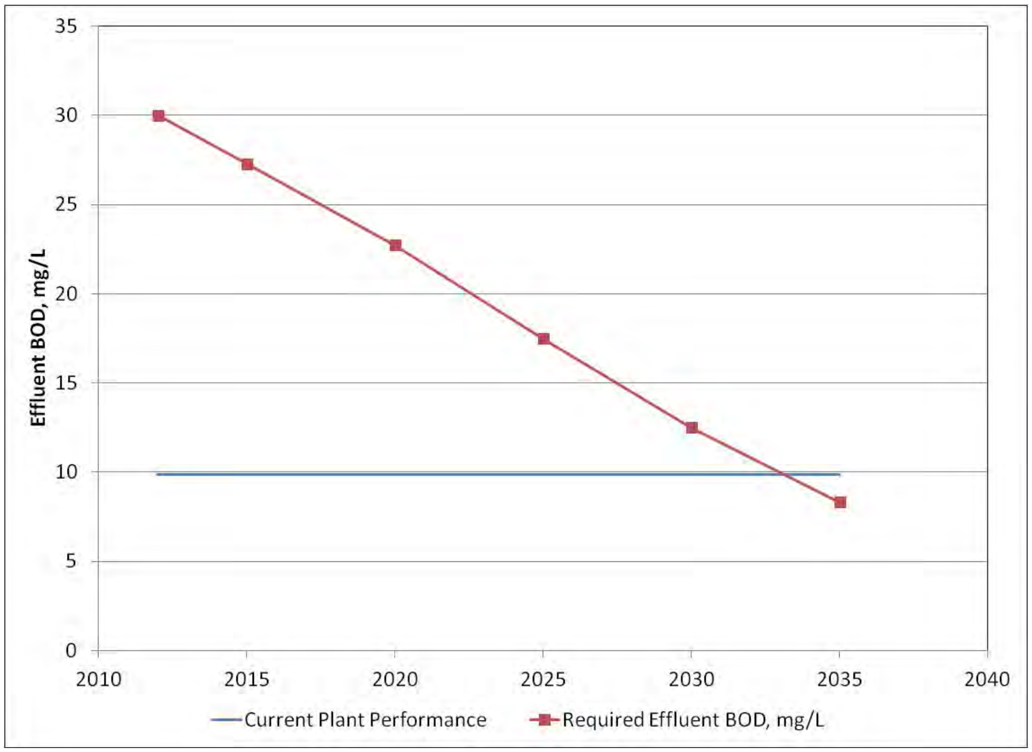

Figure 1 Required Effluent BOD Concentrations to meet No Mass Load Increase

4.5 Priority Persistent Pollutants

In The 2007 Oregon Legislature passed Senate Bill 737, which requires DEQ to list, monitor, and eventually control priority persistent bioaccumulative toxics (Priority Persistent Pollutant List) that have a documented effect on human health, wildlife and aquatic life. A priority persistent pollutant is a substance that is toxic and either persists in the environment or accumulates in the tissues of humans, fish, wildlife, or plants.

As a first step, DEQ has developed a Priority Persistent Pollutant List that meet this definition; the identified pollutants are divided into two categories:

- Persistent Pollutants - Substance that is toxic and either persists in the environment or accumulates in the tissues of humans, fish, wildlife, or plants such as polycyclic aromatic hydrocarbons (PAHs), halogenated flame retardants, pesticides, pharmaceuticals, preflorinated surfactants, metals, and industrial chemicals.
- Legacy Persistent Pollutants - Pollutants which have been banned or restricted for several years and remain in detectable levels in sediment and tissue samples such as Pesticides, herbicides, polychlorinated biphenyls (PCBs), polychlorinated naphthalenes (PCNs), dioxins, and furans.

DEQ will use this list to prioritize toxic monitoring and other state water quality programs in the future. Currently, it is developing persistent toxics reduction plan for all major plants in Oregon. The implications of this regulatory issue for the City is increased monitoring, public education to limit toxics in the sewage, and pro-active pre-treatment program outreach. within the planning period.

Appendix A
DISCHARGE PERMIT

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
WASTE DISCHARGE PERMIT

Department of Environmental Quality
Western Region – Salem Office
750 Front Street NE, Suite 120, Salem, OR 97301-1039
Telephone: (503) 378-8240

Issued pursuant to ORS 468B.050 and The Federal Clean Water Act

ISSUED TO:
City of Grants Pass
101 Northwest A Street
Grants Pass, Oregon 97526

SOURCES COVERED BY THIS PERMIT:

Type of Waste	Outfall Number	Outfall Location
Treated Wastewater (diffuser)	001a	RM 100.5
Treated Wastewater (bank outfall)	001b	RM 100.5

FACILITY TYPE AND LOCATION:
Activated Sludge
Grants Pass Water Restoration Facility

1200 SW Greenwood Avenue
Grants Pass, Oregon

Biosolids Co-Composting
Jo Gro Composting Facility
Merlin Landfill, 1749 Merlin Road, Merlin, OR

RECEIVING STREAM INFORMATION:
Basin: Rogue
USGS Sub-Basin: Middle Rogue
Receiving Stream: Rogue River
LLID: 1244292424210 – 100.5 D

County: Josephine

Treatment System Class: Level IV
Collection System Class: Level IV

EPA REFERENCE NO: OR002884-3
Issued in response to Application No. 981546 received May 31, 2005. This permit is issued based on the land use findings in the permit record.

Zachary J. Loboy, Water Quality Manager
Western Region DEQ

October 20, 2010
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:

Page

Unless specifically authorized by this permit, by another NPDES or WPCF permit, or by Oregon Administrative Rule, any other direct or indirect discharge of waste is prohibited, including discharge to waters of the state or an underground injection control system.

SCHEDULE A

1. Waste Discharge Limitations not to be exceeded after permit issuance.

a. Treated Effluent Outfall 001

(1) May 1 - October 31:

Parameter	Average Effluent Concentrations Monthly	Weekly	Monthly* Average lb/day	Weekly* Average lb/day	Daily* Maximum lbs
$CBOD_5$ (See Note 3)	10 mg/L	15 mg/L	500	750	1000
TSS	10 mg/L	15 mg/L	670	1000	1300

(2) November 1 - April 30:

Parameter	Average Effluent Concentrations Monthly	Weekly	Monthly* Average lb/day	Weekly* Average lb/day	Daily* Maximum lbs
BOD_5	30 mg/L	45 mg/L	1600	2400	3200
TSS	30 mg/L	45 mg/L	1600	2400	3200

* Average dry weather design flow to the facility equals 4.0 MGD. Summer mass load limits based upon mass loadings established in previous permits. Winter mass load limits based upon average wet weather design flow to the facility established in previous permit equaling 6.4 MGD. The daily mass load limit is suspended on any day in which the flow to the treatment facility exceeds 8 MGD (twice the design average dry weather flow), but weekly and monthly mass load limits are not suspended.

(3) Year-round (except as noted)

Other parameters	Limitations
E. coli Bacteria	Shall not exceed 126 organisms per 100 mL monthly geometric mean. No single sample shall exceed 406 organisms per 100 mL (See Note 1)
pH	Shall be within the range of 6.0 - 9.0
BOD_5 and TSS Removal Efficiency	Shall not be less than 85% monthly average for BOD_5 and 85% monthly for TSS.
Ammonia-N (June 1-30)	Shall not exceed a monthly average concentration of 21.0 mg/L and a daily maximum concentration of 34.7 mg/L
Ammonia-N (July 1-31)	Shall not exceed a monthly average concentration of 10.4 mg/L and a daily maximum concentration of 21.7 mg/L
Ammonia-N (August 1-31)	Shall not exceed a monthly average concentration of 16.8 mg/L and a daily maximum concentration of 36.0 mg/L
Ammonia-N (September 1-30)	Shall not exceed a monthly average concentration of 9.6 mg/L and a daily maximum concentration of 21.3 mg/L

(4) Excess Thermal Load

Option A

Parameter	Limitations
Excess Thermal Load (April 1 through May 15)	Shall not exceed a rolling seven-day average of 223 million Kcals/day (see Note 2)
Excess Thermal Load (May 16 through May 31)	Shall not exceed a rolling seven-day average of 270 million Kcals/day (see Note 2)
Excess Thermal Load (June 1 through June 15)	Shall not exceed a rolling seven-day average of 274 million Kcals/day (see Note 2)

Excess Thermal Load (June 16 through June 30)	Shall not exceed a rolling seven-day average of 229 million Kcals/day (see Note 2)
Excess Thermal Load (July 1 through August 31)	Shall not exceed a rolling seven-day average of 208 million Kcals/day (see Note 2)
Excess Thermal Load (September 1 through 15)	Shall not exceed a rolling seven-day average of 229 million Kcals/day (see Note 2)
Excess Thermal Load (September 16 through September 30)	Shall not exceed a rolling seven-day average of 178 million Kcals/day (see Note 2)
Excess Thermal Load (October 1 through October 15)	Shall not exceed a rolling seven-day average of 180 million Kcals/day (see Note 2)
Excess Thermal Load (October 16 through October 31)	Shall not exceed a rolling seven-day average of 194 million Kcals/day (see Note 2)

Option B - Stream flow monitoring needed to comply with the thermal limits

The thermal limit may be calculated on a daily basis when river flows are reported by using the formula:

$$ETL = (\Delta T)(Q_e + Q_R)C_f$$

Where: *ETL = Excess Thermal Load, million Kcals/day*
ΔT *= Allowable temperature increase, 0.0709°C*
Q_e *= Effluent flow rate, 7-day average of the daily maximums, cfs*
Q_R *= River flow rate, upstream, cfs*
C_f *= conversion factor (2,446,665)* $\frac{kcal \cdot s}{^\circ C \cdot ft^3 \cdot day}$

(5) No wastes may be discharged or activities conducted that cause or contribute to a violation of water quality standards in OAR 340-041 applicable to the Rogue Basin except as provided for in OAR 340-045-0080 and the following regulatory mixing zone:

The allowable mixing zone is that portion of the Rogue River contained within an area extending 10 feet on either side of the diffuser and 300 feet downstream from the outfall diffuser. The zone of initial dilution is contained within an area extending 10 feet on either side of the diffuser and 30 feet downstream from the outfall diffuser.

(6) Chlorine and chlorine compounds shall not be used as a disinfecting agent of the treated effluent and no chlorine residual shall be allowed in the discharged effluent due to chlorine used for maintenance purposes.

b. Groundwater

(1) No activities shall be conducted that could cause an adverse impact on existing or potential beneficial uses of groundwater.

NOTES:

1. If a single sample exceeds 406 organisms per 100 ml, then five consecutive re-samples may be taken at four-hour intervals beginning within 28 hours after the original sample was taken. If the log mean of the five re-samples is less than or equal to 126 organisms per 100 ml, a violation shall not be triggered.

2. Excess Thermal Load (ETL) - If any ETL Option other than Option A is used, the Discharge Monitoring Report must state which option was used during that month and include all data necessary to calculate the ETL limit. Limits are to be calculated and compliance will be evaluated starting on the seventh day of each TMDL period (e.g. TMDL period = April 1 – May 15).

3. The $CBOD_5$ concentration limits are considered equivalent to the minimum design criteria for BOD_5 specified in Oregon Administrative Rules (OAR) 340-041. These limits and $CBOD_5$ mass limits may be adjusted (up or down) by permit action if more accurate information regarding $CBOD_5/BOD_5$ becomes available.

SCHEDULE B

1. **Minimum Monitoring and Reporting Requirements**

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

The facility influent sampling location is in the influent channel on the east side of the influent Parshall Flume structure.

Item or Parameter	Minimum Frequency	Type of Sample
Total Flow (MGD)	Daily	Measurement
BOD_5	3/Week	24-hour Composite
TSS	3/Week	24-hour Composite
pH	Daily	Grab
Temperature	1/Hour	Record
Toxics:		
Metals & Cyanide (See Note 1)	Semi-annually using 3 consecutive days between Monday and Friday, inclusive	24-hour daily composite (See Note 2)

b. Treated Effluent Outfall 001

The facility effluent sampling location is in the effluent channel just after the UV system.

Item or Parameter	Minimum Frequency	Type of Sample
Total Flow (MGD)	Daily	Continuous
Flow Meter Inspection	Semi-Annual	Verification
BOD_5	3/Week	24-hour Composite
$CBOD_5$	3/Week (May – October)	24-hour Composite
Ammonia (NH3-N)	3/Week (May – October) 1/Week (November – April)	24-hour Composite (See Note 2)
TSS	3/Week	24-hour Composite
pH	Daily	Grab
E. coli	3/Week	Grab
UV Radiation Intensity	Daily	Reading (See Note 4)
Pounds Discharged (BOD_5 and TSS)	3/Week	Calculation
Pounds Discharged ($CBOD_5$)	3/Week (May – October)	Calculation
Average Percent Removed (BOD_5 and TSS)	Monthly	Calculation
Nutrients		
TKN, NO2+NO3-N, Total Phosphorus	1/Week (May-Oct)	24-hour Composite

Item or Parameter	Minimum Frequency	Type of Sample
Toxics and related parameters:		
Metals & Cyanide (See Note 1)	Semi-annually using 3 consecutive days between Monday and Friday, inclusive	24-hour daily composite (See Note 2)
Hardness	Semi-annually using 3 consecutive days between Monday and Friday, inclusive	24-hour daily composite (See Note 2)
Priority Pollutants Scan	(See Note 9)	24-hour Composite
Whole Effluent Toxicity (See Note 3)	Four Tests – Annually or Quarterly in last year of permit	Acute & chronic
Temperature:		
Temperature, daily maximums	Daily	Continuous (See Note 8)
Temperature, 7-day Average of Daily Maximums (April 1 through October 31) (See Note 8)	Daily (as a rolling seven-day average starting April 7)	Calculation
Excess Thermal Load (April 1 through October 31) Use equation below	Daily (as a rolling seven-day average starting April 7)	Calculation

Excess thermal load is calculated using the following equation:

$$ETL = Q_E(T_E - T_R)C_f$$

Where:

ETL = Excess Thermal Load, million Kcals/day
Q_E = 7-day average effluent flow, cfs
T_E = 7-day average of the daily maximums temperature flow, °C
T_R = the applicable criterion, °C (Listed in table below)
C_f = conversion factor (2,446,665) $\frac{kcal \cdot s}{°C \cdot ft^3 \cdot day}$

Time Period	Applicable Criterion, °C (T_R)
Apr 1 – May 15	13.0
May 16 – May 31	18.0
Jun 1 – Jun 15	18.0
Jun 16 – Jun 30	18.2
Jul 1 – Aug 31	20.9
Sep 1 – Sep 15	19.6
Sep 16 – Sep 30	18.0
Oct 1 – Oct 15	18.0
Oct 15 – Oct 31	13.0
Note: the applicable criterion is the higher value of the numeric criterion and the natural thermal potential as defined in the TMDL	

c. Biosolids Management

Item or Parameter	Minimum Frequency	Type of Sample
For all biosolids:		
Sludge analysis including: Total Solids (% dry wt.) Volatile solids (% dry wt.) Biosolids nitrogen for: NH_3-N; NO_3-N; & TKN (% dry wt.) Phosphorus (% dry wt.) Potassium (% dry wt.) pH (standard units)	Quarterly	Composite sample to be representative of the product to be land applied, sold or given away from the Compost pile or from anaerobic digestor (See Note 5)
Sludge metals content for: Ag, As, Cd, Cu, Hg, Mo, Ni, Pb, Se & Zn, measured as total in mg/kg	Quarterly	Composite sample to be representative of the product to be land applied from the Compost pile or from the anaerobic digestor (See Note 5)
For all composted Class A and B biosolids sold or land applied:		
Record of quantity of compost sold, given away or land applied	Each Occurrence	Record of date and volume.
Record of days composting biosolids remained at 40°C or higher	Each Batch	Start and stop dates at 40°C or higher
Record of time composting biosolids remained at 55°C or higher	Each Batch	Start and stop dates and times that pile continuously stays at 55°C or higher
Fecal coliform bacteria per gram total solids (dry weight basis) or Salmonella sp. bacteria per four grams total solids (dry weight basis)	Quarterly	At least seven (7) individual samples representative of the product to be beneficially used (See Note 5)
For all anaerobically digested Class B biosolids land applied:		
Record of locations where biosolids are applied on each DEQ approved site. (Site location maps to be maintained at treatment facility for review upon request by DEQ)	Each Occurrence	Date, volume & locations where sludges were applied recorded on site location map.
Record of % volatile solids reduction accomplished through stabilization	Monthly	Calculation (See Note 6)
Record of digestion days (mean cell residence time)	Monthly	Calculation
Daily Minimum Sludge Temperature	Daily	Record
For all sludge disposed of in a landfill:		
Record of percent total solids and volume of all sludge disposed	Each Occurrence	Record of Date and volume.

d. Rogue River (**April 1 through October 31 only**, unless noted otherwise)

Item or Parameter	Minimum Frequency	Type of Sample
Flow (upstream), daily average	Daily when using ETL Limit Option B	Compilation of data from USGS gauge 14361500 "Rogue River at Grants Pass, OR" (see Note 7, 11)
Flow, rolling 7-day average	Daily when using ETL Limit Option B (as a rolling seven-day average)	Calculation
Mercury and Cyanide	Semi-annually, in **February and August**	Grab (See Note 2)

2. Reporting Procedures

a. Monitoring results shall be reported on approved forms. The reporting period is the calendar month. Reports must be submitted to a DEQ Western Region office 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. 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 DEQ by **July 15** each year which details sewer collection maintenance activities that reduce inflow and infiltration. The report shall state those activities that have been done in the previous year and those activities planned for the following year. The report must include information adequate to demonstrate compliance with the DEQ approved inflow removal plan required by Schedule D, Condition 9.

b. For any year in which biosolids are land applied or composted, a report shall be submitted to the DEQ by **February 19** of the following 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).

NOTES:

1. For influent and effluent cyanide samples, at least six (6) discrete grab samples shall be collected over the operating day. Each aliquot shall not be less than 100 mL and shall be collected and composited into a larger container which has been preserved with sodium hydroxide for cyanide samples to insure sample integrity.

2. Daily 24-hour composite samples shall be analyzed and reported separately. Toxic monitoring results and toxics removal efficiency calculations shall be tabulated and submitted with the Pretreatment Program Annual Report as required in Schedule E. Submittal of toxic monitoring results with the monthly Discharge Monitoring Report is not required. Metals and hardness testing must be conducted twice per year with one test event occurring at the same time WET testing is being conducted. Twice per year testing must be conducted at least three months apart. Ammonia testing should be conducted with at least one test event per year occurring at the same time WET testing is being conducted. Test methods, as indicated in 40 CFR 136.3, should achieve a Quantitation Limit (QL) less

than or equal to those listed in the table below unless a higher QL is unnecessary for determining compliance with an effluent limit or water quality criterion. If the permittee is unable to achieve the necessary QL, an alternate QL may be approved in writing by the DEQ. The permittee must ensure that all discharge monitoring reports contain both the QL and the detection level as defined below:

a. Detection Level: Same as the "Method Detection Limit" (MDL) derived using 40 CFR 136 Appendix B

b. Quantitation Limit: Same as the Method Reporting Limit (MRL). It is the lowest level at which the entire analytic system must give a recognizable signal and acceptable calibration for the analyte. It is equivalent to the concentration of the lowest calibration standard, assuming that all method-specified sample weights, volumes, and cleanup procedures have been employed.

Metals[1] *and other tests*

Pollutant	CAS Number	Quantitation Limit (µg/L)	Pollutant	CAS Number	Quantitation Limit (µg/L)
Antimony	7440360	0.1	Arsenic (total) Arsenic (inorganic)	7440382	0.5 0.1
Beryllium	7440417	0.1	Cadmium	7440439	0.1
Chromium	7440473	0.4	Copper	7440508	10
Lead	7439921	5	Mercury	7439976	0.01
Nickel	7440020	10	Selenium	7782492	2
Silver	7440224	1	Thallium	7440280	0.1
Zinc	7440666	5	Cyanide (total)	57125	5
Phenols, total			Hardness		

[1]All metals must be analyzed for total and dissolved

3. Four Whole Effluent Toxicity test results will be required along with the next NPDES permit renewal application.

4. The intensity of UV radiation passing through the water column will affect the system's ability to kill organisms. To track the reduction in intensity, the UV disinfection system must include a UV intensity meter with a sensor located in the water column at a specified distance from the UV bulbs. This meter will measure the intensity of UV radiation in mWatts-seconds/cm2. The daily UV radiation intensity shall be determined by reading the meter each day. If more than one meter is used, the daily recording will be an average of all meter readings each day.

5. Composite samples from the Compost pile shall be taken from reference areas in the Compost pile pursuant to <u>Test Methods for Evaluating Solid Waste, Volume 2; Field Manual, Physical/Chemical Methods, November 1986, Third Edition, Chapter 9.</u>

   Inorganic pollutant monitoring must be conducted according to <u>Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,</u> Second Edition (1982) with Updates I and II and third Edition (1986) with Revision I.

6. Calculation of the % volatile solids reduction is to be based on comparison of a representative grab sample of total and volatile solids entering each digester (a weighted blend of the primary and secondary clarifier solids) and a representative composite sample of solids exiting each digester withdrawal line (as defined in note 5 above).

7. Receiving stream flow rate may be derived from the USGS gauging station Number 14361500 (Rogue River at Grants Pass, Oregon"). In the event that this data is temporarily unavailable, the Permittee may use the historical average for this day adjusted by the relative flows from the nearest available USGS gauging station. In the event

the Grants Pass gauging station data becomes permanently unavailable, the Permittee must obtain DEQ approval for an alternative flow determination strategy.

8. When continuous monitors are used, a maximum one hour time interval between temperature readings should be used. Temperature data should be maintained in electronic format and made available to the DEQ upon request. All continuous temperature monitors are to be checked visually monthly to insure that the devices are still in place and submerged. A QA/QC plan must be in place for continuous temperature monitoring and all monitors must be audited at least quarterly. The DEQ acknowledges that uninterrupted data collection is not guaranteed due to vandalism, theft, damage or disturbance. In the event of equipment failure or loss, the permittee must notify the DEQ and deploy new equipment to minimize interruption of data collection. If temperature data collected by another entity (e.g. USGS) is being used, the DEQ must approve of this data prior to being used. During any period of data loss beyond the reasonable control of the permittee, temperatures may be estimated by any method acceptable to the DEQ. Temperature as a7-day average of daily maximums needs to be calculated for each new TMDL period.

9. The permittee shall perform all testing required in Part D of EPA Form 2A. The testing includes all metals (total recoverable), cyanide, phenols, hardness and volatile organic, acid extractable, base-neutral, and pesticide compounds. The monitoring needs to be conducted using EPA Methods 624 for volatile organic compounds, EPA Method 625 for semi-volatile organic compounds and Polycyclic Aromatic Hydrocarbons, and EPA Method 608 for pesticides. Three scans are required during the 4 ½ years after permit issuance. Two of the three scans must be performed no fewer than 4 months and no more than eight months apart. The effluent samples shall be 24-hour daily composites, except where sampling volatile compounds. In this case, six discrete samples (not less than 40 mL) collected over the operating day are acceptable. The permittee shall take special precautions in compositing the individual grab samples for the volatile organics to insure sample integrity (i.e. no exposure to the outside air). Alternately, the discrete samples collected for volatiles may be analyzed separately and averaged. Test methods used must have quantitation limits less than or equal to those listed in the tables below unless otherwise approved by the DEQ in writing. The permittee must ensure that all monitoring analysis reports contain both the quantitation limit and detection level as defined below. For sample results below the detection level, the result shall be reported as "<DL" (e.g. <1.0). For sample results above the detection limit and below the quantitation limit, the results shall be reported as "eDL" (e.g. e1.0). Detection Level – the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. Quantitation Limit – The lowest level at which the entire analytical system must give a recognizable signal and acceptable calibration for the analyte. It is equivalent to the concentration of the lowest calibration standard, assuming that all method-specified sample weights, volumes, and cleanup procedures have been employed.

Base-Neutral Compounds

Pollutant	CAS Number	QL (µg/L)	Pollutant	CAS Number	QL (µg/L)
Acenapthene	83329	1	Acenapthylene	208968	1
Anthracene	120127	1	Benzidine	92875	10
Benzo(a)Anthracene	56553	1	Benzo(a)Pyrene	50328	1
3,4-Benzoflouranthene	205992	1	Benzo(ghi)Perylene	191242	1
Benzo(k)flouranthene	207089	1	Bis(2-Chloroethoxy) Methane	111911	2
Bis(2-Chloroethyl)-Ether	111444	1	Bis(2-Chloroiso-Propyl) Ether	108601	2
Bis(2-Ethylhexyl) Phthalate	117817	1	4-Bromophenyl Phenyl Ether	101553	1
Butyl Benzyl Phthalate	85687	1	2-Chloronaphthalene	91587	1
4-Chlorophenyl Phenyl Ether	7005723	1	Chrysene	218019	1
Dibenzo(a,h) Anthracene	53703	1	1,2-Dichlorobenzene	95501	0.5

Pollutant	CAS Number	QL (µg/L)	Pollutant	CAS Number	QL (µg/L)
1,3-Dichlorobenzene	541731	0.5	1,4-Dichlorobenzene	106467	0.5
3,3-Dichlorobenzidene	91941	1	Diethyl Phthalate	84662	1
Dimethyl Phthalate	131113	1	Di-n-Butyl Phthalate	84742	1
2,4-Dinitrotoluene	121142	1	2,6-Dinitrotoluene	606202	1
Di-n-Octyl Phthalate	117840	1	1,2-Diphenyl-hydrazine	122667	5
Flouranthene	206440	2	Flourene	86737	1
Hexachlorobenzene	118741	1	Hexachlorobutadiene	87683	2
Hexachlorocyclo-pentadiene	77474	2	Hexachloroethane	67721	2
Indeno(1,2,3-cd) Pyrene	193395	1	Isophorone	78591	10
Naphthalene	91203	1	Nitrobenzene	98953	1
NiNitrosodi-Methylamine	62759	1	N-Nitrosodi-N-Propylamine	621647	2
N-Nitrosodi-Phenylamine	86306	1	Phenanthrene	85018	1
Pyrene	129000	1	1,2,4-Trichlorobenzene	120821	0.5

Volatile Organic Compounds

Pollutant	CAS Number	QL (µg/L)	Pollutant	CAS Number	QL (µg/L)
Acrolein	107028	5	Acrylonitrile	107131	5
Benzene	71432	0.5	Bis (Chloro-methyl) Ether	542881	na
Bromoform	75252	0.5	Carbon Tetrachloride	56235	0.5
Chlorobenzene	108907	0.5	Chlorodibromomethane	124481	0.5
Chloroethane	75003	0.5	2-Chloro-Ethylvinylether	110758	5
Chloroform	67663	0.5	Dichlorobromomethane	75274	0.5
Dichloro-difluoromethane	75718	na	1,1-Dichloroethane	75343	0.5
1,2-Dichloroethane	107062	0.5	1,1-Dichloroethylene	75354	0.5
1,2-Dichloropropane	78875	0.5	1,3-Dichloropropylene	542756	0.5
Ethylbenzene	100414	0.5	Methyl Bromide	74839	0.5
Methyl Chloride	74873	0.5	Methylene Chloride	75092	0.5
1,1,2,2-Tetrachloro-ethane	79345	0.5	Tetrachloro-ethylene	127184	0.5
Toluene	108883	0.5	1,2-Trans-Dichloroethylene	156605	0.5
1,1,1-Trichloroethane	71556	0.5	1,1,2-Trichloroethane	79005	0.5
Trichloroethylene	79016	0.5	Trichlorofluoromethane	75694	na
Vinyl Chloride	75014	0.5			

Acid-Extractable Compounds

Pollutant	CAS Number	QL (µg/L)	Pollutant	CAS Number	QL (µg/L)
2-Chlorophenol	95578	1	2,4-Dichlorophenol	120832	1
2,4-Dimethylphenol	105679	2	4,6-Dinitro-O-Cresol	534521	2
2,4-Dinitrophenol	51285	5	2-Nitrophenol	88755	2
4-Nitrophenol	100027	5	P-Chloro-M-Cresol	59507	1
Pentachlorophenol	87865	2	Phenol	108952	1
2,4,6-Trichlorophenol	88062	1			

Pesticide Compounds

Pollutant	CAS Number	QL (µg/L)	Pollutant	CAS Number	QL (µg/L)
Aldrin	309002	0.01	Endrin	72208	0.01
BHC alpha-	319846	0.01	Endrin Aldehyde	7421934	0.01
BHC beta-	319857	0.01	Heptachlor	76448	0.01
BHC gamma – (Lindane)	58899	0.01	Haptachlor Epoxide	1024573	0.01
BHC delta	319868	0.01	PCB, Arochlor 1016 [1]	12674112	0.01
Chlordane	57749	0.01	PCB, Arochlor 1221 [1]	11104282	0.01
DDD 4,4'-	72548	0.01	PCB, Arochlor 1232 [1]	11141165	0.01
DDE 4,4'-	72559	0.01	PCB, Arochlor 1242 [1]	53469219	0.01
DDT 4,4'-	50293	0.01	PCB, Arochlor 1248 [1]	12675296	0.01
Dieldrin	60571	0.01	PCB, Arochlor 1254 [1]	11097691	0.01
Endosulfan alpha-	959988	0.01	PCB, Arochlor 1260 [1]	11096825	0.01
Endosulfan beta-	33213659	0.01	Toxaphene	8001352	0.01
Endosulfan Sulfate	1031078	0.01			

[1] PCB Reporting – Total PCB should be reported along with the individual PCB results

10. A minimum of seven consecutive days of daily average river flow is necessary to apply this permit limit option.

SCHEDULE D

Special Conditions

1. All biosolids shall be managed in accordance with the current, DEQ approved biosolids management plan, and the site authorization letters issued by the DEQ. Any changes in solids management activities that significantly differ from operations specified under the approved plan require the prior written approval of the DEQ. Using static aerated pile composting method, the active compost pile shall be maintained at 55° C or higher for 3 days to achieve pathogen reduction.

   All new biosolids application sites shall meet the site selection criteria set forth in OAR 340-050-0070 and must be located within Josephine and Jackson Counties. All currently approved sites are located in Josephine and Jackson Counties. No new public notice is required for the continued use of these currently approved sites. Property owners adjacent to any newly approved application sites shall be notified, in writing or by any method approved by DEQ, of the proposed activity prior to the start of application. For proposed new application sites that are deemed by the DEQ to be sensitive with respect to residential housing, runoff potential or threat to groundwater, an opportunity for public comment shall be provided in accordance with OAR 340-050-0030.

2. This permit may be modified to incorporate any applicable standard for biosolids use or disposal promulgated under section 405(d) of the Clean Water Act, if the standard for biosolids use or disposal is more stringent than any requirements for biosolids use or disposal in the permit, or controls a pollutant or practice not limited in this permit.

3. **Whole Effluent Toxicity Testing**

   a. The permittee shall conduct whole effluent toxicity (WET) tests as specified in Schedule B of this permit.

   b. The facility is required to sample once per year over the first four years of the permit. The sampling events and toxicity tests should take place in a different quarter each year (i.e. Year 1, Qtr 1). The facility may choose to conduct all tests within a single year of the permit, in which case, the tests shall be conducted quarterly.

   c. Acute Toxicity Testing - Organisms and Protocols

      (1) The permittee shall conduct 48-hour static renewal tests with *Ceriodaphnia dubia* (water flea) and 96-hour static renewal tests with *Pimephales promelas* (fathead minnow).

      (2) All test methods and procedures shall be in accordance with **Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms,** Fifth Edition, EPA-821-R-02-012, October 2002. Any deviation of the bioassay procedures outlined in this method shall be submitted in writing to the DEQ for review and approval prior to use.

      (3) Tests shall be conducted on final effluent sample collected as a single grab or 24-composite sample .No treatments to the final effluent (i.e. dechlorination, etc), except those included as part of the methodology, shall be performed by the laboratory unless approved by the DEQ prior to analysis.

      (4) Acute tests shall be conducted on a control and the following dilution series, unless otherwise approved by the DEQ in writing: 2.5%, 6.9%, 20%, 35%, and 100%.

      (5) An acute WET test shall be considered to show toxicity if there is a statistically significant difference in survival between the control and 6.9 percent effluent.

d. Chronic Toxicity Testing - Organisms and Protocols

(1) The permittee shall conduct tests with: *Ceriodaphnia dubia* (water flea) for reproduction and survival test endpoint, *Pimephales promelas* (fathead minnow) for growth and survival test endpoint, and *Raphidocelis subcapitata* (green alga formerly known as *Selanastrum capricornutum*) for growth test endpoint.

(2) All test methods and procedures shall be in accordance with **Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms**, Fourth Edition, EPA-821-R-02-013, October 2002. Any deviation of the bioassay procedures outlined in this method shall be submitted in writing to the DEQ for review and approval prior to use.

(3) Tests shall be conducted on final effluent samples collected as 24-hour composite samples. No treatments to the final effluent (i.e. dechlorination, etc), except those included as part of the methodology, shall be performed by the laboratory unless approved by the DEQ prior to analysis.

(4) Chronic tests shall be conducted on a control and the following dilution series, unless otherwise approved by the DEQ in writing: 2.5%, 4.9%, 20%, 35%, and 100%.

(5) A chronic WET test shall be considered to show toxicity if the IC_{25} (25% inhibition concentration) occurs at dilutions equal to or less than the dilution that is known to occur at the edge of the mixing zone, i.e. $IC_{25} \leq 4.9\%$.

e. Dual End-Point Tests –

(1) WET tests may be dual end-point tests in which both acute and chronic end-points can be determined from the results of a single chronic test. The acute end-point shall be based on 48-hours for the *Ceriodaphnia dubia* (water flea) and 96-hours for the *Pimephales promelas* (fathead minnow).

(2) All test methods and procedures shall be in accordance with **Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms**, Fourth Edition, EPA-821-R-02-013, October 2002. Any deviation of the bioassay procedures outlined in this method shall be submitted in writing to the DEQ for review and approval prior to use.

(3) Tests shall be conducted on final effluent samples collected as described in item d.(3).

(4) Tests run as dual end-point tests shall be conducted on a control and the following dilution series, unless otherwise approved by the DEQ in writing: 2.5%, 4.9%, 6.9%, 20%, and 100%.

(5) Toxicity determinations for dual end-point tests shall correspond to the acute, c.(5), and chronic, d.(5), described above.

f. Additional Sampling Requirements

(1) At the time of WET sampling, effluent samples should also be collected and analyzed for metals, hardness, and ammonia.

g. Evaluation of Causes and Exceedances

(1) If any test exhibits toxicity, as defined in sections c.(5) or d.(5) of this permit condition, another toxicity test using the same species and DEQ approved methodology shall be conducted within two weeks, unless otherwise approved by the DEQ.

(2) If two consecutive WET test results indicate acute and/or chronic toxicity, as defined in sections c.(5) or d.(5) of this permit condition, the permittee shall immediately notify the DEQ of the results. The DEQ will work with the permittee to determine the appropriate course of action to evaluate and address the toxicity.

h. Quality Assurance / Reporting

(1) Quality assurance criteria, statistical analyses, and data reporting for the WET tests shall be in accordance with the EPA documents stated in this condition.

(2) A bioassay laboratory report for each test shall be prepared according to the EPA method documents referenced in this Schedule. This shall include all QA/QC documentation, statistical analysis for each test performed, standard reference toxicant test (SRT) conducted on each species required for the toxicity tests, and completed Chain of Custody forms for the samples including time of sample collection and receipt. Reports shall be submitted to the DEQ within 45 days of test completion.

(3) The report should include all endpoints measured in the test, i.e. NOEC, LOEC, and IC_{25}.

(4) The permittee shall make available to the DEQ, on request, the written standard operating procedures they, or the laboratory performing the WET tests, are using for all toxicity tests required by the DEQ.

i. Reopener

(1) The DEQ may reopen and modify this permit to include new limitations, monitoring requirements, and/or conditions as determined by the DEQ to be appropriate, and in accordance with procedures outlined in Oregon Administrative Rules, Chapter 340, Division 45, if:
a. WET testing data indicate acute and/or chronic toxicity.
b. The facility undergoes any process changes.
c. Discharge monitoring data indicate a change in the reasonable potential to exhibit toxicity.

4. 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 <u>and</u> 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 4.a. 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 DEQ 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, 2020 SW 4th Avenue, Suite 400, Portland, OR 97201. This requirement is in addition to the reporting requirements contained under Schedule B of this permit.

f. Upon written request, the DEQ 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 4.b. above.

5. The permittee shall notify the appropriate DEQ Western Region - office in accordance with the response times noted in the General Conditions of this permit, of any malfunction so that corrective action can be coordinated between the permittee and the DEQ. Warranted incidents of noncompliance/spills should be reported to the Oregon Emergency Response System (Telephone Number 1-800-452-0311).

6. An adequate contingency plan for prevention and handling of spills and unplanned discharges shall be in force at all times. A continuing program of employee orientation and education shall be maintained to ensure awareness of the necessity of good inplant control and quick and proper action in the event of a spill or accident.

7. The permittee shall not be required to perform a formal hydrogeologic characterization or preliminary groundwater monitoring during the term of this permit provided:

a. The facilities are operated in accordance with the permit conditions, and;

b. There are no adverse groundwater quality impacts (complaints or other indirect evidence) resulting from the facility's operation.

If warranted, at permit renewal the DEQ may evaluate the need for a full assessment of the facilities impact on groundwater quality.

8. All reclaimed water used at the treatment plant site for landscape irrigation shall be exempt from OAR 340-055 provided the reclaimed water receives secondary treatment and disinfection. All landscape irrigation shall be confined to the treatment plant site. No spray or drift shall be allowed off the treatment plant site. Landscape irrigation shall be conducted following sound irrigation practices.

9. Within 180 days of permit issuance, the permittee shall submit to the DEQ for review and approval an updated program and time schedule for identifying and reducing inflow. Within 60 days of receiving written DEQ 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.

SCHEDULE E

Pretreatment Activities

The permittee shall implement the following pretreatment activities:

1. Program Administration

The permittee shall conduct and enforce its Pretreatment Program, as approved by the Department, and comply with the General Pretreatment Regulations (40 CFR Part 403). The permittee shall secure and maintain sufficient resources and qualified personnel to carry out the program implementation procedures described in this permit as required by 40 CFR § 403.8(f)(3).

2. Legal Authorities

The permittee shall adopt all legal authority necessary to fully implement its approved pretreatment program and to comply with all applicable State and Federal pretreatment regulations. The permittee must also establish, where necessary, contracts or agreements with contributing jurisdictions to ensure compliance with pretreatment requirements by industrial users within these jurisdictions. These contracts or agreements shall identify the agency responsible for all implementation and enforcement activities to be performed in the contributing jurisdictions. Regardless of jurisdictional situation, the permittee is responsible for ensuring that all aspects of the pretreatment program are fully implemented and enforced.

3. Industrial Waste Survey

The permittee shall update its inventory of industrial users at a frequency and diligence adequate to ensure proper identification of industrial users subject to pretreatment standards, but no less than once per year. The permittee shall notify these industrial users of applicable pretreatment standards in accordance with 40 CFR § 403.8(f)(2)(iii).

4. National Pretreatment Standards

The permittee shall enforce categorical pretreatment standards promulgated pursuant to Section 307(b) and (c) of the Act, prohibited discharge standards as set forth in 40 CFR § 403.5(a) and (b), or local limitations developed by the permittee in accordance with 40 CFR § 403.5(c), whichever are more stringent, or are applicable to any non-domestic source regulated under Section 307(b), (c), or (d) of the Act.

5. Local Limits

The permittee shall perform a technical evaluation of the need to revise local limits within 18 months after permit re-issuance unless the Department authorizes or requires, in writing, an alternate time frame. Locally derived discharge limitations shall be defined as pretreatment standards under Section 307(d) of the Act and must conform to 40 CFR §403.5(c), §403.8(f)(4). Technically based local limits shall be developed in accordance with the procedures established by the Department, and the USEPA's Local Limits Guidance.

6. Control Mechanisms

The permittee shall issue an individual control mechanism to all Significant Industrial Users except where the permittee may, at its discretion, issue a general control mechanism as defined by 40 CFR §403.8(f)(1)(iii); or certification in lieu of a control mechanism for Non-Significant Categorical Industrial Users (NSCIUs) as defined by § 403.3(v)(2), and Non-Discharging Categorical Industrial Users (NDCIUs). All individual and general control mechanisms must be enforceable and contain, at a minimum, the requirements identified in 40 CFR § 403.8(f)(1)(iii)(B); and, may contain equivalent concentration and mass based effluent limitations where appropriate under § 403.6(c)(5) and (6). Unless a more stringent definition has been adopted by the permittee, the definition of Significant Industrial User shall be as stated in 40 CFR § 403.3(v).

7. Compliance Monitoring:

Industrial User Sampling and Inspection

The permittee shall randomly sample and analyze the effluent from Industrial Users at a frequency commensurate with the character, consistency, and volume of the discharge and conduct surveillance activities in order to identify, independent of information supplied by Industrial Users, occasional and continuing noncompliance with Pretreatment Standards. The permittee shall conduct a complete facility inspection; and, sample the effluent from each Significant Industrial User at least once a year at a minimum, unless otherwise specified below:

(a) Where the permittee has authorized the Industrial User subject to a categorical Pretreatment Standard to forego sampling of a pollutant regulated by a categorical Pretreatment Standard in accordance with §403.12(e)(2), the permittee must sample for the waived pollutant(s) at least once during the term of the Categorical Industrial User's control mechanism. In the event that the permittee subsequently determines that a waived pollutant is present or is expected to be present in the Industrial User's wastewater based on changes that occur in the User's operations, the permittee must immediately begin at least annual effluent monitoring of the User's Discharge and inspection.

(b) Where the permittee has determined that an Industrial User meets the criteria for classification as a Non-Significant Categorical Industrial User, the permittee must evaluate, at least once per year, whether an Industrial User continues to meet the criteria in §403.3(v)(2).

(c) In the case of Industrial Users subject to reduced reporting requirements under §403.12(e)(3), the permittee must randomly sample and analyze the effluent from Industrial Users and conduct inspections at least once every two years. If the Industrial User no longer meets the conditions for reduced reporting in §403.12(e)(3), the permittee must immediately begin sampling and inspecting the Industrial User at least once a year.

Industrial User Self Monitoring and Other Reports

The permittee shall receive and analyze self-monitoring and other reports submitted by industrial users as required by §403.8(f)(2)(iv) and §403.12(b),(d),(e),(g) and (h). Significant Industrial User reports must include Best Management Practice (BMP) compliance information per §403.12(b), (e), (h), where appropriate.

Industrial User Monitoring in Lieu of Self-Monitoring

Where the permittee elects to conduct monitoring of an industrial user in lieu of requiring self-monitoring, the permittee shall gather all information which would otherwise have been submitted by the user. The permittee shall also perform the sampling and analyses in accordance with the protocols established for the user; and, must follow the requirements in 40 CFR §403.12(g)(2) if repeat sampling is required as the result of any sampling violation(s).

Sample Collection and Analysis

Sample collection and analysis, and the gathering of other compliance data, shall be performed with sufficient care to produce evidence admissible in enforcement proceedings or in judicial actions. Unless specified otherwise by the Director in writing, all sampling and analyses shall be performed in accordance with 40 CFR §136, or 40 CFR §503 for biosolids analytes.

8. Slug Control Plans

The permittee is required to evaluate whether each Significant Industrial User needs a slug control plan or other action to control Slug Discharges. Industrial Users identified as significant after October 14, 2005, must be evaluated within 1 year of being designated a Significant Industrial User. A Slug Discharge is any Discharge of a non-routine, episodic nature, including but not limited to an accidental spill or a non-customary batch Discharge, which has a reasonable potential to cause Interference or Pass Through, or in any other way violate the permittee's regulations, local limits or conditions of this Permit. The results of such activities shall be available to the Approval Authority upon request. The permittee shall require Significant Industrial Users to immediately notify the permittee of any changes at its facility affecting potential for a Slug Discharge. If the permittee determines that a slug control plan is needed, the requirements to control Slug Discharges shall be incorporated into the significant industrial user's control mechanism, and the plan shall contain, at a minimum, the following elements:

(a) Description of discharge practices, including non-routine batch Discharges;
(b) Description of stored chemicals;
(c) Procedures for immediately notifying the permittee of Slug Discharges, including any Discharge that would violate a prohibition under §403.5(b) with procedures for follow-up written notification within five days; and,
(d) If necessary, procedures to prevent adverse impact from accidental spills, including inspection and maintenance of storage areas, handling and transfer of materials, loading and unloading operations, control of plant site run-off, worker training, building of containment structures or equipment, measures for containing toxic organic pollutants (including solvents), and/or measures and equipment for emergency response;

9. Enforcement

The permittee shall identify all violations of the industrial user's permit or local ordinance. The permittee shall investigate all such instances of industrial user noncompliance and shall take all necessary steps to return users to compliance. The permittee's enforcement actions shall follow its approved Legal Authorities (i.e. Ordinance, etc.) and Enforcement Response Plan developed in accordance with 40 CFR § 403.8(f)(5).

10. Public Participation (significant noncompliance)

The permittee shall publish annual notification in a newspaper(s) of general circulation that provides meaningful public notice within the jurisdiction(s) served by the permittee of industrial users which, at any time during the previous 12 months, were in significant noncompliance with applicable Pretreatment requirements. For the purposes of this requirement, an industrial user is in significant noncompliance if it meets one or more of the criteria listed in 40 CFR 403.8(f)(2)(viii).

11. Data and Information Management

The permittee must develop and maintain a data management system designed to track the status of the industrial user inventory, discharge characteristics, and compliance. In accordance with 40 CFR § 403.12(o), the delegated program shall retain all records relating to pretreatment program activities for a minimum of three years, and shall make such records available to the Department and USEPA upon request. The permittee shall also provide public access to information considered effluent data under 40 CFR Part 2.

12. Annual Pretreatment Program Report

The permittee shall submit a complete report to the Department on or before March 31 that describes the pretreatment program activities during the previous calendar year pursuant to 40 CFR §403.12(h). The content and format of this report shall be as established by the Department. Reports submitted to the DEQ by the permittee must be signed by a principal executive officer, ranking elected official or other duly authorized employee. The duly authorized employee must be an individual or position having responsibility for the overall operation of the facility or the Pretreatment Program. This authorization must be made in writing by the principal executive officer or ranking elected official, and submitted to the Approval Authority prior to or together with the report being submitted.

13. Pretreatment Program Modifications

The permittee shall submit in writing to the Department a statement of the basis for any proposed modification of its approved program and a description of the proposed modification in accordance with 40 CFR § 403.18. No substantial program modifications may be implemented by the delegated program prior to receiving written authorization from the Department. This Schedule incorporates, by reference, all substantial and non-substantial pretreatment program modifications approved by the Department prior to NPDES permit re-issuance.

14. Implementation of 2005 EPA_Streamlining Amendments to 40CFR403

The permittee shall complete implementation of the required portions of the 2005 EPA streamlining amendments within twelve months after the permit reissuance unless the Department authorizes or requires in writing an alternate time frame.

SCHEDULE F

NPDES GENERAL CONDITIONS – DOMESTIC FACILITIES

SECTION A. STANDARD CONDITIONS

1. Duty to Comply with Permit
The permittee must comply with all conditions of this permit. Failure to comply with any permit condition is a violation of Oregon Revised Statutes (ORS) 468B.025 and the federal Clean Water Act and is grounds for an enforcement action. Failure to comply is also grounds for the Department to terminate, modify and reissue, revoke, or deny renewal of a permit.

2. Penalties for Water Pollution and Permit Condition Violations
The permit is enforceable by DEQ or EPA, and in some circumstances also by third-parties under the citizen suit provisions 33 USC §1365. DEQ enforcement is generally based on provisions of state statutes and EQC rules, and EPA enforcement is generally based on provisions of federal statutes and EPA regulations.

ORS 468.140 allows the Department to impose civil penalties up to $10,000 per day for violation of a term, condition, or requirement of a permit. The federal Clean Water Act provides for civil penalties not to exceed $32,500 and administrative penalties not to exceed $11,000 per day for each violation of any condition or limitation of this 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, imprisonment for not more than one year, or both. Each day on which a violation occurs or continues is a separately punishable offense. The federal Clean Water Act provides for criminal penalties of not more than $50,000 per day of violation, or imprisonment of not more than 2 years, or both for second or subsequent negligent violations of this permit.

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. The federal Clean Water Act provides for criminal penalties of $5,000 to $50,000 per day of violation, or imprisonment of not more than 3 years, or both for knowing violations of the permit. In the case of a second or subsequent conviction for knowing violation, a person shall be subject to criminal penalties of not more than $100,000 per day of violation, or imprisonment of not more than 6 years, or both.

3. Duty to Mitigate
The permittee must take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment. In addition, upon request of the Department, the permittee must 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 must be submitted at least 180 days before the expiration date of this permit.

The Department 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, 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
   c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge
   d. The permittee is identified as a Designated Management Agency or allocated a wasteload under a Total Maximum Daily Load (TMDL)

e. New information or regulations
f. Modification of compliance schedules
g. Requirements of permit reopener conditions
h. Correction of technical mistakes made in determining permit conditions
i. Determination that the permitted activity endangers human health or the environment
j. Other causes as specified in 40 CFR 122.62, 122.64, and 124.5
k. For communities with combined sewer overflows (CSOs):
   (1) To comply with any state or federal law regulation that addresses CSOs that is adopted or promulgated subsequent to the effective date of this permit
   (2) If new information, not available at the time of permit issuance, indicates that CSO controls imposed under this permit have failed to ensure attainment of water quality standards, including protection of designated uses
   (3) Resulting from implementation of the Permittee's Long-Term Control Plan and/or permit conditions related to CSOs.

The filing of a request by the permittee for a permit modification, revocation or reissuance, termination, or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

6. Toxic Pollutants
The permittee must comply with any applicable effluent standards or prohibitions established under Oregon Administrative Rules (OAR) 340-041-0033 and 307(a) of the federal Clean Water Act for toxic pollutants, and with standards for sewage sludge use or disposal established under Section 405(d) of the Clean Water Act, 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 and Other Legal Requirements
The issuance of this permit does not convey any property rights of any sort, or any exclusive privilege, or authorize any injury to persons or property or invasion of any other private rights, or any infringement of federal, tribal, state, or local laws or regulations.

8. Permit References
Except for effluent standards or prohibitions established under Section 307(a) of the federal Clean Water Act and OAR 340-041-0033 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.

9. Permit Fees
The permittee must pay the fees required by Oregon Administrative Rules.

SECTION B. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

1. Proper Operation and Maintenance
The permittee must at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) that 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 that are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

2. Need to Halt or Reduce Activity Not a Defense
For industrial or commercial facilities, upon reduction, loss, or failure of the treatment facility, the permittee must, 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 is not 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 permittee may allow any bypass to occur which does not cause effluent limitations to be exceeded, provided the diversion

is to allow essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of paragraphs b. and c. of this section.

(2) "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which causes them to become inoperable, or substantial and permanent loss of natural resources that 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 and the Department may take enforcement action against a permittee for bypass unless:
      i. Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage;
      ii. 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 that occurred during normal periods of equipment downtime or preventative maintenance; and
      iii. The permittee submitted notices and requests as required under General Condition B.3.c.
   (2) The Department may approve an anticipated bypass, after considering its adverse effects and any alternatives to bypassing, when the Department 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, a written notice must be submitted to the Department at least ten days before the date of the bypass.
   (2) Unanticipated bypass. The permittee must 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 must 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 Upset

For purposes of this permit, A Single Operational Upset that leads to simultaneous violations of more than one pollutant parameter will be treated as a single violation. A single operational upset is an exceptional incident that 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 upset 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 upset is a violation.

6. Overflows from Wastewater Conveyance Systems and Associated Pump Stations

a. Definitions
   (1) "Overflow" means any spill, release or diversion of sewage including:
      i. An overflow that results in a discharge to waters of the United States; and
      ii. An overflow of wastewater, including a wastewater backup into a building (other than a backup caused solely by a blockage or other malfunction in a privately owned sewer or building lateral), even if that overflow does not reach waters of the United States.

b. Prohibition of overflows. Overflows are prohibited. The Department may exercise enforcement discretion regarding overflow events. In exercising its enforcement discretion, the Department may consider various factors, including the adequacy of the conveyance system's capacity and the magnitude, duration and return frequency of storm events.
c. Reporting required. All 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 that threatens public health, the permittee must take such steps as are necessary to alert the public, health agencies and other affected entities (e.g., public water systems) about the extent and nature of the discharge in accordance with the notification procedures developed under General Condition B.8. 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. Emergency Response and Public Notification Plan
The permittee must develop and implement an emergency response and public notification plan that identifies measures to protect public health from overflows, bypasses or upsets that may endanger public health. At a minimum the plan must include mechanisms to:
a. Ensure that the permittee is aware (to the greatest extent possible) of such events;
b. Ensure notification of appropriate personnel and ensure that they are immediately dispatched for investigation and response;
c. Ensure immediate notification to the public, health agencies, and other affected public entities (including public water systems). The overflow response plan must identify the public health and other officials who will receive immediate notification;
d. Ensure that appropriate personnel are aware of and follow the plan and are appropriately trained;
e. Provide emergency operations; and
f. Ensure that DEQ is notified of the public notification steps taken.

9. Removed Substances
Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters must be disposed of in such a manner as to prevent any pollutant from such materials from entering waters of the state, 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 must 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 may not be changed without notification to and the approval of the Department.

2. Flow Measurements
Appropriate flow measurement devices and methods consistent with accepted scientific practices must be selected and used to ensure the accuracy and reliability of measurements of the volume of monitored discharges. The devices must 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 must 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, or in the case of sludge use and disposal, under 40 CFR part 503, 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 may, upon conviction, be punished by a fine of not more than $10,000 per violation, imprisonment for not more than two years, or 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 must be summarized each month on a Discharge Monitoring Report form approved by the Department. The reports must 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 part 136, or in the case of sludge use and disposal, under 40 CFR part 503, or as specified in this permit, the results of this monitoring must be included in the calculation and reporting of the data submitted in the Discharge Monitoring Report. Such increased frequency must 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 must be recorded unless otherwise specified in this permit.

7. Averaging of Measurements
Calculations for all limitations that require averaging of measurements must utilize an arithmetic mean, except for bacteria which shall be averaged as specified in this permit.

8. Retention of Records
Records of monitoring information required by this permit related to the permittee's sewage sludge use and disposal activities shall be retained for a period of at least five years (or longer as required by 40 CFR part 503). Records of all monitoring information including all calibration and maintenance records, 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 shall be retained 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 Department at any time.

9. Records Contents
Records of monitoring information must 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 must allow the Department or EPA 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.

11. Confidentiality of Information
Any information relating to this permit that is submitted to or obtained by DEQ is available to the public unless classified as confidential by the Director of DEQ under ORS 468.095. The Permittee may request that information be classified as confidential if it is a trade secret as defined by that statute. The name and address of the permittee, permit applications, permits, effluent data, and information required by NPDES application forms under 40 CFR 122.21 will not be classified as confidential. 40 CFR 122.7(b).

SECTION D. REPORTING REQUIREMENTS

1. Planned Changes

The permittee must comply with OAR chapter 340, division 52, "Review of Plans and Specifications" and 40 CFR Section 122.41(l) (1). Except where exempted under OAR chapter 340, division 52, no construction, installation, or modification involving disposal systems, treatment works, sewerage systems, or common sewers may be commenced until the plans and specifications are submitted to and approved by the Department. The permittee must give notice to the Department as soon as possihle of any planned physical alternations or additions to the permitted facility.

2. Anticipated Noncompliance
The permittee must give advance notice to the Department of any planned changes in the permitted facility or activity that may result in noncompliance with permit requirements.

3. Transfers
This permit may he 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 may be transferred to a third party without prior written approval from the Department. The Department may require modification, revocation, and reissuance of the permit to change the name of the permittee and incorporate such other requirements as may be necessary under 40 CFR Section 122.61. The permittee must 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 must be submitted no later than 14 days following each schedule date. Any reports of noncompliance must 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 must report any noncompliance that may endanger health or the environment. Any information must be provided orally (by telephone) to DEQ or to the Oregon Emergency Response System (1-800-452-0311) as specified below within 24 hours from the time the permittee becomes aware of the circumstances.

a. Overflows.

(1) Oral Reporting within 24 hours.

i. For overflows other than basement backups, the following information must be reported to the Oregon Emergency Response System (OERS) at 1-800-452-0311. For basement backups, this information should be reported directly to DEQ.
   a) The location of the overflow;
   b) The receiving water (if there is one);
   c) An estimate of the volume of the overflow;
   d) A description of the sewer system component from which the release occurred (e.g., manhole, constructed overflow pipe, crack in pipe); and
   e) The estimated date and time when the overflow began and stopped or will be stopped.

ii. The following information must be reported to the Department's Regional office within 24 hours, or during normal business hours, whichever is first:
   a) The OERS incident number (if applicable) along with a brief description of the event.

(2) Written reporting within 5 days.

i. The following information must be provided in writing to the Department's Regional office within 5 days of the time the permittee becomes aware of the overflow:
   a) The OERS incident number (if applicable);
   b) The cause or suspected cause of the overflow;
   c) Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the overflow and a schedule of major milestones for those steps;
   d) Steps taken or planned to mitigate the impact(s) of the overflow and a schedule of major milestones for those steps; and
   e) (for storm-related overflows) The rainfall intensity (inches/hour) and duration of the storm associated with the overflow.

The Department may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

b. Other instances of noncompliance.

(1) The following instances of noncompliance must be reported:
   i. Any unanticipated bypass that exceeds any effluent limitation in this permit;
   ii. Any upset that exceeds any effluent limitation in this permit;
   iii. Violation of maximum daily discharge limitation for any of the pollutants listed by the Department in this permit; and
   iv. Any noncompliance that may endanger human health or the environment.

(2) During normal business hours, the Department's Regional office must be called. Outside of normal business hours, the Department must be contacted at 1-800-452-0311 (Oregon Emergency Response System).

(3) A written submission must be provided within 5 days of the time the permittee becomes aware of the circumstances. The written submission must contain:
   i. A description of the noncompliance and its cause;
   ii. The period of noncompliance, including exact dates and times;
   iii. The estimated time noncompliance is expected to continue if it has not been corrected;
   iv. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance; and
   v. Public notification steps taken, pursuant to General Condition B.7

(4) The Department may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

6. <u>Other Noncompliance</u>

The permittee must report all instances of noncompliance not reported under General Condition D.4 or D.5, at the time monitoring reports are submitted. The reports must 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. <u>Duty to Provide Information</u>

The permittee must furnish to the Department within a reasonable time any information that the Department may request to determine compliance with the permit or to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit. The permittee must 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 has failed to submit any relevant facts or has submitted incorrect information in a permit application or any report to the Department, it must promptly submit such facts or information.

8. <u>Signatory Requirements</u>

All applications, reports or information submitted to the Department must be signed and certified in accordance with 40 CFR Section 122.22.

9. <u>Falsification of Information</u>

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. Additionally, according to 40 CFR 122.41(k)(2), 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 non-compliance shall, upon conviction, be punished by a federal civil penalty not to exceed $10,000 per violation, or by imprisonment for not more than 6 months per violation, or by both.

10. <u>Changes to Indirect Dischargers</u>

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.

SECTION E. DEFINITIONS

1. *BOD* means five-day biochemical oxygen demand.
2. *CBOD* means five day carbonaceous biochemical oxygen demand
3. *TSS* means total suspended solids.
4. "*Bacteria*" includes but is not limited to fecal coliform bacteria, total coliform bacteria, and E. coli bacteria.
5. *FC* means fecal coliform bacteria.
6. *Total residual chlorine* means combined chlorine forms plus free residual chlorine
7. *Technology based permit effluent limitations* means technology-based treatment requirements as defined in 40 CFR Section 125.3, and concentration and mass load effluent limitations that are based on minimum design criteria specified in OAR Chapter 340, Division 41.
8. *mg/l* means milligrams per liter.
9. *kg* means kilograms.
10. m^3/d means cubic meters per day.
11. *MGD* means million gallons per day.
12. 24-hour *Composite sample* means a sample formed by collecting and mixing discrete samples taken periodically and based on time or flow. The sample must be collected and stored in accordance with 40 CFR part 136.
13. *Grab sample* means an individual discrete sample collected over a period of time not to exceed 15 minutes.
14. *Quarter* means January through March, April through June, July through September, or October through December.
15. *Month* means calendar month.
16. *Week* means a calendar week of Sunday through Saturday.
17. *POTW* means a publicly owned treatment works.

REGISTERED PROFESSIONAL ENGINEER
19616
OREGON
FEB. 6, 1998
JEFFREY F. McCORMICK
EXPIRES: 12/31/14

City Of Grants Pass

TECHNICAL MEMORANDUM NO. 5

Water Restoration Plant Facility Plan
Liquid Stream Process Analysis

FINAL

October 2013

720 SOUTHWEST WASHINGTON STREET, SUITE 550 • PORTLAND, OREGON 97205-3507 • (503) 227-1885 • FAX (503) 227-1747

City Of Grants Pass

TECHNICAL MEMORANDUM NO. 5

Water Restoration Plant Facility Plan
Liquid Stream Process Analysis

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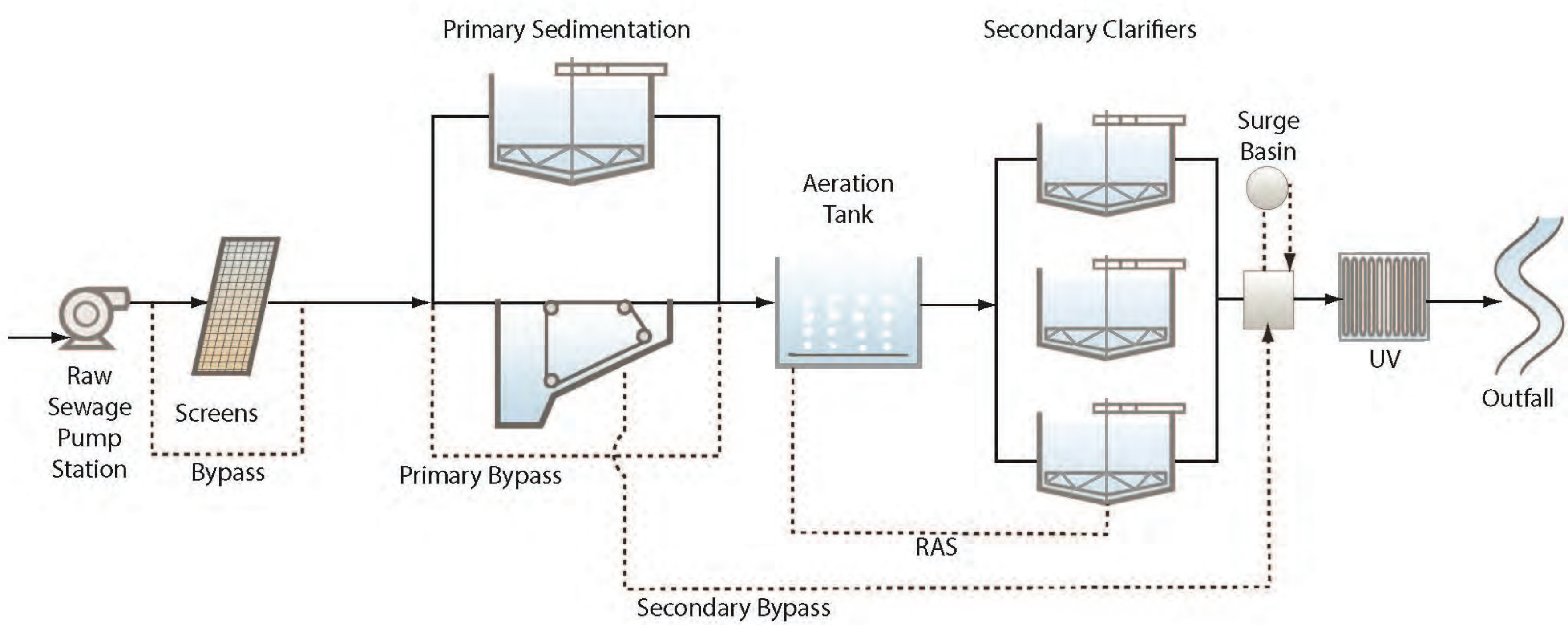
LIQUID STREAM PROCESS ANALYSIS

The Grants Pass Water Restoration Plant (WRP) provides partial nitrification in the summer and secondary treatment during winter months for the City of Grants Pass. The WRP began operation as a primary treatment plant at its current site in 1935, and was upgraded to secondary treatment in 1962. In 1974, the activated sludge process was implemented as part of a major plant upgrade project. Rectangular primaries and an ultraviolet (UV) disinfection system was added in 1995. There were subsequent upgrades in 1999 to add a second UV disinfection system. The most recent upgrade, which followed a Facilities Plan Update in 2001 (Parametrix 2001), included upgrades to the Raw Sewage Pump Station, a new Parshall flume, modifications to the activated sludge aeration tanks, a new secondary clarifier, and other ancillary improvements.

A schematic diagram of the liquid stream process units in the Grants Pass WRP is shown in Figure 1. The WRP includes the following major unit process elements:

- Raw Sewage Pump Station.
- Screening System.
- Primary Sedimentation Tanks.
- Aeration Tanks.
- Secondary Sedimentation Tanks.
- Ultraviolet Disinfection System.



GRANTS PASS WRP LIQUID STREAM PROCESS SCHEMATIC

FIGURE 1

CITY OF GRANTS PASS
LIQUID STREAM PROCESS ANALYSIS

1.0 RELIABILITY CRITERIA

To establish unit process capacity, criteria must be established for acceptable reliability of unit process elements. Reliability criteria were established by the United States Environmental Protection Agency (EPA) for national use in 1974 (EPA 1974) as part of the EPA's Construction Grants Program. Although these criteria were strictly applicable only to wastewater treatment plants constructed under that program, which no longer exists, they provide a recognized benchmark upon which to establish reliability requirements for wastewater treatment plants.

The EPA Reliability Criteria created three general reliability classes, depending on whether the effluent discharge was to receiving waters that “could be permanently or unacceptably damaged by effluent which was degraded in quality for only a few hours" (Class I) or "would not be permanently damaged, but could be damaged by continued (on the order of several days) effluent quality degradation" (Class II) or "not otherwise classified" (Class III). Reliability criteria for the unit processes in the Grants Pass WRP are shown in Table 1. The table includes reliability criteria for each major unit process in the Grants Pass WRP for each of the three EPA reliability classes and proposed reliability criteria for this Facilities Plan.

Table 1 Unit Process Reliability Criteria
City of Grants Pass – Liquid Stream Process Analysis

Unit Process	EPA Criterion Class I	EPA Criterion Class II	EPA Criterion Class III	Proposed Criterion for Grants Pass WRP
Trash removal	Shall contain	Same as for Class I	Same as for Class I	Mechanical screens provided
Grit removal	Shall contain	Same as for Class I	Same as for Class I	Provided
Mechanically-cleaned bar screens	Backup screen shall be provided (manual OK)	Same as for Class I	Same as for Class I	PHF with bypass channel(1)
Pumps	Largest unit out of service (OOS)	Same as for Class I	Same as for Class I	PHF with largest unit OOS
Primary sedimentation tank	50% capacity with largest unit OOS	Same as for Class I	At least two tanks	MMWWF (2) capacity with largest unit OOS
Aeration tank	At least two equal volumes	Same as for Class I	Single tank permissible	One tank OOS under AAF (3) (5)
Aeration blowers or aerators	Design rate with one unit OOS	At least two blowers or aerators	Same. One unit uninstalled acceptable	Max Month BOD load with one unit OOS

Table 1 Unit Process Reliability Criteria
City of Grants Pass – Liquid Stream Process Analysis

Unit Process	EPA Criterion Class I	EPA Criterion Class II	EPA Criterion Class III	Proposed Criterion for Grants Pass WRP
Air Diffusers	Largest section OOS	Same as for Class I	Same as for Class I	Largest section OOS at AAF
Secondary clarifier	75% capacity with one unit OOS	50% capacity with one unit OOS	50% capacity with one unit OOS	One tank OOS under AAF (5)
Disinfectant contact tanks	50% capacity with one unit OOS	Same as for Class I	Same as for Class I	50% capacity with one unit OOS at PHF
Hydraulic profile	100% capacity with one unit OOS	Same as for Class I	Same as for Class I	No weir submergence at PHF with AIS (4)

Notes:
(1) PHF – Peak Hour Flow,OOS – Out of Service
(2) MMWWF – Maximum Month Wet Weather Flow
(3) AAF – Average Annual Flow
(4) AIS – All in service
(5) Either one aeration tank or one secondary clarifier out at average flow

2.0 RAW SEWAGE PUMP STATION

The Raw Sewage Pump Station at the Grants Pass WRP includes three main pumps, each with a capacity of 18 mgd and one smaller pump with a capacity of 8 mgd. With all pumps in service, the rated capacity of the pumping station is 62 mgd. The firm capacity (with one of the largest units out of service) is 44 mgd. As shown in Figure 2, the firm capacity of the raw sewage pump station should exceed the anticipated peak hour flow (PHF) demand throughout the planning period.

The Raw Sewage Pump Station was upgraded in 2007 to replace the three largest pumps. These pumps are screw centrifugal pumps manufactured by Hidrostal. The small pump is a conventional horizontal centrifugal pump originally installed in 1996. There have been no operational or maintenance problems with the pumps. The pump station itself was constructed in 1974 and is in good condition.

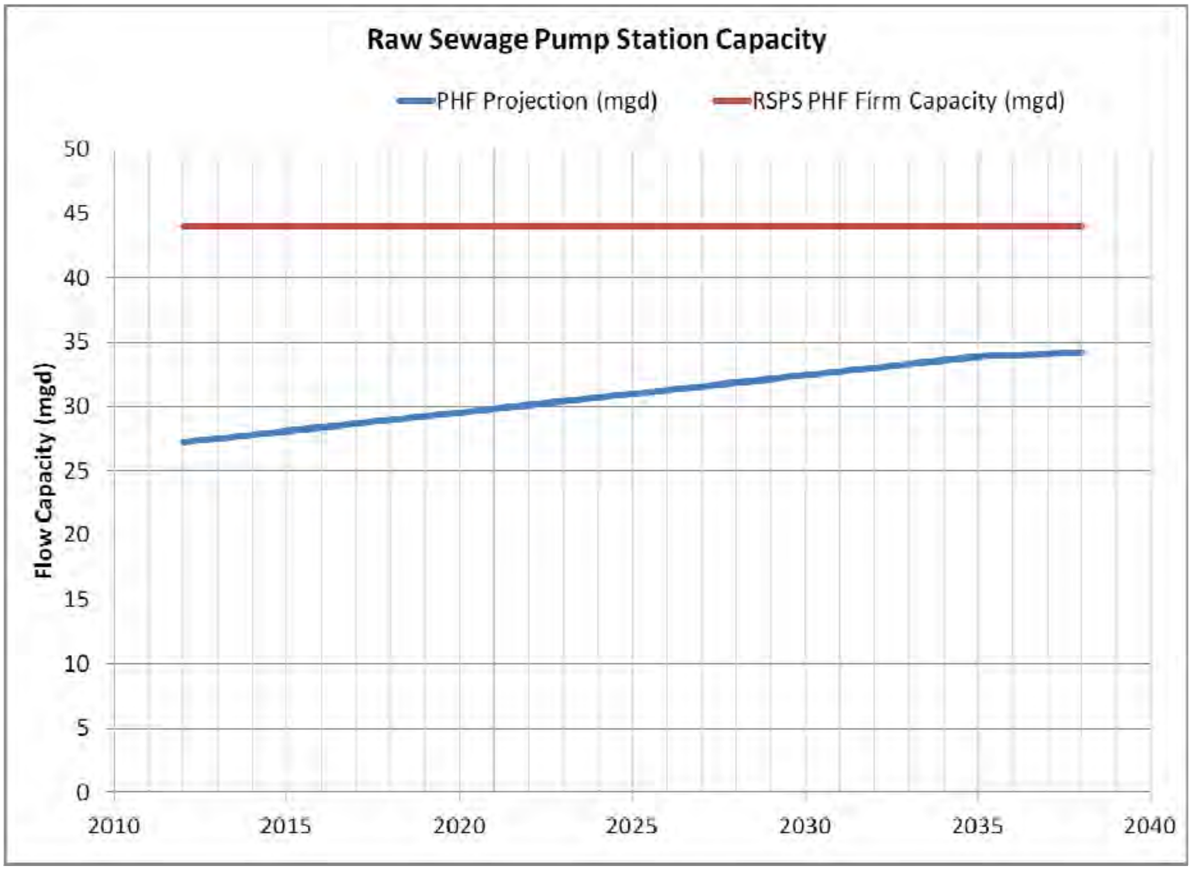


Figure 2 Raw Sewage Pumping Capacity Diagram

3.0 SCREENING SYSTEM

The raw wastewater screening system includes one mechanical screen with a PHF capacity of 23.5 mgd,and a perforated plate screen with the same PHF capacity. A bypass channel is provided. With both screens in service, the PHF capacity of the two screens is 47 mgd. The hydraulic capacity of the bypass channel with a one foot of freeboard below the top of the wall is approximately 10.5 mgd. Therefore, with one bar screen OOS and the bypass channel in service, the reliable PHF capacity of the screening system is 34 mgd. As shown in Figure 3, this is adequate capacity for the planning period. However, there are hydraulic limitations downstream of the screens that limit the flow through the screens to approximately 18.5 mgd. For a discussion of these limitations, see Section 8 below.

The screening system has one screw compactor / washer with a peak solids handling capacity of 25 cubic foot per hour (cf/hr). Assuming a screenings capture rate of 10 cubic foot per million gallons of flow, the predicted screenings quantity is compared to the capacity of the single screenings washer in Figure 4. The washer capacity is adequate for the projected planning period loading and there is adequate spare capacity after the recent purchase of a spare.

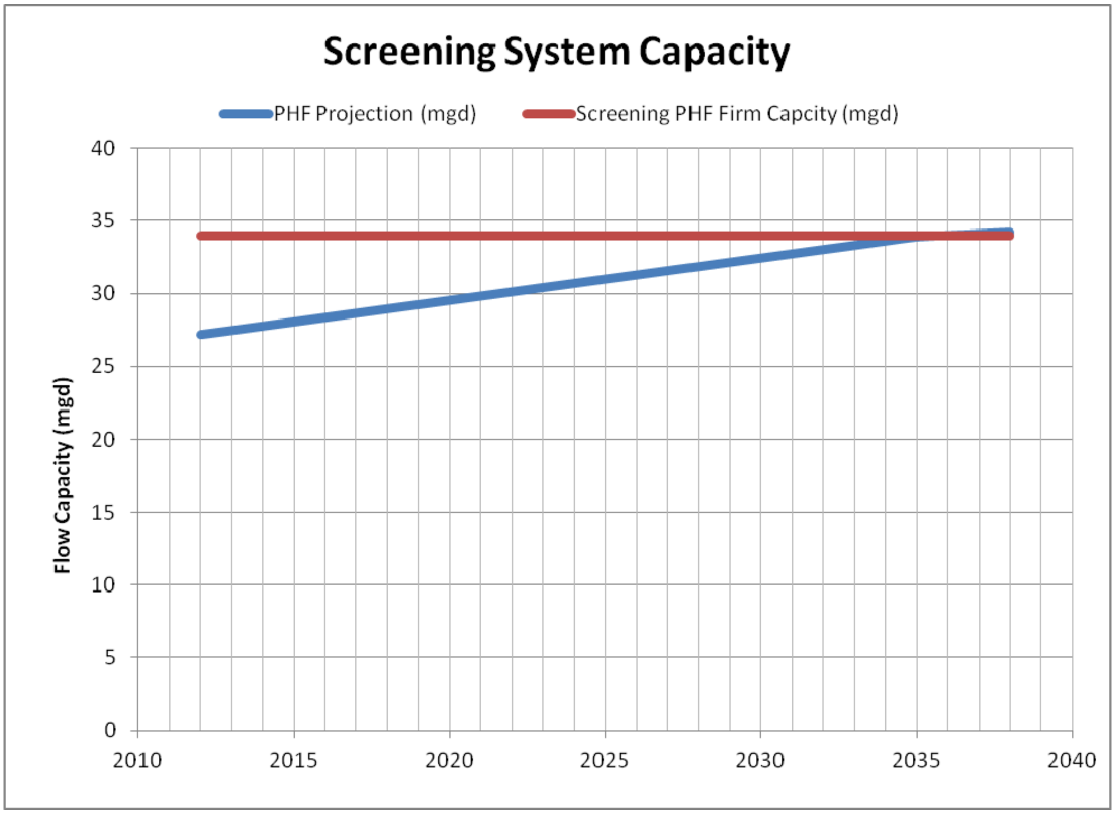


Figure 3 Screening System Capacity Diagram

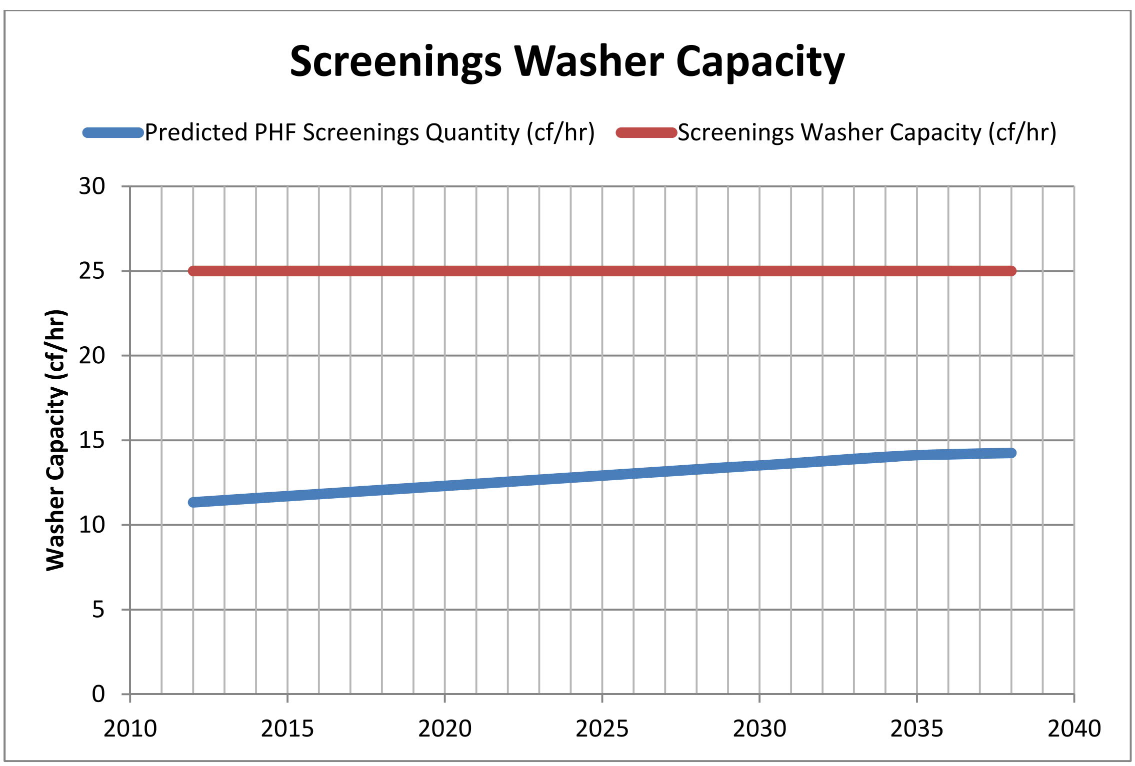


Figure 4 Screenings Washer Capacity Diagram

4.0 PRIMARY SEDIMENTATION

The Grants Pass WRP has two rectangular primary sedimentation tanks, each 108 foot by 21.5 foot, and one radial-flow circular unit, 70 foot in diameter. The circular unit was orignially configured for storm flow sedimentation, but has been converted under present operation for sludge storage and is not currently used for sedimentation.

Figure 5 presents data from the most recent five-year record of flows at the Grants Pass WRP for removal of total suspended solids (TSS) as a function of overflow rate, and Figure 6 presents comparable data for removal of five-day biochemical oxygen demand (BOD_5). Overflow rates were calculated based on both rectangular units in service except for a short period in 2011. The removal rate data show a typical scatter of performance due to the transient nature of influent solids properties. The figures show logarithmic data fits into the mean of the data.

Figure 7 presents calibration of the Carollo primary sedimentation model to the fitted mean of the measured data. This model calculates removal of rapidly settleable and slowly settleable solids particles based on assumed sewage wastewater characteristics calibrated to data from 2011. The figures show that the Carollo model is very well fitted to Grants Pass data for overflow rates up to 2,000 gpd/sf and conservative for higher overflow rates. This model was used to calculate loadings to the activated sludge system for design loadings.

Based on review of this data, Carollo recommends a design overflow criterion for max month wet weather flow (MMWWF) capacity of the primary sedimentation tanks at 2,000 gpd/sf, which produces a mean removal rate of approximately 40 percent for TSS. Based on the relatively good performance of the existing tanks under high flow conditions, we recommend a capacity rating for PHF at an overflow rate of 4,000 gpd/sf. With the two rectangular tanks in service, this produces a MMWWF capacity of 9.3 mgd and a PHF capacity of approximately 19 mgd. With only one unit in service, the capacity at 2,000 gpd/sf would be 4.6 mgd. This compares to current flows of 5.2 mgd average dry weather flow (ADWF), 10.2 mgd MMWWF, and 27.2 mgd PHF.

Figure 8 presents the MMWWF capacity of the existing rectangular units with both in service compared to projected MMWWF. The figure indicates that provision of one more rectangular unit of the same size as existing would extend MMWWF capacity to approximately the year 2020. Figure 9 presents comparable capacity comparison based on the PHF criterion. This shows that provision of two more rectangular units would provide sufficient PHF capacity beyond the year 2035.

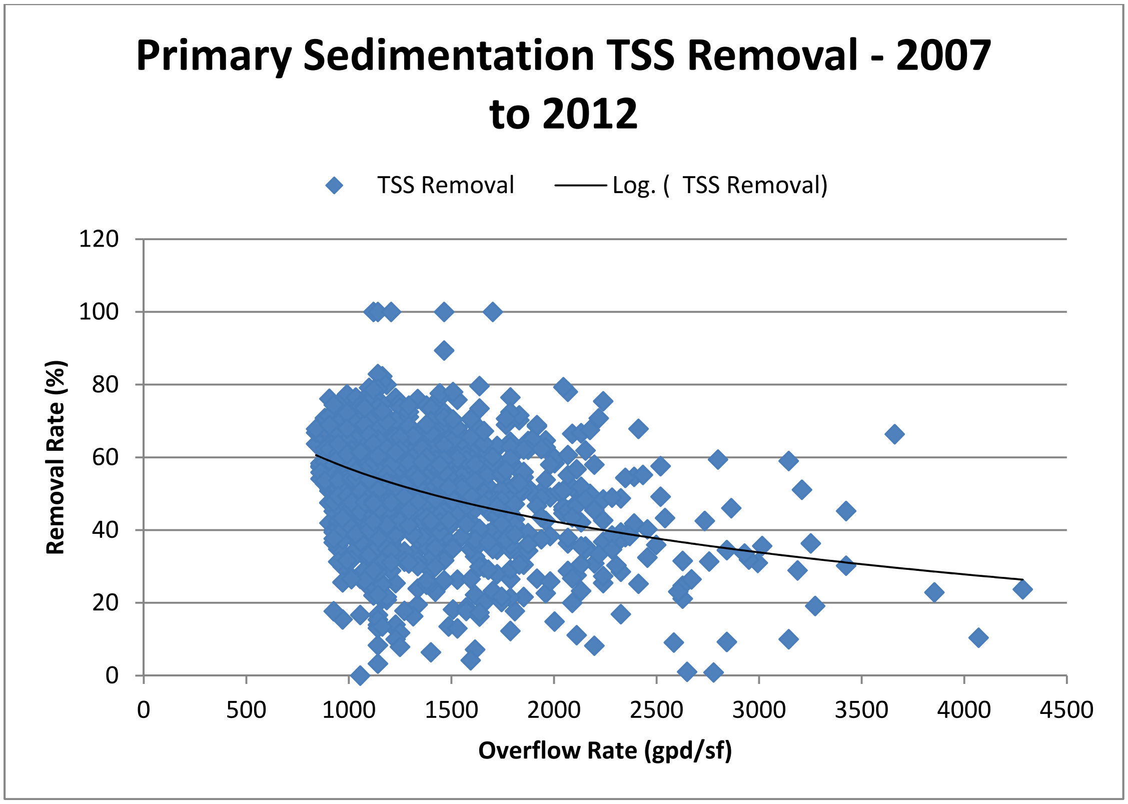


Figure 5 Primary Sedimentation TSS Removal Rate 748

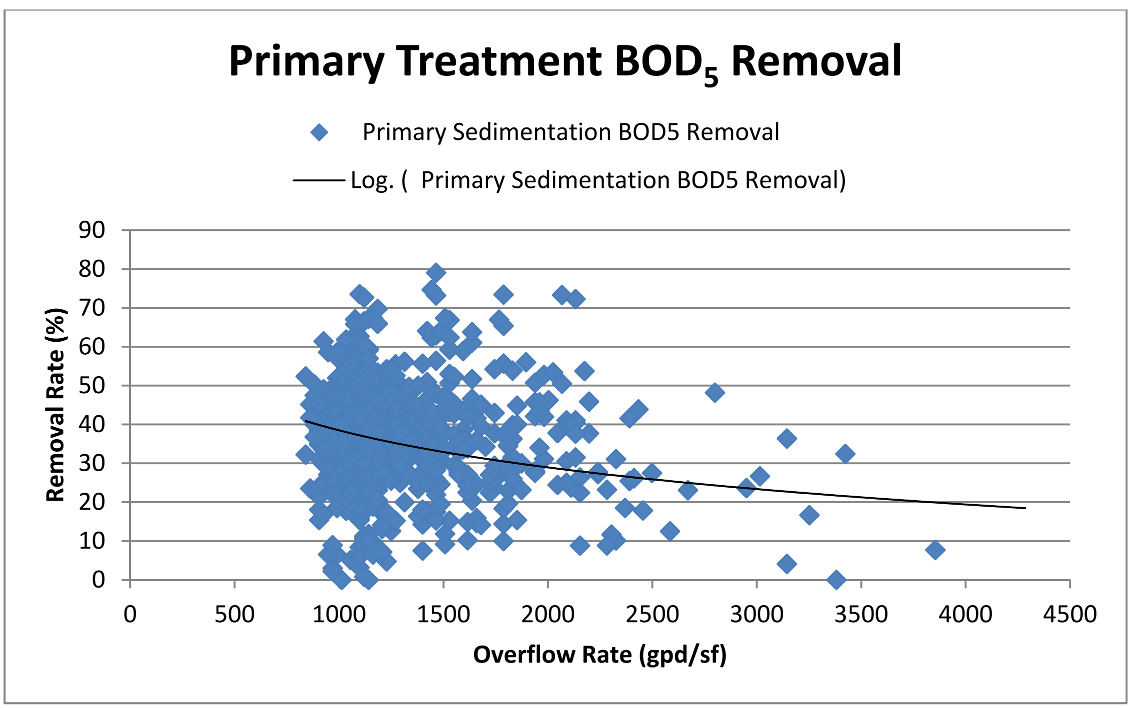
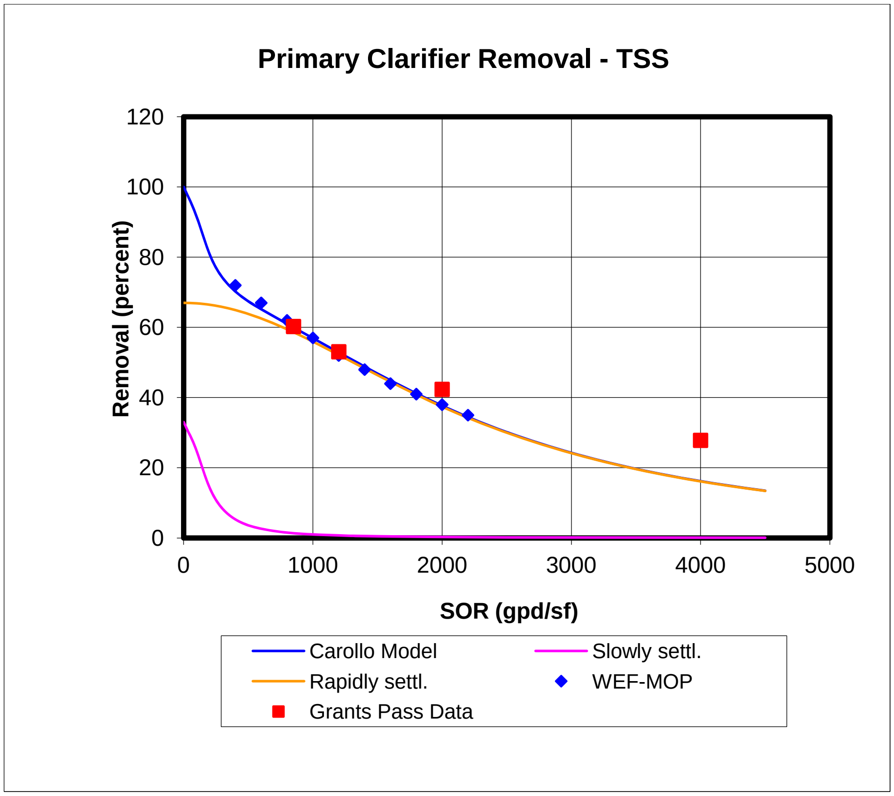


Figure 6 Primary Sedimentation BOD Removal Rate



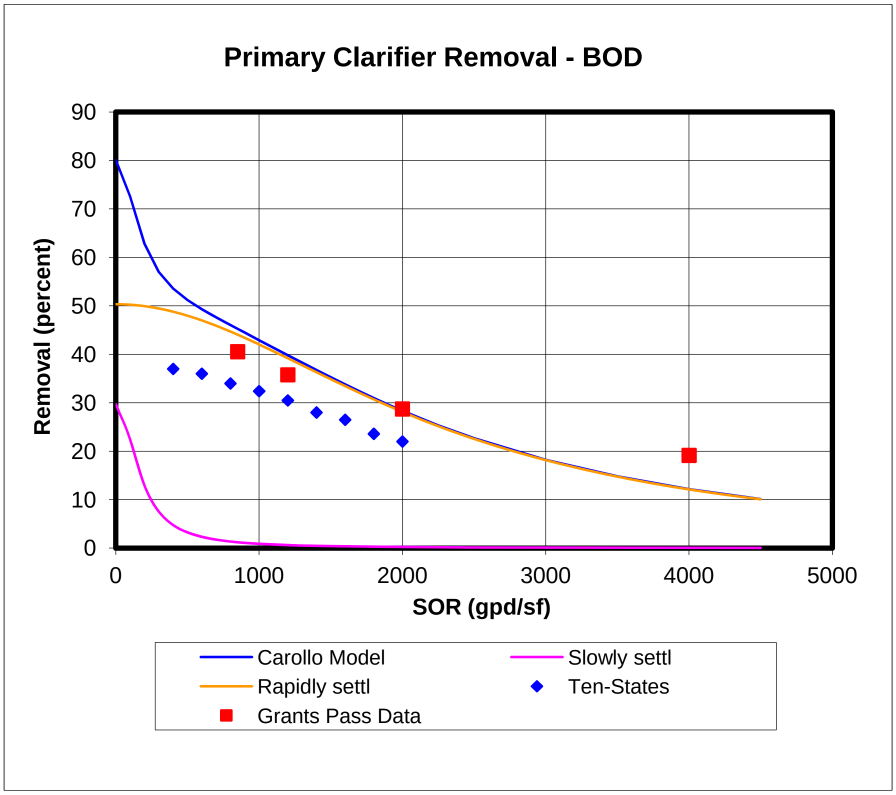


Figure 7 Comparison of Carollo Model to Grants Pass Data

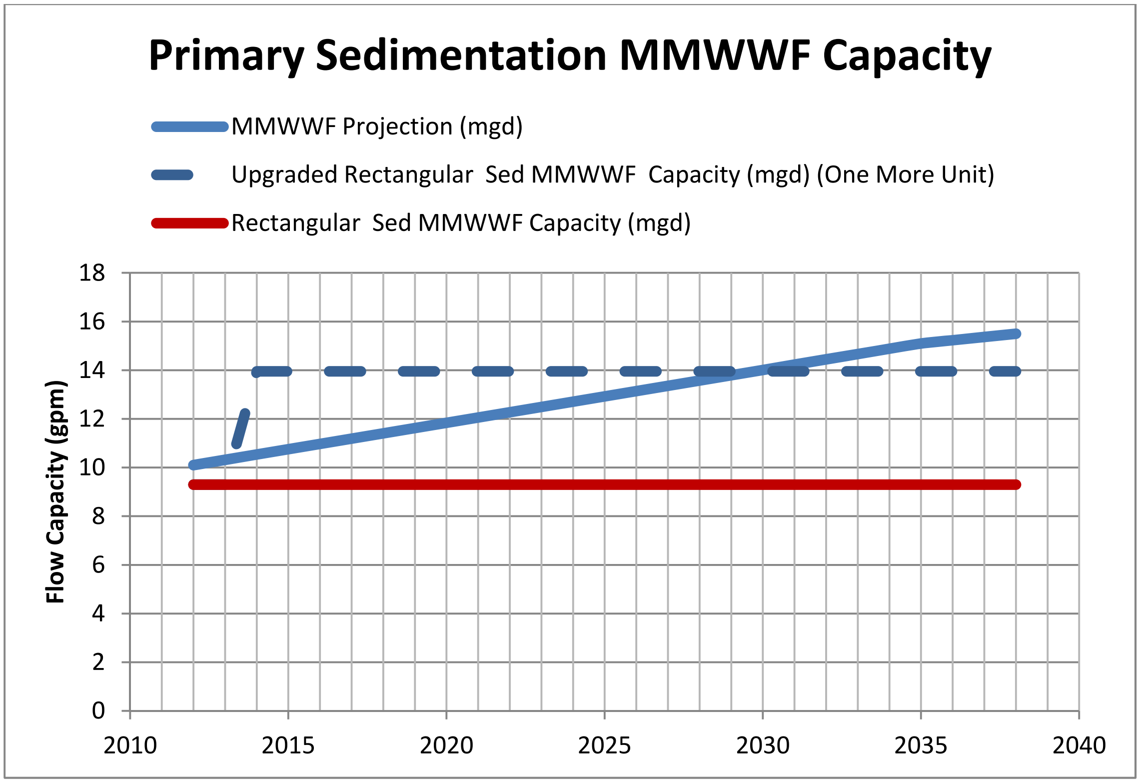


Figure 8 Primary Sedimentation MMWWF Capacity Diagram

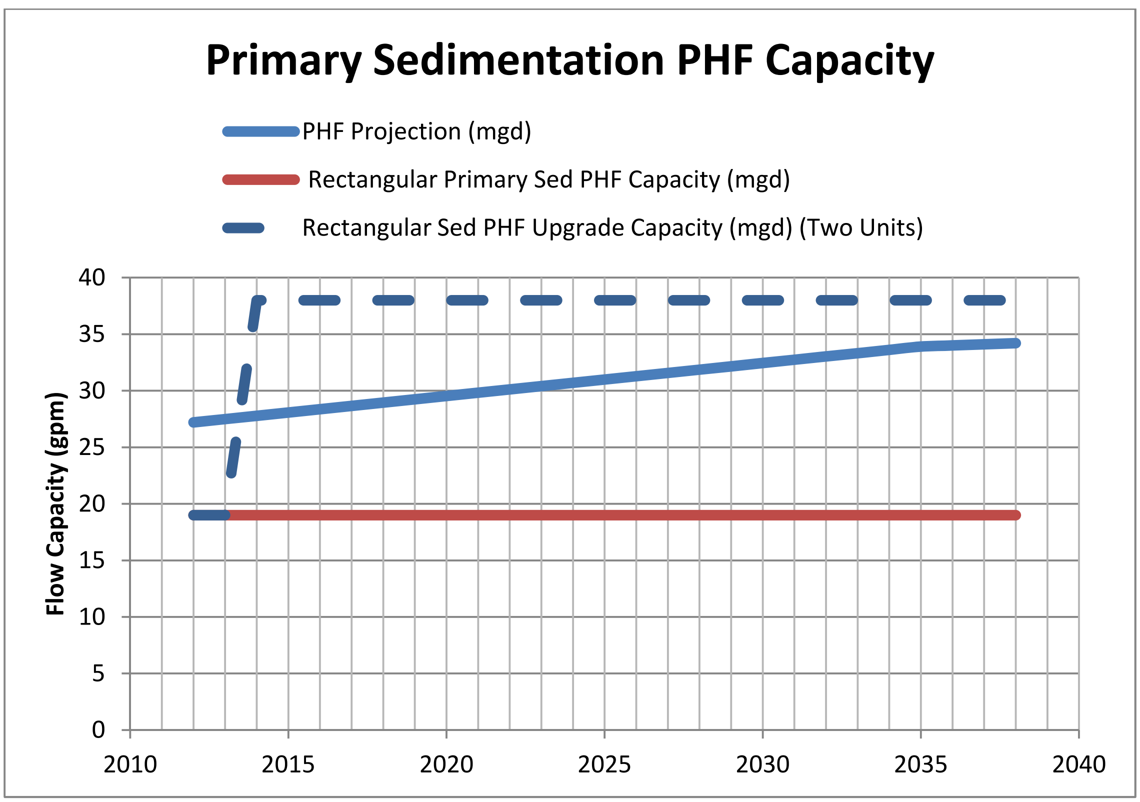


Figure 9 Primary Sedimentation PHF Capacity Diagram

5.0 GRIT REMOVAL SYSTEM

Grit removal at the Grants Pass WRP is provided by a system for pumping primary sludge through a grit separation cyclone. Grit from the cyclone is deposited into a screw sedimentation/ washer unit. Liquid sludge is directed to the gravity sludge thickener. There are three, 220-gallon per minute (gpm) capacity sludge grit pumps and two 220 gpm capacity grit cyclones, each with a slurry flow capacity of 16 gpm.

Figure 10 presents a capacity comparison for the grit system with one cyclone and one sludge/grit pump in service at a time. The figure shows the estimated total primary sludge flow at a concentration of one percent dry solids projected from current flows to 2035. The comparison indicates that the grit removal system should have adequate capacity throughout the planning period.

Grit removal equipment was installed in the 1996 plant upgrade and as such has nearly 20 years of service. Replacement should be considered well prior to the end of the planning period in 2035.

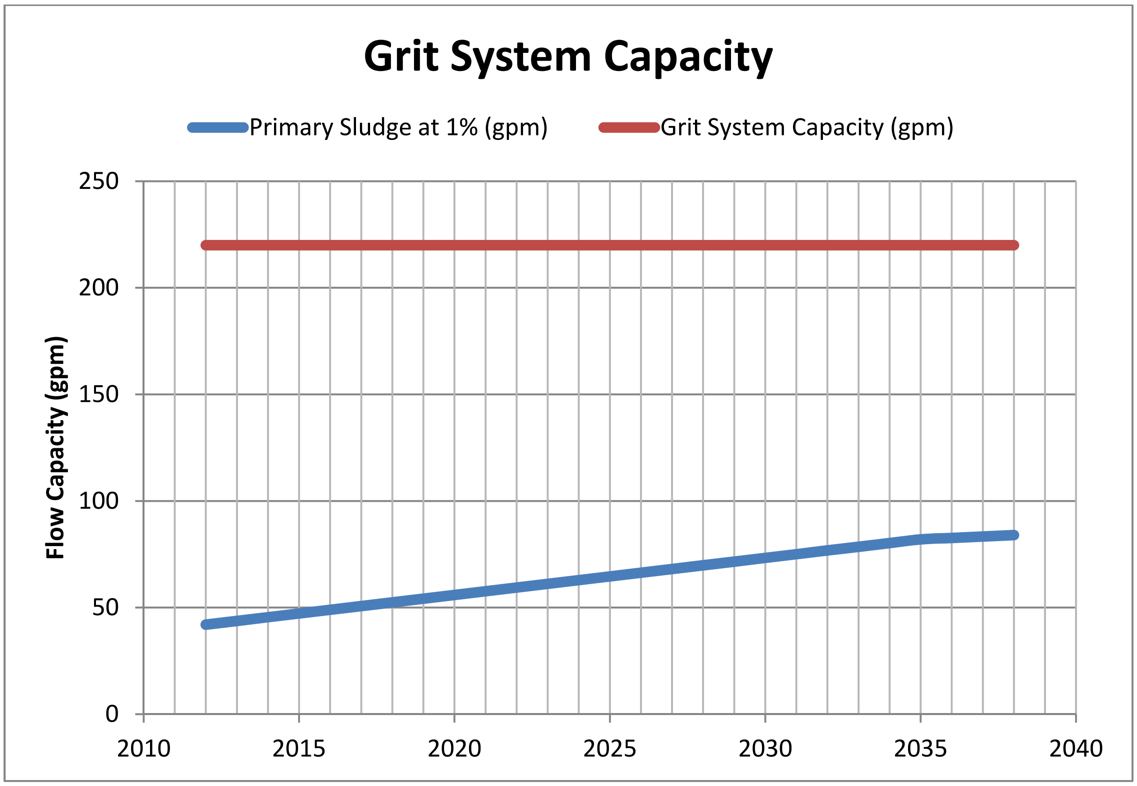


Figure 10 Grit Removal System Capacity Diagram

6.0 ACTIVATED SLUDGE SYSTEM

The activated sludge system at the Grants Pass WRP includes two aeration tanks, each with a volume of 0.42 million gallons (MG), two secondary clarifiers with a diameter of 75 feet, and one secondary clarifier with a diameter of 100 feet. The larger clarifier unit has nearly the same process area of the two smaller units combined.

The aeration tanks have a flexible configuration that permits operation in anaerobic selector plug flow aeration, conventional fully-aerobic aeration, and step feed or contact stabilization modes. The aeration tank configuration is illustrated schematically in Figure 11. The tanks are not identical in configuration. The south tank originally included five cells partitioned by fiberglass baffle walls unsuited for the hydrostatic pressure, but the partition wall between Cell 4 and Cell 5 has been removed. The first three cells in the south tank are provided with both submersible mixers and full-floor coverage panel aeration diffusers. The north tank has two, fully aerobic cells. In normal operation primary effluent (PE) and return activated sludge (RAS) flow is directed to Cell 1 and proceeds from Cell 1 through Cell 7 in series. In contact stabilization mode, RAS is directed to Cell 1 and PE is directed into the eastern-most inlet gate from the peripheral inlet channel into Cell 5.

The capacity of the activated sludge system is considered as a unit, including both aeration tanks and clarifiers, because the two elements can compensate for each other in provision of capacity. For example, an aeration tank with a high mixed liquor suspended solids (MLSS) concentration, and a relatively smaller aeration tank volume, can be compensated by providing a larger clarifier area, and conversely, a low MLSS concentration resulting from a larger aeration tank volume can permit a smaller clarifier area to be provided.

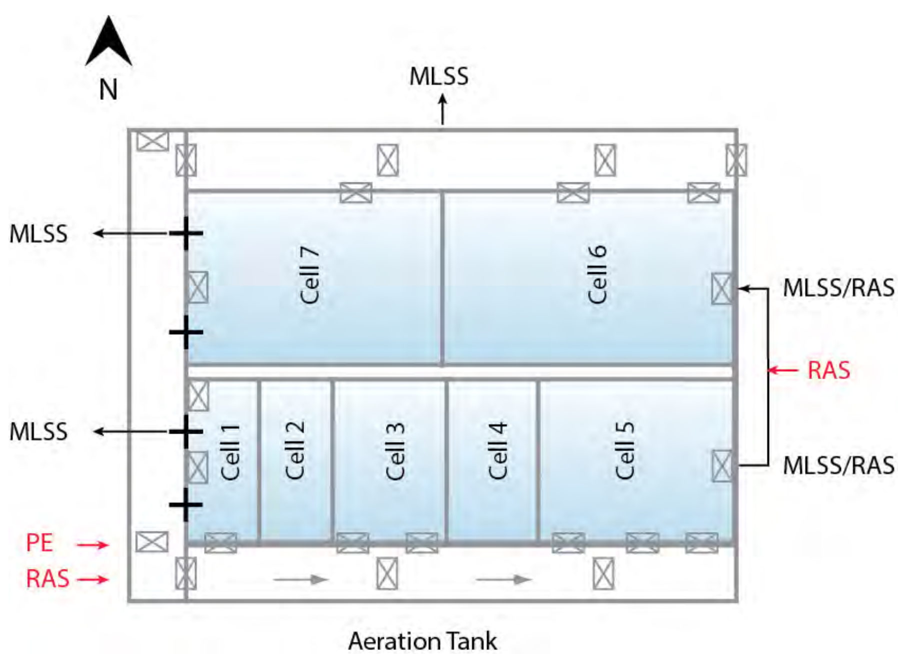


Figure 11 Aeration Tank Configuration

6.1 Activated Sludge Process Data

Key process data for determination of activated sludge capacity include:

- Flow.
- Organic loading.
- Temperature.
- MLSS concentration.
- Aerobic solids residence time (SRT).
- Effluent Ammonia.
- Sludge yield.
- SVI.
- Effluent quality.

Process data from the Grants Pass WRP process control records for the years from 2007 through 2012 are considered in the following paragraphs.

Figure 12 shows the influent flow for the period of record. Both average and peak daily flows are shown in the figure. The 30-period moving average of the average daily flow is also shown. The figure shows that the 30-day average flow reached nearly 10 mgd in the late winter of both 2010/2011 and 2011/2012. Since then, the highest peak flow reached 25 mgd in early 2011 and approximately 20 mgd several times over the period of record. On 2/5/2008 a peak flow of 40.6 mgd was recorded, but this flow appears to be an outlier and was not considered to be significant for this analysis. The aeration tanks are operated in contact stabilization mode during these high flow events. Flow directly affects activated sludge process capacity by limiting residence times in the aeration tanks and stressing secondary clarifiers. The limiting capacity of an activated sludge process occurs at the point where the aeration tank MLSS delivered to the secondary clarifiers under conditions of PHF results in solids loading failure. An appropriate safety factor needs to be used to account for turbulent flow in the clarifier. This will be illustrated in subsequent discussion.

Figure 13 shows influent loadings for influent BOD_5 for the period of record. The maximum 30-day average loading reached approximately 10,000 pounds per day (ppd) during early 2011. The figure shows estimated 2035 average annual and maximum month loadings. The experienced maximum month BOD_5 loading is approximately 60 percent of the estimated 2035 maximum month load.

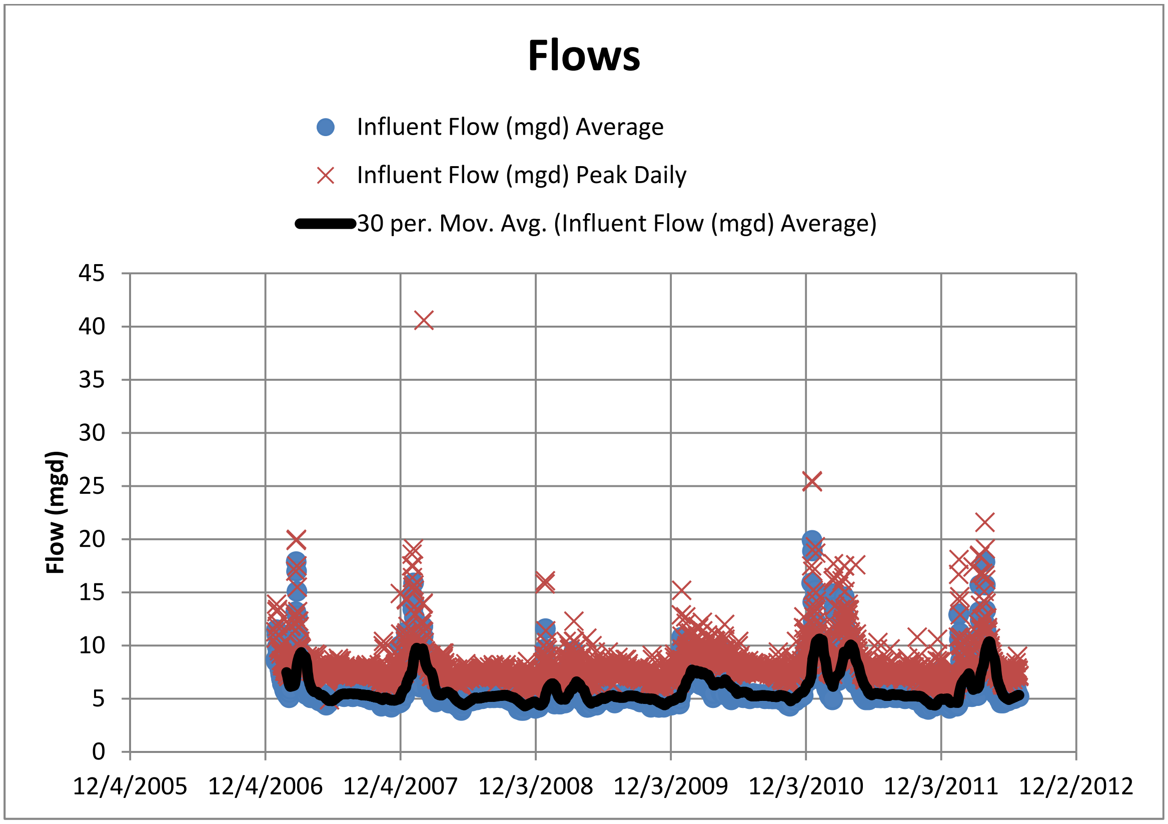


Figure 12 Flow Record

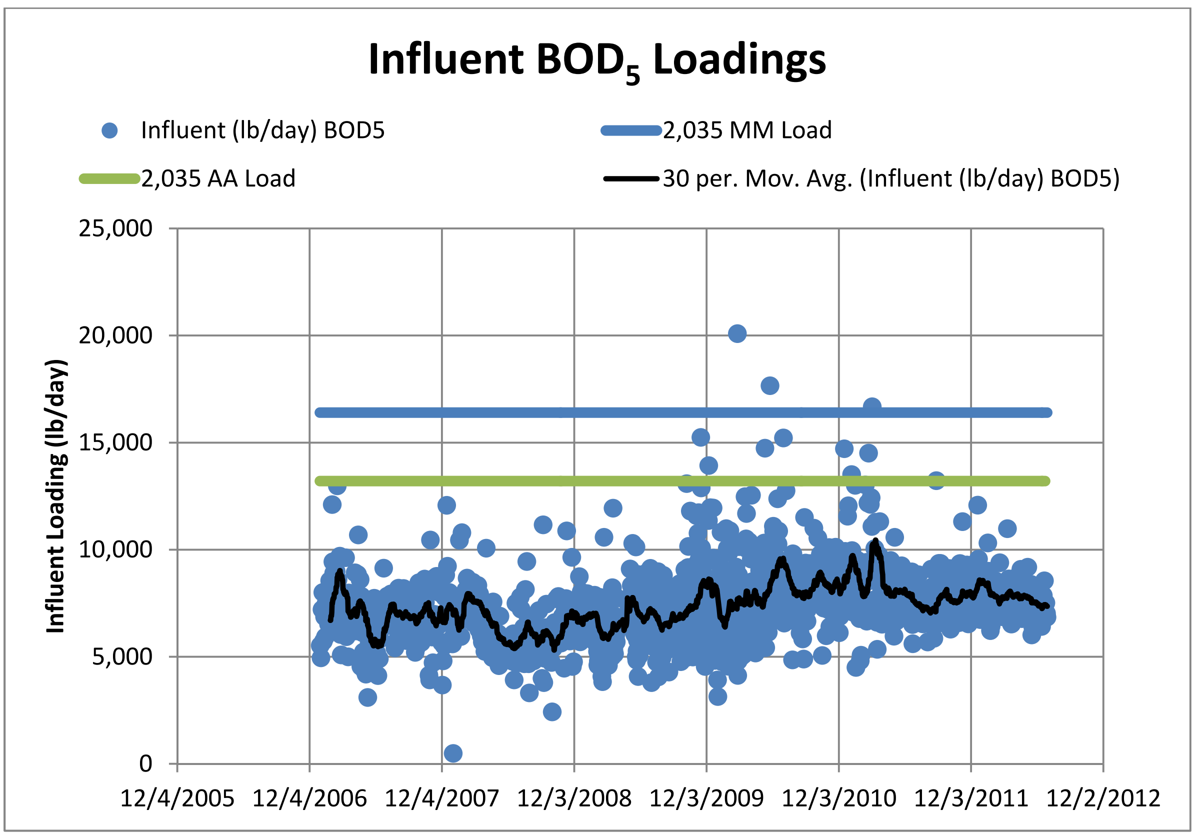


Figure 13 BOD Loading Record

Figure 14 shows temperature variation in the plant effluent. The plant measures both influent and effluent temperature, but only the effluent temperature is shown, since this more accurately reflects temperatures experienced by the activated sludge system. The minimum monthly summer temperature of 19 degrees Celsius and the minimum month winter temperature of 14 degrees Celsius are shown in the figure, and are used in the activated sludge process model.

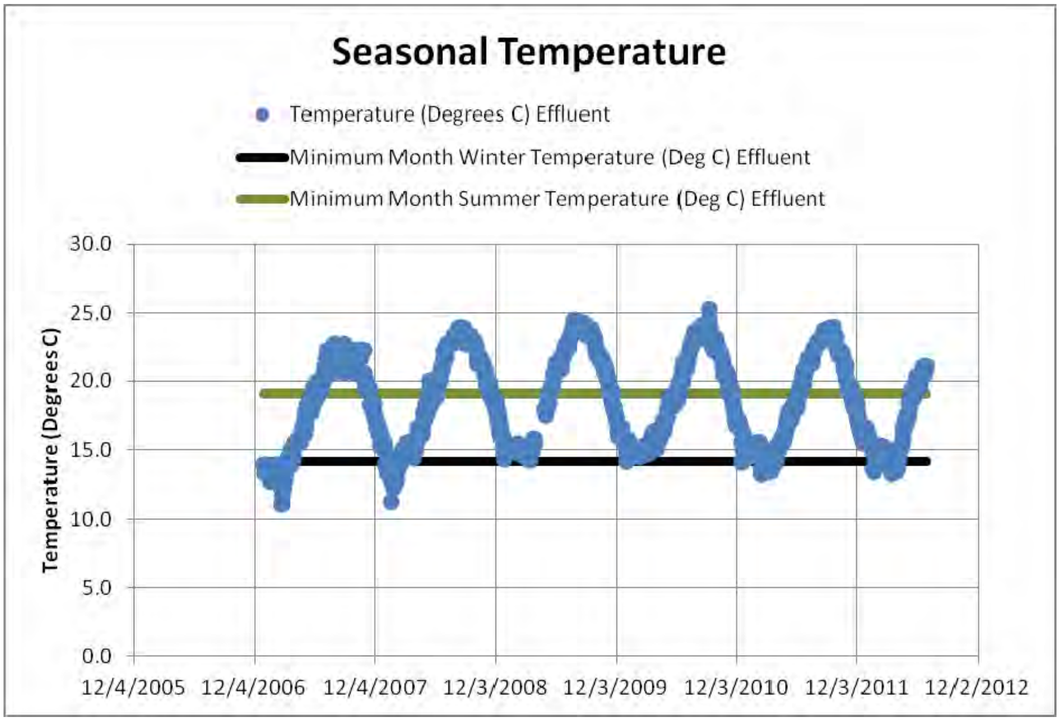


Figure 14 Temperature Record

Figure 15 presents data for MLSS concentration. It is seen that up until 2010 the WRP was operated with a MLSS concentration in the range of 1,000 to 2,500 mg/L. From 2010 on, the MLSS concentration was raised into the range of 2,000 to 4,000 mg/L. This change in operating strategy was made to improve performance of ammonia conversion (nitrification).

Figure 16 shows the consequence of the increased MLSS concentration on aerobic aeration tank SRT. The aerobic SRT is the mean time a suspended solids particle is retained in the aerated part of the aeration tanks. Aerobic SRT is an important process parameter for the activated sludge process because this sets a limit on the types of organisms that can be retained in the system. For example, typical floc-forming activated sludge bacteria may have a washout aerobic SRT on the order of 0.5 days; but the more specialized phosphorus accumulating organisms that are at least partly responsible for good settleability characteristics of activated sludge systems which, like Grants Pass WRP, contain anaerobic selector tanks, have a minimum (washout) aerobic SRT of around 2 days. The graph shows the average calculated daily value and the 30-day moving average. It is seen that the aerobic SRT averaged around 2 days during the period prior to 2010. After 2010, the average aerobic SRT increased into the range of 3 to 4 days. The minimum average SRT during this period of 2.5 days is shown in the figure. An aerobic SRT of 2.5 days was used for evaluation of capacity during the winter months and an SRT of 3.0 days during the summer partial nitrification season.

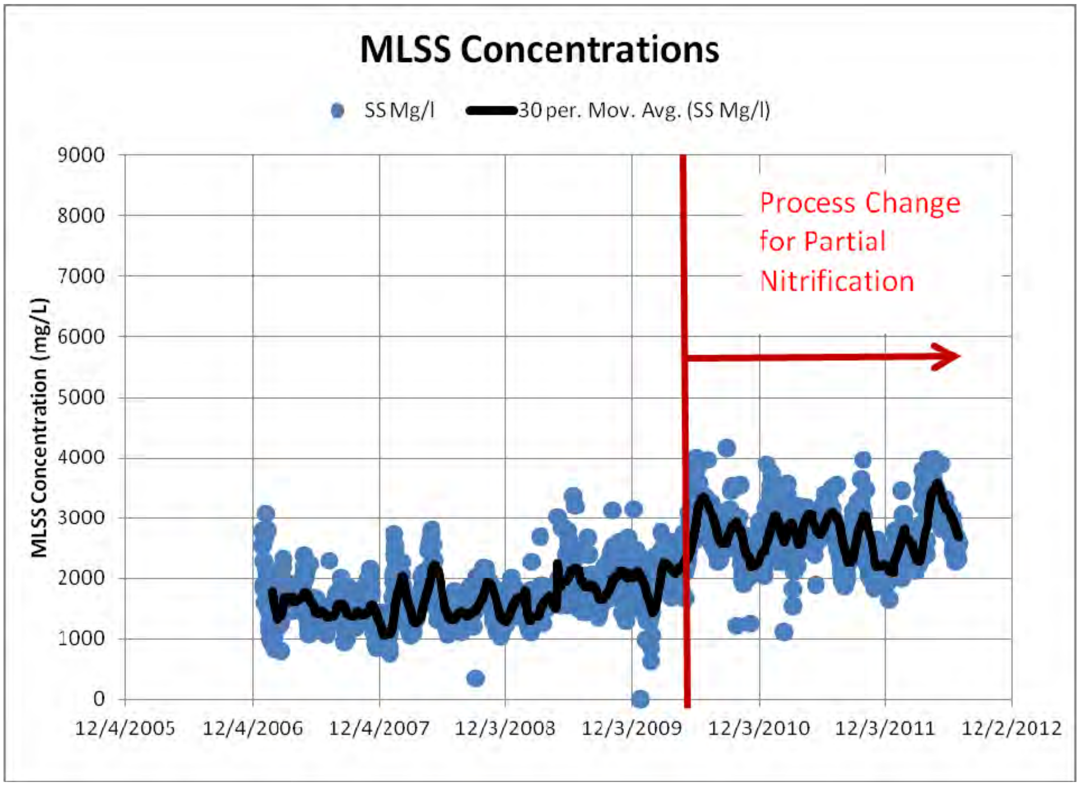


Figure 15 MLSS Concentration

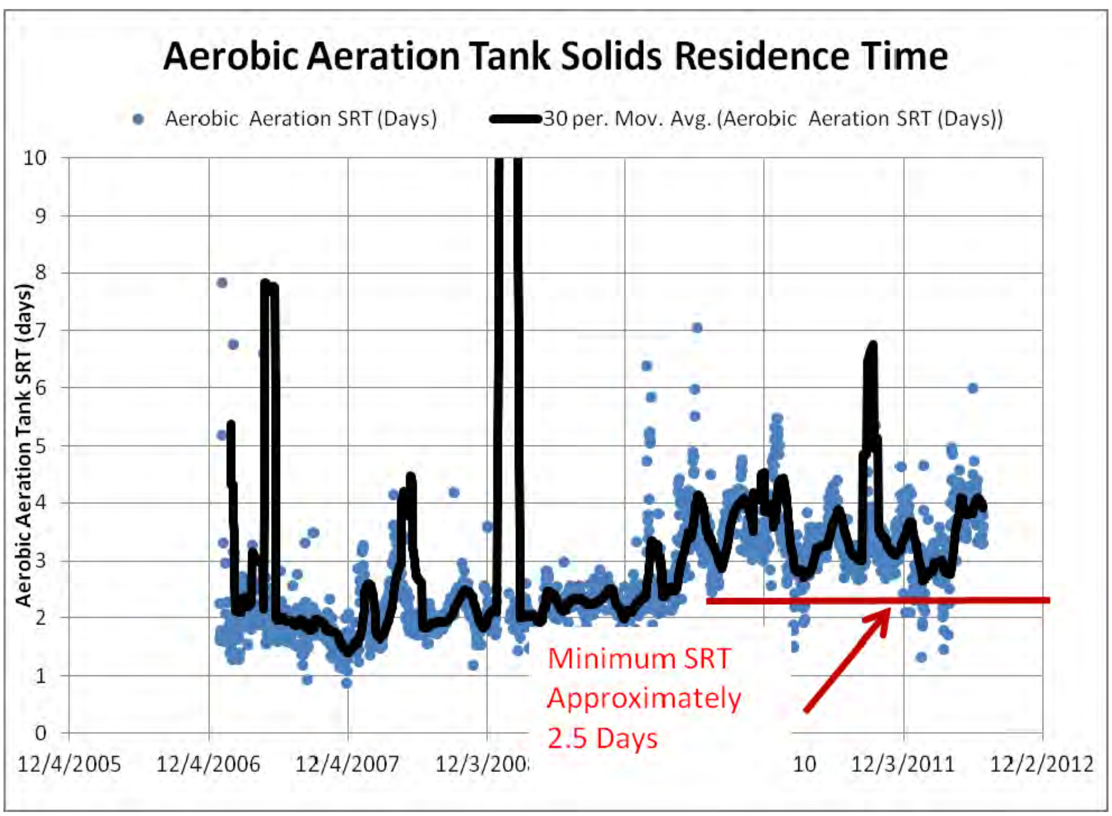


Figure 16 Aerobic Solids Residence Time (SRT)

This is consistent with improved nitrification as shown in Figure 17. It is seen that, prior to 2010, measured effluent ammonia concentrations were in a wide range from less than 5 to more than 25 mg/L. After increasing the aerobic SRT in 2010, the effluent ammonia concentration dropped into the range of less than 1 to less than 15 mg/l and less than 10 mg/L during the summer months. Maximum month and maximum day effluent ammonia levels from the NPDES permit are shown for comparison. The WRP has been in compliance for ammonia removal since raising the SRT in 2010.

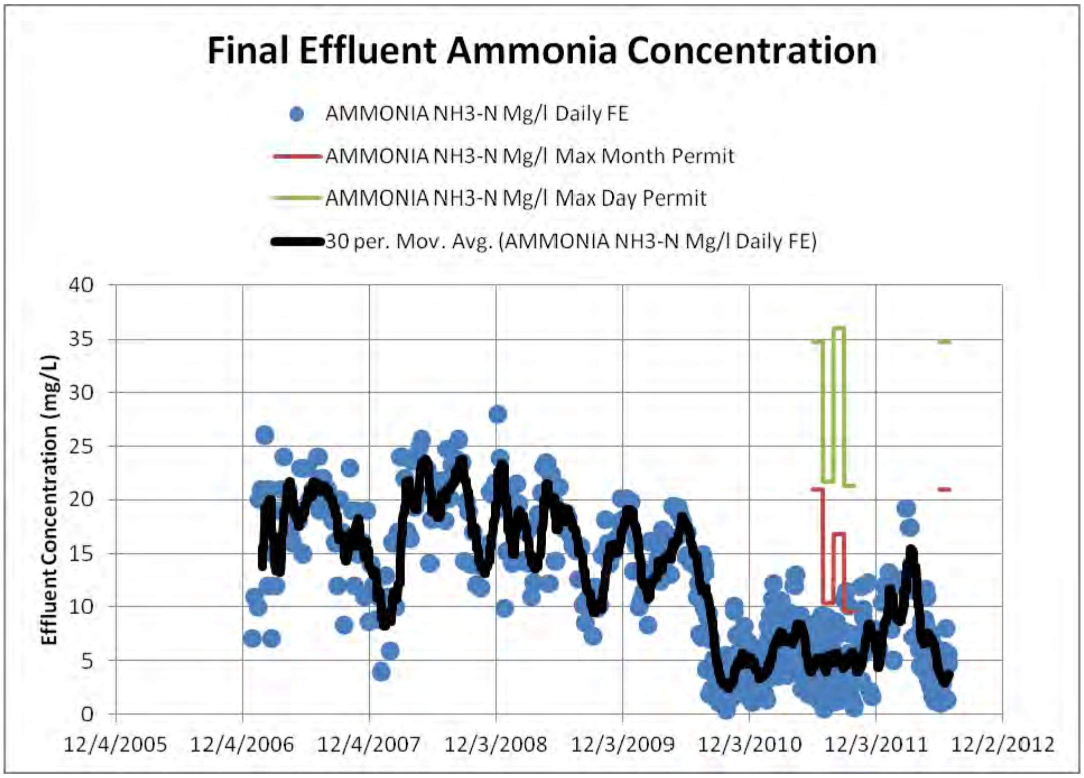


Figure 17 Effluent Ammonia Data

An important factor in activated sludge capacity is the sludge yield. The sludge yield is the weight in pounds (lb) of waste solids produced per lb of influent BOD_5 loaded to the activated sludge system. Figure 18 presents sludge yield data for the period of record. It is seen that the yield (combined effluent and waste activated sludge) was over 1.0 lb TSS per lb of BOD_5 loaded prior to 2010. In the years after 2010, the yield has decreased into the range of 0.5 to 1.0 lb per lb. This is consistent with the longer SRT used during recent years, which results in increased volatile solids destruction in the aeration tank. The average yield for 2011 was approximately 0.85 lb per lb., which was used as the yield calibration point in our process model.

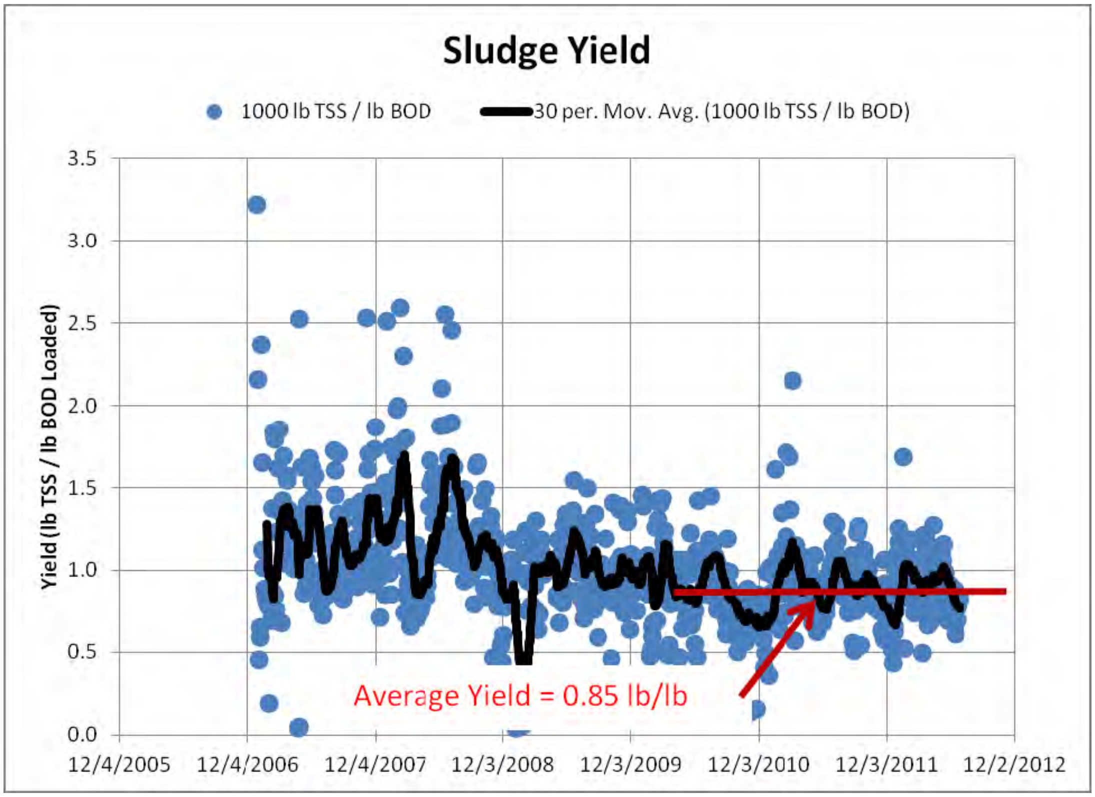


Figure 18 Sludge Yield

Another important parameter for capacity analysis of activated sludge systems is sludge settleability. The Grants Pass WRP measures settleability as sludge volume index (SVI) on a daily basis. Data for the period of record are shown in Figure 19. The data show that SVI has ranged from less than 100 milliliters per gram (mL/g) to as high as 400 mL/g. The average SVI during the summer of 2011 was approximately 150 mL/g and the average during the winter period was approximately 170 mL/g. These values were used for calculation of capacity for, respectively, the summer and winter season.

The final measure of activated sludge process success is in production of adequate secondary effluent quality. Figure 20 presents data for effluent suspended solids (ESS) concentration. Seasonal NPDES permit requirements for summer (10 mg/L) and winter (30 mg/L) are compared in the figure to effluent ESS concentration data from the recent record. The figure illustrates that average ESS has been under the summer limit of 10 mg/L and comfortably below the winter limit. Figures 21 and 22 present corresponding data for BOD_5. During the summer months, the WRP is required to meet a final effluent carbonaceous BOD_5 ($CBOD_5$) permit level of 10 mg/L. During the winter months, the WRP must meet a total BOD_5 limit of 30 mg/L. The data showsthat the 30-day average for both parameters has been comfortably below the NPDES permit level during both seasons.

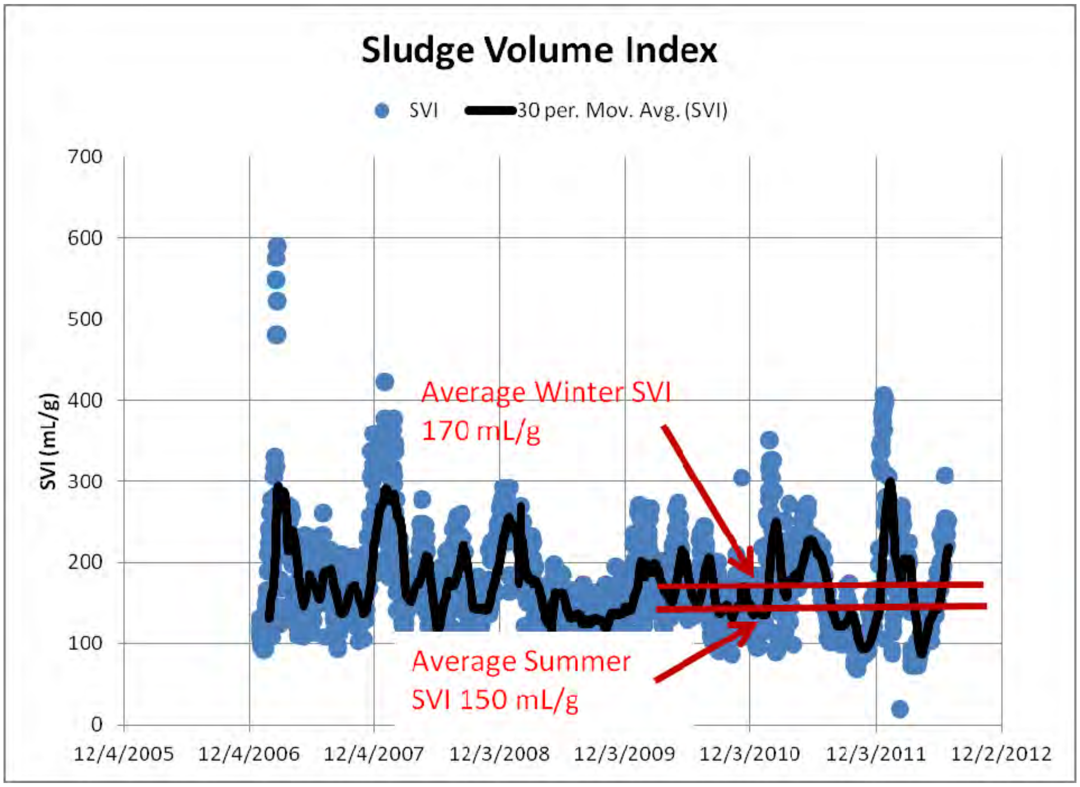


Figure 19 **SVI**

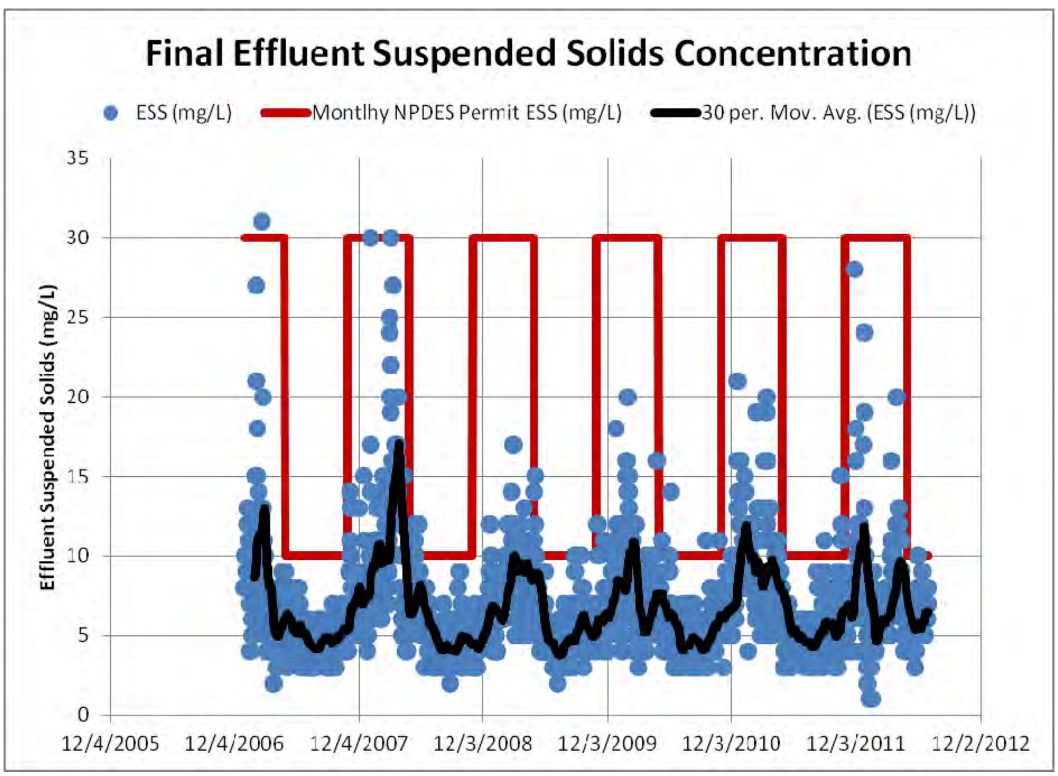


Figure 20 **Effluent Suspended Solids (ESS)**

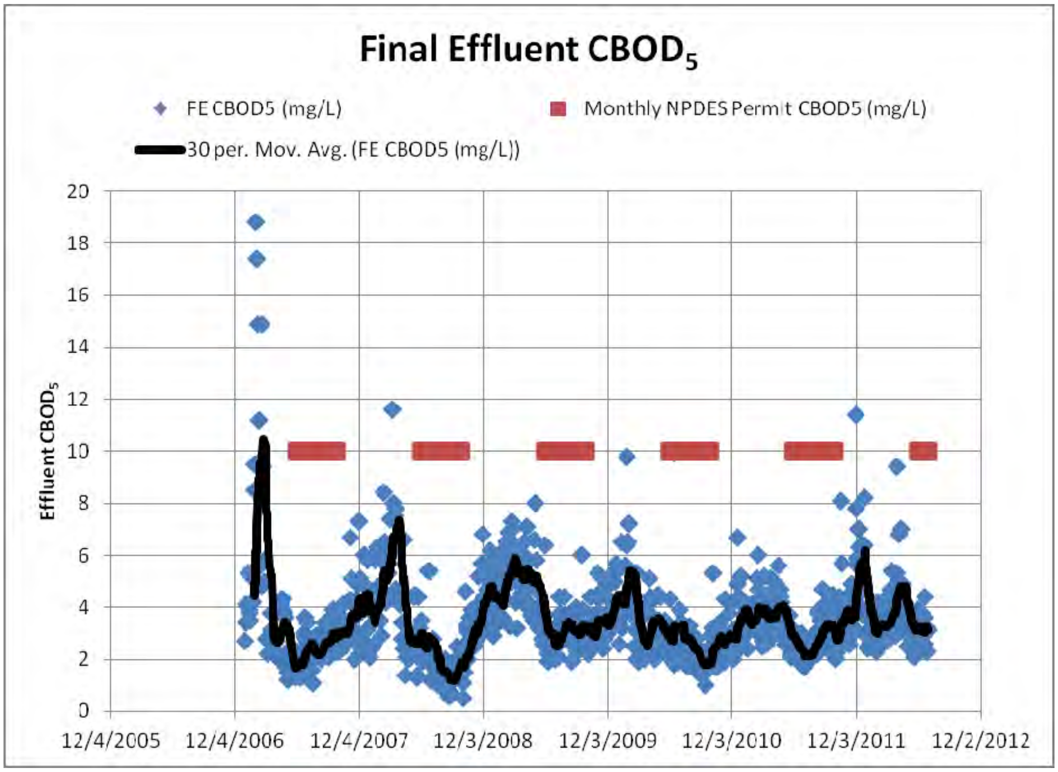


Figure 21 Effluent $CBOD_5$

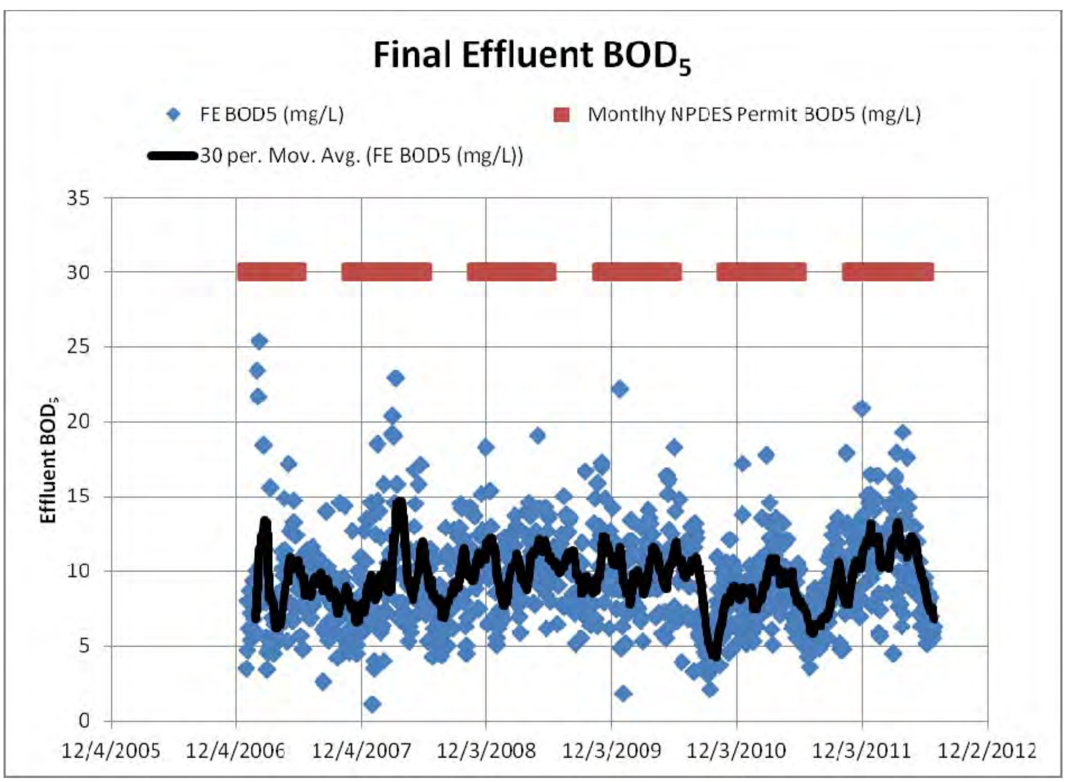


Figure 22 Effluent BOD_5

6.2 Activated Sludge Capacity Evaluation

Activated sludge system capacity was evaluated for four different loading conditions as follows:

1. Summer plug flow partial nitrification.
2. Winter plug flow secondary treatment.
3. Winter contact stabilization.
4. Summer full nitrification.

6.2.1 Summer Plug Flow Partial Nitrification

Since 2010, the Grants Pass WRP has been required by its NPDES permit to achieve partial nitrification during the months of June through September. The ammonia effluent permit level varies with river flow as follows:

- Maximum Month 21.0 mg/L and maximum day 34.7 mg/L from June 1 to June 30.
- Maximum Month 10.4 mg/L and maximum day 21.7 mg/L from July 1 to July 31.
- Maximum Month 16.8 mg/L and maximum day 36.0 mg/L from August 1 to August 31.
- Maximum Month 9.6 mg/L and maximum day 21.3 mg/L from September 1 to September 30.

Maximum month permit levels have been compared with effluent quality data in Figure 16. Performance during 2011 has shown that the new permit levels for ammonia can be met for current loadings. Based on this experience the following criteria were used for calculation of process capacity:

- Minimum aerobic aeration tank SRT of 3.0 day.
- Average yield of 0.85 lb TSS / lb BOD_5 loaded.
- Maximum month 2011 primary effluent BOD_5 concentration of 130 mg/L.
- Average 2011 primary effluent BOD_5 concentration of 110 mg/L.
- All aeration tanks and secondary clarifiers in service (AIS) at maximum month loadings.
- One aeration tank or one secondary sedimentation tank out of service (OOS) at average annual loadings.
- SVI of 150 mL/g.

Based on these criteria, activated sludge system capacity was calculated by comparing the permissible flow for the aeration tank (AT) as a function of MLSS compared to the capacity of the secondary clarifiers (SC) as a function of MLSS. The intersection of these two functions provides the system capacity. This is illustrated in Figures 23 and 24. Figure 23 shows that the flow capacity under the criteria outlined above is approximately 7 mgd, compared to a current MMDWF of 6.3 mgd. The average flow capacity with one aeration tank OOS is approximately 5 mgd compared to the current ADWF of 5.2 mgd. The average capacity with aeration tanks AIS but the large secondary clarifier OOS is higher, so the condition with one aeration tank OOS shown in Figure 23 is controlling. It should be noted that the maximum capacity with the large secondary clarifier OOS occurs at a lower MLSS concentration (approximately 2,500 mg/L) than with one AT OOS (approximately 4,000 mg/L). This indicates that the plant would have difficulty maintaining partial nitrification under current average loadings during the summer with a portion of the aeration basin taken off-line. Figure 25 presents a comparison of this capacity to future required capacity. The figure indicates that more capacity in the activated sludge system is required by 2015 based on the MMDWF capacity and sooner based on ADWF with one AT OOS.

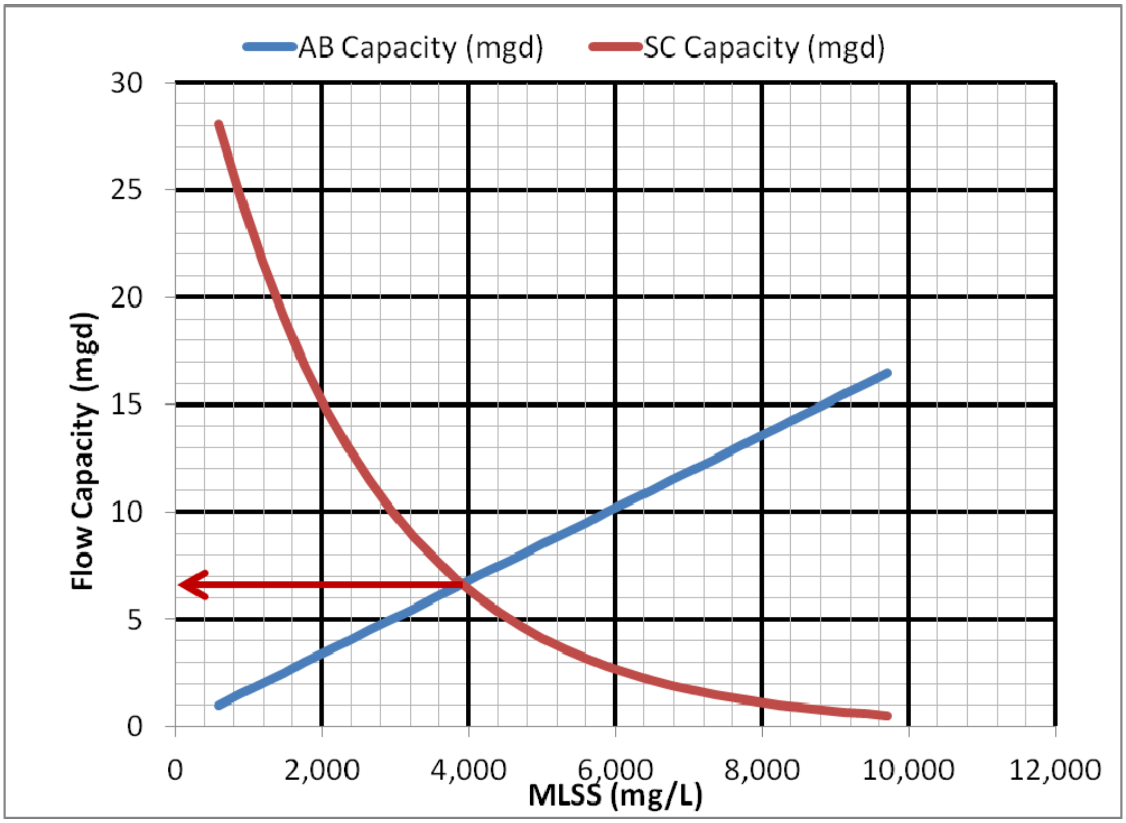


Figure 23 MMDWF Partial Nitrification Capacity (AIS)

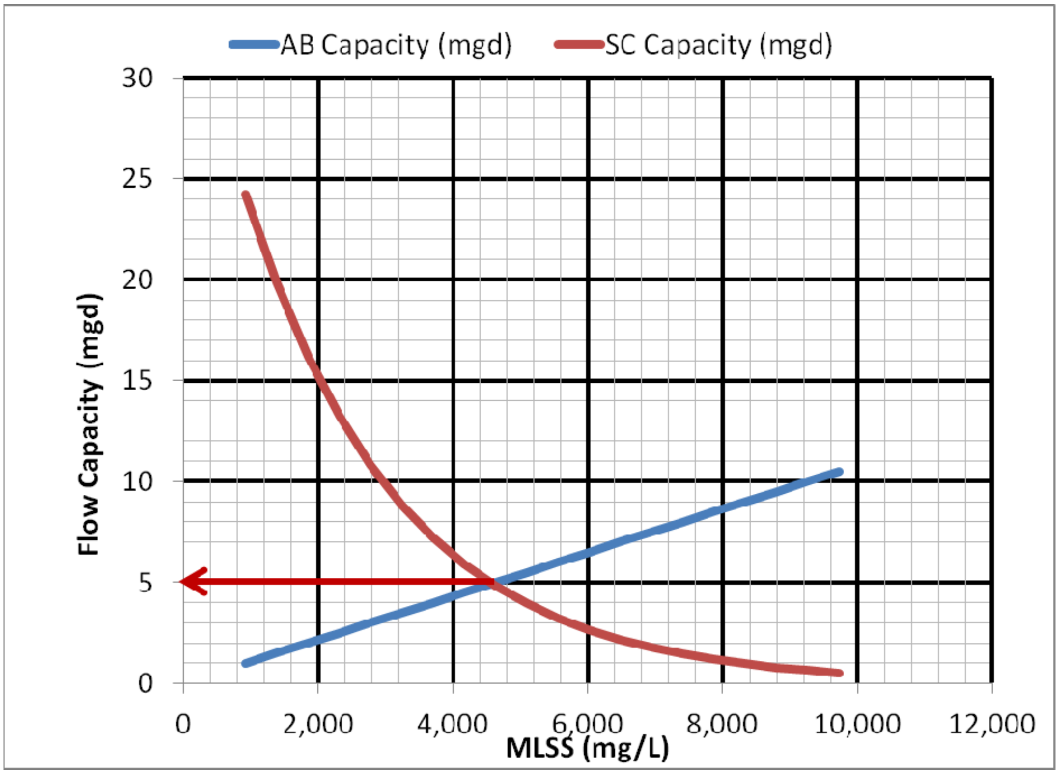


Figure 24 ADWF Partial Nitrification Capacity (One AB OOS)

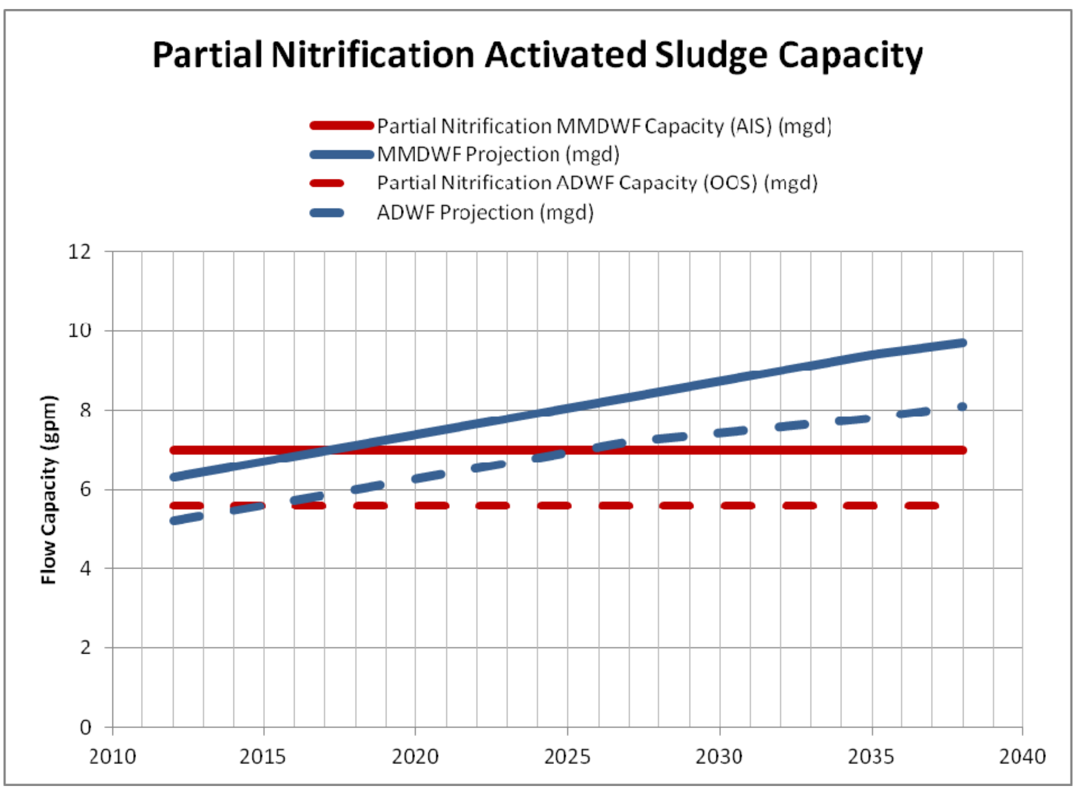


Figure 25 Partial Nitrification Capacity Compared to Future Demand

6.2.2 *Plug Flow Secondary Treatment Capacity*

The WRP can operate in either plug flow (serial flow from one tank stage to the next) or in contact stabilization (primary effluent feed to Stage 5) mode during the winter months (November to April). The plug flow mode is more sensitive to PHF capacity. Capacity criteria for this condition are as follows:

- Minimum aerobic aeration tank SRT of 2.5 day.
- Average yield of 0.82 lb TSS / lb BOD_5 loaded.
- Maximum month primary effluent BOD_5 concentration of 72 mg/L.
- Average primary effluent BOD_5 concentration of 98 mg/L.
- PHF primary effluent BOD_5 concentration of 55 mg/L.
- All aeration tanks in service (AIS) at maximum month loadings.
- All secondary clarifier tanks in service.
- SVI of 170 mL/g.

Figure 26 illustrates secondary treatment capacity at MMWWF in plug flow mode, and Figure 27 illustrates the approximate capacity limit for the activated sludge system in plug flow mode at PHF. The figures indicate a MMWWF secondary plug flow capacity of approximately 11 mgd, with a PHF capacity of approximately 13 mgd. Above 13 mgd the plant would need to change to contact stabilization mode. Current MMWWF is 10.1 mgd. As shown in Figure 28, with one aeration tank OOS the AWWF capacity by these criteria is approximately 6 mgd compared to a current AWWF of 7.1 mgd. With the large secondary clarifier OOS the capacity is approximately the same. These capacity calculations indicate that it is not advisable to take one tank OOS during the winter months under current flow and load conditions. Comparison of plug flow secondary treatment capacity to future demand is illustrated in Figure 29. This estimate indicates that MMWWF plug flow secondary treatment capacity would be reached in approximately 2018, which is slightly beyond the date MMDWF capacity is met.

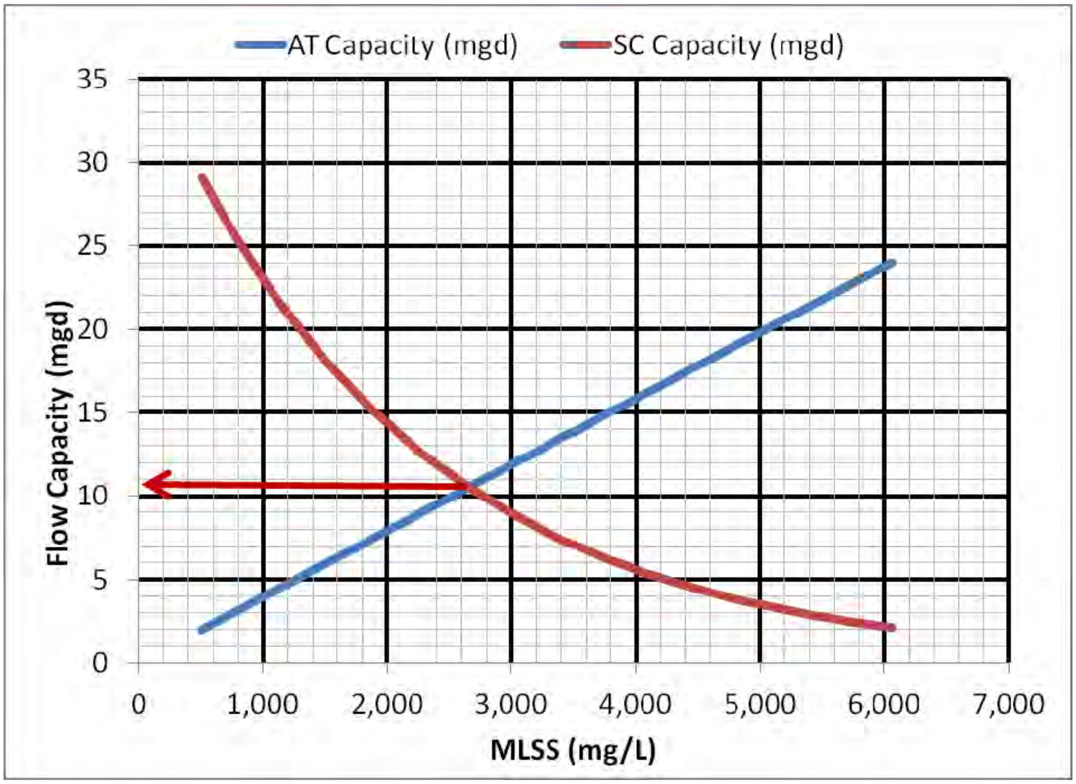


Figure 26 MMWWF Plug Flow Secondary Treatment Capacity (AIS)

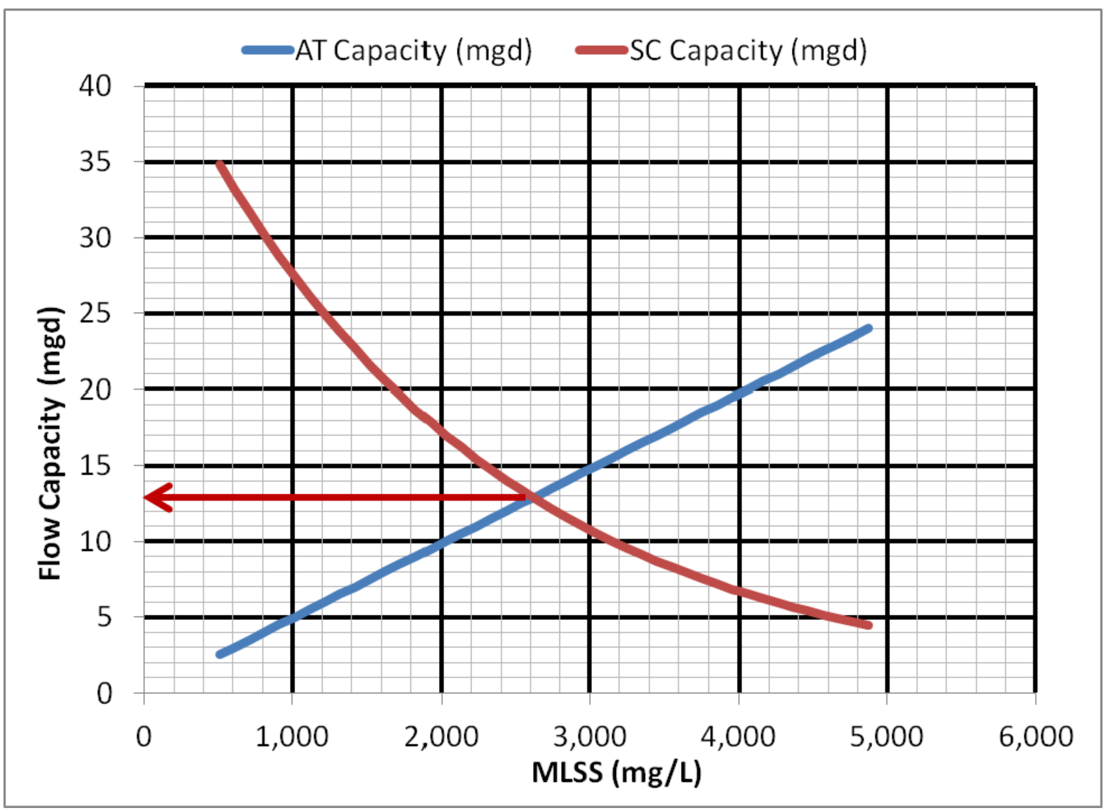


Figure 27 PHF Plug Flow Secondary Treatment Capacity (AIS)

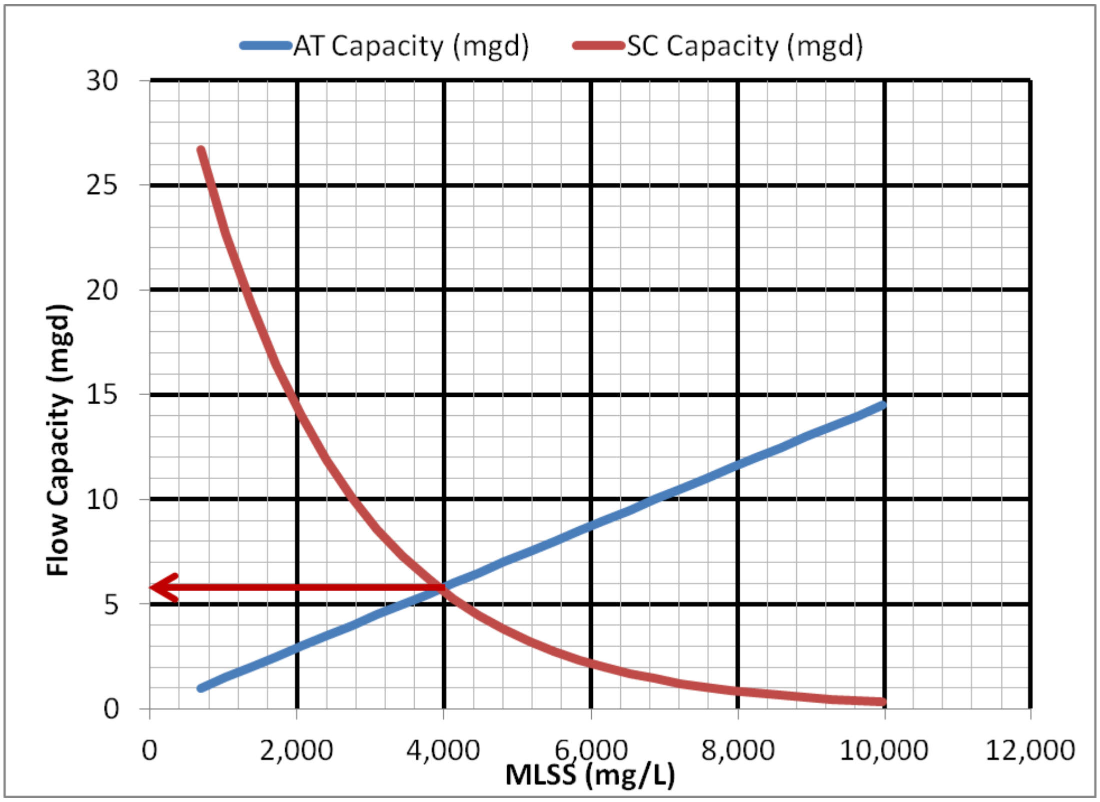
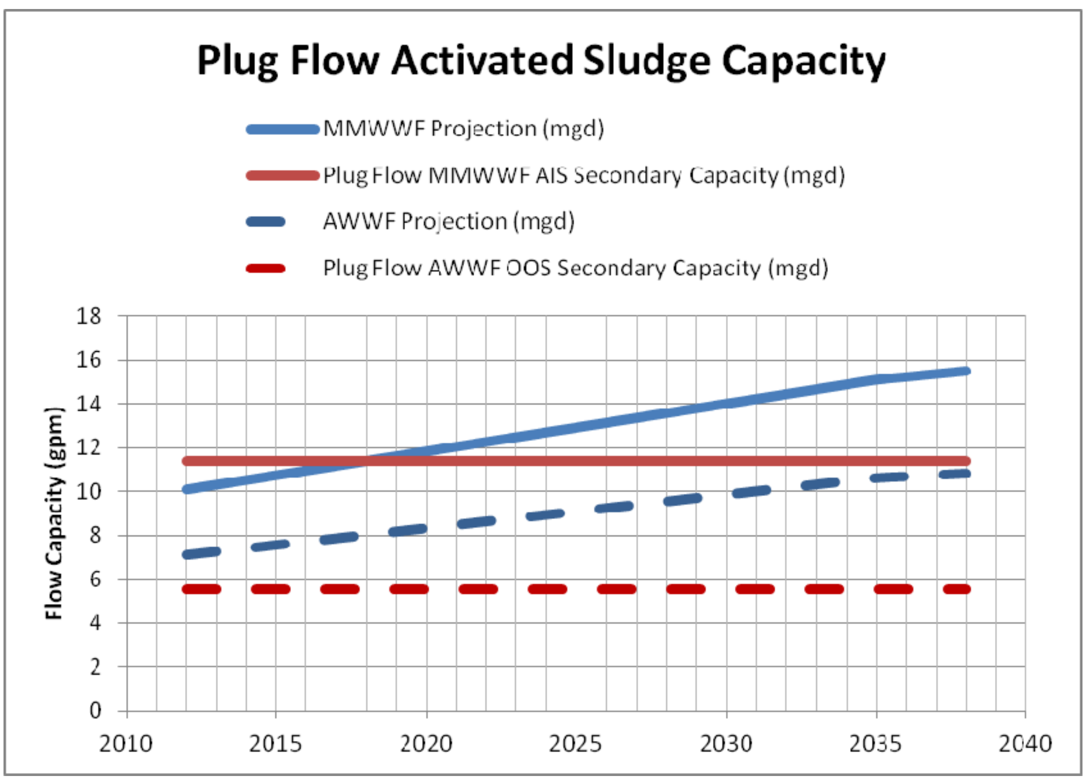


Figure 28 AWWF Plug Flow Secondary Treatment Capacity (One AT OOS)



Note: The flow projections are based on current per capita flows & loads, peaking factors, and anticipated community growth. The actual year when capacity is required may vary based on actual growth in the City.

Figure 29 Plug Flow Secondary Treatment Capacity Compared to Future Demand

6.2.3 Contact Stabilization Secondary Treatment Capacity

While PHF to the secondary treatment process should be limited to approximately 13 mgd in plug flow mode, by operating in contact stabilization mode the activated sludge system at the Grants Pass WRP can provide secondary treatment for a higher PHF. This is due to the fact that when primary effluent feed is directed to a downstream aeration tank stage, the same activated sludge inventory (and SRT) produces a lower MLSS concentration. This in turn provides increased secondary clarifier capacity. Criteria for contact stabilization operation are as follows:

- Minimum aerobic aeration tank SRT of 2.5 day.
- Average yield of 0.85 lb TSS / lb BOD_5 loaded.
- PHF primary effluent BOD_5 concentration of 55 mg/L.
- All aeration tanks in service (AIS) at PHF loadings.
- All secondary clarifier tanks in service.
- SVI of 170 mL/g.
- Overflow Rate (OFR) of 1250 gpd/sf

The capacity chart for this configuration is shown in Figure 30, and indicates that the system could accommodate a PHF as high as 30 mgd. However, the OFR design criteria limits the secondary treatment capacity to 20.8 mgd.

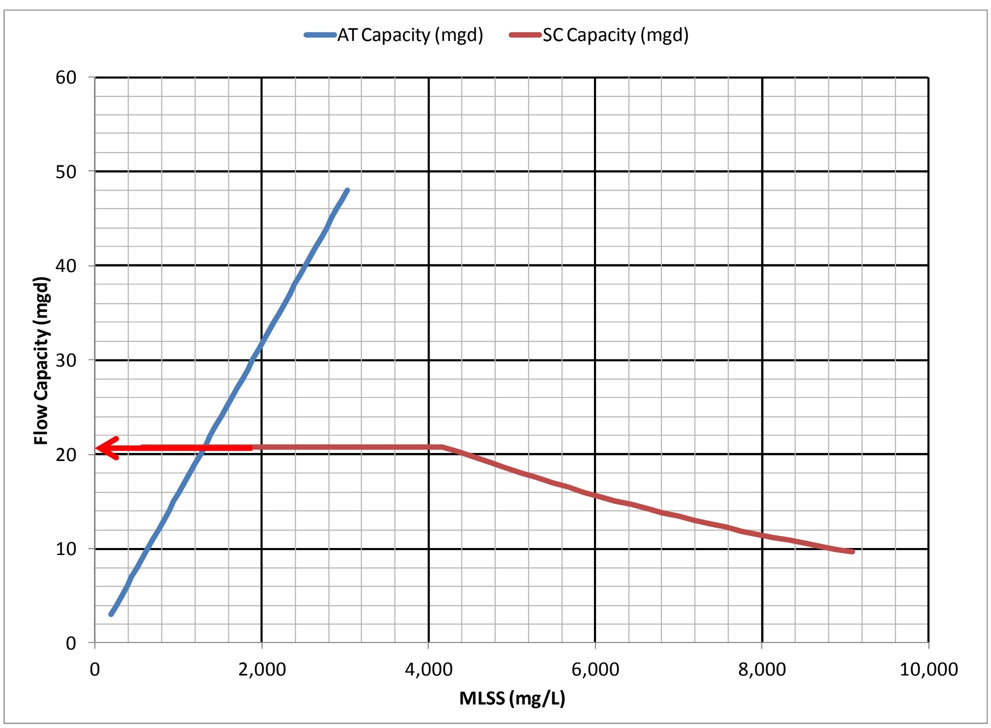


Figure 30 PHF Contact Stabilization Secondary Treatment Capacity

6.2.4 Full Nitrification Treatment Capacity

A fourth operating condition considered the capacity of the Grants Pass WRP in the event that full ammonia removal were required by the Oregon Department of Environmental Quality (DEQ) to a level of less than 1 mg/L. Capacity criteria for this mode of operation are as follows:

- Minimum aerobic aeration tank SRT of 7.5 days.
- Average yield of 0.7 lb TSS / lb BOD_5 loaded.
- MMDWF primary effluent BOD_5 concentration of 130 mg/L.
- All aeration tanks in service (AIS) at MMDWF loadings.
- All secondary clarifier tanks in service.
- SVI of 150 mL/g.
- Maximum MLSS concentration 4,000 mg/L.

Figure 31 presents the capacity chart for this condition. To keep MLSS concentrations below 4,000 mg/L, the MMDWF that could be accommodated by the existing aeration tanks and secondary clarifiers is approximately 3.5 mgd. This compares to existing MMDWF flows of 6.3 mgd and 2035 MMDWF of 9.4 mgd. Figure 32 presents the capacity diagram for full nitrification at MMDWF assuming aeration tanks were added to increase the current volume by a factor of three. This would increase system capacity to approximately 10 mgd, in excess of the MMDWF for 2035. Figure 33 presents a chart showing current full nitrification capacity compared to demand. It is seen that significant aeration tank capacity would need to be added if DEQ were to require full nitrification for the Grants Pass WRP.

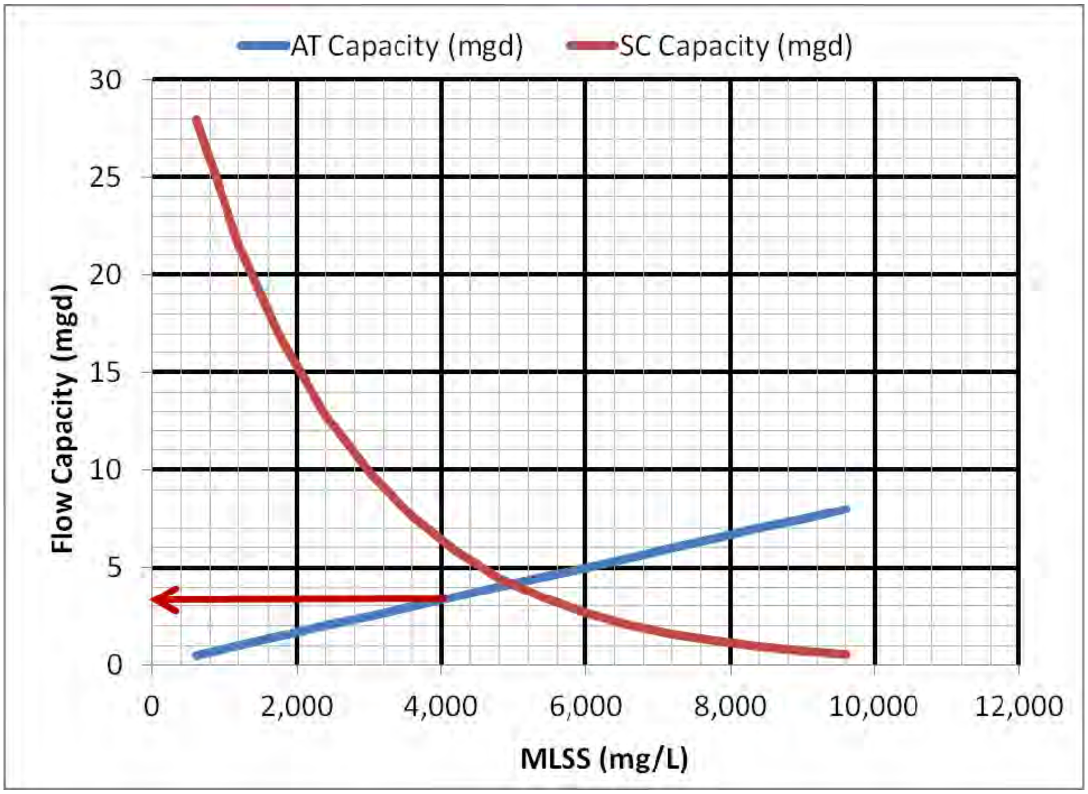


Figure 31 MMDWF Full Nitrification Treatment Capacity (AIS)

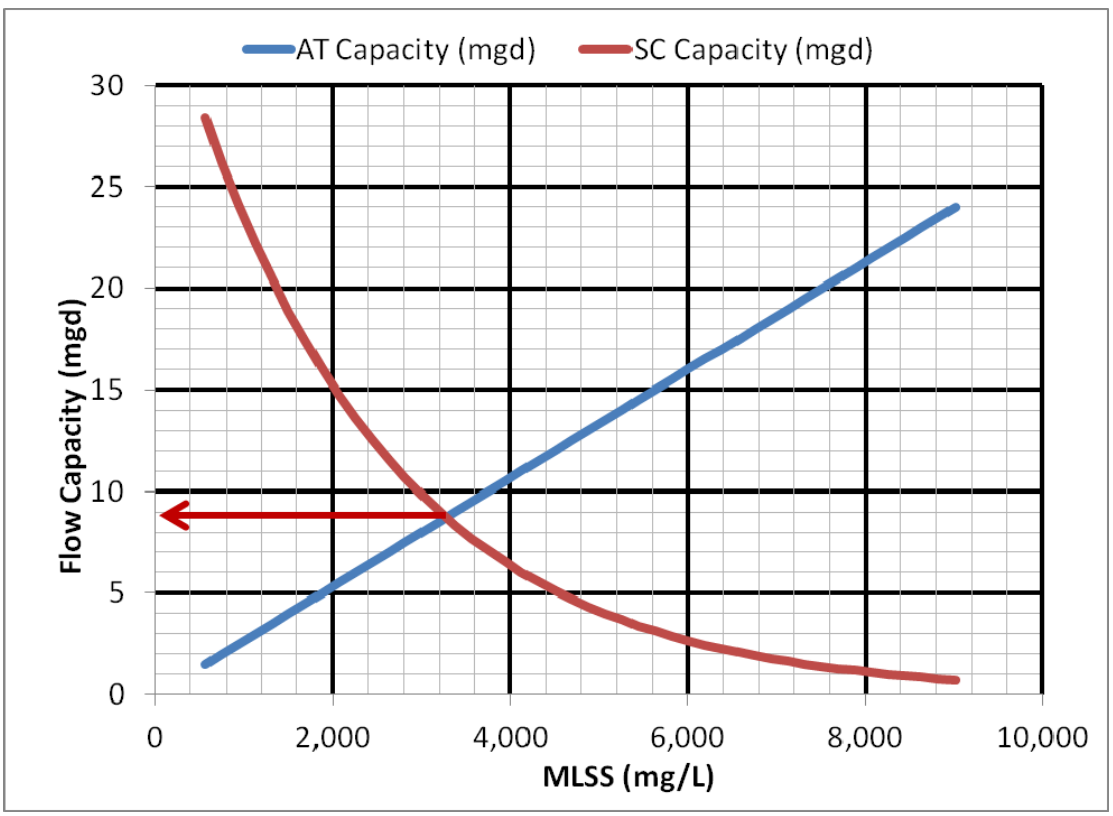


Figure 32 Upgraded MMDWF Full Nitrification Treatment Capacity (AIS)

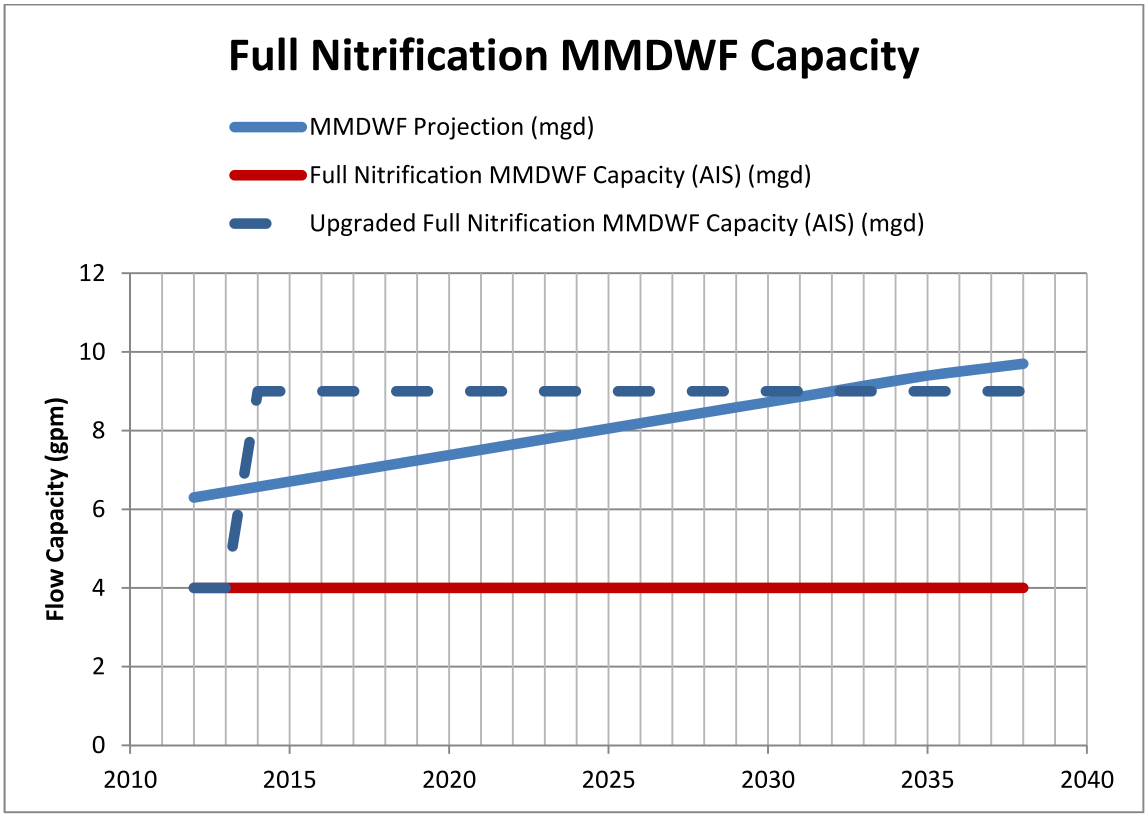


Figure 33 MMDWF Full Nitrification Treatment Capacity (AIS) Compared to Demand

6.2.5 Activated Sludge Aeration System

The aeration tanks for the Grants Pass WRP are provided with a diffused aeration system, including panel diffusers with two older 125 horsepower (hp) centrifugal blowers and two newer 3,000 standard cubic foot per minute (scfm) capacity, 200 hp centrifugal blowers. Figure 34 compares an estimate of peak future demand to the capacity of the two new blowers operating together. It is seen that, assuming the existing older blowers will have exceeded their useful life, new blowers may be required in approximately 2032.

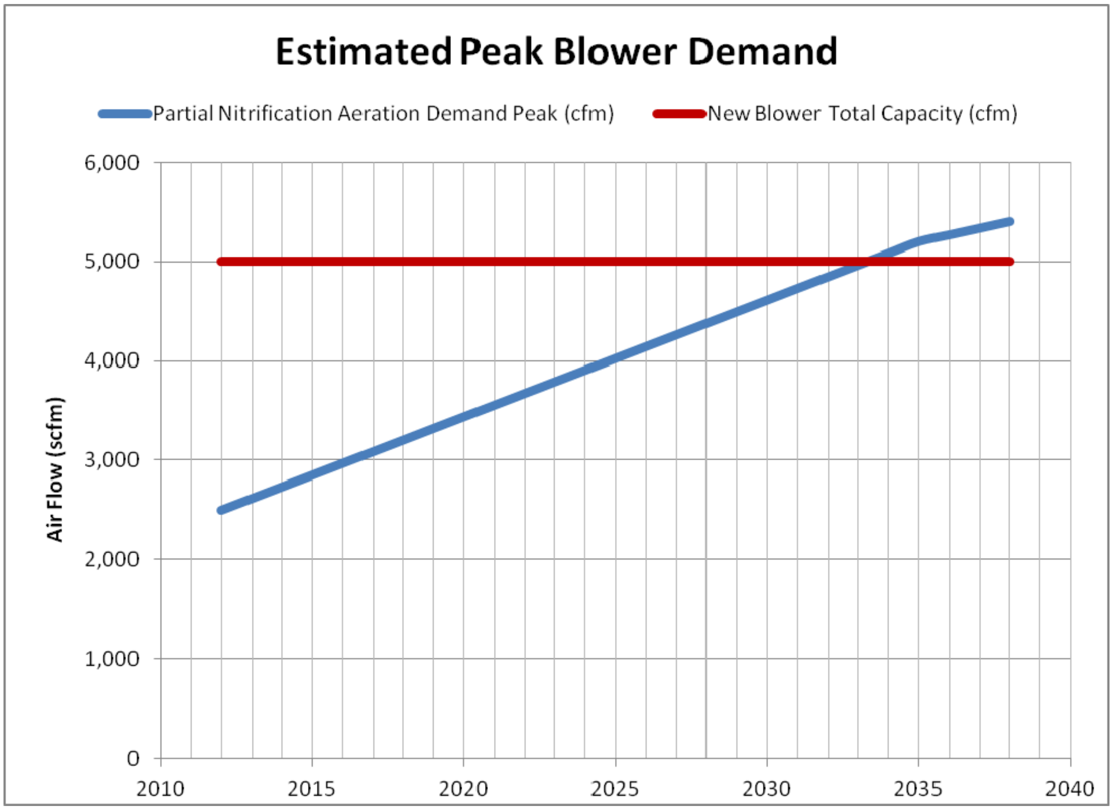


Figure 34 Estimated Peak Aeration Blower Demand to Existing Capacity (New Blowers)

7.0 ULTRAVIOLET DISINFECTION SYSTEM

The existing ultraviolet disinfection (UV) system at the Grants Pass WRP uses a Trojan Model 4000 UV system with medium pressure lamps. Characteristics of the system include the following:

- Peak flow: 23.5 MGD per channel.
- Design transmittance: 70% UVT.
- Number of channels: 2.
- Number of banks per channel: 2.
- Number of lamps per channel: 96.
- Power consumption at PHF: 269 KW.
- Expected design dose: 26 millijoules per square centimeter.

With one bank of lamps out of service, the PHF capacity of the system would be approximately 35 mgd. The capacity of the system is compared to projected demand in Figure 35. Based on these criteria, the UV system has sufficient capacity for 2035 PHF. While system capacity is adequate, there are several reasons to consider replacing the existing medium pressure system, which include:

- The system has had a poor track record for lamp and ballast failures.
- Medium pressure UV systems are very energy intensive compared to modern low pressure, high intensity systems.

Therefore, replacement of the medium pressure system by a newer system may be justified to save operation and maintenance costs compared to the current system.

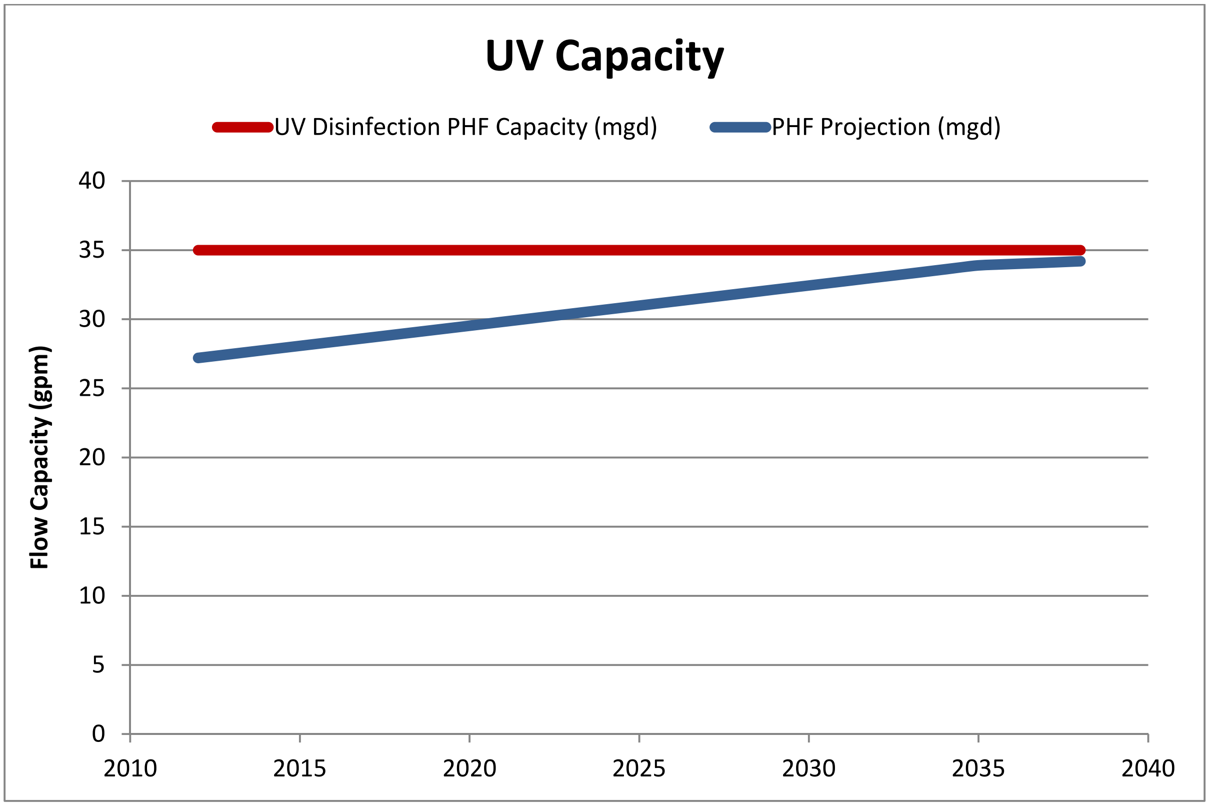


Figure 35 PHF UV System Treatment Capacity (One Bank OOS) Compared to Demand

8.0 HYDRAULIC CAPACITY

The following is a summary of the hydraulic capacity analysis for the existing City of Grant's Pass WRP. This analysis is provided to identify the hydraulic bottlenecks and capacity rating of each unit process at the WRP. Table 2 provides a summary of the capacities of each treatment process, assuming no bypassing of flows. These numbers are also independent of downstream process conditions or limitations and provide a hydraulic capacity for the specific process area only.

Table 2	Flow Capacity of Existing Processes *City of Grants Pass – Liquid Stream Process Analysis*
Process Area	**Max Flow, mgd**
Raw Sewage Pump Station	44(1)
Influent Screening Facilities	18.5
Primary Sedimentation Tanks	20.9
Aeration Tanks	13.5
Aeration Tanks with ML Bypass Open	19.7
Secondary Clarifiers	22.4
UV Disinfection	47
Effluent Outfall Diffuser	76(2)

Notes:
(1) Firm capacity, assumes largest pump out of service.
(2) Based on a Rogue River ordinary high water surface elevation of 890.00 feet.

8.1 Influent Screening Facilities

The Influent Screening Facilities where initially constructed in 1994, with additional improvements made in 2007. The hydraulic analysis for these facilities was based on record drawings from these projects. The screenings facilities and rectangular primary clarifiers are part of the same structure.

Pumped flow from the RS Influent Pumping Station discharges into the Influent Control Structure where it is metered through a Parshall flume. From there it flows by gravity through a 36-inch RS pipe to the Influent Screenings Structure inlet channel.

Alternately, there is an option to bypass the Screening Facilities and Primary Clarifiers. This can be accomplished by opening a buried butterfly valve at a wye fitting in the 36-inch RS pipe between the Influent Control Structure and Screenings Structure. Opening this valve allows the RS to flow directly into the Primary Effluent Junction Box and to the secondary treatment process.

At the Screenings Structure inlet channel, RS flow can be split into three separate channels. The western-most channel contains a Waste-Tech 3/8-inch perforated plate mechanical screen. The center channel contains a mechanical bar screen with 0.5-inch bar spacing. Motor actuated gates (GT-2001 and GT-2002) ahead of each channel are used to isolate the channels and allow flow to pass through either or both screens. It is assumed that both screening channels are used during peak flow conditions.

A screen bypass weir with an elevation of 915.52 feet allows flow to bypass the screens into a third channel without screens if the HGL upstream of the screens exceeds this elevation. This weir elevation is approximately two feet below the top wall of the structure, which has an elevation of 917.50 feet. With sewage flowing over the top of the weir with one foot of freeboard from the top of the wall of the bypass channel, the capacity of the bypass channel is approximately 10.5 mgd.

The following assumptions where made in determining the maximum capacity of the screenings facility:

- Maximum capacity is based on an HGL of 915.52 feet upstream of the screens, meaning no flow bypasses the screens.
- It is assumed that one screen and the bypass channel are in service during peak flows.
- A maximum 30% blinding of screens was used.
- Assumed Gate GT-2013 remains closed so no flow is bypassed to the circular primary clarifier.

8.1.1 Hydraulic Limitations in the Screening Facilities

The hydraulic capacity of the screening facilities is limited by the screenings effluent channel. Once flow passes through the screens, it must pass through the two openings in the wall separating the primary clarifier influent channel from the screenings effluent channel. The openings create a sudden contraction in the channel, with a downstream width of only 12-inches per opening. This constriction in the flow path accounts for losses of approximately 1.65 feet at 18.5 mgd. Widening this wall opening to 6 feet would eliminate the constriction and increase the capacity of this process to 25 mgd. In this case, at 25 mgd the Parshall flume in the Influent Control Structure becomes submerged.

8.2 Primary Sedimentation Tanks

All flow from the Influent Screening Facility flows through the two rectangular primary sedimentation tanks. Based on current operations at the WRP, the hydraulic model assumes the existing circular primary sedimentation tank is not used for primary sedimentation.

Downstream of the screenings facilities there is an alternative flow path to bypass the primary clarification process and direct screened RS to the secondary treatment process. This can be accomplished by opening either or both of the two gates (GT-2201, GT-2202) located in the primary influent channel. Opening of these gates allows the screened RS to flow directly into the primary effluent channel.

Once influent flow passes the screens, it flows into a common primary influent channel. Each primary sedimentation tank has three isolation gates through which the influent flow passes into the tank. Each tank is 21-foot by 6-inch wide and includes chain and flight style sludge collectors and mechanical scum skimmers. At the end of each primary sedimentation tank are three 39 ft long by 1 ft 3-inch wide effluent troughs with rectangular notched weirs on each side. The rectangular notches are spaced at 6 inches on center and are 1.5-inch deep by 1.25-inch wide. The invert elevation of the weirs is at 913.01 ft. Primary Effluent (PE) flows over the weirs into the effluent troughs and drops into a common PE channel.

From the PE channel there is an option to bypass PE flow through a 20-inch diameter motor operated butterfly valve, which connects to the 42-inch PE pipe which bypasses the secondary treatment processes and allows the PE to flow into the Influent Vault at the old Chlorine Contact Tank (Surge Basin) just upstream of the UV disinfection process.

If the secondary treatment process is not bypassed, flow from the PE channel is routed through a 48-inch PE pipe to the PE Junction Box. Since no flow is sent to the circular primary sedimentation tank, no additional flows are contributed at the PE Junction Box. From the Junction Box, the PE flows through a 42-inch PE pipe to the Aeration Tank(s).

8.2.1 Hydraulic Limitations in the Primary Clarification Process

The hydraulic capacity of the primary tanks is limited by the effluent troughs. At flows above 20.9 mgd, the troughs fill and submerge the weirs regardless of downstream conditions in the PE channel.

The hydraulic capacity of the primary sedimentation tanks is further limited by the downstream conditions, either by the capacity of the Aeration Tanks or by the capacity of the Secondary Treatment Bypass. If all flow is sent to the Aeration Tanks, at 19.7 mgd, the flow in the primary effluent channel backs into the primary sedimentation tank effluent troughs and submerges the weirs. If all flow is sent to the Secondary Bypass, at flows above 18 mgd the flow backs into the primary sedimentation tank effluent troughs and submerges the weirs. The best hydraulic condition for the primary process, at flows above 19.7 mgd, is to split flow to the Aeration Tanks and Secondary Bypass. This will allow the maximum hydraulic capacity of 20.9 mgd to be pushed through the primary tanks.

8.3 Aeration Tanks

PE from the 42-inch PE pipe flows into the Aeration Tank inlet channel at the southwest corner of the structure. Return Activated Sludge (RAS) flow is also typically returned to this location. However, during Peak Flow conditions, the Aeration Tank is typically operated in contact stabilization mode. In this mode, RAS flow is introduced directly into Cell 1 of the Aeration Tank (through gate V-334), while PE flow is introduced into Cell 5 through gate SG-3117. This is the configuration that was assumed for this hydraulic analysis.

The facility is currently operated as a single tank with mixed liquor (ML) exiting the tank at the northwest side after Cell 7 (See Figure 10). A second outlet was added at Cell 7 during the 2005 WRP Phase 1 Upgrade. The second outlet is referred to as a 36-inch ML Bypass; however, this is somewhat of a misnomer as the ML is only bypassing a portion of Cell 7. A 36-inch butterfly valve with electric actuator allows flow to be diverted through the bypass. Both the 36-inch ML Bypass and the 36-inch ML pipe exiting the northwest side of the tanks combine into a single 48-inch diffuser pipe at the ML Splitter Box.

Five fiberglass baffle walls, fine bubble diffusers, and the gate between Cells 5 and 6 of the Aeration Tanks contribute to the hydraulic losses through the tanks.

At the ML Splitter Box, ML flow from the 48-inch ML diffuser pipe rises over a series of finger weirs into launders which discharge into three separate outlet boxes, one for each secondary clarifier. An isolation gate at the exit of each outlet box permits the secondary tanks to be removed from service.

8.3.1 Hydraulic Limitations at the Aeration Tank

The hydraulic capacity of the Aeration Tanks is limited primarily by the tank effluent channel. Without the ML Bypass open, the flow through the tanks is limited to 13.5 mgd before it begins to affect the primary process. The tank effluent channel is a completely submerged rectangular conduit. In the channel there is a wall with a 30-inch square opening that greatly constricts the flow path. With the ML Bypass open, there is an additional 36-inch conduit through which the ML can flow out of the tank. Opening the bypass increases the hydraulic capacity of the tanks to approximately 19.7 mgd.

8.4 Secondary Clarifiers

From the ML Splitter Box, the ML flows are split to each of the three secondary clarifiers (SC) through 36-inch and 30-inch pipes.

SC's No. 1 and 2 are identical and consist of 75-foot diameter tanks. The clarifiers are center feed, with ML entering the clarifier through ports in the center column into a flocculating well. The effluent launders are offset 4-feet from the inside face of the clarifier outer walls to the center of the 2-foot wide launder channel. The launders have v-notch weirs on both sides. From the effluent launder, secondary effluent (SE) exits the clarifier through a 27-inch SE pipe.

SC No. 3 is a 100-foot diameter tank with center feed and a perimeter effluent launder with v-notch weirs on the inside face. From the launder, SE flow drops into an effluent box and flows out a 30-inch SE pipe. This clarifier is located furthest north and, therefore, has the longest effluent piping.

The 30-inch SE piping from SC No. 3 connects to the 27-inch SE piping from SC No. 2 through a wye fitting. The size of the SE piping increases to 36-inch at SC No. 1 where all SE flows combine. The 36-inch SE piping is then routed to the old Chlorine Contact Tank (CCT), also referred to as a Surge Basin on some of the drawing sets.

8.4.1 Hydraulic Limitations at the Secondary Clarifiers

The hydraulic capacity of the secondary clarifiers is limited by SC No. 1 and No. 2. At flows above 22.4 mgd (with all tanks in service), the effluent weirs in these clarifiers become submerged. The limitations are primarily due to the narrowness and depth of the effluent launders in these clarifiers.

In SC No. 3, the effluent weirs do not become submerged until the combined flow increases to approximately 29.7 mgd.

8.5 Ultraviolet (UV) Disinfection Tanks

SE flows into the old CCT inlet box where it combines with any bypassed PE and flows into a 48-inch SE to the UV influent channel. Flow is split into two separate UV channels. Each channel contains two lamp banks with 48 medium pressure lamps per bank. A control gate at the end of the

UV channel maintains the water surface elevation at the end of the channel at 904.01 feet to ensure that the lamps are submerged and prevent overheating. The maximum water surface elevation downstream of the control gate cannot exceed 903.34 feet.

8.5.1 Hydraulic Limitation at the UV Disinfection Tanks

The UV Disinfection Tanks are limited hydraulically by the maximum allowable operating level upstream of the UV banks. The downstream elevation must be maintained at 904.01 feet while the upstream elevation must not exceed 905.51 feet (information based on 1994 drawings). The hydraulic capacity of each UV channel is currently 23.5 mgd based on the information received from the WRP staff.

8.6 Effluent Outfall Diffuser

Plant effluent flow from the UV tanks exits through a 48-inch outfall pipe to the Outfall Control Structure. This structure contains a gate to isolate the outfall diffuser as well as a weir set at elevation 900.50 ft. If the HGL in the structure exceeds this elevation, effluent flow is bypassed to the old 42-inch outfall to the Rogue River.

Normally, plant effluent flows from the Control Structure through approximately 300 linear feet of 48-inch pipe to the outfall diffuser in the Rogue River. The outfall diffuser is a 42-inch diameter concrete lined steel pipe with 12, 14-inch tideflex check valve diffusers with integral 90-degree long radius elbows.

The following assumptions were made in determining the maximum capacity of the outfall diffuser and pipeline:

- Capacity is based on a maximum water surface (WS) elevation in the Rogue River of 890.00 feet. This is the Ordinary High Water Level based on the 2005 WRP Phase 1 Upgrade Project. At higher river levels the capacity of the outfall decreases since the HGL is increased.
- Maximum capacity is based on overtopping the Outfall Control Structure Weir or exceeding the maximum water surface elevation of 903.34 feet downstream of the UV automatic level control gate.

8.6.1 Hydraulic Limitation at the Effluent Diffuser and Outfall Pipeline

At a Rouge River WS elevation 890.00 feet, the hydraulic model indicates the outfall has a maximum capacity of approximately 76 mgd. At flows above 76 mgd, the HGL at the Outfall Control Structure exceeds the bypass weir elevation. At this point, some of the effluent flow would be diverted to the old outfall structure. The HGL downstream of the UV Level Control Gate would still be below the maximum operating level at approximately 902.86 feet.

If the water surface elevation in the river increases above 890.00 feet, the capacity of the outfall would be reduced. The WRP peak flow condition of 30.7 mgd can be sent through the outfall diffuser without exceeding the bypass weir elevation as long as the river level is below an elevation of 895.45 feet. This is above the 2-year flood elevation of 894.30 feet but below the 5-year flood elevation of 899.45 feet.

9.0 CAPACITY SUMMARY

The capacity of the Grants Pass WRP may be considered under several different capacity criteria corresponding to the applicable design flow for different unit processes as follows:

- PHF.
- MMWWF.
- Partial Nitrification MMDWF.
- Full Nitrification MMDWF.

9.1 PHF Capacity

Unit processes whose capacity is determined at PHF include:

- Raw Sewage Pump Station.
- Screening System.
- Primary Sedimentation.
- Activated Sludge System in Contact Stabilization.
- UV Disinfection.

Figure 36 presents a comparison of the PHF flow capacity of these unit processes to the current PHF and the anticipated PHF for the year 2035. It is seen that the raw sewage pump station, screening system, and UV disinfection system have adequate capacity for current and 2035 PHF. However, it should be noted that the screenings effluent channel limits the functional capacity of the screening system to 18.5 mgd, which is well below current peak hourly flows. The primary clarifiers and activated sludge system have inadequate PHF capacity at this time. In addition, these processes exceed overflow rate capacity criterion for current peak hourly flows by 46.5% and 30.5% respectively.

The current plant configuration requires significant process bypassing during PHF conditions. Due to hydraulic limitations downstream of the influent screening system up to 9 mgd of RS must be bypassed. Flow is bypassed again at a junction prior to the primary clarifier where approximately 9 mgd is sent directly to the aeration basins. It is likely that a portion of this flow will also not be screened. Due to the peak hour capacity of the secondary process, which is controlled by the overflow rate of the secondary clarifiers, 7.5 mgd of primary effluent will bypass secondary treatment and flow directly to the UV disinfection system. Flow splits are shown in Figure 37.

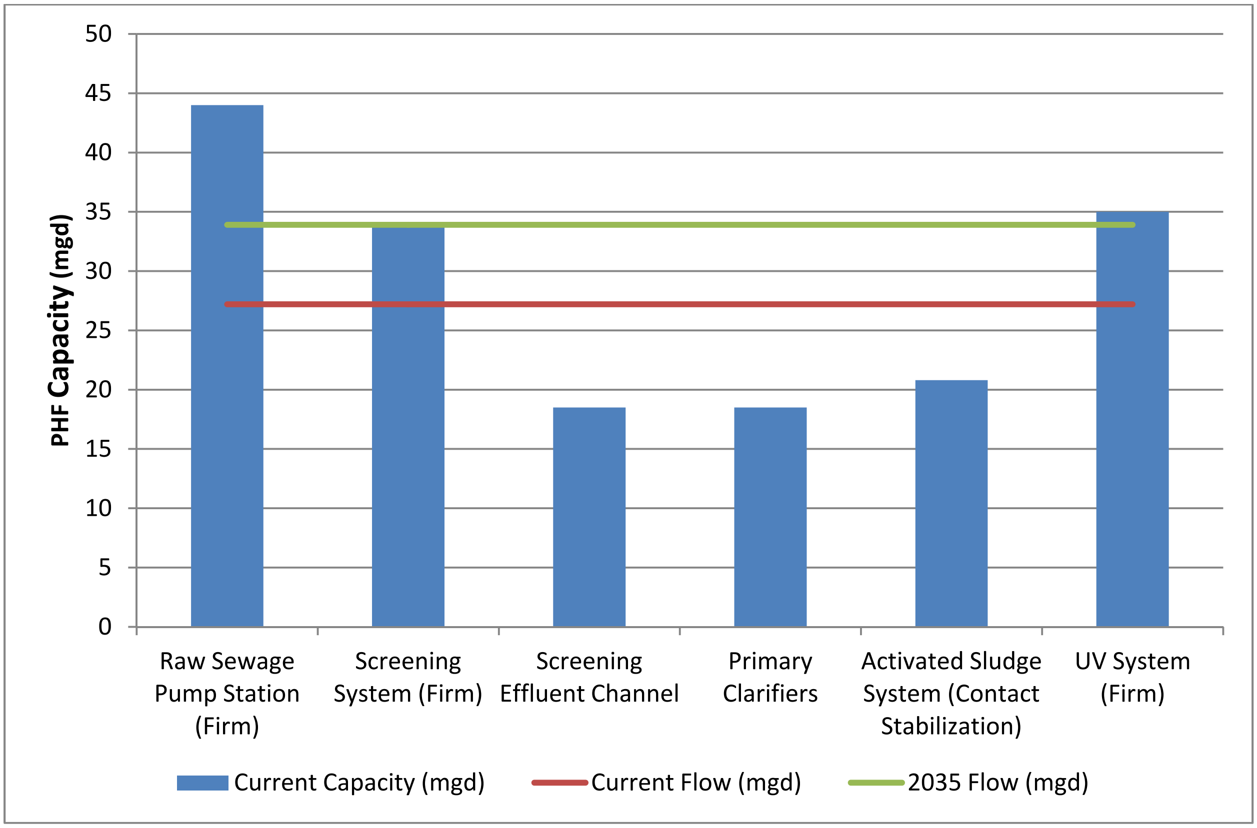
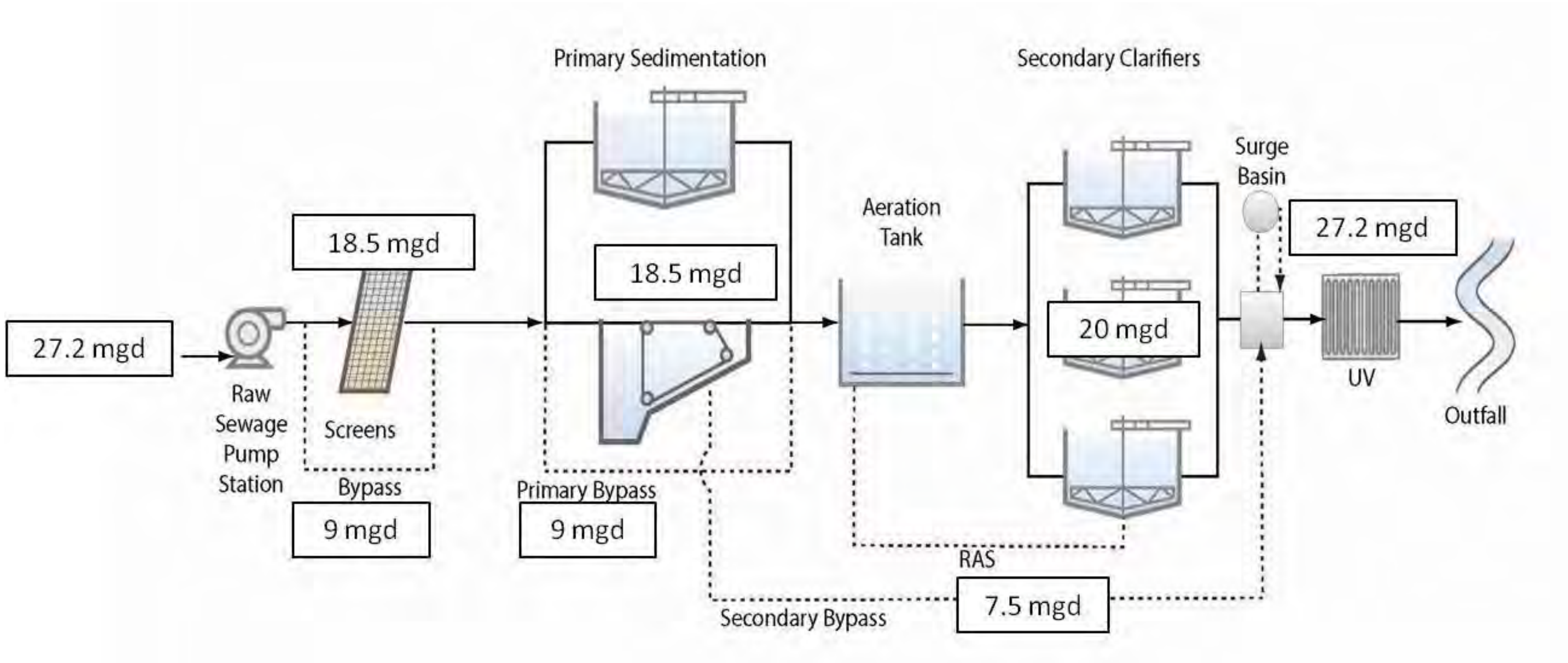


Figure 36 Summary PHF Capacity of Grants Pass WRP Unit Processes



PHF BYPASSING OF GRANTS PASS WRP UNIT PROCESSES

FIGURE 37

CITY OF GRANTS PASS
LIQUID STREAM PROCESS ANALYSIS

9.2 MMWWF Capacity

Unit processes whose capacity is determined at MMWWF include:

- Primary Sedimentation Tanks.
- Activated Sludge System.

Figure 38 presents capacity data based on MMWWF. It is seen that both unit processes have marginal capacity based on current flows and will require significant upgrade to accommodate future 2035 conditions.

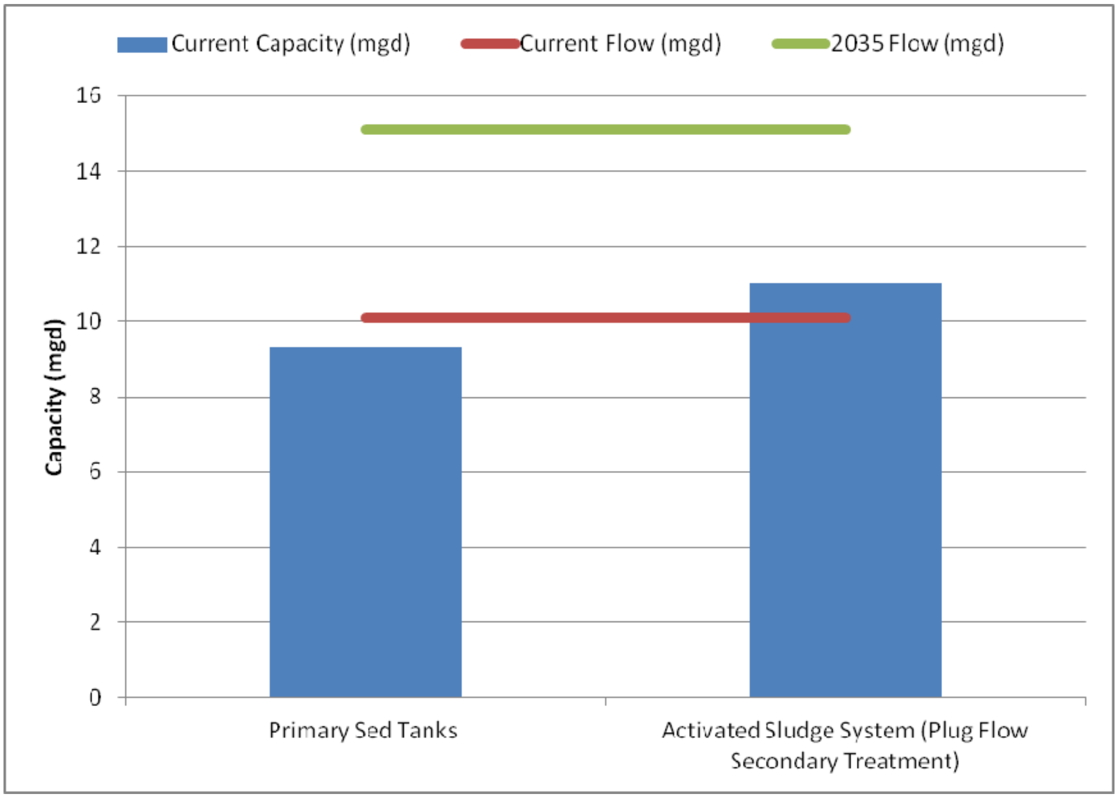


Figure 38 Summary MMWWF Capacity of Grants Pass WRP Unit Processes

9.3 Partial Nitrification MMDWF Capacity

Only the capacity of the activated sludge system is determined at MMDW. Figure 39 presents current capacity compared to current and future needs. The figure illustrates that the system has capacity for current MMDWF, but will require future upgrade to accommodate 2035 MMDWF.

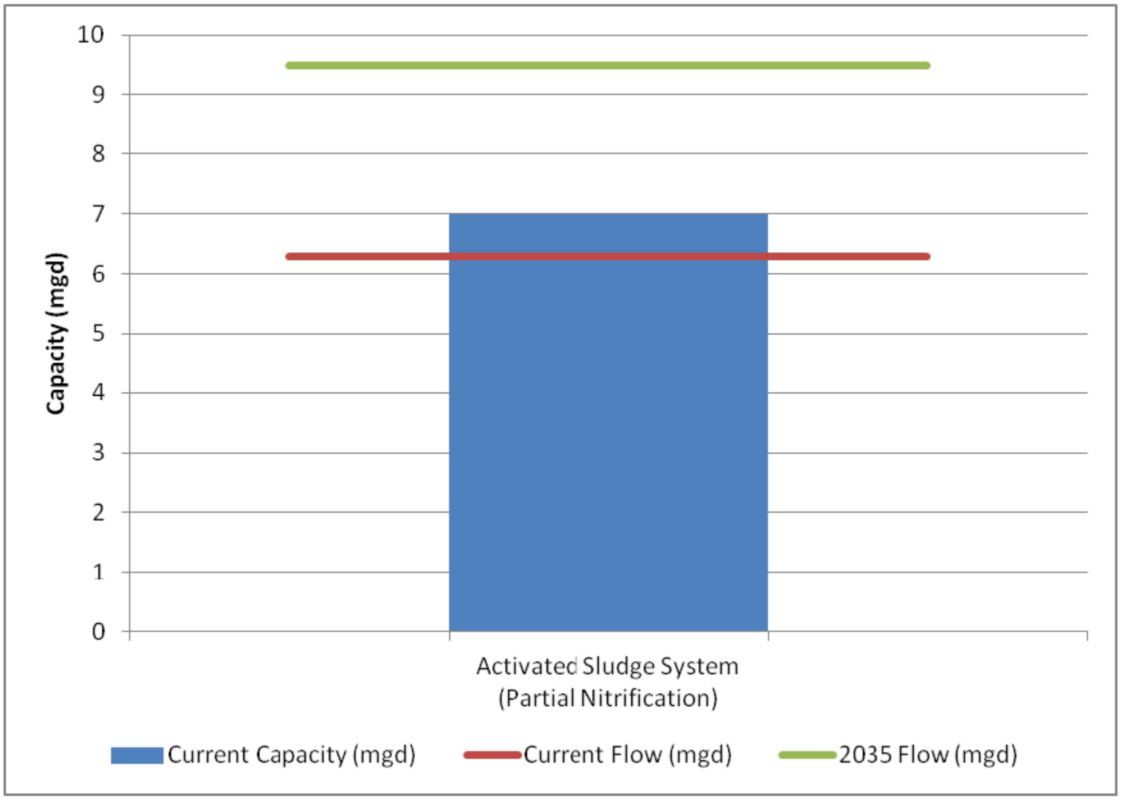


Figure 39 Partial Nitrification MMDWF Capacity of the Grants Pass WRP

10.0 EXISTING CONDITION

10.1 Condition Rating System

The condition assessment rating system described in Table 3 was used to assess the major liquid stream equipment components at the WRP. The mechanical rating addresses the overall mechanical and operational condition of the equipment. Mechanical service life is based upon input from plant staff and experience with similar equipment at other treatment plants. The structural condition is assessed in TM No. 6.

Table 3 Condition Rating System
City of Grants Pass – Liquid Stream Process Analysis

Value	Condition	Anticipated Service Life
1	Lowest priority for replacement – New or like new condition; proven to provide intended function.	20+ years
2	Low priority for replacement – signs of moderate wear; will provide service life with preventative maintenance.	10 – 20 years

Table 3	Condition Rating System *City of Grants Pass – Liquid Stream Process Analysis*	
Value	**Condition**	**Anticipated Service Life**
3	Medium priority for replacement – serviceable but worn; should provide additional service life with maintenance, repair, or replacement of components.	5 – 10 years
4	High priority for replacement – serviceable but heavily worn; requires extensive rebuild, upgrade, or replacement for extended service life.	2 – 5 years
5	Highest priority for replacement- unit includes heavily worn or outdated equipment; service life is limited without replacement.	1 – 2 years

The condition of the existing major facilities is tabulated in Table 4. Major condition assessment issues that are recommended for repair are summarized below:

- The grit cyclone and classifier are worn and due for replacement.
- Diffuser within the aeration basin are due for replacement, however the ability to replace them is limited due to a lack of redundancy in the aeration basin.
- The UV disinfection system requires excessive maintenance and is difficult to access for maintenance. As previously discussed, replacement of the disinfection system may be a cost effective solution.

Table 4 Condition Assessment

City of Grants Pass – Liquid Stream Process Analysis

Liquids Unit Process or Facility	Quantity	Approximate Year Installed or Constructed	General Comments	Process Mechanical Comments	Overall Condition Assessment Rating
Influent Pumping Station					
Influent Pumps	4	(3) 2007 (1) 1995			2
Flow Monitoring	1				2
Mechanical Bar Screen	1	1996			2
	1	2007			1
Screenings Compactor	1	1996	No redundancy	Failed at least 3-4 times.	4
Composition monitoring	1	1994	Downstream of influent pumps		1
Primary Clarifiers					
Circular Primary Clarifier	1	1974	No longer used as PC. Used for sludge storage.	Hydraulically limited	3
Rectangular Primary Clarifier	2	1996		Have put 21 mgd through but it floods the weirs. Coatings failing on components within tank	2
Primary Sludge and Grit Pumps					
Primary Sludge and Grit Pumps					
Circular Primary Clarifier					
Rectangular Primary Clarifiers	3	1996			2
Primary Scum Pumps					3
Circular Primary Clarifier	1	1974	This clarifier is not currently used		3
Rectangular Primary Clarifiers	1	1996			
Grit Removal					
Grit Cyclone/Classifier	2	1996	Worn and has been patched many times. Due for replacement.		5
Grit washer	1	1996			4
Aeration Basins					
Contact Basins	2	10 yrs old	Aerostrip diffusers. System can be operated in plug flow, step feed, or contact stabilization mode. Submersible mixers in Zones 1-3.	Diffusers due for replacement Foam gets trapped. Need motorized gates. Control boards have failed on motorized valves.	5
Blowers					
Blowers	4	(2)2005 (2)1974	Never use older blowers.	Can't run two at low speeds, old ones not hooked to SCADA.	2
Secondary Clarifiers					
Clarifier 1 & 2	2	1974		1 drive replaced in 1980's. Suction tubes are failing. Coating failing. Mechanism scrapes.	3
Clarifier 3	1		Run on blanket depth pulled from Clarifier 3	Some short circuiting.	1
RAS Pumping		2005		Need crane for maintenance.	1
WAS Pumping		2005			1
UV Disinfection					
UV System	2 Channels with 2 lamp banks each	1996	1 - Not used 2 - high maintenance requirements and hard to work on.		4

11.0 REFERENCES

Environmental Protection Agency, Office of Water Programs (1974) *Design Criteria for Mechanical, Electric, and Fluid System and Component Reliability*, MCD-05.

Parametrix (2001) *Grants Pass Water Restoration Plant Wastewater Facilities Plan*.

GRANTS PASS
OREGON
WHERE THE ROGUE RIVER RUNS

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MICHAEL E. DADIK
EXPIRES: 12/31/15

CITY OF GRANTS PASS

TECHNICAL MEMORANDUM NO. 6

Water Restoration Plant Facility Plan

Seismic Assessment

FINAL
March 2013

carollo

CITY OF GRANTS PASS

WATER RESTORATION PLANT FACILITY PLAN

TECHNICAL MEMORANDUM NO. 6

SEISMIC ASSESSMENT

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1.0 PURPOSE

Due to the age of the existing structures at the Water Restoration Plant (WRP), there is potential a major upgrade could trigger significant structural modifications to increase reliability and address life safety concerns considering the current building code level of seismic forces. Since these upgrades could impact both capital improvements and evaluation of various alternatives, a Tier 1 seismic assessment was performed as part of the WRP Facilities Plan. This Technical Memorandum (TM) presents the findings, conceptual retrofit solutions, and associated planning level costs to address the main structural deficiencies.

2.0 SUMMARY OF FINDINGS

Based on the evaluations performed, several structures at the WRP do not meet the Life Safety Level performance objective as defined by American Society of Civil Engineers Standard 31 (ASCE 31-03). Retrofit actions are recommended to mitigate the seismic deficiencies and allow the buildings to meet the adopted Immediate Occupancy performance objective. Key findings and recommendations are as follows:

- The masonry buildings, including the Operations Building, Digester Control Building, Headworks Electrical Building, Plant Drain Pump Station, and Chlorine Building, exhibit seismic deficiencies, especially in the diaphragm connections and roof-to-wall anchorage connections. Retrofitting these buildings by strengthening and reinforcing the connections will reduce the risk of wall or roof collapse.

- Two knockout walls constructed in the Aeration Basins are significantly under-reinforced for the lateral soil and seismic loads. If the basins are not expanded by removing the knockout walls, strengthening these walls with new cast-in-place concrete walls with the appropriate reinforcing is critical to continuous operation of the basins after an earthquake.

- The brick veneer installed on the façade of the Operations and Digester Control buildings is not anchored to the structural walls. Additionally, the through-wall flashing installed at the base of the face brick creates a failure surface. Anchoring the face brick to the structural walls will reduce the risk of collapse of the brick facing.

- Non-structural components throughout the plant, including mechanical and electrical equipment and storage racks, are not anchored to walls or floor. Anchoring these freestanding components will protect the equipment and occupants.

- Piping and ductwork are installed without lateral bracing. Adding lateral bracing will help ensure continuous operation of the plant after a seismic event.

- Extensive water damage was observed in the UV Disinfection building. The recommended approach is to remove and replace the building with a structure designed to the current building code. If kept in its current condition, additional wall anchorage is necessary.

A summary of the structural deficiencies is presented in Table 2 for masonry buildings with flexible diaphragms. Table 3 presents structural deficiencies for light-framed buildings, and Table 4 provides the structural evaluation summary for tanks. Conceptual retrofit strategies and their associated costs for the recommended retrofits are summarized in Table 5.

3.0 BACKGROUND

The structures identified for seismic assessment were:

- Pump and Operations Building
- Headworks Structure and Electrical Building
- Circular Primary Clarifier
- Rectangular Primary Clarifiers 1 and 2
- Secondary Clarifiers No. 1 and 2
- Aeration Basins
- Primary Digester No. 1
- Digester Control Building
- Sludge Thickener and Control Building
- Chlorine Contact Basin
- Old Chlorine Building
- UV Disinfection Building and Storage Shed
- Plant Drain Pump Station

The locations of these structures in the Water Restoration Plant are shown on the Site Plan in Figure 1.

The structures listed above were divided into three groups based on the different approaches required for each building type. The first group consists of masonry buildings with flexible wood diaphragms, and includes the Pump and Operations Building, Digester Control Building, Headworks and Electrical Building, Plant Drain Pump Station, and the Old Chlorine Building. The second group consists of light wood framed buildings: UV Disinfection Building, Sludge Control Building, and the Storage Shed. The third group consists of buried or semi-buried concrete tanks.

Digester No. 2 has been abandoned. The Secondary Clarifier No. 3, Mixed Liquor Splitter Box, and RAS/WAS electrical buildings were constructed in 2002. The design requirements for these structures have mostly remained unchanged since their inception. Therefore, these structures were not included in this memorandum.

LEGEND

1. Operations Building
2. Headworks
3. Rectangular Primary Clarifiers
4. Circular Primary Clarifiers
5. Aeration Basins
6. Mixed Liquor Splitter Box
7. Secondary Clarifiers Nos. 1 and 2
8. Secondary Clarifier No. 3
9. RAS/WAS Pump Station
10. Primary Digester No. 1
11. Digester Control Building
12. Digester No. 2
13. Sludge Thickener
14. Sludge Control Building
15. Chlorine Contact Basin
16. Chlorine Building
17. UV Disinfection
18. Plant Drain Pump Station
19. Storage Shed

Figure 1
SITE PLAN
WATER RESTORATION PLANT FACILITY PLAN
SEISMIC CONDITION ASSESSMENT
GRANTS PASS, OREGON

gp113f2-8613.ai

The record drawings that were made available to Carollo for this evaluation were:

- 1962 CH2M drawings for the Sewage Treatment Plant Additions.
- 1974 Brown and Caldwell drawings for the Original Water Restoration Plant.
- 1994 Brown and Caldwell drawings for the Headworks, Primary and Disinfection.
- 2005 Parametrix drawings for Secondary Treatment Upgrade Phase 1.
- 2007 Parametrix drawings for Influent Pumping and Screening Upgrades.

Most of the original Sewage Treatment Plant structures, built prior to 1962, were demolished or abandoned and were not evaluated.

For the Geological Site Hazard evaluation, the following geotechnical reports were reviewed:

- 1994 AGI Technologies report for Water Restoration Plant Upgrade.
- 2001 GALLI Group report for Water Restoration Plant Upgrade.

4.0 SEISMIC ASSESSMENT APPROACH

Based on the damage observed in past earthquakes, in addition to larger seismic loads, the requirements of building codes have enhanced detailing requirements for seismic load resisting systems. As a result, buildings that were designed using previous building codes may inherently not meet the detailing specifications of the 2010 Oregon Structural Specialty Code (OSSC) currently in effect. In order to evaluate seismic performance of existing structures, standards such as ASCE 31 Seismic Evaluation of Existing Buildings have been developed.

4.1 Assessment of Building-Type Structures

Carollo's approach to seismic evaluation of buildings includes a visual condition assessment, as well as using screening checklists for seismic reliability provided as part of the three-tiered process standardized in ASCE 31. The ASCE 31 standard is commonly used as a way to evaluate anticipated seismic performance of existing buildings.

The Tier 1 phase is the initial screening step to efficiently identify potential deficiencies and determine if there is a need for additional investigation. The evaluation uses Basic Checklists provided in the standard for all building structures. Separate checklists are provided in ASCE 31 for various building types, as well as lateral load resisting systems. For buildings in areas of high seismicity, such as Grants Pass, a Supplemental Structural Checklist is required by ASCE 31. Items that are identified as noncompliant in Basic and Supplemental Structural checklists require further investigation through a Tier 2 analysis to better understand the anticipated damage. Tier 2 procedures include a more rigorous evaluation of specific elements of the structure. The ASCE 31 findings are presented in Appendix A.

4.1.1 Masonry Buildings with Wood Roof Diaphragms

The above ground portion of the Pump and Operations Building, Digester Control Building, Headworks Electrical Building, Plant Drain Pump Station, and the old Chlorine Building are masonry structures with flexible roof diaphragms (RM1). The ASCE 31 Tier 1 screening checklists for masonry buildings help identify deficiencies by evaluating the configuration and geometry, condition of the construction materials, connections, and diaphragms. More specifically, the connections at the top of masonry walls are susceptible to damage due to excessive movements in the diaphragm. Weak or improperly installed straps or anchors will lead to significant damage in the masonry walls in a seismic event.

4.1.2 Light Wood Frame Buildings

The buildings in this category are constructed with a light wood frame structure with plywood shear walls. This category includes the UV disinfection building, the Sludge Control Building, and the Storage Shed.

These building serve as enclosures protecting the occupants and contents from weather and are not considered critical to the operation of the plant. Record drawings of these buildings were not available to Carollo, therefore, a full ASCE 31 Tier 1 screening was not performed. The evaluation was based primarily on field observations and experience with similar buildings. The deficiencies identified as part of the field screening process were used to provide recommendations for retrofitting the structure.

4.2 Buried/Semi-buried Concrete Structures

Design of water containing structures under the OSSC is performed based on the requirements of American Concrete Institute Standard 350 (ACI 350). The evaluation and retrofit of the existing water containing structures was also based on the ACI 350. Carollo's approach to evaluation of concrete tanks includes analyzing the design of the tanks for the hydrodynamic forces prescribed by ACI 350-06. Generally speaking, the underground portions of buried or semi-buried concrete tanks perform well during an earthquake. Results of the seismic assessment of these structures are presented in section 5.3.

Additionally, recent advances concerning behavior of anchors in concrete have led to more stringent requirements for designing anchorage of equipment to concrete. As a result, it can be expected that the existing anchorage of the clarifier mechanisms will most likely sustain significant damage during an earthquake, and may leave the mechanism inoperable after an earthquake. Reducing the risk of damage with the goal of continuous operation will therefore require a retrofit of anchorage and the concrete center block in the clarification tanks.

4.3 Performance Objectives

The basic performance objectives for building code compliance assumes the structure will be capable of resisting a minor level of ground motion without significant damage to the structural elements and be capable of resisting the strongest forecast intensity earthquake without collapsing. However, compliance with detailed requirements of the current building code may require difficult and expensive retrofit for existing buildings.

In addition to meeting these basic requirements of the building code, there are three specific performance objectives defined in ASCE 31 that were considered as part of this project. Performance objectives are Collapse Prevention/ Risk Reduction, Life Safety, and availability for Immediate Occupancy after a catastrophic event. These performance objectives are summarized in Table 1. In the selection of a specific performance objective for each structure, the following factors were considered:

1. Criticality of the structure: Will the plant operate without this structure being functional?
2. Occupancy of the structure: Does the structure house people?
3. Health hazard resulting from failure: Would damage to structure release hazardous materials or pathogens that could endanger staff or public?
4. Desired condition after a seismic event: What is the acceptable level of damage?
5. Economic loss: What are the costs of replacing damaged structures?

During the workshop held with the WRP staff and the City's public work director the Immediate Occupancy performance objective was adopted for the structural assets of the WRP. This is the typical assumption for critical structures related to wastewater treatment.

Table 1 Performance Levels for Seismic Evaluation
City of Grants Pass – Seismic Condition Assessment

Performance Level	**Description**
Collapse Prevention/ Risk Reduction	Significant damage to both structural and non-structural components during a design earthquake is expected. Extensive retrofits are required and building may not be salvageable after a design earthquake. Limited funds dictate addressing only deficiencies of significant importance. Non-structural elements will have lost restraint or collapsed
Life Safety	Significant damage to both structural and non-structural components during a design earthquake is expected. Some margin of resistance against collapse is expected. Non-structural elements are expected to be secure but may be extensively damaged.
Immediate Occupancy	Limited damage to both structural and non-structural components during the design earthquake is expected. The basic vertical and lateral force-resisting systems retain nearly all pre-earthquake strength and stiffness. The level of risk for life-threatening injury as a result of damage is very low. Some minor repairs will be necessary but the building will be fully habitable after the design earthquake.

4.4 Geotechnical Review

Geotechnical information from previous site investigation reports was reviewed as part of this project in order to identify any hazards (e.g., liquefiable sand layers that could affect the performance of the structure). The results of the geologic hazard assessment can be found in the General Site Geological Hazard checklist in Appendix A. After review of the available information, no significant concerns regarding geological hazards were identified.

4.5 Seismic Design Parameters

Site-specific characteristics were reviewed to calculate seismic acceleration values based on the 2010 OSSC. The lateral seismic demand on the structures for the seismic evaluation was calculated based on the requirements of ASCE 31. Design acceleration values were determined assuming Soil Site Class D (stiff soils):

- Short-Period Design Acceleration (T = 0.2 sec) S_{DS} = 0.61;
- Long-Period Design Acceleration (T = 1.0 sec) S_{D1} = 0.42.

5.0 SEISMIC ASSESSMENT RESULTS

The seismic design accelerations determined by OSSC place the WRP in an area designated as high seismicity; therefore, both Basic and Supplemental Structural checklists from ASCE 31 were used in the evaluations. To meet the continuous operation objective, attention has been given to non-structural contents of the buildings including piping, ductwork, mechanical and electrical equipment. The ASCE 31 Non-structural Components checklists were used for this assessment.

The criteria in the Basic Checklist are more rigorous than the Supplemental. For example, the findings for cladding in the Basic Nonstructural Checklist addresses glass becoming dislodged and falling. The Supplemental Nonstructural Checklist addresses glass providing a sufficient weather barrier following an earthquake. Table 2 summarizes the noncompliant attributes found on the Basic and Supplemental Structural Checklists required for the Tier 1 evaluation. Checklist details are presented in Appendix A.

The Findings and Recommendations section refers to numbered details, e.g., Out-of-Plane Wall Anchorage Deficiency – Detail 1. Conceptual illustrations of these details, to the extent possible, are presented in Appendix B.

5.1 Masonry Buildings with Flexible Diaphragms

The findings for this group of buildings are summarized in Table 2. Detailed description of the deficiencies and recommendations are included in this section.

Table 2	Summary of Findings for Masonry Buildings with Flexible Diaphragms *City of Grants Pass – Seismic Condition Assessment*		
	ASCE 31 Tier 1 Non-Complying Attributes		
Structure Name and Deficiencies Found	**Basic Structural**	**Supplemental Structural**	**Non-Structural Components**
Operations Building			
• Out-of-plane wall anchorage deficient for penthouse floor joists.	X		
• Out-of-plane wall anchorage to penthouse roof deck insufficient.	X		
• No continuous cross-ties between roof diaphragm chords in the penthouse roof.		X	
• Irregular in plan. Roof diaphragm collector elements deficient.		X	
• Masonry walls of the workshop and screen room are cracked due to settlement.(1)			
• Anchorage and bracing required for mechanical and electrical equipment.			X
• Lateral bracing required for piping and ductwork, and light fixtures.			X
• Brick Veneer requires anchorage.			X
• Glass windows need to be replaced.			X
Digester Control Building			
• Out-of-plane wall anchorage to roof deck insufficient.	X		
• Anchorage and bracing required for mechanical and electrical equipment.			X
• Brick Veneer requires anchorage.			X
• Glass windows need to be replaced.			X
Headworks Electrical Building			
• Out of plane wall anchorage insufficient.	X		
• No continuous cross-ties between roof diaphragm chords.		X	
• Anchorage and bracing required for mechanical and electrical equipment.			X
• Lateral bracing required for piping and ductwork and light fixtures.			X

Table 2	**Summary of Findings for Masonry Buildings with Flexible Diaphragms** *City of Grants Pass – Seismic Condition Assessment*		
	ASCE 31 Tier 1 Non-Complying Attributes		
Structure Name and Deficiencies Found	**Basic Structural**	**Supplemental Structural**	**Non-Structural Components**
Plant Drain Pump Station			
• Anchorage and bracing required for electrical equipment.			X
Old Chlorine Building			
• South Wall deficient for out-of-plane Bending.	X		
• Anchorage and bracing required for Hazardous Materials and Storage Racks.			X
Notes: (1) Structural observation not included in ASCE 31 Tier 1 checklists.			

5.1.1 Operations Building

The Pump and Operations Building is a multi-story building with a gabled roof and brick veneer siding. The buried portion of the structure is designed with reinforced concrete bearing and shear walls. The above ground portion of the structure is a combination of concrete masonry block, concrete shear walls, and reinforced brick walls. The roof consists of two separate wood diaphragms constructed at two different elevations. The east and west roof diaphragms have a maximum of 11-foot difference in elevation. The roof deck system includes straight sheathing (interlocking wood planks) and plywood nailed to the sheathing. All bearing walls were designed with reinforcement and dowels into the foundation. The building was designed using the 1971 UBC and constructed in 1972.

5.1.1.1 Structural Findings

Out-of-plane Wall Anchorage Deficiency: The deck to wall connection for the floor deck of the penthouse is at risk of failure during an earthquake. Cross-grain bending in the ledger block at the floor to wall connection is a common deficiency of buildings built in the 1970s. Addressing this connection is necessary to provide lateral support for the penthouse floor deck during an earthquake.

Continuous Cross-Tie Deficiency: The blocking between the rafters in the penthouse roof deck does not have positive connections to transfer out-of-plane wall anchorage forces through the diaphragm; without this, the walls are at risk of separating from the roof.

Out-of-Plane Wall Anchorage Deficiency: The connection of roof joists to the walls of the penthouse is deficient for out-of-plane forces. The joist hangers provided during original construction are only capable of resisting vertical loads.

Collector Element at Re-entrant Corner Deficiency: The roof diaphragm has two re-entrant corners at the east side of the workshop, and west of the control room. Collector elements are needed at these corners to provide a complete load path and avoid extensive damage.

Deflection Compatibility Deficiency: In the hallway east of the screen room (column line 7), where the lower roof diaphragm connects to the east wall of the screen room, the lower roof deck rests on a wood ledger that is connected to the face brick on the east side of the masonry wall. The drawings show an air gap between the two walls. Details of the connection of the ledger block to the brick are not included in the record drawings. It can be expected that the lower roof decking is nailed to the ledger block. Regardless of the connection details, deflection of the lower roof in the east-west direction will cause the end of the deck to pound on the brick veneer, causing it to collapse. Any damage to the brick veneer at this location will threaten the safety of the occupants.

Masonry Wall Cracking: Diagonal cracking was observed in the south and east walls of the workshop, as well as south wall of the screen room. Concrete Masonry Units (CMU) used in the building are only grouted in cells with reinforcement. Therefore, the CMU blocks have low shear capacity. In areas with high seismic risk, the building codes require that masonry wall be fully grouted. Some of the cracks occurring in the masonry wall of the screening room and the workshop may have been avoided if the masonry walls where fully grouted.

5.1.1.2 Non-Structural Components

Insufficient Lateral Bracing for Pipes and Ductwork: Many unsupported runs of pipe and ductwork were observed throughout the building, including a 4-inch diameter natural gas pipe entering through the gallery and turning towards the boiler room. These pipes, conduits, and ducts need to be braced laterally in order to avoid damage or rupture during an earthquake.

Insufficient Anchorage of Equipment: Several storage racks observed in the Operations Building were not anchored to the wall or the floors.

Electrical equipment including the pump room MCCs, older cabinets in the MCC room, UPS batteries in the pump room, and transformers were identified that are not anchored to the walls or floors.

Mechanical equipment including, the old blowers, the boiler, fans (HV16), gas heaters in the workshop and the generator room, the generator silencer, the water heater in the penthouse, and other equipment were found in need of lateral bracing and anchorage in order to resist seismic loads.

Deficient Detailing for Brick Veneer: Brick veneer is installed on the exterior of most masonry walls of the building. In high seismicity zones, the OSSC requires veneer to be reinforced using wire reinforcement cast with the masonry walls supporting the veneer. Reinforcing the veneer and attaching it to the structural walls prevents it from falling out or collapse during an earthquake. The 1972 drawings do not contain any information on anchorage of the brick veneer to the masonry walls.

Additionally, the through-wall flashing designed for the face brick creates a smooth failure surface at the base of the brick veneer. This flashing detail is used universally for all face brick. In order to avoid damage to the brick at the flashing, it should be anchored to the walls.

Light Fixtures Require Bracing: Pendant supported light fixtures were observed throughout the building. During a seismic event, lights with pendant supports swing, and may shatter the light bulbs or the covers. It is usually recommended that the pendant lights are braced or covered for the safety of the building occupants.

Tempered Glass Required: There are several long windows near occupied areas such as the Control Room and the laboratory. Since the glass is not tempered or laminated there is risk of injury to the occupants.

5.1.1.3 Geotechnical Review Results

The cracks observed on the East wall and South wall of the Workshop above the roll-up door, as well as similar cracking seen in the South and East walls of the Screen room is evidence of settlement of soil that has occurred under the southeast corner of the building. . Reviewing the record drawings showed that the south side of the operations building was built on a 10-foot compacted engineering fill up to elevation 915.38.

Compacted engineered fill is expected to settle 1 to 2 percent (1 to 2.5 inches per 10 feet) over the long term. The portion of the structures resting on the fill will lose support and cause cracking in the walls.

The settlement of an engineered fill is expected to slow down and eventually stop. Therefore, the observed cracks do not pose an immediate danger to the structure at this time.

5.1.1.4 Recommendations

Provide straps for out-of-plane wall anchorage perpendicular to floor rafters (Detail 1) to prevent cross-grain bending in the ledger blocks.

Use strap connectors to tie together blocking on opposite sides of roof joists. This will create a continuous load path between the diaphragm chords (Detail 2). Addition of these straps can be done from the underside of the joists.

Provide out-of plane wall anchorage parallel to roof rafters (Detail 3) to prevent cross-grain bending in the ledger blocks.

Anchor electrical and mechanical equipment, and storage racks throughout the building. This retrofit is a high priority since it will help maintain the continuous operation of the equipment, as well as life safety of the occupants. Lateral bracing is also required for the piping and ducts, gas heaters, and light fixtures.

Investigate the brick veneer installation to confirm whether anchors or reinforcement were provided. If anchorage was not installed, use wall façade anchors such as Simpson Strong-Tie

Heli-Tie™ to anchor the veneer to prevent it from collapsing. Brace the panels over areas of 3.5 square feet maximum. Due to the extent of the use of brick elements in the building, one approach is to anchor only brick walls adjacent to walking or occupied areas. The estimated costs assume that 30 percent of the brick veneer area will be anchored.

Based on ASCE 31 recommendations, all exterior glass and glazing over 16 square feet in area located up to a height of 10 feet above an exterior walking surface shall have safety glazing. Replace such glazing with annealed or laminated glass for Life Safety. For Immediate Occupancy and continuous operation of buildings, ASCE 31 recommends that all exterior glass and glazing is reinforced, tempered, laminated, or heat-strengthened safety glass in order to enclose the building.

5.1.2 Digester Control Building

Digester Control building was built together with Primary Digester No. 1 in 1972. The roof diaphragm consists of straight sheathing with a plywood deck. The roof is connected to two reinforced brick feature walls on the south side, and reinforced concrete masonry block walls on east and west. On the north side, the roof is connected to the walls of the digester.

5.1.2.1 Structural Findings

Out-of-Plane Wall Anchorage Deficiency: The connection of the ledger to the roof joists around the roof does not have sufficient anchors to prevent cross-grain bending damage, a common type of earthquake damage.The joist hangers provided during original construction are only capable of resisting vertical loads.

5.1.2.2 Non-Structural Components

Insufficient Lateral Bracing for Pipes: Piping inside the Digester Control Building has minimal bracing.

Insufficient Equipment Anchorage: Pump skid located in the small room outside of the Digester Control Building is not anchored to the floor. The surge tank inside the building appears to be sitting on the floor without anchorage to the concrete.

Deficient Detailing for Brick Veneer: After review of the record drawings, there is no indication that he brick used in the feature walls is anchored to the concrete core. However, the brick veneer on the exterior of the digester walls is anchored to the concrete using dovetail anchors. Unanchored brick walls are vulnerable to lateral seismic loads as mentioned in the previous section and need to be reinforced or braced. As mentioned previously, presence of flashing at the bottom of all face brick and reinforced brick walls provides a smooth failure surface for the brick. Anchoring the face brick to the supporting structural wall will address this concern.

Tempered Glass Required: The East, West, and South sides of the building have large glass windows without any labeling indicating that the glass is tempered.

5.1.2.3 Recommendations

Provide new straps for out of plane wall anchorage (Detail 3) to prevent cross-grain bending in the ledge block.

Provide additional lateral bracing for piping inside the digester control building.

Anchor surge tank inside the building to the floor using steel clips that can be welded or bolted to the sides.

Anchor pump skid located in the room outside of the Digester Control building to the floor.

Investigate the feature brick walls on the East, West, and South sides to establish whether the brick units are anchored to the concrete core. To address the concerns with the flashing at the base of the walls, anchor brick veneer to the walls using Heli-Tie or similar anchors.

Replace glass windows with tempered or laminated glass as indicated in section 5.1.1.4.

5.1.3 Headworks Electrical Building

The Headworks Electrical Building was constructed in 1994 as part of the new Headworks structure. It has masonry walls and a plywood deck nailed to roof rafters. The roof deck is connected to the walls of the building through a ledger block bolted to the walls.

5.1.3.1 Structural Findings

Out-of-Plane Wall Anchorage Deficiency: The connection of the ledger to the roof joists around the roof does not have sufficient anchors to prevent cross-grain bending damage, a common type of earthquake damage.The joist hangers provided during original construction are only capable of resisting vertical loads. Providing new wall to roof joist connections will tie the roof to the wall. This will reduce the risk of loss of support for wall during an earthquake.

Continuous Cross-Tie Deficiency: Walls parallel to joists do not have sufficient cross-ties to the opposite side of the building. There is no continuous load path perpendicular to the wall to keep the walls from separating from the building.

5.1.3.2 Non-Structural Components

There is significant water leakage through the doors and the roof opening of the Headworks Electrical building. The water has caused significant staining on the masonry blocks and around the electrical cabinets. The building requires further inspection to determine the exact location of the leaks as well as weatherproofing to prevent damage to the equipment inside.

Pendant supported light fixtures are installed in the basement of the building. These fixtures are not braced against swinging.

Miscellaneous piping and ductwork installed in the basement lacks lateral bracing.

5.1.3.3 Recommendations

Add out-of-plane anchorage on both walls (Details 1 and 3) to address the cross-grain deficiency at the roof to wall connection.

Provide strap connectors tying together blocking on opposite sides of roof joists, to create a continuous load path between the diaphragm chords (Detail 2).

Investigate cause of moisture. Replace flashing as required to waterproof the roof deck and apply waterproofing materials on the exterior of the building as required.

Provide lateral bracing for ductwork, electrical equipment, and light fixtures.

5.1.4 Plant Drain Pump Station

Plant Drain Pump Station was constructed as part of the 1962 additions to the Sewage Treatment Plant. The structure has partially grouted masonry walls with straight sheathing for the roof deck.

5.1.4.1 Structural Findings

No major structural deficiencies were found.

5.1.4.2 Non-Structural Components

Electrical cabinets and UPS battery systems installed inside the building are not anchored. This equipment is critical to the operation of the WRP and should be anchored to the walls or floor to protect against lateral seismic loads.

Signs of moisture was observed behind one of the MCC cabinets. This leakage may be associated with deteriorated roofing or flashing. Waterproofing the walls may help keep the moisture from penetrating the walls. Continued penetration of moisture may cause damage, corrosion, or short-circuiting in the electrical wiring.

5.1.4.3 Recommendations

Investigate source of moisture inside the building.

Anchor electrical cabinets to the walls or the foundation.

5.1.5 Old Chlorine Building

The old chlorine building is a small square masonry structure that was built as part of the 1962 additions to the Sewage Treatment Plant. The masonry blocks are reinforced and partially grouted.

5.1.5.1 Structural Findings

Wall Out-of-Plane Bending Deficiency: The south wall of the Old Chlorine Building has a large window opening and a double door. Because of these large openings, the south wall does not have sufficient capacity for out-of-plane wall bending.

5.1.5.2 Non-Structural Components

A cabinet containing flammable materials is not anchored to the floor. In addition, there are no containment areas for the oil barrels and other hazardous materials stored in the building.

5.1.5.3 Recommendations

Remove the existing door on the south wall of the building and fill with reinforced masonry blocks to provide additional out of plane bending capacity for the wall (Detail 4).

Anchor cabinets and storage racks to the walls or the foundation. In order to avoid an oils spill, brace the oil barrels against the walls and provide containment totes.

5.2 Light Wood Frame Buildings

A summary of findings for the Light Wood Frame Buildings is presented in Table 3, followed by detailed descriptions of the deficiencies and recommendations for retrofit.

Table 3 Summary of Findings for Light Frame Buildings
City of Grants Pass – Seismic Condition Assessment

	ASCE 31 Tier 1 - Non-complying attributes		
Structure Name and Deficiencies Found	**Basic Structural**	**Supplemental Structural**	**Non-Structural Components**
UV Disinfection Building			
• Deterioration of plywood Shear Wall.	X		
• Shear Wall hold down details deficient	X		
• Deterioration of plywood roof diaphragm.	X		
Sludge Control Building			
• Out-of-plane wall anchorage to roof deck insufficient.	X		
• Shear Wall connection details unknown.	X		
• Shear Wall hold down details deficient.	X		
Storage Shed			
• Shear Wall connection details unknown.	X		
• Shear Wall hold down details deficient.	X		
• Storage Racks are not anchored.			X

5.2.1 UV Disinfection Building

Extensive water damage was observed on the shear walls, the roof deck, and roof trusses. The building was not designed for seismic loading. The wood sills are not anchored to the floor and the building is not braced against lateral loading. The details of nailing for the shear walls are not known.

A 1.5 ton monorail is supported by the roof trusses.

5.2.2 Sludge Control Building

The sludge control building has evolved into a building from a canopy. The addition of the walls and door was done without seismic considerations.

The wood sills at the bottom of the walls are not anchored to the floor The details of the nailing for the shear walls are not known.

5.2.3 Storage Shed

The storage shed contains landscaping equipment, and spare parts that are stored on a storage rack. The storage racks are not anchored to the floor. The wood sills at the base of the walls are not anchored to the concrete slab.

5.2.4 Recommendations

The UV enclosure is not designed to comply with current building codes. Additionally, the structure has suffered extensive water damage. Demolishing and replacing the enclosure with a new structure is the recommended alternative.

For all the three buildings, the wall bottom sills should be anchored to the concrete slab to complete the load path from the building to the foundation.

Anchor storage racks and equipment to the walls or floors for improved reliability during an earthquake.

5.3 Buried/Semi-Buried Concrete Structures

All the concrete tanks in this group, except the chlorine contact basin, were in service during the site inspection, making observation of the submerged parts of these structures impossible. The findings of the visual assessment of these structures are presented in this section. Due to the age of the concrete structures, a detailed inspection of the interior walls and foundations, together with testing to evaluate deterioration of the concrete in the tanks, is recommended during scheduled maintenance.

Table 4 summarizes the findings of the seismic condition assessment followed by a detailed description. Many assets were found in good condition but will still need rehabilitation or replacement for long-term service. This would include coating the interior of the tanks. For planning purposes, it is recommended that these tanks be evaluated for replacement or rehabilitation for the long-term service (fifteen year or longer timeframe).

Photographs documenting the condition assessment findings can be found in Appendix D.

Table 4 Summary of Findings for Buried/Semi-Buried Concrete Structures
City of Grants Pass – Seismic Condition Assessment

Structure Name and Deficiencies Found	Governing Standard
Below Ground Portion of Operations Building	
• No seismic deficiencies were found.	OSSC 2010
Headworks and Rectangular Primary Clarifiers	
• Piping requires bracing.	ASCE 31
• Cracks in the concrete deck at the openings.	ASCE 31
Circular Primary Clarifier	
• Walkway and mechanism anchorage deficient.	ASCE 31
• Corrosion observed.	ASCE 31
Aeration Basins	
• Pipes require additional supports and bracing.	ASCE 31
• Knockout walls for future expansion are overstressed.	OSSC 2010, ACI 350-06
Secondary Clarifiers No. 1 and 2	
• Walkway and mechanism anchorage deficient.	ASCE 31
• Hoop reinforcing deficient. Walls may crack during a large seismic event.	OSSC 2010, ACI 350-06
Sludge Thickener Tank	
• Walkway and mechanism anchorage deficient.	ASCE 31
• Heavy corrosion of walkway piping and mechanism.	ASCE 31
Primary Digester No. 1	
• Vertical and hoop reinforcing deficient, walls may crack during a large seismic event.	OSSC 2010, ACI 350-06
• Flashing provided at the base of walls may cause the veneer to collapse.	ASCE 31
Chlorine Contact Basin	
• Vertical and hoop reinforcing deficient, walls may crack during a large seismic event.	OSSC 2010, ACI 350-06
• Masonry divider walls reinforcement deficient, may collapse during a moderate to large seismic event	OSSC 2010, ACI 350-06

5.3.1 Below-ground Portion of Operations Building

No major structural deficiencies were found.

5.3.2 Headworks and Rectangular Primary Clarifiers

The Headworks and Rectangular Primary Clarifiers were designed and constructed in 1994 using the 1991 Uniform Building Code (UBC). The masonry walls are reinforced and detailed similar to the current Building Code. Therefore, no major retrofits are required for this structure.

Diagonal cracks were observed on the deck of the Headworks area at the corners of some rectangular openings. The cost of repair and retrofit of these cracks is included in the Cost Estimates in Table 4.

5.3.3 Circular Primary and Secondary Clarifiers

The Circular Primary Clarifier was constructed in 1964 as part of the original Sewage Treatment Plant. Secondary Clarifiers No. 1 and 2 were constructed as part of the 1972 expansions of the WRP, while Secondary Clarifier Tank No. 3 was added in 2002. During Carollo's site visit in December 2012 the condition of the submerged portion of the tanks was not observed as the tanks were all in service. The older concrete structures are approaching or have exceeded their expected useful life. Therefore, it can be expected that the quality of the concrete in the tanks has diminished. The extent of deterioration of the concrete shall be inspected and tested for long-term planning during scheduled maintenance.

Seismic analysis of the Circular Primary Clarifier tank did not identify any structural deficiencies. However, analysis of the Secondary Clarifiers No. 1 and 2 found that hoop reinforcing is overstressed. During a significant seismic event, the horizontal wall reinforcing steel may become overstressed and cracks will occur in the tank wall, causing leaks that will need to be repaired. The overstressed region is located near the mid-height of the wall. In order to keep the Secondary Clarifiers in service, post-tensioning the walls from the exterior of the tanks is recommended. This would require excavating around the tanks to provide access during construction.

The walkway bridges bearing are at risk of falling off their seats at the tank walls. Increasing the size of the bearing seats will prevent walkway bridge collapse.

Recent changes in the Building Code approach to designing equipment anchorage result in increased number of anchor bolts, edge distance, and embedment. Planning for retrofit or replacement of the clarification mechanism should take into account that the new anchors will require modifications to the concrete foundation. The construction cost estimates in Table 5 include this work, along with the replacement of the mechanism center column. However, a full replacement of the clarifier mechanism will most likely be recommended if the tanks are modified.

5.3.4 Aeration Basins

Aeration Basins were constructed in 1972 as part of the original WRP project. The east wall of the aeration basins have full-height knock out walls for future expansion. These walls have little capacity to resist seismic sloshing loads. This is a significant seismic deficiency that must be addressed to meet the City's objective of continuous operation.

If not removed to expand the basins, the knockout walls should be strengthened or replaced with cast-in-place concrete walls with reinforcing steel doweled into the buttress wall located at 11-foot spacing on the east end of the aeration basins. This will require the each of the aeration basins to be out of service for at least two months.

The interior masonry baffle walls are not designed for seismic sloshing loads and are likely to collapse during a significant earthquake. These walls should be strengthened with additional reinforcing at the same time that the end walls are upgraded.

A review of the record drawings for the Aeration basin showed that the submerged air piping has long unsupported lengths that are not braced for lateral loading in a seismic event. If these pipes are left in their current condition, they will most likely sustain considerable damage during an earthquake.

5.3.5 Sludge Thickener

Originally built in 1972 as part of the original WRP design, the tank seems to be in a good shape. Only a few vertical shrinkage cracks were observed on the walls above the operating level. No structural deficiency was found through seismic analysis of the tank.

The walkway bridge bearing is at risk of falling of the seat at the tank wall. Increasing the size of the bearing seat will prevent walkway bridge collapse.

Planning for retrofit or replacement of the thickener mechanism should take into account that the new anchors will require modifications to the concrete foundation. The construction cost estimates in Table 5 include this work, along with the replacement of the mechanism center column.

The coating on the walkway and piping for the sludge thickener has failed in numerous places. Regular maintenance and coating of the pipe, walkway and guardrails will increase their expected useful life.

5.3.6 Primary Digester No. 1

The Primary Digester No. 1 was constructed in 1974 as part of the original WRP expansions. The digester tank and the Digester Control Building are part of the same structure. The digester is designed with a floating steel cover.

Seismic analysis of the structure shows that hoop reinforcing and vertical reinforcing is overstressed. During a significant seismic event, the wall reinforcing steel may become overstressed and cracks will open in the tank wall causing leaks that will need to be repaired. The overstressed region is near the middle and at the base of the wall. The tank will need to be emptied to seal the leaks.

Adding additional reinforcing steel would require excavating around the tanks. Because it is likely that the tanks will be able to remain in service following a seismic event, this deficiency does not significantly threaten continuous operation.

The concrete tank is covered with brick veneer. Contrary to the other structures in the WRP, record drawings indicate the brick veneer is anchored to the concrete tank walls. The brick veneer appears to be in good condition.

5.3.7 Chlorine Contact Basin

The Chlorine Contact Basin was constructed in 1964 as a trickling filter for the original Sewage Treatment Plant. During the 1972 expansion, the rotating mechanism and center pier were removed. To convert the tank into chlorine contact tanks, the wall was raised, a concrete wall built to divide the tank into two, and serpentine masonry walls constructed. More recently in 1995, two thirds of the masonry walls were removed. Currently the tank is used occasionally for storage. During Carollo's site visit in December 2012, the condition of the tank appeared fair.

Seismic analysis of the structure shows that hoop reinforcing and vertical reinforcing is overstressed. If the tank is full during a significant seismic event, the wall reinforcing steel may become overstressed and cracks will open in the tank wall, causing leaks that will need to be repaired. The overstressed region is over the height of the entire wall and is more significant at the ends of the divider wall. The tank will need to be emptied to seal the leaks.

More significantly, the divider wall is likely to be damaged and the serpentine masonry walls are likely to collapse in a moderate or significant seismic event. It is unclear from the record drawings how the masonry wall reinforcing was anchored into the tank's original 6-inch thick bottom slab. It is possible these walls have little or no lateral load capacity. Since these walls no longer provide any function, demolition will eliminate this risk.

5.4 Concrete Condition Evaluation

Deterioration of the concrete and erosion of the cover over the reinforcement is common for concrete tanks in wastewater plants. If the reduction of the concrete cover is not addressed, it will eventually lead to corrosion of the reinforcement and deterioration of concrete.

To address this concern, depth of deterioration is investigated during a scheduled maintenance. When significant deterioration is found and the asset is planned for long-term service, coating the concrete with elastomeric polyurethane is recommended to increase the expected useable life of the structure.

6.0 CONSTRUCTION COST ESTIMATES

The estimated construction costs presented in this TM are based on preliminary structural retrofit recommendations as developed for this TM.

The estimated construction costs for each structure were developed based on a variety of sources. Once the initial costs were prepared, a 30 percent contingency was applied to reflect uncertainties at this pre-design stage and assumptions used in the estimating methods.

A summary of retrofit projects recommended and the estimated costs associated with them are presented in Table 5 on the following page.

7.0 PRIORITIZATION

The need to address each structure's identified deficiencies was prioritized as a low, moderate or high priority. The prioritization is presented in Table 6.

Low priority projects are judged to not pose a significant risk to personnel and to plant operations. Anticipated damage can be readily repaired.

Moderate priority projects do not pose a significant threat to personnel. These deficiencies may impact operations, but are judged to be repairable in a reasonable period of time. The deficiencies can be addressed as part of maintenance and upgrades to the structure.

High priority projects pose a significant risk to the safety of plant personnel or to the plant's ability to treat wastewater. The deficiencies should be addressed as soon as possible.

Table 5 Cost Estimates
City of Grants Pass – Seismic Condition Assessment

Structure	Required Improvements	Estimated Construction Cost	Estimated Total Project Cost
Operations Building	Add straps, wall anchors, equipment anchorage, pipe bracing, roof collector element, anchor face brick, replace glass	$249,000	$311,000
Digester Control Building	Add wall anchors, replace glass, add equipment anchorage, pipe bracing	$43,000	$54,000
Headworks Electrical Building	Replace roofing, add straps, add wall anchors, equipment anchorage, brace duct and pipes.	$17,000	$21,000
Plant Drain Pump Station	Add equipment anchorage	$3,000	$4,000
Old Chlorine Building	Add anchorage, remove and infill access door	$6,000	$8,000
Sludge Control Building	Replace damaged plywood, complete nailing, add wall anchorage.	$7,000	$9,000
UV Disinfection Enclosure and Storage Shed.	Add wall anchors. Add bracing where required. Replace the UV building	$68,000	$85,000
Circular Primary Clarifier	Strengthen mechanism anchorage, replace center column, improve bridge bearing	$268,000	$335,000
Aeration Basins	Replace knockout walls and baffle walls	$225,000	$281,000
Secondary Clarifiers No. 1 & 2	Strengthen mechanism anchorage, post tension the clarifier walls, replace center column, improve bridge bearing	$791,000	$989,000
Sludge Thickener	Strengthen mechanism anchorage, replace center column, improve bridge bearing	$142,000	$178,000
Chlorine Contact Basin	Demolish concrete divider and masonry serpentine walls	$78,000	$98,000
	Total	**$1,897,000**	**$2,373,000**

Table 6 Prioritization ***City of Grants Pass – Seismic Condition Assessment***		
Structure	**Priority**	**Comment**
Operations Building	High	Falling debris from brick façade poses a risk to persons in vicinity of building during an earthquake. Roof collector element may leave the building unsafe to enter after an earthquake without significant repairs. Failure of the roof to wall connection may leave the walls unstable.
Digester Control Building	High	Failure of the roof to wall connection may leave the walls unstable. Broken glass poses a risk to persons in vicinity of building during an earthquake.
Headworks Electrical Building	Moderate	Failure of the roof to wall connection may leave the walls unstable. Water damaged roof may have compromised the building's capacity to resist earthquake loads.
Plant Drain Pump Station	Moderate	Non-structural deficiencies should be addressed as high-priority.
Old Chlorine Building	Low	South wall may be damaged. Non-structural deficiencies should be addressed as high-priority.
Sludge Control Building	Low	The building is not designed for seismic loads. If damaged during an earthquake it can be demolished
UV Disinfection Enclosure and Storage Shed.	Moderate	The building is not designed for seismic loads. Collapse can damage UV equipment.
Circular Primary Clarifier	Moderate	Anticipated damage can be repaired without significant impact on operations. Clarifier mechanism may become inoperable.
Aeration Basins	High	Damage to the knock out walls could leave the treatment plant inoperable without significant repairs.
Secondary Clarifiers No. 1 & 2	Moderate	Anticipated damage can be repaired without significant impact on operations. Clarifier mechanisms may become inoperable.
Sludge Thickener	Moderate	Thickener mechanism may become inoperable.
Chlorine Contact Basin	Low	Tank is used infrequently.

Appendix A

ASCE 31-03 STRUCTURAL EVALUATION CHECKLISTS

3.7.16 General Basic Structural Checklist

		Compliance
	Building System- Configuration	
WEAK STORY	The strength of the lateral-force-resisting system in any story shall not be less than 80 percent of the strength in an adjacent story, above or below, for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.2.1)	C
SOFT STORY	The stiffness of the lateral-force-resisting system in any story shall not be less than 70 percent of the lateral-force-resisting system stiffness in an adjacent story above or below, or less than 80 percent of the average lateral-force-resisting system stiffness of the three stories above or below for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.2.2)	C
GEOMETRY	There shall be no changes in horizontal dimension of the lateral-force-resisting system of more than 30 percent in a story relative to adjacent stories for Life Safety and Immediate Occupancy, excluding one-story penthouses and mezzanines. (Tier 2: Sec. 4.3.2.3)	C
VERTICAL DISCONTINUITIES	All vertical elements in the lateral-force-resisting system shall be continuous to the foundation. (Tier 2: Sec. 4.3.2.4)	C
MASS	There shall be no change in effective mass more than 50 percent from one story to the next for Life Safety and Immediate Occupancy. Light roofs, penthouses, and mezzanines need not be considered. (Tier 2: Sec. 4.3.2.5)	C
TORSION	The estimated distance between the story center of mass and the story center of rigidity shall be less than 20 percent of the building width in either plan dimension for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.2.6)	C
	Building System- General	
LOAD PATH	The structure shall contain a minimum of one complete load path for Life Safety and Immediate Occupancy for seismic force effects from any horizontal direction that serves to transfer the inertial forces from the mass to the foundation. (Tier 2: Sec. 4.3.1.1)	C
ADJACENT BUILDINGS	The clear distance between the building being evaluated and any adjacent building shall be greater than 4 percent of the height of the shorter building for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.1.2)	NA
MEZZANINES	Interior mezzanine levels shall be braced independently from the main structure, or shall be anchored to the lateral-force-resisting elements of the main structure. (Tier 2: Sec. 4.3.1.3)	C
	Building System- Condition of Materials	
DETERIORATION OF WOOD	There shall be no signs of decay, shrinkage, splitting, fire damage, or sagging in any of the wood members, and none of the metal connection hardware shall be deteriorated, broken, or loose. (Tier 2: Sec. 4.3.3.1)	C

DETERIORATION OF STEEL	There shall be no visible rusting, corrosion, cracking, or other deterioration in any of the steel elements or connections in the vertical- or lateral-force-resisting systems. (Tier 2: Sec. 4.3.3.3)	C
DETERIORATION OF CONCRETE	There shall be no visible deterioration of concrete or reinforcing steel in any of the vertical- or lateral-force-resisting elements. (Tier 2: Sec. 4.3.3.4)	C
MASONRY UNITS	There shall be no visible deterioration of masonry units. (Tier 2: Sec. 4.3.3.7)	C
MASONRY JOINTS	The mortar shall not be easily scraped away from the joints by hand with a metal tool, and there shall be no areas of eroded mortar. (Tier 2: Sec. 4.3.3.8)	C
CONCRETE WALL CRACKS	All existing diagonal cracks in wall elements shall be less than 1/8 inch for Life Safety and 1/16 inch for Immediate Occupancy, shall not be concentrated in one location, and shall not form an X pattern. (Tier 2: Sec. 4.3.3.9)	C
REINFORCED MASONRY WALL CRACKS	All existing diagonal cracks in wall elements shall be less than 1/8 inch for Life Safety and 1/16 inch for Immediate Occupancy, shall not be concentrated in one location, and shall not form an X pattern. (Tier 2: Sec. 4.3.3.10)	C
	Connections- Anchorage for Normal Forces	
WALL ANCHORAGE	Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support shall be anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections shall have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 3.5.3.7. (Tier 2: Sec. 4.6.1.1)	C
WOOD LEDGERS	The connection between the wall panels and the diaphragm shall not induce cross-grain bending or tension in the wood ledgers. (Tier 2: Sec. 4.6.1.2)	C
	Connections- Shear Transfer	
TRANSFER TO SHEAR WALLS	Diaphragms shall be connected for transfer of loads to the shear walls for Life Safety and the connections shall be able to develop the lesser of the shear strength of the walls or diaphragms for Immediate Occupancy. (Tier 2 Sec. 4.6.2.1)	C
TRANSFER TO STEEL FRAMES	Diaphragms shall be connected for transfer of loads to the steel frames for Life Safety, and the connections shall be able to develop the lesser of the strength of the frames or the diaphragms for Immediate Occupancy. (Tier 2: Sec. 4.6.2.2)	NA
TOPPING SLAB TO WALLS OR FRAMES	Reinforced concrete topping slabs that interconnect the precast concrete diaphragm elements shall be doweled for transfer of forces into the shear wall or frame elements for Life Safety, and the dowels shall be able to develop the lesser of the shear strength of the walls, frames, or slabs for Immediate Occupancy. (Tier 2: Sec. 4.6.2.3)	NA

Connections- Vertical Components

STEEL COLUMNS	The columns in lateral-force-resisting frames shall be anchored to the building foundation for Life Safety, and the anchorage shall be able to develop the lesser of the tensile capacity of the column, the tensile capacity of the lowest level column splice (if any), or the uplift capacity of the foundation, for Immediate Occupancy. (Tier 2: Sec. 4.6.3.1)	NA
CONCRETE COLUMNS	All concrete columns shall be doweled into the foundation for Life Safety, and the dowels shall be able to develop the tensile capacity of reinforcement in columns of lateral-force-resisting system for Immediate Occupancy. (Tier 2: Sec. 4.6.3.2)	NA
WOOD POSTS	There shall be a positive connection of wood posts to the foundation. (Tier 2: Sec. 4.6.3.3)	NA
WOOD SILLS	All wood sills shall be bolted to the foundation. (Tier 2: Sec. 4.6.3.4)	NA
FOUNDATION DOWELS	Wall reinforcement shall be doweled into the foundation for Life Safety, and the dowels shall be able to develop the lesser of the strength of the walls or the uplift capacity of the foundation for Immediate Occupancy. (Tier 2: Sec. 4.6.3.5)	C
SHEAR-WALL-BOUNDARY COLUMNS	The shear-wall-boundary columns shall be anchored to the building foundation for Life Safety, and the anchorage shall be able to develop the tensile capacity of the column for Immediate Occupancy. (Tier 2: Sec. 4.6.3.6)	NA
PRECAST WALL PANELS	Precast wall panels shall be connected to the foundation for Life Safety and the connections shall be able to develop the strength of the walls for Immediate Occupancy. (Tier 2: Sec. 4.6.3.7)	NA
WALL PANELS	Metal, fiberglass, or cementitious wall panels shall be positively attached to the foundation for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.6.3.8)	NA

Diaphragms- Precast Concrete Diaphragms

TOPPING SLAB	Precast concrete diaphragm elements shall be interconnected by a continuous reinforced concrete topping slab. (Tier 2: Sec. 4.5.5.1)	NA

Lateral Force Resisting System- Concrete Shear Walls

SHEAR STRESS CHECK	The shear stress in the concrete shear walls, calculated using the Quick Check procedure of Section 3.5.3.3, shall be less than the greater of 100 psi or 2 sqrt(f’c) for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.4.2.2.1)	C
REINFORCING STEEL	The ratio of reinforcing steel area to gross concrete area shall be not less than 0.0015 in the vertical direction and 0.0025 in the horizontal direction for Life Safety and Immediate Occupancy. The spacing of reinforcing steel shall be equal to or less than 18 inches for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.4.2.2.2)	C
COLUMN SPLICES	Steel columns encased in shear-wall-boundary elements shall have splices that develop the tensile strength of the column. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.4.2.2.9)	NA

Lateral Force Resisting System- Frames Not Part of the Lateral-Force-Resisting System

COMPLETE FRAMES	Steel or concrete frames classified as secondary components shall form a complete vertical-load-carrying system. (Tier 2: Sec. 4.4.1.6.1)	C

Lateral Force Resisting System- General Shear Walls

REDUNDANCY	The number of lines of shear walls in each principal direction shall be greater than or equal to 2 for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.4.2.1.1)	C

Lateral Force Resisting System- Walls in Wood-Frame Buildings

STUCCO (EXTERIOR PLASTER) SHEAR WALLS	Multi-story buildings shall not rely on exterior stucco walls as the primary lateral-force-resisting system. (Tier 2: Sec. 4.4.2.7.2)	NA

Lateral Force Resisting System-General Moment Frames

REDUNDANCY	The number of lines of moment frames in each principal direction shall be greater than or equal to 2 for Life Safety and Immediate Occupancy. The number of bays of moment frames in each line shall be greater than or equal to 2 for Life Safety and 3 for Immediate Occupancy. (Tier 2: Sec. 4.4.1.1.1)	NA

3.7.16S General Supplemental Structural Checklist

		Compliance
	Connections- Anchorage For Normal Forces	
STIFFNESS OF WALL ANCHORS	Anchors of concrete or masonry walls to wood structural elements shall be installed taut and shall be stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 inch prior to engagement of the anchors. (Tier 2: Sec. 4.6.1.4)	C
	Connections- Interconnection Of Elements	
GIRDERS	Girders supported by walls or pilasters shall have at least two ties securing the anchor bolts for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.6.4.2)	NC
CORBEL BEARING	If the frame girders bear on column corbels, the length of bearing shall be greater than 3 inches for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.6.4.3)	C
CORBEL CONNECTIONS	The frame girders shall not be connected to corbels with welded elements. (Tier 2: Sec. 4.6.4.4)	C
BEAM, GIRDER, AND TRUSS SUPPORTS	Beams, girders, and trusses supported by unreinforced masonry walls or pilasters shall have independent secondary columns for support of vertical loads. (Tier 2: Sec. 4.6.4.5)	NA
	Diaphragms	
CROSS TIES	There shall be continuous cross ties between diaphragm chords. (Tier 2: Sec. 4.5.1.2)	NC
ROOF CHORD CONTINUITY	All chord elements shall be continuous, regardless of changes in roof elevation. (Tier 2: Sec. 4.5.1.3)	C
OPENINGS AT SHEAR WALLS	Diaphragm openings immediately adjacent to the shear walls shall be less than 25 percent of the wall length for Life Safety and 15 percent of the wall length for Immediate Occupancy. (Tier 2: Sec. 4.5.1.4)	C
OPENINGS AT EXTERIOR MASONRY SHEAR WALLS	Diaphragm openings immediately adjacent to exterior masonry shear walls shall not be greater than 8 feet long for Life Safety and 4 feet long for Immediate Occupancy. (Tier 2: Sec. 4.5.1.6)	NA
PLAN IRREGULARITIES	There shall be tensile capacity to develop the strength of the diaphragm at re-entrant corners or other locations of plan irregularities. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.5.1.7)	NC
DIAPHRAGM REINFORCEMENT AT OPENINGS	There shall be reinforcing around all diaphragm openings larger than 50 percent of the building width in either major plan dimension. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.5.1.8)	C

Diaphragms- Wood Diaphragms

STRAIGHT SHEATHING	All straight sheathed diaphragms shall have aspect ratios less than 2-to-1 for Life Safety and 1-to-1 for Immediate Occupancy in the direction being considered. (Tier 2: Sec. 4.5.2.1)	C
SPANS	All wood diaphragms with spans greater than 24 feet for Life Safety and 12 feet for Immediate Occupancy shall consist of wood structural panels or diagonal sheathing. Wood commercial and industrial buildings may have rod-braced systems. (Tier 2: Sec. 4.5.2.2)	NC
UNBLOCKED DIAPHRAGMS	All diagonally sheathed or unblocked wood structural panel diaphragms shall have horizontal spans less than 40 feet for Life Safety and 30 feet for Immediate Occupancy and shall have aspect ratios less than or equal to 4-to-1 for Life Safety and 3-to-1 for Immediate ccupancy. (Tier 2: Sec. 4.5.2.3)	NC

Lateral Force Resisting System

OVERTURNING	All shear walls shall have aspect ratios less than 4-to-1. Wall piers need not be considered. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.4.2.2.4)	C
CONFINEMENT REINFORCING	For shear walls with aspect ratios greater than 2-to-1, the boundary elements shall be confined with spirals or ties with spacing less than 8db. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.4.2.2.5)	C
WALL THICKNESS	Thickness of bearing walls shall not be less than 1/25 the unsupported height or length, whichever is shorter, nor less than 4 inches. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.4.2.2.7)	NC

Lateral Force Resisting System- Reinforced Masonry Shear Walls

REINFORCING AT OPENINGS	All wall openings that interrupt rebar shall have trim reinforcing on all sides. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.4.2.4.3)	C

Lateral Force Resisting System-Concrete Shear Walls

REINFORCING AT OPENINGS	There shall be added trim reinforcement around all wall openings with a dimension greater than three times the thickness of the wall. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.4.2.2.6)	C
WALL CONNECTIONS	There shall be a positive connection between the shear walls and the steel beams and columns for Life Safety and the connection shall be able to develop the strength of the walls for Immediate Occupancy. (Tier 2: Sec. 4.4.2.2.8)	NA

3.7.13 Reinforced Masonry Bearing Walls with Flexible Diaphragms

		Compliance
	Building System	
LOAD PATH	The structure shall contain a minimum of one complete load path for Life Safety and Immediate Occupancy for seismic force effects from any horizontal direction that serves to transfer the inertial forces from the mass to the foundation. (Tier 2: Sec. 4.3.1.1)	C
ADJACENT BUILDINGS	The clear distance between the building being evaluated and any adjacent building shall be greater than 4 percent of the height of the shorter building for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.1.2)	C
MEZZANINES	Interior mezzanine levels shall be braced independently from the main structure, or shall be anchored to the lateral-force-resisting elements of the main structure. (Tier 2: Sec. 4.3.1.3)	NA
WEAK STORY	The strength of the lateral-force-resisting system in any story shall not be less than 80 percent of the strength in an adjacent story, above or below, for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.2.1)	NA
SOFT STORY	The stiffness of the lateral-force-resisting system in any story shall not be less than 70 percent of the lateral-force-resisting system stiffness in an adjacent story above or below, or less than 80 percent of the average lateral-force-resisting system stiffness of the three stories above or below for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.2.2)	NA
GEOMETRY	There shall be no changes in horizontal dimension of the lateral-force-resisting system of more than 30 percent in a story relative to adjacent stories for Life Safety and Immediate Occupancy, excluding one-story penthouses and mezzanines. (Tier 2: Sec. 4.3.2.3)	NA
VERTICAL DISCONTINUITIES	All vertical elements in the lateral-force-resisting system shall be continuous to the foundation. (Tier 2: Sec. 4.3.2.4)	C
MASS	There shall be no change in effective mass more than 50 percent from one story to the next for Life Safety and Immediate Occupancy. Light roofs, penthouses, and mezzanines need not be considered. (Tier 2: Sec. 4.3.2.5)	NA
DETERIORATION OF WOOD	There shall be no signs of decay, shrinkage, splitting, fire damage, or sagging in any of the wood members, and none of the metal connection hardware shall be deteriorated, broken, or loose. (Tier 2: Sec. 4.3.3.1)	C
MASONRY UNITS	There shall be no visible deterioration of masonry units. (Tier 2: Sec. 4.3.3.7)	C
MASONRY JOINTS	The mortar shall not be easily scraped away from the joints by hand with a metal tool, and there shall be no areas of eroded mortar. (Tier 2: Sec. 4.3.3.8)	C

REINFORCED MASONRY WALL CRACKS	All existing diagonal cracks in wall elements shall be less than 1/8 inch for Life Safety and 1/16 inch for Immediate Occupancy, shall not be concentrated in one location, and shall not form an X pattern. (Tier 2: Sec. 4.3.3.10)	NA
	Connections	
WALL ANCHORAGE	Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support shall be anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections shall have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 3.5.3.7. (Tier 2: Sec. 4.6.1.1)	C
WOOD LEDGERS	The connection between the wall panels and the diaphragm shall not induce cross-grain bending or tension in the wood ledgers. (Tier 2: Sec. 4.6.1.2)	NC
TRANSFER TO SHEAR WALLS	Diaphragms shall be connected for transfer of loads to the shear walls for Life Safety and the connections shall be able to develop the lesser of the shear strength of the walls or diaphragms for Immediate Occupancy. (Tier 2: Sec. 4.6.2.1)	C
FOUNDATION DOWELS	Wall reinforcement shall be doweled into the foundation for Life Safety, and the dowels shall be able to develop the lesser of the strength of the walls or the uplift capacity of the foundation for Immediate Occupancy. (Tier 2: Sec. 4.6.3.5)	C
GIRDER/COLUMN CONNECTION	There shall be a positive connection utilizing plates, connection hardware, or straps between the girder and the column support. (Tier 2: Sec. 4.6.4.1)	C
	Lateral Force Resisting System	
REDUNDANCY	The number of lines of shear walls in each principal direction shall be greater than or equal to 2 for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.4.2.1.1)	C
SHEAR STRESS CHECK	The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 3.5.3.3, shall be less than 70 psi for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.4.2.4.1)	C
REINFORCING STEEL	The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls shall be greater than 0.002 for Life Safety and Immediate Occupancy of the wall with the minimum of 0.0007 for Life Safety and Immediate Occupancy in either of the two directions; the spacing of reinforcing steel shall be less than 48 inches for Life Safety and Immediate Occupancy; and all vertical bars shall extend to the top of the walls. (Tier 2: Sec. 4.4.2.4.2)	C

3.7.13 Reinforced Masonry Bearing Walls with Flexible Diaphragms

	Building System	Compliance
LOAD PATH	The structure shall contain a minimum of one complete load path for Life Safety and Immediate Occupancy for seismic force effects from any horizontal direction that serves to transfer the inertial forces from the mass to the foundation. (Tier 2: Sec. 4.3.1.1)	C
ADJACENT BUILDINGS	The clear distance between the building being evaluated and any adjacent building shall be greater than 4 percent of the height of the shorter building for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.1.2)	C
MEZZANINES	Interior mezzanine levels shall be braced independently from the main structure, or shall be anchored to the lateral-force-resisting elements of the main structure. (Tier 2: Sec. 4.3.1.3)	NA
WEAK STORY	The strength of the lateral-force-resisting system in any story shall not be less than 80 percent of the strength in an adjacent story, above or below, for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.2.1)	NA
SOFT STORY	The stiffness of the lateral-force-resisting system in any story shall not be less than 70 percent of the lateral-force-resisting system stiffness in an adjacent story above or below, or less than 80 percent of the average lateral-force-resisting system stiffness of the three stories above or below for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.2.2)	NA
GEOMETRY	There shall be no changes in horizontal dimension of the lateral-force-resisting system of more than 30 percent in a story relative to adjacent stories for Life Safety and Immediate Occupancy, excluding one-story penthouses and mezzanines. (Tier 2: Sec. 4.3.2.3)	C
VERTICAL DISCONTINUITIES	All vertical elements in the lateral-force-resisting system shall be continuous to the foundation. (Tier 2: Sec. 4.3.2.4)	NA
MASS	There shall be no change in effective mass more than 50 percent from one story to the next for Life Safety and Immediate Occupancy. Light roofs, penthouses, and mezzanines need not be considered. (Tier 2: Sec. 4.3.2.5)	NA
DETERIORATION OF WOOD	There shall be no signs of decay, shrinkage, splitting, fire damage, or sagging in any of the wood members, and none of the metal connection hardware shall be deteriorated, broken, or loose. (Tier 2: Sec. 4.3.3.1)	C
MASONRY UNITS	There shall be no visible deterioration of masonry units. (Tier 2: Sec. 4.3.3.7)	C
MASONRY JOINTS	The mortar shall not be easily scraped away from the joints by hand with a metal tool, and there shall be no areas of eroded mortar. (Tier 2: Sec. 4.3.3.8)	C

REINFORCED MASONRY WALL CRACKS	All existing diagonal cracks in wall elements shall be less than 1/8 inch for Life Safety and 1/16 inch for Immediate Occupancy, shall not be concentrated in one location, and shall not form an X pattern. (Tier 2: Sec. 4.3.3.10)	NA
	Connections	
WALL ANCHORAGE	Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support shall be anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections shall have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 3.5.3.7. (Tier 2: Sec. 4.6.1.1)	C
WOOD LEDGERS	The connection between the wall panels and the diaphragm shall not induce cross-grain bending or tension in the wood ledgers. (Tier 2: Sec. 4.6.1.2)	NC
TRANSFER TO SHEAR WALLS	Diaphragms shall be connected for transfer of loads to the shear walls for Life Safety and the connections shall be able to develop the lesser of the shear strength of the walls or diaphragms for Immediate Occupancy. (Tier 2: Sec. 4.6.2.1)	C
FOUNDATION DOWELS	Wall reinforcement shall be doweled into the foundation for Life Safety, and the dowels shall be able to develop the lesser of the strength of the walls or the uplift capacity of the foundation for Immediate Occupancy. (Tier 2: Sec. 4.6.3.5)	C
GIRDER/COLUMN CONNECTION	There shall be a positive connection utilizing plates, connection hardware, or straps between the girder and the column support. (Tier 2: Sec. 4.6.4.1)	NA
	Lateral Force Resisting System	
REDUNDANCY	The number of lines of shear walls in each principal direction shall be greater than or equal to 2 for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.4.2.1.1)	C
SHEAR STRESS CHECK	The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 3.5.3.3, shall be less than 70 psi for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.4.2.4.1)	C
REINFORCING STEEL	The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls shall be greater than 0.002 for Life Safety and Immediate Occupancy of the wall with the minimum of 0.0007 for Life Safety and Immediate Occupancy in either of the two directions; the spacing of reinforcing steel shall be less than 48 inches for Life Safety and Immediate Occupancy; and all vertical bars shall extend to the top of the walls. (Tier 2: Sec. 4.4.2.4.2)	C

3.7.13 Reinforced Masonry Bearing Walls with Flexible Diaphragms

		Compliance
	Building System	
LOAD PATH	The structure shall contain a minimum of one complete load path for Life Safety and Immediate Occupancy for seismic force effects from any horizontal direction that serves to transfer the inertial forces from the mass to the foundation. (Tier 2: Sec. 4.3.1.1)	C
ADJACENT BUILDINGS	The clear distance between the building being evaluated and any adjacent building shall be greater than 4 percent of the height of the shorter building for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.1.2)	C
MEZZANINES	Interior mezzanine levels shall be braced independently from the main structure, or shall be anchored to the lateral-force-resisting elements of the main structure. (Tier 2: Sec. 4.3.1.3)	NA
WEAK STORY	The strength of the lateral-force-resisting system in any story shall not be less than 80 percent of the strength in an adjacent story, above or below, for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.2.1)	NA
SOFT STORY	The stiffness of the lateral-force-resisting system in any story shall not be less than 70 percent of the lateral-force-resisting system stiffness in an adjacent story above or below, or less than 80 percent of the average lateral-force-resisting system stiffness of the three stories above or below for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.2.2)	NA
GEOMETRY	There shall be no changes in horizontal dimension of the lateral-force-resisting system of more than 30 percent in a story relative to adjacent stories for Life Safety and Immediate Occupancy, excluding one-story penthouses and mezzanines. (Tier 2: Sec. 4.3.2.3)	C
VERTICAL DISCONTINUITIES	All vertical elements in the lateral-force-resisting system shall be continuous to the foundation. (Tier 2: Sec. 4.3.2.4)	C
MASS	There shall be no change in effective mass more than 50 percent from one story to the next for Life Safety and Immediate Occupancy. Light roofs, penthouses, and mezzanines need not be considered. (Tier 2: Sec. 4.3.2.5)	NA
DETERIORATION OF WOOD	There shall be no signs of decay, shrinkage, splitting, fire damage, or sagging in any of the wood members, and none of the metal connection hardware shall be deteriorated, broken, or loose. (Tier 2: Sec. 4.3.3.1)	C
MASONRY UNITS	There shall be no visible deterioration of masonry units. (Tier 2: Sec. 4.3.3.7)	C
MASONRY JOINTS	The mortar shall not be easily scraped away from the joints by hand with a metal tool, and there shall be no areas of eroded mortar. (Tier 2: Sec. 4.3.3.8)	C

REINFORCED MASONRY WALL CRACKS	All existing diagonal cracks in wall elements shall be less than 1/8 inch for Life Safety and 1/16 inch for Immediate Occupancy, shall not be concentrated in one location, and shall not form an X pattern. (Tier 2: Sec. 4.3.3.10)	C
	Connections	
WALL ANCHORAGE	Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support shall be anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections shall have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 3.5.3.7. (Tier 2: Sec. 4.6.1.1)	C
WOOD LEDGERS	The connection between the wall panels and the diaphragm shall not induce cross-grain bending or tension in the wood ledgers. (Tier 2: Sec. 4.6.1.2)	C
TRANSFER TO SHEAR WALLS	Diaphragms shall be connected for transfer of loads to the shear walls for Life Safety and the connections shall be able to develop the lesser of the shear strength of the walls or diaphragms for Immediate Occupancy. (Tier 2: Sec. 4.6.2.1)	C
FOUNDATION DOWELS	Wall reinforcement shall be doweled into the foundation for Life Safety, and the dowels shall be able to develop the lesser of the strength of the walls or the uplift capacity of the foundation for Immediate Occupancy. (Tier 2: Sec. 4.6.3.5)	C
GIRDER/COLUMN CONNECTION	There shall be a positive connection utilizing plates, connection hardware, or straps between the girder and the column support. (Tier 2: Sec. 4.6.4.1)	C
	Lateral Force Resisting System	
REDUNDANCY	The number of lines of shear walls in each principal direction shall be greater than or equal to 2 for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.4.2.1.1)	C
SHEAR STRESS CHECK	The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 3.5.3.3, shall be less than 70 psi for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.4.2.4.1)	C
REINFORCING STEEL	The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls shall be greater than 0.002 for Life Safety and Immediate Occupancy of the wall with the minimum of 0.0007 for Life Safety and Immediate Occupancy in either of the two directions; the spacing of reinforcing steel shall be less than 48 inches for Life Safety and Immediate Occupancy; and all vertical bars shall extend to the top of the walls. (Tier 2: Sec. 4.4.2.4.2)	C

3.7.13 Reinforced Masonry Bearing Walls with Flexible Diaphragms

	Building System	Compliance
LOAD PATH	The structure shall contain a minimum of one complete load path for Life Safety and Immediate Occupancy for seismic force effects from any horizontal direction that serves to transfer the inertial forces from the mass to the foundation. (Tier 2: Sec. 4.3.1.1)	C
ADJACENT BUILDINGS	The clear distance between the building being evaluated and any adjacent building shall be greater than 4 percent of the height of the shorter building for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.1.2)	NA
MEZZANINES	Interior mezzanine levels shall be braced independently from the main structure, or shall be anchored to the lateral-force-resisting elements of the main structure. (Tier 2: Sec. 4.3.1.3)	NA
WEAK STORY	The strength of the lateral-force-resisting system in any story shall not be less than 80 percent of the strength in an adjacent story, above or below, for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.2.1)	NA
SOFT STORY	The stiffness of the lateral-force-resisting system in any story shall not be less than 70 percent of the lateral-force-resisting system stiffness in an adjacent story above or below, or less than 80 percent of the average lateral-force-resisting system stiffness of the three stories above or below for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.3.2.2)	NA
GEOMETRY	There shall be no changes in horizontal dimension of the lateral-force-resisting system of more than 30 percent in a story relative to adjacent stories for Life Safety and Immediate Occupancy, excluding one-story penthouses and mezzanines. (Tier 2: Sec. 4.3.2.3)	C
VERTICAL DISCONTINUITIES	All vertical elements in the lateral-force-resisting system shall be continuous to the foundation. (Tier 2: Sec. 4.3.2.4)	C
MASS	There shall be no change in effective mass more than 50 percent from one story to the next for Life Safety and Immediate Occupancy. Light roofs, penthouses, and mezzanines need not be considered. (Tier 2: Sec. 4.3.2.5)	NA
DETERIORATION OF WOOD	There shall be no signs of decay, shrinkage, splitting, fire damage, or sagging in any of the wood members, and none of the metal connection hardware shall be deteriorated, broken, or loose. (Tier 2: Sec. 4.3.3.1)	C
MASONRY UNITS	There shall be no visible deterioration of masonry units. (Tier 2: Sec. 4.3.3.7)	C
MASONRY JOINTS	The mortar shall not be easily scraped away from the joints by hand with a metal tool, and there shall be no areas of eroded mortar. (Tier 2: Sec. 4.3.3.8)	C

REINFORCED MASONRY WALL CRACKS	All existing diagonal cracks in wall elements shall be less than 1/8 inch for Life Safety and 1/16 inch for Immediate Occupancy, shall not be concentrated in one location, and shall not form an X pattern. (Tier 2: Sec. 4.3.3.10)	NA
	Connections	
WALL ANCHORAGE	Exterior concrete or masonry walls that are dependent on the diaphragm for lateral support shall be anchored for out-of-plane forces at each diaphragm level with steel anchors, reinforcing dowels, or straps that are developed into the diaphragm. Connections shall have adequate strength to resist the connection force calculated in the Quick Check procedure of Section 3.5.3.7. (Tier 2: Sec. 4.6.1.1)	C
WOOD LEDGERS	The connection between the wall panels and the diaphragm shall not induce cross-grain bending or tension in the wood ledgers. (Tier 2: Sec. 4.6.1.2)	NA
TRANSFER TO SHEAR WALLS	Diaphragms shall be connected for transfer of loads to the shear walls for Life Safety and the connections shall be able to develop the lesser of the shear strength of the walls or diaphragms for Immediate Occupancy. (Tier 2: Sec. 4.6.2.1)	C
FOUNDATION DOWELS	Wall reinforcement shall be doweled into the foundation for Life Safety, and the dowels shall be able to develop the lesser of the strength of the walls or the uplift capacity of the foundation for Immediate Occupancy. (Tier 2: Sec. 4.6.3.5)	C
GIRDER/COLUMN CONNECTION	There shall be a positive connection utilizing plates, connection hardware, or straps between the girder and the column support. (Tier 2: Sec. 4.6.4.1)	C
	Lateral Force Resisting System	
REDUNDANCY	The number of lines of shear walls in each principal direction shall be greater than or equal to 2 for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.4.2.1.1)	C
SHEAR STRESS CHECK	The shear stress in the reinforced masonry shear walls, calculated using the Quick Check procedure of Section 3.5.3.3, shall be less than 70 psi for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.4.2.4.1)	NC
REINFORCING STEEL	The total vertical and horizontal reinforcing steel ratio in reinforced masonry walls shall be greater than 0.002 for Life Safety and Immediate Occupancy of the wall with the minimum of 0.0007 for Life Safety and Immediate Occupancy in either of the two directions; the spacing of reinforcing steel shall be less than 48 inches for Life Safety and Immediate Occupancy; and all vertical bars shall extend to the top of the walls. (Tier 2: Sec. 4.4.2.4.2)	C

3.7.13S Reinforced Masonry Bearing Walls with Flexible Diaphragms

		Compliance
	Connections	
STIFFNESS OF WALL ANCHORS	Anchors of concrete or masonry walls to wood structural elements shall be installed taut and shall be stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 inch prior to engagement of the anchors. (Tier 2: Sec. 4.6.1.4)	C
	Diaphragms	
CROSS TIES	There shall be continuous cross ties between diaphragm chords. (Tier 2: Sec. 4.5.1.2)	C
OPENINGS AT SHEAR WALLS	Diaphragm openings immediately adjacent to the shear walls shall be less than 25 percent of the wall length for Life Safety and 15 percent of the wall length for Immediate Occupancy. (Tier 2: Sec. 4.5.1.4)	NA
OPENINGS AT EXTERIOR MASONRY SHEAR WALLS	Diaphragm openings immediately adjacent to exterior masonry shear walls shall not be greater than 8 feet long for Life Safety and 4 feet long for Immediate Occupancy. (Tier 2: Sec. 4.5.1.6)	NA
PLAN IRREGULARITIES	There shall be tensile capacity to develop the strength of the diaphragm at re-entrant corners or other locations of plan irregularities. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.5.1.7)	NA
DIAPHRAGM REINFORCEMENT AT OPENINGS	There shall be reinforcing around all diaphragm openings larger than 50 percent of the building width in either major plan dimension. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.5.1.8)	NA
STRAIGHT SHEATHING	All straight sheathed diaphragms shall have aspect ratios less than 2- to-1 for Life Safety and 1-to-1 for Immediate Occupancy in the direction being considered. (Tier 2: Sec. 4.5.2.1)	C
SPANS	All wood diaphragms with spans greater than 24 feet for Life Safety and 12 feet for Immediate Occupancy shall consist of wood structural panels or diagonal sheathing. (Tier 2: Sec. 4.5.2.2)	NA
UNBLOCKED DIAPHRAGMS	All diagonally sheathed or unblocked wood structural panel diaphragms shall have horizontal spans less than 40 feet for Life Safety and 30 feet for Immediate Occupancy and shall have aspect ratios less than or equal to 4-to-1 for Life Safety and 3-to-1 for Immediate Occupancy. (Tier 2: Sec. 4.5.2.3)	NA
NON-CONCRETE FILLED DIAPHRAGMS	Untopped metal deck diaphragms or metal deck diaphragms with fill other than concrete shall consist of horizontal spans of less than 40 feet and shall have span/depth ratios less than 4-to-1. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.5.3.1)	NA
OTHER DIAPHRAGMS	The diaphragm shall not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Tier 2: Sec. 4.5.7.1)	C

Lateral Force Resisting System

REINFORCING AT OPENINGS	All wall openings that interrupt rebar shall have trim reinforcing on all sides. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.4.2.4.3)	NA
PROPORTIONS	The height-to-thickness ratio of the shear walls at each story shall be less than 30. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.4.2.4.4)	C

3.7.13S Reinforced Masonry Bearing Walls with Flexible Diaphragms

		Compliance
	Connections	
STIFFNESS OF WALL ANCHORS	Anchors of concrete or masonry walls to wood structural elements shall be installed taut and shall be stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 inch prior to engagement of the anchors. (Tier 2: Sec. 4.6.1.4)	C
	Diaphragms	
CROSS TIES	There shall be continuous cross ties between diaphragm chords. (Tier 2: Sec. 4.5.1.2)	C
OPENINGS AT SHEAR WALLS	Diaphragm openings immediately adjacent to the shear walls shall be less than 25 percent of the wall length for Life Safety and 15 percent of the wall length for Immediate Occupancy. (Tier 2: Sec. 4.5.1.4)	C
OPENINGS AT EXTERIOR MASONRY SHEAR WALLS	Diaphragm openings immediately adjacent to exterior masonry shear walls shall not be greater than 8 feet long for Life Safety and 4 feet long for Immediate Occupancy. (Tier 2: Sec. 4.5.1.6)	C
PLAN IRREGULARITIES	There shall be tensile capacity to develop the strength of the diaphragm at re-entrant corners or other locations of plan irregularities. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.5.1.7)	NA
DIAPHRAGM REINFORCEMENT AT OPENINGS	There shall be reinforcing around all diaphragm openings larger than 50 percent of the building width in either major plan dimension. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.5.1.8)	C
STRAIGHT SHEATHING	All straight sheathed diaphragms shall have aspect ratios less than 2- to-1 for Life Safety and 1-to-1 for Immediate Occupancy in the direction being considered. (Tier 2: Sec. 4.5.2.1)	NA
SPANS	All wood diaphragms with spans greater than 24 feet for Life Safety and 12 feet for Immediate Occupancy shall consist of wood structural panels or diagonal sheathing. (Tier 2: Sec. 4.5.2.2)	C
UNBLOCKED DIAPHRAGMS	All diagonally sheathed or unblocked wood structural panel diaphragms shall have horizontal spans less than 40 feet for Life Safety and 30 feet for Immediate Occupancy and shall have aspect ratios less than or equal to 4-to-1 for Life Safety and 3-to-1 for Immediate Occupancy. (Tier 2: Sec. 4.5.2.3)	NA
NON-CONCRETE FILLED DIAPHRAGMS	Untopped metal deck diaphragms or metal deck diaphragms with fill other than concrete shall consist of horizontal spans of less than 40 feet and shall have span/depth ratios less than 4-to-1. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.5.3.1)	NA
OTHER DIAPHRAGMS	The diaphragm shall not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Tier 2: Sec. 4.5.7.1)	C

Lateral Force Resisting System

REINFORCING AT OPENINGS	All wall openings that interrupt rebar shall have trim reinforcing on all sides. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.4.2.4.3)	C
PROPORTIONS	The height-to-thickness ratio of the shear walls at each story shall be less than 30. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.4.2.4.4)	C

3.7.13S Reinforced Masonry Bearing Walls with Flexible Diaphragms

		Compliance
	Connections	
STIFFNESS OF WALL ANCHORS	Anchors of concrete or masonry walls to wood structural elements shall be installed taut and shall be stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 inch prior to engagement of the anchors. (Tier 2: Sec. 4.6.1.4)	C
	Diaphragms	
CROSS TIES	There shall be continuous cross ties between diaphragm chords. (Tier 2: Sec. 4.5.1.2)	C
OPENINGS AT SHEAR WALLS	Diaphragm openings immediately adjacent to the shear walls shall be less than 25 percent of the wall length for Life Safety and 15 percent of the wall length for Immediate Occupancy. (Tier 2: Sec. 4.5.1.4)	C
OPENINGS AT EXTERIOR MASONRY SHEAR WALLS	Diaphragm openings immediately adjacent to exterior masonry shear walls shall not be greater than 8 feet long for Life Safety and 4 feet long for Immediate Occupancy. (Tier 2: Sec. 4.5.1.6)	C
PLAN IRREGULARITIES	There shall be tensile capacity to develop the strength of the diaphragm at re-entrant corners or other locations of plan irregularities. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.5.1.7)	NA
DIAPHRAGM REINFORCEMENT AT OPENINGS	There shall be reinforcing around all diaphragm openings larger than 50 percent of the building width in either major plan dimension. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.5.1.8)	NA
STRAIGHT SHEATHING	All straight sheathed diaphragms shall have aspect ratios less than 2- to-1 for Life Safety and 1-to-1 for Immediate Occupancy in the direction being considered. (Tier 2: Sec. 4.5.2.1)	NA
SPANS	All wood diaphragms with spans greater than 24 feet for Life Safety and 12 feet for Immediate Occupancy shall consist of wood structural panels or diagonal sheathing. (Tier 2: Sec. 4.5.2.2)	C
UNBLOCKED DIAPHRAGMS	All diagonally sheathed or unblocked wood structural panel diaphragms shall have horizontal spans less than 40 feet for Life Safety and 30 feet for Immediate Occupancy and shall have aspect ratios less than or equal to 4-to-1 for Life Safety and 3-to-1 for Immediate Occupancy. (Tier 2: Sec. 4.5.2.3)	C
NON-CONCRETE FILLED DIAPHRAGMS	Untopped metal deck diaphragms or metal deck diaphragms with fill other than concrete shall consist of horizontal spans of less than 40 feet and shall have span/depth ratios less than 4-to-1. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.5.3.1)	NA
OTHER DIAPHRAGMS	The diaphragm shall not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Tier 2: Sec. 4.5.7.1)	C

Lateral Force Resisting System

REINFORCING AT OPENINGS	All wall openings that interrupt rebar shall have trim reinforcing on all sides. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.4.2.4.3)	C
PROPORTIONS	The height-to-thickness ratio of the shear walls at each story shall be less than 30. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.4.2.4.4)	C

3.7.13S Reinforced Masonry Bearing Walls with Flexible Diaphragms

		Compliance
	Connections	
STIFFNESS OF WALL ANCHORS	Anchors of concrete or masonry walls to wood structural elements shall be installed taut and shall be stiff enough to limit the relative movement between the wall and the diaphragm to no greater than 1/8 inch prior to engagement of the anchors. (Tier 2: Sec. 4.6.1.4)	C
	Diaphragms	
CROSS TIES	There shall be continuous cross ties between diaphragm chords. (Tier 2: Sec. 4.5.1.2)	NA
OPENINGS AT SHEAR WALLS	Diaphragm openings immediately adjacent to the shear walls shall be less than 25 percent of the wall length for Life Safety and 15 percent of the wall length for Immediate Occupancy. (Tier 2: Sec. 4.5.1.4)	NC
OPENINGS AT EXTERIOR MASONRY SHEAR WALLS	Diaphragm openings immediately adjacent to exterior masonry shear walls shall not be greater than 8 feet long for Life Safety and 4 feet long for Immediate Occupancy. (Tier 2: Sec. 4.5.1.6)	NA
PLAN IRREGULARITIES	There shall be tensile capacity to develop the strength of the diaphragm at re-entrant corners or other locations of plan irregularities. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.5.1.7)	NA
DIAPHRAGM REINFORCEMENT AT OPENINGS	There shall be reinforcing around all diaphragm openings larger than 50 percent of the building width in either major plan dimension. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.5.1.8)	NA
STRAIGHT SHEATHING	All straight sheathed diaphragms shall have aspect ratios less than 2- to-1 for Life Safety and 1-to-1 for Immediate Occupancy in the direction being considered. (Tier 2: Sec. 4.5.2.1)	NA
SPANS	All wood diaphragms with spans greater than 24 feet for Life Safety and 12 feet for Immediate Occupancy shall consist of wood structural panels or diagonal sheathing. (Tier 2: Sec. 4.5.2.2)	NA
UNBLOCKED DIAPHRAGMS	All diagonally sheathed or unblocked wood structural panel diaphragms shall have horizontal spans less than 40 feet for Life Safety and 30 feet for Immediate Occupancy and shall have aspect ratios less than or equal to 4-to-1 for Life Safety and 3-to-1 for Immediate Occupancy. (Tier 2: Sec. 4.5.2.3)	NA
NON-CONCRETE FILLED DIAPHRAGMS	Untopped metal deck diaphragms or metal deck diaphragms with fill other than concrete shall consist of horizontal spans of less than 40 feet and shall have span/depth ratios less than 4-to-1. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.5.3.1)	NA
OTHER DIAPHRAGMS	The diaphragm shall not consist of a system other than wood, metal deck, concrete, or horizontal bracing. (Tier 2: Sec. 4.5.7.1)	C

Lateral Force Resisting System

REINFORCING AT OPENINGS	All wall openings that interrupt rebar shall have trim reinforcing on all sides. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.4.2.4.3)	C
PROPORTIONS	The height-to-thickness ratio of the shear walls at each story shall be less than 30. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.4.2.4.4)	C

3.8 Geologic Site Hazards and Foundations Checklist

		Compliance
	Capacity of Foundations	
POLE FOUNDATIONS	Pole foundations shall have a minimum embedment depth of 4 feet for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.7.3.1)	NA
OVERTURNING	The ratio of the horizontal dimension of the lateral-force-resisting system at the foundation level to the building height (base/height) shall be greater than 0.6Sa• (Tier 2: Sec. 4.7.3.2)	C
TIES BETWEEN FOUNDATION ELEMENTS	The foundation shall have ties adequate to resist seismic forces where footings, piles, and piers are not restrained by beams, slabs, or soils classified as Class A, B, or C. (Section 3.5.2.3.1, Tier 2: Sec. 4.7.3.3)	C
DEEP FOUNDATIONS	Piles and piers shall be capable of transferring the lateral forces between the structure and the soil. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.7.3.4)	NA
SLOPING SITES	The difference in foundation embedment depth from one side of the building to another shall not exceed one story in height. This statement shall apply to the Immediate Occupancy Performance Level only. (Tier 2: Sec. 4.7.3.5)	C
	Condition of Foundations	
FOUNDATION PERFORMANCE	There shall be no evidence of excessive foundation movement such as settlement or heave that would affect the integrity or strength of the structure. (Tier 2: Sec. 4.7.2.1)	NC
DETERIORATION	There shall not be evidence that foundation elements have deteriorated due to corrosion, sulfate attack, material breakdown, or other reasons in a manner that would affect the integrity or strength of the structure. (Tier 2: Sec. 4.7.2.2)	C
	Geologic Site Hazards	
LIQUEFACTION	Liquefaction-susceptible, saturated, loose granular sils that could jeopardize the building's seismic performance shall not exist in the foundation soils at depths within 50 feet under the building for Life Safety and Immediate Occupancy. (Tier 2: Sec. 4.7.1.1)	C
SLOPE FAILURE	The building site shall be sufficiently remote from potential earthquake-induced slope failures or rockfalls to be unaffected by such failures or shall be capable of accommodating any predicted movements without failure. (Tier 2: Sec. 4.7.1.2)	C
SURFACE FAULT RUPTURE	Surface fault rupture and surface displacement at the building site is not anticipated. (Tier 2: Sec. 4.7.1.3)	C

3.9.1 Basic Nonstructural Component Checklist

		Compliance
	Building Contents and Furnishing	
TALL NARROW CONTENTS	Contents over 4 feet in height with a height-to-depth or height-to-width ratio greater than 3-to-1 shall be anchored to the floor slab or adjacent structural walls. A height-to-depth or height-to-width ratio of up to 4-to-1 is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.11.1)	NC
	Location: Old Chlorine Room, Storage Room	
	Ceiling Systems	
SUPPORT	The integrated suspended ceiling system shall not be used to laterally support the tops of gypsum board, masonry, or hollow clay tile partitions. Gypsum board partitions need not be evaluated where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.2.1)	C
	Cladding and Glazing	
CLADDING ANCHORS	Cladding components weighing more than 10 psf shall be mechanically anchored to the exterior wall framing at a spacing equal to or less than 4 feet. A spacing of up to 6 feet is permitted where only the Basic Nonstructural Component checklist is required by Table 3-2 (Tier 2: Sec. 4.8.4.1)	NA
DETERIORATION	There shall be no evidence of deterioration, damage or corrosion in any of the connection elements. (Tier 2: Sec. 4.8.4.2)	NA
CLADDING ISOLATION	For moment frame buildings of steel or concrete, panel connections shall be detailed to accommodate a story drift ratio of 0.02. Panel connection detailing for a story drift ratio of 0.01 is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.4.3)	NA
MULTI-STORY PANELS	For multi-story panels attached at each floor level, panel connections shall be detailed to accommodate a story drift ratio of 0.02. Panel connection detailing for a story drift ratio of 0.01 is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.4.4)	NA
BEARING CONNECTIONS	Where bearing connections are required, there shall be a minimum of two bearing connections for each wall panel. (Tier 2: Sec. 4.8.4.5)	NA
INSERTS	Where inserts are used in concrete connections, the inserts shall be anchored to reinforcing steel or other positive anchorage. (Tier 2: Sec. 4.8.4.6)	NA
PANEL CONNECTIONS	Exterior cladding panels shall be anchored out-of-plane with a minimum of 4 connections for each wall panel. Two connections per wall panel are permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.4.7)	NA

Hazardous Materials Storage and Distribution

TOXIC SUBSTANCES	Toxic and hazardous substances stored in breakable containers shall be restrained from falling by latched doors, shelf lips, wires, or other methods. (Tier 2: Sec 4.8.15.1)	NA

Light Fixtures

EMERGENCY LIGHTING	Emergency lighting shall be anchored or braced to prevent falling during an earthquake. (Tier 2: Sec. 4.8.3.1)	NC

Masonry Chimneys

URM CHIMNEYS	No reinforced masonry chimney shall extend above the roof surface more than twice the least dimension of the chimney. A height above the roof surface of up to three times the least dimension of the chimney is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.9.1)	NA

Masonry Veneer

SHELF ANGLES	Masonry veneer shall be supported by shelf angles or other elements at each floor 30 feet or more above ground for Life Safety and at each floor above the first floor for Immediate Occupancy. (Tier 2: Sec. 4.8.5.1)	C
WEAKENED PLANES	Masonry veneer shall be anchored to the back-up adjacent to weakened planes, such as at the locations of flashing. (Tier 2: Sec. 4.8.5.3)	NC
DETERIORATION	There shall be no evidence of deterioration, damage or corrosion in any of the connection elements. (Tier 2: Sec. 4.8.5.4)	C

Mechanical and Electrical Equipment

EMERGENCY POWER	Equipment used as part of an emergency power system shall be mounted to maintain continued operation after an earthquake. (Tier 2: Sec. 4.8.12.1) *Backup power influent pump MCC and other room*	NC
HAZARDOUS MATERIAL EQUIPMENT	HVAC or other equipment containing hazardous material shall not have damaged supply lines or unbraced isolation supports. (Tier 2: Sec. 4.8.12.2)	NC
DETERIORATION	There shall be no evidence of deterioration, damage, or corrosion in any of the anchorage or supports of mechanical or electrical equipment. (Tier 2: Sec. 4.8.12.3) *Pipe under the boiler*	NC
ATTACHED EQUIPMENT	Equipment weighing over 20 lb that is attached to ceilings, walls, or other supports 4 feet above the floor level shall be braced. (Tier 2: Sec 4.8.12.4)	NC

Parapets, Cornices, Ornamentation, and Appendages

URM PARAPETS	There shall be no laterally unsupported unreinforced masonry parapets or cornices with height-to-thickness ratios greater than 1.5. A height-to-thickness ratio of up to 2.5 is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.8.1)	NA

CANOPIES	Canopies located at building exits shall be anchored to the structural framing at a spacing of 6 feet or less. An anchorage spacing of up to 10 feet is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.8.2)	NA
	Partitions	
UNREINFORCED MASONRY	Unreinforced masonry or hollow clay tile partitions shall be braded at a spacing equal to or less than 10 feet in levels of low or moderate seismicity and 6 feet in levels of high seismicity. (Tier 2: Sec. 4.8.1.1)	NA
	Piping	
FIRE SUPPRESSION PIPING	Fire suppression piping shall be anchored and braced in accordance with NFPA-13 (NFPA, 1996). (Tier 2: Sec. 4.8.13.1)	NA
FLEXIBLE COUPLINGS	Fluid, gas, and fire suppression piping shall have flexible couplings. (Tier 2: Sec. 4.8.13.2)	NA
	Stairs	
URM WALLS	Walls around stair enclosures shall not consist of unbraced hollow clay tile or unreinforced masonry with a height-to-thickness ratio greater than 12-to-1. A height-to-thickness ratio of up to 15-to-1 is permitted where only the Basic Nonstructural Component Checklist is required by Table 3-2. (Tier 2: Sec. 4.8.10.1)	NA
STAIR DETAILS	In moment frame structures, the connection between the stairs and the structure shall not rely on shallow anchors in concrete. Alternatively, the stair details shall be capable of accommodating the drift calculated using the Quick Check procedure of Section 3.5.3.1 without including tension in the anchors. (Tier 2: Sec. 4.8.10.2)	C

3.9.1S Supplemental Nonstructural Component Checklist

		Compliance
	Building Contents and Furnishing	
FILE CABINETS	File cabinets arranged in groups shall be attached to one another. (Tier 2: Sec. 4.8.11.2)	C
CABINET DOORS AND DRAWERS	Cabinet doors and drawers shall have latches to keep them closed during an earthquake. (Tier 2: Sec. 4.8.11.3)	NC
ACCESS FLOORS	Access floors over 9 inches in height shall be braced. (Tier 2: Sec. 4.8.11.4)	NA
EQUIPMENT ON ACCESS FLOORS	Equipment and computers supported on access floor systems shall be either attached to the structure or fastened to a laterally braced floor system. (Tier 2: Sec. 4.8.11.5)	NC *In penthouse*
	Ceiling Systems	
EDGES	The edges of integrated suspended ceilings shall be separated from enclosing walls by a minimum of 1/2 inch. (Tier 2: Sec. 4.8.2.5)	C
SEISMIC JOINT	The ceiling system shall not extend continuously across any seismic joint. (Tier 2: Sec. 4.8.2.6)	NA
	Cladding and Glazing	
GLAZING	All exterior glazing shall be laminated, annealed or laminated heat-strengthened safety glass or other glazing system that will remain in the frame when glass is cracked. (Tier 2: Sec. 4.8.4.9)	NA
	Concrete Block and Masonry Back-Up Systems	
URM BACK-UP	There shall be no unreinforced masonry back-up. (Tier 2: Sec. 4.8.7.2)	NA
	Ducts	
DUCT BRACING	Rectangular ductwork exceeding 6 square feet in cross-sectional area, and round ducts exceeding 28 inches in diameter, shall be braced. Maximum spacing of transverse bracing shall not exceed 30 feet. Maximum spacing of longitudinal bracing shall not exceed 60 feet. Intermediate supports shall not be considered part of the lateral-force resisting system. (Tier 2: Sec. 4.8.14.2)	NC
DUCT SUPPORT	Ducts shall not be supported by piping or electrical conduit. (Tier 2: Sec. 4.8.14.3)	C
	Elevators	
SUPPORT SYSTEM	All elements of the elevator system shall be anchored. (Tier 2: Sec. 4.8.16.1)	NA

SEISMIC SWITCH	All elevators shall be equipped with seismic switches that will terminate operations when the ground motion exceeds 0.10g. (Tier 2: Sec. 4.8.16.2)	NA
SHAFT WALLS	All elevator shaft walls shall be anchored and reinforced to prevent toppling into the shaft during strong shaking. (Tier 2: Sec. 4.8.16.3)	NA
RETAINER GUARDS	Cable retainer guards on sheaves and drums shall be present to inhibit the displacement of cables. (Tier 2: Sec. 4.8.16.4)	NA
COUNTERWEIGHT RAILS	All counterweight rails and divider beams shall be sized in accordance with ASME A17.1. (Tier 2: Sec. 4.8.16.6)	NA
BRACKETS	The brackets that tie the car rails and the counterweight rail to the building structure shall be sized in accordance with ASME A17.1. (Tier 2: Sec. 4.8.16.7)	NA
SPREADER BRACKET	Spreader brackets shall not be used to resist seismic forces. (Tier 2: Sec. 4.8.16.8)	NA
GO-SLOW ELEVATORS	The building shall have a go-slow elevator system. (Tier 2: Sec. 4.8.16.9)	NA
	Hazardous Materials Storage and Distribution	
GAS CYLINDERS	Compressed gas-cylinders shall be restrained. (Tier 2: Sec. 4.8.15.2)	NA
	Light Fixtures	
PENDANT SUPPORTS	Light fixtures on pendant supports shall be attached at a spacing equal to or less than 6 feet and, if rigidly supported, shall be free to move with the structure to which they are attached without damaging adjoining materials. (Tier 2: Sec. 4.8.3.3)	NC
LENS COVERS	Lens covers on light fixtures shall be attached or supplied with safety devices. (Tier 2: Sec. 4.8.3.4)	C
	Masonry Veneer	
MORTAR	The mortar in masonry veneer shall not be easily scraped away from the joints by hand with a metal tool, and there shall not be significant areas of eroded mortar. (Tier 2: Sec. 4.8.5.5)	C
WEEP HOLES	In veneer braced by stud walls, functioning weep holes and base flashing shall be present. (Tier 2: Sec. 4.8.5.6)	C
STONE CRACKS	There shall be no visible cracks or signs of visible distortion in the stone. (Tier 2: Sec. 4.8.5.7)	NA
	Mechanical and Electrical Equipment	
HEAVY EQUIPMENT	Equipment weighing over 100 pounds shall be anchored to the structure or foundation. (Tier 2: Sec. 4.8.12.6)	NC *Boilers*
ELECTRICAL EQUIPMENT	Electrical equipment and associated wiring shall be laterally braced to the structural system. (Tier 2: Sec. 4.8.12.7)	NC *Electrical cabinets in MCC room*

DOORS	Mechanically operated doors shall be detailed to operate at a story drift ratio of 0.01. (Tier 2: Sec. 4.8.12.8)	NA
	Metal Stud Back-Up Systems	
STUD TRACKS	Stud tracks shall be fastened to structural framing at a spacing equal to or less than 24 inches on center. (Tier 2: Sec. 4.8.6.1)	NA
OPENINGS	Steel studs shall frame window and door openings. (Tier 2: Sec. 4.8.6.2)	NA
	Partitions	
DRIFT	Rigid cementitious partitions shall be detailed to accommodate a drift ratio of 0.02 in steel moment frame, concrete moment frame, and wood frame buildings. Rigid cementitious partitions shall be detailed to accommodate a drift ratio of 0.005 in other buildings. (Tier 2: Sec. 4.8.1.2)	NC
STRUCTURAL SEPARATIONS	Partitions at structural separations shall have seismic or control joints. (Tier 2: Sec. 4.8.1.3)	NC
	Piping	
FLUID AND GAS PIPING	Fluid and gas piping shall be anchored and braced to the structure to prevent breakage in piping. (Tier 2: Sec 4.8.13.3)	NC *NG pipe*
C-CLAMPS	One-sided C-clamps that support piping greater than 2.5 inches in diameter shall be restrained. (Tier 2: Sec. 4.8.13.5)	C

3.9.2 Intermediate Nonstructural Component Checklist

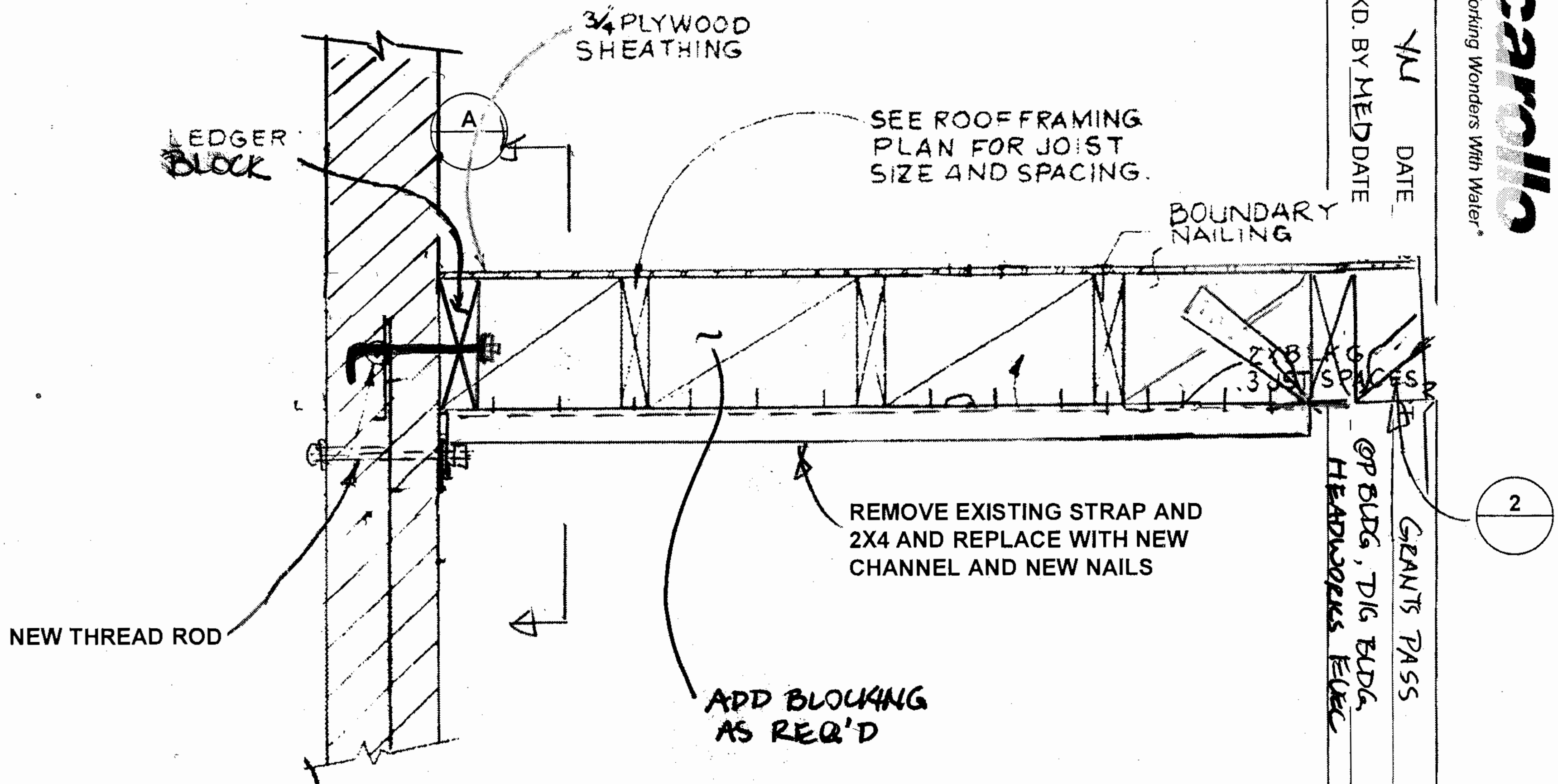
		Compliance
	Ceiling Systems	
LAY-IN TILES	Lay-in tiles used in ceiling panels located at exits and corridors shall be secured with clips. (Tier 2: Sec. 4.8.2.2)	NC
INTEGRATED CEILINGS	Integrated suspended ceilings at exits and corridors or weighing more than 2 pounds per square foot shall be laterally restrained with a minimum of four diagonal wires or rigid members attached to the structure above at a spacing equal to or less than 12 feet. (Tier 2: Sec. 4.8.2.3)	C
SUSPENDED LATH AND PLASTER	Ceilings consisting of suspended lath and plaster or gypsum board shall be attached to resist seismic forces for every 12 square feet of area. (Tier 2: Sec. 4.8.2.4)	NA
	Cladding and Glazing	
LAMINATED SAFETY GLASS (GLAZING)	Glazing in curtain walls and individual panes over 16 square feet in area, located up to a height of 10 feet above an exterior walking surface, shall have safety glazing. Such glazing located over 10 feet above an exterior walking surface shall be laminated, annealed, or laminated heat-strengthened safety glass that will remain in the frame when glass is cracked. (Tier 2: Sec. 4.8.4.8)	NC
	Ducts	
STAIR AND SMOKE DUCTS	Stair pressurization and smoke control ducts shall be braced and shall have flexible connections at seismic joints. (Tier 2: Sec. 4.8.14.1)	NC
	Light Fixtures	
INDEPENDENT SUPPORT	Light fixtures in suspended grid ceilings shall be supported independently of the ceiling suspension system by a minimum of two wires at diagonally opposite corners of the fixtures. (Tier 2: Sec. 4.8.3.2)	C
	Masonry Chimneys	
ANCHORAGE	Masonry chimneys shall be anchored at each floor level and the roof. (Tier 2: Sec. 4.8.9.2)	NA
	Mechanical and Electrical Equipment	
VIBRATION ISOLATORS	Equipment mounted on vibration isolators shall be equipped with restraints or snubbers. (Tier 2: Sec. 4.8.12.5)	C
	Parapets, Cornices, Ornamentation, and Appendages	
CONCRETE PARAPETS	Concrete parapets with height-to-thickness ratios greater than 2.5 shall have vertical reinforcement. (Tier 2: Sec. 4.8.8.3)	NC

Wall in the penthouse

APPENDAGES	Cornices, parapets, signs, and other appendages that extend above the highest point of anchorage to the structure or cantilever from exterior wall faces and other exterior wall ornamentation shall be reinforced and anchored to the structural system at a spacing equal to or less than 10 feet for Life Safety and 6 feet for Immediate Occupancy. This requirement need not apply to parapets or cornices compliant with Section 4.8.8.1 or 4.8.8.3. (Tier 2: Sec. 4.8.8.4)	C

Appendix B

CONCEPTUAL RETROFIT DESIGN SKETCHES



1 DETAIL – OUT OF PLANE WALL ANCHORAGE RETROFIT

carollo
Engineers...Working Wonders With Water®

BY YJJ DATE

CHKD. BY MED DATE

GRANTS PASS

OP BLDG, DIG BLDG, HEADWORKS ELEC

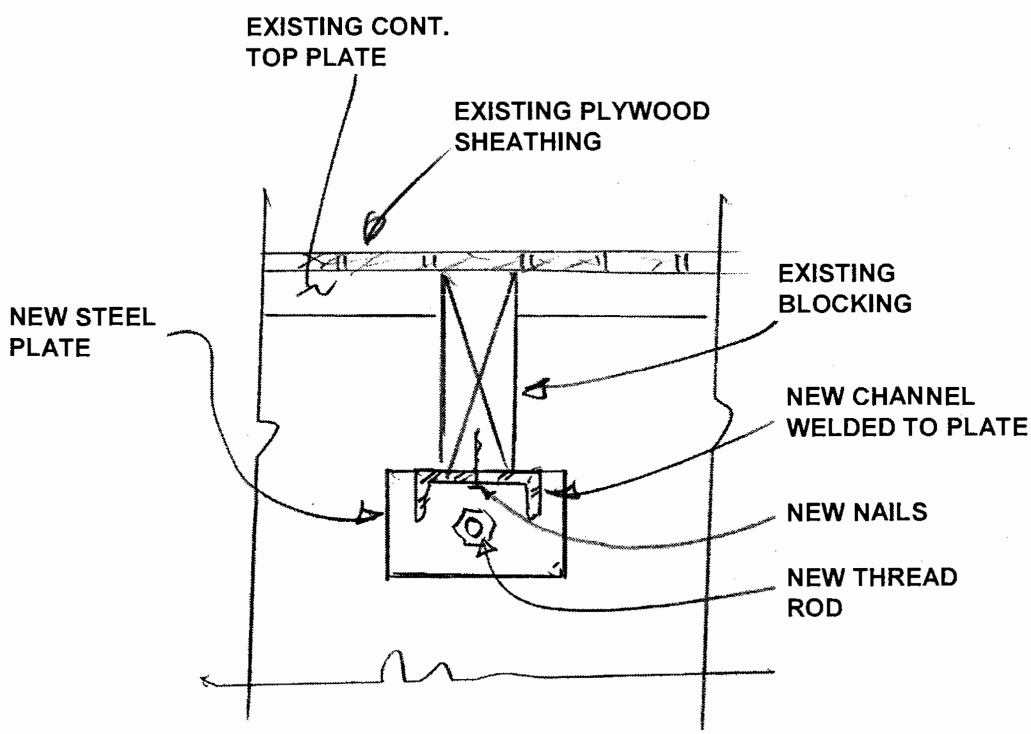
SHEET NO. 1 OF

JOB NO.

Engineers...Working Wonders With Water®

BY YN DATE 2/13 SUBJECT GRANTS PASS SHEET NO. 2 OF

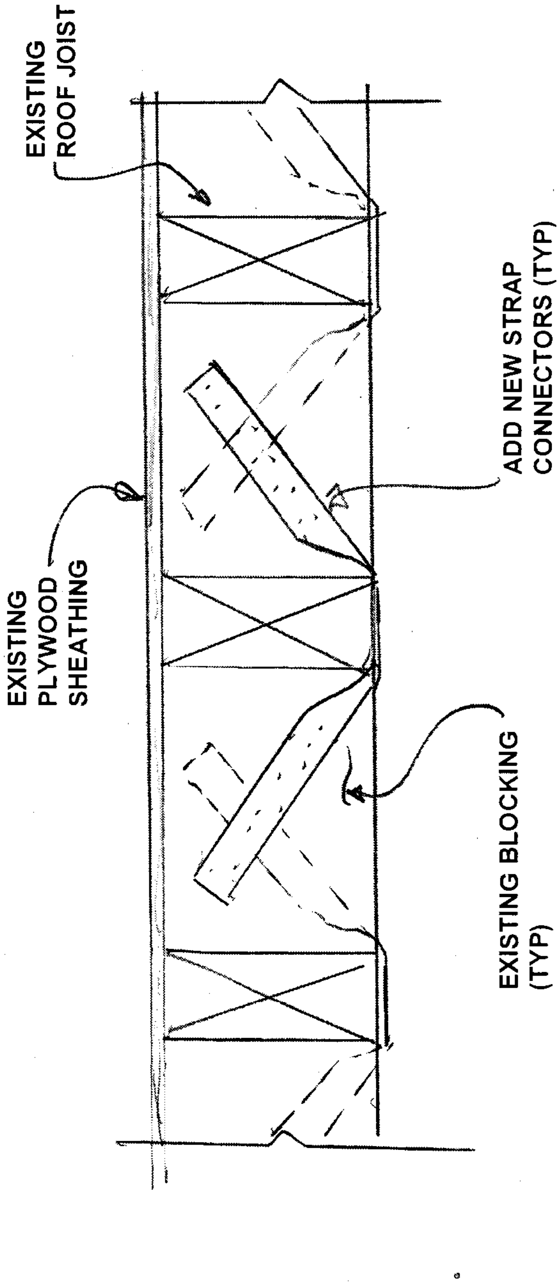
CHKD. BY MED DATE JOB NO.



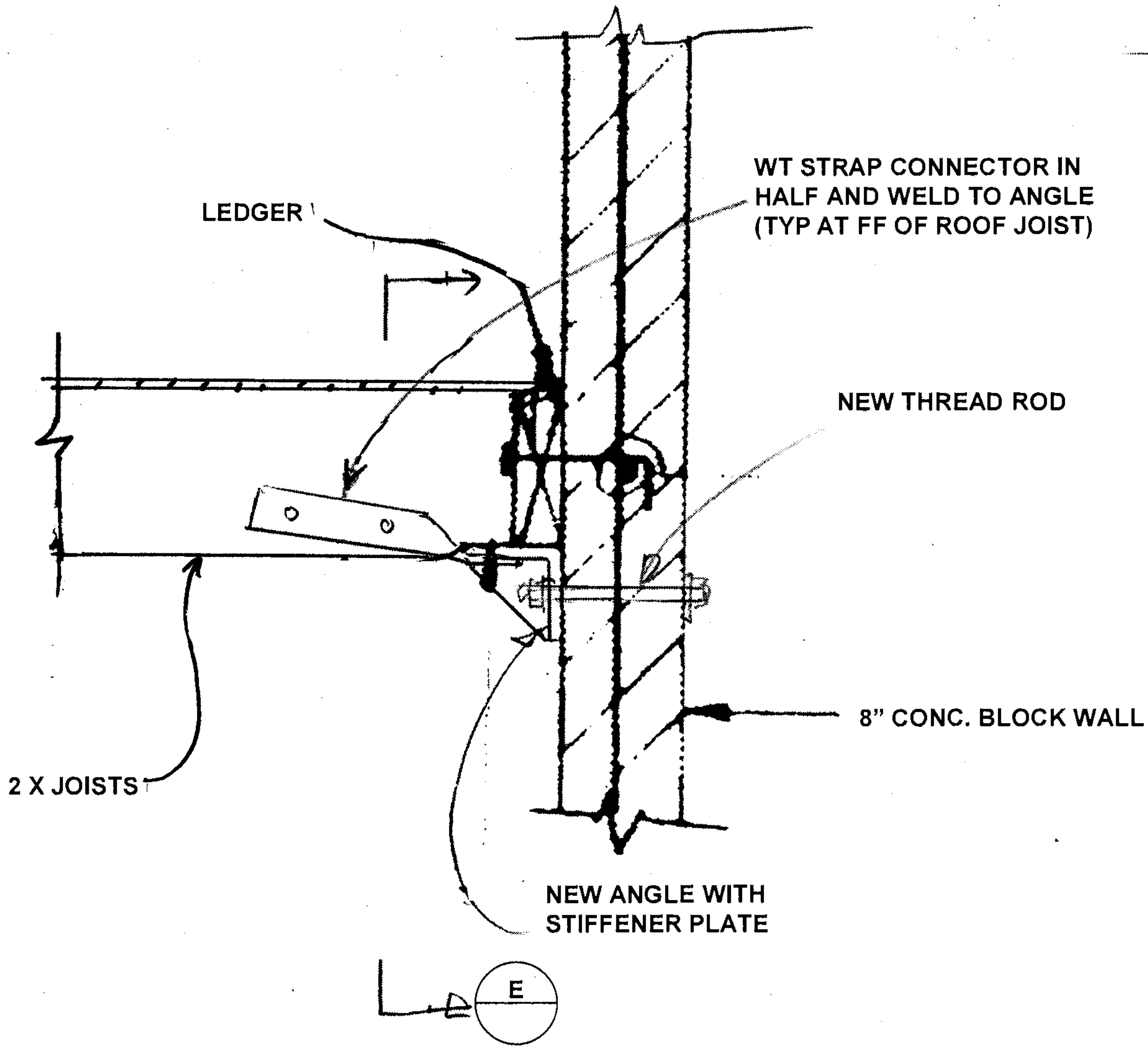
A SECTION

carollo
Engineers...Working Wonders With Water®

BY	YN	DATE	2/13	SUBJECT	GRANTS PASS	SHEET NO.	3 OF -
CHKD. BY	MED	DATE			OPERATIONS, DIG CTRL BLDG, HEADWRKS ELEC BLDGS	JOB NO.	



2 DETAIL – CONTINUOUS CHORD CROSS TIE RETROFIT

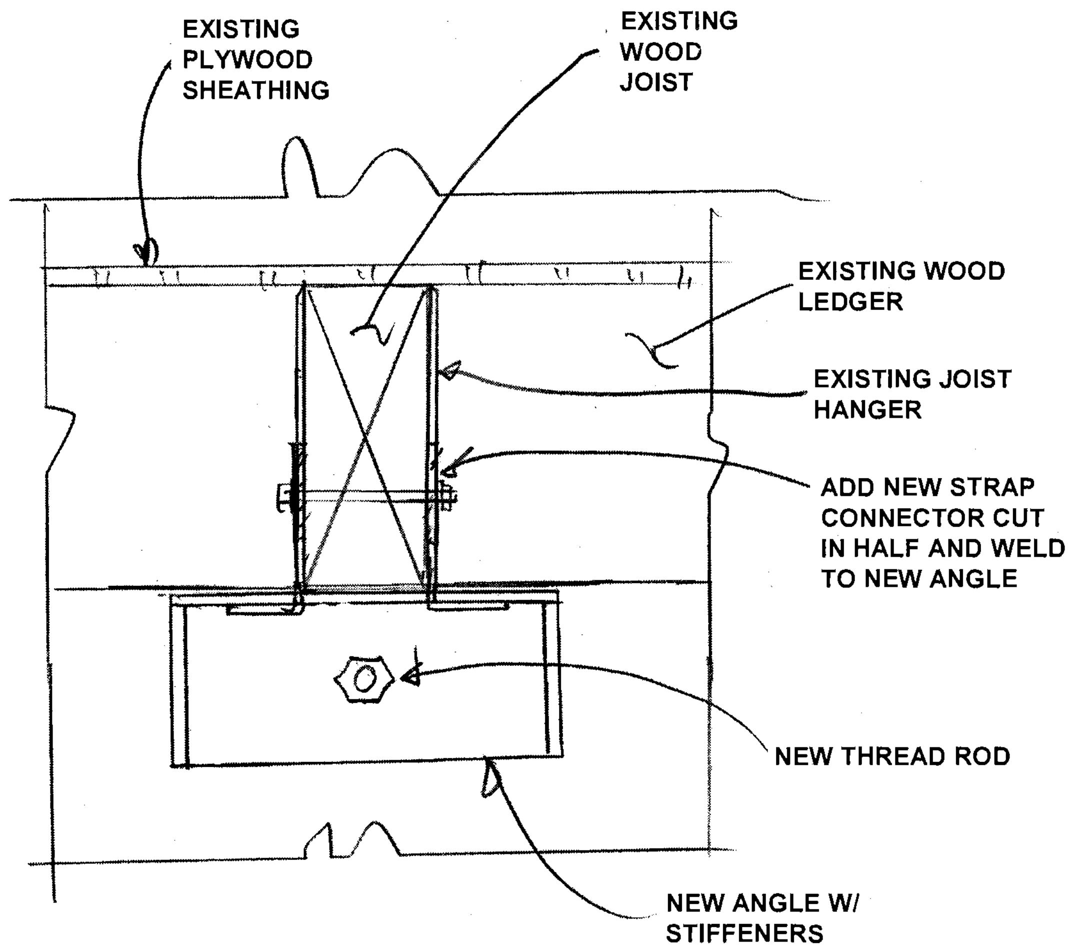


3 DETAIL – OUT OF PLANE WALL ANCHORAGE RETROFIT

Engineers...Working Wonders With Water®

BY YW DATE 2/13 SUBJECT GRANTS PASS SHEET NO. ___ OF ___

CHKD. BY ___ DATE ___ HEADWORKS ELEC BLDG JOB NO. ___



E SECTION

carollo
Engineers...Working Wonders With Water®

BY YN DATE 2/13 SUBJECT GRANTS PASS SHEET NO. ___ OF ___

CHKD. BY ___ DATE ___ JOB NO. ___

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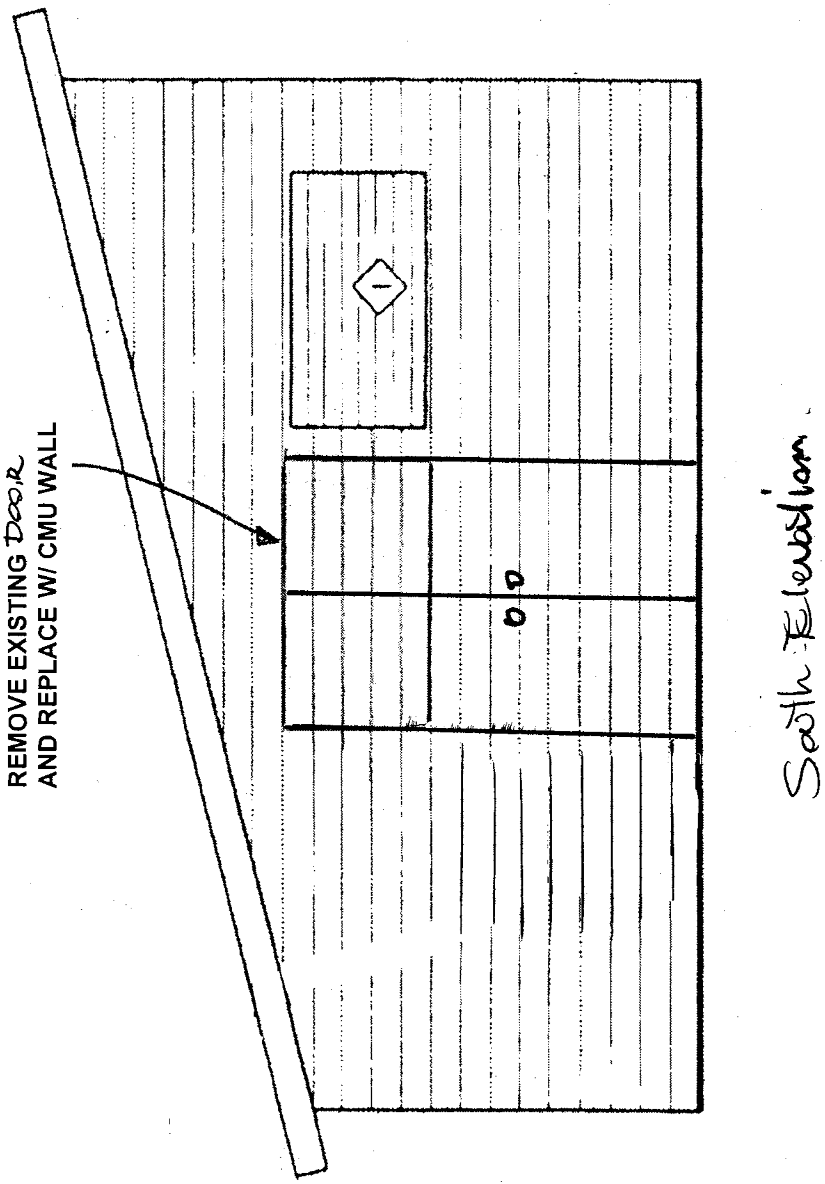
Engineers...Working Wonders With Water®

BY YNL DATE 2-13 SUBJECT GRANTS PASS SHEET NO. ____ OF ____
CHKD. BY ____ DATE ____ OLD CHLORINE BLDG JOB NO. ____

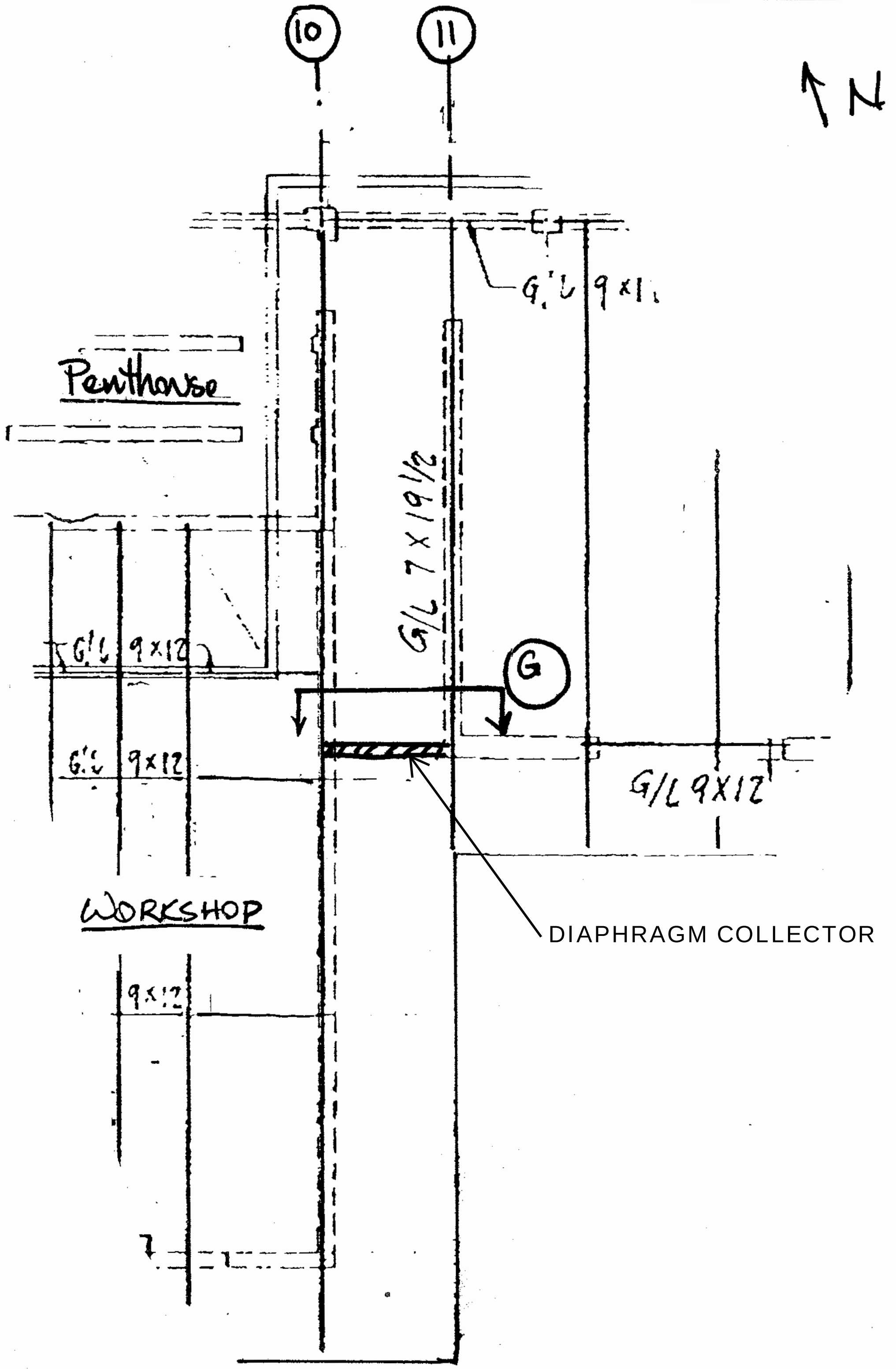


4 DETAIL – SHEAR WALL OUT OF PLANE CAPACITY RETROFIT

Carollo

Engineers...Working Wonders With Water™

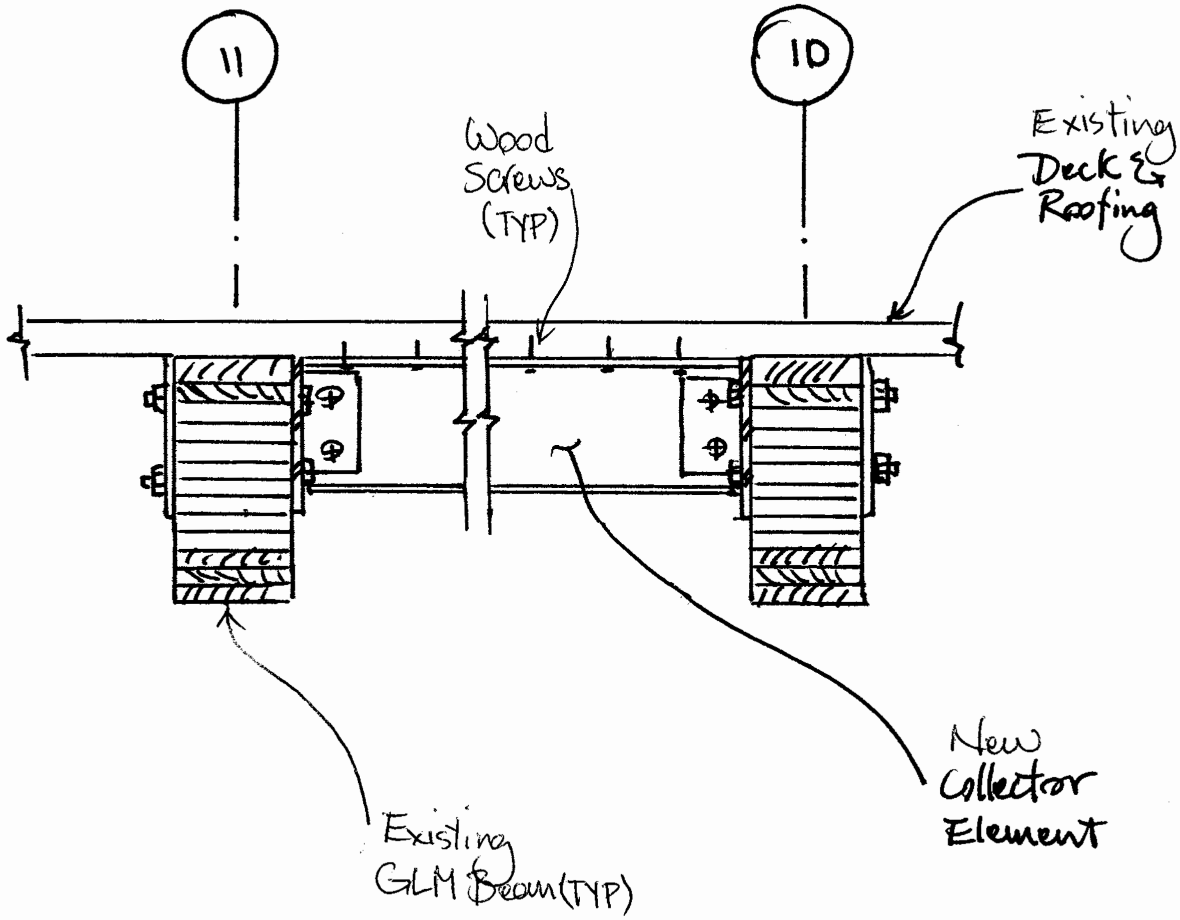
BY	YKL	DATE	2/13	SUBJECT	GRANTS PASS	SHEET NO.	OF
CHKD. BY		DATE			OP BLDG	JOB NO.	



5 Detail – Diaphragm Collector at Reentrant Corner

Engineers...Working Wonders With Water™

BY YN DATE 2/13 SUBJECT Grants Pass SHEET NO. ____ OF ____
CHKD. BY ____ DATE ____ Operations Building JOB NO. ____



G Section

Appendix C

CONSTRUCTION COST ESTIMATES

Engineers...Working Wonders With Water®

DETAILED COST ESTIMATE

Project: WRP Structural Condition Assessment
Client: Grants Pass
Location: Grants Pass, OR
Element: 01 Operations Building

Date : March 15, 2013
By : YN
Reviewed: MED

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 04 - Masonry					
04000	Anchorage of Brick Veneer	1765.5	EA	$29.61	$52,276	
04000	Detail 1 - Out of Plane Wall Anchorage with Blocking	5.00	EA	$250.00	$1,250	
04000	Detail 2 - Continuous Chord Cross Tie	205.00	EA	$25.00	$5,125	
04000	Detail 3 - Out of Plane Wall Anchorage Retrofit	5.00	EA	$150.00	$750	
04000	Detail 5 - Diaphragm Tension at Reentrant Corners	1.00	EA	$4,935.00	$4,935	
	Total					**$112,408**
	Division 05 - Metals					
05000	Anchorage of Mechanical Equipment	8	DAY	$473.76	$3,790	
05000	Anchorage of Electrical Equipment	10	DAY	$473.76	$4,738	
05000	Anchorage of Storage Racks	4	DAY	$473.76	$1,895	
	Total					**$10,423**
	Division 08 - Doors and Windows					
08520	.5" Tempered (Clear) Fixed Glazing	528	SF	$46.39	$24,493	
	Total					**$24,493**
	Division 15 - Mechanical					
15000	Pipe Supports	35	EA	$239.18	$8,371	
15000	Duct Supports	20	EA	$239.18	$4,784	
	Total					**$13,155**
	TOTAL DIRECT COST					**$160,479**
	Contingency	30.0%				$48,144
	Subtotal					**$208,622**
	General Contractor Overhead, Profit & Risk	15.0%				$24,072
	Subtotal					**$232,694**
	Demobilization, Bond, Inusrance &Overhead	10.0%				$16,048
	Subtotal					**$248,742**
	Bid Market Allowance	0.0%				$0
	TOTAL ESTIMATED CONSTRUCTION COST					**$249,000**
	Engineering, Legal & Administration Fees	25.0%				$62,250
	TOTAL ESTIMATED PROJECT COST					**$311,000**

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo Engineers have no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. Carollo Engineers cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented as shown.

Engineers...Working Wonders With Water®

DETAILED COST ESTIMATE

Project: WRP Structural Condition Assessment
Client: Grants Pass
Location: Grants Pass, OR
Element: 02 Digester Control Building

Date : March 15, 2013
By : YN
Reviewed: MED

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 04 - Masonry					
04000	Anchorage of Brick Veneer	136	EA	$29.61	$4,027	
04000	Detail 1 - Out of Plane Wall Anchorage with Blocking	4	EA	$250.00	$1,000	
	Total					**$5,027**
	Division 05 - Metals					
05000	Anchorage of Equipment	4	DAY	$473.76	$1,895	
	Total					**$1,895**
	Division 08 - Doors and Windows					
08520	.5" Tempered (Clear) Fixed Glazing	432	SF	$46.39	$20,040	
	Total					**$20,040**
	Division 15 - Mechanical					
15000	Pipe Supports	3	EA	$239.18	$718	
	Total					**$718**
	TOTAL DIRECT COST					**$27,680**
	Contingency	30.0%				$8,304
	Subtotal					**$35,983**
	General Contractor Overhead, Profit & Risk	15.0%				$4,152
	Subtotal					**$40,135**
	Demobilization, Bond, Inusrance &Overhead	10.0%				$2,768
	Subtotal					**$42,903**
	Bid Market Allowance	0.0%				$0
	TOTAL ESTIMATED CONSTRUCTION COST					**$43,000**
	Engineering, Legal & Administration Fees	25.0%				$10,750
	TOTAL ESTIMATED PROJECT COST					**$54,000**

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo Engineers have no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. Carollo Engineers cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented as shown.

Engineers...Working Wonders With Water®

DETAILED COST ESTIMATE

Project: WRP Structural Condition Assessment
Client: Grants Pass
Location: Grants Pass, OR
Element: 03 Headworks

Date : March 15, 2013
By : YN
Reviewed: MED

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 03 - Concrete					
03000	Type A Concrete Repair	24	LF	$148.05	$3,553	
	Total					**$3,553**
	Division 04 - Masonry					
04000	Detail 1 - Out of Plane Wall Anchorage with Blocking	5.00	EA	$250.00	$1,250	
04000	Detail 2 - Continuous Chord Cross Tie	48.00	EA	$25.00	$1,200	
04000	Detail 3 - Out of Plane Wall Anchorage Retrofit	5.00	EA	$150.00	$750	
	Total					**$3,200**
	Division 05 - Metals					
05000	Anchorage of Equipment	3.00	DAY	$473.76	$1,421	
	Total					**$1,421**
	Division 15 - Mechanical					
15000	Pipe Supports	8.00	EA	$239.18	$1,913	
15000	Duct Supports	3.00	EA	$239.18	$718	
	Total					**$2,631**
	TOTAL DIRECT COST					**$10,805**
	Contingency	30.0%				$3,242
	Subtotal					**$14,047**
	General Contractor Overhead, Profit & Risk	15.0%				$1,621
	Subtotal					**$15,668**
	Demobilization, Bond, Inusrance &Overhead	10.0%				$1,081
	Subtotal					**$16,749**
	Bid Market Allowance	0.0%				$0
	TOTAL ESTIMATED CONSTRUCTION COST					**$17,000**
	Engineering, Legal & Administration Fees	25.0%				$4,250
	TOTAL ESTIMATED PROJECT COST					**$21,000**

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo Engineers have no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. Carollo Engineers cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented as shown.

Engineers...Working Wonders With Water®

DETAILED COST ESTIMATE

Project: WRP Structural Condition Assessment
Client: Grants Pass
Location: Grants Pass, OR
Element: 04 Plant Drain Pump Station

Date : March 15, 2013
By : YN
Reviewed: MED

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 05 - Metals					
05000	Anchorage of Electrical Equipment	4	DAY	$473.76	$1,895	
	Total					**$1,895**
	TOTAL DIRECT COST					**$1,895**
	Contingency	30.0%				$569
	Subtotal					**$2,464**
	General Contractor Overhead, Profit & Risk	15.0%				$284
	Subtotal					**$2,748**
	Demobilization, Bond, Inusrance &Overhead	10.0%				$190
	Subtotal					**$2,937**
	Bid Market Allowance	0.0%				$0
	TOTAL ESTIMATED CONSTRUCTION COST					**$3,000**
	Engineering, Legal & Administration Fees	25.0%				$750
	TOTAL ESTIMATED PROJECT COST					**$4,000**

The cost estimate herein is based on our perception of current conditions at the project location. This estimate reflects our professional opinion of accurate costs at this time and is subject to change as the project design matures. Carollo Engineers have no control over variances in the cost of labor, materials, equipment; nor services provided by others, contractor's means and methods of executing the work or of determining prices, competitive bidding or market conditions, practices or bidding strategies. Carollo Engineers cannot and does not warrant or guarantee that proposals, bids or actual construction costs will not vary from the costs presented as shown.

DETAILED COST ESTIMATE

Project: WRP Structural Condition Assessment
Client: Grants Pass
Location: Grants Pass, OR
Element: 05 Old Chlorine Building

Date : March 15, 2013
By : YN
Reviewed: MED

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 04 - Masonry					
04220	Concrete Block, Split Face, 8"	56	SF	$30.37	$1,700	
04220	Seismic Reinforcement Adder	56	SF	$1.36	$76	
04220	Full Grout (All Cells)	56	SF	$1.24	$70	
	Total					**$1,846**
	Division 05 - Metals					
05000	Anchorage of Equipment	3	DAY	$473.76	$1,421	
	Total					**$1,421**
	TOTAL DIRECT COST					**$3,268**
	Contingency	30.0%				$980
	Subtotal					**$4,248**
	General Contractor Overhead, Profit & Risk	15.0%				$490
	Subtotal					**$4,738**
	Demobilization, Bond, Inusrance &Overhead	10.0%				$327
	Subtotal					**$5,065**
	Bid Market Allowance	0.0%				$0
	TOTAL ESTIMATED CONSTRUCTION COST					**$6,000**
	Engineering, Legal & Administration Fees	25.0%				$1,500
	TOTAL ESTIMATED PROJECT COST					**$8,000**

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DETAILED COST ESTIMATE

Project: WRP Structural Condition Assessment
Client: Grants Pass
Location: Grants Pass, OR
Element: 06 Sludge Control Building

Date : March 15, 2013
By : YN
Reviewed: MED

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 05 - Metals					
05000	Anchorage of Wood Sills	3.00	DAY	$473.76	$1,421	
05000	Completing the nailing on shear walls	1.00	DAY	$473.76	$474	
	Total					**$1,895**
	Division 09 - Finishes					
09000	Epoxy Coating	5	DAY	$473.76	$2,369	
	Total					**$2,369**
	TOTAL DIRECT COST					**$4,264**
	Contingency	30.0%				$1,279
	Subtotal					**$5,543**
	General Contractor Overhead, Profit & Risk	15.0%				$640
	Subtotal					**$6,183**
	Demobilization, Bond, Inusrance &Overhead	10.0%				$426
	Subtotal					**$6,609**
	Bid Market Allowance	0.0%				$0
	TOTAL ESTIMATED CONSTRUCTION COST					**$7,000**
	Engineering, Legal & Administration Fees	25.0%				$1,750
	TOTAL ESTIMATED PROJECT COST					**$9,000**

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Engineers...Working Wonders With Water®

DETAILED COST ESTIMATE

Project: WRP Structural Condition Assessment
Client: Grants Pass
Location: Grants Pass, OR
Element: 07 UV Disinfection Building

Date : March 15, 2013
By : YN
Reviewed: MED

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 05 - Metals					
05000	Tool shed - Anchorage of Wood Sills and Racks	2.00	DAY	$473.76	$948	
05000	Completig nailing of the Shear Walls	1.00	DAY	$473.76	$474	
	Total					**$1,421**
	Division 06 - Wood and Plastics					
06000	UV Building - Light Wood Frame Building	1400	SF	$30.00	$42,000	
	Total					**$42,000**
	TOTAL DIRECT COST					**$43,421**
	Contingency	30.0%				$13,026
	Subtotal					**$56,448**
	General Contractor Overhead, Profit & Risk	15.0%				$6,513
	Subtotal					**$62,961**
	Demobilization, Bond, Inusrance &Overhead	10.0%				$4,342
	Subtotal					**$67,303**
	Bid Market Allowance	0.0%				$0
	TOTAL ESTIMATED CONSTRUCTION COST					**$68,000**
	Engineering, Legal & Administration Fees	25.0%				$17,000
	TOTAL ESTIMATED PROJECT COST					**$85,000**

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Engineers...Working Wonders With Water®

DETAILED COST ESTIMATE

Project: WRP Structural Condition Assessment
Client: Grants Pass
Location: Grants Pass, OR
Element: 08 Circular Primary Clarifier

Date : March 15, 2013
By : YN
Reviewed: MED

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02220	Cut Concrete Slab On Grade	226.19	INFT	$.83	$188	
02220	Demo and Remove Concrete Foundation	384.00	CF	$24.67	$9,475	
02300	Tractor/Backhoe, 30" Bucket Class B (Medium Digging), 0-5' D	279.25	CY	$9.90	$2,765	
02300	Native Trench Backfill/Unconfined Struct. Bf, Class B Material	279.25	CY	$14.63	$4,085	
	Total					**$16,513**
	Division 03 - Concrete					
03000	Concrete Foundation	32.00	CY	$1,974.00	$63,168	
	Total					**$63,168**
	Division 09 - Finishes					
09000	Coat Clarifier Mechanism Center Column	1.00	LS	$14,000.00	$14,000	
	Total					**$14,000**
	Division 11 - Equipment					
11000	Clarifier Center Column Modifications	1.00	LS	$78,960.00	$78,960	
	Total					**$78,960**
	TOTAL DIRECT COST					**$172,641**
	Contingency	30.0%				$51,792
	Subtotal					**$224,433**
	General Contractor Overhead, Profit & Risk	15.0%				$25,896
	Subtotal					**$250,329**
	Demobilization, Bond, Inusrance &Overhead	10.0%				$17,264
	Subtotal					**$267,593**
	Bid Market Allowance	0.0%				$0
	TOTAL ESTIMATED CONSTRUCTION COST					**$268,000**
	Engineering, Legal & Administration Fees	25.0%				$67,000
	TOTAL ESTIMATED PROJECT COST					**$335,000**

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Engineers...Working Wonders With Water®

DETAILED COST ESTIMATE

Project: WRP Structural Condition Assessment
Client: Grants Pass
Location: Grants Pass, OR
Element: 09 Aeration Basins

Date : March 15, 2013
By : YN
Reviewed: MED

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02220	Cut Concrete Walls	2592	INFT	$1.93	$5,014	
02220	Asphalt Pavement Cutting	456	INFT	$.74	$338	
02220	Demo and Remove Knockout Wall	324	CF	$24.67	$7,995	
02300	Native Trench Backfill/Unconfined Struct. Bf, Class B Material	1400	CY	$14.63	$20,481	
02300	Cat 235 Trackhoe 1.50Cy Bucket, Class B (Medium Digging), 0-20' D	1733.33	CY	$3.10	$5,381	
02742	4" Ac Paving On 12" Abc	2600	INFT	$4.22	$10,978	
	Total					**$50,186**
	Division 03 - Concrete					
03000	Replacement of Knockout Walls	12	CY	$1,974.00	$23,688	
	Total					**$23,688**
	Division 05 - Metals					
05120	Custom Baffle Wall Framing	18000	LB	$2.20	$39,632	
	Total					**$39,632**
	Division 15 - Mechanical					
15000	Stainless Steel Pipe Supports	16	EA	$1,954.26	$31,268	
	Total					**$31,268**
	TOTAL DIRECT COST					**$144,775**
	Contingency	30.0%				$43,432
	Subtotal					**$188,207**
	General Contractor Overhead, Profit & Risk	15.0%				$21,716
	Subtotal					**$209,923**
	Demobilization, Bond, Inusrance &Overhead	10.0%				$14,477
	Subtotal					**$224,401**
	Bid Market Allowance	0.0%				$0
	TOTAL ESTIMATED CONSTRUCTION COST					**$225,000**
	Engineering, Legal & Administration Fees	25.0%				$56,250
	TOTAL ESTIMATED PROJECT COST					**$281,000**

Engineers...Working Wonders With Water®

DETAILED COST ESTIMATE

Project: WRP Structural Condition Assessment
Client: Grants Pass
Location: Grants Pass, OR
Element: 10 Secondary Clarifiers

Date : March 15, 2013
By : YN
Reviewed: MED

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
09000						
05000	**Division 02 - Site Construction**					
02220	Demo and Remove Concrete Foundation	1,200.00	CF	$24.67	$29,610	
02300	Tractor/Backhoe, 30" Bucket Class B (Medium Digging), 0-5' D	1,413.72	CY	$9.90	$13,996	
02300	Native Trench Backfill/Unconfined Struct. Bf, Class B Material	1,413.72	CY	$14.63	$20,682	
02742	4" Ac Paving On 12" Abc	3,180.87	SF	$4.22	$13,430	
	Shotcrete	3,015.93	SF	$10.00	$30,159	
	Total					**$107,878**
	Division 03 - Concrete					
03000	Concrete Foundation	64.00	CY	$1,974.00	$126,336	
	Post Tensioning Circular Tank Walls	2.00	LS	$45,000.00	$90,000	
	Total					**$216,336**
	Division 09 - Finishes					
09000	Coating Clarifier Mechanism Center Column	2.00	LS	$14,000.00	$28,000	
	Total					**$28,000**
	Division 11 - Equipment					
11000	Clarifier Center Column Modifications	2.00	LS	$78,960.00	$157,920	
	Total					**$157,920**
	TOTAL DIRECT COST					**$510,134**
	Contingency	30.0%				$153,040
	Subtotal					**$663,174**
	General Contractor Overhead, Profit & Risk	15.0%				$76,520
	Subtotal					**$739,694**
	Demobilization, Bond, Inusrance &Overhead	10.0%				$51,013
	Subtotal					**$790,707**
	Bid Market Allowance	0.0%				$0
	TOTAL ESTIMATED CONSTRUCTION COST					**$791,000**
	Engineering, Legal & Administration Fees	25.0%				$197,750
	TOTAL ESTIMATED PROJECT COST					**$989,000**

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Carollo Engineers...Working Wonders With Water®

DETAILED COST ESTIMATE

Project: WRP Structural Condition Assessment
Client: Grants Pass
Location: Grants Pass, OR
Element: 11 Sludge Thickener

Date : March 15, 2013
By : YN
Reviewed: MED

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02220	Demo and Remove Concrete Foundation	384.00	CF	$24.67	$9,475	
02300	Native Trench Backfill/Unconfined Struct. Bf, Class B Material	163.63	CY	$14.63	$2,394	
02300	Tractor/Backhoe, 30" Bucket Class B (Medium Digging), 0-5' D	163.63	CY	$9.90	$1,620	
	Total					**$13,489**
	Division 03 - Concrete					
03000	Concrete Foundation	14.22	CY	$1,974.00	$28,070	
03000	Type A Concrete Repair	24.00	LF	$148.05	$3,553	
	Total					**$31,623**
	Division 09 - Finishes					
09000	Coating Clarifier Center Column	1.00	LS	$7,000.00	$7,000	
	Total					**$7,000**
	Division 11 - Equipment					
09000	Clarifier Center Column modifications	1.00	LS	$39,480.00	$39,480	
	Total					**$39,480**
	TOTAL DIRECT COST					**$91,592**
	Contingency	30.0%				$27,478
	Subtotal					**$119,070**
	General Contractor Overhead, Profit & Risk	15.0%				$13,739
	Subtotal					**$132,809**
	Demobilization, Bond, Inusrance &Overhead	10.0%				$9,159
	Subtotal					**$141,968**
	Bid Market Allowance	0.0%				$0
	TOTAL ESTIMATED CONSTRUCTION COST					**$142,000**
	Engineering, Legal & Administration Fees	25.0%				$35,500
	TOTAL ESTIMATED PROJECT COST					**$178,000**

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DETAILED COST ESTIMATE

Project: WRP Structural Condition Assessment
Client: Grants Pass
Location: Grants Pass, OR
Element: 12 Chlorine Contact Basin

Date : March 15, 2013
By : YN
Reviewed: MED

SPEC. NO.	DESCRIPTION	QUANTITY	UNIT	UNIT COST	SUBTOTAL	TOTAL
	Division 02 - Site Construction					
02220	Demolish Masonry Walls	2,090.00	SF	$9.06	$18,935	
02220	Demolish Concrete Divider Wall	1,230.00	SF	$25.34	$31,171	
	Total					**$50,106**
	TOTAL DIRECT COST					**$50,106**
	Contingency	30.0%				$15,032
	Subtotal					**$65,138**
	General Contractor Overhead, Profit & Risk	15.0%				$7,516
	Subtotal					**$72,654**
	Demobilization, Bond, Inusrance &Overhead	10.0%				$5,011
	Subtotal					**$77,664**
	Bid Market Allowance	0.0%				$0
	TOTAL ESTIMATED CONSTRUCTION COST					**$78,000**
	Engineering, Legal & Administration Fees	25.0%				$19,500
	TOTAL ESTIMATED PROJECT COST					**$98,000**

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Appendix D

SELECTED PHOTOGRAPHS

Operations Building

Figure 1. Ductwork Requires Bracing

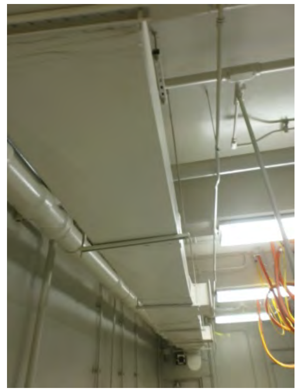

Figure 2. Cable Tray Requires Bracing

Figure 3. Cracking was observed occasionally on the concrete staircase, at the guardrail post attachment.

Figure 4. Electrical Cabinets are only anchored on one side.

Figure 5. Several suspended pipes including a Natural Gas Pipe are not braced properly against lateral loads.

Figure 6. Blower unit is not anchored properly

Operations Building

Figure 7 .Storage Rack Requires Bracing

Figure 8 .Heater without side bracing

Figure 9. Storage Rack Requires Bracing

Figure 10.Transformers require to be anchored

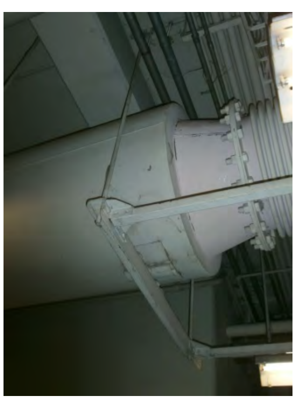

Figure 11 .Silencer without lateral bracing

Figure 12 .Silencer without lateral bracing

Operations Building

Figure 13. Storage Rack Requires Bracing

Figure 14 Hot Water pipes are not braced laterally.

Figure 15. Boiler is not anchored to the floor

Figure 16. Hot Water pipes are not braced laterally.

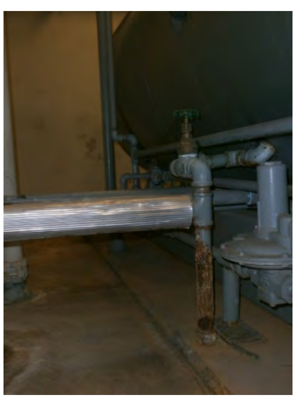

Figure 17. Deterioration of a pipe support in the boiler room

Figure 18. Old blowers are not anchored

Operations Building

Figure 19. Blower duct is not braced

Figure 20. UPS batteries are not protected against lateral loads

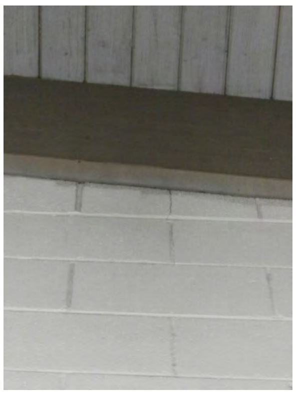

Figure 21. Diagonal Cracking in the East Wall of the Belt Press Hopper Room due to settlement

Figure 22. Diagonal Cracking in the West wall of the workshop due to settlement

Figure 23. Sampling equipment needs to be braced to the concrete pedestal

Figure 24. Duct work requires bracing

Operations Building

Figure 25. Reinforcement of the deck at the diaphragm performed with joist hangers without provisions for lateral loads

Figure 26. Long tall vertical duct work without bracing

Figure 27. Duct work requires bracing

Figure 28. Hot Water piping requires bracing

Figure 29. Crack on the concrete elevated slab, outside of the dewatering room entrance.

Figure 30. Cracks on the short wall, west of the pump room entrance. It shows the extent of settlement damage

Operations Building

Figure 31. Makeshift Storage rack in the penthouse will be unstable during an earthquake

Figure 32. Storage rack in the penthouse is not braced

Figure 33. Joist connections do not have positive capacity for diaphragm shear in the penthouse roof deck.

Figure 34. Penthouse crawlspace: The masonry blocks are not fully grouted

Figure 35. Penthouse crawlspace: The masonry blocks are not fully grouted

Figure 36. Blockings missing between the roof rafters in the Penthouse

Operations Building

Figure 37.Out of plane anchorage is not provided for the penthouse roof deck.

Figure 38.Water heater in the penthouse is not braced properly

Figure 39.Stroage racks are not anchored

Figure 40.Storage racks and electrical cabinets are not anchored properly

Figure 41. Electrical cabinets are not anchored properly

Digester Control Building

Figure 1.The south side of the Digester Control Building is covered by a long glass façade.

Figure 2.Brick veneer on Digester No.1 is installed with dovetail anchors and weep holes are provided

Figure 3.Untempered glass on the south side of the Digester Control Building

Figure 4.Piping in Digester Control Building requires bracing

Figure 5. Piping in Digester Control Building requires bracing

Figure 6.Surge Tank in the Digester Control Building appears to be unanchored

Digester Control Building

 Figure 7.Pump Skid outside of the Digester Control Building is not anchored	 Figure 8.Miscellanous piping in the Digester Gas Room next to the Digester Building require bracing

Headworks Electrical Building

Figure 1.Long run of pipe is not tied to the deck

Figure 2.Cracks in the elevated deck were observed at the openings.

Figure 3.Unbraced piping under the deck. Headworks Structure

Figure 4.Incorrect detailing at the roof to wall connection of the Headworks electrical building will cause cross grain bending in the ledger block

Figure 5.Water damage inside the Headworks Electrical Building

Figure 6 Piping in the basement of the Headworks Electrical Building requires additional bracing.

Headworks Electrical Building

 *Figure 7. Duct work in the basement of the Headworks Electrical Building requires additional bracing*	

Sludge Thickener

Figure 1. No positive connection between the roof diaphragm and top of shear wall

Figure 2. Center columns supporting the roof beams have little to none lateral support capacity

Figure 3. Failure of coating of the piping

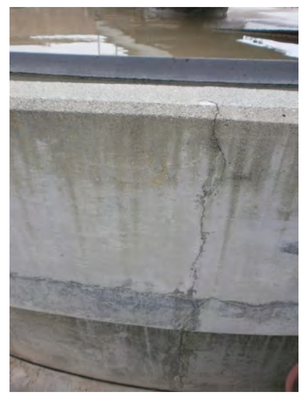

Figure 4. Shrinkage cracks were observed on the tank walls above grade.

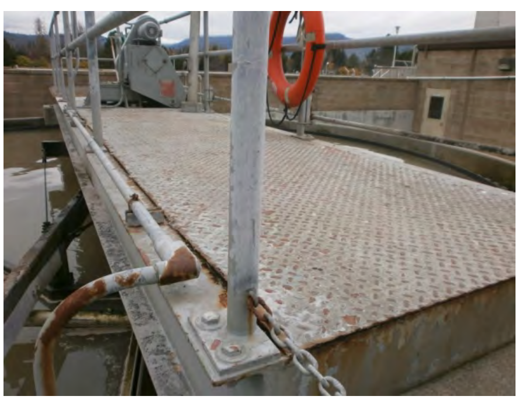

Figure 5. Walkway bridge shows signs of corrosion on conduits, guardrail, as well as the bridge structure.

Figure 6. The Thickener mechanism shows signs of wear and corrosion.

Sludge Thickener

Figure 7. Walkway bridge bearing requires strengthening.

Plant Drain Pump Station

Figure 1. MCC cabinet is anchored to the wall behind using a small clip angle. Signs of moisture penetration through the building wall, is apparent on the concrete pad.

Figure 2. Electrical cabinets are not anchored to the floor.

Figure 3. UPS batteries are resting on a shelf without any restraint against lateral movements

Figure 4. Light fixtures with pendant supports are recommended to have covers to protect the broken light bulbs from falling.

UV Disinfection Building and Storage Shed

Figure 1. Water damage was observed on the shear walls. The building is not currently anchored down to the slab.

Figure 2. Monorail attached to the roof trusses.

Figure 3. Large opening with a weak collector beam above the opening.

Figure 4. Storage shed has unanchored storage racks and piping

Old Chlorine Building

Figure 1. Unanchored storage rack

Figure 2. Hazardous Material cabinet is not anchored.

Figure 3. Oil barrels do not have a containment area to protect against spilling. The barrels are not anchored to the walls.

Figure 4. Large opening in the south shear wall of the building.

Miscellaneous

Figure 1. Air piping has long unsupported vertical runs in the Aeration Basins

Figure 2. Pendant light fixtures in the RAS/WAS electrical room are not braced

Figure 3. Storage rack in the RAS/WAS electrical room is not anchored

Figure 4. Secondary Clarifier No.3, the bridge walkway bearing requires strengthening.

Figure 5. The walkway bridge bearing on the Clarifier wall requires strengthening.

REGISTERED PROFESSIONAL ENGINEER
19616
OREGON
FEB. 6, 1998
JEFFREY F. McCORMICK

EXPIRES: 12/31/14

City of Grants Pass

TECHNICAL MEMORANDUM NO. 7

Water Restoration Plant Facility Plan
Liquid Treatment Upgrade Alternatives

FINAL

April 2014

720 SOUTHWEST WASHINGTON STREET, SUITE 550 • PORTLAND, OREGON 97205-3507 • (503) 227-1885 • FAX (503) 227-1747

City of Grants Pass

TECHNICAL MEMORANDUM NO. 7

Water Restoration Plant Facility Plan
Liquid Treatment Upgrade Alternatives

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LIQUID TREATMENT UPGRADE ALTERNATIVES

1.0 BACKGROUND

Technical Memorandum No. 5 developed an analysis of the capacity of major unit processes in the liquid stream of the Grants Pass Water Restoration Plant (WRP). Table 1 presents a summary of capacity evaluations for each unit process in the liquid stream. For each unit process, the table shows a capacity criterion and values for that criterion under three different conditions: rated process capacity, current condition, and future (2035) condition. The last three columns indicate the adequacy of process capacity under current and future loading conditions and the estimated adequacy based on unit process condition.

The capacity analysis indicated that the headworks, primary clarifiers, and secondary treatment system have insufficient capacity at PHF for hydraulic criteria, process criteria, or both at this time. The primary sedimentation tanks are also out of capacity for max month wet weather (MMWWF) overflow rates. The activated sludge aeration tanks (AT) are currently out of capacity for average dry weather flow (ADWF) conditions with one aeration tank out of service (OOS) and for max month dry weather flows (MMDWF) in full nitrification operation. In Table 1, the third to last column indicates the adequacy of each unit process under loading conditions predicted for the year 2035. This shows that the headworks, primary sedimentation tanks, activated sludge system, and secondary clarifiers have capacity deficiencies under 2035 loading conditions. The second to last column indicates the estimated year when a capacity deficiency would take place. The last column shows estimated 2035 condition and indicates that several additional facilities may require upgrades due to condition issues that impact reliability.

Based on either capacity or condition deficiencies, the following unit processes require some kind of upgrade:

- Screenings compaction system.
- Primary sedimentation tanks.
- Grit removal system.
- Activated sludge system.
- UV disinfection system.

Alternatives for upgrading these unit processes are evaluated in this memorandum.

Table 1 Liquid Stream Capacity Summary
City of Grants Pass – Liquid Treatment Upgrade Alternatives

Unit Process	Capacity Criterion	Unit	Rated Capacity	Current Flow	2035 Flow	Adequate Current Capacity?	Adequate 2035 Capacity?	Estimated Year Capacity Exceeded	Adequate Current Condition	Adequate 2035 Condition?
Raw Sewage Pumps	PHF (Firm)	mgd	44.0	27.2	33.9	Yes	Yes	After 2035	Yes	Yes
Screening System	PHF (Firm)	mgd	34.0	27.2	33.9	Yes	Yes	After 2035	Yes	Yes
Screenings Compaction	PHF	cf/hr	25	14	17	Yes	Yes	After 2035	No	No
Screening Effluent Channel	PHF	mgd	18.5	27.2	33.9	No	No	Exceeded Now	No	No
Primary Sedimentation Tanks	MMWWF Overflow Rate	gpd/sf	2,000	2,218	3,338	No	No	Exceeded Now	Yes	Yes
Primary Sedimentation Tanks	PHF Overflow Rate	gpd/sf	4,000	5,860	7,300	No	No	Exceeded Now	Yes	Yes
Primary Sedimentation Tanks	PHF Hydraulic Capacity	mgd	18.5	27.2	33.9	No	No	Exceeded Now	No	No
Grit Removal System	Flow Capacity	gpm	220	143	178	Yes	Yes	After 2035	No	No
Activated Sludge System	ADWF One AT OOS	mgd	5.0	5.2	8.0	No	No	Exceeded Now	No	No
Activated Sludge System	ADWF One SC OOS	mgd	6.2	5.2	8	Yes	No	Approximately 2020	No	No
Activated Sludge System	MMDWF Partial Nitrification	mgd	7.0	6.3	9.7	Yes	No	2017	No	No
Activated Sludge System	MMWWF Secondary Treatment	mgd	11.0	10.3	15.5	Yes	No	2018	No	No
Activated Sludge System	PHF Contact Stabilization, Overflow Rate	gpd/sf	1,250	1,631	2,032	No	No	Exceeded Now	No	No
Activated Sludge System	MMDWF Full Nitrification	mgd	3.5	6.3	9.7	No	No	Exceeded Now	No	No
Activated Sludge Blowers	MMDWF Demand (Partial Nitrification)	cfm	8000	4,800	7,000	Yes	Yes	After 2035	Yes	No
Activated Sludge Blowers	MMDWF Demand (Full Nitrification)	cfm	8000	4,000	5,800	Yes	Yes	After 2035	Yes	No
Secondary Clarification	PHF Hydraulic Capacity	mgd	20.8	27.2	33.9	No	No	Exceeded Now	Yes	No
Ultraviolet Disinfection System	PHF (Firm)	mgd	35	27.2	33.9	Yes	Yes	After 2035	No	No

2.0 UPGRADE ALTERNATIVES

Upgrade alternatives were discussed in a workshop conducted in March 2013. The following analysis and conclusions were presented.

2.1 Screening Facilities

During peak hour flows, there is inadequate hydraulic capacity in the screenings effluent channel to pass all of the influent raw sewage (RS) to the primary sedimentation tanks. Once flow passes through the screens, it must pass through the two openings in the wall separating the primary clarifier influent channel from the screenings effluent channel. The openings create a sudden contraction in the channel, with a downstream width of only 12-inches per opening, which limits flow to 18.5 mgd. In order to meet PHF for 2035, hydraulic improvements including widening the existing openings and removing the knockouts for the future expansion will be required. The estimated construction cost for this project, including engineering, legal, and administration (ELA) costs, is $112,000.

While the capacity of the screenings compaction system appears to be adequate for anticipated 2035 loadings, the existing unit has failed on multiple occasions and the fact that there is only one unit places stress on operations staff during an equipment outage. As a result, it is recommended that replacement alternatives be considered. Table 2 presents the estimated cost for replacement of a single washer/compactor and the estimated cost with purchase of an uninstalled spare. The table shows the estimated equipment replacement cost, the estimated cost for construction by a contractor, and the total estimated project cost including an allowance of 20 percent for engineering, legal, and administration (ELA) costs.

Table 2 Cost Comparison for Screenings Compactor Replacement Alternatives
City of Grants Pass – Liquid Treatment Upgrade Alternatives

Cost Element	Single Washer/Compactor	Washer/Compactor with Uninstalled Spare
Equipment Cost	$88,000	$176,400
Estimated Construction Cost	$188,000	$333,400
Project Cost with ELA	$226,000	$400,300

The City purchased a new screenings compactor in 2013.

2.2 Primary Sedimentation Tanks

Technical Memorandum No. 5 presented the analysis of the primary sedimentation system, which concluded that short-term improvements are required to upgrade the capacity of the system. Under current PHF conditions up to 9 mgd of RS, some of which may be unscreened, must bypass the primary clarifiers. Alternatives considered for upgrade included:

- Construction of additional rectangular primary tanks.
- Construction of alternative sludge storage and rehabilitation of the existing circular sedimentation tank.
- Construction of a parallel high rate sedimentation system.

2.2.1 New Rectangular Sedimentation Tanks

Figure 1 illustrates a potential location for construction of additional primary sedimentation tanks. Construction of one new rectangular tank of the same dimensions as one of the existing tanks would increase PHF hydraulic capacity to approximately 28 mgd, which is sufficient for current peak hourly flows.

A second rectangular clarifier provides capacity to treat 2035 PHF flows at 3650 gpd/sf and well exceeds the capacity requirement for MMWWF. With all four tanks in service, the mean removal rates for total suspended solids (TSS) are greater than 45% for MMWWF and greater than 25% for PHF. Capacity analysis for the activated sludge process in Technical Memorandum (TM) No. 5 was based on construction of two new primary tanks.

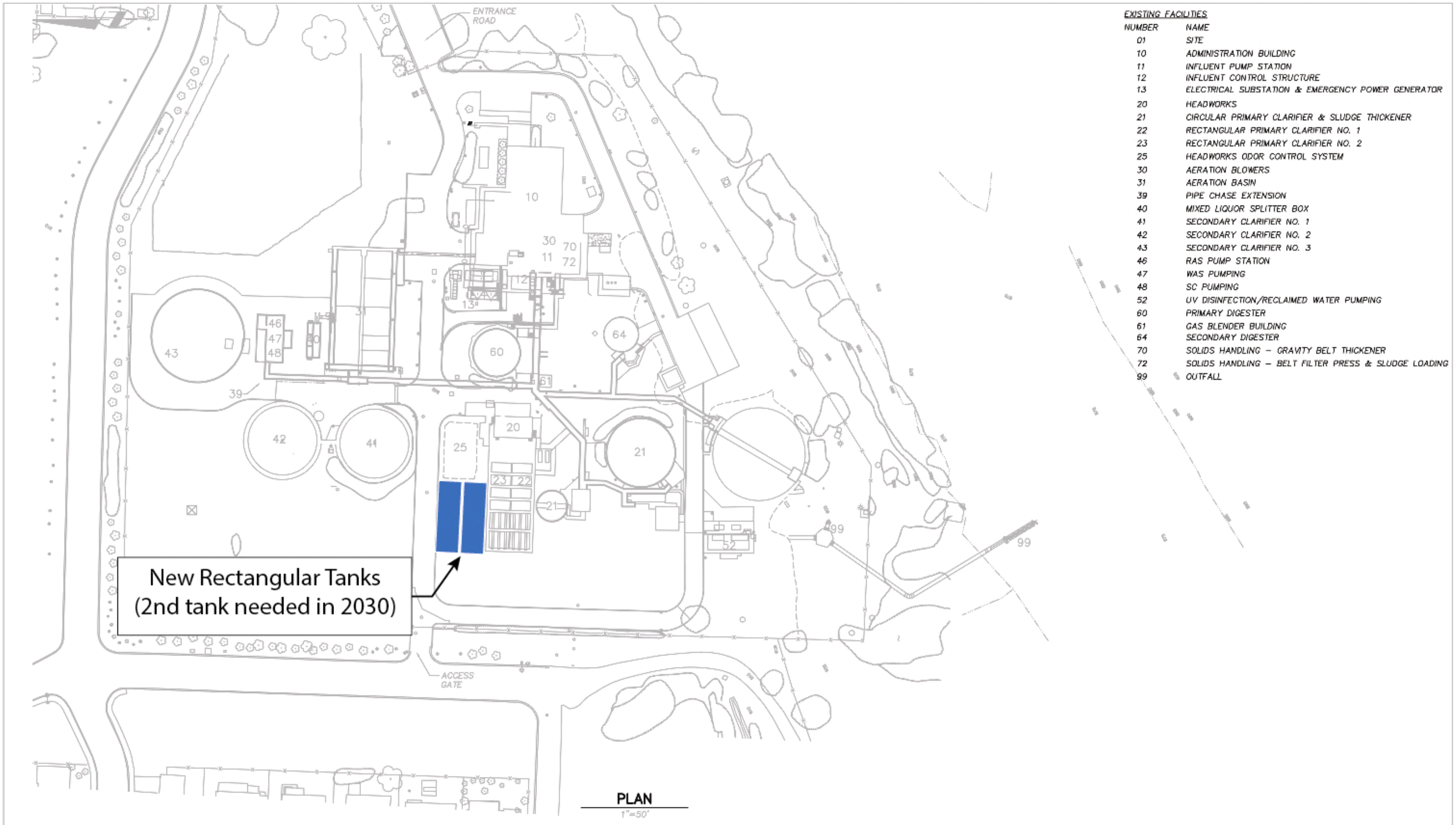
2.2.2 New Sludge Storage Tanks

The existing circular sedimentation tank is currently being used for sludge storage. While this tank dates from the 1950's and would require significant refurbishment, returning this tank to sedimentation service is a potentially viable alternative for correction of current capacity deficiencies in primary sedimentation. One additional barrier to returning this tank to service is that during high flows water overflows into the basin from the secondary treatment system. In this case, a new tank would be constructed for sludge storage. Figure 2 presents a possible location for a new sludge storage tank. It was assumed that a new 50-ft diameter, 25-ft depth storage tank would be constructed with approximately the same storage time as the existing 75-ft diameter, 12.5-ft depth clarifier tank.

2.2.3 New High Rate Sedimentation Tanks

An alternative primary sedimentation system to conventional gravity sedimentation uses "ballast" to increase settling rates with resulting decrease in required sedimentation area. The 2001 *Facilities Plan Update* (Parametrix 2001) recommended upgrade of the Grants Pass WRP by construction of new high rate sedimentation tanks to reduce loadings on the activated sludge system. High rate sedimentation could also provide hydraulic relief of existing rectangular primary sedimentation tanks, which with withdrawal of the older circular tank from service, are near to overloaded under currently experienced flows.

There are several kinds of high rate sedimentation products on sale in the current marketplace. The two common kinds include the Actiflo™ process manufactured by Veolia in France and marketed by Krüger in the United States and the Densadeg™ process manufactured by Degremont. The Actiflo™ process uses sand as ballast, which is recovered in cyclone separators. The process uses chemical treatment with iron or aluminum salts and organic polymers to stabilize sludge particles and entrain finer particles into the sludge floc. A schematic diagram of the Actiflo™ process provided by Veolia is shown in Figure 3. The Densadeg™ process recirculates primary sludge to provide the ballast to increase sedimentation rates. The Densadeg™ process typically operates at up to five times lower overflow rate than the Actiflo™ process. Therefore, for this project, we received a proposal from Krüger for an Actiflo™ process to operate in place of new gravity sedimentation tanks. A potential location for the new high rate sedimentation (HRS) process on the Grants Pass WRP site is illustrated in Figure 4.



POTENTIAL LOCATION FOR NEW PRIMARY SEDIMENTATION TANKS

FIGURE 1

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WATER RESTORATION PLANT FACILITY PLAN

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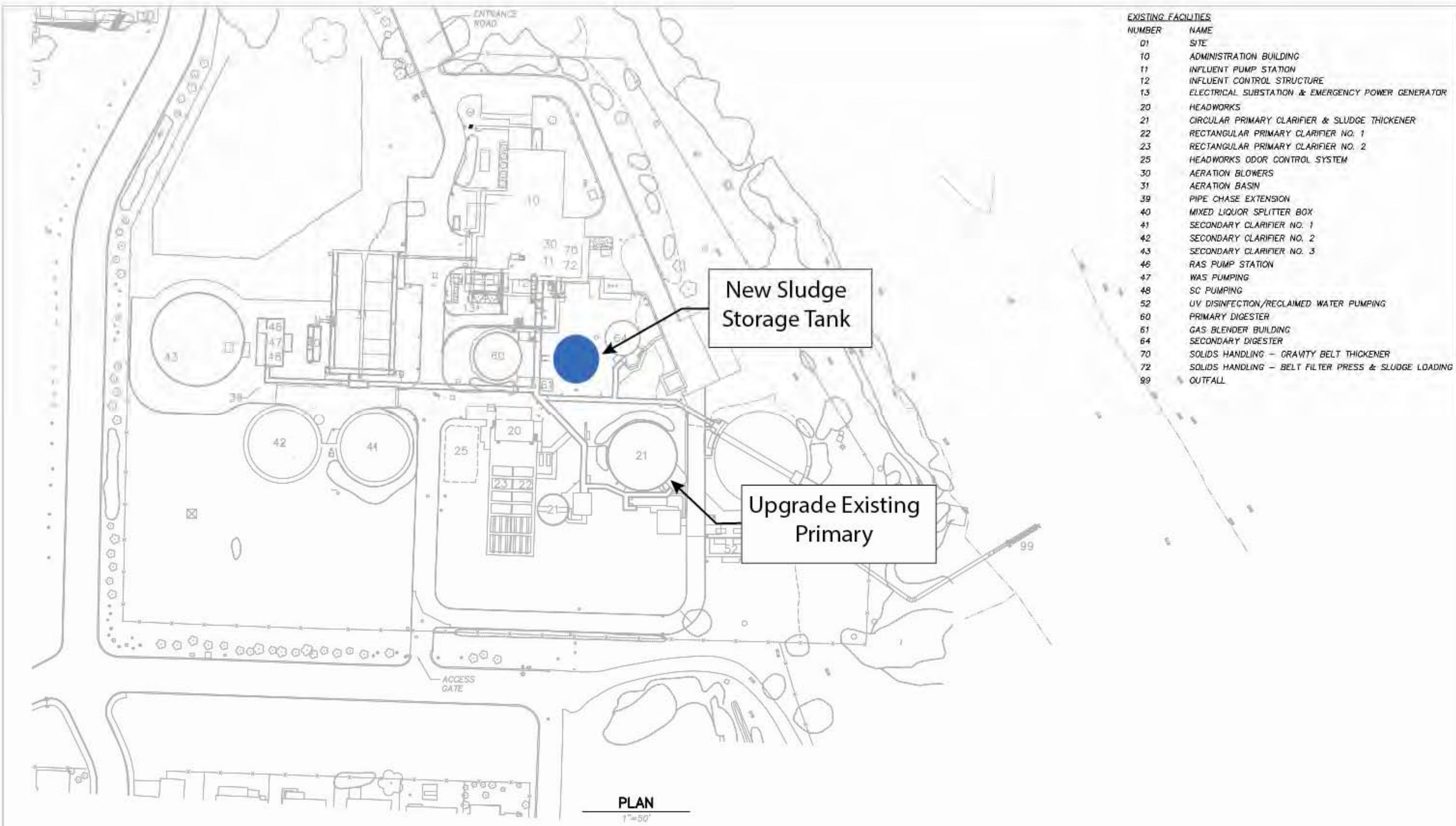
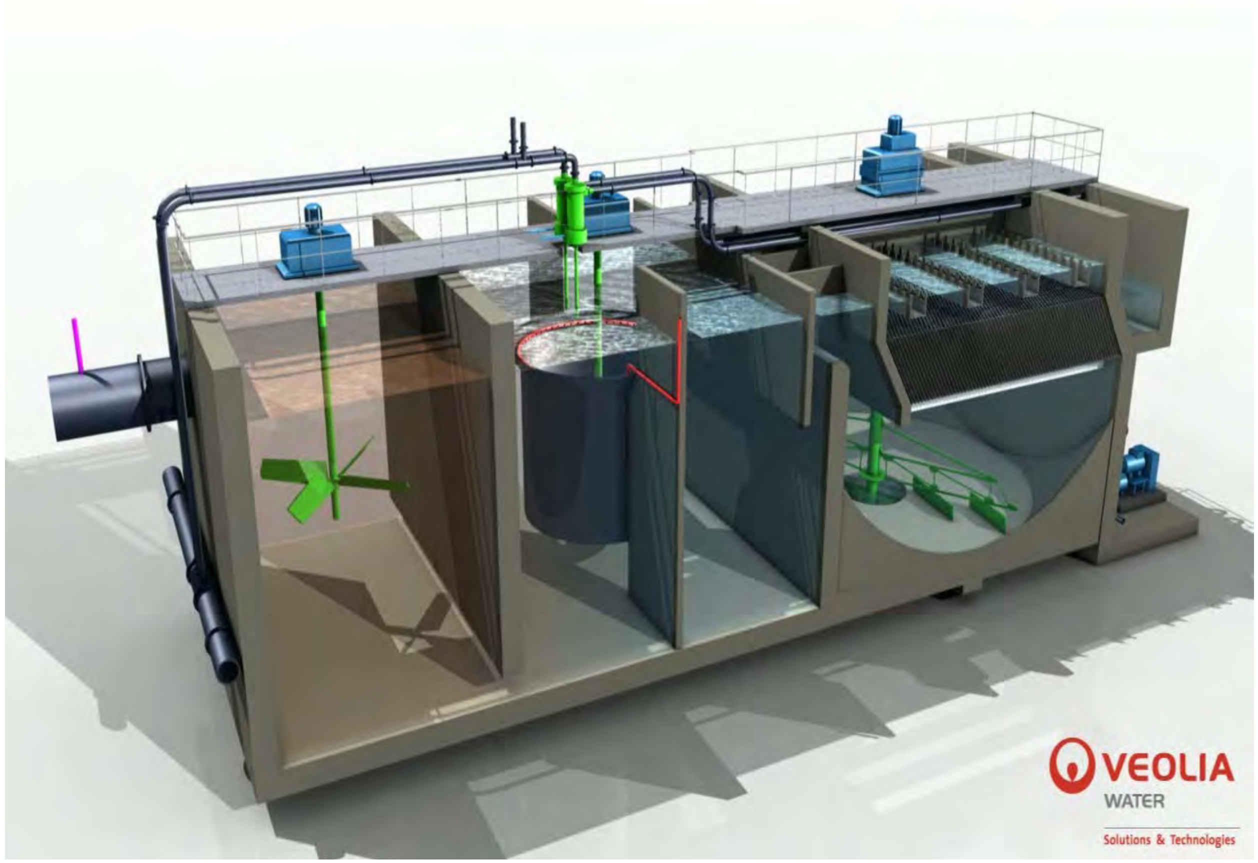


POTENTIAL LOCATION FOR NEW SLUDGE STORAGE TANK

FIGURE 2

CITY OF GRANTS PASS
WATER RESTORATION PLANT FACILITY PLAN



SCHEMATIC DIAGRAM OF THE ACTIFLO™ PROCESS

FIGURE 3

CITY OF GRANTS PASS
WATER RESTORATION PLANT FACILITY PLAN

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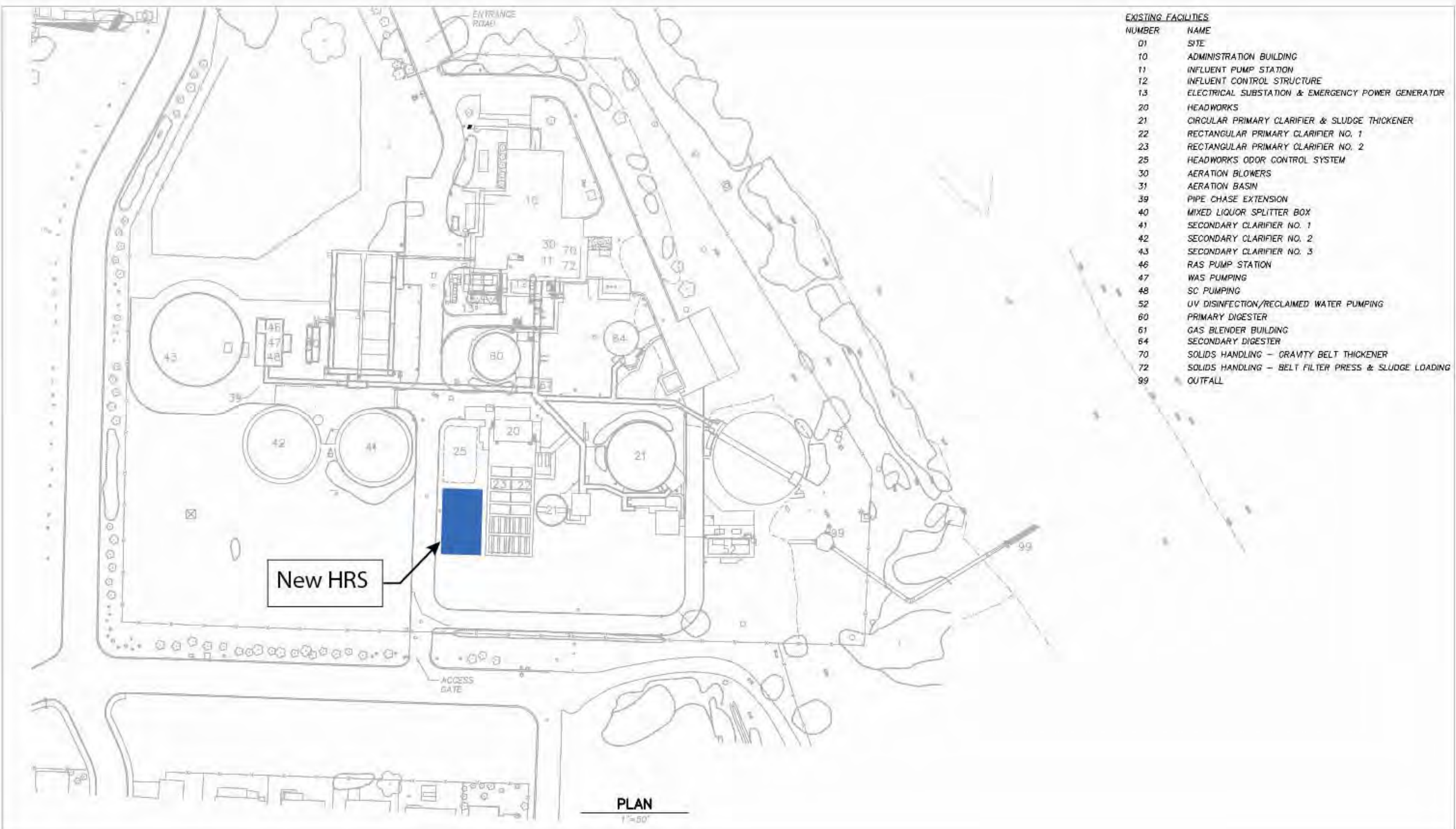

POTENTIAL LOCATION FOR NEW ACTIFLO™ PROCESS

FIGURE 4

CITY OF GRANTS PASS
WATER RESTORATION PLANT FACILITY PLAN

2.2.4 Primary Sedimentation Alternatives Comparison

Table 3 presents a comparison of costs for the alternative primary sedimentation alternatives. Installation of two new rectangular primary sedimentation tanks would have a lower capital, operating, and present worth cost than the alternatives. This comparison does not capture the reduction in solids and BOD loading to the secondary treatment process for an Actiflo™. This will be considered further when we evaluate activated sludge system upgrade alternatives.

Table 3 Cost Comparison for Primary Treatment Upgrade Alternatives
City of Grants Pass – Liquid Treatment Upgrade Alternatives

Cost Element	New Primary Tanks	Sludge Holding Tank	New Actiflo™
Capital Cost ($ Million)	$4.52	$5.10	$9.97
Chemical Cost ($/year)	N/A	N/A	$82,000
Total Present Worth Cost ($ Million)	$4.72	$5.30	$11.19

As a way to consider factors in addition to cost in selection of process alternatives, we have prepared a selection criteria-ranking system. The basis for this system is illustrated in Figure 5.

A total of 10 ranking criteria were identified, including 8 criteria not based on cost. For criteria where a quantitative value can be assigned to the alternative, a ranking of 3 was given to the best alternative, a ranking of 2 for the alternative that had a quantitative value less than 1.5 times the lowest alternative, and a value of 1 for alternatives greater than 1.5 times the value of the lowest alternative. The ranking of qualitative criteria is explained in the table. For example, the process that produced the best effluent quality is given a ranking of 3, the process that would be expected to produce the worst effluent quality is given a ranking of 1, and a process with an intermediate effluent quality is given a ranking of 2.

Figure 6 presents the resulting un-weighted scoring for the primary treatment alternatives. The highest ranked alternative is to provide new rectangular primary sedimentation tanks.

Criterion	Criterion Ranking Explanation		
	Worst	**Intermediate**	**Best**
Capital Cost	>1.5 * Lowest = 1	< 1.5 * Lowest = 2	Lowest = 3
O&M Cost, PW	> 1.5 * Lowest = 1	<1.5 * Lowest = 2	Lowest = 3
Risk	Few worldwide installation; New technology = 1	Intermediate level of success.	Several local and large number of successful worldwide installations = 3
Future Flexibility	No room for future	Intermediate	Ample room for future
Footprint, sf	> 1.5 * Lowest = 1	< 1.5 * Lowest = 2	Lowest = 3
Energy, kWh/year	> 1.5 * Lowest = 1	< 1.5 * Lowest = 2	Lowest = 3
Odor	Most odor prone	Intermediate	Least odor prone
Compatibility with existing processes	Most stranded assets = 1	Intermediate = 2	Least stranded assets = 3
Biosolids Quality/Quantity	Least suitable for composting	Intermediate = 2	Most suitable for composting = 3
Effluent Quality	Worst Effluent Quality = 1	Intermediate = 2	Best Effluent Quality = 3

Figure 5 Alternatives Ranking Criteria

Criterion	Weight	Weighted Ranking		
		New Primary Tanks	Sludge Holding Tank	New Actiflo
Capital Cost	1	3	1	1
O&M Cost	1	3	3	1
Risk	1	3	3	1
Future Flexibility	1	2	2	2
Footprint	1	1	1	3
Energy	1	3	3	2
Odor	1	2	2	2
Compatibility with existing processes	1	3	3	2
Biosolids Quality / Quantity	1	2	2	1
Effluent Quality	1	2	2	3
Total		**24**	**22**	**18**

Legend:	Score
Highest Ranking	3
Intermediate Ranking	2
Lowest Ranking	1

Figure 6 Alternatives Ranking for Primary Treatment Alternatives

2.3 Grit Removal System

The grit removal system for the Grants Pass WRP uses cyclones and grit washers to remove grit particles from primary sludge flows. This system has been in place since 1996 and will require replacement due to deficient condition at some time during the planning period. The alternative to primary sludge de-gritting would require construction of a de-gritting tank for the entire liquid stream process flow. Whatever system that could be used for grit removal of the entire flow stream, head losses would be in excess of 3 feet, which would probably require intermediate pumping or significant modification of the influent pumping system. For this reason, this kind of upgrade was not considered further. The least-cost alternative is replacement of existing primary sludge pumps, grit cyclone and grit washer with new equipment. A cost estimate for these replacement projects is presented in Table 4. They are shown as separate projects for grit pump replacement and grit cyclone and washer replacement because Grants Pass may wish to implement them separately.

Table 4 Cost Comparison for Grit Removal Equipment Replacement Alternatives *City of Grants Pass – Liquid Treatment Upgrade Alternatives*		
Cost Element	**3 Grit Pumps**	**Cyclone and Washer**
Equipment Cost	$113,000	$119,000
Construction Cost	$241,000	$255,000
Project Cost with ELA	$289,000	$306,000

2.4 Activated Sludge System

As discussed in TM No. 5, the activated sludge system must be evaluated as a complete system, including both aeration and sedimentation (clarifier) tanks. This capacity analysis in TM No. 5 concluded that the activated sludge system is near to full capacity under current loadings. The Department of Environmental Quality (DEQ) imposed new effluent quality requirements for ammonia at Grants Pass in 2009. To increase removal of ammonia (nitrification) the activated sludge system has been operated with a higher solids residence time (SRT). This increase in SRT results in a decrease in activated sludge capacity, since it must be implemented by increasing mixed liquor suspended solids (MLSS) concentrations, which in turn reduces the flow that can be accommodated by the secondary clarifiers.

A series of potential upgrade alternatives were identified in a workshop with Grants Pass staff in January 2013. These included:

- Improved settleability.
- Chemically enhanced primary treatment (CEPT) or Actiflo™.
- Increase aeration tank volume.
- Increase clarifier area.
- BioMag™.
- Integrated fixed film activated sludge (IFAS).
- Parallel membrane bioreactors (MBR).

Analysis of each of these potential upgrade strategies is provided below.

2.4.1 Improved Settleability

TM No. 5 showed that settleability of the activated sludge system at the Grants Pass WRP has been variable. Sludge volume index (SVI) is a commonly used operational test for sludge settleability. This test is an indicator of how well activated sludge settles in the secondary clarifiers. The SVI test measures the volume of settled activated sludge in a 1,000-milliliter (mL) container after a 30 minute settling time. This value is then divided by the MLSS concentration and multiplied by 1,000 to calculate the SVI value. A high value for SVI indicates relatively poorly settling sludge.

A low value for SVI indicates a relatively well settling sludge. SVI values for the Grants Pass WRP over the last five years have varied from under 100 mL/g to over 400 mL/g. The average SVI in the summer season has been approximately 150 mL/g, and the average SVI in the wet weather season has been approximately 170 mL/g. Activated sludge systems with anaerobic selector zones, like the system at the Grants Pass WRP, often experience SVI values under 120 mL/g. Thus, there is potential for improvement of WRP capacity by optimizing sludge settleability.

To identify potential capacity improvements from settleability improvement, we considered what improvement in capacity would result if the SVI could be lowered to 120 mL/g from the current average of 150 mL/g during the partial nitrification season. This result is shown in Figure 7. Reduction in SVI increases the partial nitrification capacity only modestly, from estimated MMDWF capacity of approximately 7 mgd with an SVI of 150 mL/g to approximately 8 mgd with an SVI of 120 mL/g. This degree of capacity improvement would be insufficient to accommodate the 2035 MMDWF 9.4 mgd. As a result, this alternative is rejected as a long-term capacity solution, although settleability improvement could improve the ability of the operators of the WRP to take one aeration tank out of service for membrane diffuser inspection and cleaning during the partial nitrification season.

2.4.2 Chemically Enhanced Primary Treatment (CEPT) or Actiflo™

Actiflo™ was considered as an alternative primary sedimentation upgrade strategy above, but the influence of improved primary sedimentation performance on activated sludge system capacity was not considered there. By improving primary sedimentation capture of suspended solids, chemically enhanced primary treatment (CEPT) increases the relative capacity of the activated sludge system. Either conventional CEPT or Actiflo™ operates on the same principle of chemically coagulating sludge particles and enhancing separation. Carollo used its steady state process model Biotran to estimate the degree of enhancement that would take place with CEPT. The model indicated a modest reduction in influent BOD concentration during MMDWF from approximately 140 mg/l with conventional sedimentation compared to 123 mg/l with CEPT. Concentrations for TSS removal were respectively 104 mg/L for conventional versus 90 mg/L for CEPT. This represents a removal rate increase from 30 percent to 39 percent for BOD and from 46 percent to 53 percent for TSS. As shown in Figure 8, this produces a modest increase in activated sludge capacity to approximately 8 mgd from the capacity of 7 mgd with conventional sedimentation. For MMWWF conditions, the predicted improvement in primary effluent concentration for BOD was from 72 mg/L to 67 mg/L for BOD and from 67 mg/l to 63 mg/l for TSS. This corresponds to a removal rate increase from 22 percent to 28 percent for BOD and from 33 percent to 38 percent for TSS. As shown in Figure 9, this produces a modest increase in activated sludge system capacity to no more than 12 mgd compared to 11 mgd for conventional primary sedimentation. As shown in Figure 10, CEPT plus addition of one aeration tank would increase capacity of the WRP to approximately 14 mgd during MMWWF. We used a proposal received from Krüger to estimate capital and operating costs for a CEPT / Actiflo™ alternative assuming only one new aeration tank would be required.

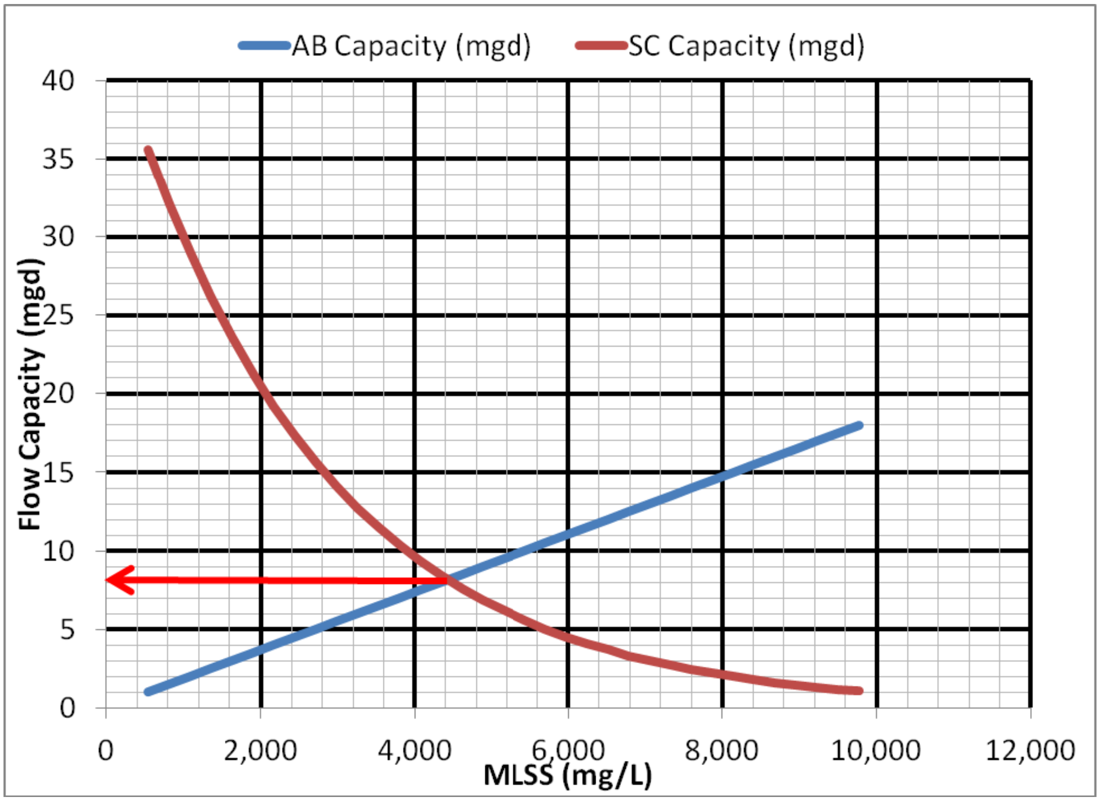

Figure 7 **MMDWF Capacity by Reduction of SVI to 120 mL/g**

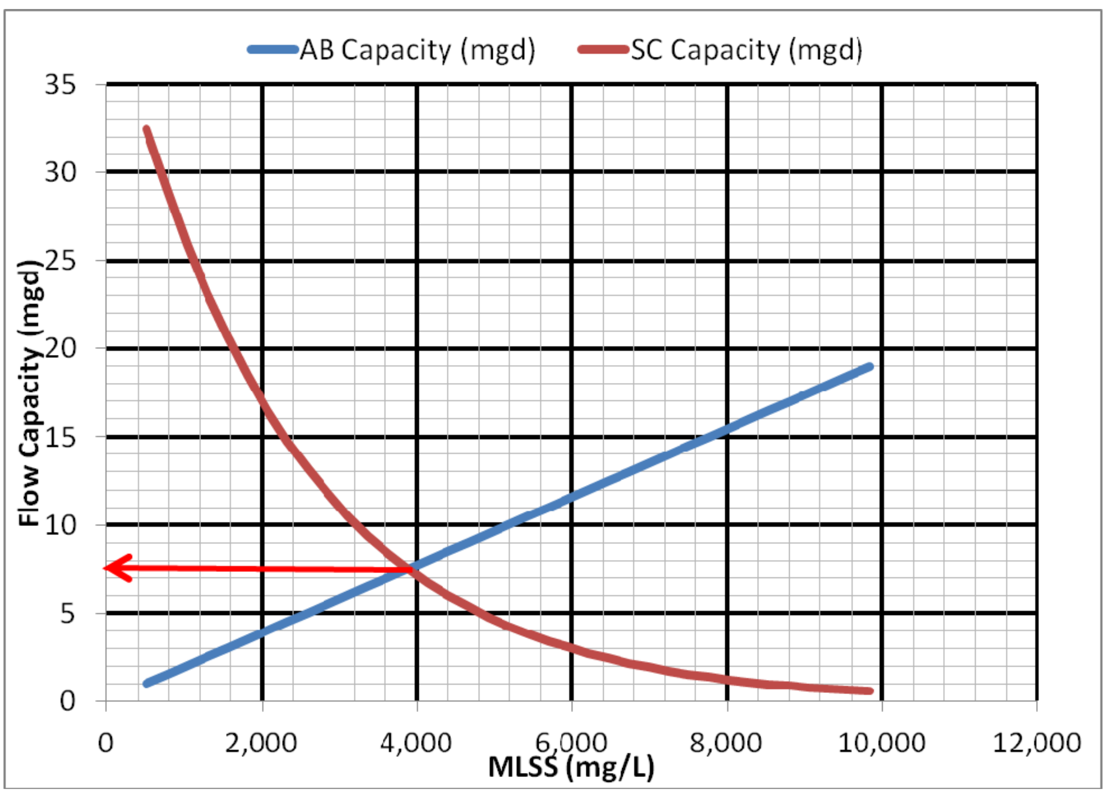

Figure 8 **MMDWF Capacity of CEPT**

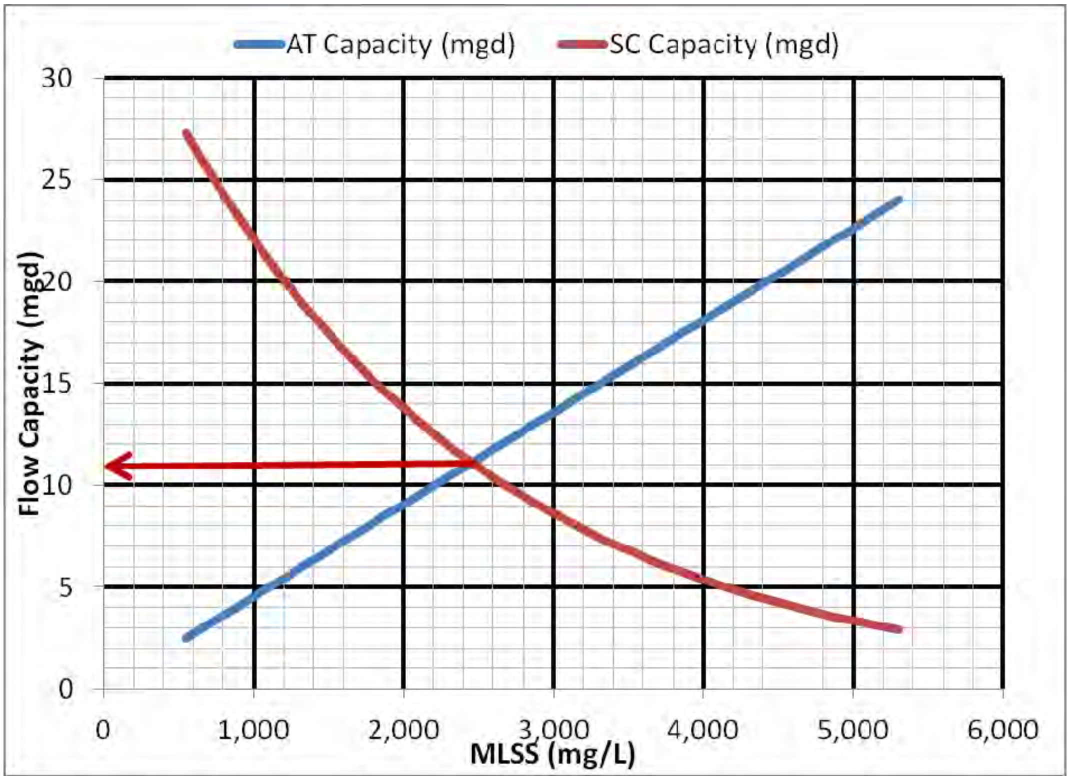

Figure 9 **MMWWF Capacity of CEPT**

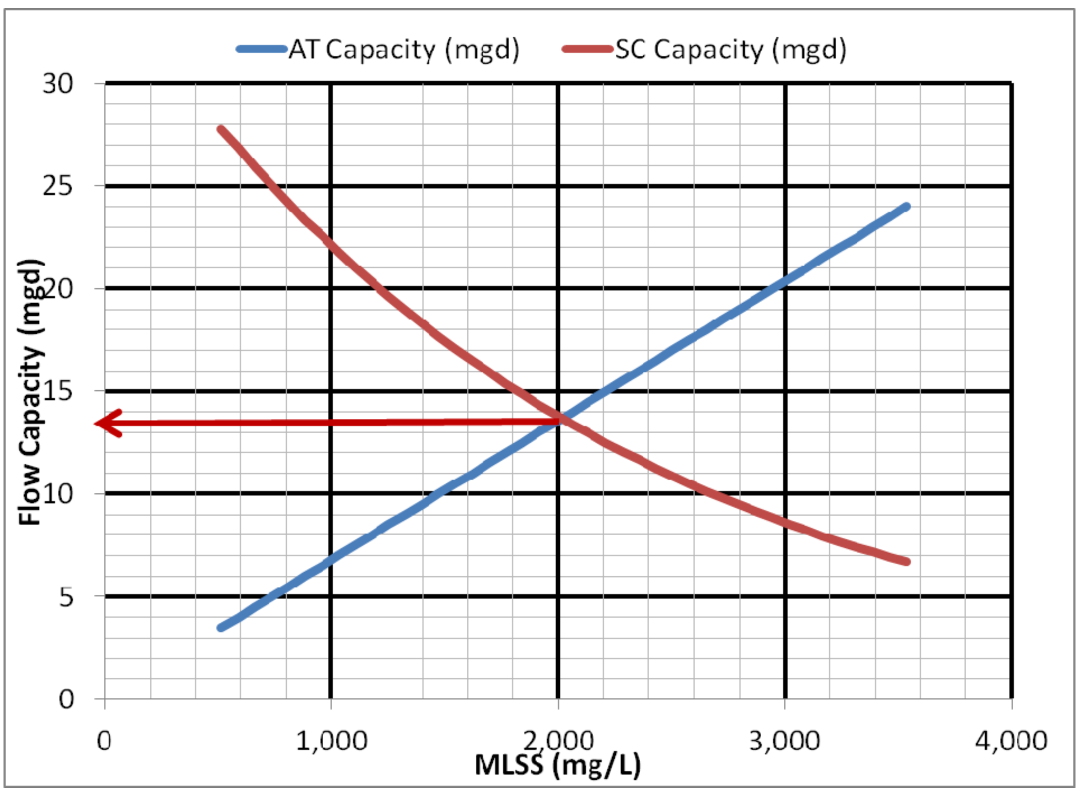

Figure 10 **MMWWF Capacity of CEPT with Addition of One Aeration Tank**

2.4.3 Increase Aeration Tank Volume

A conventional strategy for upgrade of the WRP for Grants Pass would be to add additional aeration tank volume. Figures 11 and 12 indicate that by doubling the current aeration tank volume without increasing sedimentation tank area, the MMDWF capacity would be increased from 7 mgd to approximately 10 mgd and the MMWWF capacity would be increased from approximately 11 mgd currently to approximately 15 mgd. This would approximately satisfy capacity needs for 2035. Figure 13 presents a potential site location for two new aeration tanks.

2.4.4 Increase Clarifier Area

An alternative strategy for increasing the capacity of the activated sludge process would be to increase the secondary clarifier area. Figure 14 shows the impact on WRP capacity of doubling the secondary clarifier area, instead of doubling the aeration tank volume. The figure shows the impact on capacity for the partial nitrification season at MMDWF. The figure shows that increasing secondary clarifier tank area would increase capacity from approximately 7 mgd to approximately 9 mgd, but to do so would require operation with a MLSS concentration of almost 5,000 mg/L. Such a high MLSS concentration would be well outside the normal range of 2,000 to 4,000 mg/L. Additional clarifier area alone will not significantly increase the capacity of the activated sludge system. Upgrades to aeration tank volume and clarifier area should be considered in tandem because capacity of the two processes is inherently related.

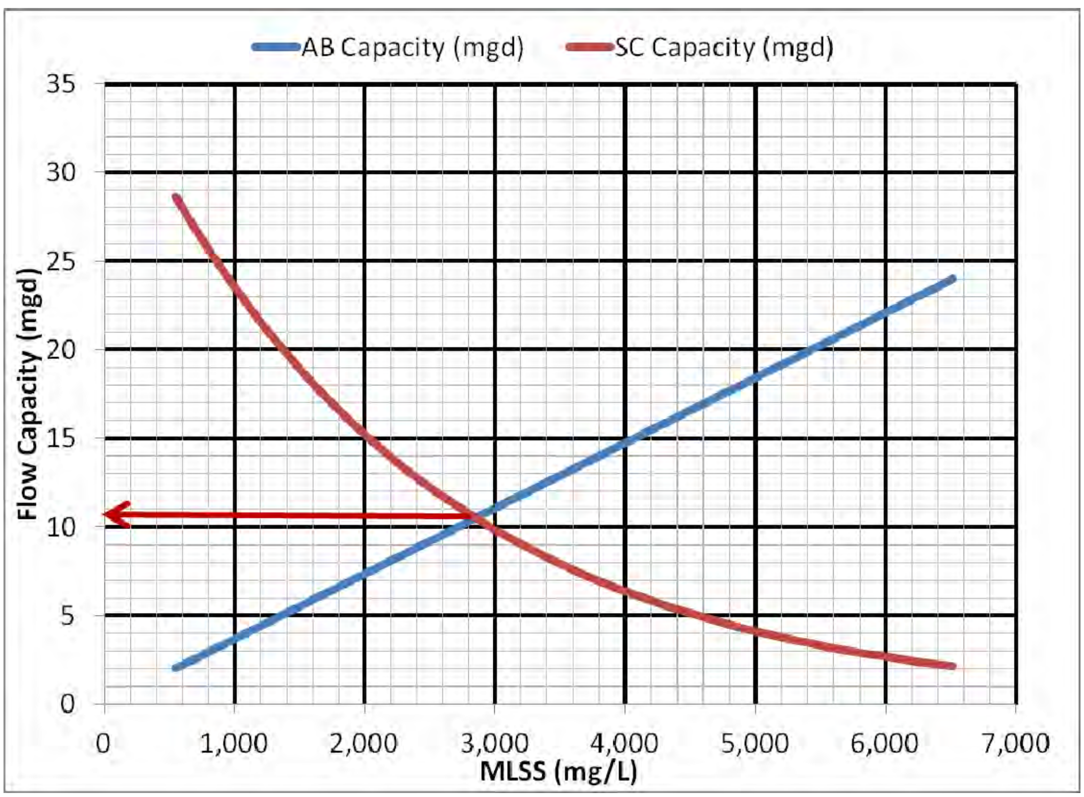

Figure 11 MMDWF Capacity of Addition of Two Aeration Tanks

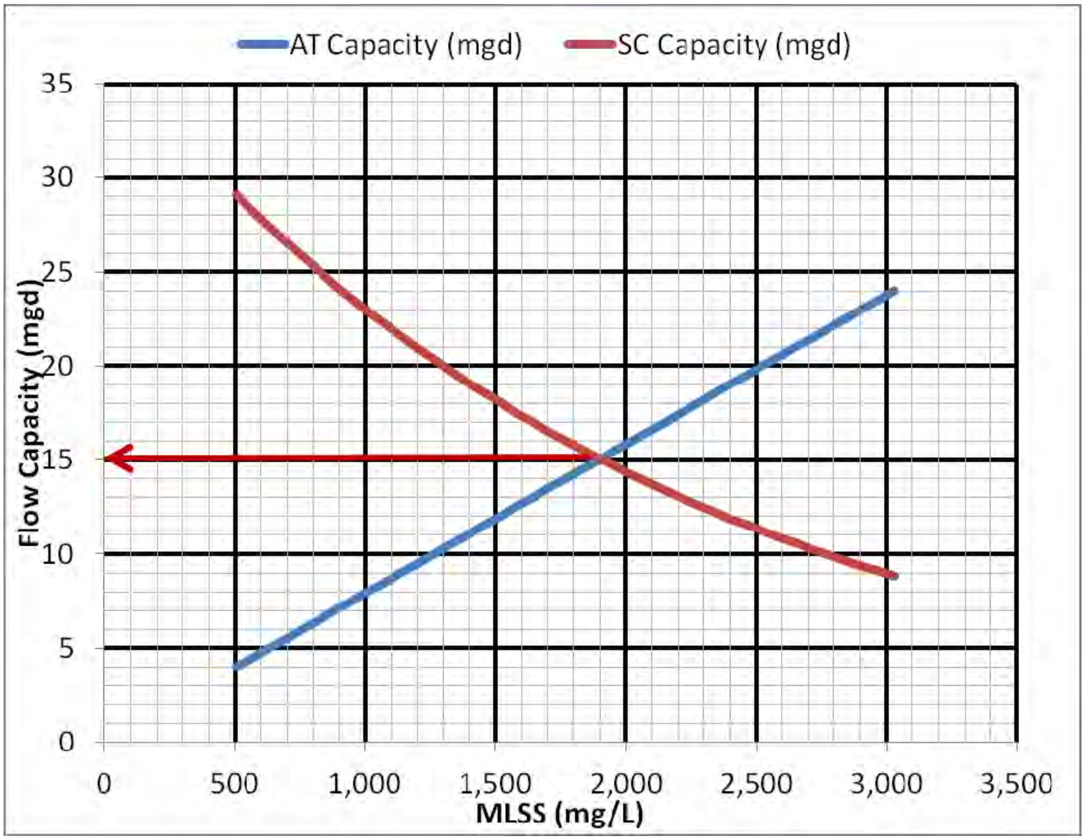

Figure 12 MMWWF Capacity of Addition of Two Aeration Tanks

POTENTIAL LOCATION FOR TWO NEW AERATION TANKS

FIGURE 13

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WATER RESTORATION PLANT FACILITY PLAN

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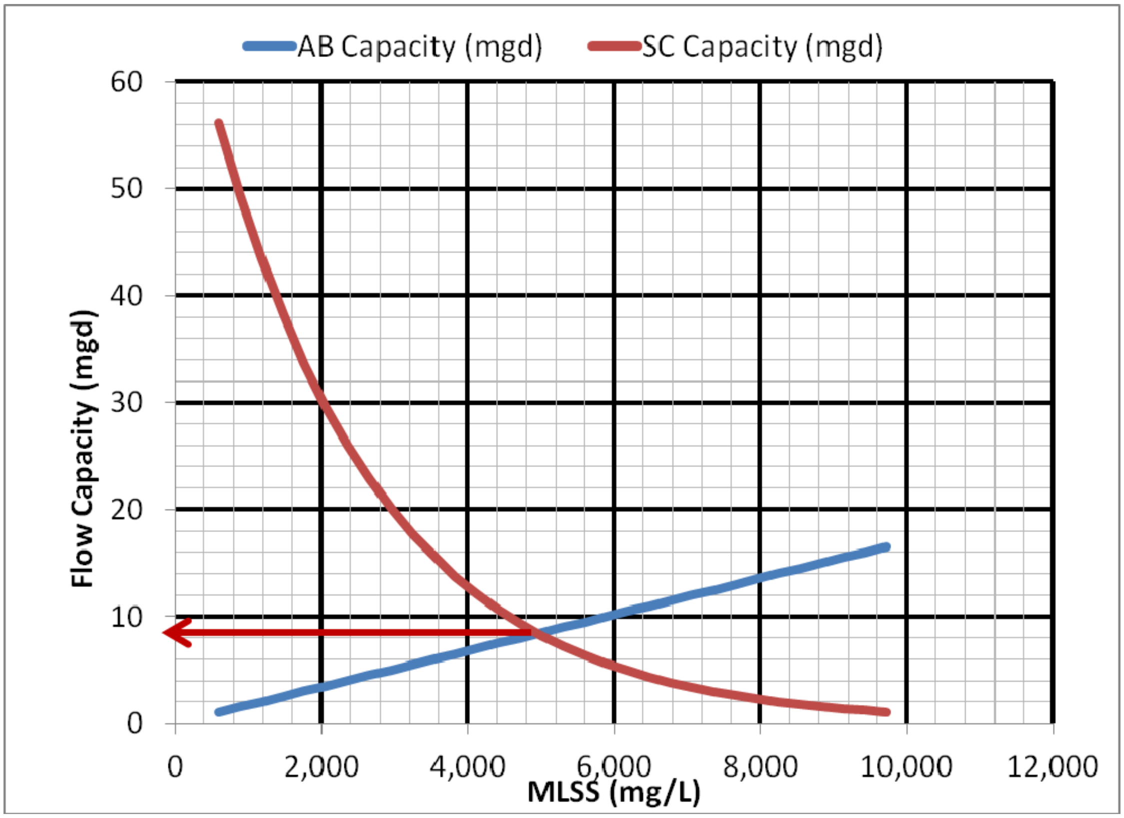
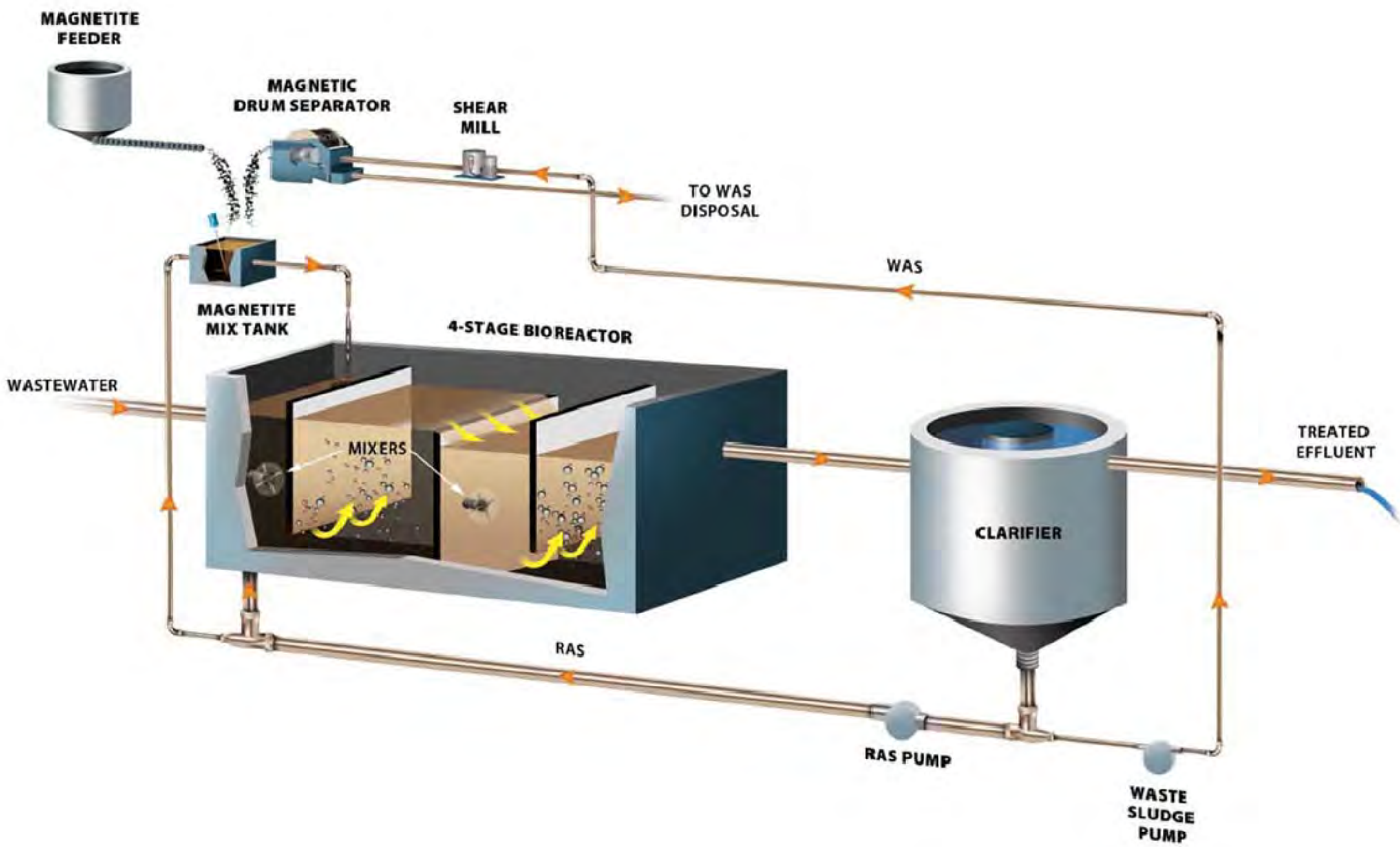


Figure 14 Impact on Capacity of Doubling Secondary Clarifier Area

2.4.5 BioMag™

BioMag™ is a trademarked process to increase the capacity of an activated sludge process by adding a magnetized ballast to the MLSS to produce dramatically higher settling rates. The process was developed by an American company, Cambridge Water Technologies, and recently sold to the large German industrial firm, Siemens. In this process, magnetite is added to the MLSS and removed from the waste activated sludge (WAS) by a magnetic drum separator after passage through a grinder mill to disturb adhesion of sludge particles to the magnetite. After separation, magnetite is returned to the MLSS. A continuous make-up of magnetite is required. This process is illustrated schematically in Figure 15.

We received a proposal from Siemens for this project. Siemens proposed maintaining the same aeration tank volume, but construction of two new 100-foot diameter secondary clarifiers in addition to BioMag equipment. The proposal included supply of ballast storage and feed system, a ballast recovery system, a chemical feed system and control hardware. The quoted price for equipment only was $2,100,000. This did not include installation, buildings to house the new equipment, nor any piping or electrical appurtenances. Since the BioMag™ process increases the capacity of the secondary clarifiers by increasing settling rates, we have assumed that the Siemens proposal to add new secondary clarifiers was a misunderstanding of details about the existing plant, and have ignored this in our cost and other impact comparisons.



SCHEMATIC DIAGRAM FOR THE BIOMAG™ PROCESS
(COURTESY SIEMENS INDUSTRY INC.)

FIGURE 15

CITY OF GRANTS PASS
WATER RESTORATION PLANT FACILITY PLAN

2.4.6 Integrated Fixed Film Activated Sludge (IFAS)

Another potential strategy for upgrade of the Grants Pass WRP would be to add fixed film media to the activated sludge system to increase the inventory of biological organisms without increasing the MLSS concentration loaded to the secondary clarifiers. These systems are called integrated fixed film activated sludge or IFAS systems. Various types of media are commercially available for these systems, including suspended media manufactured as sponges, hard plastic "wagon wheels," or plastic rope or web media fixed into trays that would be mounted on the aeration tank floor. The suspended media typically require relatively coarse bubble mixing, which increases the operating cost of these systems compared to conventional, fine-bubble aeration systems such as the one at the Grants Pass WRP. Fixed media installations have an apparent energy-efficiency advantage; however, there have been very few IFAS media installations in the United States of this type, and another agency's fixed IFAS media failed to meet the manufacturer's promises for improved nitrification. For these reasons, we have evaluated suspended media for Grants Pass, rather than fixed media.

Carollo received a proposal from Krüger for suspended media and equipment to upgrade the Grants Pass WRP. Krüger is owned by the international water technology company Veolia. The Krüger media was developed originally by a Norwegian company, AnoxKaldnes. Krüger proposed to place their K5 media with a unit surface area of 800 m^2/m^3 (243 ft^2/ft^3) in a fill density of 25 percent in one-half of the existing aeration tanks. Krüger calls this process configuration Hybas (for hybrid activated sludge).

Krüger proposed to modify the flow pattern through the tanks to reduce the forward velocity of the flow and reduce media migration. Figure 16 presents a sketch of the configuration that Krüger proposed. Carollo modeled this configuration using the fixed media module in the commercial biological process model BioWin™. We confirmed that this configuration should partially nitrify under 2035 MMDWF conditions. We also confirmed that part of the upstream portion of the aeration tanks could be anaerobic while partially nitrifying at 2035 MMDWF loadings.

The Krüger proposal included media, screens to contain the media in the Hybas reactor, and new "medium bubble (4.0 mm orifice)" stainless steel diffusers. Fine bubble panel diffusers would continue to be used in the upstream portion of the aeration tanks. The quoted price for media and equipment without installation or any other appurtenances was $801,000.

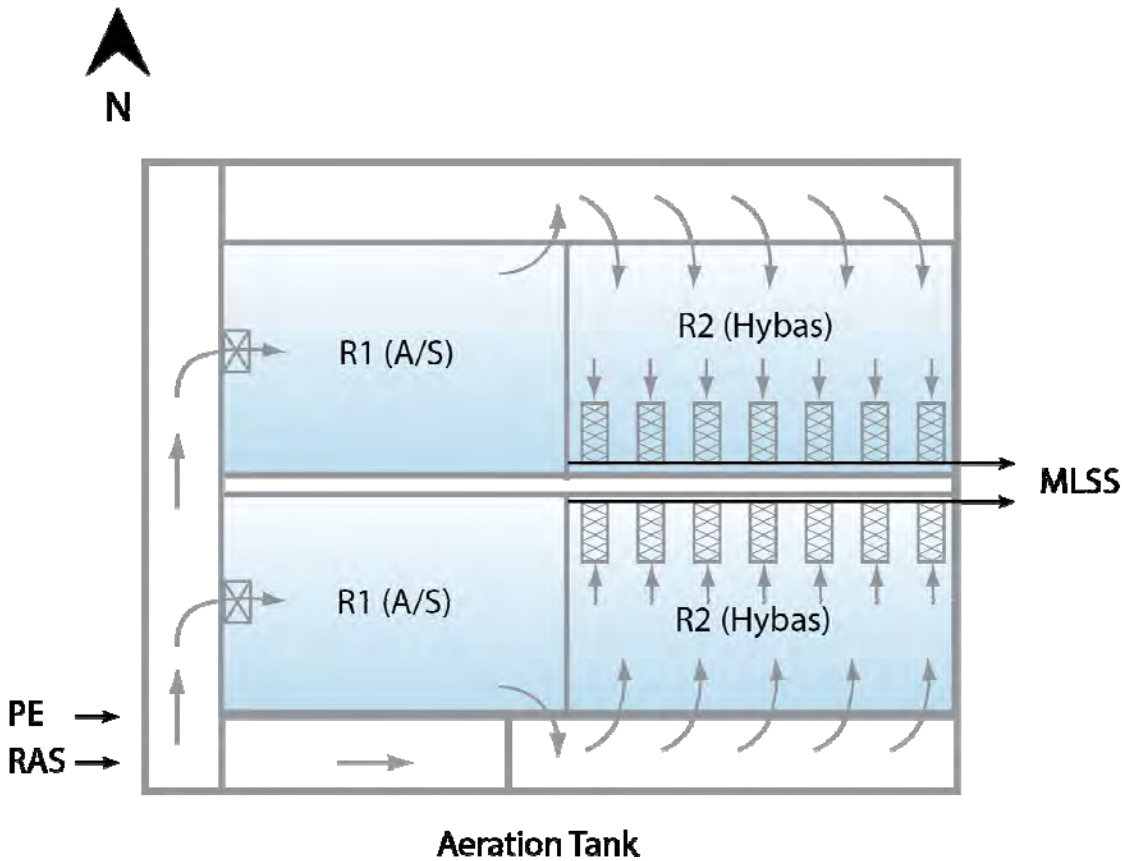


Figure 16 Sketch of Proposed IFAS Installation (Courtesy Krüger)

2.4.7 Parallel membrane bioreactors (MBR)

The last alternative considered for upgrade of the Grants Pass WRP was the membrane bioreactor (MBR) process. This process uses ultrafiltration or microfiltration sized membranes for separation of activated sludge from the MLSS, rather than gravity clarifiers. As a result, the MBR process can operate at relatively high concentrations of MLSS in the range of 6,000 to 10,000 mg/L. Higher concentrations than this result in excessively high aeration costs, because of reduced oxygen transfer efficiency. Membranes can be configured in either pressurized canisters or as hollow core fibers or flat plates suspended in the MBR aeration tank. The typical configuration for activated sludge applications is for hollow core fibers suspended in membrane tanks.

Because of the relatively small footprint of the membrane tanks compared to gravity clarifiers and the reduction in required aeration tank volume because of the higher MLSS concentration, a chief advantage of the MBR process is its relatively small footprint compared to the conventional activated sludge process. To retain the value of existing investment in activated sludge aeration tanks and clarifiers at Grants Pass, it was assumed that the MBR process would be operated as a base-loaded facility in parallel with existing aeration tanks and clarifiers, receiving one half of the flow up to a maximum flow of approximately one half of MMWWF (8 mgd). Figure 17 presents a potential location for new MBR and membrane tanks.

POTENTIAL LOCATION FOR TWO NEW MBR AND MEMBRANE TANKS

FIGURE 17

CITY OF GRANTS PASS
WATER RESTORATION PLANT FACILITY PLAN

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2.4.8 Activated Sludge System Upgrade Comparisons

Cost estimates for activated sludge upgrade alternatives are shown in Table 5. The cost estimates indicate that the capital cost of an upgrade using IFAS equipment would be essentially the same as the cost for construction of two new aeration tanks. The operating costs for power would be greater for the IFAS system, however. The cost estimates indicate that both the BioMag™ and Parallel MBR alternatives would be significantly more expensive than construction of new aeration tanks. Figure 18 presents an un-weighted ranking of these four alternatives in terms of the criteria identified above. Construction of new aeration tanks has the highest ranking in five out of ten categories. IFAS has the highest ranking for future flexibility and footprint. Parallel MBR has the highest ranking for effluent quality. BioMag™ does not score a highest ranking in any category.

Table 5 Cost Comparison of Aeration Tank Upgrade Alternatives
City of Grants Pass – Liquid Treatment Upgrade Alternatives

Cost Element	New Aeration Tanks	New IFAS	New BioMag™	Parallel MBR
Capital Cost ($ Million)	$5.72	$5.75	$11.52	$30.16
Power and Chemical Cost ($/year)	$116,000	$146,000	$169,000	$618,000
Total Present Worth Cost ($ Million)	$7.42	$7.95	$14.02	$39.36

Notes:
1) MBR costs include membrane replacement cost.

Table 6 presents a cost estimate comparison for combined upgrade alternatives for primary and activated sludge process upgrade. This comparison captures the true impact of using CEPT or Actiflo™ as a primary sedimentation upgrade, since it gives credit to the impact of improved primary treatment performance on the secondary system. In this comparison, it is seen that the Actiflo™ alternative is more cost-effective than would be indicated by its ranking in Table 5 and Figure 6, where the impacts on secondary treatment are not included, but that it remains a higher cost alternative compared to construction of new primary and aeration tanks. Figure 19 shows the criteria ranking for these alternatives. The conventional alternative of constructing new primary and aeration tanks has the highest ranking overall and the highest ranking in 5 out of the ten criteria. The MBR has the highest ranking in three criteria: future flexibility, footprint, and effluent quality. The Actiflo™ has the lowest ranking overall and ranks highest in no individual criterion.

Table 6 Cost Comparison of Combined Primary Treatment and Aeration Tank Upgrade Alternatives
City of Grants Pass – Liquid Treatment Upgrade Alternatives

Cost Element	New Primaries and Aeration Tanks	New Actiflo™/ CEPT + One New AT	MBR
Capital Cost ($ Million)	$10.24	$14.59	$30.16
Power and Chemical Cost ($/year)	$136,000	$375,000	$618,000
Total Present Worth Cost ($ Million)	$12.24	$20.19	$39.36

Notes:
1) MBR operational costs include membrane replacement cost.

Criterion	Weight	Weighted Ranking			
		New Aeration Tanks	New IFAS	New BioMag™	Parallel MBR
Capital Cost	1	3	2	1	1
O&M Cost	1	3	2	2	1
Risk	1	3	1	1	2
Future Flexibility	1	1	3	2	2
Footprint	1	1	3	2	2
Energy	1	3	2	2	1
Odor	1	2	2	2	2
Compatibility with existing processes	1	3	2	2	2
Biosolids Quality/Quantity	1	2	2	2	2
Effluent Quality	1	2	2	2	3
Total		**23**	**21**	**18**	**18**

Legend:	Score
Highest Ranking	3
Intermediate Ranking	2
Lowest Ranking	1

Figure 18 Comparison of Selection Criteria for Activated Sludge Upgrade Alternatives

Criterion	Weight	Weighted Ranking		
		New Primaries and Aeration Tanks	New Actiflo™ / CEPT + One New AT	MBR
Capital Cost	1	3	2	1
O&M Cost	1	3	1	1
Risk	1	3	1	2
Future Flexibility	1	1	2	3
Footprint	1	1	2	3
Energy	1	3	2	1
Odor	1	2	2	2
Compatibility with existing processes	1	3	2	2
Biosolids Quality / Quantity	1	2	1	2
Effluent Quality	1	2	2	3
Total		**23**	**17**	**20**

Legend:	Score
Highest Ranking	3
Intermediate Ranking	2
Lowest Ranking	1

Figure 19 Comparison of Selection Criteria for Combined Upgrade Alternatives

2.4.9 Full Nitrification Alternatives

Upgrade alternatives considered so far have been based on the assumption that the existing NPDES permit requirements for partial nitrification will remain in place in the future. The current NPDES permit requirement was based on toxicity analysis for ammonia in the Rogue River. This requires partial nitrification down to a level of 9.6 to 21 mg/L during the summer months. Partial nitrification has several disadvantages compared to full nitrification. Nitrite is not currently monitored at the Grants Pass WRP, but modeling of partial nitrification scenarios for Grants Pass by Carollo indicates the likely presence of nitrite in concentrations as high as 10 mg/L under some scenarios.

Nitrite has a significant chlorine demand. For plants that use chlorine for disinfection, nitrite has a demand of one pound of chlorine for each pound of nitrite. This does not affect the Grants Pass

WRP however, since UV disinfection is used rather than chlorine. Nitrite has some of the adverse effects of ammonia as a toxicant, however, and can also contribute to algal growth and potential nitrate contamination of downstream water resources. Based on these considerations, it is possible that nitrite could be regulated in the future.

Because of potential for a full nitrification requirement in the future, we developed alternatives to meet these possible permitting scenarios for Grants Pass. These were variations on the alternatives already discussed, including:

- New aeration tanks.
- IFAS.
- MBR.

Modeling indicated that four new aeration tanks would be required to allow operation with an aerobic SRT of 7.5 days to produce full nitrification. It was also assumed that alkalinity recovery using internal recycle to anoxic zones would be included in a full nitrification design. For the IFAS alternative, modeling indicated that addition of two new aeration tanks and IFAS media retrofit of existing tanks would produce a fully nitrified effluent. The MBR alternative developed in previous alternatives would not need modification since full nitrification is required for the MBR process.

Table 7 presents a comparison of estimated costs for these three alternatives. In this comparison, the conventional alternative of constructing new aeration tanks is more cost effective compared to IFAS alternative because of the need for tank expansion with IFAS for full nitrification. The MBR alternative is more cost competitive if full nitrification were to be required than it would be for partial nitrification, but it is still significantly more expensive than conventional upgrade. Figure 20 illustrates that building new aeration tanks is the preferred alternative with the highest total ranking overall and the highest ranking on five of the ten ranking criteria.

Table 7 Cost Comparison of Aeration Tank Upgrade Alternatives Full Nitrification
City of Grants Pass – Liquid Treatment Upgrade Alternatives

Cost Element	New Aeration Tanks	New IFAS	Parallel MBR
Capital Cost ($ Million)	$13.00	$22.08	$30.16
Operating Cost ($/year)	$119,000	$185,000	$618,000
Total Present Worth Cost ($ Million)	$14.80	$24.88	$39.36

Criterion	Weight	Weighted Ranking		
		4 New Aeration Tanks	New IFAS + 2 New AT	Parallel MBR
Capital Cost	1	3	1	1
O&M Cost	1	3	1	1
Risk	1	3	1	2
Future Flexibility	1	2	3	3
Footprint	1	1	3	2
Energy	1	3	1	1
Odor	1	2	2	2
Compatibility with existing processes	1	3	2	2
Biosolids Quality / Quantity	1	2	2	2
Effluent Quality	1	2	2	3
Total		**24**	**18**	**19**

Legend:	Score
Highest Ranking	3
Intermediate Ranking	2
Lowest Ranking	1

Figure 20 Comparison of Selection Criteria for Full Nitrification Upgrade Alternatives

2.4.10 Secondary Sedimentation Tank Addition

Additional secondary sedimentation tank area is recommended to maintain capacity of the Grants Pass WRP. The condition of the two, older sedimentation tanks is such that they will need replacement prior to 2035, but they may be left in service or evaluated for repairs at a later date. Under current PHF conditions, the secondary clarifiers are able to provide treatment for approximately 20 mgd, at a maximum overflow rate of 1250 gpd/sf, which requires over 7 mgd of PE to be bypassed directly to UV disinfection. By constructing a new 100-foot diameter clarifier the treatment capacity is increased to 30.6 mgd, which is nearly sufficient for 2035 PHF conditions. However, it should be noted that approximately 3 mgd of PE will still be bypassed around secondary treatment at peak flows. Table 8 presents a cost estimate for one new 100-foot diameter tank.

Table 8 Estimated Cost for New 100-Foot Diameter Clarifier
City of Grants Pass – Liquid Treatment Upgrade Alternatives

Cost Element	New 100-foot Diameter Tank
New Tank Structural Cost	$1,328,000
New Tank Equipment Cost	$300,000
Estimated Total Construction Cost	$4,170,000
Total Cost with ELA	$5,000,000

2.5 Ultraviolet Disinfection

The existing disinfection system at the Grants Pass WRP uses medium pressure ultraviolet (UV) disinfection. TM No. 5 discusses the potential cost-effectiveness of replacing the existing medium pressure UV lamp system with a more energy efficient low-pressure high intensity system. As part of the work for this memorandum, cost estimates were developed for replacement of the existing Trojan Model 4000 UV system with an open channel low-pressure high output (LPHO) system.

Table 9 presents comparisons of estimated costs for operation of the existing system compared to the present worth cost of replacement with a more efficient system. The estimated operating cost for electricity, lamp replacement, and maintenance for the existing system are estimated at approximately $128,000 per year. The present worth of this cost, assuming a discount rate of 3 percent over a 20-year period, is approximately $1.9 million. Compared to this, the operating and maintenance cost for the Calgon system is estimated at approximately $40,000 per year, with a present worth of approximately $600,000. This means that the City could spend up to $1.3 million in project cost for an equivalent present worth cost to the existing system. Replacement of one channel, which would accommodate WRP flow during average periods, is estimated to cost less than $800,000. Replacement of both existing channels is estimated to cost $1.2 million. Either of these projects would cost less in present worth than operation and maintenance of the existing system. Initial analysis indicates that the project may be eligible for an Energy Trust incentive of approximately $200,000. Furthermore, the existing “prototype” system is highly variable. On this basis, it would be justified to replace equipment in either one or two channels.

Table 9	**Cost Comparison for Upgrade of the Existing Trojan 4000 UV System** ***City of Grants Pass – Liquid Treatment Upgrade Alternatives***	
Cost Element	**Existing Trojan UV 4000**	**LPHO Replacement**
Capital Cost	$0	Both existing: $1.2 million One existing: $775,000 New channels: $2 million
Operating Cost ($/year) - Energy - O&M	 $60,000 $68,000	 $13,000 $27,000
Total Present Worth Cost ($ Million)	**$1.9**	**$1.4 to $2.8**

Notes:
1) Estimated Calgon equipment cost ($250 - $600K).
2) Does not include potential energy incentive of $200,000.

3.0 CONCLUSIONS AND RECOMMENDATIONS

Recommended improvements for major liquid stream unit processes are summarized below:

- **Raw Sewage Pump Station**: The current pump station has sufficient capacity through 2035. No upgrades are needed.

- **Screening System**: The two existing screens and screenings handling system have adequate capacity for 2035 loadings however, structural modifications will be required to allow all flows to go through the headworks under PHF conditions.

- **Primary Sedimentation Tanks**: To operate effectively with 2035 flows, two additional primary sedimentation tanks of equivalent size to the two existing rectangular units will be needed. Construction of two new tanks was compared to rehabilitation of the existing circular sedimentation tank and construction of a new sludge storage tank, which would replace the current function of the circular sedimentation tank. Construction of new high rate sedimentation tanks using chemical treatment was also considered. The conventional alternative of constructing two new primary sedimentation tanks is the lower cost alternative and is preferred based on consideration of a series of ten selection criteria. The estimated project cost in current dollars for both tanks is approximately $4.5 million. To meet the MMWWF capacity criterion, one new tank is required immediately, while the second would be needed by 2030.

- **Grit Removal System**: The existing grit removal system has adequate capacity for 2035 loadings. Its condition, however, indicates that it should be replaced soon. The estimated cost for replacement is approximately $758,000. If needed, it may be possible to phase this upgrade deferring the pump replacement portion of the project.

- **Activated Sludge System**: The activated sludge system is nearing current capacity during both the partial nitrification and winter secondary treatment seasons. A series of alternatives were investigated for system upgrade. The most cost-effective and preferred system based on a series of ten selection criteria is construction of two new aeration tanks with associated appurtenances. The estimated cost for this project in current dollars is approximately $5.7 million. The capacity of the existing secondary clarifiers is inadequate for current PHF loadings at the desired loading rate of 1250 gpd/sf. The cost of a new 100-foot diameter unit is approximately $5 million in current dollars and will provide treatment capacity for the majority of the planning period.

- **UV Disinfection**: Alternatives for upgrade of the existing medium pressure UV system with a more energy efficient system with an estimated lower maintenance cost were investigated. It is concluded that replacement of the equipment in either one or two UV channels would be cost-effective without consideration of potential energy efficiency grants. These grants would make a replacement project even more attractive.

4.0 REFERENCES

Parametrix (June 2001) *Grants Pass Water Restoration Plant Wastewater Facilities Plan Update*.

REGISTERED PROFESSIONAL ENGINEER
19616
OREGON
FEB. 6, 1998
JEFFREY F. McCORMICK
EXPIRES: 12/31/14

City Of Grants Pass

TECHNICAL MEMORANDUM NO. 8

Water Restoration Plant Facility Plan

Solids Treatment Alternatives

FINAL

April 2014

720 SOUTHWEST WASHINGTON STREET, SUITE 550 • PORTLAND, OREGON 97205-3507 • (503) 227-1885 • FAX (503) 227-1747

City Of Grants Pass

TECHNICAL MEMORANDUM NO. 8

Water Restoration Plant Facility Plan
Solids Treatment Alternatives

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SOLIDS TREATMENT ALTERNATIVES

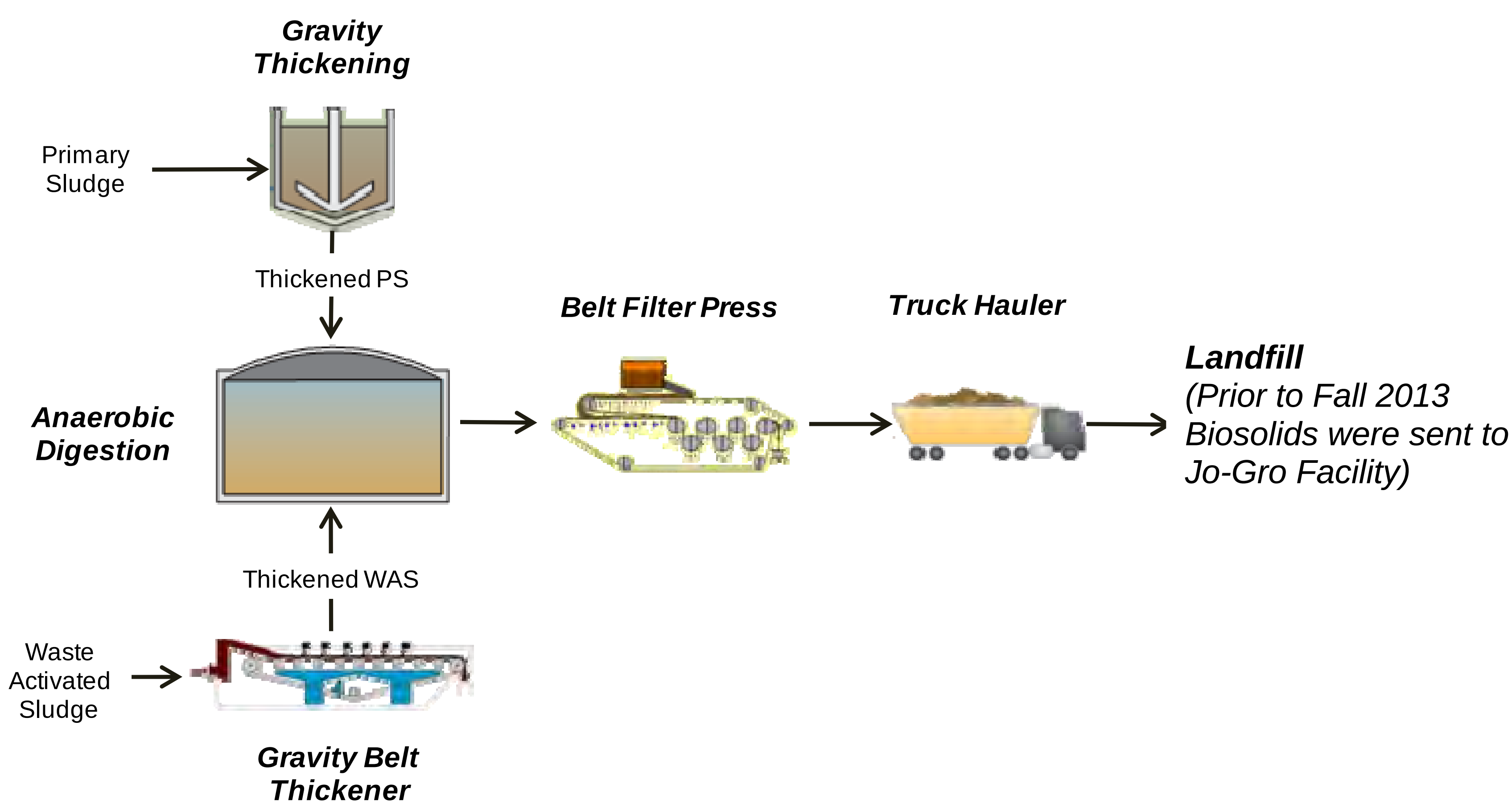
1.0 INTRODUCTION

This memorandum summarizes the solids treatment alternatives evaluated for the Grants Pass Water Restoration Plant (WRP). The evaluation included alternatives for solids treatment and biosolids dewatering and handling. Flows and loads assumed for the study are presented in Influent Flows and Loads Technical Memorandum (TM 4) (Carollo, 2013).

The WRP started as a primary treatment facility in 1935, including two small sludge digestion tanks. The WRP was upgraded to provide secondary treatment in 1962. An anaerobic digester, gravity thickener, and dewatering centrifuge were added in 1974 alongside the activated sludge treatment system. In 1975, the dewatering centrifuge was retired and a trailer mounted belt filter press was added in its place. A permanent belt filter press was added in 2003. The JO-GRO™ Composting Facility was added in 2001.

A schematic diagram of the solid stream process is shown in Figure 1. The WRP includes the following major unit process elements:

- Gravity Thickener.
- Gravity Belt Thickener.
- Anaerobic Digester.
- Belt Filter Press.



PROCESS SCHEMATIC FOR EXISTING SOLIDS TREATMENT

FIGURE 1

CITY OF GRANTS PASS
WATER RESTORATION PLANT FACILITY PLAN

2.0 SOLIDS LOADING PROJECTION AND DESIGN CRITERIA

The solids loading to the plant was determined based on the flows and loads analysis presented in the Flows and Loads TM. The flows and loads were input into a Biotran model calibrated with historical data and developed for the Liquid Treatment Alternatives TM (Carollo, 2013). The solids loading and flow rates calculated by the Biotran model for both annual average and maximum month dry weather conditions are summarized in Table 1. A summary of design criteria used for this evaluation is summarized in Table 2.

Table 1 Year 2035 Solids Projections
City of Grants Pass – Solids Treatment Alternatives

Parameter	Loading, ppd	Flow, mgd
Primary Sludge		
Annual Average	7,800	0.09
Maximum Month Dry Weather	10,800	0.13
Waste Activated Sludge		
Annual Average	5,200	0.08
Maximum Month Dry Weather	6,900	0.11
Digested Sludge		
Annual Average	6,600	0.03
Maximum Month Dry Weather	9,300	0.04

Table 2 Design Criteria for Existing Equipment and Processes
City of Grants Pass – Solids Treatment Alternatives

Unit Process	Value	Design Criteria	Comments
Primary Sludge Thickening			
Gravity Thickener	25 ppd/sf/day	Solids loading rate	Maximum month dry weather solids loading
WAS Thickening			
Gravity Belt Thickener	150 gpm/m[1]	24 hours/ 7 days/week	Maximum month dry weather flow
Anaerobic Digestion			
All units in service	20 days 0.15 ppd VS/day	HRT Volatile Solids Loading	Maximum month dry weather solids loading
Largest unit out of service	15 days 0.20 ppd VS/day	HRT Volatile Solids Loading	Average dry weather solids loading

Table 2	Design Criteria for Existing Equipment and Processes *City of Grants Pass – Solids Treatment Alternatives*		
Unit Process	**Value**	**Design Criteria**	**Comments**
Dewatering			
Belt Filter Press	900 lbs/hr-m	6 hours/ 5 days/week	Maximum month dry weather solids loading
Composting			
Mixing	4,000 sf	30 days	Average dry weather solids loading
Composting	2,200 cy	30 days	
Curing	2,100 cy	30 days	
Storage	1,800 cy	90 days	
Green Waste	6,400 sf	30 days	
Wood Waste	7,100 sf	30 days	
Notes: (1) gpm/m = gallons per minute per meter			

3.0 SOLIDS TREATMENT PROCESSES

3.1 Primary Sludge Thickening

Primary sludge (PS) is presently thickened in a 30-foot diameter gravity thickener (GT), constructed in 1974. At present, the mechanical system is showing severe corrosion, the concrete has exposed aggregate, and poor performance of the auger that removes sludge from the tank limits the overall performance of thickener. Current solids loading is approximately 8 lbs/day-ft^2 during maximum month dry weather conditions (MMDW). The underflow, limited by the poorly performing auger, has a total solids concentration of 3.6 percent. Figure 2 presents the capacity of the existing gravity thickener and the projected solids loadings for the planning period.

There is sufficient capacity in the current gravity thickener to process the max month dry weather sludge loadings in year 2035. However, there is no process redundancy and much of the gravity thickener is at the end of its useful life. The City has the option of constructing two new 25-foot gravity thickeners or rehabilitate the existing gravity thickener. Rehabilitation would include structural work and concrete repair in addition to replacing the sludge mechanism, auger, and pumps. Both options will provide greater solids concentrations (upwards of 5.5%) and reliable primary sludge thickening. However, process redundancy will only be achieved through constructing the new thickeners.

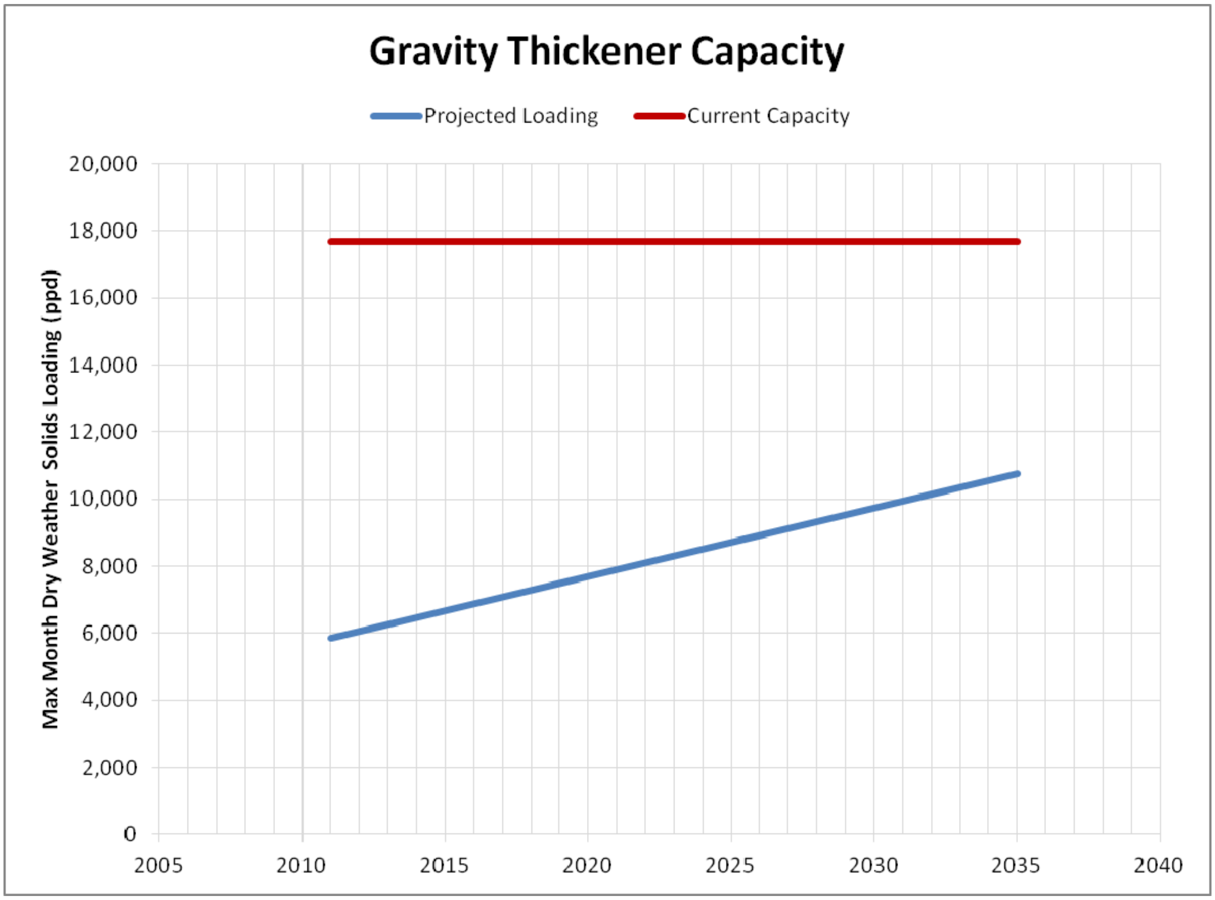


Figure 2 Existing Primary Sludge Thickening Capacity

3.2 Waste Activated Sludge Thickening

Waste activated sludge (WAS) is pumped to and thickened on a 1.5-meter Gravity Belt Thickener (GBT) installed in 1994. Current hydraulic loading is approximately 28 gallons per minute (gpm) per meter for MMDW conditions. The GBT approximately captures 95 percent of the solids and produces a solids steam with a total solids concentration, on average, of 5.4 percent. Figure 3 presents the capacity of the existing gravity belt thickener and the projected solids loadings for the planning period.

The capacity of the existing equipment used for WAS thickening is sufficient through the planning period including reasonable downtime for cleaning and routine maintenance. However, there is no redundancy for WAS thickening. In the case of the GBT failing, there is sufficient capacity in the aeration basins to store solids for one day and maintain mixed liquor concentrations below 4,000 mg/L. A pipe from the WAS line should be connected to the new Gravity Thickeners (GTs), and be used to provide solids thickening and storage as well. This would allow extended periods of equipment downtime in the case of catastrophic system failure. Given those two storage options, an additional GBT for redundancy considerations is not recommended.

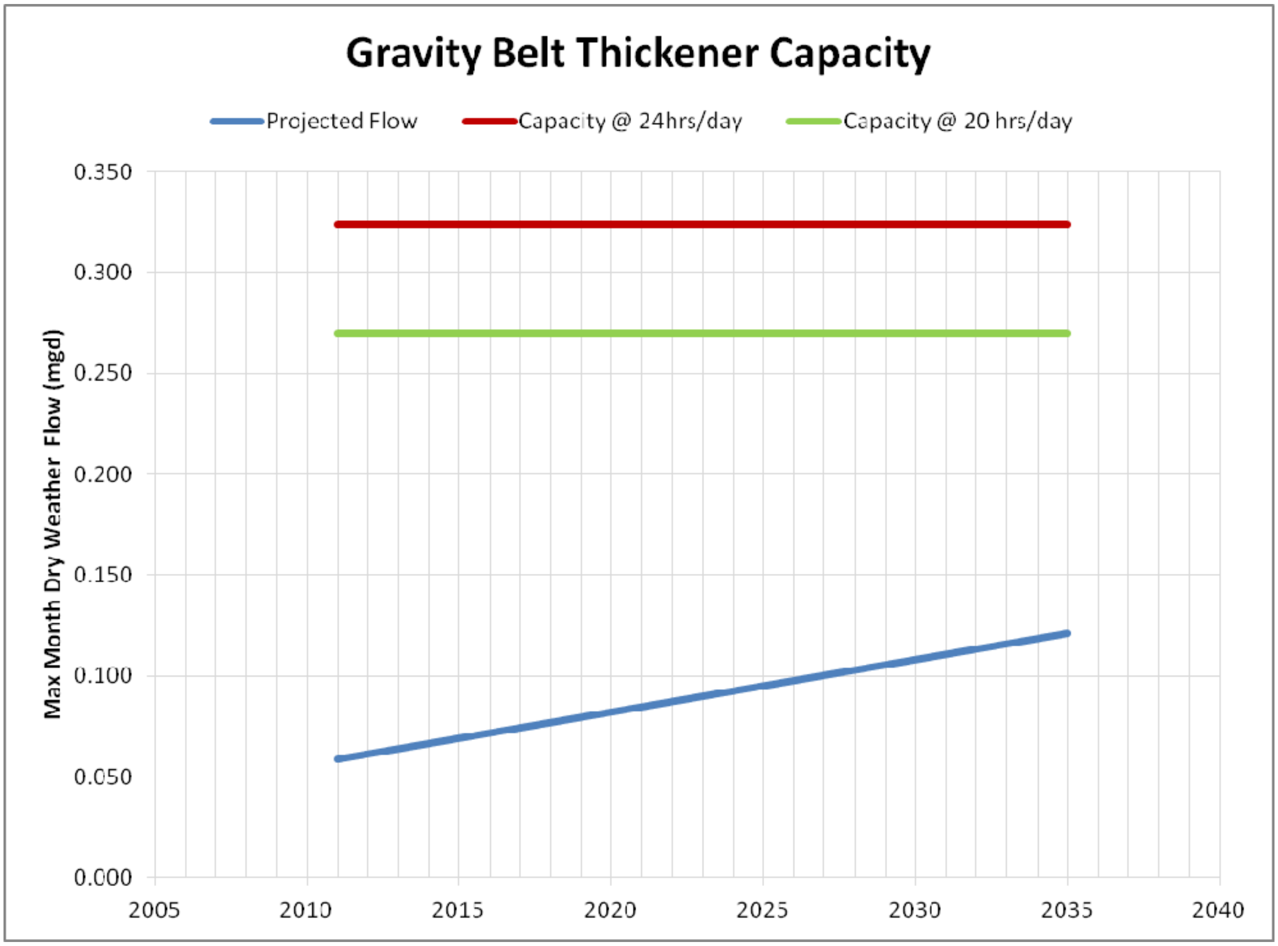


Figure 3 Waste Activated Sludge Thickening Capacity

3.3 Biosolids Production and Handling Processes

Post WAS and PS thickening, there are a number of different alternatives available for the treatment of biosolids. A number of these alternatives affect both anaerobic digestion and dewatering requirements. Therefore, recommendations for those processes will be discussed in conjunction with the solids treatment alternatives.

3.3.1 Anaerobic Digestion

There is one heated anaerobic digester on site. The digester was constructed in 1975 and is 50 feet in diameter with a maximum side water depth of 30 feet. Historically, it has volatile solids destruction of 54 percent. At present, the hydraulic residence time and volatile solids loading rate in the digester is at 15 days and 0.14 lbs/day-ft^3, respectively, during MMDW conditions. Of the two capacity conditions, hydraulic and solids, hydraulic capacity is limiting. MMDW is the more limiting weather condition. Plots of the capacities of the digester are presented in Figures 4 and 5. No redundant facilities are available for digestion.

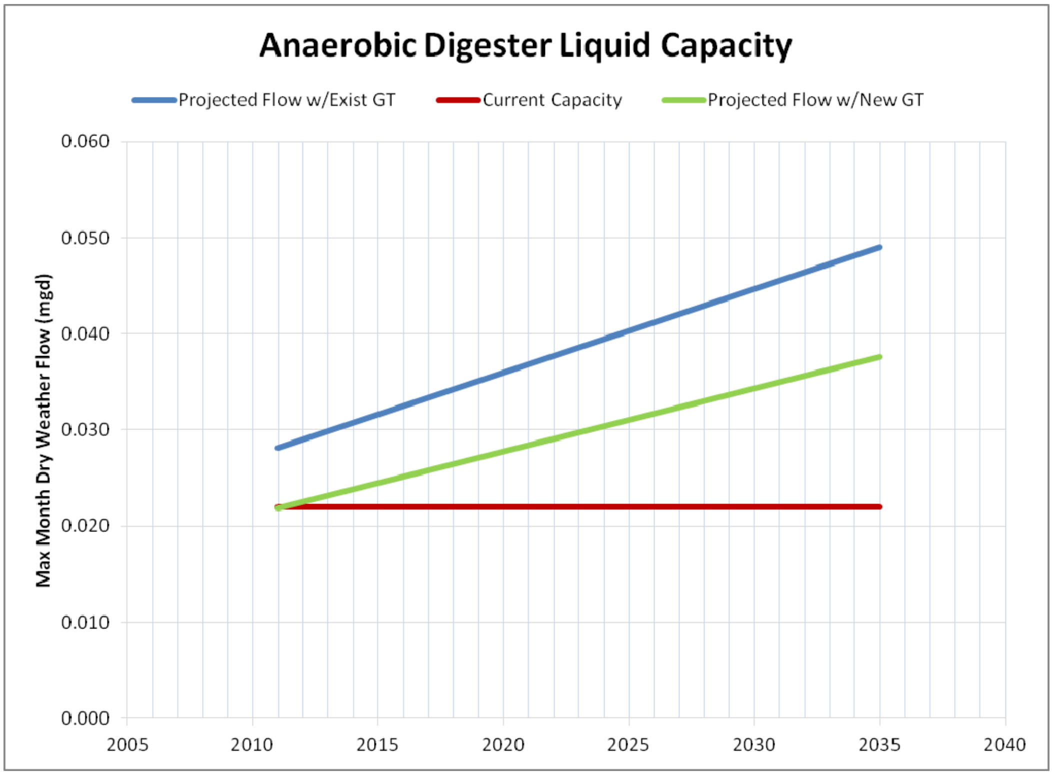


Figure 4 **Anaerobic Digester Liquid Capacity Based on a 20-Day Hydraulic Residence Time**

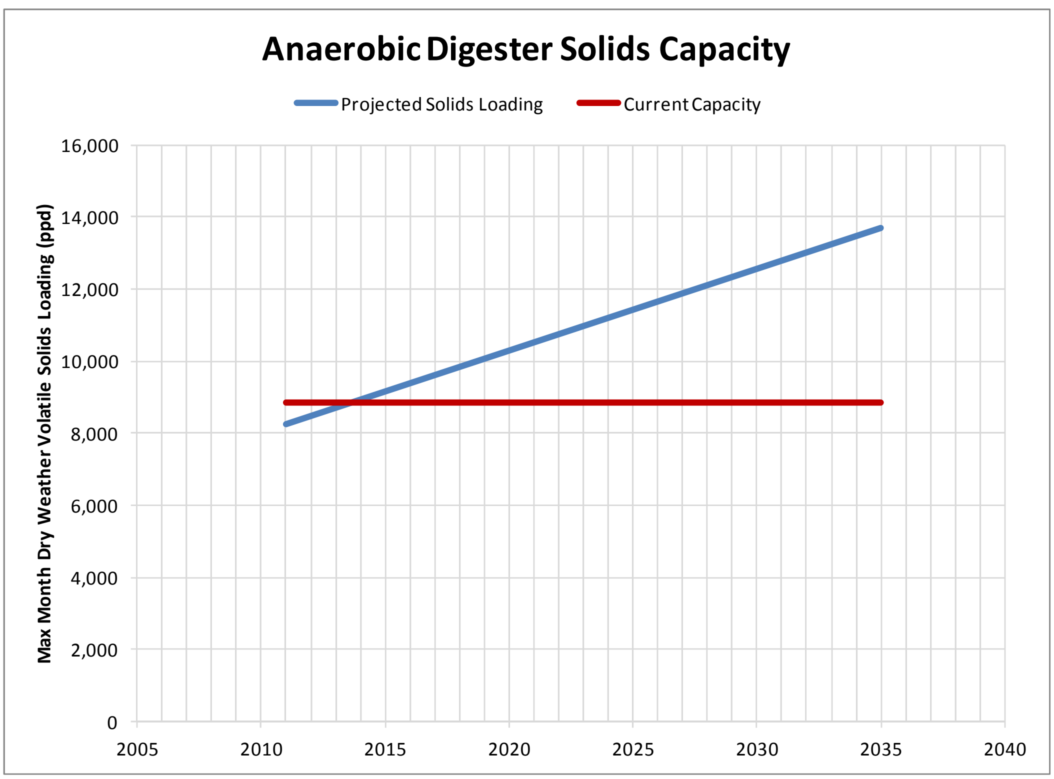


Figure 5 **Anaerobic Digester Volatile Solids Capacity Based on a Loading Rate of 0.15 Lbs VSS/cf-Day**

3.3.2 Sludge Dewatering

Digested sludge is dewatered to 13 percent total solids concentration on a 2.2-meter belt filter press (BFP), installed in 2003. Under current operation, the belt press is assumed to run 6 hours a day, 5 days a week. Solids loading is projected to exceed the capacity of the press in the year 2029. At that time, it is recommended that the City simply increase the hours of operation by the equivalent of 5 hours per week versus installing a new larger BFP or second unit. No redundant equipment is available for dewatering. However, the sludge storage tank on site can provide emergency storage. The City may require odor control if the sludge storage tank is used consistently. Additionally with some modification, the former chlorine contact basin can also be used for sludge storage. These modifications include removing slide gates to prevent accidental sludge spills into the final effluent. Hence, no new equipment is recommended for dewatering. Figure 6 presents the capacity of the existing belt filter press and the projected solids loadings for the planning period.

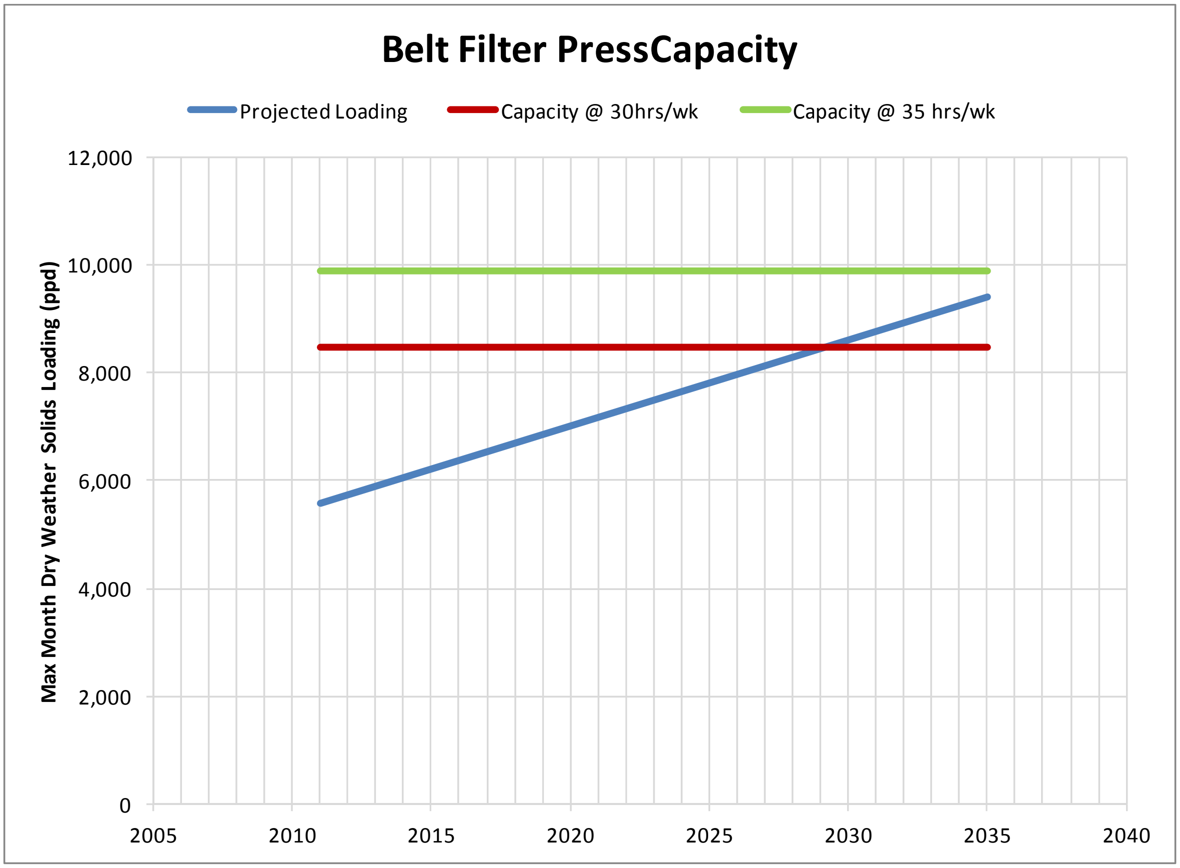


Figure 6 Belt Filter Press Solids Capacity

3.3.3 Composting

Dewatered biosolids are trucked to the JO-GRO™ composting facility and combined with green waste and undergoes the composting process for 60 to 120 days. The composting process consists of the following steps:

1. Batch Mixing:
    a. Consists of biosolids, shredded green waste, and screened returns.
    b. 3:1 to 4:1 bulking agents to biosolids ratio.
2. Extended Aerated Compost Pile:
    a. 30-day residence time.
3. Aerated Curing:
    a. 30-day residence time.
4. Screening:
    a. Screened material is taken to batch mixing process.
5. Compost Storage:
    a. 60 days, or as needed.

Both the extended aeration composting and the curing steps occur in covered areas. Existing covered storage area is used only temporarily to screen the compost product. After screening, the compost is stored in large piles around the site. Stormwater is routed and collected in an onsite stormwater pond. The operational staff rotates the compost once every 30 days in large batches. The original design intended that only a few days of on-site storage would be needed.

Capacity of the JO-GRO™ facility was determined through review of operating data, discussions with staff and modeling of the inputs and outputs of the facility. The results of the analysis are presented in Table 3 and represent approximate capacity needs based on the current operations.

Table 3 JO-GRO™ Capacity Needs
City of Grants Pass – Solids Treatment Alternatives

Process	Rated	Current	2035
Mixing	4,000 sf	6,800 sf	11,000 sf
Composting	2,200 cy	2,000 cy	3,200 cy
Curing	2,100 cy	1,300 cy	2,100 cy
Storage(1)	1,800 cy	1,900 cy	3,100 cy
Green Waste	6,400 sf	5,900 sf	8,000 sf
Wood Waste	7,100 sf	4,300 sf	6,000 sf

Notes:
1) Assumes current storage issues are resolved.

The JO-GRO™ facility is out of capacity currently for mixing area and storage. By 2035, the facility is out of capacity in every process, excluding wood waste storage. This analysis assumes that the current finished compost stockpiling issues at the JO-GRO™ facility are remedied.

4.0 SOLIDS TREATMENT ALTERNATIVES

A total of eight different solids treatment and biosolids handling alternatives were initially evaluated. They are as follows:

1. Continue Composting at JO-GRO™.
2. Landfill.
3. Class B Land Application.
4. Sludge Lagoon and Drying Bed.
5. Greenhouse Dryers.
6. Poplar Tree Farm.
7. Heated Dryer.
8. JO-GRO™ and Landfill.

Alternatives No. 4, 5, and 7 were eliminated from detailed evaluation due to concerns of efficacy and cost. The remaining alternatives are detailed below. Table 4 presents the parameters used to calculate the operational costs associated with solids treatment alternatives.

Table 4 Alternatives Analysis Parameters
City of Grants Pass – Solids Treatment Alternatives

Item	Unit	Cost	Source
Electricity	$/kWh	0.07	Derived from total monthly costs divided by kWh consumed
Natural Gas	$/therm	0.88	Rate from natural gas statement
Polymer	$/active dry pound	2.50	Calculated from Grants Pass historical data
Labor	$/hr	68	Average of total personnel for WRP
Landfill			
Hauling & Disposal	$/wet ton	40	Landfill operator quote. Price includes tipping fee.

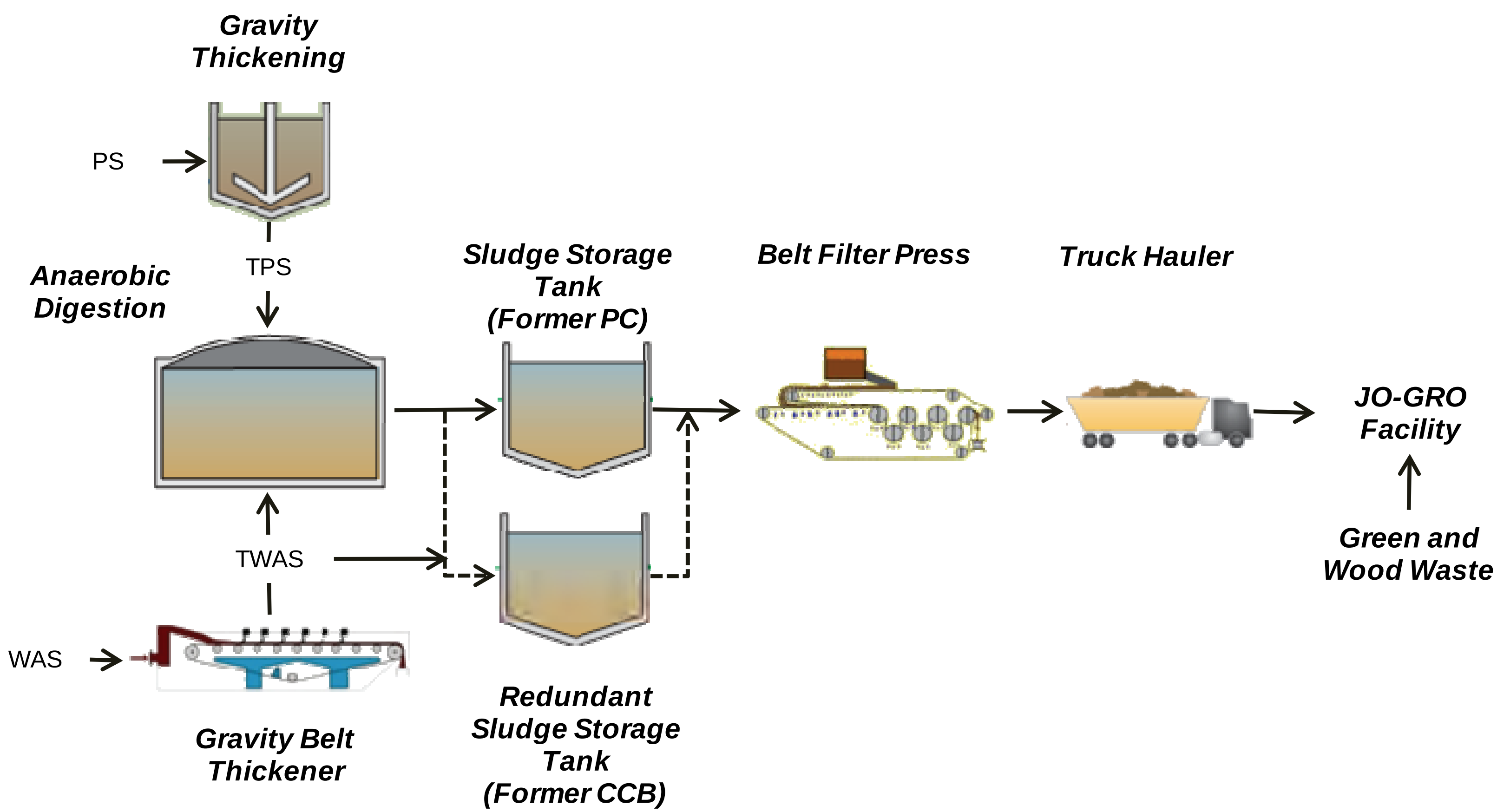
Table 4	Alternatives Analysis Parameters *City of Grants Pass – Solids Treatment Alternatives*		
Item	**Unit**	**Cost**	**Source**
Land Apply			
Western OR	$/wet ton	25	Estimate from private operator
Eastern OR	$/wet ton	40	Estimate from private operator
JO-GRO™			
Hauling	$/wet ton	9.50	Assumed 2 hour travel/loading time, 16-mile roundtrip, and 18 wet tons per load
O&M	$/wet ton	93	Historical data
Wood Waste	$/cy	2.00	Average of last three years
Green Waste	$/cy	1.70	Average of last five years
Compost	$/cy	15.00	Current price

4.1 Alternative No. 1 – Continue Composting at JO-GRO™

Alternative No. 1 assumes that the City will maintain current operations at the plant and treat biosolids at the JO-GRO™ facility. The JO-GRO™ facility is out of capacity in a number of processes as highlighted in Table 3 and is in need of expansion. The capital investment required at JO-GRO™ is approximately $2.0 million dollars and includes an expansion of stormwater treatment at the composting site, a biosolids and green waste covered mixing area, expansion of primary composting facilities, site development, and a covered finished compost area.

In addition to upgrades at the JO-GRO™ facility, Alternative No. 1 requires addressing anaerobic digestion capacity at the WRP. The anaerobic digester is currently out of capacity. A diversion pipeline to transfer a portion of WAS directly to the old primary clarifier basin will allow maximum digester capacity without process upset. Some modifications to the sludge holding tank will need to occur, including removal of the failing sludge mechanism and installation of a new mixer. The unused chlorine contact basin can also be modified by removing the baffle walls and installing mixers to allow storage of sludge during future max month conditions, or when the BFP is out of service for extensive maintenance. Treatment plant modifications, as mentioned above, will cost approximately $440,000. A simplified schematic of the proposed solids stream for Alternative No. 1 is presented in Figure 7.

There are a number of advantages and disadvantages in proceeding with Alternative No. 1. The overall advantages include maintaining the status quo in terms of both treatment operations and community benefits. However, demand for JO-GRO™ has declined and compost inventory has been increasing on site since the initiation of the price change in 2010. For JO-GRO™ to continue as a viable alternative this trend would need to be addressed. A list of the advantages and disadvantages of Alternative No. 1 is presented in Table 5.



PROCESS SCHEMATIC FOR ALTERNATIVE NO. 1 – CONTINUE COMPOSTING AT JO-GRO™

FIGURE 7

CITY OF GRANTS PASS
WATER RESTORATION PLANT FACILITY PLAN

Table 5	**Non-Cost Evaluation of Alternative No. 1 – Continue Composting at JO-GRO™** ***City of Grants Pass – Solids Treatment Alternatives***	
Category	**Advantages**	**Disadvantages**
Treatment	• Familiar process • Treatment plant site not affected	• Difficult to sell compost product at current pricing scheme
Environment	• Beneficial use of Class A biosolids product	• Requires stormwater control
Community	• No change in truck traffic out of plant • Community accepts facility and compost product	

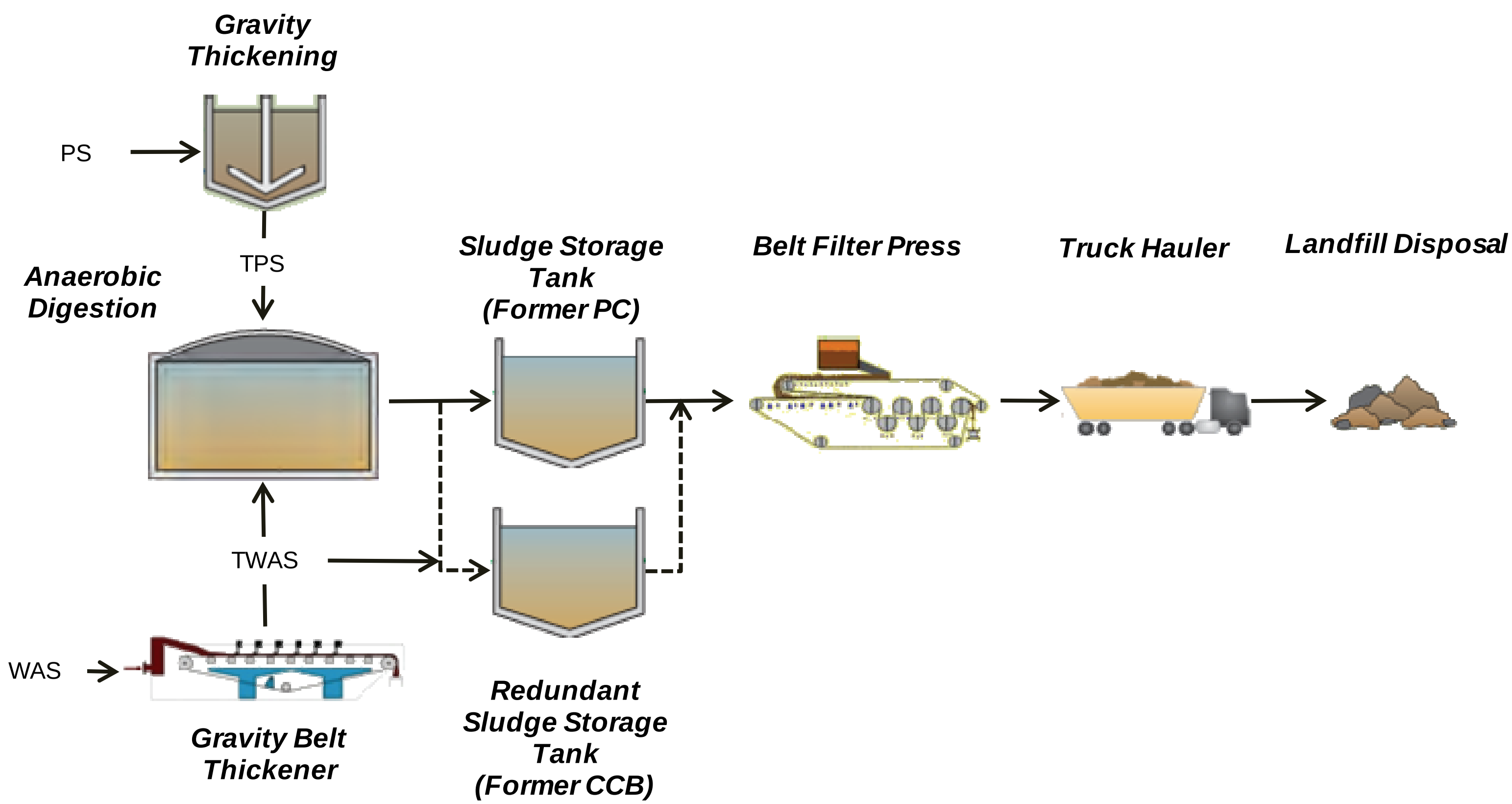
4.2 Alternative No. 2 – Landfill

Alternative No. 2 assumes that operations will continue as is, except that the biosolids will be transported to the landfill for disposal instead of producing compost at the JO-GRO™ facility. Identical to Alternative No. 1, a WAS diversion pipeline and the basin upgrades for the sludge storage tank and chlorine contact basin are required. A simplified process schematic is presented in Figure 8.

There are financial and non-financial benefits for this alternative. Financially, the capital expenditures for this alternative are minimal. They include only the $440,000 in tank mixing and piping construction projects. However, the hauling and disposal costs are controlled by outside entities, and therefore at risk for fluctuation and increase.

The non-financial benefits include maintaining future operations similar to current. The disadvantages are community and environmentally based. By landfilling biosolids, the plant is no longer producing a compost product that is environmentally friendly and enjoyed by the community. One way a benefit can still be realized with this option is if the biosolids can be used as an alternative daily cover (ADC) at the landfill. A summary of these non-cost advantages and disadvantages is presented in Table 6.

Table 6	**Non-Cost Evaluation of Alternative No. 2 – Landfill** ***City of Grants Pass – Solids Treatment Alternatives***	
Category	**Advantages**	**Disadvantages**
Treatment	• Familiar process • Treatment plant site not affected • No significant construction	
Environment	• Beneficial use if used as ADC	• No beneficial use if land filled
Community	• No change in truck traffic out of plant	• Potential odor impact at landfill • Community loss of compost



PROCESS SCHEMATIC
FOR ALTERNATIVE NO. 2 – LANDFILL

FIGURE 8

CITY OF GRANTS PASS
WATER RESTORATION PLANT FACILITY PLAN

4.3 Alternative No. 3 – Class B Land Application

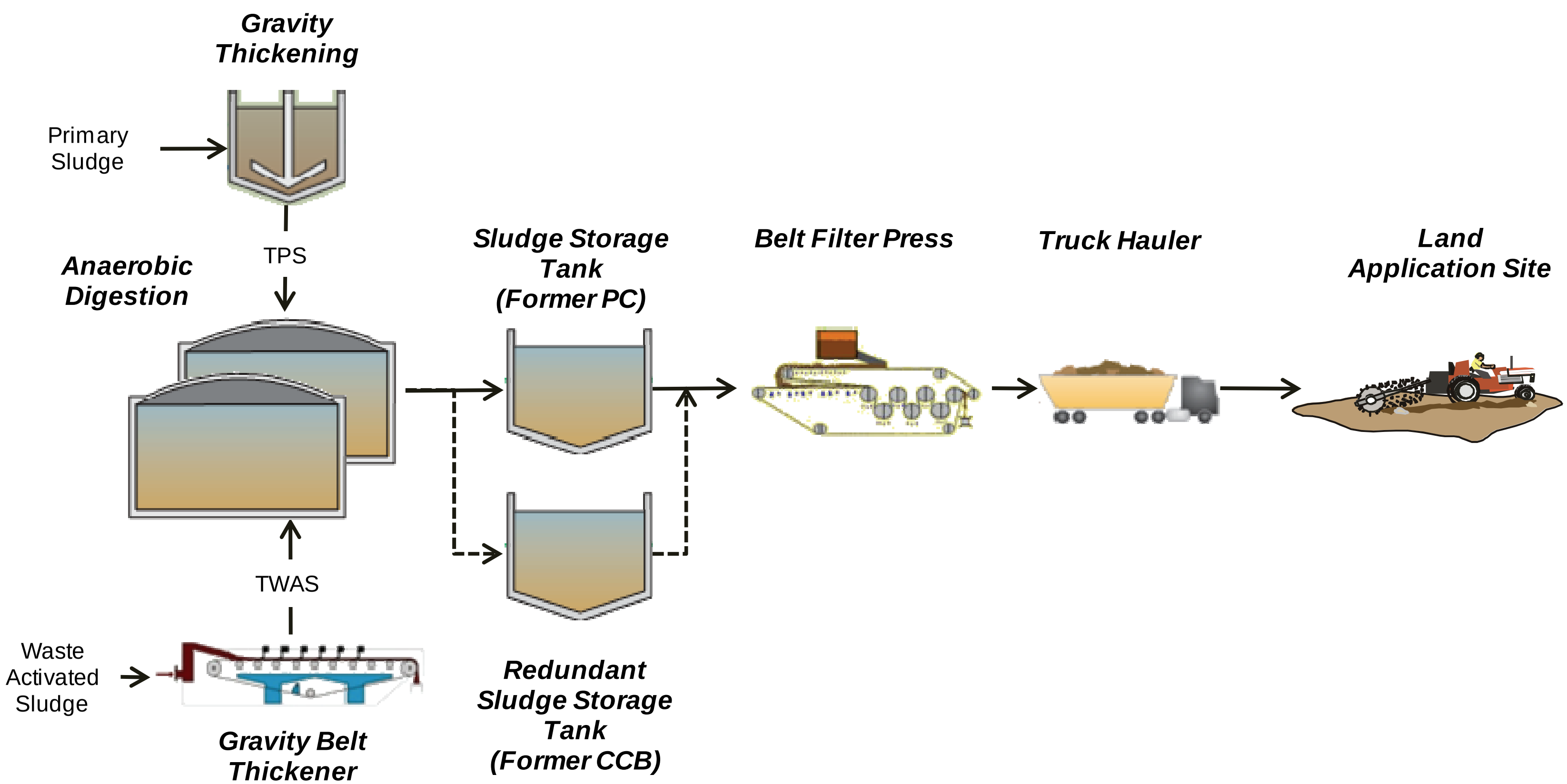
Alternative No. 3 assumes the construction of a new anaerobic digester and the ancillary facilities needed to operate a second digester, including boiler, heat exchanger system, and piping modifications. This new digester will be placed in the same location as the existing Digester No. 2. Unlike the other alternatives, this alternative does not include the WAS diversion pipeline, but it still requires the basin upgrades to the chlorine contact basin and sludge holding tank to provide sludge storage. Under this option, JO-GRO™ will no longer be operated. Instead, Class B biosolids will be land applied locally or in central Oregon. A simplified process schematic is presented in Figure 9.

This alternative requires significantly more capital investment than either Alternative No. 1 or 2. Approximately $5.1 million will need to be invested to realize the previously mentioned modifications. However, the operation and maintenance costs with this alternative are the low (similar to Alternative 2).

There are a number of non-financial advantages and disadvantages for this alternative. The primary benefit is that the operational process is similar to the current plant operation. The major disadvantages surround the unknowns around land application of the biosolids. Namely, the Class B product is not perceived by the public as positively as the JO-GRO™ compost, and there may be odor issues at the land application sites. Because of this, there may be resistance in the local area to land apply the biosolids. A list of the non-financial advantage and disadvantages are presented in Table 7.

Table 7 Non-Cost Evaluation of Alternative No. 3 – Class B Land Application
City of Grants Pass – Solids Treatment Alternatives

Category	Advantages	Disadvantages
Treatment	• Familiar process • Constructible	
Environment	• Beneficial use of biosolids	
Community	• No change in truck traffic out of plant	• Potential odor impact at land application site • Public perception of land application • Community loss of compost



PROCESS SCHEMATIC FOR ALTERNATIVE NO. 3 – CLASS B LAND APPLICATION

FIGURE 9

CITY OF GRANTS PASS
WATER RESTORATION PLANT FACILITY PLAN

4.4 Alternative No. 6 – Poplar Tree Farm

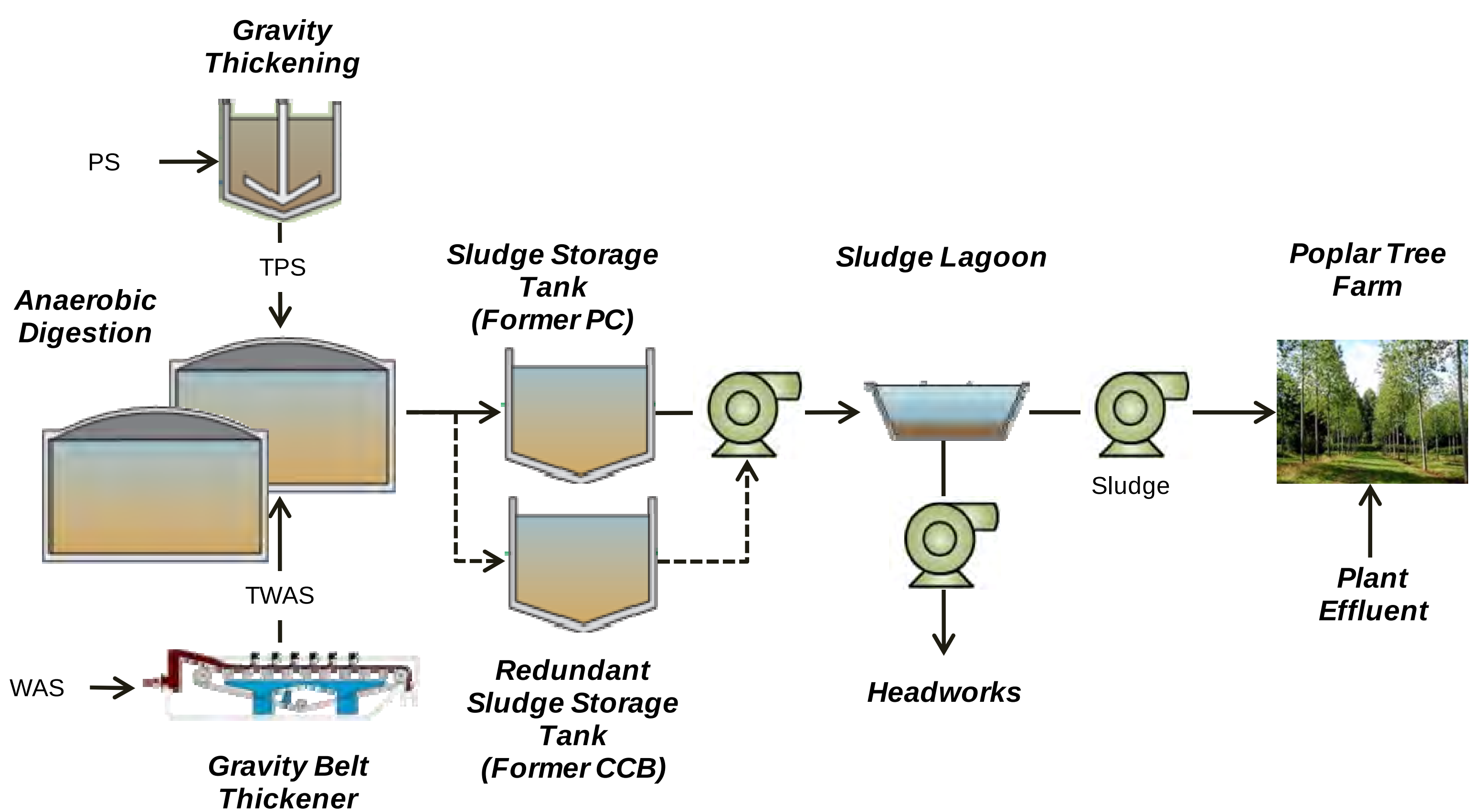
Alternative No. 6 represents the largest operational change of all the alternatives. Under this option, the JO-GRO™ facility is abandoned and in its place, a poplar tree farm is constructed at the River Reserve. A new anaerobic digester will be built to allow the production of Class B biosolids to land apply on the tree farm. The belt filter press will be taken out of service and instead the digested sludge will be pumped to a sludge lagoon where it will be allowed to settle and thicken. The lagoon solids will be land applied at the poplar farm and the separated liquid will be pumped back to the head of the treatment plant. Water for the farm will be supplied by treatment plant effluent. Identical to all the other alternatives, basin upgrades will need to take place on the chlorine contact basin and sludge holding tank. A simplified process schematic is presented in Figure 10.

The operation and maintenance costs for this alternative are low, second only to Alternatives No. 2 and 3. However, the capital expenditures necessary for this project are the highest of all the alternatives at $14.9 million. Financially, this alternative requires an investment into poplar trees; a market that is weak and historically volatile.

Non-financial advantages for this alternative include removal of dewatering at the treatment site, continued beneficial use of biosolids, beneficial use of plant effluent, elimination of biosolids trucks, and excellent public acceptance of tree farms. The disadvantages include the need for a new pipeline constructed to deliver sludge to the lagoon, return decanted liquid from the lagoon to the plant and treated plant effluent to water the farm. For this project, there will also be significant construction at the River Reserve location for the lagoon and farm. A summary of the non-financial advantages and disadvantages are presented in Table 8.

Table 8 Non-Cost Evaluation of Alternative No. 6 – Poplar Tree Farm
City of Grants Pass – Solids Treatment Alternatives

Category	Advantages	Disadvantages
Treatment	• Reduce solids operations at plant	• Major construction at River Reserve • New pipeline construction • Market for trees is small
Environment	• Beneficial use of biosolids	
Community	• Less truck traffic at plant • No visual impacts • Public perception of planting trees • Public perception of land application	• Construction noise and traffic at River Reserve



PROCESS SCHEMATIC FOR ALTERNATIVE NO. 6 – POPLAR TREE FARM

FIGURE 10

CITY OF GRANTS PASS
WATER RESTORATION PLANT FACILITY PLAN

4.5 Alternative No. 8 – JO-GRO™ and Landfill

To preserve the financial benefits from land filling to the City in addition to the community benefit of the JO-GRO™ compost, an eighth alternative was developed of a combination of both Alternative Nos. 1 and 2.

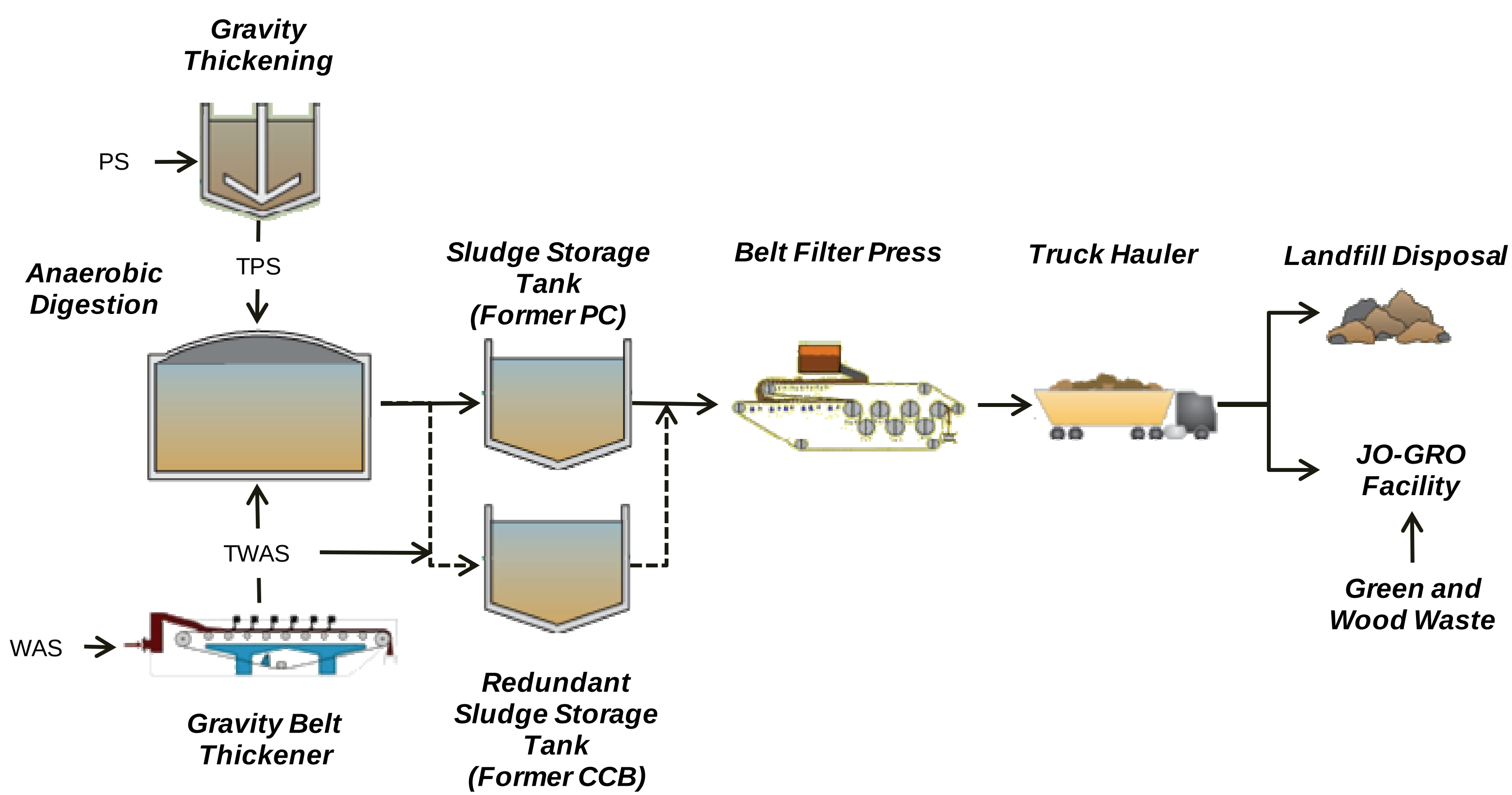
Under Alternative No. 8, the City would continue use of the JO-GRO™ facility and maximize its production capacity. Any biosolids produced at the plant in excess of what is processed at the JO-GRO™ facility would be trucked to the landfill for disposal. To accomplish this, key capital investments at the JO-GRO™ facility would need to occur, such as expansion of the stormwater system, addition of a covered mixing area, expansion of the primary composting building, and paving for more green/wood waste storage. Construction of the WAS diversion pipeline and the basin upgrades to the chlorine contact basin and sludge holding tank would need to occur as well. A simplified process schematic for this alternative is presented in Figure 11.

The necessary capital investments for Alternative No. 8 total approximately $1.5 million. The operational and maintenance costs for this alternative are between that of Alternative No. 1 and 2. The non-financial advantages and disadvantages are a combination of Alternatives Nos. 1 and 2.

Namely, operations will not change, the plant will continue to accept green/wood waste from the City, and compost product is produced. The disadvantages include the public perception and lack of environmental benefits of landfilling biosolids. Table 9 lists the non-cost advantages and disadvantages.

Table 9 Non-Cost Evaluation of Alternative No. 8 – JO-GRO™ and Landfill
City of Grants Pass – Solids Treatment Alternatives

Category	Advantages	Disadvantages
Treatment	• Familiar process • Treatment plant site not affected	• Difficult to sell compost product at current pricing scheme
Environment	• Beneficial use of Class A biosolids product	• Requires stormwater control • No beneficial use if land filled
Community	• No change in truck traffic out of plant • Community accepts facility and compost product	• Potential odor impact at landfill



PROCESS SCHEMATIC FOR ALTERNATIVES NO. 8 – JO-GRO™ AND LANDFILL

FIGURE 11

CITY OF GRANTS PASS
WATER RESTORATION PLANT FACILITY PLAN

4.6 Overall Comparison and Recommended Alternative

As a basis of comparison, the 20-year life cycle costs for all the solids treatment evaluated are alternatives is presented in Table 10. As the construction of two gravity thickeners is common to all alternatives, it is not included in the costs presented in Table 10. The overall least-cost alternative is Alternative No. 2 and Alternative No. 6 has the highest cost. Alternatives with the lowest capital costs and operation and maintenance costs are those that include landfill of solids. The Poplar tree farm option will be removed from further consideration because of the comparatively high financial costs.

Table 10 Alternatives 20-year Life Cycle Costs
City of Grants Pass – Solids Treatment Alternatives

Alternative	Capital Cost, $M	O&M Cost, $M	Total Cost, $M
Alt 1 – JO-GRO™	$1.8	$11.1	$12.9
Alt 2 – Landfill	$0.4	$7.5	$7.9
Alt 3 – Land Apply	$5.1	$7.5	$12.6
Alt 6 – Poplar Farm	$14.9	$8.8	$23.7
Alt 8 - JO-GRO™ and Landfill	$1.0(1)	$10.2	$11.2

Notes:
1) Lower capital cost assumes eliminating storage facility.

Of the remaining alternatives, there is a significant difference in both the cost and non-cost impacts. Selecting land application or either of the JO-GRO™ alternatives allows the plant to continue to provide a service/commodity for the City. Currently there are no catastrophic issues at the JO-GRO™ facility that need to be corrected to continue to provide service. The capacity issues at JO-GRO™ can be addressed in a stepwise fashion. At any point, the City can begin landfilling biosolids if the JO-GRO™ facility reaches capacity, undergoes a catastrophic failure of equipment/facilities, or the market, maintenance, or operations cost change significantly.

Selecting Alternative No. 3 locks the City into investing into another digester and thereby commits it to pursue land application to recover capital costs through lower operation and maintenance costs. There is no driver to pursue land application when the JO-GRO™ facility is available, preferred by the community, and its present operations are not in jeopardy. However, disposing biosolids at the landfill under Alternative No. 2 provides a solution that may save approximately $5 million over the next 20 years. Based on the financial benefit, the Council decided that the City pursue Alternative No. 2.

4.7 Recommended Gravity Thickener Alternative

Four alternatives were evaluated to upgrade the gravity thickener process as summarized in Table 11. The City has the option of constructing two new 25-ft diameter gravity thickeners with 17-ft walls (Alt G1) or rehabilitating the existing 30-ft diameter gravity thickener (Alt G2). The projects would include two new progressive cavity pumps for underflow pumping and scum pumps. Other alternatives available are rehabilitating the existing gravity thickener and constructing one new 25-ft gravity thickener (Alt G3), or rehabilitating the existing gravity thickener and adding piping modifications, small structure, and pumps to allow primary sludge to be transferred directly to the GBT to provide redundancy (Alt G4), or constructing one new gravity thickener and adding piping modifications, small structure, and pumps to allow primary sludge to be transferred directly to the GBT to provide redundancy (Alt G5). Table 11 lists both the redundancy capabilities and the capital costs for each of these alternatives.

Table 11 Gravity Thickener Alternatives Capital Costs
City of Grants Pass – Solids Treatment Alternatives

Alternative	Capital Cost, $M	Redundancy
Alt G1 - Two New Thickeners	$1.4	Yes
Alt G2 - Rehabilitate GT	$0.4	No
Alt G3 - Rehabilitate GT and One New GT	$1.1	Yes
Alt G4 - Rehabilitate GT and PS Diversion	$0.6	Yes; Through GBT
Alt G5 - One new GT and PS Diversion	$0.9	Yes

In order to landfill the biosolids, it is essential that primary sludge is digested at all times. For this reason, it is not recommended that the City purse Alternative No. G2. This option offers no redundancy and there will be times when the thickener is inoperative and unthickened sludge will have to be sent directly to the digester or aeration basin. Current digester capacity is insufficient to pride enough residence time for unthickened sludge to be digested. This would lead to highly odorous sludge that the landfill would likely not accept.

Alternative No. G3 is the recommended alternative of the remaining four alternatives. This is primarily because of cost savings associated with constructing one new gravity thickener. It is anticipated that the work needed to rehabilitate the gravity thickener would likely take it out of service for a three to four month period. The project can be phased such that contract processing of PS would not be needed during this period. Alternative No. G3 provides a consistent, reliable, and long-lasting investment as compared to the remaining alternatives. It is recommended that Alternative No. G3 be pursued immediately because the poor condition of the existing thickener.

5.0 RECOMMENDED SOLIDS ALTERNATIVE PHASING

Based on the City Council decision, the recommended alternative is to dispose of biosolids at the landfill and upgrade the necessary facilities at the plant. Phasing for this alternative is presented in Table 12. Total project cost is approximately $1,540,000.

Table 12	**Phasing for Recommended Alternative** ***City of Grants Pass – Solids Treatment Alternatives***	
Equipment	**Year**	**Project Cost, M(1)**
Rehabilitate GT and One New GT	2014	$1.10
WAS Diversion Pipeline and Mixing Upgrades	2021	$0.44
TOTAL		**$1.54**
Notes: 1) 2012 dollars.		

The recommended equipment and facilities improvements are as follows:

Gravity Thickeners. This project assumes construction of one 25-ft diameter gravity thickeners with 17 ft walls and rehabilitating the existing gravity thickener. Two progressive cavity pumps for underflow pumping and scum pumps are also included. As the current gravity thickener is in poor condition, it is assumed these would be constructed immediately.

WAS Diversion Pipeline and Mixing Upgrades. The WAS diversion pipeline includes the installation of a pipeline to provide a TWAS bypass for the digester. This pipeline would connect the GBT to the sludge holding tank. Mixer and basin upgrades would also need to occur at the sludge holding tank and chlorine contact basin to allow sludge storage to allow for catastrophic downtime for the BFP. Basin upgrades include replacing the existing sludge mechanism in the sludge holding tank with a mixer, as it is in poor condition, and removing the baffle walls and installing a mixer in the chlorine contact basin. The pipeline and basin upgrades are not necessary until year 2021.

REGISTERED PROFESSIONAL ENGINEER
76549
OREGON
DEC. 31, 2007
BHARGAVI MAREMANDA
EXPIRES: 12/31/14

City of Grants Pass

TECHNICAL MEMORANDUM NO. 9

Water Restoration Plant Facility Plan
Implementation Plan

FINAL

March 2014

carollo

720 SOUTHWEST WASHINGTON STREET, SUITE 550 • PORTLAND, OREGON 97205-3507 • (503) 227-1885 • FAX (503) 227-1747

City of Grants Pass

TECHNICAL MEMORANDUM NO. 9

Water Restoration Plant Facility Plan
Implementation Plan

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IMPLEMENTATION PLAN

1.0 INTRODUCTION

This Technical Memorandum (TM) outlines a Capital Improvement Plan (CIP) for implementing upgrades at the Water Restoration Plant (WRP) that were identified through the facility planning process. Undertaking these improvements will provide reliable equipment and facilities, address capacity limitations, and accommodate future growth. The CIP provides a guide for planning and budgeting of improvements at the WRP through the year 2035.

2.0 CAPITAL IMPROVEMENT PLAN

Improvements required at the WRP were grouped under three phases in the CIP. The phasing reflects priorities identified during the facility planning process, the interrelationship of unit processes, and sequencing needed to address constructability issues and constraints. The implementation phases are summarized as follows:

CIP Phase 1 – Plant Upgrades (2014 through 2016)

In Phase 1, the older of the two aged ultraviolet (UV) disinfection units is replaced with a new, more energy efficient UV unit. This upgrade restores the reliability of the disinfection process. Additionally, seismic upgrades are made to existing facilities to address life safety issues that are not addressed in Phase 2. The following projects are included in CIP Phase 1:

- Replacing one UV unit.
- Seismic upgrade of facilities to address life safety issues that are not addressed in Phase 2.

CIP Phase 2 – Plant Expansion (2016 through 2020)

Phase 2 includes projects needed to treat maximum month wet weather flows, increase peak hour capacity, and allow the existing aeration basin to be taken offline to replace diffusers and make other needed repairs. Additionally, Phase 2 includes rehabilitation of the existing gravity thickener and construction of one new gravity thickener to provide a reliable sludge thickening process. The following projects are included in CIP Phase 2:

- Primary Clarifier No. 3.
- Aeration Basins No. 3 and 4.
- Rehabilitation of existing gravity thickener and one new gravity thickener.
- Screening hydraulic improvements.

CIP Phase 3 – Plant Expansion (2020 through 2023)

Phase 3 expands plant capacity to accommodate growth and addresses the remainder of plant upgrades needed through the planning year 2035. The following projects are included in CIP Phase 3:

- Primary Clarifier No. 4.
- Secondary Clarifier No. 3.
- WAS diversion pipeline and mixing upgrades.
- Degritting improvements.

The estimated total project costs for the improvements outlined in the phased CIP are summarized in the following Table 1:

Table 1 Recommended CIP
City of Grants Pass – Implementation Plan

CIP Project Phase	Cost, $	Fiscal Years
Phase 1	1,500,000	2015 – 2016
UV Disinfection	1,093,000	
Seismic Upgrades	407,000	
Phase 2	9,643,000	2016-2020
Primary Clarifier No. 3	2,703,000	
Aeration Basins No. 3 and 4	5,728,000	
Rehabilitate GT and One New GT	1,100,000	
Screening Hydraulic Improvements	112,000	
Phase 3	8,918,000	2020-2023
Primary Clarifier No. 4	2,703,000	
Secondary Clarifier No. 4	5,017,000	
WAS Diversion Pipeline and Mixing Upgrades	440,000	
Degritting Improvements	758,000	
Total CIP	20,061,000	

3.0 SUMMARY OF PROJECTS

A brief summary of the recommended projects is presented in this section.

3.1 CIP Phase 1 Projects

3.1.1 UV Disinfection Upgrades

The existing UV disinfection system has sufficient capacity, however, the existing equipment is approaching the end of its useful life and new models have significantly higher energy efficiencies. There is a significant potential in reduction in operating costs by replacing one of the existing units with a more energy efficient low-pressure unit. Additionally, there are grants available, which can reduce the capital cost of this project.

3.1.2 Seismic Upgrades

Based on the seismic evaluations performed as outlined in TM 6, several structures at the WRP do not meet the Life Safety Level performance objectives as defined by American Society of Civil Engineers Standard 31 (ASCE 31-03). The seismic upgrades included in CIP Phase 1 mitigate existing deficiencies and allow the WRP buildings to comply with Immediate Occupancy performance objectives. A summary of the upgrades included in this phase are listed below:

- Operations Building: Adding straps, wall anchors, equipment anchorage, pipe bracing, roof collector element, anchor face brick, and replacing glass.
- Digester Control Building: Upgrades in the digester control building include adding wall anchors, replacing glass, adding equipment anchorage, and pipe bracing.
- Headworks Electrical Building: This project element includes replacing roofing, adding straps, adding wall anchors, equipment anchorage, bracing duct and pipes.
- Plant Drain Pump Station: Adding equipment anchorage.
- Oil Storage House: The task under this project will include adding anchorage and removing and infilling access door.
- Gravity Thickener Sludge Pump Building: Replacing damaged plywood, complete nailing, and adding wall anchorage.

3.2 CIP Phase 2 Projects

3.2.1 Primary Clarifier No. 3

The existing primary clarifiers are unable to meet the current maximum month wet weather flow capacity. In order to provide sufficient maximum month capacity, Primary Clarifier No. 3 is included in this CIP Phase 2.

3.2.2 Aeration Basins No. 3 and 4

The activated sludge system is nearing capacity during both the partial nitrification and winter secondary treatment seasons. The Department of Environmental Quality (DEQ) recently imposed new more stringent seasonal effluent quality requirements (from May through October) for ammonia in 2009. The activated sludge system operates in a partial nitrification mode to meet these limits. Additional capacity is required to meet the limits while accommodating demands from population growth. Under CIP Phase 2, two new aeration tanks with associated appurtenances are constructed. This will allow the existing aeration basin to be taken off line for needed maintenance work, facilities construction sequencing, and provides capacity required through the planning year 2035.

3.2.3 Rehabilitate Existing Gravity Thickener and Build One New Gravity Thickener

Primary sludge is currently thickened in one gravity thickener, constructed in 1974. This one gravity thickener provides sufficient capacity for max month dry weather sludge loadings, however, there are significant signs of corrosion of both the mechanism and the concrete structure. Given there is no gravity thickener process redundancy, construction of one new 25-foot diameter thickener provides the treatment capacity needed for the existing gravity thickener to be removed from service and renovated. Following the work, this CIP Phase 2 project will provide process redundancy for greater reliability and improved performance.

3.2.4 Screening Hydraulic Improvements

The two existing screens have adequate capacity for the 2035 flows projections. However, during peak hourly flows, there is inadequate hydraulic capacity in the screenings effluent channel to pass all of the influent raw sewage to the primary sedimentation tanks. Structural modifications are included in CIP Phase 2 to increase hydraulic capacity of the channel.

3.3 CIP Phase 3 Projects

3.3.1 Primary Clarifier No. 4

Primary Clarifier No. 4 is required to meet projected maximum month demands through the planning year 2035.

3.3.2 Secondary Clarifier No. 4

As mentioned in Section 3.2.2, the existing activated sludge system needs additional capacity to meet stringent limits and projected demands. The capacity of the existing secondary clarifiers is inadequate for current peak hour flow (PHF) at the desired loading rate of 1250 gpd/sf. A new 100-foot diameter clarifier is recommended for construction in Phase 3.

3.3.3 WAS Diversion Pipeline and Mixing Upgrades

This project includes installation of waste activated sludge (WAS) diversion pipeline to provide a bypass for the digester, and mixing and basin upgrades. Mixer and basin upgrades are needed to provide sludge storage when the belt filter press is unavailable.

3.3.4 Degritting Improvements

The existing grit removal system has adequate capacity for 2035 loadings. However, due to the condition and age of the equipment, it is anticipated that the grit pumps and grit classifier will require replacement in the 2020 - 2023 time period. At the time of replacement, this equipment will be approximately 25 years old.

Water Treatment Plant Facility Plan Update

Murray, Smith & Associates, Inc.
Engineers/Planners

MWH

City of Grants Pass

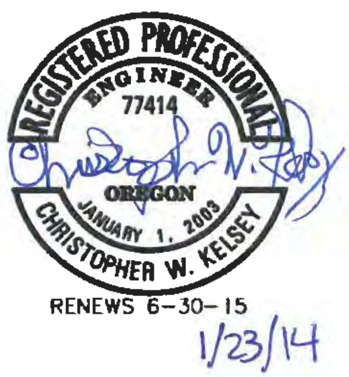
January 2014

WATER TREATMENT PLANT FACILITY PLAN UPDATE

FOR

CITY OF GRANT PASS

JANUARY 2014



MURRAY, SMITH & ASSOCIATES, INC.
121 SW Salmon, Suite 900
Portland, OR 97204
503.225.9010

In association with:
MWH AMERICAS, INC.
806 SW Broadway, Suite 200
Portland, OR 97205
503.226.7377

12-1340.404

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ACKNOWLEDGEMENTS

The following City of Grants Pass staff contributed to the development of this Water Treatment Plant Facility Plan Update.

- Ole Ahlstrom, Treatment Plant Specialist
- Jason Canady, Water Treatment Plant Superintendent
- Terry Haugen, Public Works Director
- Craig Kuhnert, Treatment Plant Specialist
- Frank Morgan, Treatment Plant Specialist
- Jeff Thompson, Treatment Plant Specialist
- Joey Wright, Engineering Technician

Water Facility Advisory Committee:

Citizens:
- Gordon Longhurst
- Colene Martin
- Robert Bellenbaum
- Brett Loper
- Jeff Hyde
- Carl Wilson

Councilors:
- Jim Williams
- Ken Hannum
- Dennis Webber

Facilitator:
- Greg Fishwick

Mayor and Council members in addition to above:
- Darin Fowler, Mayor
- Lily Morgan
- Rick Riker
- Dan DeYoung
- Mark Gatlin
- Jim Goodwin

ACRONYMS AND ABBREVIATIONS

The following is a list of definitions of acronyms and abbreviations.

°C	degrees Celsius
°F	degrees Fahrenheit
ACH	aluminum chlorohydrate
ADA	Americans with Disabilities Act
ADD	average day demand
$Al_2(SO_4)$	aluminum sulfate or alum
AWWA	American Water Works Association
BF	ballasted flocculation
$CaCO_3$	calcium carbonate
$Ca(OH)_2$	calcium hydroxide
$Ca(S_2O_3)$	calcium thiosulfate
CFE	combined filter effluent
CFR	Code of Federal Regulations
CIP	capital improvement program
City	City of Grants Pass
Cl_2	free chlorine
CMU	concrete masonry unit
CO_2	carbon dioxide
Cr+6	hexavalent chromium
CT	disinfectant concentration multiplied by the contact time
D/DBP	Disinfectants and Disinfection Byproducts
DBP	disinfection by-products
E. coli	*Escherichia coli*
EDC	endocrine disruptor
EPA	Environmental Protection Agency (United States)
ESWTR	Enhanced Surface Water Treatment Rule
FBRR	Filter Backwash Recycling Rule
fps	feet per second
FRP	fiberglass reinforced plastic
ft	foot or feet
FTE	full-time employee
FTW	filter-to-waste
FWP	finished water pipeline
FWPS	finished water pump station
g/L	grams per liter
GAC	granular activated carbon
gal	gallon or gallons
gal/sf	gallons per square foot
GIS	geographic information system
gph	gallons per hour

gpm	gallons per minute
gpm/sf	gallons per minute per square foot
HAA5	haloacetic acids – D/DBP rule
HDPE	high-density polyethylene
HGL	hydraulic grade line
HI	Hydraulic Institute
HSPS	high service pump station
HP	horsepower
HRT	hydraulic retention time
HVAC	heating, ventilation, and air conditioning
in.	inch or inches
IOC	inorganic compound
k	thousands
$KMnO_4$	potassium permanganate
kW	kilowatt
lb/sf/day	pounds per square foot per day
LCR	Lead and Copper Rule
LOX	liquid oxygen
LRAA	Locational Running Annual Average
LT2	Long-Term 2
LT2ESWTR	Long-Term 2 Enhanced Surface Water Treatment Rule
M	million
mA	milliampere
MCL	maximum contaminant level
MDD	maximum day demand or peak day demand
MG	million gallon
mg/L	milligrams per liter
mgd	million gallons per day
MIB	2-Methylisoborneol
min	minute or minutes
mL	milliliter
mm	millimeter or millimeters
MRDL	maximum residual disinfectant level
MSA	Murray, Smith and Associates, Inc.
MWH	MWH Americas, Inc.
N	nitrogen
Na_2CO_3	soda ash
NaOCl	sodium hypochlorite
NaOH	sodium hydroxide
NPDES	National Pollutant Discharge Elimination System
NTU	Nephelometric Turbidity Units
O_3	ozone
OAR	Oregon Administrative Rules
OCl	hypochlorite
OHA	Oregon Health Authority

OSHA	Occupational Safety and Health Administration
PAC	powdered activated carbon
PACl	polyaluminum chloride
pCi/L	picocuries per liter
PCP	personal care product
pH	measure of the acidic or basicity of an aqueous solution
phAC	pharmaceuticals
ppb	parts per billion
ppd	pounds per day
ppm	parts per million
ppt	parts per trillion
psi	pounds per square inch
psig	pounds per square inch gauge
PVC	polyvinyl chloride
RAA	Running Annual Average
RO	reverse osmosis
ROW	right-of-way
rpm	revolutions per minute
RWP	raw water pipeline
SCADA	Supervisory Control and Data Acquisition
SOC	synthetic organic compound
ST1DBPR	Stage 1 Disinfectants and Disinfection Byproducts Rule
ST2DBPR	Stage 2 Disinfectants and Disinfection Byproducts Rule
State	State of Oregon
SWTR	Surface Water Treatment Rule
T or T_{10}	"effective" detention time through a section of the plant
TC	total coliform
TCR	Total Coliform Rule
TDH	total dynamic head
THM	trihalomethanes
TOC	total organic carbon
TON	threshold odor number
TSS	total suspended solids
TTHM	total trihalomethanes
UCMR	Unregulated Contaminants Monitoring Rule
UL	Underwriters Laboratories
USGS	United States Geological Survey
UV	ultraviolet
UVA	ultraviolet A
V	volt
VDC	volts direct current
VFD	variable frequency drive
VOC	volatile organic compound
WTPFP	Water Treatment Plant Facility Plan
WTP	water treatment plant

WW	washwater
WWW	waste washwater
yr	year

EXECUTIVE SUMMARY

EXECUTIVE SUMMARY

This report presents an update to the 2004 Water Treatment Plant Facility Plan (WTPFP) for the City of Grants Pass (City). The 2004 WTPFP provided guidance for improving the City's water treatment plant (WTP) and recommended a two-tiered capital improvement program (CIP). The City implemented a number of the recommended improvements which included addressing reliability and redundancy shortfalls and performing critical structural crack repairs in process basins.

Despite these improvements, conditions at the WTP have deteriorated since the 2004 WTPFP was created. In order to continue to reliably produce water for the community, a significant decision needs to be made in regards to the existing treatment facility. This WTPFP update provides the City with a sound basis for making the key decision: proceed with further major capital investments to maintain the existing facility or proceed with planning, design and construction of a new WTP to replace the aging facility. Both alternatives require immediate capital expenditures from the City to secure the water system's reliability. The final decision will lay the foundation for more than a hundred years of water system operations and will need to balance the economic, social, and environmental needs of the City.

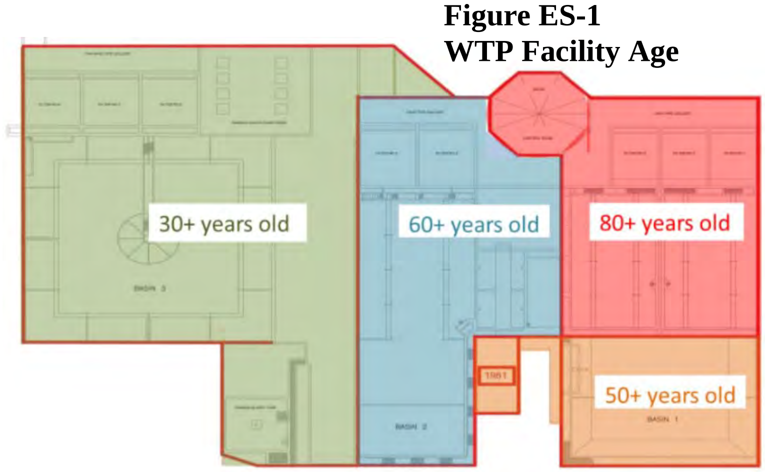
The primary objectives of this WTPFP update included:

- Evaluate the recent performance of the WTP in terms of quality and capacity
- Update the impacts of current drinking water regulations as they affect current and future treatment requirements
- Evaluation and documentation of the existing condition and remaining useful life of the WTP's structural systems
- Incorporation of recently updated water system demand projections to help identify potential WTP capacity deficiencies and the need for development of expanded capacity
- Evaluation of alternative approaches for maintaining the existing WTP and providing expanded capacity
- Evaluation of siting and construction of a new WTP
- Develop a CIP implementation plan based on community stakeholder input and triple bottom line analyses of existing and new facility improvement alternatives

Water Treatment Plant Overview

The Grants Pass WTP, located at 821 Southeast "M" Street, was originally built in 1931 and has undergone several upgrades and expansions to serve a growing population and to meet more stringent treatment standards. Capacity upgrades were completed in 1950, 1961, and 1983, as illustrated in **Figure ES-1**. The plant's current hydraulic capacity is approximately 20 mgd.

Figure ES-1
WTP Facility Age



Water Treatment Plant Condition

Several structures at the WTP continue to show increasing signs of deterioration as many parts of the WTP have reached or exceeded their expected service life. As highlighted in the pictures on this page, the deterioration includes:

- Exposed rebar and concrete failure in sections of the clearwell.
- Spalling and cracking concrete in older primary process components of the WTP.
- Failure of submerged structural elements.

All of these elements are critical in supplying a reliable quantity and quality of drinking water to the citizens of Grants Pass.

A seismic and structural review of the Grants Pass WTP was completed in 2011 in response to the observed structural deteriorations. The review concluded that the WTP is at a high seismic risk and **is susceptible to collapse in a strong earthquake**. A planning-level project cost to address deficiencies observed during the review was estimated to be approximately $8.5 million. While these structural improvements would reduce the overall seismic vulnerability of the WTP, they do not improve the facilities to current building code standards for seismic events, and they do little to address the declining condition of the aging facility and would not increase WTP production capacity.

Spalled concrete and exposed rebar

Exposed rebar in clearwell beam

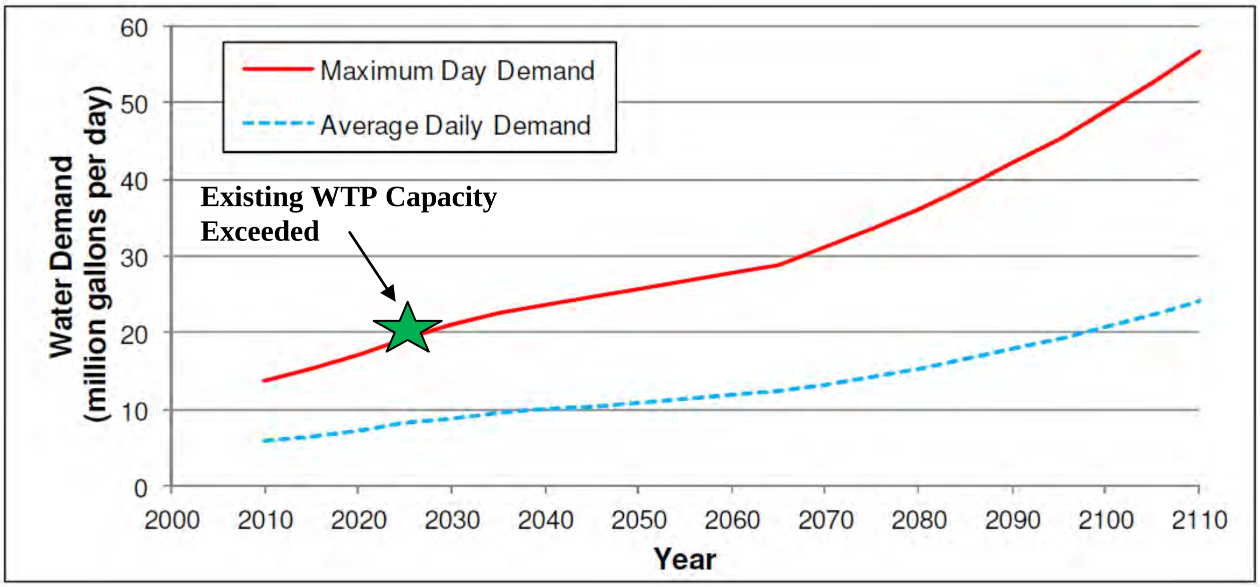
Vertical cracking in basin wall

In February 2013, the Oregon Resilience Plan (Plan) was completed, highlighting the real risk of a major Cascadia Subduction Zone earthquake with a magnitude of 9.0. One of the key recommendations of the Plan is the completion of comprehensive assessment and mitigation plans for critical water system infrastructure. **For the City of Grants Pass, the WTP, as the City's sole source of water supply with no emergency backup, is the most critical facility in the water system.** The age and condition of the WTP, as described herein, emphasizes how vulnerable this facility is to catastrophic damage in a major earthquake.

Water Demand Projections and Capacity Needs

The design flow for WTP capacity is the maximum day demand (MDD) for water utilities that have adequate distribution system storage. Per regulatory requirements, the development of water demand projections consider the existing service area, future service areas, and trending of historical population and water demand information. As illustrated in **Figure ES-2**, the MDD is projected to exceed the existing WTP capacity between 2025 and 2030, and will reach approximately 30 mgd by 2065. While continued reduction in water use through conservation and increased efficiency may delay the need for expanded capacity, water demands will continue to increase over time as the City's population grows, ultimately requiring expanded water treatment capacity.

Figure ES-2
Water Demand Projections



Capital Improvement Alternatives Overview

Five capital improvement alternatives were developed to represent a full range of potential space, cost, and risk scenarios that address the identified WTP deficiencies and promote reliable, long-term source of supply from the Rogue River. The alternatives are:

Alternative 1: Existing WTP Upgrade, Maximize Reuse of Existing Facilities

Alternative 2: Existing WTP Upgrade, Phased Replacement of Facilities

Alternative 3: Construct a New WTP with Consolidated Footprint

Alternative 4: Construct a New WTP with Large Footprint

Alternative 5: Construct a New WTP with Consolidated Footprint on Property already owned by the City

Capital Improvements Program Recommendation

An Advisory Committee of community leaders and City Council members was assembled to assist in the evaluation and recommendation of a preferred alternative from those presented above. City Public Works employees integral to the project also participated to offer information about operational impacts, zoning and land use implications, and necessary steps in the City approval process.

A series of four workshops was conducted over a three-month period with the Advisory Committee using an independent facilitator from the Grants Pass community. The Advisory Committee evaluated each alternative considering its economic, social, and environmental impacts.

For the benefit of the Advisory Committee, a list of suggested criteria was developed from similar projects to evaluate the alternatives. The committee then modified and finalized the criteria, establishing appropriate weighting for each through group discussion. **The members of the Advisory Committee independently scored the alternatives and Alternatives 3 and 4 - building a new WTP at a site to be determined - scored the highest**. These alternatives were selected by the Advisory Committee because they provide the City with a seismically secure, reliable WTP, with a treatment process able to provide improved water quality for existing and future generations, all at a cost to the community that is comparable to continuing to invest in the existing WTP.

Workshop results and scoring were presented to the City Council during its August 5, 2013 Workshop and then discussed further during its September 9, 2013 Workshop. In reviewing the materials developed and scoring performed, **the Council directed the completion of this Facility Plan Update with the recommendation to move forward in the planning process to construct a new WTP at a site to be determined**.

Capital Improvement Program Implementation Plan

The conceptual project cost to construct a new WTP is estimated to be approximately $56 million, with an accuracy range of –30 percent to + 50 percent. **It is recommended that the City establish a capital budget for this project which reflects this estimate and the level of uncertainty and risk associated with the current level of project definition**. This budget should be updated and refined over time as the implementation plan progresses and planning and design uncertainties are addressed.

The City should proceed with the processes necessary to construct the new WTP as quickly as possible to avoid extensive investments in the existing plant that are critical to ensuring the plant can continue to reliably meet water quality regulations. Delays in implementation would require the City to remain reliant upon the existing WTP. This presents not only significant structural and seismic reliability risks, but other production reliability and redundancy issues as highlighted in this WTPFP Update. The required capital investment in the existing WTP to mitigate these risks will increase over time, and represent stranded investments once the new WTP is constructed.

The recommended schedule to proceed with the planning, design and construction of the new WTP is presented in **Figure ES-3**. It is possible to have a new WTP online by the middle of 2019 using a traditional design-bid-build project delivery approach. **Table ES-1** presents a summary of anticipated capital expenditures (project costs) for the next 10 years to implement a new WTP based on this Implementation Schedule. While WTP construction would be completed in year 6, additional expenditure activities such as decommissioning of the existing WTP, reconfiguration of the WTP site, and the warranty period for the new WTP, will extend through the remainder of the 10-year timeframe.

Figure ES-3
Project Implementation Schedule

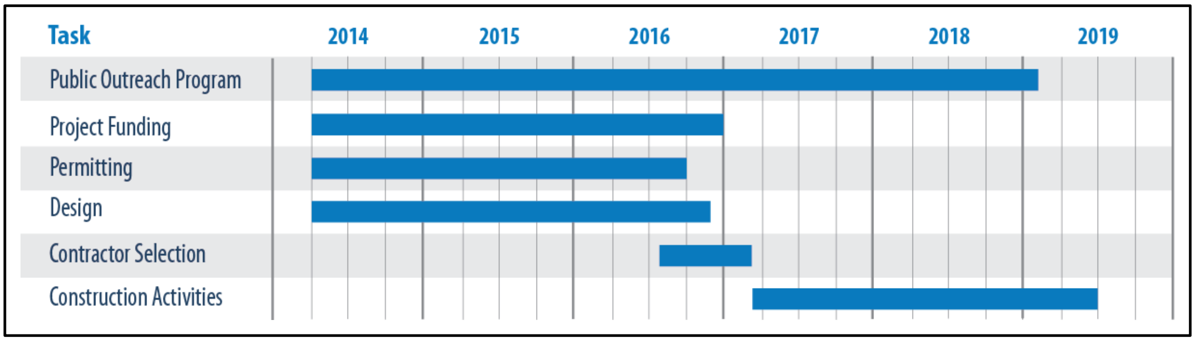


Table ES-1
Recommended Capital Improvement Program Summary

Capital Project	Capital Expenditure
New Water Treatment Plant Implementation	
Pilot Plant Study	$500,000
Siting Study and Property Acquisition	$1,300,000
Funding Study and Rate Impact Study	$200,000
Project Implementation Approach and Procurement Strategy	$50,000
Public Information/Involvement	$250,000
Permitting and Land-Use Approvals	$200,000
Preliminary Design	$1,000,000
Final Design	$4,000,000
Bidding and Award	$250,000
Construction	$47,200,000
Post-Construction and Warranty Period	$200,000
Existing Water Treatment Plant Investments	
Emergency Response Plan	$50,000
Decommission and Demolition of Existing Plant	$1,000,000
Total Anticipated Expenditures (2013 dollars)	**$56,200,000**

Project Initiation Activities

To bring a new WTP on-line by 2019, the City will be required to accomplish the following tasks during the first year of planning, beginning with the FY2014-2015 budget:

- Develop a funding strategy.
- Prepare an Emergency Response Plan for the potential failure of the existing WTP.
- Select a site for the new WTP.
- Conduct a year-long pilot plant study to evaluate clarification, intermediate disinfection and high-rate filtration process alternatives.
- Confirm the project schedule and project delivery strategy.
- Plan and implement a public outreach program.
- Develop a permitting and regulatory approval plan.

It is anticipated that the City will need to allocate approximately $1 million to complete these activities. Once significant progress has been made on each of these tasks, the detailed design phase may begin. If the City does not proceed with the proposed implementation plan and schedule to construct a new WTP, then funds should immediately be allocated and expended to complete critical structural and seismic repairs at the existing WTP. These improvements, including approximately $8.5 million dollars in structural upgrades, would be necessary to reduce the risk of failure of essential treatment process components in the interim. **Critical early planning activities should begin in the next fiscal year to avoid additional stranded capital investments in the existing WTP**.

CHAPTER 1

CHAPTER 1
INTRODUCTION AND BACKGROUND

Purpose

This report presents an update to the 2004 WTPFP for the City. The 2004 WTPFP provided guidance for improving this major element of the City's water system and recommended a two-tiered CIP. The main elements of the CIP were developed after a review and evaluation of historical plant performance and regulatory requirements. Many of the recommended improvements have been completed since 2004. The objectives of this WTPFP update include:

- Update the impacts of current drinking water regulations as they affect current and future treatment requirements.
- Update the capacity evaluation of the WTP, incorporating facility improvements and operational changes that have been implemented since 2004.
- Review information presented in recent structural evaluations and additional tests to help determine the remaining useful life of the WTP's structural systems.
- Visually inspect and review equipment in terms of age, condition, and code compliance to assess the remaining useful life of electrical and mechanical equipment.
- Incorporate recently updated water system demand projections to help identify potential plant capacity deficiencies. These demands were developed to assist in the City's water rights extension process and will be adopted into upcoming water system master planning documents.
- Evaluate alternative improvements to address existing and potential future WTP deficiencies.
- Feasibility evaluation for siting and construction of a new WTP.
- Develop planning-level cost estimates associated with both existing and new WTP project alternatives.
- Assist in selecting a capital improvements implementation plan based on input from an Advisory Committee of community leaders and City Council members and an analysis of existing and new facility improvement alternatives.

Project Background

The WTP uses chemical and physical processes to treat water from the Rogue River to produce high-quality drinking water and is the City's sole source of potable water. The original WTP facilities were constructed in 1931 with subsequent expansion projects in 1950, 1961, and 1983.

Due to observed and on-going deterioration in some older structural elements of the WTP, a seismic and structural review of the Grants Pass WTP was completed in 2011. A review of geotechnical studies conducted at the plant site showed that ground shaking and slope stability along the Rogue River bluff are the two most significant seismic geotechnical risks. A review of the construction documents of the plant shows that, overall, the structures appear to have been designed and detailed prior to consideration of seismic loads. Given this lack of seismic design consideration, the plant is judged to have a high seismic risk and is susceptible to collapse in a strong earthquake.

A planning-level project cost to retrofit the various structural deficiencies observed during the review was estimated to be approximately $8.5 million. These structural studies and observations led the City to initiate this update to the WTPFP to help guide the planning of the City's water treatment and supply system and to help the City prioritize improvements over the next 20 years. This updated WTPFP evaluates the advantages and disadvantages of continuing to invest in this older, structurally deficient facility considering that it may have limited remaining useful life.

Water Treatment Plant Overview

The Grants Pass WTP, located at 821 Southeast "M" Street, was originally built in 1931 with a single sedimentation basin and three filters for a design capacity of approximately 3.5 mgd. The plant has undergone several upgrades and expansions to serve a growing population and to meet more stringent treatment standards. Capacity upgrades were completed in 1950, 1961, and 1983, and the plant has received numerous process and safety upgrades over the past two decades as well. The plant's current hydraulic capacity is approximately 20 mgd, but the plant cannot operate at this rate throughout the year due to process and regulatory compliance constraints during the colder months of the year. These constraints have yet to affect the plant's ability to produce high-quality water while meeting the City's water demands. The 1983 expansion required extensive internal remodeling of the original building, while preserving its current listing as a Historic Landmark by the Grants Pass Historic Building and Sites Commission and the American Water Works Association's (AWWA) National Historic Water Landmarks.

Raw Water Supply

The plant draws water from the adjacent intake on the Rogue River. The City has been drawing water from the Rogue since 1888 and currently has a total water right of 82 cubic feet per second (CFS) or 53 mgd. The river is prone to turbidity events and yearly fluctuations in temperature and pH which create seasonal challenges to plant operations. The river flow and quality are also influenced by upstream dam operations, most notably the Lost Creek Reservoir. In 2010, the Gold Ray Dam on the Rogue River was removed and this has created additional challenges to plant operations, including increased sediment and turbidity which among other things, has negatively affected the performance of the intake and screen cleaning system.

Facilities and Processes

The WTP is operated and rated as a conventional filtration plant, although it lacks flocculation prior to sedimentation in its basins. Liquid residuals, including dirty backwash water and filter-to-waste water, are transferred to the old mill pond, located across the street from the plant which overflows to Skunk Creek. The majority of plant solids, which collect in the sedimentation basins, are now handled on-site, but were previously discharged to the old mill pond along with the backwash water and filter-to-waste water.

Figure 1-1 is a photographic overview of the City's Water Treatment System and Figure 1-2 provides a plan-view layout of the WTP's current configuration. Figure 1-3 is a Process Flow Schematic of the plant indicating key processes and chemical addition points. Major facilities and structures at the Grants Pass WTP include:

- Raw water intake and screening facility.
- Raw water pumping station which has four pumps, all with 75 HP motors and two with variable frequency drives (VFDs), a flow meter, and 36-inch diameter static mixer.
- One mixing basin, currently operating as a flow-through structure without mixing, servicing basins 1 and 2.
- Three sedimentation basins with a total surface area of 18,800 square feet and total volume of 1,835,300 gallons.
- Eight dual media gravity filters with 30 inches of media depth and a total of 2,493 square feet of surface area.
- A 433,000 gallon baffled clearwell. The clearwell's volume of 433,000 gallons represents the maximum volume at the overflow level. The actual operating volume varies from 362,000 gallons to 400,000 gallons.
- Two backwash pumps with VFDs, 16-inch diameter backwash supply pipeline and flow meter.
- A high service pumping station which has six pumps, one constant-speed pump with 300 HP motor, two constant-speed pumps with 250 HP motors, two pumps with VFD 250 HP motors, and one pump with VFD 200 HP motor.
- One 36-inch diameter finished water transmission pipeline with flow meter.
- One hydropneumatic surge tank with a volume of 11,300 gallons located on the finished water discharge.
- Chemical storage, metering, and rapid mixing systems for liquid alum, liquid proprietary coagulant, liquid sodium hypochlorite, and dry polymer. ACH is used as the primary coagulant, alum is used as a supplemental coagulant and to aid in pH adjustment, and filter aid polymer is added to the basin effluent to improve filter performance. Disinfection is achieved through both pre- and post-chlorination by addition of sodium hypochlorite.
- One 116,000-gallon equalization basin for backwash wastewater and filter-to-waste water.

- Equalization basin pumping station with three pumps, two pumps with 30 HP each with a combined capacity of 2,100 gpm at a TDH of 42 feet, and one pump with 60 HP motor rated at 1,750 gpm at a TDH of 60 feet.
- One residual solids lagoon, called the old mill pond, which discharges decant into Skunk Creek and eventually into the Rogue River.
- The old powdered activated carbon slurry tank was re-purposed as a solids conditioning tank to receive residual solids from sedimentation basins. After conditioning with polymer, the solids are pumped into geomembrane bags or "geobags" for on-site dewatering and hauled to off-site disposal.

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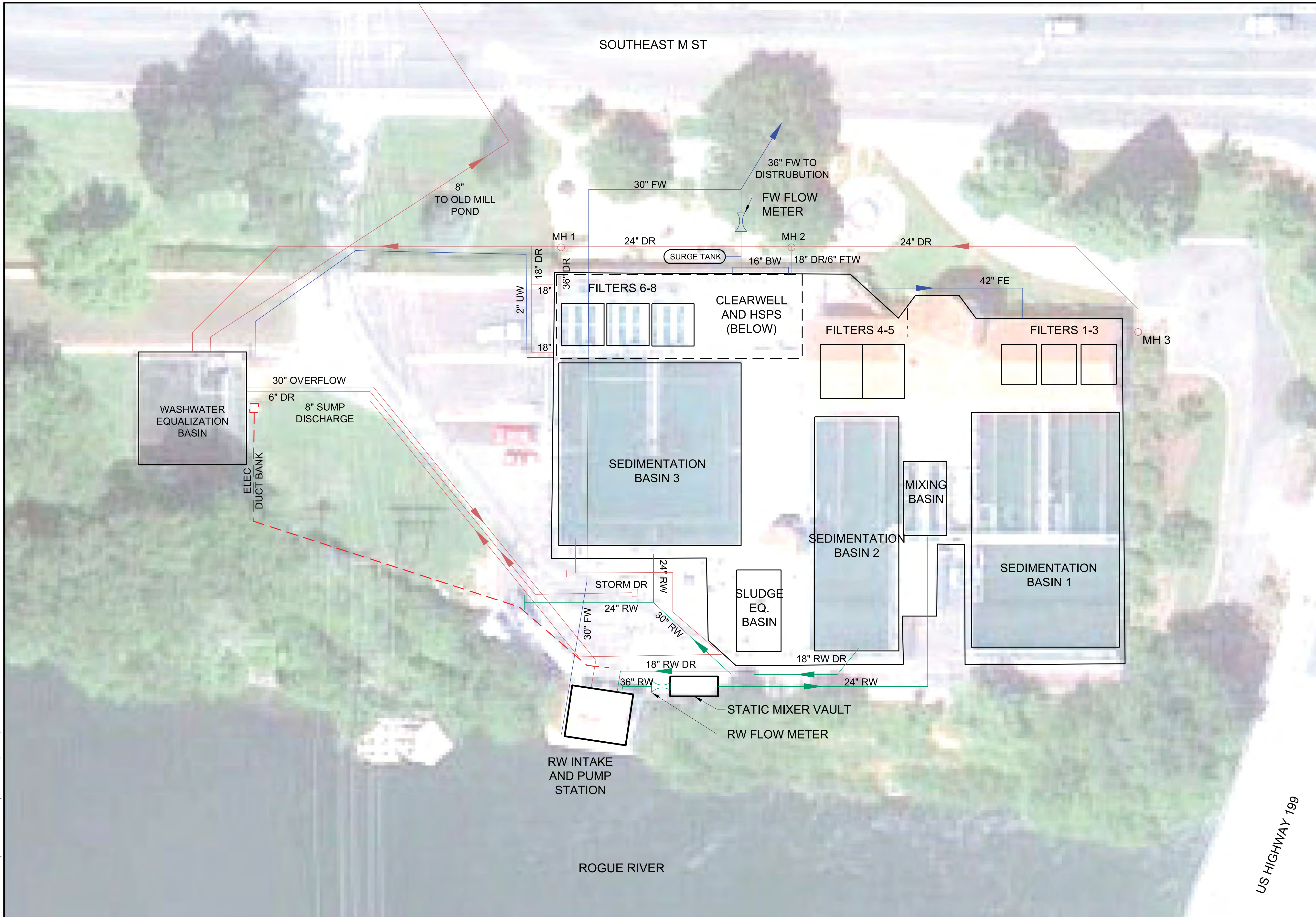

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LEGEND

—	BUILDINGS AND MAJOR PROCESS COMPONENTS
—	RAW WATER PIPING
—	FINISHED WATER PIPING
—	WASTE/OVERFLOW PIPING
—	ELECTRICAL DUCT BANK
BW	BACKWASH WATER
DR	DRAIN
FE	FILTER EFFLUENT
FW	FINISHED WATER
FTW	FILTER-TO-WASTE
MH	MANHOLE
OF	OVERFLOW
RW	RAW WATER

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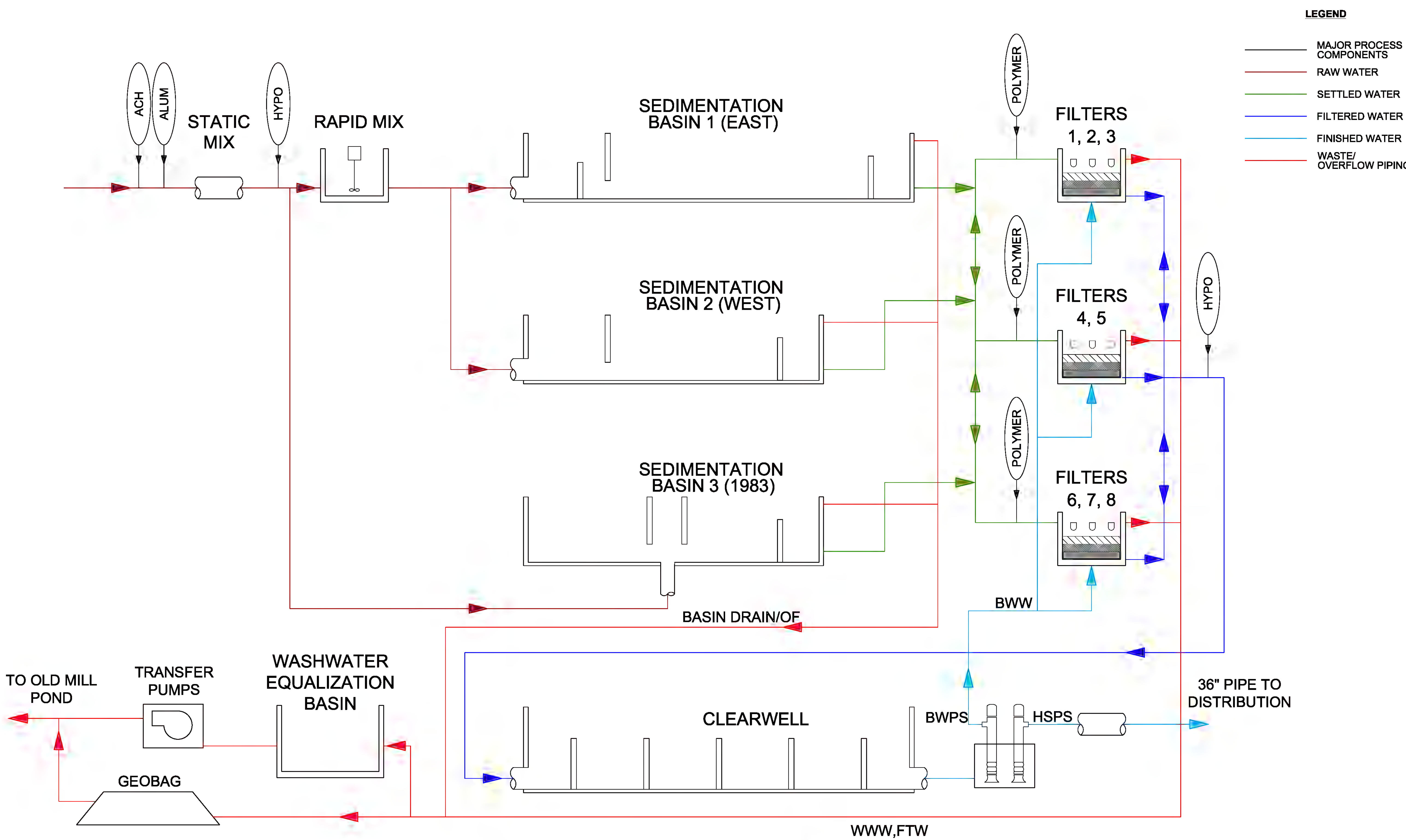
City of Grants Pass

WATER TREATMENT PLANT FACILITY PLAN UPDATE
FIGURE 1-2
PLAN VIEW LAYOUT

PAGE
1-5



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City of Grants Pass

WATER TREATMENT PLANT FACILITY PLAN UPDATE
FIGURE 1-3
EXISTING SYSTEM PROCESS FLOW SCHEMATIC

PAGE
1-6

The operations building includes a water quality laboratory for treatment process monitoring and control, the plant's electrical distribution equipment, main control board, and other instrumentation and control equipment. The operations building also has office and administrative spaces, a lunchroom, workshop, and meeting area.

The plant typically operates between 8 and 24 hours per day, depending on system demands. During the peak demand months of July through September, the plant is operated for up to 24 hours per day to meet peak day demands. The plant is staffed at all times when operating and employs six full-time employees (FTE) and five seasonal, part-time employees.

Plant Improvements Since 2004

The 2004 WTPFP recommended a two-tiered CIP to improve plant performance to meet regulatory requirements and improve overall plant operations and safety. Major improvements made at the WTP since the 2004 WTPFP include:

- Screening improvements at the Rogue River intake to meet fish protection criteria.
- Addition of VFDs to the raw water pumps to improve plant operating flexibility.
- Replacement of filter underdrains and media to improve plant performance.
- Addition of solids handling and dewatering facilities to reduce the volume of solids and liquids being discharged to the old mill pond across the street from the WTP; "Geobags" are now used to handle solids for dewatering.
- Incorporation of a new coagulation chemical scheme which has eliminated the need to add lime for pH adjustment; hence, the lime system has been demolished.
- Addition of a second filter backwash pump to improve plant reliability.
- Addition of a standby generator at the WTP to improve plant reliability and reduce vulnerability during power outages; to be completed in the spring of 2014.

A project involving solids removal systems in the sedimentation basins was investigated in 2009 and this work was deferred by the City due to high costs. The high cost was due to structural and seismic retrofitting required as part of the installation of the equipment.

Summary

Chapter 1 establishes the purpose of this Facility Plan update and provides background on activities leading up to its development. Subsequent chapters will review various aspects of the WTP's condition and performance. The evaluation of the existing plant includes a performance evaluation, regulatory review, capacity review, and facilities review. Each review is summarized in separate sections of this report. These reviews and analyses document potential improvements at the existing WTP which may be required for a number of reasons including maintaining existing capacity, increasing capacity, optimizing performance, meeting future drinking water regulations, extending remaining useful facility life, and improving safety and operational efficiency. Proposed WTP improvement alternatives include estimated project costs and alternatives that consider construction of a new WTP at a site other than the existing WTP site.

The evaluation and final recommendation of the preferred capital improvement alternative was accomplished using a triple-bottom-line analysis. The City assembled an Advisory Committee of community leaders and City Council members to assist in the evaluation and recommendation of a preferred alternative. The Advisory Committee convened for four separate workshops during the summer of 2013 to review and discuss the alternatives before selecting a preferred alternative.

CHAPTER 2
HISTORICAL PLANT PERFORMANCE

Introduction

Historic operating data for the Grants Pass WTP are reviewed and analyzed in this chapter. The purpose of this data review is to evaluate the existing WTP processes for capacity, operational efficiency, and regulatory compliance. Data collected and reviewed from 2004 to 2011, the period after completion of the 2004 WTPFP, included: plant flow and production information; selected raw, finished and distribution system water quality parameters; basin performance; chemical usage data; and overall filter performance indicators. As highlighted in Chapter 1, a number of recommended improvements in the 2004 WTPFP have been completed at the plant and have had a beneficial impact on plant performance.

Water Treatment Plant Production

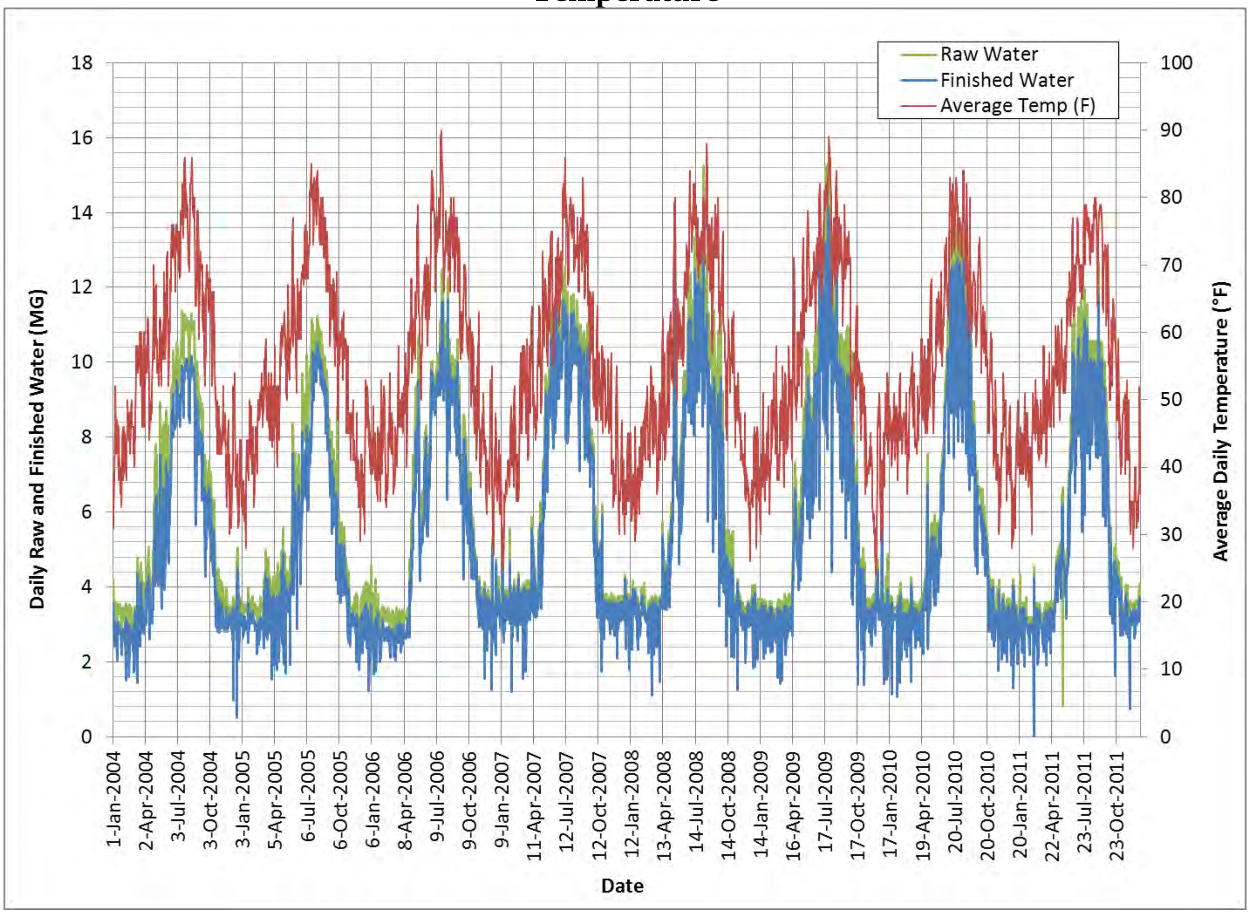
The Grants Pass WTP measures and records raw and finished water flows through the plant on a daily basis. Raw water flow is measured using a differential pressure type (Venturi) flow meter located on the influent line prior to chemical addition. Finished water flow is measured using a Venturi flow meter located on the WTP effluent line just downstream of the HSPS. Filter backwash flow is measured in the backwash supply line. FTW flows are discharged upstream of the filter effluent flow meters, and therefore have not been historically measured or recorded since the installation of the FTW line in 1997. The duration of FTW after filters are backwashed usually only lasts for a few minutes and has limited impact on overall plant flow and performance.

The 2004 WTPFP noted an increase of approximately 3 percent of recorded values for raw and finished water flow rates between 2001 and 2002, attributing the increase to installation of the new SCADA system. The plant staff was of the opinion that the old signal converters may have inadvertently dampened the flow signal, causing the measured flow rate to be as much as 10 percent less than the actual flow rate. There was an observed steady increase in annual average production as measured by the WTP effluent plant flow from 1999 to 2003. The trend of increased production has generally continued from 2004 to 2011.

Figure 2-1 presents the historic average daily raw water volume and finished water production from January 2004 to December 2011. Table 2-1 presents a summary of the plant production data including: annual average flow, average peak and off-season flow, minimum and maximum monthly average flows, maximum weekly average flows, and peak day flows. The City has been experiencing increasing water demands over the past decade. Average day production increased approximately 2 percent per year from 2004 to 2009. Demand in 2010 and 2011 decreased to 2004 levels, but this may have been due to mild summers and a depressed economy, and it is not anticipated that this trend will continue. The peak day production in 2012 of 13.6 mgd occurred on August 8. The summer of 2012 was drier and warmer compared to the summers of 2010 and 2011. Figure 2-1 highlights that 2010 and 2011 did not experience the peaks in water temperature that prior years have experienced.

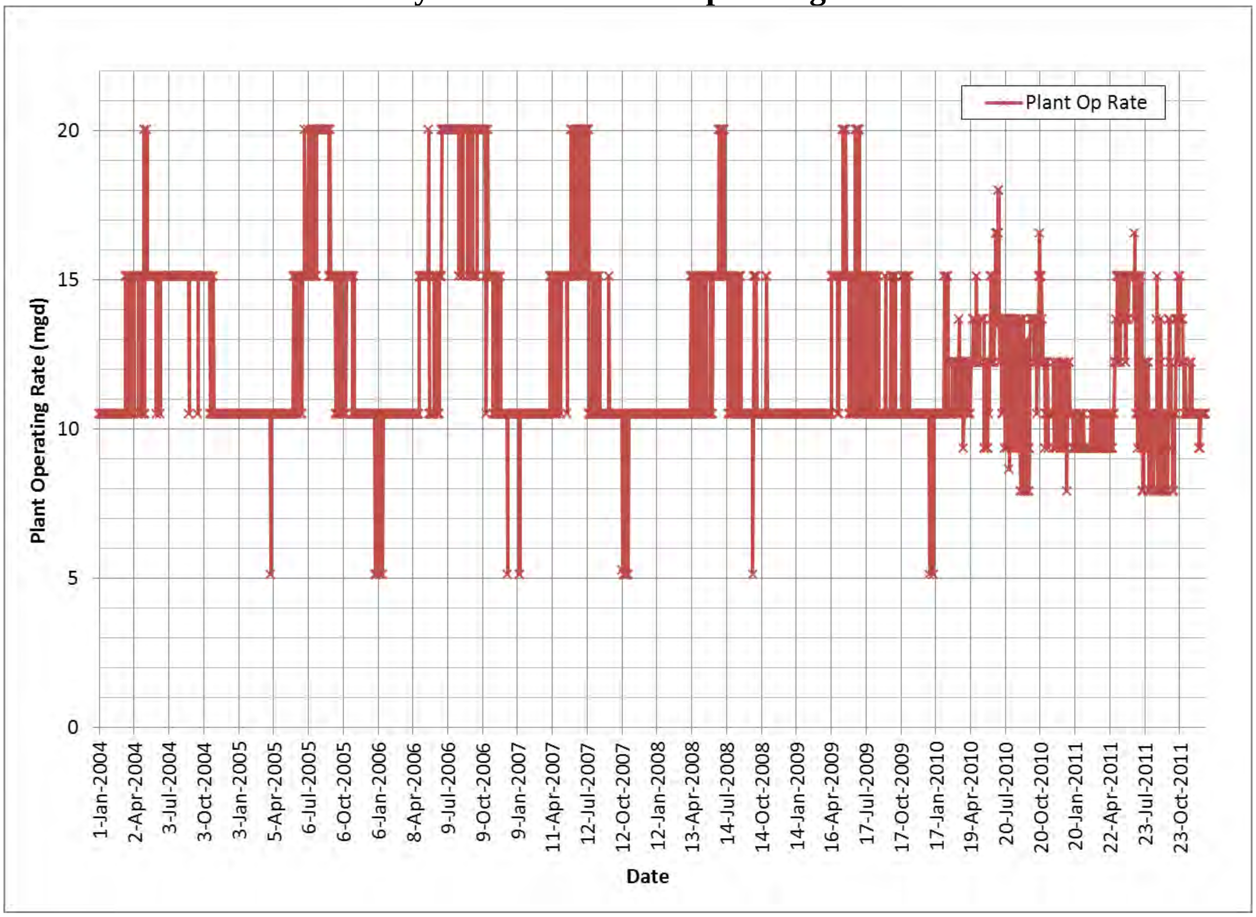
A maximum day production from the Grants Pass WTP of 14.2 mgd was observed on July 28, 2009. The highest average maximum monthly production of 10.5 mgd was observed in July 2010. Figure 2-2 displays the maximum daily operating rate of the plant from 2004 to 2011. Increasing demands can most likely be attributed to steady growth in the service area.

Figure 2-1
Historical Raw Water Intake and Finished Water Production and Average Daily Water Temperature



The flow data presented in Table 2-1 was used to develop peaking factors that are useful in water supply planning. The primary peaking factor is the ratio of peak day flow to annual average flow; this value ranged between 2.0 occurring in 2004 and 2007 to 2.5 occurring in 2009. Another important peaking factor is the ratio of peak month flow to annual average flow. For Grants Pass, this value ranged from 1.7 in 2007 to 2.0 in 2010. These values are consistent with those used for demand forecasting in the City's most-recent Water Distribution System Master Plan, where peaking factors of 2.2 and 1.8 were used for the peak day and peak month flows, respectively. This is in agreement with other recent studies on systems in the Pacific Northwest where maximum day peaking factors typically varied from approximately 2.0 to 2.5. The peaking factors for the City system are consistent with these regional numbers.

Figure 2-2
Daily Maximum Plant Operating Rate



Typical Operations

The WTP operates in a daily start-and-stop mode for most of the year to minimize labor costs. The plant currently has 5 FTEs and uses seasonal employees when needed for a total of 6.0 to 6.5 FTEs on an annual basis. During the winter months, the plant is able to meet demands by typically running at 10.5 mgd for 8 hours per day. During the spring and fall, the plant historically ran at 10.5 mgd or 15.1 mgd for 8 to 12 hours per day. During the summer, the plant has run at the15.1 mgd or 20 mgd flow rate for 12 to 16 hours per day. The plant switched to 24 hour per day summer operations starting in 2007 at reduced flow rates. After the raw water pumps were equipped with VFDs in 2010, the plant has had more operational flexibility with respect to flow rates.

Table 2-1
Water Treatment Plant Production Summary[1]

Year		Flow (mgd) 2004	2005	2006	2007	2008	2009	2010	2011
Annual Average		5.0	4.8	5.3	5.8	5.5	5.6	5.2	5.0
Peak Season Average[2]		8.1	7.6	8.4	9.4	9.0	9.1	8.6	8.3
Off-Season Average[3]		3.4	3.3	3.7	4.0	3.8	3.8	3.4	3.3
Minimum Monthly Average	**Month**	Feb	Dec	Jan	Nov	Mar	Jan	Dec	Mar
	Flow	2.6	2.7	2.7	3.3	3.1	2.9	3.0	2.9
Maximum Monthly Average	**Month**	Jul	Aug	Jul	Jul	Jul	Jul	Jul	Aug
	Flow	9.3	9.6	9.6	10.1	10.	10.3	10.5	9.4
Maximum Weekly Average	**Week**	8/12-8/18	8/5-8/11	7/22-7/28	7/1-7/7	7/15-7/21	7/29-8/4	8/12-8/18	9/2-9/8
	Flow	9.9	10.0	10.2	11.1	10.8	11.2	11.5	9.5
Maximum Daily	**Date**	8/12	8/5	8/10	6/15	8/6	7/28	7/28	9/3
	Flow	10.2	10.5	11.7	11.9	13.9	14.2	12.8	11.8

Notes
1. Values as reported from plant effluent meter
2. Peak season average from June to September
3. Off-season average from January to May and October to December
4. From 1999 to 2003: Average day demand of 4.7 mgd, peak day demand of 10.5 mgd

Raw Water Quality

Five raw water quality parameters were analyzed as part of this review:

- turbidity,
- temperature,
- pH,
- alkalinity, and
- TOC.

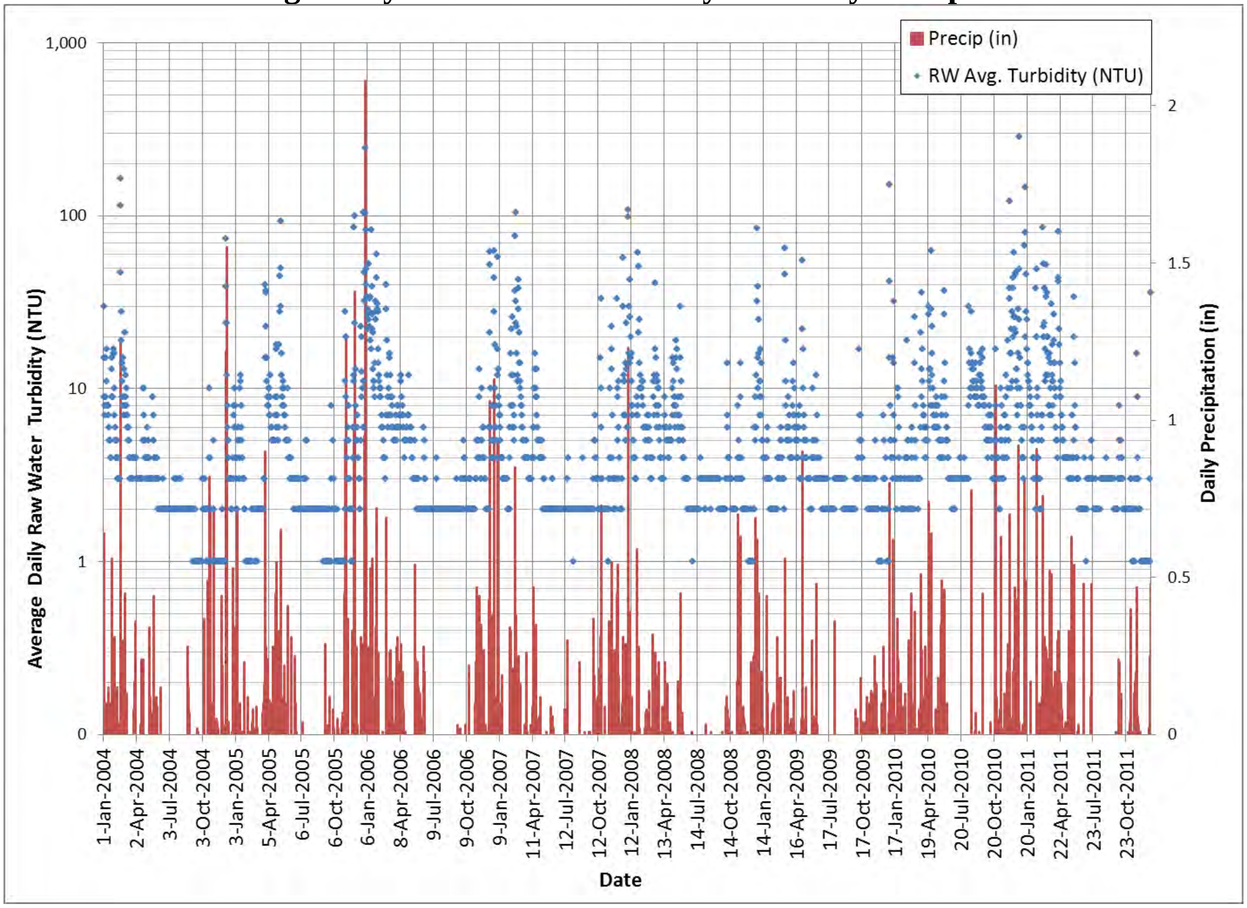
These parameters are typically of most importance when evaluating a treatment plant's overall performance. A discussion of each of these parameters is presented as part of this section.

Turbidity

Turbidity is a measure of light penetration through a water sample and is indicative of the amount of particulate matter in the sample. It is measured in nephelometric turbidity units, or NTUs. Water with lower turbidity is typically easier to treat and usually requires lower chemical doses for optimum coagulation and filtration. High turbidity levels can reduce the effectiveness of disinfection treatment processes and can provide a medium for the growth of microorganisms.

The raw water turbidity from the Rogue River has historically been low and moderately variable during the majority of the year. Increases in raw water turbidity generally correspond to high rainfall events. Figure 2-3 presents the average daily raw water turbidity, as well as the observed daily precipitation, between January 2004 and December 2011. The lowest turbidity periods occur during the warmer, drier months and the highest turbidity periods occur during the wet weather months.

Figure 2-3
Average Daily Raw Water Turbidity and Daily Precipitation



Average turbidities were generally less than 6 NTU from May to October; minimum turbidities were as low as 1.0 NTU during these months. Between November and April, turbidities typically averaged 9 NTU, with average maximums approaching 200 NTU. The highest average day raw water turbidity was reached in December 2010 when a daily average turbidity value of 286 NTU was observed in the raw water. A daily maximum turbidity spike of 787 NTU was observed in December 2005.

During the past few years, the WTP has experienced less predictable turbidity trends and the turbidity values have been more variable than they were in the past twenty years. This is attributed to the removal of the Gold Ray Dam, located on the Rogue River upstream of the WTP raw water intake, which began in the summer of 2010. Especially notable was the coffer dam failure in August 2010 that caused a breach in the dam. The plant experienced turbidity spikes of over 100 NTU; the August average turbidity is usually around 3 NTU. Since dam removal, the plant staff has noticed an increase of sediment accumulation on the base of the raw water intake screens, and has had to modify cleaning operations. The volume of solids that collect in the sedimentation basins has also increased, resulting in higher volumes of solids that needed to be handled and dewatered at the plant. The effects of the dam removal are not expected to be long-term, but it is currently unknown what effects the dam removal will have on turbidity and plant operations in the future.

Temperature

The temperature of raw water impacts water treatment by affecting the rate of chemical reactions, including disinfection and the formation of disinfection byproducts, floc formation and settling, and filter performance. As the temperature of the raw water increases, chemical doses generally decrease for floc formation, settling, filtration, and disinfection. An increase in optimal filter backwash rates results from an increase in water temperature due to the decreased viscosity of the warmer water.

Figure 2-4 shows that the maximum daily temperature of the raw water entering the WTP varies by season. From 2004 to 2011, winter temperatures averaged approximately 43.7 °F (6.5 °C) and summer temperatures averaged approximately 63.6 °F (17.6 °C). The lowest observed temperature in the time period was 33.3 °F (0.7 °C) on December 9, 2009. The highest observed temperature in the time period was 70.0 °F (21.1 °C), occurring on July 22, 23, and 24, 2004. Temperatures of 69.7 °F (20.9 °C) were also observed on July 24 and 25, 2010.

Raw Water pH

The acidic or basic nature of water is measured by pH and can be indicative of the water's corrosiveness. A pH of 7.0 represents neutral conditions, and pH values greater than 7.0 are generally considered less corrosive. Lower pH values usually indicate corrosiveness, which can lead to leaching of toxic metals into the water system and potential degradation of conveyance facilities. In water treatment, pH is also important because of its impacts on coagulation performance and chemical disinfection. A pH in the range of 6.0 to 7.0 is considered optimum for aluminum sulfate (alum) coagulation, and lower pH values are often desirable to enhance the removal of dissolved organic carbon. Lower pH values are often desirable for enhanced disinfection with chlorine. The formation of DBPs such as THMs and haloacetic acids is affected by the pH of the water during and following chlorination.

In plants lacking the ability to adjust pH at several points throughout the treatment process, corrosion control targets typically govern the pH, with perhaps some sacrifice in coagulation and disinfection performance. The addition of certain water treatment chemicals alters the pH. Aluminum sulfate depresses the pH, while NaOCl increases the pH.

Figure 2-4
Maximum Daily Raw Water Temperature

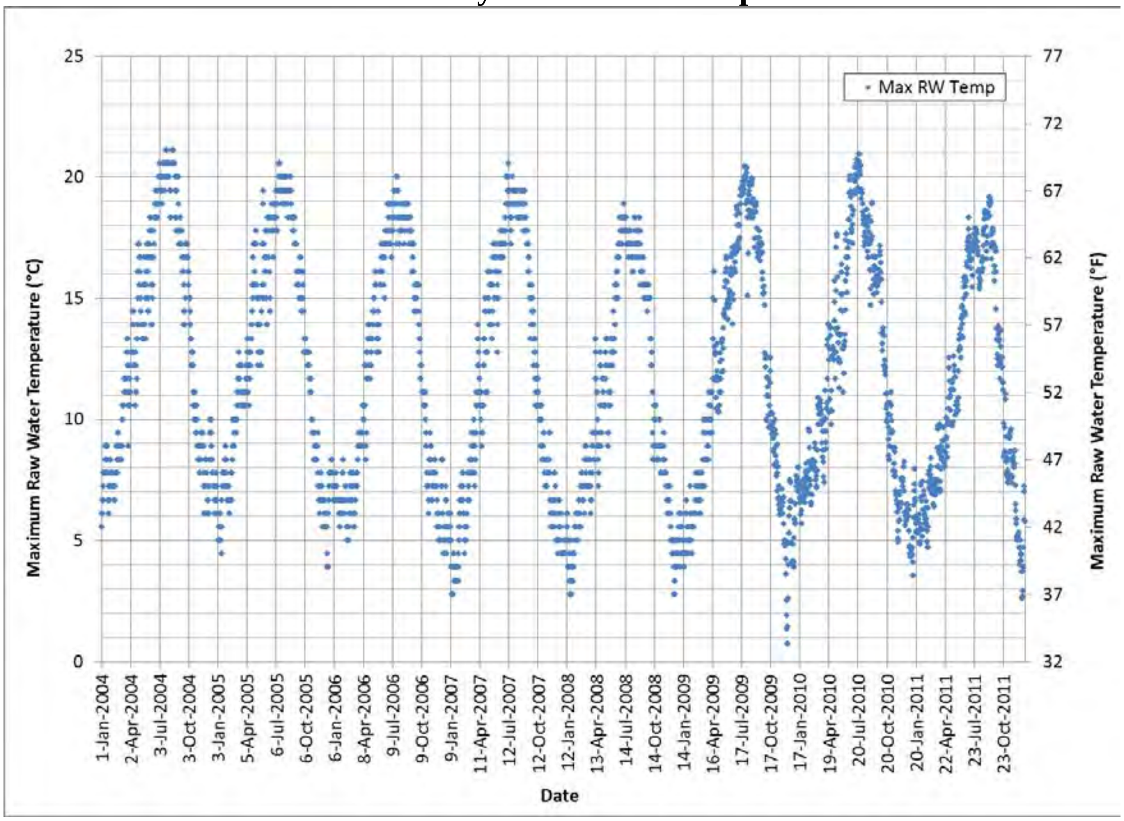


Figure 2-5 presents the historical raw water pH values recorded at the WTP between January 2004 and December 2011. As shown in Figure 2-5, the pH of the raw water from the river typically varies between 7.4 and 8.3 throughout the year, with average values between 7.6 and 8.0. Historically, pH peaks a few times each calendar year with the most pronounced peak occurring in mid-spring and a secondary peak occurring in the early fall, probably corresponding to algal activity in the river. Historic minimums occur in the winter months due to higher precipitation. The lowest observed raw water pH was 7.3 in December 2006. The highest observed pH was 8.6 in March 2005. Raw water pH can also be affected by algae throughout the summer, with diurnal variations between 7.5 and 8.5.

Figure 2-6 shows the historical finished water pH values recorded at the WTP between January 2004 and December 2011. Finished water pH has increased from 2007 to 2011 due to the reduction of alum usage and use of a new primary coagulant. The reduction in alum

Figure 2-5
Average Daily Raw Water pH

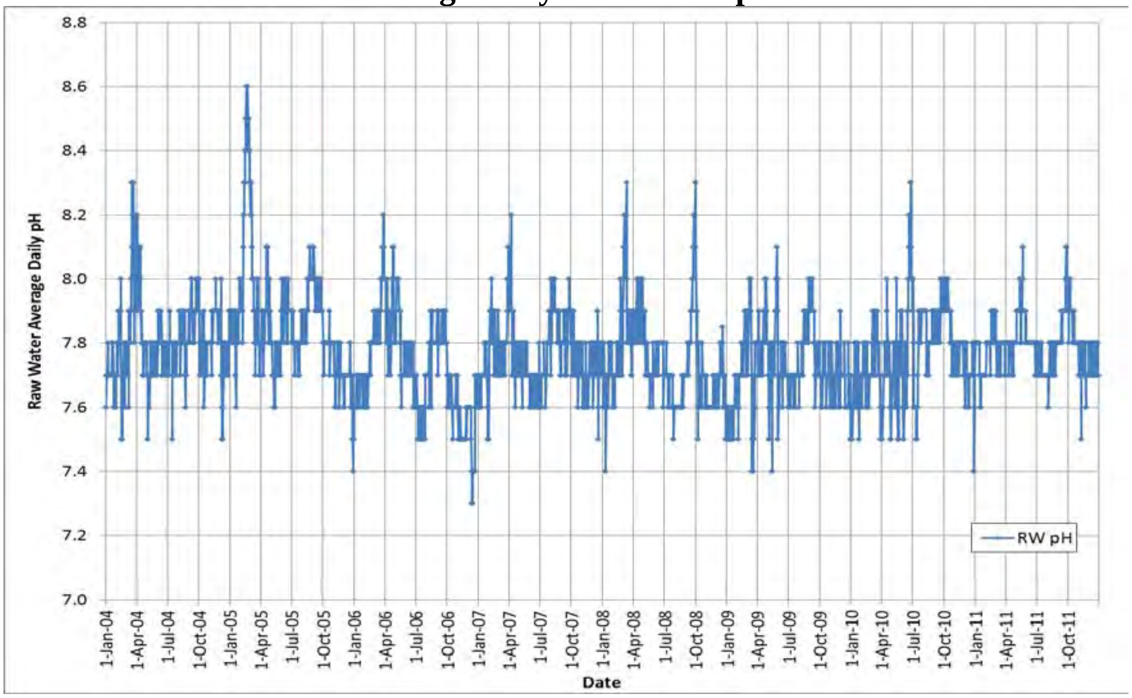
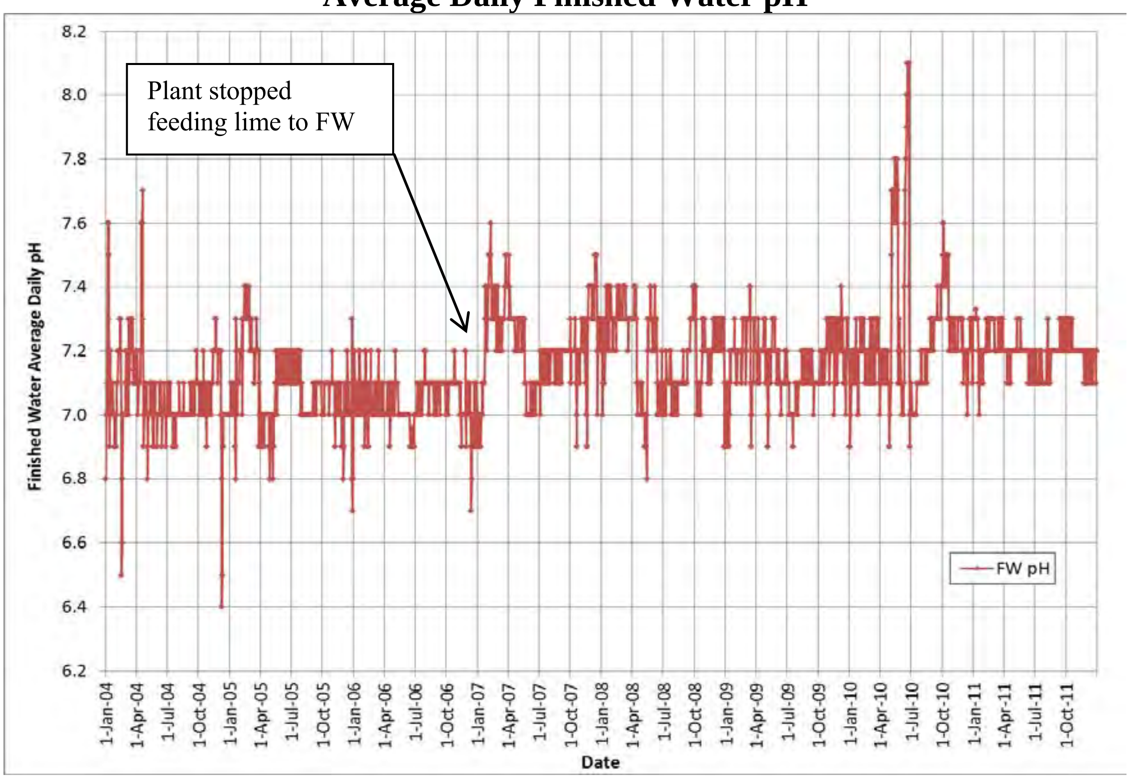


Figure 2-6
Average Daily Finished Water pH



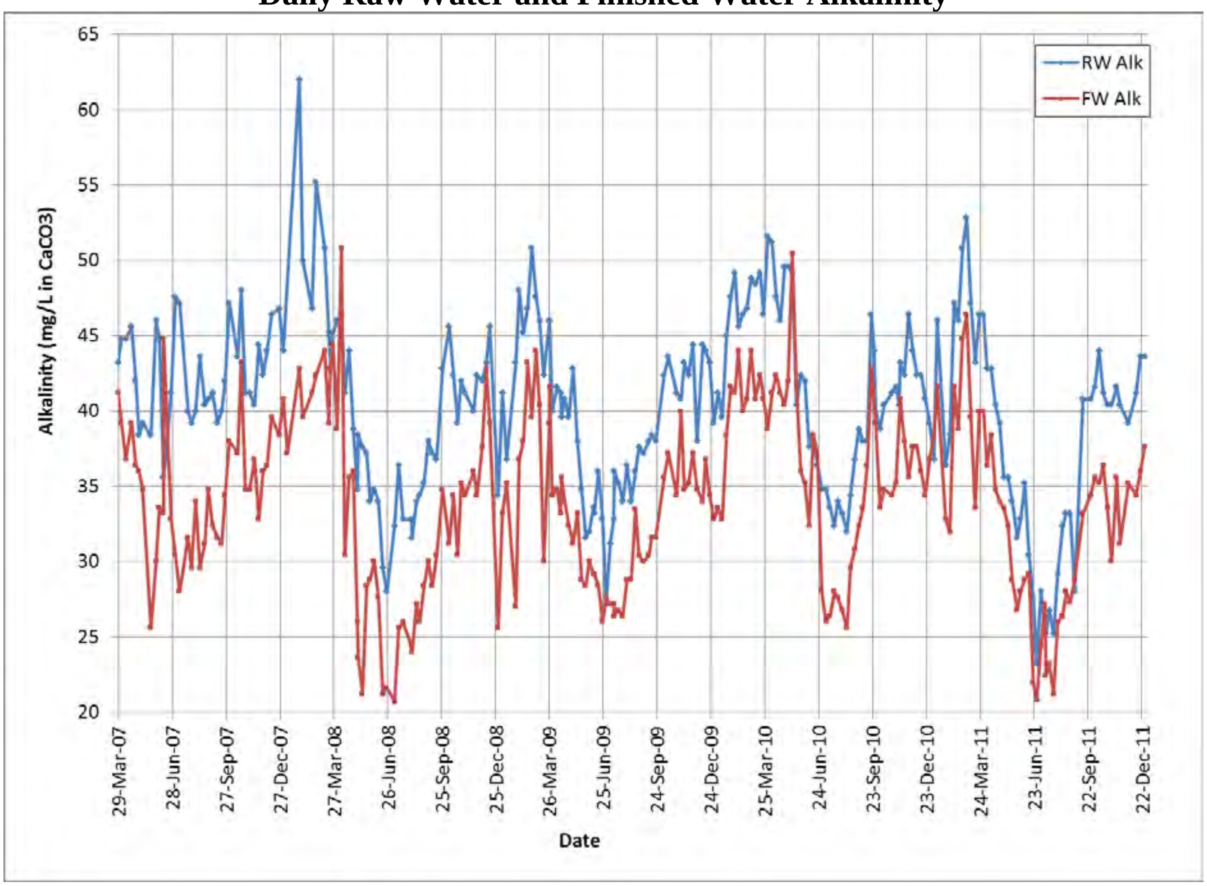
usage influenced the staff's decision to remove the lime system since post-filter pH adjustment is no longer practiced.

Alkalinity

Alkalinity is important in water treatment because of its impact on pH stability, coagulation performance, and corrosiveness. Alkalinity greater than 20 mg/L as $CaCO_3$ is generally considered adequate for aluminum sulfate coagulation and for improved pH stability in the distribution system. Alkalinity can also impact TOC removal requirements, depending on raw water organic concentrations.

The raw water alkalinity of Rogue River water varies seasonally as depicted in Figure 2-7, and seasonal trends seem to follow pH variability. The raw water alkalinity can be as low as 20 mg/L during winter periods and can be as high as 62 mg/L during the summer. When the alkalinity is low and turbidities are high, higher alum doses are required which can further depress the pH below optimum coagulation conditions. Using a coagulant which does not depress the pH or affect alkalinity during periods when the raw water turbidity is increased has eliminated the need to add an alkali to the raw water. Figure 2-7 also shows that finished water alkalinity is lower than the raw water alkalinity.

Figure 2-7
Daily Raw Water and Finished Water Alkalinity



Organic Content

The natural level of organic matter in the raw water can affect its treatability as well as other parameters, including chlorine demand, DBP formation, and tastes and odors. Organic content can be derived from the natural decay of plant life, as in humic and fulvic acids, or the presence of algae, or in some cases, from human activities. As the concentration of organic matter in the raw water increases, the need for chemicals such as alum and chlorine also typically increases. Since DBPs result from chlorine's reaction with organic matter, higher concentrations of organic matter in raw water usually result in higher levels of DBPs in the distribution system. Elevated algae concentrations can sometimes create difficult treatment conditions and can interfere with coagulation, cause filter clogging, or create nuisance tastes and odors, depending upon the type and concentration of the algae.

Total organic carbon is a general measure of the natural organic matter present in water. This parameter is sometimes used as an indicator of DBP formation potential. Total organic carbon is also important because existing regulations intended to minimize DBP formation require the removal of a fraction of the overall raw water TOC through the treatment process, depending on the raw water TOC concentration and alkalinity.

The Grants Pass WTP staff has been monitoring TOC concentrations in the raw and finished water at least monthly since 2002. Results from 2004 to 2010 are presented in Figure 2-8. The data suggest that the TOC concentrations in the raw water are comparable to other U.S. surface water supplies, typically ranging between 0.5 to 5 mg/L, and slightly higher than other similar Pacific Northwest surface water supplies, which often range between 1.0 to 3.0 mg/L. There were several samples prior to 2008 that were above 2.0 mg/L, the current "trigger" concentration for TOC removal requirements under existing regulations. Since 2008, there have only been four such instances. Further discussion of required TOC removal efficiencies and other regulatory issues associated with TOC are discussed in Chapter 3.

Because TOC analysis is expensive and labor-intensive, the 2004 WTPFP recommended the City consider purchasing a bench-top UV spectrophotometer and incorporating daily UV absorbance monitoring at the WTP as a surrogate measure for TOC. Dissolved and soluble organic carbon absorbs UV light at a wavelength of 254 nm. A spectrophotometer measures the percentage of UV absorbance, a value directly proportional to TOC concentration. Once calibrated, UV_{254} readings can be correlated to TOC concentrations. UV_{254} sampling is a relatively inexpensive and simple alternative to off-site lab analysis of TOC. The plant began recording UV_{254} in July 2004. For comparison, Figure 2-9 displays raw water TOC and UV_{254} readings.

Taste and Odor

The Grants Pass WTP does not typically experience significant taste and odor issues. Typically, WTPs that use the same source water have similar taste and odor characteristics. However, the taste and odor events related to algae that occur at the Medford Water Commission WTP upstream rarely occur at the Grants Pass WTP.

Figure 2-8
Raw Water and Finished Water Total Organic Carbon

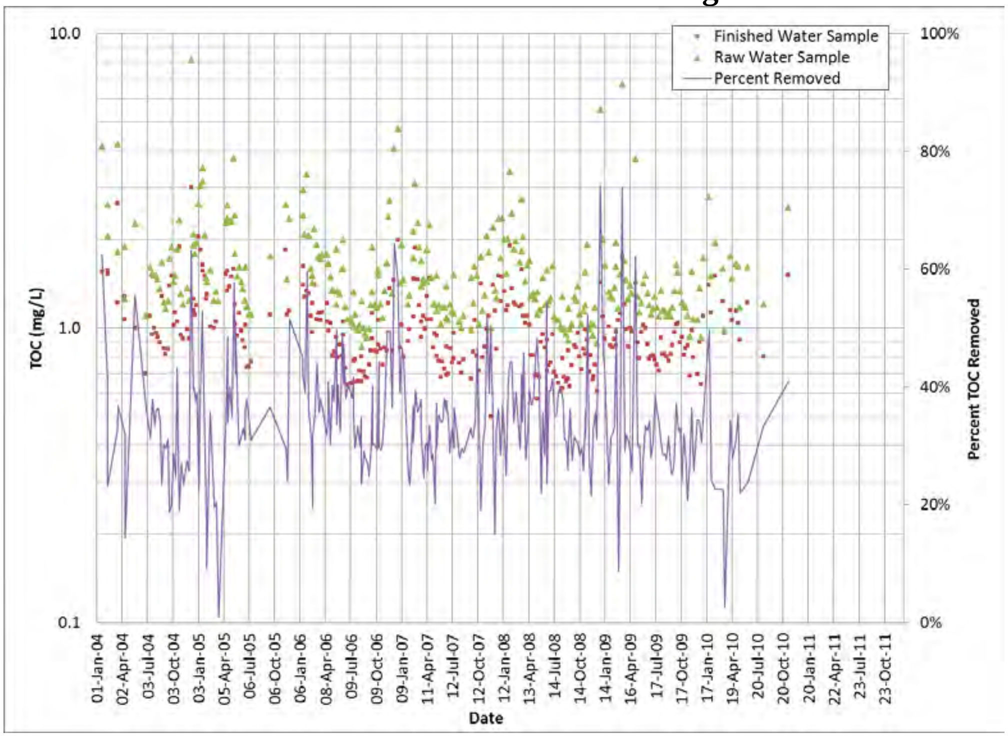
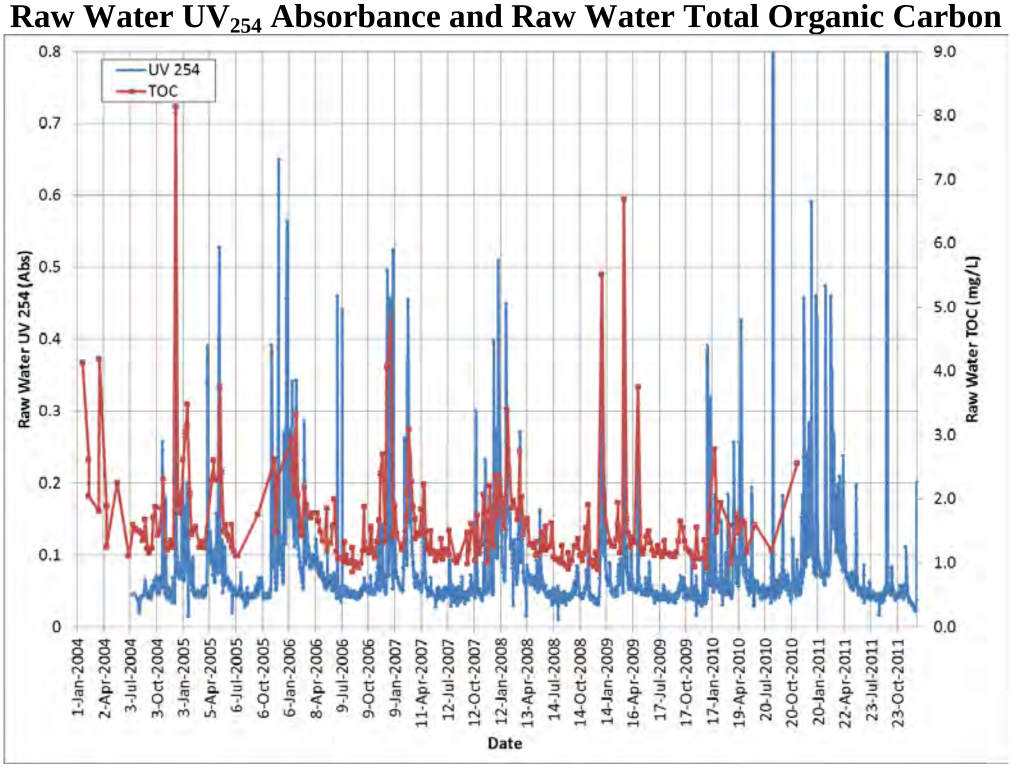


Figure 2-9
Raw Water UV_{254} Absorbance and Raw Water Total Organic Carbon



Chemical Usage

The four major chemicals currently used at the Grants Pass WTP are:

- alum
- ACH,
- filter aid polymer, and
- liquid sodium hypochlorite.

Liquid alum and ACH are used as the coagulants and are fed year-round. The polymer is used to condition the water entering the filters for improved filter performance. Sodium hypochlorite is added to the raw water and finished water as a disinfectant. Hydrated lime and potassium permanganate are chemicals that were used in the past. As noted above, lime use has been discontinued, and potassium permanganate is used infrequently. A brief discussion of each chemical is presented as part of this section.

Aluminum Sulfate

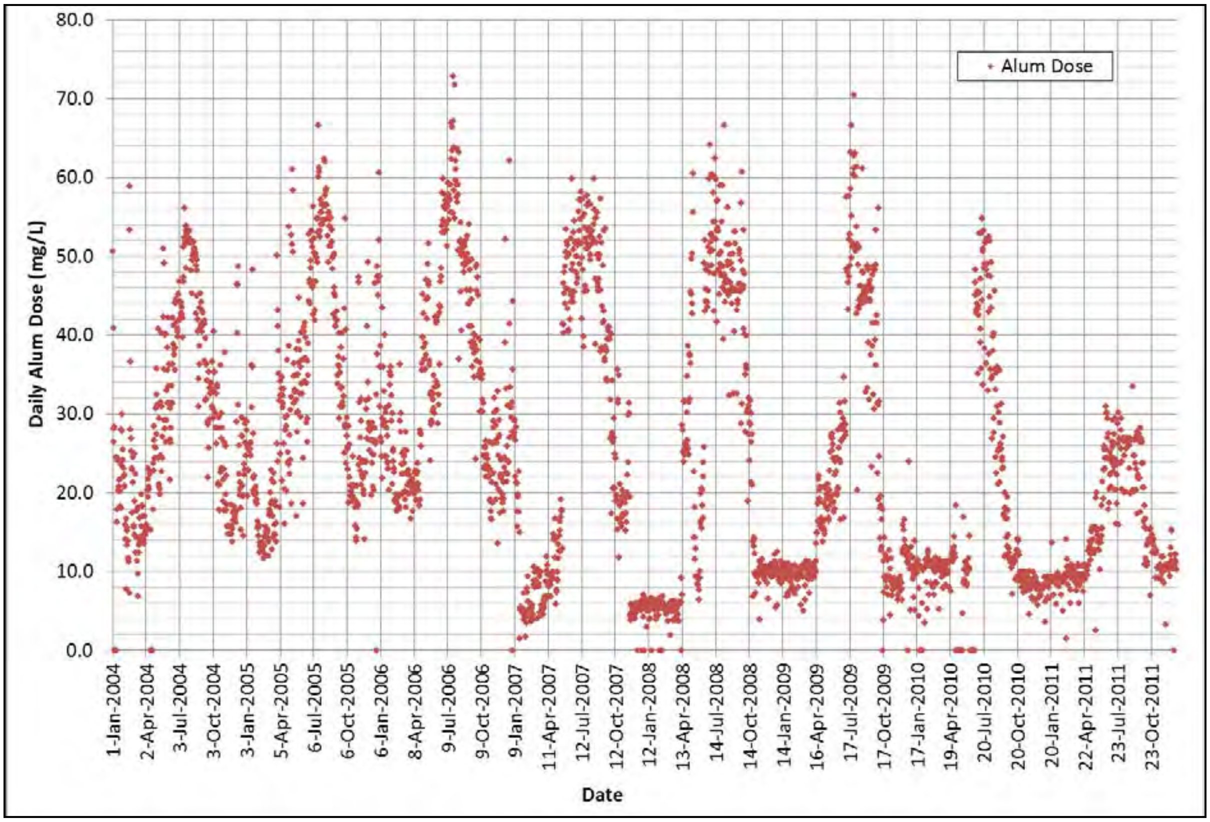
Liquid alum is stored as a 50 percent solution, by weight, and fed via metering pump to the raw water pipeline upstream of the static mixer prior to the flow split to the basins. The addition of alum to the raw water destabilizes negatively charged suspended particles, thereby allowing the formation of insoluble floc particles via coagulation and flocculation, and their subsequent removal via clarification and filtration.

Figure 2-10 shows the annual trends in alum usage between January 2004 and December 2011. The required alum dose varies throughout the year. From 2004 to 2006, when alum was the sole coagulant used, the typical off-peak season alum doses averaged 27 mg/L as dry alum while peak season alum doses averaged 21 to 22 mg/L as dry alum. The highest alum doses have typically been above 60 mg/L as dry alum during fall and winter because of high turbidity events. The plant used an average of 200 tons of alum per year from 2004 to 2006. In response to the 2004 WTPFP, the plant staff began experimenting with different coagulants (ACH and PACl) and started using these other coagulants with alum intermittently from 2007 to 2008. Starting in the fall of 2009, the plant began feeding alum and ACH concurrently. In all cases, use of an additional coagulant has been able to reduce alum dosages and multiple benefits have been observed including less pH depression and lower solids production rates. In addition, the plant was able to stop feeding lime for pH adjustment. Filter performance may also be enhanced by the current coagulation process as the floc formed is generally stronger and has a higher shear resistance within filter media. Alum usage from 2010 and 2011 averaged 93 tons per year.

Other Coagulants

ACH and PACl are generic terms used to describe different formulations of proprietary coagulants that are derivatives of the general base molecular formula of an aluminum chlorohydrate molecule. These proprietary formulations vary in strength, pH, basicity, freezing point, and specific gravity. ACH and PACl offer many benefits to optimizing coagulation strategies. They do not depress pH like alum and, as a result, reduce the need of an alkali addition to adjust the pH.

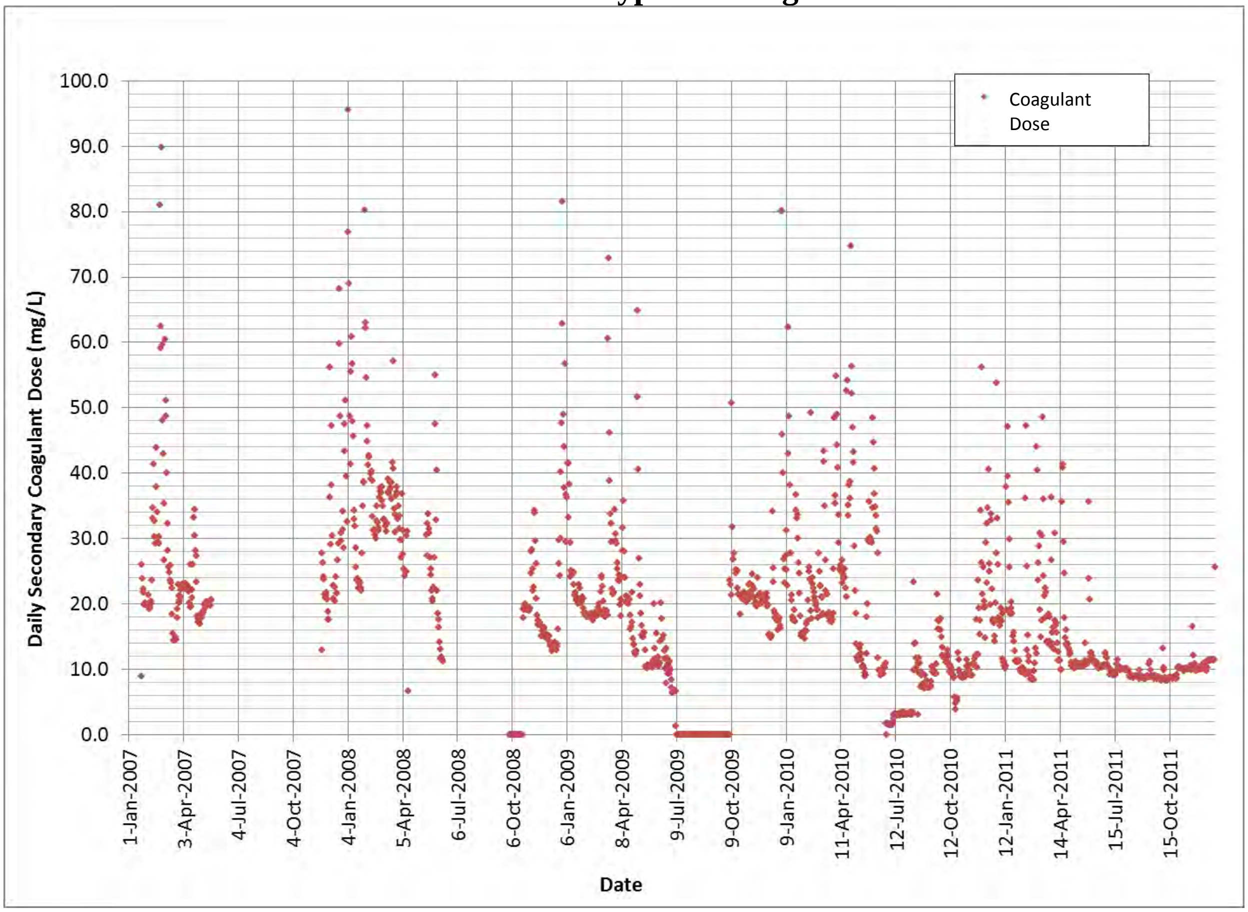
Figure 2-10
Alum Doses



From 2007 to 2008, the plant tested Pass-C, a PACl derivative, in conjunction with alum during different seasons. Except for one week in January 2010 when the plant tested NIAD I-5, another PACl derivative, as the sole coagulant, the plant began feeding an additional coagulant with alum during daily operations in the fall of 2008. In May 2010, the plant switched from Pass-C to T-Floc B-135, a derivative of ACH. Since that time, the plant has transitioned from using alum as its primary coagulant to ACH as its primary coagulant. Alum is now used as a supplementary coagulant.

Use of ACH as a primary coagulant has reduced alum usage at the City's WTP. Because of this, a tank which was formerly used to store alum is now used to store ACH in bulk. A separate metering pump doses ACH to the injection location. Figure 2-11 shows doses of coagulants other than alum from 2007 to 2011.

Figure 2-11
Doses of Other Types of Coagulant

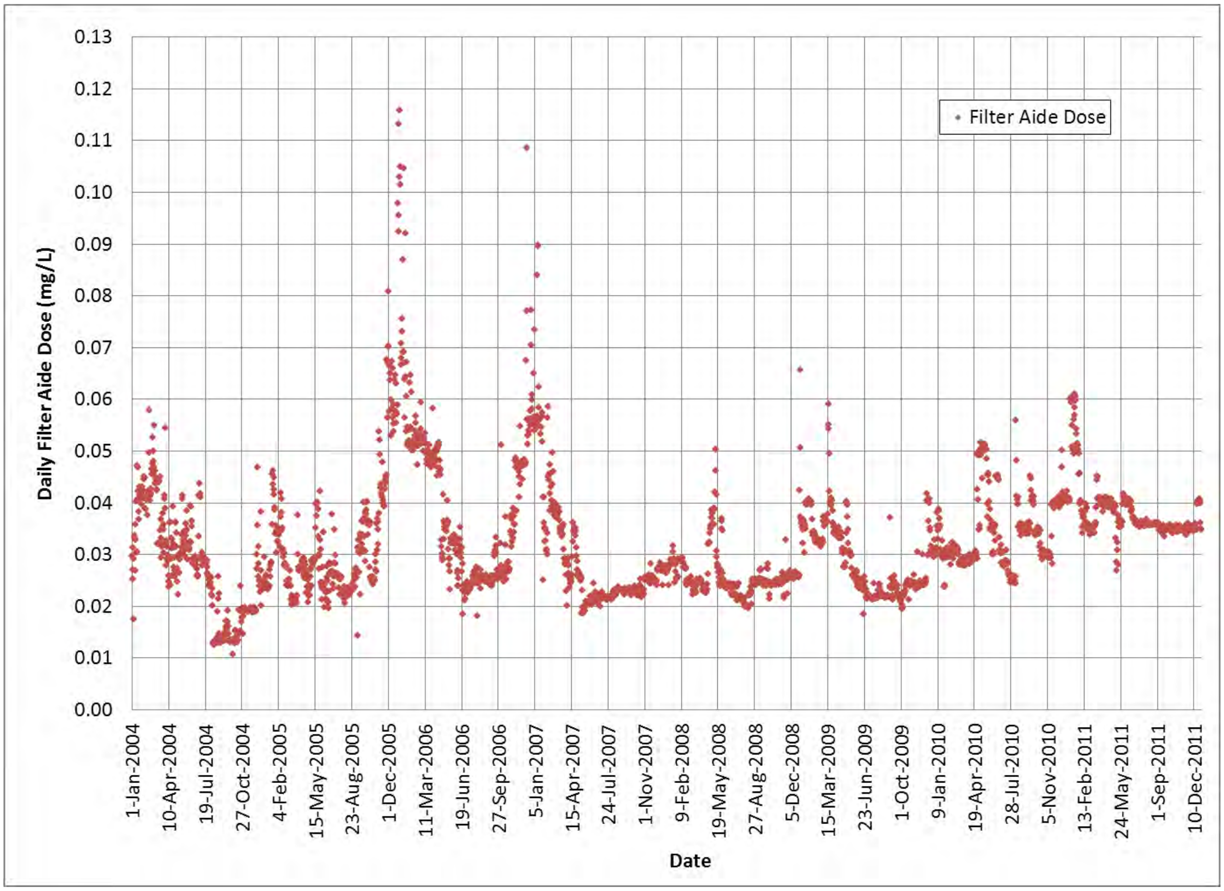


Polymer Filter Aid

The Grants Pass WTP currently uses a low-molecular-weight polymer as a filter aid. The dry polymer is mixed and aged with water, then fed via metering pump and carrier water to the filter influent. Flows are split eight ways to each filter using rotameters. Filter aid polymer is used continuously throughout the year and total daily usage is monitored and recorded. The polymer's role in improving overall turbidity removal at the Grants Pass WTP is important. When introduced to the settled water, the polymer helps make the alum floc that leaves the sedimentation basins "stickier." This property helps the filters retain the floc better and minimizes turbidity "breakthrough." If the filter aid were not added, the filtered water turbidity would be higher and filter run lengths would be significantly shorter due to premature breakthrough. This would require more frequent backwashing.

Figure 2-12 presents the historic average daily filter aid polymer dosages from 2004 to 2011. Filter aid polymer dosages tend to increase in the winter when water temperatures are low and decrease in the summer and early fall when the water is warmer. The average daily polymer dose was 0.027 mg/L during the summer, increasing to approximately 0.040 mg/L in the winter and as high as 0.12 mg/L during winter's most challenging raw water conditions.

Figure 2-12
Filter Aid Doses



Lime

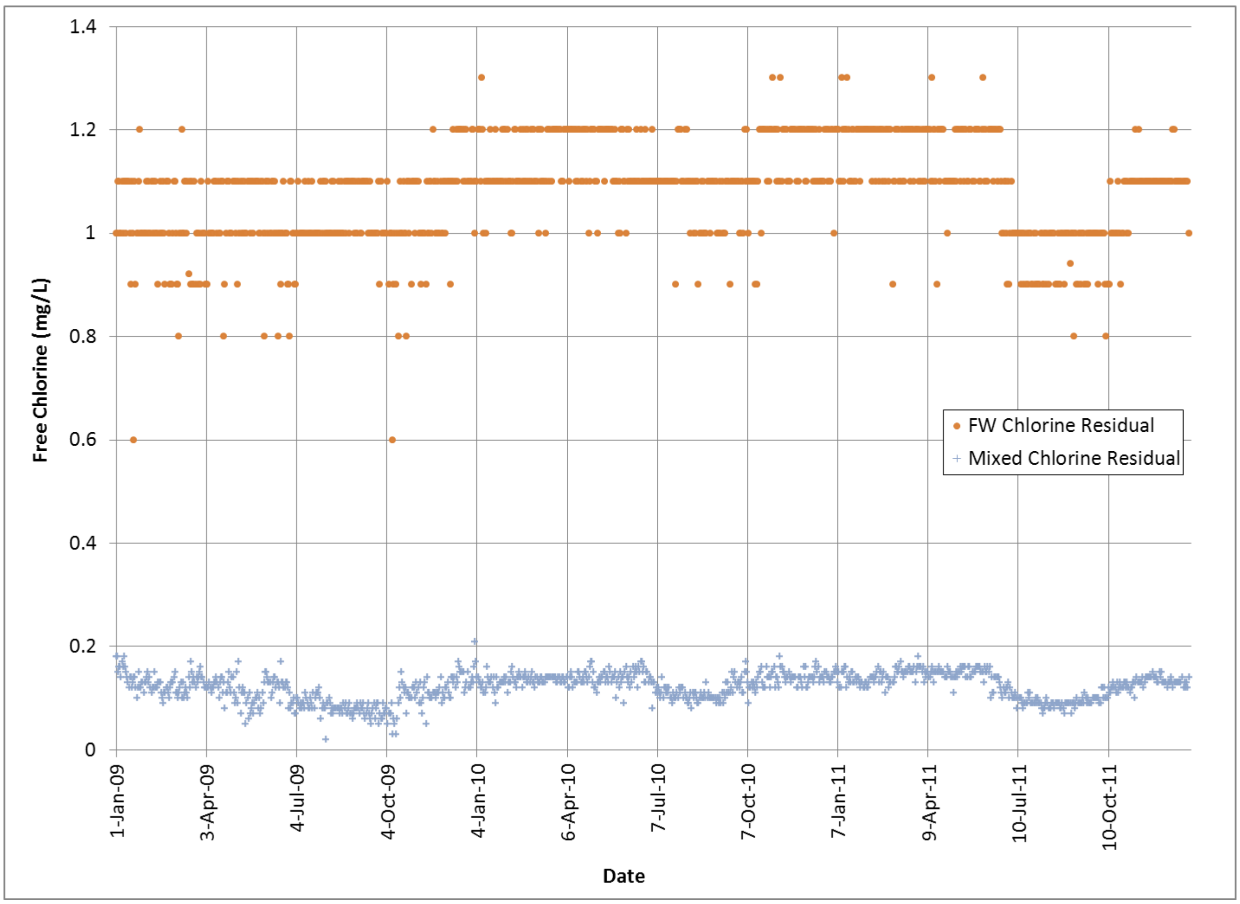
Lime was historically used to raise the pH by restoring alkalinity consumed through the coagulation process when alum was the sole coagulant. Plant staff maintains a target finished water pH of 7.2 for corrosion control. Since the plant has changed the coagulation approach and now uses ACH in addition to alum, the alum dose has decreased. The pH depression caused by alum has been to the point where lime is no longer needed to maintain proper finished water pH for corrosion control.

Sodium Hypochlorite

Hypochlorite is added to the raw water to assist in coagulation, control biological growth through the sedimentation basins, and for disinfection purposes. The target chlorine residual exiting the sedimentation basin is approximately 0.2 mg/L to ensure a measurable residual is maintained throughout the basins and to ensure disinfection compliance. The plant has reduced the pre-chlorination dose over the past few years to minimize DBP formation.

Chlorine addition to the finished water is intended for disinfection purposes and is added to maintain a chlorine residual in the distribution system. Chlorine is "boosted" throughout the distribution system (up to three times for some parts of the system) for residual maintenance. Figure 2-13 shows the free-chlorine residual in the treated raw water following chemical addition and rapid mixing by the 36-inch diameter static mixer. Pre-chlorination doses have typically ranged from 0.2 mg/L to 1.4 mg/L, although this range represents changes in operational strategy as well as fluctuations caused by normal operation. The figure also shows the free chlorine residual in the finished water effluent following post-chlorination. Finished water chlorine residuals are generally maintained between 0.9 mg/L and 1.3 mg/L with an average of approximately 1.1 mg/L.

Figure 2-13
Mixed and Finished Water Free Chlorine Residuals



Liquid sodium hypochlorite is stored at 12.5 percent solution in three 2,300-gallon fiberglass tanks located on-site. The hypochlorite system was installed in 2001 to replace the original gas chlorine injection system.

Additional Chemicals

In addition to the primary treatment chemicals used daily at the Grants Pass WTP, the plant also has the ability to dose $KMnO_4$ for taste and odor control. The use of potassium permanganate is rare. It was last used over a four-day period in December 2010 to January 2011 in response to a taste and odor event. Originally, the plant was designed to use PAC as an additional taste and odor control process, but PAC was rarely, if ever, used. The PAC slurry tank was converted to a solids mixing and conditioning tank and PAC can no longer be fed.

The WTP uses other miscellaneous chemicals for operational purposes. A long-chain polymer is applied to sedimentation basin residual solids during cleaning activities to aid in dewatering. Calcium thiosulfate is used to dechlorinate filter maintenance water and is also dosed to water for the intake structure wash system.

Plant Performance Data

The WTP staff keeps daily records of plant performance data that were used to assist in the evaluation of overall plant performance. This section summarizes the historic operating performance of the treatment processes including the sedimentation basins and filters.

Coagulation

The Rogue River water quality presents some treatment challenges at the WTP resulting from seasonal and diurnal variations in pH, seasonally variable turbidity, and temperature, as well as occasional taste and odor events. Excepting taste and odor, this variable raw water quality can significantly impact coagulation performance at the plant. Historically, these challenges were met by using a relatively high dosage of alum. This strategy resulted in high solids production and depressed pH which corresponded to an increase in pH adjustment chemical usage and cost and decreased overall plant efficiencies. The 2004 WTP Facility Plan suggested the use of a different coagulant to offset these deficiencies. Now that the plant is using ACH as a primary coagulant, overall alum usage has decreased by half. As a result, the plant operates at higher efficiencies and the use of a pH adjustment chemical is no longer necessary.

Clarification

The City's WTP relies on three sedimentation basins for clarification prior to filtration; no formal flocculation is provided in the basins. Basin 1 was constructed as part of the original plant; basins 2 and 3 were incorporated into the plant during the various plant expansions. The design of the basins are different and effluent water quality differs between the basins as a result.

The basins are each drained and cleaned at least twice per year. Prior to 2007, cleaning was restricted to off-peak seasons, as the plant required the full capacity to meet summer demands. Now that the plant is operating 24 hours per day during the summer, each basin operates at a lower flow rate and it is possible to take a basin out of service for cleaning while still meeting peak season demands. As solids accumulate in the basins, the detention time decreases, which reduces the solids removal and disinfection performance of the basins.

The State currently rates the plant as "complete conventional," but the lack of formal flocculation and higher-than-desired surface loading rates of the basins could result in a future de-rating to a direct filtration plant. This would present significant challenges to providing disinfection during periods of high demands.

Typical Operations and Flow Control

Raw water flow is split into two pipes downstream of the static mixer; the first pipe leads to a slow mix basin for basins 1 and 2, the second leads to basin 3. Each pipe has a butterfly valve for flow control. A butterfly valve located at the influent to the slow mix basin can be used to control flow, but it is normally left open. The pipes and valves were designed to split the plant flow proportionally to each basin based on the basin's settling area. The proportions of flow reaching each basin are approximately 36 percent, 24 percent, and 40 percent of plant flow to basin 1, 2, and 3, respectively. Short-circuiting has caused flows through basin 3 to be reduced. The valves controlling the flows to each basin were set based on a plant flow of 20 mgd and the percentage of flow to each basin varies at lower plant flow rates unless the valves are manually adjusted.

Clarified water flows from the sedimentation basins to the filter influent channel. In general, filters 1, 2, and 3 are fed by basin 1; filters 4 and 5 are fed by basin 2; and filters 6, 7, and 8 are fed by basin 3. The clarified water trough is continuous between the filters and is intended to distribute the water evenly to the filters associated with each sedimentation basin. Because basin 3 is farther from basins 1 and 2 and has a longer pipe connection, the amount of water mixing and sharing between basins 1 and 2 and basin 3 may be somewhat restricted.

Sedimentation Basin Geometry

An optimal sedimentation basin is rectangular with a minimum length-to-width ratio of 4:1, a minimum length-to-depth ratio of 1:15 and a sufficient volume to keep mean flow velocity under 3.5 ft/min. Optimal basins provide approximately 20 to 30 minutes of flocculation and 90 to 120 minutes of sedimentation, or a total of 120 to 150 minutes of detention time. Baffles are useful to ensure good flow distribution and prevent short-circuiting. None of the three basins meet these optimal parameters.

Basins 1 and 2 are rectangular basins. Water enters at the south ends of the basins. Laminar flow conditions are improved in basin 1 by two baffle walls: one at the inlet, the second approximately half way along the length of the basins. Basin effluent collects in launders located on the north ends of the basins.

Basin 3 is the newest basin in the plant, built in 1983. Water enters this square basin via a central vertical pipe that discharges through ports located from 3 to 5.5 ft below the water surface. The water then flows under a circular baffle that extends from just above the water surface to 8 ft below. Water exits from the basin into one continuous square launder. Water from this square launder collects in a common trough that flows to the filter influent trough. Because its square shape and radial flow, basin 3 is vulnerable to short-circuiting. Despite the large volume of the tank, the path length from the inlet to the outlet is relatively short.

Based on these criteria, it is expected that basins 1 and 2 will be more efficient with solids removal than basin 3. Stable flow is difficult to maintain in basin 3 because its cross-sectional area is large in comparison to the cross-sectional area of flow. There are no automated solids removal mechanisms installed inside any of the basins, although provisions for future upgrades were included in the design of basin 3.

Sedimentation Basin Performance

Overall, the sedimentation basins provide satisfactory water for filtration during most of the year, as evident by filtered water turbidities. All basins experience challenges with regard to short-circuiting, high solids loading resulting from relatively high coagulant dosages, sub-optimal flocculation, and seasonal turbidity spikes. The basins are not equipped with any type of automated solids removal system. As solids accumulate in the basin, the effective volume of the basin is reduced which compromises flow characteristics and overall performance in the basin until the solids are removed. Without having continuous residual solids removal in the basins, basin cleaning events create large, "slug" doses of solids that present operational challenges. Basin 3 is especially vulnerable to short-circuiting or not clarifying as efficiently as basin 1 and basin 2, as indicated by filters 6, 7, and 8 needing more frequent backwashing. Plant staff observations and operating data support that the filters fed by basin 3 are backwashed approximately 25 percent more often than the rest of the filters.

Filtration

The plant has eight dual-media gravity filters of varying sizes and shapes, depending on the time of construction. Filters 1, 2, and 3, also called the East Filters, were constructed in 1931 as part of the original construction. filters 4 and 5, called the West Filters, were constructed as part of the 1950 plant expansion. Filters 6, 7, and 8, were added as part of the 1983 expansion project.

All of the filters which were constructed at the same time have the same individual surface areas, but the surface areas of filters in other groups are different. It is uncommon for a WTP to have variable filter shapes because demands on the filter support systems common to all filters (i.e. backwash pump, surface wash pump, washwater conveyance system, etc.) will vary according to the different filter surface areas.

The original filter design used mixed media with gravel support. Based on recommendations made in the 2004 WTPFP, the filters were modified in 2005 to use a deeper dual media with new underdrains that do not use gravel support. The current dual media design includes 20 inches of 1.0-mm anthracite over 10-inches of 0.5-mm sand. This new dual media has resulted in longer filter run times between backwashes and has improved overall plant production efficiency while continuing to produce low filtered water turbidities.

Typical Operations

The filters are operated by rate-of-flow control. Butterfly valves on individual filter effluent pipes modulate to maintain a specific filtration rate. Overall filter flow is adjusted to maintain a constant water level in the filter influent channel. Filter aid is dosed at the influent to each filter. The filters share common backwash pumps equipped with VFDs to provide variable flow rates depending on filter size and water temperature. Until an additional backwash pump was installed in 2012, there was no back-up supply for backwash water.

Turbidity

Each filter at the Grants Pass WTP is equipped with a turbidimeter to measure the turbidity of the individual filter effluent. Another turbidimeter is located in the filter gallery to measure the plant's combined filter effluent (CFE) turbidity. Data from each of these instruments is used for regulatory reporting. Figure 2-14 presents a summary of daily maximum combined filtered water turbidities between 2004 and 2011, taken from the plant's regulatory summary sheets reported monthly to the OHA. As shown in the figure, the maximum daily turbidity has always been less than 0.70 NTU, and is usually less than 0.10 NTU. Figure 2-15 presents a statistical summary of maximum daily combined filter effluent turbidities between 2004 and 2011 . From the figure, the plant has produced water with a turbidity of 0.05 NTU or less 95 percent of the time. The plant has normally performed well with respect to meeting the desired turbidity goal for optimal particulate removal.

Individual filtered water turbidities have also been recorded since 2004. These measurements are used to monitor filter performance and help decide when a filter needs to be backwashed. They are also used to determine when a filter-to-waste cycle should be stopped following a backwash.

All eight filters have produced filtered water turbidities under 0.15 NTU for at least 95 percent of the time. In general, all filters are performing well with regard to overall particulate removal.

Figure 2-14
CFE Turbidity Values

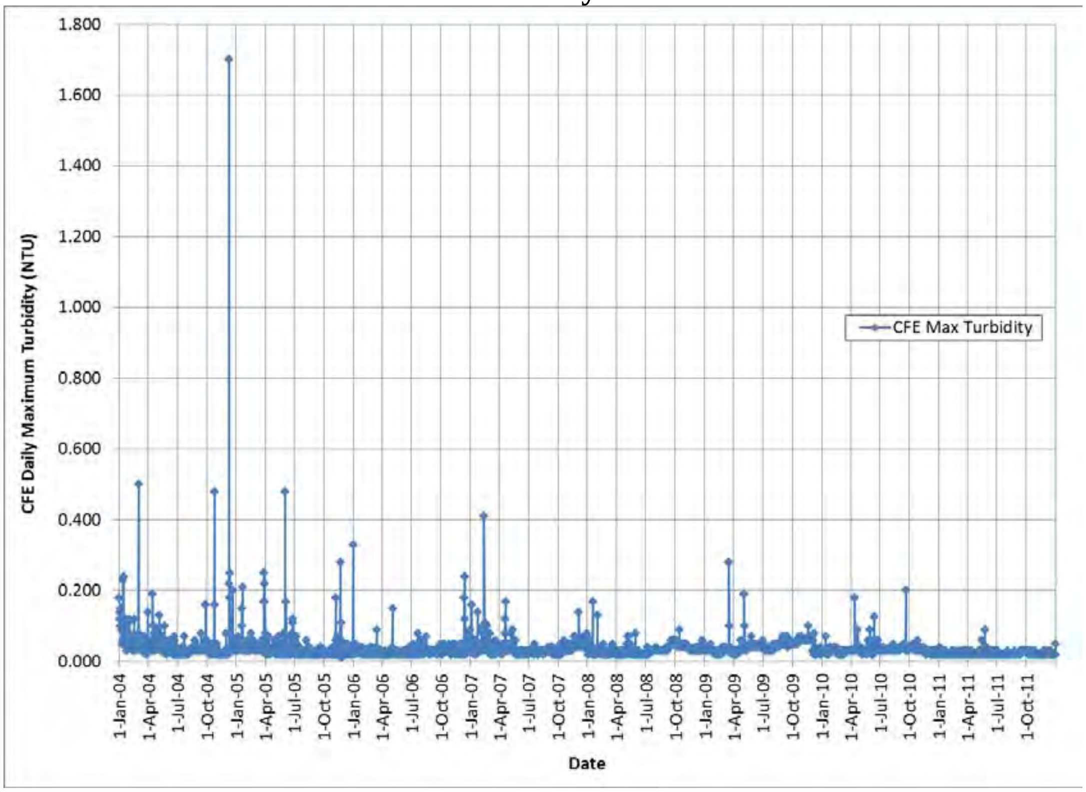
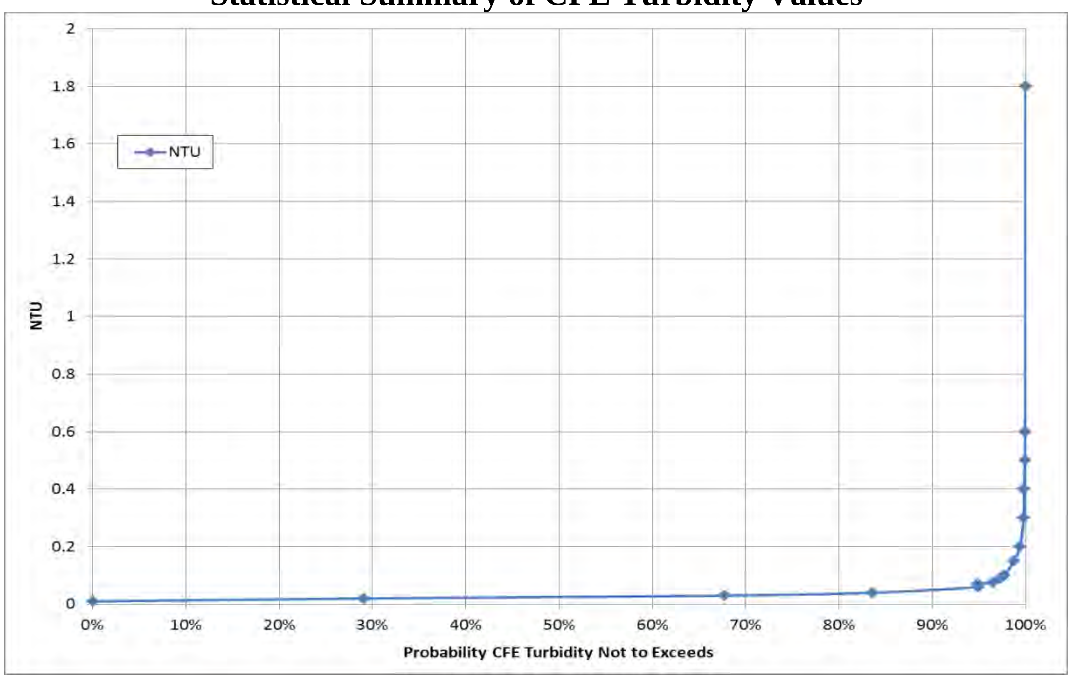


Figure 2-15
Statistical Summary of CFE Turbidity Values



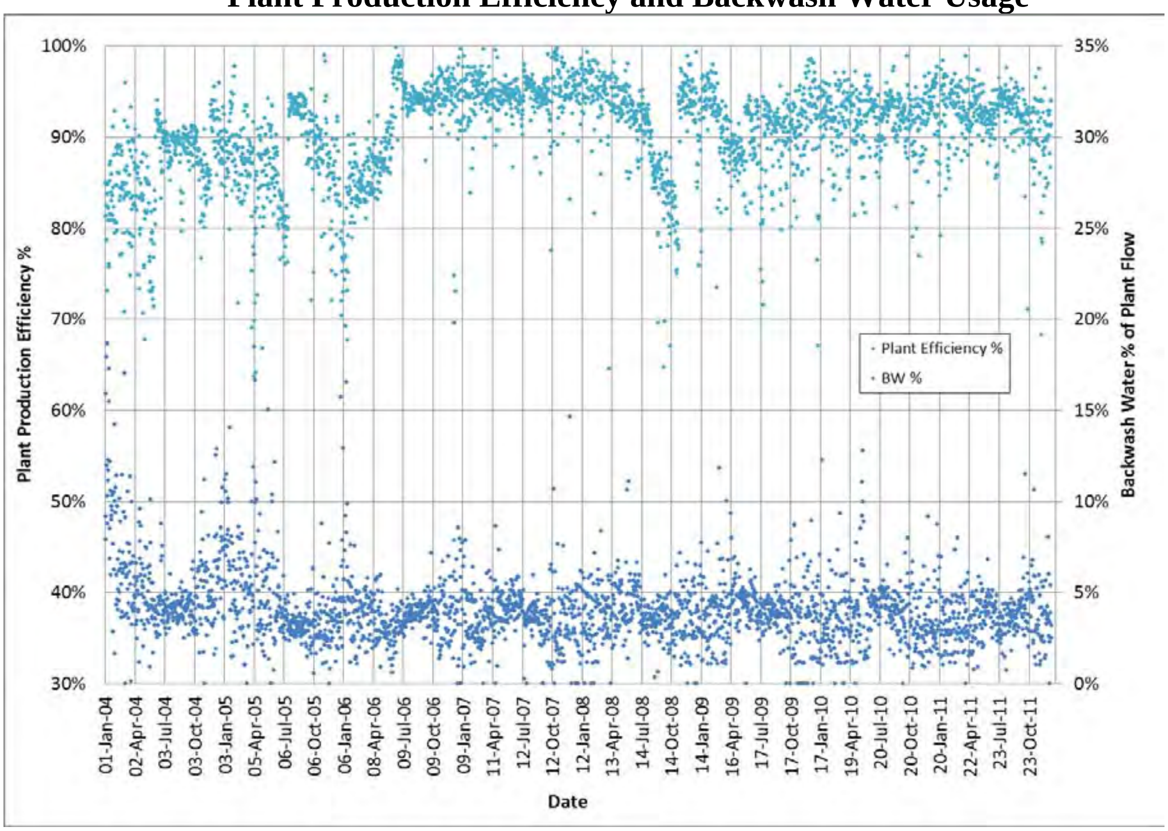
Filter Production Efficiencies

For a new surface water treatment plant, a typical suggested minimum overall efficiency is 97 percent. The City's WTP efficiency does not consistently meet this goal. The 2004 WTPFP identified a number of improvements that could be made to the filtration process to improve production efficiencies. As a result, the City has made the following upgrades:

- Filter media replacement and optimization
- Filter underdrain improvements
- Optimized filter backwash procedure and Unit Filter Run Volume optimization
- Addition of a second backwash pump to help provide backwash operational reliability

Figure 2-16 shows how plant efficiency has increased since 2004 and that the amount of backwash water used as a percent of plant flow has decreased. Prior to 2006, plant production efficiencies were in the range of 80 to 90 percent, while from 2006 onward plant efficiencies are observed to be consistently 85 to 95 percent. If basin 3 turbidities could be reduced, filters 6, 7, and 8 may require less frequent backwashing, resulting in increased plant efficiency.

Figure 2-16
Plant Production Efficiency and Backwash Water Usage



Operations and Maintenance

Historical operations and maintenance costs for the WTP since 2004 are presented in Table 2-2. Plant operations and maintenance costs are typically classified as either fixed or variable. The fixed costs remain fairly constant except for minor variations that are within typical budgeting allowances. The greatest fixed cost for a WTP is usually labor and administrative support. Variable costs are based on the annual volume of water being treated and pumped, and can also be affected by variations in raw water quality which can change chemical and solids handling requirements. The greatest variable costs for a WTP include power for pumping raw and treated water, chemicals, and solids handling and disposal. The operations and maintenance costs for the WTP have increased significantly since the 2004 WTPFP was completed for the following reasons:

- Changes in plant operating strategy including operating for longer periods each day at lower flow rates to improve plant production efficiency
- Increases in power costs
- Increases in chemical costs
- Incorporation of a solids handling program (geobag dewatering system) beginning in 2005
- Maintenance and repair related to the fish screens and screen cleaning system
- Additional plant staff and administrative support and re-structuring of the Public Works Department accounting methods

The unit production cost of treating water, shown in Table 2-2, is currently approximately $632/MG. Given the plant's current condition, this is a relatively low cost compared to similar utilities in the Pacific Northwest.

Summary

The Grants Pass WTP has supplied water to meet the City’s water demands using a daily start-and-stop operating approach in the past. The recent historic peak day plant production was 14.2 mgd in July 2009 and is well below the nominal plant capacity of 20 mgd. Generally speaking, water demands have increased approximately 2 percent per year over the last decade.

The plant has performed well with regard to finished water quality and has met the regulatory requirements for filtered water turbidity. Plant production efficiencies have greatly improved since the 2004 WTPFP, averaging over 92 percent for the past five years compared to an average of about 87 percent prior. A minimum plant production efficiency of 97 percent should still be considered the long-term goal.

By switching from alum as a primary coagulant to ACH as a primary coagulant, alum usage has decreased and lime addition is no longer needed. It may be possible that coagulation chemistry between alum and ACH or PACl can be further optimized to reduce solids production or reduce chemical addition at the plant, or both. An optimal coagulation strategy will balance plant efficiency with coagulation chemical costs, disinfection requirements, pH adjustment requirements, and residual solids production.

Table 2-2
Summary of Annual Water Treatment Plant Operations and Maintenance Costs[1]

	FY[2] 2004	FY 2005	FY 2006	FY 2007	FY 2008	FY 2009	FY 2010	FY 2011	FY 2012
Support Services									
Personnel	156,036	236,523	186,944	213,190	247,205	277,102	270,541	282,022	277,896
Operating Supplies	15,866	19,537	9,681	10,515	14,253	27,395	11,591	25,960	18,804
Contract Services	32,157	90,459	98,191	100,155	107,054	121,510	109,758	125,677	117,264
Capital Outlay	1,243	7,370	6,582	10,054	2,405	4,035	10,412	7,782	2,164
Sub-Total	*205,302*	*353,889*	*301,398*	*333,914*	*370,917*	*430,043*	*402,301*	*441,441*	*416,127*
Process									
Personnel	119,341	108,884	117,960	119,222	145,379	145,289	135,748	135,722	152,277
Operating Supplies	90,094	84,764	116,723	134,710	147,763	153,991	179,473	145,418	172,886
Contract Services	173,973	162,840	168,535	191,893	176,491	192,053	193,487	200,797	202,270
Capital Outlay	0	7,099	5,119	16,551	10,418	2,410	5,420	3,413	0
Sub-Total	*383,408*	*363,587*	*408,337*	*462,376*	*480,051*	*493,743*	*514,127*	*485,351*	*527,433*
Maintenance									
Personnel	36,613	64,256	61,188	60,758	102,155	98,076	125,817	137,101	133,999
Operating Supplies	44,421	21,152	27,197	32,744	33,402	30,492	26,727	26,877	31,815
Contract Services	26,137	24,541	22,603	40,971	43,874	53,874	70,302	41,354	19,449
Capital Outlay	10,576	0	0	5,532	1,590	4,241	0	7,735	0
Sub-Total	*117,747*	*109,948*	*110,988*	*140,004*	*181,021*	*186,683*	*222,846*	*213,067*	*185,263*
Pump Stations									
Personnel	8,485	3,967	16,686	23,989	15,787	22,630	27,795	33,598	39,667
Operating Supplies	12,159	15,159	21,259	22,000	20,651	6,855	12,341	18,660	16,150
Contract Services	78,331	81,387	77,448	98,106	88,769	99,206	107,464	129,153	115,897
Capital Outlay	5,781	292	0	1,260	0	0	0	0	0
Sub-Total	*104,756*	*100,804*	*115,393*	*145,354*	*125,207*	*128,691*	*147,599*	*181,410*	*171,714*
Solids Handling									
Personnel	143	12,416	16,915	40,095	11,831	32,734	22,652	12,838	17,908
Operating Supplies	1,364	24,111	32,895	39,229	18,617	37,382	28,761	32,187	34,245
Contract Services	2,811	11,328	30,127	15,642	18,936	17,341	29,077	38,872	30,597
Capital Outlay	0	0	801	0	0	0	0	0	0
Sub-Total	*4,319*	*47,855*	*80,738*	*94,966*	*49,384*	*87,458*	*80,490*	*83,897*	*82,749*
Total Annual Cost	**$815,532**	**$976,083**	**$1,016,855**	**$1,176,614**	**$1,206,580**	**$1,326,618**	**$1,367,363**	**$1,405,166**	**$1,432,162**
Total Annual Cost of Treatment[3]	**$698,957**	**$860,810**	**$888,959**	**$999,123**	**$1,066,960**	**$1,187,241**	**$1,203,932**	**$1,204,826**	**$1,209,408**
ADD (MGD)	**4.92**	**4.84**	**4.95**	**5.81**	**5.62**	**5.40**	**5.26**	**5.15**	**5.24**
Unit Treatment Cost ($/MG)	**$390**	**$487**	**$492**	**$471**	**$521**	**$602**	**$627**	**$641**	**$632**

Notes
1. All costs are in respective fiscal year dollars.
2. Fiscal year represented by the year at the end of the reporting period; e.g. FY 2004 represents July 2003 through June 2004.
3. Total Annual Cost of Treatment excludes Pump Station line items and all Capital Outlay costs.

Overall, the sedimentation basins provide satisfactory clarified water for filtration, as well as adequate contact time for disinfection during most of the year. All basins experience challenges with regard to short-circuiting, moderate solids loading, sub-optimal flocculation, and seasonal turbidity spikes. The basins are not equipped with any type of automated solids removal system. As solids accumulate in the basin, the effective volume of the basin is reduced, compromising flow characteristics and overall performance in the basin.

The filters have provided finished water with acceptable turbidity levels. Filtration efficiency has been improved by recent upgrades to the filters. Overall efficiency is consistently between 85 and 95 percent. Additional improvements to clarification could potentially result in increased efficiency.

As water demands continue to increase, the annual plant operating strategy may also need to be adjusted. Longer operating periods during the spring and fall months may be required. Due to occasional challenges in meeting disinfection requirements, mostly during winter cold water conditions, it may be necessary to operate the plant at lower flow rates and extend the hours of operation. Plant staffing assignments may need to be adjusted to accommodate this. These potential staffing adjustments need to be considered by the City when developing future operations budgets.

The WTP operating costs have increased by approximately 50 percent since 2004 for a variety of reasons. When considering future capacity expansions, the operating costs need to be evaluated carefully in addition to capital costs.

CHAPTER 3
REGULATORY REVIEW

Introduction

This chapter provides a general overview of current drinking water regulations under the Oregon Drinking Water Quality Act (OAR 333-061 – Rules for Public Water Systems), as well as anticipated future regulations. The discussion of each regulation is followed by an assessment of historic compliance, or in the case of future regulations, anticipated compliance. Recommended process and monitoring improvements to ensure continued compliance with all existing and anticipated regulatory requirements are discussed where appropriate. This regulatory summary is current as of April 2013. The City WTP is rated by the OHA as a conventional filtration plant. The WTP has been able to successfully produce water that has met all past and current drinking water regulations and also has met the needs of the City of Grants Pass customers.

Review of Current and Future Regulations

Currently enforced national drinking water regulations that have implications for Grants Pass are listed below:

- National Primary Drinking Water Regulations (1975)
- National Secondary Drinking Water Regulations (Secondary Standards) (1979, 1991)
- Phase I, II, and V Regulations for inorganic contaminants, synthetic organic compounds, and volatile organic compounds (1987, 1991, 1992, respectively)
- Surface Water Treatment Rule (1989)
- Interim Enhanced Surface Water Treatment Rule (1999)
- Long Term 2 Enhanced Surface Water Treatment Rule (2006)
- Total Coliform Rule (1989)
- Lead and Copper Rule (1991); being amended in 2013
- Consumer Confidence Reports Rule (1998)
- Stage 1 Disinfectants/Disinfectant By-Product Rule (1998) – supersedes Total Trihalomethane Rule (1979)
- Stage 2 Disinfectants/Disinfectant By-Product Rule (2006)
- Unregulated Contaminants Monitoring Rule 1 (1999) and 2 (2006) and 3 (2012)
- Radionuclides Rule (2000)
- Arsenic Rule (2001)
- Filter Backwash Recycle Rule (2001)

With the exception of the Unregulated Contaminants Monitoring Rule (UCMR), the water quality standards established under these national regulations have been or are planned to be adopted into the Oregon Drinking Water Quality Act (OAR 333-061) by the OHA Drinking Water Program. In addition to implementation, OHA is responsible for enforcing these national water quality standards. If a system is found to be in violation, OHA will issue a Notice of Violation. If violations are accumulated, the system is considered a "significant non-complier." An administrative order is issued for monitoring violations or a remedial order is issued where plant improvements are required. A schedule for compliance is included in the order. If the schedule is not met, civil penalties are issued, usually in the form of fines. Enforcement of the UCMR is the responsibility of the U.S. EPA.

There are currently drinking water quality standards for 95 primary and 12 secondary contaminants in the State of Oregon (State). Under the Oregon Drinking Water Quality Act, each contaminant has either an established MCL or recommended treatment technique. These contaminants are grouped into the following general categories:

- Inorganic Contaminants,
- Organic (Synthetic and Volatile) Compounds,
- Radiologic Contaminants,
- Disinfectants and Disinfection Byproducts,
- Microbial Contaminants, and
- Secondary Contaminants.

Table 3-1 summarizes the primary and secondary drinking water contaminants regulated under the Oregon Drinking Water Quality Act found in Oregon Administrative Rule 333-061-0030. Some contaminants have a recommended treatment technique in lieu of an MCL. The following is a discussion of these state-regulated contaminants, as well as the federally monitored unregulated contaminants.

Table 3-1
Maximum Contaminant Levels and Action Levels

Contaminant	MCL[1]	Sampling Frequency
Inorganic Contaminants		
Antimony	0.006	Annually
Arsenic	0.01	Annually
Asbestos (fibers >10μm)	7 MFL	9 years
Barium	2.0	Annually
Beryllium	0.004	Annually
Cadmium	0.005	Annually
Chromium (total)	0.1	Annually
Copper	1.3[2]	See text
Cyanide	0.2	Annually
Fluoride	4.0	Annually
Lead	0.015[2]	See text
Mercury	0.002	Annually

Table 3-1 (continued)

Nickel	0.1[3]	Annually
Nitrate (as N)	10.0	Annually
Nitrate and Nitrite (as N)	10.0	Annually
Nitrite (as N)	1.0	Annually
Selenium	0.05	Annually
Thallium	0.002	Annually
Synthetic Organic Compounds		
Acrylamide	TT	Annually, if applicable
Alachlor	0.002	Twice in 3 years
Atrazine	0.003	Twice in 3 years
Benzo(a)pyrene (PAHs)	0.0002	Twice in 3 years
Carbofuran	0.04	Twice in 3 years
Chlordane	0.002	Twice in 3 years
2,4-D	0.07	Twice in 3 years
Dalapon	0.2	Twice in 3 years
Di (2-ethylhexyl) adipate	0.4	Twice in 3 years
Di (2-ethylhexyl) phthalate	0.006	Twice in 3 years
Dinoseb	0.007	Twice in 3 years
Diquat	0.02	Twice in 3 years
Endothall	0.1	Twice in 3 years
Endrin	0.002	Twice in 3 years
Epichlorohydrin	TT	Annually, if applicable
Ethylene dibromide (EDB)	0.00005	Twice in 3 years
Glyphosate	0.7	Twice in 3 years
Heptachlor	0.0004	Twice in 3 years
Heptachlor epoxide	0.0002	Twice in 3 years
Hexachlorobenzene	0.001	Twice in 3 years
Hexachlorocyclopentadiene	0.05	Twice in 3 years
Lindane	0.0002	Twice in 3 years
Methoxychlor	0.04	Twice in 3 years
Oxamyl (Vydate)	0.2	Twice in 3 years
Pentachlorophenol	0.001	Twice in 3 years
Picloram	0.5	Twice in 3 years
Polychlorinated biphenyls (PCBs)	0.0005	Twice in 3 years
Simazine	0.004	Twice in 3 years
2,3,7,8-TCDD (Dioxin)	0.00000003	Risk dependent
Toxaphene	0.003	Twice in 3 years
2,4,5-TP (Silvex)	0.05	Twice in 3 years
Volatile Organic Compounds		
Benzene	0.005	3 years
Carbon tetrachloride	0.005	3 years
1,2-Dibromo-3-chloropropane (DBCP)	0.0002	3 years

Table 3-1 (continued)

p-Dichlorobenzene	0.075	3 years
o-Dichlorobenzene	0.6	3 years
1,2-Dichloroethane	0.005	3 years
1,1-Dichloroethylene	0.007	3 years
cis-1,2-Dichloroethylene	0.07	3 years
Chlorobenzene	0.1	3 years
Dichloromethane	0.005	3 years
1,2-Dichloropropane	0.005	3 years
Ethylbenzene	0.7	3 years
Styrene	0.1	3 years
Tetrachloroethylene (PCE)	0.005	3 years
Toluene	1	3 years
1,2,4-Trichlorobenzene	0.07	3 years
1,1,1-Trichloroethane	0.2	3 years
1,1,2-Trichloroethane	0.005	3 years
Trichloroethylene	0.005	3 years
Vinyl chloride	0.002	3 years
Xylenes (total)	10	3 years
Radionuclides		
Gross alpha	15 pCi/L	4 years
Beta particle/photon activity	4 mrem/yr	4 years
Iodine - 131	3 pCi/L	4 years
Radium-226 + 228	5 pCi/L[3]	4 years
Strontium 90	8 pCi/L	4 years
Tritium	20,000 pCi/L	4 years
Disinfectant Residuals and Disinfection Byproducts		
Bromate	0.01	Quarterly
Chlorite	1.0	Quarterly
Haloacetic Acids	0.06	Quarterly
Dichloroacetic Acid	–	–
Trichloroacetic Acid	–	–
Total Trihalomethanes	0.08	Quarterly
Bromodichloromethane	–	–
Bromoform	–	–
Chloroform	–	–
Dibromochloromethane	–	–
Microbial Contaminants		
Giardia lamblia	TT	–
Cryptosporidium	TT	–
Legionella	TT	–
Heterotrophic plate count	TT	–
Turbidity	TT	See text
Viruses	TT	–

Table 3-1 (continued)

Total Coliform (TC)	< 5% positive	40/month
Fecal Coliform	Confirmed Presence	–
E. Coli	Confirmed Presence	If Total Coliform Test Positive
Secondary Standards		
Color (Color Units)	15	–
Corrosiveness	Noncorrosive	–
Foaming Agents	0.5	–
pH	6.5 to 8.5	–
Hardness (as $CaCO_3$)	250	–
Odor	3 TON[4]	–
Total Dissolved Solids	500	–
Aluminum	0.05 to 0.2	–
Chloride	250	–
Copper	1	–
Fluoride	2.0	–
Iron	0.3	–
Manganese	0.05	–
Silver	0.1	–
Sulfate	250	–
Zinc	5.0	–

Notes
1. Values reported in mg/L unless otherwise specified.
2. Action Level
3. MCL currently being re-evaluated by the EPA
4. Threshold odor number

Surface Water Treatment

All public water systems using surface water sources are required to comply with the Oregon Drinking Water Quality Act's treatment performance and disinfection requirements. Three specific areas are addressed within the Act, including:

- Overall filtration performance,
- Individual filtration performance, and
- Disinfection performance.

These are discussed below in detail.

Overall Filtration Performance Requirements

Current overall filtration performance standards require that the turbidity measurements from the combined filter effluent must be measured in 4-hour intervals by grab sampling or continuous monitoring. Ninety-five percent of these turbidity readings must be less than or equal to 0.3 NTU, and may never exceed 1.0 NTU. In addition, treatment strategies, in combination with disinfection, must consistently remove or inactivate 99.9 percent (3-log) of *Giardia*, 99.99 percent (4-log) of viruses, and 99 percent (2-log) removal (i.e., no inactivation) of *Cryptosporidium*. Each utility is required to submit a report to the State on a monthly basis and identify any exceptions.

Individual Filter Performance Requirements

Oregon law requires continuous, on-line measurement of turbidity for each individual filter. This data must be recorded every 15 minutes. If there is a failure in the turbidity monitoring equipment, the system may conduct grab sampling every 4 hours in lieu, but for not more than 5 working days following the failure. Each utility is required to submit a report to the State on a monthly basis and identify any exceptions. Exceptions under Oregon law occur when:

1. Individual filter effluent turbidity exceeds 1.0 NTU in two consecutive measurements, 15 minutes apart at any time during the filter operation.
2. Individual filter effluent turbidity exceeds 0.5 NTU in two consecutive measurements, 15 minutes apart, after 4 hours of operation following backwash.
3. Individual filter effluent turbidity exceeds 1.0 NTU in two consecutive measurements, 15 minutes apart, at any time during the filter operation in three consecutive months or for three months in a row.
4. Individual filter effluent turbidity exceeds 2.0 NTU in two consecutive measurements, 15 minutes apart, at any time during the filter operation in two consecutive months or for two months in a row.

Disinfection Performance Requirements

The Oregon Drinking Water Quality Act requires all utilities served by a surface water supply to achieve a minimum of 99.9 percent (3-log) reduction in *Giardia lamblia* cysts, 99.99 percent (4-log) reduction in viruses, and 99 percent (2-log) removal of *Cryptosporidium* cysts during drinking water treatment. Removal credit is awarded to WTPs based on the types of processes provided by the plants. For a conventional filtration plant with filter-to-waste capabilities, such as the Grants Pass WTP, a 2.5-log, 2.0-log, and 2.0-log removal credit is usually granted for *Giardia lamblia*, viruses, and *Cryptosporidium*, respectively. The remaining reduction in pathogenic organisms must come in the form of disinfection or inactivation, or both. For the Grants Pass WTP, a minimum of 0.5-log inactivation of *Giardia* and 2.0-log inactivation of viruses is required prior to the first customer. Due to its longer time requirement for inactivation, *Giardia* inactivation typically governs disinfection through the WTP compared to viruses.

To determine the level of inactivation achieved during chemical disinfection, the EPA developed the "CT" concept. "CT" is the product of disinfectant residual measured at the outlet of a disinfection section and the time in which 10 percent (by volume) of an added tracer passes through the section, known as the T_{10}. To remain in compliance with disinfection performance standards, the following criteria must be met:

1. Disinfection residual must be continuously recorded at the entry point to the distribution system and must never fall below 0.2 mg/L.
2. CT must be calculated every day. To ensure that the values are conservative, the highest flow rate and minimum clearwell volume recorded for the day must be used in the calculation; tracer studies should be used to verify hydraulic efficiencies through the various treatment trains.
3. The CT calculated must be sufficient to meet the needed removal or inactivation levels.
4. The residual disinfectant concentration in the distribution system cannot be undetectable in more than 5 percent of the samples. For simplicity, samples should be collected at coliform bacteria monitoring points.

In Oregon, the OHA also enacted a requirement in the mid 1990s that a minimum of 0.5-log inactivation of *Giardia* and 1.0-log inactivation of viruses must be achieved following filtration and prior to the first customer. The OHA has grandfathered the Grants Pass WTP and allowed a disinfection credit for pre-chlorination through the plant upstream of the clearwell, including basins before filtration and the filters themselves. The City has been proactive in communicating the disinfection profile at the plant to the OHA and has worked with the State to ensure that the evaluation of CT at the plant is accurate. The rating and status of the WTP should remain the same as long as the WTP continues to meets water quality requirements and there are no major projects completed that would alter plant performance. In addition, the plant will be limited to a maximum capacity of 20 mgd. If flow exceeds this limit on a filter-by-filter basis, the WTP status will be reviewed and the ability to count pre-filtration CT could be revoked. In most cases, the OHA offers no disinfection credit for conventional plants prior to filtration even if a chlorine residual is carried through the unit operations preceding filtration.

Historical Compliance

The Grants Pass WTP complies with the Oregon Drinking Water Quality Act. Performance is discussed in the sections that follow.

Overall Filter Performance

Filtered water turbidity is measured at the combined filter effluent before entering the clearwell in the filter gallery. During the period from January 2004 to December 2011, filter effluent turbidity averaged 0.03 NTU. No filter effluent samples during this period exceeded the regulatory maximum of 1.0 NTU. The WTP has been in compliance with this regulation for the past 7 years.

Individual Filter Performance

On-line turbidimeters necessary for monitoring the individual filtered water turbidity have been used at the WTP for many years. Plant staff indicated that none of the individual filter effluent turbidity thresholds have ever been exceeded since their installation in the early 1990s.

Disinfection Performance

CT achieved through the WTP and through the clearwell is calculated daily according to OHA's guidelines which were originally established in the mid 1990s. Calculations include the daily finished water temperature, chlorine residual of the basin effluent and clearwell effluent measured every hour, pH, and the maximum daily treated water flow. Once calculated, this value is compared to the CT required; if CT achieved is greater than the CT required, then compliance is achieved.

The actual CT value is currently being calculated from a tracer study that was completed in 2003 for the clearwell. A new tracer study was recently completed to verify the T_{10}/T assumed for the WTP upstream of the clearwell. Appendix A includes a detailed summary of the new tracer study. To date, Grants Pass has consistently met CT requirements at the WTP using the calculation methodology approved by OHA. From 2009 to 2011, there was only one instance where the total calculated *Giardia* inactivation through the plant was less than 0.5-log. This occured on October 29, 2009 when a value of 0.49 log was recorded. The WTP has had no violations with regard to disinfection residual monitoring or residual concentrations in the distribution system. Calculated CT values through the plant from year 2009 to 2011 are shown in Figure 3-1. Figure 3-1 also shows the plant's internal benchmark of 0.75-log *Giardia* inactivation. This benchmark is normally achieved except during the spring and fall seasons and during periods with very low raw water temperature.

If OHA decides to change the calculation methodology used by the plant to only allow credit for CT achieved through the clearwell, the plant may be significantly challenged to meet the CT required throughout the year. According to Figure 3-2, from 2009 to 2011, the CT achieved in the clearwell did not result in 0.5-log *Giardia* inactivation for almost 10 percent of the time. This often occurred during the winter months when the water temperature was very cold or during the spring and fall seasons when water demand started to increase, resulting in a higher plant operating flow rate, while the water temperature was still fairly cold. It is likely that the plant could modify its operational procedures during challenging water quality periods to be able to achieve 0.5-log *Giardia* inactivation in the clearwell under all conditions, mostly by operating the plant at a lower flow rate for longer periods.

If the WTP were ever to be rated by OHA as a direct filtration plant instead of a conventional filtration plant, then it would have to achieve a minimum of 1.0-log *Giardia* inactivation through the plant and at least 0.5-log *Giardia* inactivation would have to be achieved post-filtration. As seen from Figure 3-1, achieving 1.0-log *Giardia* inactivation throughout the year would be extremely challenging and may not be possible without significant capital improvements.

Figure 3-1
Overall *Giardia* Inactivation Achieved

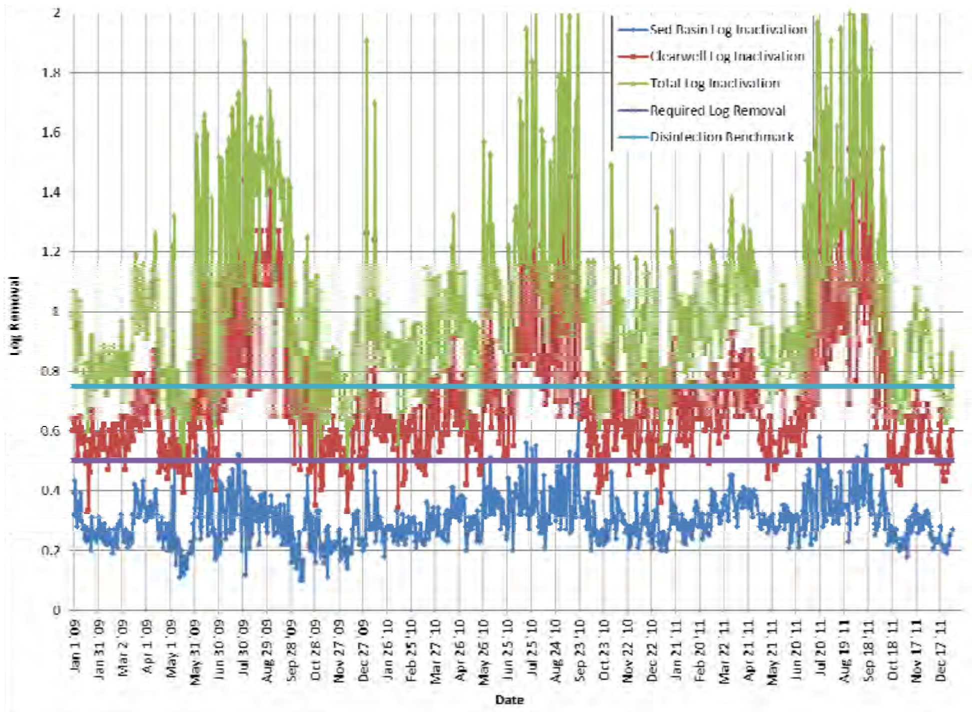
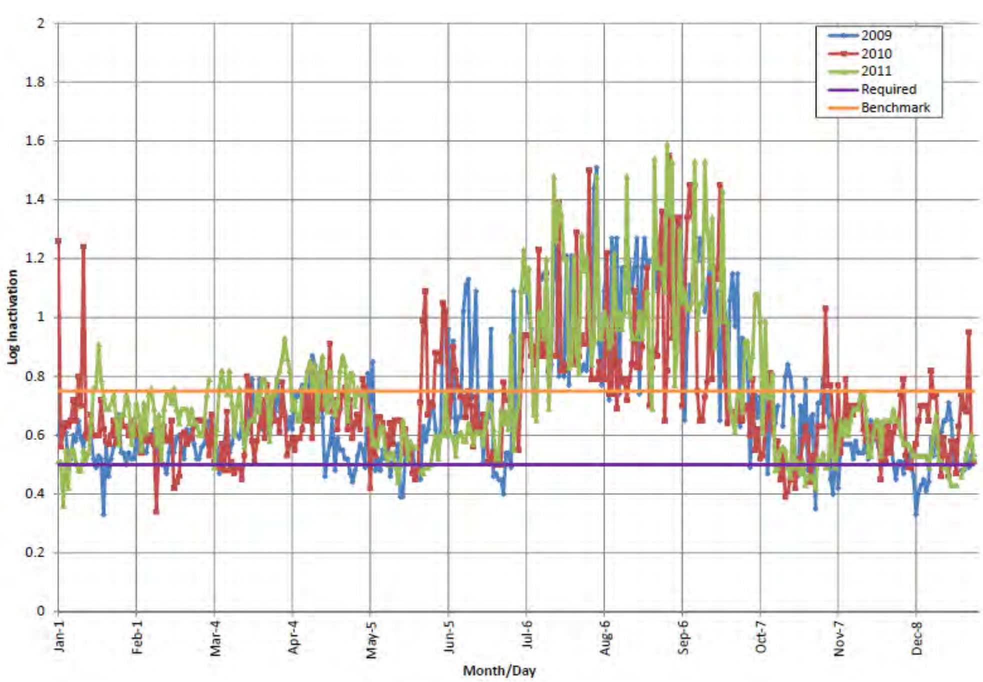


Figure 3-2
***Giardia* Inactivation Through the Clearwell**



Total Coliform Rule

Based on the City's population, the Oregon Drinking Water Quality Act requires the City of Grants Pass to collect a minimum of 40 water samples per month from representative sites throughout the water distribution system. If a routine sample is positive for total coliform, the City must collect a set of three repeat samples: one from the original site, one from a location within five service connections upstream of the original site, and one from a location within five service connections downstream of the original site.

The repeat samples must be collected within 24 hours of notification of the positive result. Further, any routine or repeat coliform positive samples must be analyzed for the presence of fecal coliform or *E. coli* as an indicator organism. When a system learns of the presence of fecal coliform or *E. coli*, the system must notify the State by the end of the same day. In Oregon, the total coliform MCL is violated in any of the following situations:

1. More than one sample collected within a single month is coliform positive, referred to as a non-acute violation.
2. A repeat sample following a total coliform positive contains fecal coliform or *E. coli*, referred to as an acute violation.
3. A repeat sample following a fecal coliform positive or *E. coli* positive contains total coliform, also an acute violation.

The City of Grants Pass monitors all of the water system microbial data, since the City owns and operates its distribution system that receives water produced by the WTP. To date, no information has been identified that indicates the City has violated the Total Coliform Rule. The finished water produced by the WTP has always met the requirements related to maintaining the minimum chlorine residual and booster chlorination is practiced in the distribution system at key locations to ensure that a minimum residual is maintained.

Long-term 2 Enhanced Surface Water Treatment Rule

The purpose of the Long-term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) is to further improve the control of *Cryptosporidium* in drinking water. The LT2ESWTR was published in the *Federal Register* on January 5, 2006. It applies to public water systems serving 10,000 or more people. Compliance with the LT2ESWTR was required in 2008 for the Grants Pass WTP. The LT2ESWTR requirements that potentially will impact the Grants Pass WTP include:

1. Source water sampling to establish concentrations of *Cryptosporidium*, which in turn defines additional treatment requirements for *Cryptosporidium*.
2. Potential additional *Cryptosporidium* inactivation and removal requirements.
3. Incorporation of a multi-barrier disinfection strategy.

To quantify system vulnerability, a 24-month monitoring program for *Cryptosporidium* is required to classify plants into treatment bins associated with source water concentration.

The rule includes a "toolbox" of control measures for meeting treatment requirements including watershed control options, treatment options, filter performance, and challenge tests. Table 3-2 presents the proposed treatment requirements for conventional plants and direct filtration plants based on results from the monitoring program.

Table 3-2
LT2ESWTR *Cryptosporidium* Monitoring Bin Classifications

Bin Number	Sample Results (Crypto oocyst per liter raw water)	Additional Treatment Requirements
1	< 0.075	No additional treatment required
2	0.075 to 1.0	1-log reduction
3	1.0 to 3.0	2-log reduction (1-log from disinfection)
4	> 3.0	2.5-log reduction (1-log from disinfection)

Non-disinfection-related reduction can be achieved through one or more alternatives presented in the LT2ESWTR "toolbox", below.

- Watershed control – 0.5 log.
- Alternative source or intake management – can get lower bin assignment.
- Off-stream storage – 0.5 log, 1.0 log based on hydraulic residence time.
- Pre-sedimentation basin (with coagulation) – 0.5 log
- Lime softening – 0.5 log
- Lower finished water turbidity – 0.5 log for CFE of 0.15 NTU (95 percent of the time), or 1.0 log for individual filter effluent less than or equal to 0.15 NTU (95 percent of the time). Cannot get credit for both.
- Membranes – Demonstrated with integrity testing for membranes that have been challenge-tested by the manufacturer.

In addition to raw water monitoring requirements, the LT2ESWTR requires all systems to perform disinfection profiling. If any modifications are made to the WTP, the WTP will need to work with OHA to establish expectations for the disinfection profile for the plant improvements.

The Rogue River is classified as a Bin #1 supply by OHA and therefore does not require any additional treatment processes for *Cryptosporidium* inactivation or removal. Extensive testing has been done on the Rogue River to validate this classification.

Disinfectants and Disinfection Byproducts

The Federal Total Trihalomethane Rule (TTHM Rule) was published in the *Federal Register* in November 1979; Oregon adopted the MCLs established in this law in September 1982.

The TTHM Rule set an MCL for TTHM of 0.10 mg/L based on a running annual average of quarterly sampling in the distribution system. However, these MCLs were superseded when the State of Oregon adopted the Stage 1 Disinfectants/Disinfection Byproducts Rule (D/DBPR) on July 15, 2000. The Stage 1 D/DBPR added an MCL of 0.060 mg/L for five haloacetic acids (HAA5), and reduced the MCL for TTHMs to 0.080 mg/L. The Stage 2 D/DBPR was promulgated by the EPA on January 4, 2006 and built on the Stage 1 rule by requiring that compliance be based on locational running annual averages (LRAAs) rather than a system-wide average of all sample locations. In addition, the Stage 2 D/DBPR required systems to revisit sample locations and perform more DBP sampling to determine sample locations that are most representative of worst-case DBP water quality. According to the OHA guidelines, the City's schedule for meeting the Stage 2 D/DBP Rule is as follows:

- 10/1/2007: Submit IDSE standard monitoring plan
- 9/30/2009: Complete an initial distribution system evaluation
- 1/1/2010: Submit IDSE report
- 10/1/2013: Begin Stage 2 compliance monitoring

To date, the City has completed the first three tasks and has now begun preliminary sampling of its stage 2 sites in preparation for Stage 2 compliance monitoring.

Monitoring Requirements

The Oregon Drinking Water Quality Act requires monitoring of disinfection byproducts. Compliance is currently based on a system-wide running annual average of quarterly samples, but in 2013 will move to a locational running annual average at each of the four sampling locations. To remain in compliance, the locational running annual average for TTHMs and HAA5s must not exceed 0.08 mg/L and 0.060 mg/L, respectively, at any location. Table 3-3 shows the DBPs and corresponding MCLs.

Table 3-3
Maximum Contaminant Levels for Disinfection Byproducts

Contaminant	Maximum Contaminant Level (mg/L)
Total Trihalomethanes[1] (TTHMs)	0.080
Haloacetic Acids[2] (HAA5)	0.060

Notes
1. "Total Trihalomethanes" includes the sum of concentrations of chloroform, bromodichloromethane, dibromochloromethane, and bromoform.
2. "Haloacetic acids" includes the sum of concentrations of monochloroacetic, dichloroacetic, trichloroacetic, monobromoacetic, and dibromoacetic acids.

Maximum residual disinfectant levels (MRDLs) present in the distribution system are also regulated. These MRDLs are summarized in Table 3-4. Monitoring and compliance for the MRDL of chloramines is similar to that required under the Total Coliform Rule (TCR). Utilities are required to collect these disinfection residual samples at the same locations and frequency as coliform samples.

Table 3-4
Maximum Residual Disinfectant Levels

Disinfectant	Maximum Residual Disinfectant Level (mg/L)
Chlorine	4.0 mg/L as Cl_2
Chloramines	4.0 mg/L as Cl_2
Chlorine Dioxide	0.8 mg/L as ClO_2

In addition to DBP MCLs and disinfectant MRDLs, conventional WTPs that have surface water as a supply are required to remove specific amounts of organic material through their treatment process. The percent of removal required depends on source water TOC and alkalinity. Table 3-5 provides a summary of the removal requirements.

Table 3-5
Percent Required Removal of Total Organic Carbon by Enhanced Coagulation for Plants Using Conventional Treatment

Total Organic Carbon in Raw Water (mg/L)	Source Water Alkalinity (mg/L as $CaCO_3$)		
	0 – 60	60 – 120	> 120
2.0 – 4.0	35	25	15
4.0 – 8.0	45	35	25
> 8.0	50	40	30

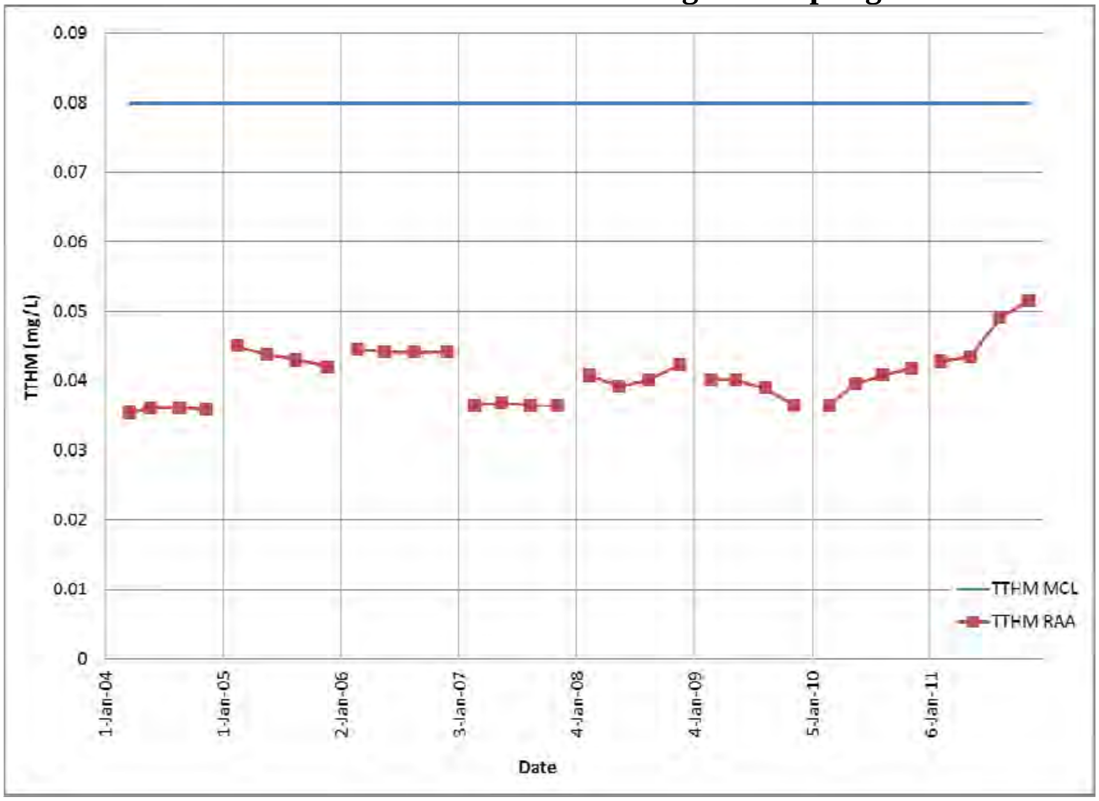
Compliance with this treatment requirement must be calculated as a running annual average on a quarterly basis after 12 months of data are available. Systems having raw water TOC concentrations under 2.0 mg/L are exempt from any TOC removal requirements.

Historical Compliance and Implications for Future Operation

The City of Grants Pass samples for the regulated DBPs at various locations throughout the distribution system. The current sampling protocol for DBPs includes four sites, with one sample representative of the maximum residence time in the distribution system at the Merlin Landfill and the remaining sample locations at the New Hope Pump Station, the Water Restoration Plant, and the Hillcrest Fire Station. The latter three sites are representative of the average residence time through the distribution system. Stage 2 protocol will add three additional sampling sites.

Prior to 2010, the City was only required to take four samples per quarter and that data was used to calculate a RAA for the average of the four samples. Figures 3-3 and 3-4 present DBP monitoring data for TTHMs and HAA5s prior to 2010 which was used to determine compliance with the Stage 1 D/DBP rule.

Figure 3-3
Total Trihalomethane Results from the Stage 1 Sampling Locations



Compliance with Stage 2 D/DBP will require a locational running annual average approach at each of the seven sampling locations and will be determined based on the worst-case location in the distribution system. It is highly likely that the worst-case location for TTHMs and HAA5s will be at the Merlin Landfill. However, due to HAA5s being mainly formed immediately downstream of the clearwell, the LRAA for HAA5s could be in a different location. Figures 3-5 and 3-6 present the LRAA TTHMs and HAA5s monitoring data from 2004 to 2011 at the Merlin Landfill sampling location.

Based on the historical DBP monitoring data, there have been periods when both TTHMs and HAA5s have been elevated above the regulatory limits, but no violations of the Stage 1 D/DBP Rule have occurred. There is no consistent annual pattern of elevated DBPs that would suggest that dramatic changes would have to be made to the treatment process. It is also not clear what influence raw water TOC and TOC removal through the plant has on DBP formation. It is possible that additional plant operating improvements or optimized distribution system operations may be able to ensure compliance with the future Stage 2

Figure 3-4
Haloacetic Acids Results from the Stage 1 Sampling Locations

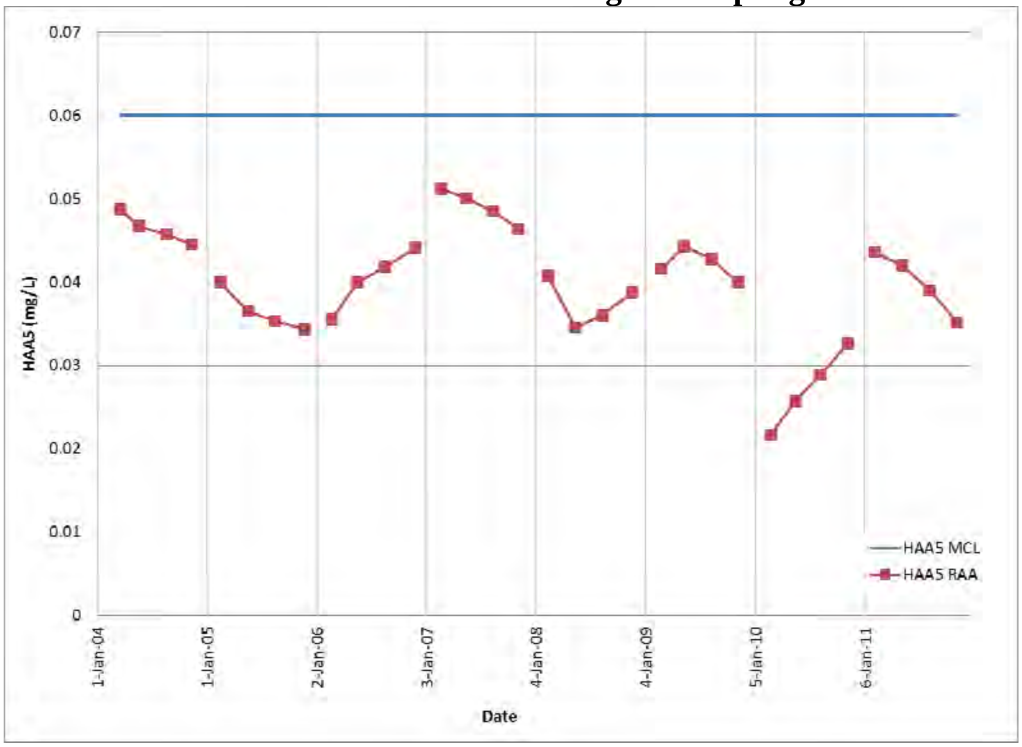


Figure 3-5
Total Trihalomethane Results at the Merlin Landfill

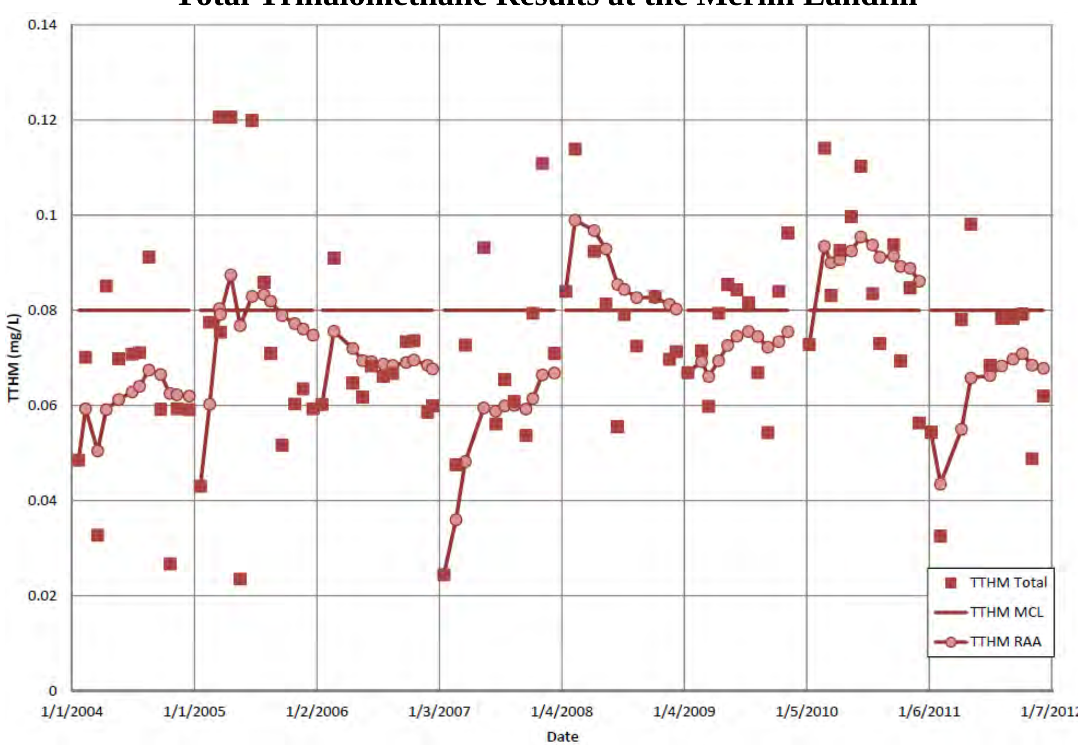
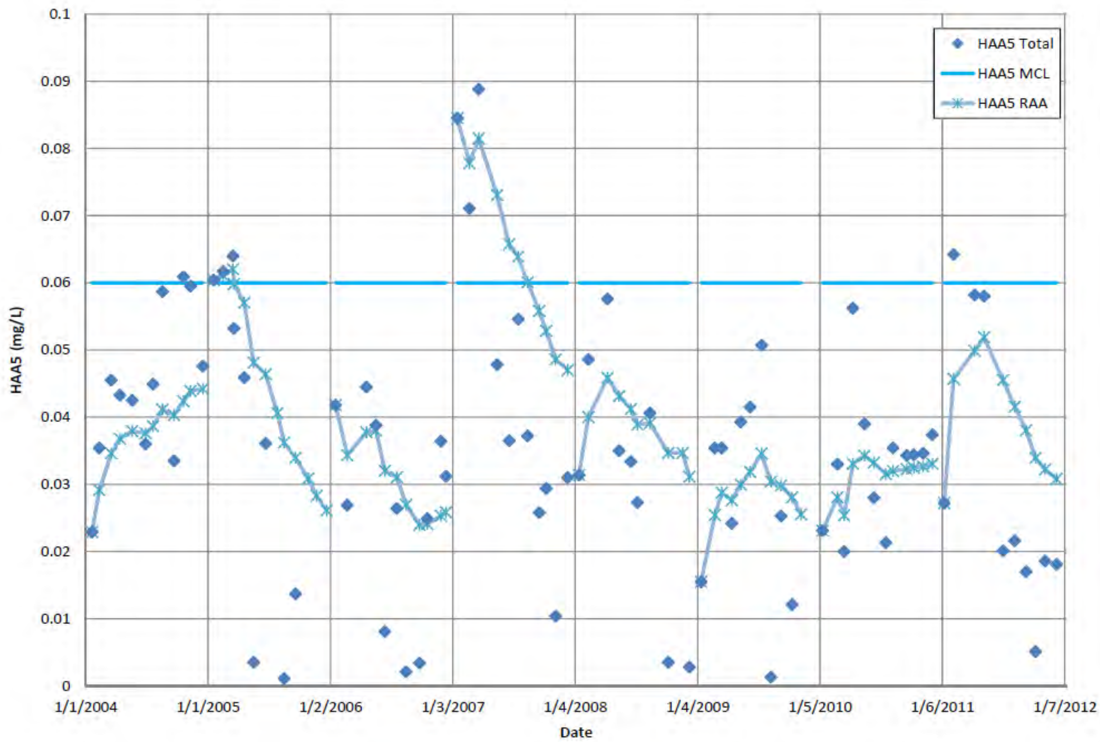


Figure 3-6
Haloacetic Acids Results at the Merlin Landfill



D/DBP Rule. These improvements could be lowering the chlorine residual in the plant and decreasing residence time in the distribution system.

Total Organic Carbon

The Grants Pass WTP monitored raw and finished water TOC monthly from 2004 to 2011 and this data is presented in Figure 3-7. Since the RAA of the raw water TOC was less than 2.0 mg/L, the City is not required to achieve a regulated amount of TOC removal through the plant. Also, the plant has recently had its TOC sampling frequency reduced from monthly to quarterly. The average raw TOC concentration in the Rogue River source from 2004 to 2011 was 1.6 mg/L and historical TOC removal through the plant has averaged 35 percent on an annualized basis. Unless the quality of the source water drastically changes, it is unlikely that TOC removal will be a problem for the Grants Pass WTP.

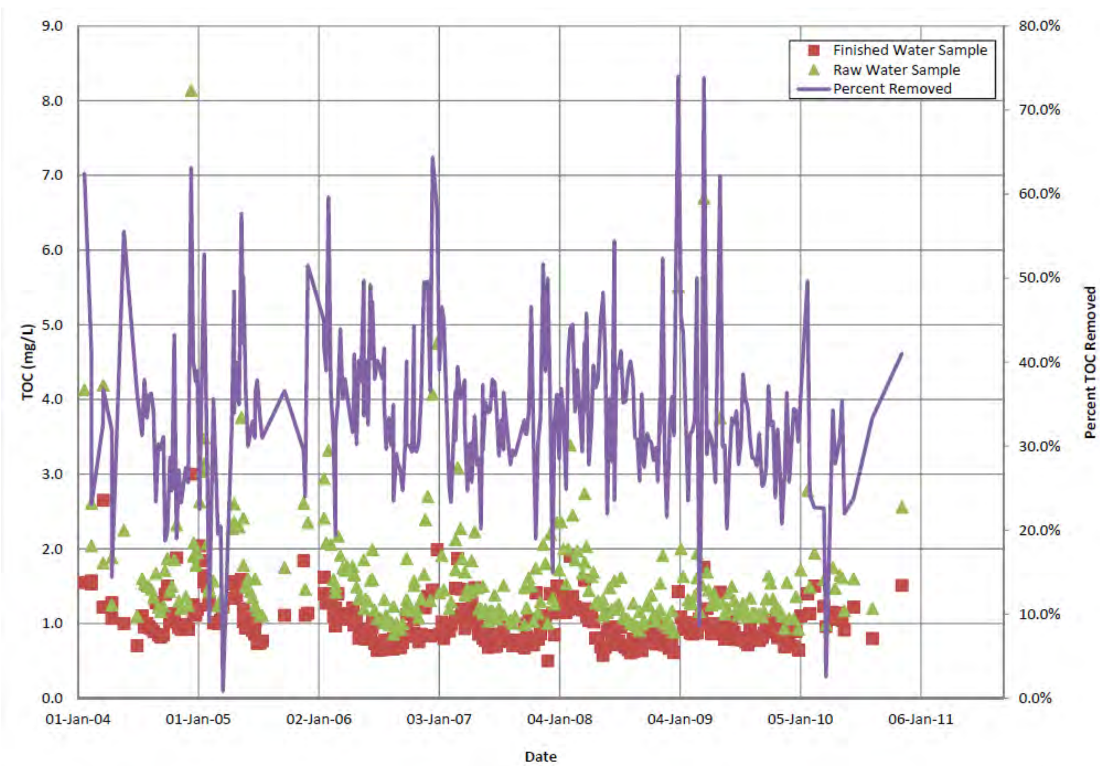
Lead and Copper and Corrosion Control

In 1991, LCR was promulgated by the EPA to reduce lead and copper concentrations in drinking water. Oregon adopted the LCR on December 7, 1992, without exception. The Lead and Copper rule established action levels for lead and copper set at 0.015 mg/L and 1.3 mg/L, respectively. Lead and copper regulations, under the Oregon Drinking Water Quality Act, require utilities to implement optimal corrosion control treatment that minimizes the lead and copper concentrations at users' taps, while ensuring that the treatment efforts do not cause the water system to violate other existing water regulations. It should be noted that an update to the LCR is expected to be promulgated in 2013, though implications to the City's plant are anticipated to be minimal.

Monitoring Requirements

Utilities are required to conduct monitoring for lead and copper from taps in "high risk" homes. Two rounds of initial sampling were required from 1992 to 1994, collected at 6-month intervals. Annual sampling was required after these initial efforts. Following this initial three-year period of sampling, samples are to be taken every three years. The action level for either compound is exceeded when, in a given monitoring period, more than 10 percent of the samples are greater than the action level.

Figure 3-7
Raw and Finished Water Total Organic Carbon Concentrations and Percent Removal



Sampling requirements of the LCR are based on the population served by the utility. For the service area of the Grants Pass WTP, which has a combined population of between 10,001 and 100,000, Oregon law requires 60 initial sampling sites; subsequent monitoring could be reduced to 30 sites provided initial sampling efforts demonstrate that lead and copper action levels are not exceeded. Water systems unable to meet action levels must either integrate corrosion control strategies into their treatment process train or develop an alternate source of water.

Historical Compliance

The Grants Pass WTP has historically produced non-corrosive water, keeping it in compliance with the Lead and Copper Rule since it was enacted in the early 1990s. Due to the WTPs ability to consistently produce water with low corrosiveness as evidenced by low ‘at-the-tap’ concentrations of lead and copper, OHA has reduced the sampling frequency to once every three years. There appears to be no concerns with future compliance with the Lead and Copper Rule.

Inorganic Contaminants

The goal of the Primary Drinking Water Regulations, with regard to inorganic contaminants, is to control the levels of minerals and metals in drinking water that create health concerns. For most inorganic contaminants, these health concerns result after long-term exposure to the compounds. However, the risks associated with nitrates and nitrites are acute; thus, additional monitoring requirements for nitrates and nitrites are included in Oregon law.

Monitoring Requirements

Monitoring requirements and MCLs for regulated inorganic contaminants are included in Table 3-1. Initial monitoring for nitrite and nitrate was quarterly for a minimum of one year. If all collected samples were below 50 percent of the MCLs for nitrite and nitrate, sampling was reduced to yearly. For water systems that contain asbestos-cement water pipes, samples testing for asbestos fibers must be taken every nine years. Monitoring for and compliance with the new arsenic MCL of 0.010 mg/L was required by January 2006. Concentrations of all other inorganic contaminants must be measured annually. Quarterly follow-up testing is required for any contaminants that are detected above the MCL.

Historical Compliance

The Grants Pass WTP has remained in compliance with regard to all inorganic contaminant MCLs during the period evaluated. Due to the high quality of the source water, the WTP is only required to sample for inorganic contaminants every nine years.

Organic Contaminants

Maximum contaminant levels for 53 different organic contaminants under the Oregon Drinking Water Quality Act were adopted from the Safe Drinking Water Act (SDWA) and are listed in Table 3-1. Monitoring requirements and MCLs for synthetic organic compounds (SOCs) and volatile organic compounds (VOCs) are listed in Table 3-1. The WTP monitors VOCs yearly and SOCs two consecutive quarters every three years per the state requirements. No concentration of regulated VOCs or SOCs above the detection limit is on record in the past five years.

Radiological Contaminants

The original MCLs adopted from the NPDWR by Oregon on September 24, 1982 are still in effect in the Oregon Drinking Water Quality Act today. These rules were revised in October 2002 to include a new MCL for Uranium and to clarify and modify monitoring requirements. Together, these established MCLs seek to minimize the cancer risk associated with long-term exposure to six natural and manmade radiological contaminants.

Monitoring Requirements

Monitoring requirements and MCLs for radiological contaminants are listed in Table 3-1. Monitoring for radionuclides is required once every four years from surface water sources. If gross alpha is measured below 5 picocuries per liter (pCi/L), no radium analyses are required. Only systems with elevated risks, such as impacts by manmade radiation sources, must sample for beta and photon radiation.

Historical Compliance

The City WTP staff analyzes radiological samples every nine years, a reduction in monitoring frequency granted by OHA based on no detection of radiological contaminants. The WTP has fully complied with all OHA radiological standards for the period evaluated, and no elevated gross alpha measurements have ever been observed.

Federally Monitored Unregulated Contaminants

The final UCMR was published by the EPA in the March 12, 2002 *Federal Register*. Under this rule, EPA develops a list of unregulated contaminants every five years. Contaminants on the list are under consideration for eventual regulation but the EPA has insufficient occurrence information for each of them. This rule is administered and enforced by the EPA rather than the State primacy agencies.

Monitoring Requirements

UCMR 1, published in 1999, established a new list of contaminants to be monitored, procedures for selecting a national representative sample of public water systems, and procedures for incorporating the monitoring results into the National Contaminant Occurrence Database. UCMR 1 re-designed the UCM program to incorporate a tiered monitoring approach that divided monitoring of contaminants into three lists:

- List 1 contaminants are monitored by all public water systems serving over 10,000 people and a smaller group of public water systems serving less than 10,000 people;
- List 2 contaminants are monitored by a representative group of 300 randomly chosen public water systems;

- List 3 contaminants are monitored by 200 “vulnerable” systems across the country.

For chemical contaminants, surface water systems monitor quarterly for one year and ground water systems monitor two times six months apart. For microbiological contaminants, systems monitor twice, six months apart. For all chemical constituents in Lists 1 and 2, monitoring must be conducted at the entry point to the distribution system. For microbiological contaminants in List 1, monitoring is conducted near the end of the distribution system and at a representative site within the distribution system. Nationwide sampling for UCMR 1 took place from 2001 to 2003. The list of UCMR 1 contaminants is provided in Table 3-6.

The second monitoring cycle established a new list of contaminants in UCMR 2, promulgated in 2007. The WTP completed its UCMR 2 monitoring, which nation-wide extended from 2008 through 2010. Twenty-five contaminants were listed by the EPA for monitoring under UCMR 2: 10 List 1 contaminants and 15 List 2 contaminants, which are shown in Table 3-6.

UCMR 3 was finalized in May 2012. The City will begin monitoring and reporting the 30 identified contaminants (28 chemical, 2 viruses) in 2013. The program will be running from 2013 to 2015 and have similar sampling and reporting requirements as UCMR 2.

Historical Compliance

The WTP has historically complied with unregulated contaminant monitoring required by the EPA. No contaminants of concern have been detected in the Rogue River supply.

Secondary Standards

The secondary standards for drinking water, listed in Table 3-1, are intended as guidelines that address water quality issues which are related to the taste, odor, aesthetics, and corrosiveness of drinking water. These standards are non-enforceable guidelines for water quality parameters not known to adversely affect human health.

The WTP monitors finished water alkalinity, pH, chlorine, and turbidity on a daily basis as presented in Chapter 2. The WTP has occasionally received customer complaints related to drinking water tastes and odors on an infrequent and seasonal basis. The Grants Pass WTP has historically complied with water regulations addressed by the Secondary Standards.

Filter Backwash Recycling Rule

The final Filter Backwash Recycling Rule (FBRR), promulgated in 2001, applies to all public water systems that use surface water and employ conventional or direct filtration and also recycle water within the plant.

Table 3-6
Unregulated Contaminant Monitoring Program Summary

Unregulated Contaminant Monitoring Rule 1		
List 1	**List 2**	**List 3**
Assessment Monitoring of Contaminants with Available Methods	**Screening Surveys of Contaminants with Methods Just Developed**	**Prescreen Testing of Contaminants Needing Research on Methods**
2,4-dinitrotoluene	1,2-diphenylhydrazine	Lead-210
2,6-dinitrotoluene	2-methyl-phenol	Polonium-210
Acetochlor	2,4-dichlorophenol	Cyanobacteria
DCPA mono-acid degradate	2,4-dinitrophenol	Echoviruses
DCPA di-acid degradate	2,4,6-trichlorophenol	Coxsackieviruses
4,4'-DDE	Diazinon	Helicobacter pylori
EPTC	Disulfoton	Microsporidia
Molinate	Diuron	Caliciviruses
MTBE	Fonofos	Adenoviruses
Nitrobenzene	Linuron	
Perchlorate	Nitrobenzene	
Terbacil	Prometon	
	Terbufos	
	Aeromonas	
	Alachlor ESA	
	RDX	

Unregulated Contaminant Monitoring Rule 2	
List 1	**List 2**
Dimethoate	**Three Parent Acetanilides**
Terbufos sulfone	Acetochlor
Five Flame Retardants	Alachlor
2,2',4,4'-tetrabromodiphenyl ether (BDE-47)	Metolachlor
2,2',4,4',5-pentabromodiphenyl ether (BDE-99)	**Six Acetanilide Degradates**
2,2',4,4',5,5'-hexabromobiphenyl (HBB)	Acetochlor ethane sulfonic acid (ESA)
2,2',4,4',5,5'-hexabromodiphenyl ether (BDE-153)	Acetochlor oxanilic acid (OA)
2,2',4,4',6-pentabromodiphenyl ether (BDE-100)	Alachlor ethane sulfonic acid(ESA)
Three Explosives	Alachlor oxanilic acid (OA)
1,3-dinitrobenzene	Metolachlor ethane sulfonic acid(ESA)
2,4,6-trinitrotoluene (TNT)	Metolachlor oxanilic acid (OA)
Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	**Six Nitrosamines**
	N-nitroso-diethylamine (NDEA)
	N-nitroso-dimethylamine (NDMA)
	N-nitroso-di-n-butylamine (NDBA)
	N-nitroso-di-n-propylamine (NDPA)
	N-nitroso-methylethylamine (NMEA)
	N-nitroso-pyrrolidine (NPYR)

Monitoring and Compliance Requirements

This rule requires the three major recycle streams, spent filter backwash water, solids thickener supernatant, and liquids from dewatering processes, to pass through all treatment processes. Therefore, these recycle streams must be returned prior to chemical addition and coagulation. The rule is unclear as to whether FTW water is considered a recycle stream and whether such water can be returned downstream of chemical addition and coagulation. This decision is made between the utility and OHA on a case-by-case basis.

Each utility was required to notify OHA in writing by December 8, 2003, that they practice recycling. This notification included a plant schematic that shows the type and location of recycle streams, typical recycle flow data, highest plant flow in the previous year, design flow of the plant, and OHA-approved operating capacity. Each system must collect and maintain the following information for compliance with this rule:

- Copy of recycle notice to OHA.
- List of all recycle flows and frequency.
- Average and maximum backwash flow and duration.
- Typical filter run duration and how it was determined.
- Type of recycle treatment (if any) and data on recycle stream facilities.

This rule may affect decisions regarding how recycle streams are handled for a new or upgraded WTP.

Historical Compliance

Since the WTP does not recycle any of its residual streams, the FBRR does not apply, but is mentioned for consideration if WTP operational issues drive the plant to recycle some or all of its waste streams in the future. The plant sends its filter backwash water and filter-to-waste to the old mill pond located across the street from the WTP. The old mill pond releases decant or overflow water to Skunk Creek. A NPDES permit has been issued by Oregon DEQ for this discharge stream. Solids from the sedimentation basin are dewatered on-site using geobags and the “pressate” is not recycled within the WTP.

Tastes and Odors

Taste and odor events from the City’s water supply are very rare in Grants Pass. Other upstream users of the Rogue River, such as the Medford Water Commission, experience taste and odor episodes on a frequent basis. The common taste and odor reported in Medford is earthy or musty and is commonly caused by excessive algal activity. The conditions in the lower Rogue River in and around Grants Pass are apparently not as conducive to excessive algal activity during the summer and fall as in the upper parts of the watershed. Algae can produce excessive concentrations of MIB and geosmin which are organic compounds that impart earthy or musty tastes and odors to the water. These compounds do not present a health hazard, but create an aesthetic and public perception problem.

Because of the low historical occurrence of taste and odor in its water supply, the Grants Pass WTP is not equipped with processes capable of removing earthy or musty tastes and odors. The only treatment alternatives for this particular water quality issue include the following:

- Oxidation with ozone
- Adsorption with high doses of powdered activated carbon (PAC)
- Adsorption with granular activated carbon (GAC), either as a filter adsorber or in a separate contactor
- Oxidation using ultraviolet (UV) light combined with addition of hydrogen peroxide

The Medford Water Commission's Duff WTP uses pre-ozonation to combat earthy or musty tastes and odors. Before ozonation was installed, there was a high frequency of taste and odor events and customer complaints received when the City started up the Duff WTP in the summer to handle their peaks in demand. The rest of the year, Medford Water Commission customers receive Butte Spring water that typically does not have taste and odor concerns. The City of Grants Pass should be aware of the potential for taste and odor events in the future and will have to decide if investment in taste and odor control technology in the future will be beneficial to its customers. The City will also have to balance the need for taste and odor control with the risk of re-rating the plant if major process changes are made.

Trace Organics and Emerging Contaminants

Trace organics and contaminants of interest for the Rogue River supply which could become regulated within the next decade include:

- Hexavalent chromium
- Emerging contaminants
- Herbicides and pesticides
- Algal toxins

Concerns about the presence of hexavalent chromium have become elevated in the western United States, especially in California. Currently, only total chromium is regulated at an MCL of 0.1 mg/L (100 ppb). Hexavalent chromium is an identified carcinogen, but it is not currently known what a future MCL might be. It is not anticipated that hexavalent chromium will be a trace metal of concern in the Rogue River supply nor for the WTP.

The water industry's understanding of the treatment technologies needed to remove trace organics and emerging contaminants is in its infancy. These emerging contaminants include EDCs, PhACs and PCPs, all of which may be present in drinking water supplies, especially those which receive discharges from wastewater treatment plants or stormwater runoff from urban and agricultural areas. Algal toxins are also an emerging trace contaminant of interest in surface water supplies. Most of these compounds are currently not regulated in drinking water, but it is possible that regulations will be promulgated in the future. Therefore, many drinking water providers are taking a close look at their treatment plant's ability to remove or destroy these compounds. Based on limited data searches, it does not appear that the Rogue River has been investigated for the presence of emerging contaminants.

Removal of Emerging Contaminants

Table 3-7 presents a summary of the anticipated performance of different types of drinking water treatment processes for removal of various classes of compounds based on the most recent industry research. Researchers have concluded that, in general, advanced treatment technologies such as activated carbon, high-pressure membrane processes (such as nanofiltration or reverse osmosis), and advanced oxidation (such as ozone or UV with hydrogen peroxide) are effective in the removal of many of these trace contaminants. However, no single treatment process has been demonstrated to be consistently effective in removing all of the emerging contaminants currently targeted due to the wide ranges in their physical and chemical properties.

It is anticipated that future drinking water treatment facilities will likely include one or more advanced treatment modules added to existing and new conventional treatment plants creating multi-barriers to a full range of potential existing and emerging contaminants. The existing Grants Pass WTP does not have any processes which can be considered excellent or good to reliably treat for emerging contaminants. Planning for emerging contaminants is addressed in subsequent chapters of this Facility Plan Update.

Historical Compliance

Grants Pass WTP staff began proactively monitoring for hexavalent chromium by testing samples monthly starting in February 2011, as suggested by EPA. As of March 2011, sampling has been reduced to quarterly per EPA recommendations. Figure 3-8 displays the results of this testing. Concentrations of hexavalent chromium are well below the total chromium MCL of 100 ppb. Chromium and hexavalent chromium are on the list for UCMR 3 testing.

Table 3-7
Unit Processes and Operations Used for Removal of Emerging Contaminants

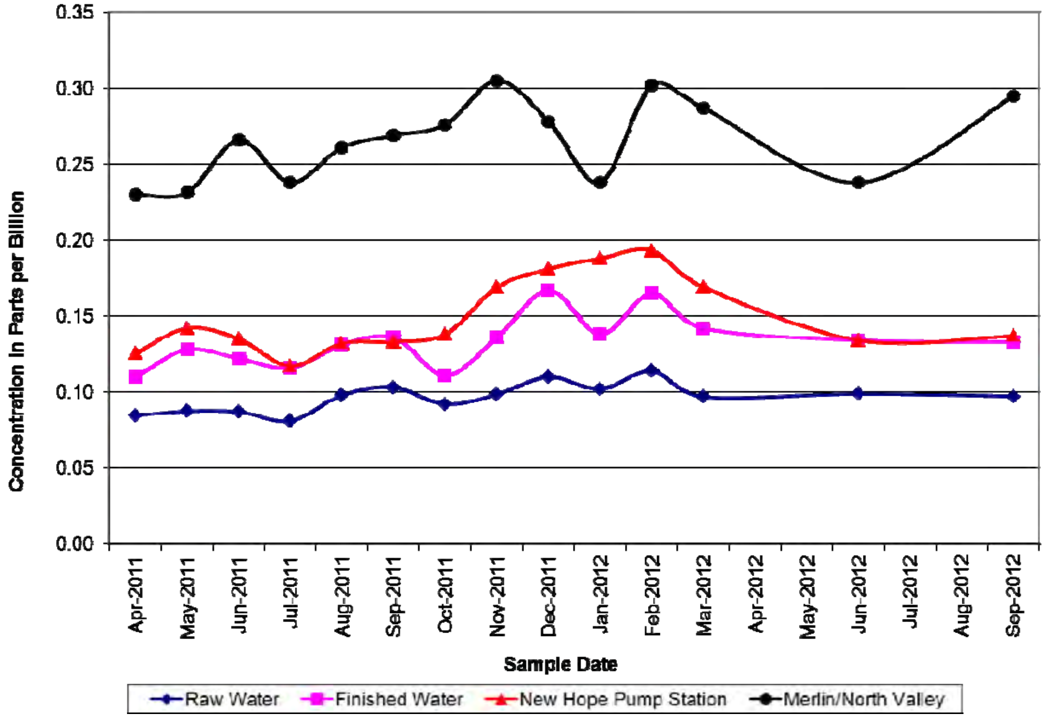
Group	Classification or Use	AC	BAC	O_3 and AOPs	UV and AOPs	CL_2 or ClO_2	Coagulation and Flocculation	Softening and Metal Oxides	NF	RO
EDCs	Pesticides	E	E	L-E	E	P-E	P	G	G	E
	Industrial chemicals	E	E	F-G	E	P	P-L	P-L	E	E
	Steroids	E	E	E	E	E	P	P-L	G	E
	Metals	G	G	P	P	P	F-G	F-G	G	E
	Inorganics	P-L	F	P	P	P	P	G	G	E
	Organometallics	G-E	G-E	L-E	F-G	P-F	P-L	P-L	G-E	E
PhACs	Antibiotics	F-G	E	L-E	F-G	P-G	P-L	P-L	E	E
	Antidepressants	G-E	G-E	L-E	F-G	P-F	P-L	P-L	G-E	E
	Anti-inflammatory	E	G-E	E	E	P-F	P	P-L	G-E	E
	Lipid regulators	E	E	E	F-G	P-F	P	P-L	G-E	E
	X-ray contract media	G-E	G-E	L-E	F-G	P-F	P-L	P-L	G-E	E
	Psychiatric control	G-E	G-E	L-E	F-G	P-F	P-L	P-L	G-E	E
PCPs	Synthetic musks	G-E	G-E	L-E	E	P-F	P-L	P-L	G-E	E
	Sunscreens	G-E	G-E	L-E	F-G	P-F	P-L	P-L	G-E	E
	Antimicrobials	G-E	G-E	L-E	F-G	P-F	P-L	P-L	G-E	E
	Surfactants and detergents	E	E	F-G	F-G	P	P-L	P-L	E	E

E: excellent (> 90%); G: good (70 – 90%); F: fair (40 - 70%); L: low (20 - 40%); P: poor (< 20%). Date and Source: Snyder et. al., 2003

Table Abbreviations

AC – Activated Carbon
AOPs – Advanced Oxidation Process
BAC – Biologically Activated Carbon
Cl_2 – Free chlorine
EDCs – Endocrine Disruptors
PCPs – Personal Care Products
PhACs – Pharmaceuticals
NF – Nanofiltration
O_3 – Ozone
RO – Reverse Osmosis
UV – Ultraviolet Light

Figure 3-8
Hexavalent Chromium Levels for the Grants Pass Water Treatment Plant and Distribution System



Summary

The Grants Pass WTP has consistently met all existing primary water quality regulations for over a decade. There are no major regulatory issues of concern at this time. However, there are some regulatory and water quality issues which the City should consider as part of future plant expansions and improvements:

1. Ensure that the plant continues to be rated as "complete conventional filtration," or its equivalent, to minimize the *Giardia* inactivation requirements.
2. Consider that potential challenges will arise if OHA decides to strictly enforce the post-filtration CT requirements (i.e., to achieve a minimum 0.5-log *Giardia* inactivation in the clearwell at all times).
3. Focus on treatment strategies and optimized plant and distribution system operations to minimize formation of DBPs.
4. Focus on producing a consistent finished water pH and alkalinity to continue complying with the Lead and Copper Rule.
5. Consider treatment process alternatives to reduce or eliminate earthy and musty tastes and odors which may possibly occur in the lower Rogue River during summer and fall based on what currently occurs in Medford.
6. Consider treatment process alternatives that can remove trace organics and emerging contaminants which may be present in the Rogue River or become a regulatory requirement in the future.

The biggest impacts to the plant processes, facility layouts, space requirements, and costs would come from regulatory changes by OHA related to disinfection compliance, complying with the Stage 2 D/DBP Rule, the City's decisions to implement taste and odor control, and control of emerging contaminants. These issues are discussed further in subsequent chapters of this Facility Plan Update.

CHAPTER 4

CHAPTER 4
CAPACITY REVIEW

Introduction

This chapter presents a review of the hydraulic capacity and treatment process capacity of the existing WTP. This work will determine the current and possible future capacity of the WTP given the limitations of each process and the system as a whole. The hydraulic capacity is determined by the piping, pumping, and flow control systems. Each process or support system has its own capacity relative to certain design criteria or operating parameters which are independent of other unit processes. Presented as part of this work will be a determination of the most limiting or controlling process or feature of the WTP's capacity. As part of this capacity analysis, an estimation of the WTP's firm capacity will be made.

Hydraulic Capacity Evaluation

This section presents a methodology overview of the hydraulic capacity evaluation and results of this evaluation. The hydraulic capacity analysis performed in the previous 2004 Facility Plan used hand calculations to establish maximum and firm capacities of individual portions of the WTP from the intake to the finished water pumps. The analysis performed as part of this Facility Plan Update uses a computer model to simulate the hydraulic performance and plant operations and determine the impacts of specific existing limitations on upstream and downstream facilities that are hydraulically linked. Previous planning work used hand calculations for this determination of the plant's hydraulic capacity. The mathematical formulas used for open and closed conduit calculations are the same as those used for the 2004 plan.

Typical Plant Operation

This section describes standard operating procedures and physical conditions which were incorporated into the analysis.

Raw Water Pumping

Raw water pumps are operated at one of ten internally approved plant production or flow rates based on anticipated system demand. The approved flow rates have been developed to aid in water quality measurement and production calculations that are recorded for regulatory compliance monitoring. The approved flow rates are shown in Table 4-1.

Sedimentation Basins

Flow from the raw water pumps is split between sedimentation basins 1, 2 and 3. Flow is controlled and proportioned by throttling the inlet valve to basin 3. Further adjustment can be made through the positions of the mud valves at the inlets of basins 1 and 2. The plant is typically operated with the inlet valve to basin 3 throttled to control flow split and optimize individual basin resident time for compliance purposes. Basin dimensions and flow splitting are summarized in Table 4-2.

Table 4-1
Approved Plant Flow Rates

	Plant Production					
Gallons per minute	3,560	4,500	5,500	6,500	7,300	8,500
Million gallons per day	5.1	6.5	7.9	9.4	10.5	12.2
Gallons per minute	9,500	10,500	11,500	12,500	13,500	13,900
Million gallons per day	13.7	15.1	16.6	18.0	19.4	20.0

Table 4-2
Sedimentation Basin Summary

Parameter	Unit	Basin 1	Basin 2	Basin 3
Width	ft	61	38	80
Length	ft	98	98	80
Depth	ft	13	13	13
Surface Area	ft^2	5,978	3,724	6,400
Volume	ft^3	77,714	48,412	83,200
	gal	581,301	362,122	622,336
Tank Flow Percent of Total	%	37	23	40

Filtration

Water from each basin flows by gravity over weirs within the basins and collected by launders. The water flows from the launders and fills a common channel which conveys flow to the filters. The common channel water level is monitored at three points: near filters 3 and 5 and between filters 7 and 8. The water level in the common channel is kept at 3.6 feet (the total height of the channel is approximately 5 feet) by the plant's control system, which adjusts flow to each group of filters. The flow is optimally split by a ratio of flow to area and the number of filters in service. Filter dimensions and flow splitting are summarized in Table 4-3.

Flow through each filter is controlled by throttling the effluent valve on the filter. As the head loss through the filter increases due to increased flow or solids loading, the filter's effluent valve is opened farther to maintain a constant flow. Backwashes are initiated when the head loss through the filter is greater than 7 feet, turbidity is greater than 0.15 NTU, or the filter has not been backwashed for 80 hours. The maximum backwash time criteria includes both time in operation and time offline.

Table 4-3
Filter Summary

Parameter	Unit	Filters 1 to 3	Filters 4 and 5	Filters 6 to 8
Length	ft	17	21	18
Width	ft	15	18	18
Area of Each Filter	ft^2	255	378	324
Total Area	ft^2	765	756	972
Filter Flow Percent of Total	%	31	30	39
Each Filter Flow Ratio	%	10	15	13

The plant typically operates with one filter offline. The offline filter is brought online when another filter needs to be backwashed. This control strategy has helped to eliminate surges in the filter levels and a corresponding fluctuation in plant flow rate. At flows greater than 15 mgd, or if water is backing up into the common inlet channel (which can occur during maintenance activities that leave facilities offline), operation of all filters becomes necessary. Filter effluent is collected in closed manifold piping and flows to the clearwell.

Finished Water Storage

The clearwell is operated at a fixed water level that maximizes chlorine contact time for regulatory compliance. As the level rises and falls, the effluent pumps increase or decrease their speeds to maintain the constant water level, currently set at 14.5 feet.

Hydraulic Model

A digital hydraulic model was developed to determine the hydraulic capacity of the various conveyance systems at the WTP. The following sections describe model development, input, and results. Visual Hydraulics, a commercially available hydraulic analysis software program, was used to develop and run flow scenarios to assess the plant's hydraulic performance and to identify areas of hydraulic concern. These areas of concern were then further analyzed using hand calculations and discussion with City staff.

Conveyance Systems

The Visual Hydraulics program analyzes water surface profiles of water conveyance systems. Specifically, a downstream control point is selected, and the hydraulic profile is then determined upstream of that control point. Review of historical WTP record drawings were used to initially develop the model. Table 4-4 summarizes the values used in the model for different criteria. See Appendix B for a Hydraulic Model Schematic.

Table 4-4
Hydraulic Parameters Summary

Condition	Equation	Parameter	Value
Pressure Pipe	Hazen-Williams	C-coefficient	110
Pressure Pipe	90-Degree Bend Minor Loss	K-value	0.25
Pressure Pipe	Entrance Minor Loss	K-value	0.5
Pressure Pipe	Exit Minor Loss	K-value	1.0
Open Channel	Manning's Equation	Manning's *n*	0.013

Revisions were made to the model using City input and iterative refinements. The following is a summary of changes incorporated in developing the final hydraulic model.

- Minor Losses – Typical design values for minor losses, e.g. pipe entrance and exit losses, were used where applicable.
- City Experience – Through conversations with City staff, input on the hydraulic performance of the WTP was collected and compared to the preliminary results of this study. For example, filters 4 and 5 are not able to handle as much flow as would be anticipated from splitting flows based on comparative surface areas within the WTP.
- Flow Split – The flow split to the sedimentation basins and the filters was modified to more evenly match head loss through a basin or filter train relative to the other basins or filters.

Failure Criteria

In estimating the maximum hydraulic flow through the WTP, the flow used in the hydraulic model was increased in 0.5-mgd increments until one or more of the failure criteria were met. The failure criteria are as follows:

- Loss of containment – The estimated water levels across the entire treatment plant were compared to the top of the holding structures to determine if the plant flow being modeled would be contained within the system.
- Weirs fully flooded – The flow being modeled was considered to be at failure once a weir had become fully submerged and no appreciable drop was predicted across the weir.
- Adverse impact water elevations – The final failure criteria involved determining if the predicted water level would have an adverse impact on the operation of mechanical equipment at the plant.

The acceptable flow for the various flow scenarios was assumed to be 0.5 mgd below the flow triggering failure.

Pump Station Conveyance

There are three pumping facilities at the WTP: raw water pumping, high service or finished water pumping, and backwash pumping. The initial capacity rating of each facility was based on equipment data, supplemental information provided by the City, and previous documentation. The capacity of each facility was determined for two conditions, total capacity and firm capacity. Total capacity is the production capacity with all pumps in operation. Firm capacity is the production capacity with the largest pump out of service. This section includes descriptions of each pumping facility and their associated total and firm capacity assessments.

Raw Water Pumping

The WTP uses four 75-HP vertical turbine pumps for raw water pumping. Each pump has a design capacity of 3,200 gpm at a design TDH of 65 feet. They are each Worthington model 15HH-340 pumps. Since the 2004 Facility Plan, VFDs have been added to pumps 1 and 4 to allow additional flexibility in producing desired flow rates and splitting operational hours between pumps. The pumps were installed in the early 1980s when the raw water intake was built. Based on the design point, the pump station has a total capacity of approximately 20.2 mgd and a firm capacity of approximately 15.15 mgd.

There is space for six pumps within the pump station and if similar pumps are installed, the total pumping capacity would theoretically be 30.2 mgd. Based on comparing testing of flow and pressure in the raw water discharge line and head loss calculations, the raw water pumps may have been oversized, i.e., the design TDH is more than actual TDH. The pumps are likely pumping at higher flows than the original design anticipated, and a design-level analysis is needed to more accurately determine the actual capacity increase.

High Service Pumping

There are six pumps that transfer finished water from the clearwell into the distribution system. The size, design capacity, and pump control scheme is summarized in Table 4-5. The pumps are controlled by the staff and the SCADA system based on the distribution system demand. They are also operated to maintain the water level in the clearwell necessary to meet chlorine contact time (CT) requirements. Based on design points, the total pumping capacity is approximately 29.7 mgd, with a firm capacity of approximately 23.9 mgd. Assuming the velocity in the 36-inch diameter finished water pipeline is limited to a velocity of 6 feet per second (fps), the capacity of the pipeline that the pumps discharge to is approximately 27.4 mgd. Using a velocity of 6.5 fps, the existing 36-inch diameter pipeline is capable of conveying approximately 30 mgd. With the existing surge tank and the addition of three VFDs, the potential for surge has been reduced for these pumping facilities.

Table 4-5
High Service Pumping Summary

Pump Number	Model	Size (HP)	Head (ft)	Flow (gpm)	Control
1	Worthington Model 15HH-340	250	210	3,500	Soft Start
2	Fairbanks Morse Model 18HC	300	210	4,000	On/Off
3	National pump Company/Worthington Model H14XHC	250	220	3,500	VFD
3A	National pump Company/Worthington Model H14XHC	250	220	3,500	VFD
4	Worthington Model 15HH-340	250	210	3,500	On/Off
5	Worthington Model 15HH-277	200	210	2,600	VFD

Backwash Pumping

The two backwash pumps, including one pump that has just recently been added, are vertical turbine pumps which pump water out of the clearwell. Both pumps are controlled by VFDs. Table 4-6 summarizes the backwash pump capacity. The station has a redundant pump if one pump is not operable due to maintenance or damage. Because both pumps are on VFD control, the backwash system is able to prevent excessive surges in the backwash system and limit the flow velocity in the discharge line.

Table 4-6
Backwash Pumping Summary

Pump Number	Model	Size (HP)	Head (ft)	Flow (gpm)
1	Peabody Floway 22-BLK	200	62	7,000
2	Goulds Water Technology VIT-FFFM	150	60	7,600

Hydraulic Capacity Analysis Results

The following sections summarize results of the analysis and improvements that could increase hydraulic capacity.

Model Results

The hydraulic model of the WTP was first used to simulate plant operations as described in this chapter. At a plant flow of 21.0 mgd, the sedimentation basin weirs became flooded. If these weirs become flooded, flow splits in the plant will become more difficult to control and the sediment and floc loading to the filters will increase, diminishing their performance. However, this condition is not considered a failure for the WTP overall because the plant can still operate hydraulically above this flow. At a flow over 23.0 mgd, the mixing basin before sedimentation basins 1 and 2 is flooded and loses containment. At 23.0 mgd, the WTP could no longer pass additional flow, and this is considered the maximum hydraulic capacity of the WTP. Table 4-7 shows a summary of the hydraulic profile of the plant at 23 mgd.

Table 4-7
Hydraulic Summary at 23 mgd Maximum Capacity

Hydraulic Element		**Water Surface Elevation**		**Limiting Criteria**
Downstream	**Upstream**	**Downstream**	**Upstream**	
Distribution System	Clearwell	1,085 to 1,108 (70 to 80 psi)	922.96	Pipe Velocity
Clearwell	Common Filter Channel	922.96	935.34	Pipe Velocity, Head Loss Through Filter, Loss of Containment
Common Filter Channel	Sedimentation Basins	935.34	Basin 1 935.39 Basin 2 935.42 Basin 3 935.49	Loss of Containment
Sedimentation Basin	Mixing Basin	No. 1 935.39 No. 2 935.42	936.00	Weir Submergence, Loss of Containment
Mixing Basin	River Intake	936.00	886.00	Pipe Velocity

After the initial results were obtained, operating parameters were changed in the model in an effort to determine if higher flows could be passed by the WTP. Optimization included splitting flow to the filters and basins in a manner that more evenly matched head loss through a train. Under this analysis, at a flow over 23.0 mgd, the sedimentation basin weirs are flooded. At flows over 24.5 mgd, the mixing basin is flooded. Operating the WTP in a manner similar to the optimized model would entail iterative adjustment of both manual and automated valves that control individual contact and filter basins and would result in differing contact times that would make regulatory compliance difficult to achieve. For this reason, the higher flows are not considered practical.

Maximum and Firm Hydraulic Capacities

Based on design capacity alone, the WTP capacity is currently limited by the raw water pump station capacity. The maximum overall hydraulic plant capacity is 20.2 mgd. The firm hydraulic capacity, with the largest river intake pump out of service, is approximately 15.1 mgd.

Increasing Hydraulic Capacity

Using the projected water demands, the current maximum plant capacity of 20.2 mgd will meet projected system MDD until the year 2028. Improvements could be made to the WTP to increase its hydraulic capacity to 25 mgd. The WTP would then be able to meet projected system MDD until year 2046. Increasing the hydraulic capacity of the WTP to 25 mgd would require substantial capital investments in the form of additional basin and conduit upgrades. If implemented collectively, the following improvements would increase the maximum plant hydraulic capacity to 25 mgd:

- Increase river intake pumping capacity by installing additional pumps or modifying existing pumps.
- Enlarge submerged opening in mixing basin baffle wall.
- Add additional launders to basins 1, 2, and 3.
- Filters 1 through 5 effluent pipe gallery modifications including weir plate invert set at consistent 926.62 feet.
- Perform operational tests of the raw water pump station and the high service pump station to determine the firm capacity of these facilities under actual operating conditions.

Process Capacity Evaluations

The capacity of each of the plant processes was evaluated for its ability to meet existing production needs and to estimate its maximum capacity. The evaluations are summarized in this section.

Chemical Feed Systems

The WTP's primary chemical storage, metering, and feed systems at the plant include:

- Liquid alum (50 percent) for coagulation
- ACH for coagulation
- Liquid sodium hypochlorite (12.5 percent) for disinfection, pre- and post-chlorination
- Dry polymer for filter aid
- Dry $KMnO_4$ for taste and odor control, used intermittently

The first four systems are typically used continuously whenever the plant is in operation. Potassium permanganate is used only during infrequent taste and odor events. The doses of each chemical depend on the plant production rate and raw water quality.

Alum

Alum is stored in a 6,000-gallon fiberglass tank inside the WTP's chemical storage room. Alum is added to the raw water to aid in coagulation prior to static mixing. Alum is dosed using positive displacement diaphragm pumps. The pumps are rated at 39.6 gph at 58 psi, and the other is rated at 15.9 gph at 145 psi. These pumps are also used to feed ACH (see below).

When alum was the only coagulant used, the maximum day alum usage from 2004 to 2007 was 2,445 ppd. With the use of ACH, the maximum day usage for alum was reduced to 1,123 ppd. The corresponding maximum day ACH usage rate is approximately 690 ppd. Both maximum coagulant usage days had similar water quality and flow parameters.

At the current maximum instantaneous plant flow of 20 mgd, an estimated maximum alum usage rate is 1,250 ppd at an alum dose of 7.5 mg/L. This equates to a maximum chemical pumping rate of 4.9 gph using 5.4 pounds of alum per gallon of solution, which is less than the current rated pumping capacity of the alum feed pumps. It is not expected that chemical feed pumps would need to be replaced due to increased demand requirements.

Chemical storage quantities depend on a plant's proximity to chemical distributors and ability to have chemicals delivered at any time of the year. It is typical to maintain 15 to 30 days of chemical storage based on maximum dosage and ADD. The current ADD is 5.5 mgd and the current alum dose is 25 mg/L. For these flow conditions, the necessary alum storage is approximately 3,250 gallons for 15 days or 6,500 gallons for 30 days. This is more than the 6,000-gallon tank storage at the WTP. There are several suppliers of alum nearby and the ACH dosage could be increased and alum dosage decreased, so this slight lack of alum storage volume does not appear to be of immediate concern.

Aluminum Chlorohydrate

Aluminum chlorohydrate is stored inside the WTP's chemical room in a 6,000-gallon fiberglass tank which was formerly used to store alum. ACH is added to the raw water at the static mixer with alum. ACH is dosed using positive displacement diaphragm pumps. Since beginning use of ACH on a daily basis, the average dose was 15.8 mg/L and the plant used an average of 54.4 gpd. Under average conditions, the plant has more than 100 days of storage of ACH using the 6,000-gallon tank.

Sodium Hypochlorite

Liquid sodium hypochlorite is delivered and stored at the plant in three fiberglass reinforced plastic tanks, each with a capacity of 2,300 gallons, for a total storage capacity of 6,900 gallons. These tanks are located inside the hypochlorite feed room adjacent to the chemical feed room. The storage tanks and metering pumps are located within a concrete containment area to contain a major leak. There are three positive displacement mechanical diaphragm metering pumps, each rated at 24.0 gph. Under normal operating conditions, one pump is dedicated for pre-disinfection, injecting into the static mixing vault. Another pump is for post-disinfection with injection into the clearwell. The last pump serves as backup. Space and a piping connection have been included for a future pump.

At the current maximum instantaneous plant flow of 20 mgd, the estimated hypochlorite usage is 500 ppd at a combined pre- and post-chlorination dose of 3.0 mg/L. The dosage used in this calculation conservatively estimates hypochlorite usage during peak season demands. This equates to a total chemical pumping rate of 20.9 gph total, or 10.5 gph per pump, well below the 24.0 gph rating of the current feed pumps. Using this same dose at 30 mgd, the existing pumping system should be capable of reliably meeting plant demands.

At the current ADD of 5.5 mgd and a maximum hypochlorite dose of 3.0 mg/L, hypochlorite storage required is approximately 2,000 gallons for 15 days and 4,000 gallons for 30 days. During periods of low demands, some utilities dilute the chemical to a concentration of 10 percent or less to reduce degradation of the chemical associated with longer holding times. Existing on-site storage capacity is sufficient for peak demand flows in excess of 30 mgd, providing more than 15 days of storage. No additional hypochlorite storage will be required in the foreseeable future.

Polymer

A low-molecular-weight polymer is added to the filter influent pipelines as a filter aid to improve filter performance. A dry feed system, including two 290-gallon mix/aging and feed tanks and one diaphragm positive displacement metering pump rated at 15.9 gph (at 145 psi), are used to make and feed the solution. Eight rotameters split the feed to each filter's influent pipe. Dry polymer is shipped in 55-pound bags and stored adjacent to the mixing tanks in the chemical room.

Using a filter aid dose of 0.05 mg/L and a plant flow of 20 mgd, the polymer used would be approximately 8.3 ppd. At 30 mgd, the plant would use approximately 12.5 ppd. The existing system is adequately sized and improvements or upgrades are not anticipated for increased demand. If improvements are made to the clarification process, the filter aid requirements and dosages would most likely decrease.

Potassium Permanganate

The plant infrequently adds potassium permanganate to the raw water pipeline and mixing basin for taste and odor control. The permanganate feed pump is a volumetric pump ($^1/_3$ HP, 1,800 rpm) type with a hopper that discharges to a flushing funnel and eductor which discharges the resulting solution to the application point. Prior to injection, the permanganate solution is further diluted; dilution water is controlled by a solenoid valve. Dry potassium permanganate is shipped in 110-pound steel drums and stored between the permanganate feeder and the polymer metering pumps.

Assuming a dose of 0.25 mg/L and a plant flow of 20 mgd, the permanganate used would be approximately 41.7 ppd. At 30 mgd, the plant would use approximately 62.5 ppd. The existing system is adequately sized and would not be expected to need improvements or upgrades for increased demand.

Coagulation Performance

Water from the Rogue River is generally considered a low turbidity, good quality supply, but some treatment challenges exist due to seasonal and diurnal variation in pH, seasonally variable turbidity, temperature, and occasional taste and odor events. These variable raw water quality conditions can significantly impact coagulation and sedimentation performance at the plant.

Elevated turbidity was historically treated using high doses of alum. High doses of alum corresponded with increased solids production and, in turn, put high stress on the old solids handling facilities. Increased alum also depressed pH to levels where pH adjustment chemical was required to bring the pH back to targeted levels for corrosion control. This resulted in higher overall chemical and operations and maintenance costs with a reduction in plant efficiency.

After the 2004 WTPFP, the plant began experimenting with different alternative coagulation chemicals and now uses two coagulants at the plant. PASS-C, a PACl derivative, was originally used until the plant transitioned to an ACH derivative. Alum usage and overall coagulant usage has decreased significantly under current operations and there is no longer a need for a pH adjustment chemical at the plant. The original lime feed system has already been decommissioned and removed from the plant.

Sedimentation Basins

The sedimentation basins currently provide contact time for disinfection and some solids removal prior to filtration; no formal flocculation is provided in the basins other than mild hydraulic turbulence. Basins 1 and 2 have a combined rated capacity of 12 mgd; basin 3 is rated at 8 mgd , so the total rated process capacity is 20 mgd. The basins provide satisfactory water for filtration most of the year. However, all basins experience challenges with regard to short-circuiting, high solids loading to the filters, sub-optimal flocculation and seasonal turbidity spikes. Basin 3 is particularly vulnerable to short-circuiting. In addition, there is no continuous solids removal system; as solids accumulate in the basins, effective volume is reduced, compromising CT compliance and reducing settling efficiencies.

Selected design criteria for the existing basins were summarized and compared to criteria that are considered optimal for pretreatment in the 2004 WTPFP. Based on the comparison, several improvements to the basins which could be made to ensure the current plant capacity can be fully realized are:

- Incorporation of formal flocculation by either mechanical or hydraulic means for improved settled water quality
- Installation of a continuous residual solids removal system to minimize short-circuiting associated with solids accumulation and to equalize residual solids loading to the solids handling system
- Installation of internal baffling in basin 3, in addition to flocculation, to minimize short-circuiting resulting from the geometry of the basin

The City completed pre-design of automated residual solids removal for basins 1 and 2 in February 2010, which also reviewed flocculation alternatives, but the project was deferred due to high costs which included significant structural improvements.

The suggested improvements are intended to optimize the treatment process, but will not necessarily increase the process capacity of the basins. Alternatives to address these process limitations are discussed in detail in Chapter 7.

Filtration

Chapter 2 presents a detailed evaluation of historical filter performance and a discussion of possible capacity limitations. The filter improvements made in 2006 have significantly improved filter performance. However, there are some deficiencies identified as part of the historical performance analysis and filter investigations which include the following:

- Filter production efficiencies currently range from 90 to 94 percent; 97 percent is considered the minimum desirable filter production efficiency.
- Plant records show that filters 6, 7 and 8 are backwashed approximately 25 percent more frequently than the other five filters. This can be attributed to short-circuiting of water through basin 3 (more turbid settled water than from basins 1 and 2) and therefore higher solids loading rates to the filters which increases the head loss accumulation rate. Flow-splitting or other improvements made to clarification may help balance filter run times to increase overall plant efficiency.
- The existing surface wash system is not optimal and regular cleaning by hand is required. The addition of an air scour system and filter trough modifications could help improve cleaning and reduce overall operations and maintenance.

Certain deficiencies in the sedimentation basins and filter media design make it difficult to operate the plant at 20 mgd for extended periods without frequent filter backwashes. This is consistent with plant operations staff experience. The existing filters are not adequate for flows higher than 20 mgd, so modifications to the filters or additional filters would be required to increase capacity. A discussion of alternatives to address these issues is presented in Chapter 7.

Clearwell

The existing 433,000-gallon clearwell is relatively small for a 20-mgd plant; CT compliance at the plant is only possible by carefully monitoring and controlling the chlorine residual through the basins, and also by not exceeding certain operating flow rates during winter and spring due to water quality constraints. The use of VFDs on selected high service pumps helps maintain a relatively high water level in the clearwell. However, multiple "back-to-back" backwashes can create challenges to CT compliance because this tends to lower the clearwell level. Running the plant at lower production rates for longer periods of time during challenging water quality conditions, mainly cold water events, can help ensure continued CT compliance in the near-term.

Clearwell volume will need to be expanded in the future when plant demands exceed 20 mgd if free chlorine continues to be used for primary disinfection. Alternatives to integrate additional clearwell volume with the existing clearwell and high service pump station are discussed in Chapter 7.

Disinfection and Disinfection Byproduct Formation

The plant is currently capable of meeting CT requirements within the existing basins and clearwell by using pre-chlorination residual and maximizing the operating level in the clearwell. However, the dependence of disinfection compliance on the contact time achieved through the basins significantly limits operational flexibility at the plant; free chlorine residual must be carefully monitored and maintained through the basins to meet CT requirements. In addition, efforts to increase the pre- and post-chlorination residual must be balanced with disinfection byproduct (DBP) control. Process challenges in meeting CT are related primarily to increased demands during the spring and fall when demands are still fairly high and water temperatures are lower. Chapter 3 discusses this issue and how the plant could make operational adjustments to run the plant for longer periods during these times to still meet CT.

Disinfection and DBP regulations may drive disinfection improvements at the plant in the coming years if ongoing monitoring indicates elevated concentrations of these compounds within the distribution system. Alternate process modifications may be necessary to avoid the reliance on free chlorine for disinfection. Such processes may include ozone or UV irradiation. Discussions of improvement alternatives for each case are presented in Chapter 7.

Washwater and Solids Handling Systems

The 2004 WTPFP concluded that the old mill pond was full of residual solids and needed to be cleaned. The old mill pond was deemed to be inadequate for residual solids drying and an alternative method for solids handling was needed. The City determined that mechanical dewatering systems were cost-prohibitive and that solar drying lagoons were space-prohibitive. The plant transitioned to an approach that utilizes geofabric bags for dewatering solids.

Residual solids conditioned with dewatering polymer are loaded into the geofabric bags and allowed to drain and dry. Once the dewatered residual solids are considered dry enough, the bags are cut open and the dried solids are hauled off-site for disposal. There is space reserved on the plant site for dewatering the residual solids from the sedimentation basins. The old mill pond is dredged using a remotely operated dredging system to bring residual solids to shore to be placed into the geofabric bags for dewatering on-shore. This current practice is effective and requires little maintenance, but it is labor-intensive and requires a lot of space. As plant production increases and space is needed for expansion or plant upgrades, an alternate solids handling approach will be necessary. A detailed discussion of alternative solids handling and disposal methods is presented in Chapter 6.

Summary

A summary of findings from the hydraulic capacity and treatment process evaluations is presented below. Alternatives to address deficiencies at the existing WTP are presented in Chapter 7.

- The existing raw water pumps and finished water pumps are capable of pumping at least 20 mgd into and out of the plant.
- The firm hydraulic capacity of the plant is approximately 15 mgd. Installation of an additional 5 mgd of raw water pumping capacity would provide added operational flexibility and redundancy when plant demands reach 15 mgd, which is anticipated to occur within the next 5 to 10 years.
- The current maximum hydraulic capacity of the plant is 21 mgd. Significant modifications and improvements would be required to provide more hydraulic capacity in the existing plant.
- The chemical systems appear to be adequate to meet demands for the next 10 years except for periodic maintenance and replacement. This equipment may need to be supplemented to provide additional capacity or replaced if the plant capacity is expanded beyond 20 mgd.
- The existing sedimentation basins have a maximum process capacity of 20 mgd. Additional clarification capacity is required if the plant is to be expanded. Also, basin 3 is not as efficient as basins 1 and 2 due to the square geometry and radial flow pattern. This deficiency inhibits filter and plant performance at higher flows.
- The existing filters have a maximum process capacity of 20 mgd. Additional filters are required if the plant capacity is to be expanded.
- Continuous residual solids removal systems in the sedimentation basins would equalize solids loading to the solids handling system, maximize the chlorine contact time and settling time by minimizing solids accumulation, and eliminate the need for taking basins out of service for cleaning. Basins cannot currently be taken out of service for solids removal during the summer months and this can become a constraint in the future as water demands and solids production increase.
- The plant is currently capable of meeting CT requirements as long as flow is restricted to 10 mgd during winter and spring. The clearwell will need to be expanded as plant demands increase or another method of disinfection will be required.
- The strategy of dredging the old mill pond on a semi-regular basis and periodically removing solids from the sedimentation basins is effective, but is labor- and time-intensive. As plant demands and solids production increase, the plant site may no longer be able to process all of the solids. An alternative long-

term strategy for solids handling and disposal will be necessary if the existing plant will continue to be used for the next 10 to 20 years, or longer.

CHAPTER 5

CHAPTER 5
EVALUATION OF EXISTING WATER TREATMENT PLANT FACILITIES

Introduction

In this chapter, each of the existing plant's systems and structures is reviewed to determine if improvements are required, and to estimate remaining useful life. The results of this review are integrated with the regulatory and capacity reviews to develop capital improvement recommendations to maintain existing capacity and to increase capacity, if needed. This chapter also presents a review of key structural and seismic risks and recent structural testing results that provide additional information related to this critical aspect of the existing plant. As mentioned in Chapter 1, one of the key drivers for completing this WTPFP update is concern about continuing to invest in the existing plant given its age and structural vulnerability.

Structural and Seismic Risks

Over the past few years, the WTP staff has observed cracks and other observable damage to the concrete when making minor repairs in basin 1. This damage has presented in the form of concrete loss, staining from reinforcing steel or reinforcing steel wire spacers, oxidation, and rusting. Some visual deficiencies were noted consisting of some minor hairline cracking and softness at the top of the walls where the concrete is most exposed to the weather, and where a freeze-thaw environment exists.

Structural Review

A seismic and structural review of the Grants Pass WTP was completed in 2011. A review of geotechnical studies previously conducted at the plant site show that ground-shaking and slope stability along the Rogue River bluff are the two most significant seismic geotechnical risks. A review of the construction documents of the plant shows that, overall, the structures appear to have been designed and constructed prior to consideration of seismic loads. Due to the lack of seismic design, or inadequate design for seismic loads, the facility is judged to have a high seismic risk with portions susceptible to collapse in a strong earthquake. In general, major structural elements and connections of the lateral-load carrying systems were not designed to conform to current code requirements. They were also not designed for expected wind load performance for this type of structure. A planning-level project cost to address the various structural deficiencies observed during the review was estimated to be approximately $8.5 million. This review is documented and on file with the City's records. A technical memorandum summarizing the structural review of the clearwell is included with this report as Appendix C.

A seismic event could cause complete loss of water supply for the City. A severe wind event could cause a prolonged outage. With no apparent second source of supply available to the City, these risks are unacceptable. As such, all capital improvement alternatives developed to upgrade the existing WTP include the recommended structural upgrades as a baseline requirement.

Carbonation Testing

After initial discussions with City staff, different types of concrete and structural testing methods were reviewed to further define areas in the plant which may be subject to concrete or rebar failure within the current planning horizon. The goal of this physical assessment was to provide further information regarding the remaining useful life of the existing facilities and to better inform the decision making process.

To further investigate the condition of critical structures where cracking and leaking has been observed, the City conducted carbonation tests. Carbonation testing measures pH to determine the degree of degradation of the concrete. These tests were conducted in parallel with semi-annual basin cleaning in late October 2012.

The assessed condition of the basins is based on observations, soundings, and carbonation testing. The exterior concrete of the basins is in good condition. The interior concrete of the drained and accessible basins 1, 2, and 3 is in good condition. There are, however, some areas of concern.

In basin 1, the walls were immediately noted as having internal areas with some through-thickness cracking and some surficial concrete spalling of a depth less than ½ inch and varying lengths and widths in both directions. It appears that the strength of the concrete around the spalled areas has been deteriorating. Some minor cracks on the perimeter walls were observed that had efflorescence present for a long period of time and had no water seepage. The efflorescence indicates autogenous healing of the concrete had already taken place on these minor cracks. No serious rusting of rebar on the external surfaces of the walls was observed. Previous inspections of the West and East clearwells found that the interior walls and ceiling of the original clearwells have multiple locations where rust is bleeding through to the inside face of the wall from multiple reinforcing steel locations, most notably below the original control room. This is an indication of rebar corrosion.

As observed by the WTP staff, the concrete and reinforcing steel in most elements of basins 1, 2, and 3 are in relatively good condition with only limited carbonation depths and rusting. The concrete pH is in the suitable range for protection of the reinforcing steel and hence the composite reinforced concrete system meets the criteria of being able to protect the reinforcing steel.

Test Results

Based on the results of the initial round of carbonation testing in basins 1, 2, and 3, it does not appear to be necessary to conduct additional concrete testing. From a non-seismic perspective, the current assessment of basins 1, 2, and 3 from the areas inspected and tested is that the concrete and reinforcing steel are in generally good condition with some wear after up to 80 years of service. However, there is evidence of corrosion damage to concrete in the original clearwells.

Based on these tests and previous inspections and analyses of the existing plant structures, it is believed that the remaining useful life can be in excess of 40 years should the seismic and structural upgrades be completed.

Plant Inventory and Condition Assessments

The following is a discussion of each major system at the WTP, including pertinent information and observations used to determine remaining useful life and suggested capital improvements associated with the equipment. Table D-1 in Appendix D provides a detailed summary of plant equipment.

Raw Water Intake and Pump Station

The intake and pump station were constructed in the early 1980s as part of the last major plant expansion. The intake screening system was upgraded in 2008 and is equipped with four wedge wire screen panels that provide screening with a capacity of approximately 30 mgd. The intake screen also includes an articulating arm wash system. Accumulation of silt and sediment on the screens and in the wet well has become a problem since the Gold Ray Dam was removed in 2010. Divers have been employed to help remove sediment from the space between the screens and the base of the concrete structure. The City evaluated the possibility of implementing a low-cost fixed spray nozzle system to reduce sediment build-up at the base of the screen face in 2013. These improvements were deferred pending the completion of this Plan. If the existing WTP intake is going to continue to be used, improvements to address sediment accumulation will likely be required.

The four existing raw water pumps were installed in 1983 when the new intake facility was constructed. There is space available to add two more pumps. Since installation, the pumps are rebuilt and the pump impellers replaced on an approximate 6-year cycle. The pumps were originally water-lubricated, but were converted to oil lubrication after recurring problems were observed with the water-lubricating system. The pumps occasionally have had issues with taking oil after being rebuilt, but have generally worked well. With continued maintenance and repair, the pumps should have significant remaining useful life. As described in previous sections, the firm raw water pumping capacity is approximately 15 mgd. Installation of an additional pump is required when demands approach 15 mgd to reliably deliver a peak flow of 20 mgd.

The raw water pumps have performed well and are in no need of immediate attention. Recent VFDs installed by the City on two of the raw water pumps have provided better flow control of the plant and added operational flexibility. See the Photo Log, Appendix D – River Intake for additional details and photos.

Chemical Storage Areas

The plant has five chemical storage and feed systems, including:

- Liquid alum
- Liquid ACH
- Liquid sodium hypochlorite
- Dry polymer
- Dry potassium permanganate

A brief description of the plant's chemical storage areas is presented below.

Sodium Hypochlorite Room

Liquid sodium hypochlorite is stored in three cylindrical fiberglass reinforced plastic tanks with volumes of 2,300 gallons each. The tanks are housed in a room adjacent to the main chemical storage area. There is a containment system provided and it is ventilated by a three-fan system. The sodium hypochlorite solution has a 12.5 percent solution strength and is fairly corrosive. Plant staff has observed that joints in piping must be continuously monitored for leaks and have been replaced fairly frequently. Due to the size of the tanks and room configuration, only one tank, the tank adjacent to exterior building wall, can be removed for maintenance. If there is a problem with either of the other two tanks, they would need to be repaired in-place or would require the adjacent tanks to be moved out of the building in order to perform work on them. In the case that the tank most inward in the building experiences failure, the tank would have to be demolished in place and removed in pieces. In addition, the paint in the room has started to peel and may require maintenance to prevent corrosion to the interior of the building.

There are three positive displacement diaphragm sodium hypochlorite feed pumps also located in the sodium hypochlorite room. A limitation of these pumps is that there is no alarm system to alert plant staff of a pump failure. The only way the plant staff can ascertain chlorine feed pump failure has occurred is by observing a steady decrease of the chlorine residual in the clearwell. See the Photo Log, Appendix D – Sodium Hypochlorite Room for additional details and photos of the equipment.

Chemical Storage Room

The chemical storage room houses the rest of the chemicals used at the plant and their associated feed systems. Plant space is at such a premium that the main maintenance area for the plant is co-located in the chemical room along with the WTP's pilot filters and the portable pilot filter used for public outreach and plant operation demonstrations. Removal of the lime equipment has provided some limited additional space for storage.

In general, all chemical feed systems have been maintained very well, are in good condition, and should reliably meet the City's needs for many years. However, chemical feed equipment has a finite useful life and will likely need to be replaced at least a few times during the planning horizon considered for this report. The replacement schedule will depend on when the equipment was installed and will vary. The City should also consider chemical feed system replacements if the plant capacity at the existing site is expanded. This is recommended because as feed pumps age, it can become more difficult to find replacement parts and perform maintenance, especially if models are discontinued or a manufacturer goes out of business or is purchased by another company that no longer offers service.

Following a recommendation in the 2004 WTPFP, a containment wall around both coagulant tanks has been constructed that can adequately handle the 12,000-gallon volume from the coagulant tanks. The other chemical that is used frequently that could warrant a containment system is the area around the filter aid polymer tanks. The polymer tanks have a combined volume of 580 gallons.

Visual structural deficiencies were noted in the concrete masonry unit (CMU) blocks on the east wall. Due to a gap between the basin wall and the CMU wall, water has started to seep through and cause the CMU blocks to deteriorate. The west wall is comprised of cast-in-place concrete on the bottom portion with CMU blocks starting where basin 3 is located. Water has started leaking through the CMU blocks on the west wall. Deterioration of the plaster architectural material and corroded process piping was observed by the south entrance floor. See the Photo Log, Appendix D – Chemical Storage and Maintenance Room for additional details and photos.

Sedimentation Basins

Basin 1 was built as part of the original plant construction in 1931 and is over 80 years old. Basins 2 and 3 were added to increase plant capacity in 1950 and 1983, respectively. The concrete in basin 3 appears to be structurally sound with few observed cracks in the exterior walls. Basins 1 and 2 have started to show degradation and cracks in their walls. The launders in all basins show little sign of deterioration and are in fair condition. The Structural and Seismic Report details the structural deficiencies and improvements that would need to be made to the older basins as part of the baseline improvements.

Filters

Filters 1, 2, and 3, were built as part of the original plant construction in 1931 and are over 80 years old. Filters 4 and 5 were added in 1950. Filters 6, 7, and 8 were added as part of the most recent plant expansion project in 1983. Structurally, the filters appear to have many years of remaining useful life.

As discussed in Chapter 2 and Chapter 4, many improvements to the existing filter media and underdrains were performed in 2005 that increased plant production efficiency and ensured continued compliance with water quality regulations. At the time the improvements were made, the consensus industry opinion was that the shallow media filters would not need air scour. However, accumulation of solids on the filter walls that need to be periodically manually cleaned has suggested a need for air scour to further improve filter performance efficiencies. In addition, the task of manually cleaning the filter walls is dangerous for workers and presents an elevated risk of injury. Also affecting filter performance is the location of the filter effluent flow meters which does not allow the measurement of filter-to-waste flows. This condition prevents monitoring of the filter flow during initial startup and hinders the transition from filter-to-waste to filter production.

Filter Galleries

The filter galleries and equipment have been maintained very well and most of the observed deficiencies can be attributed to general wear in line with the WTP's age. Routine maintenance has been performed to address leaks, valve problems, and other equipment maintenance needs and repair cycles. Despite this, the gallery for filters 1, 2, and 3, and the gallery for filters 4 and 5 include piping that lacks proper seismic and structural support. Some piping is in need repair or replacement of insulation or repair of exterior corrosion protection coating, or both. In addition, conduits were placed behind an architectural wall cladding, making modifications difficult. This wall cladding is deteriorating in many areas. See the Photo Log, Appendix D – Filter Galleries for additional details and photos.

Clearwell

The 433,000-gallon clearwell, which serves as a wetwell for the high service and backwash pumps, and a contact basin for disinfection, appears to have significant structural deficiencies. The clearwell is actually comprised of three interconnected areas which were built at different times. These three areas are referred to as the East, Center, and West clearwells and are located under each group of filters and the lobby of the plant. A common filtered water channel currently routes all filtered water to the east clearwell where it is chlorinated. It then flows through a series of serpentine baffles through the center and west areas and finally to the finished water pump area in the west clearwell.

Additional clearwell volume should be added if the plant's capacity is increased, preferably to provide a minimum of 1 hour of detention time at peak flow, but with enough volume to provide for successive filter backwashes at approximately 35,000 to 55,000 gallons each without compromising disinfection performance.

High Service Pump Station

The high service pump station includes high service pumps, backwash pumps, and an air compressor system. Each of these are reviewed in this section.

High Service Pumps

The high service pump station includes two large pumps, two medium pumps, and one small pump, installed in 1961, 1983, and 1983, respectively. The sizes of these pumps are presented in Chapter 4. The high service pump station is currently rated for a firm capacity of 16.7 mgd with a maximum pumping capacity of 21 mgd with all five pumps operating. All of the pumps and motors have been rebuilt within the last 15 years and the City has budgeted for at least one pump and motor rebuild over the next five years. With continued maintenance and repair, the pumps appear to be capable of continued service throughout the planning horizon considered for this report. With future pump upgrades, the existing pump station would be able to supply up to 30 mgd to the distribution system.

Backwash Pumps

The original backwash pump was installed in 1983 as part of the plant expansion project. A back-up backwash line connected to the high service discharge header was also installed, but has never been used due to a lack of pressure and flow control. The backwash pump has required little maintenance according to plant staff, and appears to be functioning appropriately. The pump and system should have significant remaining useful life.

An additional backwash pump was installed in 2012, and the connection to the high service discharge header was removed. This modification allows the 1983 pump to be removed and serviced. During the process, however, it was discovered that the check valve on the pump discharge line is failing and will need to be replaced.

Air Compressor System

The plant is equipped with two air compressor and receiver systems located in the high service pump room. Both systems provide plant air to operate the pneumatic valve actuators for the filters, as well as providing air to keep the surge tank pressurized. Both systems have required little maintenance and appear to be functioning properly. Plant staff is considering relocating the air compressor systems to a different area of the plant to aid in general operations. It is expected that these systems have many years of useful life remaining, although they may not be required in the future if the pneumatic valve actuators are replaced with electric actuators. See the Photo Log, Appendix D – High Service Pump Room for additional details and photos.

Flow Meters and Flash Mix Vault

Both the raw water and finished water pipelines are equipped with Venturi type flow meters. The backwash flow is measured using an electromagnetic type flow meter. The pressure-sensing tubing associated with a Venturi type meter is prone to collecting air bubbles, significantly decreasing the accuracy of the meter. Replacement of the raw and finished water flow meters with electromagnetic type meters is recommended when the budget will allow.

The flash mix vault currently uses static mixing to disperse chemicals. Drawings and specifications of this system appear to be missing from plant records. Since the plant is able to operate at such a wide range of flows, static mixing most likely does not provide the most efficient chemical dosing and mixing. Replacement with a pressure diffusion system, addition of another static mixer, or another approach could positively impact chemical usage. The capital improvement alternatives developed in later chapters discuss mixing options.

Major Valves and Actuators

Most pneumatic actuators at the plant were installed prior to 1980, except those installed in filters 6, 7, and 8 during the most recent plant expansion. All pneumatically operated filter valve actuators are old and in need of repair. Replacement parts for these actuators are becoming increasingly difficult to obtain. Replacement of these actuators with modern electric valve actuators for ease of control and maintenance is recommended. All of the existing air piping in the filter galleries would be removed as part of the actuator replacement project. This would create space in the galleries and allow for better access to the existing equipment.

Several valves, including the filter influent valves and the backwash valves, currently leak and are in need of replacement or repair. Installing new valves with the actuator replacements is recommended since the valves are relatively inexpensive compared to the electric actuators. The City will also benefit from warranties if new valves are provided with new actuators. These improvements should be made in conjunction with other filter gallery piping and flow meter improvements and general maintenance such as removing plaster, relocating electrical conduits mounted on the walls, and painting walls and floors.

Washwater and Solids Handling

The equalization basin contains three transfer pumps which deliver washwater and solids to the old mill pond. The two smaller pumps were installed as part of the 1983 expansion and the larger pump was installed after as part of another project. Largely due to the rough conditions of service that these pumps experience, they are all at the end of their remaining useful lives. When replacing these pumps, the City should consider installing at least one pump with a higher capacity to increase the overall pumping capacity and reliability. However, doing this would increase space demands, as pump configurations provided by manufacturers have changed since the installation of the existing pumps. This may require some challenging new configurations of piping and pump layouts.

Depending on the long-term strategy for solids handling at the plant, improvements to the old mill pond and the washwater equalization basin may be required. Improvement alternatives for solids and washwater handling are presented in Chapter 6. See the Photo Log, Appendix D – Solids Handling for additional details and photos.

Water Quality Testing and Monitoring Facilities

The plant uses on-line water quality instrumentation and bench-top equipment to monitor and control plant performance. Raw water turbidity is continuously monitored using a HACH Surface Scatter on-line analyzer. Settled water turbidity from each basin is also continuously monitored using individual HACH 1720E turbidimeters to assist in process optimization. Each filter is equipped with a HACH 1720E on-line turbidimeter to monitor filter performance and ensure regulatory compliance. A similar on-line turbidimeter is installed on the high service pump station discharge header pipe to continuously monitor the combined filtered water quality exiting the plant. All turbidimeter signals are integrated into the SCADA system. Installation of individual particle counters on the filter effluent is recommended to better predict turbidity breakthrough in the future and ensure continued regulatory compliance.

The plant is equipped with an on-line finished water pH analyzer (HACH pHd) to continuously monitor the plant effluent pH to monitor for corrosion control compliance. Raw water and settled water pH are measured periodically each day via grab samples analyzed in the plant's laboratory.

One HACH CL-17 on-line chlorine residual analyzer is used to monitor the plant effluent residual from the high service pump station discharge header. Pre-basin and settled water chlorine residuals are measured periodically each day via grab samples. The plant's laboratory appears to be equipped with adequate bench-top analytical equipment to perform routine daily testing for monitoring and control, but lacks storage space and would benefit from having additional bench-top space to make working in the lab more efficient. See the Photo Log, Appendix D – Laboratory for additional details and photos.

Plant Drain Sump Pump

The plant has a common sump which collects discharge from the drains of the basins during cleaning operations. The discharge is collected in the sump and pumped to the washwater equalization basin. Currently, cleaning operations are hindered by the sump pump because it is undersized. Plant staff is considering a near-term improvement to replace this sump pump with a larger pump. If a new clarification process is constructed, basin cleaning will be done differently and the size of the sump pump will not be as critical.

Instrumentation and Control Systems

The plant has a Windows-based SCADA and control system that is operated via a central computer station. The existing control systems were installed as part of the SCADA improvements in 2002, and should have some remaining useful life. Recent upgrades at the WTP include new processors, software updates, and upgrading from wires and cables to fiber optic communications. When new systems and equipment are added to the plant, the existing SCADA system will need to be modified and integrated accordingly.

As technology continues to evolve, the SCADA system at the plant will likely require additional software and firmware upgrades. During the planning horizon considered for this report, it is anticipated that replacement software and hardware will be needed to stay current with developing technology. These improvements and upgrades should be made via operating budget investments at the appropriate time and are not included as part of any near-term capital investments included in this Plan.

Electrical Systems

The plant's electrical power is provided via a 1,500 kVA main transformer located on the plant site. The electrical service and transformer were upgraded during the 1983 plant expansion project. The existing plant electrical service and transformer appear adequate to provide service over the next 20 years as demands increase to 20 mgd. Improvements to the electrical system capacity and service need be addressed as part of future expansion projects or if major new electrical loads are added prior to the expansion.

The plant has not experienced any prolonged or severe power outages over the past 20 years. During normal power outages, service has been restored within 1 to 2 hours, with a few cases where power has been out for 16 to 24 hours. This historical level of power service is expected to continue, but there is no guarantee that the City will not face an extended power outage in the future.

Some water treatment facilities are equipped with emergency power sources, such as generators, which can allow a minimum level of water production in the case of an extended power outage by the service provider. Some water providers also have dual electrical feeds from different parts of the power grid to reduce the risk of an extended outage. The City is currently in the process of procuring a back-up power generation project that will provide 5 mgd of water production capability at the plant in a power outage.

In 2010, all interior lighting was upgraded with new ballasts and high-energy-efficiency bulbs. However, this project did not accommodate the outdoor lighting. The current outdoor lighting is not adequate for a plant that operates close to 24 hours per day on a semi-regular basis. The staff often needs to use portable lighting outside to perform tasks. This is inefficient and can pose safety hazards. A project to upgrade outdoor lighting should be included in this plan as a new capital improvement.

Plant staff has responded to increasing security needs by keeping the main gate to the plant normally closed during all hours. Since there is no intercom or other communication system between the gate and the plant, this can cause difficulties for visitors, deliveries, and vendors. Some type of communication system is recommended for the main gate to improve security and operator efficiency.

Control Attic

The existing HVAC system does not provide efficient climate control. Temperatures are often too hot in the summer and too cold in the winter. The existing HVAC control panel has become dated to the point that it is difficult to find technicians to perform work on the equipment and find parts. The system must be operated manually and does not take advantage of the energy savings that could result from a more modern, programmable system. Improvements to update heating and cooling systems in the control and break rooms located within the control attic are recommended.

There is currently limited space available for storage and maintenance or repair within the control attic and throughout the plant. As the plant grows or equipment is replaced, space requirements will increase. Improvements to increase the available storage and working space at the WTP are recommended. See the Photo Log, Appendix D – HVAC for additional details and photos.

Plumbing

Drains at the plant should be inspected to confirm their service and discharge connections to the sewer, the old mill pond, or wastewater equalization basin, and to determine if they are damaged or in need of repair. Most observed plant drains appear to be undersized for their service areas. A recent leak in the high service pump station room caused water to pool into the electrical room and could have potentially caused an electrical failure at the plant.

Other Code Compliance Issues

A cursory review of the WTP was completed to assess conformance to current regulatory codes and standards including seismic and structural integrity, building code conformance, OSHA, and ADA compliance. This information will help identify further needs and planning-level costs associated with future improvements.

A review of the construction documents for the WTP confirmed that the major WTP structures were designed and constructed prior to the consideration of current seismic loads, leaving them susceptible to significant damage or potential collapse in the event of a strong ground motion earthquake. There have been several earthquakes in the Pacific Northwest over the past 20 years that could have severely damaged the WTP had they occurred in proximity to Grants Pass. Anticipated improvements as part of this project include installation of pipeline restraints and reinforcement of concrete structures, especially the older basins and filters.

The walkways around the filters and basins are protected by guardrails. The spacing between horizontal railings may be too large to meet current OSHA requirements. No improvements are recommended at this time.

The plant access and pathways do not meet current ADA requirements. The City should work with local building officials to establish the degree of ADA compliance necessary at the WTP during preliminary design of improvements. Project costs to make the existing plant fully compliant with ADA standards are not included in costs developed with this planning document.

Summary

Table D-2 in Appendix D presents a detailed discussion of major deficiencies identified at the existing WTP. The following list provides a summary.

- Results of structural testing have shown that concrete and rebar in basins 1, 2, and 3 are generally in good condition. The concrete in the East and West clearwells is showing some degradation. Based on these tests and previous inspections and analyses of the existing plant structures, it is believed that the remaining useful life can be in excess of 40 years if seismic and structural upgrades are implemented.
- All chemical feed systems are in relatively good condition and can reliably meet the City's needs for many years. However, this equipment has a finite useful life, and will need to be replaced once within the planning horizon considered for this report. The replacement schedule will depend on when the equipment was installed and is hard to predict, so is shown as a longer-term CIP item within the CIP. The City may also need to replace or upsize chemical feed systems if the plant capacity is expanded.
- In order to improve operator safety and communications, improvements to outdoor lighting and additional perimeter cameras for the main gate are recommended.
- The location of the filter effluent flow meters prevents the measurement of filter-to-waste flows which results in potential operations and water quality problems. The existing flow meters lack adequate lengths of upstream and downstream straight pipe, significantly reducing the accuracy of the meters. Therefore, replacement of the filter effluent flow meters is recommended along with piping changes to integrate filter-to-waste flow measurement.
- As technology evolves, the SCADA system at the plant will likely require additional upgrades. During the planning horizon considered for this report, replacement hardware and software will be needed to stay current with developing technology.
- The City could consider improvements to the HVAC system to provide efficient climate control; temperatures are often too hot in the summer and too cold in the winter. Currently, the server room is not climate-controlled. To protect sensitive computer equipment, addition of ventilation is recommended.
- There is currently limited space available for storage and maintenance on the WTP property. The plant currently rents a storage unit off-site from the facility to supplement its on-site storage. As plant demands increase, storage requirements

for dry chemicals will increase, exacerbating the storage limitations. Improvements to increase the available storage space at the plant site are recommended.

CHAPTER 6

CHAPTER 6
FACILITIES PLANNING CRITERIA

Introduction

This chapter establishes planning criteria and introduces capital improvement alternatives to address the deficiencies summarized in the preceding chapters. The objective of all of the capital improvement alternatives is to enable reliable long-term water supply from the City's Rogue River source, meeting both demand and water quality requirements.

Planning Criteria

Planning criteria for developing capital improvement alternatives include the planning period, water demand projections, a pre-screening of treatment process alternatives, and considerations for redundancy and water supply reliability. Each of these criteria is discussed in the following sections.

Planning Period

Selection of an appropriate planning period for facility upgrades is critical to establishing hydraulic and process capacity requirements. In order to complete an equitable comparison of all possible capital improvement alternatives, the planning period must be the same for each alternative. Factors that affect selection of the planning period include:

- Life expectancy of new or existing civil, mechanical, and electrical equipment needed with the upgrade.
- Life expectancy of any new or existing structure being designed or integrated as part of the upgrade.
- Capacity limitations due to water rights, required space, or other restrictions that are likely to remain fixed for the planning period duration.
- Capacity limitations of existing infrastructure planned to remain.
- Other design considerations, such as desired level of treatment redundancy and nominal capacities of individual treatment trains.

It is anticipated that construction of a new WTP would begin in five to seven years, allowing time for potential property acquisition, design, environmental and regulatory permitting, public acceptance, financing, bidding, construction, and commissioning. Construction of improvements at the existing plant might begin sooner.

For facility replacement cost planning, a life expectancy of 20 to 30 years is often used for equipment with electrical, hydraulic, or mechanical support systems. Facilities such as pipe, concrete basins, and buildings are expected to last longer, with a minimum life expectancy of 75 years. If construction begins in 2020, these facilities would be expected to last until 2095. Therefore, the planning period for all alternatives is through 2095.

Water Demand Projections

To properly size the upgrades for all processes and transmission facilities, water demand projections must be established. The design flow for WTP capacity is normally MDD for water utilities that have adequate distribution system storage. Using MDD as the capacity criteria for upgrades within this Facility Plan Update is consistent with methodologies used in previous Grants Pass planning documents and adheres to State of Oregon and AWWA guidelines.

Table 6-1 summarizes future water demand projections developed as part of the April 2013 MSA technical memorandum titled Long-Term Water Demand Projections which is included as Appendix E. Development of these water demand projections considered existing service area, future service areas, and trending of historical population and water demand information. As recommended in the technical memorandum, these demands should be re-evaluated at regular intervals to account for changing conditions.

Chapter 4 establishes a current WTP capacity of approximately 20 mgd, which is estimated to meet MDD until year 2028. Therefore, the recommended immediate need for capital improvements is based less on capacity expansion and more on the condition and operational constraints of existing facilities.

The City recently made significant improvements to its raw water intake structure allowing for an ultimate intake capacity of 30 mgd. With seismic and structural upgrades, it is anticipated that the structure would be suitable for use through 2065 when system MDD reaches 30 mgd. The cost of upgrading the existing structure is lower than the cost of permitting and constructing a new intake. Constructing other facilities to an initial capacity of 30 mgd allows a consistent criteria for evaluating alternatives and maximizes use of the existing intake structure. Providing 30 mgd capacity is adequate to meet the City’s projected MDD through year 2065. For the purposes of this study, the planning capacity for initial construction of all other WTP elements is chosen to match the capacity of the intake for the development of all improvement alternatives. The ultimate design capacity is chosen to be 45 mgd anticipating that new structures and buildings will have design life of 75 years.

Treatment Process Pre-Screening

This section presents a pre-screening of treatment processes considered for WTP improvement alternatives. Design criteria for appropriate treatment technologies used in the alternatives are discussed further in Chapters 7 and 8. Included as part of the pre-screening process is the nature of the Rogue River’s source water quality, current and anticipated future water quality regulations, and the City’s historical plant operation experience.

Table 6-1
Grants Pass Water Demand Projection Summary

Year	Service Area Population	AAGR[1] (percent)	Per Capita Demand (gpcd[2])	ADD[3] (mgd)	MDD[4] (mgd)
2015	38,632	2.1	170	6.6	15.5
2020	42,862	2.0	170	7.3	17.1
2025	47,323	1.9	170	8.0	18.9
2030	51,993	1.8	170	8.8	20.8
2035	56,844	1.7	170	9.7	22.7
2040	61,843	1.6	165	10.2	24.0
2045	66,951	1.5	160	10.7	25.2
2050	72,125	1.5	155	11.2	26.3
2055	77,700	1.5	150	11.7	27.4
2060	83,704	1.5	145	12.1	28.5
2065	90,173	1.5	140	12.6	29.7
2070	97,142	1.5	140	13.6	32.0
2075	104,650	1.5	140	14.7	34.4
2080	112,738	1.5	140	15.8	37.1
2085	121,451	1.5	140	17.0	40.0
2090	130,837	1.5	140	18.3	43.0
2095	140,948	1.5	140	19.7	46.4
2100	151,841	1.5	140	21.3	50.0
2105	163,576	1.5	140	22.9	53.8
2110	176,218	1.5	140	24.7	58.0

Notes
1. Average annual growth rate
2. Gallons per capita per day
3. Average day demand
4. Maximum day demand

Clarification

Water pumped from the river intake is called raw water and it is pumped from the river to sedimentation basins. Clarification is performed ahead of filtration and usually makes use of chemical coagulation. The clarification process removes a sufficient portion of sediment from the raw water to allow for an efficient filtration process. A conventional WTP uses separate chemical mixing, flocculation, and sedimentation facilities prior to filtration. The three sedimentation basins at the existing Grants Pass WTP currently fulfill this role. However, no flocculation process precedes the sedimentation basins after rapid in-line chemical mixing and none of the basins were designed for optimal hydraulic flow. In addition, chemical injection and mixing equipment is not optimal for the full range of plant flows. Cumulatively, this reduces the effectiveness of the clarification process and requires increased maintenance associated with basin cleaning and residuals removal. It also causes periodic increased solids loading on the filters which results in more frequent backwashing. The City’s WTP has three sedimentation basins, each with a unique configuration and size.

Flow splitting between these existing basins is used because of their distinctly different hydraulic and treatment characteristics. Flow splitting is accomplished by visual observation of basin levels and manual valve throttling.

The performance and structural analysis of these basins found seismic deficiencies in all three basins, in addition to high maintenance needs associated with frequent manual basin cleaning. Given the visible cracking and structural degradation of basins 1 and 2, and the short-circuiting that occurs in basin 3, these basins are at the limits of their design life and are in need of replacement.

There are a number of potential clarification process alternatives including:

- Conventional mixing, flocculation, and sedimentation
- Solids contact and sludge blanket clarification
- Dissolved air flotation
- Ballasted flocculation
- No clarification

Table 6-2 shows advantages and disadvantages associated with these clarification processes, all of which would include chemical addition for coagulation. These factors are used to determine whether the technology is appropriate for further analysis. As shown in Table 6-2, both conventional clarification and ballasted flocculation are considered in capital improvement alternatives. These two technologies also present a range of planning-level cost considerations and space requirements associated with clarification.

Ozone

Ozone is a strong oxidant used for disinfection as well as taste and odor control. It can also be used in combination with granular activated carbon filter media to provide biologically active filtration that promotes multiple water quality benefits, including the removal of trace organic compounds. While water produced at the City's WTP has high overall water quality, occasional taste and odor events have occurred in recent years. The potential influence of climate change within the Rogue River watershed could result in more frequent algal blooms and increased taste and odor concerns. The addition of ozone to the treatment process will minimize the occurrence and severity of these events. The preferred location for ozone contact is between clarification and filtration, referred to as intermediate ozonation. Ozone technology is considered in all improvement alternatives as a potential future technology.

Filtration

The eight existing filters at the Grants Pass WTP all have identified seismic issues. Concrete deterioration and cracking of filters 1 through 5 have been observed, though not to the degree of the older exterior sedimentation basins. With an investment in retrofitting work that includes both seismic restraint and concrete basin rehabilitation, additional filter life can be

Table 6-2
Summary of Clarification Process Alternatives

Clarification Process	Advantages	Disadvantages	Screening for Further Consideration
Conventional sedimentation preceded by mixing and flocculation	• Proven treatment technique for Grants Pass • Multiple processes offers level of operational flexibility • Low equipment cost • Higher rate sedimentation can be offered through installation of inclined settlers	• Large footprint required • Higher cost associated with basin construction • Inadequate space at existing WTP site for 30 mgd	Considered at a new WTP site where space is less restrictive
Solids contact and sludge blanket clarification	• Smaller footprint than conventional sedimentation • Lower chemical use	• High operator attention required with changed water conditions • More mechanical components • Higher power costs associated with recirculation • Can take longer periods to achieve effective treatment at start up • Not commonly used	Not considered, other technologies offer higher clarification rates and reduced footprints
Dissolved air flotation	• Smaller footprint than conventional sedimentation • High clarification rate achievable • Lower chemical use	• High operator attention required • More mechanical components associated with skimming • Higher power costs associated with aeration • Not suited for turbid waters which contain silts and settleable solids	Not considered, other technologies offer higher clarification rates and reduced footprints
Ballasted flocculation	• Very high clarification rates achieved • Lowest footprint required • Lower overall capital cost than conventional • Increased recent popularity	• High operator attention required • More mechanical components associated with flocculation and sand addition • Higher power cost than conventional sedimentation and flocculation	Considered for existing WTP upgrades and new WTP construction
No clarification	• Smaller footprint and cost savings • Reduced operator time	• Direct filtration would require large clearwell/ additional disinfection time • Might create disinfection byproduct issues • Rogue River water quality not conducive to direct filtration	Not considered because direct filtration of Rogue River water would create an undue increase in maintenance associated with downstream facilities

achieved, though not the same design life of newly constructed filters. Retrofitting work may not eliminate the limitations on operational efficiencies that treatment processes currently experience as the analysis has found that hydraulics and filter media depth will limit filtration rates and a lack of air scouring can limit backwashing efficiencies.

Capital improvement alternatives include existing filter rehabilitation scenarios and new filter construction scenarios. The rehabilitation alternatives will be based on achieving a life expectancy sufficient to last through 2065 when system MDD reaches 30 mgd. This capacity has been determined as the maximum attainable capacity at the existing WTP site.

Filtration alternatives considered as part of this plan include:

- Mixed granular media
- Deep-bed granular media
- Low-pressure membranes
- Slow sand filtration
- Diatomaceous earth

Table 6-3 lists advantages and disadvantages associated with these filtration processes to identify whether the technology is appropriate for incorporation into capital improvement alternatives. Membrane filtration is a relatively new technology that comes at a premium but consistently produces high quality water. However, membranes do not usually perform well on water from turbid sources such as the Rogue River. As such, membrane technology is not considered to be a good candidate for Grants Pass because the Rogue River source water would require clarification before the membranes. The construction of clarification prior to membranes, which is not typical for membrane installations, makes the cost of this technology prohibitively high. For this reason, granular media filtration, including standard and deep-bed configurations, is the only technology incorporated into capital improvement alternatives.

Solids Dewatering and Residuals Handling

Until ten years ago, no dewatering was performed at the Grants Pass WTP. All solids accumulated through basin cleaning or backwashing cycles were eventually passed along to the old mill pond. Pond dredging and frequent hauling of solids residuals from the pond for disposal became increasingly expensive. Geomembrane bags have since been used effectively to reduce the amount of solids delivered to the pond, but this practice requires a lot of space and labor. The need for solids handling will only increase as demands increase, and this geomembrane method of dewatering could lead to obstacles in meeting NPDES discharge permit requirements for the outfall from the pond. Hauling fees for disposal in the near future might also be subject to increases associated with more stringent permitting.

Table 6-4 summarizes the advantages and disadvantages associated with common solids handling technologies. With reduced footprint either being required or desired, and with the

Table 6-3
Summary of Filtration Process Alternatives

Filtration Process	Advantages	Disadvantages	Screening for Further Consideration
Mixed granular media	• Proven treatment technique for Grants Pass • Lower equipment and capital costs compared to membrane filtration	• Lower filtration rates • Larger footprint required	Considered
Deep bed granular media	• Higher filtration rates available • Smaller footprint required	• Higher capital cost to construct deeper filters • Filter efficiency might decrease slightly compared to shallow media	Considered
Low-pressure membranes	• Consistent high quality water • Physical barrier against waterborne pathogens • Lower chemical use for coagulation • High level of redundancy	• High operator attention associated with control and testing/cleaning support systems • Very high capital cost • Higher operational costs • Cost prohibitive where savings in reduced clarification facilities cannot be achieved	Not considered, due to probable need for a clarification process and pre-screening to protect the membranes (cost prohibitive)
Slow sand filtration	• Simple, reliable technology • Low operator attention required • Low equipment cost	• Very low filtration rates • Requires longer ripening period at startup • Very large footprint required makes it prohibitive for both existing or a new property • Not appropriate for "live" rivers with turbidities > 10 NTU	Not considered due to regulatory constraints and raw water turbidities
Diatomaceous earth	• Lower equipment and chemical costs	• High operator attention associated with pre-coating process and frequent media changes • Not commonly used, very seldom for large capacity facilities • More expensive than granular media filters	Not considered because the media is not readily available

Table 6-4
Summary of Solids Handling Alternatives

Dewatering Process	Advantages	Disadvantages	Screening for Further Consideration
None	• Minimizes number of treatment facilities	• Recent operations indicate that the capacity limitation of the old mill pond renders this alternative as an undesirable high risk, cost-prohibitive alternative	Not considered because of risk and cost
Drying beds	• Simple technology • High percent solids can be achieved with adequate space and weather	• For solids production levels at 30 mgd, space prohibitive at either the existing or a new property	Not considered because space is too limited
Geomembranes	• Portable technology • High percent solids can be achieved with adequate space and weather	• Polymer needed • Space prohibitive at 30 mgd • Labor intensive • Extended process might result in future old mill pond discharge permit compliance issues	Not considered – this current practice is too labor-intensive and will take up too much space at future production levels
Mechanical	• More compact footprint • More automated process, less labor involved • High percent solids achievable without weather conditions • Reduction in hauled volumes	• High initial capital costs • Polymer and power needed • More mechanical equipment	Considered

possibility of increased disposal and permitting costs, mechanical dewatering is the appropriate technology to use with all capital improvements. The process typically uses dewatering equipment preceded by thickening.

As long as the City can continue to discharge liquid residuals from the old mill pond to Skunk Creek, then continued use of the pond to receive spent filter backwash water is considered feasible. Spent backwash water contains relatively low solids concentrations compared to residual streams produced by the clarification process.

Recycling of Residual Streams

The City does not currently recycle any liquid waste streams, and existing WTP site constraints might make it more challenging to use recycling alternatives at that site. No cost or space provisions are included in any of the capital improvement alternatives for liquid residual stream recycling. It may be beneficial to consider recycling larger residual streams at some future date, especially if a new WTP is constructed. Future increases in demand and potential NPDES discharge permit requirements might make continued use of the old mill pond too costly to continue. A brief evaluation of sending residual streams with a large volume to the wastewater collection system found that this is not a viable alternative.

The Filter Backwash Recycling Rule (FBRR) discussed in Chapter 3 regulates recycling of filter backwash, thickener supernatant, and water from dewatering. These streams must be re-introduced upstream of chemical addition for coagulation so that the water undergoes full treatment through the plant. Filter-to-waste is not regulated by the rule because it is typically of high quality and has been filtered, but it is often economical and practical to combine it with the other recycled streams to minimize capital improvement expenditures and operational complexities associated with recycling.

The FBRR does not require treatment of recycle streams as long as they are introduced into the plant ahead of all of the main treatment processes. However, some plants and states have found it beneficial to treat recycled water because it may contain higher levels of pathogens than raw water. The decision to treat recycled streams is usually made on a case-by-case basis between the utility and the regulatory agency.

If recycling were implemented, an equalization storage facility for the various streams would be required to control the recycle flow stream back to the front end of the treatment facility. Often, flow control is best managed by pumping. Equalization basins may be constructed with a common wall, or some other means of redundancy, to facilitate relatively infrequent manual cleaning of settled solids in the basins. Additional space might also be needed if future treatment of recycle streams is necessary.

Using an ultimate design capacity of 45 mgd, typical recovery rates and the potential recovery volumes that might be achieved by recycling the various waste streams under either alternative are shown in Table 6-5. The recovery rates are offered as general industry ranges.

The performance of the City's WTP will vary depending on actual conditions and plant operations.

Table 6-5
New Water Treatment Plant Waste Stream Recycling Summary

Waste Stream	Typical Volume (Percent of Production)	Regulated under FBRR	Potential Recovery at 45 mgd Production (mgd)
Spent Filter Backwash Water	2 to 5	Yes	0.90 to 2.25
Gravity Thickener Supernatant	0.07 to 1	Yes	0.03 to 0.45
Mechanical Dewatering Pressate	0.1 to 0.2	Yes	0.05 to 0.10
Filter-to-Waste	≈ 0.5	No	0.23
Total Potential Recovery from All Waste Streams			**1.21 to 3.03**
Total Potential Recovery from Filters Only (Backwash and Filter-to-Waste)			**1.13 to 2.48**

Chemical Systems

For the purposes of this plan, it is assumed that chemical systems associated with new facility construction will be proportionally similar in configuration and space requirements to existing chemical facilities. Cost estimates and space requirements will be included in improvement alternatives for multiple coagulant (alum, ACH, or PACl) injection systems, a filter aid, thickening agents, and chlorination. Although there are alternative systems associated with each of these chemical processes, such as on-site hypochlorite generation in lieu of 12.5 percent solution delivered, the cost differential between them is not considered consequential in the analysis of alternatives. Space requirements for the largest chemical systems are included in the analyses, as well as additional space for potential future ozonation and pH adjustment equipment systems.

Redundancy Considerations

Designing a WTP to provide redundancy such that the plant could still produce at MDD capacity with any one treatment train for each process off line or out of service comes at a significant capital investment. Additionally, redundant facilities would be underused under normal operating conditions. In practice, most planned facility shutdowns are operationally triggered and can be scheduled during non-peak production periods. Redundancy strategies used in the development of capital improvement alternatives include:

- Backup power supply through an on-site emergency generator sufficient for production of average day winter demands.

- Additional hydraulic capacity in basins and pipelines to provide operation at increased production rates for individual treatment trains over short periods of time.
- No redundancy in raw water pumping facilities to achieve a capacity of 30 mgd. There will be a minimum of six pumps required to meet this capacity, each rated at approximately 5 mgd. Space is available at the intake for no more than six pumps of this size.
- Full redundancy to meet MDD for other pumping facilities that represent critical plant operations including chemical injection, finished water service, and backwash pumping. Full redundancy of filters is also planned, as they represent a critical plant operation.
- No clarification and disinfection basin redundancy to meet MDD. Under this assumption, if only two treatment trains are planned for 30 mgd of clarification, more than 50 percent of MDD could be achieved from either train by running it at higher loading rates for short periods of time. Better raw water quality is anticipated to typically occur during periods of the year which coincide with peak demands. A clearwell which provides adequate CT is compartmentalized, so it is possible to remove portions of the clearwell from service for cleaning and inspection. This work can also be scheduled during a low demand period where CT is still adequately met.

Space Provisions

For new facilities design, several factors beyond the actual required square footage of the treatment process need to be considered in determining adequate treatment facility site footprint including:

- Space for support systems associated with the treatment process, such as air supply, electrical, chemical, HVAC equipment, and mechanical equipment.
- Adequate workspace for operational access to equipment and basins for purposes of inspection and maintenance.
- Code requirements, including building, electrical, mechanical, fire, and plumbing codes.
- Staffing areas such as offices, lunch areas, lockers, restrooms, meeting rooms, and administrative storage.
- Equipment storage and maintenance areas for tools and spare parts associated with treatment plant operations.
- Adequate vehicle access and parking, including consideration of ingress and egress and turning radiuses for large delivery trucks, as well as construction vehicles that will be needed to support future facility maintenance.
- Site designated land uses, setbacks, and consideration of identified critical areas.

Space provisions associated with these considerations are discussed further in the alternatives developed in Chapters 7 and 8, and general site plans are developed.

Capital Improvement Alternatives Overview

Five capital improvement alternatives were developed to represent a full range of potential space, cost, and risk scenarios that address the identified WTP deficiencies and promote reliable, long-term supply of the Rogue River source of supply. The capital improvement alternatives include two existing plant upgrade scenarios and three new plant construction scenarios. The alternatives are as follows:

- Alternative 1: Existing Water Treatment Plant Upgrade, Maximize Reuse of Existing Facilities
- Alternative 2: Existing Water Treatment Plant Upgrade, Phased Replacement of Facilities
- Alternative 3: Construct a New Water Treatment Plant with Consolidated Footprint
- Alternative 4: Construct a New Water Treatment Plant with Large Footprint
- Alternative 5: Construct a New Water Treatment Plant with Consolidated Footprint on Property that the City Already Owns

Chapter 7 discusses the development of Alternatives 1 and 2 which propose improvements at the existing WTP. Chapter 8 discusses the development of Alternatives 3, 4, and 5 which propose construction of a new WTP at a new site.

Other Alternatives

Two other alternatives were initially considered. These alternatives are discussed in this section.

Baseline Alternative

The baseline alternative proposes to make the required structural and seismic upgrades to all of the existing plant structures. A new clearwell and high service pump station would be constructed to enable continued water supply to the distribution system while the existing clearwells and high service pump station are renovated. The cost of these improvements is approximately $12.5 million.

This alternative defers capital investments necessary to expand the plant's capacity and extends the useful life of the existing facilities. The initial capital investment is smaller than that of other alternatives, but the lifecycle cost of this alternative is higher for the following reasons:

- Some of the structures that would initially be renovated would be demolished during later improvements needed to increase plant capacity. A significant portion of the investment to renovate those structures would be wasted.

- The existing plant would still operate inefficiently so annual operations and maintenance costs would continue to be higher than other alternatives.

In addition, this alternative does not address long-term capacity needs or structural longevity needs beyond year 2065, when a capacity of more than 30 mgd is needed. Due to existing property size and constraints, a new WTP with a capacity of 45 mgd would need to be built at a new location. The approximate cost of this new WTP is $75.4 million (2013 dollars). Because of the inherent economic and operational challenges associated with this alternative, it was not evaluated any further.

Peaking Facility Alternative

Another alternative which was initially considered proposes to continue use of the existing plant as a "peaking facility" during peak demand periods. The City would construct a new plant with a capacity of 10 to 15 mgd capable of providing off-peak system demands with provisions to expand capacity up to 45 mgd in the future. The intent of this alternative is to minimize investments in the existing plant and to use the new plant throughout the year as a baseline production facility.

This alternative may have lower initial costs than other alternatives, but it presents major risks and challenges. In addition, the City would need to operate two separate facilities for four to five months every year, requiring additional staff and higher operations and maintenance costs. The existing plant would be "mothballed" every fall and re-started every spring which also presents additional costs and challenges.

Based on preliminary discussions with City staff, it was decided that this option was not due any further analysis. The main reason for this decision was to avoid the need to hire additional plant staff and to avoid the additional annual costs which would be incurred. The higher life cycle cost from the additional labor costs was deemed to be high enough to exclude this option from further consideration.

Summary

A summary of the WTP improvement planning criteria established in this chapter is shown in Table 6-6. The planning criteria summarized in this chapter serve as a basis for development of the capital improvement alternatives discussed in Chapters 7 and 8.

Table 6-6
WTP Improvement Alternatives Planning Criteria Summary

Item	General Criteria Adopted for Improvement Alternatives
Capacity of Structures	30 mgd initial, 45 mgd ultimate
Capacity of Equipment	30 mgd or less initially, deferment as appropriate to save life expectancy, 45 mgd ultimate
Design Life Expectancy of New Equipment	20 to 30 years minimum
Design Life Expectancy of New Structures	75 years minimum
Design Life Expectancy of Refurbished Structures	45 years
Clarification Processes Considered	Conventional clarification, ballasted flocculation
Filtration Processes Considered	Granular media, standard or deep-bed, high-rate
Solids Handling Processes Considered	Mechanical thickening and dewatering
Chemical Systems	Largest alternative space requirement for each, provisional space for ozone and pH adjustment
Full Redundancy	Hydraulic capacity, finished water service and backwash supply pumping, chemical injection pumping, filtration
Partial Redundancy	Emergency power supply, raw water pumping, clarification, disinfection

CHAPTER 7

CHAPTER 7
EXISTING WATER TREATMENT PLANT ALTERNATIVES

Introduction

This chapter presents alternatives which can expand capacity and address the existing deficiencies at the existing WTP site. Planning level project cost estimates are also presented which are used for comparison with other alternatives.

The ultimate capacity at the existing WTP site is limited to 30 mgd. This is due to space limitations at the site and raw water intake capacity. Therefore, in order to meet long-term water demands, a new treatment facility with a new intake would still be required in approximately 2065 according to Chapter 6 findings. The capacity of the new facility could vary depending on the degree of investment initially made in new facilities at the existing site. Two alternatives for expanding the existing plant were developed for this facility plan; the alternatives were intended to bracket the spectrum of options with regard to cost.

Alternative 1 Overview

Alternative 1 retains as many existing process facilities at the existing WTP site as practicable at a lower granular media filtration rate. For this alternative, the existing filter building, clearwells, and high service pumping facilities are retained and upgraded. A new clarification process facility uses ballasted flocculation to reduce the treatment process footprint and a mechanical dewatering process is added. Three additional filters and new clearwell systems are constructed to provide 30 mgd capacity. Alternative 1's approach attempts to use as much of the older existing structure as possible. A significant capital investment would be required for this alternative once 30 mgd is exceeded in year 2065. A new 45-mgd treatment facility would then need to be constructed and the existing 30 mgd plant would be abandoned. This alternative involves a higher level of risk associated with extending the life of existing deteriorated facilities, some of which have reached the end of their useful design life.

Alternative 2 Overview

Alternative 2 replaces most of the facilities at the existing WTP using phased demolition and reconstruction. This alternative adds new ballasted flocculation and dewatering facilities and demolishes the existing filter building. As part of this alternative, deep bed, high rate filters would be constructed. A new clearwell and high service pump station would also be constructed. Because all critical facilities under this alternative are newly constructed, the life expectancy of the resulting 30 mgd WTP would be approximately 75 years, through the end of the planning period evaluation. In 2065, when system MDD reaches 30 mgd, a new WTP and intake will be needed to supplement the existing WTP and achieve a total capacity of 45 mgd between the two plants. The City would operate two plants through the end of the planning period resulting in higher operating costs than operating a single WTP.

Site and Construction Constraints

Implementing either alternative requires consideration of the risks and challenges related to construction activities around the existing plant and within the limited available space. Since this is the City's only water supply, construction activities at the existing plant site must not interfere with on-going operations and the production of safe drinking water. These alternatives are subject to the following additional planning criteria:

- To implement the required improvements, the maximum plant production rate will likely be reduced for extended periods of time, as basins or filters are taken out of service for repairs or demolition. Based on recent historical water system demands which show a peak week demand and peak month demand of approximately 11.5 and 10.5 mgd, respectively, a maximum plant production rate of 10 to 12 mgd may be tolerable as construction activities occur. The City may need to implement water use restrictions or rationing during hot weather conditions to limit demands based on plant production limitations with facilities out of service.
- The WTP cannot be shut down for more than two to three consecutive days during the low-demand period from November to April. Shutdowns which last for one day may be tolerable during October and May. No plant shutdowns are acceptable from June to September.
- The most pressing short-term concern is structural and seismic rehabilitation of the east and west clearwells. The 1980s clearwell, which also serves as a wet well for the high service pumps, also requires structural and seismic upgrades. All of these clearwell upgrades will take longer than three consecutive days to complete. Therefore, other plant additions must be completed, such as another clearwell and a new high service pump station (HSPS), before upgrades can be completed on the 1980s clearwell.
- Existing high-voltage power lines run north-to-south over the western part of the site, limiting construction activities which can be performed directly beneath. Locating permanent facilities directly beneath the power lines would present significant construction and permitting challenges.
- There is a 50-foot set-back between the edge of the property and above-grade structures.
- Construction activities cannot hinder vehicular traffic around the plant perimeter, including chemical delivery traffic.
- The space required for construction staging and storage exceeds the available space at the existing plant site. This limitation could result in added construction costs for both alternatives.
- A phased construction program may be considered to spread out capital investments, but extended construction duration will have an impact on plant operations and project costs.

- While there is no immediate need to expand production capacity in order to meet near term water demands, there is an immediate need for seismic and structural upgrades.

Process Alternatives and Selection

This section presents the basis for developing the two alternatives introduced in this chapter. Each of the primary processes and main support facilities are briefly discussed below.

Intake and Raw Water Pump Station

The existing intake was retrofitted with a fish screen system in 2008 and has a hydraulic capacity of 30 mgd. The four existing raw water pumps are a vertical turbine configuration which withdraws water from a wetwell downstream of the screens. The raw water pump station (RWPS) has space provisions for two additional pumps to expand from 20 mgd to 30 mgd. The intake and adjacent riverbank requires structural upgrades and stabilization to protect against failure resulting from a seismic event. Beyond 2065, an adjacent second intake structure and associated pumping and transmission facilities will be required to bring intake capacity to 45 mgd. The proposed improvements to the intake and RWPS are similar for both alternatives.

Rapid Mixing

A new rapid mixing system that provides for optimum chemical dispersion will be required to expand the plant capacity to 30 mgd. The new system will need to be located in the new raw water pipeline to be constructed between the existing RWPS and the new ballasted flocculation system. There are a number of rapid mixing systems considered as part of this assessment, including:

- In-line static mixer, similar to the existing system
- In-line mechanical mixer
- Pumped diffusion system

For planning purposes, a new pumped diffusion system is recommended since it provides optimum mixing over a wide range of flows, reduces chemical use and head loss, and uses less energy than the other options.

Clarification

The combined area occupied by basins 1, 2, and 3 is approximately 21,000 square feet. Basins 1 and 2 have an approximate combined hydraulic capacity of 12 mgd and basin 3 has an approximate hydraulic capacity of 8 mgd. As discussed in Chapter 2, basin 3 does not perform as well as basins 1 and 2 due to its square configuration and radial flow design.

Basin 1, 2, and 3 Improvements

Without significant structural and seismic improvements, basins 1 and 2 are approaching the end of their useful lives. Even with these improvements, their hydraulic capacity cannot be increased enough to provide an additional 10 mgd of clarification capacity. As part of earlier studies completed in 2009 concerning installation of a settled solids collection system, it was estimated that the project cost of the recommended improvements for basins 1 and 2 would be approximately $3 million and would not result in additional capacity. Additional costs are required for basin 3 to make structural and seismic upgrades and to improve its performance. In order to increase its clarification capacity to 30 mgd using similar technology, an additional large basin would be necessary. In total, all of these improvements would likely cost in excess of $7 million to achieve a capacity of 30 mgd and to extend the useful life of the older basins by approximately 45 years.

New High-Rate Clarification

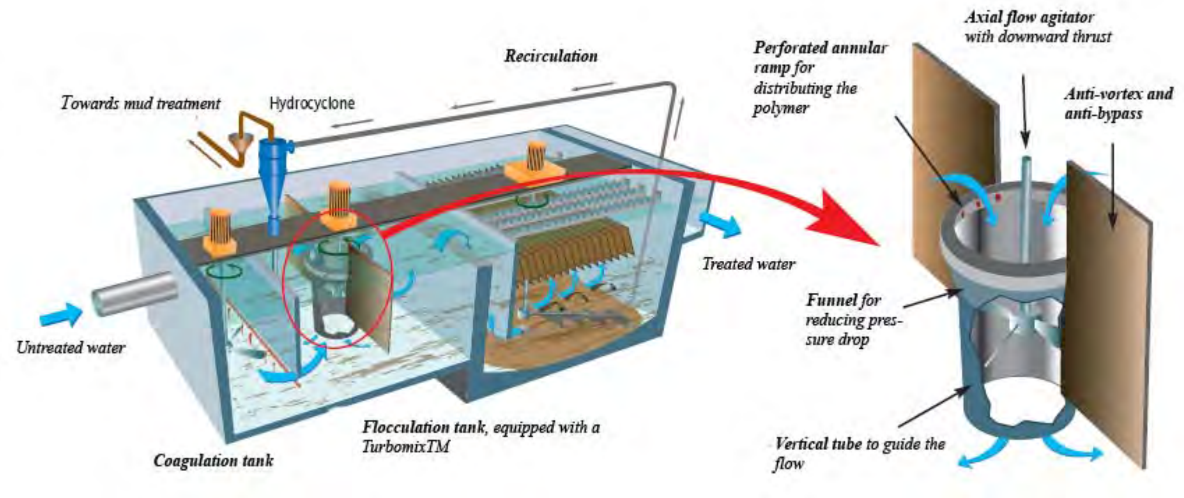
An alternative to improving the existing clarification structures is the construction of a higher-rate clarification system which will reduce surface area requirements. As discussed in Chapter 6, potential high-rate processes include:

- Tube settlers or plate settlers preceded by mechanical flocculation
- Upflow sludge blanket clarifiers
- Dissolved air flotation
- Ballasted flocculation

Based on the consultant team's experience elsewhere in the region, a new high-rate ballasted flocculation process could be constructed to replace the three existing basins and provide an optimized clarification system. This technology has gained considerable acceptance in Oregon and throughout the country over the past decade, and it is believed to be appropriate for treatment of the Rogue River raw water. The process uses settling rates of 20 to 30 gpm/ft^2, compared to settling rates of 1 to 6 gpm/ft^2 for other clarification processes, and can be constructed on a very small footprint. Figure 7-1 presents a schematic overview of this process.

The required footprint for ballasted flocculation at 30 mgd capacity is approximately 2,100 square feet which is smaller than any one of the existing basins. Basin 1 or 3 could be taken off-line for a season and demolished. Then, ballasted flocculation could be constructed in that space. The two remaining basins could then be re-purposed or demolished to create space at the site for other improvements. Ballasted flocculation and its associated costs are not expected to be any higher than the costs of improving the existing basins and building and constructing an additional basin to get to 30 mgd capacity. The new ballasted flocculation structures will have a 75-year expected useful design life.

Figure 7-1
Schematic of the Actiflo™ Turbo Ballasted Flocculation Process



(Courtesy of Kruger, Inc.)

Ballasted flocculation to provide 30 mgd capacity would consist of two 15-mgd process trains. This would provide operational flexibility and redundancy and would be less expensive than installing three process trains with individual capacities of 10 mgd. It would also require that a solids thickener be constructed to handle the recycle flows and the solids produced, as well as a sand feed system and a polymer feed system. Improvements to the settled water conveyance system would be required to properly distribute flows to the filters.

Based on recent manufacturer quotes and construction costs elsewhere, it will cost less than $5 million to install a 30-mgd ballasted flocculation system, including thickening, at the existing WTP site. For all of these reasons, ballasted flocculation is recommended as the clarification process for both Alternatives 1 and 2 to expand and upgrade the existing WTP.

Ozone

Space for future ozone equipment is reserved under Alternatives 1 and 2 in case the City decides to implement ozone for taste and odor control, or for any other unforeseen circumstance in the future. Multiple ozone contact basins sized to provide adequate contact time at full capacity could be installed between the clarification and filtration processes with liquid oxygen storage and ozone generators located nearby. Approximately 2 feet of hydraulic head would be needed if ozonation facilities were added in the future, which results in a clarification water surface level that is higher than the current level.

Filtration

As discussed in Chapter 6, it is recommended to continue use of granular media filtration for the Rogue River supply. Low-pressure membrane filtration, the other common alternative, is more expensive to construct and operate than granular filters. Therefore, both upgrade and expansion alternatives for the existing Grants Pass WTP include granular media filtration.

The eight existing filters at the WTP were upgraded in 2007 and are deemed to have useful life for the next 40 years with a production capacity of 20 mgd with one filter out of service. Some structural and seismic upgrades are required, particularly in the oldest three filters. The filter design is not ideal to meet current filtration standards due in part to a relatively shallow media depth. It is believed, however, that these filters can continue to operate efficiently in the future in conjunction with an optimized clarification system such as ballasted flocculation.

Alternative 1 Filtration

Alternative 1 proposes the continued use of the eight existing filters. To achieve 30 mgd of filtration capacity, the construction of three new filters with a media area similar in size to filters 4 and 5 is recommended. The depth of media can be slightly deeper than the existing filter media to enhance performance. The new filters would be backwashed using the existing backwash pumps inside the HSPS. The location of the new filters should be determined based on available space and proximity to the clearwells and HSPS.

Alternative 2 Filtration

For Alternative 2, it is proposed to demolish all of the existing filters, including the associated buildings and clearwells, and replace them with six new high-rate, deep-bed granular media filters. A maximum filtration rate of 8 gpm/ft^2 with one filter out of service using 48 to 60 inches of dual media is recommended, based on successful experiences elsewhere with similar raw water and clarification systems. This higher filtration rate will reduce footprint and reduce construction costs. The new filters would initially be built and put in service before the existing filters are demolished, so they need to be located in an area that is currently open or available after demolition of the existing sedimentation basins. The new deep-bed filters would be backwashed using new pumps inside the proposed new HSPS and would also be cleaned using an air scour system. It is also possible to consider the use of granular activated carbon as a filter media in lieu of anthracite as an added taste and odor control feature.

Disinfection and Finished Water Storage

The WTP existing finished water storage structures include three separate clearwells built at different times. They have a combined total volume of approximately 433,000 gallons with an operating volume of 362,000 to 400,000 gallons, which is just enough to meet current disinfection requirements using free chlorine under most conditions. Ultraviolet irradiation (UV) disinfection is an alternative to free chlorination for future primary disinfection at the Grants Pass WTP. Implementing UV allows for a reduction in required finished water storage volume required for disinfection, but does result in increased power cost. Because a large finished water storage basin is needed for proper operation of the HSPS, it is believed that free chlorine will continue to be the most cost-effective alternative for future primary and secondary disinfection. It is also anticipated that disinfection byproduct concentrations will be reduced after improvements are complete, due mainly to the planned discontinuation of pre-chlorination. Future disinfection with free chlorine will need to be achieved downstream of filtration.

If free chlorine remains the primary disinfectant at the Grants Pass WTP, additional clearwell volume will be required. Based on seasonal demands and temperature profiles, at least 650,000 gallons of baffled storage will be required to meet the 0.5-log *Giardia* inactivation requirements at 30 mgd.

As documented in the June 2012, "Structural and Seismic Evaluation Report" presented in Appendix D, the existing clearwell is in immediate need of structural upgrades to minimize the risk of damage during a seismic event. Unfortunately, the estimated duration of implementing these improvements exceeds the maximum allowable plant shut-down duration of three days. Though a temporary UV disinfection system could potentially allow for upgrades to the 1930s and 1960s portions of the clearwell, additional clearwell and distribution pumping capacity will be needed prior to upgrades to the 1980s portion of the clearwell because this is where the existing HSPS is located. Therefore, for Alternative 1, construction of a new 375,000-gallon clearwell and a new HSPS is recommended. The recommended volume is adequate to meet current CT requirements with free chlorine during the clearwell upgrade construction period when operating at flows under 15 mgd. Once the new clearwell and HSPS are put into service, the existing clearwell can be taken out of service and repaired, either all at once or sequentially. Temporary and permanent yard piping improvements will also be required to connect the old and new clearwells.

For Alternative 2, a new 650,000-gallon clearwell is recommended for construction in conjunction with a new 30-mgd HSPS prior to abandoning and demolishing the existing three clearwells.

For both Alternatives 1 and 2, it is recommended that the new clearwell be located directly beneath the new filters and HSPS to minimize footprint and piping.

High Service Pumping

The existing HSPS has approximately 30 mgd of available capacity, assuming that the distribution system is upgraded to receive this additional flow. However, the clearwell below the HSPS requires structural and seismic upgrades, requiring construction of a new clearwell and a 10 to 12 mgd HSPS for Alternative 1 as previously discussed. The discharge piping of this new, smaller HSPS would be connected to the existing plant finished water pipeline. Following the structural and seismic upgrades, this new HSPS would operate in parallel with the existing HSPS, increasing operational flexibility and overall plant reliability.

For Alternative 2, a new 30-mgd HSPS should be constructed along with a new 650,000-gallon clearwell. The proposed location for the new HSPS and clearwell is in the area currently occupied by basins 1 and 2. Hence, these older basins would need to be demolished following construction and startup of the proposed new ballasted flocculation system so that the new HSPS and clearwell can be constructed. When these new facilities have been completed, the existing HSPS and associated buildings can be demolished. The new HSPS would discharge into a new finished water pipeline that would connect to the existing pipeline. The new HSPS would also be equipped with backwash pumps to support the new filters proposed under Alternative 2.

Chemical Storage and Injection

The existing chemical storage area and sodium hypochlorite room has enough capacity to treat more than 20 mgd. It is not anticipated that additional space on the site would need to be dedicated to treat 30 mgd, even when considering the additional polymer system required for the proposed ballasted flocculation system. Chemical metering pumps could be added or replaced to meet the increased chemical feed rate.

Alternative 1 Chemical Storage and Injection

Rather than increasing the number or size of the existing chemical storage tanks, the Alternative 1 approach would be to schedule more frequent chemical deliveries. As such, Alternative 1 will use the existing chemical storage and feed areas, following structural and seismic upgrades, to achieve a remaining useful life of 45 years. The existing maintenance area for the WTP is currently co-located in the chemical storage area. This maintenance area will be moved to a new dedicated space elsewhere on the site for Alternative 1. Space is also available to add a carbon dioxide tank and feed system for raw water coagulation and pH control if it becomes necessary in the future.

Alternative 2 Chemical Storage and Injection

For Alternative 2, the existing chemical storage areas will be replaced with a new chemical building. This new building would be built and put into service before demolition of the existing chemical building. The proposed location for the new chemical building is adjacent to the new filters.

Residuals and Solids Handling

The backwash water from the existing filters is currently equalized in a basin located on the west end of the plant, then pumped to the old mill pond across the street. The suspended solids concentration in this water is relatively low and the pond acts as a settling basin to ensure that the overflow from the pond, which discharges to Skunk Creek, meets NPDES requirements. The pond also provides time for the chlorine residual to dissipate. Because the pond is partially filled with solids deposited prior to the development of the geobag dewatering program, the City employs a dredging program in the pond every summer to remove and dewater settled solids.

The solids which collect in the three contact basins are removed two to three times per year on a batch basis since the basins do not have continuous solids removal systems. These solids are equalized in an on-site tank and then treated with polymer before being pumped into geobags. The geobags are located to the west of basin 3 and to the north of the equalization basin.

Mechanical Dewatering

Due to limited available space, a mechanical dewatering system is recommended which can remove solids on a continuous basis and produce higher dewatered solids concentrations than the current method. A mechanical dewatering system includes three key components: thickening, storage and equalization, and mechanical dewatering equipment. Dewatering equipment options include belt presses, centrifuges, and screw presses.

The mechanical dewatering equipment and ancillary features should be installed in a building, preferably with the dewatering equipment on the second story to facilitate truck loading for off-site disposal. For both Alternatives 1 and 2, the mechanical dewatering building is located to the west of the main plant facilities and is capable of accommodating any of the mechanical dewatering variations.

Liquid Residuals

As long as disposal of liquid decant from the old mill pond to Skunk Creek remains acceptable, it is recommended to continue handling backwash water using the current practice. Decant from the new gravity thickener would also be pumped to the old mill pond. If Skunk Creek becomes unavailable in the future, then improvements to clarify and recycle the backwash water and thickener decant to the raw water stream upstream of flash mix would likely be necessary. For Alternatives 1 and 2, the existing equalization basin is retained. The pumps would be replaced due to age, and conveyance capacity to the pond would be increased.

Operations and Maintenance Support Facilities

The existing plant provides insufficient space for efficiency and effective operations and maintenance activities. Under Alternative 1, the existing administrative building and facilities will remain and a new maintenance/shop/storage building is recommended for construction. It should be located in available space created by demolition of the existing buildings. In Alternative 2, the existing administrative building will be demolished and a new operations and maintenance building will be built where the existing administrative building and filters 1 to 5 are currently located. Based on preliminary discussions with the City's planning department, the new operations building must be similar in appearance to the existing buildings to match the historical nature of the older plant buildings.

Summary of Alternatives

Both Alternative 1 and 2 site plans for expanding and upgrading the existing WTP include the following primary treatment processes:

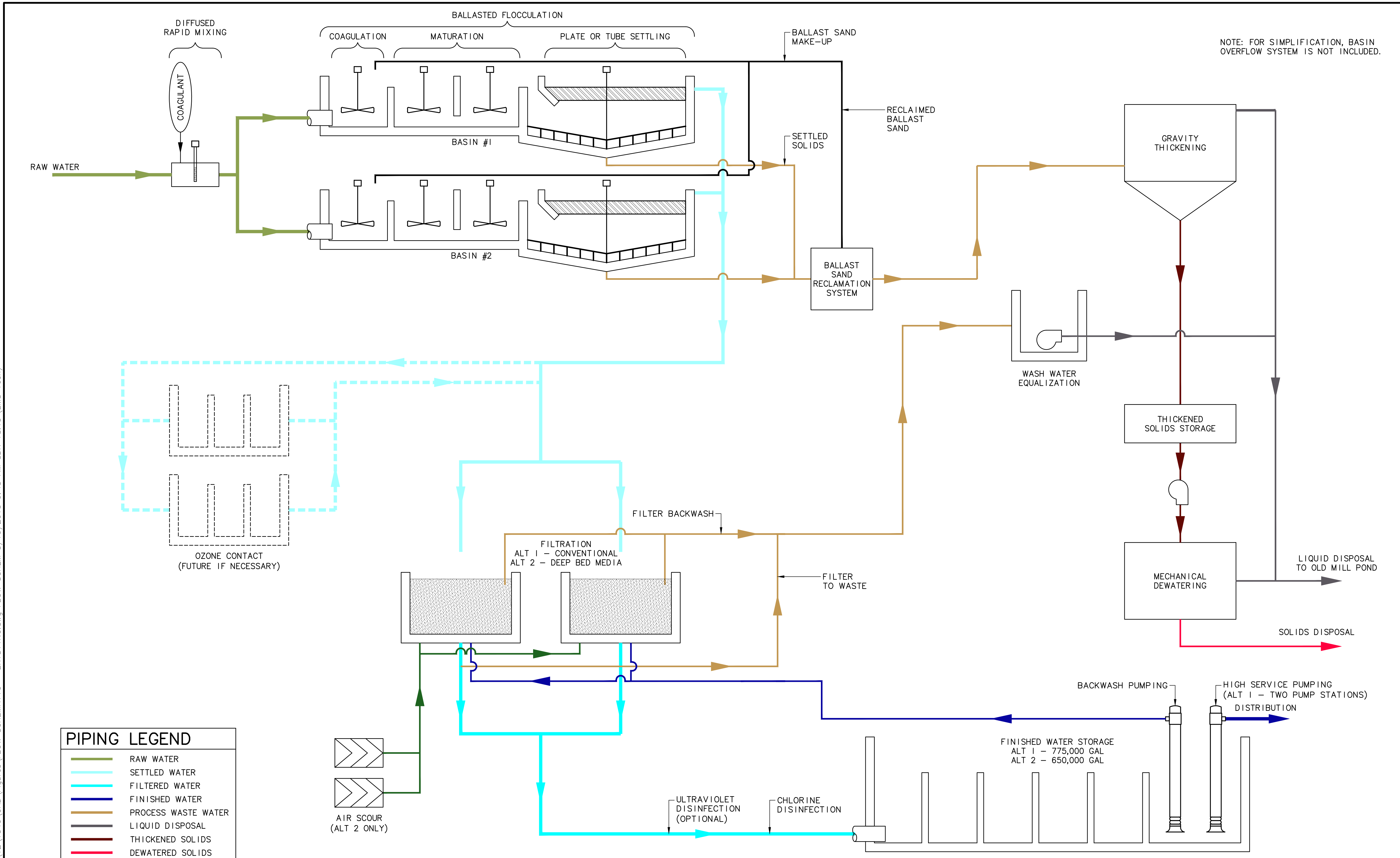
- Pumped diffusion rapid mixing
- Ballasted flocculation
- Potential future intermediate ozonation
- Granular media filtration
- Chlorine disinfection

The solids treatment train includes gravity thickening, solids homogenization, and mechanical dewatering facilities. New high service pumping facilities are also required for both alternatives. In both alternatives, the layout attempts to minimize building footprints and costs where possible. Both alternatives would result in a 30-mgd WTP with a remaining useful life of approximately 45 years. Alternative 2 has a longer useful life as it includes construction of multiple new facilities. Figure 7-2 shows process flow schematics for Alternatives 1 and 2.

Table 7-1 presents a comparison of the advantages and disadvantages for the two alternatives. Either alternative will require the construction of new intake facilities and a new WTP at a different site in approximately 2065 when the water system MDD reaches 30 mgd. The capacity of the future new WTP would be 45 mgd for Alternative 1 and 15 mgd for Alternative 2.

Table 7-1
Existing Water Treatment Plant Expansion and Upgrade Alternative Summary

Alternative	Advantages	Disadvantages
1	• Lowest initial capital cost • Increased HSPS reliability and operational flexibility • Preserves architectural look of historical buildings	• Increased risk of water rationing during construction • Multiple smaller filters with shallow media depth • Requires construction of a new 45-mgd plant in 2065
2	• New facilities offer useful life of more than 45 years • More efficient equipment and support systems • Deeper filter media helps with taste and odor control • Newer facilities provide opportunity to comply with current OSHA and ESA codes	• Longest construction duration and water rationing • Highest initial capital cost • Requires construction of a new 15-mgd WTP in 2065 • Results in operation of two plants beyond 2065



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SCALE: NO SCALE

DESIGNED A. NISHIHARA
DRAWN S. KIRK
CHECKED P. KREFT

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WATER TREATMENT PLANT FACILITY PLAN UPDATE
FIGURE 7-2
PROCESS FLOW SCHEMATIC - ALTERNATIVES 1 AND 2

PAGE 7-11

Facility Layouts and Construction Sequencing

Figures 7-3 and 7-4 illustrate the proposed facilities layouts for Alternatives 1 and 2, respectively. The size, placement, and timing of facilities shown in the figures reflect the discussion of treatment processes in this chapter.

A phased approach to construction is required for both alternatives in order to sequentially complete key elements of the work, assure adequate plant production capacity, and to spread out the costs. In order for plant staff to become familiar with the operation of new facilities associated with progressive phases of work, each construction phase will be followed by a break from construction.

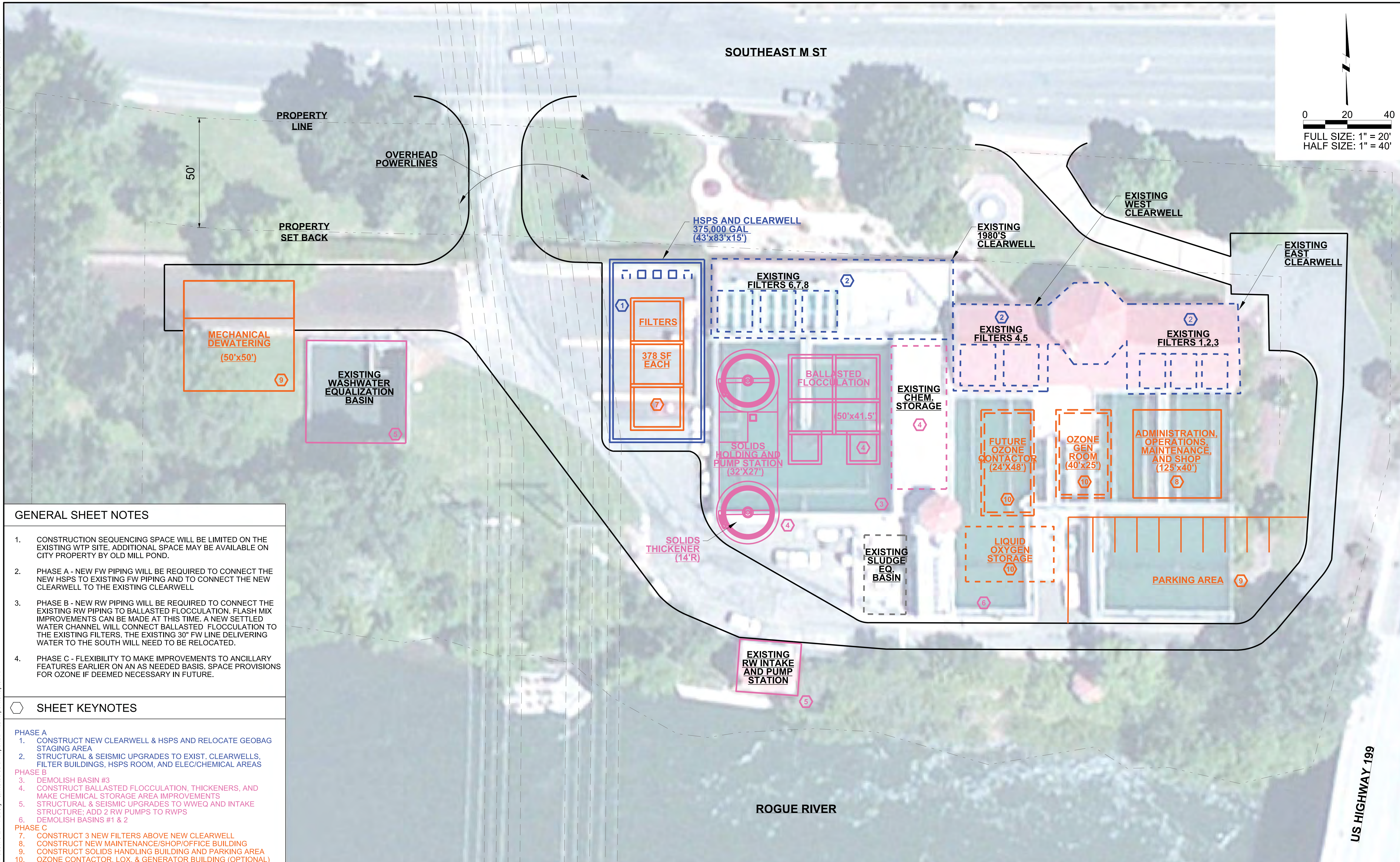
For each alternative, three suggested phases of work with separate construction contracts are summarized in the figure legends. The itemized scope of work for each phase included in the legends is intended to balance the risk of prolonged operational obstructions with addressing the most critical upgrades as early as possible. This staged approach is necessary to maintain plant production and will result in a longer construction duration compared to completing the work under a single construction contract, which will increase costs. Both alternatives will require that the plant operate at a maximum production of 10 to 12 mgd for a period of 12 to 18 months, including at least one summer with potential water rationing, until key facilities can be constructed and brought on-line. For purposes of estimating comparative contractor overhead and profit between alternatives, Alternative 1 is estimated to have three phases. The first phase would have a duration of 12 months and the second and third phases would each last18 months. Alternative 2 is estimated to have three equal phases with a duration of 18 month each.

Construction Constraints

Both alternatives require careful planning and design to implement the proposed improvements and a pre-qualified, experienced contractor with a proven ability to work within the significant site constraints. Discussion of work sequencing, permissible work areas and work hours, and coordination with City operational staff for activities impacting normal plant operations will all need to be included in the construction contract and bidding documents. Construction storage and staging areas need to be established and additional off-site staging may be required. Access to and around the plant site for chemical deliveries and plant activities must be maintained throughout the course of construction activities.

Project Cost Estimates

Table 7-2 and Table 7-3 present planning-level project cost estimates for Alternative 1 and Alternative 2, respectively. The estimated project costs are expressed in 2013 dollars. Due to the phased nature of both alternatives, it is anticipated that these project costs would be incurred in several expenditures over the course of several years. As such, net present value is a more meaningful way to compare the costs associated with these alternatives and the additional alternatives presented in Chapter 8.



GENERAL SHEET NOTES

1. CONSTRUCTION SEQUENCING SPACE WILL BE LIMITED ON THE EXISTING WTP SITE. ADDITIONAL SPACE MAY BE AVAILABLE ON CITY PROPERTY BY OLD MILL POND.
2. PHASE A - NEW FW PIPING WILL BE REQUIRED TO CONNECT THE NEW HSPS TO EXISTING FW PIPING AND TO CONNECT THE NEW CLEARWELL TO THE EXISTING CLEARWELL
3. PHASE B - NEW RW PIPING WILL BE REQUIRED TO CONNECT THE EXISTING RW PIPING TO BALLASTED FLOCCULATION. FLASH MIX IMPROVEMENTS CAN BE MADE AT THIS TIME. A NEW SETTLED WATER CHANNEL WILL CONNECT BALLASTED FLOCCULATION TO THE EXISTING FILTERS. THE EXISTING 30" FW LINE DELIVERING WATER TO THE SOUTH WILL NEED TO BE RELOCATED.
4. PHASE C - FLEXIBILITY TO MAKE IMPROVEMENTS TO ANCILLARY FEATURES EARLIER ON AN AS NEEDED BASIS. SPACE PROVISIONS FOR OZONE IF DEEMED NECESSARY IN FUTURE.

SHEET KEYNOTES

PHASE A
1. CONSTRUCT NEW CLEARWELL & HSPS AND RELOCATE GEOBAG STAGING AREA
2. STRUCTURAL & SEISMIC UPGRADES TO EXIST. CLEARWELLS, FILTER BUILDINGS, HSPS ROOM, AND ELEC/CHEMICAL AREAS

PHASE B
3. DEMOLISH BASIN #3
4. CONSTRUCT BALLASTED FLOCCULATION, THICKENERS, AND MAKE CHEMICAL STORAGE AREA IMPROVEMENTS
5. STRUCTURAL & SEISMIC UPGRADES TO WWEQ AND INTAKE STRUCTURE; ADD 2 RW PUMPS TO RWPS
6. DEMOLISH BASINS #1 & 2

PHASE C
7. CONSTRUCT 3 NEW FILTERS ABOVE NEW CLEARWELL
8. CONSTRUCT NEW MAINTENANCE/SHOP/OFFICE BUILDING
9. CONSTRUCT SOLIDS HANDLING BUILDING AND PARKING AREA
10. OZONE CONTACTOR, LOX, & GENERATOR BUILDING (OPTIONAL)

REV	DATE	BY	DESCRIPTION	SCALE
				AS NOTED

DESIGNED A. NISHIHARA
DRAWN A. ORR
CHECKED P. KREFT

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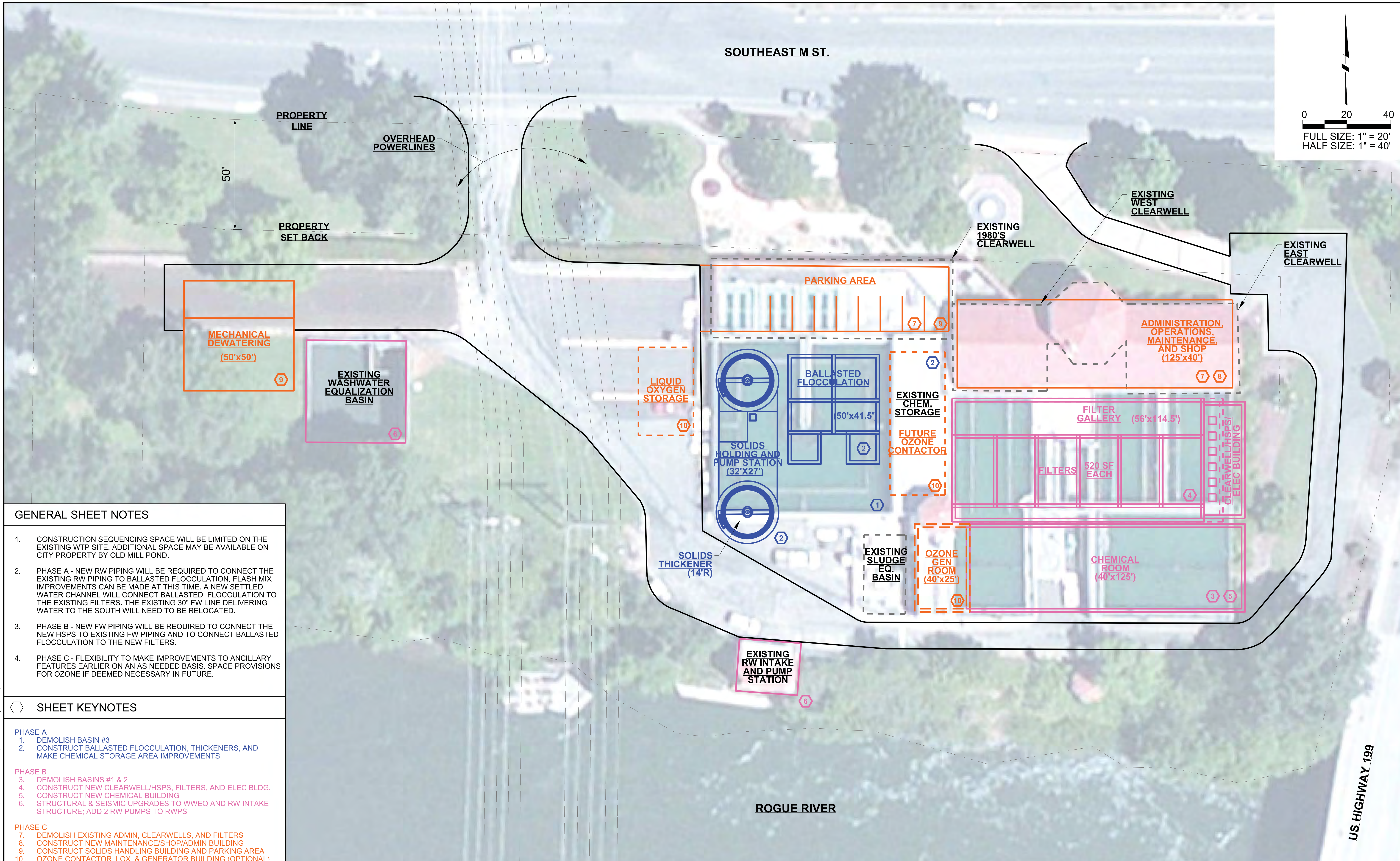
WATER TREATMENT PLANT FACILITY PLAN UPDATE
FIGURE 7-3
SITE LAYOUT - ALTERNATIVE 1



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USER: NISHIHAM

GENERAL SHEET NOTES

1. CONSTRUCTION SEQUENCING SPACE WILL BE LIMITED ON THE EXISTING WTP SITE. ADDITIONAL SPACE MAY BE AVAILABLE ON CITY PROPERTY BY OLD MILL POND.
2. PHASE A - NEW RW PIPING WILL BE REQUIRED TO CONNECT THE EXISTING RW PIPING TO BALLASTED FLOCCULATION. FLASH MIX IMPROVEMENTS CAN BE MADE AT THIS TIME. A NEW SETTLED WATER CHANNEL WILL CONNECT BALLASTED FLOCCULATION TO THE EXISTING FILTERS. THE EXISTING 30" FW LINE DELIVERING WATER TO THE SOUTH WILL NEED TO BE RELOCATED.
3. PHASE B - NEW FW PIPING WILL BE REQUIRED TO CONNECT THE NEW HSPS TO EXISTING FW PIPING AND TO CONNECT BALLASTED FLOCCULATION TO THE NEW FILTERS.
4. PHASE C - FLEXIBILITY TO MAKE IMPROVEMENTS TO ANCILLARY FEATURES EARLIER ON AN AS NEEDED BASIS. SPACE PROVISIONS FOR OZONE IF DEEMED NECESSARY IN FUTURE.

SHEET KEYNOTES

PHASE A
1. DEMOLISH BASIN #3
2. CONSTRUCT BALLASTED FLOCCULATION, THICKENERS, AND MAKE CHEMICAL STORAGE AREA IMPROVEMENTS

PHASE B
3. DEMOLISH BASINS #1 & 2
4. CONSTRUCT NEW CLEARWELL/HSPS, FILTERS, AND ELEC BLDG.
5. CONSTRUCT NEW CHEMICAL BUILDING
6. STRUCTURAL & SEISMIC UPGRADES TO WWEQ AND RW INTAKE STRUCTURE; ADD 2 RW PUMPS TO RWPS

PHASE C
7. DEMOLISH EXISTING ADMIN, CLEARWELLS, AND FILTERS
8. CONSTRUCT NEW MAINTENANCE/SHOP/ADMIN BUILDING
9. CONSTRUCT SOLIDS HANDLING BUILDING AND PARKING AREA
10. OZONE CONTACTOR, LOX, & GENERATOR BUILDING (OPTIONAL)

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				AS NOTED	DESIGNED A. NISHIHARA DRAWN A. ORR CHECKED P. KREFT

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WATER TREATMENT PLANT FACILITY PLAN UPDATE
FIGURE 7-4
SITE LAYOUT - ALTERNATIVE 2

Table 7-2
Alternative 1 Project Cost Estimate

Facility	Estimated Cost (2013 USD)
Mobilization and General Conditions (12 percent)	$2,500,000
Intake and Raw Water Pump Station Improvements	$1,450,000
375,000 gallons of New Treated Water Storage	$1,000,000
New 7.5 MGD Capacity High Service Pumping Equipment	$1,000,000
New Finished Water Piping	$250,000
Relocate Geobag Staging Area	$100,000
Structural/Seismic Upgrades to Existing 3 Clearwells	$750,000
Structural/Seismic Upgrades to HSPS Room	$100,000
Structural/Seismic Upgrades to Existing Filter Buildings	$500,000
Structural/Seismic Upgrades to Chemical and Electrical Rooms	$400,000
Tank, Electrical Equipment, and Pipe Anchorages	$250,000
Demolish Existing Basin 3	$300,000
Relocate 30-inch diameter Finished Water Pipe	$200,000
New Ballasted Flocculation and Sedimentation	$3,200,000
New Gravity Thickeners and Associated Piping	$900,000
Thickened Solids Storage	$450,000
New Chemical Systems for Ballasted Flocculation and Thickeners	$150,000
36-inch diameter Raw Water Pipe to Ballasted Floc Basins and Flow Splitter	$150,000
Add New Settled Water Channel	$200,000
Demolish Basins 1 and 2	$300,000
Influent Flow Metering and Flash Mix Facilities	$300,000
Build Three New Filters, Retain Filters 1 through 8	$2,600,000
Upgrades to Existing Wastewater Equalization Basin, Pumps, and Piping	$300,000
Mechanical Dewatering Building	$1,350,000
New Maintenance/Shop/Office Building	$2,000,000
Electrical and Instrumentation	$1,500,000
Site Civil and Miscellaneous Yard Piping	$500,000
Landscaping	$50,000
Subtotal: Construction without Contingency	**$22,800,000**
Contingency (25 percent)	$5,700,000
Additional Contractor Overhead and Profit for Three Phases	$2,052,000
Subtotal: Construction with Contingency	**$30,600,000**
Engineering, Permitting, Construction Management Services, Legal, Administration (30 percent)	**$6,840,000**
Total Estimated Project Cost with Contingencies	**$37,400,000**

Table 7-3
Alternative 2 Project Cost Estimate

Facility	Estimated Cost (2013 USD)
Mobilization and General Conditions (12 percent)	$3,700,000
Intake and Raw Water Pump Station Improvements	$1,450,000
Demolish Existing Basin 3	$300,000
Relocate 30-inch diameter Finished Water Pipe	$200,000
New Ballasted Flocculation and Sedimentation	$3,200,000
New Gravity Thickeners and Associated Piping	$900,000
Thickened Solids Storage Tank	$450,000
New Chemical Systems for Ballasted Flocculation and Thickening	$150,000
36-inch diameter Raw Water Pipe to Ballasted Floc Basins and Flow Splitter	$150,000
New Settled Water Channel	$200,000
Influent Flow Metering and Flash Mix Facilities	$300,000
Demolish Existing Basins 1 and 2	$300,000
650,000 gallons of New Treated Water Storage	$1,500,000
New 30 MGD High Service Pump Station	$3,750,000
New Finished Water Piping	$500,000
Build Six New Filters	$5,200,000
Demolish Filters 6, 7, 8, Existing HSPS, and 1980s Clearwell	$500,000
Demolish Filters 1, 2, 3, and East Clearwell	$500,000
Upgrades to Existing Wastewater Equalization Basin, Pumps, and Piping	$300,000
New Administration and Maintenance Building	$2,500,000
Demolish Filters 4, 5, Existing Ops Building, and West Clearwell	$500,000
New Chemical Building	$2,500,000
Mechanical Dewatering Building	$1,750,000
Electrical and Instrumentation	$2,000,000
Site Civil and Miscellaneous Yard Piping	$1,000,000
Landscaping	$100,000
Subtotal: Construction without Contingency	**$33,900,000**
Contingency (25 percent)	$8,500,000
Additional Contractor Overhead and Profit for Three Phases	$3,850,000
Subtotal: Construction with Contingency	**$46,300,000**
Engineering, Permitting, Construction Management Services, Legal, Administration (30 percent)	**$10,200,000**
Total Estimated Project Cost with Contingencies	**$56,500,000**

Project cost estimates were developed using recent local industry information from estimates, bid tabs, vendor quotations, and other material unit costs for similar treatment facilities. Line item estimates represent installed costs that include materials, labor, equipment, and contractor overhead and profit. Building costs for Alternative 2 are higher to account for more expensive architectural finishes that match the look of the existing buildings.

The project cost estimates are Class 5 estimates as defined by the American Association of Cost Engineering. These opinions of probable cost are based on planning-level analysis and a low level of project definition. Accuracy typically ranges from –30 percent to +50 percent.

In developing the project costs for Alternatives 1 and 2, it was necessary to add premiums associated with the risk and difficulty associated with construction at the existing site. Assumptions that were used to develop these costs, which are different from those used to develop costs for the construction of a new WTP, include the following:

- A mobilization cost at a higher percentage than used for construction of a new WTP to account for the potential need by the contractor to secure additional off-site staging areas, and the likely necessity for more heavy equipment transport and storage to minimize on-site contractor presence and impact on ongoing plant operations.
- A higher planning-level construction cost contingency allowance than used for construction of a new WTP, recognizing the increased potential for changed conditions and contractor claims on a confined site with various existing utilities and working constraints.
- Additional contractor overhead and profit assessed when compared to construction of a new WTP intended to account for the cost of on-site equipment and labor proportional to the increased total construction time of all three phases. This is relative to an estimated 30-month construction duration for a new WTP. Contractor overhead and profit was taken as 15 percent of construction cost in this analysis.
- A higher markup used between construction and project costs than used for the new WTP alternatives, accounting for the increased engineering, permitting, construction management, legal, and administrative cost allowances required to administering three separate construction contracts instead of a single contract.

Summary

The two alternatives for expanding and upgrading the existing WTP on the existing WTP site have a wide range of capital costs and have different implications for long-term operation of the City's water supply system over the next century. New WTP Alternatives 3, 4 and 5, presented in Chapter 8, evaluate the construction of new treatment facilities on new sites. A comparative evaluation of all five alternatives, which includes social and environmental considerations as well as costs, is presented in Chapter 9. Chapter 9 includes a final recommendation for the preferred capital improvement program.

CHAPTER 8

CHAPTER 8
NEW WATER TREATMENT PLANT ALTERNATIVES

Introduction

This chapter presents a detailed discussion of alternatives which propose to construct a new WTP at a new site. The decision to investigate replacement alternatives at a new site was made because the cost to retrofit the existing plant is high and the ultimate capacity of any WTP on the existing property is practically limited to 30 mgd. Construction of a new WTP also offers a lower risk profile and more straightforward capacity expansion opportunities when compared to upgrades at the existing WTP. Alternatives 3 and 4 are intended to bracket the spectrum of options with regard to cost and space requirements associated with a new WTP on a new site of unspecified nature. Alternative 5 was developed to investigate construction of a new WTP on a site which is already owned by the City.

Alternative 3 Overview

Alternative 3 proposes construction of a new WTP using newer treatment technologies which have smaller footprints than their conventional counterparts. These processes tend to be more mechanically driven and may require additional regulatory approval. They typically have higher initial equipment costs than traditional treatment technologies, but lower overall costs resulting from smaller basins and structures. The consolidated footprints are used to define the minimum adequate property size that would be needed for a WTP with an ultimate capacity of 45 mgd. It is assumed that initial construction would be for a WTP capacity of 30 mgd, with expansion in 2065 to 45 mgd.

Alternative 4 Overview

Alternative 4 uses conventional treatment technologies which rely on hydraulic residence time for effectiveness. These technologies are proven and accepted by regulatory agencies, but they have a higher capital cost than more recent treatment technologies because they require larger basins and structures. Traditional processes offer some operational flexibility and a degree of reliability that more modern technologies may lack. Larger process footprints associated with conventional clarification and filtration facilities that have lower average flow rates are used to determine minimum property size requirements. Mechanical dewatering is still included by necessity for this alternative, and planned facilities are designed to accommodate an ultimate capacity of 45 mgd. It is assumed that initial construction would be for a WTP capacity of 30 mgd, with expansion in 2065 to 45 mgd.

Alternative 5 Overview

Alternative 5 proposes construction of a new WTP on a property which is currently owned by the City. The property is located across the street from the current WTP property and is currently the site of both the City's skate park and the WTP residuals handling pond. Initial layouts were completed using both conventional processes and more technologically advanced processes, but it was determined that the property cannot practically accommodate conventional treatment processes and achieve 45 mgd ultimate capacity. The development of this alternative assumes the use of new treatment technologies with consolidated footprints. Since the old mill pond would be filled in under this alternative, additional washwater clarification basins are necessary to handle process wastewater before discharge to Skunk Creek. It is assumed that initial construction would be for a WTP capacity of 30 mgd, with expansion in 2065 to 45 mgd.

Alternative 3, 4, and 5 Planning Principles

The development of new WTP construction alternatives considers some general principles for planning which are different from those associated with the development of Alternatives 1 and 2 as presented in Chapter 7. These considerations include:

- Operations at the existing WTP would continue for the duration of the new plant construction. Production up to the rated 20 mgd capacity of the existing plant would continue to be available during peak periods without the potential need for water rationing.
- The duration of construction for a new WTP is shorter than the duration of construction of improvements at the existing WTP under either Alternative 1 or 2.
- Temporary facilities might be necessary during construction to allow for raw water supply and treated water disposal during startup and commissioning of the new WTP. This may present some disruption to production at the existing WTP, but impacts could be minimized by properly timing the interruptions.
- Construction of a new WTP would not begin as soon as construction of improvements under Alternative 1 or 2 because of the added time required for property acquisition, funding, and potentially more extensive permitting requirements.
- Site layout and construction sequencing of a new WTP are not subject to the constraints of Alternatives 1 and 2.
- Site access, internal traffic flow, parking, visual appeal, and the final site layout would be better optimized with a new WTP.

Property Considerations

For the purposes of connecting a new WTP to the existing water distribution system infrastructure, it is best to locate a new WTP in close proximity to the existing plant. The large-diameter distribution system piping in the vicinity of the existing plant can be used to adequately convey plant flows without significant upgrades. In addition, the existing raw water intake could be reused without major modification, and the old mill pond could continue to be used for process water discharge unless needed for other facility siting, as in Alternative 5. The cost and time to integrate a new treatment plant increases significantly with more distant sites because of pipeline construction costs and potential electrical infrastructure upgrades. Other challenges associated with a distant site include right-of-way acquisition, environmental permitting for a new intake, liquid waste stream handling, and additional engineering for needed pipelines and electrical infrastructure.

The scope of this study does not include the identification of a specific site for a new WTP under Alternatives 3 and 4. A cursory review of City GIS property, land use, topography, and critical areas information suggests that there are several viable properties within ½ mile of the existing plant. Without knowing specific property characteristics, the most useful methodology for developing new plant alternatives is to cover a full range of potential space and cost requirements at the conceptual level which meet project objectives. Alternative 3 represents the smallest reasonable footprint and Alternative 4 represents the largest reasonable footprint. The treatment process selections bracket cost ranges subject to the planning criteria presented in Chapter 6.

The property used for Alternative 5 is the parcel across the street from the City's existing WTP. The City already owns this property. In this alternative, the old mill pond would be drained and filled to accommodate construction of new WTP structures on the site. The site is too small to accommodate conventional treatment processes at 45 mgd capacity. Available information regarding the geotechnical conditions at the site suggest that construction of WTP structures on the site will be challenging and more costly than typical construction. The City would also be required to demolish the existing skate park located on the property and rebuild the skate park at another location.

Process Alternatives and Selection

This section presents the basis for developing Alternatives 3, 4, and 5. Each of the primary treatment processes and main support facilities are discussed below.

Intake, Raw Water Pump Station, and Rapid Mixing

Alternatives 3, 4, and 5 propose the same improvements for the intake, raw water pumping, and rapid mixing facilities. As with Alternatives 1 and 2, two additional pumps will be added to the existing intake facilities to expand its capacity to 30 mgd. Upgrades to securely tie the structure back into the riverbank to prevent failure during a seismic event or slide will also be made to the existing intake. As with existing plant scenarios, a new intake would be required for production rates in excess of 30 mgd. A new pumped diffusion system for chemical coagulant addition will be constructed at the new WTP site. Construction of a new WTP at any location requires additional raw water transmission piping to supply water to the new location.

Clarification

Without the space restrictions imposed by the existing site, the City may choose to use clarification technologies other than ballasted flocculation. Two locally proven technologies were selected through Chapter 6 pre-screening; these were conventional flocculation and sedimentation, and ballasted flocculation. Both processes use flocculation and sedimentation, but the ballasted process uses mechanical mixing, microsand addition, and inclined plate settlers to achieve floc maturation and settling with significantly less hydraulic retention time and surface area. These processes represent the high and low end of acceptable clarification rates per unit of surface area and, consequentially, the lowest and highest required surface areas and resulting footprints.

Alternative 3 Clarification

Ballasted flocculation is proposed in Alternative 3, with a proposed configuration of the equipment identical to the existing plant upgrade alternatives. The ballasted flocculation system and unit size would result in a settling rate of approximately 22 gpm/ft^2 at design capacity.

Alternative 4 Clarification

Alternative 4 proposes conventional flocculation and sedimentation which would make use of long, rectangular basins. The train consists of a tapered flocculation process followed by sedimentation. For sizing purposes, two rectangular basins would initially be constructed to achieve a combined capacity of 30 mgd. Each train would have three flocculation chambers with a detention time of 20 to 30 minutes, and a sedimentation basin sized to have a design surface overflow rate of 1 gpm/ft^2. These criteria represent conservative industry standards and the largest process footprint. Higher overflow rates might be achieved in practice, and could certainly be increased with the addition of inclined settlers to the basins. Evaluating these options could be made part of value engineering work completed during final design.

Alternative 5 Clarification

Ballasted flocculation is proposed in Alternative 5 with the same configuration and design flow rate as in Alternative 3. Conventional flocculation and sedimentation requires too much space for this alternative.

Ozone

As with Alternatives 1 and 2, space provisions are allocated for the new WTP alternatives to allow for the future addition of intermediate ozonation. Multiple contact basins sized to provide adequate contact time at full capacity would be installed between the clarification and filtration processes with liquid oxygen storage and ozone generators located nearby. The hydraulic profile of the new WTP should also allow water surface level differentials between the sedimentation basins and filters to allow for head loss associated with the ozonation process.

Filtration

Granular media filters are incorporated into all new WTP alternatives, as recommended in the pre-screening discussions in Chapter 6. New filter design would allow for air scouring during the backwashing process which is currently unavailable with the existing WTP filters. Air scour will reduce spent filter backwash water volumes and increase cycle durations. Filters would also be initially constructed with a deeper bed of granular media that allows higher filtration rates. A common channel for all clarified water can be used to distribute flow to all filters. With this approach, the number of filters does not need to be equally divisible by the number of clarification treatment trains. For Alternatives 3, 4, and 5, the filter layout is based on sizing each filter area to maintain uniform flow and air distribution while providing an appropriate filtration rate.

Alternatives 3 and 5 Filtration

Alternatives 3 and 5 use ten filters with an area of 440 ft^2 each to meet the 45 mgd capacity at a standard deep-bed filtration rate of 8 gpm/ft^2 with one filter off line. Six filters would be initially constructed to achieve 30 mgd at the same filtration rate without redundancy. This configuration would allow the plant to operate long enough to determine if a higher filtration rate can be used while still adequately meeting performance requirements. Other plants in the region commonly achieve 10 gpm/ft^2 with deep-bed media and optimized clarification upstream of the filters.

Alternative 4 Filtration

Alternative 4 uses a more conservative filtration rate of 5 gpm/ft^2 associated with standard granular media depths. This would require a larger ultimate configuration using twelve filters with an area of 520 ft^2 each, with eight initially constructed. Final design of this alternative might include initial construction of basins that could accommodate a future deep-bed media depth, thereby reducing the number of additional filters needed for an expanded plant capacity of 45 mgd.

Disinfection and Finished Water Storage

Alternatives 3, 4, and 5 assume the use of free chlorine to achieve the most stringent 0.5-log *Giardia* inactivation requirements for post-filtration disinfection. The contact time necessary in the clearwell to meet this disinfection requirement is conservatively based on current chlorination practices, historic seasonal demand and temperature profiles, and a well-baffled clearwell design. The clearwell should also have multiple cells, allowing a cell to be isolated and taken off line for inspection during lower demand periods. This configuration would also allow the clearwell to be operated at lower volumes during lower capacity production periods if a water quality benefit is achieved.

For all alternatives, sizing of the clearwell is based on initial construction of the volume required at the ultimate WTP capacity of 45 mgd. This approach eliminates the risks associated with expansion of this critical facility at a later date.

Different clearwell sizes were used for each alternative. The minimum volume necessary to meet disinfection requirements at 45 mgd is 1.1 million gallons. This size of clearwell is used for Alternatives 3 and 5. The clearwell proposed in Alternative 4 has a volume of 2.0 million gallons, reflecting the more conservative footprint of the new WTP planned in this alternative. Clearwell volume requirements will be determined during preliminary design for the selected alternative.

For all alternatives, the new clearwell is located directly beneath the new HSPS to minimize footprint and piping. Minimal space requirements to allow for the installation of future in-line UV units as an alternative future disinfection approach is also provided with the facility layouts.

High Service Pumping

As described above, Alternatives 3, 4, and 5 propose construction of a new HSPS in an enclosed building above the clearwell. The HSPS building footprint is sized to allow adequate spacing for pipe and support equipment between vertical turbine pump units, which would ultimately provide a firm pumping capacity of 45 mgd. The HSPS will also house the backwash pumps.

Chemicals

Chemical storage space needs and cost estimates are based on similar, comparable treatment facilities using similar treatment processes. Optimal chemical storage tank volumes and configurations would be developed as part of the final design process based on delivery schedules and operational preferences. All three alternatives include space provisions and layouts for chemical systems adequate to meet needs for a capacity of 45 mgd. Chemical systems might include multiple coagulants and filter aid systems, sodium hypochlorite, and future potential pH adjustment and ozonation.

Residuals and Solids Handling

Alternatives 1 and 2 included mechanical dewatering processes and equipment for processing filter backwash, filter-to-waste, and other residuals streams. Alternatives 3, 4, and 5 include similar thickening, storage and equalization, and dewatering facilities. The sizing of these facilities at the new WTP differ in that they are sized for an ultimate production capacity of 45 mgd rather than the 30 mgd capacity used in Alternatives 1 and 2.

Alternatives 3, 4, and 5 include an initial 50-foot diameter gravity thickener with an estimated loading rate of 10 lbs per day per square foot of surface area. Space to construct a second thickener of the same size is included for the future expansion. A storage and equalization tank for thickened solids, initially sized to handle four days of volume at 45 mgd capacity, is also included to offer operational flexibility. The mechanical dewatering building is sized based on the initial installation of two dewatering units and with provisions for one future dewatering unit, along with conveyance systems and a truck loading bay.

It is assumed that dewatered solids are conveyed by trucks for off-site disposal. An equalization basin is also included on site layouts for liquid process stream storage prior to discharge. For Alternatives 3 and 4, the old mill pond will be retained for clarification and discharge to Skunk Creek. Alternative 5 includes a washwater clarification basin to replace the old mill pond because the space occupied by the pond is required for other facilities.

Support Facilities

New WTP support facilities do not include specialty historic architectural finishing like those required at the existing WTP site. The support buildings under new WTP alternatives are based on layout and configuration of treatment facilities that have similar capacities, staffing levels, and support systems to that of Grants Pass. Project cost estimates for the support buildings are based on estimates developed for these similar facilities and assume CMU block walls and metal roof construction materials. Support buildings and areas are the same for Alternatives 3, 4, and 5 and are presented in Table 8-1. The operations and administration building would include staff work areas such as offices, meeting rooms, lockers and restrooms, lunch room, and records storage.

Table 8-1
Planning-Level Support Building Size Summary

Building	Dimensions (Length × Width × Height) (ft)	Area (ft^2)
Chemical Storage	105 × 60 × 20	6,300
Ozone Generator Room	25 × 75 × 20	1,875
Maintenance and Shop	40 × 60 × 15	2,400
Operations and Administration (Two stories)	60 × 50 × 30	6,000
Electrical Building	40 × 40 × 15	1,600

Summary of Alternatives

The treatment processes and facilities included in the new WTP alternatives offer a planning-level analysis of space requirements and allow a fair value comparison between all of the alternatives. Treatment processes common in footprint and cost between Alternatives 3, 4, and 5 include:

- Rapid mixing
- Finished water pumping

- Solids handling facilities
- Support buildings
- Backup power
- Future space provisions

Treatment facilities that differ in footprint and costs between Alternatives 3 and 5 and Alternative 4 include:

- Clarification
- Filtration
- Finished water storage
- Site civil, including site preparation, paving, yard piping, landscaping, security, etc.
- Distribution system integration, based on feasible sites for the different total property requirements

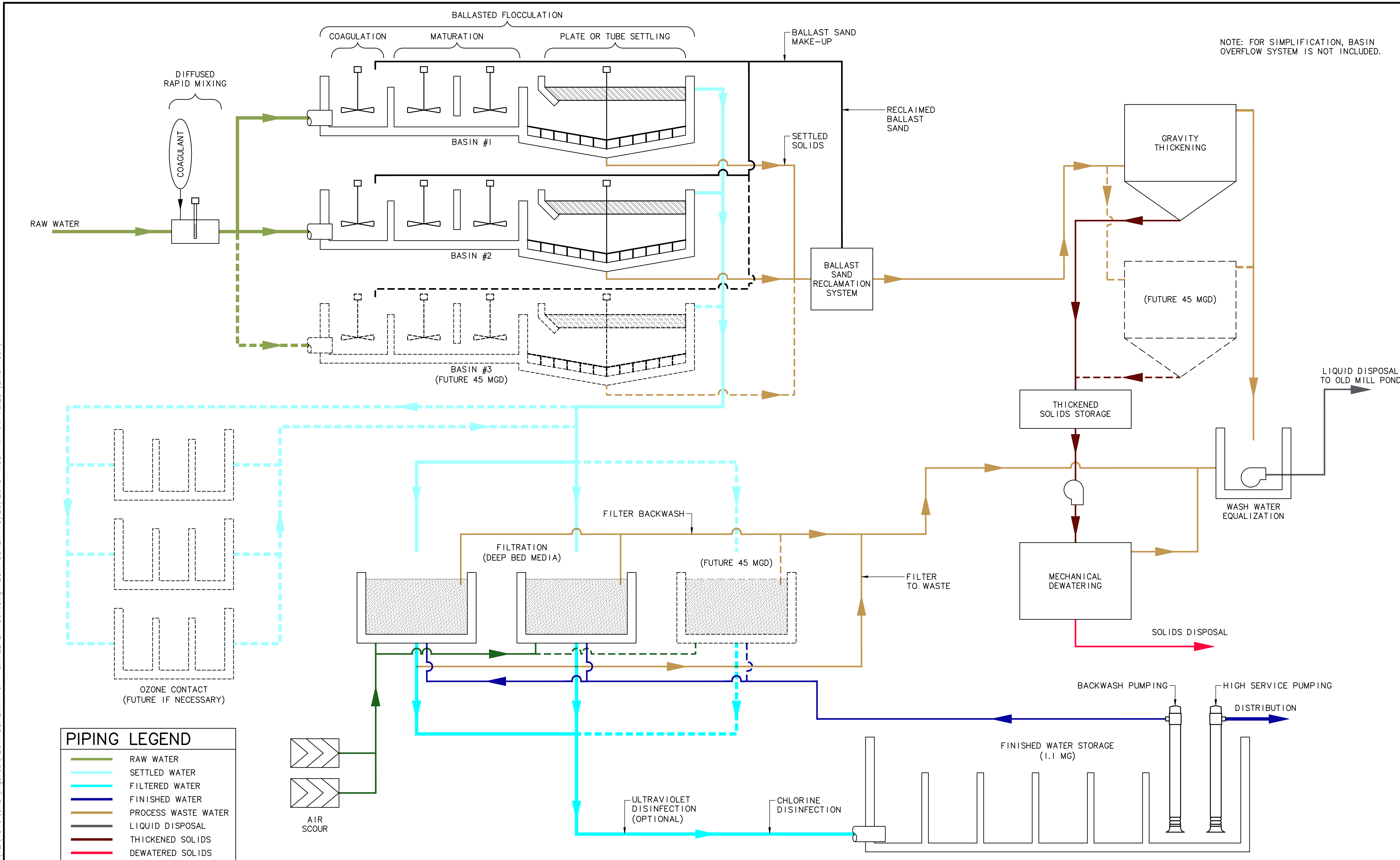
Alternative 5 differs from both Alternatives 3 and 4 in that it includes construction of washwater clarification basins.

Figures 8-1, 8-2, and 8-3 show process flow schematics for Alternatives 3, 4, and 5, respectively. Table 8-2 presents a comparison of the advantages and disadvantages for the three alternatives.

Facility Layouts and Construction Sequencing

Conceptual level site plans for Alternatives 3, 4, and 5 are shown in Figures 8-4, 8-5, and 8-6, respectively. The site plans shown for Alternatives 3 and 4 are intended to be representative of site layouts for each alternative without considering specific property or site orientation needs. It is expected that final site layouts would depend on the shape and orientation of the actual property. The site layout for Alternative 5 takes the unique dimensions and configuration of the City property into consideration. As the life expectancy of the new WTP structures would be expected to be a minimum of 75 years, the site plans include footprints associated with initial construction to achieve a capacity of 30 mgd and space provisions that allow expansion to an ultimate capacity of 45 mgd.

Based on the layouts, the property size requirements for a new WTP under Alternatives 3 and 4 ranges between 3.3 and 5.0 acres. These space requirements do not include additional space requirements that might become necessary for an irregularly-shaped parcel; unusable critical areas such as wetlands, steep slopes, or flood plains; unique land use codes or setbacks; or unfavorable geotechnical conditions. For the identified parcel under Alternative 5, all of the information known concerning such property constraints is considered.



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DESIGNED F. MARESCALCO
DRAWN F. MARESCALCO
CHECKED B. GINTER

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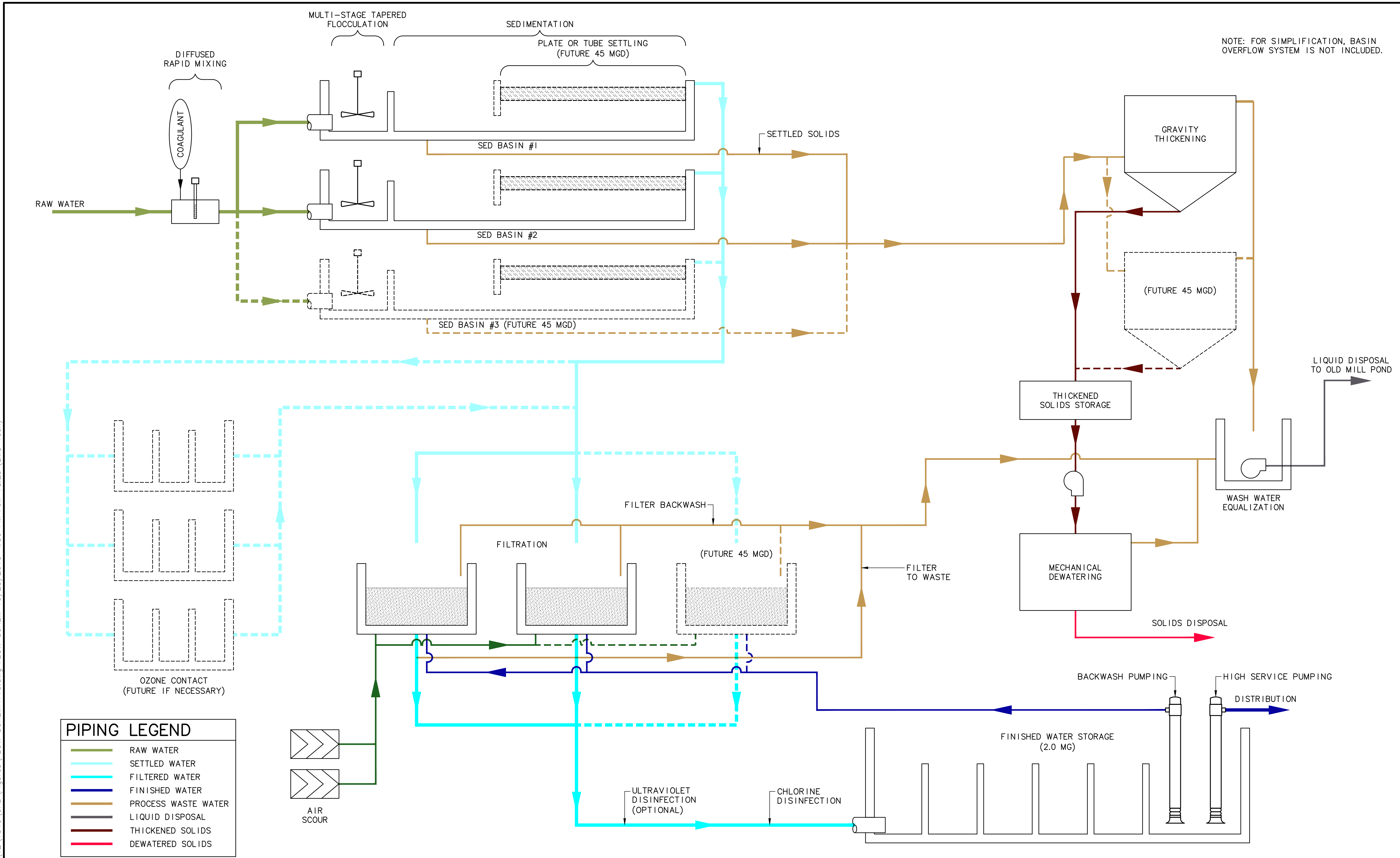
WATER TREATMENT PLANT FACILITY PLAN UPDATE
FIGURE 8-1
PROCESS FLOW SCHEMATIC - ALTERNATIVE 3

PAGE 8-9



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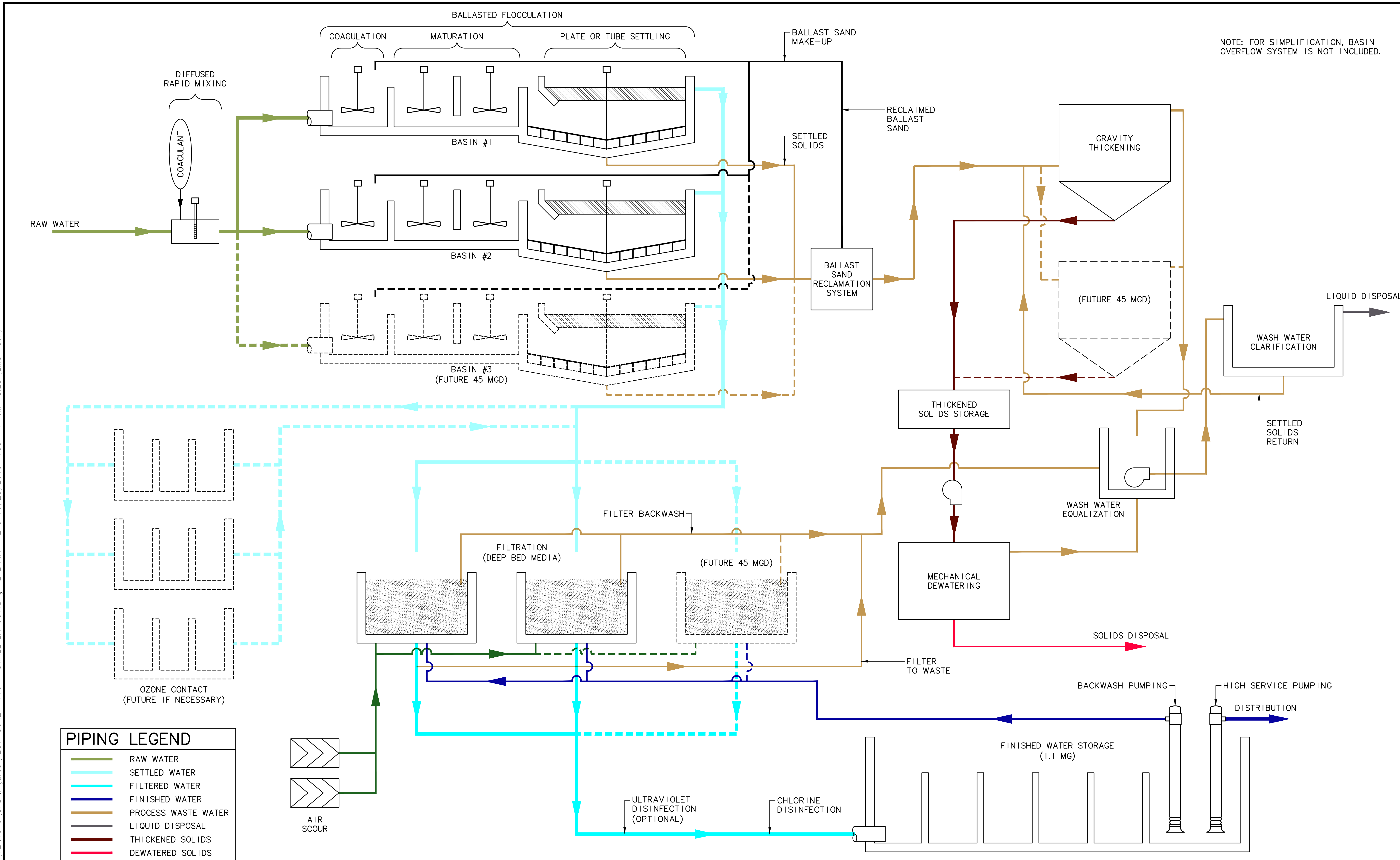
WATER TREATMENT PLANT FACILITY PLAN UPDATE
FIGURE 8-2
PROCESS FLOW SCHEMATIC - ALTERNATIVE 4



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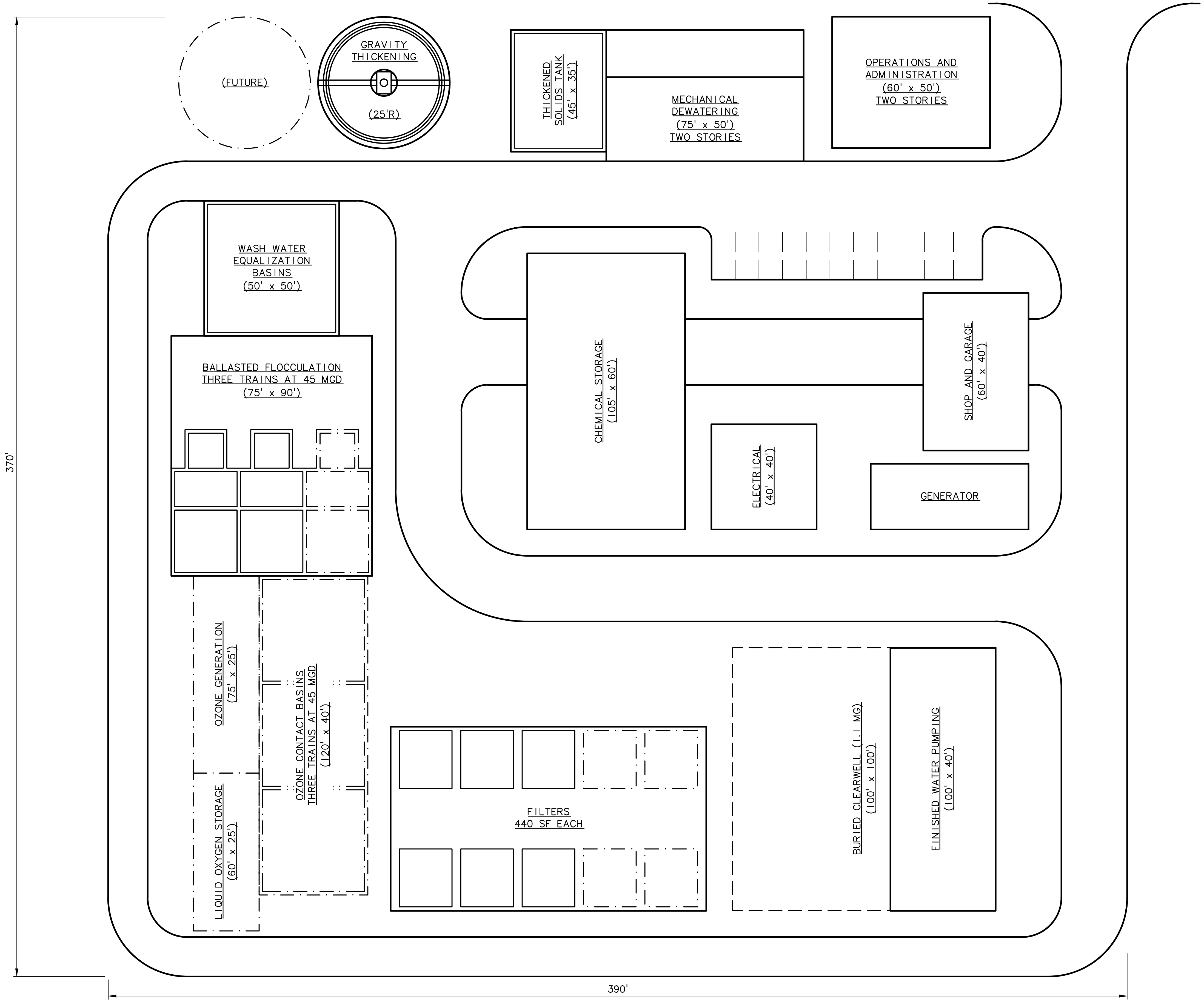
WATER TREATMENT PLANT FACILITY PLAN UPDATE
FIGURE 8-3
PROCESS FLOW SCHEMATIC - ALTERNATIVE 5

PAGE
8-11



APPROXIMATE REQUIRED AREA = 3.3 ACRES

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CHECKED C. KELSEY

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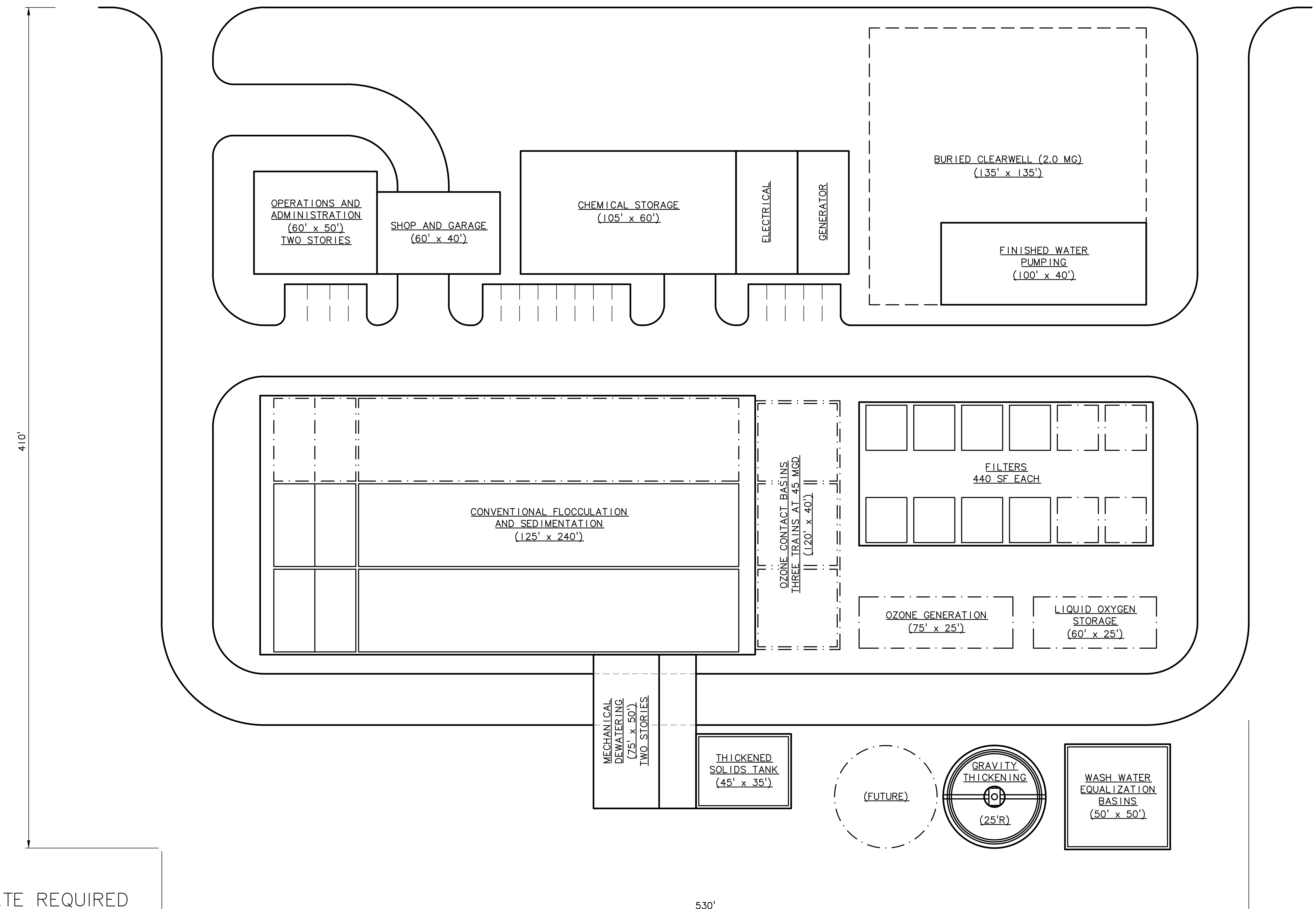
WATER TREATMENT PLANT FACILITY PLAN UPDATE
FIGURE 8-4
SITE LAYOUT - ALTERNATIVE 3



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WATER TREATMENT PLANT FACILITY PLAN UPDATE
FIGURE 8-5
SITE LAYOUT - ALTERNATIVE 4

PAGE 8-13

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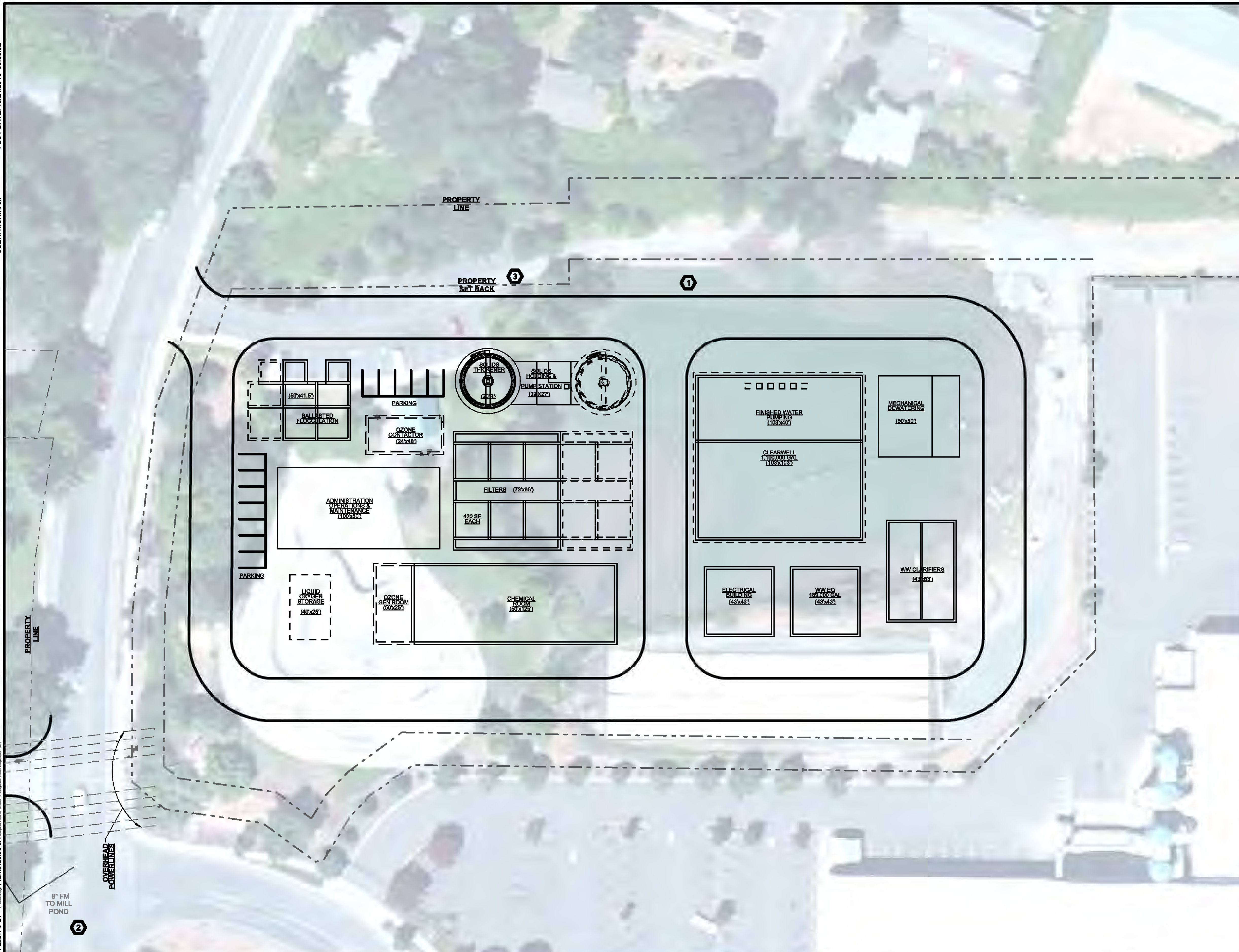

0 30 60

FULL SIZE: 1" = 30'
HALF SIZE: 1" = 60'

GENERAL SHEET NOTES

1. PROPOSED NEW WTP WILL BE 30 MGD. EXPANSION TO 45 MGD MAY BE ACHIEVED IN THE FUTURE. THIS WOULD ELIMINATE NEED TO BUILD A NEW 15 MGD WTP ON THE EXISTING SITE AND THEREFORE WOULD ELIMINATE THE NEED TO OPERATE TWO UNIQUE WTP FACILITIES FOR 4-5 MONTHS DURING PEAK DEMAND PERIOD.
2. NEW WASHWATER CLARIFICATION SYSTEM WILL BE NEEDED WITH NEW WTP SINCE OLD MILL POND IS BEING RECLAIMED
3. CONSTRUCTION STAGING SPACE MAY BE AVAILABLE ON THE PROPOSED NEW WTP SITE AFTER RECLAMATION OF THE OLD MILL POND.
4. EXISTING WTP SITE WILL BE ABANDONED AFTER START-UP OF NEW WTP. COULD CONTINUE TO USE THE SPACE FOR MISCELLANEOUS FUNCTIONS.
5. LOT SIZE IS APPROXIMATELY 5.1 ACRES; 3.5 ACRES AFTER SETBACKS. OLD MILL POND IS APPROXIMATELY 1.4 ACRES.

SHEET KEYNOTES

1. OLD MILL POND WILL BE RECLAIMED IN ITS ENTIRETY, BUT WILL RETAIN THE DISCHARGE LOCATION TO SKUNK CREEK.
2. FORCE MAIN FROM EXISTING WASHWATER EQUALIZATION BASIN TO OLD MILL POND WILL NEED TO BE RELOCATED TO TEMPORARY WASHWATER CLARIFICATION SYSTEM TO KEEP EXISTING WTP IN SERVICE.
3. ASSUMED 50' SETBACK ON WEST EDGE OF PROPERTY ADJACENT TO RESIDENTIAL ZONED PROPERTY AND 20' SETBACK ON SOUTH AND EAST EDGE OF PROPERTY ADJACENT TO M STREET AND INDUSTRIAL ZONED PROPERTY.

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				AS NOTED	DESIGNED A. NISHIHARA DRAWN A. NISHIHARA CHECKED P. KREFT	MSA	MWH	City of Grants Pass	WATER TREATMENT PLANT FACILITY PLAN UPDATE FIGURE 8-6 SITE LAYOUT - ALTERNATIVE 5	8-14

Table 8-2
Alternatives 3,4 and 5 Comparison Summary

Alternative	Advantages	Disadvantages
3	• Lowest initial construction and expansion costs • Smaller basin structures to maintain • Less property required	• Additional operator oversight of ballasted flocculation process • More mechanical systems to maintain • Additional regulatory approval may be required
4	• Proven clarification technologies for Grants Pass' Rogue River supply • Larger clearwell offers system storage reliability in addition to disinfection • Process retrofitting might offer capacity increases without new basin construction	• Requires more property • Higher initial construction and expansion costs
5	• City already owns the property • Smaller basin structures to maintain • Close to existing WTP and intake structure • Lower cost of connecting WTP to existing raw water and finished water pipelines.	• Geotechnical conditions of property are likely challenging • Permitting may be more difficult due to proximity to critical areas • Additional operator oversight of ballasted flocculation process • More mechanical systems to maintain • Additional regulatory approval may be required • Wetland mitigation and construction of a new skate park would be necessary

For each alternative, a single uninterrupted construction period of 28 months is estimated. Alternative 5 might require an increased duration for site preparation due to demolition and potential unsuitable soils. The construction period assumes that the contractor is allowed use of the entire undeveloped property for the duration of construction. Alternative 5 might require use of part of the existing WTP for staging and storage, if the City is willing to allow this. This assumption results in a shorter construction duration than those estimated for Alternatives 1 and 2 as presented in Chapter 7. The estimated construction duration for Alternatives 1 and 2 is approximately 48 to 54 months due to phasing of improvements.

Project Cost Estimates

Tables 8-3, 8-4, and 8-5 present planning-level project cost estimates for Alternatives 3, 4, and 5, respectively. The anticipated total project costs are expressed in 2013 dollars. These costs are for the initial construction under each alternative and will result in a new WTP with a rated capacity of 30 mgd. Tables 8-3, 8-4, and 8-5 do not show costs for expansion in 2065. A cursory review of City GIS property, land use, topography, and critical areas information suggests that there are several viable properties, in addition to the skate park property, within ½ mile of the existing plant. Costs associated with integrating a new WTP into the existing system were developed based on this general vicinity. Actual property acquisition and integration costs for Alternatives 3 and 4 will vary with site.

It is anticipated that construction of a new WTP would likely not begin for several years to allow time for property acquisition, design, environmental and regulatory permitting, public acceptance, financing, and bidding. Expansion to 45 mgd under any alternative would not take place until approximately 2065. Because the timing of capital outlays is different between alternatives, the net present value analysis of alternatives is presented in Chapter 9 for equivalent cost comparisons of all the alternatives.

Estimated project costs were developed using recent local industry information from estimates, bid tabs, vendor quotations, and other material unit costs for similar treatment facilities. Line item estimates represent installed costs that include materials, labor, equipment, and contractor overhead and profit.

These opinions of probable cost are based on planning-level analysis and a low level of project definition. These estimates are Class 5 estimates as defined in Chapter 7. They are subject to the following list of assumptions.

- No cost has been included for unusual site conditions requiring environmental remediation, poor soil conditions, or demolition of existing structures in Alternatives 3 or 4. Costs for extra foundations and remediation of poor soil conditions in Alternative 5 are based on similar projects. The cost for wetlands mitigation is based on an average cost of wetland mitigation banks in Oregon. Skate park construction costs are based on information associated with construction of the current park and appropriate escalation factors.
- No cost has been included associated with demolition of the existing WTP once the new plant is online.
- Cost for property acquisition in Alternatives 3 and 4 is based on a conservative assumption of recently assessed suitable properties in Grants Pass.
- Costs for piping connections to the existing raw water intake and the distribution system in Alternatives 3 and 4 are representative values and may vary widely depending on final site location. The cost for Alternative 5 is based on smaller assumed lengths because the location is known. All of the alternatives assume 48-

inch diameter steel pipe in public right-of-way. No cost for private easements is included.

- Costs for a permanent standby generator to produce approximately 5 MGD of finished water are included.
- No allowance is included for premium architectural finishes on plant structures. Concrete masonry unit construction with architectural metal roofing is assumed for building costs.
- Site civil and finishing costs will vary based on actual site size and layout.

Table 8-3
Alternative 3 Project Cost Estimate

Facility	Estimated Cost (2013 USD)
Mobilization and General Conditions (8 percent)	$2,400,000
Intake and Raw Water Pump Station Improvements	$1,450,000
Raw Water Transmission Main	$1,000,000
Rapid Mixing	$340,000
Clarification	$3,200,000
Filtration	$5,200,000
Treated Water Storage and Chlorine Contact Basin	$1,570,000
Finished Water Pumping and Metering	$4,400,000
Finished Water Transmission	$380,000
Process Wastewater Equalization Basin	$390,000
Backwash Force Main to Old Mill Pond	$400,000
Gravity Thickener	$1,500,000
Thickened Solids Storage Tank	$500,000
Mechanical Dewatering Structure and Equipment	$1,900,000
Chemical Storage and Feed Building and Equipment	$2,000,000
Maintenance, Operations, and Administration Building	$2,250,000
Site Electrical	$2,500,000
Miscellaneous Yard Piping	$260,000
Site Civil	$160,000
Site Finishing and Security	$80,000
Subtotal: Construction without Contingency	**$31,900,000**
Contingency (20 percent)	**$6,400,000**
Subtotal: Construction with Contingency	**$38,300,000**
Engineering, Permitting, Construction Management Services, Legal, Administration (25 percent)	**$8,000,000**
Property Acquisition	**$1,100,000**
Total Estimated Project Cost with Contingencies	**$47,400,000**

Table 8-4
Alternative 4 Project Cost Estimate

Facility	Estimated Cost (2013 USD)
Mobilization and General Conditions (8 percent)	$2,800,000
Intake and Raw Water Pump Station Improvements	$1,450,000
Raw Water Transmission Main	$1,260,000
Rapid Mixing	$340,000
Clarification	$4,500,000
Filtration	$7,500,000
Treated Water Storage and Chlorine Contact Basin	$2,630,000
Finished Water Pumping and Metering	$4,400,000
Finished Water Transmission	$380,000
Process Wastewater Equalization Basin	$390,000
Backwash Force Main to Old Mill Pond	$400,000
Gravity Thickener	$1,500,000
Thickened Solids Storage Tank	$500,000
Mechanical Dewatering Structure and Equipment	$1,900,000
Chemical Storage and Feed Building and Equipment	$2,000,000
Maintenance, Operations, and Administration Building	$2,225,000
Site Electrical	$2,500,000
Miscellaneous Yard Piping	$400,000
Site Civil	$240,000
Site Finishing and Security	$100,000
Subtotal: Construction without Contingency	**$37,400,000**
Contingency (20 percent)	**$7,500,000**
Subtotal: Construction with Contingency	**$44,900,000**
Engineering, Permitting, Construction Management Services, Legal, Administration (25 percent)	**$9,400,000**
Property Acquisition	**$1,100,000**
Total Estimated Project Cost with Contingencies	**$55,400,000**

Table 8-5
Alternative 5 Project Cost Estimate

Facility	Estimated Cost (2013 USD)
Mobilization and General Conditions (8 percent)	$2,700,000
Intake and Raw Water Pump Station Improvements	$1,450,000
Raw Water Transmission Main	$250,000
Rapid Mixing	$340,000
Clarification	$3,200,000
Filtration	$5,200,000
Treated Water Storage and Chlorine Contact Basin	$1,570,000
Finished Water Pumping and Metering	$4,400,000
Finished Water Transmission	$300,000
Process Wastewater Equalization Basin	$390,000
Washwater Clarification Basins	$600,000
Gravity Thickener	$1,500,000
Thickened Solids Storage Tank	$500,000
Mechanical Dewatering Structure and Equipment	$1,900,000
Chemical Storage and Feed Building and Equipment	$2,000,000
Maintenance, Operations, and Administration Building	$2,250,000
Site Electrical	$2,500,000
Miscellaneous Yard Piping	$260,000
Construction Dewatering	$700,000
Temporary Washwater Clarification Facilities	$250,000
Site Preparation	$1,000,000
Additional Cost for Building and Structure Pile Foundations	$3,000,000
Site Finishing and Security	$120,000
Subtotal: Construction without Contingency	**$36,400,000**
Contingency (20 percent)	**$7,300,000**
Subtotal: Construction with Contingency	**$43,700,000**
Engineering, Permitting, Construction Management Services, Legal, Administration (25 percent)	**$9,100,000**
Wetlands Mitigation Cost	**$600,000**
Property Acquisition and Skate Park Construction	**$800,000**
Total Estimated Project Cost with Contingencies	**$54,200,000**

A new WTP constructed under any new WTP alternative would require expansion from a capacity of 30 mgd to a capacity of 45 mgd in approximately 2065. Expansion to 45 mgd under any alternative requires the construction of a new intake structure and raw water pump station and the construction of additional treatment trains. Estimated project costs for this expansion for each alternative are shown in Table 8-6. These expansion costs affect the net present value of alternatives which are developed and presented in Chapter 9.

Table 8-6
Estimated Project Cost for Plant Expansions in 2065

Alternative	Estimated Project Cost (2013 USD)
3	$33,000,000
4	$36,700,000
5	$37,000,000

Note: This is a Class 5 estimate. The accuracy ranges from –30 percent to +50 percent.

Near-Term Improvements

During construction of a new WTP, the existing plant would continue to supply drinking water to the system. The structural condition of the clearwell at the existing WTP is of such concern that the team investigated a separate project which would increase short-term disinfection and supply reliability at the existing WTP. A project cost of approximately $450,000 was developed based on a combination of structural fortification within the clearwell and plumbing provisions to allow emergency insertion of post-filtration UV disinfection units if the clearwell were to fail. This project cost was included in economic calculations for new treatment plant alternatives in order to provide a conservative financial comparison to other alternatives.

Based on further investigation of the feasibility of completing such improvements in the clearwell, including recent analysis of potential structural improvements, it was concluded that such improvements cannot be completed while maintaining adequate water production to meet the City's water demands. Because of these difficulties and the fact that no investment can effectively mitigate damage in a major event, the project was not investigated any further.

Summary

Alternatives 3, 4, and 5 propose constructing a new WTP on a new site and each have a range of initial capital costs and operational implications, similar to those presented in Chapter 7. The alternatives also offer differing approaches to layout and configuration, each with varying advantages, disadvantages, and estimated project costs. They also define a range of required property size for the purposes of selecting an appropriate location. A comparative evaluation of all five alternatives, which includes social and environmental considerations in addition to the costs developed, is presented in Chapter 9 and is used as the basis for capital improvement recommendations.

CHAPTER 9
CAPITAL IMPROVEMENT PROGRAM RECOMMENDATIONS

Introduction

Over the past decade, evaluation of alternative utility engineering solutions through the use of TBL evaluations has become commonplace. TBL decision-making is a process where evaluations consider social and environmental impacts in addition to the economic aspects of a proposed project.

Within the water and wastewater industries, TBL evaluations have been employed for projects where the capital investment and anticipated longevity of constructed facilities have long-term impacts to the image and culture of a community. Treatment facilities are the most common types of projects where TBL evaluations have been used. By including community leaders during the TBL process for evaluating alternative improvements, a measure of public involvement and consensus building can be achieved. The recommended project solution then becomes more reflective of the community's culture.

Due to the importance of this CIP, an Advisory Committee of community leaders and City Council (Council) members was assembled to assist in the evaluation and recommendation of a preferred alternative from those presented in Chapters 7 and 8. City Public Works employees integral to the project also participated to offer input on operational impacts, zoning and land use information, and necessary steps in the City approval process.

A series of four workshops were conducted over a three-month period with the Advisory Committee using an independent facilitator. The MSA Team's role in these workshops was to present information on the alternatives developed and to answer technical questions posed by committee members. Below is a summary of activities for each of the four workshops:

- Workshop 1 (May 14, 2013): Introduction of Advisory Committee members, consulting team, and public works employees; tour of the existing WTP; and dissemination of suggested TBL evaluation criteria. Draft text for Chapters 1 through 8 of this Facilities Plan Update was also made available for review.
- Workshop 2 (May 30, 2013): Discussion and finalization of TBL criteria and individual weighting; presentation and questions-and-answers period for each of the capital improvement alternatives; distribution of TBL scoring matrix spreadsheets to committee members for review and scoring.
- Workshop 3 (June 4, 2013): Review of information requested by the committee concerning alternative property constraints (setbacks and relocation of overhead power lines); discussion and scoring of alternatives; request for development of a fifth alternative.
- Workshop 4 (July 15, 2013): Presentation of requested Alternative 5, finalization of committee scoring, and development of recommendation to Council.

The following sections discuss the development of TBL evaluation criteria, considerations included within each evaluation category, scoring of alternatives, and the CIP recommendation. The final sections of the chapter outline an implementation plan for the recommended program.

Development and Weighting of TBL Criteria

For the benefit of the Advisory Committee, a list of suggested criteria for each of the TBL categories was developed from similar projects. The committee then modified and finalized the criteria, establishing appropriate weighting for each through group discussion. Each criterion was assigned a weighting from 1 to 5, with 5 representing the highest level of importance. The final criteria and weightings are offered in Table 9-1. Definitions for the economic, social, and environmental categories are discussed in the following sections.

Economic Measures

Economic variables are those that deal with the flow of money or change in financial value. These factors consider income or expenditures, taxes, business climate factors, and employment. A net present value analysis was performed by the MSA team and presented to the Advisory Committee during the workshops. The net present value analysis is summarized later in this chapter.

Social Measures

Social variables include measurements of education, equity, access to resources, health and well-being, quality of life, and social capital. The social variables identified by the Advisory Committee as most important for the selection of an alternative are described below.

Safe water supply

A safe water supply is one that is free of pathogens and microorganisms that, if ingested, can cause mild to severe illness and even death. In addition to the absence of pathogens, a safe water supply should be free of cancer-causing toxins such as heavy metals, pesticides, herbicides, and solvents.

Reliable Water Supply

Western Oregon borders the Cascadia subduction zone. A comprehensive study lead by researchers at Oregon State University published by the USGS in 2012 predicted that if an earthquake were to occur along the Cascadia fault, it would have a magnitude between 8.7 and 9.2 as calculated by the Richter magnitude scale. Buildings and infrastructure not up to current seismic code could be compromised or completely destroyed in the event of such a large earthquake. Grants Pass has only one source of drinking water. The reliability of the water supply during emergencies such as a fire, earthquake, or drought is critical to the community. Structures, mechanical equipment, and electrical infrastructure supporting the WTP need to be reliable to ensure that water is available whenever it is needed.

Table 9-1
Scoring Criteria and Weighting Summary

Criteria		**Weighting**
Economic Measures		
1	Capital cost	5
2	Operations and maintenance costs	5
3	Net present value	5
4	Rate impact	2
5	Sustaining existing industry	3
6	Job growth opportunities	4
7	Construction period impacts	1
	Economic Measures Weighting Subtotal	25
Social Measures		
8	Safe water supply	4
9	Reliable water supply	4
10	Community growth	3
11	Operability and staff accommodations	1
12	Construction impact	2
13	Historical values	4
	Social Measures Weighting Subtotal	18
Environmental Measures		
14	Proximity of new facilities to existing intake	1
15	Energy efficiency of structures	5
16	Solids handling	4
17	Electricity consumption	3
18	Change in land use	5
19	Construction period impacts	2
	Environmental Measures Weighting Subtotal	20
	Total Weighted score	**63**

Community Growth

Last year, MSA did a planning study for the City of Grants Pass and projected that the population will grow to 90,173 people by the year 2065. This increase in population will lead to increased demand for potable water. In addition, potential new industrial and commercial development that comes with population growth can further increase water demand.

Operability and Staff Accommodations

A good WTP design will allow for safe, efficient, straightforward operation by plant staff. Design elements such as the use of guard rails, automated pumps, leak detection systems, color coding, telemetry, and the elimination of tripping hazards are just a few examples of the many considerations engineers and contractors make to ensure operability for a safe community asset.

Construction Impact

Construction activities can have a significant impact on residents' quality of life. During construction, residents may be exposed to loud noises, trucks and heavy machinery driving through their neighborhoods, a temporary decline in air quality, and the potential for water service interruptions which may be accidental or necessary for certain phases of construction.

Historical Values

The City of Grants Pass is currently served by the second-oldest water treatment plant in the State of Oregon. The plant was designated an American Water Landmark by AWWA in 1998 and holds nostalgic value for many residents.

Environmental Measures

Environmental variables consider natural resources and the potential impacts a project may have on them. Some factors include air and water quality, energy consumption, natural resources, solid and toxic waste, and land use. Brief descriptions of the environmental variables that the Committee considered during its analysis are presented below.

Proximity of New Facilities to Existing Intake

The closer a WTP is to the location of its intake, the less the surrounding environment is impacted. Water must be conveyed to the WTP from the intake via large-diameter piping, which can be challenging to install without significant environmental impacts.

Energy Efficiency of Structures

Energy-efficient structures have several environmental benefits. These benefits include, but are not limited to, minimizing air pollution, reducing carbon footprint, decreasing thermal pollution, and reducing greenhouse gas emissions.

Solids Handling

Water treatment plant solids consist primarily of silts, sands, and organics that are transported with the river water through the intake and either settled out or filtered out at the WTP. A good solids handling plan can have many environmental benefits, but a poor solids handling plan can result in negative environmental impacts. There are many things to consider when developing a plan for solids handling including the presence of treatment chemicals, off-hauling, facility footprint, and energy usage.

Electricity Consumption

The way a WTP is designed and operated has far-reaching impacts to the plant's consumption of electrical power. New structures and treatment processes normally offer more energy conservation potential than retrofitting existing processes. Hydraulic conditions, plant location, distribution system design, valves, automated controls, and timing of production are just a few of the aspects of a WTP that affect energy consumption.

Change in Land Use

Choosing an alternative that requires a new WTP site would likely require a change in the land use designation at the new site. It is better to locate a new WTP so that it does not disrupt habitat for wildlife.

Construction Period Impacts

During construction, workers and the environment are at a heightened risk of impact. There may be exposure to toxic fumes; soil contamination; excessive runoff into surrounding surface water bodies; disturbance of lead-based paint, caulk containing PCBs, or asbestos; and inadvertent spills of asphalt or chemicals. Sound construction practices can reduce these risks and the risks are different between working on an existing structure and building a new structure.

Evaluation of Alternatives

This section describes how each alternative was evaluated against the criteria defined by the Advisory Committee. A net present value analysis was used to evaluate each alternative's economic aspects. The detailed analyses of each alternative with respect to social and environmental considerations were performed by the Advisory Committee during the course of its workshops.

Economic Considerations

A net present value analysis was performed to compare alternatives on the basis of cost. The net present value is a better way to compare costs between the alternatives than comparing the project costs developed in Chapters 7 and 8 because each alternative proposes the expenditure of different amounts of money at different times. In the present value analysis, each expenditure is escalated to the anticipated year of occurrence and then discounted back to a common year. In this analysis, the common year is 2013.

The Baseline Alternative, briefly described in Chapter 6, proposes to make approximately $12.5 million in structural upgrades to the existing WTP structures. This alternative was not included in the detailed economic study for the following reasons:

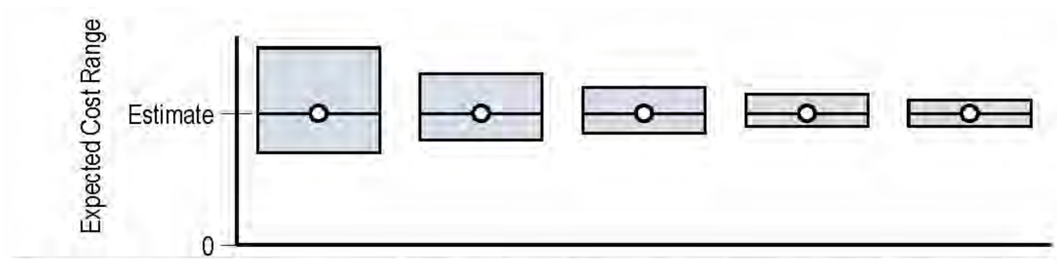
- Some of the structures that would initially be renovated would be demolished during later improvements needed to increase plant capacity. A significant portion of the investment to renovate those structures would be wasted.
- The existing plant would still operate inefficiently, so annual operations and maintenance costs would continue to be higher than other alternatives.
- This alternative does not address short-term capacity needs, long-term capacity needs, or structural longevity needs beyond year 2065. A new WTP with a capacity of 45 mgd would need to be built in a new location in 2065. The approximate cost of this new WTP would be $75.4 million (2013 dollars).

The Baseline Alternative was included during the workshops, however, and the Advisory Committee's analysis confirmed that this alternative is not a desirable solution.

Project Definition Level and Cost Index

The American Association of Cost Engineers (AACE) defines classes of cost estimating based on the level of project definition. The accuracy of cost estimates varies with the level of project definition. As shown in Figure 9-1, estimating accuracy improves as project definition increases.

Figure 9-1
Cost Estimating Accuracy Based on Level of Project Definition



Estimate Class	Class 5	Class 4	Class 3	Class 2	Class 2
Level of Project Definition	1%	10%	30%	60%	90%
Accuracy Range	-30%/+50%	-20%/+30%	-15%/+20%	-10%/+15%	-10%/+10%

Adapted from AACE International Recommended Practice No. 18R-97

AACE considers the type of planning work done for this Facility Plan Update to be a very low level of project definition, corresponding to somewhere between 1 and 3 percent complete. It is likely that changes in the construction market or overall economy, new regulatory requirements, site conditions, and other factors will affect the total project cost.

The costs prepared for this Facility Plan Update are subject to the accuracy range of –30 percent to +50 percent as shown in Figure 9-1.

Construction costs are also subject to change with time. All of the costs used in this chapter are in 2013 dollars. It will be necessary to adjust these present cost estimates in the future. An indexing method is useful for this purpose. The Engineering News Record (ENR) Construction Cost Index (CCI) is a commonly used index for this purpose. For purposes of future cost estimate updating, the December 2013 ENR CCI for Seattle, Washington is 10142.65.

Capital Costs

For the present value analysis, an escalation rate of 2 percent was assumed. A discount rate of 3 percent was used. These parameters are used to predict the effects of deferring project costs. The escalation rate is a measure of the general fall in the purchasing value of money, also called inflation. The discount rate reflects the value to the City in deferring capital costs. The analysis is carried through 2095 which is consistent with the planning period identified in Chapter 6.

<u>Alternatives 1 and 2</u>

Alternatives 1 and 2 propose improvements to existing plant structures and processes as discussed in Chapter 7. These improvements must occur in separate phases because the plant must remain online during construction. The capital costs for these improvements were shown in Chapter 7 and each line item was assigned to a specific project phase. To develop phase costs, the capital costs for items associated with each phase were added together and associated project costs were distributed proportionally. Phases are anticipated to occur three years apart and begin in year 2018. As discussed in Chapter 7, Alternative 1 requires the construction of a new 45-mgd plant in 2065 and Alternative 2 requires the construction of a new 15-mgd plant in 2065. Tables 9-2 and 9-3 show the net present value for project costs associated with Alternative 1 and Alternative 2, respectively.

Table 9-2
Alternative 1 Project Cost Present Value Summary

Description	Current Cost	Year Spent	Escalated Cost	Present Value
Phase A	$9,000,000	2018	$9,936,727	$8,571,508
Phase B	$12,700,000	2021	$14,880,074	$11,746,468
Phase C	$15,700,000	2024	$19,520,977	$14,102,369
New 45-mgd Plant Construction	$75,400,000	2065	$211,144,745	$45,398,823
			Net Present Value	**$79,819,168**

Note: This is a Class 5 estimate. The accuracy ranges from –30 percent to +50 percent.

Table 9-3
Alternative 2 Project Cost Present Value Summary

Description	Current Cost	Year Spent	Escalated Cost	Present Value
Phase A	$12,300,000	2018	$13,580,194	$11,714,395
Phase B	$27,200,000	2021	$31,869,135	$25,157,790
Phase C	$17,300,000	2024	$21,510,376	$15,539,553
New 15-mgd Plant Construction	$47,202,000	2065	$132,181,091	$28,420,627
			Net Present Value	**$80,832,364**

Note: This is a Class 5 estimate. The accuracy ranges from –30 percent to +50 percent.

Alternatives 3, 4, and 5

Alternatives 3, 4, and 5 propose construction of a new WTP at a new site as discussed in Chapter 8. If any alternative were to be implemented, the City may need to construct immediate improvements at the existing WTP to ensure disinfection reliability while planning and building the new facilities. The construction of a new WTP is not phased like improvements to the existing plant are, but an expansion will be required in 2065 under any alternative to increase plant capacity from 30 mgd to 45 mgd. The need for property acquisition and environmental studies and permitting is anticipated to delay completion of a new WTP to the year 2020. Tables 9-4, 9-5, and 9-6 show the net present value for project costs associated with Alternatives 3, 4, and 5, respectively.

Table 9-4
Alternative 3 Project Cost Present Value Summary

Description	Current Cost	Year Spent	Escalated Cost	Present Value
Near-Term Disinfection Reliability	$450,000	2013	-	$450,000
Initial Construction to 30 mgd	$47,400,000	2020	$54,447,701	$44,270,963
Expansion of WTP to 45 mgd	$32,956,000	2065	$92,287,616	$19,843,019
			Net Present Value	**$64,563,982**

Note: This is a Class 5 estimate. The accuracy ranges from –30 percent to +50 percent.

Table 9-5
Alternative 4 Project Cost Present Value Summary

Description	Current Cost	Year Spent	Escalated Cost	Present Value
Near-Term Disinfection Reliability	$450,000	2013	-	$450,000
Initial Construction to 30 mgd	$55,400,000	2020	$63,637,186	$51,742,856
Expansion of WTP to 45 mgd	$36,668,000	2065	$102,682,434	$22,078,038
			Net Present Value	**$74,270,893**

Note: This is a Class 5 estimate. The accuracy ranges from –30 percent to +50 percent.

Table 9-6
Alternative 5 Project Cost Present Value Summary

Description	Current Cost	Year Spent	Escalated Cost	Present Value
Near-Term Disinfection Reliability	$450,000	2013	-	$450,000
Initial Construction to 30 mgd	$54,200,000	2020	$62,258,763	$50,622,072
Expansion of WTP to 45 mgd	$36,990,000	2065	$103,584,140	$22,271,916
			Net Present Value	**$73,343,988**

Note: This is a Class 5 estimate. The accuracy ranges from –30 percent to +50 percent.

Operations and Maintenance Costs

All annual costs are projected based on recent existing plant operating cost records and are increased proportional to projected demand increases and escalation rates. At this planning level, no difference in annual operational costs can be justified between alternatives 1, 3, 4, and 5 even though some technologies might require slightly more power, slightly less chemical usage, or some other subtle difference. Alternative 2 has higher labor costs starting in 2065, when two separate treatment plants would begin to operate. Table 9-7 shows the assumed annual 2013 value for each operating cost category and the lump sum of each operating cost over the entire 75-year planning period in 2013 dollars.

Summary of Net Present Value Analysis

The total net present value of each project is the sum of the annual costs and the capital costs, discounted back to the same year. Table 9-8 shows a summary of all of the alternatives with the complete lifecycle cost in present value. According to the analysis, building a new WTP has a lower lifecycle cost than upgrading the existing WTP.

Table 9-7
Operations and Maintenance Costs Present Value Summary[1]

Description	Annual Cost in 2013 US Dollars	Total Present Value[2]
Power	$287,873	$32,368,433
Labor	$601,280	$61,111,423
Chemicals	$176,097	$19,759,248
General Maintenance and Equipment Recovery	$339,915	$34,161,690
Net Present Value, Alternatives 1, 3, 4, and 5		**$147,400,793**
Additional Cost to Manage Two Plants[3]	$300,640	$11,992,689
Net Present Value, Alternative 2		**$159,393,482**

Notes
1. Values are scaled annually according to increases in production and general inflation
2. Lump sum of all annual payments made over 75-year planning period
3. Alternative 2 only
4. This is a Class 5 estimate. The accuracy ranges from –30 percent to +50 percent.

Sensitivity to Economic Conditions

The present value analysis shows which alternative has the lowest overall lifecycle cost in 2013 dollars. The analysis relies on planning criteria established in Chapter 6 and assumptions which are representative of normal industry and economic conditions. It is possible that these conditions could change. Therefore, the sensitivity of the analysis was investigated by modifying parameters which reflect economic conditions, demand projections, and assumptions about risk associated with construction at the existing WTP. This section presents a summary of these analyses and their effects on the lifecycle costs of the five alternatives.

The escalation and discount rates used in the base present value analysis are 2 percent and 3 percent, respectively. These parameters are representative of the economic climate of the past several decades. In a robust economy, the difference between the escalation and discount rates would be larger. In a more depressed economy, the difference would be smaller. In order to simulate these two types of economies, the present value analysis was repeated. To represent a robust economy, an escalation rate of 2 percent and discount rate of 5 percent were selected. In the depressed economy scenario, the escalation rate is 2.8 percent and the discount rate is 3 percent. Table 9-9 shows how these different economic conditions affect the results of the present value analysis.

The results of the sensitivity analysis indicate that in an unusually robust economy, Alternatives 1 and 3 are comparable in lifecycle cost over the planning period. In any other situation, Alternative 3 has the lowest lifecycle cost. In a typical or depressed economy, Alternative 3 has a lower lifecycle cost than the other alternatives, and building a new WTP costs less than upgrading the existing WTP.

Table 9-8
Net Present Value Analysis Summary

Item Description	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
Capital Costs					
Phase A	$8,572,000	$11,715,000	-	-	-
Phase B	$11,747,000	$25,158,000	-	-	-
Phase C	$14,103,000	$15,540,000	-	-	-
New 15 MGD Plant Construction	-	$28,421,000	-	-	-
New 45 MGD Plant Construction	$45,400,000	-	-	-	-
New 30 MGD Plant Construction	-	-	$44,271,000	$51,743,000	$50,622,000
Expansion to 45 MGD	-	-	$19,844,000	$22,079,000	$22,272,000
Near-Term Disinfection Reliability	-	-	$450,000	$450,000	$450,000
Annual Costs					
Power	$32,369,000	$32,369,000	$32,369,000	$32,369,000	$32,369,000
Labor	$61,112,000	$61,112,000	$61,112,000	$61,112,000	$61,112,000
Chemicals	$19,760,000	$19,760,000	$19,760,000	$19,760,000	$19,760,000
General Maintenance and Equipment Recovery	$34,162,000	$34,162,000	$34,162,000	$34,162,000	$34,162,000
Additional Cost to Manage Two Plants	-	$11,993,000	-	-	-
Total Present Value	**$227,200,000**	**$240,200,000**	**$212,000,000**	**$221,700,000**	**$220,700,000**

Note: This is a Class 5 estimate. The accuracy ranges from –30 percent to +50 percent.

Table 9-9
Economic Sensitivity of Present Value Analysis Summary

Alternative	1	2	3	4	5
Robust Economy, Escalation Rate = 2 percent, Discount Rate = 5 percent					
Capital Cost Present Value	$45,973,000	$55,245,000	$46,445,000	$53,798,000	$52,889,000
Annual Cost Present Value	$67,983,000	$71,155,000	$67,983,000	$67,983,000	$67,983,000
Rounded Total Present Value	**$114,000,000**	**$126,400,000**	**$114,400,000**	**$121,800,000**	**$120,900,000**
Depressed Economy, Escalation Rate = 2.8 percent, Discount Rate = 3 percent					
Capital Cost Present Value	$104,938,000	$98,563,000	$76,998,000	$88,246,000	$87,352,000
Annual Cost Present Value	$213,660,000	$234,409,000	$213,660,000	$213,660,000	$213,660,000
Rounded Total Present Value	**$318,600,000**	**$332,900,000**	**$290,700,000**	**$301,900,000**	**$301,000,000**

Note: This is a Class 5 estimate. The accuracy ranges from –30 percent to +50 percent.

Construction Risk at Existing Water Treatment Plant

In Chapter 7, the risk of constructing improvements at the existing WTP was discussed. These risks are due to unpredictable construction conditions at the WTP and the difficulty associated with making the improvements while keeping the existing WTP on-line. The cost estimates for Alternatives 1 and 2 accounted for those risks by incorporating additional costs using methodologies explained in Chapter 7. These added costs influence the lifecycle cost of Alternatives 1 and 2. To examine the effects of those assumptions on the present value analysis, the analysis was repeated without those added costs. This analysis was done under the base economic conditions of 2 percent escalation and 3 percent discount. The results of analysis without addition of any risk to Alternatives 1 and 2 are summarized in Table 9-10.

Table 9-10
Present Value Analysis Results with No Additional Risk at Existing WTP

Alternative	1	2	3	4	5
Capital Cost Present Value	$74,945,000	$72,437,000	$64,565,000	$74,272,000	$73,344,000
Annual Cost Present Value	$147,403,000	$159,396,000	$147,403,000	$147,403,000	$147,403,000
Rounded Total Present Value	**$222,300,000**	**$231,800,000**	**$212,000,000**	**$221,700,000**	**$220,700,000**

Note: This is a Class 5 estimate. The accuracy ranges from –30 percent to +50 percent.

If there is no additional risk associated with construction of improvements at the existing WTP, the initial capital costs of Alternatives 1 and 2 are lower as expected. However, Alternatives 3 and 4 have lower lifecycle costs than Alternatives 1 and 2, even under these unlikely assumptions.

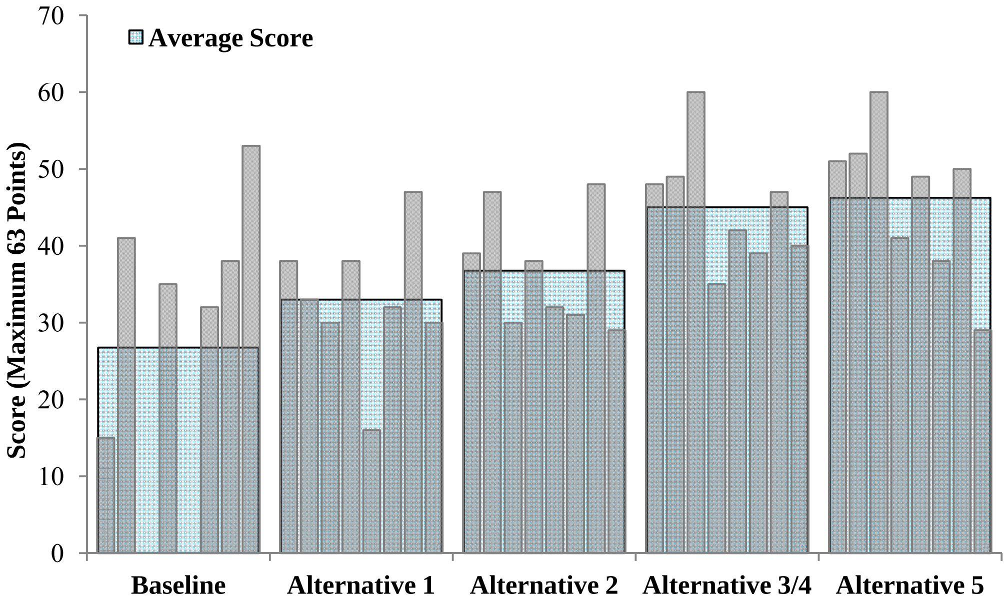
Social and Environmental Considerations

The net present value analysis used to compare the economic aspects of each alternative is considered an objective process because it relies on quantities and calculations. The social and environmental analyses of the alternatives are subjective processes because they cannot be easily quantified and are subject to interpretations based on opinions. Therefore, the detailed analyses with respect to social and environmental considerations were left to the members of the Advisory Committee. The details of the social and environmental analyses are beyond the scope of this report. The results are presented below.

Alternative Selection and Recommendation

Following presentations and discussions of each Alternative, the members of the Advisory Committee independently scored the alternatives by each of the established TBL criteria. Scores were given on a scale of 1 to 5, with a score of 5 meaning that the alternative in question was considered the most desirable with respect to the given criterion. The scores assigned were scaled and multiplied by each criterion's weighting factor to derive individual and composite scores for each alternative. Alternatives 3 and 4 were scored collectively as a composite alternative representing a new WTP on an undefined property. The individual and composite scores are summarized in Figure 9-2.

Figure 9-2
Advisory Committee Alternative Scoring Results



Workshop results and scoring were presented to the City Council during its August 5, 2013 Workshop and then discussed further during its September 9, 2013 workshop. In reviewing the materials developed and scoring performed, the Council approved completion of this Facility Plan Update with the recommendation to move forward in the planning process to construct a new WTP. Due to the close scoring between Alternatives 3, 4, and 5, the Council instructed that a detailed investigation of prospective properties be conducted to identify the optimal site from a cost, facility layout, permitting, and constructability standpoint.

Capital Improvement Program Implementation Plan

As detailed in Chapter 8, the conceptual project cost to construct a new WTP is estimated to be approximately $56 million, with an accuracy range of -30% to +50% (Class 5 estimate). It is recommended that the City establish a capital budget for this project which reflects this estimate and the level of uncertainty and risk associated with the current level of project definition. This budget should be updated and refined over time as the implementation plan progresses and planning and design uncertainties are addressed.. The budget should include decommissioning and demolition of the existing WTP. If pilot testing and other near-term activities demonstrate the ability to use higher-rate treatment processes which require less space and have lower construction costs, such as Alternative 3, then it may be possible to reduce the total project expenditures accordingly.

The recommended schedule to implement the new WTP is presented in Figure 9-3. It is possible to have a new WTP online by the middle 2019 using a traditional design-bid-build (DBB) project delivery approach.

The City should implement the new WTP as quickly as possible to avoid extensive investments in the existing plant. Keeping the current WTP online presents structural and seismic risks and risks related to other deficiencies. The required capital investment in the existing WTP to mitigate these risks will increase as time goes on. The Advisory Committee was not tasked with addressing this schedule-related risk challenge, but the City staff and City Council should discuss this topic as part of its planning and budgeting process for fiscal year 2014-2015 and beyond.

It is recommended that the City complete an Emergency Response Plan for the existing WTP and related water supply infrastructure to allow the City to make informed decisions related to the risks at the existing WTP. This Emergency Response Plan is the minimum investment that the City should make while it waits to have a new WTP designed and constructed. This planning work may identify additional investments needed to mitigate for risks that cannot be effectively managed.

Table 9-11 presents a summary of anticipated yearly capital expenditures (project costs) for the next 10 years to implement a new WTP based on the Implementation Schedule discussed above. The considerations and recommended tasks to undertake a project of this magnitude are presented in the following sections. There are no capital investments required for the City's water treatment and supply system in the next 10 years after the new WTP becomes operational in 2019, so the CIP planning horizon is 10 years.

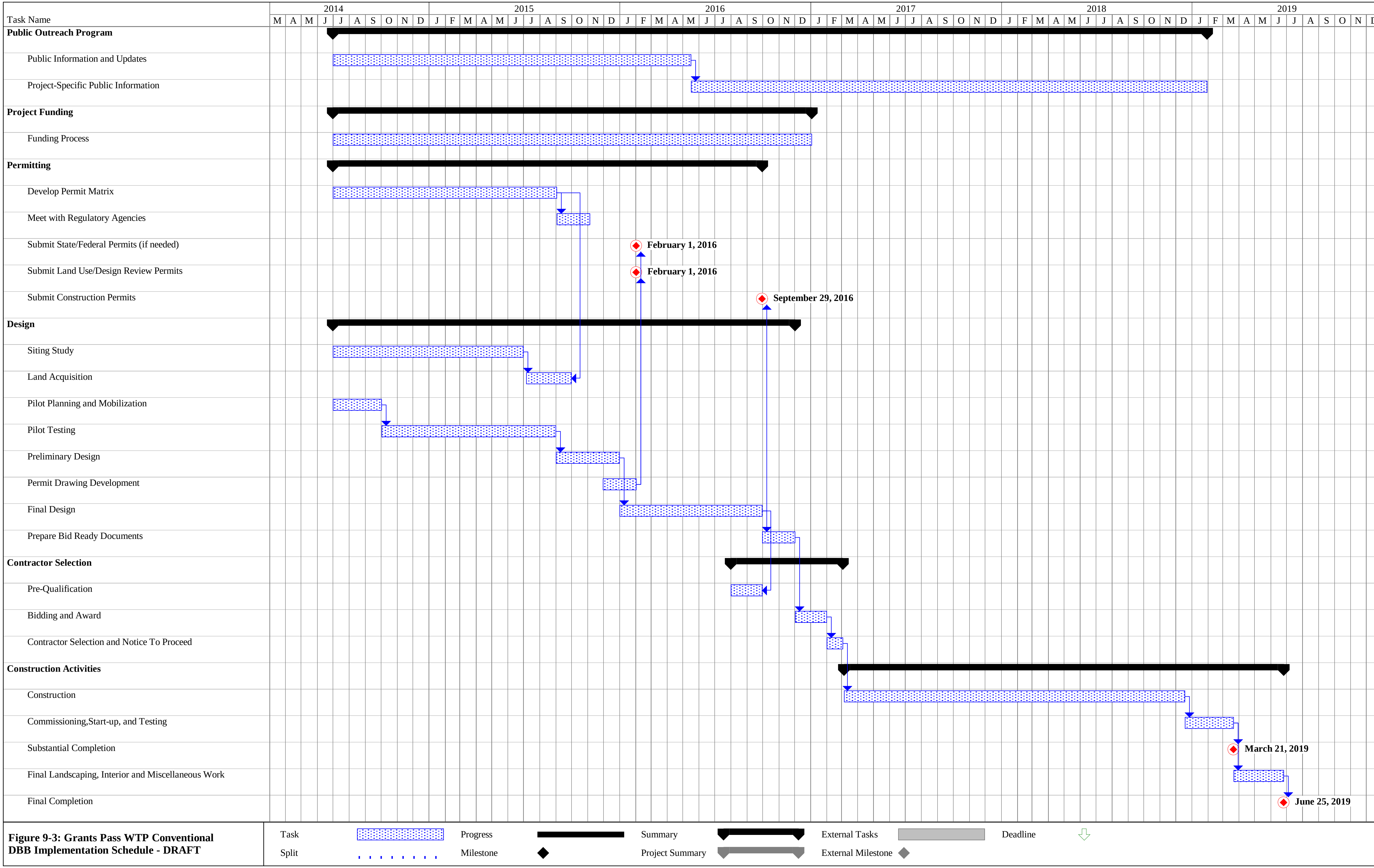


Figure 9-3: Grants Pass WTP Conventional DBB Implementation Schedule - DRAFT

Table 9-11
Recommended Capital Improvement Program Summary[1,2,3,4]

CIP Year	1	2	3	4	5	6	7	8	9	10	Anticipated CIP Expenditures for Project Component
Fiscal Year	**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**	**2019-20**	**2020-21**	**2021-22**	**2022-23**	**2023-24**	
New Water Treatment Plant Implementation											
Pilot Plant Study	$400,000	$100,000									$500,000
Siting Study and Property Acquisition	$200,000	$1,100,000									$1,300,000
Funding Study and Rate Impact Study[5]	$100,000	$100,000									$200,000
Project Implementation Approach and Procurement Strategy	$50,000										$50,000
Public Information/Involvement	$50,000	$50,000	$50,000	$50,000	$50,000						$250,000
Permitting and Land-Use Approvals	$50,000	$75,000	$75,000								$200,000
Preliminary Design		$1,000,000									$1,000,000
Final Design		$1,000,000	$3,000,000								$4,000,000
Bidding and Award			$250,000								$250,000
Construction			$10,200,000	$18,500,000	$18,500,000						$47,200,000
Post-Construction and Warranty Period						$100,000	$100,000				$200,000
Existing Water Treatment Plant Investments											
Emergency Response Plan	$50,000										$50,000
Decommission and Demolition of Existing Plant[6]							$250,000	$250,000	$250,000	$250,000	$1,000,000
Total Anticipated Annual Expenditures	**$1,000,000**	**$3,525,000**	**$13,375,000**	**$18,550,000**	**$18,550,000**	**$100,000**	**$350,000**	**$250,000**	**$250,000**	**$250,000**	**$56,200,000**

Notes
1. Schedule assumes design-bid-build project delivery.
2. From fiscal year 2014-15 to 2023-24, based on Alternative 4 project costs
3. All costs are in 2013 U.S. dollars.
4. This is a Class 5 estimate. The accuracy ranges from –30 percent to +50 percent.
5. Funding and rate impact study costs assume that separate studies are not performed for the distribution system capital improvements program.
6. Costs for decommissioning and demolishing the existing water treatment plant were not included in the project costs presented in Chapter 8.

Project Initiation Activities

It is recommended that the City accomplish the following tasks during the first year of planning for construction of a new WTP:

- Develop a funding strategy
- Select a site for the new WTP
- Conduct a pilot plant study to evaluate high-rate filtration, high-rate clarification processes, and intermediate ozonation processes
- Confirm the project schedule and project delivery strategy
- Plan and implement a public outreach program
- Develop a permitting and regulatory approval plan

It is anticipated that the City will need to allocate approximately $1 million to complete these activities. Once significant progress has been made on each of these tasks, the detailed design phase may begin. Each of the tasks is briefly described below.

Funding Strategy

The City will need to decide how to fund this large capital improvement project. Impacts to customer rates from the WTP project will need to be determined. The rate study should also consider the financial impacts of other potential water system capital improvement projects which will be determined during preparation of the upcoming Water System Master Plan. This effort should begin as soon as possible and will take at least 12 months to complete, depending on when the Water System Master Plan CIP is finalized.

Site Selection

Per Council direction, the City needs to evaluate potential locations for the new WTP and then select a preferred site for acquisition. This task should be initiated as soon as possible and will likely take 12 to 18 months to complete.

There are currently a number of potential sites near the existing WTP which are considered suitable. This includes the property across the street from the existing WTP. This property is currently owned by the City.

After an initial screening of potential sites, testing should be performed at the selected properties to assess geotechnical conditions, determine whether hazardous materials are present, and identify anything else which may present obstacles to developing the property. The siting study should include a permitting review to identify potential permitting issues and development conditions.

Pilot Plant Study

In order to take advantage of the lower capital costs and smaller space requirements offered by high-rate clarification and filtration processes, a pilot plant study is needed to proof-test these processes with Rogue River water. The OHA requires a one-year long pilot plant study for use of filtration rates above 6 gpm/sf. Continuous pilot testing of alternative clarification technologies, such as ballasted flocculation, throughout the year may not be required, but a "reasonable" duration of testing during each season is necessary. This duration can range from 4 to 8 weeks per season depending on a number of testing and performance evaluation parameters. It is also recommended to pilot test the use of intermediate ozonation to determine its impacts to water quality and other processes.

Pilot testing should ideally be conducted on a seasonal basis to determine performance under variable water quality conditions which are experienced at the existing WTP, especially winter, summer and fall/transitional periods. If the City begins the pilot testing work in July 2014, the testing can be completed by spring 2015 and the final reporting completed during summer 2015.

The following tasks are suggested as part of the pilot plant study:

- Develop a testing plan, determine equipment needs, and confirm budget
- Procure equipment, deliver to site and install
- Seasonal pilot testing and data collection
- Reporting, including interim reports after first two seasons of testing
- Report submittal to OHA and review meeting
- Confirmation of treatment process selection

The costs to complete a pilot plant study can be highly variable and depend on factors like equipment costs and labor assigned to operate and monitor the pilot plant equipment. The most economic approach is to have City staff assume the daily operations and data collection duties after receiving training and startup assistance from consultant staff and equipment suppliers.

Project Schedule and Delivery Method

The City needs to confirm the appropriate project schedule for the new WTP and to verify the desired method to deliver the project. The schedule will ultimately depend on the method of project delivery. There are multiple project delivery options for the City to consider in addition to a traditional design-bid-build approach. For example, design-build may allow earlier completion. The City may also consider a public-private partnership. Public-private partnerships are becoming more common for large capital projects because they are partially or completely funded by a private party as part of the program.

In addition to project schedule and method of project delivery, the City should consider the following:

- Whether improvements to the water supply system which are necessary to integrate the new WTP should be designed and constructed as unique projects or completed as part of the WTP project
- Early procurement of key process equipment
- Long-term strategy for operating the new WTP (continuing with City staff operation or using a third party as in design-build-operate)

Public Outreach

Public support will be an important component in the overall success of the project. Experiences from recent similar projects in the region has shown that the public is interested in and aware of its source of drinking water supply and will be very active in expressing their opinions in this matter.

The City has laid the foundation for a very open, transparent, and active public information program over the past year to keep the public updated on the various water supply alternatives. This program should continue until long after the new plant is constructed to ensure a level of transparency that the community demands. As the City has gathered all of the information needed to properly evaluate all of its future water supply alternatives, the information program should be expanded to include a range of activities from a broader public education campaign to inclusion of a public involvement component to assist in the final design decision-making process as it relates to public amenities.

Permitting and Regulatory Approvals

The City should develop an inventory of permitting requirements and submittals that will be required for the project. Assignments of responsibility should be made to ensure that all of the required permits and regulatory approvals are obtained within the appropriate time frame. The scope of permitting will become clearer as the level of project definition increases. This task is of critical importance and should begin in the first year of planning. Experience has shown that permitting can take longer than any other part of a project. Failure to address permitting issues early enough in the project can delay the schedule.

Preliminary Design Activities

Once a site has been acquired, the funding method has been determined, and pilot testing has been completed, the next steps in the plant design process will include:

- Development of Basis of Design Report (BoDR) which reflects approximately 10 percent design completion
- Initial opinion of probable construction cost (OPCC) based on BoDR

- Continuance of public outreach program
- Refinement of permitting requirements

It is anticipated that this activity will begin during fiscal year 2 in fall 2015 and will take approximately four months to complete.

Final Design Activities

After preliminary design activities have been completed, final design will commence. Final design tasks include:

- Early equipment procurement, if determined to be beneficial to the project
- Development of detailed plans, specifications, and bidding documents
- Additional OPCCs at selected intermediate and final design stages
- Project permitting and approvals
- Continuance of public outreach program

It is anticipated that this activity will begin during the latter half of fiscal year 2 in early 2016 and will take approximately 10 months to complete. This would allow bidding to begin in fall 2016 during fiscal year 3.

Bidding and Award

After final design has been completed, bidding activities will commence. These activities will include:

- Pre-qualification of bidders
- Advertisement for bids and pre-bid meeting with prospective bidders
- Receipt of questions from prospective bidders and issuance of addenda as necessary
- Receipt and review of bids
- Recommendation of award to apparent low bidder
- Project permitting and approvals, if needed
- Continuance of public outreach program

With bidding set to begin in fiscal year 3, it is anticipated that this activity will take approximately three months to complete to allow the award to be made in the latter half of fiscal year 3. This schedule and list of tasks assumes that a design-bid-build project delivery will be used. Conditions could change if the City uses a different project delivery method.

Construction, Startup, and Commissioning

A 28-month construction duration is anticipated which would provide for final completion in June 2019. The last few months of this activity include time for startup, testing, commissioning, and operator training. It is anticipated that the City will desire a two-year warranty period which would conclude in 2021. The project costs for this activity include construction, inspection, construction management, and engineering services during construction.

Investments in the Existing Water Treatment Plant

Since a new WTP will be constructed, the City should limit its investment in the existing WTP. With the exception of the intake structure, investments in the existing WTP structures would be lost as soon as the new WTP is online and the existing WTP is decommissioned. However, the City should budget some money for the existing WTP including the following items:

- The existing intake may require modifications to improve the handling of silts and solids which accumulate in the pumping wetwell. The City has completed designs for low-cost upgrades of the de-silt system to help alleviate these issues. Completion of these improvements or a more permanent, long-term improvement should be deferred and re-evaluated based on observation of siltation in the spring of 2014 and the overall sequencing of the Project Initiation Activities described earlier in this chapter.
- The City will need to determine the ultimate fate of the existing WTP after the new WTP becomes operational. A budget of $1 million has been allocated for decommissioning and demolition activities in the final four years of the CIP presented in Table 9-11.
- The City should develop an Emergency Response Plan. Specific attention should be given to areas of the plant which are highly susceptible to partial or complete failure in a seismic event.

Summary

The City of Grants Pass should immediately begin the process to construct a new WTP due to the age and structural condition of the existing WTP. In order to minimize the risks to the City's only drinking water supply, and to reduce continued investment in the existing plant, the City should plan to have a new WTP online in 2019. The estimated project cost to plan, design, and build a new WTP is $56.2 million. This project cost will be incurred in capital expenditures made over the next 10 years.

Critical early planning activities should begin in the next fiscal year to ensure that the new WTP is online in 2019. The City should budget approximately $1.0 million for this initial planning work which includes site selection, a pilot plant study, and a funding analysis.

The City will need to determine how to pay for this significant investment and should also consider potential investments in its distribution system, which will not be identified until after the upcoming Water System Master Plan is completed. A public outreach program can help the City engage its citizens to help explain why these investments are important to the community.

MSA

APPENDIX A

PUBLIC HEALTH DIVISION
Drinking Water Program
John A. Kitzhaber, MD, Governor

Oregon Health Authority

2860 State Street
Medford, OR 97504
(541) 618-7872
FAX: (541) 776-6013
scott.g.curry@state.or.us

December 05, 2012

Michael McWhirter
MWH
806 SW Broadway, #200
Portland, OR 97205

RE: Plan Review #187-2012 / Approval
Disinfection Tracer Study / City of Grants Pass (PWS #4100342)

Dear Mr. McWhirter:

We have received a copy of the Disinfection Contact Time Tracer Study that was conducted at the Grants Pass water treatment plant between July and September 2012.

We note that the protocol for this study was submitted and approved earlier, and the objective of the study was to evaluate the contact time available in the sedimentation basins at low, medium, and high (95% of peak) flowrates. Contact time in the clearwell has been determined with a previous study.

We agree with the results of this tracer study, and it is approved. The City may start using the new contact time (T10) numbers for reporting purposes in the monthly surface water treatment report. Should the plant flowrate exceed that of the study, a new tracer study will be required.

Thank you for submitting this report for our review. We appreciate the City's efforts to ensure their compliance with surface water treatment regulations.

Sincerely,

Scott G. Curry, P.E.
Regional Engineer
Drinking Water Program

cc: Jason Canady, City of Grants Pass

MEMORANDUM

TO: Jason Canady, City of Grants Pass

DATE: November 7, 2012

FROM: Michael McWhirter, MWH
Andrew Nishihara, MWH

CC: Brian Ginter, MSA
Chris Kelsey, MSA

REVIEWED BY: Jude Grounds, MWH
Peter Kreft, MWH

SUBJECT: Grants Pass WTP – Tracer Test Results

Executive Summary

Tracer tests for the sedimentation basins were conducted at the City of Grants Pass Water Treatment Plant (Grants Pass WTP) from July to September 2012. These tests were requested by the Oregon Health Authority (OHA) following the Water System Survey and WTP Inspection conducted in June 2011. Historical calculations of chlorine disinfection performance at the Grants Pass WTP were partially based on estimates of hydraulic efficiency through the sedimentation basins without supporting tracer test data. This technical memorandum summarizes the results of these tests.

The hydraulic efficiency values obtained through tracer testing ranged from 0.46 to 0.57 for the three flowrates tested. These results will be used for future disinfection performance (CT) calculations by plant staff, and produce similar results to the historical CT calculation method. A CT model was created for use by the plant staff based on these findings; operators can input plant flow rate, pH, chlorine residual and water temperature and determine the resulting inactivation of *Giardia*. Staff can use this model to proactively manage operation of the WTP to ensure continued compliance with disinfection requirements.

Introduction

A series of tracer tests were performed at the WTP by plant staff between July and September 2012. MWH assisted in the preparation of the tracer test plan and also in analysis and verification of the results. The tracer tests were performed to meet the requirements of the Surface Water Treatment Rule (SWTR), which was promulgated by the United States Environmental Protection Agency (EPA) in 1989. The SWTR was then augmented by the Interim Enhanced Surface Water Treatment Rule in 1999 and the Long Term 2 Enhanced Surface Water Treatment Rule (LT2ESWTR) in 2006. The objective of these regulations is to protect the public from exposure to waterborne pathogens, particularly *Cryptosporidium* oocysts, *Giardia* cysts, *Legionella* and viruses, which can be found in surface water supplies. The regulations require all utilities served by a surface water supply to achieve a minimum 3-log reduction of *Giardia* cysts, a 4-log reduction of viruses and a 2-log reduction of *Cryptosporidium* oocysts during the treatment of drinking water. The reductions in *Giardia*, bacteria and viruses are to be achieved through a multi-barrier approach of both physical removal and chemical inactivation. Under the LT2ESWTR, utilities were required to provide additional reduction of *Cryptosporidium* if their raw water source was found to be susceptible to elevated concentrations of those protozoa.

The Grants Pass WTP is classified and operated as a conventional filtration plant. The OHA has awarded the Grants Pass WTP with a 2.5-log removal credit for *Giardia*, a 2.0-log removal credit for viruses and a 2.0-log removal credit for *Cryptosporidium* at all plant flows up to its maximum production rate of approximately 20 mgd. The Grants Pass WTP is required to achieve the remaining level of *Giardia* and virus reduction via disinfection. Thus, disinfection at the plant must achieve a minimum of 0.5-log inactivation of *Giardia* and 2.0-log inactivation of viruses for compliance with the existing regulations. Sampling of the *Cryptosporidium* concentrations in the Rogue River, which is the source for the Grants Pass WTP, has shown that no additional removal/disinfection of *Cryptosporidium* is required at this time.

In order to determine the level of inactivation achieved during chemical disinfection, the EPA developed the "CT" concept. "CT" is the product of the disinfectant residual concentration (C) measured at the outlet of a disinfection section(s) and the time (T) representing the minimum detention time experienced by 90% of the water passing (or the time in which 10 percent of an added tracer passes through the section(s)). This time period is commonly referred to as the T_{10}. Tables are provided in the SWTR Guidance Manual identifying the minimum level of CT required to achieve various levels of *Giardia* and virus inactivation based on site specific water quality conditions. The EPA recommends that utilities conduct a tracer test to determine the value of T_{10} available in the disinfection section(s) which will be used for CT compliance.

As a result of a Water System Survey and WTP Inspection conducted in June 2011, the OHA requested that the City complete tracer testing at the WTP to demonstrate the hydraulic efficiency which is achieved through the plant. The City has previously conducted tracer tests for the clearwell; consequently the tests conducted for this report investigated the portion of the WTP between the static mixer, where sodium hypochlorite is first introduced to the water, and the Combined Filter Effluent (CFE) point upstream of the clearwell.

The tracer tests were conducted at three flowrates: 9.4 mgd, 15.1 mgd, and 19 mgd. The flowrates represent low, average, and high (95% of peak flowrate), operating rates at the plant.

WTP Process Description

The Grants Pass WTP is rated a conventional filtration water treatment plant with a maximum capacity of approximately 20 mgd. Raw water is pumped from the adjacent intake on the Rogue River into three sedimentation basins. Valve positions are set to split the flow between the basins based on basin size. Coagulation at the plant is achieved by dosing alum in conjunction with aluminum chlorohydrate (ACH) or poly-aluminum chloride (PACl). Filter aid polymer is added to the settled water to improve filter performance. Disinfection is achieved through pre- and post-filtration chlorination using 12.5% sodium hypochlorite. Potassium permanganate is used occasionally to control taste and odor in the finished water. The plant is frequently operated for less than 24 hours a day when there is low demand for water.

Tracer Test Methodology

Per Oregon Administrative Rules (OAR), the City was required to submit a tracer test plan to the State for approval prior to conducting any tracer tests. The testing plan was completed and submitted in March 2012. Tracer tests were conducted by injecting a solution of calcium chloride ($CaCl_2$) for the 'slug dose' method. Testing under the three flow conditions (low, average and high) as prescribed by the testing plan was completed in July 2012. Additional testing for verification and to confirm results continued intermittently through September 2012.

Tracer testing was conducted in all three of the plant's sedimentation basins at the same time. The slug dose of $CaCl_2$ was added to the flash mixer immediately downstream of coagulant addition and just prior to sodium hypochlorite addition.

Preliminary testing showed that a slug dose of 200 lbs of $CaCl_2$ dissolved with 40 gallons of water was adequate to increase the conductivity of the water high enough above the baseline conductivity to allow accurate analyses. The tracer solution was made up in the plant's polymer batching tanks. Due to the exothermic reaction from dissolution of $CaCl_2$ in water, an ice bath was used to cool the tracer solution before being used in the tests.

Successful slug dose testing introduces the full volume of dosing solution to the water in less than two percent of the hydraulic residence time (HRT) of the portion of the plant being tested. Based on the maximum test flow rate of 19 mgd, this required the tracer solution to be added in less than 2.5 minutes. The more quickly the solution is introduced, the more accurate and reliable the results. The injection system used by the plant staff was able to introduce the tracer solution in approximately 10 seconds or less.

The City of Grants Pass used their HACH conductivity monitor, with six separate sensors, to gather data points at one-minute intervals during the tracer test. Conductivity was measured at the following locations:

1. the inlet to the mixing basin which feeds Sedimentation Basins 1 and 2,
2. the inlet to Sedimentation Basin 3
3. the effluent from Sedimentation Basin 1,
4. the effluent from Sedimentation Basin 2,
5. the effluent from Sedimentation Basin 3, and
6. the CFE immediately upstream of the clearwell.

The sample probes for locations 1-5 were immersed directly into the basins. Water for sample 6 was fed to the conductivity probe through a sample pump and a short length of sample tubing.

The background conductivity was measured at all six conductivity sample points prior to the test, for a period of thirty minutes, to ensure that the background conductivity was stable. The tests were conducted during a period of stable raw water quality and flowrate to ensure there was no need to change the dosing rates of any of the treatment chemicals during the test. Approximately once per hour, grab samples were collected from each of the six locations for conductivity spot checks using the WTP's laboratory conductivity analyzer to verify the on-line conductivity measurements.

All three sedimentation basins and all eight filters were in service throughout each of the tests. No backwashing or recycling occurred during the tests. Each tracer test lasted for at least two HRTs and was conducted until sampling and calculations showed that close to 100% of the tracer had been passed.

Table 1 shows approximate HRTs through the various parts of the plant based on dimensions and volumes of basins, filters, and their related piping.

Table 1: Approximate Hydraulic Residence Times

	Hydraulic Residence Time (minutes)		
Segment of Plant	**@ 9.4 mgd**	**@ 15.1 mgd**	**@ 19 mgd**
Sedimentation Basins	247	153	122
Filters[1]	12	8	6
Total	259	161	128

[1] This estimate of the hydraulic residence times through the filters is based on a porosity in the filter media of 50% and minimum assumed water level above the top of the media of 4-feet .

Due to the long period of time necessary to obtain results from the test at the minimum flow rate, the 19 mgd test was conducted first. The 19 mgd test lasted for 287 minutes (2.2 HRT), the 15.1 mgd test lasted for 422 minutes (2.6 HRT), and the 9.4 mgd test lasted for 963 minutes (3.7 HRT).

Results

Appendix A presents plots of conductivity versus time for the WTP CFE for the tests. Time is plotted on the x-axis where '0' represents the time when the tracer solution was introduced. The primary y-axis on the left side of the plots indicates the percent of tracer solution which had passed the CFE measuring location, while the secondary y-axis on the right side of the plots shows the instantaneous conductivity measurement of each sample point. A single point, highlighting the time when 10% of the tracer solution had passed (T_{10}), was placed on each of the plots based on the observation that 100% of the tracer was recovered once the conductivity drops to background levels. $T_{theoretical}$ (T_{th}) values were equivalent to the HRT for each flowrate. As shown in the plots, the measured peak conductivity after slug addition was at least 38% higher than the measured background conductivity for each of the tests. The calculated T_{10}/T_{th} (hydraulic efficiency) values based on the test results are summarized in **Table 2** as follows:

Table 2: Tracer Test Results

Date	**Flow Rate (mgd)**	**T_{10}/T_{th} (CFE)**
7/5/12	19.0	0.48
7/6/12	15.1	0.46
7/18/12	9.4	0.57

The hydraulic efficiencies shown for the CFE are similar under the average and high flow conditions. At the low flow condition, the hydraulic efficiency increased. The measured values are consistent with values that have been measured at similar WTPs in the region. The most conservative approach for the WTP would be to use the lowest hydraulic efficiency measured for all flowrates. However, the rules allow for interpolation between data points based on flow, as is currently practiced for the Clearwell CT calculations. For consistency in CT calculation methodology, we recommend that the plant use the values from this study for the pre-Clearwell CT calculations as summarized in **Appendix B: Table B-1**.

Conclusions

Using the tracer test results for the different flow rates and the EPA's "*Compliance with the Filtration and Disinfection Requirements for Public Water Systems Using Surface Water Sources Guidance Manual"*, a profile was developed to interpolate and extrapolate additional T_{10} values to be used for CT calculations at the plant for the 10 currently approved operating flows. The graph and table of these values can be found in **Appendix B**.

As discussed previously, the plant must achieve a minimum of 0.5-log inactivation of *Giardia* and 2.0-log inactivation of viruses for compliance. When using free chlorine as the primary disinfectant, *Giardia* inactivation requirements are higher than the virus inactivation requirements under all conditions.

Water temperature fluctuations have the biggest impact on *Giardia* inactivation with free chlorine, followed by pH and then chlorine residual. The lowest recorded raw water temperature since 2004 has been 0.7°C, and there is a potential for the plant to experience 0.5°C water. The raw water temperature is typically less than 5°C approximately 18 days per year.

Table 3 presents a summary of maximum plant flows to meet CT over a range of water temperatures, as calculated by a CT model. The 0.7 log column represents the WTP's internal disinfection benchmark, while the 1.0 log column shows an additional conservative condition. This analysis assumed the following conservative water quality parameters based on historical plant operating data:

- Sedimentation Basin pH = 7.5
- Sedimentation Basin effluent chlorine residual = 0.1 mg/L
- Clearwell pH = 7.5
- Clearwell effluent chlorine residual = 0.9 mg/L

Table 3: Maximum Plant Flow Rates for Various Temperatures

Temp (°C)	Max Flow that achieves CT = 0.5 log DS of Filters (mgd)	Max Flow that Achieves CT = 0.5 log Total (mgd)	Max Flow that Achieves CT = 0.7 log Total (mgd)	Max Flow that Achieves CT = 1.0 log Total (mgd)
0.5	5.6	8.3	6.0	4.1
5	8.0	11.7	8.4	5.9
10	10.6	15.7	11.2	7.9
15	15.5	20+	16.4	11.4
25	20+	20+	20+	20+

DS – downstream

mgd – million gallons per day

Figure 1 visually displays the modeled log inactivation of *Giardia* through the WTP and clearwell over a range of water temperatures.

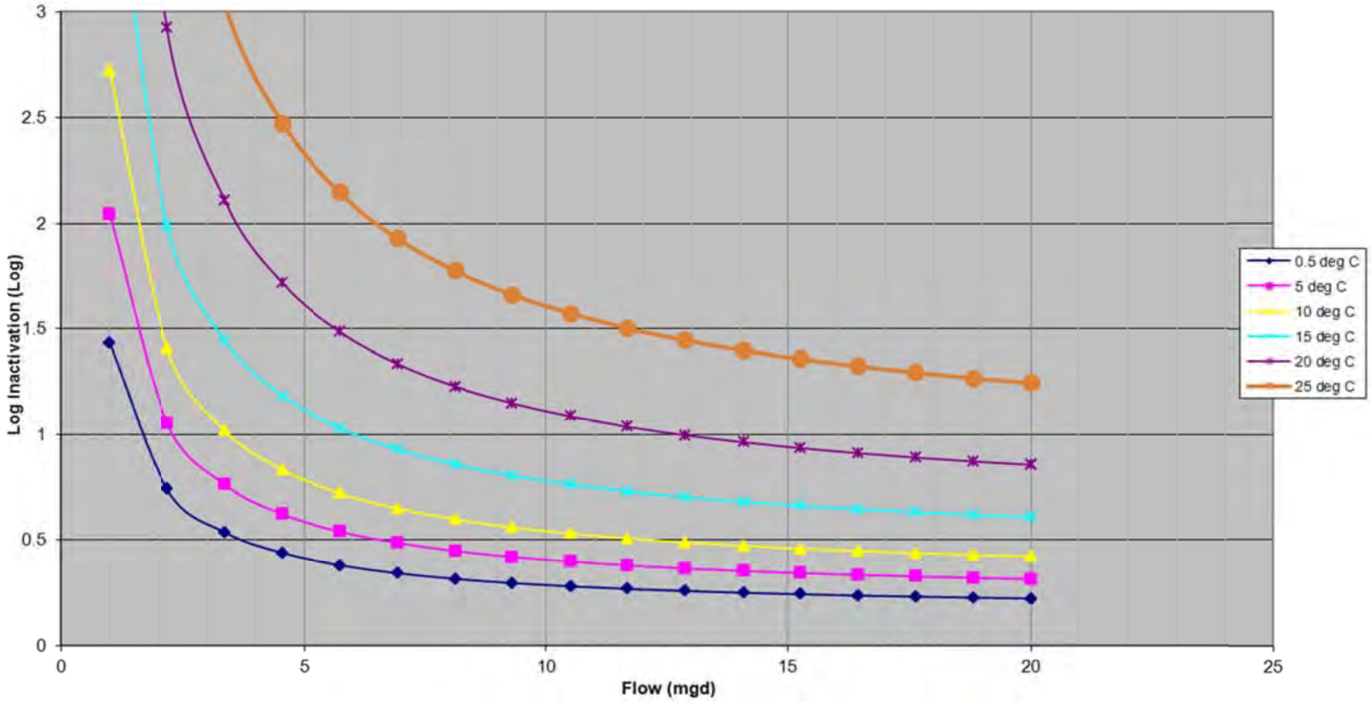


Figure 1: Log inactivation of *Giardia* through the WTP and Clearwell

Under these conservative conditions the calculations demonstrate that the WTP can continue to meet the required 0.5-log inactivation of *Giardia* while meeting customer demands. If/when winter demands increase, the WTP will need to adjust its disinfection practices by increasing the chlorine residual, or expanding the Clearwell volume, or installing an alternative disinfectant like UV irradiation.

[NOTE: A CT model was developed for the Grants Pass WTP, and was used to determine Giardia inactivation (since Giardia disinfection requirements are more onerous than virus for Grants Pass WTP) under different water quality and operating conditions. This model incorporates CT values for free chlorine as presented in the EPA's "Surface Water Treatment Rule Guidance Manual". MWH has successfully used this model for other plants throughout the nation to optimize CT performance. A copy of the model and the User's Guide is included in ***Appendix C****. Though this CT Model will not replace OHA-prescribed CT calculations at the plant, in the future, the model may be used by WTP staff to optimize chlorine use at the plant.]*

Appendix A: Tracer Test Results

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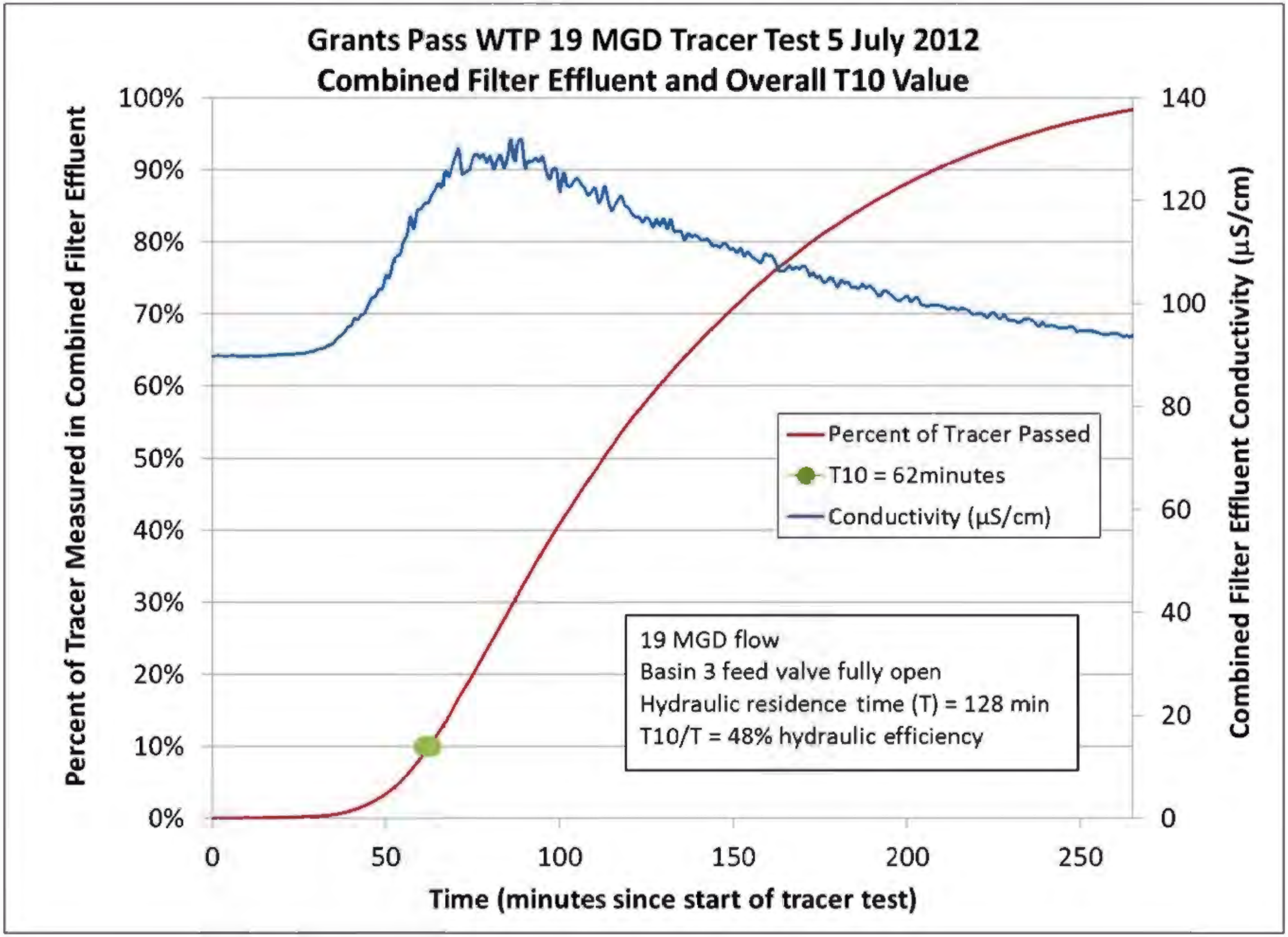
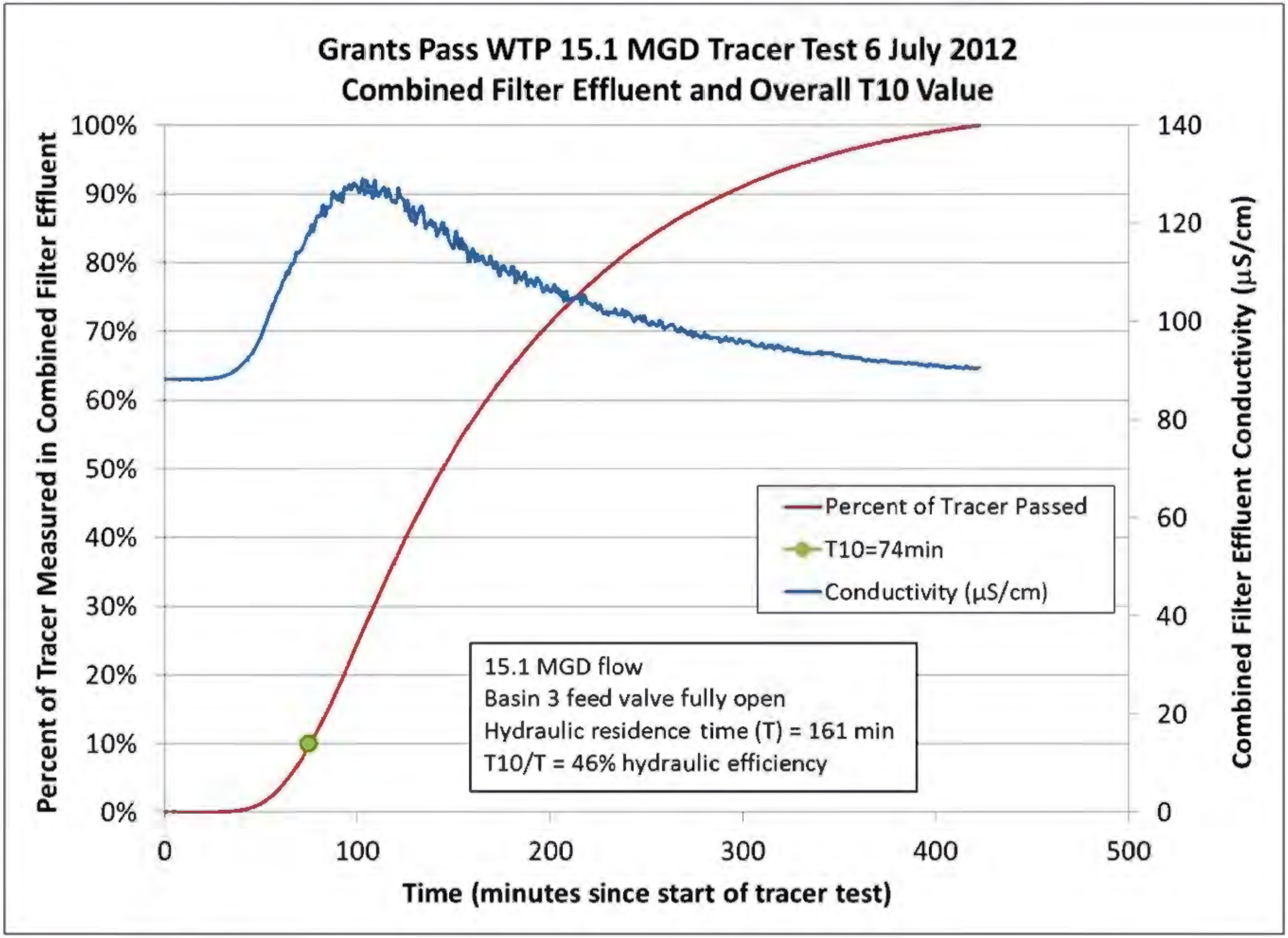
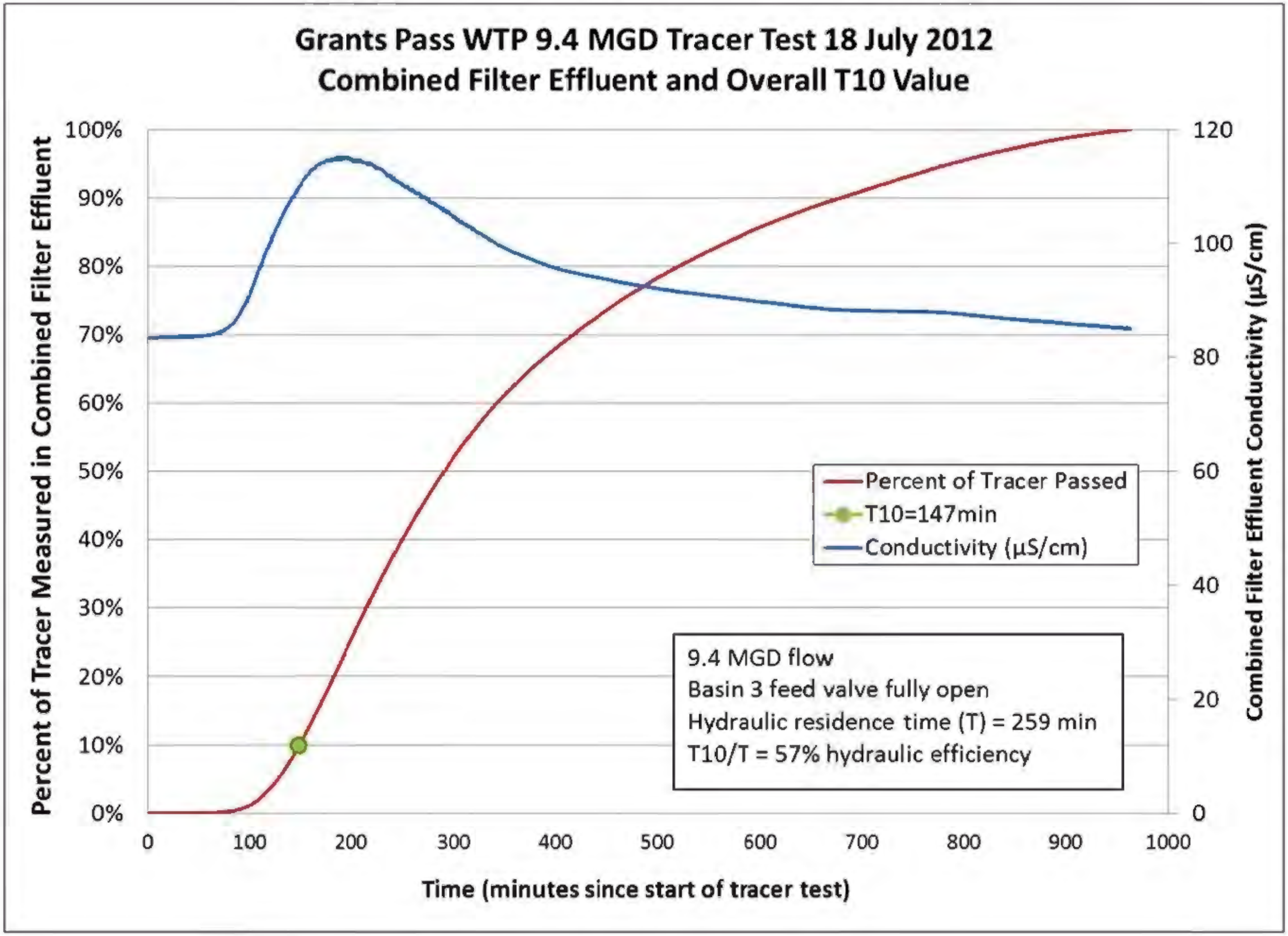

Grants Pass WTP 19 MGD Tracer Test 5 July 2012
Combined Filter Effluent and Overall T10 Value
Percent of Tracer Measured in Combined Filter Effluent
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
140
120
100
80
60
40
20
0
Combined Filter Effluent Conductivity (µS/cm)
0
50
100
150
200
250
Time (minutes since start of tracer test)
Percent of Tracer Passed
T10 = 62minutes
Conductivity (µS/cm)
19 MGD flow
Basin 3 feed valve fully open
Hydraulic residence time (T) = 128 min
T10/T = 48% hydraulic efficiency


Grants Pass WTP 15.1 MGD Tracer Test 6 July 2012
Combined Filter Effluent and Overall T10 Value
Percent of Tracer Measured in Combined Filter Effluent
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Combined Filter Effluent Conductivity (µS/cm)
140
120
100
80
60
40
20
0
0
100
200
300
400
500
Time (minutes since start of tracer test)
Percent of Tracer Passed
T10=74min
Conductivity (µS/cm)
15.1 MGD flow
Basin 3 feed valve fully open
Hydraulic residence time (T) = 161 min
T10/T = 46% hydraulic efficiency


Grants Pass WTP 9.4 MGD Tracer Test 18 July 2012
Combined Filter Effluent and Overall T10 Value
Percent of Tracer Measured in Combined Filter Effluent
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0
100
200
300
400
500
600
700
800
900
1000
Time (minutes since start of tracer test)
Combined Filter Effluent Conductivity (µS/cm)
120
100
80
60
40
20
0
Percent of Tracer Passed
T10=147min
Conductivity (µS/cm)
9.4 MGD flow
Basin 3 feed valve fully open
Hydraulic residence time (T) = 259 min
T10/T = 57% hydraulic efficiency

Appendix B: Hydraulic Efficiency Values

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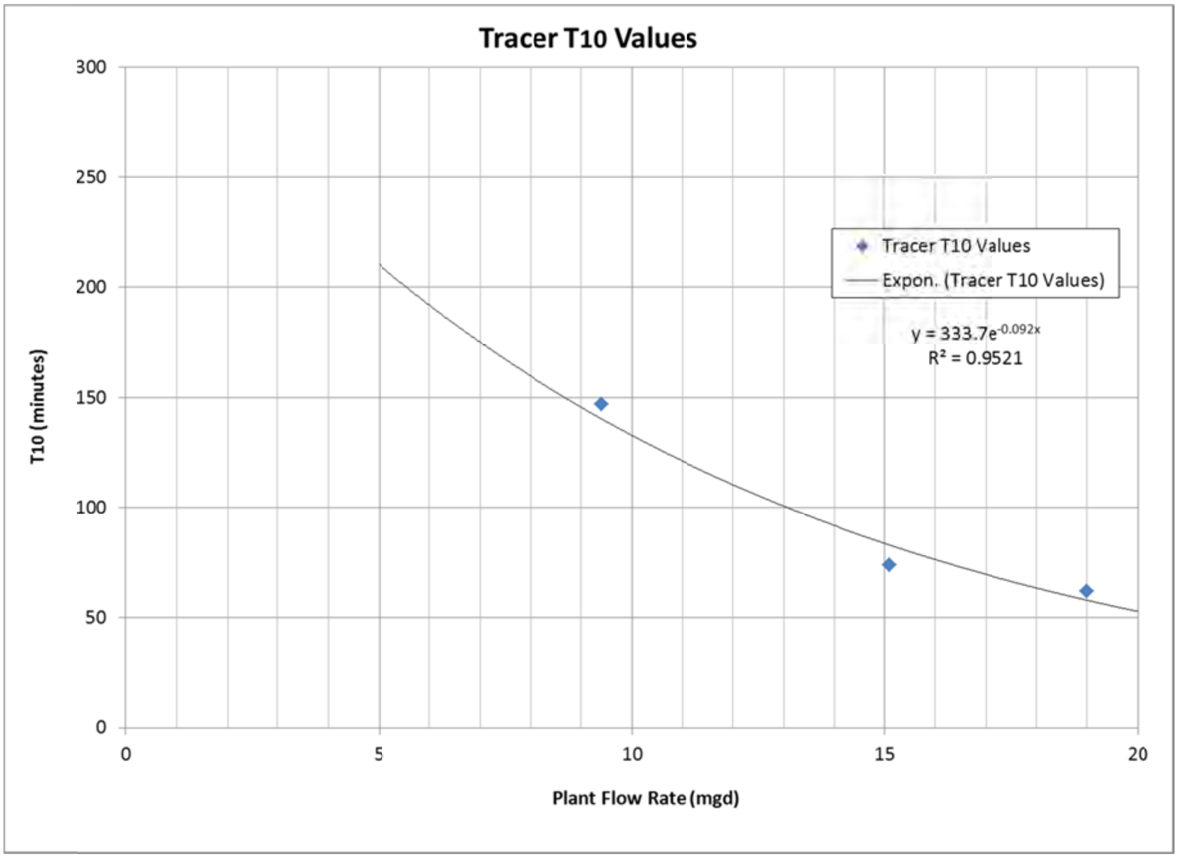

Figure B-1: Plot of 3-value T_{10} Curve

Table B-1: Tracer T_{10} and T_{10}/T_{TH} Values for CT Calculations

Flowrate (mgd)	T10 (mins)	T_{10}/T_{TH}
5.1	208	0.44
6.5	184	0.49
7.9	161	0.53
9.4	141	0.54
10.5	127	0.55
12.2	108	0.55
13.7	95	0.53
15.1	83	0.51
16.6	72	0.48
18.0	63	0.47
19.0	58	0.45
19.4	56	0.44
20.0	53	0.44

Appendix C: CT Model User Guide

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MEMORANDUM

TO:	Jason Canady, City of Grants Pass	**DATE:**	November 7, 2012
FROM:	Michael McWhirter, MWH Andrew Nishihara, MWH	**CC:**	Brian Ginter, MSA Chris Kelsey, MSA
REVIEWED BY:	Jude Grounds, MWH		
SUBJECT:	CT Model – User Guide – Draft		

Introduction

The City of Grants Pass Water Treatment Plant (WTP) CT Model is intended for two purposes: 1) to serve as a tool for doing “what if” analyses when optimizing the plant’s disinfection strategy, and 2) to assist plant operators in accurately calculating and consistently reporting daily CT compliance. The model is interactive, and should be modified to best represent the treatment conditions of interest. The model breaks the plant into several “disinfection sections”, and uses look-up tables to calculate the log-removal of *Giardia lamblia* through that particular section. Overall disinfection performance is then calculated by summing the disinfection achieved through the individual sections of the plant.

This Users Guide presents regulatory and theoretical background necessary for determining disinfection compliance, as well as a step-by-step guide to operating the model and interpreting the results.

Background

The following section provides background information on the disinfection requirements for the Grants Pass WTP and a review of the calculations involved when reporting inactivation performance.

CT Requirements

Drinking water requirements, as defined under the Surface Water Treatment Rule (SWTR), are defined in Oregon law under OAR 333-061. The objective of OAR 333-061 is to protect the public from exposure to pathogenic organisms, particularly *Giardia lamblia* cysts, *Legionella*, and viruses, which can be found in surface water supplies. By law, all utilities served by a surface water supply are required to achieve a minimum of 99.9% (3-log) reduction in *Giardia lamblia* cysts and 99.99% (4-log) reduction in viruses during drinking water treatment. Removal credit is awarded to water treatment plants based on the types of processes provided. For plants rated conventional such as the Grants Pass WTP, a 2.5-log and 2.0-log removal credit is achieved for *Giardia lamblia* and viruses, respectively. The remaining reduction in pathogenic organisms must come in the form of disinfection. For the Grants Pass WTP, a minimum of 0.5-log inactivation of *Giardia*, and 2-log inactivation of viruses is required prior to the first customer.

To determine the level of inactivation achieved during chemical disinfection, the EPA developed the "CT" concept. Compliance with the disinfection requirements is achieved when the following equation is true:

1. $\mathbf{CT_{achieved} \geq CT_{required}}$

Where: $CT_{achieved}$ through the treatment process is calculated by the product of the disinfectant residual concentration measured at the outlet of a disinfection section ("C") and the "effective" detention time through a section of the plant ("T"), commonly referred to as the T_{10}. Additional discussion of the T_{10} is presented in a later section.

$CT_{required}$ can be determined using tables provided in the SWTR Guidance Manual, which identify the minimum level of CT that is required to achieve various levels of *Giardia lamblia* and virus inactivation. This value is a function of the following water quality parameters, as measured at the end of the disinfection section:

- Disinfectant residual
- pH
- Temperature

The Grants Pass WTP relies on free chlorine contact time through the plant to achieve the necessary CT.

Calculating T_{10}

The theoretical detention time (T_{th}) through a basin (in this case, a disinfection section) represents the average time a molecule of water spends in that basin, and is calculated using the following equation:

2. $$T_{th}\text{ (min)} = \frac{\text{Disinfection Section Volume (gal)}}{\text{Flow Rate (gal/min)}}$$

T_{10}, or the effective detention time is used when calculating "CT" to better account for any "short-circuiting" that may occur through a particular disinfection section, and is typically a fraction of the theoretical detention time. T_{10} is defined as the time in which 10% (by volume) of an added tracer would passes through the outlet of the disinfection section. Thus, the ratio of T_{10}/T_{th}, or hydraulic efficiency (*e*) is always less than or equal to 1, depending on the mixing characteristics in the disinfection section. For example, well mixed portions of the treatment process (rapid mix, for example) will have a hydraulic efficiency of approximately 0.1—only 10% of the theoretical detention time will be considered when calculating "CT". Pipelines, where very little mixing occurs, will have hydraulic efficiencies that approach 1.0. The following equation can be used to determine the T_{10} through any disinfection section, at any flow rate:

3. $$T_{10}\text{ (min)} = \frac{\text{Hydraulic Efficiency } (e) \times \text{Disinfection Section Volume (gal)}}{\text{Flow Rate (gal/min)}}$$

Though recommended values for hydraulic efficiency are presented in the SWTR Guidance Manual for various treatment processes, the only way to accurately measure hydraulic efficiency is through a tracer test. Once hydraulic efficiency is determined, it can be used to calculate T_{10} at a range of flowrates through a disinfection section (i.e. flocculation/sedimentation basin, clearwell, etc.).

Calculating CT through a WTP

The overall disinfection achieved through a treatment plant and/or a transmission pipeline is simply the sum of the disinfection achieved through the various disinfection sections of the plant. Because the $CT_{required}$ varies according to the water quality characteristics (chlorine residual, pH and temperature), the boundaries of these disinfection sections are typically defined by the points of chemical addition and chemical monitoring (i.e. pH adjustment, chlorine injection/residual monitoring, etc.). The water quality characteristics used to determine the $CT_{required}$ represent the "worst case" conditions (i.e. the highest pH, lowest temperature and highest chlorine residual measured through the disinfection section).

Calculating overall disinfection performance at the Grants Pass WTP, with various points of chlorine injection and/or pH adjustment, is slightly more complex than simply summing the $CT_{achieved}$ through each disinfection section because the $CT_{required}$ varies between sections. Rather, to quantify the overall disinfection performance, the fraction of the overall disinfection requirement (or ratio of the total $CT_{achieved}$ to the $CT_{required}$), or more simply, the log-inactivation achieved through each disinfection section is summed. For example, if 0.2-log inactivation is achieved in the Basins, 0.05-log inactivation is achieved in the Filters, and 0.4-log inactivation is achieved through the clearwell, a total inactivation of 0.65-log was achieved. In this case, the plant would have exceeded the disinfection requirement of 0.5-log inactivation, in compliance with the regulations.

The following equation is used to calculate the log-inactivation achieved through a disinfection section:

4. Log-inactivation = $$\frac{CT_{achieved}}{CT_{required}}$$

Example 1 illustrates the CT calculation for a single disinfection section at the Grants Pass WTP.

EXAMPLE #1: Calculate $CT_{achieved}$ and resulting log-inactivation through the Basins, given the following information:

- T_{10}/T of Basin = 0.28
- Basin Volume (rate-limiting basin) = 214,000 gallons
- Flow in Basin (rate-limiting basin) = 3704 gpm
- Chlorine residual at Basin Effluent = 0.6 mg/L
- Maximum pH = 7.0
- Minimum Water Temperature = 15 deg C

SOLUTION: The $CT_{achieved}$ through the Basin can be calculated according to the following equation:

1. $CT_{achieved}$ (Basin) = Chlorine Residual (Basin effluent) x T_{10} (Basin)

   Where:

   T_{10} (Basin) = hydraulic efficiency x T_{ave}

   Where T_{ave} = Basin Volume (gal) / Flow in Basin (gpm), so

   $$T_{10}\text{ (Basin)} = \frac{\text{hydraulic efficiency x Basin Volume (gal)}}{\text{Flow in Basin (gpm)}}$$

   $$T_{10}\text{ (Basin)} = \frac{0.28 \times 214{,}000\text{ (gallons)}}{3704\text{ (gpm)}}$$

   T_{10} (Basin) = 16 min

   $CT_{achieved}$ (Basin) = 0.6 mg/L x 16 min

   $CT_{achieved}$ (Basin) = 9.7 mg/L –min

2. Using CT Tables from the SWTR Guidance Manual for 1-log inactivation of *Giardia*, $CT_{required}$ at our water quality conditions is **24 mg/L – min**, well above our $CT_{achieved}$. To calculate log-inactivation use a simple ratio:

   $$\textbf{X-log kill} = \frac{9.7\text{ mg/L -min}}{24\text{ mg/L-min}}$$

   or **0.40-log** inactivation of *Giardia*!!!

NOTE: Due to unequal Basin volumes, an option exists in the model to turn the Basins on or off individually to simulate situations involving cleaning or maintenance activities.

Example 2 illustrates a CT calculation for a WTP with variable water quality characteristics.

EXAMPLE #2: Calculate log-inactivation through the Contact Basins and Clearwell, given the following additional information:

- T_{10}/T of Clearwell = 0.51
- Clearwell Volume = 325,000 gallons
- Flow in Clearwell = 11,111 gpm (or 16 mgd total through the plant)
- Chlorine residual at Clearwell Effluent = 0.85 mg/L
- Maximum pH = 8.0
- Minimum Water Temperature = 15 deg C

SOLUTION: The $CT_{achieved}$ through the Basin and Clearwell, combined, can be calculated according to the following equation:

1. Total inactivation (log) = log-inactivation (Basin) + log-inactivation (Clearwell)

We know the log inactivation through the Basin (from Example #1); we must solve for the log-inactivation through the Clearwell. We do this by calculating the $CT_{achieved}$, then solving for the log-inactivation.

$CT_{achieved}$ (Clearwell) = Chlorine Residual (Clearwell effluent) x T_{10} (Clearwell)

Where:

T_{10} (Clearwell) = hydraulic efficiency x T_{ave}

Where T_{ave} = Clearwell Volume (gal) / Flow in Clearwell (gpm), so

$$T_{10}\text{ (Clearwell)} = \frac{\text{hydraulic efficiency x Clearwell Volume (gal)}}{\text{Flow in Clearwell (gpm)}}$$

$$T_{10}\text{ (Clearwell)} = \frac{\text{0.51 x 325,000 (gallons)}}{\text{11,111 (gpm)}}$$

T_{10} (Clearwell) = 14.9 min

$CT_{achieved}$ (Clearwell) = 0.51 mg/L x 14.9 min

$CT_{achieved}$ (Clearwell) = 12.7 mg/L –min

2. Again, using CT Tables from the SWTR Guidance Manual for 1.0-log inactivation of *Giardia*, $CT_{required}$ at our water quality conditions is **36 mg/L – min**. To calculate log-inactivation use a simple ratio:

$$\textbf{X-log kill} = \frac{\text{12.7 mg/L -min}}{\text{36 mg/L-min}}$$

or **0.35-log** inactivation of *Giardia* through the Clearwell.

3. Total inactivation (log) = log-inactivation (Basin) ***(EX 1)*** + log-inactivation (Clearwell)

Total inactivation (log) = 0.40-log + 0.35-log

Total inactivation (log) = 0.75-log

WTP DISINFECTION MODEL

To accurately model the disinfection performance through the Grants Pass WTP, a model was created to perform these calculations. To do so, the plant was divided into the following disinfection sections:

- Contact basins,
- Filters,
- Clearwell,
- Pipeline (not used/optional)

Some components were intentionally excluded in the model due to poor mixing characteristics and/or potential short-circuiting issues that minimize the effective detention time, and render the overall CT achieved through the component inconsequential. These sections include: the Rapid Mix Basin, the channels/pipelines that convey water from the Contact Basins to the filters and the channel that conveys filtered water to the Clearwell.

The model was built in Microsoft Excel, and consists of a series of cross-referenced worksheets. A list of the worksheets, and a brief description follows.

- "User's Guide": contains a link to an embedded PDF copy of this Guide and contact information for the author.
- "Model Input & Results": presents a system schematic and summary of calculated values from the model. User defined variables such as plant flow rate, water quality parameters (pH, chlorine residual, etc…), and operating parameters (number of basins/filters on-line, etc…) can all be input in this worksheet. In most cases, notes and assumptions have been included beneath each of the individual disinfection sections. **In general, input variables are all contained within yellow cells; output variables are contained within red cells.**
- "Performance Summary": provides a graphical representation of *Giardia* log inactivation for the water quality parameters input for different scenarios.
- "CT Look-up Tables": These are the CT tables as transcribed from the SWTR Guidance Manual for 0.5-log inactivation of *Giardia lamblia*. These tables should not be altered.
- "T10 Reference Tables": this worksheet is provided for the user's reference when inputing the T_{10}/T values into the model.

A discussion of the user-input variables on the "Model Input & Results" worksheet (for each of the disinfection sections), as well as the assumptions made when calculating the disinfection performance of each section is discussed below.

General: User-defined variables include plant flow (in mgd) and water temperature (in ^{o}C). These values are referenced and used throughout the spreadsheet when calculating detention times, flow splitting and CT values. Note: the water temperature may increase slightly through the plant, and if desired, temperature should be input separately for each disinfection section.

***Basins*:** Flow to each of the basins has been set-up to use the Grants Pass WTP's flow split configuration. Basins can be turned on and off as needed for modeling purposes. The T_{10}/T values used in the model are based on recommended values presented in the SWTR Guidance Manual.

In addition, the user can also adjust the chlorine residual and pH for the Contact Basins. NOTE: chlorine residual should be based on the residual monitor in the "flume", downstream of the Basins. The volume of the basins (used to calculate the T_{10}) were based on an operator input "Water level in Basin". The basin water level fluctuates with filter water level, which is typically controlled to +/- 0.1 foot, so there will be little change in basin water level.

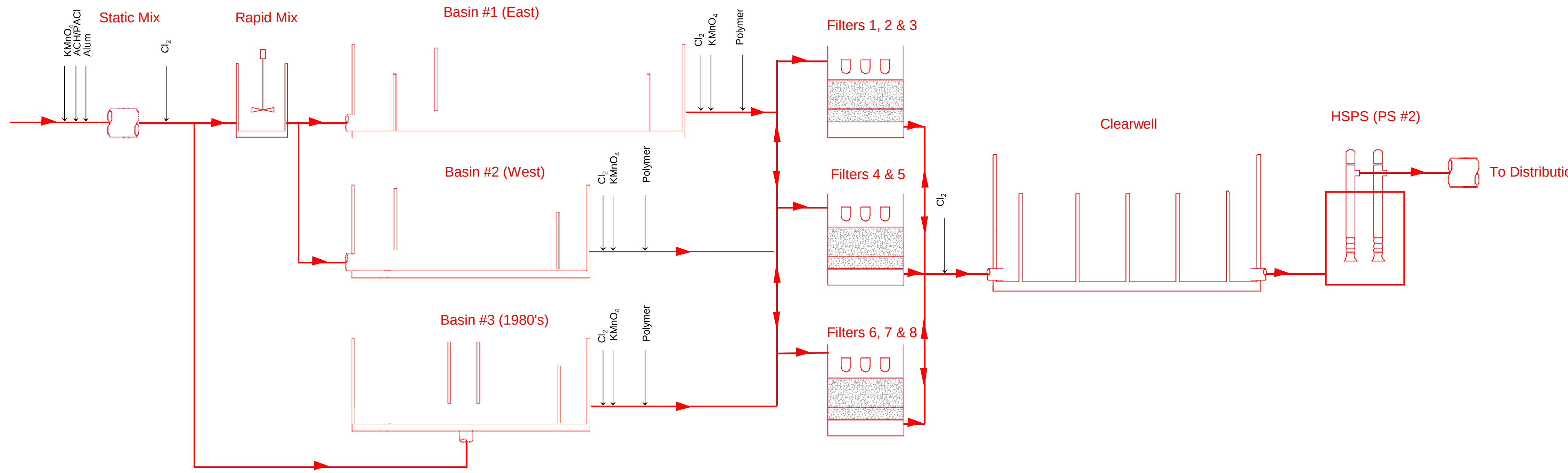
Filters: Flow through the individual filters is calculated by dividing the total plant flow by the number of filters on-line (an user-input variable). In calculating the total volume of the filters, a filter media porosity of 0.5 was used. NOTE: A operator-input variable named "Use Filters for CT?" can be toggled between Y/N, depending on the scenario desired. Typically, the Grants Pass WTP will use the Filters for CT compliance.

***Clearwell*:** For the Clearwell, the user-input variables include: water depth, chlorine residual and pH. Again, water quality characteristics must be measured downstream of the Clearwell (i.e. in the HSPS discharge, for example).

***Pipeline*:** The flow to the transmission pipeline must be input by the user. As with previous disinfection sections, chlorine residual and pH are user-input variables. Again, these water quality values need to be measured at the down-stream side of the transmission pipeline to be considered in the CT calculation. As the Grants Pass WTP does not use the transmission pipeline to meet CT, the input variable are placeholders and the log-inactivation will read "0" for this section. This section of the model is left purely for "what-if" scenarios.

***Totals*:** A summary of the log-inactivation achieved through each of the disinfection sections is presented in this section of the model. Overall totals, including the inactivation achieved through the pipeline (if ever used).

Grants Pass WTP CT Model



Input/Results:

General:

Plant Flow Rate (for CT Calcs)	13500	(gpm)
Plant Flow Rate	19.4	(mgd)
Finished Water Temperature	15.00	(°C)
MAX Design Rate	20	(mgd)
MIN Design Rate	1	(mgd)

Notes:
1. Yellow boxes indicate operator input variables
2. Red boxes indicate calculated values

Notes:
1. Verify flow calculations; include recycle streams where appropriate.

Floc/Sed Basins

General

Flow to Basin #1	6.9	(mgd)
Flow to Basin #2	4.1	(mgd)
Flow to Basins #3	8.4	(mgd)
Basin #1 Online (Y/N)	Y	(mgd)
Basin #2 Online (Y/N)	Y	(mgd)
Basin #3 Online (Y/N)	Y	(mgd)
Water Depth in Basin	14.5	(ft)

Basin #1

MIN Chlorine Residual (effluent)	0.10	(mg/L)
MAX pH (Rapid Mix)	7.50	
Temperature	15.00	(°C)
T_{10}/T	0.44	
Hydraulic Residence Time	119	(min)
T10 (for CT Calculation)	52	(min)
CT Achieved	5.2	(mg/L-min)
Log Inactivation	0.17	(log)

Basin #2:

MIN Chlorine Residual (effluent)	0.10	(mg/L)
MAX pH (Rapid Mix)	7.50	
Temperature	15.00	(°C)
T_{10}/T	0.44	
Hydraulic Residence Time	119	(min)
T10 (for CT Calculation)	52	(min)
CT Achieved	5.2	(mg/L-min)
Log Inactivation	0.17	

Basin #3:

MIN Chlorine Residual (effluent)	0.10	(mg/L)
MAX pH (Rapid Mix)	7.50	
Temperature	15.00	(°C)
T_{10}/T	0.44	
Hydraulic Residence Time	119	(min)
T10 (for CT Calculation)	52	(min)
CT Achieved	5.2	(mg/L-min)
Log Inactivation	0.17	

Notes:
1. T10/T Ratio based on 2012 tracer testing

Anthracite/Sand Filter

General

Number of Filters On-line	8	(no)
Use Filters for CT? (see Note 3)	Y	(Y/N)
Filter Surface Area	311.5	(sf)
Media Depth	30	(in)
MIN Water Depth	6.25	(ft)
Single Filter Volume	11651.66	(gal)

Filters:

MIN Chlorine Residual (effluent)	0.10	(mg/L)
MAX pH (Rapid Mix)	7.50	
Temperature	15.00	(°C)
T_{10}/T	0.44	
Hydraulic Residence Time	6.9	(min)
T10 (for CT Calculation)	3.0	(min)
CT Required	30	(mg/L-min)
CT Achieved	0.3	(mg/L-min)
Log Inactivation	0.01	(log)

Notes:
1. Need to confirm Cl2 & pH sample points to ensure compliance
2. Volume Calcs assume a media porosity of 0.5
3. Filters can be turned off to model other scenarios.

Clearwell:

General

Basin Surface Area	3558	(ft)
Water Depth	13.6	(ft)
Basin Volume	361996.6	(gal)

Clearwell:

MIN Chlorine Residual (effluent)	0.90	(mg/L)
MAX pH (Rapid Mix)	7.50	
Temperature	15.00	(°C)
T_{10}/T	0.53	
Hydraulic Residence Time	27	(min)
T10 (for CT Calculation)	14	(min)
CT Required	30	(mg/L-min)
CT Achieved	12.9	(mg/L-min)
Log Inactivation	0.43	

Notes:
1. T10/T Ratio based on B&V 2003 tracer testing.

Pipeline:

General

Plant Efficiency	0.95	(%)
Pipeline Diameter	36	(in)
Pipe Length	5	(ft)
Pipe Volume	264	(gal)
Pipeline Flow	18.43	(mgd)

Transmission Main to First Customer

Chlorine Residual	0.85	(mg/L)
pH	8.00	
Temperature	15.00	(°C)
T_{10}/T	1.00	
Hydraulic Residence Time	0.0	(min)
T10 (for CT Calculation)	0.0	(min)
CT Required	36	(mg/L-min)
CT Achieved	0.0	(mg/L-min)
Log Inactivation	0.00	

Notes:
1. Pipeline is not used in this calculation and is provided solely for 'what if' scenarios.
2. Pipeline Flow calculated by multipling Plant Flow and Plant Efficiency.

Totals:

In-plant Sub-Total

Process	**Log**
Floc/Sed Basins	0.17
Filter	0.01
Clearwell	0.43
Sub-total (In-plant)	***0.61***

24-inch Transmission Main

Pipeline (to First Customer)	0.00

Totals:

Total Achieved in Plant	0.61

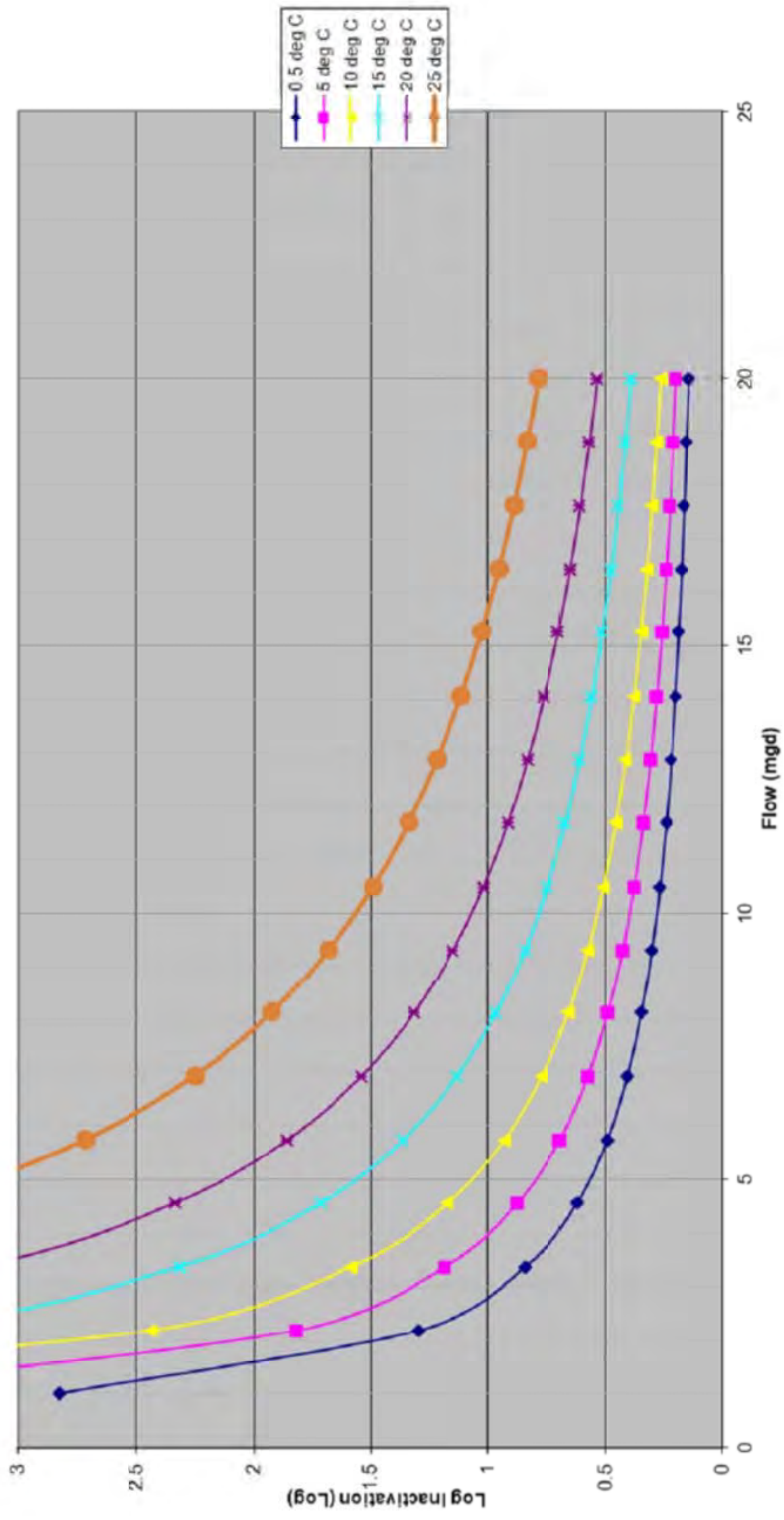


Figure C-2: Log inactivation of *Giardia* through the Clearwell from the CT Model for the Water Quality Parameters Input

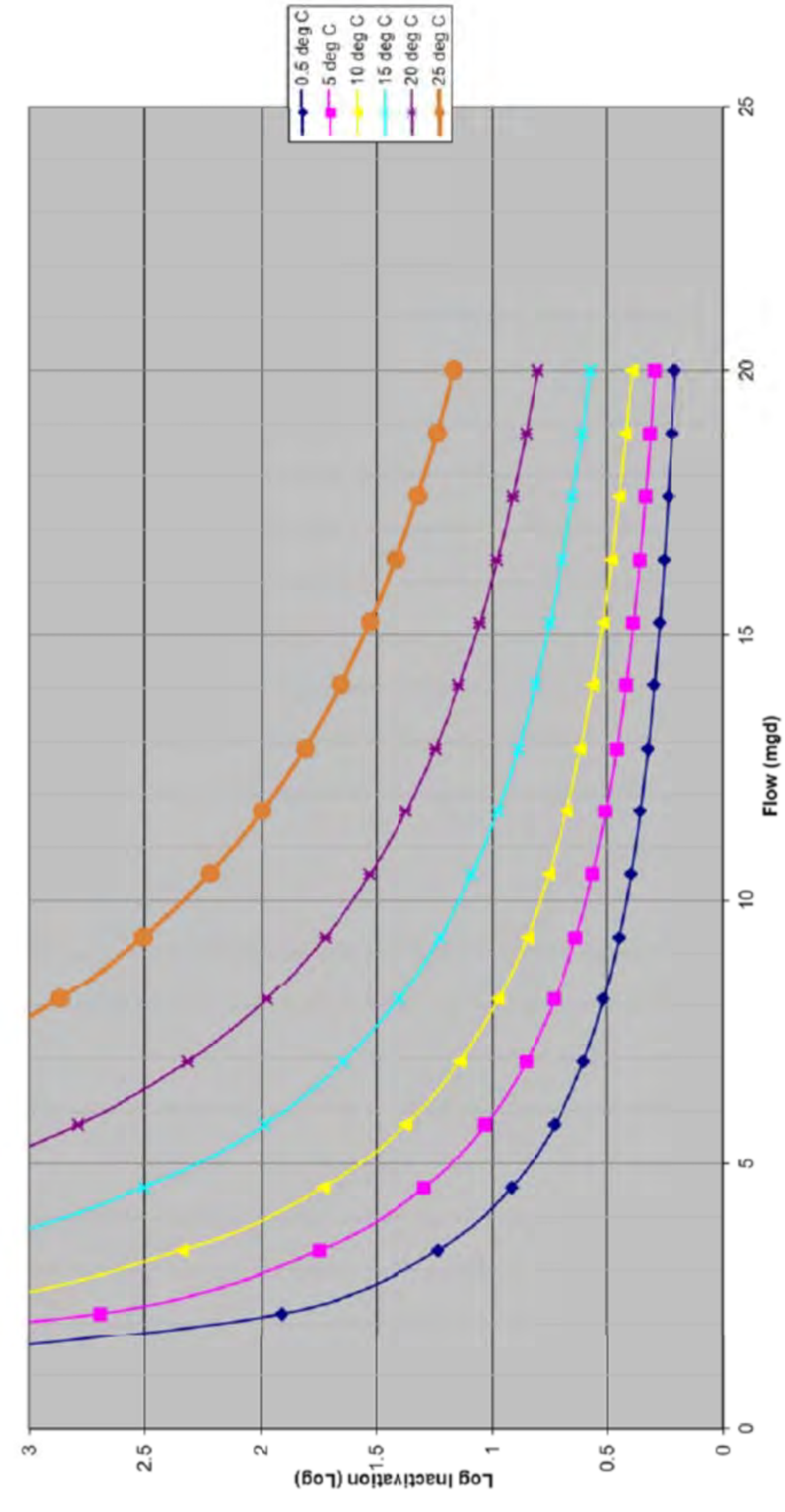


Figure C-3: Log inactivation of *Giardia* through the WTP & Clearwell from the CT Model for the Water Quality Parameters Input

APPENDIX B

Starting water surface elevation
922.96
Clearwell
Filter 1 Effluent Piping
Filter 2 Effluent Piping
Filter 3 Effluent Piping
Filter 4 Effluent Piping
Filter 5 Effluent Piping
Filter 6 Effluent Piping
Filter 7 Effluent Piping
Filters 8 Effluent Piping
Off-line
Common Filter Influent Channel
935.34
Filter Influent Channel
Sedimentation Basin 1
Sedimentation Basin 2
Sedimentation Basin 3
Mud Valves Inlet Sedimentation Basin 1
Mud Valves Inlet Sedimentation Basin 2
RW Split
940.93
BFV

APPENDIX C

MEMORANDUM

TO: Jason Canady

DATE: 7/15/2011

FROM: Todd Petrik, P.E., MWH

CC: Chris Uber, P.E., MSA
Brian Ginter, P. E., MSA

REVIEWED BY: Pete Kreft, P.E., MWH
Corie Peterson, P.E., MWH

SUBJECT: **Grants Pass WTP – Inspection of the Clearwell (Inspection Date 5/24/2011)**

Background

On May 24, 2011, MWH conducted a follow-up inspection of the clearwell concrete roof and beams in the original 1930's constructed part of the building. A photo log of this visit is attached as Appendix A. The follow-up was conducted to determine a more-defined extent of the concrete deterioration that was first discovered during the March 2, 2011 inspection. As a reference, the March 2, 2011 report and photo log are attached as Appendix B. It should be noted that the March 2, 2011 inspection was focused on the area of the clearwell that was leaking in groundwater, but some other areas of concern were observed then as well. The leak area and general recommendations from the March 2, 2011 inspection are summarized below:

Clearwell Water Intrusion Repair Recommendations

- MWH recommends that the backfill on the exterior of the wall adjacent to the joint between the 1930 and 1950 construction be removed for further inspection of this joint from outside the building.
- Once the cause of the water intrusion is known for sure, then repairs to the leak should proceed as quickly as possible.
- There is more than one way to repair this leak. These are, but are not limited to:
  - An exterior rubber strip sealed on both sides of the crack and covering over the crack to prevent the migration of the groundwater into the building.
  - Injection grouting into the crack
- One thing that should be considered by the City is to chip away the exterior wall concrete down to the 10 ga galv. iron waterstop and remove it altogether. This will help to eliminate any future rusting of this waterstop and help to prevent the rusting of the waterstop and spalling of concrete.

Clearwell General Inspection Repair Recommendations

Ladder Rungs in Each of the Three Clearwell Manhole Access

- None of the ladder rungs are in a state of immediate collapse. Yet, they should be replaced in the near future. It is important to mitigate any further rusting of the ladder rungs back into the concrete wall. New rungs should be installed with a "drill and epoxy" system. The rungs should be either stainless steel or FRP.

<u>Various Concrete Beams in the Roof of the Octagon Clearwell</u>

- None of the beams have deteriorated to a point where the beams are failing. Yet, they should be repaired in the near future. It is important to mitigate any further rusting of the reinforcement. Once the rusting starts, it will travel over time down the length of the entire bar. They are many different options for the repair of these types of deterioration in concrete. These options will be discussed at length with the City Staff at a time closer to put together a repair plan.

The most recent inspection was completed on Tuesday, May 24, 2011 by Todd Petrik and accompanied by the Treatment Plant Superintendent, Jason Canady. A summary of this visit and recommendations that resulted from it are listed below.

Clearwell - General Structural Inspection

Note: All of the photos referenced in the following text below are included in the attached annotated site photo log, attached as Appendix A.

Generally, the concrete floors, walls, columns, beams, and undersides of the top decks are in good condition. However, a more aggressive approach was taken during the most recent inspection to determine how far-reaching the spalling concrete and corroding reinforcement is that was first encountered during the March 3 inspection. For those areas that do have issues, the extent of the deterioration is worse than originally determined. If certain areas are not repaired, damage could continue to spread and threaten the structural stability and integrity of the clearwell. In turn, this could potentially threaten the ability of the Water Treatment Facility to effectively disinfect water and deliver safe drinking water to the citizens of Grants Pass.

Identification of Various Concrete Beams in the Roof of the Octagon Clearwell

There are four interior concrete columns in the clearwell that divide the roof/beams into nine different panels. Running in the North/South direction, there are north, middle and south beams. Running in the East/West direction, there are east, middle and west beams. These beams and the exterior walls of the clearwell define the 9 different panels. Reference the attached sketch presented as **Figure 1**. The summary below makes use of the labeling defined above and shown in **Figure 1**.

Common/Typical General Concrete Repair Methods

One common, and often-used, method for the repair of concrete structural elements is to use a bonded fiberglass reinforced plastic (FRP) system. This practice is governed by ACI 440.2R and is widely used throughout the engineering community. For this report, this process will be referred to as FRP Repair.

<u>Repair Priority</u>

MWH has determined that the repairs presented below fall into two different Priority categories.

Priority 1: Denoted by “P1”, this is the higher of the two levels. These repairs should be made in the next Low-Water demand period. These repairs should be given a higher priority to prevent the conditions from growing worse which could lead to a failure of the structural systems in the clearwell ceiling.

Priority 2: Denoted by “P2”, this is the lower of the two levels. These issues have much less of an impact on the structural system in the clearwell ceiling. Not completing these repairs will result in worsening of the condition, yet it is not urgent that these repairs take place in the next Low-water demand period,

1. **West-South Beam (Photos 0070 to 0074)**

The bottom-west corner of this beam has rock pockets that extend south about 30-inches in length from the interior column. There is no visible reinforcement. It appears that the concrete was never consolidated in this corner during the initial construction.

P2-Repair: Sand blast clean and fill the pockets with a non-shrink epoxy grout.

2. **South-West Beam (Photos 0075 to 0080)**

The bottom-south corner of this beam has rock pockets that extend from the west wall for about half the length of the beam to the east. There is no visible reinforcement. It appears that the concrete was never consolidated in this corner during the initial construction. On the south side of this beam, there is an abandoned steel floor drain. It is rusting and starting to spall the concrete around it.

P2-Rock Pocket Repair: Sand blast clean and fill the pockets with a non-shrink epoxy grout.

P2-Pipe Repair: Cut off the drain pipe and burn it back up into the concrete a minimum of 1-1/2 inches. Grout over the hole with a non-shrink epoxy grout.

3. **West-Middle Beam (Photos 0082 to 0085)**

The bottom-west corner of this beam from the north column to 48-inches south has significant concrete spalling and deteriorated reinforcing bars. The east side of the beam has a short, 12 to 16-inch section of rock pockets in the mid-span of the lower corner. On the east side of this beam, there is an abandoned steel floor drain. It is rusting and starting to spall the concrete around it.

P1-Reinforcement Repair: Chip back the concrete until clean, bright reinforcement is encountered. Remove the rusted reinforcement. Build back up the deteriorated concrete beam with a non-shrink grout and the use of the FRP repair method to bring back the integrity of this beam.

P2-Rock Pocket Repair: Sand blast clean and fill the pockets with a non-shrink epoxy grout.

P2-Pipe Repair: Cut off the drain pipe and burn it back up into the concrete a minimum of 1-1/2 inches. Grout over the hole with a non-shrink epoxy grout.

4. **South-Middle Beam (Photos 0089 to 0096)**

At the west end of this beam and in the center of the beam, there is a hole from unconsolidated concrete that has resulted in exposed reinforcing bars. The two exposed bars are rusting. The rusting of these bars is causing further spalling of the concrete. Along the north side of the beam, there is a rock pocket that extends for about a 5 foot length.

P1-Reinforcement Repair: Chip back the concrete until clean, bright reinforcement is encountered. Remove the rusted reinforcement. Build back up the deteriorated concrete beam with a non-shrink grout and the use of the repair method to bring back the integrity of this beam.

P2-Rock Pocket Repair: Sand blast clean and fill the pockets with a non-shrink epoxy grout.

5. **East-Middle Beam (Photos 0097 to 0103)**

At the bottom west corner of the beam and for the entire length of the beam, the concrete has spalled off and exposed the reinforcing bar(s). Also, along the east side of the beam, there is a short 6 to 8-inch long section of spalled concrete and exposed reinforcement.

P1-Reinforcement Repair: For the entire length of this beam, chip back the concrete until clean, bright reinforcement is encountered. Remove the rusted reinforcement. Build back up the deteriorated concrete beam with a non-shrink grout and the use of the FRP repair method to bring back the integrity of this beam.

6. **Middle-East Ceiling Panel (Photos 0104 to 0110)**

There is a 54-foot long section of reinforcement that has rusted and spalled the concrete around it. There is a 2-inch deep hole in the bottom of the floor from a deteriorated wood block. Also, there is an abandoned steel floor drain pipe that is rusting and starting to spall the concrete around it.

P1-Reinforcement Repair: Chip back the concrete until clean, bright reinforcement is encountered. Remove the rusted reinforcement. Build back up the deteriorated concrete floor with a non-shrink grout and the use of the FRP repair method to bring back the integrity of this floor.

P1-Hole Repair: Chip back the concrete until clean, bright reinforcement is encountered. Remove the rusted reinforcement. Build back up the deteriorated concrete floor with a non-shrink grout and the use of the RFP repair method to bring back the integrity of this floor.

P2-Pipe Repair: Cut off the drain pipe and burn it back up into the concrete a minimum of 1-1/2 inches. Grout over the hole with a non-shrink epoxy grout.

7. **East-South Beam (Photos 0111 to 0116)**

Along the west and east sides of the beam, there are various rock pockets. There is no visible rusted reinforcement showing. Near the center column. there is an abandoned pipe stuffed with some type of insulation. The pipe is rusting and spalling the concrete around it.

P2-Rock Pocket Repair: Sand blast clean and fill the pockets with a non-shrink epoxy grout.

P2-Pipe Repair: Cut off the drain pipe and burn it back up into the concrete a minimum of 1-1/2 inches. Grout over the hole with a non-shrink epoxy grout.

8. **South-East Beam (Photos 0117 to 0120)**

There is no spalling of the concrete or any visible rusting reinforcement on either side or bottom of the beam.

Repair: None required

9. **South-East Ceiling Panel (Photos 0121 to 0124)**

In the underside of the floor, there is a large circular patch that appears to have the hole filled at two different times. The outer patch is starting to deteriorate and the older concrete is spalling off. There is no visible rusting reinforcement.

P2-Patch Repair: Chip out the old concrete to sound, solid concrete. Sandblast the hole clean. Place new non-shrink grout into the hole. If the hole becomes over 12-inches in diameter, there may be a need to drill and epoxy in small reinforcing bars to hold the new grout into place.

10. Clearwell Access hole in East wall (Photos 125 to 131)

In order to expand the clearwell to the East, a hole was cut in the wall. When the hole was cut, it appears that reinforcing bars were left exposed. These reinforcing bars are now rusting and spalling the concrete around them. While there is no real structural significance to this, it is worth cleaning out the old bars and patching up the edges of the hole.

P1-Repair: Chip the concrete back to expose clean bright reinforcement. Cut off all rusted reinforcement and burn the bars back into the solid concrete a minimum of 1-1/2 inches. Drill in new, short #4 dowels around the edge of the opening. Form a new opening and cast in new non-shrink grout.

11. North-West Beam (Photos 0132 to 0136)

On the north side of the beam and on the west end, the bottom corner has spalled off and rusted reinforcement is visible.

P1-Reinforcement Repair: For the entire length of this beam, chip back the concrete until clean, bright reinforcement is encountered. Remove the rusted reinforcement. Build back up the deteriorated concrete beam with a non-shrink grout and the use of the FRP repair method to bring back the integrity of this beam.

12. North-West Ceiling Panel (Photo 138)

There is a small hole that has spalling concrete around it. There is no visible rusting of reinforcement.

P2-Hole Repair: Chip back the concrete until clean, bright reinforcement is encountered. Remove the rusted reinforcement. Build back up the deteriorated concrete floor with a non-shrink grout and the use of the RFP repair method to bring back the integrity of this floor.

13. West-North Beam (Photos 139 to 141)

There is no spalling of the concrete or any visible rusting reinforcement on either side or bottom of the beam. There are a few small rock pockets along the length of the beam.

P2-Rock Pocket Repair: Sand blast clean and fill the pockets with a non-shrink epoxy grout.

14. North-Middle Beam (Photos 142 to 148)

There is no spalling of the concrete or any visible rusting reinforcement on either side or bottom of the beam. There are a few small rock pockets along the length of the beam. At the west end of the beam, adjacent to the large patch in the ceiling, there is a small hole in the corner where the beam meets the ceiling. There is a 2 to 3-inch long piece of reinforcement that is visible. This reinforcement is not rusting and the concrete is not spalling.

P2-Rock Pocket Repair: Sand blast clean and fill the pockets with a non-shrink epoxy grout.

P2-Small Hole Repair: Sand blast clean and fill the hole with a non-shrink epoxy grout.

15. North-Middle Ceiling Panel (Photos 149 to 153)

Up tight against the north wall of the clearwell, there are two exposed bars that are rusting and starting to spall the concrete. The west bar is exposed for about 6 to 8-inches. The East bar is exposed for about 14 to 16-inches. And there is an abandoned steel floor drain pipe that is rusting and starting to spall the concrete around it.

P1-Reinforcement Repair: Chip back the concrete until clean, bright reinforcement is encountered. Remove the rusted reinforcement. Build back up the deteriorated concrete floor with a non-shrink grout and the use of the FRP repair method to bring back the integrity of this floor.

P2-Pipe Repair: Cut off the drain pipe and burn it back up into the concrete a minimum of 1-1/2 inches. Grout over the hole with a non-shrink epoxy grout.

16. **North-East Beam (Photos 154 to 159)**

There is one hole in the middle of the underside of the beam. It is about 2-inches in diameter and about 2-inches deep. There is rusting reinforcement visible in the hole. The rest of the beam is in good conditions.

P2-Hole Repair: Chip back the concrete until clean, bright reinforcement is encountered. Remove the rusted reinforcement. Build back up the deteriorated concrete floor with a non-shrink grout and the use of the FRP repair method to bring back the integrity of this floor.

17. **North-East Beam (Photos 0160 to 0165)**

On the east end of the beam, along the bottom south corner for 3 feet, the concrete is spalling off and rusted reinforcement is visible. Also, there is a 12- to 14-inch long section of spalling concrete and rusting reinforcement in the center of the beam.

P1-Reinforcement Repair: For the entire length of this beam, chip back the concrete until clean, bright reinforcement is encountered. Remove the rusted reinforcement. Build back up the deteriorated concrete beam with a non-shrink grout and the use of the FRP repair method to bring back the integrity of this beam.

18. **North-East Ceiling Panel (Photos 0166 to 0169)**

There are three smaller holes in the ceiling, each having a small section of rusting reinforcement visible in the hole. There are also several small rock pockets with no visible reinforcement.

P1-Reinforcement Repair: Chip back the concrete until clean, bright reinforcement is encountered. Remove the rusted reinforcement. Build back up the deteriorated concrete floor with a non-shrink grout and the use of the FRP repair method to bring back the integrity of this floor.

P2-Rock Pocket Repair: Sand blast clean and fill the pockets with a non-shrink epoxy grout.

19. **Clearwell East of the 1930 octagon (Photos 0170 to 0194)**

There did not appear to be any visible spalling of concrete or exposed and rusting reinforcement.

Repairs: None required.

20. **Clearwell west opf the 1930 Octagon (Photos 195 to 198)**

There did not appear to be any visible spalling of concrete or exposed and rusting reinforcement.

Repairs: None required.

Summary

MWH strongly recommends that the P1 level repairs presented in this memo occur during the next low demand period of operation as the repairs will most likely require the clearwell to be taken out of service and dewatered for a period of time. Should the City choose to move forward with repairs, a detailed set of repair plans and specification that can be used for construction should be prepared. In addition, during the next low demand period, the clearwell is slated to be dewatered for construction related to the installation of a new redundant filter backwash pump. Combining these projects may provide significant savings to the City in mobilization costs of similar contractor types, and common construction periods for both categories of work while the clearwell is dewatered.

During any of the repairs stated above, the floor deck and possibly the adjacent beams are to be shored to limit the possibility of the floor deflecting.

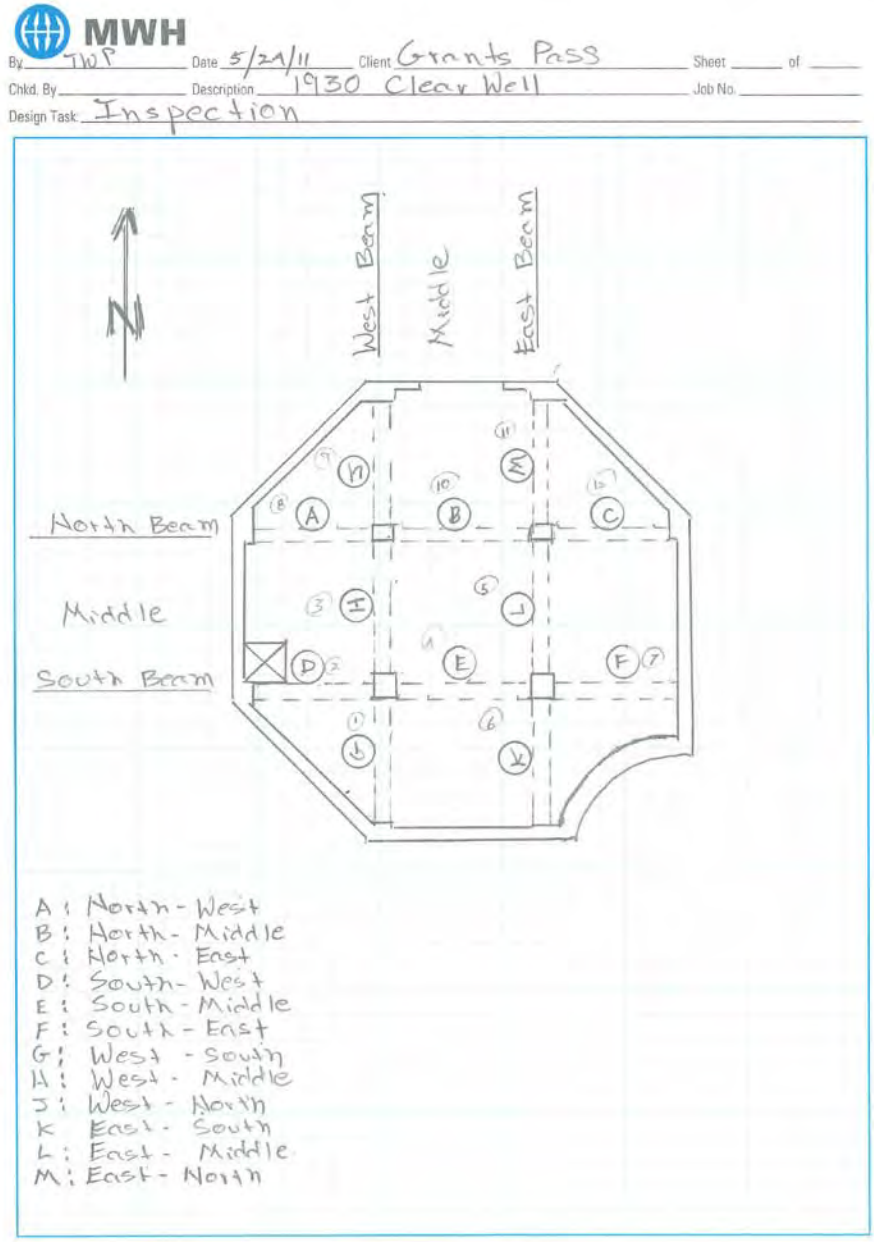

MWH
By TWP
Date 5/24/11
Client Grants Pass
Sheet of
Chkd. By
Description 1930 Clear Well
Job No.
Design Task: Inspection
N
West Beam
Middle
East Beam
North Beam
Middle
South Beam
A
B
C
D
E
F
H
I
J
K
L
M
A: North-West
B: North-Middle
C: North-East
D: South-West
E: South-Middle
F: South-East
G: West-South
H: West-Middle
J: West-North
K East-South
L: East-Middle
M: East-North

Figure 1

Appendix A

City of Grants Pass
Water Filtration Plant
821 SE M Street
Grants Pass OR 97526

Inspection Date: **May 24, 2011**
Inspected By: **Todd Petrik**
Clearwell

West-South Beam
Photos 00700 – 0074

Photo 0070

- The concrete is Sound overall
- Rock pockets on west side. 30” in length.

Photo 0071
Showing the rock Pockets

Photo 0072
Showing the rock Pockets

Photo 0073

Photo 0074

South-West Beam
Photos 0075 – 0080

Photo 0075

- The concrete is Sound overall
- Rock pockets on south side

At west end of the beam, there is a drain in slab that is rusting and needs to be cut back and slab bottom patched.

Photo 0076

Photo 0077
Showing the rusting floor drain

Photo 0078
Showing the rusting floor drain

Photo 0079
Showing the rusting floor drain

Photo 0080

South Clearwell Wall
Photo 0081

Rock pocket in south wall

West-Middle Beam
Photos 0082 – 0085

Photo 0082

- West side beam at the lower corner has 48” of spalling concrete and exposed reinforcement.
- Scraped the Reinforcing bar & lost about 50% of the area of reinforcement..
- East side is okay

Photo 0083

No real spalling of concrete. Burn back pipe and patch.

Photo 0084

- West side beam at the lower corner has 48” of spalling concrete and exposed reinforcement.

Photo 0085

- West side beam at the lower corner has 48” of spalling concrete and exposed reinforcement.

Photo 0086
Exposed steel pipe that is rusting

Photo 0087

East side rock pocket

Photo 0088

Pipe in ceiling & reinforcement in corner

South-Middle Beam
Photos 0089 – 0096
Photo 0089

- At the West end of the beam and in the middle of the beam width there is a deep rock pocket – with rusted reinforcement showing. 16” wide at this part of beam.
- East end solid
- The clearwell ceiling is okay in this area
- North side of beam has rock pockets for a length of 5’-0”

Photo 0090

- North side of beam has rock pockets for a length of 5’-0”

Photo 0091

- Rock pockets and exposed reinforcement

Photo 0092

Photo 0093

- North side of beam has rock pockets for a length of 5’-0”

Photo 0094

- Rock pockets and exposed reinforcement

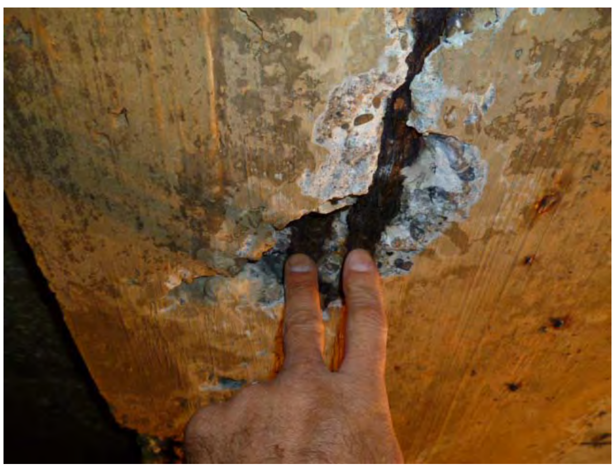


Photo 0095

- Rock pockets and exposed reinforcement

Photo 0096

East-Middle Beam
Photos 0097 – 0103

Photo 0097

- The entire bottom corner on the west side of the beam up to ceiling has spalled off.
- 1 bar is exposed the entire length of spall
- 2 bars are exposed at the center of beam
- At the East side of the beam at north end, there is also spalling concrete and exposed reinforcement.

Photo 0098

- Showing a close up of the spalled concrete and exposed bar on the west side of the beam.

Photo 0099

- Showing a close up of the spalled concrete and exposed bar on the west side of the beam.

Photo 0100

- Showing a close up of the spalled concrete and exposed bar on the west side of the beam.

Photo 0101

- Showing the spalled concrete at the center of the beam

Photo 0102

Photo 0103

- Showing the spalled concrete at the center of the beam

Middle-East Ceiling Panel
Photos 0104 to 0110

Photo 0104

- Showing a patch and a hole in the ceiling

Photo 0105

Photo 0106

Reinforcement bar with no cover has spalled the concrete for about a 5’-0” length

Photo 0107

Photo 0108

- 2-inch deep hole with rotting wood up inside of it.

Photo 0109

- 2-inch deep hole with rotting wood up inside of it.

Photo 0110

- Abandoned steel floor drain pipe that is rusting.

East-south Beam
Photos 0111 – 0116

Photo 0111

- There are rock pockets on the west and east sides of the beam
- There is no visible rusting reinforcement in the rock pockets
- Near the center column There is an abandoned steel pipe stuffed with installation and about 2-inches deep of spalled of concrete

Photo 0112

Photo 0113

- Showing rock pockets

Photo 0114

- Showing the abandoned steel pipe with insulation

Photo 0115

- Showing the abandoned steel pipe with insulation

Photo 0116

- Showing the abandoned steel pipe with insulation

South-East Beam
Photos 0117 – 0120

Photo 0117

- The concrete is solid on all sides and the bottom of the beam
- No spalling of concrete
- No visible reinforcement

Photo 0118

Photo 0119

Photo 0120

South-East Ceiling Panel
Photos 0121 – 0124

Photo 0121

- There is a circular inside patch and an irregular patch around the outside of the circle.
- The outside patch is spalling and revealing rusting reinforcement

Photo 0122

Photo 0123

Photo 0124

Wall at the Clearwell southeast corner
Photos 0125 - 0127

Photo 0125

- Showing a short section of rusting reinforcement at the face of the wall

Photo 0126

Photo 0127

- There is a small length of exposed reinforcement and spalled concrete

Clearwell access hole in East wall (Photos 125 to 131)

Photo 0128

- Hole cut in East Wall for water flow and access
- The reinforcement around the edge of the opening is rusting and spalling of section of concrete.
- The wall is about 4-1/4 inches wide

Photo 0129

- Showing the edge of the opening

Photo 0130

- Showing the edge of the opening

Photo 0131

North-West Beam
Photos 0132 - 0136

Photo 0132

- At the North side at west end the entire corner has spalled off
- The corner reinforcing bar is exposed and the middle bar is exposed for about 4'-0"

Photo 0133

Photo 0134

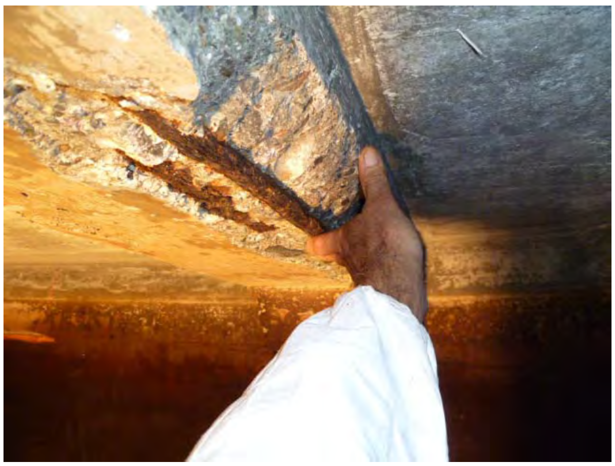


Photo 0135

- Showing exposed reinforcing bars

Photo 0136

North-West Ceiling Panel
Photos 0137 – 0138

Photo 0137

- Cone-tie hole needs to be patched

Photo 0138

- Cone-tie hole needs to be patched

West-North Beam
Photos 0139 – 0141

Photo 0139

- The concrete is solid on both sides and the bottom of the beam
- No spalling
- No rusting reinforcement
- Small rock pockets

Photo 0140

Photo 0141

North-Middle Beam
Photos 0142 - 146

Photo 0142

- The concrete is solid on both sides and the bottom of the beam
- No spalling
- No rusting reinforcement
- Small rock pockets

Photo 0143

Photo 0144

Photo 0145

- Showing a small hole at the west end and it is about 1-1/2 inches deep with a short piece of
- Reinforcement exposed but not rusted

Photo 0146

North-Middle Ceiling Panel
(Photos 147 to 153)

Photo 0147

- There are two patched holes where it appears there used to be pump cans. Both of the patches are in good condition

Photo 0148

Photo 0149

- Against north wall are 2 spalling and rusting reinforcement bars.

Photo 0150

Photo 0151

- The West bar is rusting and spalling concrete for about 6-inches from the wall

Photo 0152

- The East bar is rusting and spalling concrete for about 14-inches from the wall

Photo 0153

- Shows an abandoned pipe. The concrete around it is good but the end of the pipe is rusting

North-East Beam
Photos 0154 - 0159

Photo 0154

- There is one main hole in the middle of the beam about 1 to 2-inches deep
- In the hole, the reinforcement is exposed and rusting
- All other parts of the beam are solid

Photo 0155

Photo 0156

Photo 0157

- Showing the hole in the beam

Photo 0158

Photo 0159

- Showing at the south end of beam on the west side there is a small rock pocket

North-East Beam
Photos 0160 – 0165

Photo 0160

- At the east end of the beam on the south side of beam there is spalling concrete and reinforcement is rusting
- There is also spalling at the center of beam about 3’-0” from the east end
- At the west end of the beam the concrete is solid

Photo 0161

Photo 0162

- Showing the spalling concrete and rusting reinforcement at the east end of the beam

Photo 0163

Photo 0164

Photo 0165

North-East Ceiling Panel
Photos 0166 - 0169

Photo 0166

- There is a concrete cone tie hole 2-inches deep and about 1-1/2 inches in diameter at the concrete surface
- There are also 2 other small reinforcement or tie rusting spots
- And there are a few smal rock pockets

Photo 0167

- Showing the small reinforcement rusting

Photo 0168

Photo 0169

Clearwell East of the 1930 octagon (Photos 0170 to 0194)

For all of this area, there is no visible spalling of concrete or rusting reinforcement

Photo 0170

Photo 0171

Photo 0172

Photo 0173

Photo 0174

Photo 0175

Photo 0176

Photo 0177

Photo 0178

Photo 0179

Photo 0180

Photo 0181

Photo 0182

Photo 0183

Photo 0184

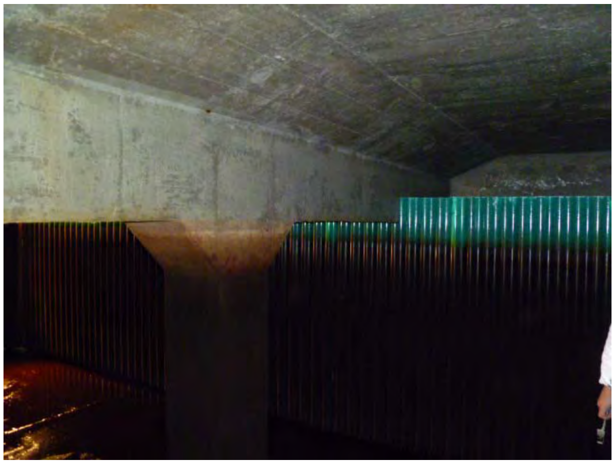


Photo 0185

Photo 0186

Photo 0187

Photo 0188

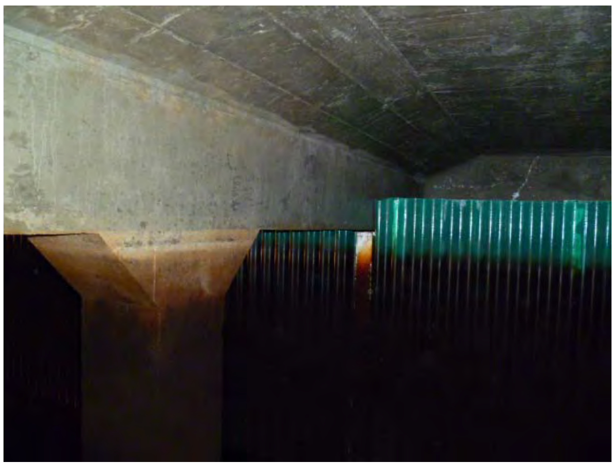


Photo 0189

Photo 0190

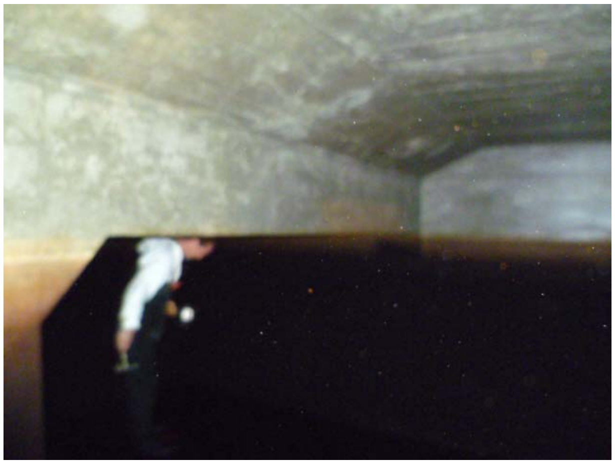


Photo 0191

Photo 0192

Photo 0193

Photo 0194

Clearwell West of the 1930 octagon (Photos 0195 to 0198)

For all of this area, there is no visible spalling of concrete or rusting reinforcement

Photo 0195

Photo 0196

Photo 0197

Photo 0198

Appendix B

MEMORANDUM

To: Jason Canady, City of Grants Pass
From: Todd Petrik, MWH
Date: 3/15/2011 – Inspection Date
Subject: Grants Pass, Inspection of the Clearwell

Background

The staff at the Water Treatment plant in Grants Pass contacted MWH to come inspect water intrusion into the interior spaces of the plant. Plant staff stated that it appear that the water intrusion is occurring at a joint that is between the original 1930 construction and the West Clearwell constructed in the 1950s.

In summary, the structural inspection was to review the following items at the plant:

- The current condition of the water intrusion in the space that is above the clearwell in the pipe gallery west of the Octagon lobby. This is dry space.
- The current condition of the water instruction in the water channel down in the clearwell west of the Octagon Lobby. This is wet space.
- Since the entire clearwell was able to be de-watered, a walkthrough of all three spaces was completed.

Clearwell Water Intrusion Inspection Summary

Each of the spaces stated above are below the final grade that is exterior to the building and adjacent to where the water intrusion is occurring.

(All of the photos referenced below are included in the attached site inspection photo log.)

<u>Dry Space Above the Clearwell</u>

1. Photos 1 through 3 show the area of water intrusion from the exterior of the building.
2. Photos 4 and 5 show the inside wall of the 1930s constructed Octagon. There was no indication of water instruction into this space. It appears that the wall of the original 1930 building is holding up to any water intrusion.
3. Photos 6 through 8 shows where the water intrusion is occurring into the space constructed in the 1950s. The conclusion is that the water is coming in through the joint between the exterior wall of the 1930 building and the exterior wall of the 1950 building. The construction detail of this joint can be found in the 1950 expansion drawings in the upper right corner of Sheet No. 5 of 13.

<u>Wet Space Down in the Clearwell</u>

1. Photos 9 through 11 show the joint between the manhole access into the clearwell and the top slab. The water that is coming in from outside has also found its way into this joint. This water is rusting the reinforcement steel in the joint and spalling the concrete. This spalling and rusting is only evident on the East side of the manhole access, which, is adjacent to the vertical crack in the exterior wall shown in Photos 6 through 8.

2. While the channel below the top deck, down in the clearwell is wet, the top part of the channel is above the water line and remains dry. The concrete here also looks dry. This is the case except in the corner at the joint between the 1930 and 1950 construction. Reference photo 12. This picture shows a white effloresce.

Clearwell Water Intrusion Repair Recommendations

- MWH recommends that the back fill on the exterior of the wall adjacent to the joint between the 1930 and 1950 construction be removed for further inspection of this joint from outside the building.
- The most likely outcome will reveal that the water intrusion is starting in this exterior fill and migrating through the joint between the 1930 and 1950 buildings. This would mean that the seal shown in the 1950 drawing detail on sheet 5 of 13 has deteriorated. This seal, or waterstop, is called out in this detail as a "10ga galv. Iron – caulked into a saw cut slot and grouted into place with lead or cement".
- Once the cause of the water intrusion is know for sure, then repairs to the leak should proceed as quickly as possible.
- There is more than one way to repair this leak. These are, but are not limited to:
  - An exterior rubber strip sealed on both sides of the crack and covering over the crack to prevent the migration of the groundwater into the building.
  - Injection grouting into the crack
- One thing that should be considered by the City is to chip away the exterior wall concrete down to the 10 ga galv. iron waterstop and remove it altogether. This will help to eliminate any future rusting of this waterstop and help to prevent the rusting of the waterstop and spalling of concrete.

Clearwell, General Inspection Summary

In general, all of the concrete floors, walls, columns, beams, undersides of the top decks and the interior baffle walls are in good condition. There are a total of three different chambers that make up the complete clearwell and these three chambers also serve as the chlorine contact basin. The flow of the water goes in the direction as follows:

- Starts in the channel on the North side of the west clearwell constructed in the 1950 addition
- Through a pipe that passes through the clearwell constructed in the original 1930 building
- Into the east clearwell that was constructed in the 1980 building.
- Through baffle walls in the east well, into the 1930 well and finally into the west well.

There are several areas found during the inspection that are of concern and a repair for these issues should be put forth soon.

(All of the photos referenced below are included in the attached site photo log.)

<u>Ladder Rungs in Each of the Three Clearwell Manhole Access</u>

1. Photos 13 through 19 show the ladder rungs in the three clearwell access manholes. Most all of the ladder rungs are in poor shape and are in need of replacement sometime in the near future.

<u>Various Concrete Beams in the Roof of the Octagon Clearwell</u>

2. Photos 20, 21 and 22 show the corner of one of the clearwell floor beams. This floor beam (floor to the dry room above and roof to the wet clearwell space below) occurs south of the NW column in the octagon well. The reinforcement rusting and concrete spalling occurs on the bottom west corner of the beam.
3. Photos 23 through 26 show the corner of one of the other clearwell floor beams. This floor beam (floor to the dry room above and roof to the wet clearwell space below) occurs west of the NW column in the octagon clearwell. The reinforcement rusting and concrete spalling occurs on the bottom north corner of the beam.
4. Photo 27 shows a spot in the center of a third beam. This beam occurs north of the NE column in the octagon clearwell. It appears that there was a wood block left in place during the construction. The wood block has rotted and exposed the reinforcement. Then, the reinforcement rusted, causing concrete around the hole to start spalling away from the beam.

Clearwell General Inspection Repair Recommendations

<u>Ladder Rungs in Each of the Three Clearwell Manhole Access</u>

- None of the ladder rungs are in a state of immediate collapse. Yet they should be replaced in the near future. It is important to mitigate any further rusting of the ladder rungs back into the concrete wall. New rungs should be installed with a “drill and epoxy” system. The rungs should be either stainless steel or FRP.

<u>Various Concrete Beams in the Roof of the Octagon Clearwell</u>

- None of the beams have deteriorated to a point where the beams are failing. Yet, they should be repaired in the near future. It is important to mitigate any further rusting of the reinforcement. Once the rusting starts, it will travel over time down the length of the entire bar. They are many different options for the repair of these types of deterioration in concrete. These options will be discussed at length with the City Staff at a time closer to put together a repair plan.

City of Grants Pass
Water Filtration Plant
821 SE M Street
Grants Pass OR 97526

Inspection Date: **March 3, 2011**
Inspected By: **Todd Petrik**
Clearwell

<u>Inspection Photos of the Water Intrusion</u>

Photo 1
Overview of the interface of the 1930 (left side of photo) and 1950 (right side of photo)

The water intrusion is occurring directly behind the water fountain through a crack that is visable from the exterior of the building.

Photo 2

Close up of the interface between the 1930s and 1950 construction.

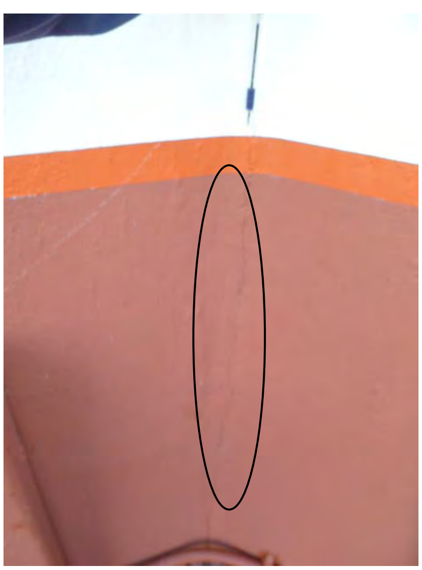


Photo 3

Close in view showing the crack between the 1930s and 1950s construction. This crack was visible from the eave of the roof line clear down to the walk that was sitting on grade

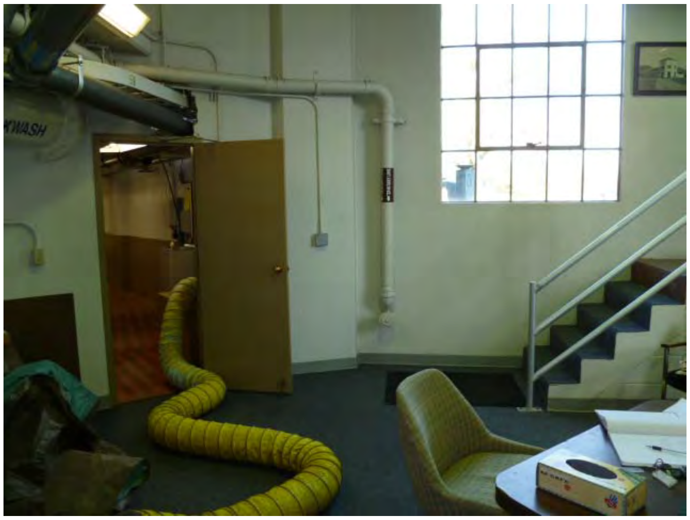


Photo 4

Photos 4 & 5 showing the interface between the 1930 and 1950 construction from inside the Octagon structure, or the 1930s construction.

Photo 5

Photo 6

Photos 6, 7 and 8 show the interface from inside the 1950 construction

Photo 7

Water is coming in from outside in the location directly in the corner where the dark stain is traveling up the joint.

Photo 8

Photo 9

This photo shows the interface, or joint, between the top of the clearwell slab and the tall curb around the manhole access.

Photo 10

Photo11

Photo 12

This photo shows the underside of the top slab interfacing with exterior wall of the 1930 construction (right hand wall) and the exterior wall of the 1950 construction (left hand wall). The white in the picture is staining from the water intrusion that is coming through this joint from outside the building.

<u>Photos for the General Inspection of all three Clearwells</u>

Photo 13

This photo and photo 14 shows the ladder rungs in the manhole access that enters into the channel along the north side of the west clearwell. These ladder rungs were installed in the 1950 construction.

Photo 14
This photo is a close up of the joint.

Photo 15

Photos 15, 16 and 17 show the ladder rungs that enter into the east clearwell.

These ladder rungs were installed in the 1980 construction.

Photo 16

Photo 17

Photo 18

This photo and photo 19 show the ladder rungs extending out of the access in the center, Octagon clearwell. These rungs were most likely installed in the 1930 construction.

Photo 19

Photo 20

Photos 20, 21 and 22 show a corner of one of the beams in the octagon clearwell. This beam is located south of the NW column in the octagon clearwell. The spalling is occurring on the west bottom corner of this beam.

Photo 21

Photo 22

Photo 23

Photos 23, 24, 25 and 26 shows a corner of one of the other beams in the octagon clearwell. This beam is located west of the NW column in the octagon clearwell. The spalling is occurring on the north bottom corner of this beam.

Photo 24

Photo 25

Photo 26

.

Photo 27

This photo shows a spot in the center of the beam where the reinforcement is rusting and the concrete is spalling. This beam is located north of the NE column in the octagon clearwell. It appears that there was a wood block left in place during the construction. The wood has rotted and exposed the reinforcement. Then the reinforcement rusted causing concrete around the hole to start spalling away from the beam.

APPENDIX D

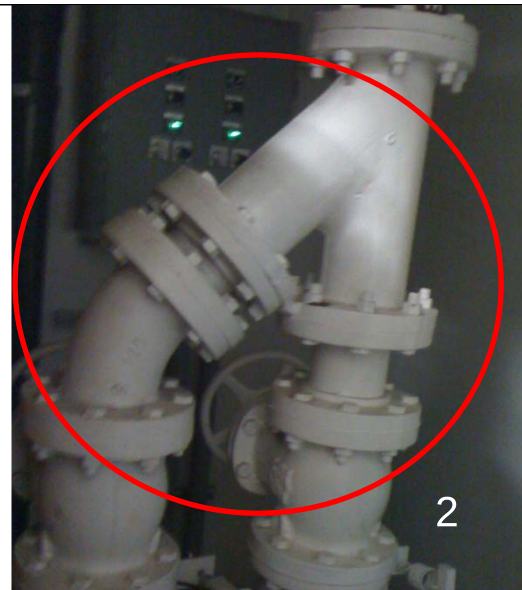
APPENDIX D
PHOTOGRAPH LOG AND PLANT EQUIPMENT INVENTORY

Photo Log - Table of Contents

Break Areas

Limited area and space in break room and break areas.

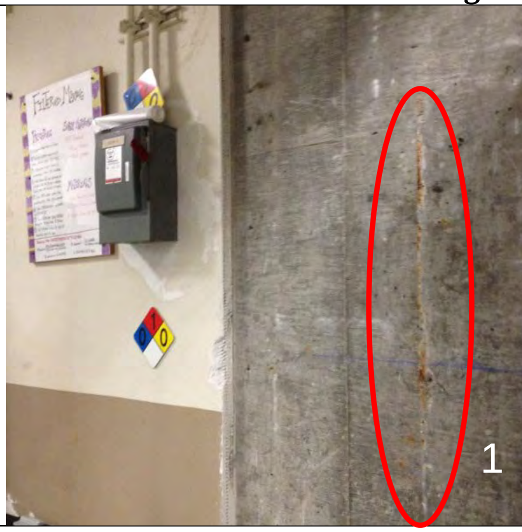
Panel board located in break room.



1. Cosmetic damage to tiling and general wear due to age.

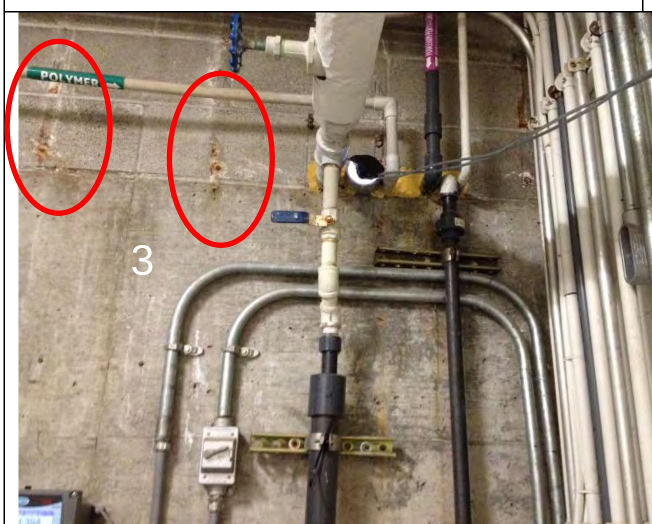
2. Limited access to panel.
3. Wall in break room gives limited access for maintenance activities.

Chemical Storage and Maintenance Room



1. Concrete cracking observed on wall.

2. Drain may not be adequately sized to handle flows. Drain lines are not seismically supported.

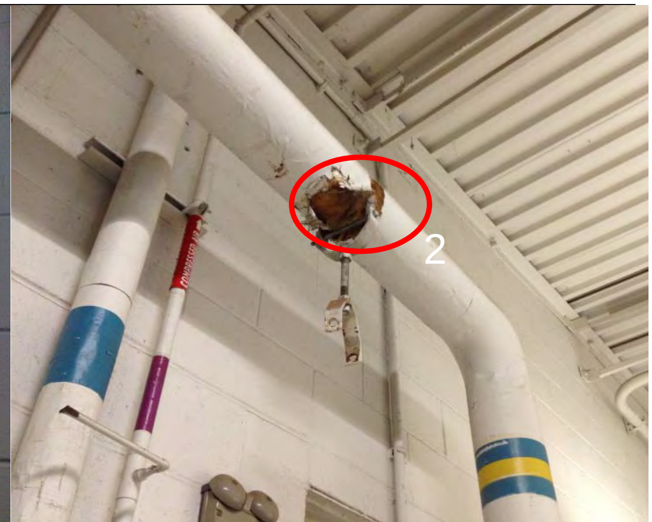


3. CMU deterioration.

4. Piping and conduits have insufficient support.

Chemical Storage and Maintenance Room Cont.

1. Paint failure.



2. Damage to pipe insulation; observed in multiple places.

3. Paint deterioration.
4. CMU deterioration.
5. Pipe coating corrosion.

6. Door not sealed: HVAC problem.
7. Door frame rusting and deterioration.
8. Pipe coating corrosion.

Chemical Storage and Maintenance Room Cont.

1. Paint deterioration.
2. CMU deterioration.
3. Pipe coating corrosion.

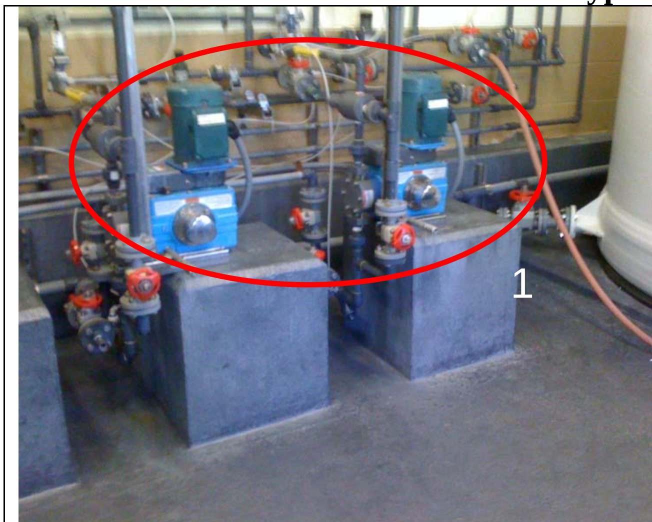
4. Pain failure close-up; found in multiple locations.

Inadequate storage and limited space.

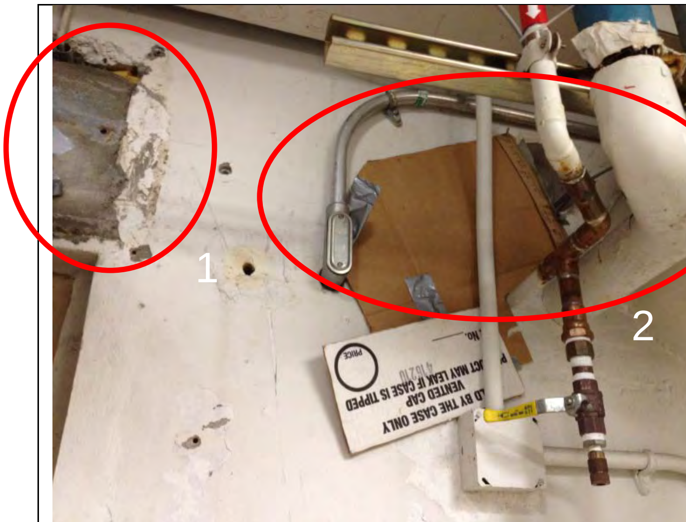
Chemical Storage and Maintenance Room (Continued)

	
Maintenance area co-located in the chemical room. Inadequate storage for equipment and parts.	Coagulant storage with containment area and metering pumps. Tanks cannot be removed or replaced without significant effort.
	
No spill containment for batching tanks.	1. Paint failure.

Sodium Hypochlorite Room

	
1. Sodium hypochlorite pumps.	2. Tanks may not be adequately anchored for seismic event. Corrosion observed on existing anchors.

Electrical Room



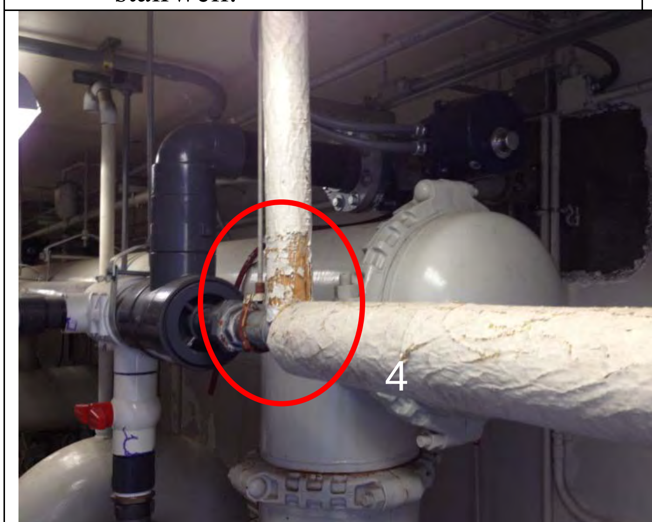
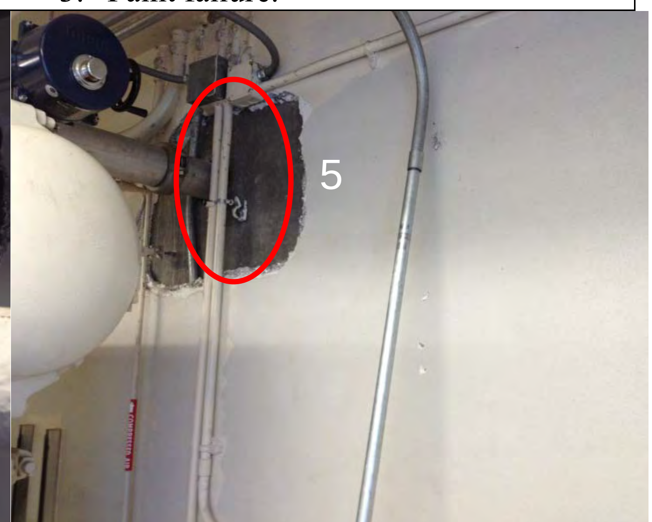
1. Paint failure.
2. Pipe wall penetration not seismically supported.

3. Limited HVAC control in electrical room.

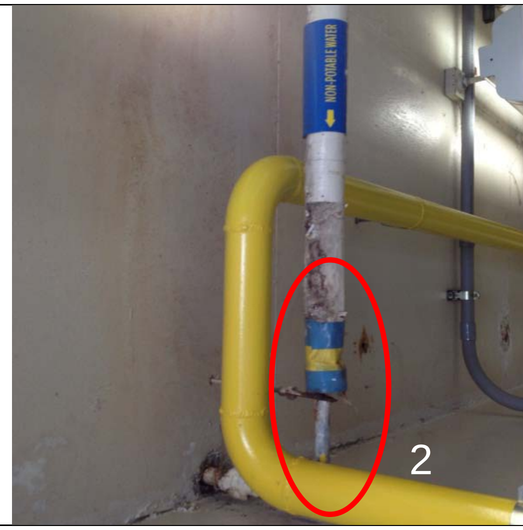
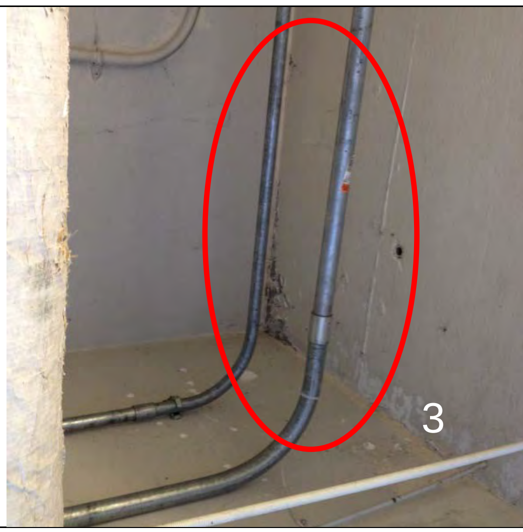
4. Pipe penetration wall insulation may need to be replaced.

5. Floor drain in electrical room located adjacent to filter gallery is undersized to handle emergency flows to prevent damage to electrical equipment.

Filter Galleries

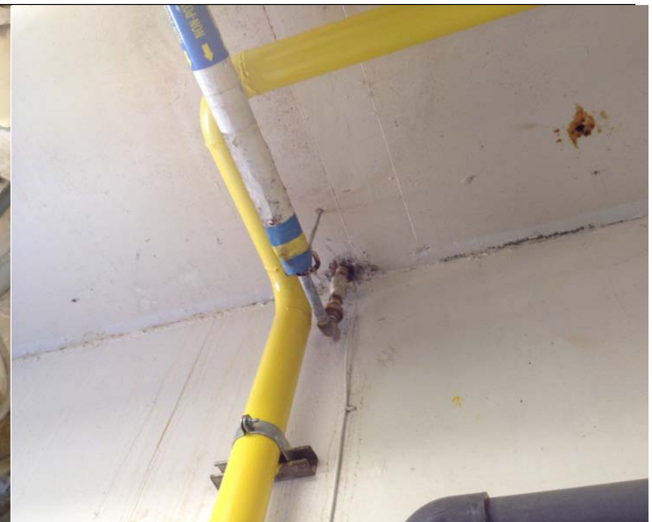
	
1. Paint failure and corrosion underneath stairwell.	2. Flange coating failure. 3. Paint failure.
	
4. Pipe insulation deterioration and pipe hanger corroded.	5. Some electrical conduit was installed between wall cladding and wall. This presents a challenge to conduit maintenance, modification, and wall cladding removal.

Filter Galleries Cont.

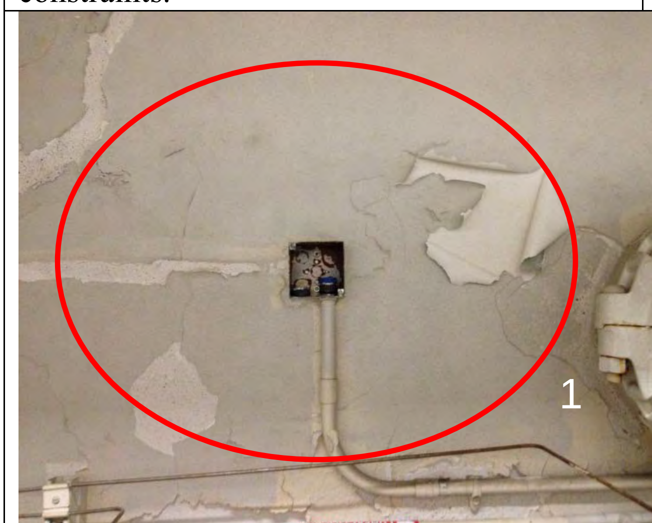
	
1. Cladding deterioration and exposed wire framework.	2. Damaged pipe insulation; found in multiple places in filter galleries.
	
3. Unsupported conduits.	4. Paint on wall peeling; found in other locations within galleries.

Filter Galleries Cont.

Maintenance made challenging by space constraints.



Piping is not seismically supported.



1. Wall paint peeling and uncovered electrical junction box.

2. Drain line(s) may be undersized to handle major leaks or emergencies.

Filter Galleries Cont.

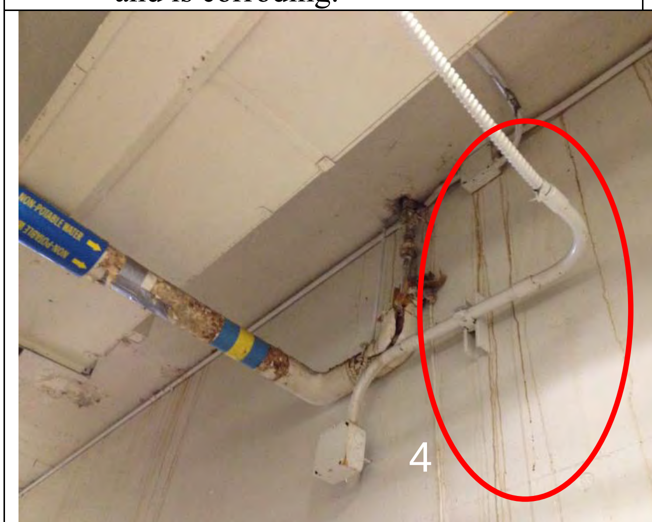
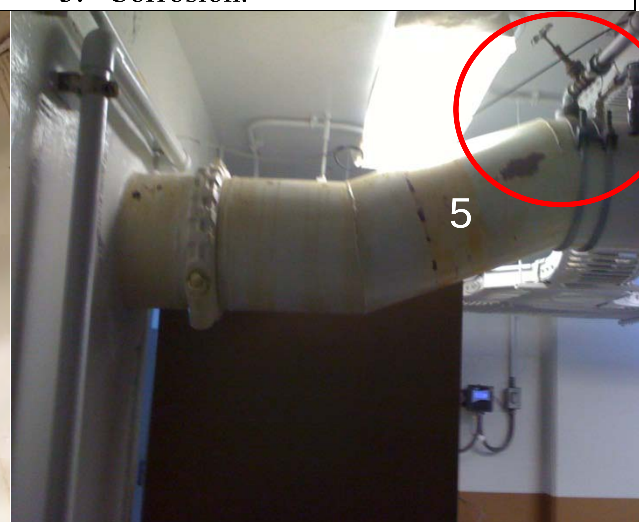
1. Pipe joint corrosion.

2. Pipe hanger showing signs of rust, pipe not insulated.

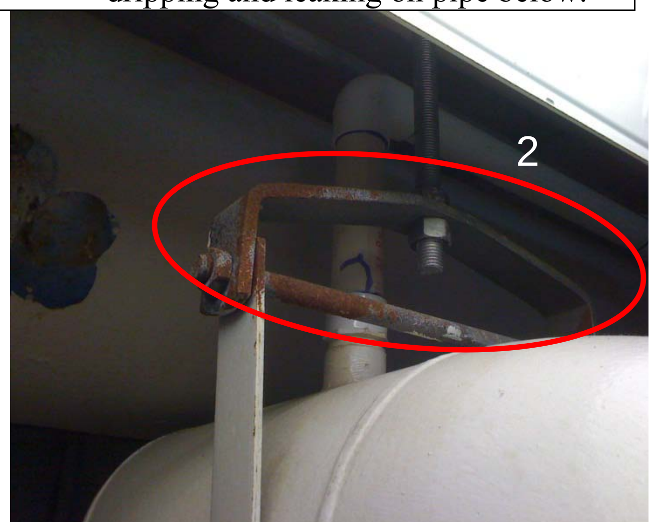
Challenging access for maintenance.

3. Exposed junction boxes.

Filter Galleries Cont.

<table>
<tr><td>
</td><td>
</td></tr>
<tr><td>1. Joint experiences intermittent leaking and is corroding.</td><td>2. Wall cladding and paint deterioration.
3. Corrosion.</td></tr>
<tr><td>
</td><td>
</td></tr>
<tr><td>4. Evidence of water dripping along wall.</td><td>5. Challenging access to water tap.</td></tr>
</table>

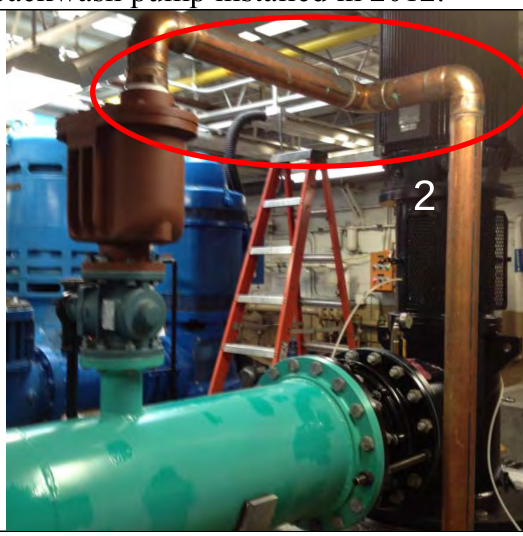
Filter Galleries Cont.

	
Pipe ceiling support not adequately designed for seismic event.	1. Crack in ceiling causing intermittent dripping and leaking on pipe below.
	
Cable tray not seismically supported.	2. Rusted pipe support.

High Service Pump Station Room

New backwash pump installed in 2012.

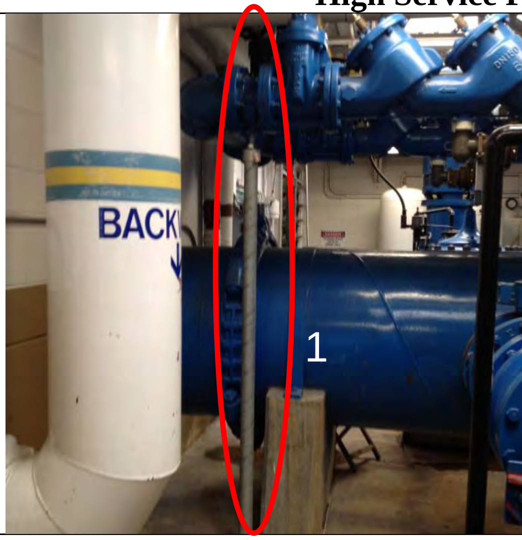
1. Inside wall core rusted.



2. Unsupported vent piping.

3. Temporary hose connection

High Service Pump Room Cont.



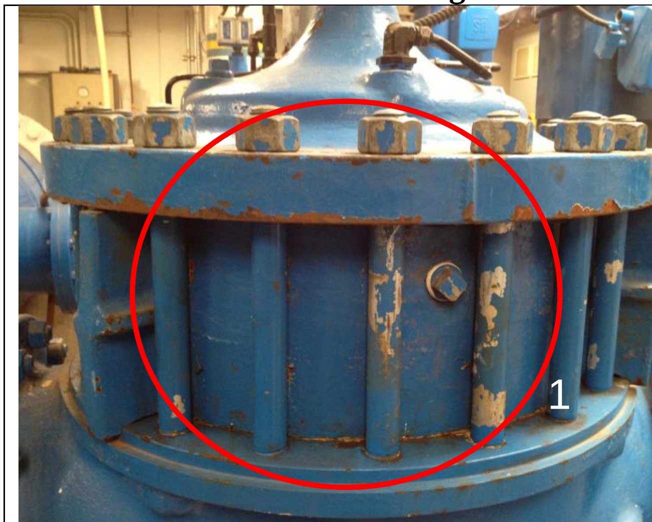
1. Pipe support not adequate for seismic event.

2. Label worn and in need of replacement.

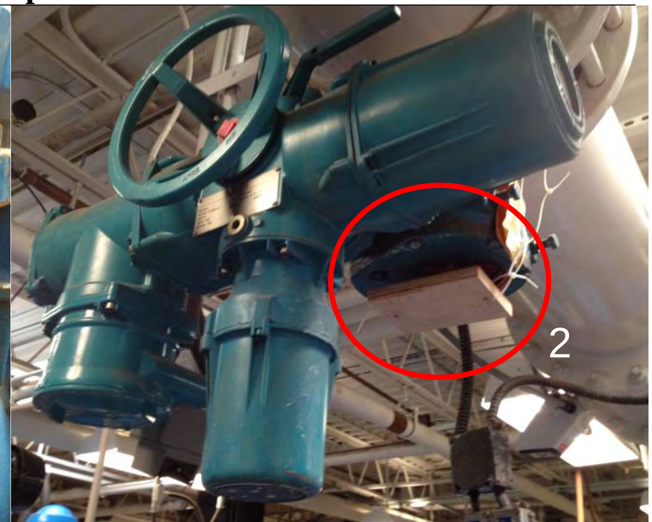
3. Pad not adequately sized for seismic event.

4. Drains in room undersized for emergency flows.

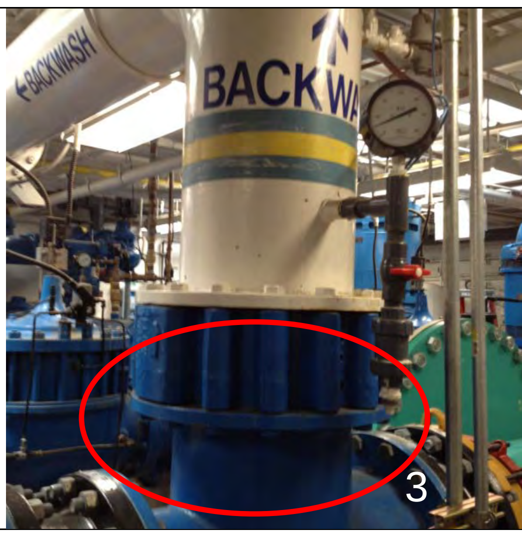
High Service Pump Room Cont.



1. Corrosion.



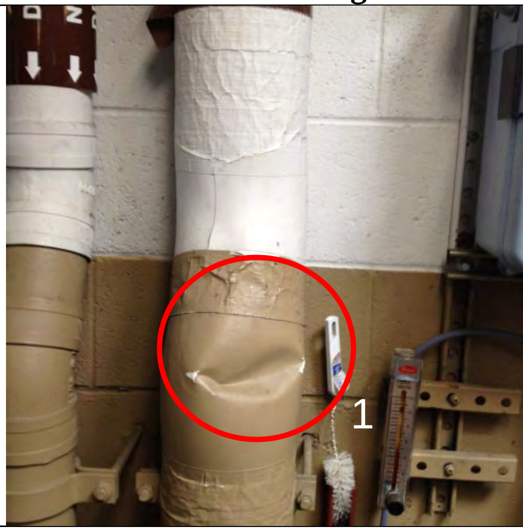
2. Wooden block being held in place with plastic zip ties; needs permanent solution.



3. Valve may be failing. Difficult access and location for replacement and maintenance activities.

4. Temporary support may need to be replaced with something more permanent.

High Service Pump Room Cont.



1. Damage to pipe insulation.

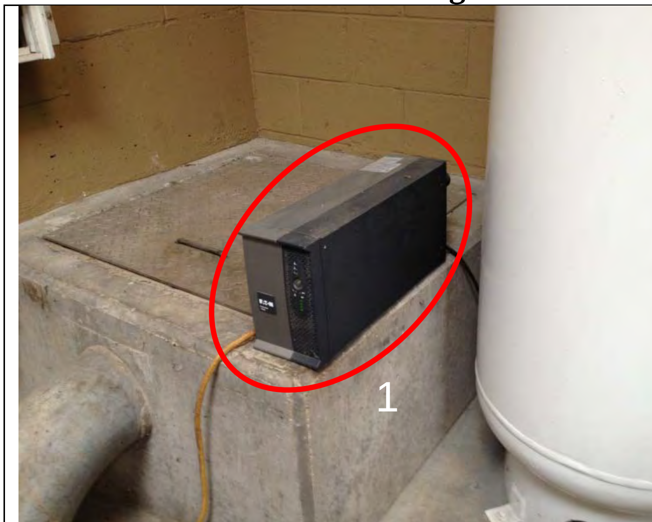
2. Trip hazard identified.

3. Damage to screen poses a potential safety concern.

4. No hose bib or rack.

   As part of future work, the air compressors may be relocated to the chemical and maintenance area to alleviate risks associated with being located above the clearwell.

High Service Pump Room Cont.

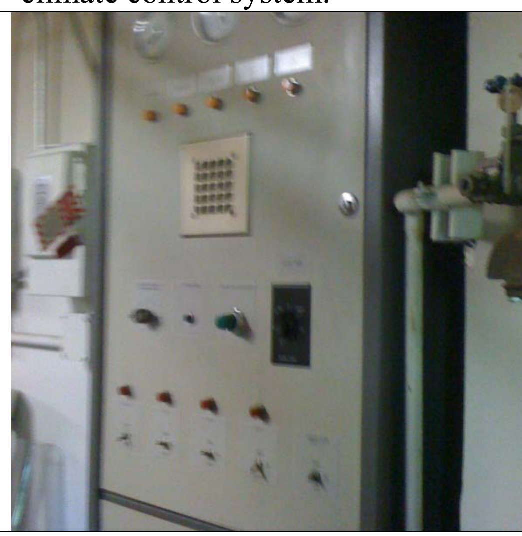


1. Separate housing for battery back-up power supply to protect from potential leaks.

2. Poor access to wet well level

3. Tape and insulation may need to be replaced above doorframe.

HVAC

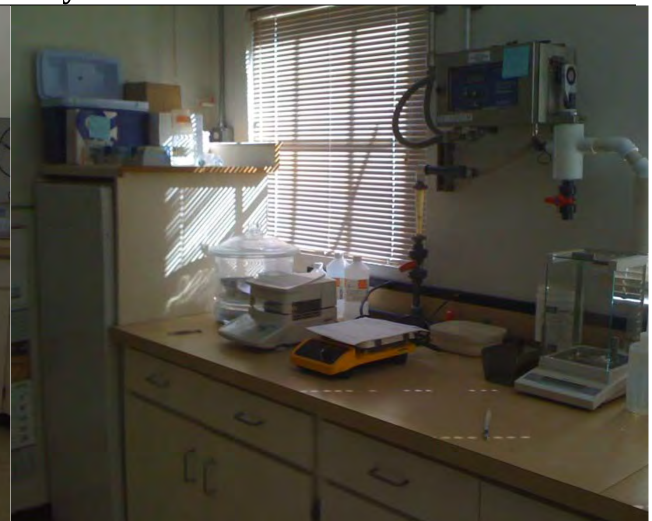
	
Main duct for air flow to operations building.	1. Example electric heater used in multiple locations around the plant. The plant lacks an optimized central climate control system.
	

HVAC panels and components are dated and cannot be serviced or repaired easily by local contractors. It is difficult to find replacement parts.

River Intake

Existing raw water pump station. Additional space for pumps, but maintenance will be challenging in gallery below. The structure will need to be seismically upgraded as it is currently not laterally supported.

Laboratory



Limited bench-top area for staff to run samples or locate general lab equipment. Limited storage space for testing supplies.

Streaming current monitor.

Bench-top area being used for testing equipment; limited work area.

Laboratory Cont.

Finished water and raw water taps used for water quality monitoring and analysis.

Mill Pond

Geobags in use at Mill Pond.

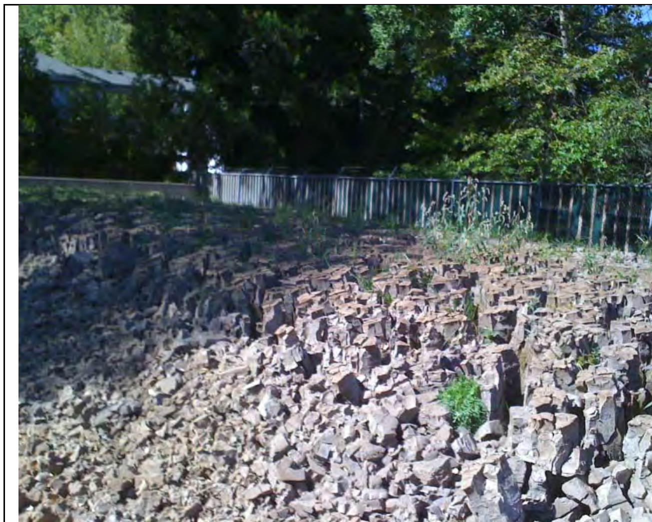
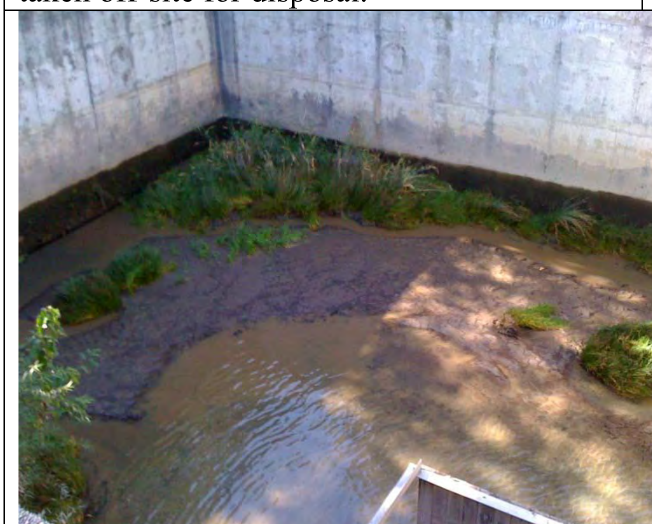
Dewatering polymer feed system.

Mill Pond overview.

1. Dredge used to collect solids for on-shore dewatering.

Effluent gate to Skunk Creek.

Solids Handling

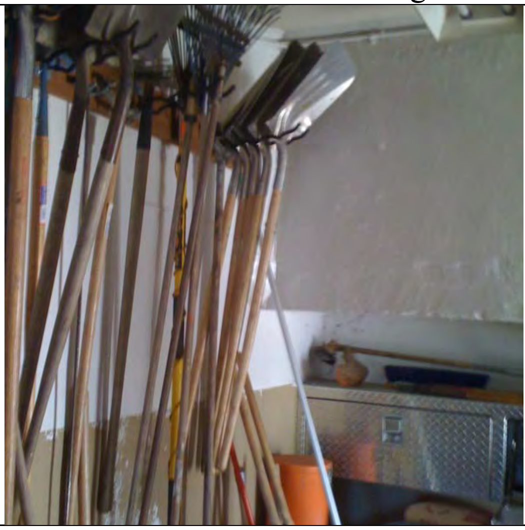
	
Solids being dried on-site at the plant before taken off-site for disposal.	Washwater equalization basin.
	
Cleaning and maintenance of washwater equalization basin is extremely labor-intensive because accessing the bottom is difficult. As a result, unwanted vegetation growth is common.	Space constraints on-site can lead to encroachment of access to valve boxes during solids dewatering.

Solids Handling Cont.

Washwater equalization basin pump(s) nearing end of useful life. Replacement will be challenging in compact space.

WTP Storage Areas

Storage space at the water treatment plant is limited. Crawl spaces and other non-traditional spaces have been utilized for storage of spare parts, maintenance supplies, equipment, etc. The plant also rents a storage locker off-site for additional items that cannot be stored locally.

<table>
<tr><td></td><td></td></tr>
<tr><td>Portion of server room used for storage.</td><td>1. Oil stored on-site.</td></tr>
<tr><td></td><td></td></tr>
<tr><td>Landscaping equipment housed on-site.</td><td></td></tr>
</table>

WTP Storage Areas Cont.

Portions of the HVAC control attic used for storage.

Miscellaneous

	
Portable generator not sized to run water treatment plant.	1. Exterior pipe supports corroding.

Table D-1
Inventory of Existing Grants Pass Water Treatment Plant Systems

Unit Process and Components	Quantity	Type	Manufacturer/Model	Capacity or Size
Screening				
Raw Water Intake Screen	4	Wedgewire Screen	Custom	4'-6" × 8'-0"
Wash System	1	Articulating Arm	Custom	25 – H3/8U-00120
Raw Water Pumping				
Raw Water Pumps				
Pump 1	1	Vertical Turbine	Worthington/ 15HH-340	75 HP/3,200 gpm/ 65 ft TDH
	1		AB Power Flex 700	
Pump 2	1	Vertical Turbine	Worthington/ 15HH-340	75 HP/3,200 gpm/ 65 ft TDH
Pump 3	1	Vertical Turbine	Worthington/ 15HH-340	75 HP/3,200 gpm/ 65 ft TDH
Pump 4	1	Vertical Turbine	Worthington/ 15HH-340	75 HP/3,200 gpm/ 65 ft TDH
	1		AB Power Flex 700	
Chemical Feed				
Coagulant				
Storage	2	Cylindrical Fiberglass		6,000 gal
Metering Pumps	3	PD Diaphragm	Grundfos/ Model DME 150	39.6 gph at 58 psi
	1	PD Diaphragm	Grundfos/ Model DME 60	15.9 gph at 145 psi
Air				
Compressor	2	Twin Units	Quincy/ Model 325	5 HP/ 19 cfm/ 130 gal receiver tank
After Drier 1	1		Hankison/ Model HPR50	50 scfm
Permanganate				
Storage		Stored in Metal Buckets		
Feed Unit	1	Hopper/Feeder/Mixer	BIF/ Model 25-06	$^{1}/_{3}$ HP/ 1,800 rpm

			AB Power Flex 700	
Polymer				
Storage	2	Stainless Steel Cylinder, Open-Top		290 gal
Mixing	1	Propeller	Neptune/ Model D-4.00	420 rpm
Mixing	1	Propeller	Philadelphia Mixer Co/ Model PG 34	420 rpm
Metering Pumps	1	PD Diaphragm	Grundfos/ Model DME 60	15.9 gpm at 145 psi
Hypochlorite				
Storage	3	FRP Cylinder	RTP, Inc.	2,300 gal
Pre-Chlorination Metering	1	PD Diaphragm	Wallace and Tiernan/ Encore 700	¾ HP/ 24 gph
Post-Chlorination Metering	1	PD Diaphragm	Wallace and Tiernan/ Encore 700	¾ HP/ 24 gph
Back-Up Metering	1	PD Diaphragm	Wallace and Tiernan/ Encore 700	¾ HP/ 24 gph
Transfer	1	Seal-less Magnetic	March/ Model TE-7.5K-MD	2 HP/ 3,435 rpm
Filtration				
Backwash Pump	1	Vertical Turbine with VFD	Peabody Floway/ Model 22-BLK	200 HP/ 7,000 gpm
	1		AB 1336 PLUS II	
	1	Vertical Turbine with VFD	Goulds Water Technology/ Model VIT-FFFM	150 HP/ 7,600 gpm/ 60 ft TDH
	1		AB Power Flex 700	
Surface Wash System				
Filters 1, 2, and 3	12	Stainless Steel	Leopold S Sweep	14.8 gpm per Sweep at 100 psi
Filters 4 and 5	8	Stainless Steel	Leopold S Sweep	14.8 gpm per Sweep at 100 psi
Filters 6, 7, and 8	12	Stainless Steel	Leopold S Sweep	14.8 gpm per Sweep at 100 psi

On-Line Monitoring				
Turbidity				
Raw Water	1	Digital – Integrated in SCADA	HACH Solitax Sc	0.001 to 4000 NTU
	1	Digital – Integrated in SCADA	HACH Surface Scatter 7	0.01 to 9999.9 NTU
Settled Water				
Sedimentation Basin 1	1	Digital – Integrated in SCADA	HACH 1720E	0 to 100 NTU
Sedimentation Basin 2	1	Digital – Integrated in SCADA	HACH 1720E	0 to 100 NTU
Sedimentation Basin 3	1	Digital – Integrated in SCADA	HACH 1720E	0 to 100 NTU
Filter Effluent				
Filter 1	1	Digital – Integrated in SCADA	HACH 1720E	0 to 100 NTU
Filter 2	1	Digital – Integrated in SCADA	HACH 1720E	0 to 100 NTU
Filter 3	1	Digital – Integrated in SCADA	HACH 1720E	0 to 100 NTU
Filter 4	1	Digital – Integrated in SCADA	HACH 1720E	0 to 100 NTU
Filter 5	1	Digital – Integrated in SCADA	HACH 1720E	0 to 100 NTU
Filter 6	1	Digital – Integrated in SCADA	HACH 1720E	0 to 100 NTU
Filter 7	1	Digital – Integrated in SCADA	HACH 1720E	0 to 100 NTU
Filter 8	1	Digital – Integrated in SCADA	HACH 1720E	0 to 100 NTU
Combined Filter Effluent	1	Digital – Integrated in SCADA	HACH 1720E	0 to 100 NTU
Plant Effluent	1	Digital – Integrated in SCADA	HACH 1720E	0 to 100 NTU
Chlorine Analyzers				
Mixed Water	1	Digital – Integrated in SCADA	HACH Cl-17	0 to 5 mg/L free Cl_2
Clearwell Influent	1	Digital – Integrated in SCADA	HACH CLF-10	0 to 10 mg/L free Cl_2
Clearwell Effluent	1	Digital – Integrated in SCADA	HACH Cl-17	0 to 5 mg/L free Cl_2
Flow Meters				
Raw Water	1	Venturi Differential Pressure	Barton/Fuji	0 to 125 in. water
Filter Effluent				
Filter 1	1	Orifice Differential Pressure	Barton	0 to 125 in. water
Filter 2	1	Orifice Differential Pressure	Bristol/ACCO Signature	0 to 100 in. water

Filter 3	1	Orifice Differential Pressure	Barton/Fuji	0 to 125 in. water
Filter 4	1	Orifice Differential Pressure	Barton	0 to 125 in. water
Filter 5	1	Orifice Differential Pressure	Barton	0 to 125 in. water
Filter 6	1	Orifice Differential Pressure	Barton	0 to 125 in. water
Filter 7	1	Orifice Differential Pressure	Barton/Fuji	0 to 125 in. water
Filter 8	1	Orifice Differential Pressure	Barton	0 to 125 in. water
Backwash	1	Electromagnetic Flow Meter	Danfoss Magflo Type MAG 5000	33 fps
Finished Water	1	Venturi Differential Pressure	Barton	0 to 125 in. water
Filter Head Loss				
Filter 1	1	Orifice Differential Pressure	Barton	0 to 125 in. water
Filter 2	1	Orifice Differential Pressure	Bristol/ACCO Signature	0 to 100 in. water
Filter 3	1	Orifice Differential Pressure	Bristol/ACCO Signature	0 to 100 in. water
Filter 4	1	Orifice Differential Pressure	Bristol/ACCO Signature	0 to 100 in. water
Filter 5	1	Orifice Differential Pressure	Bristol/ACCO Signature	0 to 100 in. water
Filter 6	1	Orifice Differential Pressure	Bristol/ACCO Signature	0 to 100 in. water
Filter 7	1	Orifice Differential Pressure	Bristol/ACCO Signature	0 to 100 in. water
Filter 8	1	Orifice Differential Pressure	Barton	0 to 125 in. water
pH				
Raw Water	1	pH Sensor	HACH pHD Sensor	2.0 to 14.0 pH
Clearwell	1	pH Sensor	HACH pHD Sensor	2.0 to 14.0 pH
Point of Entry	1	pH Sensor	HACH pHD Sensor	2.0 to 14.0 pH
High Service Pump Station				
Finished Water Pumps				
Pump 1	1	Vertical Turbine	Worthington/ Model 15HH-340	250 HP/ 3,500 gpm/ 210 ft TDH
Pump 2	1	Vertical Turbine	Fairbanks Morse/ Model 18HC	300 HP/ 4,000 gpm/ 210 ft TDH
Pump 3	1	Vertical Turbine	National Pump Company/ Worthington/ Model H14XHC	250 HP/ 3,500 gpm/ 220 ft TDH
	1		AB 1336 PLUS II	

Pump 3A	1	Vertical Turbine	National Pump Company/ Worthington/ Model H14XHC	250 HP/ 3,500 gpm/ 220 ft TDH
	1		AB 1336 PLUS II	
Pump 4	1	Vertical Turbine	Worthington/ Model 15HH-340	250 HP/ 3,500 gpm/ 210 ft TDH
Pump 5	1	Vertical Turbine	Worthington/ Model 15HH-277	250 HP/ 2,600 gpm/ 210 ft TDH
	1		AB 1336 PLUS II	
Waste Water				
Sewage Pumping				
Pumps	2	Submersible	EBARA/ Model 100DLMFU61.52	2 HP/ 1,800 rpm/ 80 gpm/ 30 ft TDH
Wastewater and Solids Equalization Tank	1	Concrete Tank	Custom	116,000 gal
Pump	1	Quick-disconnect Submersible	Peabody Barnes/ Model 6SEH2004	30 HP/ 1,500 gpm/ 36 ft TDH
Pump	1	Quick-disconnect Submersible	Peabody Barnes/ Model 6SE30034HL	60 HP/ 1,750 gpm/ 60 ft TDH
Pump	1	Quick-disconnect Submersible	Flygt/ Model CP3300.181-2200	60 HP/ 1,760 rpm
Plant Sump Pump	1	Quick-disconnect Submersible	Peabody Barnes/ Model 6SE-1004	12 HP/ 830 gpm/ 15 ft TDH
Solids Handling				
Storage	2	Polyurethane Cylinder, Open-Top	Snyder Industries, Inc/ Model HDPE	440 gal
Mixing	2	Propeller	Wingert/ Model WXL-20C/60	$^{1}/_{3}$ HP/ 1,725 rpm
Polymer Pump	1	Progressive Cavity	Moyno Inc/ Model 36701	2 HP/ 870 rpm
	1		AB Power Flex 700	
Solids Pump	1	Quick-disconnect Submersible	Flygt/ Model NP3153 HT 3153.181	15 HP/ 550 gpm/ 50 ft TDH
	1		AB Power Flex 700	

Turbidity	1	Digital – Integrated in Panel View	HACH Solitax Sc/ Model LXG 424.99	Solids 0.001 to 150 g/L
Flow Meter	1	Electromagnetic Flow Meter	Siemens/ Model Sitrans F M Magflo 5100, MAG 5000	33 fps
Level Sensor	2	Polymer Ultrasonic Level Sensor	Flowline/ Model Echospan LU81-510	8 in. to 16.4 ft
Level Sensor	1	Solids Ultrasonic Level Sensor	Siemens/ Model HydroRanger 200	1 ft to 50 ft
Dilution Valve	1	Ball Valve	Georg Fischer/ Model Type 546 with EA21 Actuator	2-inch dia PVC
Mixing Valve	2	Galvanized Steel Mixing Valve	Bellmer/ Model 36274-2	4-inch dia mixing chamber
Dredging				
Dredge	1	Log Pond Dredge	Liquid Waste Technologies, LLC/ Model Pit Hog Runt	480 V/ submersible pump 20 HP/ hydraulic motor 7.5 HP
	1		AB Power Flex 700	
Polymer Pump	1	Progressive Cavity	Moyno, Inc	1 HP/ 1-inch dia wet end
Sludge Pump	1	Slurry Pump on Dredge	Yeomans/ Model 9100X 4310L	20 HP/ 1,741 rpm/ 3 phase/ 460 V
Flow Meter	1	Electromagnetic Flow Meter	Toshiba/ Model LF434	0.3 to 10 mps velocity
Solids Monitor	1	Suspended Solids Monitor	Mobrey/ Model MSM400 Intelligent	0.5 to 50 percent solids
Mixing	1	Propeller	Neptune/ Model JG-6.1	1.5 HP/ 350 rpm
Storage	1	Polyurethane Cylinder, Open-Top	Poly Cal Plastics	500 gal
Mixing Valve	1	Galvanized Steel Mixing Valve	Bellmer/ Model 36274-2	4-inch dia mixing chamber

Table D-2
Observed Water Treatment Plant Deficiencies

Process, Building, or Area	Factors	Notes	Priority
Intake Structure	Seismic and Structural	Structure not laterally supported for seismic event. See Structural and Seismic Evaluation Report (2012) for additional information.	Medium
Intake Pumps	Process Hydraulic O/M	Firm capacity of 15 mgd with three pumps running. Operations and maintenance difficult due to space constraints. Additional pump installation to increase capacity will compound problems.	Medium
Mixing Basin	Seismic and Structural Hydraulic	Originally built in 1930's, does not meet current IBC requirements for "design earthquake." Cannot pass more than maximum plant flow without significant modifications.	Medium
Basin 1	Seismic and Structural Hydraulic Regulatory	Built in 1930's, does not meet current IBC requirements for "design earthquake." Visible cracks with leaking occurring from basin walls. Including other basins, cannot pass more than 21 mgd without significant modifications. Absence of solids removal system could impact disinfection and CT compliance.	High
Basin 2	Seismic and Structural Hydraulic Regulatory	Built in 1950's, does not meet current IBC requirements for "design Earthquake." Visible cracks with leaking occurring from basin walls. Including other basins, cannot pass more than 21 mgd without significant modifications. Absence of solids removal system could impact disinfection and CT compliance.	High
Basin 3	Seismic and Structural Hydraulic Process Regulatory	Built in 1980's, does not meet current IBC requirements for "design Earthquake." Including other basins, cannot pass more than 21 mgd without significant modifications. At high flows, basin short-circuits, reducing filter efficiency. Absence of sludge removal system could impact disinfection and CT compliance.	Medium
Filters 1, 2, 3, and Gallery	Seismic and Structural Process O/M	Built in 1930's, does not meet current IBC requirements for "design earthquake." Filters lack air scour resulting in increased maintenance and decreased plant efficiency. Cracks in walls and leaking observed.	Medium
Filters 4 and 5 and Gallery	Seismic and Structural Process O/M	Built in 1950's, does not meet current IBC requirements for "design earthquake." Filters lack air scour resulting in increased maintenance and decreased plant efficiency. Cracks in walls and leaking observed.	Medium

Filters 6, 7, 8, and Gallery	Seismic and Structural Process O/M	Built in 1980's, does not meet current IBC requirements for "design earthquake." Filters lack air scour resulting in increased maintenance and decreased plant efficiency. Cracks in walls and leaking observed.	Medium
Clearwell	Seismic and Structural Regulatory O/M	Does not meet current IBC requirements. Walls and supports have significant deterioration. See Structural and Seismic Evaluation Report (2012) for additional information. Limited volume has CT implications or disinfection. Poor confined space access.	High
Chemical and Maintenance Area	Seismic and Structural Environmental, Health, and Safety O/M	CMU blocks in load-bearing walls adjacent to basins are experiencing deterioration. Polymer system lacks containment. Due to lack of space, maintenance area is shared adjacent to chemical systems; very limited space for additional chemical storage. Ventilation and fire protection may not meet code requirements.	Medium
Sodium Hypochlorite Storage Room	Environmental, Health, and Safety O/M	Sodium Hypochlorite is very corrosive. Fittings need to be replaced with some frequency. Room lacks active ventilation. Only one of the three tanks can be removed from the building with ease. No room to add additional storage. Pumping systems do not have a failure alarm.	Low
Solids Handling	O/M Regulatory	Need updated NPDES permit for continued discharge to Skunk Creek. As system demands and solids production increase, current solids handling approach will need to be revised due to space restrictions and impact on plant efficiency.	Medium
Laboratory	O/M	Limited space to perform testing, and little to no space for additional testing equipment.	Low
Server Room	O/M	Server room does not have HVAC for climate control. Sensitive equipment subject to wide swings in temperature.	Low
Plumbing	Environmental, Health, and Safety O/M	Many plant drains are undersized to handle potential flows from surrounding equipment during maintenance or emergency events, and their condition, service, and discharge location are unknown.	Low
HVAC	O/M	System installed in 1980's and is in relatively good condition, but does not provide consistent heating, ventilation, and cooling throughout the plant. System has to be manually operated and adjusted. Control panel is antiquated and finding local service technicians is difficult.	Low
Electrical Systems	O/M Environmental, Health, and Safety	Most major electrical components are no older than 30 years. Some components have become harder to replace with age. Various cable trays and wiring are not seismically or structurally supported. Plant does not have a secure back-up power	Low

		supply, although City is in the process of obtaining a generator system.	
Major Process Piping	O/M	Sections of piping are beginning to show corrosion due to age. A lot of piping lacks structural and seismic pipe supports. Some pipes penetrate load-bearing walls.	Medium
Major Process Equipment	O/M	Various mechanical equipment will need to be replaced or rebuilt within the next 10 to 20 years. As the equipment continues to age, maintenance and repair cycles will shorten, causing increased labor costs and impacting plant efficiency.	Low

MSA

APPENDIX E

MSA
Murray, Smith & Associates, Inc.
Engineers/Planners
121 S.W. Salmon, Suite 900 • Portland, Oregon 97204-2919 • PHONE 503.225.9010 • FAX 503.225.9022

TECHNICAL MEMORANDUM

DATE: March 4, 2013

PROJECT: 12-1320.401

TO: Mr. Terry Haugen, Public Works Director
City of Grants Pass, Oregon

FROM: Brian Ginter, P.E.
Michael McKillip, P.E., Ph.D.
Murray, Smith & Associates, Inc.

RE: Long-Term Water Demand Projections

Introduction

The City of Grants Pass (City) authorized Murray, Smith & Associates, Inc (MSA) to prepare updated long-term water demand projections for the City's municipal drinking water supply. The purpose of this memorandum is to document the analysis, methodology and projections of water demand for both 20- and long-range planning horizons. The projections presented in this memorandum were developed considering the City's historical population, historical and present water demand characteristics, as well as other local and regional planning data. The water demand projections will be used as the basis for two water system planning projects: the Water Treatment Plant Facilities Plan Update, and an update of the City's Water Management and Conservation Plan. Long-range forecasting of demands will also serve as the basis for the City's request for Extensions of Time to put water rights permits to beneficial use. It is anticipated that further refinement of these water demand projections needed to support the analysis of demands by pressure zone and the analysis of saturation development condition for the anticipated 2012 Urban Growth Boundary (UGB) expansion will be completed as part of the upcoming Water Distribution System Master Plan Update. These refined water demand projections are to be prepared under a separate memorandum.

Current and Future Service Area

The City currently provides water service to a population of approximately 34,756 people primarily within the existing City limits. The City limits encompass an area of approximately 7,000 acres, and include most of the area within the existing City UGB. The City began a process to expand the UGB in 2006 and it is anticipating that the completion of the process will occur by the end of 2012. The proposed expansion plan will be reviewed and jointly approved by the City and the Josephine County Board of Commissioners and subsequently approved by the State of Oregon Department of Land Conservation and Development. Based on a current analysis by the City's Community Development Department, it is anticipated that approximately 1,200 acres will be added to the UGB providing a 20-year land supply.

The City also provides water service to approximately 105 residential and commercial acres in the North Valley area located north of the City limits along Interstate Highway 5, and southeast of the unincorporated community of Merlin. Long-term future growth in this area is anticipated to be served by the City.

There are some adjacent developed areas outside the City limits that are not served by the City. These areas include the Rogue Community College to the west and unincorporated County areas to the southeast of the City. There is a potential for these areas to be served by the City in the future.

There are no significant jurisdictional constraints that would prevent long-term continued expansion of the UGB as the City grows. The City is not adjacent to any other municipality and while there are some mountainous areas not ideally suited for development, there are no significant topographic restrictions to the City's ultimate expansion.

Historical and Future Population Estimates

General

Estimates of the current and anticipated population within the water service area were developed through a review of existing City of Grants Pass planning data, previous water supply planning efforts, census data and Josephine County population forecasts. For planning purposes, the existing population within the City limits and the population of the water service area are assumed to be equal.

Historical and Existing Population

Historical City population data was obtained from the Portland State University's Population Research Center certified population estimates. The Population Research Center produces the annual population estimates for the State of Oregon and its counties and cities. These estimates, made July 1 of each year, are widely used for planning purposes. Table 1 summarizes historical and current populations within the City and for all of Josephine County. Figure 1 graphically illustrates this historical population data. From the year 2000 through 2010, the population in the City grew at an average annual rate of 4.0 percent. For the same period, Josephine County grew at a lower annual average rate of 0.85 percent. The City grew from 23,170 to 34,533 people and Josephine County (including the City) grew from 76,050 to 82,775 people. As the entire County added fewer people than the City added during the 10-year period, the overall demographic trend within Josephine County indicates a net shift in population into the City from the rural areas of Josephine County.

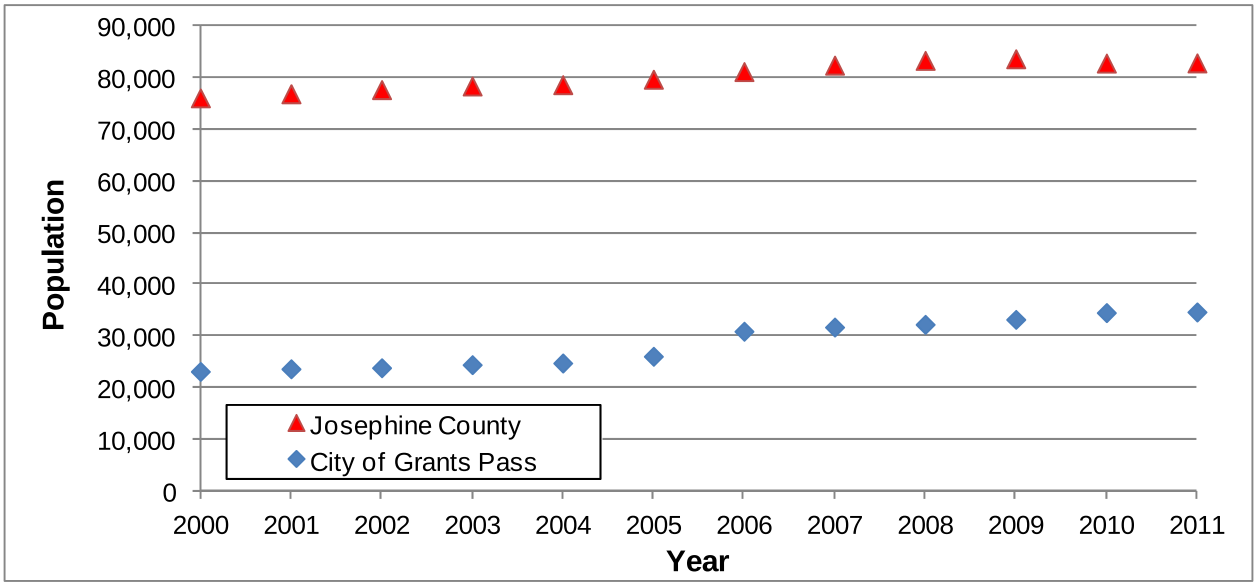
The City provided water to 36 residential properties in the North Valley area in 2011. At the City's residential density of 2.68 people per dwelling unit, the North Valley area is estimated to contribute a population of 96 to the City's service area.

Table 1
Historical City and County Population Summary

Year	City of Grants Pass		Josephine County		Percent of County Population
	Population	Percent Annual Growth	Population	Percent Annual Growth	
2000	23,170		76,050		30%
2001	23,670	2.2%	76,850	1.1%	31%
2002	23,870	0.8%	77,650	1.0%	31%
2003	24,470	2.5%	78,350	0.9%	31%
2004	24,790	1.3%	78,600	0.3%	32%
2005	26,085	5.2%	79,645	1.3%	33%
2006	30,930	19%	81,125	1.9%	38%
2007	31,740	2.6%	82,390	1.6%	39%
2008	32,260	1.6%	83,290	1.1%	39%
2009	33,225	3.0%	83,600	0.4%	40%
2010[1]	34,533	3.9%	82,775	-1.0%	42%
2011	34,660	0.4%	82,820	0.1%	42%

Note: 1. 2010 population estimates are adjusted to reflect 2010 Census data.

Figure 1
Historical City and County Population Summary



Population Forecast

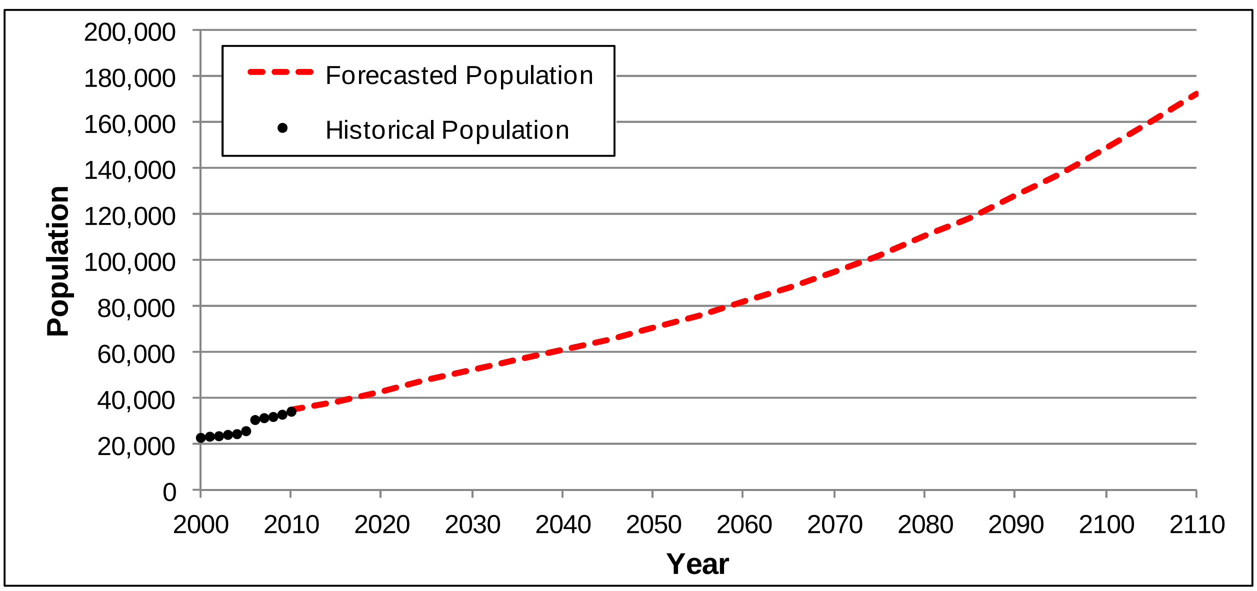
Planning studies have been prepared that forecast long-term population growth rates for Josephine County and the City. The Office of Economic Analysis reported a forecasted annual average growth rate for Josephine County from 2010 to 2040 of 1.1 percent. The relative historical growth rates of the City and Josephine County suggest that the 1.1 percent rate projected for the whole county is much lower than the recent and historical population growth rate of the City. The City's current Comprehensive Plan contains forecasted annual average population growth rates of 2.2 percent for the period 2007 through 2027 and 1.51 percent for the period 2007 through 2057. These rates are below the 2000 through 2010 actual growth rate of 4.0 percent.

Given the historically high recent growth rates of the City, a 2.2 percent annual growth rate is assumed through 2014. Thereafter, the annual growth rate is assumed to decline at a rate of 0.1 percent every five (5) years until it reaches an annual rate of 1.5 percent in 40 years. This results in a 20-year average annual growth rate of approximately 2.05 percent and a 50-year average annual growth rate of approximately 1.78 percent. The population projections using this approach are generally consistent with those in the City's Comprehensive Plan which projects a population of 54,540 in 2029 and 79,275 in 2057. The population forecast through a 100-year planning horizon to 2110 is reported in Table 2 and illustrated in Figure 2.

Table 2
Population Forecast Summary

Year	Service Area Population	Average Annual Growth Rate
2010 (Census Estimate plus North Valley Estimate)	34,649	2.2%
2015	38,632	2.1%
2020	42,862	2.0%
2025	47,323	1.9%
2030	51,993	1.8%
2035	56,844	1.7%
2040	61,843	1.6%
2050	72,125	1.5%
2060	83,704	1.5%
2070	97,142	1.5%
2080	112,738	1.5%
2090	130,837	1.5%
2100	151,841	1.5%
2110	176,218	1.5%

Figure 2
Historical and Forecasted City Population



The population forecasts presented in this memorandum are based on a review of historical population trends within the City and Josephine County and an extrapolation of population projections developed by the City for the purposes of land use and economic forecasting. The long-range forecasts presented do not consider potential future external influences on growth rates such as limitations on developable land, changing economic conditions, large shifts in demographic characteristics, and other factors. The projections provide an appropriate basis for long-term water system planning. It is expected that the accuracy of this forecast will decline significantly beyond a 20-year planning horizon as external influences not considered impact growth patterns.

Water Demand

General

Existing and future water demand estimates were developed following a review of historical water demand data provided by the City and population forecasts presented above. The term "water demand" refers to all the water requirements of the system including domestic, commercial, municipal, institutional as well as unaccounted-for water. A given water demand at any one time includes the sum of production from the City's Water Filtration Plant (WFP) plus the outflow from storage reservoirs. Demands are discussed in terms of gallons per unit time such as million gallons per day (mgd) or gallons per minute (gpm). Demands are also related to per capita use as gallons per capita per day (gpcd). Terminology used in this section to describe water usage characteristics are defined below:

Average Daily Demand (ADD): The Average Daily Demand is the total volume of water produced in a given year divided by 365 days. ADD is often used to forecast water volumes on an annual basis for estimating power costs, water revenue, and other considerations.

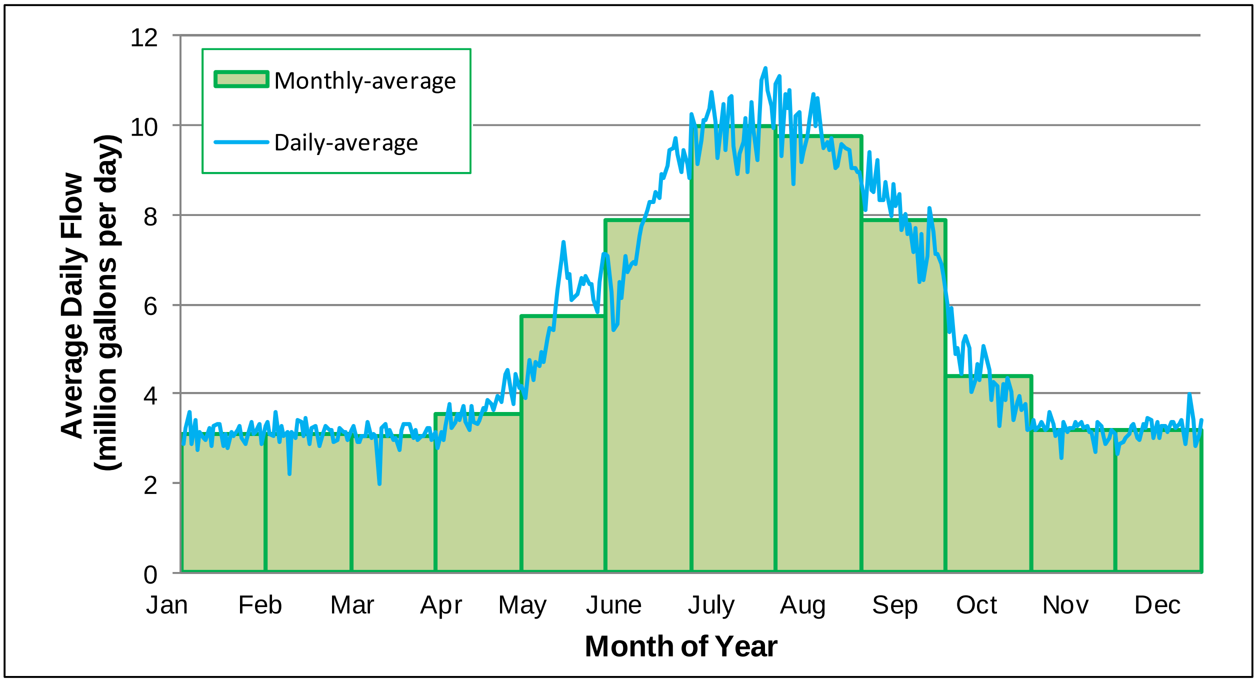
Peak Season Demand (PSD): Peak Season Demand is the average daily demand for the 122 days of the peak water use season; defined as June 1st to September 30th. The PSD reflects summer season outdoor water use patterns.

Maximum Day Demand (MDD): The Maximum Day Demand is the largest volume of water used, through production and changes in reservoir storage, in any single day of the calendar year. MDD is typically used to size the capacity of supply sources, treatment facilities, transmission piping, pumping facilities and finished water storage facilities. MDD usually occurs in the July to August months in the Pacific Northwest and is associated with increased outdoor water use on the hottest days of the year.

Peaking Factor: The ratio of the MDD to the ADD is commonly described as the peaking factor.

Figure 3 graphically presents both daily demand records and average monthly demands based on 5 years of production records. This figure illustrates the daily and seasonal variations in water demand for the water system.

Figure 3
Historical Average Demand



Historical Water Demand

The City records daily production at the WFP which are used to generate historical water demand statistics. Based on the historical average population presented above and water usage patterns, the water service area's average daily demand over the last five years has been between 5.0 and 5.8 mgd with an average day per capita consumption ranging between 145 gpcd and 184 gpcd. This is a typical range of average per capita daily demands for the region.

The historical MDD has been between 9.3 and 14.2 mgd with a maximum day per capita consumption ranging between 266 gpcd and 447 gpcd. The large range in maximum demand is due to the large number of variables that can influence summer season demand which include air temperature, precipitation, weekday versus weekend weather patterns, and other factors. Maximum day demands typically range from 250 to 450 gpcd using similar aggregate forecasting methods for similar sized communities in western Oregon and Washington. Table 3 summarizes historical water demand data for the years 2000 through 2011 by total production, per capita rates and peaking factor. The water demand characteristics for 2011 are anomalous in that the MDD is much smaller than the previous years. Figures 4 and 5 illustrate the historical water demand characteristic as both daily and per capita demands.

Figure 4
Historical Daily Water Demand Characteristics

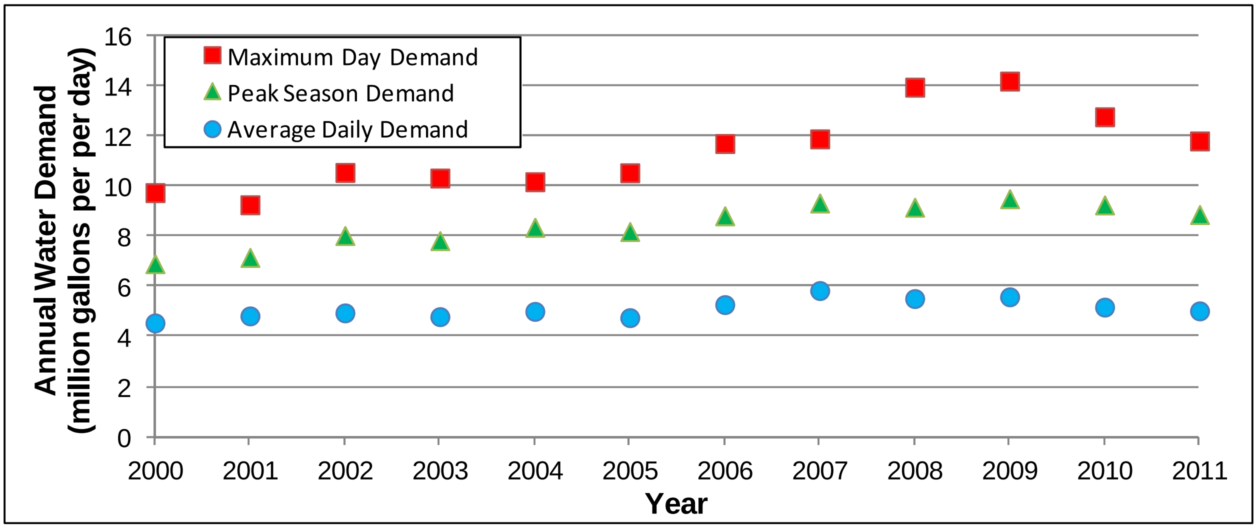


Figure 5
Historical Per Capita Water Demand Characteristics

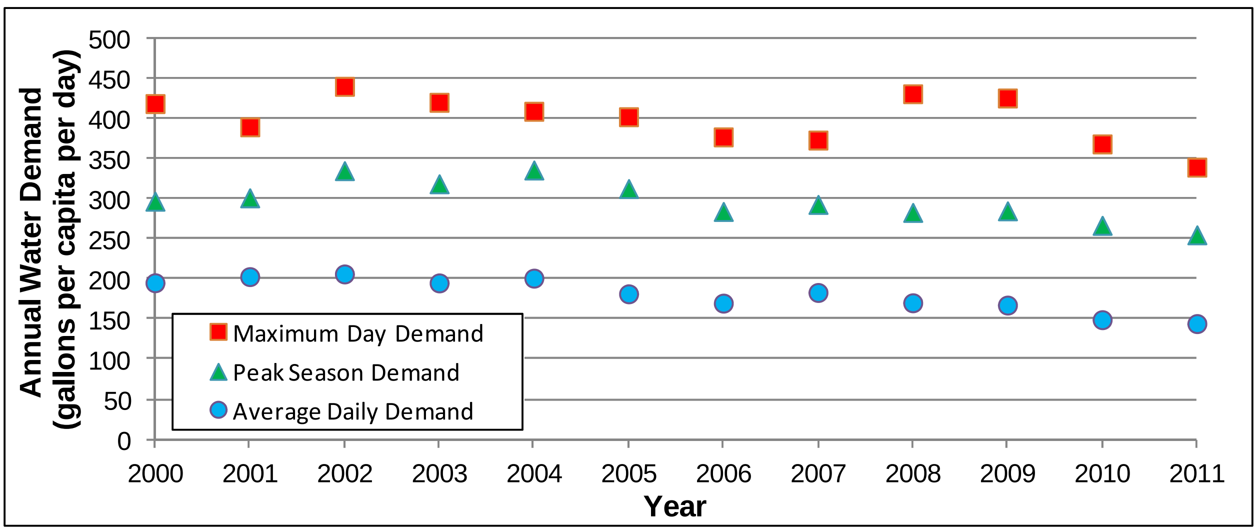


Table 3
Historical Water Demand Summary

Year	Water Service Area Population	Water Demand (million gallons per day)			Per Capita Water Demand (gallons per capita per day)			Peaking Factor	
		ADD	PSD	MDD	ADD	PSD	MDD	PSD	MDD
2000	23,249	4.5	6.9	9.7	195	296	419	1.52	2.14
2001	23,750	4.8	7.1	9.2	203	300	389	1.48	1.92
2002	23,951	4.9	7.9	10.5	206	328	440	1.59	2.13
2003	24,552	4.8	7.9	10.3	195	322	420	1.65	2.15
2004	24,873	5.0	8.1	10.2	201	327	409	1.63	2.03
2005	26,169	4.8	7.6	10.5	182	291	402	1.60	2.22
2006	31,015	5.3	8.4	11.7	170	272	377	1.60	2.22
2007	31,826	5.8	9.4	11.9	183	296	373	1.61	2.04
2008	32,346	5.5	9.0	13.9	170	277	431	1.63	2.53
2009	33,318	5.6	9.1	14.2	167	273	425	1.63	2.54
2010	34,632	5.2	8.6	12.8	149	248	368	1.66	2.47
2011	34,756	5.0	8.3	11.8	144	240	339	1.66	2.35
5-year average ('06-'10)		*5.5*	*8.9*	*12.9*	*168*	*273*	*395*	*1.63*	*2.36*
10-year average ('00-'10)		*5.1*	*8.2*	*11.4*	*184*	*294*	*405*	*1.60*	*2.22*

Notes:
1. Abbreviations: Average Daily Demand (ADD); Peak Season Demand (PSD); Maximum Daily Demand (MDD).
2. The water demand characteristics for 2011 are anomalous, and are not used to calculate historical averages.
3. Water service area population includes the North Valley area component.

Projected Water Demands

Projections of future water demands are determined based upon present and historical per capita water use characteristics and forecasted future population.

Water demand forecasts are used to ensure adequate supply and transmission capacity under a maximum day demand scenario. Major water infrastructure projects often take 5 to 10 years to complete as the City proceeds from identification of a deficiency through project planning, funding, design, bidding, award and construction. Based on a review of historical and current water use characteristics within the City's water service area, observation of regional and national water use trends, and anticipated future advances in water saving technology, the following water demand projection criteria are used:

<u>20-Year Planning Horizon (~2035)</u>

- Per capita average day demand assumed to be at the average rate over the 5 years from 2006 through 2010, 170 gpcd.
- Per capita maximum day demand assumed to be approximately 400 gpcd based on the average peaking factor of 2.35 over the 2006 through 2010 period.

<u>Beyond the 20-Year Planning Horizon</u>

- Beyond the 20-year planning period, it is more probable that water demand growth will not increase at the same rate as assumed for the near term planning purposes.
- The per capita water demand rate was assumed to decrease from 170 gpcd by 5 gpcd after each 5-year block such that a demand of 140 gpcd is achieved by 2065.

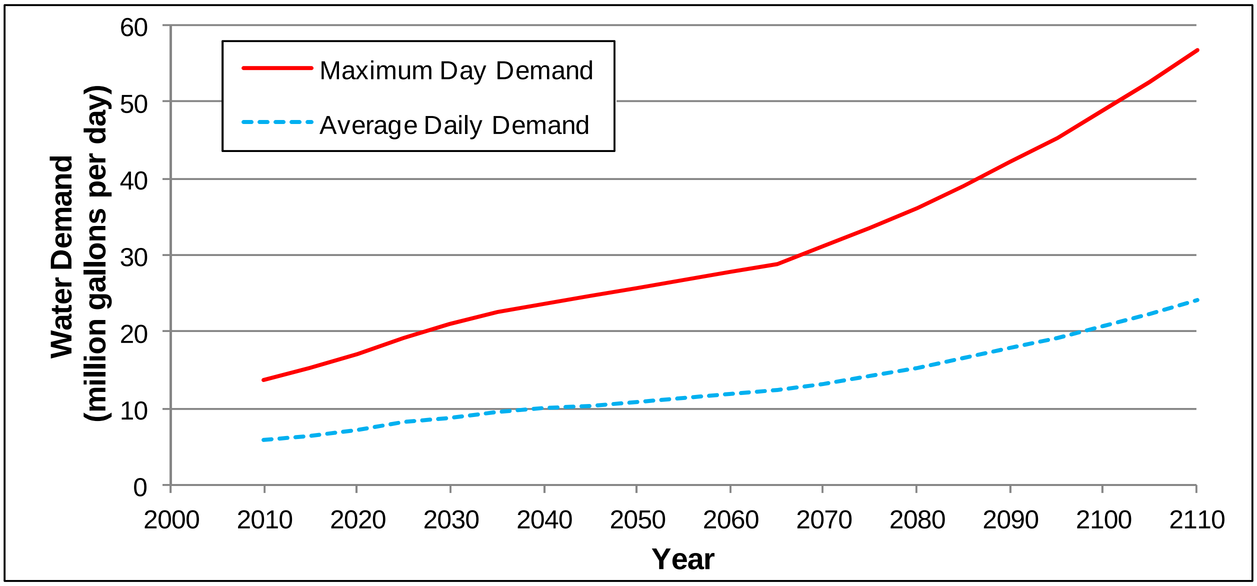
Table 4 presents a summary of population and water demand forecasts in five year increments through 2040 and in 10-year increments to the year 2110. The purpose of the forecasts presented in this memorandum is to provide a basis for planning of water supply and treatment needs. It is recommended that these projections be updated every 5 to 10 years to reflect current conditions and to support updates of capital infrastructure prioritization, funding and implementation.

Table 4
Population and Water Demand Forecasts Summary

Year	Service Area Population	AAGR (percent)	Per Capita Demand (gpcd)	ADD (mgd)	MDD (mgd)
2015	38,632	2.1%	170	6.6	15.5
2020	42,862	2.0%	170	7.3	17.1
2025	47,323	1.9%	170	8.0	18.9
2030	51,993	1.8%	170	8.8	20.8
2035	56,844	1.7%	170	9.7	22.7
2040	61,843	1.6%	165	10.2	24.0
2045	66,951	1.5%	160	10.7	25.2
2050	72,125	1.5%	155	11.2	26.3
2055	77,700	1.5%	150	11.7	27.4
2060	83,704	1.5%	145	12.1	28.5
2065	90,173	1.5%	140	12.6	29.7
2070	97,142	1.5%	140	13.6	32.0
2075	104,650	1.5%	140	14.7	34.4
2080	112,738	1.5%	140	15.8	37.1
2085	121,451	1.5%	140	17.0	40.0
2090	130,837	1.5%	140	18.3	43.0
2095	140,948	1.5%	140	19.7	46.4
2100	151,841	1.5%	140	21.3	50.0
2105	163,576	1.5%	140	22.9	53.8
2110	176,218	1.5%	140	24.7	58.0

Note: 1. Abbreviations: Average Annual Population Growth Rate (AAGR); Average Daily Demand (ADD); Maximum Daily Demand (MDD); million gallons per day (mgd); gallons per capita per day (gpcd)

Figure 6
Projected Water Demand



Summary

This memorandum presents historical and forecasted population and water demands. The current service area population is approximately 34,756 and the planning level ADD of 5.9 mgd and MDD of 13.9 mgd. By 2030, the population is forecasted to be approximately 51,993 and the projected ADD is 8.8 and the MDD is 20.8 mgd. The City of Grants Pass is anticipated to continue to expand and grow well beyond the UGB expansion currently being adopted. By 2110, the population is forecasted to be approximately 176,218 and the projected ADD is 25 and the MDD is 58 mgd. These projections are generally consistent with the Josephine County and City's current Comprehensive Plan projections. It is recommended that these projections will be updated every five (5) to 10 years to reflect current conditions and to support updates of capital infrastructure prioritization, funding and implementation.

BMG:mlm

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121 S.W. Salmon, Suite 900 ▪ Portland, Oregon 97204-2919 ▪ www.msa-ep.com