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

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

720 SW WASHINGTON STREET, SUITE 550 • PORTLAND, OREGON 97205 • P. 503.227.1885 • F. 503.227.1747

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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

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May 2014

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CITY OF GRANTS PASS

WATER RESTORATION PLANT FACILITY PLAN

EXECUTIVE SUMMARY

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EXECUTIVE SUMMARY

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.

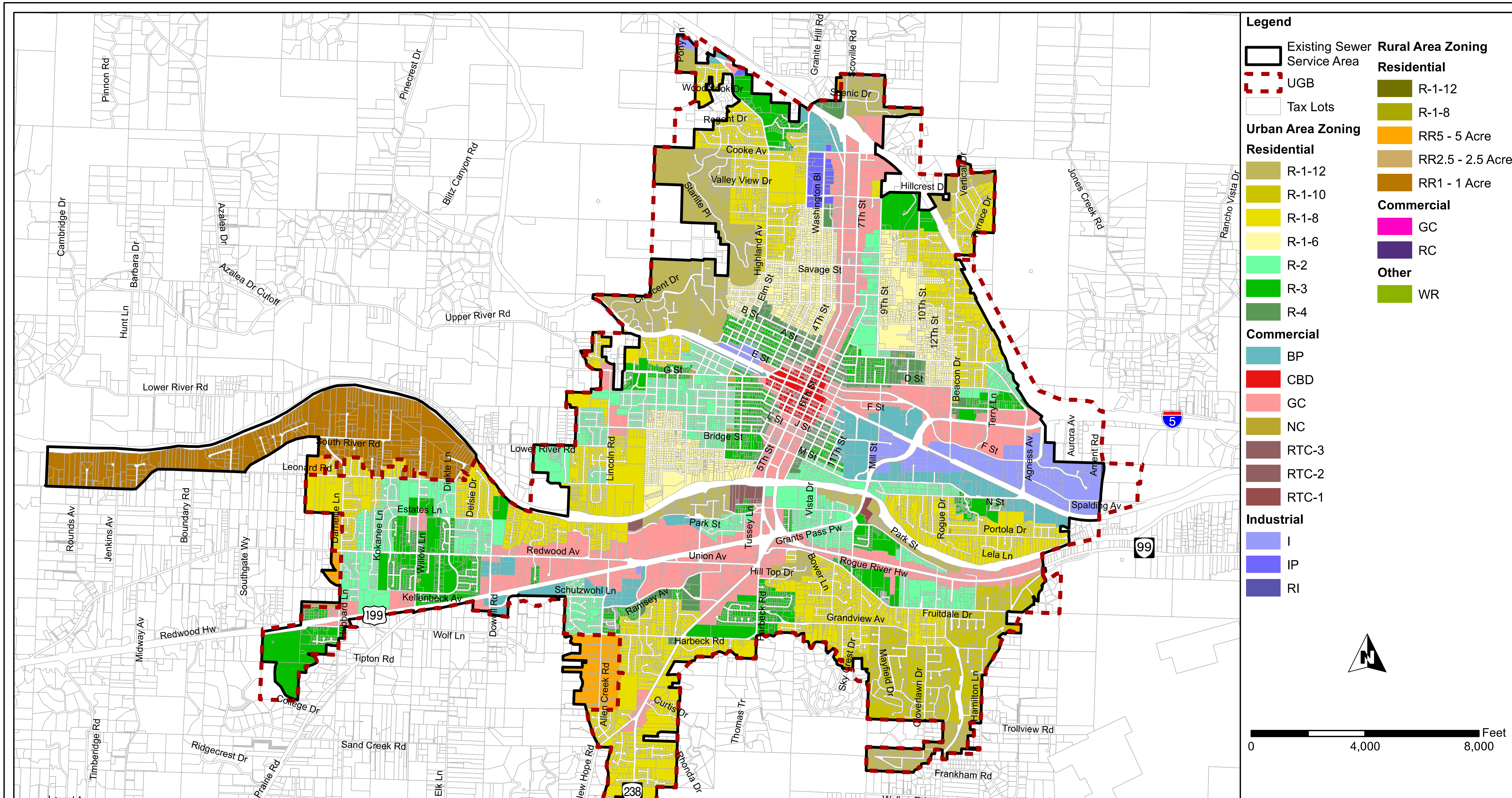


Figure ES 1
Existing Service Area Land Use
Water Restoration Plant Facilities Plan
City of Grants Pass

Population, Flow, and Load Projections

Population projections for the 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
Flows:		
Average Dry Weather Flow (ADWF), mgd	5.2	7.8
Average Annual Flow (AAF), mgd	6.2	9.3
Average Wet Weather Flow (AWWF), mgd	7.1	10.6
Maximum Month Dry Weather Flow (MMDWF), mgd	6.3	9.4
Maximum Month Wet Weather Flow (MMWWF), mgd	10.3	15.5
Peak Day Flow (PDF), mgd	21.7	27.7
Peak Hour Flow (PHF), mgd	27.2	33.9
Loads:		
BOD_5		
Annual Average	7,500	12,000
Maximum Month	9,300	14,800
Maximum Week	12,200	19,400
Peak Day	16,500	26,300
TSS		
Annual Average	8,400	12,600
Maximum Month	11,600	17,500
Maximum Week	13,600	20,500
Peak Day	21,700	32,700
Ammonia		
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 in a "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 peak hour flows (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 ammonia levels 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 process capacity. The plan identifies 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. The Plan recommends monitoring this issue closely.
- 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

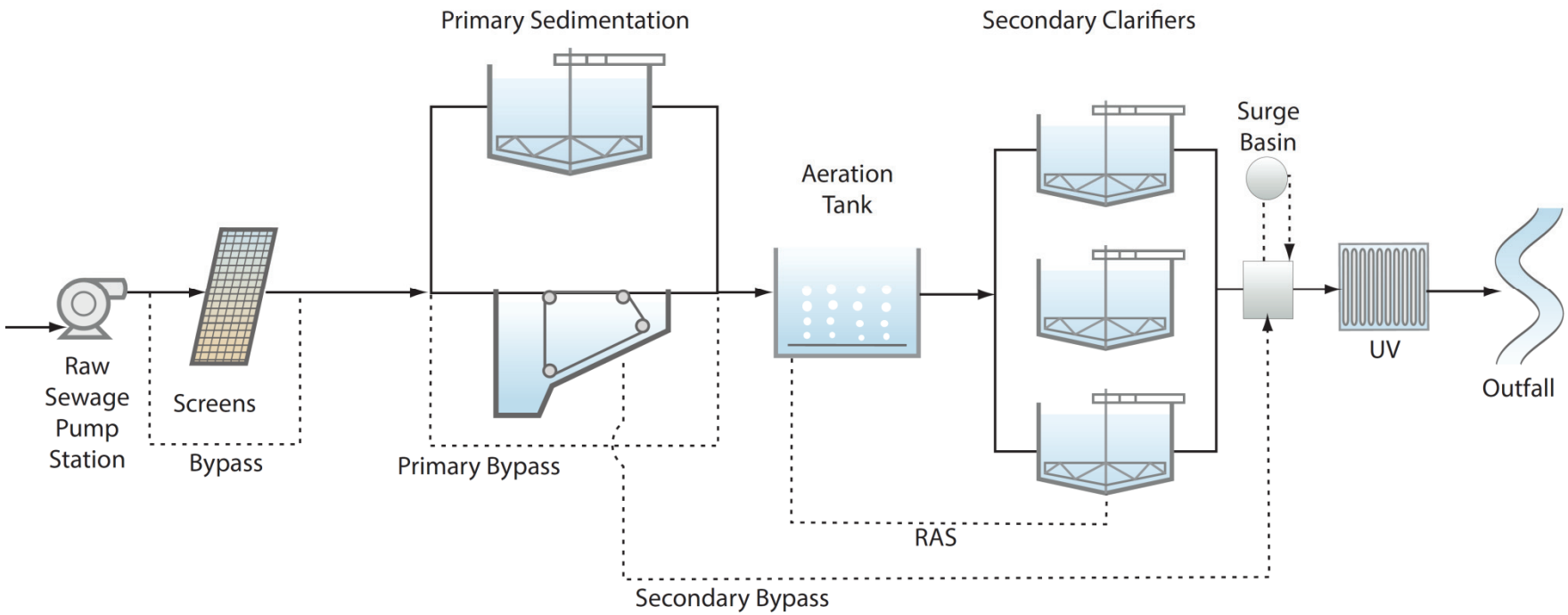
The Grants Pass WRP liquid stream processes includes the following major unit process - raw sewage pump station, screening, primary sedimentation, aeration, secondary sedimentation, and ultraviolet disinfection system. Figure ES.2 presents the liquids stream process schematic.

Solids from the primary process are processed in a gravity thickener (GT) prior to conveying to the 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.

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

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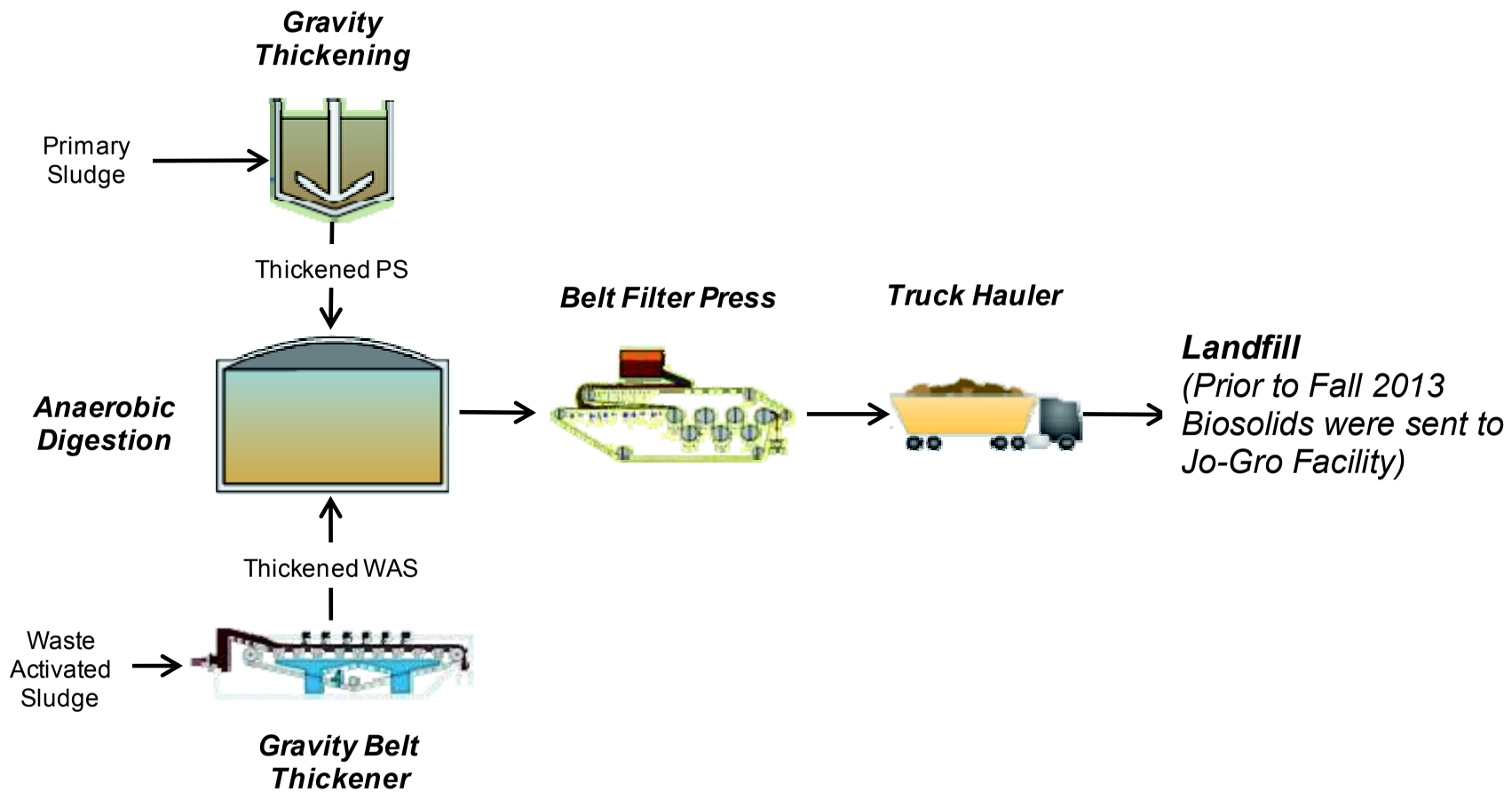

PROCESS SCHEMATIC FOR EXISTING SOLIDS TREATMENT

FIGURE ES 3

CITY OF GRANTS PASS
WATER RESTORATION PLANT FACILITY PLAN

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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

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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

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March 2014

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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.

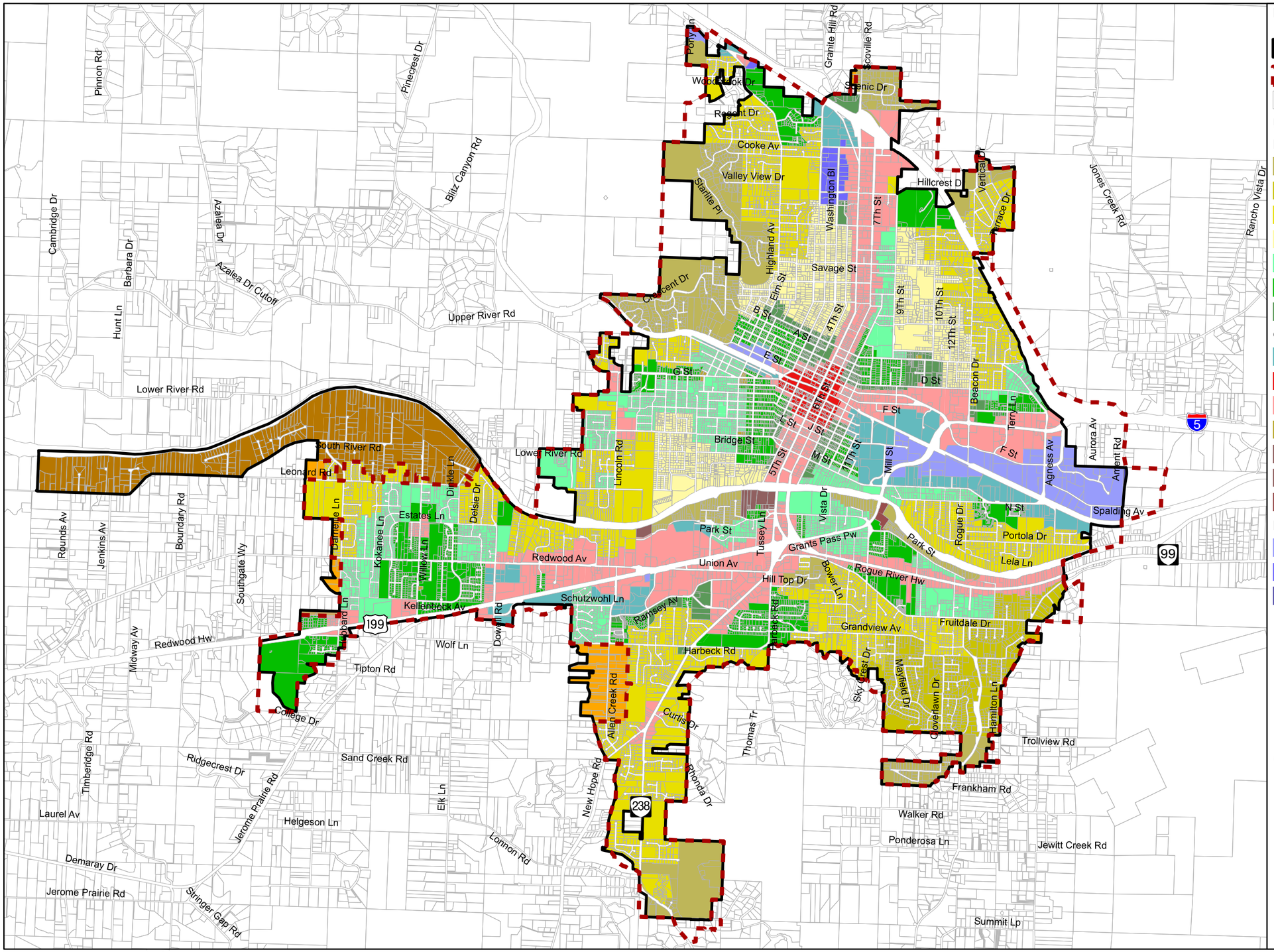


Figure 1
Existing Service Area Land Use
Water Restoration Plant Facilities Plan
City of Grants Pass

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 Planwith 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

WHERE THE ROGUE RIVER RUNS

GRANTS PASS

OREGON

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

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.** This 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.***

ATTACHMENT 1A

(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.

ITEM: 2.d. RESOLUTION PROVIDING DIRECTION TO STAFF ON THE POPULATION FORECAST AND SCOPE OF WORK FOR THE UGB/URBAN AREA PLANNING WORK.

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):

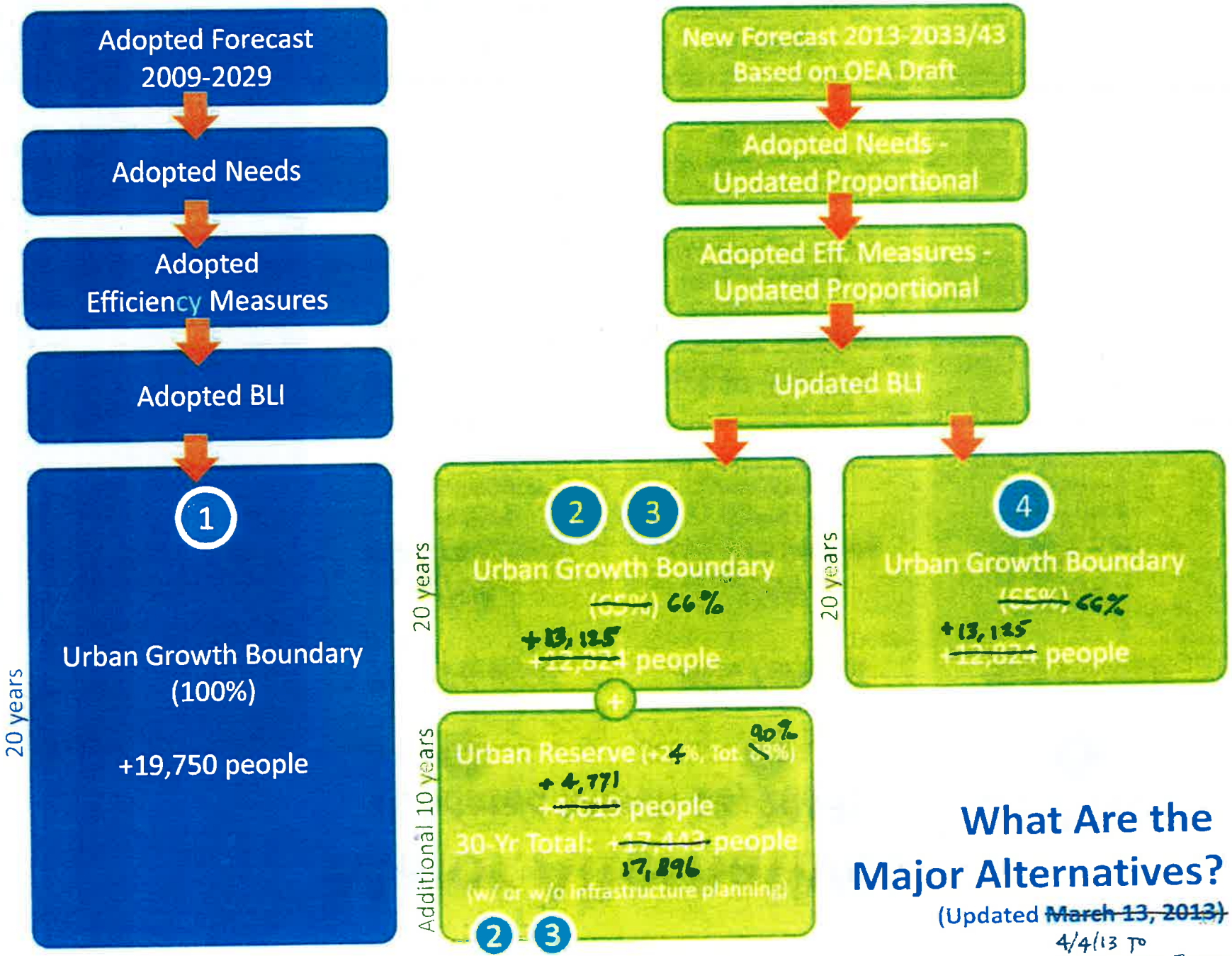
RECOMMENDED ACTION:

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.



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

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 potential 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.

ITEM: 2.e. MOTION PROVIDING DIRECTION TO STAFF ON THE EXTENT OF REZONES TO CONSIDER FOR PRELIMINARY DRAFT UGB PLANNING ALTERNATIVES.

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

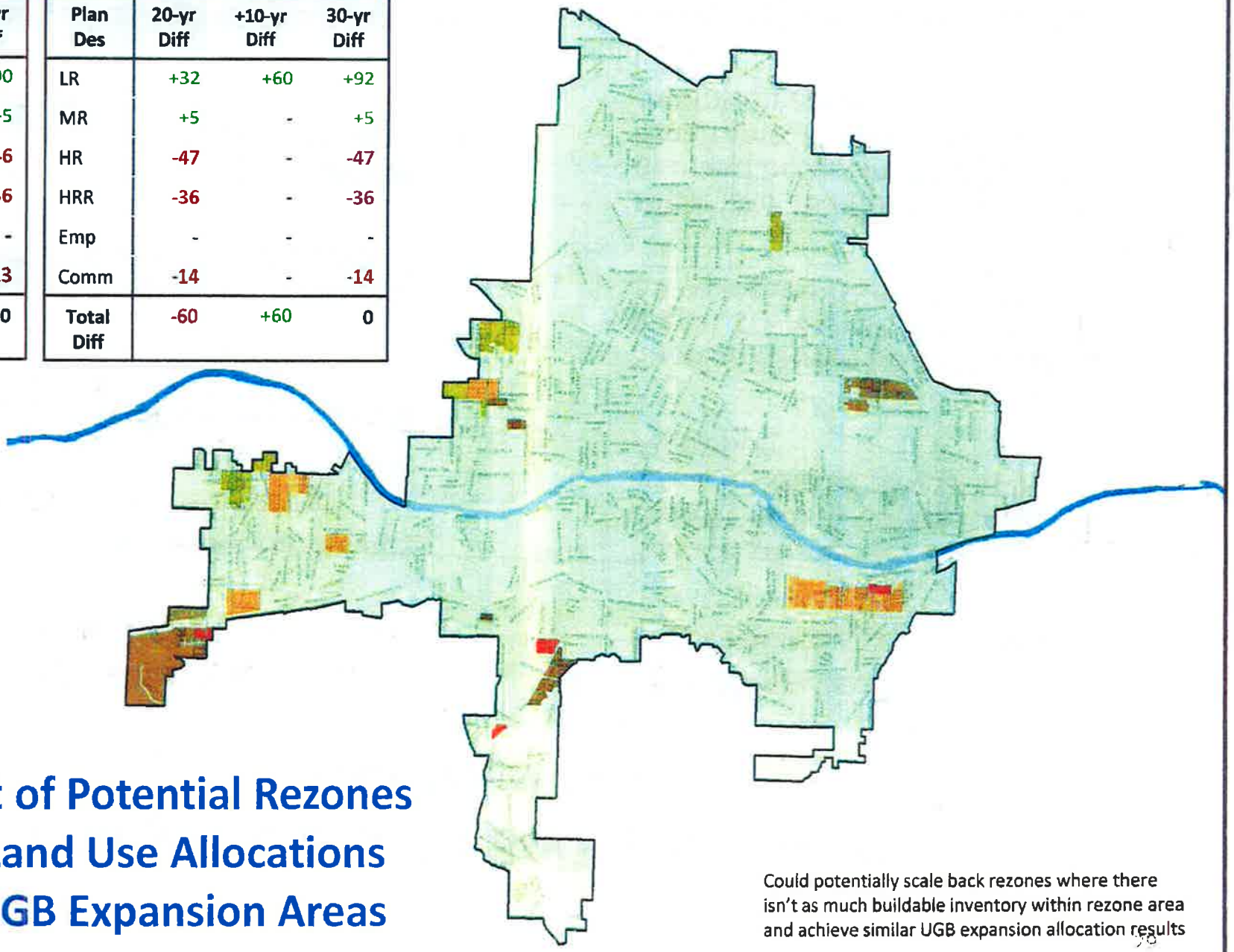
- Planning for entire community, not just expansion areas
- Adjust edges between existing zoning districts
- Disperse rather than concentrate higher-density designations
- Locate more of higher-density near commercial nodes & corridors with services
- Locate less higher-density at UGB fringes, affecting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

Exhibit 2

ATTACHMENT 2

City of
Grants Pass

WHERE THE ROGUE RIVER RUNS

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).

'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)

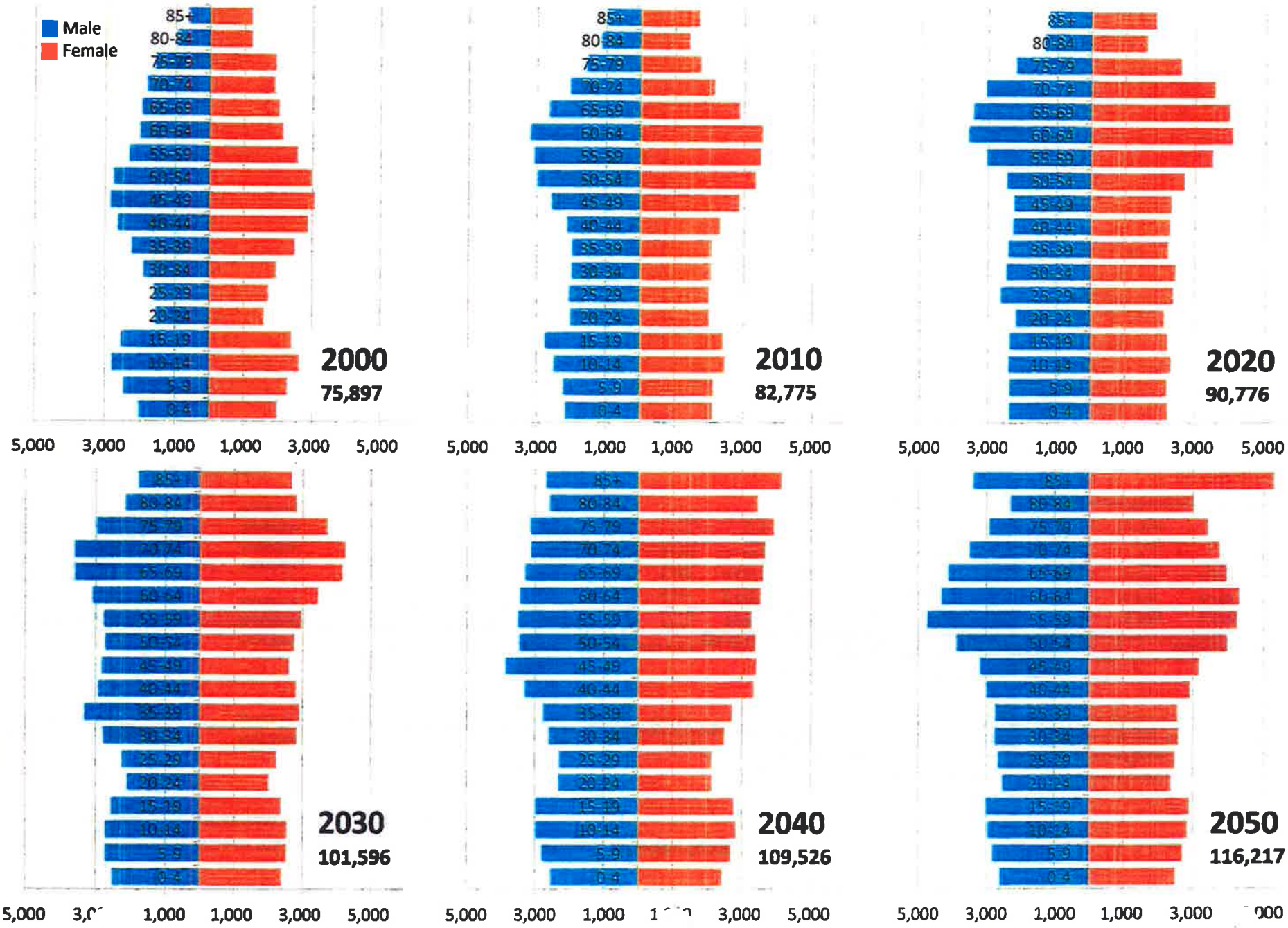
Josephine Co. Population	Area Name	1980	1985	1990	1995	2000	2005	2010	2015	2020	2025	2030	2035	2040	2045	2050
					Estimate				FORECAST							
Population	Josephine	58,982	60,666	62,985	71,313	75,897	79,134	82,775	85,313	90,776	96,468	101,596	105,829	109,526	112,906	116,217

Components of Change	Area Name	1980-1985	985-1990	990-1995	995-2000	000-2005	005-2010	010-2015	015-2020	020-2025	2025-2030	2030-2035	2035-2040	2040-2045	2045-2050
					Estimate			FORECAST							
Population Change	Josephine	1,684	2,319	8,328	4,584	3,237	3,641	2,538	3,463	3,692	3,128	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



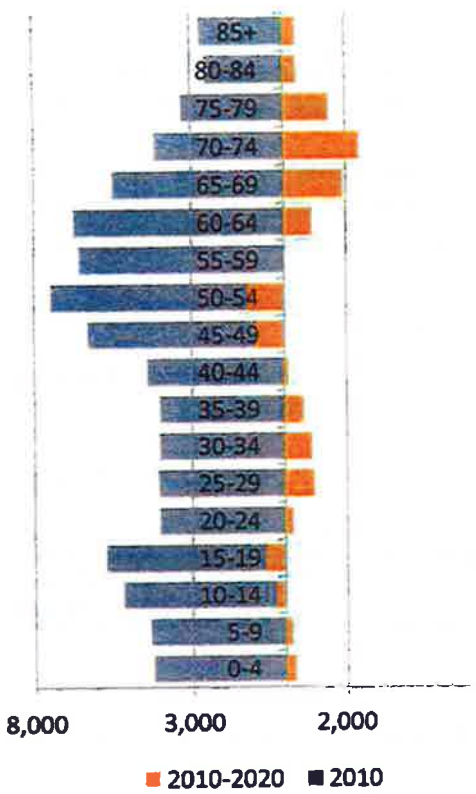
EXHIBIT

Josephine County Population Change from 2010

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

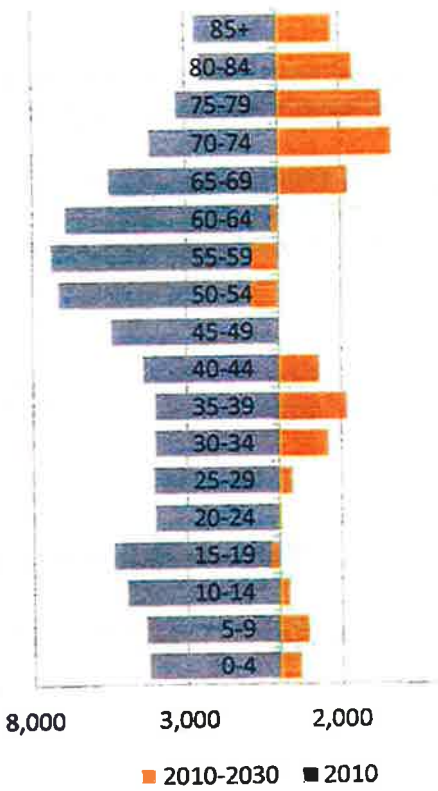
JoCo 2020 Population and 10-Year Change

90,776 (+8,001)



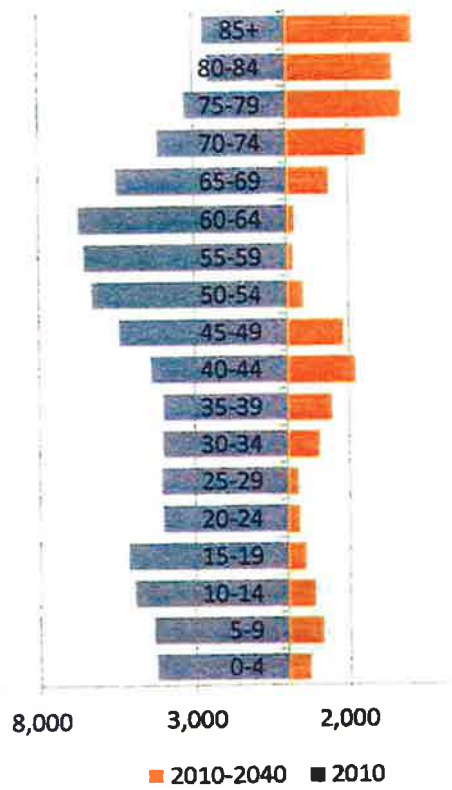
JoCo 2030 Population and 20-Year Change

101,596 (+18,821)



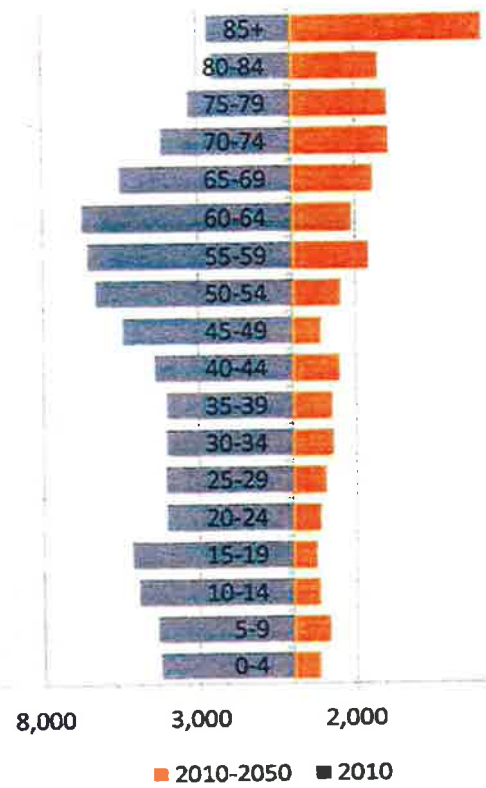
JoCo 2040 Population and 30-Year Change

109,526 (+26,751)



JoCo 2050 Population and 40-Year Change

116,217 (+33,442)



EXHIBIT

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

EXHIBIT 3

ATTACHMENT 3

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, 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.

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.

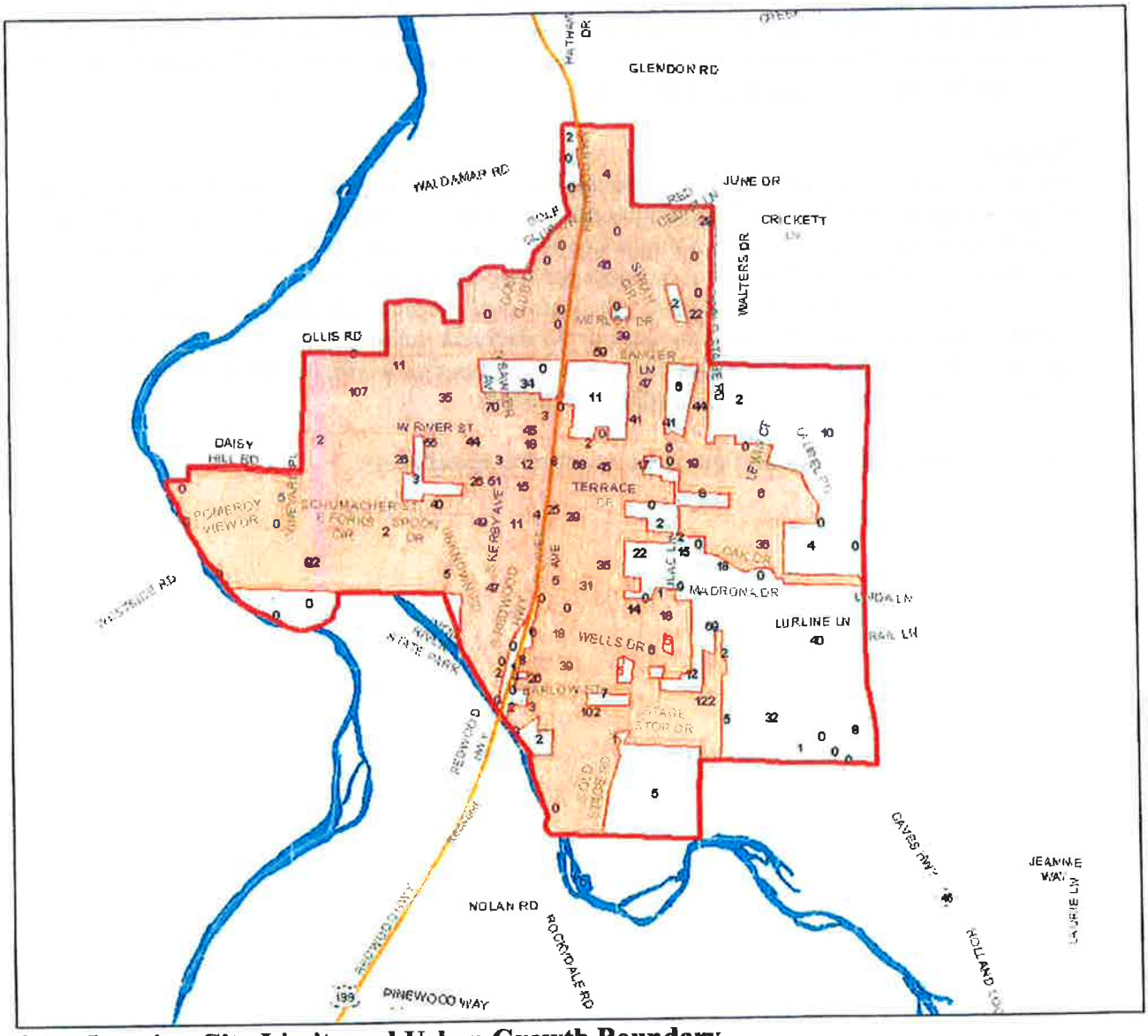
Cave Junction. The Cave Junction forecast specified growth to a population of 5,500 people in 2027. The actual growth during the originally forecast years 2007-2012 has been less than the forecast for those years. Therefore, there are a couple options for incorporating the Cave Junction forecast into 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			Grants Pass Urban Area		Cave Junction Urban Area			
	Growth Rate OEA	Population OEA	Population Updated Base Yr	Share of JoCo	Population	Growth Rate Original	Population Original	Growth Rate Updated Base Year	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%	4,596	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	286%	5,509
2029	1.0412%	100,549	99,342	0.492	48,876	1.054%	5,562	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	51,432	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%	6,928	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, 2013Update

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	41,119	3,177	43,191
2019	88,580	41,810	3,377	43,393
2020	89,686	42,511	3,589	43,585
2021	90,784	43,213	3,815	43,756
2022	91,895	43,926	4,055	43,914
2023	93,019	44,649	4,310	44,060
2024	94,157	45,384	4,581	44,193
2025	95,310	46,130	4,869	44,311
2026	96,302	46,803	5,175	44,325
2027	97,305	47,485		44,320
2028	98,318	48,176	5,616	44,585
2029	99,342	48,876	5,675	44,849
2030	100,376	49,586	5,735	45,115
2031	101,199	50,195	5,796	45,269
2032	102,028	50,810	5,857	45,423
2033	102,865		5,918	45,576
2034	103,708	51,958	5,981	45,832
2035	104,558	52,488	6,044	46,089
2036	105,279	52,955	6,107	46,280
2037	106,004	53,426	6,172	46,471
2038	106,735	53,901	6,237	46,662
2039	107,470	54,380	6,303	46,853
2040	108,211	54,863	6,369	47,045
2041	108,871	55,306	6,436	47,195
2042	109,534	55,753	6,504	47,345
2043	110,202	56,203	6,573	47,495
2044	110,874	57,114	6,642	47,645
2045	111,550	57,557	6,712	47,795
2046	112,197	58,004	6,783	47,928
2047	112,847	58,453	6,854	48,061
2048	113,502	58,906	6,926	48,194
2049	114,160	59,363	6,999	48,327
2050	114,822			48,459

nsus/Estimate
Black = Forecast
Blue = Ce

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.

REGISTERED PROFESSIONAL ENGINEER
19618
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.

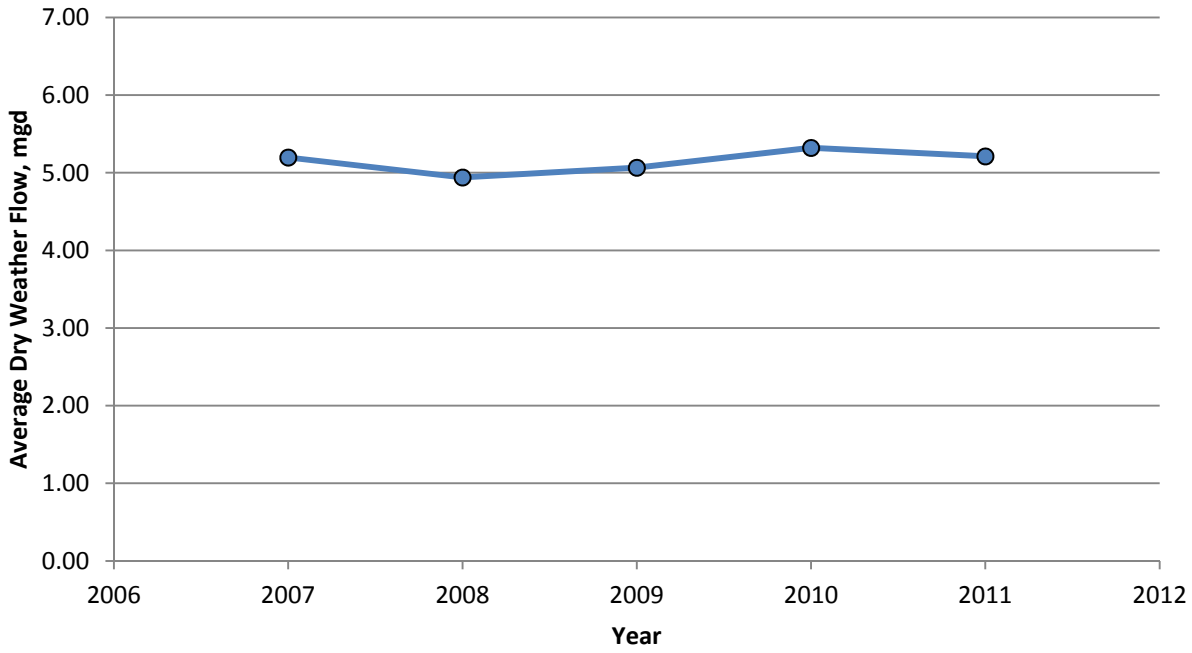

Figure 1 Average Monthly Influent Flows

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.

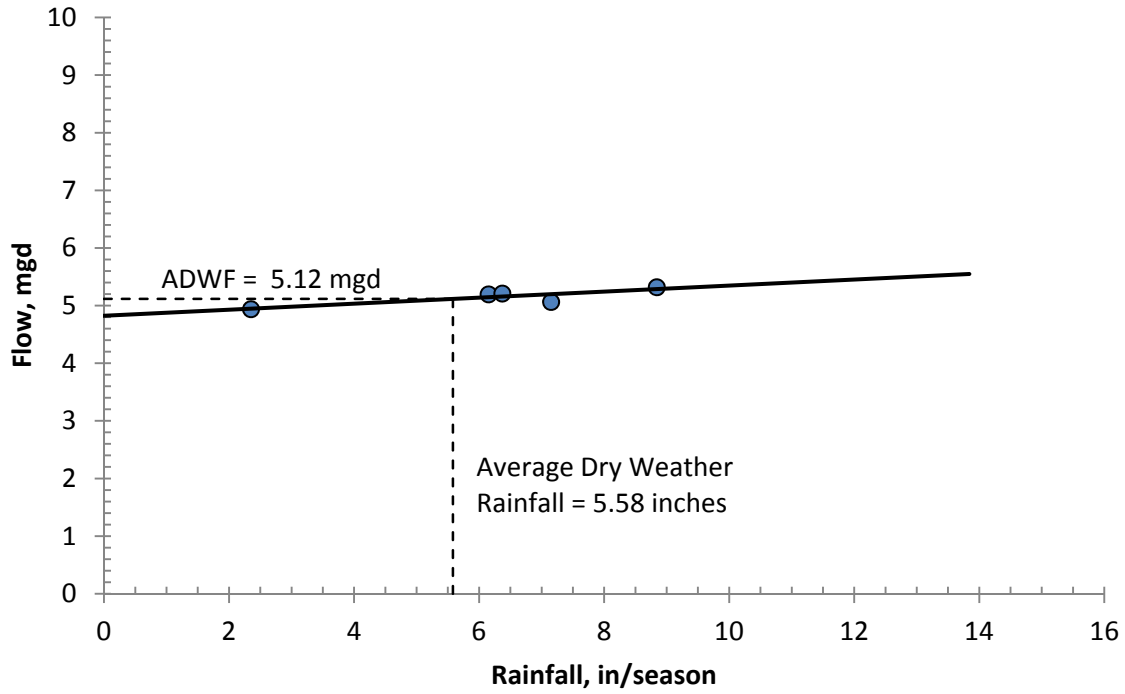

Figure 2 Average Dry Weather Flow

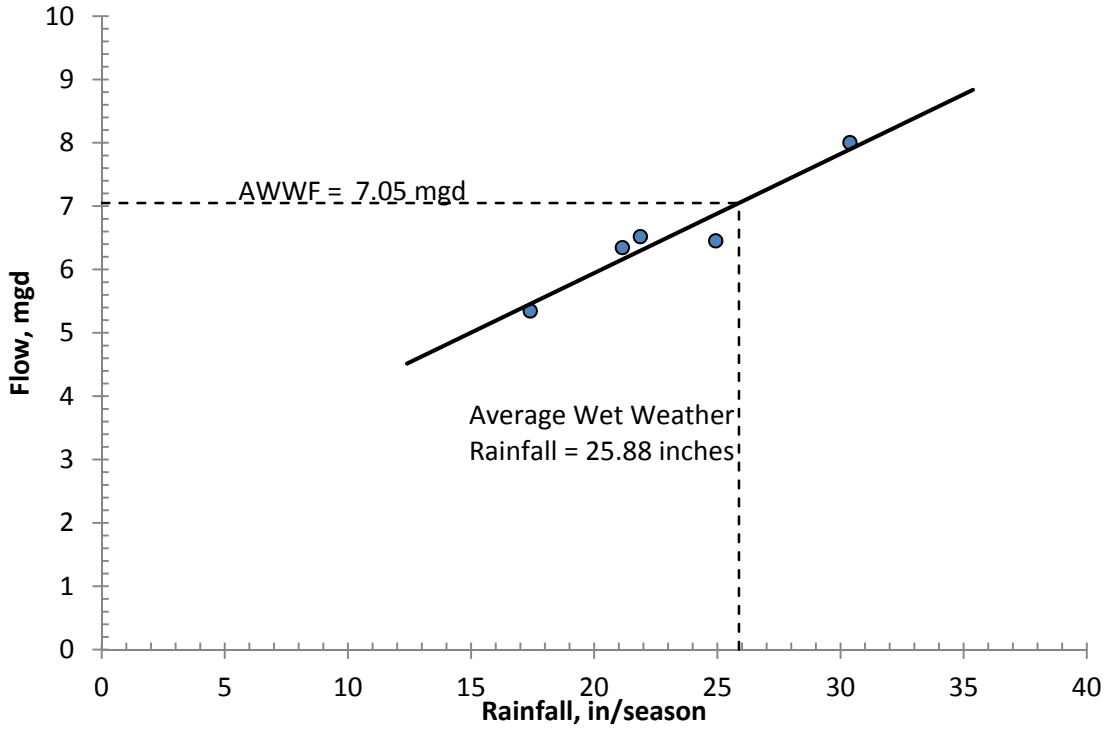

Figure 3 Average Wet Weather Flow

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.

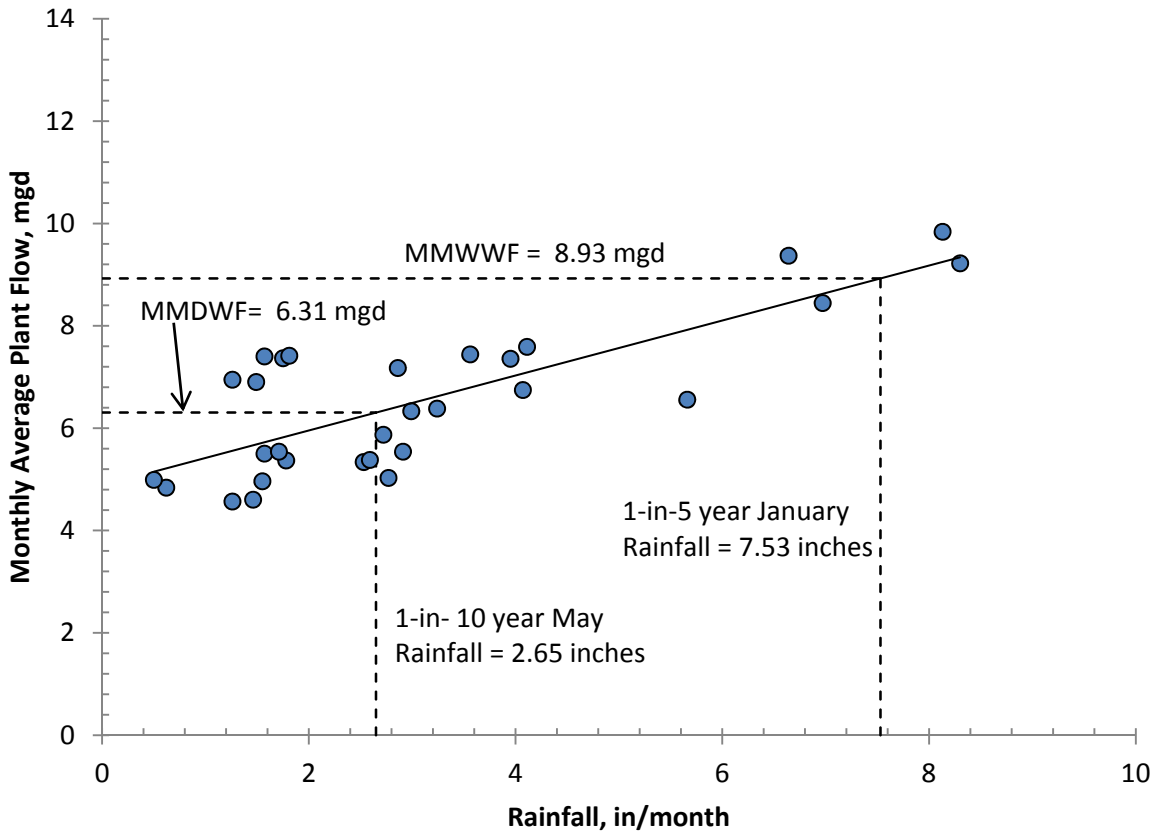

Figure 4 Maximum Month Flows

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

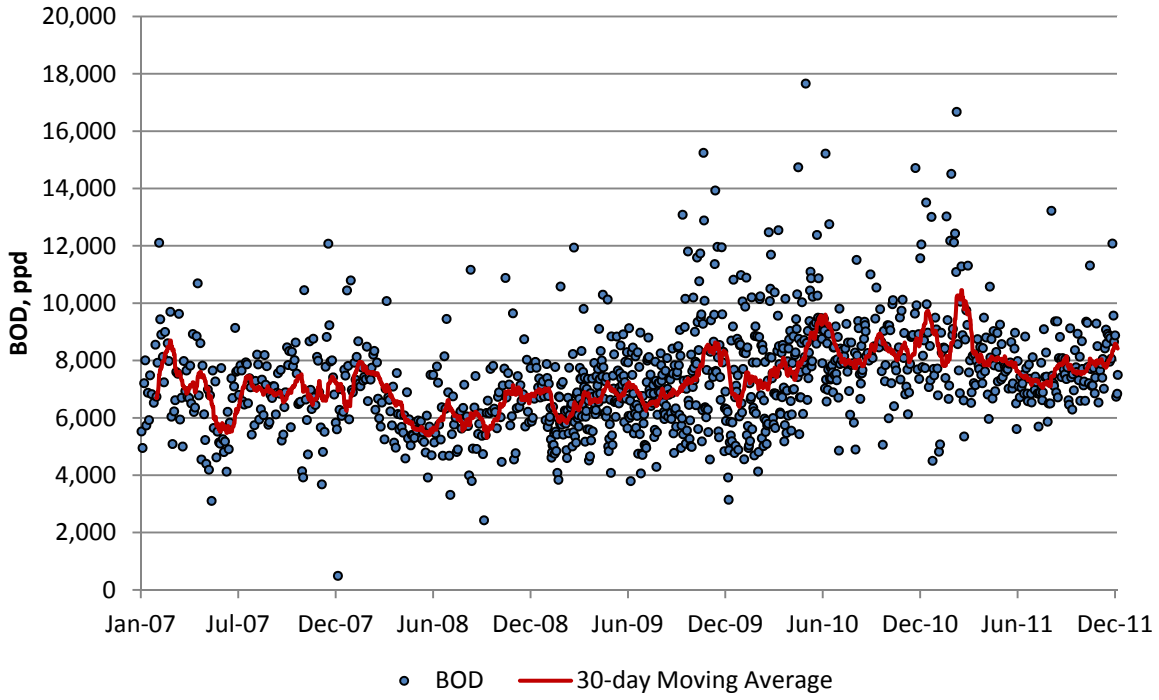

Figure 5 Daily BOD_5 Loading 2007-2011

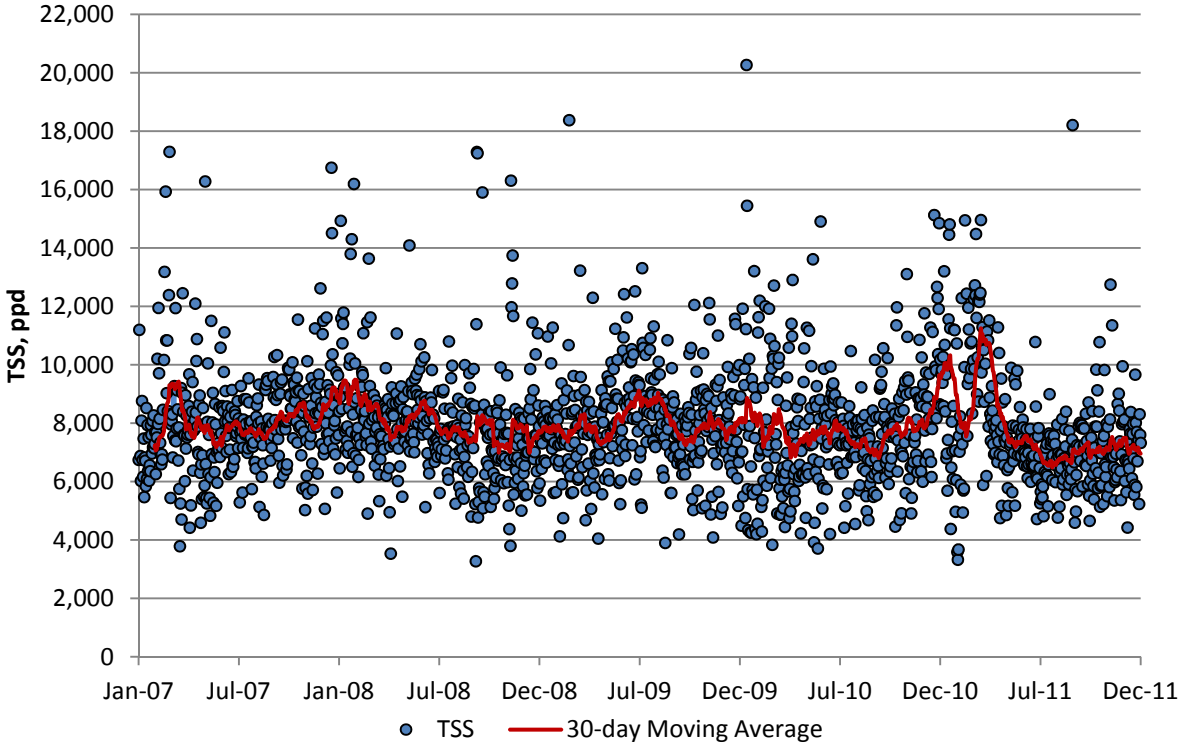

Figure 6 Daily TSS Loading 2007-2011

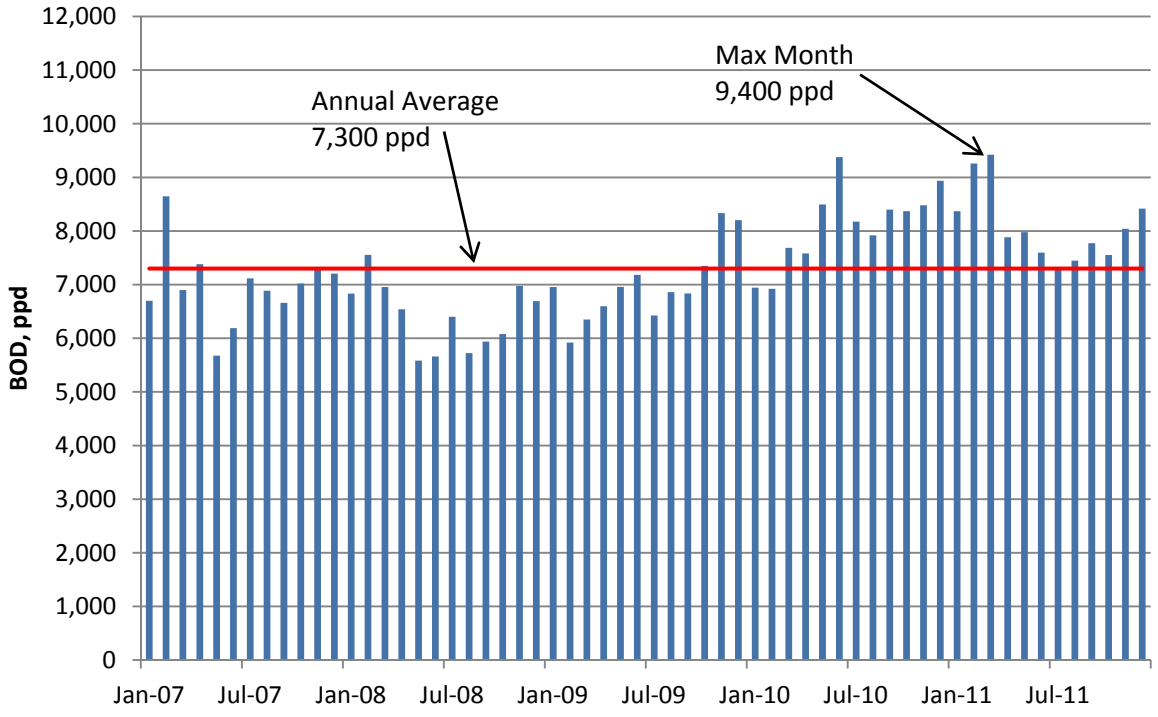

Figure 7 Monthly BOD_5 Loading 2007-2011

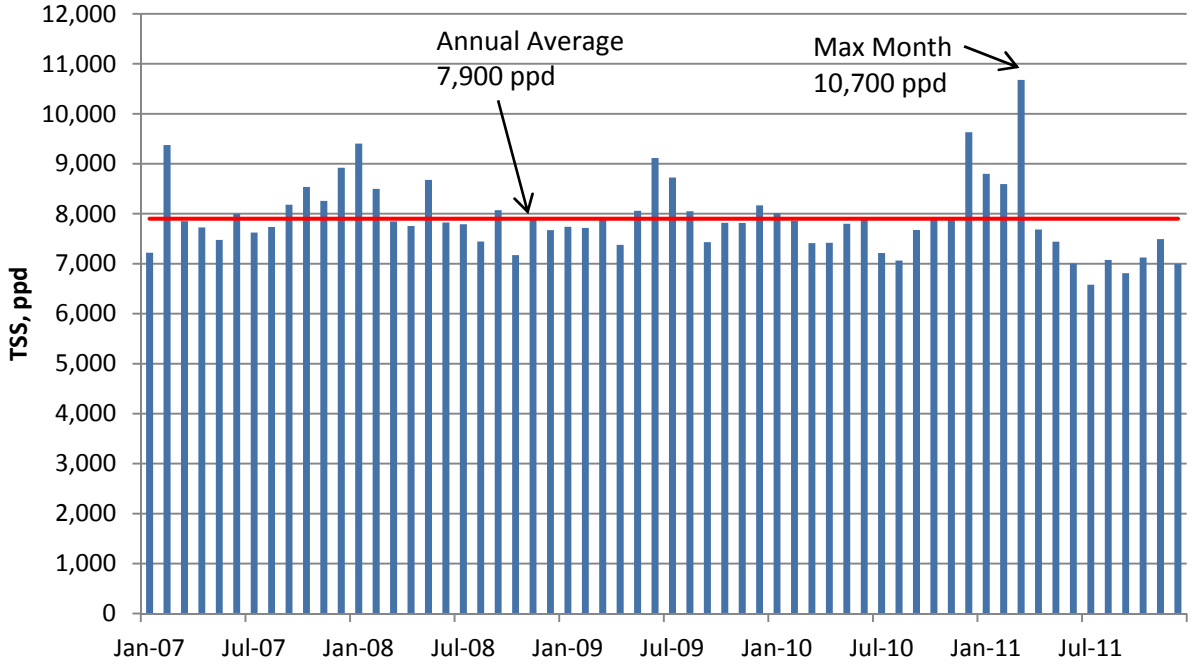

Figure 8 Monthly TSS Loading 2007-2011

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

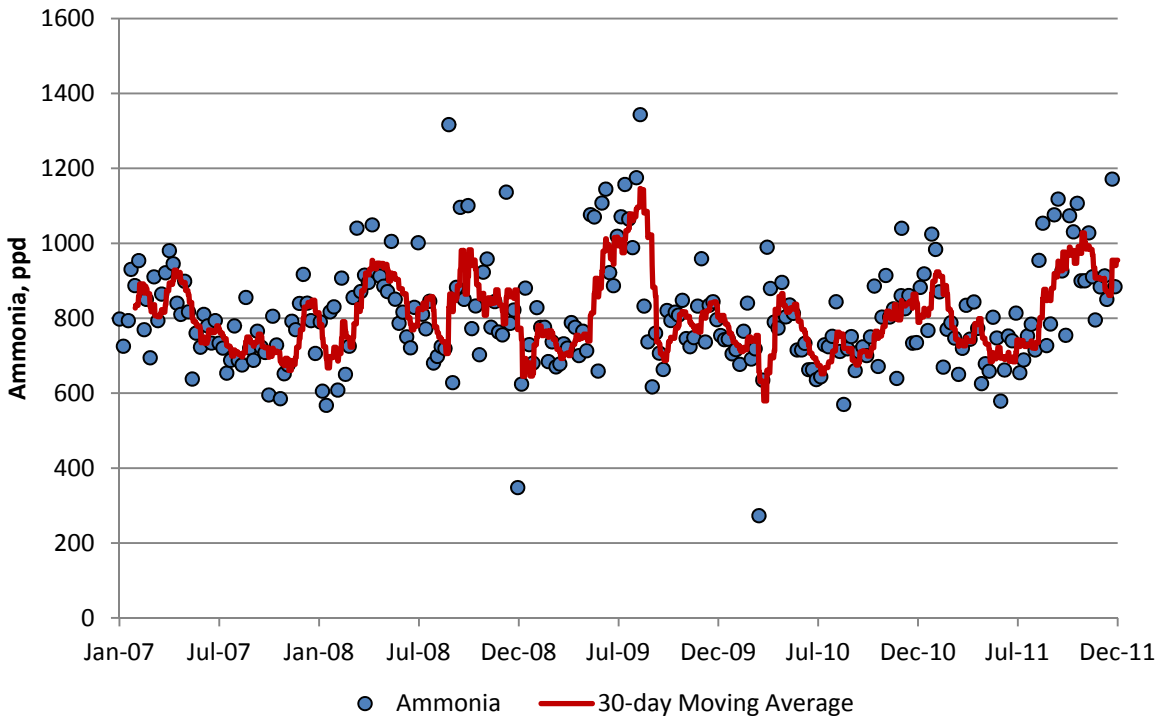

Figure 9 Weekly Ammonia Loading

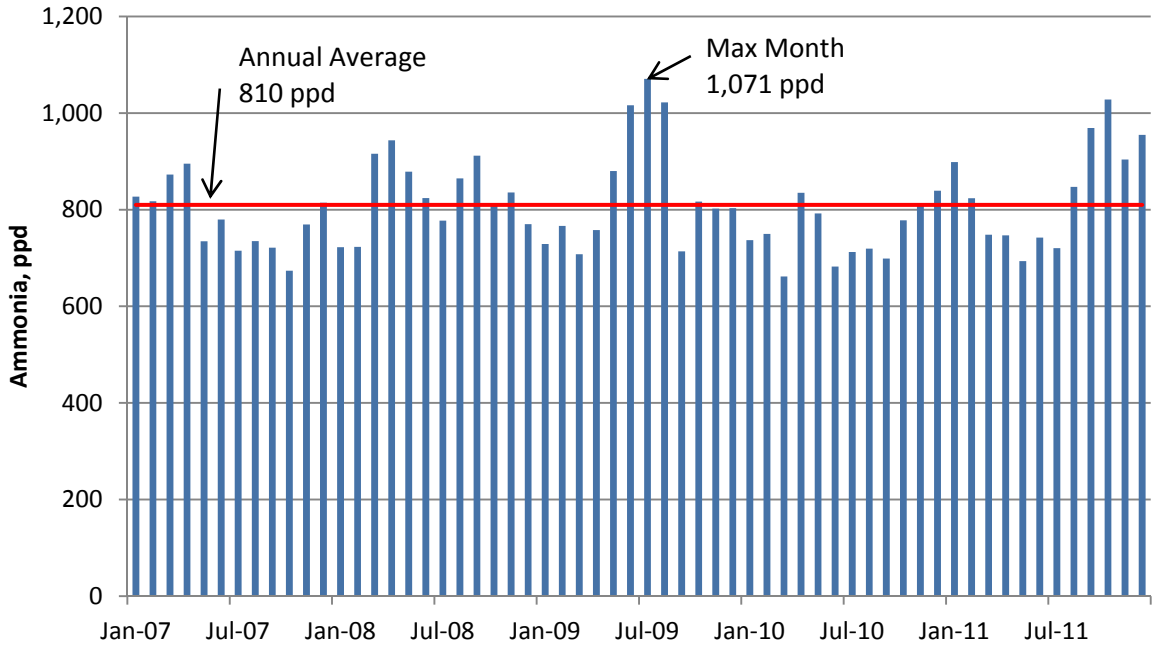

Figure 10 Monthly Ammonia Loading

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

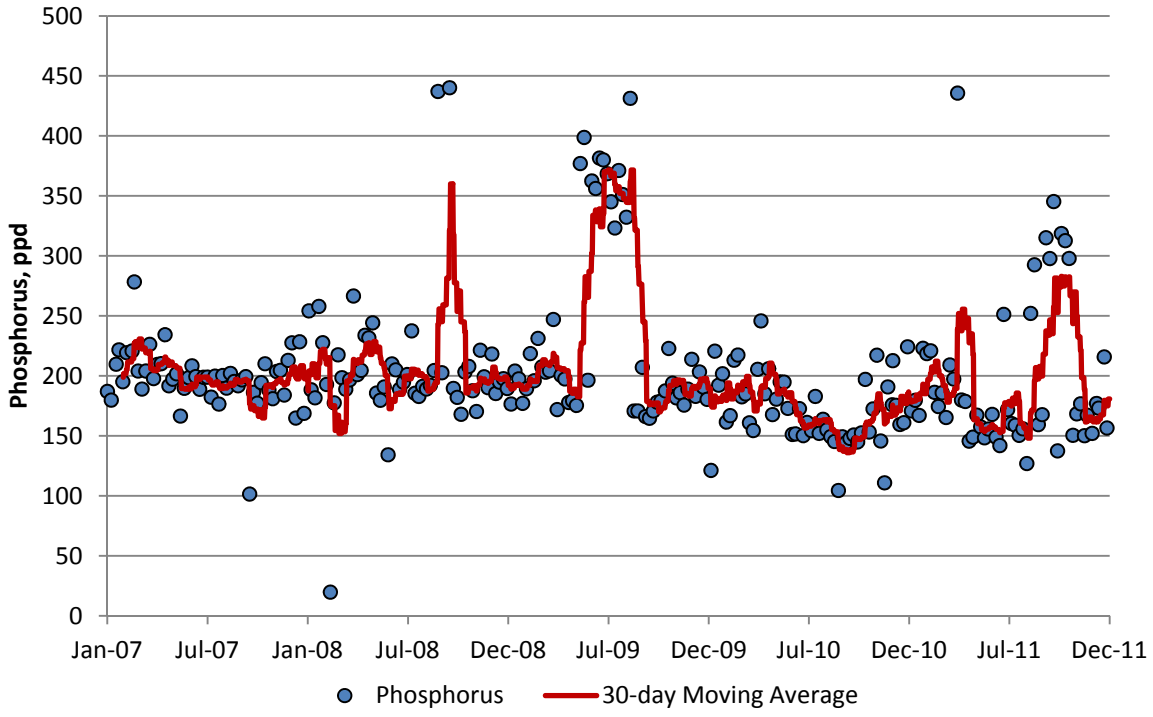

Figure 11 Weekly Phosphorus Loading

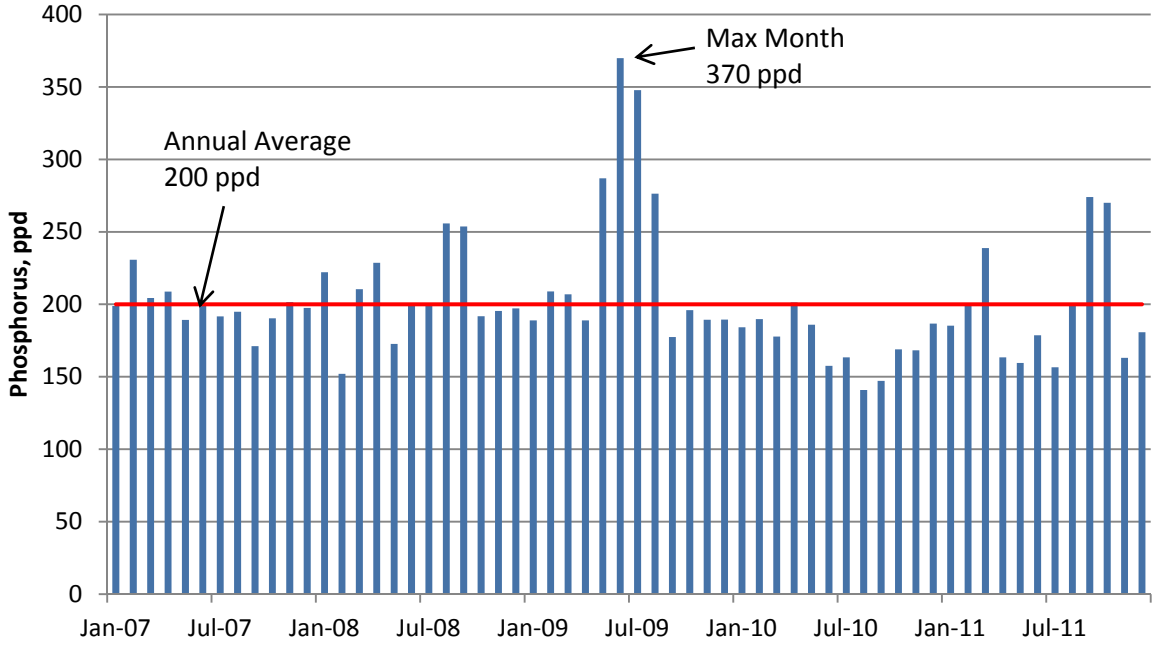

Figure 12 Monthly Phosphorus Loading

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.

REGISTERED PROFESSIONAL ENGINEER
76549
OREGON
DEC. 31, 2007
BHARGAVI MAREMANDA

EXPIRES: 12/31/14

City of Grants Pass

TECHNICAL MEMORANDUM NO. 4

Water Restoration Plant Facility Plan
Permitting and Regulatory Considerations

FINAL

February 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. 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 Average, Lbs/day**	**Weekly Average, Lbs/day**	**Daily Maximum, Lbs/day**
	Monthly, mg/L	**Weekly, mg/L**			
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.

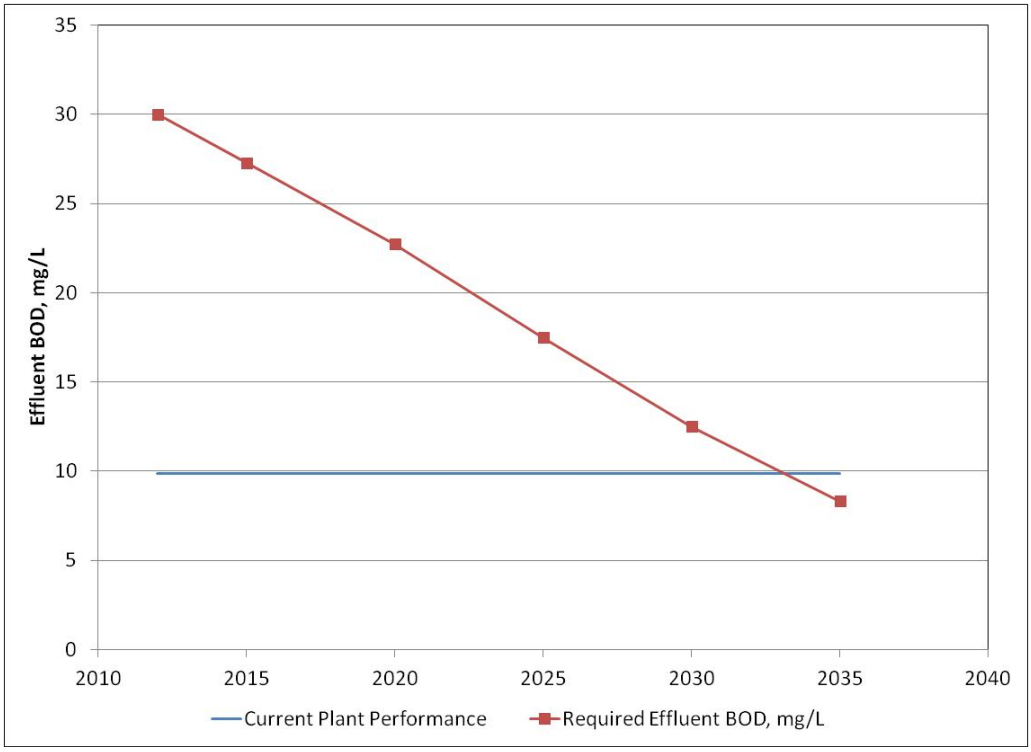

Figure 1 Required Effluent BOD Concentrations to meet No Mass Load Increase

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
Schedule A - Waste Discharge Limitations not to be Exceeded 2
Schedule B - Minimum Monitoring and Reporting Requirements 5
Schedule D - Special Conditions 13
Schedule E - Pretreatment Activities 18
Schedule F - General Conditions 22

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 Test Methods for Evaluating Solid Waste, Volume 2; Field Manual, Physical/Chemical Methods, November 1986, Third Edition, Chapter 9.

   Inorganic pollutant monitoring must be conducted according to Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Second Edition (1982) with Updates I and II and third Edition (1986) with Revision I.

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 possible 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 be transferred to a new permittee provided the transferee acquires a property interest in the permitted activity and agrees in writing to fully comply with all the terms and conditions of the permit and the rules of the Commission. No permit 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. Other Noncompliance

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. Duty to Provide Information

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. Signatory Requirements

All applications, reports or information submitted to the Department must be signed and certified in accordance with 40 CFR Section 122.22.

9. Falsification of Information

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. Changes to Indirect Dischargers

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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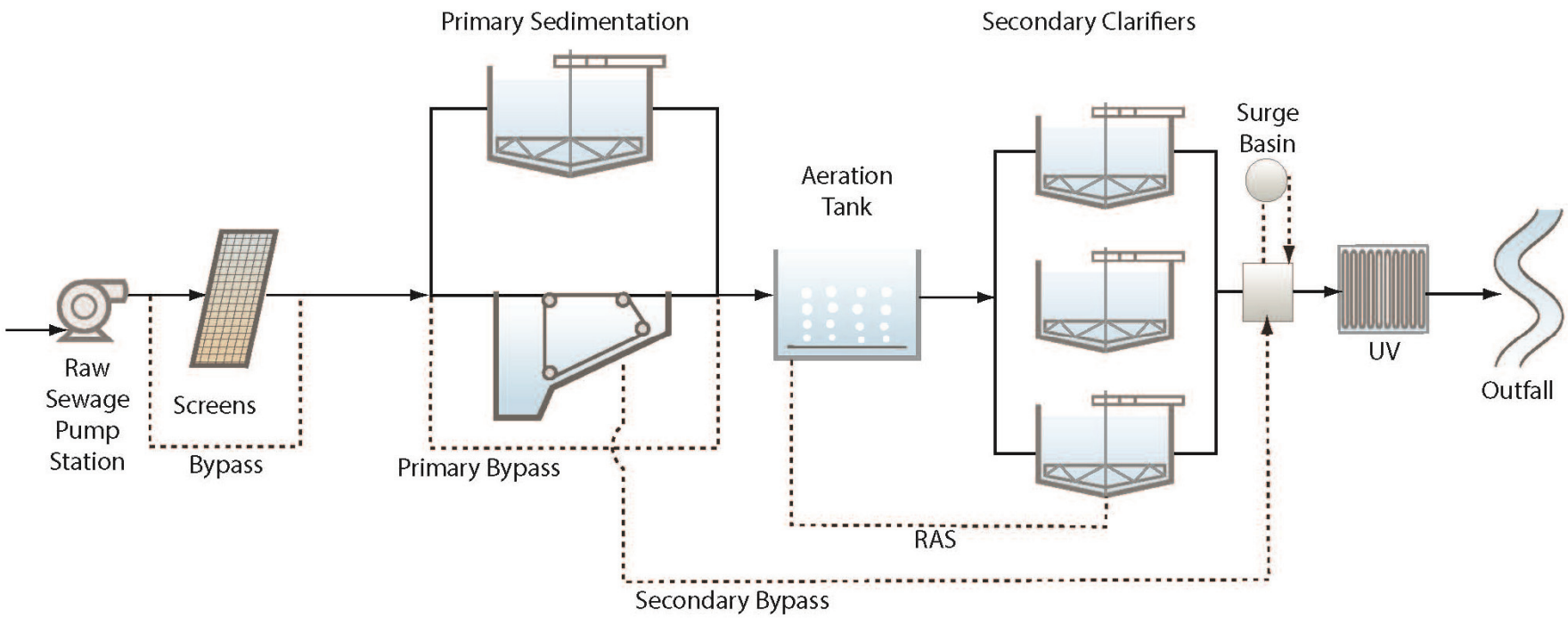
LIQUID STREAM PROCESS ANALYSIS

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.

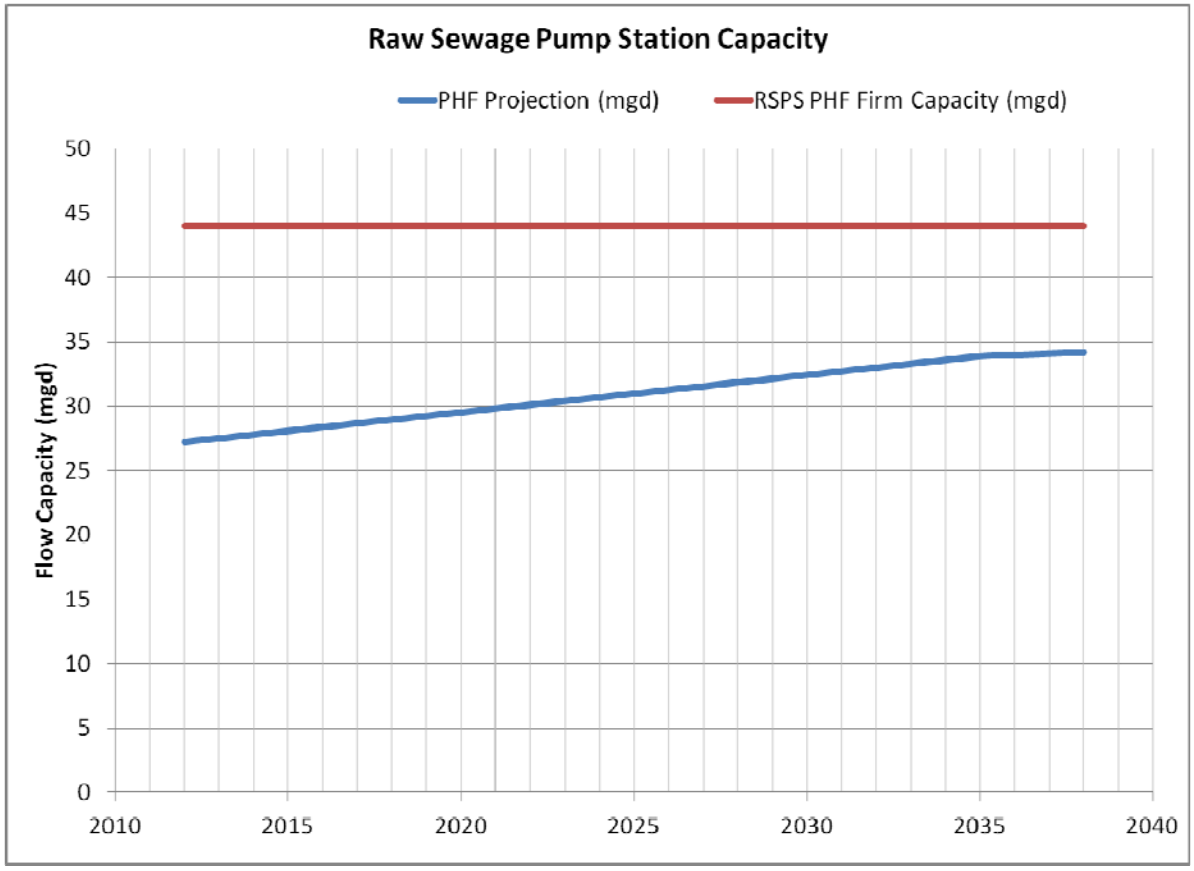


Figure 2 Raw Sewage Pumping Capacity Diagram

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.

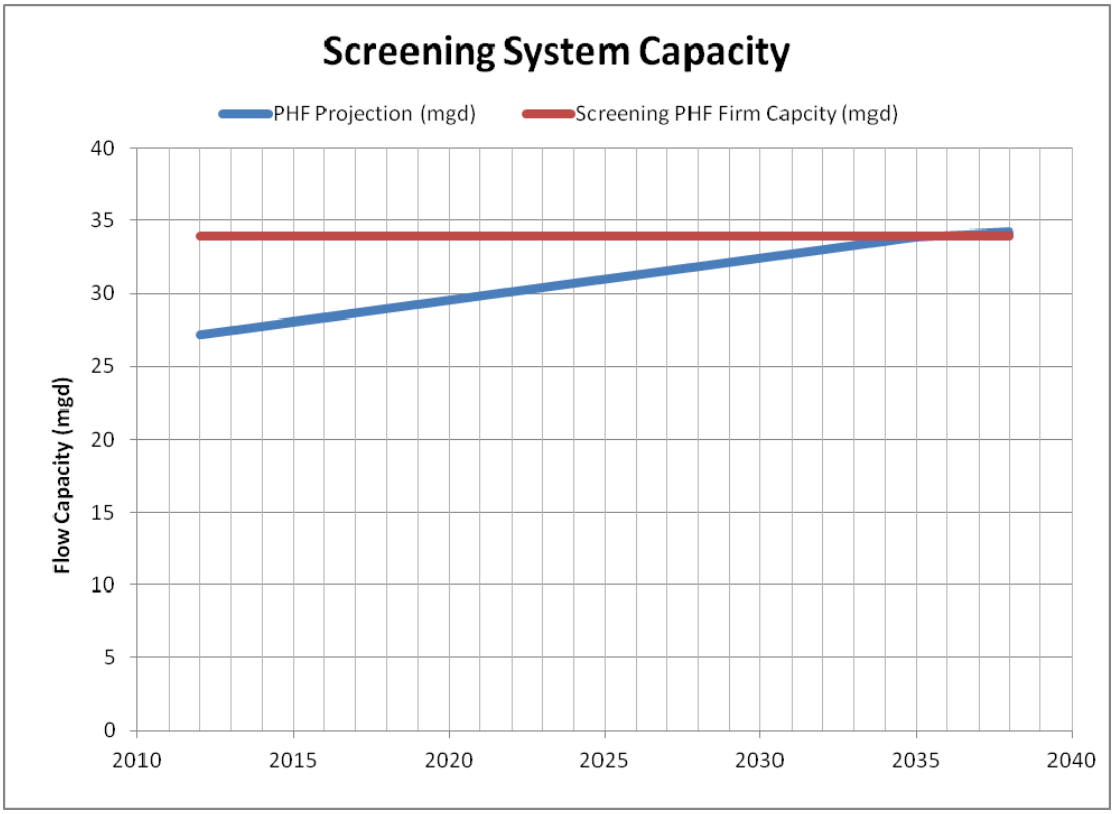


Figure 3 Screening System Capacity Diagram

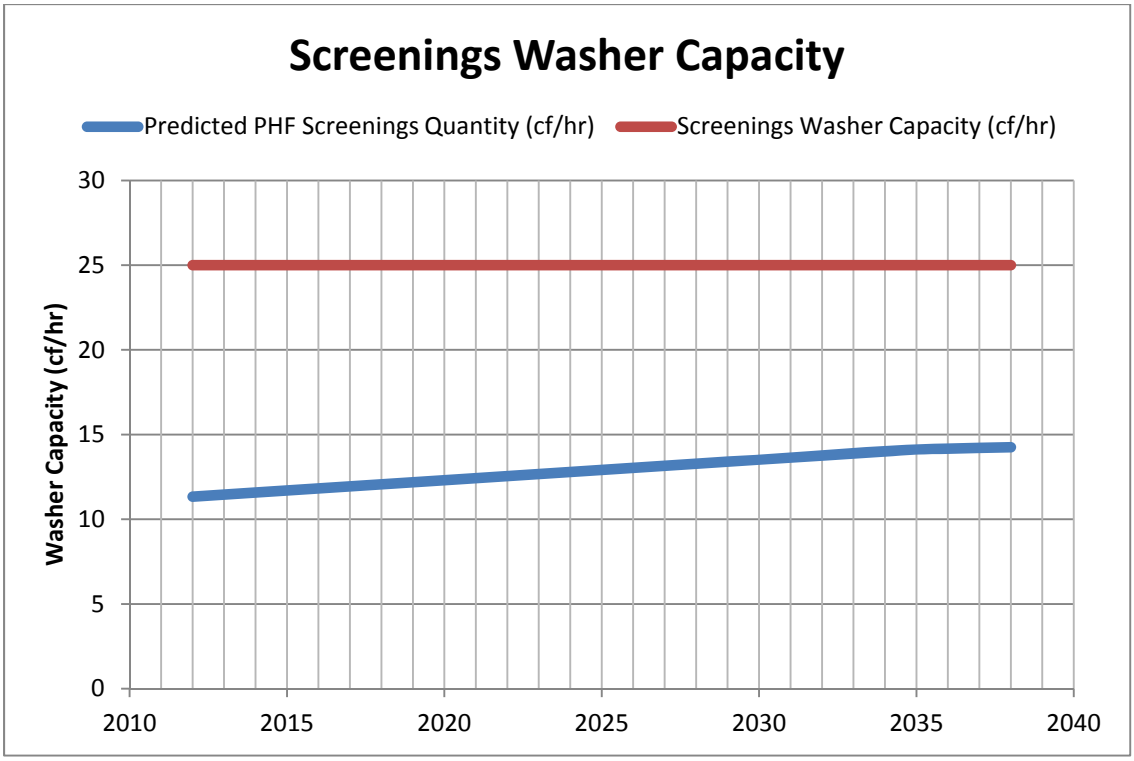


Figure 4 Screenings Washer Capacity Diagram

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.

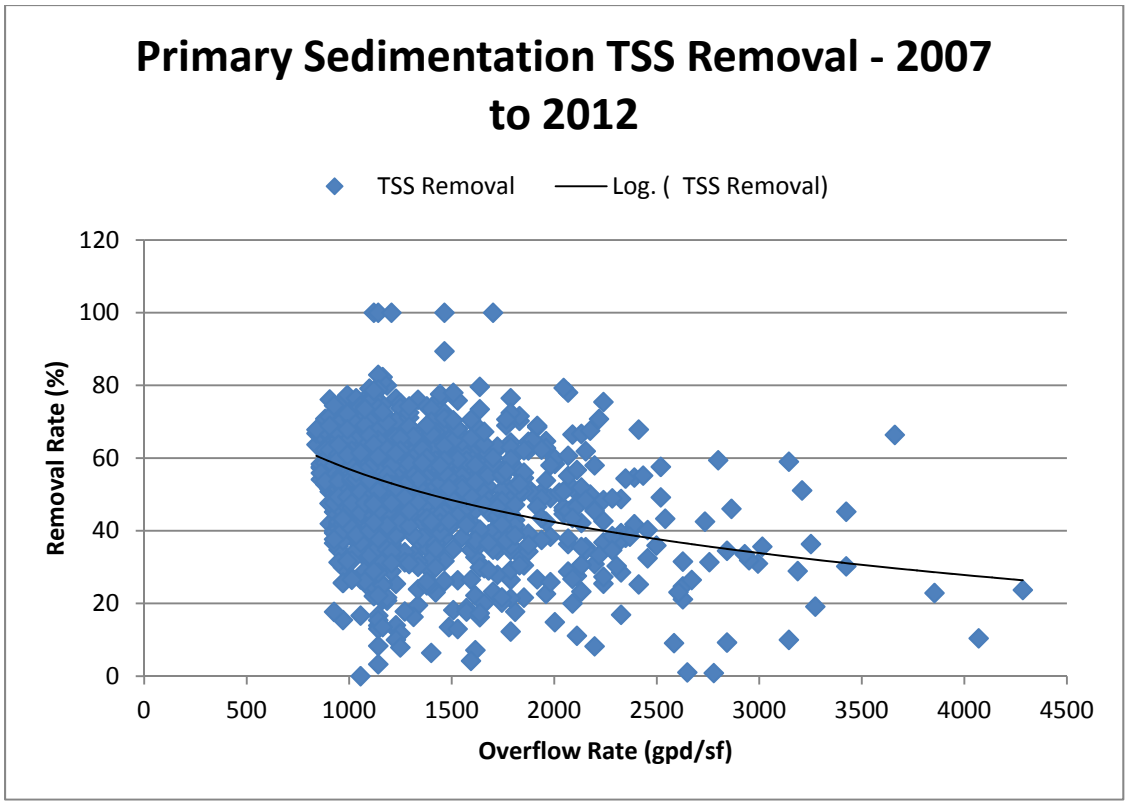


Figure 5 Primary Sedimentation TSS Removal Rate 748

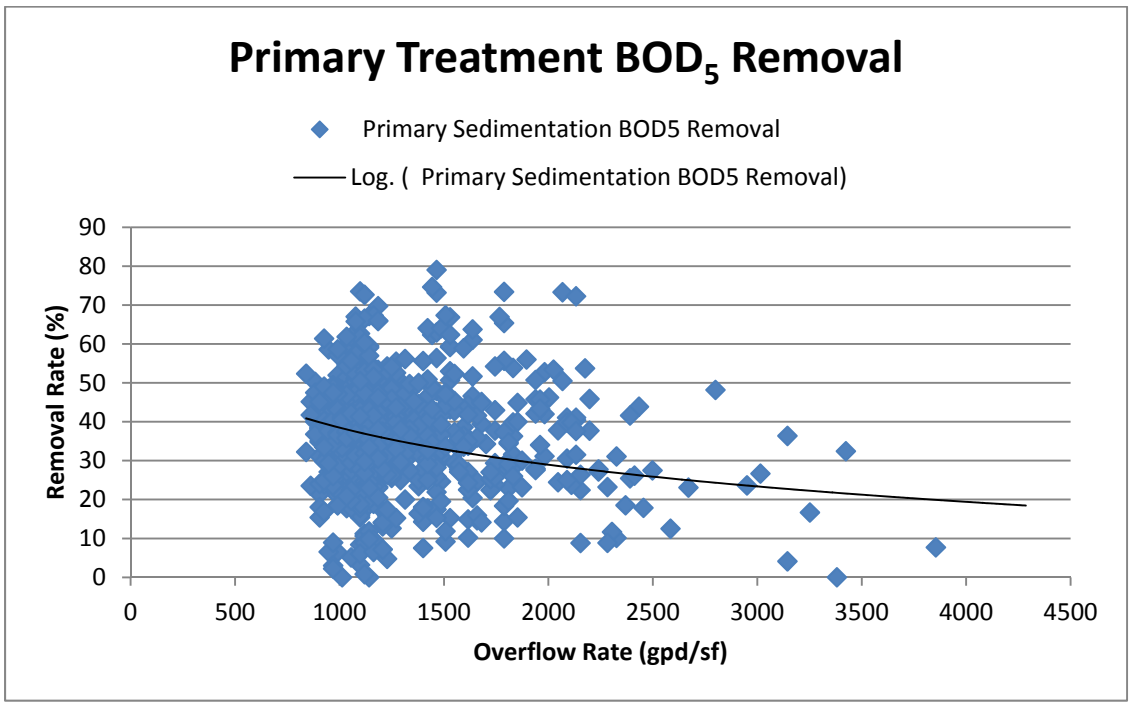
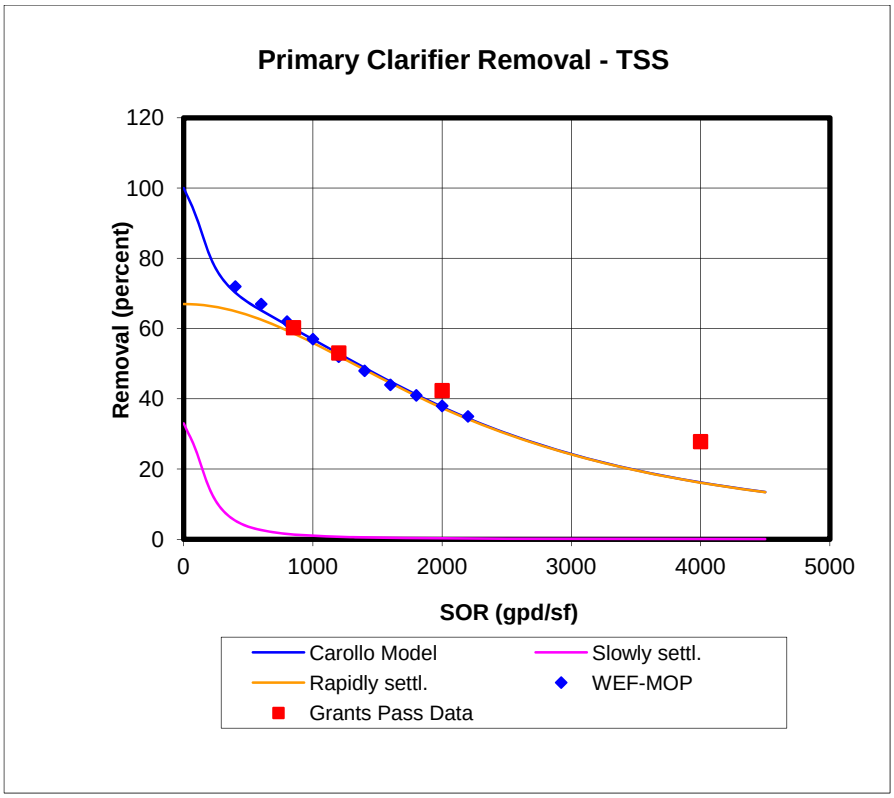


Figure 6 Primary Sedimentation BOD Removal Rate



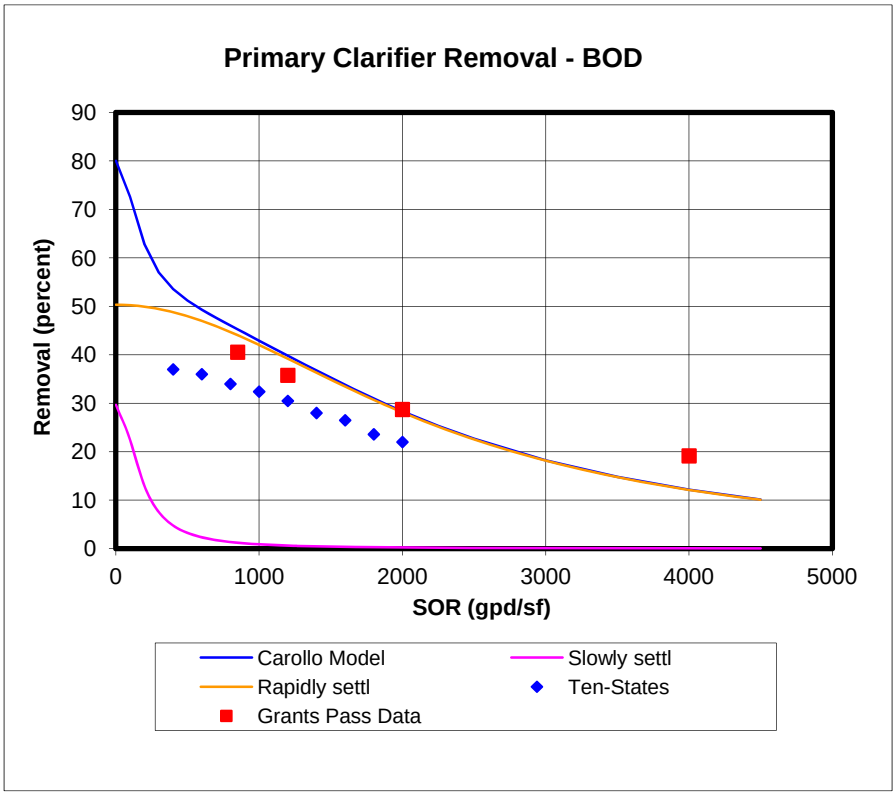


Figure 7 Comparison of Carollo Model to Grants Pass Data

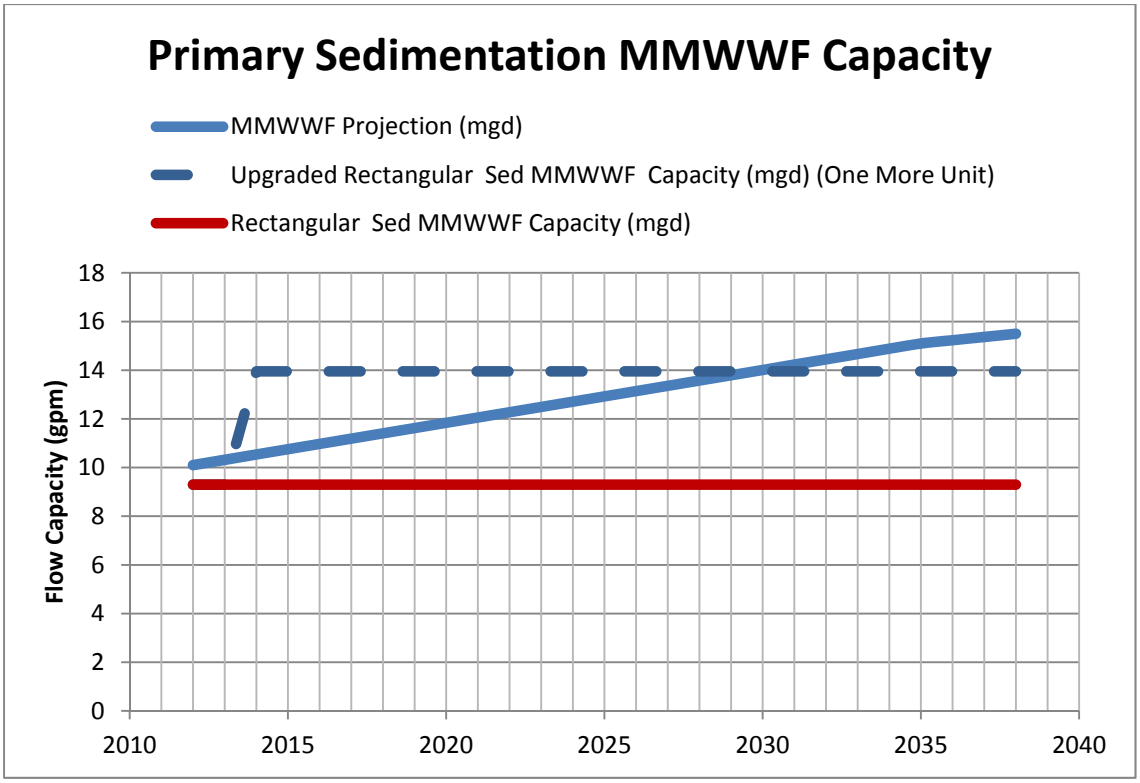


Figure 8 Primary Sedimentation MMWWF Capacity Diagram

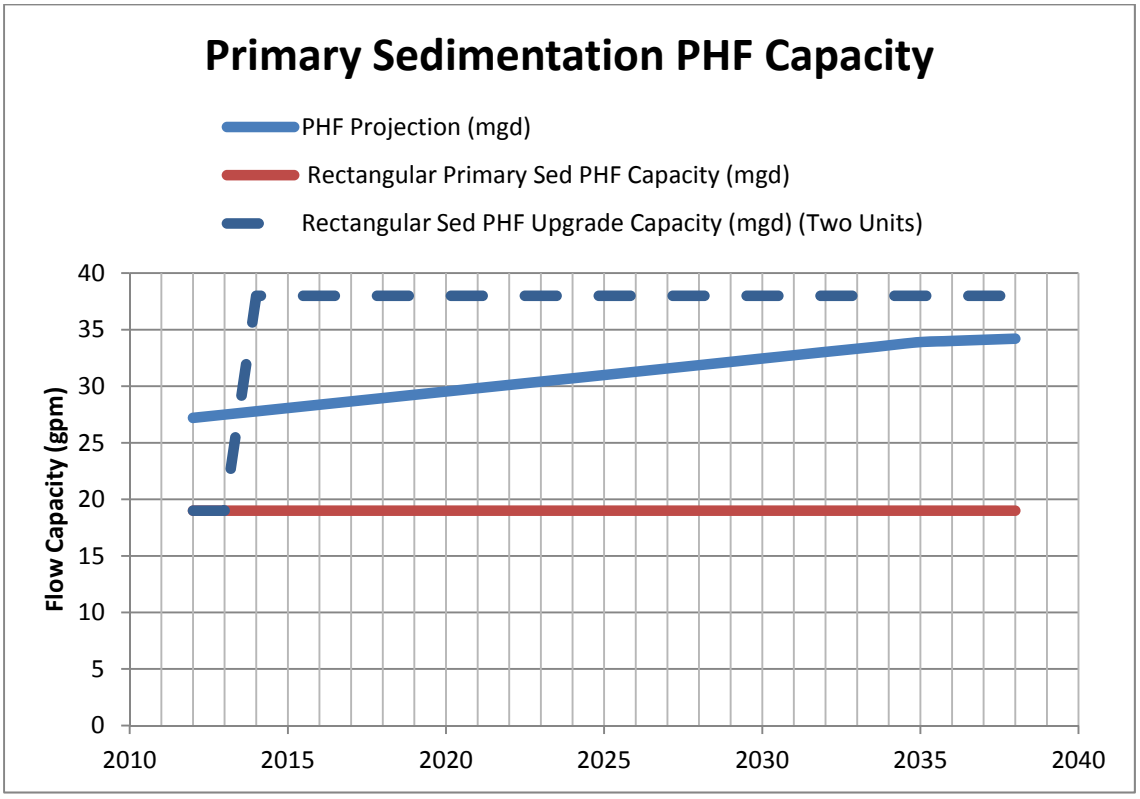


Figure 9 Primary Sedimentation PHF Capacity Diagram

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.

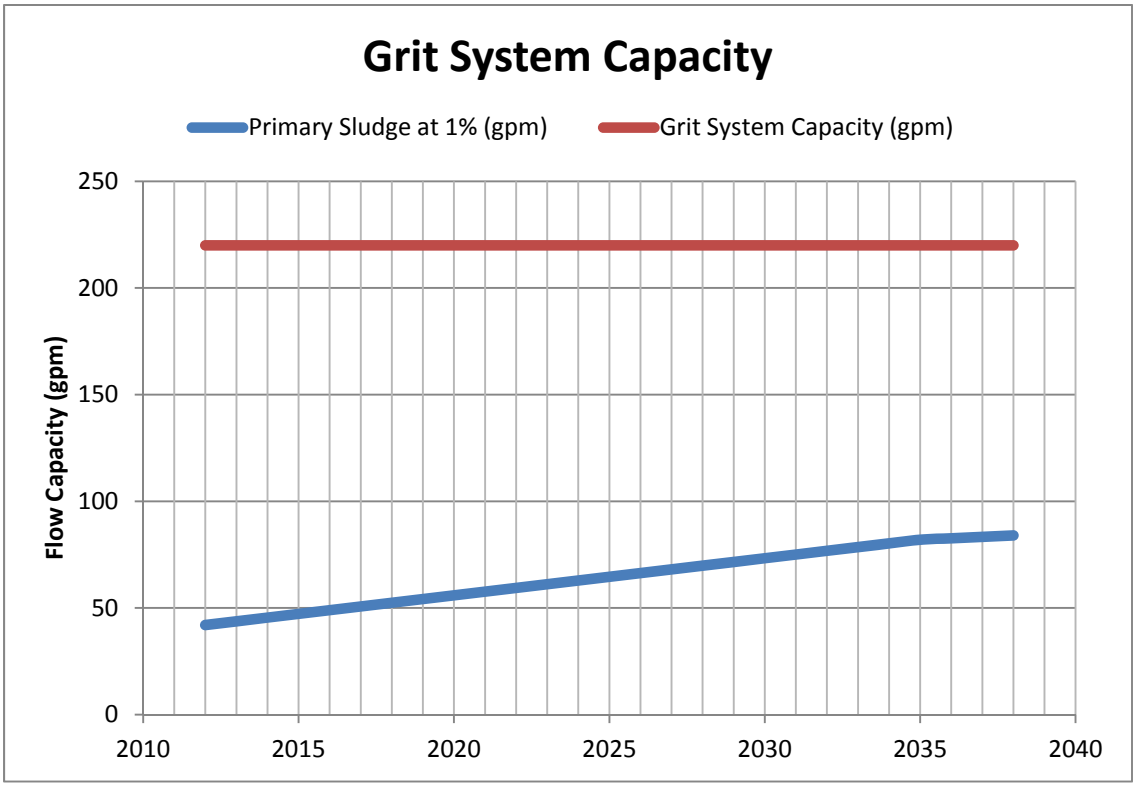


Figure 10 Grit Removal System Capacity Diagram

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.

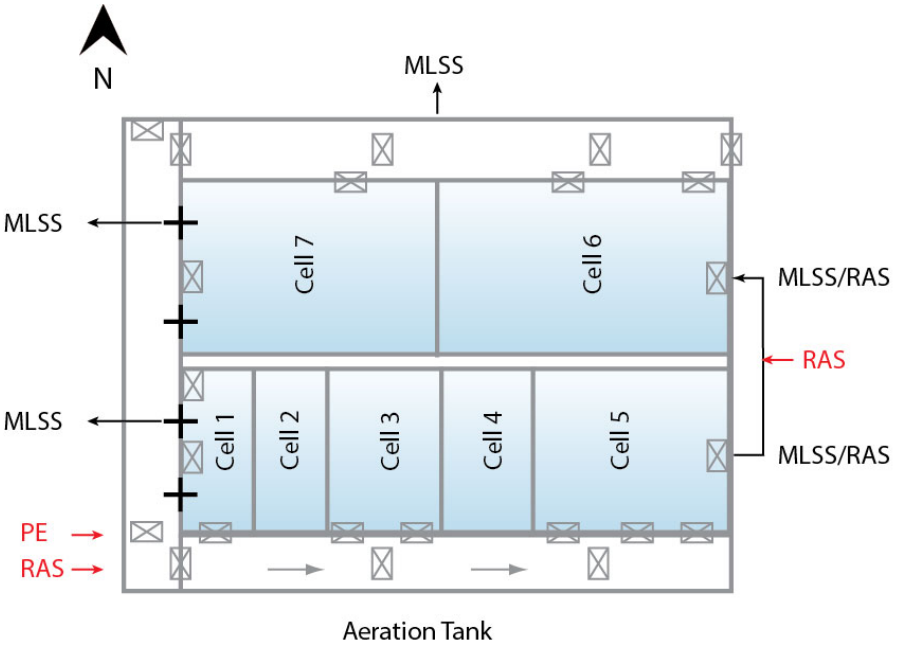


Figure 11 Aeration Tank Configuration

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.

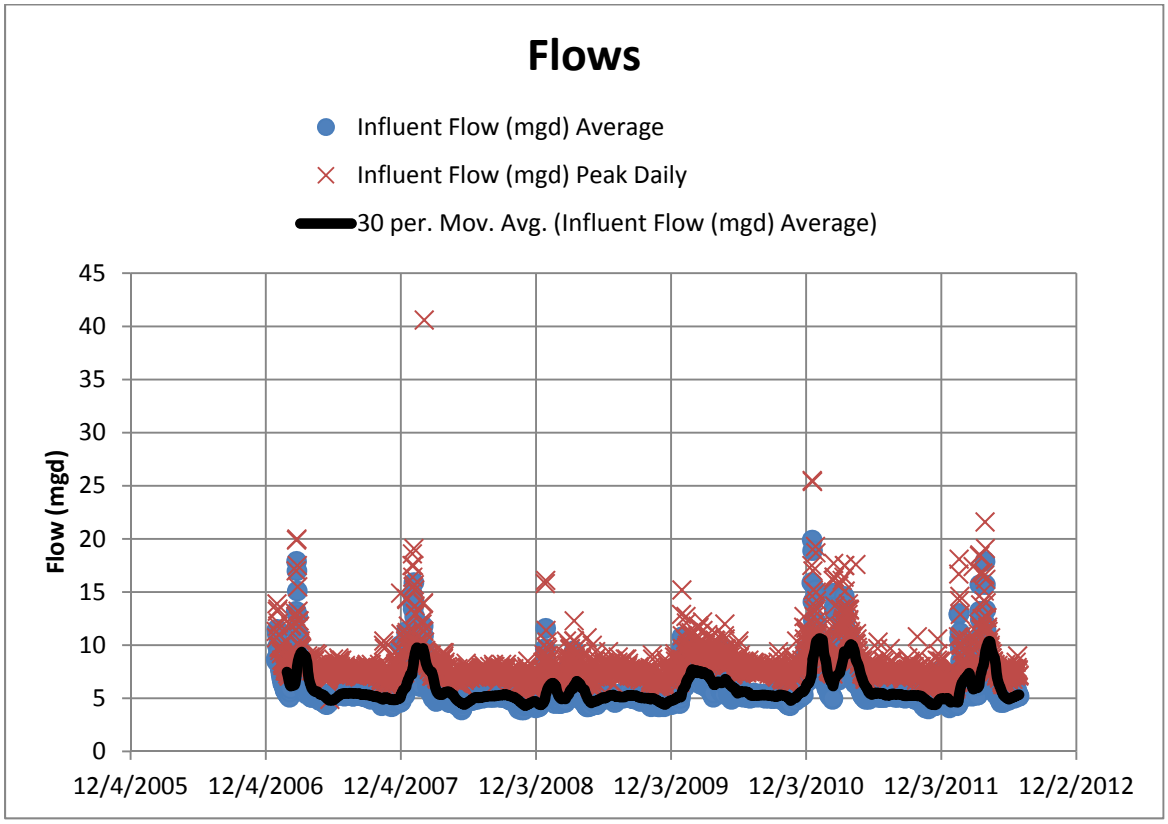


Figure 12 Flow Record

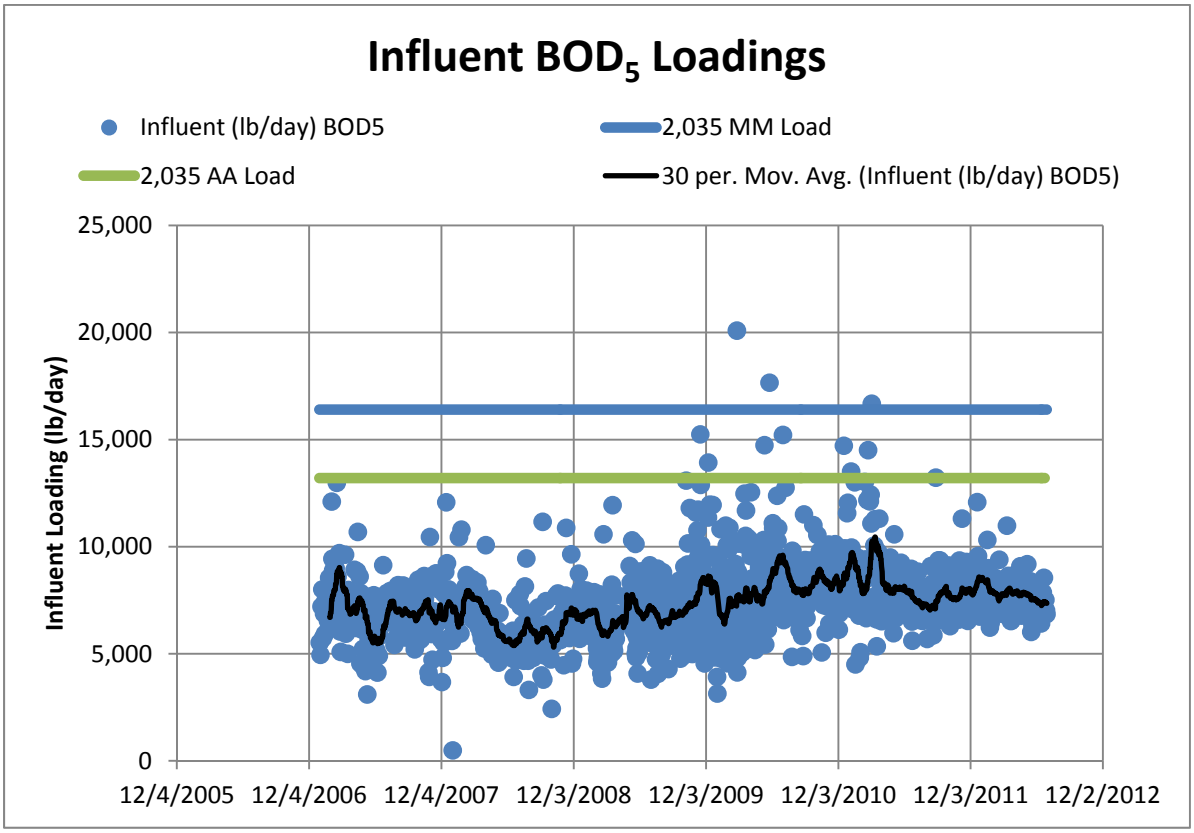


Figure 13 BOD Loading Record

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.

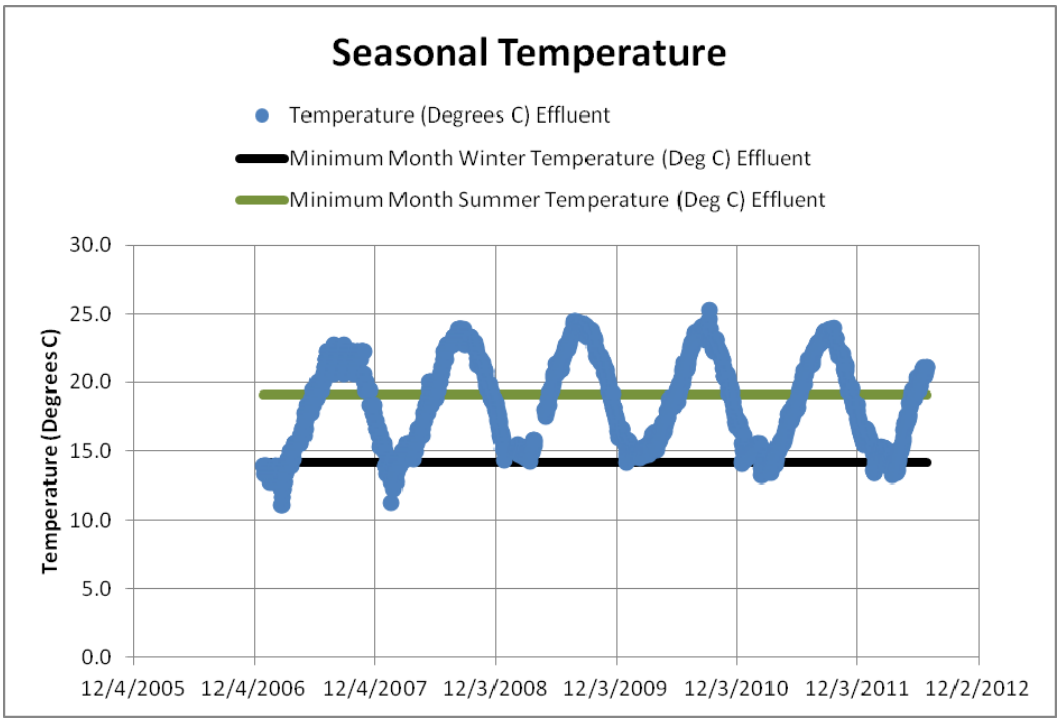


Figure 14 Temperature Record

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.

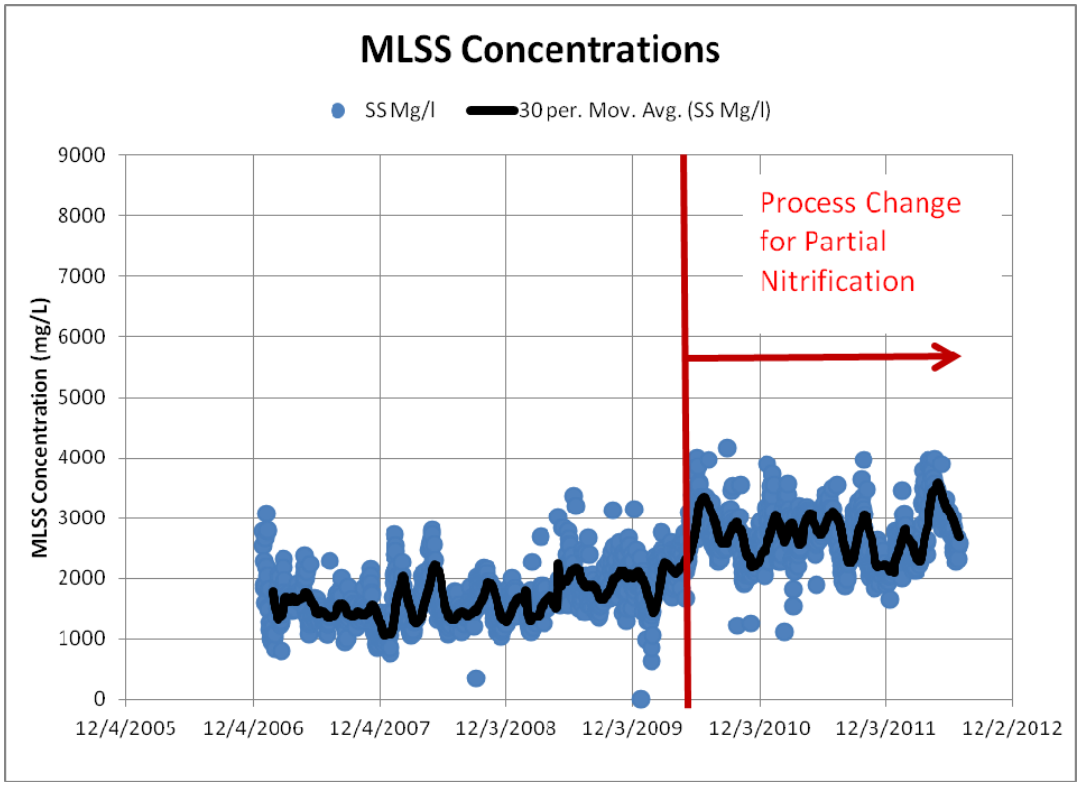


Figure 15 MLSS Concentration

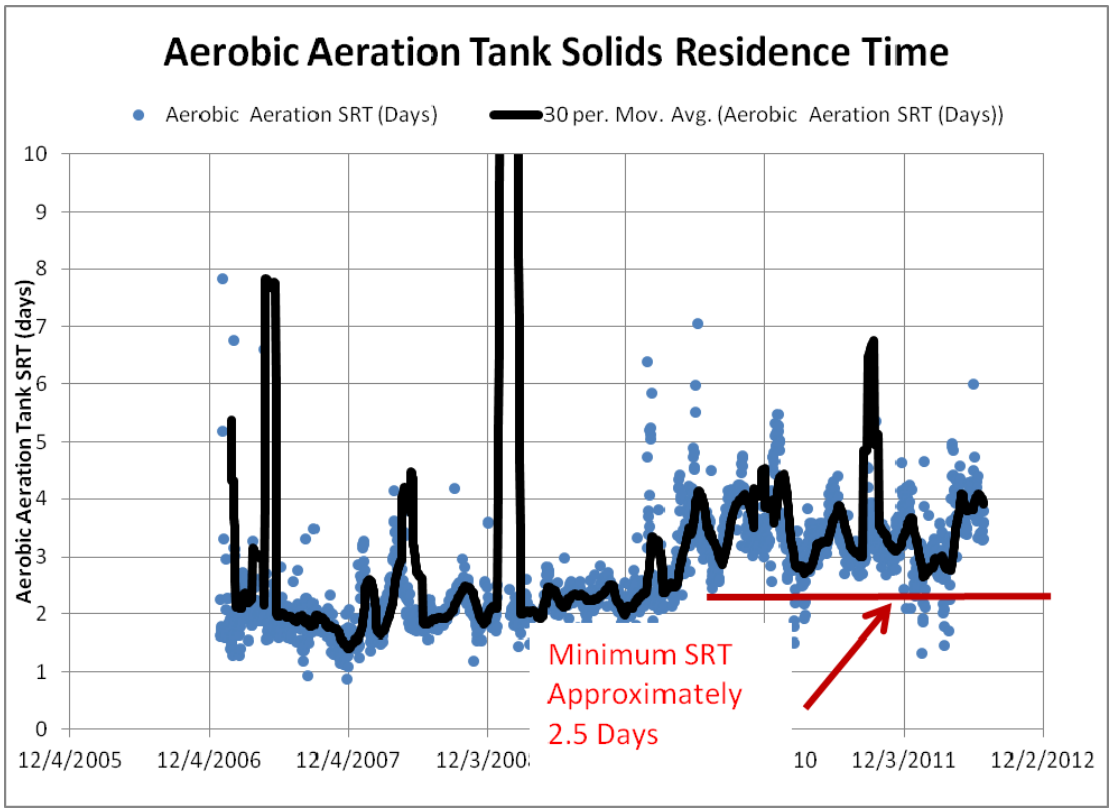


Figure 16 Aerobic Solids Residence Time (SRT)

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.

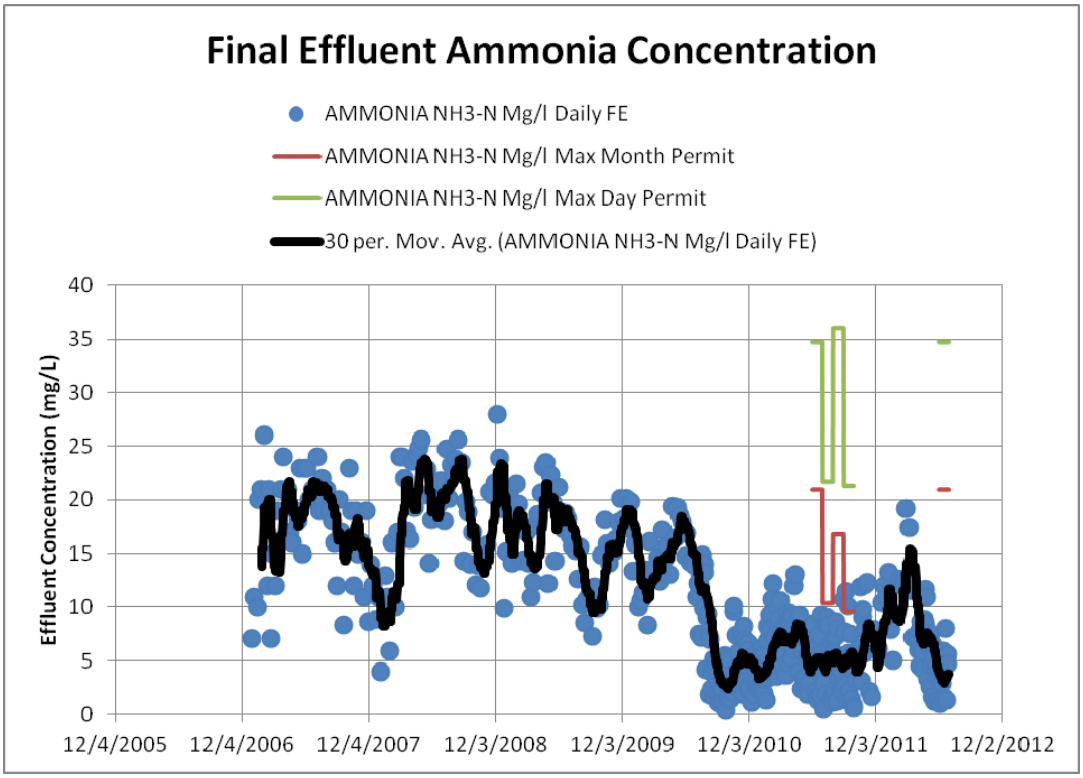


Figure 17 Effluent Ammonia Data

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.

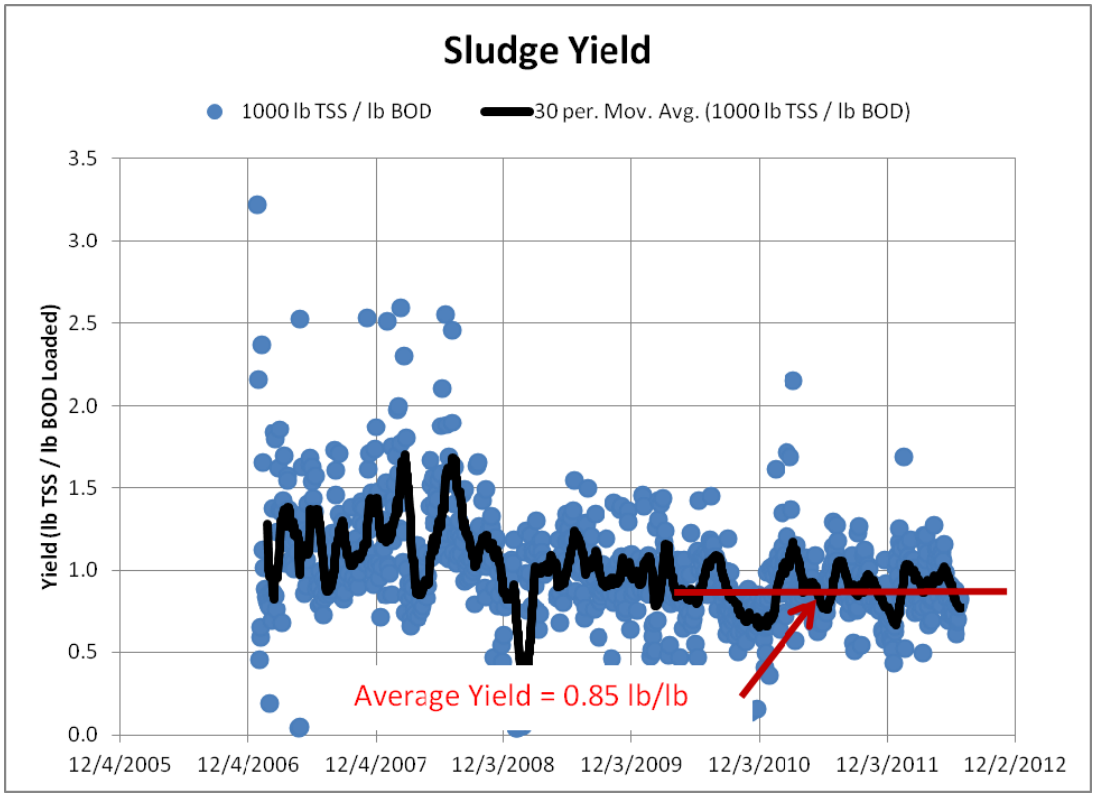


Figure 18 Sludge Yield

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.

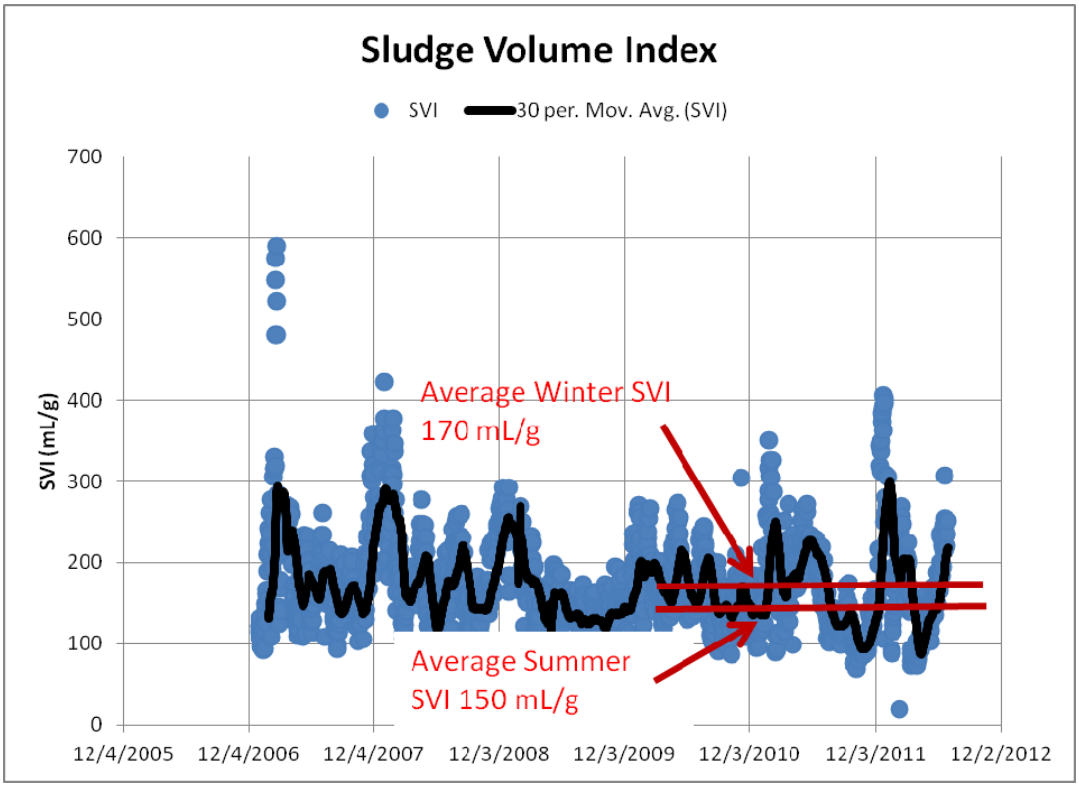


Figure 19 SVI

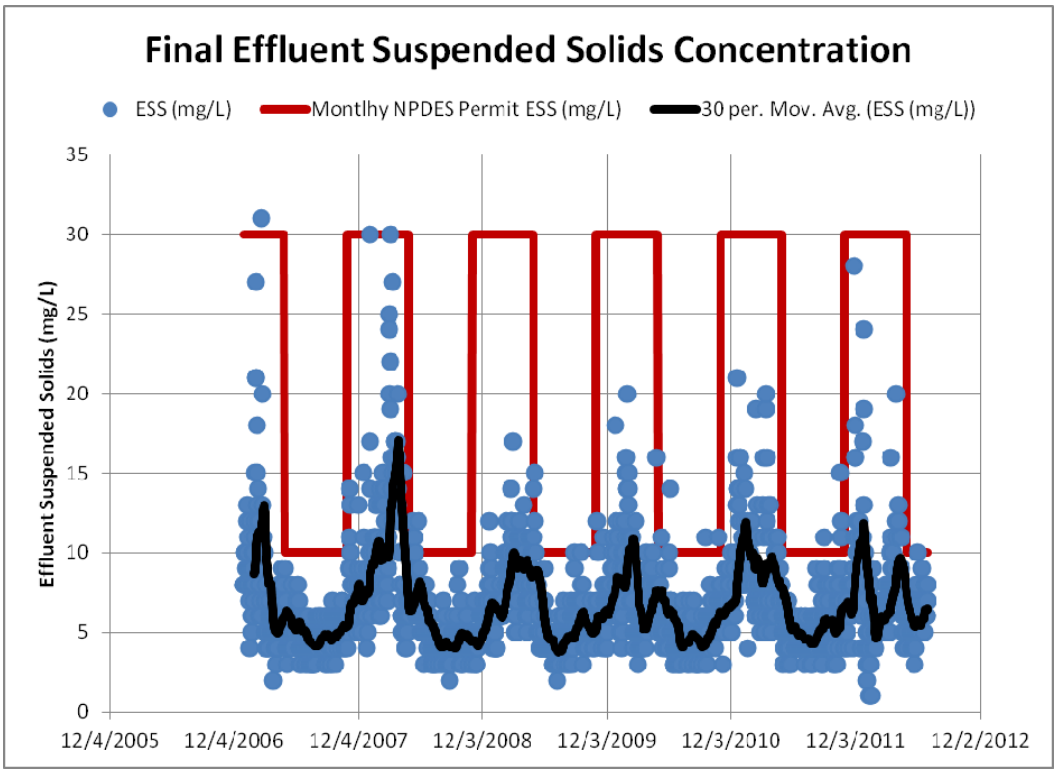


Figure 20 Effluent Suspended Solids (ESS)

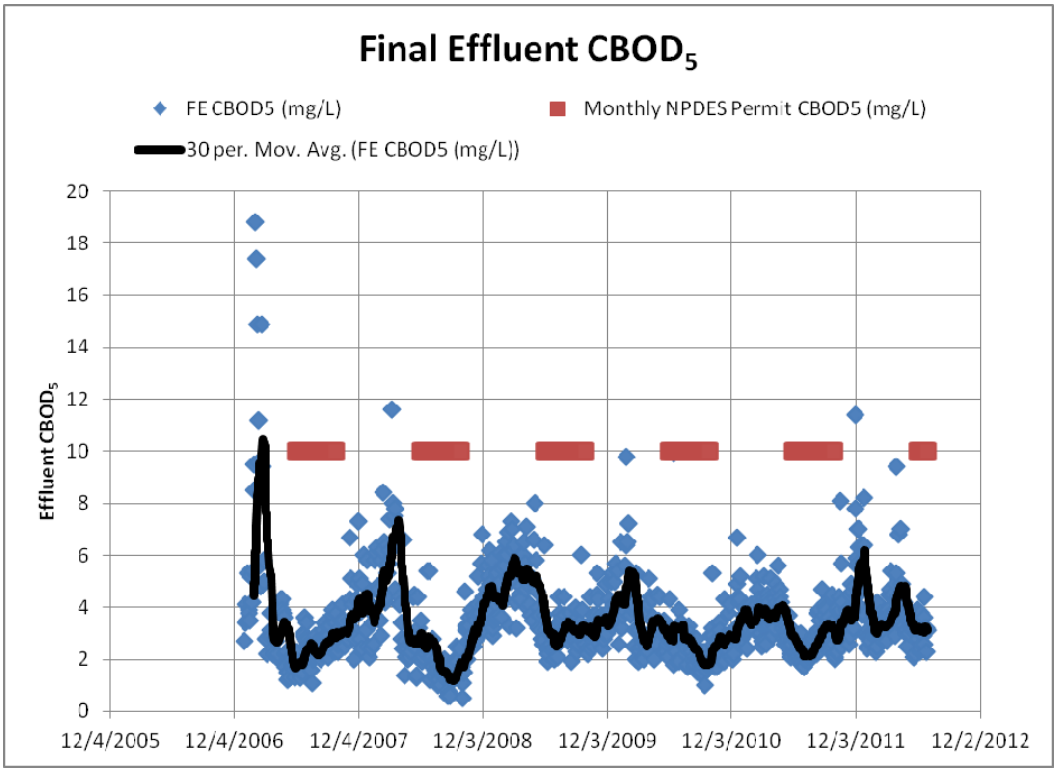


Figure 21 Effluent $CBOD_5$

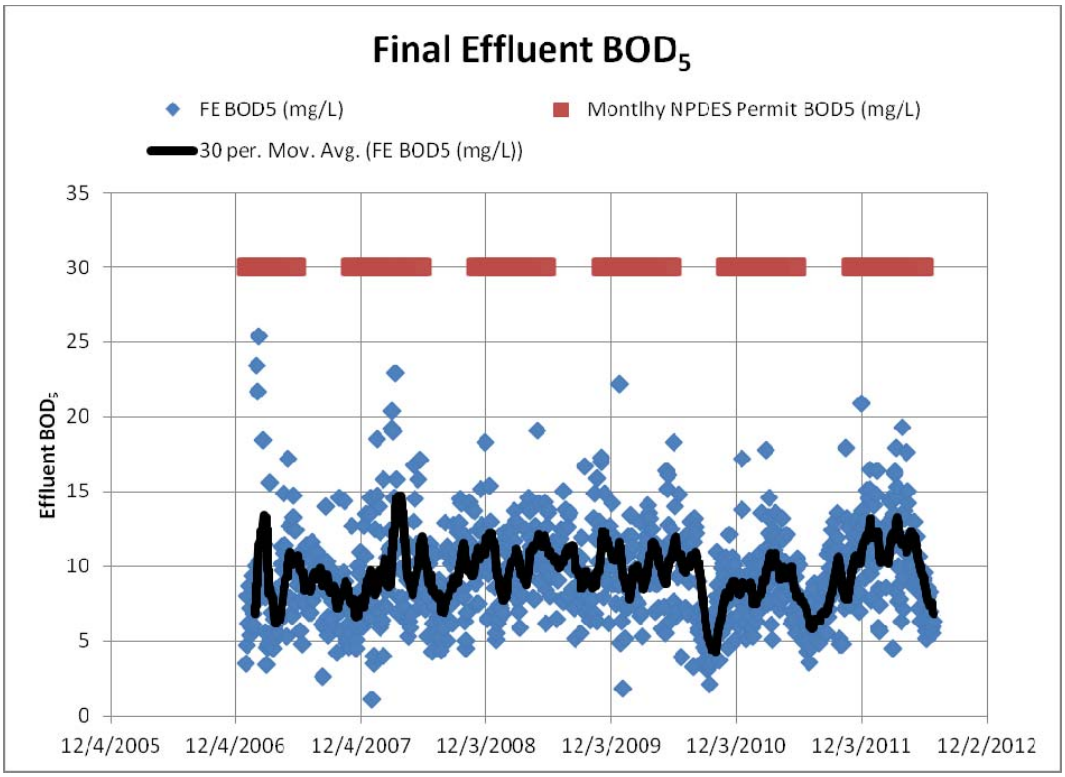


Figure 22 Effluent BOD_5

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.

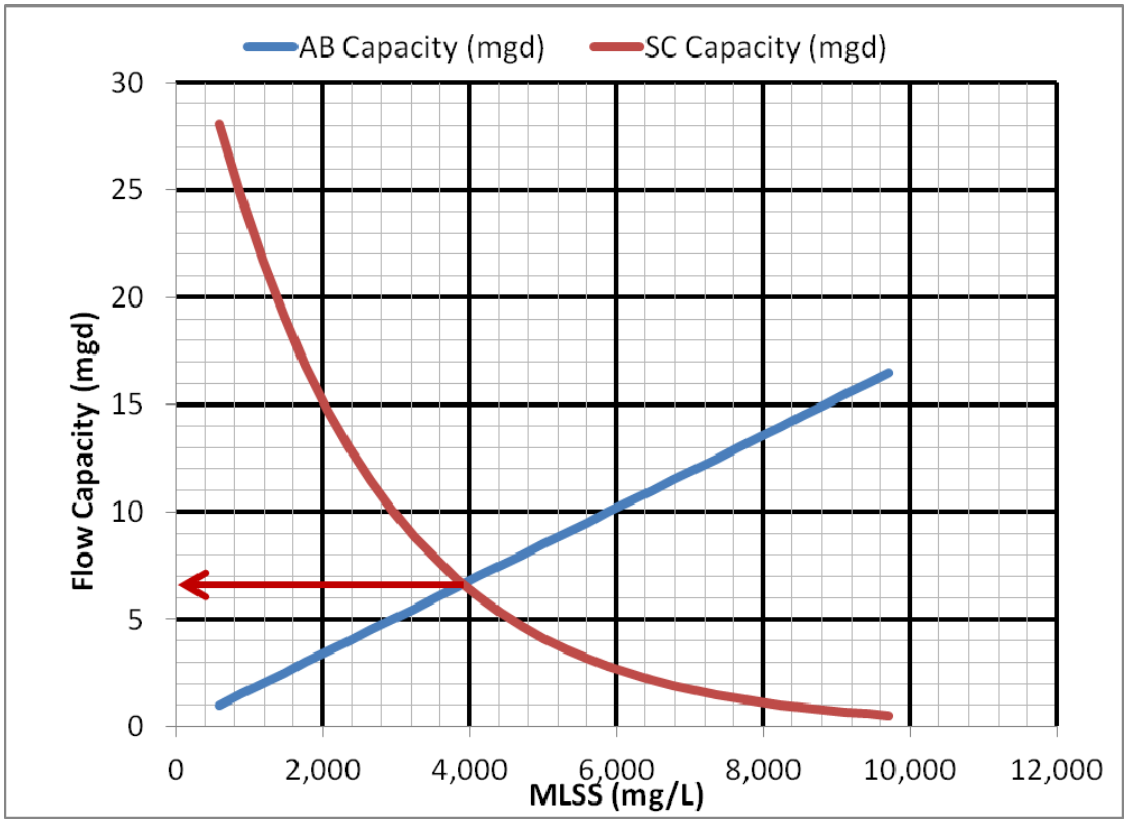


Figure 23 MMDWF Partial Nitrification Capacity (AIS)

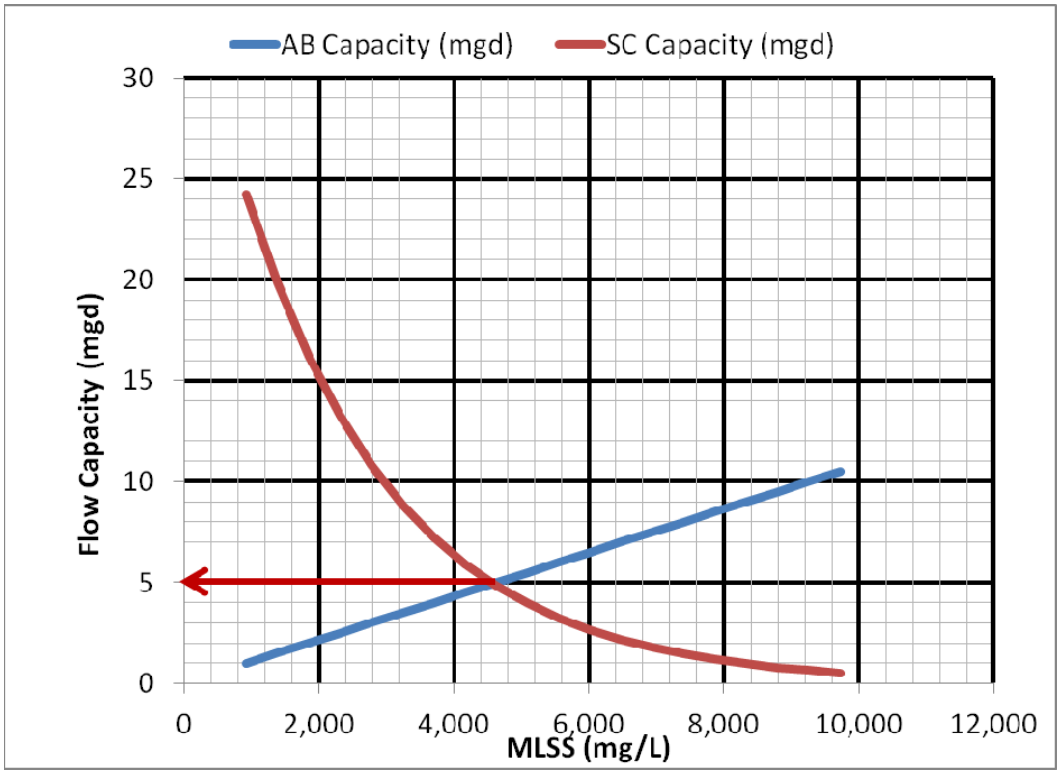


Figure 24 ADWF Partial Nitrification Capacity (One AB OOS)

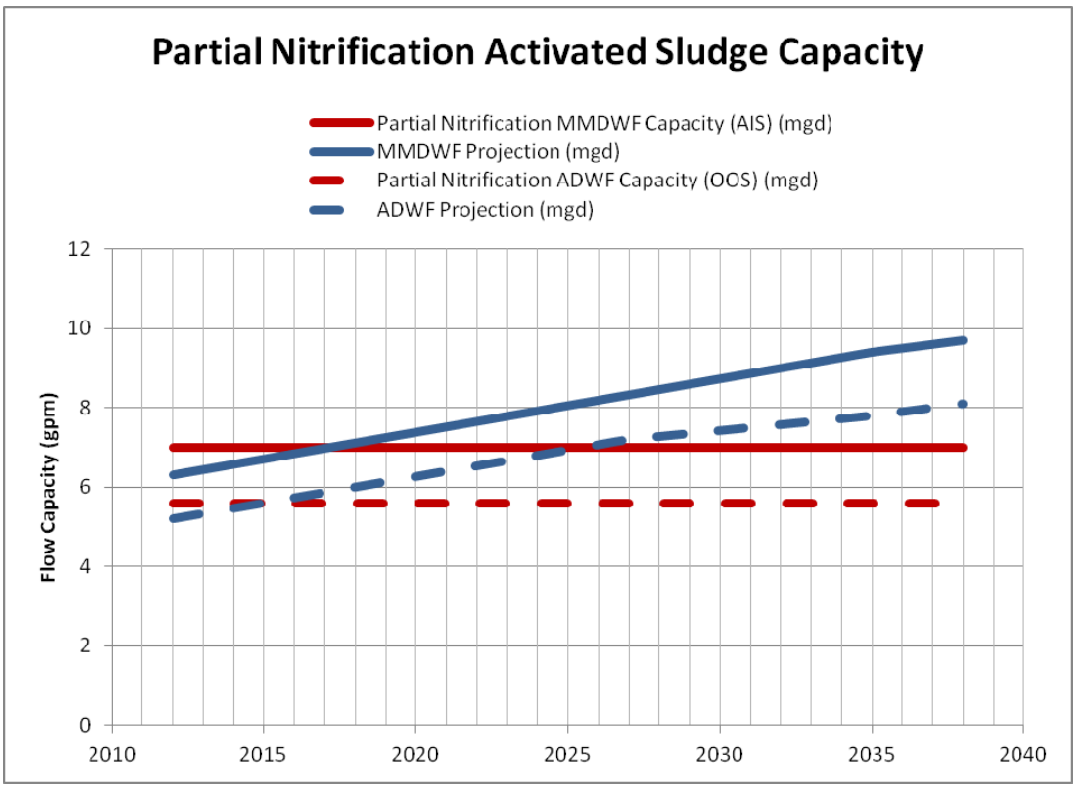


Figure 25 Partial Nitrification Capacity Compared to Future Demand

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.

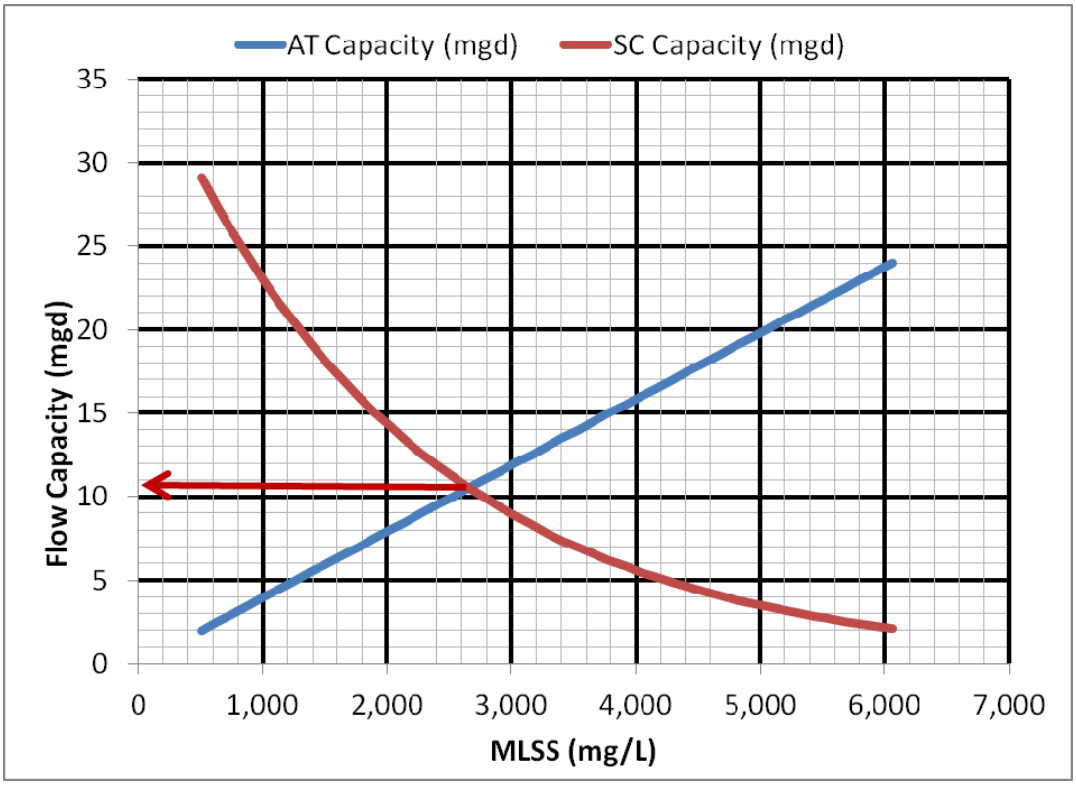


Figure 26 MMWWF Plug Flow Secondary Treatment Capacity (AIS)

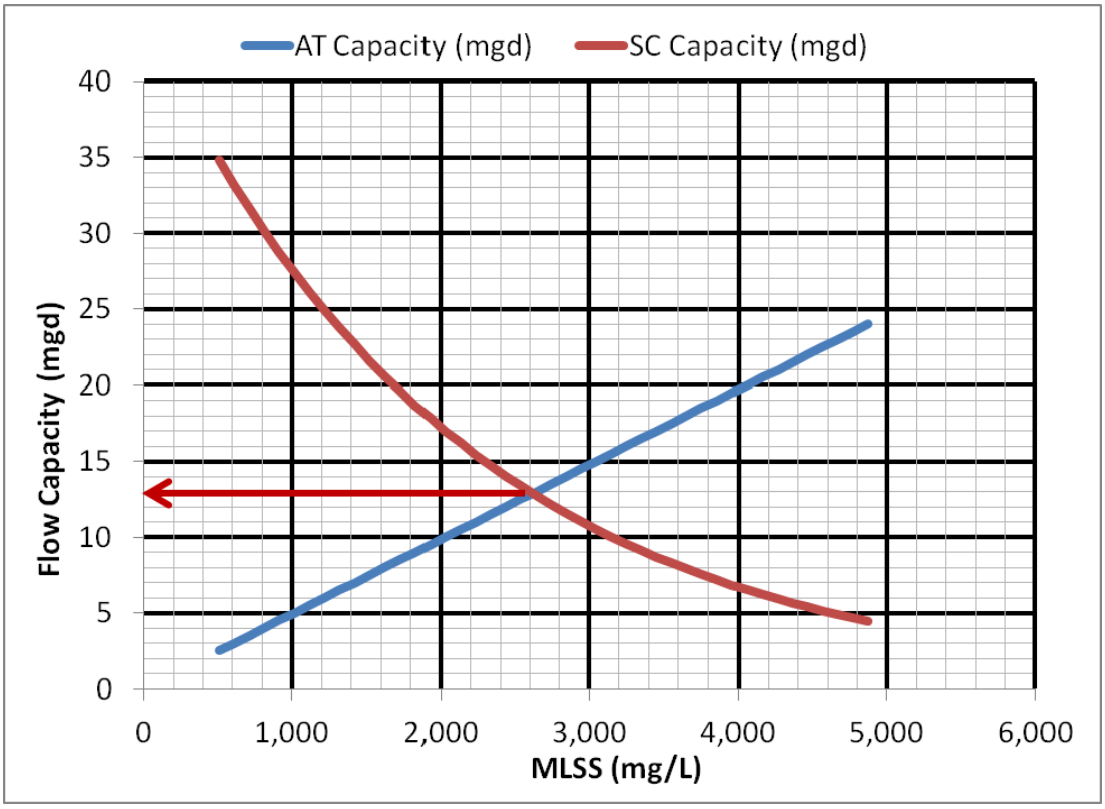


Figure 27 PHF Plug Flow Secondary Treatment Capacity (AIS)

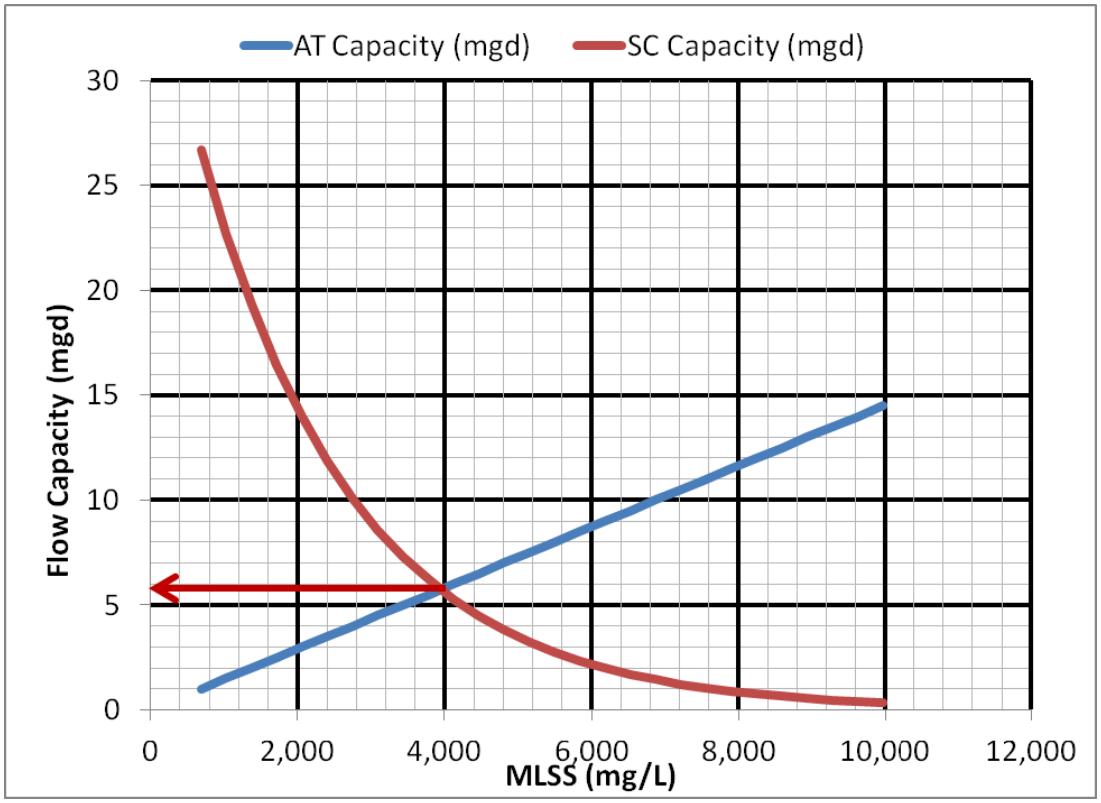
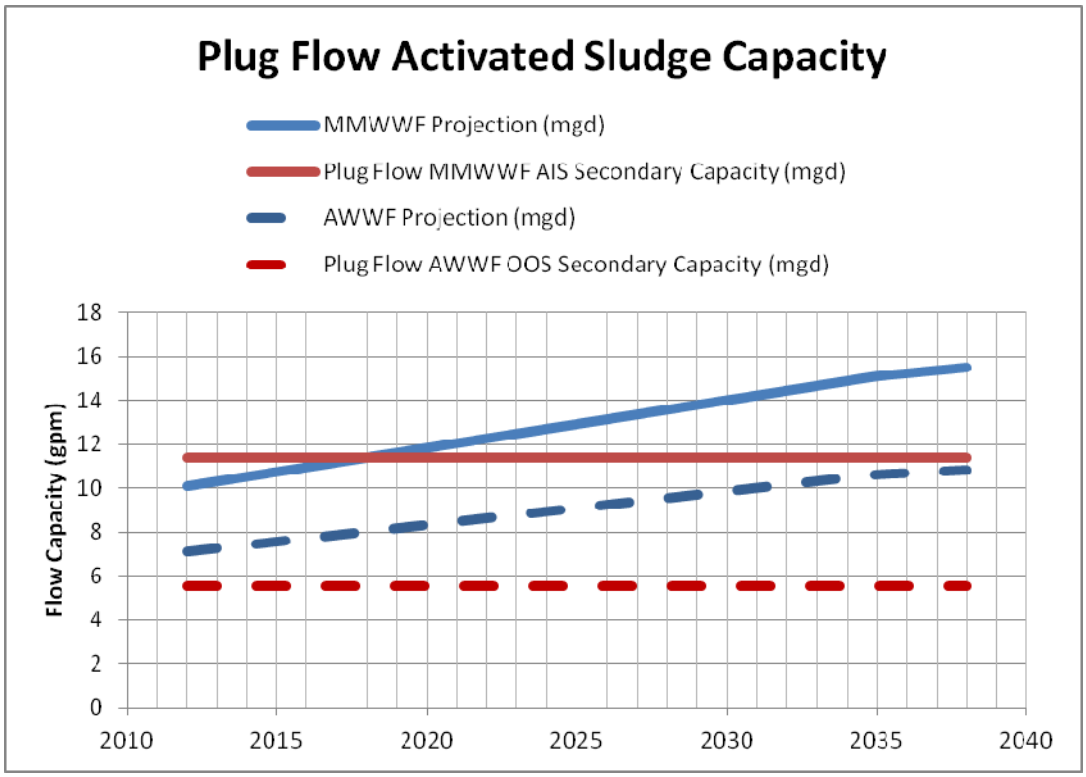


Figure 28 AWWF Plug Flow Secondary Treatment Capacity (One AT OOS)



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.

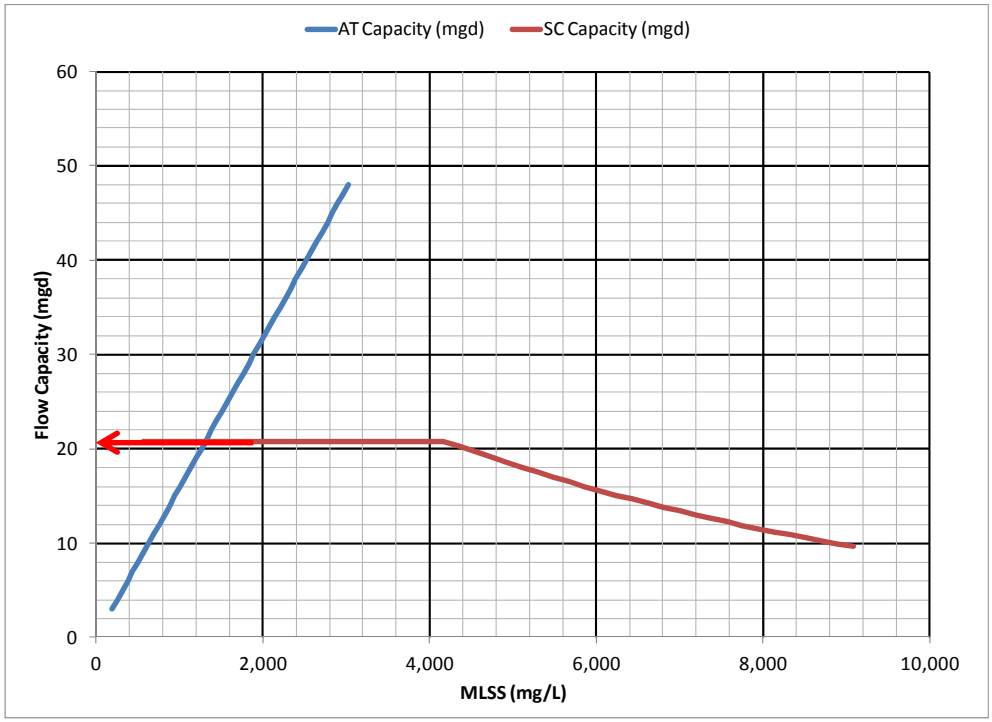


Figure 30 PHF Contact Stabilization Secondary Treatment Capacity

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.

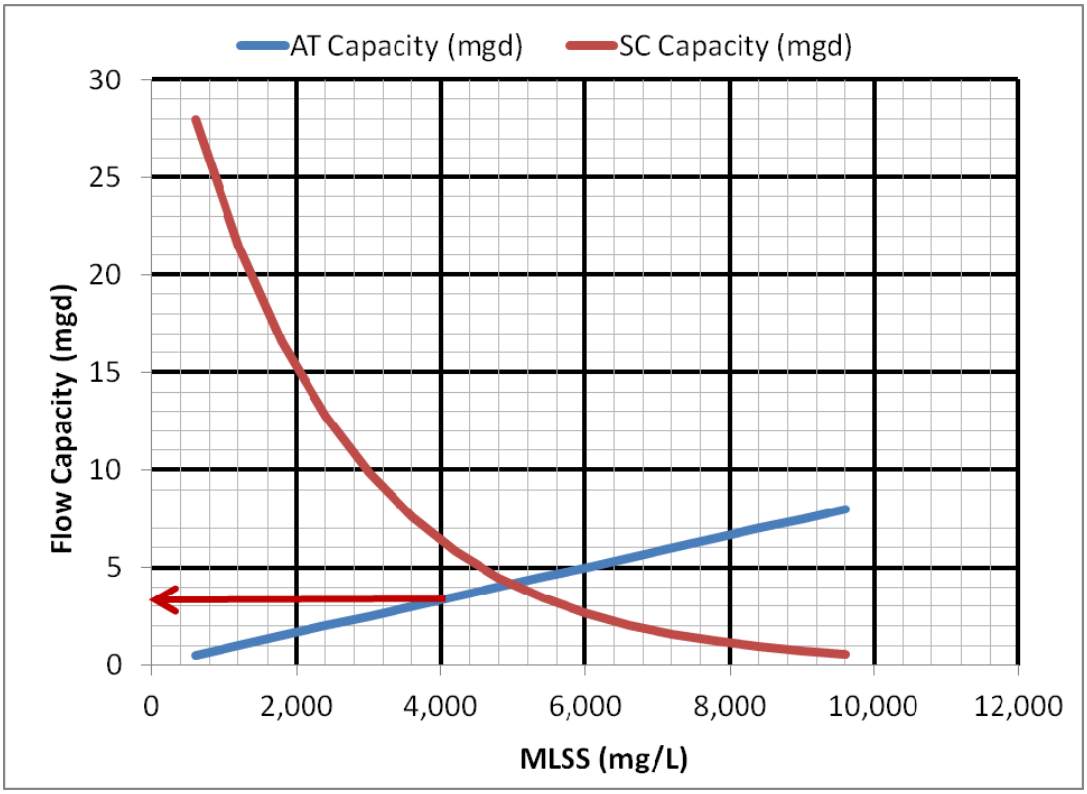


Figure 31 MMDWF Full Nitrification Treatment Capacity (AIS)

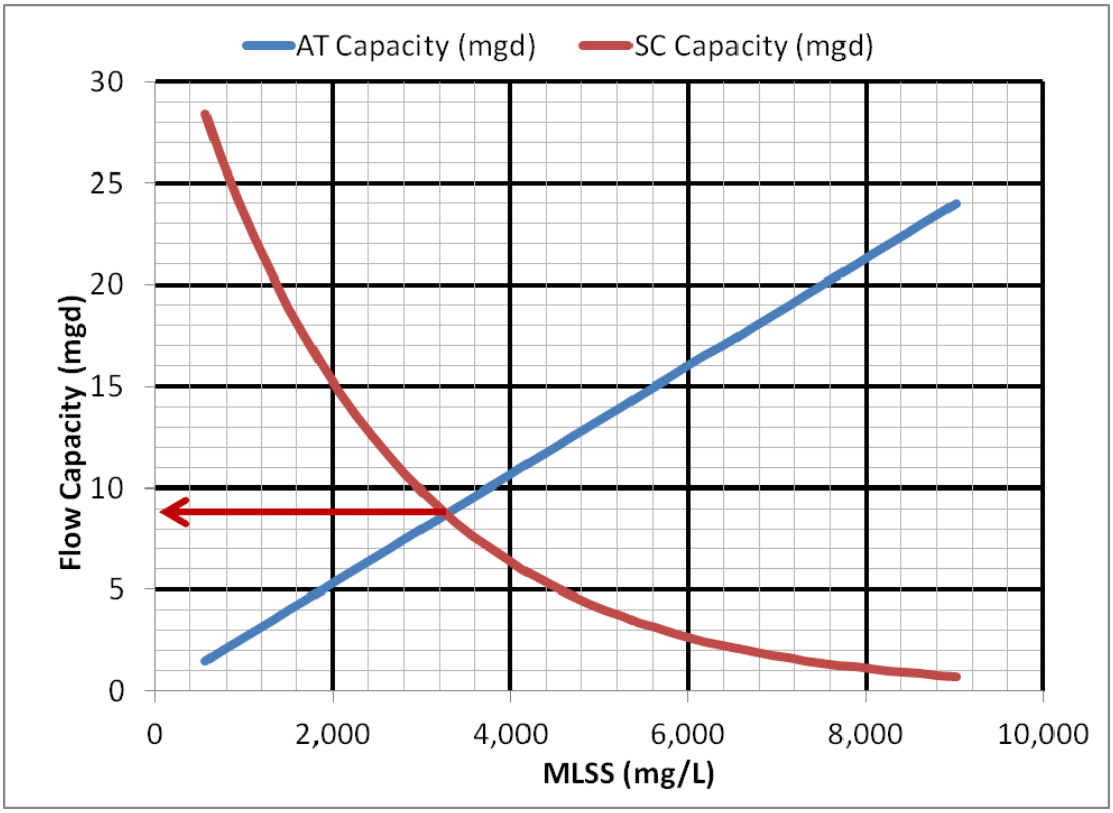


Figure 32 Upgraded MMDWF Full Nitrification Treatment Capacity (AIS)

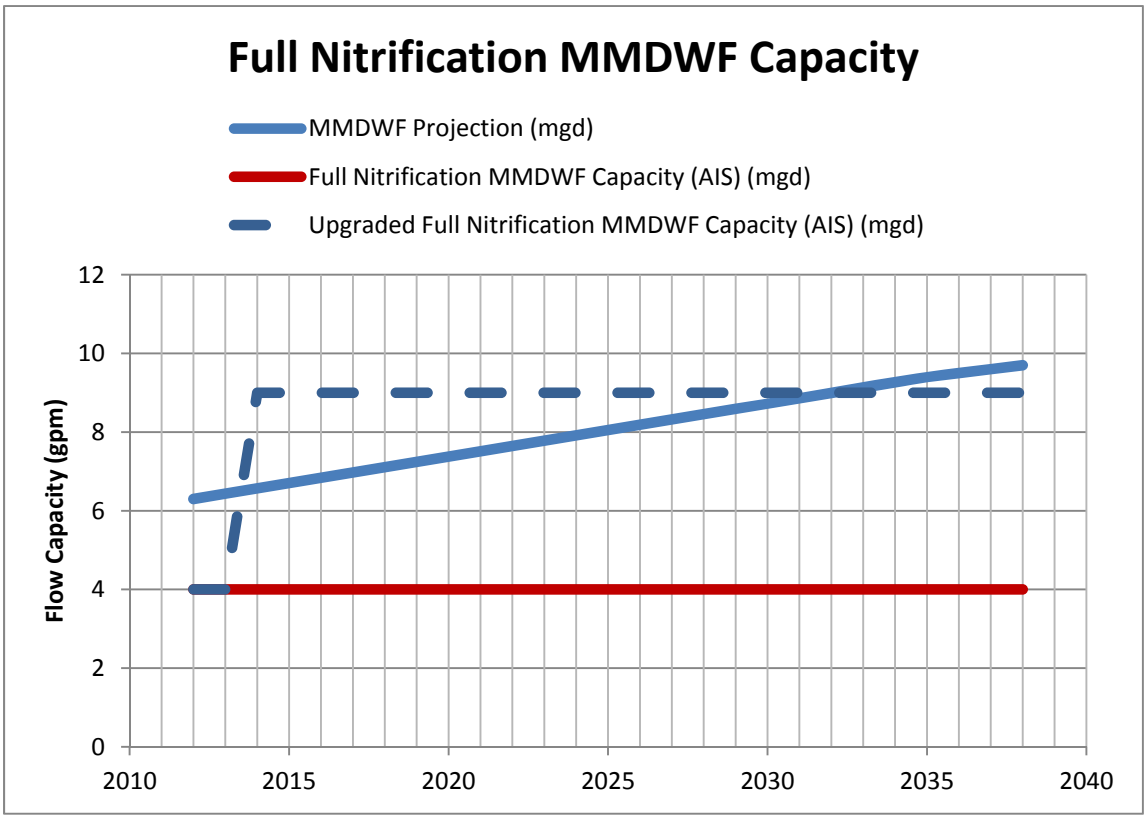


Figure 33 MMDWF Full Nitrification Treatment Capacity (AIS) Compared to Demand

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.

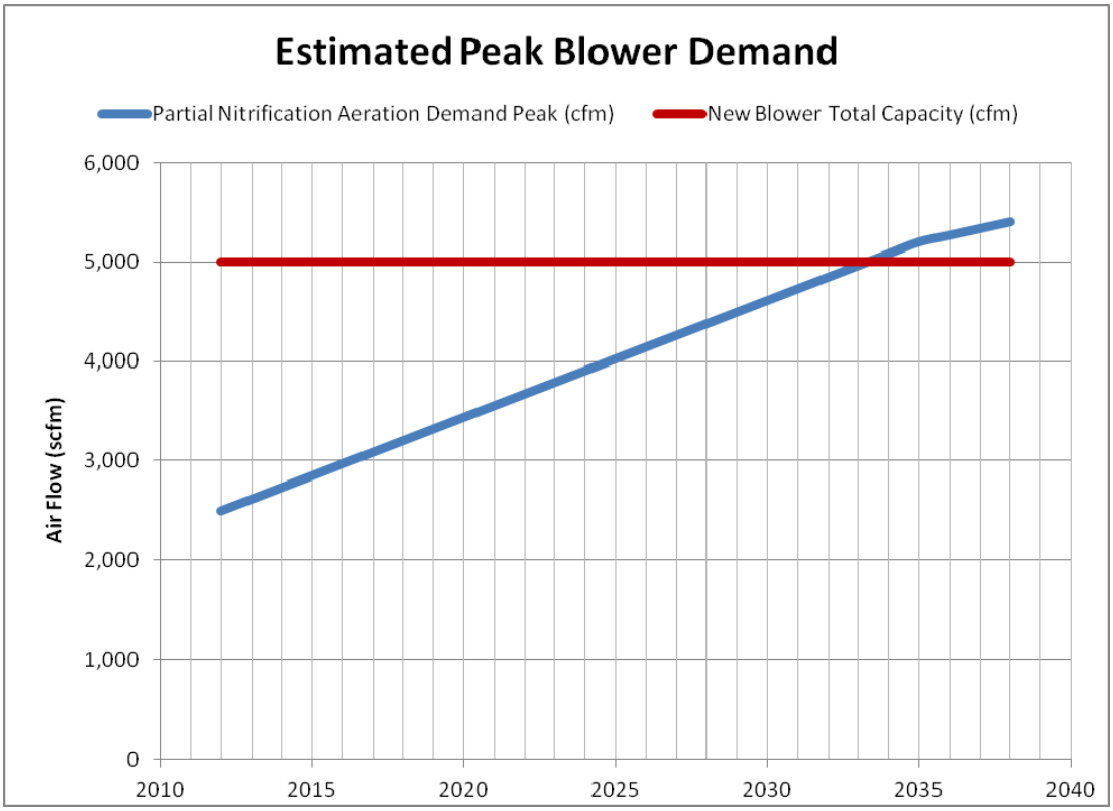


Figure 34 Estimated Peak Aeration Blower Demand to Existing Capacity (New Blowers)

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.

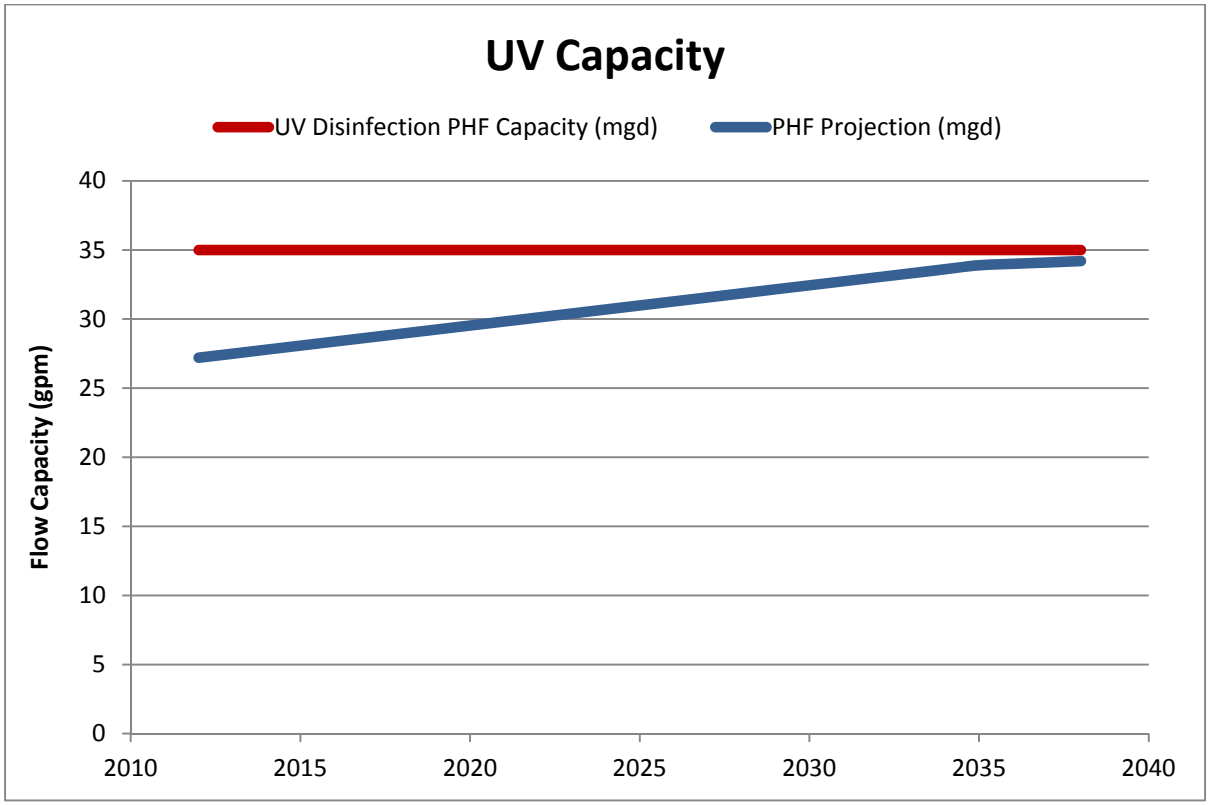


Figure 35 PHF UV System Treatment Capacity (One Bank OOS) Compared to Demand

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.

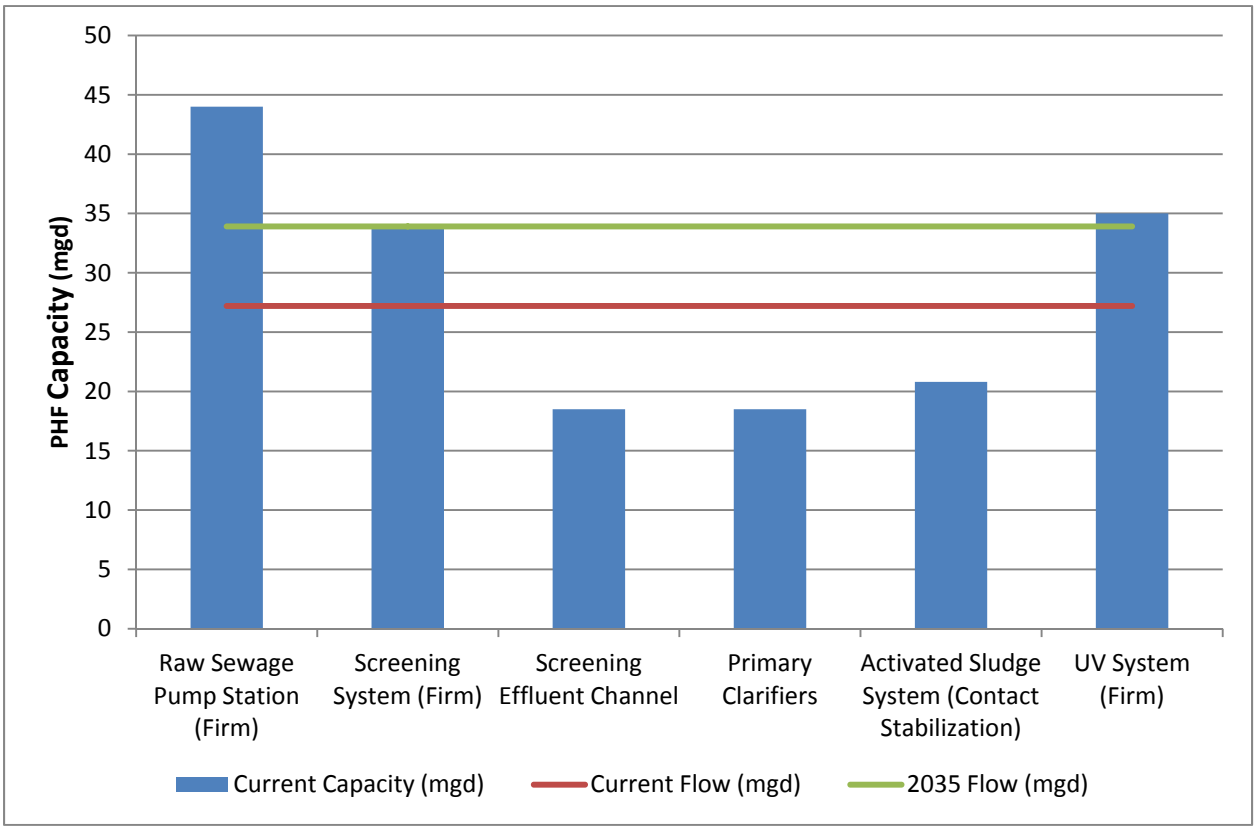
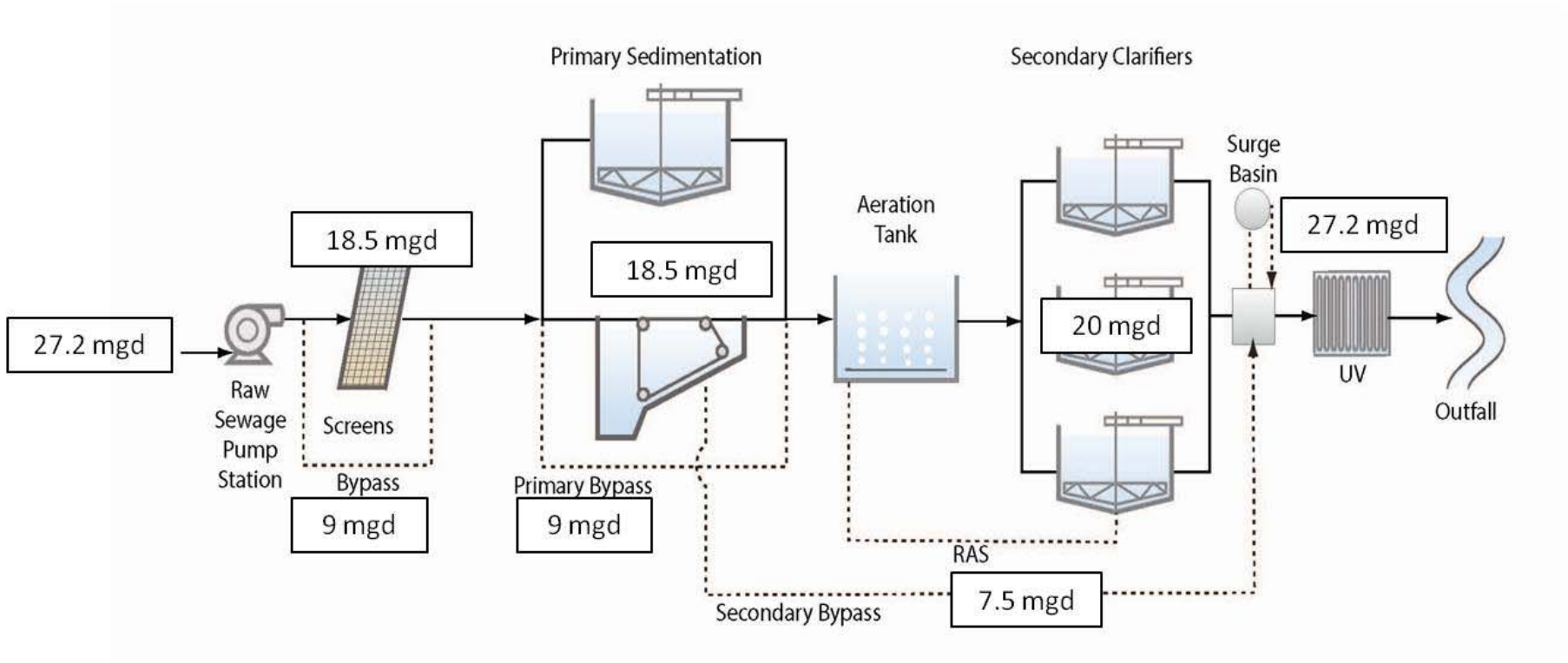


Figure 36 Summary PHF Capacity of Grants Pass WRP Unit Processes



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.

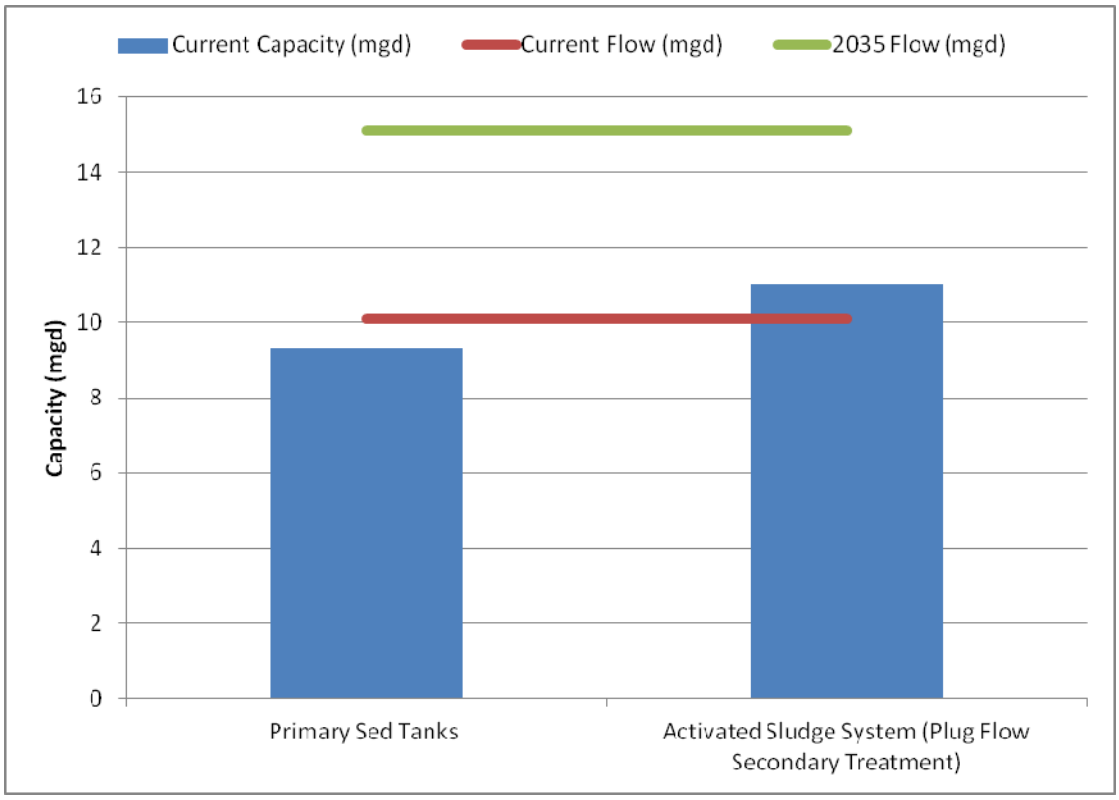


Figure 38 Summary MMWWF Capacity of Grants Pass WRP Unit Processes

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.

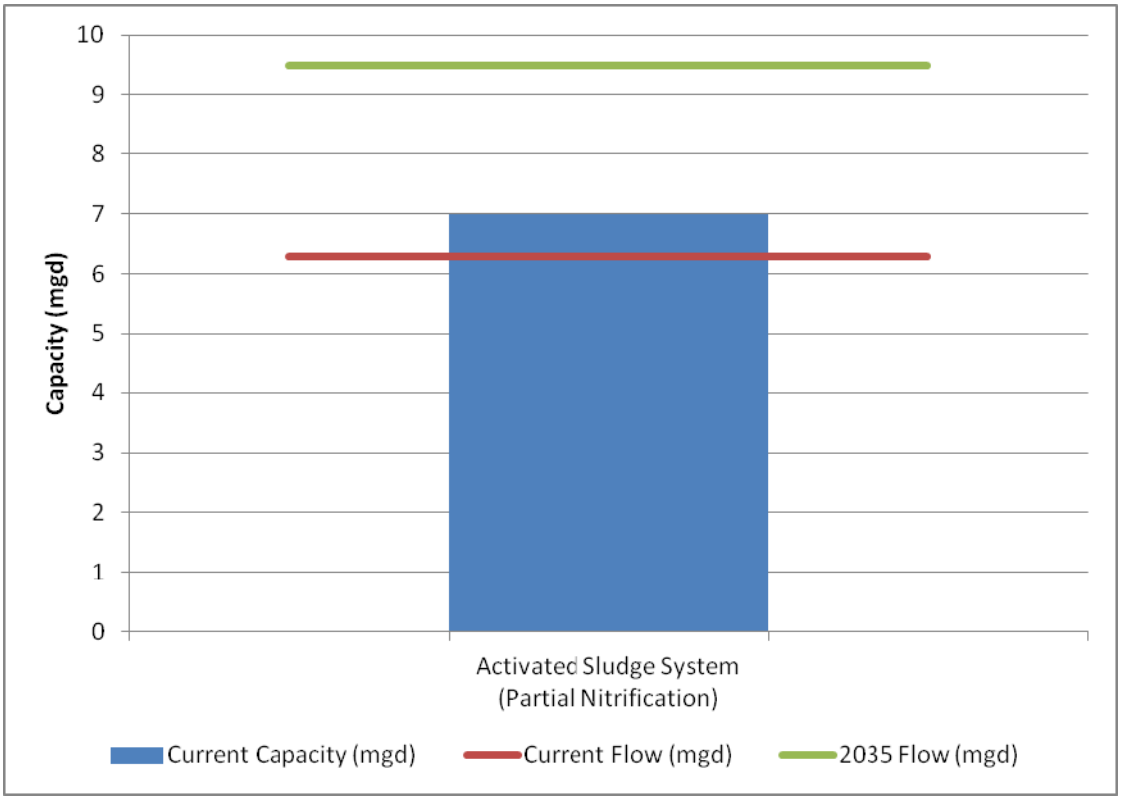


Figure 39 Partial Nitrification MMDWF Capacity of the Grants Pass WRP

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*.

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MICHAEL E. DADIK

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CITY OF GRANTS PASS

TECHNICAL MEMORANDUM NO. 6

Water Restoration Plant Facility Plan

Seismic Assessment

FINAL
March 2013

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

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Figure 1
SITE PLAN
WATER RESTORATION PLANT FACILITY PLAN
SEISMIC CONDITION ASSESSMENT
GRANTS PASS, OREGON

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

	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)	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

	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)	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)	NC
	Backup power influent pump MCC and other room	
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)	NC
	Pipe under the boiler	
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

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BY YM DATE

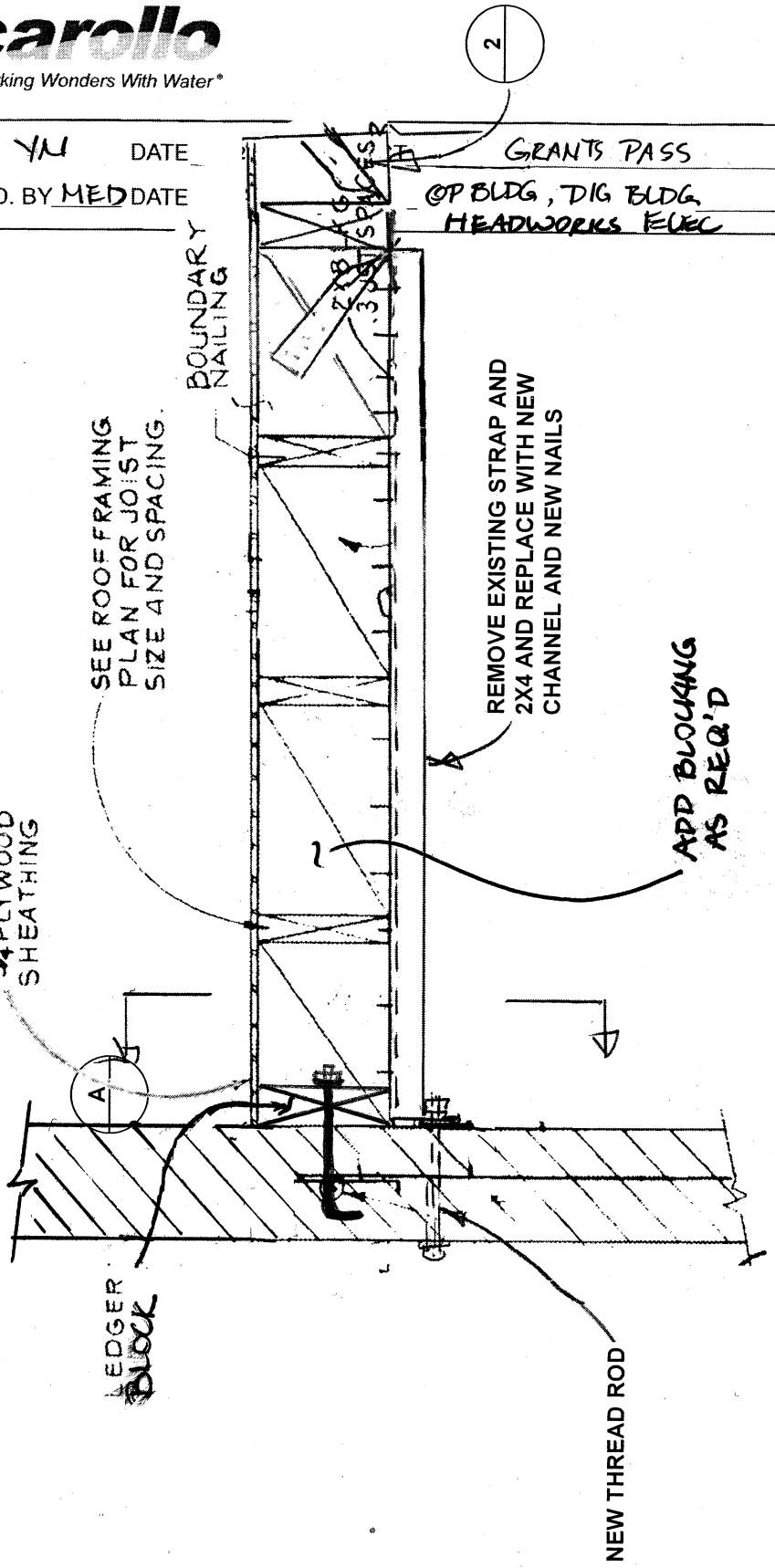
CHKD. BY MED DATE

GRANTS PASS

OP BLDG, DIG BLDG, HEADWORKS ELEC

SHEET NO. 1 OF

JOB NO.



1 DETAIL – OUT OF PLANE WALL ANCHORAGE RETROFIT

Mixed Sources Cert no. SCS-COC-001503 © 1994 FSC

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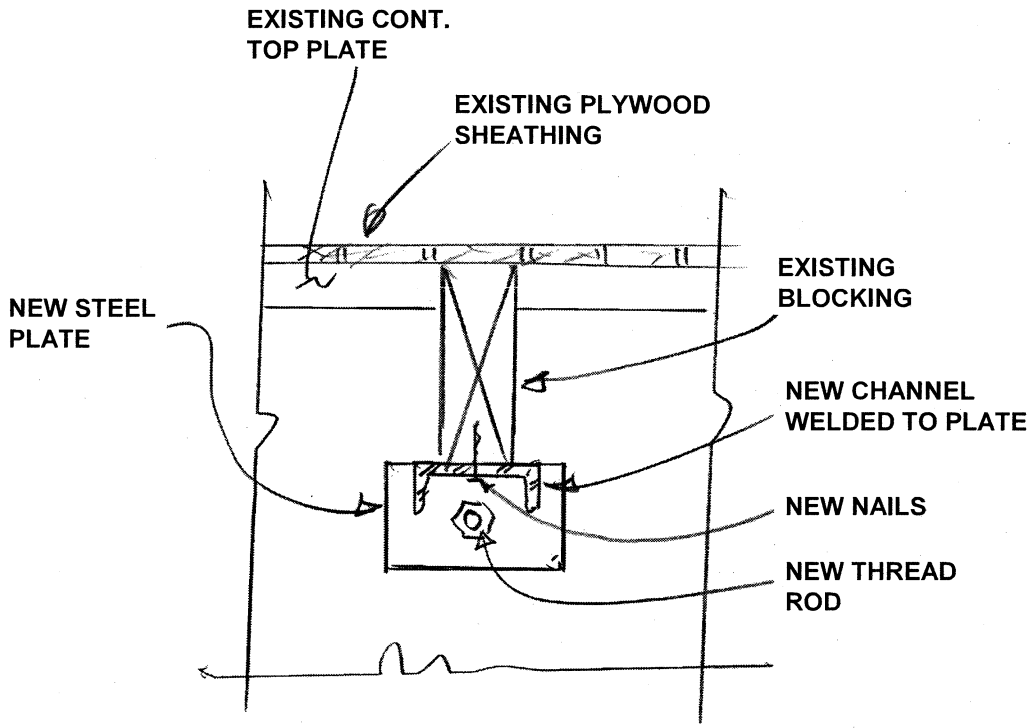
BY YN DATE 2/13 SUBJECT GRANTS PASS SHEET NO. 2 OF

CHKD. BY MED DATE JOB NO.



A SECTION

Mixed Sources Cert no. SCS-COC-001503 © 1996 FSC

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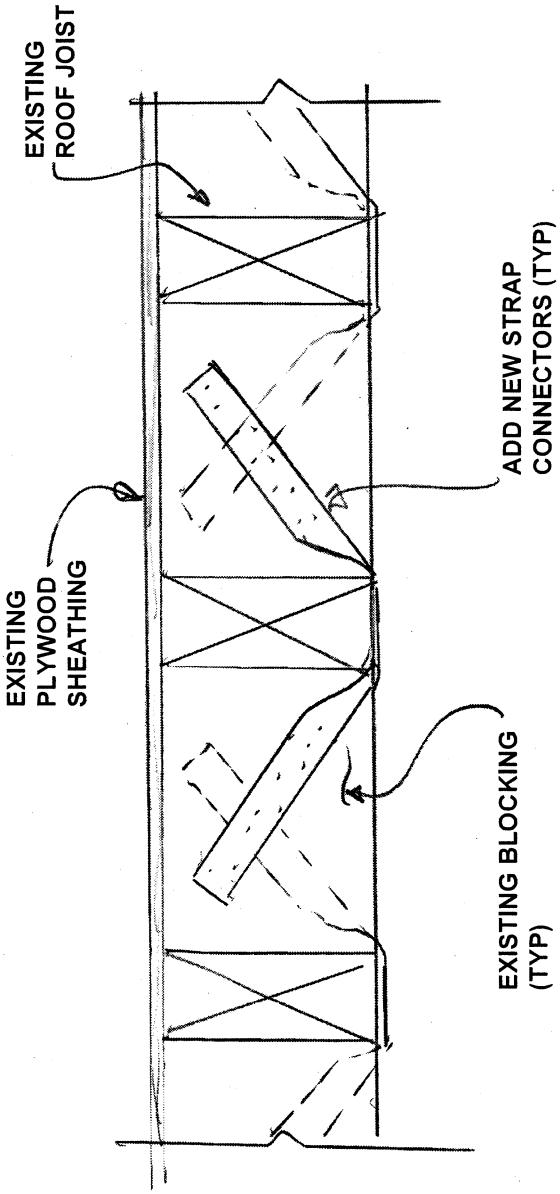
BY YN DATE 2/13 SUBJECT GRANTS PASS SHEET NO. 3 OF

CHKD. BY MED DATE OPERATIONS, DIG CTRL BLDG, HEADWRKS ELEC BLDGS JOB NO.



2 DETAIL – CONTINUOUS CHORD CROSS TIE RETROFIT

Mixed Sources Cert no. SCS-COC-001503 © 1996 FSC

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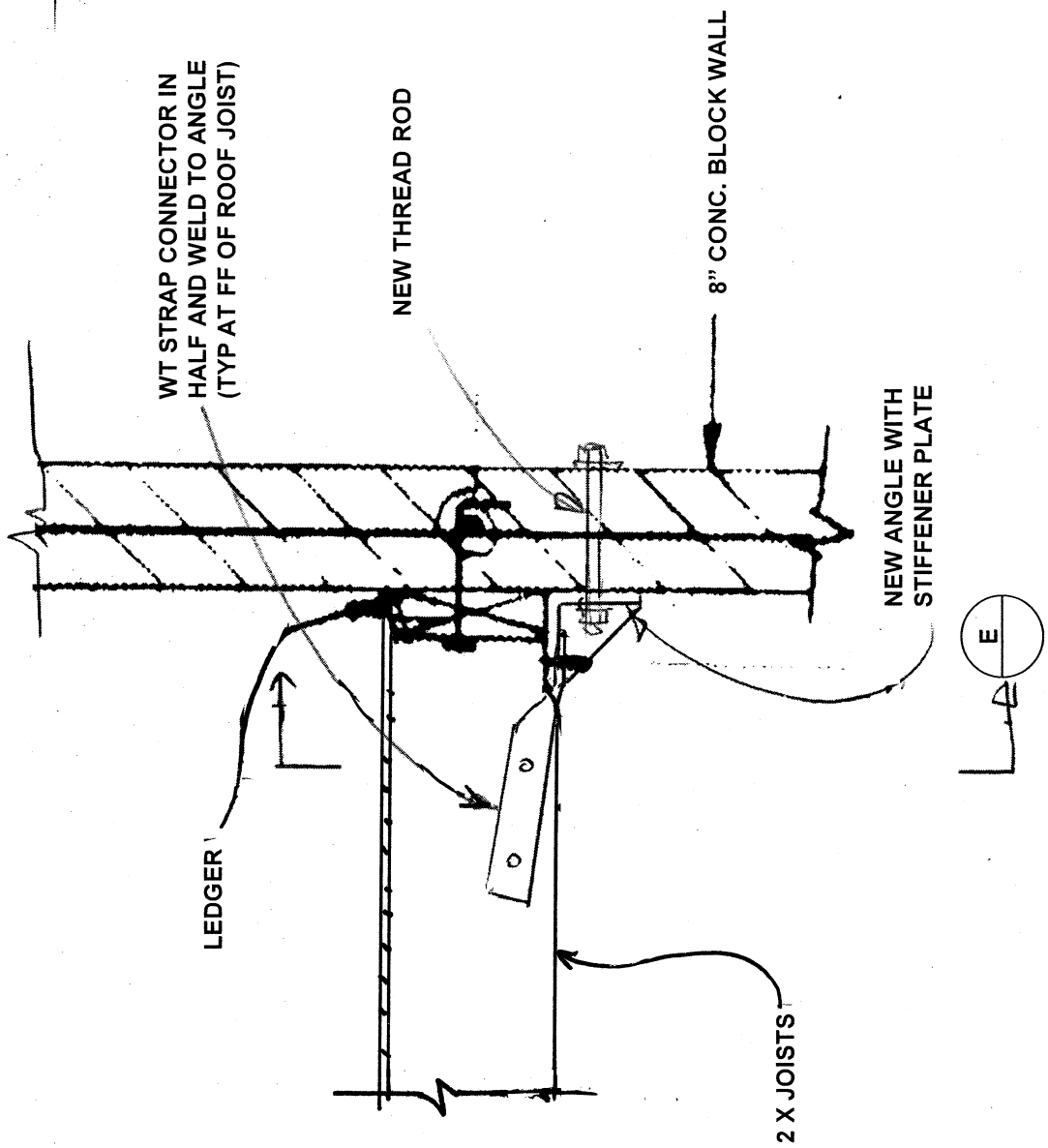
BY YN	DATE 2/13	SUBJECT GRANTS PASS		SHEET NO. ____	OF ____
CHKD. BY ____	DATE ____	HEADWORKS ELEC BLDG		JOB NO. ____	



3 DETAIL – OUT OF PLANE WALL ANCHORAGE RETROFIT

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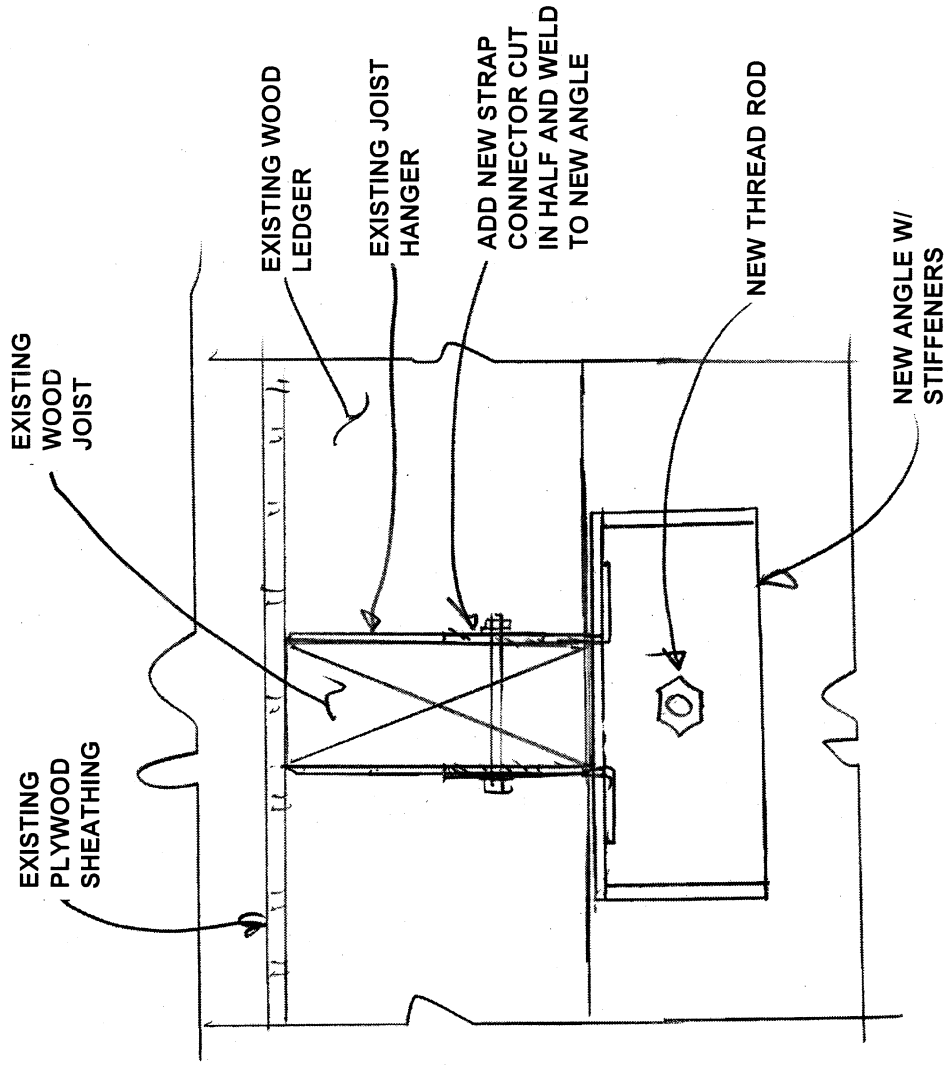
Engineers...Working Wonders With Water®

BY YN DATE 2/13 SUBJECT GRANTS PASS SHEET NO. ____ OF ____

CHKD. BY ____ DATE ____ JOB NO. ____



E SECTION

Mixed Sources FSC Cert no. SCS-COC-001503 © 1996 FSC

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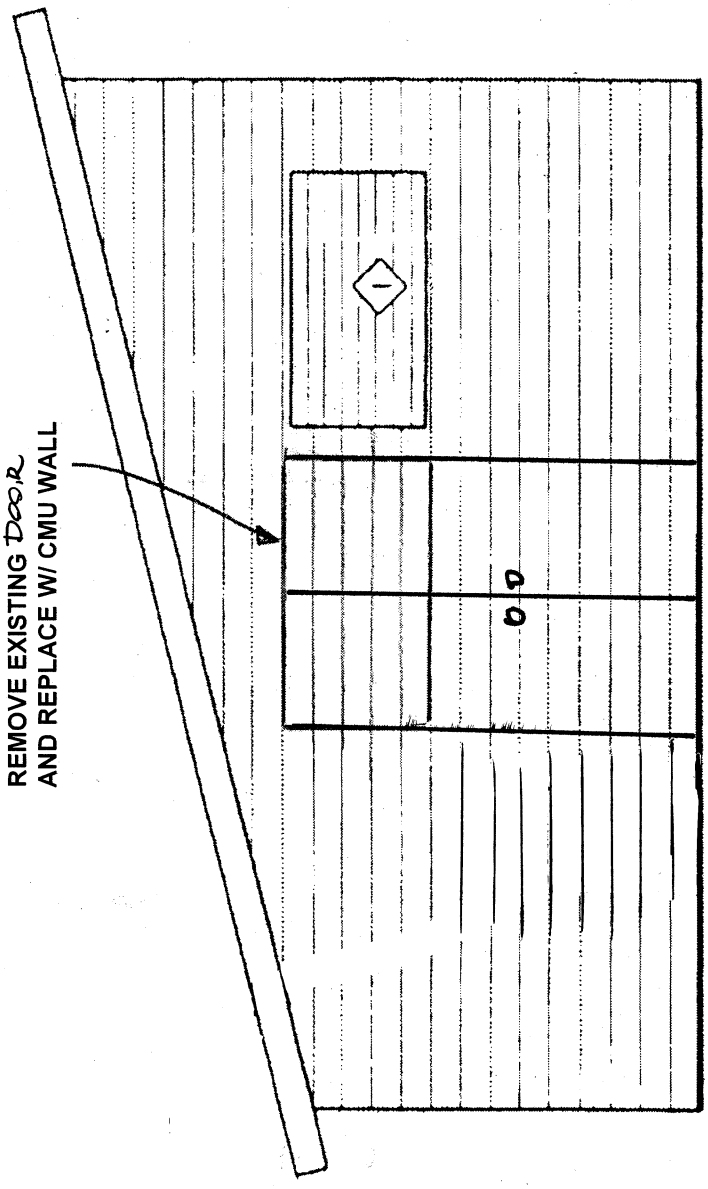
BY YNL DATE 2-13 SUBJECT GRANTS PASS OLD CHLORINE BLDG SHEET NO. ____ OF ____

CHKD. BY ____ DATE ____ JOB NO. ____



4 DETAIL – SHEAR WALL OUT OF PLANE CAPACITY RETROFIT

Mixed Sources Cert no. SCS-COC-001502 © 1996 FSC

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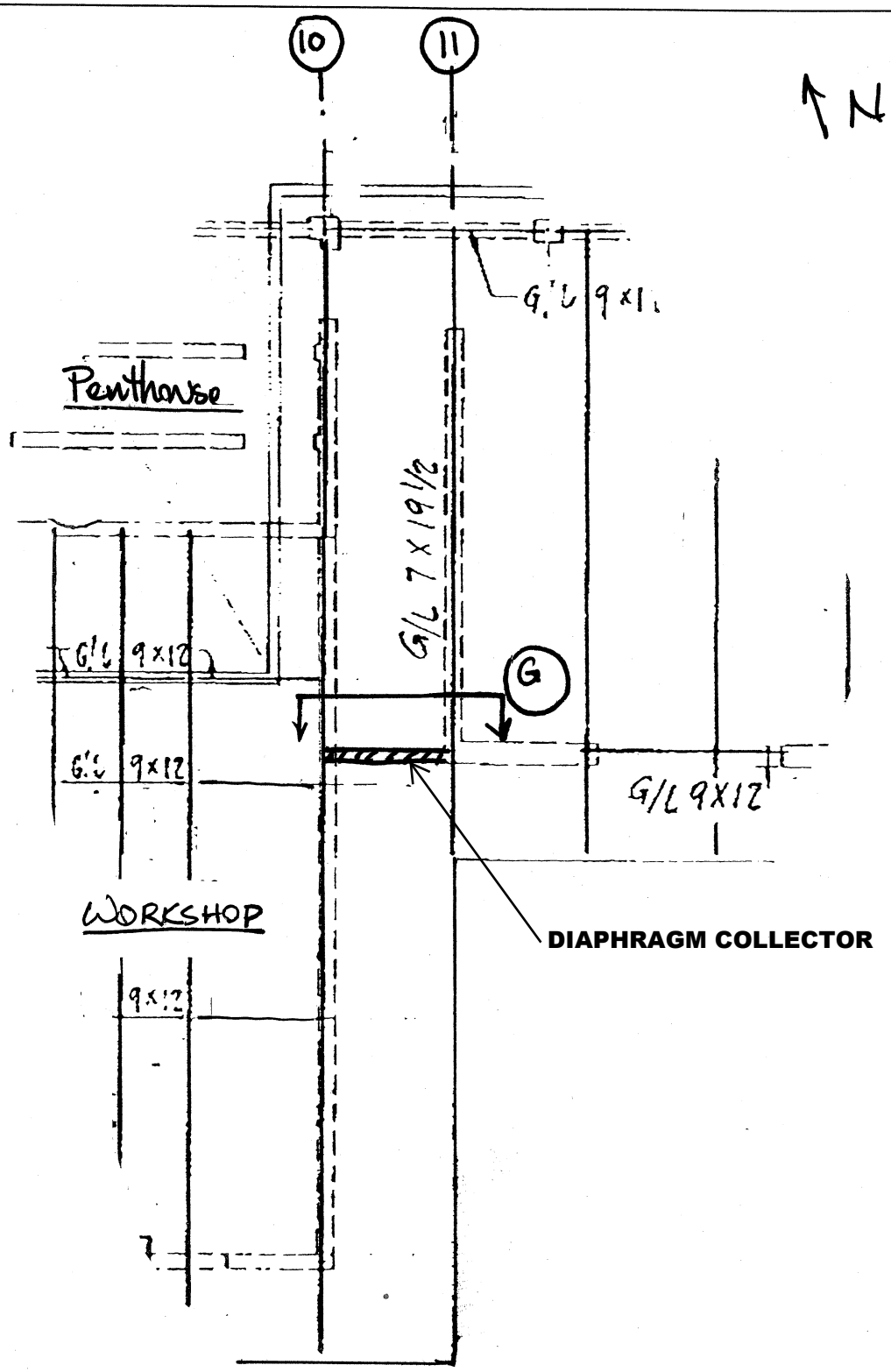
BY YN DATE 2/13 SUBJECT GRANTS PASS OP BLDG SHEET NO. ____ OF ____

CHKD. BY ____ DATE ____ JOB NO. ____



5 Detail – Diaphragm Collector at Reventrant Corner

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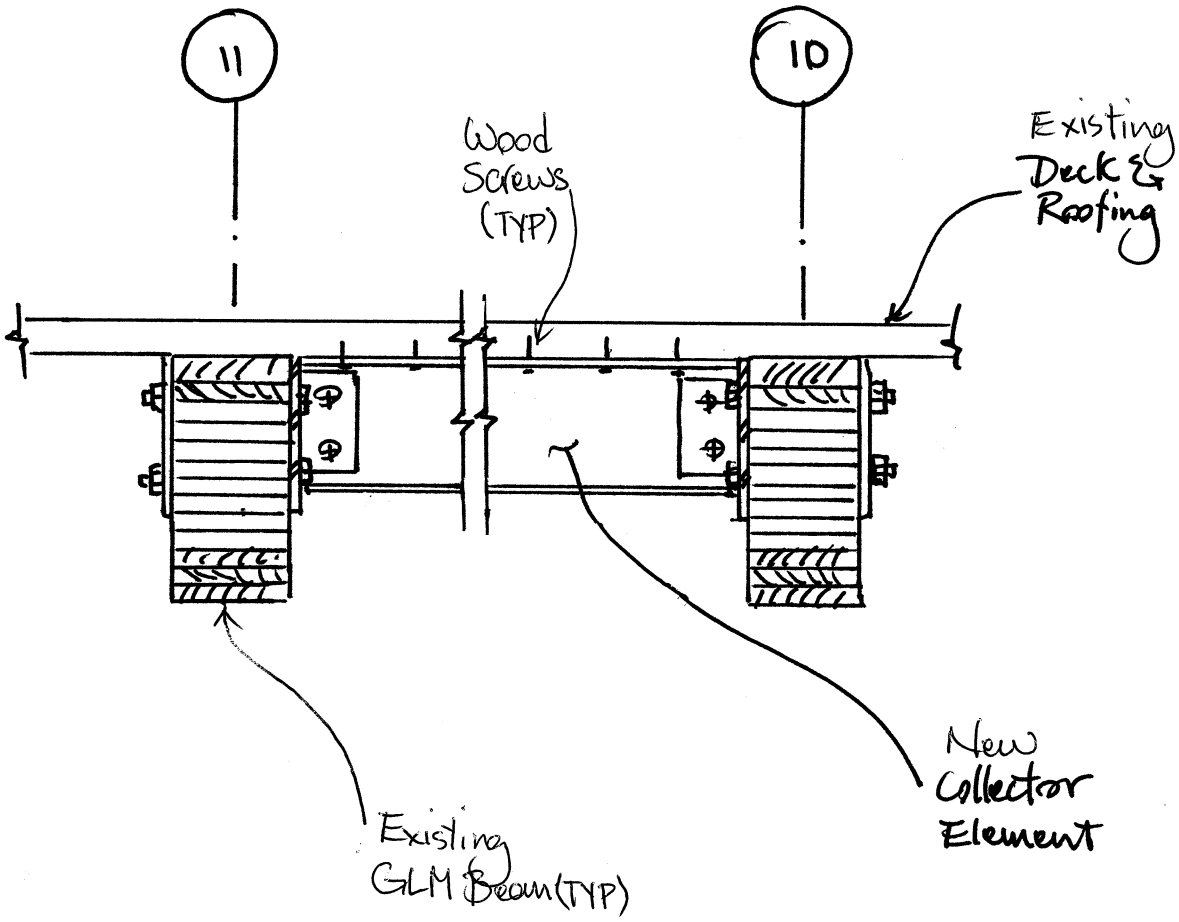
Engineers...Working Wonders With Water™

BY YN DATE 2/13 SUBJECT Grants Pass Operations Building SHEET NO. ____ OF ____
CHKD. BY ____ DATE ____ JOB NO. ____



G Section

Appendix C

CONSTRUCTION COST ESTIMATES

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.

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.

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.

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**

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: 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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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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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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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**

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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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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

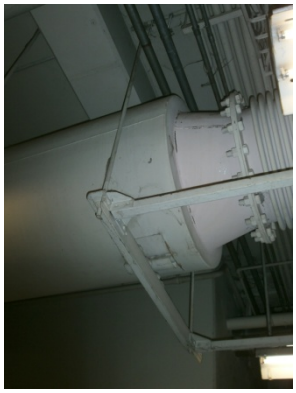

Figure 11 .Silencer without lateral bracing

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

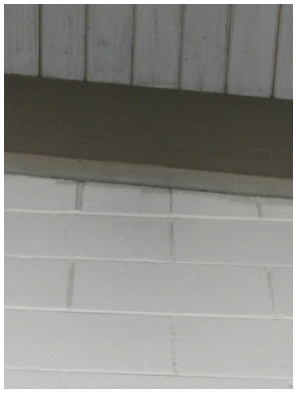

Figure 21. Diagonal Cracking in the East Wall of the Belt Press Hopper Room due to settlement

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

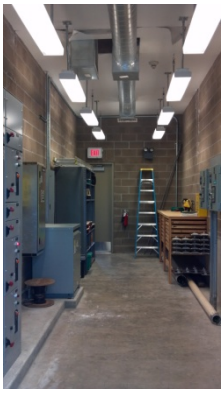

Figure 2. Pendant light fixtures in the RAS/WAS electrical room are not braced

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
18616
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

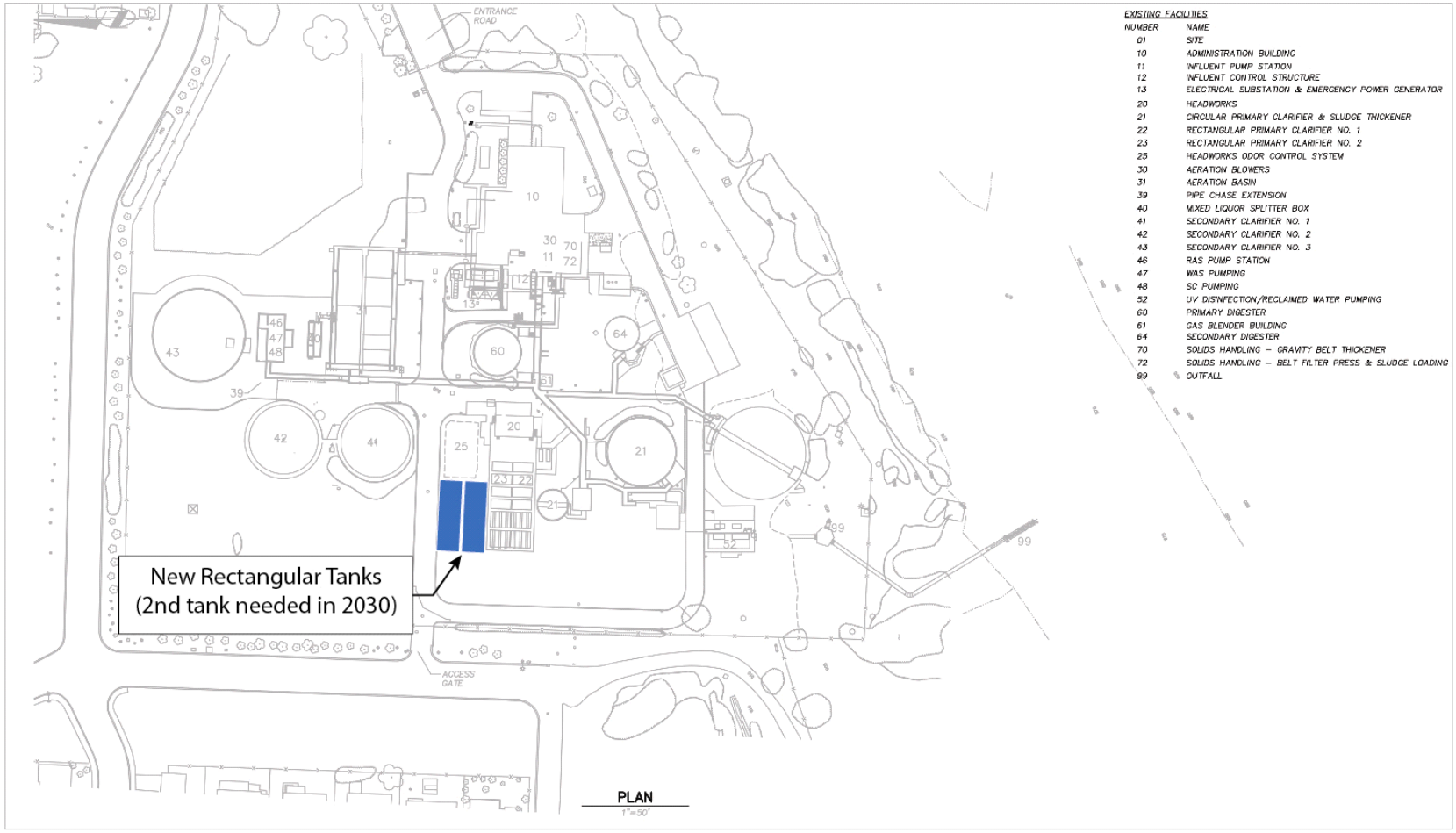
The existing circular sedimentation tank is currently being used for sludge storage. While this tank dates from the 1950's and would require significant refurbishment, returning this tank to sedimentation service is a potentially viable alternative for correction of current capacity deficiencies in primary 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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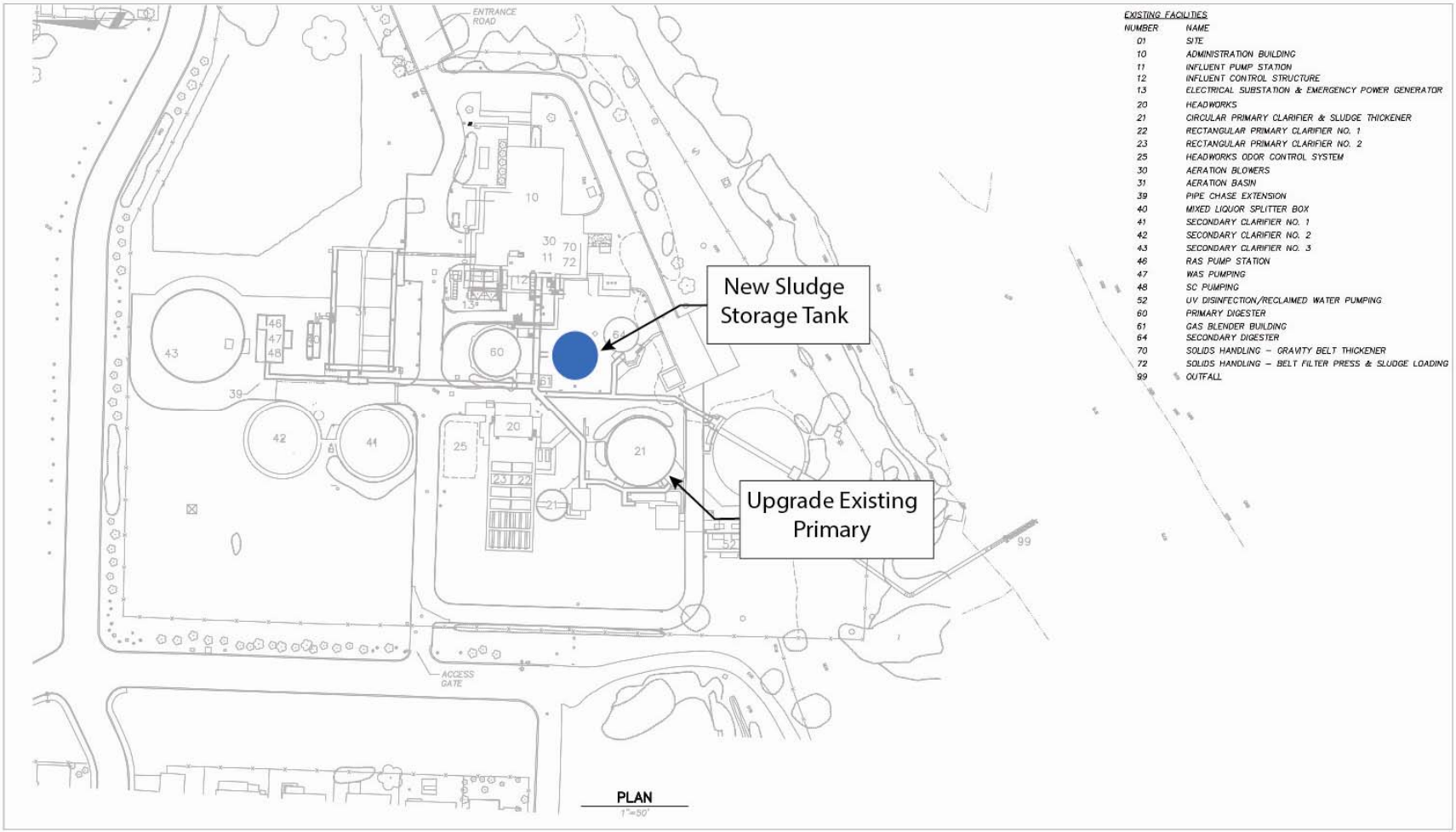

POTENTIAL LOCATION FOR NEW SLUDGE STORAGE TANK

FIGURE 2

CITY OF GRANTS PASS
WATER RESTORATION PLANT FACILITY PLAN

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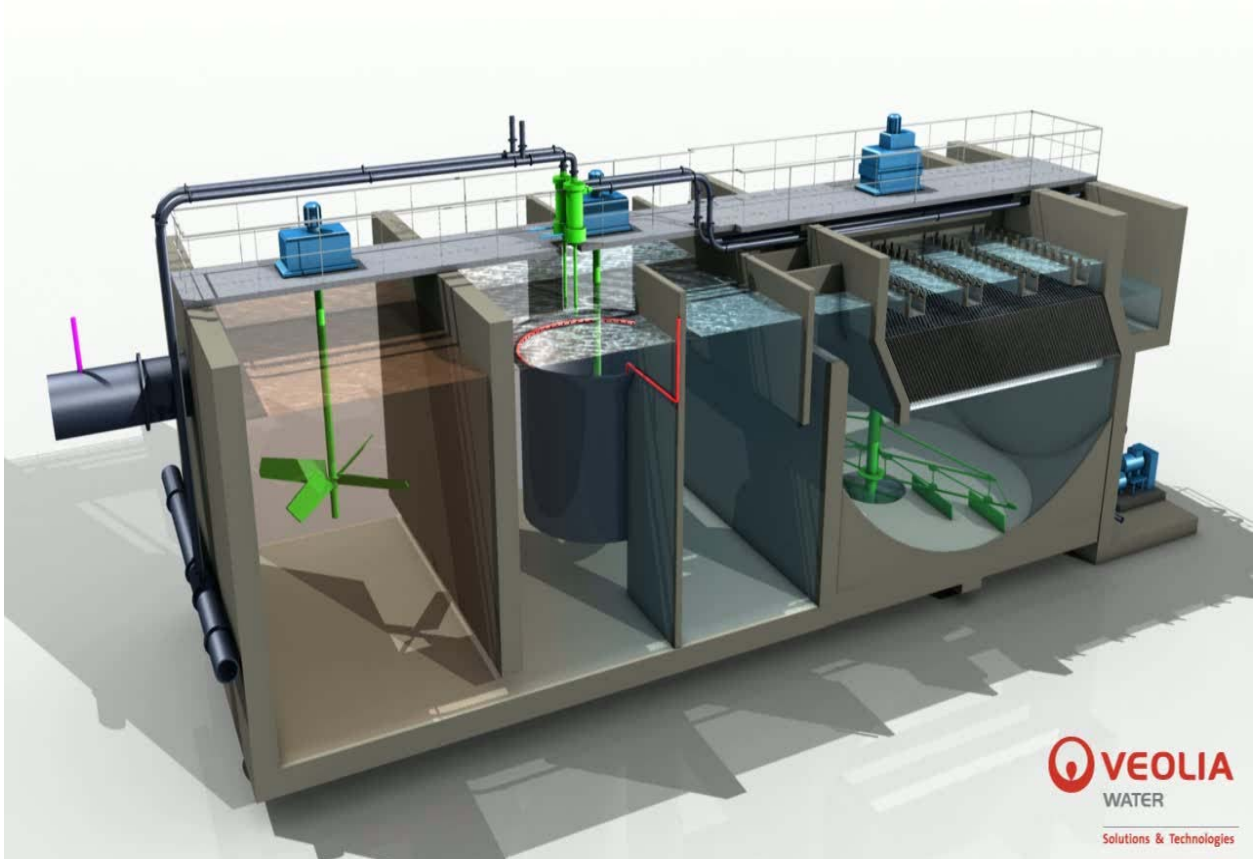

SCHEMATIC DIAGRAM OF THE ACTIFLO™ PROCESS

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

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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.

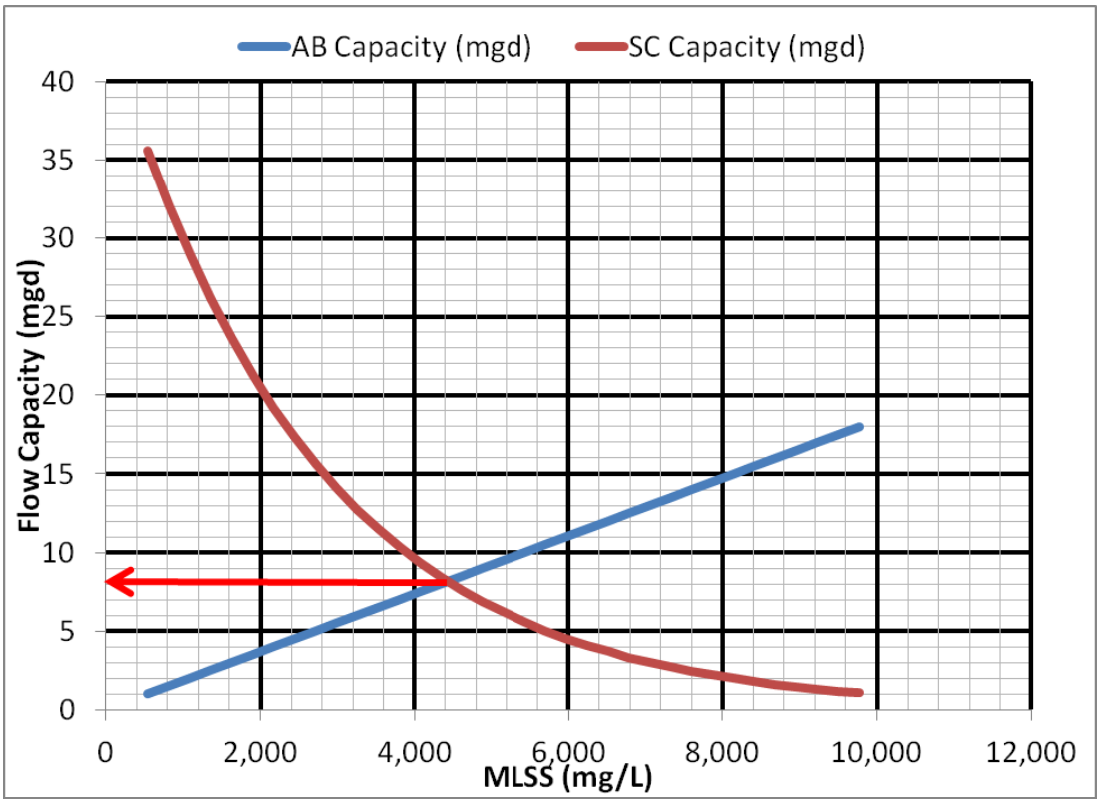

Figure 7 MMDWF Capacity by Reduction of SVI to 120 mL/g

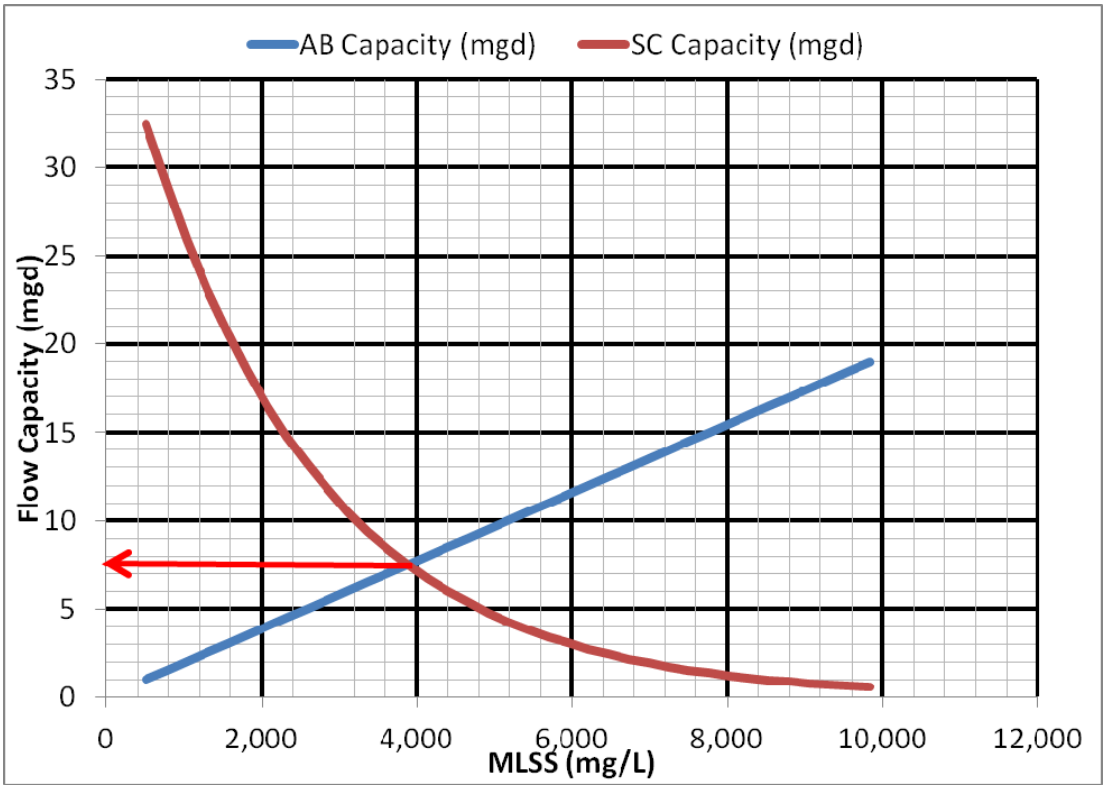

Figure 8 MMDWF Capacity of CEPT

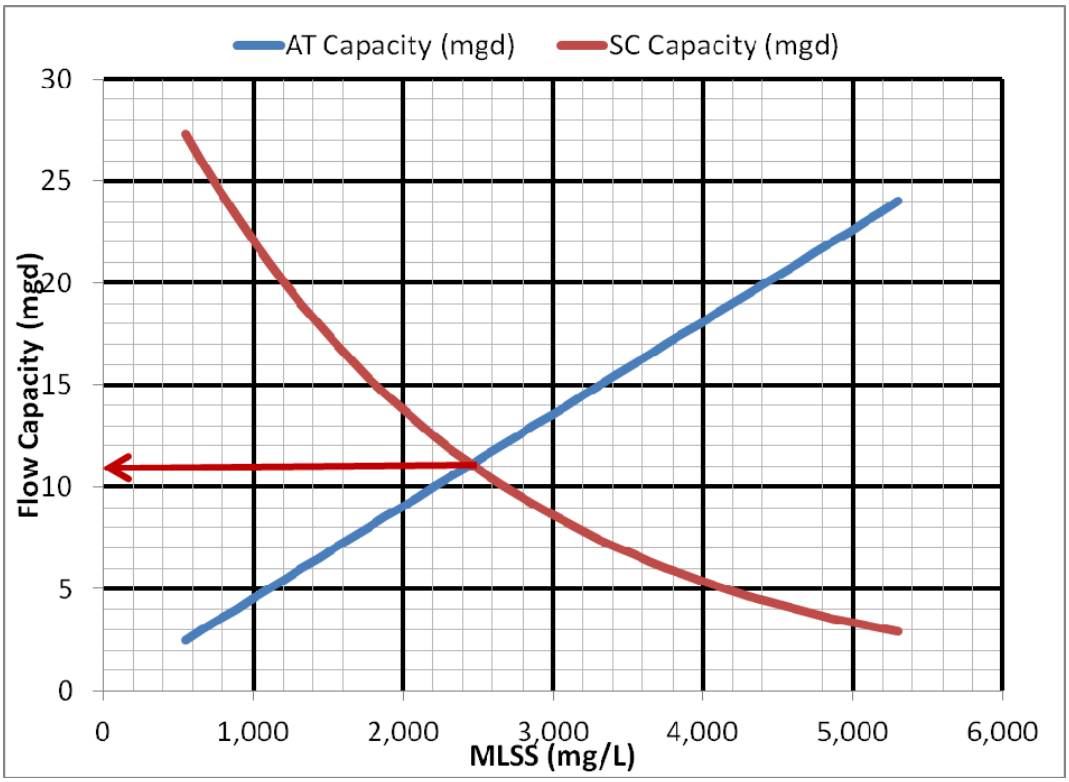

Figure 9 MMWWF Capacity of CEPT

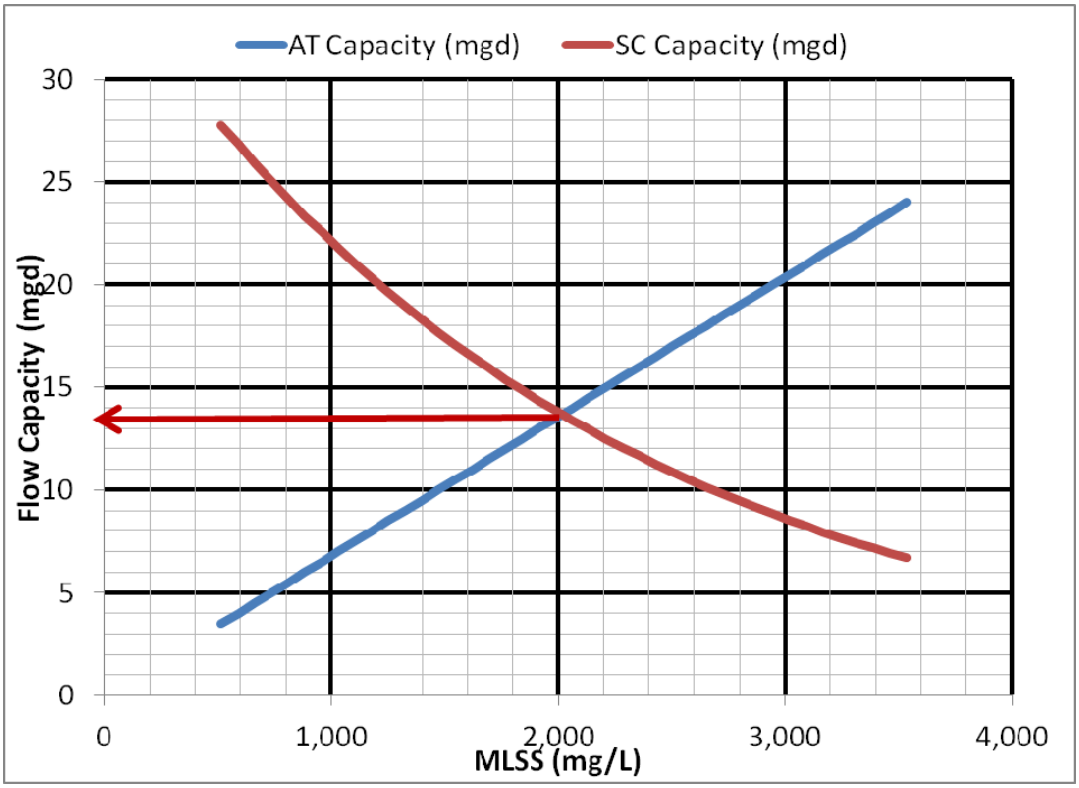

Figure 10 MMWWF Capacity of CEPT with Addition of One Aeration Tank

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.

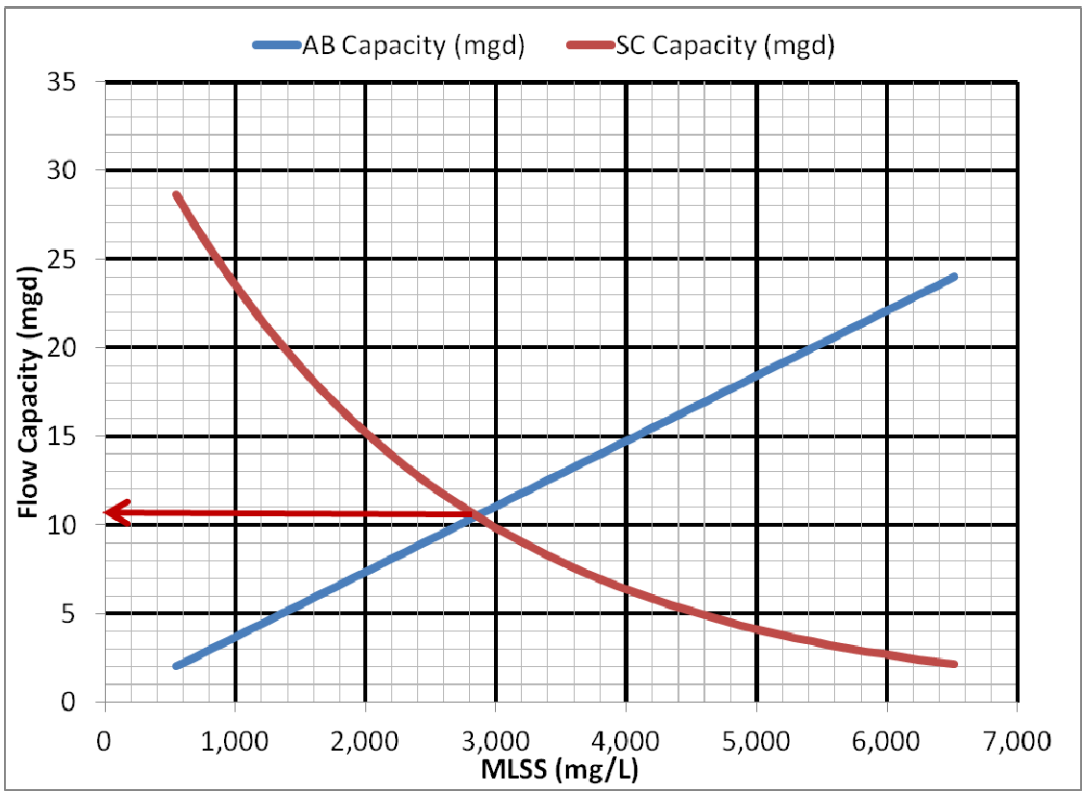

Figure 11 MMDWF Capacity of Addition of Two Aeration Tanks

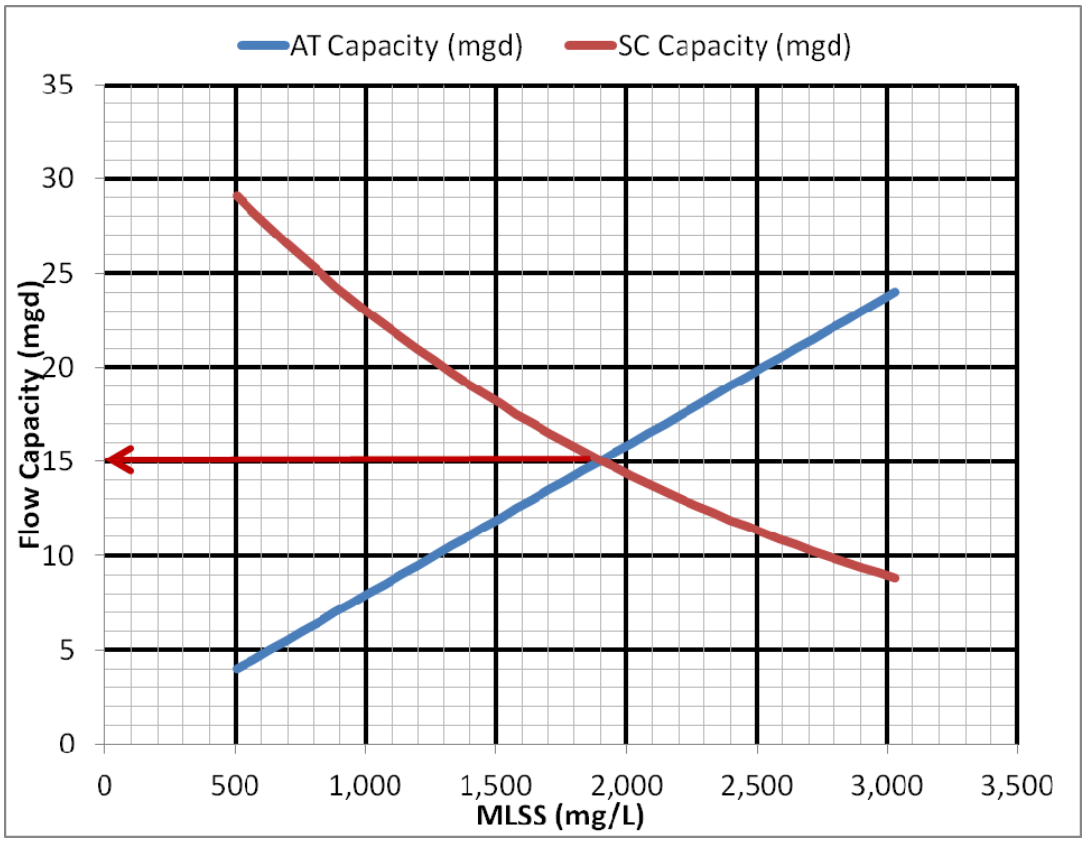

Figure 12 MMWWF Capacity of Addition of Two Aeration Tanks

POTENTIAL LOCATION FOR TWO NEW AERATION TANKS

FIGURE 13

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WATER RESTORATION PLANT FACILITY PLAN

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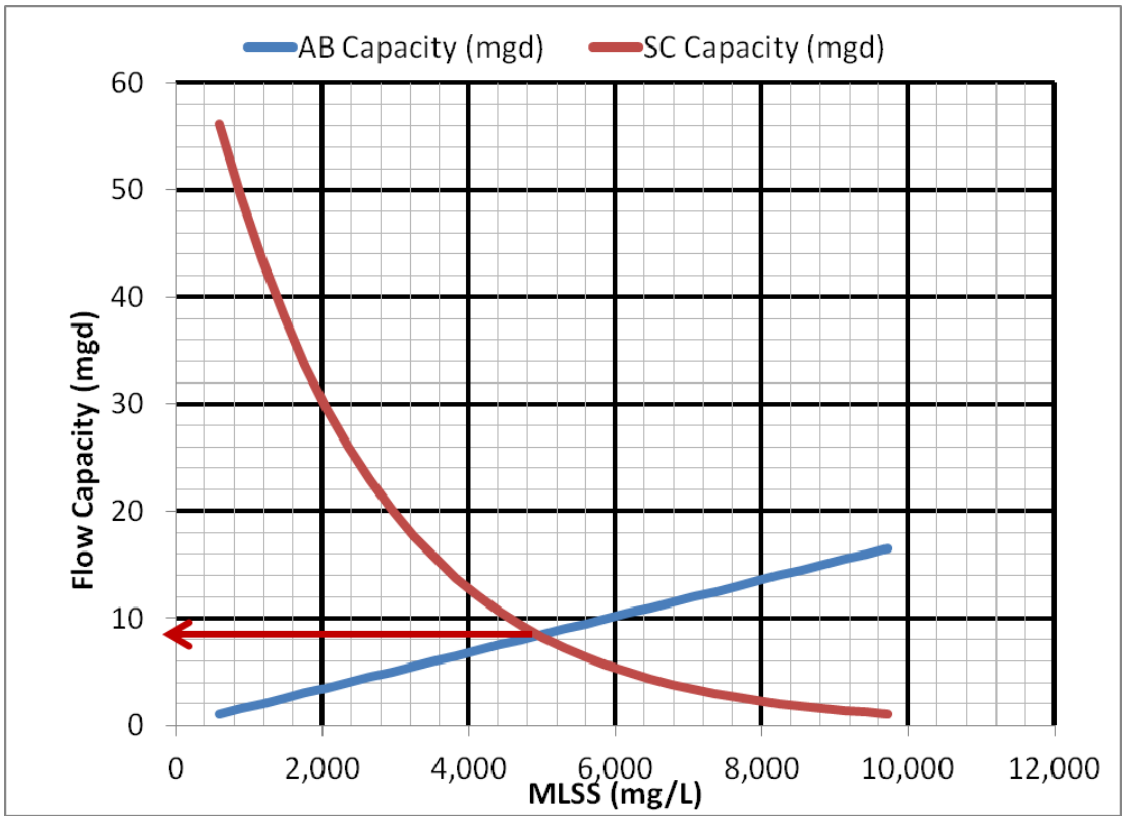
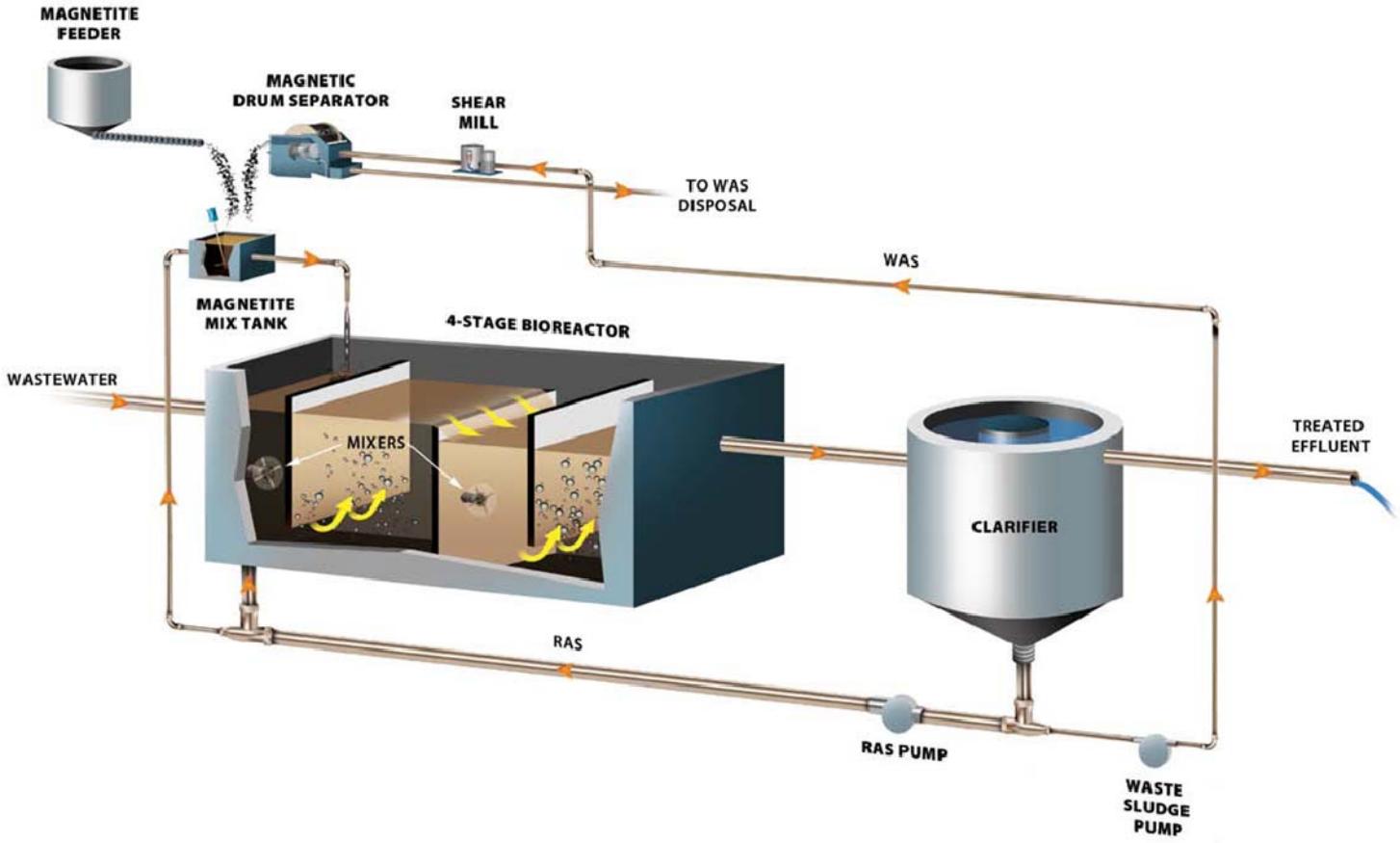


Figure 14 Impact on Capacity of Doubling Secondary Clarifier Area

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

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.

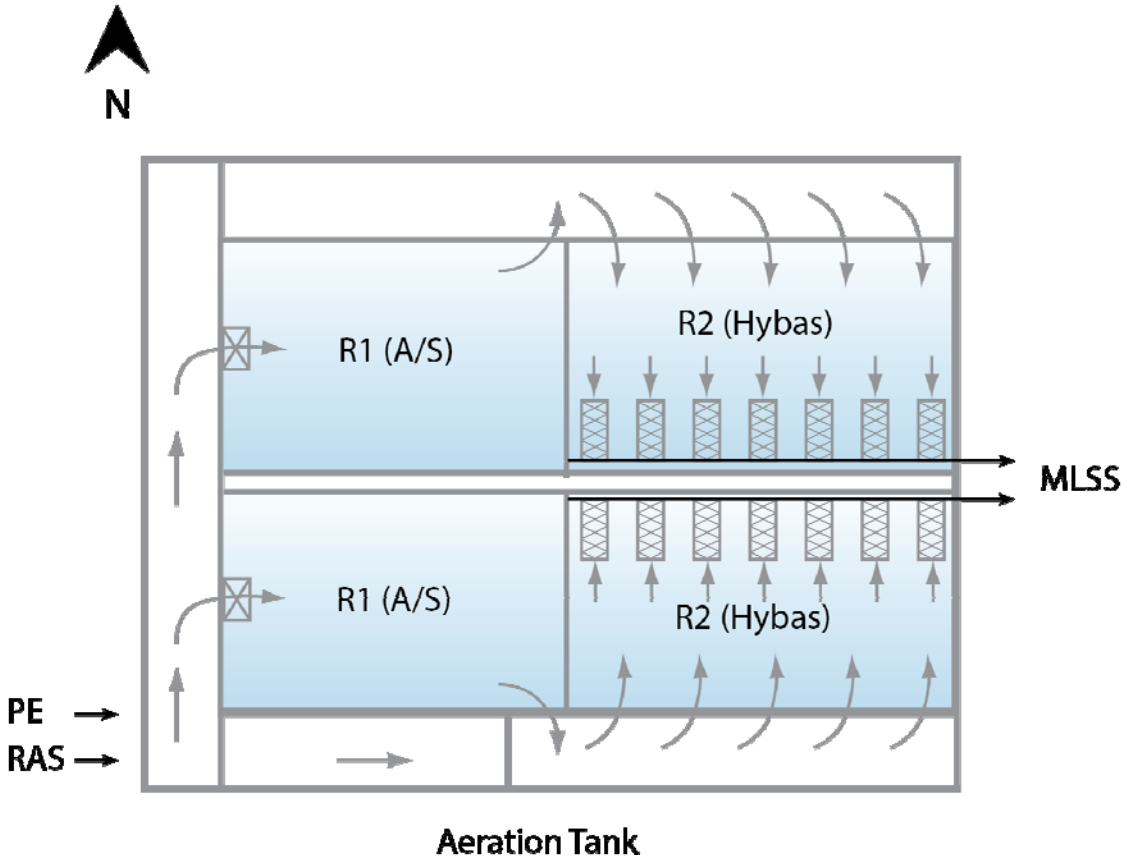
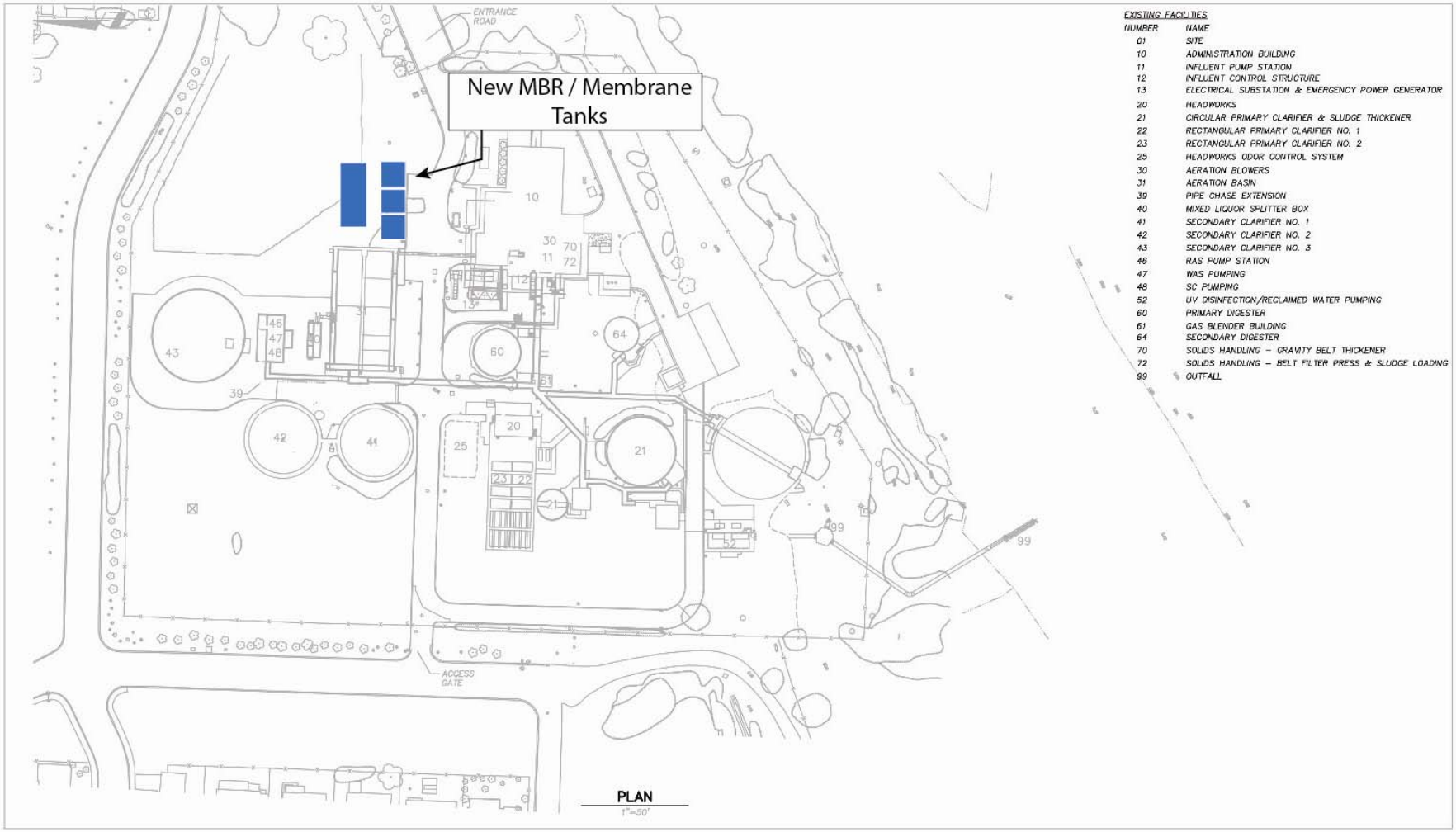


Figure 16 Sketch of Proposed IFAS Installation (Courtesy Krüger)

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

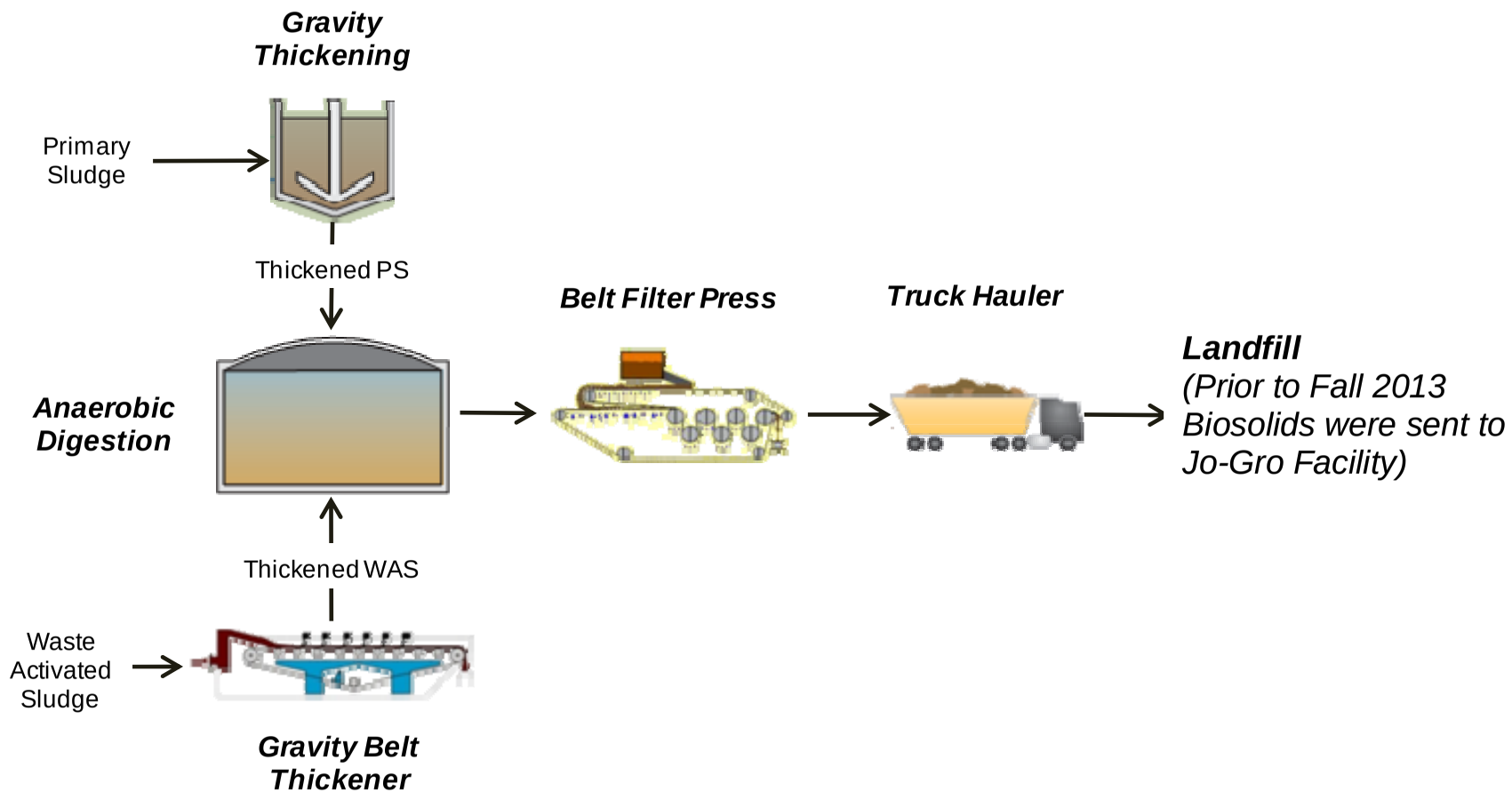
1.0 INTRODUCTION

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

carollo

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.

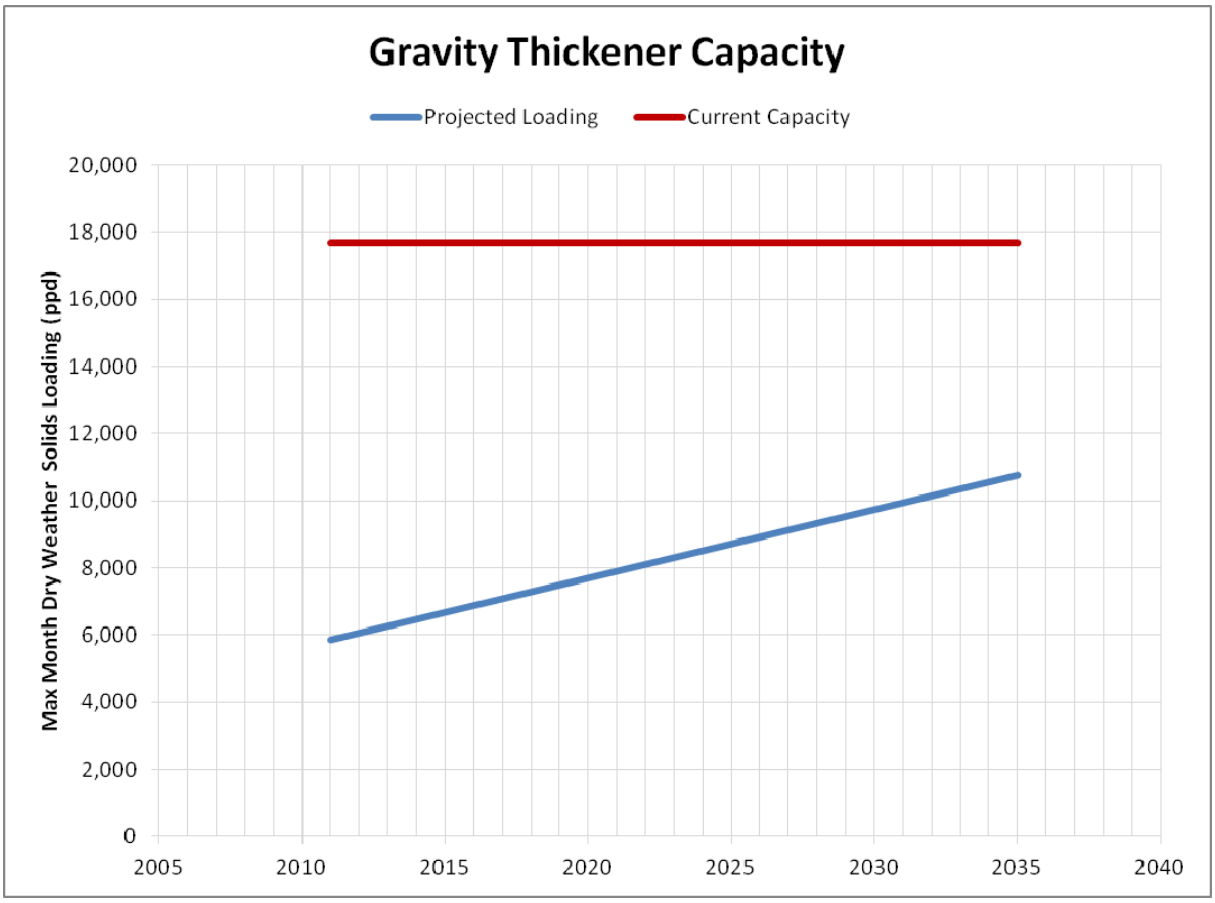


Figure 2 Existing Primary Sludge Thickening Capacity

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.

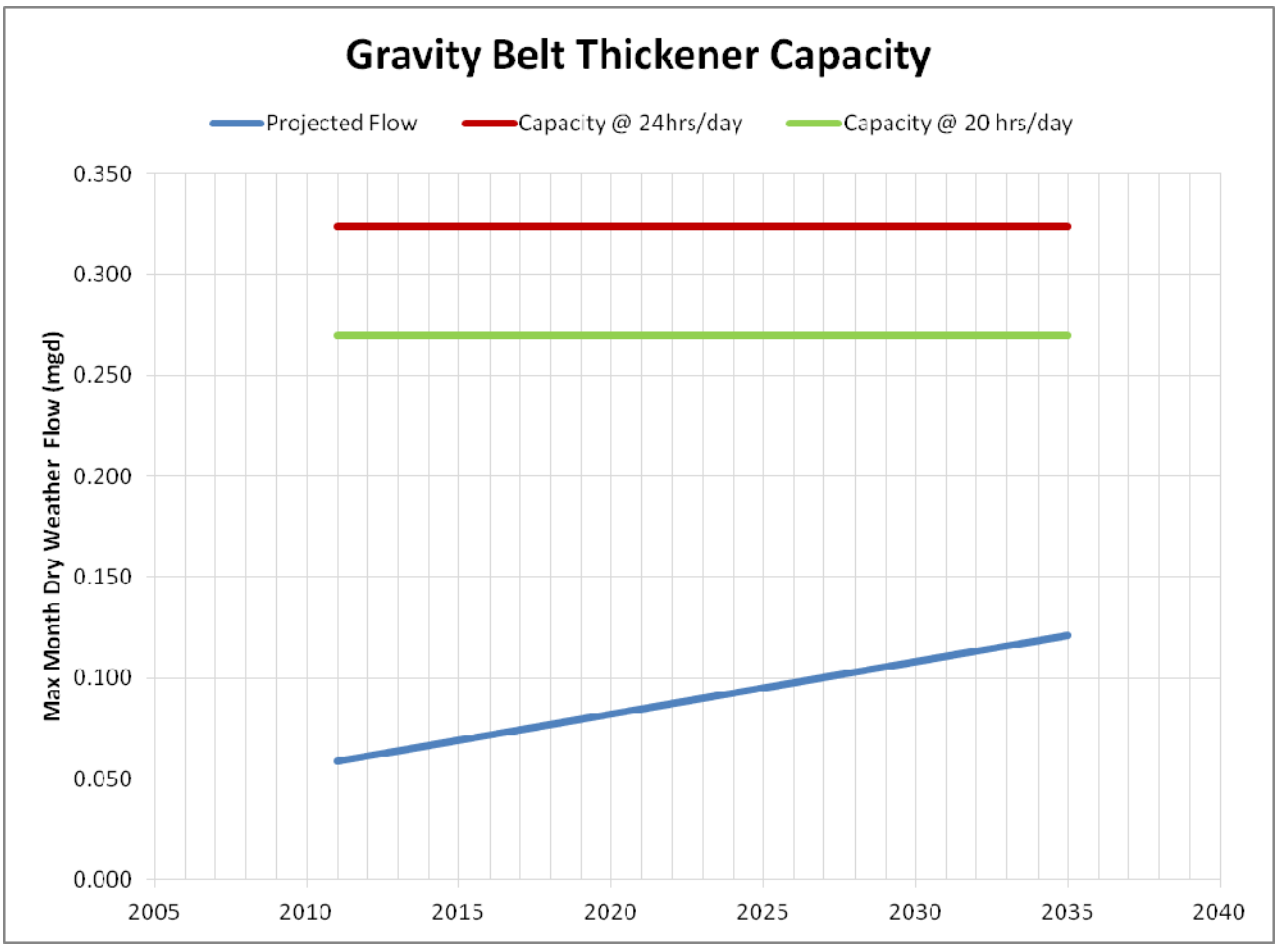


Figure 3 Waste Activated Sludge Thickening Capacity

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.

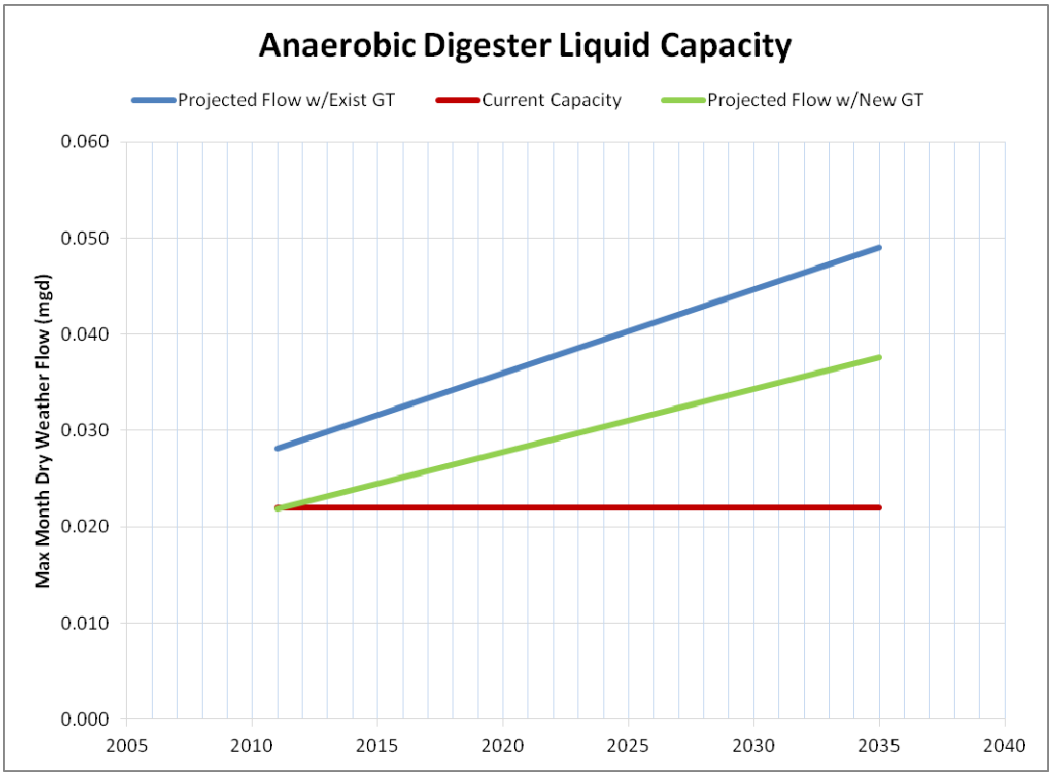


Figure 4 **Anaerobic Digester Liquid Capacity Based on a 20-Day Hydraulic Residence Time**

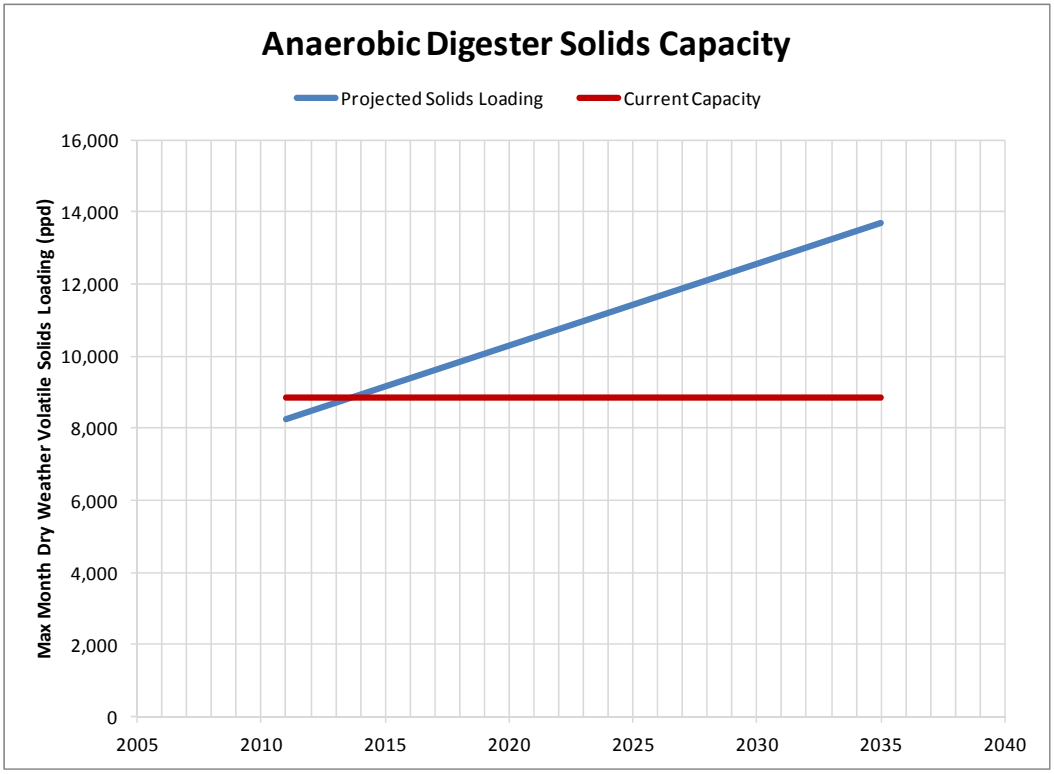


Figure 5 **Anaerobic Digester Volatile Solids Capacity Based on a Loading Rate of 0.15 Lbs VSS/cf-Day**

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.

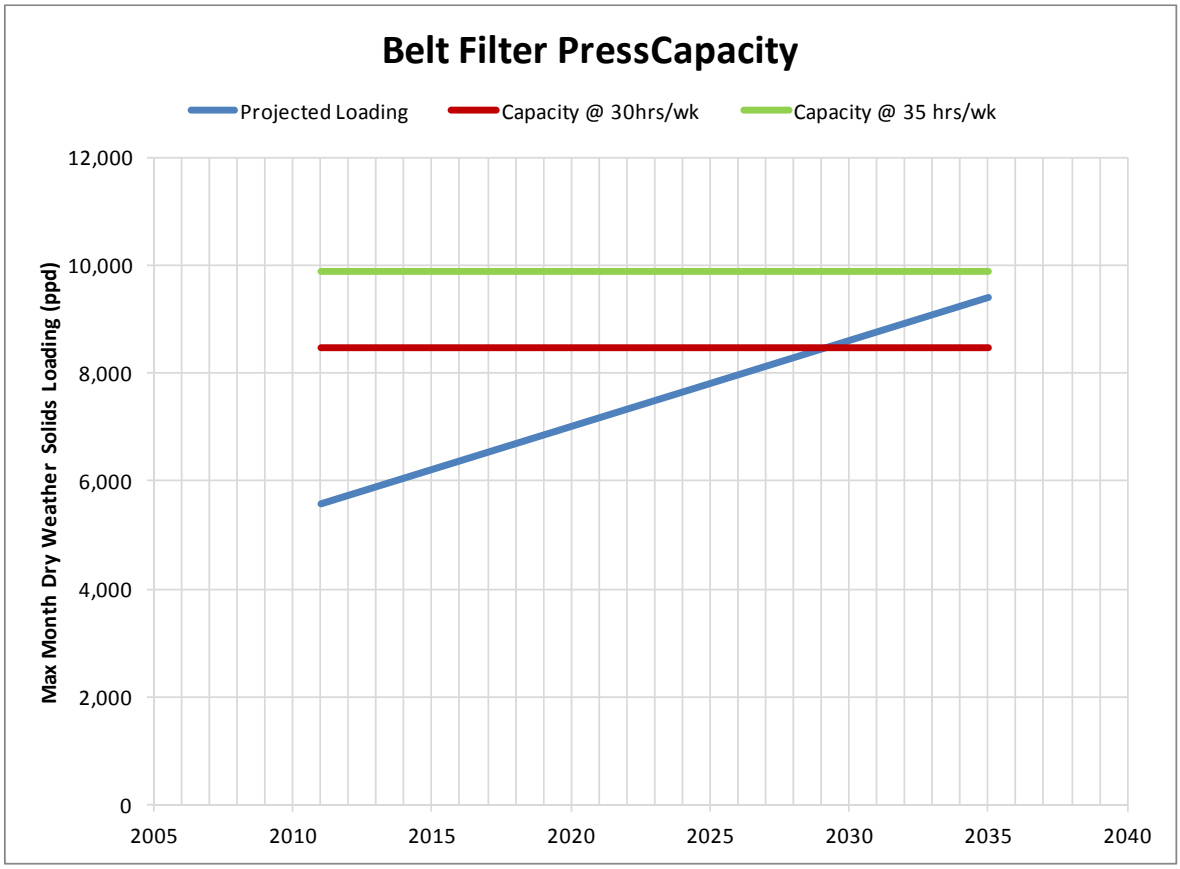


Figure 6 Belt Filter Press Solids Capacity

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.

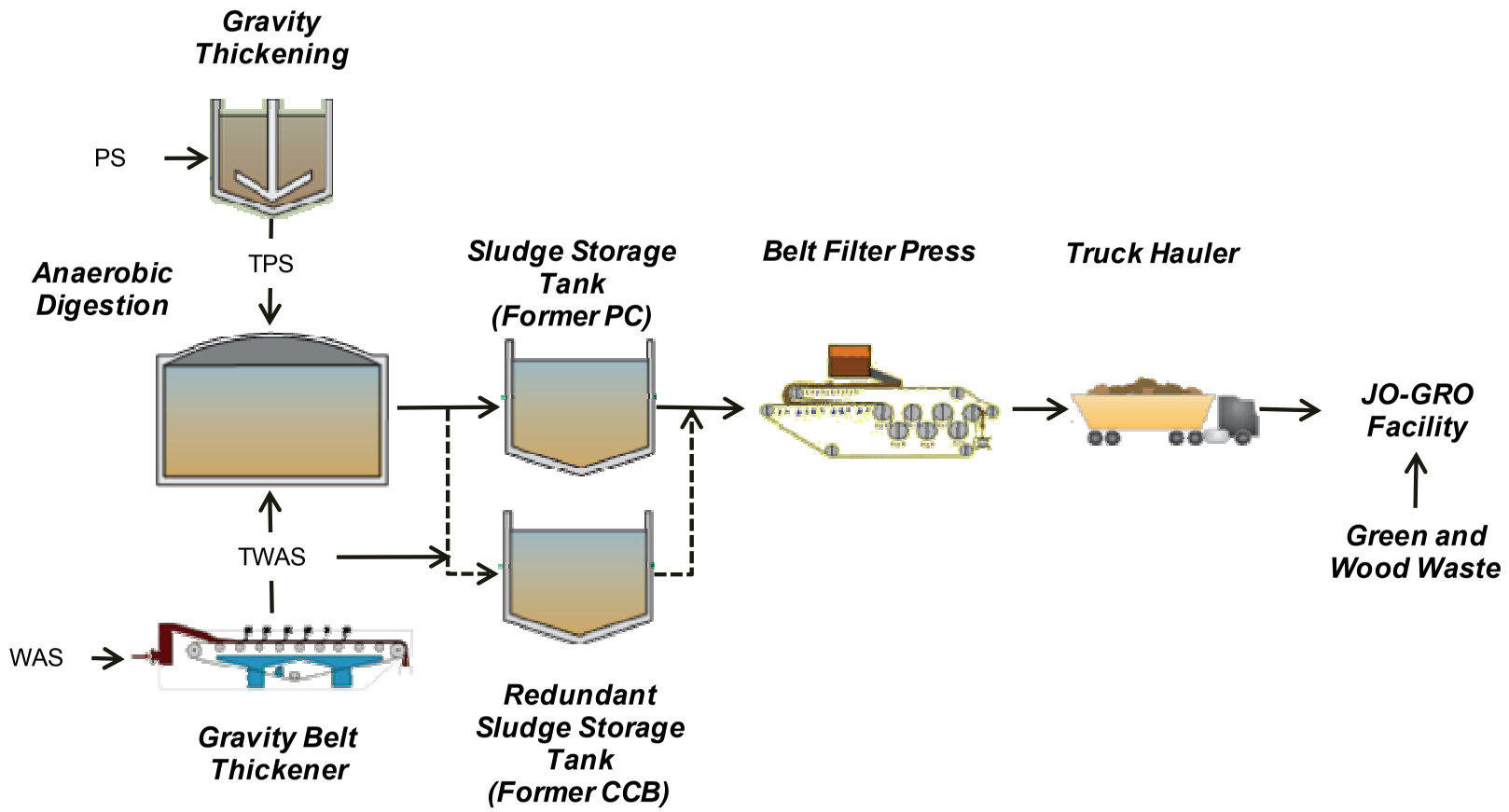
Table 4	Alternatives Analysis Parameters *City of Grants Pass – Solids Treatment Alternatives*		
Item	**Unit**	**Cost**	**Source**
Land Apply			
Western OR	$/wet ton	25	Estimate from private operator
Eastern OR	$/wet ton	40	Estimate from private operator
JO-GRO™			
Hauling	$/wet ton	9.50	Assumed 2 hour 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	

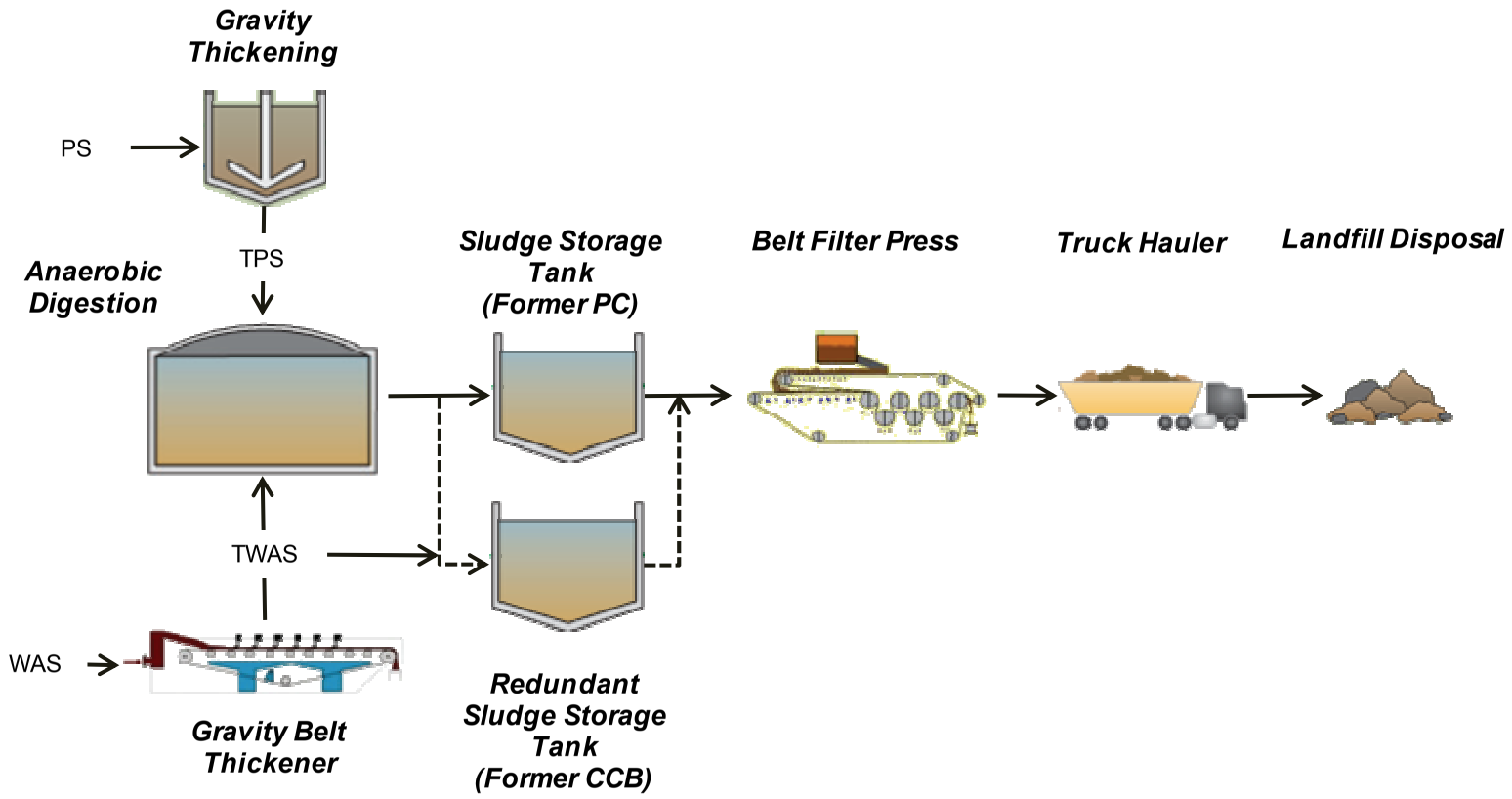
4.2 Alternative No. 2 – Landfill

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

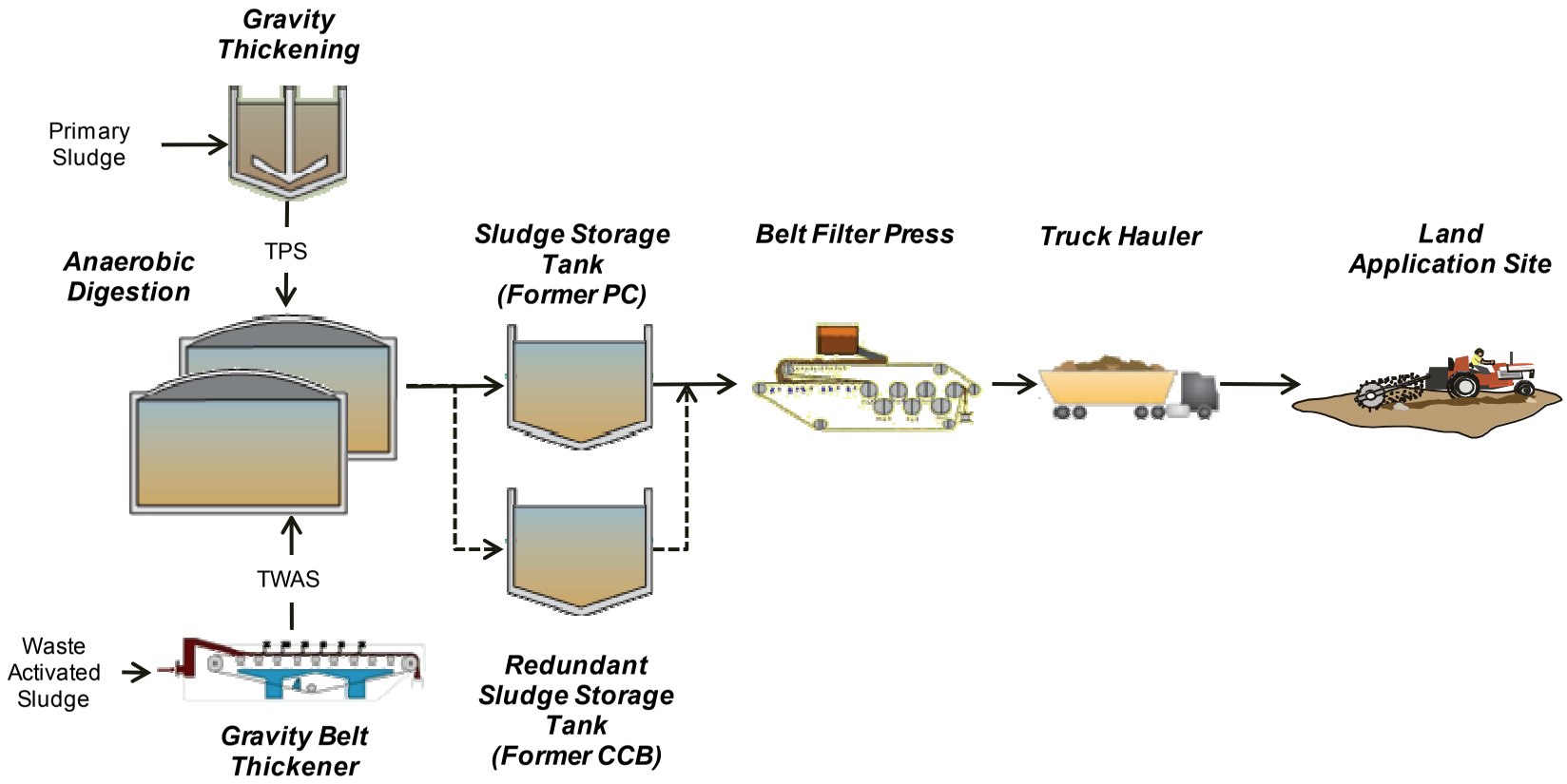
Alternative No. 3 assumes the construction of a new anaerobic digester and the ancillary facilities needed to operate a second digester, including boiler, heat exchanger system, and piping modifications. This new digester will be placed in the same location as the existing Digester No. 2. Unlike the 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

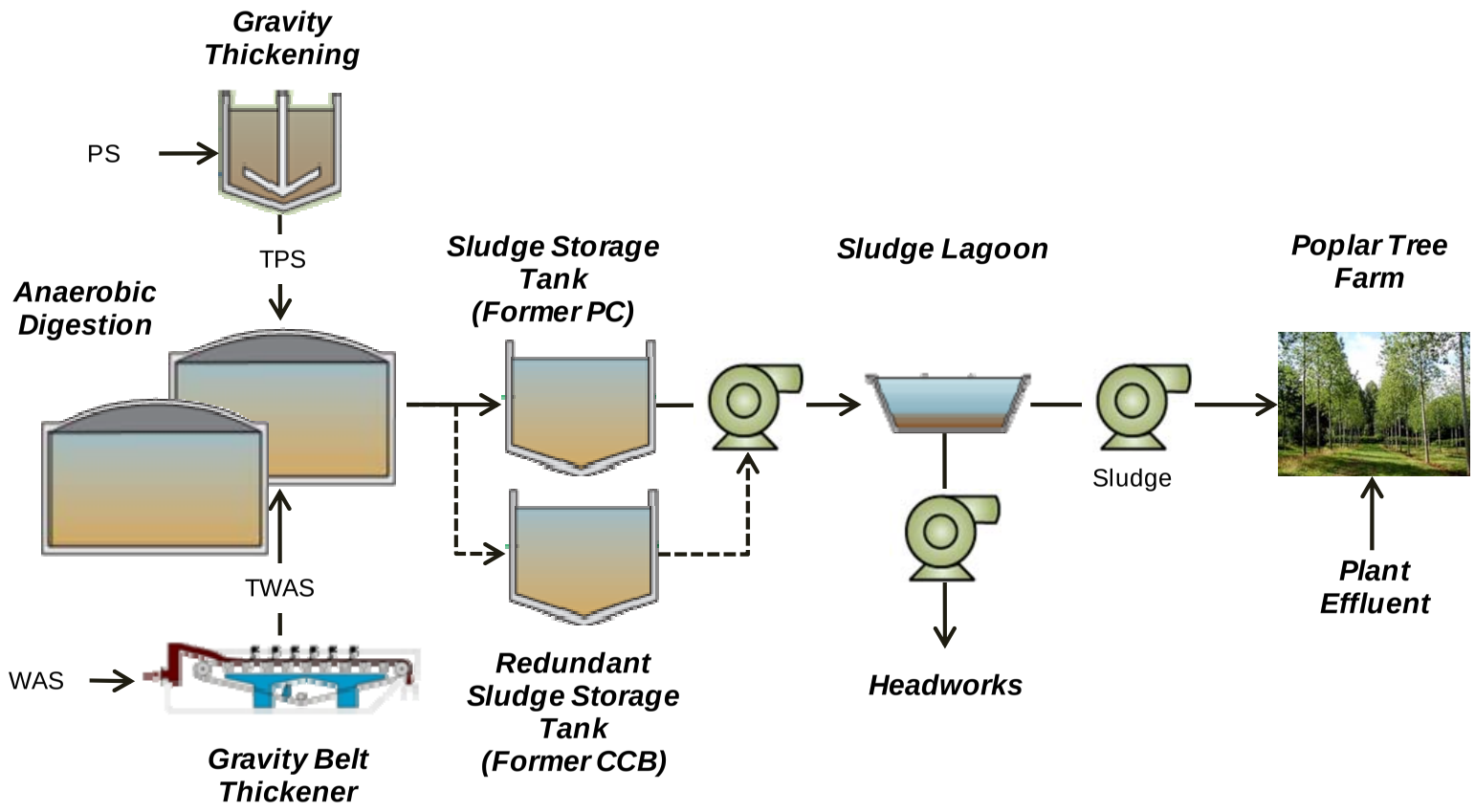
Alternative No. 6 represents the largest operational change of all the alternatives. Under this option, the JO-GRO™ facility is abandoned and in its place, a poplar tree farm is constructed at the River Reserve. A new anaerobic digester will be built to allow the production of Class B biosolids to land 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

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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.

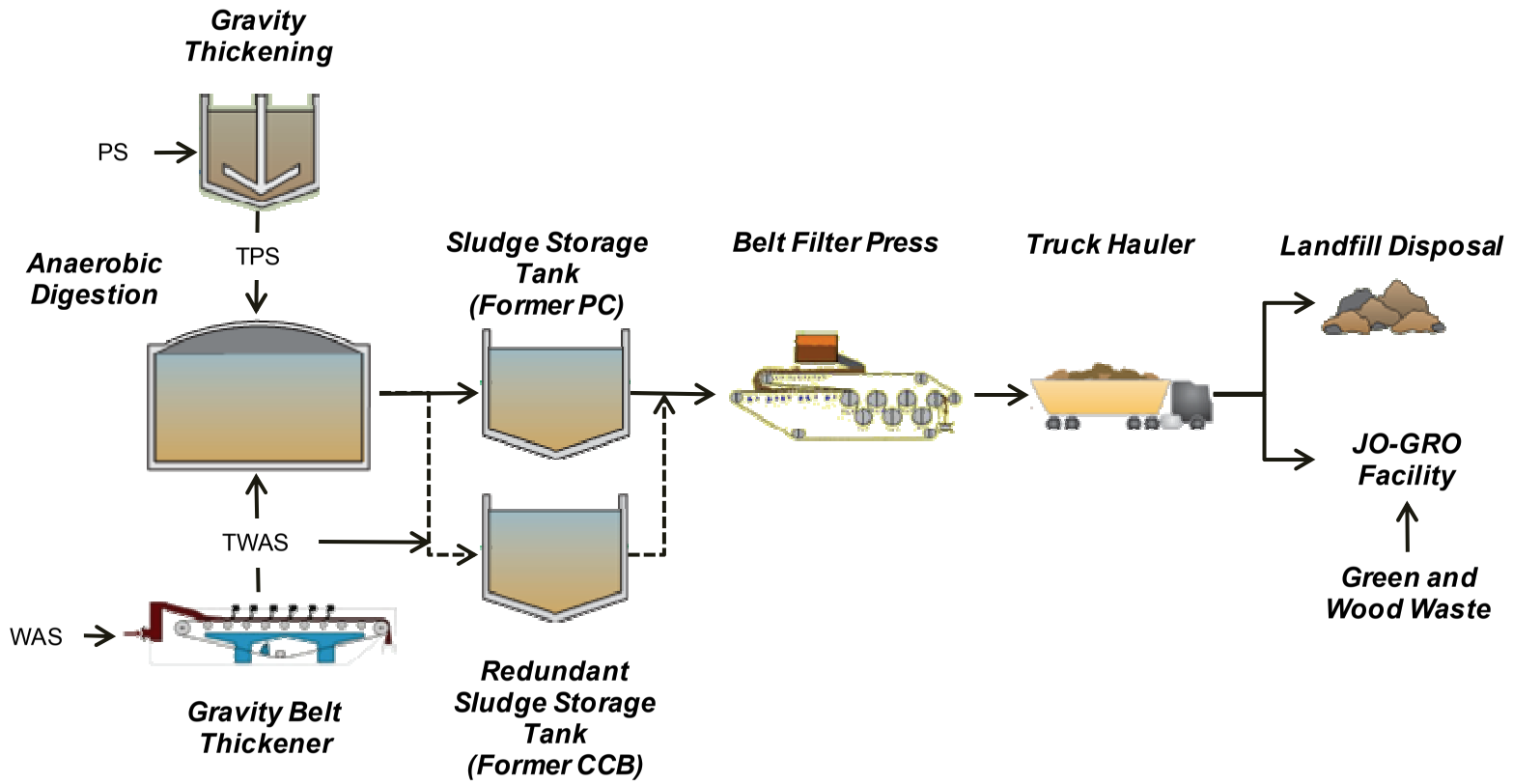
Under Alternative No. 8, the City would continue use of the JO-GRO™ facility and maximize its production capacity. Any biosolids produced at the plant in excess of what is processed at the JO-GRO™ facility would be trucked to the landfill for disposal. To accomplish this, key capital investments at the 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

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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Table 1 Recommended CIP 2

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.