Preliminary Engineering Report
Wastewater Treatment Plant Upgrade

Prepared for
Pacific City Joint Water-Sanitary Authority

January 2015

Prepared by
Parametrix

Preliminary Engineering Report Wastewater Treatment Plant Upgrade

Prepared for

Pacific City Joint Water-Sanitary Authority
P.O. Box 520
34005 Cape Kiwanda Drive
Pacific City, OR 97135

Prepared by

Parametrix
700 NE Multnomah, Suite 1000
Portland, OR 97232-4110
T. 503.233.2400 T. 360.694.5020 F. 503.233.4825
www.parametrix.com

January 2015 | 276-3300-004

CITATION

Parametrix. 2015. Preliminary Engineering Report Wastewater Treatment Plant Upgrade. Prepared by Parametrix, Portland, Oregon. January 2015.

CERTIFICATION

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned, whose seal, as a professional engineer licensed to practice as such, is affixed below.

REGISTERED PROFESSIONAL
ENGINEER
16,791
OREGON
JULY 20, 1993
THOMAS S. NIELSEN

1/23/15

EXPIRES: 12/31/16

Prepared by Thomas Nielsen, PE, Allan Maas, PE, Michael Pyszka, PE, and Brandon Williams

Checked by David Kopchynski, PhD, PE

Approved by Daniel McIntire, PE

TABLE OF CONTENTS

TABLE OF CONTENTS (CONTINUED)

TABLE OF CONTENTS (CONTINUED)

LIST OF FIGURES

LIST OF TABLES

TABLE OF CONTENTS (CONTINUED)

APPENDICES

TABLE OF CONTENTS (CONTINUED)

ACRONYMS

ADWF	Average Dry Weather Flows
AWWF	Average Wet Weather Flow
BLM	Bureau of Land Management
BOD_5	Biochemical Oxygen Demand, five day
CMU	concrete masonry units
CZMA	Coastal Zone Management Act
DEQ	Oregon Department of Environmental Quality
DLCD	Department of Land Conservation and Development
ESA	Endangered Species Act
FEB	flow equalization basin
gpcd	gallons per capita per day
I/I	infiltration/inflow
IFA	Oregon Business Development Department of Infrastructure Finance Authority
MBR	membrane bioreactor
MGD	million gallons per day
MLSS	mixed liquor suspended solids
MMDWF	Maximum Monthly Dry Weather Flow
MMWWF	Maximum Monthly Wet Weather Flow
NEPA	National Environmental Policy Act
NPDES	National Pollutant Discharge Elimination System
O&M	Operation and Maintenance
OAR	Oregon Administrative Rules
ODFW	Oregon Department of Fish and Wildlife
ODGMI	Oregon Department of Geology and Mineral Industries
PCJWSA	Pacific City Joint Water-Sanitary Authority
PER	Preliminary Engineering Report
PIF	peak instantaneous (hourly) flow
R&M	repair and maintenance
RCAC	Rural Community Assistance Corporation
RDG	Rural Development Grants
SBR	sequencing batch reactor plant
SCADA	Supervisory control and data acquisition
SHPO	Oregon State Historic Preservation Office

ACRONYMS (CONTINUED)

SLA	short-lived assets
TSS	Total suspended solids
USDA-RD	U.S. Department of Agriculture Rural Development
USFWS	US Fish and Wildlife Service
UV	ultraviolet
VOC	volatile organic compound
WAS	waste activated sludge
WPCF	Water Pollution Control Facility
WWMP	Wastewater Master Plan
WWTP	Wastewater treatment plant

1. INTRODUCTION

1.1 BACKGROUND AND PROJECT OBJECTIVES

The Pacific City Joint Water-Sanitary Authority (PCJWSA) is a publicly owned water and sewer authority located in Pacific City, Oregon in southern Tillamook County, adjacent to the confluence of the Nestucca River and the Pacific Ocean, at latitude 45° 12' north, longitude 123° 57' west. Pacific City is approximately midway between Lincoln City and Tillamook. The Pacific City Sanitary District was organized in 1974. The Pacific City Water District was formed in 1959. The two organizations shared offices and were joined into one agency in 1998 and called the Pacific City Joint Water-Sanitary Authority. PCJWSA is controlled by a five member Board of Directors.

PCJWSA owns and operates the wastewater treatment plant (WWTP) that serves approximately 1,000 full time residents and up to approximately 5,000 seasonal residents in the unincorporated communities of Pacific City and Woods.

Parametrix completed a Wastewater Master Plan (WWMP) in 2005 and developed a recommended list of WWTP improvements and their costs. The listing and costs were updated in a 2009 update to the WWMP. Appendix A contains the Executive Summary from the 2005 WWMP and the improvement listing from the 2009 WWMP update. A CD copy of the 2005 WWMP is included as an exhibit to Appendix A.

The WWTP has experienced permit violations and recently PCJWSA was fined by the Oregon Department of Environmental Quality (DEQ). PCJWSA desires to implement selected projects from the WWMP improvement list in order to bring the WWTP back into compliance.

To construct these improvements, PCJWSA will need funding assistance. Four organizations are the primary source of funding assistance to public agencies: the DEQ, the Oregon Business Development Department of Infrastructure Finance Authority (IFA), the U.S. Department of Agriculture Rural Development (USDA-RD), and the Rural Community Assistance Corporation (RCAC). These funding organizations published a joint guideline in May 2013 to assist public agencies in preparing planning documents to support their application for funding to improve wastewater systems: *Preparing Wastewater Planning Documents and Environmental Reports for Public Utilities financed by IFA, DEQ, RCAC, USDA-RD, 2013* (Agency Guidelines).

The purpose of this project is to prepare a Predesign Report (Preliminary Engineering Report, or PER [this document]) and Environmental Report to successfully support PCJWSA's application for funding assistance from one of the four funding assistance organizations. Based on meetings and correspondence with DEQ (Pinney 2013), information in the existing WWMP may be supplemented with a Predesign Report and that information will satisfy the requirements of the Agency Guidelines (2013).

1.2 REPORT CONTENT

DEQ agreed that this PER will address the following issues to supplement the 2005/2009 WWMP (Pinney 2013). Subsequent sections of this report cover these items:

- A summary of current National Pollutant Discharge Elimination System (NPDES) permit requirements.
- An update and summary of WWTP flows and loading from the past 3 years.

- An update of population and associated flow and loading projections through 2034.
- An evaluation of the feasibility of four potential options for management of wastewater. These are “big picture” planning level evaluations of the approach to managing wastewater:
    - Build new centralized facilities.
    - Optimize the current facilities.
    - Develop centrally managed decentralized systems.
    - Develop an optimum combination of centralized and decentralized systems.
- An evaluation of options for reuse of wastewater effluent including land application of effluent to neighboring property and reuse of effluent for WWTP washdown.
- An evaluation of options for reuse of wastewater effluent including land application of effluent to neighboring property and reuse of effluent for WWTP washdown.
- An evaluation of options for dewatering biosolids to determine the most cost effective method of reducing the volume of biosolids transported for disposal.
- An alternative evaluation of treatment processes will be conducted. It will consist of a qualitative analysis and comparison of costs for the following:
    - Upgrade the existing WWTP by implementing projects identified in the 2009 WWMP Update.
    - Converting the existing WWTP to a membrane bioreactor plant.
    - Converting the existing WWTP to a sequencing batch reactor plant.
- Based on the above evaluations, an update will be prepared with recommended project improvement listing and costs.
- An Environmental Report meeting USDA requirements is included as Appendix B to the report, and a summary of findings of the Environmental Report is in this report.
- In accordance with the Agency Guidelines (2013), the appendices will include a summary of effluent data, rainfall statistics, a flood plain map, soils map, the current NPDES permit, and a land use map.
- A draft copy of this PER was sent for review by DEQ in October 2014. A copy of DEQ’s approval of the draft PER is in Appendix D.

1.3 SERVICE AREA

The PCJWSA service area includes the communities of Pacific City and Woods. The service area is approximately 1.7 square miles in size. The properties within the service area are zoned as residential, commercial, planned development, or airpark land use types. There currently is one dairy farm located within the service area, and PCJWSA supplies water to that site. Figure 1 shows an aerial map of the Pacific City area and indicates the major streets, sanitary pipelines, pump stations, and PCJWSA service area boundary.

The boundary of the service area was defined in the Community Growth Plan. PCJWSA provides both sanitary and water service to property owners within the service area. PCJWSA may not provide sanitary service to customers outside of its service area. The service area was defined in the Community Development Plan, which was last updated in 1996. The service area defined in the community plan remains in effect for 20 years and cannot be changed during that time period (Krueger 2004).

If Pacific City incorporated and became a city rather than a community, the PCJWSA Board of Directors could modify the service area. However, this would be a lengthy process and incorporation would probably not be done solely to extend the service area boundaries.

1.4 EXISTING WASTEWATER TREATMENT PLANT

A site plan of the existing WWTP is shown in Figure 2. The original WWTP was constructed in 1979. Improvements since the original construction include the following:

- Influent Pump Station was upgraded in 2013.
- Side Hill Screens, the first unit was added in 1991, second unit was added in 2014.
- Flow Equalization Basin and Parshall flume were added in 1998.
- Two Cloth Media Filters replaced the dual-media filter in 2005.
- Ultraviolet Light disinfection system replaced the chlorine disinfection system in 2002.

The WWTP currently consists of an influent pump station, two side-hill screens; a Parshall flume; an in-line flow equalization basin (FEB) with three pumps; two activated sludge aeration basins; two secondary clarifiers; two 10-micron cloth media filters; and an ultraviolet disinfection system. The current WWTP design criteria is in Appendix C1. The discharge is by gravity to the Nestucca River. The WWTP is rated by DEQ to treat an average monthly flow of 0.36 million gallons per day (MGD). Biosolids management consists of an aerobic digester, to which hydrated lime is added, and after appropriate time for pathogen destruction, the biosolids are land-applied.

2. REGULATORY REQUIREMENTS

2.1 NPDES PERMIT

PCJWSA has a NPDES permit number 101519, which became effective on November 1, 2011, and expires on October 31, 2016. A copy of the current permit is in Appendix D. Table 1 summarizes the NPDES permit limitations.

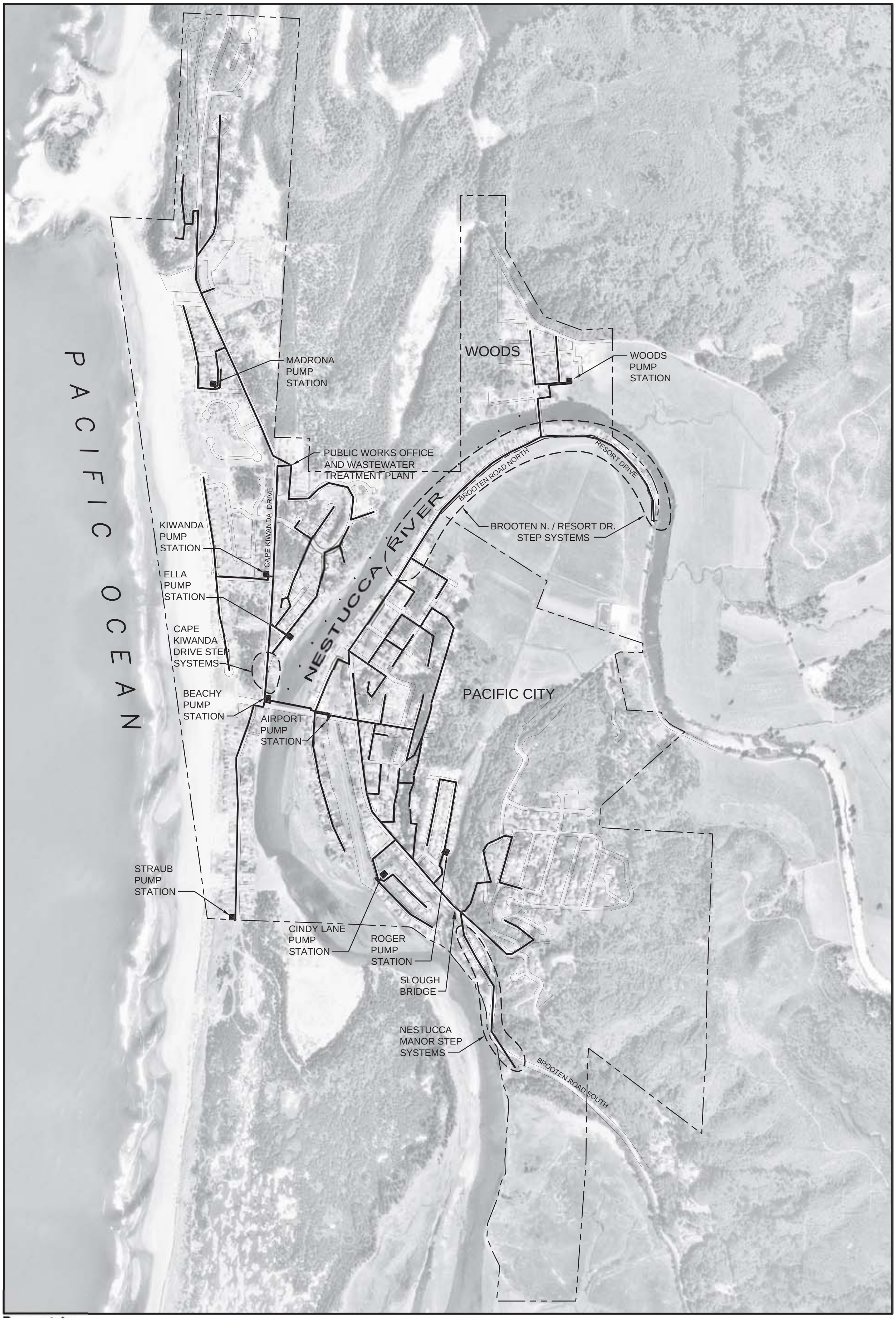
Table 1. Treated Effluent Year Round Limitations

Parameter	Average Effluent Concentrations		Monthly[a] Average (lbs/day)	Weekly[a] Average (lbs/day)	Daily[a] Maximum (lbs/day)
BOD_5	10 mg/L monthly	15 mg/L weekly	30	45	60
TSS	10 mg/L monthly	15 mg/L weekly	30	45	60

a Average dry weather design flow to the facility equals 0.36 MGD. Mass load limits are based upon average dry weather design flow to the facility.

BOD_5 = 5-day biochemical oxygen demand

TSS = total suspended solids



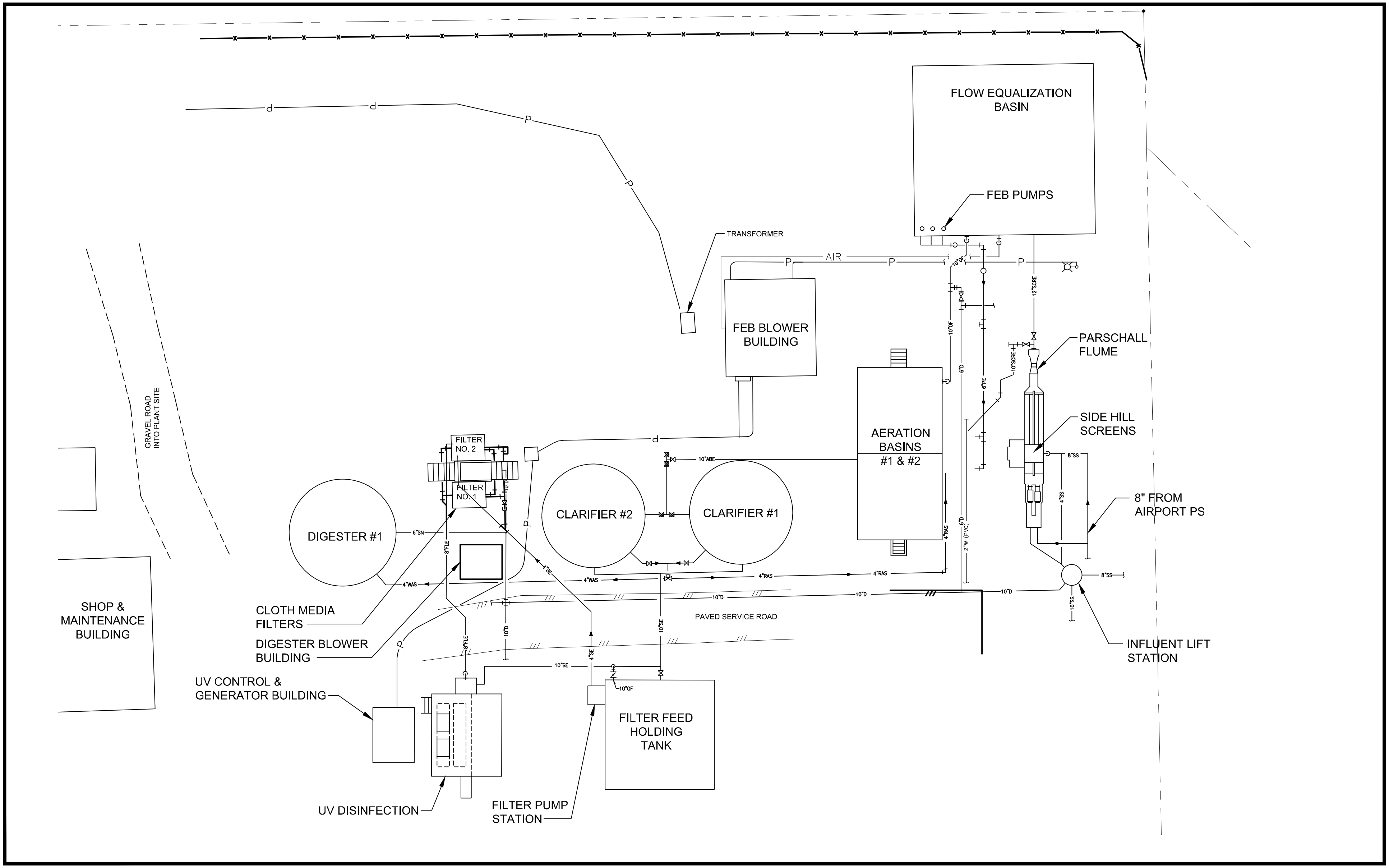
Parametrix DATE: 03/10/05 2:51pm FILE: PO3300004P5F-07

N

LEGEND

SEWER PIPELINE
SERVICE AREA BOUNDARY
PUMP STATION

Figure 1.
PCJWSA Wastewater System Overview



Parametrix

Figure 2
Existing WWTP Site Plan

Other parameters limited year-round include the following:

- *E.coli* bacteria shall not exceed 34 organisms per 100 mL based on a monthly geometric mean. Not more than 10 percent of the samples shall exceed 110 organisms per 100 mL.
- pH shall be maintained between 6.0 to 9.0.
- The 5 day biochemical oxygen demand (BOD_5) and total suspended solids (TSS) removal efficiency shall not be less than 85 percent monthly.
- Not allowed to use chlorine compounds as a disinfecting agent of treated effluent.

2.2 PERMIT EXCURSIONS

The PCJWSA WWTP exceeded monthly and weekly permit discharge limits for TSS and BOD_5 three times in 2012 and two times in 2013. DEQ issued warning letters to PCJWSA in 2011 and 2012 for permit violations. In June 2013, DEQ issued a penalty to PCJWSA for permit violations. The DEQ pre-enforcement notice of April 9, 2013, stated that "the current treatment facility provides your operators with little margin for error." The letter further stated that "without substantive facility changes these violations are likely to recur."

Appendix C2 shows a summary of influent and effluent parameters and a chart of effluent BOD_5 and TSS from 2010 to 2014. This chart shows that permit excursions did not appear to correspond to either the wet season or to seasonal visitor loads; effluent BOD_5 and TSS values could occur through-out the year.

To address these permit violations, PCJWSA initiated identifying sources for funding the needed improvements to eliminate future permit violations.

2.3 NUTRIENT REMOVAL, MIXING ZONE, INFILTRATION/INFLOW ANALYSIS, BIOSOLIDS MANAGEMENT, AND SEWER RATES

Based on discussions with DEQ, the following components of the Agency Guidelines (2013) are adequately covered in other documents or are not applicable, and do not need to be included in the Predesign Report (Pinney 2013):

- Nutrient removal is not an anticipated requirement of future permits.
- A mixing zone study need not be addressed in the Predesign Report because it will be required as part of the next NPDES permit renewal.
- The 2005 WWMP accurately described the existing collection system. There have been recent updates such as the replacement of the Pacific Avenue Bridge force main and Airport Pump Station.
- Because peak flows to PCJWSA occur in warmer months, corresponding to seasonal population peaks, Infiltration/Inflow (I/I) is not a concern, and no further evaluation of I/I is needed. A formal I/I analysis following Environmental Protection Agency (EPA) guidelines is not required. The I/I report prepared by PCJWSA is included as Appendix E.
- The current DEQ approved biosolids management plan submitted in compliance with the permit satisfactorily addresses biosolids management. A copy is in Appendix F.

- A sewer use rate study was conducted as part of the 2009 WWMP Update and any further rate analyses will be addressed by IFA.

2.4 NATURAL RESOURCES, AND LAND USE REQUIREMENTS

2.4.1 Natural Resources

Parametrix prepared a draft Environmental Report for submission to the USDA Rural Development Grants program (RDG). The complete report is in Appendix B. USDA staff reviewed and commented on the Environmental Report. The comments were reviewed by telephone conference with Parametrix and USDA staff on November 21, 2014. A response to the comment letter was prepared on December 9, 2014. The comment response and USDA comments are in Appendix B following the Environmental Report.

The primary goal of this report was to provide brief analysis of the potential impacts to environmental resources from construction of improvements to the PCJWSA WWTP.

The Environmental Report complies with RDG’s requirements regarding conformity with the National Environmental Policy Act (NEPA), Endangered Species Act (ESA), and Coastal Zone Management Act (CZMA), among others.

Some of the requested funds for this project originate with USDA-RUS, and the project requires DEQ approval. Therefore, several Federal and State processes must occur. Federal processes include screening of project impacts for NEPA compliance, determination of any effects to species listed under the federal ESA, and compliance with Section 106 National Historic Preservation Act and CZMA.

The following tasks were completed to support preparation of the Environmental Report and compliance with agency requirements.

- Contacted agency staff including DEQ, State Historic Preservation Office (SHPO), Department of Land Conservation and Development (DLCD), Oregon Department of Fish and Wildlife (ODFW), U.S. Fish and Wildlife Service (USFWS), and the Tillamook County planning department.
- Coordinated with SHPO and the Oregon Legislative Commission on Indian Services to determine appropriate contacts with tribes and to confirm tribal communication protocols.
- Reviewed zoning and summarized land use requirements for proposed improvements.

The Environmental Report addresses the following elements:

- Land Use.
- Floodplains (addressing 100- and 500-year floodplains).
- Wetlands.
- Historic Properties and Archaeology.
- Biological Resources.
- Water Quality.
- Wild and Scenic Rivers Act.
- Coastal Zone Management Act.

- Socio-economic and Environmental Justice.
- Air Quality.
- Transportation.
- Noise.
- Cumulative Effects.

Additional documents addressing grant processes include the following:

- CZMA Consistency Determination:
  - The Environmental Report contains a project description and brief analysis of consistency with local land use designations.
  - A consistency review request was submitted to DLCD.
- No-effect determination addresses the following species:
  - Oregon Coast Coho salmon.
  - Southern resident green sturgeon.
  - Northern spotted owl.
  - Marbled murrelet.
  - Short-tailed albatross.
  - Western snowy plover.

The requirement to conduct a civil rights impact analysis will be completed by the loan specialist. The draft Environmental Report, no-effect determination, and CZMA consistency determination will be submitted to PCJWSA, USDA and DEQ for review. Based on PCJWSA and agency comments, these documents will then be finalized.

2.4.2 Land Use

No changes to land use or zoning are required, and no special permits are required for the proposed project. Necessary permits would be limited to those required for any construction project, such as construction, grading, and development permits. Details of land use issues can be found in the Environmental Report in Appendix B.

There will likely need to be construction and grading permits, as with any construction project. But is not likely to need a Type II or Type III review for changes to the zoning or allowed uses.

3. POPULATION AND WASTEWATER FLOW AND LOADS

3.1 EXISTING AND PROJECTED POPULATIONS

The current population is difficult to precisely estimate because of the seasonal nature of the community. There are permanent residents, estimated at approximately 1,000, and seasonal residents, which can bring the total population to between 2,500 and 5,000.

A recent review of available data from the U.S. Census Bureau, Portland State University, and Oregon Office of Economic Analysis revealed no projections for Pacific City (U.S. Census

Bureau 2013; Portland State University 2013; and Oregon Office of Economic Analysis 2013). Review of the Tillamook County Comprehensive Plan (2013) and calls with Tillamook County staff indicated they had no population data for Pacific City.

The method used to approximate the total current population was to use the number of sewer service connections. As of December 2013, there were 1,352 sewer service connections, of which 1,099 were residential and 169 were residential rentals. There were also 83 commercial services (restaurants, gift shops, grocery stores, offices, and motels) and one industrial service (the Pelican Pub brewery). These commercial and industrial services were not considered separately for estimating the population. Using residential services, there were a total of 1,268 residential and rental service connections.

From the 2005 WWMP, population and persons-per-household estimates were examined from Tillamook County and the U.S. census. In that previous analysis, 2-persons per household best represented the housing density in Pacific City. Based on residential and rental service connections and using 2-persons per household, the current population was estimated as 2,536.

To project future population, the number of service connections added per year was evaluated. Between 1995 and 2014, the growth in service connections per year ranged from 0.3 percent to 7.7 percent, averaging 2.7 percent per year. The highest growth rate occurred in 2005, and the years 2011 to 2014 saw 0.3 to 0.4 percent growth. It is interesting to note that the growth rate since 2000 has averaged 2.4 percent. It is inferred that growth will taper off somewhat as the density increases and the economic growth rate is reduced. Therefore, for the future population projection, a growth rate of 2.5 percent per year was used.

A 20-year period was used for the span of this report. Using a 2.5 percent growth rate, the predicted 2035 population is 4,259. Figure 3 shows a graph of the population projections based on service connection growth and compares it to projected population growth rates from the Tillamook County Comprehensive Plan (2013), and the State Office of Economic Analysis, Department of Administrative Services (2013). The Tillamook County Comprehensive Plan predicts an average growth rate of 0.65 percent and the state predicts an average growth rate of 0.62 percent in Tillamook County from 2015 to 2035.

There are other justifications besides the growth in service connections for using a 2.5 percent growth rate in PCJWSA while state projections for growth are less than 1 percent. Currently, approximately 30 to 35 percent of the homes in PCJWSA service area are occupied year round. There is a real potential for significant numbers of non-permanent residents, who live in the other 65 percent of homes, to retire in Pacific City. There are also approximately 1,000 undeveloped lots. Should more persons sell their first homes and retire in Pacific City (becoming permanent residents), while seeing continued growth in service connections, further coupled with the “crush” of vacationers using the WWTP, the flows and loading can easily meet or exceed the values projected.

3.2 EXISTING AND PROJECTED WASTEWATER FLOWS AND LOADS

DEQ defines flows to WWTPs based on seasonal differences. Typically, in western Oregon, flows are described as Average Dry Weather Flows (ADWF) and Maximum Monthly Dry Weather Flow (MMDWF) for dry periods (May through October) and Average Wet Weather Flow (AWWF) and Maximum Monthly Wet Weather Flow (MMWWF) for the wet season (November through April). DEQ does not typically use an average annual flow to describe flows in western Oregon because of seasonal flow variations due to the rainy and dry seasons. The closest National Oceanic and Atmospheric Administration station that records precipitation is in Cloverdale, Oregon; data from 2009 – 2014 is in Appendix C3. A chart comparing daily rainfall and daily wastewater flows indicates little or no correlation between high flows and high rainfalls at the PCJWSA WWTP. See Figure C3 in Appendix C3.

To estimate future wastewater flows and loads, first the historical trends were evaluated. Unlike other communities in western Oregon, Pacific City does not experience the maximum flows based on the wet season, but based on peak populations from seasonal visitors. Maximum month flows to the Pacific City WWTP typically occur in July or August. Figure 4 shows daily flows from 2010 to 2014. For this period, the annual average flow was 0.135 MGD. The average flow in just the months of July and August was 0.187 MGD. This July and August value is the MMDWF. It was used with the estimated population to determine a per capita flow rate of 74 gallons per capita per day (gpcd). The per capita flow rate was in turn used with population projections to estimate the future MMDWF.

The maximum daily flow also typically occurs in July and August. The maximum daily flow from 2010–2014 was 0.377 MGD (July 2011). The ratio of the maximum daily flow to the MMDWF was 2.01, and this ratio was used to predict future maximum daily flows.

A summary of flows to the PCJWSA WWTP from 2010 to 2013 is shown in Table 2, comparing the typical ADWF, MMDWF, AWWF, and MMWWF values to the average and maximum flows observed in July and August. Table 2 demonstrates why the July and August values should be used for evaluating and projecting flows for PCJWSA.

Table 2. Summary of Flows from 2010-2013

	Million Gallons per Day (MGD)			
Flow Description	**2010–2011**	**2011–2102**	**2012–2013**	**2013–2014**
ADWF (May to October)	0.127	0.156	0.152	0.149
MMDWF (May to October)	0.256	0.377	0.276	0.310
AWWF (November to April)	0.113	0.130	0.134	0.122
MMWWF (November to April)	0.283	0.286	0.324	0.254
July and August Averages	0.143 & 0.186	0.196 & 0.187	0.186 & 0.184	0.188 & 0.184
July and August Maximums	0.215 & 0.239	0.377 & 0.249	0.252 & 0.259	0.310 & 0.233

The peak instantaneous (hourly) flow (PIF) is an important parameter used to size hydraulic facilities. The PCJWSA WWTP does not have flow recording instrumentation to record the PIF, so this value must be estimated. All the flows into the WWTP are pumped from two sources: the Airport Pump Station and the plant influent pump station. The combined flows from these pump stations are routed to the side-hill screens and then to the FEB. Thus, the screens, flume, future grit chamber, and equalization basin must handle the PIF. The remainder of the WWTP must have the hydraulic capacity to manage flows from the pumps from the FEB. To estimate the PIF, a hydraulic analysis previously conducted and approved by DEQ was used (Parametrix 2000). This analysis developed a peaking factor of 5.4 to apply to the MMDWF to estimate PIF.

Historical BOD_5 and TSS loadings to the WWTP have not increased in proportion to the increase in service connections. While service connections increased at about 2.4 percent per year over 13 years, BOD_5 and TSS increased at 7.1 percent and 4.0 percent per year, respectively. Typically BOD_5 and TSS loadings increase in proportion to the population.

An obvious reason and potential cause for an increase in BOD_5 and TSS loading would be the Pelican Pub Brewery. Brewery production over the past 5 years was compared to annual BOD_5 and TSS loadings at the WWTP as shown in Figure 5. While changes in production at the brewery contribute to loads at the WWTP, they do not appear to correspond uniformly to proportional increases at the WWTP. See Table 3. The brewery has an industrial discharge permit and have consistently met permit limits.

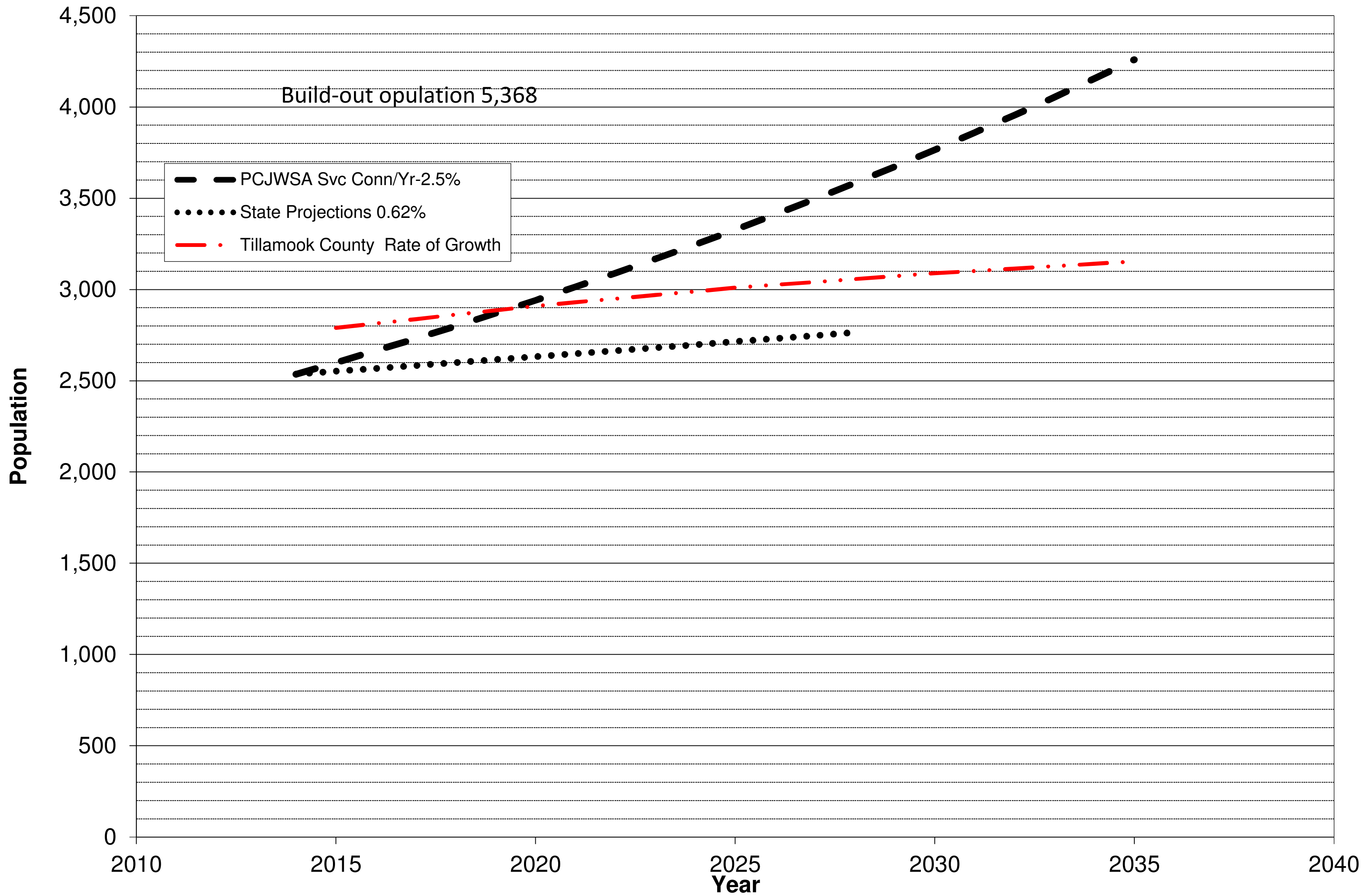


Figure 3. Comparison of Population Projections for Pacific City

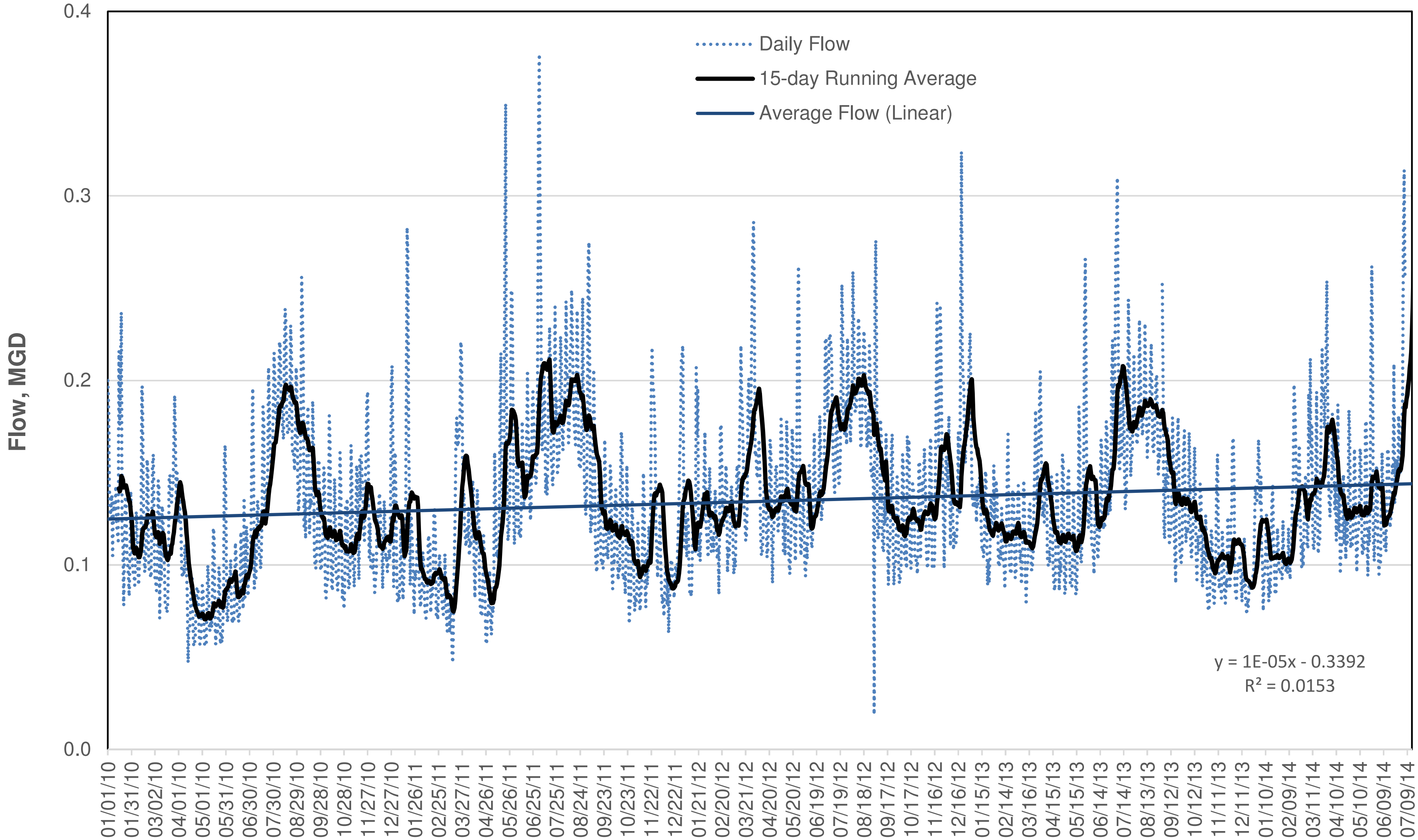


Figure 4. PCJWSA Wastewater Flow Data 2010-2014

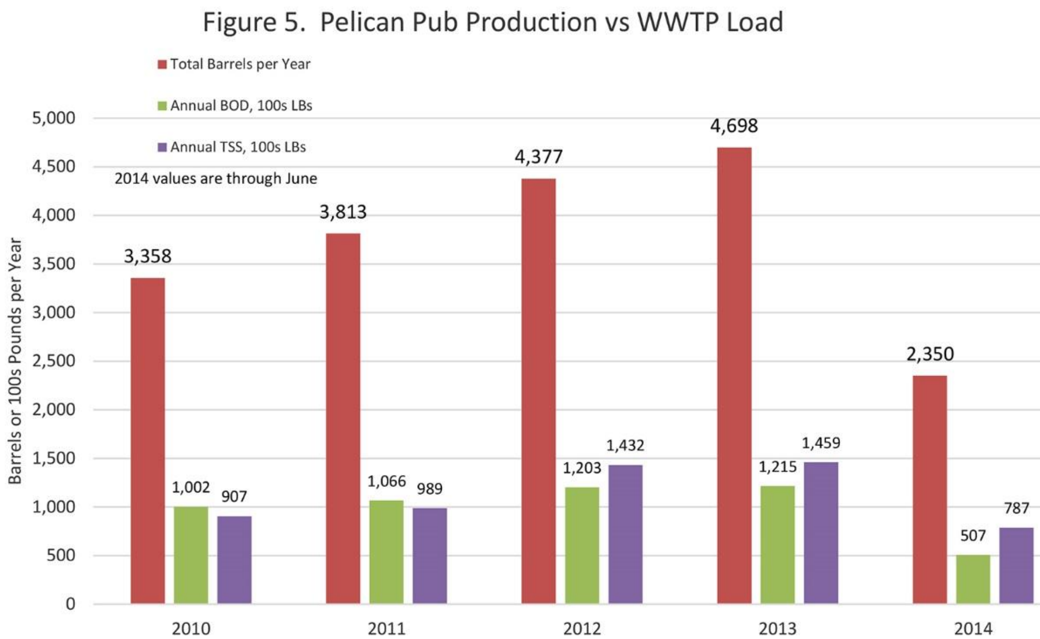


Figure 5. Pelican Pub Production vs WWTP Load

Table 3. Annual Percent Change in Brewery Production Compared to Organic (BOD_5) and Solids Loading (TSS)

	Percent Change			
Parameter	**2010–2011**	**2011–2102**	**2012–2013**	**2013–2014**
Barrels Produced per Year	14	15	7	-50
BOD_5, Pounds per Year	6	13	1	-58
TSS, Pounds per year	9	45	2	-46

Other potential causes of increased rates of organic and solids loading are higher density in the use of seasonal housing. It is common for multiple people (approximately 4 to 10) to stay in motels or rental homes in Pacific City during seasonal peaks. In addition, numerous visitors use rest rooms at restaurants and parks, but are not staying at motels using showers, which could increase the concentration of wastewater.

The maximum organic and solids loadings are important as they dictate the size of aeration and biosolids systems. To predict future organic and solids loadings, data from 2010 to 2014 were evaluated. The maximum month values for this period were first examined, but there was concern that it might undersize the systems. So a running 30-day average was calculated, and the 95th percentile of those values was used to establish the loadings to start the projections. The loadings were then increased by 4 percent per year for BOD_5 and 5 percent per year for TSS. These were not compounded percent increases.

Table 4 summarizes by year projected population, flows, and organic and solids loadings from 2014 through the planning year 2035. These flows and loadings were used in sizing future system needs for the WWTP.

Table 4. PCJWSA Flow and Load Projections

		Wastewater Flows, GPD				Wastewater Loading, ppd	
	Increases at 2.5 percent per year	At 54 GPCD	At 74 GPCD			Using 4 percent increase per year	Using 5 percent increase per year
Year	Population	Average Annual Daily Flow	Maximum Monthly Average Daily Flow	Maximum Day per Year	Peak Instantaneous Flow (hourly)	Max Mo. BOD_5	Max Mo TSS
2014	2,536	136,944	187,664	377,205	1,013,386	559	606
2015	2,599	140,368	192,356	386,635	1,038,720	581	636
2016	2,664	143,877	197,164	396,301	1,064,688	604	667
2017	2,731	147,474	202,094	406,208	1,091,305	626	697
2018	2,799	151,161	207,146	416,363	1,118,588	648	727
2019	2,869	154,940	212,325	426,772	1,146,553	671	758
2020	2,941	158,813	217,633	437,442	1,175,217	693	788
2021	3,015	162,783	223,074	448,378	1,204,597	716	818
2022	3,090	166,853	228,650	459,587	1,234,712	738	848
2023	3,167	171,024	234,367	471,077	1,265,580	760	879
2024	3,246	175,300	240,226	482,854	1,297,219	783	909
2025	3,327	179,682	246,231	494,925	1,329,650	805	939
2026	3,411	184,174	252,387	507,298	1,362,891	827	970
2027	3,496	188,779	258,697	519,981	1,396,963	850	1,000
2028	3,583	193,498	265,164	532,980	1,431,887	872	1,030
2029	3,673	198,336	271,793	546,305	1,467,685	894	1,061
2030	3,765	203,294	278,588	559,962	1,504,377	917	1,091
2031	3,859	208,376	285,553	573,961	1,541,986	939	1,121
2032	3,955	213,586	292,692	588,311	1,580,536	961	1,151
2033	4,054	218,926	300,009	603,018	1,620,049	984	1,182
2034	4,156	224,399	307,509	618,094	1,660,550	1,006	1,212
2035	4,259	230,009	315,197	633,546	1,702,064	1,029	1,242

GPD = gallons per day
GPCD = gallons per capita per day
ppd = pounds per day

4. ALTERNATIVE WASTEWATER MANAGEMENT APPROACHES AND WATER REUSE CONSIDERATIONS

This section describes alternative wastewater management options, as well as evaluates the potential for implementing practices such as water reuse, energy efficiency, and green infrastructure.

4.1 ALTERNATIVE WASTEWATER MANAGEMENT

An analysis of the feasibility of four potential options for alternative management of wastewater is required by the Agency Guidelines (2013). The four options are listed below, and discussion and evaluation of each option follows in this section:

- Build new centralized facilities.
- Optimize the current facilities.
- Develop centrally managed decentralized systems.
- Develop an optimum combination of centralized and decentralized systems.

4.1.1 Build New Centralized Facilities

Building new centralized facilities entails either constructing an entirely new WWTP at a new site or consolidating the current WWTP with a neighboring facility. There were four sub-alternatives considered:

1. Build a new WWTP at a remote site serving PCJWSA.
2. Build a new WWTP at a site neighboring the existing WWTP, utilizing some of the existing infrastructure, and serving PCJWSA.
3. Build a new WWTP at the site of a neighboring WWTP community, serving PCJWSA and that neighboring community.
4. Expand the existing WWTP at the current site, serving PCJWSA and that neighboring community.

Option 1. Build a new WWTP at a remote site serving PCJWSA

Constructing an entirely new WWTP at a new site would require obtaining a new site, routing flows from where they collect at the existing WWTP site and transferring them to the new WWTP with a new pump station and force main, and obtaining a new outfall or connecting into the existing outfall.

If the WWTP were moved some distance from the existing site, not allowing the reuse of the existing outfall, the cost of constructing a new WWTP at a new site, the force mains to transfer flows, and the cost of a new outfall would make it much more expensive, more time consuming, and would not be a feasible alternative.

Option 2. Build a new WWTP at a site neighboring the existing WWTP, utilizing some of the existing infrastructure, and serving PCJWSA

There are over 30 acres of property east and north of the existing WWTP site owned by the Bureau of Land Management (BLM). This property is attractive because it is on higher ground (approximate elevation 85 feet above sea level [ASL]) and it is out of the tsunami inundation zone. The existing WWTP is at an approximate elevation of 25 feet ASL, within the tsunami inundation zone (ODGMI 1995). PCJWSA is currently negotiating with BLM to explore use of this property for siting a water reservoir. For the WWTP upgrade to utilize this BLM property, it is assumed that the existing headworks and FEB would be maintained at the current site. The pumps in the FEB would be upsized to provide sufficient head and a new 12-inch-diameter pipeline routed to the new site. The secondary and tertiary treatment process upgrades (activated sludge, clarifiers, and filters; or SBR and filters; or MBR) and biosolids processes would be conducted at the new site. The two existing tertiary filters would be relocated to a new basin at the new site. A new ultraviolet (UV) basin would be constructed and the existing

UV banks would be relocated to the new site. A new effluent pipe would be routed down from the site and connected to the existing outfall pipe. Relocation of existing equipment would be phased after the new site was on-line. The approximate construction costs are listed below.

- Further upgrade of pumps in Flow Equalization Basin: $25,000.
- New force main from the Flow Equalization Basin to new WWTP site, 1,200 feet of 12-inch pipe: $70,000.
- WWTP upgrade at PCJWSA: $9.5 to$10 million (as described in subsequent analyses).
    - New filter sump, piping, and relocate two tertiary filters: $100,000.
    - New UV basin, relocate existing UV banks: $130,000.
    - Yard piping: $40,000.
- New outfall to connect to existing outfall, 1,200 feet of 12-inch pipe: $70,000.
- New administration building, 2,000 square feet: $300,000.
- Site work: $300,000.
- Property lease: $500,000.
- Total Construction Costs: $10.7 to $11.2 million.

The high cost of this option makes it infeasible.

Option 3. Build a new WWTP at the site of a neighboring WWTP community, serving PCJWSA and that neighboring community

The nearest neighboring WWTPs are in Cloverdale which is 7 miles away, Hebo which is 9 miles away, and Neskowin which is 10 miles away. Because Cloverdale is the nearest facility, the approach would be as follows:

- Use the existing Airport Pump Station as a central point. It already collects sewage from all of the service area east of the Nestucca River. New pumps would be needed to provide the higher discharge head and flow.
- The existing influent pump station at the WWTP would be changed out to pump to the Airport Pump Station. New pumps would be needed to provide the higher discharge head to pump to the Airport Pump Station. The existing force main from the Airport Pump Station to the WWTP would be re-used, but flow direction would be reversed.
- A new force main would be needed from the Airport Pump Station to the Cloverdale WWTP. Six miles of new 12-inch pipeline would be needed. The most feasible pipeline alignment would be along Old Woods Road, to avoid the higher traffic encountered and Oregon Department of Transportation permits needed if the alignment was in US 101.
- The existing Cloverdale WWTP consists of a “donut” hole activated sludge facility constructed in 1978 and with a dry weather capacity of 0.04 MGD. To utilize this option would require constructing a 2-MGD WWTP on the site and upsizing the existing outfall.
- The Cloverdale WWTP discharges into the Nestucca River. The NPDES permit would need to be revised and reissued, requiring added time.

The estimated construction costs for transferring flows to Cloverdale WWTP are listed below:

- Upgrade/retrofit the Airport and Influent Pump Stations: $100,000.
- New force main from Airport Pump Station to Cloverdale WWTP: $2 to $3.2 million.
- New WWTP and outfall at Cloverdale: $10 to $11 million.
- Total Construction Costs: $12.1 to $13.3 million.

The Hebo WWTP has a dry weather capacity of 0.025 MGD and discharges into Three Rivers. The approach used for Cloverdale would work for Hebo, but the length of the force main would be longer, and portions of the pipeline alignment would need to be in US 101 for the last 2 miles.

The Neskowin WWTP has a dry weather capacity of 0.2 MGD and discharges into Neskowin Creek. The approach used for Cloverdale would work for Neskowin, but the length of the force main would be longer, and pipeline alignment would need to be in US 101 for 7 miles.

The cost of retrofitting the existing pump stations, a new force main to any of these other WWTPs, and a new 2-MGD WWTP and outfall would make any of these options infeasible.

Option 4. Expand the existing WWTP at the current site, serving PCJWSA and that neighboring community

This option was considered only for Cloverdale. It is similar to Option 3, except the pump station would be installed at the Cloverdale WWTP. The advantage is the pump station would have a smaller capacity and the force main would be smaller diameter. The NPDES permit held by PCJWSA would need to be modified to allow it to accept the added flows. The approach would be as follows.

A new pump station would be constructed to pump the peak wet weather flows. Current Cloverdale dry weather flows are 40,000 gpd, or 28 gallons per minute (gpm). Even with a 6:1 peaking factor, the peak flow would not dictate the needed pump size. The pumps would be sized at a pumping rate to maintain solids in suspension in the force main. For the distance involved, a 6-inch-diameter pipeline is recommended. The force main would follow Old Woods Road from the Cloverdale WWTP to the PCJWSA Airport Pump Station. To maintain a minimum scouring velocity of 3 feet per second in a 6-pipeline, two 300-gpm pumps would be provided. The estimated construction costs are listed below.

- New duplex submersible pump station: $500,000.
- New force main from the Cloverdale WWTP to the Airport Pump Station: $1.6 to 2.4 million.
- WWTP upgrade at PCJWSA: $9.5 to $10 million (from subsequent analyses).
- Total Construction Costs: $11.6 to $12.9 million.

This option is not deemed feasible for the following reasons. There are approximately 242 residents in Cloverdale. The added costs for the pump station and force main over and above the WWTP upgrade that PCJWSA would conduct would be passed on to Cloverdale. Additionally, PCJWSA would be due a service charge to treat the added flows. These added costs to Cloverdale bring them no real benefit since their WWTP is currently in compliance. There are also added risks that Cloverdale takes on by pumping sewage 6 miles. The force main could potentially be broken or leak from construction activity, flooding, or other events.

4.1.2 Optimize the Current Facilities

This option has the most merit and is discussed in greater detail in subsequent sections.

4.1.3 Develop Centrally Managed Decentralized Systems

This option would entail decommissioning the existing WWTP and constructing decentralized treatment systems serving clusters of homes.

According to the US Environmental Protection Agency (2010), there are two approaches for decentralized treatment that can be summarized as follows:

- Conventional decentralized systems, such as septic tanks with soil dispersal fields (drainfields).
- Advanced decentralized systems, designed to pretreat septic tank effluent before discharge to drainfields. Examples include elevated mound systems, aerobic treatment units, and media filters. Another alternative is the submerged flow wetland, or vegetative submerged bed, which was not considered further because of the larger amount of land required.

Properly designed and maintained septic tank/drainfield systems can serve the wastewater treatment needs of a population adequately. However, regional septic systems by nature contain a number of points of possible failure distributed over a large area, which can threaten the health of the individual system owner, community, or local ecology in the event of a malfunction. Drainfield failures, for example, caused by overloading and/or plugging of the soil are common sources of both groundwater and surface water contamination by fecal coliforms and nutrients. In addition, individual homeowner maintenance of each system varies, which introduces considerable heterogeneity in septic tank operations that can be contentious or difficult to resolve if any issues with local contamination or other problems arise.

All of these decentralized systems require drainfields. The original WWTP in Pacific City was constructed because the existing septic tank drainfields were failing. Soil conditions were not uniformly suitable in the community for drainfields. In addition, current development has led to more dense housing with lots that are too small to support drainfields. Thus, decentralized treatment systems are not feasible.

4.1.4 Develop an Optimum Combination of Centralized And Decentralized Systems

Neither the centralized option nor decentralized option described above was feasible, so combining them is also not feasible.

4.2 WATER REUSE, ENERGY EFFICIENCY, AND GREEN INFRASTRUCTURE

4.2.1 Water Reuse

Recycled water refers to any treated effluent from a domestic wastewater treatment system that (as a result of treatment) is suitable for a direct beneficial purpose [OAR 340-055-0010(13)]. The April 2008 revisions to Oregon's Recycled Water Use Rules allow the use of recycled water for beneficial purposes so long as the use provides a resource value, protects public health, and protects the environment (OAR 340-055-0007). Recycled water use in Oregon requires at a minimum an NPDES or Water Pollution Control Facility permit, and a Recycled Water Use Plan.

The new WWTP will produce water that has the potential to meet Water Reuse Rules and Class A requirements. According to DEQ (2009), there are three major beneficial uses for recycled water:

- Irrigation – crops not intended for human consumption, nursery, sod, animal grazing, golf courses, cemeteries, and industrial or business campuses. The level of treatment dictates which beneficial use can receive treated effluent. For example, parks, playgrounds, and landscaping accessible to the public must receive effluent having Class A treatment.
- Industrial, Commercial, or Construction – aggregate washing, dust control, non-structural firefighting using aircraft, cooling water, sewer flushing, stand-alone fire suppression systems, non-residential toilet or urinal flushing, commercial vehicle washing, and fountains when the water is not available for human consumption.
- Impoundments or Artificial Groundwater Recharge – landscaping impoundments, restricted recreational impoundments, and artificial groundwater recharge.

Crop irrigation is not feasible because there are no crops within reasonable distance from the WWTP. The nearest irrigated crops are in Cloverdale, over 6 miles away. Impoundments are not located within a reasonable distance from the WWTP. The neighboring property to the WWTP is owned by BLM and leased by PCJWSA for one of their wellfields. That groundwater is a direct potable water source and the water table is relatively close to the surface and would not be suitable for aquifer recharge. There are no applicable industrial or commercial users that have fire suppression, cooling towers, vehicle washes, or fountains.

Potential uses for recycled water at the PCJWSA WWTP include the following:

- Washwater for screenings, general plant washdown, and filter wash.
- Sewer flushing. This will require a holding tank.

The above options can be examined in more detail and potentially implemented during detailed design.

4.2.2 Energy Efficiency

Potential savings in power use can be achieved through the following measures:

- Use of super premium high efficiency (greater than 90 percent) motors on all equipment will result in power savings.
- All new structures will fully comply with the Oregon Energy Code and utilize high efficiency insulation.
- Variable frequency drives for blowers can be coupled with dissolved oxygen sensors in the aeration basins to optimize blower operation. This runs the blower at the needed speed to provide the appropriate level of dissolved oxygen, but does not over-aerate and waste electrical energy.
- Variable frequency drives for pumps optimizes pump run time and saves on power use.
- Raising the walls on the aeration basins will allow flows to be transmitted to the clarifiers and filters by gravity, instead of being pumped as is currently practiced. Eliminating the need to pump will yield a significant energy savings.
- Control of the WWTP with a programmable logic controller (PLC) can optimize power demand and reduce peak power use.
- Use of energy efficient fixtures for lighting.

4.2.3 Sustainability and Green Infrastructure

Considerations for sustainable practices and green infrastructure are discussed below:

- Leadership in Energy and Environmental Design (LEED)-certified structures. This is a certification of use of sustainable materials of construction, water conservation, and energy use. Obtaining LEED certification increases design costs, construction costs, and there is an added cost to become LEED-certified. LEED certification is most applicable to structures which are occupied, such as offices or apartments, because much of the energy savings come from of heating and cooling systems. This is not applicable to the proposed new buildings at the WWTP. However, there are sustainable, green approaches to construction that can be adopted without obtaining the LEED certification.
- By implementing a biosolids dewatering system, the volume of water in the solids is greatly reduced. This will reduce the volume of biosolids to haul, which will reduce the number of trips by the truck. Currently solids are hauled at 1.5 percent solids. If 15 percent solids is achieved, the volume hauled will be reduced by a factor of 10. This will lead to lower fuel usage, lower vehicle maintenance costs, and reduced labor costs.
- A potential to manage stormwater is the use of eco-roofs. This consists of a slightly sloping roof with a layer of soil and native plantings over a waterproof membrane. This is not applicable for the generator building but is potentially feasible for the biosolids building. Implementing an eco-roof requires increased structural capacity of the roof and supporting structure. The cost of the building increases. The feasibility of using an eco-roof will be investigated during detailed design.
- Specify domestic ductile iron pipe, which is made from 93 percent recycled scrap steel.
- Submit and process deliverables (reports, drawings, correspondence, construction submittals) electronically to reduce paper use.
- Specify paint coatings that have minimal to no volatile organic compound content.

5. EVALUATION OF ALTERNATIVE TREATMENT PROCESSES

5.1 OVERVIEW OF PROCESSES

Three alternative approaches were evaluated for upgrading the existing WWTP.

- Upgrade the existing activated sludge WWTP in general as described in the WWMP.
- Convert the existing WWTP to a sequencing batch reactor (SBR) plant.
- Convert the existing WWTP to a membrane bioreactor (MBR) plant.

For each alternative, flow and loadings under current and future conditions were provided to representatives of equipment manufacturers and technical proposals were requested. Information from these proposals was developed into design criteria. Appendix G contains details on the design criteria for each alternative and technical proposals from the equipment representatives. Data on equipment common to all the alternatives is in Appendix G1. A description of each alternative and associated advantages and disadvantages is presented below. This is followed by comparison of alternatives using a matrix and weighted evaluation criteria.

Common to all the alternative approaches are the following improvements:

- **Headworks improvements.** The current WWTP does not have grit removal equipment. A new grit tank, grit pump, grit classifier/washer, and screenings compactor are recommended. The system would be sized for over 2.0 MGD. A second side-hill screen was added in 2014. The MBR process would require new screens with smaller slot sizes of 1 or 2 mm.
- **Replacement of pumps in the 82,000 gallon FEB.** Currently, at periods of high flows, all three pumps (each rated at 170 gpm) are required to provide adequate flow. Regulatory requirements include redundancy such that flows can be pumped with the largest pump out of service. Pumps would be provided with an individual capacity of 350 gpm (0.5 MGD). With two (out of three) pumps operating, a firm capacity of 700 gpm (1.0 MGD) would be provided, which is sufficient for post-equalization flows. Replacement discharge piping and valves will also be provided.
- **Filter Feed Holding Tank.** Currently, this 32-foot square tank with a usable volume of 38,000 gallons is used as a wet well for the feed pumps for the cloth media filters. For the Activated Sludge and SBR options, the tank would still fulfill this role. This tank also provides the operator with the ability to hold effluent in the event of a process upset, and it would be retained for all options for this purpose. The tank has a flat floor and accumulates solids. Improvements to this tank would be constructing a sloped floor. For options retaining the cloth media filters, the filter feed pumps would be replaced—this is described in the appropriate section.
- **A second UV light disinfection system.** The previous UV upgrade in 2002 installed channels and empty conduits which allow installation of future UV modules/banks with minimal new construction. Two duplicate UV banks would be installed parallel to the existing unit, providing a redundant UV system at typical flows, and a total capacity of 2.0 MGD to handle future peak flows.
- **Improvements to the existing aerobic digester.** Provide a new coarse bubble aeration system, two new blowers, and associated piping and valves.
- **New aerobic digesters in a square concrete tank, coarse bubble diffusers, blowers, pumps, piping, and valves.** Note that originally one added digester was envisioned, however, future loading dictates that added capacity is needed and two rectangular units are recommended to provide staged digestion.
- **A new biosolids dewatering system housed in a new building.** The specific dewatering technology is dependent upon outcome of the analysis in the subsequent section. As part of that biosolids system, a new modular lime handling system is envisioned.
- **A new standby diesel generator and automatic transfer switch housed in a 26 by 17 foot expansion of the existing blower building.** The generator capacity is described in a subsequent section.
- **Instruments and controls.** New unit processes will have integrated control panels. Level sensors (ultrasonic) with backup floats will be provided in all pumped systems. Dissolved oxygen meters will monitor aeration systems. New flow meters and a new level sensor for the Parshall flume will be provided. A supervisory control and data acquisition (SCADA) system will be included to make the operation easier to monitor and to increase reliability.

5.2 DESCRIPTION AND ADVANTAGES AND DISADVANTAGES OF ALTERNATIVES

5.2.1 Activated Sludge

There have been excursions exceeding permit limits for BOD_5 and TSS. Appendix C2 contains a summary of BOD_5 and TSS and a graph showing when these excursions occurred. The graph shows that the excursions do not appear to correspond to wet weather or to the seasonal visitor load, but occur throughout the year. The capacity of the existing aeration basins and shallow secondary clarifiers (8-foot side water depth) were determined to be limiting factors and contributed to the inability of the WWTP to consistently meet permit requirements. The BioWin model was used to determine design parameters for improving the activated sludge process. The model provided output on several design parameters including aeration air, effluent quality, and waste sludge quantity. The design criteria for the activated sludge process are included in Appendix G2 along with technical proposals from manufacturers' representatives. Figure 6 shows the proposed site layout for the activated sludge alternative. The below listed improvements are recommended for upgrading the existing activated sludge treatment system.

- Replacement of existing mechanical aeration system with fine bubble diffusers and associated air piping, valves, and blowers in the two existing aeration basins. To accommodate clarifier improvements, this also entails raising the walls of the existing aeration basins to provide sufficient head for flows to go through the new clarifiers and filters without the need for pumping. This feature will reduce power needs and improve effluent quality by bypassing the solids accumulation and resuspension that occurs in the holding tank.
- Addition of a third aeration basin located on the east side of the existing basins. The new basin would include new fine bubble diffusers and supporting piping and valves.
- Clarifier improvements.
  - In the 2005 WWMP, it was envisioned to improve the existing clarifiers by adding scum beach/skimmer, and peripheral baffles. However, these improvements would still depend on 8-foot-deep clarifiers. Current practice is for new clarifiers to be at least 14 feet deep to provide a buffer for the rising sludge blanket during flow surges and prevent solids carry-over from the sludge blanket.
  - Originally, one additional (third) clarifier was envisioned. After evaluation, it was felt that retaining the two existing shallow clarifiers with one larger, deeper clarifier would not provide adequate redundancy. So it was decided to add two new 35-foot-diameter circular secondary clarifiers, each sized to take the maximum monthly average daily flow. During peak hourly events, both clarifiers would be needed. Having a second clarifier also allows one clarifier to be taken out of service for maintenance during lower flow periods.
  - Supporting equipment would also be included such as return-activated sludge (RAS) pumps, waste-activated sludge (WAS) pumps, piping, valves, and flow meters.
- Filter Feed Holding Tank. As described under improvements applicable for all options, this tank has a flat floor and accumulates solids. Improvements to the tank would include providing a sloped floor in the tank. In addition, the existing dry pit horizontal filter feed pumps are undersized and from the original 1979 construction. They would

be replaced with submersible pumps on slide rails. The tank would be provided with baffles around the pumps to prevent solids from being pumped to the filters. The floor would slope to a sump to make cleaning easier.

- Currently, the two cloth media filters have a capacity of 1 MGD. Projected future flows will exceed this capacity. A new (third) tertiary cloth media filter and associated piping and valves are needed to accommodate future flows and provide needed redundancy.

Advantages of Activated Sludge

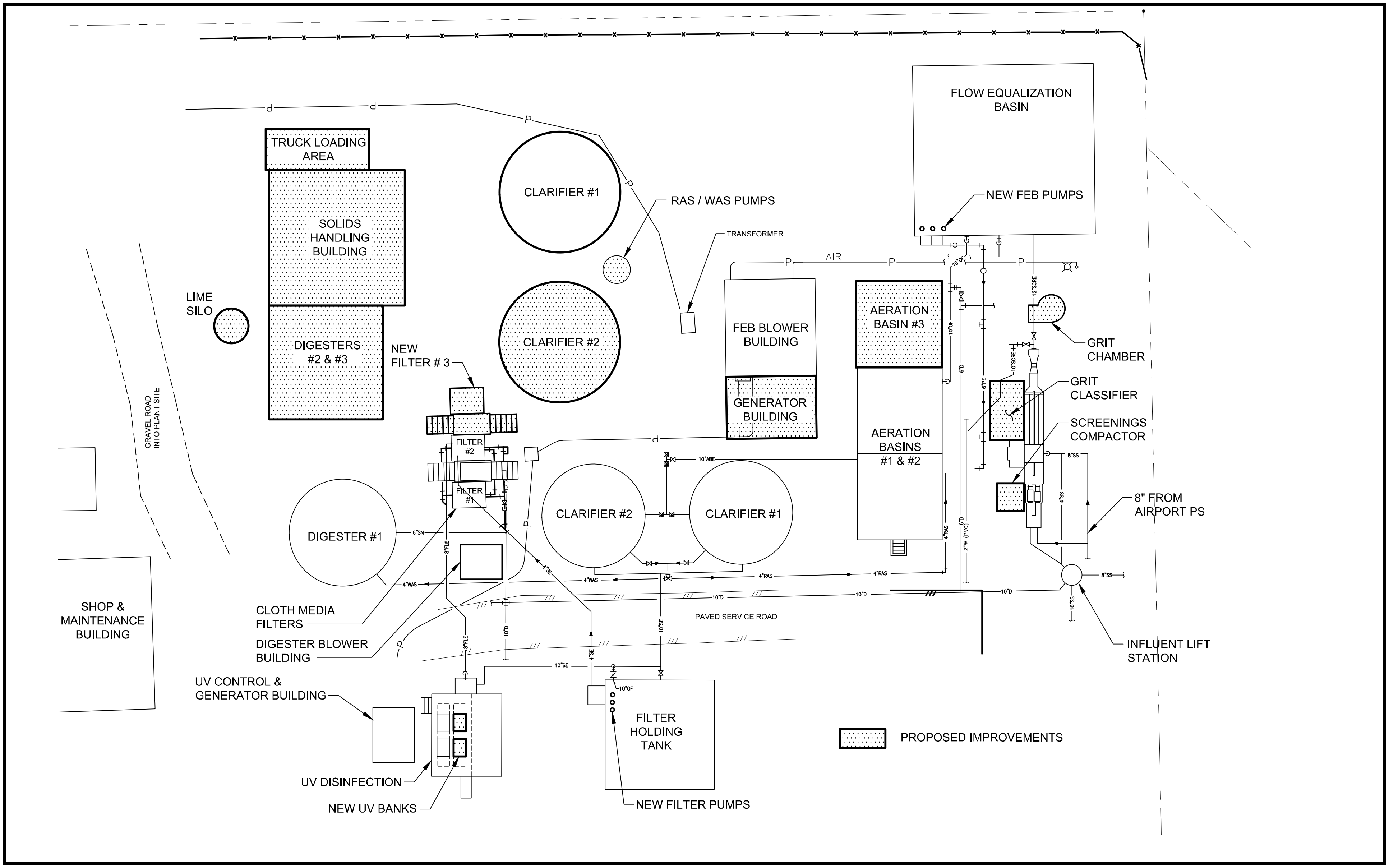
- Great process familiarity. This is the process that current operators have been utilizing for many years.
- Maximizes use of existing aeration basins.
- Minimal need for new process flow and no piping needs to be upsized.
- Can be modified by adding anoxic zones to provide for nutrient removal

Disadvantages of Activated Sludge

- Requires added excavation and concrete for clarifiers when compared to SBR or MBR.
- When operated in a continuous flow configuration, as is done in PCJWSA, the activated sludge process can be operationally difficult to control when it is subjected to highly variable flows and loads.
- Construction would need to be phased, building the third aeration basin and replacing the pumps in the flow equalization basin, and then sequentially taking each existing aeration basin out of service prior to raising the wall height and installing the diffused aeration systems.

5.2.2 Sequencing Batch Reactor

The SBR process is used effectively in many communities the size of Pacific City to treat organic loads and remove solids from wastewater. The SBR treats flows in batches. Each batch includes phases for filling, aerobic reaction, settling, and decanting (emptying). Additional phases can be included to provide anoxic phases for nitrogen removal. The SBR system would include two parallel basins. Each SBR uses the same basin for aerobic reaction as for settling, thus eliminating the need for separate clarifiers. During the settling cycle, the tank mixing and aeration are stopped to provide completely quiescent conditions—which makes for excellent solids removal—an important aspect for any treatment system. Appendix G3 contains the design criteria for the SBR, manufacturer’s technical quotations, and an EPA bulletin describing the process in more detail. The SBR quotation includes three blowers (one duty for each SBR and one standby), a control panel, influent valves, mixers, decanters, pumps, retrievable fine bubble diffuser equipment, and level sensors. Materials of construction would be concrete tanks with stainless steel for exposed or submerged metallic features.



Parametrix

N

Figure 6
Activated Sludge Site Plan

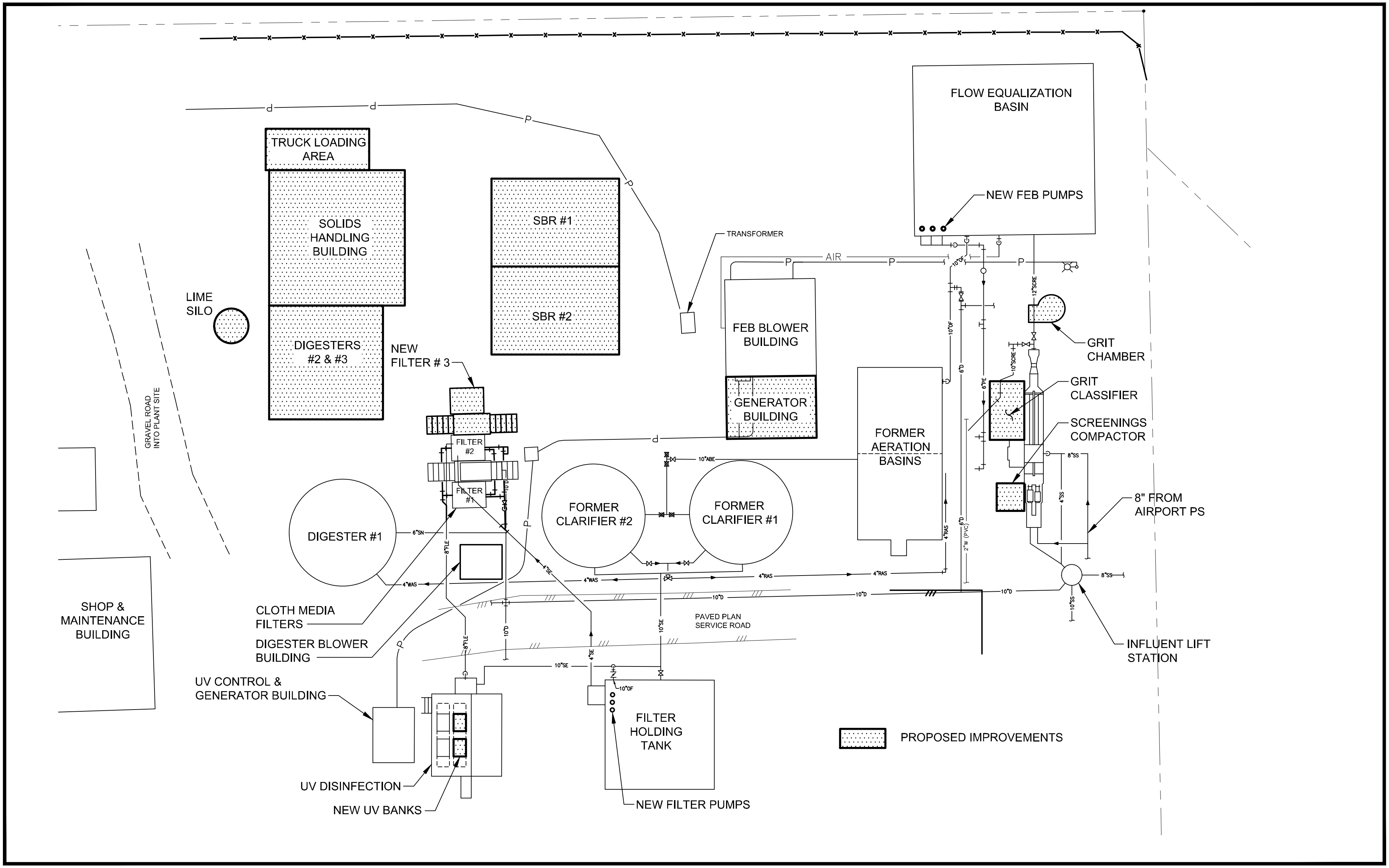
For Pacific City, modification to the existing headworks, flow equalization basin, cloth media filters, and UV disinfection would be the same as for the activated sludge process. See Figure 7 for a proposed site layout of the SBR alternative. Pumped flows from the equalization basin would alternate between the SBR tanks for the filling cycle. While one tank is filling, the second tank would be going through mixing, aeration, settling, or decanting cycles. During the decant cycle, flows would be directed to the holding tank, if desired, then pumped to the cloth media filters and then the UV disinfection basin prior to discharge. Use of the holding tank should not normally be necessary.

Advantages of SBR

- The process utilizes less equipment and is therefore simpler to operate and maintain.
- Eliminates the need for clarifiers and associated costs for excavation and concrete. This means a smaller footprint on the site. Also eliminates need for maintenance of clarifier equipment.
- System programming allows significant flexibility. The process can be adjusted for different cycles, such as anoxic cycles, to provide nutrient removal (this reduces available basin volume).
- Systems are typically highly automated, reducing operator attention.
- The new system could be constructed separately from the existing WWTP with minimal impact to its operation.
- Removable aeration diffusers make the system easier to maintain.
- SBR process has more operational flexibility in adjusting to significant seasonal flow patterns, summer versus winter.
- If the SBR option is implemented, the existing aeration basins and clarifiers could be converted to aerobic digesters. This could save significantly on construction costs for excavation, dewatering, and concrete.

Disadvantages of SBR

- The process would require operators to learn a new treatment system.
- Requires more sophisticated controls.
- Higher level of maintenance (compared to conventional systems) associated with more sophisticated controls, automated switches, and automated valves.
- Potential of discharging floating or settled sludge during the decant phase with some SBR manufacturers.
- When the SBR is in decant cycle, it discharges the working volume of the tank, which can overwhelm downstream processes. The flow rate is estimated at 755 gpm and total volume is 48,400 gallons. Sufficient downstream equalization in existing holding tank needs to be evaluated in detailed design.



Parametrix

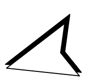


Figure 7
SBR Site Plan

5.2.3 Membrane Bioreactor

MBRs combine the biological process with membrane technology by submerging membrane cartridges within an activated sludge basin. Within one basin, a high standard of treatment is achieved, replacing the conventional clarifier and filters needed to achieve tertiary treatment.

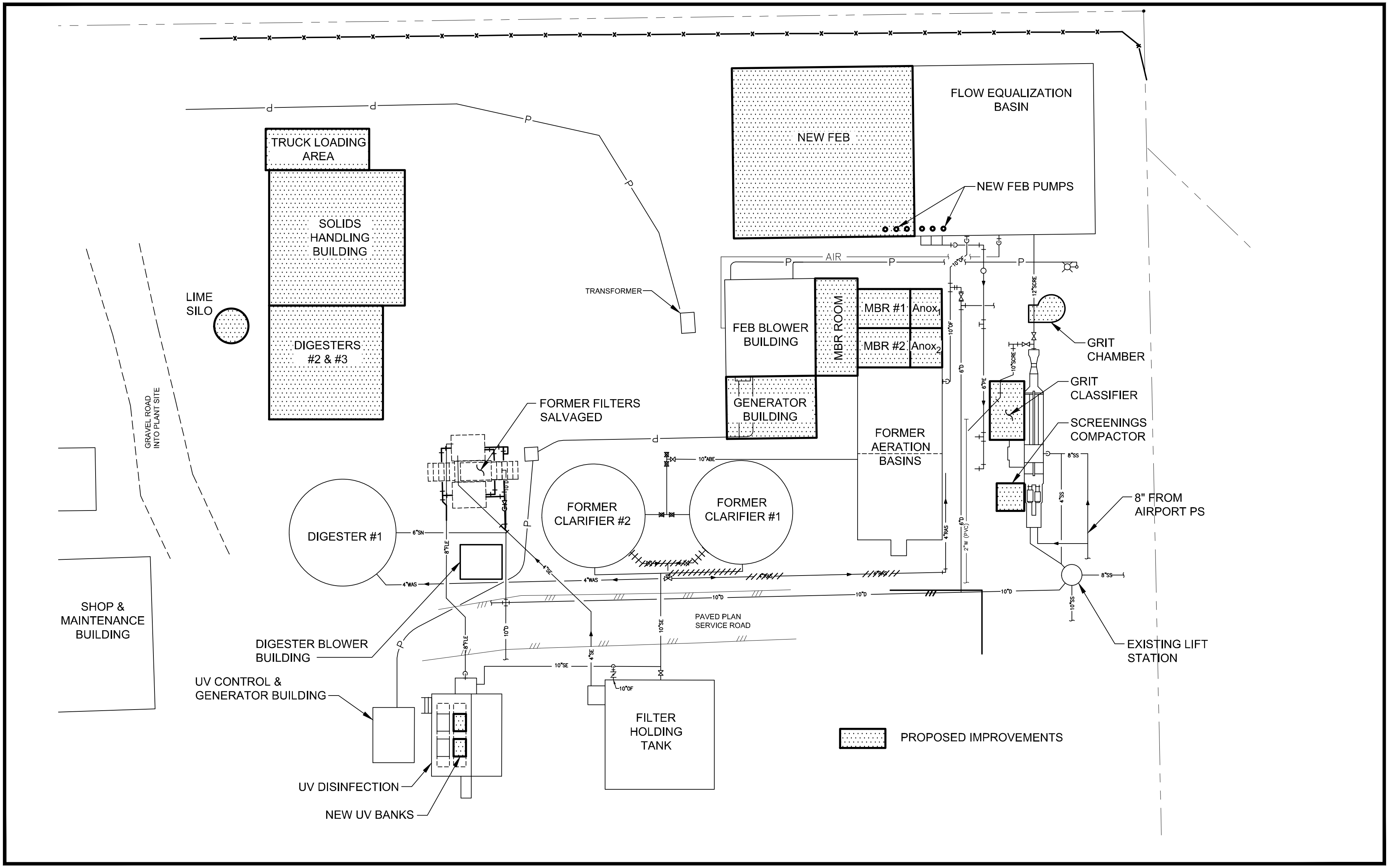
The membranes have pore openings ranging from 0.01 to 0.1 microns, which capture microorganisms, reducing their concentration in the effluent. MBRs typically operate at a higher mixed liquor suspended solids (MLSS) concentration and older sludge age. Appendix G4 contains the design criteria for the MBR, the manufacturer's technical quotation, and an EPA bulletin describing the process in more detail. For Pacific City, the UV disinfection would remain the same as with activated sludge and SBR. Modifications to the existing flume would be needed, and finer influent screens would be provided. A second flow FEB required to minimize flow peaks to the MBR. See Figure 8 for a proposed site layout for the MBR alternative. Flows from the equalization basin would be pumped to both of the MBR tanks simultaneously. Upon passing through the MBR, flows would be directed to the UV disinfection basin prior to discharge.

Advantages of MBR

- Eliminates the need for clarifiers and cloth media filters and associated costs for excavation and concrete. Also eliminates need for maintenance of clarifier and filter equipment.
- The MBR has the smallest site footprint of the alternatives considered.
- Process can be adjusted to provide nutrient removal.
- Effluent from MBRs have lower concentrations of bacteria and TSS, enabling high level of disinfection, easing the load on the UV system.
- Systems are highly automated, reducing operator attention.
- Effluent is highly polished and ready for reuse applications.
- The new system could be constructed with minimal impact to the operations of the existing WWTP.
- If the MBR option is implemented, the existing aeration basins and clarifiers could be converted to aerobic digesters. This could save significantly on construction costs for excavation, dewatering, and concrete.

Disadvantages of MBR

- The process would require the most significant changes from current operational practices.
- Requires a second FEB.
- Requires 2-mm screens at the headworks. This increases the volume of screenings for disposal.
- Higher level of maintenance (compared to conventional systems) associated with more equipment and automated valves.
- The MBR requires replacement of the membranes about every ten years, at a cost of about $1,000,000.
- MBR has the highest capital and O&M costs of alternatives considered.
- Membranes are susceptible to fouling.



Parametrix

Figure 8
MBR Site Plan

5.2.4 Treatment Alternative Costs and Comparisons

5.2.4.1 Treatment Alternative Construction Costs

A summary of construction costs for treatment alternatives is presented in Table 5. Details for development of the construction costs are in Appendix I and discussed relative to other factors in a subsequent section.

Table 5. Capital Cost for Treatment Alternatives

Option	Cost
Activated Sludge	$9,483,300
SBR	$8,573,600
MBR	$10,013,800

5.2.4.2 Comparison of Treatment Alternatives

In this section, evaluation criteria are described and the treatment alternatives are compared against selected criteria in an evaluation matrix. The criteria are listed and where not self-explanatory, briefly described below:

- Treatment dependability – how dependably the process will meet permit requirements. Also, how will process respond to variations in flow and loading?
- Constructability – complexity of construction as it relates to needing more sophisticated contractors to conduct the work.
- Ease of operation – more complicated systems are more difficult to operate. More automated systems are easier to operate.
- Ease of maintenance – access. More complex items require specialized support. Added equipment means there is more to maintain.
- Construction cost.
- Annual operating cost for power, chemicals, materials, and operational labor.

The criteria were first assigned an importance factor between 1 and 5 that compares each criterion independent of the options. See Table 6. Higher numbers represent more important issues or more influence on feasibility. Each criterion was then given a raw score relative to other options using a rating of 1 to 10, with 10 being a more favorable rating. The raw score was then multiplied by the importance factor to determine a weighted score for each criterion and each option. The weighted scores were then summed for each option in Table 6. Based upon this evaluation, the options were ranked from most favorable (highest score) to least:

1. SBR: 211
2. Activated Sludge: 195
3. MBR: 178

Note that the ratings for importance factors and raw scores on next page need to be adjusted based on PCJWSA selection of importance factors.

Table 6. Treatment Process Option Evaluation Matrix

Criterion	Importance Factor	Activated Sludge		SBR		MBR	
		Raw	Wtd	Raw	Wtd	Raw	Wtd
Treatment Dependability	5	8	40	8	40	9	45
Constructability	3	8	24	9	27	9	27
Ease of Operation	4	8	32	9	36	7	28
Ease of Maintenance	5	7	35	8	40	6	30
Construction Cost	4	8	32	9	36	6	24
Annual Costs	4	8	32	8	32	6	24
Total Weighted Score:		**195**		**211**		**178**	

Notes:
Wtd – weighted score
Importance factor compares criteria independent of options.
Raw score is relative score of an option compared to other options.

5.3 OTHER IMPROVEMENTS

5.3.1 Subsurface Geotechnical Conditions

Geotechnical investigations have not yet been conducted for the proposed improvements. Based on previous geotechnical reports, the subsurface is sand to 40 feet below grade. Groundwater depth varies seasonally and can rise to within a few feet of the surface. There is a piezometer on the south side of the site. Dewatering during construction is anticipated for excavation of deeper structures (aeration basin and clarifiers or SBRs or MBRs and digesters).

Another consideration for design of the new facilities is potential seismic activity. In the event of an earthquake, in addition to direct damage, the subsurface sand can liquefy, during which groups of soil particles collapse together and behave as a liquid rather than a solid. This creates an unstable subsurface for structures and causes further damage. Liquid filled tanks need to be designed to resist the “sloshing” of fluid inside them during a seismic event, which can cause rises/falls of liquid, creating load surges on vessels.

It is assumed that the building and adjacent tanks can be supported on a traditional concrete slab foundation. Pilings, deep foundations, or preloading of the site are not anticipated, however, further geotechnical investigations specific to the proposed improvements will be conducted to support the design. As data becomes available, foundation design may need to be modified accordingly.

5.3.2 Code Requirements

Building designs will conform to the current Oregon Structural Code and Oregon Energy Code. Features will include:

- Seismic design Importance factor = 1.25 for Risk Category III – structures with potential to cause a substantial economic impact and/or mass disruption of day-to-day civilian life in the event of a failure.
- Roof live load = 25 pounds per square foot.

- Wind ultimate design speed = 145 mph, exposure O.
- Insulation in conformance with prescriptive Energy Code requirements for non-residential buildings, i.e., R-19 roof insulation and perlite type insulating fill in the CMU walls (or R-13 wall insulation for metal framed walls).
- Slab edge insulation of R-7.5 in accordance with prescriptive Energy Code requirements.
- Thermal rated doors to conform to code. (Note: Entry/exit doors less than 4-foot leaf width and overhead coiling doors are exempt per Table 13-E footnote 4).
- Building openings will be sealed, caulked, gasketed, or weather-stripped to conform to the code.

5.3.3 Generator Building

The existing building housing blowers for the FEB will be expanded to the west to house a new standby diesel generator and automatic transfer switch. The expansion will be 26 by 17 feet in plan view. Materials of construction will match the existing building: wood frame construction, T111 siding, truss framing with a metal roof.

The roof will be of aluminum/galvanized or painted sheet steel, raised rib pattern with a factory-applied high-performance coating system. These roof systems are typically warrantied for periods of up to 25 years and should provide a low maintenance roofing system.

5.3.4 Solids Handling Building

The Solids Handling Building will be 39 feet, 4 inches by 35 feet, 4 inches in size with walls 15 feet, 4 inches tall. There will be one 12-foot overhead rollup door for material and equipment access and one 3-foot door for personnel access. The interior will contain two smaller rooms: one for electrical controls and the other one for the blowers. The electrical room will be 9 feet by 14 feet with one, two-leaf, 6-foot access door. The blower room will be 14 feet by 9 feet with one, two-leaf, 6-foot door for access. The remaining interior of the building will house the screw press, progressive cavity pumps, belt conveyor, and other related solids-handling appurtenances. The belt conveyor will transport solids from the screw press to a truck parked outside, adjacent to the east side of the building. The truck parking area will be 12 feet by 30 feet, open walls covered with an overhead roof approximately 15 feet high. The solids spreader truck will load on a concrete pad under the overhead roof. The location of the conveyor and covered pad will accommodate longitudinal travel of the truck to facilitate even loading of biosolids.

Concrete is considered the most suitable material of construction for treatment plants given the nature of the material being processed. Concrete options consist of cast-in-place, precast, or concrete masonry units (CMU). Given the size of the proposed building, CMU is the most economical and will be used for the exterior walls. Textures may be varied to provide aesthetic features as deemed appropriate. Interior walls will be steel framed.

The roof of both the solids handling building and the truck loading area will be as described for the generator building: aluminum/galvanized or painted sheet steel, raised rib pattern with a factory-applied high-performance coating system.

5.4 ELECTRICAL AND CONTROL

5.4.1 Existing Electrical System

The existing electrical system at the WWTP is shown on the record drawings and is described in the Operation and Maintenance Manuals. There are three power feeds into the WWTP: the original service enters from the west near the administration building, a second service enters from north near the maintenance and storage building, and a newer service enters the WWTP from the north.

The original service is rated 230 V, 3-phase, 3-wire and supplies the influent pump station, administration building, and all plant processes except the FEB, the equalization basin blower building, and the UV light disinfection system. Stand-by power is provided by a portable diesel generator and manual transfer switch. This generator is housed adjacent to the administration building. Its rating is 80 kW, 100 kVA, 230 V, 3-phase, 3-wire. It is capable of serving the entire original WWTP, the administration building, and the influent pump station.

The second service is rated 230 V, single-phase, 3-wire and supplies the maintenance and storage building. There is currently no permanent stand-by power available for the maintenance and storage building. Standby power is available from a portable 30 kW portable generator that also serves smaller pump stations in the collection system.

The third and newer service is rated 480Y/277 V, 3-phase, 4-wire and supplies power to a 500 kVA pad-mounted transformer near the blower building. This in turn supplies power to a Power Distribution Panel labeled “PP-BB.” The equipment and loads served by this panel are listed in Table 7. As indicated, the 500 kVA transformer and panel PP-BB have spare capacity for future loads.

Table 7. Power Distribution Panel “PP-BB” in Blower Building

Rating: 480 “Y” / 277 volt, 3-phase, 4 wire, 800 ampere		
Equipment	**Load Served**	**Status**
Motor Control Center – Panel “BB”	Blowers, blower building, and equalization basin pumps	Active
Automatic Transfer Switch for UV System	UV Disinfection System	Active
Transformer 480-volt to 240-volt, 3-phase	Administration building, influent pump station, remainder of WWTP	Future
Motor Control Center – MCC “BB” / Future Process Loads	Future filters and other future loads	Future

Stand-by power is not available for Power Distribution Panel PP-BB. Therefore, it is necessary to manually by-pass the equalization basin during a power outage. However, stand-by power is available for the UV disinfection system. This stand-by power is a diesel generator and automatic transfer switch, which are installed in the UV System Control Building, adjacent to the UV Basin. The generator rating is 11.5 kW, 14.4 kVA, 480 V, 3-phase, 3-wire. It is capable of serving both banks of the UV system as well as the future two new banks.

PCJWSA staff reported that they experience a power outage about once every 3 to 4 months. A new standby generator is needed that can supply power to the entire WWTP.

5.4.2 Existing Instrumentation and Controls

There is an existing autodialer system to alert the on-site or on-call operator of the following malfunctions:

- High or low level at the equalization basin
- Pump seal failure
- Pump or variable frequency drive failure
- UV system failure

There are flow measuring devices at the following locations:

- The Parshall flume at the headworks uses an ultrasonic level sensor to monitor the water level in the flume and thus, influent flow. There is a chart recorder located in the blower building. It has a one-week circular paper chart and a digital read-out that is manually recorded every day.
- Discharge from the FEB pumps is measured by a magmeter mounted in a manhole near the pumps. A signal from the magmeter is sent to a recorder in the blower building. It has a digital readout that is manually recorded every day. There is no paper chart on this instrument.
- A V-notch weir monitors effluent flow and controls the operation of the banks of the UV disinfection system. Typically, both UV banks run continuously. It has a digital read-out. There is no paper chart on this instrument.

5.4.3 Recommended Future Electrical and Control Improvements for the Wastewater Treatment Plant

These electrical and control improvements are applicable to any of the options.

5.4.3.1 Electrical

The new 480 VAC electrical system has enough available capacity to serve all of the existing and projected future loads to 2024. Improvements to the electrical components must be made as part of the improvements to the individual process units and operations described previously.

The following improvements should be made specific to the electrical system:

- Provide a 500 kW stand-by generator and 800 A automatic transfer switch to supply power to the WWTP, administration building, and the influent pump station. The generator will be supplied fuel by a 3,000 gallon, outdoor, free standing, UL 142–listed fuel tank. Due to the frequent power outages seen at the WWTP and the extended response times, it is necessary that the fuel tank be large enough to provide a minimum of 72 hours of fuel for generator operation at full load.
- Install a step-down transformer to connect the original 230 VAC power system to the new 480 VAC Power Distribution Panel PP-BB at the blower building; disconnect the original 230 VAC service entrance and utility meter.
- Install multiple distribution panels as needed for marshaling of electrical feeders for the new process loads.

5.4.3.2 Instrumentation and Control

Improvements to the control and monitoring systems must be made as part of the improvements to individual processes and operations previously described.

The following improvements should be made specific to the control system:

- Incorporate monitoring and alarm functions to alert the on-site or on-call operator of the following additional malfunctions:
  - Failure at the influent pump station
  - Failure of the equalization basin pumps
  - Failure of the activated sludge aeration blowers
  - Failure of the filter feed pumps
  - Failure of UV system

A new SCADA system should be provided. Although not originally part of the proposed improvements for this phase of work, a SCADA system should be strongly considered for these improvements. It allows real-time monitoring of the system status and can fine tune the operation of many functions of the WWTP. SCADA also allows remote operation of the WWTP. This allows operators to make remote adjustments prior to arriving on site. The efficiency obtained by controlling operations from the SCADA will result in energy savings. SCADA systems can be fairly simple or comprehensive and complex. As a minimum, the improvements should consist of the following.

- Install a base station for a proposed system-wide SCADA system.
- Provide sensors at key points within the process stream. Connect these to the plant-wide SCADA system. This would include the above-listed monitoring and alarm functions into the new SCADA system.
- The SCADA system would accept signals from an anticipated 11 level sensors, 2 flow meters, 4 pump on/off sensors, and 3 dissolved oxygen meters. Construction would include new vaults, a computer with an uninterruptable power supply, an ethernet switch, Wonderware software, PLC configuration, and new conduit and wire to connect the system.
- The SCADA system should be constructed to allow expansion in the future to accept signals from future WWTP improvements as well as status signals from pump stations in the collection system.

5.5 OPERATION AND MAINTENANCE COSTS

The 2014 budget and expenditures for the actual operation and maintenance (O&M) costs to PCJWSA were used to estimate future O&M costs for each alternative. Because the actual budget includes costs to operate and maintain both the potable water and wastewater systems, the data were evaluated and costs distributed appropriately between the two systems. The O&M costs were inflated at 3 percent per year to project future costs, after adjustments specific to each option.

The O&M costs include labor, materials, supplies, chemicals, training, office supplies, biosolids management and disposal, short-lived assets (SLA), laboratory supplies and testing, electricity, and equipment.

The SLA line items for each option provides a set-aside of dollars each year so that equipment can be replaced at the end of its useful life. Up to a 15 year life was assumed for this SLA equipment. The equipment includes pumps, motors, grit systems, drives, filters, chemical systems, instruments, dewatering equipment, etc.

Table 8 shows a summary of estimated O&M costs projected through the year 2035 and converted to present worth values. A 1.6 percent interest rate (OMB 2013), 3 percent inflation, and 20-year return period were used to determine the present worth, assuming O&M costs begin in 2015. The O&M costs were estimated for each alternative. See Appendix I for details on O&M costs.

As shown in Table 8, the present worth O&M costs for the three alternatives are very similar, varying less than 1.0 percent between the activated sludge and SBR options and 25 percent between the SBR and MBR options. The percent difference between the Activated Sludge and SBR options is well within the variability of the cost estimates.

Table 8. Operation and Maintenance Costs for Alternatives

Category Name	Activated Sludge	SBR	MBR
Annual O&M Cost, 2015	$693,792	$692,913	$778,014
Membrane Replacement Present Worth Cost	$ -	$ -	$1,581,214
O&M Present Worth Cost	$11,794,860	$11,779,915	$13,226,684
Total O&M Present Worth	**$11,794,860**	**$11,779,915**	**$14,807,898**

Assumes discount rate of 1.6 percent and 20 year planning period.

5.6 TOTAL PROJECT CAPITAL COST COMPARISON

Table 9 shows the costs needed to implement the projects. These costs include construction, contingency, one year of inflation, administrative costs, and SCADA programming. The most cost-effective biosolids management option was selected based on the analysis conducted in Section 6 of this report. Professional services are included for survey of the site, geotechnical subsurface investigation and report, engineering design, engineering services during construction, and full-time construction observation. Construction observation costs assumes one full-time observer and includes the cost of lodging for one year. SCADA programming is listed as a range in recognition of the different levels of complexity. The extent of SCADA programming will be finalized during detailed design.

A potential cost savings could be realized if the SBR or MBR options were implemented, which would leave the existing aeration basins and clarifiers out of service. These concrete basins could be converted into aerobic digesters. The total volume of these basins is greater than 23,000 cubic feet, which is the volume needed for two new digesters. This could save excavation, dewatering, and concrete costs for these alternatives. The cost savings were not considered in this evaluation, but these options should be considered during detailed design.

Construction costs were developed from manufacturer's quotes, cost-estimating guides, and contractor bid prices from recent similar construction projects. The opinion of construction cost cannot account for variations in labor costs; attitudes of bidders regarding their need for work; availability of materials; climate and seasonal factors; local site conditions; and other variables that affect actual construction costs. The costs in Table 9 represent the capital costs needed to implement the project.

Table 9. Total Project Capital Costs

Item	Activated Sludge	SBR	MBR
Opinion of Probable Construction Cost	$6,403,700	$5,756,600	$6,781,000
Contingency, 30%	$1,921,100	$1,727,000	$2,034,300
1 year Inflation adjustment to fall 2015, 3%	$249,700	$224,500	$264,500
Subtotal	**$8,574,500**	**$7,708,100**	**$9,079,800**
PCJWSA Administration, 5%	$428,800	$385,800	$454,000
SCADA Programming (range160,000 to 480,000)	$480,000	$480,000	$480,000
Total Construction	**$9,483,300**	**$8,573,600**	**$10,013,800**
Pilot Dewatering System	$26,800	$26,800	$26,800
Survey	$20,000	$20,000	$20,000
Geotechnical Investigation/Report	$25,000	$25,000	$25,000
Engineering – Design	$1,138,000	$1,028,900	$1,201,700
Engineering – Services During Construction	$758,700	$685,900	$801,200
Construction Observation (12 months)	$217,200	$217,200	$217,200
Total Capital Costs	**$11,669,000**	**$10,577,400**	**$12,305,700**

5.7 CONSIDERATION OF NON-MONETARY FACTORS

The Agency Guidelines (2013) require considering both life cycle costs and non-monetary factors in the analysis of alternatives. These include financial, social, and environmental factors.

5.7.1 Potential Financial Impacts

The financial impact is greatest if none of the proposed alternatives are implemented. Allowing the WWTP discharge to continue to violate the NPDES permit will lead to further, ever increasing fines from DEQ. Other potential financial impacts of not meeting the permit are degradation in the water quality of the Nestucca River and potential adverse impacts on the recreational and commercial fisheries in and around Pacific City.

The financial impact of implementing any of the feasible alternatives will be the added debt burden taken on by PCJWSA. This debt will lead to an increase in monthly sewer use rates and/or an increase in the system development charges. Determination of the exact increases is beyond the scope of this report. Those increases in sewer use rates and system development charges will be the subject of a separate study.

The financial impact of implementing any of the biosolids dewatering alternatives will have a positive financial impact on PCJWSA because of a reduction in the volume of biosolids hauled for land application. A higher solids content in the dewatering biosolids will reduce the number of truck trips, leading to lower fuel costs for the truck, less labor to operate the truck, and lower maintenance on the truck.

5.7.2 Potential Social Impacts

Implementing any of the feasible alternatives will not have any foreseeable impacts on social impacts, such as cost of living, changes to the minority makeup of the community, revenue generated by businesses, or wages of employees.

Not implementing any of the feasible alternatives could degrade the water quality of the Nestucca River and reduce the attractiveness of Pacific City as a resort community. It is also conceivable that unabated increases in organic and solids loading without concurrent capacity increases at the WWTP will increase odor generation and adversely affect the property value and desirability of properties neighboring or downwind of the WWTP. Implementing any of the feasible alternatives will have a positive impact on the receiving water, and will contribute to maintaining the recreational and commercial value of the water resource.

Implementing any of the alternatives will require additional initial training of the operators on new equipment, which would be a short term “learning curve.” Likewise, implementing any dewatering alternatives will require additional initial training of the operators in the use of the new equipment, which would also be a short term item. The operators are already required to take continuing education courses during each year as part of maintaining their operator certification. The choice of continuing education would naturally be tailored to include the new equipment at the upgraded WWTP.

5.7.3 Potential Environmental Impacts

Environmental impacts would be greatest if the proposed alternatives are not implemented. Increased solids and organic loads on the Nestucca River will have adverse impacts on water quality. The Environmental Report in Appendix B, as summarized in Section 2.4 concludes that there will be no significant adverse environmental impacts from implementing any of the alternatives.

Sustainability considerations are discussed in Section 4.2 and potential opportunities are identified. Implementing any of the dewatering options will significantly reduce the number of truck trips for land application of biosolids. This will reduce fuel use having a positive effect on the release of greenhouse gases.

6. BIOSOLIDS TREATMENT AND HANDLING ALTERNATIVES

This section evaluates options for dewatering biosolids to determine the most cost-effective method of reducing the volume of biosolids transported for disposal.

6.1 EXISTING BIOSOLIDS OPERATION

The existing biosolids treatment and disposal method used at the PCJWSA WWTP is to hold the solids in an aerated storage tank followed by lime stabilization. The facility has one aerated solids holding tank where the waste activated sludge (WAS) is stored and lime-treated. The stabilized sludge is land-applied at a concentration of 1.0 to 1.4 percent solids on property owned by PCJWSA in Beaver, approximately 13 miles from the WWTP.

When the sludge holding tank is full and waste biosolids needs to be removed from site, the operators add one ton of hydrated lime to the holding tank, thoroughly mix the lime and then monitor the pH of the biosolids over a 24-hour period to ensure it is stabilized. Once the biosolids are stabilized to meet Class B requirements, they are trucked off site and land-applied.

Operators also take samples to confirm and document that vector attraction reduction requirements have been met. Table 10 shows volume and dry tons of biosolids land-applied in 2010–2012.

Table 10. Volume of Class B Biosolids Applied

Year	Gallons Applied	Dry Tons Applied
2010	879,000	3.74
2011	738,000	2.71
2012	732,000	4.11

To size potential future biosolids stabilization and dewatering processes, projected future organic and solids loadings were developed, as shown in Table 3. Appropriate sludge yield factors were applied to project the volume and pounds of biosolids produced from the treatment processes. Yields for all processes were based on relatively short mean cell residence times to minimize nitrification. This resulted in similar solids production from each process, estimated as an average of 864 dry pounds per day in the year 2035. After digestion and reduction in volatile solids, a total of 554 dry pounds per day of solids will be processed by the dewatering system selected in 2035.

6.1.1 Sludge Stabilization Criteria

There are many methods of treating and disposing of waste biosolids including composting, anaerobic digestion, pasteurization, drying, incineration, lime stabilization, and aerobic digestion. The regulations for disposal of biosolids are contained in Title 40 of the Code of Federal Regulations, Part 503. The PCJWSA facility currently meets Class B biosolids stabilization standards and they would like to continue with processes that meet this criterion. They may choose to treat to Class A standards in the future, but because of capital costs and very large energy costs, they do not want to pursue this now.

Based on the existing facility tanks, cost of advanced treatment options and the fact that PCJWSA has viable land disposal options, they have chosen to continue using aerobic digestion followed by lime stabilization and dewatering.

Before biosolids can be land-applied they have to be tested to ensure that they are well-stabilized to minimize the risk of spreading disease. These rules are included in the federal vector attraction reduction requirements. Ultimately biosolids have to meet vector attraction reduction regardless of the treatment facility design sizing. The biosolids treatment criterion used in the alternative evaluation is based on EPA facility sizing guidelines. Biosolids facilities designed to these guidelines consistently meet the 40 CFR 503 vector attraction reduction requirements.

6.1.2 Lime Stabilization

PCJWSA currently uses lime stabilization and wanted to compare this method with one other for the evaluation. The 40 CFR 503 regulations for lime stabilization require the biosolids pH to be elevated to 12 for 2 hours and then held for an additional 22 hours at a pH above 11.5. This treatment method has operated effectively at the WWTP for many years. The disadvantage of the current method for lime stabilization is that lime bags are handled and added to the digester manually, which is inefficient and labor intensive.

6.1.3 Aerobic digestion

Aerobic digestion of biosolids has proven to be a cost-effective method of biosolids treatment for smaller communities. The reasons for this are the relatively small facility size, ease in operation, minimized labor cost, relatively small capital costs and the ability to integrate into existing facilities without major changes. The EPA guidelines for aerobic digestion require providing a mean cell residence time of 40 days while maintaining a temperature of 20°C.

6.2 BIOSOLIDS TREATMENT ALTERNATIVES

As stated above, PCJWSA wanted to compare their existing biosolids treatment and disposal with other options. To reduce trucking cost and operator time, they also wants all alternatives to include dewatering systems. To provide system redundancy, all alternatives include the ability to add lime to biosolids upstream of dewatering. The three alternatives chosen are listed below and the layout of these options in a proposed solids handling building are in the figures indicated.

- Aerobic digestion with belt filter press dewatering – Figure 9
- Aerobic digestion with centrifuge dewatering – Figure 10
- Aerobic digestion/lime stabilization with screw press dewatering – Figure 11

6.2.1 Aerobic Digestion

Aerobic digestion is a common method of meeting the Class B biosolids stabilization requirements. The process for PCJWSA would include three digester tanks that would normally operate in series. By placing the tanks in series, it maximizes the treatment efficiency and minimizes the passing of fresh waste activated solids to the solids leaving the facility. The existing solids holding tank would become the first digester. Digesters 2 and 3 would be constructed west of the new solids building and east of the existing digester. See Figures 6, 7, and 8. The digesters would be covered and insulated to ensure the biosolids maintain at 20°C temperature. The digesters would be sized to provide 44 days mean cell residence time (including the lime mixing cell). Refer to the design criteria information in Appendix G5 and the site plan in Figures 9 to 11. Aeration and mixing of the digesters would be provided with regenerative blowers and coarse bubble diffusers. A mechanism will be provided in each digester to allow decanting of supernatant to allow drawing off excess water.

Justification for covering the digesters is warranted. Covers will allow digesters to maintain 20°C temperature and a 44-day detention time. Without covers, temperatures will fall to 15° to 20°C, in which case a 60-day detention time is required. Increasing the detention time to 60 days would require an increase in digester volume by close to 50 percent with proportional increases in diffusers and blower capacity. Thus, the added cost for covers is less than the added costs without covers because of costs for added digester size (excavation and concrete), added diffusers, added blower capacity, and increased power costs.

6.2.2 Lime Stabilization

Lime stabilization is a common method of meeting the Class B biosolids requirements. All of the process alternatives would include the ability to add lime to the liquid biosolids. This would provide a backup system for solids stabilization in the event the new dewatering process was out of service. The liquid biosolids could be land-applied with the equipment already owned by PCJWSA.

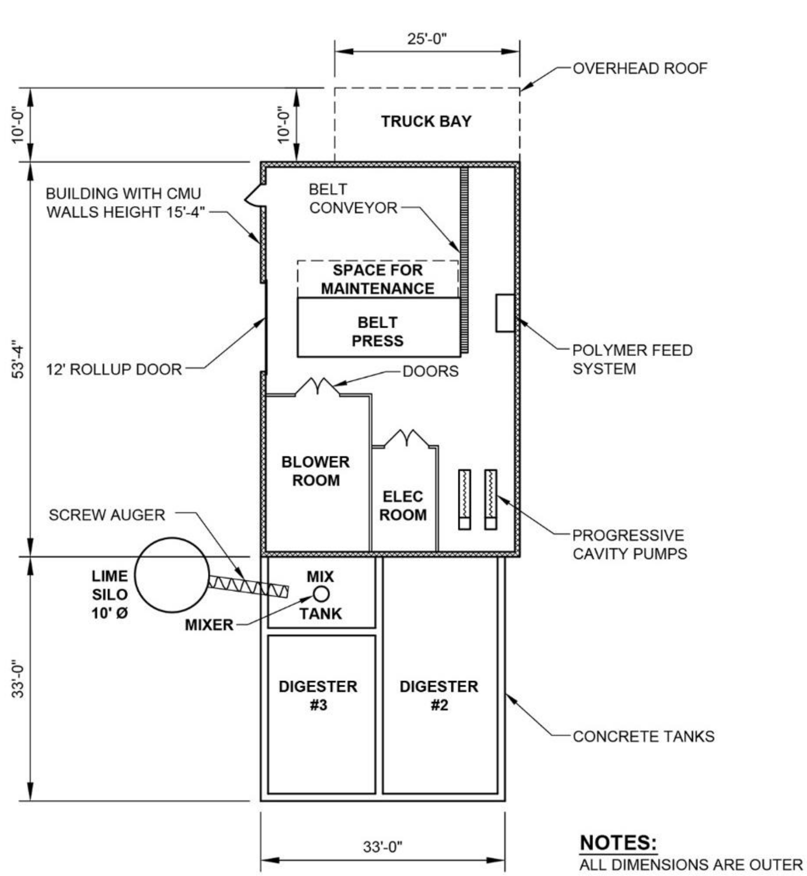


Figure 9. Solids Handling Building with Belt Press

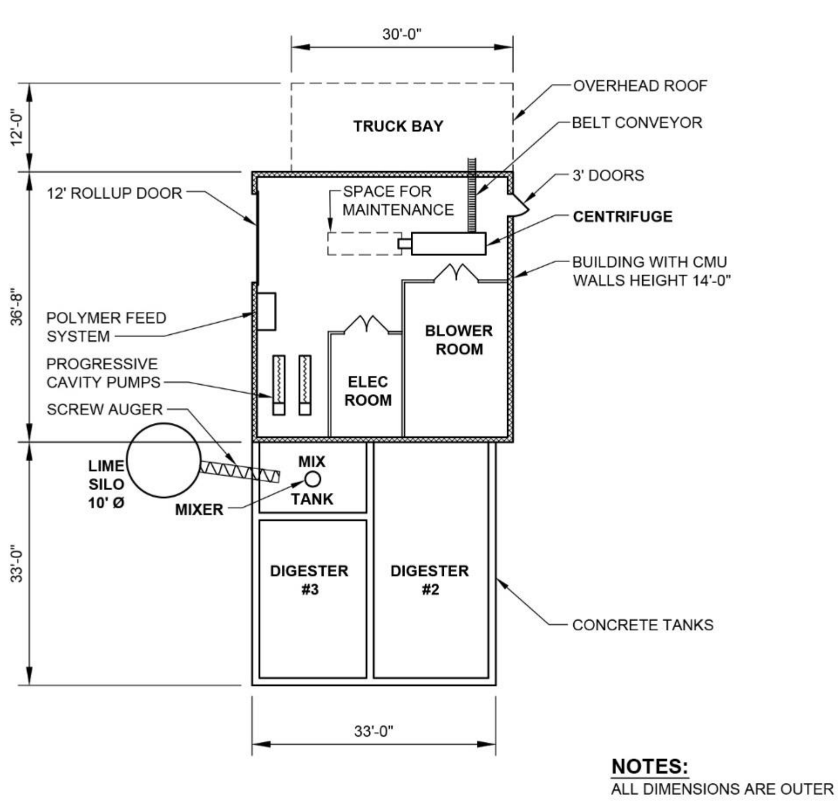


Figure 10. Solids Handling Building with Centrifuge

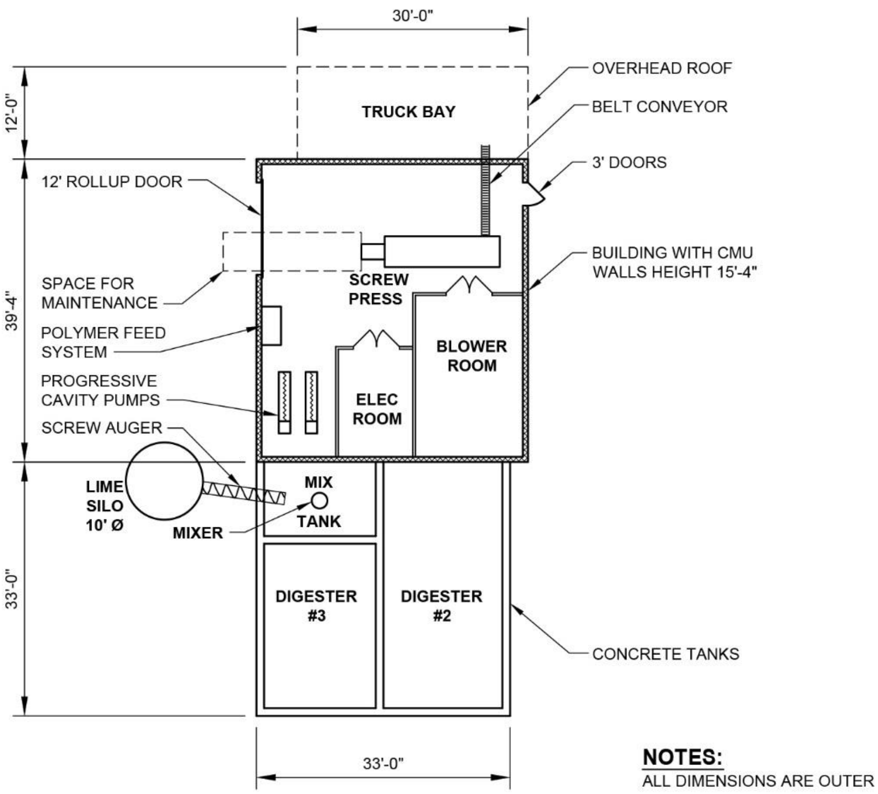


Figure 11. Solids Handling Building with Screw Press

Addition of lime upstream of belt presses or centrifuges is not recommended because of the maintenance issues caused by lime precipitation. Lime addition upstream of a screw press, however, has been proven to work effectively. The pH monitoring and holding times are met in the lime mix tank prior to pumping to the screw press. The final solids samples would be taken from the dewatered cake.

6.3 DEWATERING

Waste activated sludge is currently stored in the solids storage tank at between 1 and 1.4 percent solids. For this evaluation the solids concentration was assumed to be 1.2 percent. PCJWSA wants to dewater these solids before land application to minimize the trucking and labor costs. The dewatering process considered should be able to achieve 16 percent to 19 percent solids concentrations. By taking 1.2 percent biosolids and dewatering 18 percent, the biosolids volume can be reduced by 93 percent. The next sections present three dewatering alternatives.

6.3.1 Belt Press Dewatering

The use of belt presses for biosolids dewatering is very common. Just upstream of the belt press, polymer would be added to the wet biosolids to help bind the solids together and maximize particle capture in the press. For the PCJWSA project, a three-belt system has been assumed. The belts would be 0.75 to 1 meter wide (depending on the manufacturer) and allow water to pass through, but hold the solids. The first belt section would be a gravity thickening belt to thicken the biosolids to 4 or 5 percent. The solids are placed on the horizontal gravity belt and water drains off the material. Then the thickened solids enter the next section of the press which consists of two belts. The solids are placed between the two belts just prior to where the belts are squeezed together. This squeezing action presses more water out of the biosolids. The belt press can achieve approximately 17 percent dry solids, although values vary with specific biosolids and polymer addition. The belt press can achieve approximately 98 percent solids capture. The solids capture is important because solids not captured pass through the dewatering process and are returned to the headworks in the centrate. Design criteria for the belt press are in Appendix G5.

After the squeezing step, the biosolids drop to a conveyor which moves them into a biosolids spreader truck. The spreader truck transports the solids to the land application site and then spreads the dewatered material.

6.3.2 Centrifuge Dewatering

The use of centrifuges for biosolids dewatering is also very common. Like the belt press process, polymer is added upstream of the centrifuge to help bind the solids. The centrifuge consists of an outer bowl (2-meter-long tube) and an inner scroll. The solids are pumped into the centrifuge while the outer bowl is spinning at a high speed. The high rotational speed creates centrifugal forces that push the solids to the outer circumference of the bowl. The scroll then pushes these solids onto a belt conveyor that moves the dewatered solids into the spreader truck. The water removed from the solids (centrate) drains back to the wastewater treatment process. The centrifuge can achieve approximately 18 percent dry solids, although values vary with specific biosolids and polymer addition. The centrifuge can achieve approximately 95 percent solids capture. Design criteria for the centrifuge is in Appendix G5.

6.3.3 Screw Press Dewatering

The third dewatering process alternative, the screw press, would include upstream polymer treatment to help with binding the solids. The main difference with the screw press process is that lime addition could occur upstream of the press (unlike the belt press and centrifuge). The evaluation of the screw press process, therefore, includes lime stabilization combined with dewatering. A screw press consists of a cylindrical wedge wire basket that allows water to drain off the solids as the solids are pushed through by a slowly rotating screw. Continuous dewatering of the sludge takes place in the press while pressure builds up at the dewatered solids end of the press. This pressure build-up occurs because of the greater force required to move dewatered solids. The screw press can achieve approximately 16 percent dry solids, although values vary with specific biosolids and polymer addition. The screw press can achieve approximately 85 to 90 percent solids capture. Design criteria for the screw press are in Appendix G5. As with the belt press and centrifuge, the dewatered solids would be conveyed to a spreader truck for hauling and field spreading.

6.3.4 Dewatering Alternative Cost Summary and Comparison

6.3.4.1 Dewatering Alternative Cost Summary

An opinion of cost was generated for each of the three biosolids dewatering and treatment alternatives and is shown in Table 11. These costs include a new building, the dewatering system, polymer feed, and sludge pumps. These costs do not include contingency or inflation. As shown in Table 11, the costs of each option were very close.

Table 11. Dewatering System Capital Costs

Option	Cost
Belt Filter Press	$1,054,000
Centrifuge	$1,071,000
Screw Press	$1,063,000

6.3.4.2 Advantages and Disadvantages of Dewatering Alternatives

As part of the alternative selection process, advantages and disadvantages for each process were described and are shown in Table 12.

Table 12. Biosolids Evaluation of Alternatives

Alternative	Advantages	Disadvantages
Aerobic Digestion with Belt Press Dewatering	• Produces a relatively dry sludge • Low energy use • Medium capital and operation cost • Quick startup/shutdown	• Medium labor cost • Largest space requirement (largest building) • Skilled operator required • Increased odor potential
Aerobic Digestion with Centrifuge Dewatering	• Produces a high solids product • Has low odor potential • Has smallest footprint (smaller building) • Requires less operator time	• Skilled operator required • High power requirement • Highest capital cost • Requires a long startup/shutdown
Aerobic Digestion/Lime Stabilization with Screw Press Dewatering	• Low odor potential • Less operator time for press • Lowest power cost • Can be easily converted to a Class A sludge treatment system • Can use both aerobic digestion and lime stabilization prior to dewatering	• Lower cake solids • Outer casing cleaning required • Medium space requirement • More operator time to manage the lime system

6.3.4.3 Matrix Evaluation of Dewatering Alternatives

Evaluation criteria were developed for the dewatering alternatives, and the alternatives were compared against selected criteria in an evaluation matrix. The criteria are listed and where not self-explanatory, briefly described below:

- Dewatering and solids retention – the percent solids the dewatering process will produce and the level of solids that pass through the process.
- Ease of operation – more complicated equipment are more difficult to operate.

- Ease of maintenance – access. More complex equipment require specialized support. Added equipment means there is more to maintain.
- Construction cost.
- Annual operating cost for power, chemicals, materials, and operational labor.

The criteria were first assigned an importance factor between 1 and 5 that compares each criterion independent of the options. See Table 13. Higher numbers represent more important issues or more influence on feasibility. Each criterion was then given a raw score relative to other options using a rating of 1 to 10, with 10 being a more favorable rating. The raw score was then multiplied by the importance factor to determine a weighted score for each criterion and each option. The weighted scores were then summed for each option in Table 13. Based upon this evaluation, the options were ranked from most favorable (highest score) to least:

1. Screw Press: 208
2. Belt Filter Press: 208
3. Centrifuge: 195

Note that the ratings for importance factors and raw scores below need to be adjusted based on PCJWSA selection of importance factors.

Table 13. Dewatering Option Evaluation Matrix

Criteria	Importance Factor	Belt Filter Press		Centrifuge		Screw Press	
		Raw	Wtd	Raw	Wtd	Raw	Wtd
Dewatering/Solids Capture	4	8	32	9	36	7	28
Ease of Operation	5	8	40	8	40	8	40
Ease of Maintenance	5	8	40	7	35	8	40
Longevity	4	8	32	7	28	9	36
Construction Cost	4	8	32	8	32	8	32
Annual Costs	4	8	32	6	24	8	32
Total Weighted Score		**208**		**195**		**208**	

Notes:
Wtd – weighted score
Importance factor compares criteria independent of options.
Raw score is relative score of an option compared to other options.
Higher values are more favorable.

6.4 PREFERRED ALTERNATIVE

The matrix scores and capital costs were very similar. The final solids produced from each of these dewatering systems can vary depending upon the specific sludge being processed. We recommend that each system be piloted on site with small scale units using PCJWSA sludge. Piloting will provide firm data on performance of the dewatering system and will help make a more informed decision. We also recommend that PCJWSA staff visit installed dewatering systems using each of these technologies and interview other operators before finalizing the ratings in Table 13 and selecting the preferred dewatering alternative.

7. RECOMMENDATIONS AND PROPOSED PROJECT IMPROVEMENTS

7.1 TOTAL PROJECT COSTS

Table 14 combines total project capital costs, the present worth value of O&M costs, subtracts the present worth salvage value of the proposed improvements, and determines the net present worth of each alternative. This approach is in conformance with Agency Guidelines (2013), uses a 20 year planning period, and a 1.6 percent interest rate. The SBR has the least life cycle cost, however, it is only 5.0 percent less than the activated sludge option. This is well within the variation of a planning level cost estimate.

Table 14. Total Project Present Value Cost Comparison

Items	Activated Sludge	SBR	MBR
Total Project Capital Costs	$11,669,000	$10,577,400	$12,305,700
O&M Costs Present Worth Cost	$11,794,860	$11,779,915	$14,807,898
Salvage Value	$296,633	$312,203	$610,858
Salvage Value Present Worth	<$215,946>	<$227,281>	<$444,699>
Net Present Worth	**$23,247,914**	**$22,130,034**	**$26,668,899**

7.2 RECOMMENDATIONS

Based on the evaluation conducted in this report, we recommend that PCJWSA implement design and construction of the sequencing batch reactor (SBR). The SBR was rated highest from the matrix comparison, had the lowest capital cost, and the lowest present worth O&M costs, and life cycle costs. The design criteria for the SBR are in Appendix G3.

Because the life cycle cost difference between the SBR and activated sludge alternatives are so close, PCJWSA may wish to make the selection based on other, non-monetary, considerations.

For biosolids dewatering, we recommend, with conditions, the screw press. The recommendation is conditional because the matrix evaluations and costs for the different systems were very close:

- PCJWSA should conduct field visits to observe the different dewatering technologies and interview operators of each system.
- PCJWSA should conduct on-site piloting of the three dewatering technologies to confirm performance using actual PCJWSA biosolids. Piloting the dewatering units allows them to be more accurately designed, saving on installation and operational costs. The cost for piloting was included in the estimates.

7.3 PROPOSED IMPROVEMENTS

Improvements identified in the 2009 Master Plan update that were not included in the current project improvement plan are listed with the proposed projects in Appendix H. Projects already completed by PCJWSA are also listed.

Costs for improvements from the 2009 WWMP that were not included in the current project improvement plan were updated to 2014 dollars using the *Engineering News-Record* construction cost indices. To bring the 2014 dollars to 2015 dollars, a 3 percent inflation factor was used.

8. REFERENCES

IFA, DEQ, RCAC, ad USDA-RD. 2013. Preparing Wastewater Planning Documents and Environmental Reports for Public Utilities financed by IFA, DEQ, RCAC, and USDA-RD.

Krueger, Lynne. 2004. Tillamook County Department of Community Development. January 20, 2004. Telephone record with Gunther, Dan, Parametrix. Subject: Population Projections for Pacific City and Tillamook County.

Oregon Department of Environmental Quality (DEQ). 2009. Implementing Oregon's Recycled Water Use Rules. Quality Division. Internal Management Directive. June 2009.

DEQ. 2012. Applicant Guide to the State Environmental Review Process.

OMB (Office of Management and Budget). 2013. Discount Rates for Cost-Effectiveness, Lease Purchase, and Related Analyses. Office of Management and Budget, Circular A-94 Appendix C, Revised December 2013. Available at: http://www.whitehouse.gov/omb/circulars_a094/a94_appx-c. Accessed October 1, 2014.

Oregon Department of Geology and Mineral Industries (ODGMI). 1995. Open File Report O-95-23, Tsunami Hazard Map of the Nestucca Bay Quadrangle, Tillamook County, Oregon. October-November, 1995.Parametrix. 2000. Letters to David Mann, DEQ. Subject: Pacific City – Design Flows and Design Criteria for UV System. July 18, 2000.

Oregon Office of Economic Analysis. 2013. Long-term Oregon State's County Population Forecast, 2010-2050. Available at: http://www.oregon.gov/DAS/OEA/Pages/demographic.aspx. Accessed September 2, 2014.

Pinney, 2013. Personal communication (email to Tony Owen, Tom Nielsen) of September 6, 2013. Subject: RE: Pacific City Predesign Report. Oregon Department of Environmental Quality, Portland, Oregon.

Population Research Center. 2013. Certified Population Estimates 2013: Population Estimates for Oregon and Counties. Portland State University. Available at: http://www.pdx.edu/prc/population-reports-estimates. Accessed September 2, 2014.

Rollier, Charlotte, 2013. Personal communication (email to Tom Nielsen) of November 14, 2013. Subject: RE: Pacific City Scope. Rural Development-Oregon, United States Department of Agriculture, Portland, Oregon.

Tillamook County. 2011. Comprehensive Plan. Available at: http://www.co.tillamook.or.us/Gov/ComDev/Planning/compplan.htm. Accessed September 25, 2014.

U.S. Environmental Protection Agency, Office of Water. 2010. Interactive Handbook for Managing Individual and Clustered (Decentralized) Wastewater Treatment Systems, Resource Guides. EPA 832-B-05-005 January 2010 Web Supplement.

APPENDIX A

Previous Wastewater Master Plans

Executive Summary, Pacific City Wastewater Master Plan, 2005

Pacific City Wastewater Master Plan 2009 Update

Exhibit 1. CD of Pacific City Wastewater Master Plan, 2005

Pacific City Wastewater Master Plan

EXCERPT, EXECUTIVE SUMMARY

Prepared for

Pacific City Joint Water-Sanitary Authority

Prepared by

Parametrix
700 NE Multnomah, Suite 1000
Portland, Oregon 97232
(503) 233-2400
www.parametrix.com

March 2005
Project No. 276-3300-004

EXECUTIVE SUMMARY

OVERVIEW

The Pacific City Joint Water-Sanitary Authority (PCJWSA) is a publicly-owned water and sewer district located in Pacific City in southern Tillamook County, adjacent to the confluence of the Nestucca River with the Pacific Ocean.

The PCJWSA serves the unincorporated communities of Pacific City and Woods approximately midway between Lincoln City and Tillamook, Oregon. The PCJWSA currently serves an approximate permanent resident population of 1,000, with seasonal population peaks up to an estimated 2,500. There were 1,098 wastewater service connections as of October 30, 2003. The estimated 2003 population served by PCJWSA is 2,012 with an estimated 2.0 persons per household.

The intent of this Wastewater Master Plan (WWMP) was to describe and evaluate regulatory requirements; the existing service area; existing and future population and wastewater flows and loads; the wastewater collection, pumping, treatment, and biosolids systems; and existing operational practices. Then future wastewater system needs were identified based on the projected populations, flows, and loads. A listing of recommended system improvements were developed and capital and operating costs were estimated. A financial analysis was conducted to determine how to pay for the recommended improvements.

REGULATORY REQUIREMENTS

This Wastewater Master Plan followed "Guidelines for Writing Wastewater Engineering Design and Pre-Design Reports – 1994." This master plan meets all of the requirements of a facilities plan, except those requiring State Revolving Funding (SRF). There are additional elements needed to meet SRF requirements for a facility plan. These include an evaluation and cost analysis of alternative treatment processes, characterization of natural and human elements impacted by the project, documentation of public participation, conducting an environmental analysis addressing wetlands, threatened and endangered species, cultural resources, and preparation of an Environmental Assessment in accordance with the National Environmental Policy Act.

PCJWSA has a National Pollutant Discharge Elimination System Permit which expires on December 31, 2006. The wastewater treatment plant (WWTP) discharge limits essentially require the average monthly effluent five-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS) concentrations be less than 10 mg/L on a year round basis. The permit is in Appendix D. A wasteload allocation is established for bacteria, and standards are set for *Escherichia coli* (*E. Coli*) in the PCJWSA discharge. The permit requires nutrients to be monitored every two weeks in summer (various nitrogen species and total phosphorous); temperature must be monitored twice per week during the summer; and a contingency plan must be developed for spill and unplanned discharge prevention and management.

Since 1998, DEQ identified six minor violations of the permit, but believed the facility was in substantial compliance with the terms of the current permit. PCJWSA reported that some of the reported violations were the result of erroneous laboratory readings due to a faulty dissolved oxygen probe. The effluent filter and small size and shallow depth of the clarifiers were believed to be the source of other violations.

FLOWS AND LOADING

During the period June 1999 – December 2003, the average influent daily flow was 0.131 million gallons per day (mgd) and the maximum daily flow was 0.587 mgd. The typical trend in flows was generally two annual peaks, one in summer corresponding to higher populations, and a second in winter corresponding to higher rainfall. Statistics were used for July and January 1999-2003 to characterize dry and wet flows, respectively. Peaking factors were developed based on a previous report (Parametrix, 2000) as a tool to project the existing and future peak instantaneous (hourly) flow. The peak instantaneous flow (PIF) is necessary to design hydraulic features such as pipelines and basins to reduce the incidence of overflows.

Monthly data for influent BOD5 and TSS concentrations and loadings were examined from the years 2000 to 2003 and the ranges and averages were typical of domestic wastewater. A general trend was an increase in the loading of BOD5 over the last four years. The loading of TSS over the same period has been about the same, or declined. Based on the analysis of population, flow, and loading, per capita rates were developed and used with population projections to estimate future wastewater flows and loads. Table ES-1 shows a summary of projected populations, flows, and loadings for 2004, 2010, and 2024. This table shows that flows and loadings will essentially double in the next 20 years.

Table ES-1 Projected Future Populations and Wastewater Flows and Loadings

			Wastewater Flows			Maximum Monthly Wastewater Loading	
Year	Population	GPCD	Dry Weather Flow, gpd	Peak Day Average Flow, gpd	Peak Instantaneous Flow, gpd	BOD_5, ppd	TSS, ppd
2,004	2,082	80	166,560	599,616	899,424	396	500
2,010	2,560	80	204,800	737,280	1,105,920	486	614
2,024	4,144	80	331,520	1,193,472	1,790,208	787	995

EXISTING COLLECTION AND PUMPING SYSTEM

The collection system consists of about 45,000 feet of gravity sewers, 122 Septic Tank Effluent Pump (STEP) systems, and nine pumping stations. Eight of the pump stations consist of two submersible pumps in a precast manhole. The ninth is Airport Pump Station, which has a dry chamber for electrical gear and valves above the wet well. Airport Pump Station is the largest station and handles all flows east of the Nestucca River.

The Brooten North/Resort Drive STEP system that pumps into the Woods Pump Station force main does not have sufficient discharge pressure to pump when the Woods Pump Station is operating. STEP system service will deteriorate if the Woods Pump Station pumps more frequently should its service area develop and produce higher flows. The Brooten North/Resort Drive STEP systems are susceptible to flooding during high stages of the Nestucca River. Another concern with the STEP systems was the great amount of maintenance required. PCJWSA spent $3,400 to $12,000 per year recently for material costs alone. The Brooten North/Resort Drive and Nestucca Manor STEP systems should each be replaced with gravity sewers and a pumping station.

The Airport Pump Station is over 30 years old, has no dedicated standby generator, and is adjacent to the Nestucca River. If the Airport Pump Station were to fail, it could have serious consequences. During busy weekends and holidays, flows occur that require operation of both the lead and standby pump, a situation not allowed by DEQ. Thus, upgrading or replacing the Airport Pump Station is a high priority. The upgrade in flow of the Airport Pump Station will adversely affect the Beachy, Ella, and Kiwanda Pump Stations and the Cape Kiwanda Drive STEP systems that pump into the Airport Pump Station force main. To avoid upgrading those systems, a 900 foot section of the Airport Pump Station 6-inch force main should be replaced with an 8-inch diameter pipeline to reduce pressures.

The other pumping stations are all over 25 years old, show signs of their age, and many of the pumps have exceeded their useful life. The control panels are exposed to the weather, and many have seriously corroded components. All of the pump stations should be systematically upgraded over the course of the planning period.

The river crossing pipelines on the Woods, Slough, and Pacific Avenue Bridges were either not constructed to accommodate a seismic event and/or are susceptible to corrosion. All of these bridge crossing pipelines should be replaced with a corrosion resistant pipeline with a telescoping ball joint.

The collection system needs to be cleaned on a more regular basis and a vactor truck should be purchased to allow more routine cleaning.

EXISTING WASTEWATER TREATMENT SYSTEM

The WWTP consists of an influent pump station, a headworks side screen, a Parshall flume, an in-line flow equalization basin, two parallel activated sludge aeration basins, two secondary clarifiers, a single dual media vertical steel filter, and an ultraviolet disinfection system. The WWTP was originally designed to treat an average monthly flow of 0.36 mgd. The actual capacity has been estimated to be approximately 0.18 mgd, based upon the capacity limitation in the existing tertiary filter. The filter capacity can be as low as 0.12 mgd, if the suspended solids concentration to the filter exceeds 15 mg/L.

A hydraulic analysis was conducted on the outfall and diffuser showed their capacity at 1.2 mgd. If the pipe interior condition is in poor condition because of greater tuberculation or sand buildup, the capacity could be 1.0 mgd.

Recent developments will add flows that exceed the capacity of the Influent Pump Station and it should be upgraded as soon as possible.

There is no grit removal process which causes a buildup in grit in the flow equalization basin, necessitating manual grit removal twice per year. A new grit removal process should be provided between the Parshall flume and equalization basin.

To accommodate increases in flows and organic loading, the existing mechanical aeration system in the activated sludge basins should be replaced with a fine bubble diffused aeration system and new blowers.

The existing clarifiers are shallow, lack a dedicated scum removal system, need improved skimmers, peripheral baffles, and improved sludge return and wasting pumps and components.

The existing filter has insufficient capacity, no standby unit, and needs to be replaced with two filters capable of handling peak flows.

A new 500 kilowatt generator and automatic transfer switch is needed to provide standby power at the WWTP in the event of a power outage.

A central system is needed for control, data acquisition, intrusion, and monitoring of the WWTP and pumping stations.

A centralized odor control system is needed for the headworks. This would be sized to accommodate future inclusion of foul air from the digester and ultimately the flow equalization basin.

As flows and loads increase with community growth over the next 20 years, added unit processes will be needed. These include a third aeration basin, third clarifier, a second equalization basin, more filter capacity, and a second ultraviolet light disinfection unit. Another building is needed to store vehicles, supplies, and equipment.

BIOSOLIDS MANAGEMENT

Biosolids from the activated sludge system are pumped to an aerobic digester where they are aerobically digested, typically for 30 days. Biosolids are further stabilized with hydrated lime sufficient to satisfy Class B requirements of the 503 regulations. Stabilized liquid biosolids are trucked to a 40-acre site in Beaver, Oregon, and land applied with a manure spreader. The site, tanker truck, and manure spreader are owned by PCJWSA. The site is beneficially used to grow hay. Biosolids are tested and the results met regulatory standards.

There are several deficiencies with the biosolids program. The existing digester blowers are undersized and the aeration system inadequate for oxygen transfer and mixing. The aerobic digester is also a significant source of odors. The capacity of the digester is limited and a second digester will be needed in the future to accommodate growth.

The method of mixing lime and sludge in the digester is inefficient and labor intensive. A new system for storing lime and blending lime with biosolids is needed.

The current method of biosolids disposal involves hauling it at 1.5 percent solids, which means hauling a large volume of water. If the biosolids were dewatered to over 10 percent, transportation and application costs could be reduced. This cost savings could pay for the biosolids dewatering system in about five to seven years. The proposed system would be housed in a new building.

A baler is needed to allow routine hay removal from the application site.

OPERATIONS

PCJWSA has four full-time operators, one full-time supervisor, and one full-time and one part time administrative staff. All operators are certified at appropriate levels by the State. Future growth of the system will require an increase in operations staff to accommodate the added workload as new system components are brought on line with flow increases. New staff added over the next 20 years are projected to include a mechanic, three additional certified operators, and a part-time laboratory technician.

RECOMMENDED IMPROVEMENTS

A prioritized listing of recommended improvements to the wastewater system was developed through the year 2024. The objective was to first replace system components that were undersized or need replacing, and to provide new components to better accommodate growth. Recommended improvements were identified based upon deficiencies identified by PCJWSA staff, engineering analysis of the wastewater system, and system needs to accommodate growth. The improvements were tabulated over the planning period and an opinion of capital and operational costs were estimated. The list and costs are in Tables 4-1 and 4-2 in the text.

FINANCIAL ANALYSIS

The PCJWSA can fund major capital improvements with cash reserves, Federal or State grants, or by issuing debt either to various Federal or State agencies with lending programs, or to the municipal bond market. To repay the debt, PCJWSA can increase sewer rates sufficient to pay all operating costs and annual debt service (principal and interest). Or, PCJWSA can legally issue voter-approved general obligation (GO) bonds and assess property taxes to pay annual debt service until the debt is fully repaid. The Financing Section of this WWMP reviews methods of borrowing, sources of revenues to repay the loans, the possible lenders, current financial conditions, and initial estimates of impacts on sewer rates, or on tax rates, if GO bonds are used.

If the PCJWSA obtains voter approval and sells GO bonds to fund improvements, then sewer rates will increase modestly and property taxes can be assessed to pay debt service on the bonds. If the PCJWSA borrows the needed money either directly from the State of Oregon, or by issuing revenue bonds, the sewer rate will increase nearly 192 percent over the next 10 years and property taxes will not be affected.

If funding is not appropriated, for example if a GO bond were not approved by voters, PCJWSA may be faced with not making the needed improvements. This could result in a permit violation or a moratorium on growth, or both.

Pacific City Wastewater Master Plan 2009 Update

Prepared for

Pacific City Joint Water-Sanitary Authority

Contains an update of Sections 4.1 and 4.2 Project Descriptions and Appendix G Project Costs

Prepared by

Parametrix
700 NE Multnomah, Suite 1000
Portland, Oregon 97232
(503) 233-2400
www.parametrix.com

February 2010

Project No. 276-3300-004

[redacted]

4. RECOMMENDED IMPROVEMENTS, COSTS AND IMPLEMENTATION

This section presents the 2009 updates of sections 4.1 and 4.2 to the 2005 PCJWSA Wastewater Master Plan. Pages 50 through 54 as well as Table 4-1 should be replaced with the following pages. Figure 4-1 from the 2005 Wastewater Master Plan (page 52) and Section 4.3 have not changed. Appendix G was also updated. Project numbers were retained from the 2005 report. Included are recommended improvements based upon previous evaluations, deficiencies identified by PCJWSA staff, and system needs to accommodate growth. The first section describes recommend improvements. The second section tabulates the improvements over the planning period and provides an opinion of capital costs. The third section lists operational needs and costs.

4.1 DESCRIPTIONS OF RECOMMENDED COLLECTION, PUMPING, AND TREATMENT IMPROVEMENT PROJECTS

The following listing contains recommended improvement projects for the wastewater system through the year 2026. Each item is listed by priority and contains a title and brief description. Figure 4-1 shows the proposed improvements on the existing WWTP site. The objective is to replace system components that are undersized, need replacing, or to provide new components to better accommodate growth. Project numbers correspond to the prioritized project list with cost opinions in Table 4-1.

1. WWTP Influent Pump Station and Outfall Hydraulic Modeling. Upgrade with duplex pumps, each rated at 350 gpm. Conduct hydraulic modeling of outfall pipe to confirm its capacity and the extent of surcharging.

2. Generator Deployment Plan. Project completed.

3. Tertiary Filters. Project completed.

4. Hay Baler. Purchase to remove hay from biosolids application fields.

5. Activated Sludge Diffused Aeration System. Replace mechanical aeration system with a fine bubble diffused aeration system. Provide three new blowers and associated air piping.

6. Vactor Truck. Purchase for collection system cleaning.

7. Clarifier Improvements. Provide a new larger scum beach made of epoxy coated steel or FRP. Provide a new concrete scum collection box to separate scum from return sludge, and provide a new pump and piping to route scum to the digester. Provide full diameter skimmers. Install a peripheral epoxy coated steel or FRP baffle inboard of the weirs. Provide new return/waste sludge pumps, a flow meter, and modify sludge pump piping and valves to improve sludge return and wasting.

8. Grit System. Provide a 2 mgd vortex type grit removal system with air lift in a concrete basin. Provide a grit classifier and storage hopper.

9A. Airport Pump Station. Replace the Airport Pump Station with a new facility using submersible pumps in an 8-foot precast wet well. Provide a 75 kW standby diesel generator. Provide a 15’x25’ block building to house the generator and controls. Replace the 320 linear feet of 6-inch force main with an 8-inch diameter pipeline up to where it connects to the Pacific Avenue Bridge. Includes cost of acquiring property (unique to this project).

9B Woods Pump Stations Upgrade. Upgrade the Woods Pump Station by replacing the pumps to match existing capacity, provide new discharge piping to a buried vault to house valves. Upgrade the electrical panel, controls, security, and safety features. Replace the Woods Pump Station generator and provide an automatic transfer switch. Provide a 15'x25' block building to house the generator and controls.

9C Airport Force Main Upgrade. Replace 2,900 linear feet of 6-inch force main with a 12-inch diameter pipeline along Cape Kiwanda Drive. Provide controlled density backfill and asphalt patch where the pipeline is in Cape Kiwanda. Replace 13 STEP ejector pumps and their discharge pipelines where they connect to the new force main. Provide an air/vacuum release valve in buried vault.

10. River crossing pipelines – Slough and Woods Avenue Bridges. Replace pipelines with ductile iron pipe with flexible seismic joints. Provide an air release valve on Woods Bridge.

11. Aerobic Digester Aeration Improvements. Replace existing aeration system and blowers with a new coarse baffle aeration system and two 20 hp blowers.

12. Expand UV System. Provide two new UV banks in the second channel to allow disinfection to 2 mgd.

13. Expand Tertiary Filters. Add third filter to allow firm treatment capacity of 2 mgd.

14. Upgrade the Ella, Madrona, and Kiwanda Pump Stations. Upgrade the pump station by replacing the pumps to match existing capacity, provide new discharge piping to a 4'x4' vault to house new valves. Upgrade the electrical panel, controls, security, and safety features. Relocate the Ella Pump Station electrical panel above the high water level.

15. WWTP Standby Generator. Provide a new 500 kW/625 kVA standby generator capable of running the electrical load of the entire WWTP. Provide 800 ampere automatic transfer switch.

16. Biosolids Dewatering and Lime Blending System. This project combines projects 16, 24, and 28 from the 2005 WWMP. Conduct predesign evaluation to select the most cost effective dewatering technology. For purposes of costing for this CIP Update, a belt filter press was assumed. This may be refined after the predesign evaluation.

16A. Dewatering System. Provide a 0.7 meter, 230 pound per hour belt filter press with a lobe type solids feed pump, access platform of FRP grating, polymer feed system, and a lime storage hopper with paddle mixer and conveyor. House the system in a 26'x20' block building with a metal roof. Provide a 40 cubic yard roll off container.

16B Second Aerobic Digester(previously project 24). Construct a second new aerobic digester, 50-foot diameter, 12-foot deep with a coarse bubble aeration system (50 each 15 cfm diffusers), two 50 hp blowers, and 100 gpm decant pump. Enclose digester with an

FRP cover and collect and route foul air with an FRP fan and buried FRP ducts to the centralized odor control facility (project 18).

16C Lime Handling System. Construct modular system for lime application contained in a 12' diameter 34' high 1,000 cubic foot silo, bin vibrator, 1,725 pound per hour slurry screw feeder, 750 gallon slurry mix tank, two 40 gpm centrifugal slurry pumps, programmable logic controller, NEMA 4 enclosure, truck fill panel, and dust filter. Mounted on a 18'x18' concrete foundation.

17. Third Aeration Basin & Blower and Third Clarifier & RAS/WAS sludge pump. Construct a third aeration basin, size to match the existing. Provide fine bubble diffused aeration, blower, air piping, and associated influent/effluent piping and valves.

Construct 60 foot diameter 14 foot deep clarifier with full diameter sludge collection system, skimmer, drives, feed well, and access bridge. Provide new return/waste sludge pump. Provide associated piping and valves.

18. Headworks/Centralized Biofilter Odor Control. Enclose headworks in a 45'x15'x10' high FRP structure. Provide a 6-foot diameter x 14-foot tall synthetic media biofilter with duct and blowers to serve as a centralized facility for odor control. Biofilter is sized to accept air flow from future processes.

19. Storage Building. Construct a new 40'x35'x12' high pole frame building for storage of materials, equipment, and vehicles. Features to match existing pole storage building.

20. Cover Existing Digester and Equalization Basin – Odor Control. Enclose digester and equalization basin with FRP covers to collect foul air and direct air with FRP fan and buried FRP ducts to the centralized odor control facility.

21. The Brooten North/Resort Drive and Nestucca Manor STEP Systems. Replace each STEP system with a 100 gpm submersible pump station in a 6-foot diameter precast wet well. On Brooten North/Resort Drive, provide 4,000 feet of new 8-inch gravity sewer. At Nestucca Manor, provide 2,000 feet of 8-inch gravity sewer.

22. Filter Feed Pumps. Replace existing filter feed pumps with submersible pumps. Provide selected new piping and valves. Grout the floor of holding tank to allow positive drainage and improve maintenance.

23. Upgrade the Roger and Beachy Pump Stations. Upgrade the pump station by replacing the pumps to match existing capacity, provide new discharge piping to a 4'x4' vault to house new check valves. Upgrade the electrical panel, controls, security, and safety features.

25. Second Equalization Basin with Odor Control. Construct a second flow equalization basin with coarse bubble aeration and a new 20 hp blower. Interconnect to existing basin using gates. Provide three submersible pumps with variable frequency drives and level control. Enclose new basin with an FRP cover and collect and route foul air with an FRP fan and buried FRP ducts to the centralized odor control facility.

26. Pump Station Telemetry. Provide a system-wide radio telemetry system to monitor key functions of each pump station. Central system will consist of a base station with personal computer, software and transceiver. At each pump station to provide intrusion alarms, pump on/off sensor, level sensors, control panel, PLC, radio, and antennae. Includes programming by systems contractor.

27. WWTP Monitoring. Provide sensors at key points within the process stream. Connect these to the plant-wide monitoring system. Includes eleven level sensors, two flow meters, 4 pump on/off sensors, 4 vaults, 3 dissolved oxygen meters, a computer with UPS and ethernet switch, Wonderware software, PLC configuration, and 1,000 feet of new conduit and wire.

29. Upgrade the Straub and Cindy Lane Pump Stations. Upgrade the pump station by replacing the pumps to match existing capacity, provide new discharge piping to a 4'x4' vault to house new check valves. Upgrade the electrical panel, controls, security, and safety features.

4.2 IMPLEMENTATION SCHEDULE AND CAPITAL COST OPINIONS FOR RECOMMENDED IMPROVEMENTS

Table 4-1 contains the improvements and proposed schedule for implementation. An opinion of the total project cost is also shown in Table 4-1. More details on the cost opinion are in Appendix G. The cost opinion includes construction cost, surveying, engineering, a contingency, and PCJWSA administrative costs. The following general assumptions apply to the cost opinions:

- For the 2009 CIP Update, costs were escalated from 2004 to January 2009 using the Engineering News Record Building Cost Index. This increased costs 22 percent. For selected equipment, such as the clarifier and grit system, updated quotes were obtained from equipment manufacturer representatives. Additionally, electrical and control costs, included as a percentage of construction, were increased for the 2009 estimate to 25-30%, depending on complexity, based on recent project experience.
- Treatment plant improvements were based on vendor quotations for major process equipment plus installation. Other costs might include piping, valves, electrical and controls, site work, structures, ventilation, and lighting.
- A 25 percent contingency was added to address details not covered in this preliminary estimate and to attend to unanticipated circumstances. Actual costs may vary because of market conditions, contractor desire for work, subsurface conditions, and other factors not know at this time.
- Pipeline project costs were based on bids from recent similar work.
- Surveying is included for new pipeline and site work. Production rates were estimated based on the complexity of the project. Includes technician time to prepare base maps for engineering design. Survey crew and technicians were updated to 2009 rates.
- Restoration for pipeline work was by one of two methods: (1) County road restoration that requires backfill using control density fill. (2) City road restoration that applies to all other paved areas. This requires less costly aggregate backfill.
- The bridge pipeline costs were based on previous bids tabs for bridge work inflated to the proposed year of construction.

- An 18 percent markup was added for contractor mobilization, overhead and profit. The exception to this is where PCJWSA directly purchases and installs equipment with minimal contractor involvement. Examples include the UV upgrade, the filter upgrade, and the purchase of the vactor truck.
- Other project costs include design engineering, bidding and construction phase services, project management, quality control reviews, and preparation of the DEQ required operation and maintenance manual and record drawings. Engineering was based on the complexity of the project and the estimated number of engineering plans. The number of drawings were estimated based on recent projects. Labor and expenses were based on 2009 rates.
- Geotechnical investigations were added to support selected projects.
- PCJWSA administrative costs were assumed to be 5 percent of the total to cover project management, coordination, administrative, and legal review costs.
- Costs for property purchase or easements are not included.

PCJWSA Wastewater System Improvements Update - 2009

Project	Description	Year	Construction	Contractor Mob & Markup- 18%	Contingency 25%	Surveying	Geotechnical	Engineering	Subtotal	PCJWSA Admin	Project Total 2009 Dollars
1	WWTP Influent Pump Station and Outfall Hydraulic Modeling.	2009	$ 55.0	$ 10.0	$ 16.0			$ 12.0	$ 93.0	$ 4.0	$ 97.0
2	Generator Deployment Plan.	Project Completed		$ -	$ -						
3	Tertiary Filters.	Project Completed									
4	Hay Baler.		$ 75.0	$ 14.0	$ 19.0			$ -	$ 108.0	$ 1.0	$ 109.0
5	Activated Sludge Diffused Aeration System.	2010	$ 158.4	$ 29.0	$ 40.0			$ 98.9	$ 326.4	$ 15.0	$ 341.4
6	Vactor Truck.		$ 268.5	*	$ 67.0				$ 335.5	$ 17.0	$ 352.5
7	Clarifier Scum Box/Collection, skimmers/baffle/sludge pump/piping, RAS/WAS Flow meter		$ 210.9	$ 38.0	$ 53.0			$ 84.2	$ 386.1	$ 17.0	$ 403.1
8	Grit System		$ 95.1	$ 17.0	$ 24.0			$ 74.1	$ 210.2	$ 10.0	$ 220.2
9A	Airport Pump Station	2011	$ 559.3	$ 101.0	$ 140.0	$ 2.5	$ 9.0	$ 207.7	$ 1,019.5	$ 46.0	$ 1,065.5
9B	Woods Pump Station Upgrade	2011	$ 237.6	$ 43.0	$ 59.0	$ -		$ 175.0	$ 514.6	$ 24.0	$ 538.6
9C	Replace Airport PS Force Main in Cape Kiwanda, Replace STEP pumps	2011	$ 354.2	$ 64.0	$ 89.0	$ 4.4	$ 6.0	$ 62.2	$ 579.8	$ 26.0	$ 605.8
10	River Crossing Pipelines - Slough, Woods Bridges		$ 121.5	$ 22.0	$ 30.0	$ 2.5		$ 82.6	$ 258.6	$ 12.0	$ 270.6
11	Aerobic Digester Aeration Improvements.		$ 39.7	$ 7.0	$ 10.0			$ 73.4	$ 130.2	$ 6.0	$ 136.2
12	Expand UV System.		$ 61.8	*	$ 15.0			$ 5.4	$ 82.2	$ 4.0	$ 86.2
13	Expand Tertiary Filters	2012	$ 160.6	*	$ 40.0			$ 7.3	$ 207.8	$ 10.0	$ 217.8
14	Upgrade Ella, Madrona, Kiwanda PSs	2013	$ 188.6	$ 34.0	$ 47.0			$ 157.3	$ 426.9	$ 20.0	$ 446.9
15	WWTP Standby Generator.	2014	$ 304.0	$ 55.0	$ 76.0			$ 93.8	$ 528.8	$ 24.0	$ 552.8
16,24,28	**Biosolids: Lime System, 2nd Digester, Dewatering**		$ 1,034.8	$ 186.0	$ 259.0	$ 4.4	$ 12.0	$ 350.3	$ 1,846.4	$ 83.0	$ 1,929.4
17	Third Aeration Basin & Blower, Third Clarifier & RAS/WAS Sludge Pump		$ 618.8	$ 111.0	$ 155.0		$ 9.0	$ 207.9	$ 1,101.7	$ 50.0	$ 1,151.7
18	Headworks/Centralized Biofilter Odor Control	2015	$ 170.7	$ 31.0	$ 43.0			$ 130.1	$ 374.8	$ 17.0	$ 391.8
19	Storage Building.		$ 83.4	$ 15.0	$ 21.0			$ 42.7	$ 162.0	$ 7.0	$ 169.0
20	Cover Digester & Equalization - Odor Control	2016	$ 220.8	$ 40.0	$ 55.0			$ 103.0	$ 418.7	$ 19.0	$ 437.7
21	Brooten N/Resort Dr and Nestucca Manor PSs to replace STEP systems.	2017	$ 911.4	$ 164.0	$ 228.0	$ 12.5	$ 6.0	$ 176.4	$ 1,498.3	$ 67.0	$ 1,565.3
22	Filter Feed Pumps.	2018	$ 106.5	*	$ 27.0			$ 11.1	$ 144.6	$ 7.0	$ 151.6
23	Upgrade Roger and Beachy PSs		$ 119.1	$ 21.0	$ 30.0			$ 135.3	$ 305.4	$ 14.0	$ 319.4
24	Consolidated into project 16	2019		$ -	$ -				$ -	$ -	$ -
25	Second Equalization Basin with Cover and Odor Control.	2020	$ 385.9	$ 69.0	$ 96.0		$ 6.0	$ 128.3	$ 685.2	$ 31.0	$ 716.2
26	Pump Station Telemetry System	2021	$ 320.5	$ 58.0	$ 80.0			$ 72.1	$ 530.6	$ 24.0	$ 554.6
27	WWTP Monitoring.	2022	$ 167.6	$ 30.0	$ 42.0			$ 61.4	$ 301.0	$ 14.0	$ 315.0
28	Consolidated into project 16	2024		$ -	$ -				$ -	$ -	$ -
29	Upgrade Straub and Cindy Lane PSs	2026	$ 129.1	$ 23.0	$ 32.0			$ 120.4	$ 304.5	$ 14.0	$ 318.5
TOTAL								$ 2,672.8	**$ 12,880.7**		$ 13,463.7

Prepared by Tom Nielsen and Ken Brown, Parametrix

Exhibit 1. CD of Pacific City Wastewater Master Plan, 2005

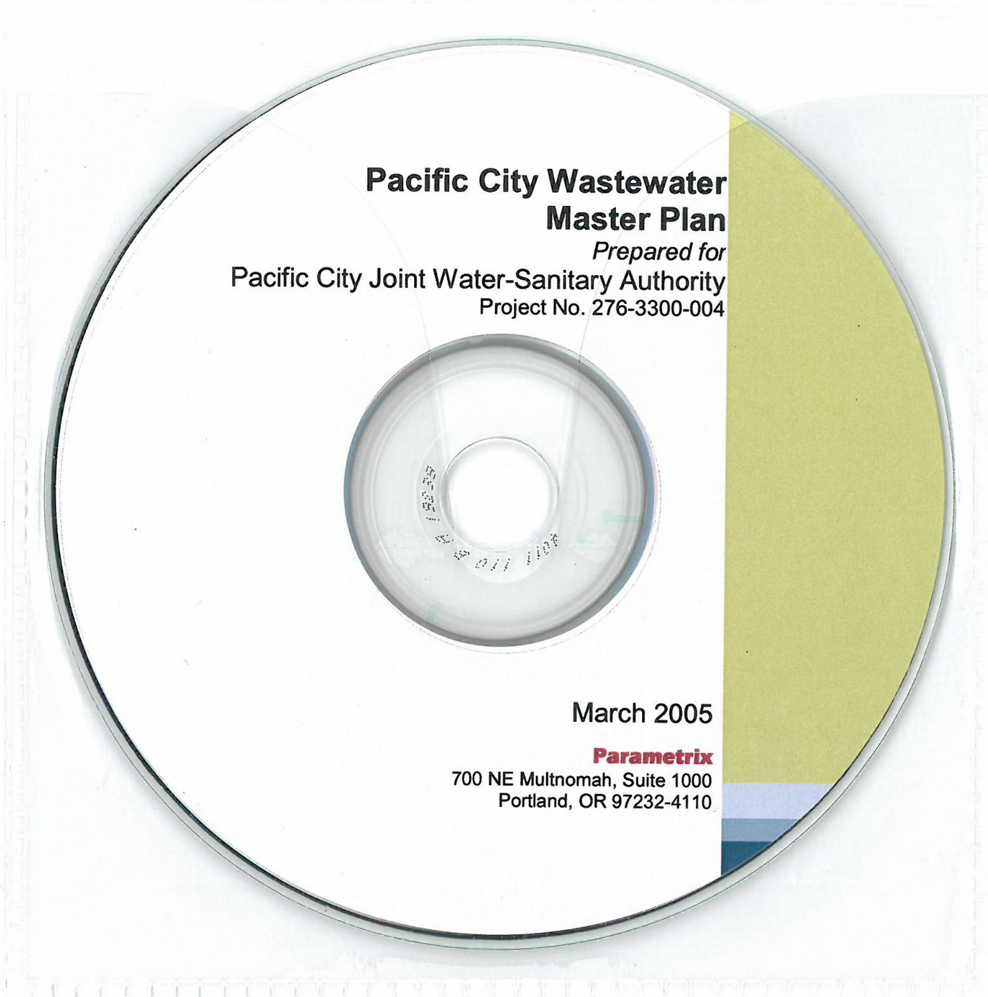


Exhibit 1. CD of Pacific City Wastewater Master Plan, 2005

APPENDIX B

Environmental Report and Response to USDA Comments

B1. DRAFT Preliminary Environmental Report

B2. USDA Comments

B1. DRAFT Preliminary Environmental Report

DRAFT
Preliminary Environmental Report

Prepared for

Pacific City Joint Water-Sanitary Authority
P.O. Box 520
34005 Cape Kiwanda Drive
Pacific City, OR 97135

Prepared by

Parametrix
700 NE Multnomah, Suite 1000
Portland, OR 97232-4110
T. 503.233.2400 T. 360.694.5020 F. 503.233.4825
www.parametrix.com

October 2014 | 276-3300-004

CITATION

Parametrix. 2014. DRAFT
Preliminary Environmental Report. Prepared by
Parametrix, Portland, Oregon. October 2014.

TABLE OF CONTENTS

LIST OF TABLES

EXHIBITS

ACRONYMS

APE	area of potential effect
BLM	Bureau of Land Management
BOD	Biochemical Oxygen Demand
CDP	Census-designated place
CGB	Community Growth Boundary
CZMA	Coastal Zone Management Act
DEQ	Oregon Department of Environmental Quality
DLCD	Department of Land Conservation and Development
ESA	Endangered Species Act
FIRM	Flood Insurance Rate Map
LCDC	Land Conservation and Development Commission
MBR	membrane bioreactor
MGD	million gallons per day
NMFS	National Marine Fisheries
NPDES	National Pollutant Discharge Elimination System
OAR	Oregon Administrative Rules
OCMP	Oregon Coastal Management Program
ORBIC	Oregon Biodiversity Information Center
PCJWSA	Pacific City Joint Water-Sanitary Authority
PCW-P	Pacific City/Woods Park Zone
PCW-R2	Pacific City/Woods Medium Density Residential
PCW-R3	Pacific City/Woods High Density Residential
SBR	sequencing batch reactor plant
SHPO	Oregon State Historic Preservation Office
TSS	total suspended solids
USDA-RD	U.S. Department of Agriculture Rural Development
USFWS	US Fish and Wildlife Service
UV	ultraviolet
WWMP	Wastewater Master Plan
WWTP	Wastewater treatment plant

1. PURPOSE AND NEED OF THE PROPOSAL

The Pacific City Joint Water-Sanitary Authority (PCJWSA) owns and operates the wastewater treatment plant (WWTP) that serves approximately 1,000 full-time residents and approximately 3,000 seasonal residents in the unincorporated communities of Pacific City and Woods.

The WWTP has experienced permit violations, and recently PCJWSA was fined by the Oregon Department of Environmental Quality (DEQ) for exceedances in water quality parameters of the National Pollutant Discharge Elimination System (NPDES) permit for total suspended solids (TSS), biochemical oxygen demand (BOD), and pH on several occasions in 2011, 2012, and 2013. The purpose of this proposal is to upgrade existing facilities to bring the facility into compliance with the water discharge permit.

2. ALTERNATIVES TO THE PROPOSED ACTION

This environmental report is limited to reviewing the proposed action, which is detailed below, and the no action alternative. Other alternatives considered but rejected are listed in the section below.

The No Action Alternative would result in no changes to the existing facility. The current exceedances in water quality parameters would continue and potentially increase in frequency as the system is currently operating at capacity. The facility is currently running as efficiently as possible with the current configuration, so future water quality violations are inevitable without changes to the facility itself.

The proposed action is to upgrade the existing WWTP. Three engineering options evaluated for upgrading the existing WWTP are listed below:

- Upgrading the existing activated sludge WWTP, in general as described in the 2005 WWMP.
- Converting the existing WWTP to a sequencing batch reactor plant (SBR).
- Converting the existing WWTP to a membrane bioreactor (MBR) plant.

For each option, flow and loading under current and future conditions were estimated to develop the size of treatment processes. The activated sludge option affects the largest footprint on the site and is not significantly different in construction, operation, or long-term environmental effects from the other options. The activated sludge was used for the analysis in this environmental report. An overview of the improvements needed to implement the activated sludge option and the approximate areas and volumes of excavation are described below.

- Headworks improvements. The current WWTP does not have grit removal equipment. A new grit tank, grit pump, grit classifier/washer, and screenings compactor are recommended. This involves shallow 2-foot excavation for installation of three concrete foundations on grade for some components and for the concrete grit tank excavation to a depth of 10 feet and total excavation volume of 67 cubic yards.
- Replacement of pumps in the flow equalization basin and discharge piping and valves. This involves 3-foot-deep excavation for the new piping for a volume of approximately 15 cubic yards.

- Construction of a third concrete aeration basin encompassing an area of 625 square feet on the east side of the existing aeration basins. Replace existing mechanical aeration system with fine bubble diffusers and associated air piping, valves, and blowers. Raise the concrete walls in the two existing aeration basins. This involves 3-foot-deep excavation for the air piping and 13-foot-deep excavation for the third aeration basin for a total excavation of approximately 1,072 cubic yards.
- Construction of two new 35-foot-diameter circular secondary clarifiers and supporting equipment such as sludge pumps, piping, valves, and flow meters. This involves 3-foot-deep excavation for the piping and 15-foot-deep excavation for the clarifiers for a total excavation of approximately 2,460 cubic yards.
- Filter feed holding tank improvements would involve constructing a new sloped floor. No excavation is needed.
- Construction of third tertiary cloth media filter and associated piping and valves is needed to accommodate future flows and provide needed redundancy. The filter would be on an 8- by 12-foot concrete foundation on grade and requires 2-foot-deep excavation of 6 cubic yards.
- Two ultraviolet (UV) light disinfection banks would be installed in an existing basin. No excavation is needed.
- Improvements to the existing aerobic digester consisting of new aeration system, two new blowers, and associated piping and valves. This involves 3-foot-deep excavation for new piping for a volume of approximately 8 cubic yards.
- New aerobic digesters in a 1,089-square-foot concrete tank, coarse bubble diffusers, blowers, pumps, piping, and valves. The tank would have an excavation depth of 13 feet and a total approximate excavation volume of 1,450 cubic yards.
- A new biosolids dewatering system housed in a new 35- by 40-foot building. The building would require 2-foot-deep excavation for installation of a concrete foundation on grade and total excavation volume of 141 cubic yards.
- A new standby diesel generator and automatic transfer switch housed in an expansion of the existing blower building. The building would require 2-foot-deep excavation over a 26- by 17-foot area for the concrete foundation on grade and total excavation of 42 cubic yards.
- Instruments and controls would be provided on new equipment. Various electrical conduits would be installed in shallow trenches 2 feet deep for a total excavation volume of 15 cubic yards.

2.1 ALTERNATIVES CONSIDERED BUT REJECTED

Three alternatives other than upgrades to the existing WWTP were considered but rejected. These include:

- Building transmissions lines to new or different centralized facilities. This alternative assumes a new pump station and transmission pipeline would transmit sewage to the nearest neighboring community with a wastewater treatment system, which is currently more than 5 miles away. This option was rejected because the cost and time required to build the pump station and transmission line greatly exceed upgrading the existing facility, and the neighboring facility may also need upgrades to handle the additional wastewater. In addition, placement of more than 5 miles of additional transmission pipe would likely result in greater environmental impacts.

- Developing centrally managed decentralized systems. This alternative would decommission the existing WWTP and construct septic tanks serving clusters of homes. This alternative would be a return to the previous condition before the community built the WWTP. The soils are poor and lot sizes are small, which makes this alternative a poor and unreasonable option. In addition, water quality would likely decrease under this option.
- Developing an optimum combination of centralized and decentralized systems. This alternative would maintain the existing WWTP facility in the current condition and remove some residential and commercial properties from service. Instead these properties, as well as future construction, would have septic systems installed. This alternative was rejected because the soils in the area are poor for drainfields and lot sizes are too small to support building development along with a drain field. In addition, water quality would likely decrease under this option.

3. AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES

3.1 LAND USE

Pacific City is an unincorporated community in Tillamook County, Oregon (Pacific City 2014). While the community did have a working-town history mostly for fishing, logging, and dairies, it has primarily been a resort and vacation destination since the 1950s.

The WWTP is located at 34005 Cape Kiwanda Drive, Pacific City, Tillamook County, Oregon, and parcel information is Map 4S10-19 Tax Lot 301 (see Figure 1). The facility is located in Pacific City/Woods Park Zone (PCW-P) where wastewater treatment plants are an outright permitted use (Murphy 2014). The outfall is located at the road end of Ella Avenue on the Nestucca River; however, no changes are planned for the outfall or any of the transmission lines to or from the WWTP. No changes to land use or zoning are required, and no special permits are required for the proposed project. Necessary permits would be limited to those required for any construction project, such as construction, grading, and development permits.

3.1.1 General Land Use

The zoning around the WWTP includes the following:

- PCW-P Pacific City/Woods Park Zone
- PCW-R2 Pacific City/Woods Medium Density Residential
- PCW-R3 Pacific City/Woods High Density Residential

The lot to the north of the WWTP is zoned PCW-P and is currently forested (Figure 2). The property to the east is part of the Salem District of the Bureau of Land Management (BLM) and is forested. To the northwest is PCW-R3 and the remainder is PCW-R2, high density and medium density residential, respectively. The uses west of the facility are residential, and the use to the south is mini-storage.

3.1.2 Important Farmland

According to the USDA Web Soil Survey, the site is located on Waldport fine sand, thin surface, 3 to 12 percent slopes (see Figure 3), which is not rated as prime farmland (NRCS 2013). No important farmland would be impacted.

3.1.3 Formally Classified Lands

The project area is not located within or directly adjacent to formally classified lands. Within 1 mile of the facility are four local, state, and national parklands. These facilities are located within the service area of the WWTP and would benefit positively by the proposed project as water quality in the area would be protected.

Name	Distance and direction from WWTP	Owner
Mugg County Park	0.4 mile SE	Tillamook County
Webb County Park	0.4 mile NNW	Tillamook County
Cape Kiwanda State Park	0.8 mile NW	State of Oregon
Bureau of Land Management	Portions within 0.5 mile NE, E, and S	Bureau of Land Management

3.2 FLOODPLAINS

The WWTP is located in Zone C per the most recent Flood Insurance Rate Map (FIRM), Community-Panel Number 41096-0305A and dated August 1, 1978 (FEMA 1978) (see Figure 4). Flood Zone C is listed as having a minimal flood hazard and less than a 0.2 percent chance of annual flooding. There is minimal flooding hazard for the facility.

Related to flooding and of concern for the entire west coast are tsunami hazards. Under the Local Source (Cascadia Subduction Zone) inundation map, the facility is located in the tsunami hazard zone under a large earthquake situation (DOGAMI 2014). The facility is included in the local evacuation planning, including protection of key facilities and evacuation routes. The proposed project would not impact current tsunami planning efforts, and no changes are proposed to the facility tsunami planning documents.

3.3 WETLANDS

Based on a June 10, 2014, site visit by Parametrix staff, no wetlands occur within the project area. According to the United States Fish and Wildlife Service (USFWS) National Wetlands Inventory, no wetlands occur within the project area (USFWS 2014) (see Figure 3). Furthermore, according to the United States Department of Agriculture Natural Resources Conservation Service Web Soil Survey, hydric soils are not present within the project area (NRCS 2013). Local Wetlands Inventory is not available for the project area.

Based on the above information, the proposed project would have no impacts to wetlands.

3.4 HISTORIC PROPERTIES AND ARCHAEOLOGY

Pacific City was originally homesteaded as Ocean Park in 1893, with the name changed to Pacific City in 1907 to reduce confusion with another city in Washington (Pacific City 2014).

3.4.1 Historic Property Information

The purpose of this section is to identify if there are properties or places within or near the project area that are protected under Section 106 of the National Historic Preservation Act. For purposes of this review, the area of potential effect (APE) is the property boundary as all work would occur on the existing property. Two properties were identified on the Oregon Historic Sites Database (OPRD 2014a, 2014b) as being within 1 mile of the APE. They are Cape Kiwanda and Ferry Street house.

Cape Kiwanda is a park/plaza area located at the end of Beach Road and approximately 1 mile northwest of the WWTP. Its historical name was Sand Cape. The site is listed in the Tillamook County Comprehensive Plan as being significant to the county for its association with travel and recreation (Tillamook Comprehensive Plan). The site is also identified as a dory launching site, which is of cultural significance to the area. The original construction occurred circa 1910 with an update possibly constructed in 1972. The site is eligible and a contributing element for a potentially eligible site for listing on the National Register of Historic Places. The site would not be directly impacted by the proposed action. There are no indirect impacts including visual impacts of the view from and to the park because there would be no noticeable changes to the view of or to the park. Negligible indirect construction impacts may occur due to the visual impact of construction vehicles but noise is not expected to impact park activities.

The second site is a single-family dwelling located at 6445 Ferry Street, reportedly built circa 1947. It is located approximately 0.5 mile south-southeast of the WWTP and across the Nestucca River. It was deemed ineligible for listing on the National Register of Historic Places. Therefore, there are no Section 106–related impacts to this property.

3.4.2 Archaeological Resources

Correspondence with SHPO indicated there were no known archaeological sites and/or buried human remains reported in the general project vicinity but that the "project area lies within an area generally perceived to have a high probability for possessing archaeological sites and/or buried human remains." However, few surveys have previously been conducted near the project area. SHPO recommends extreme caution during ground-disturbing activities.

The project team conducted an archaeological survey of the site on September 17, 2014. The entire WWTP property was surveyed with walking transects spaced no more than 10 meters apart. The ground surface was found to be disturbed across most of the APE, but no archaeological deposits were identified on the ground surface. Because of the location near the base of Cape Kiwanda between the ocean and the Nestucca River, the APE is considered to have moderate to high probability to contain subsurface archaeological resources. However, the specific project area appears to have lower potential. For that reason, it was recommended that no further archaeological investigations are necessary. If during construction activities discolored soils, rocks, buried soil horizons, artifacts (prehistoric or historical), or cultural features are encountered, all activities should cease immediately and the Oregon SHPO should be promptly notified. The methods, results, and conclusions are detailed in the survey report (see Exhibit A).

3.4.3 Visual Aesthetics

Pacific City is a resort destination community so visual aesthetics are important to the visitor experience. Visiting the beach and viewing the ocean, including Haystack Rock, are visually important activities within the community. The community is sensitive to ensuring a quality experience for visitors including seasonal residents, tourists to the community, and others enjoying the Oregon beach in general. Among the ways the community protects views and visual aesthetics is through implementation of the comprehensive plan, which limits the heights of most structures, including locating communication towers away from where aesthetic views could be impacted.

In addition to the general resort area, there are several sensitive visual aesthetics receptors in the area including several county and state parks, BLM land, and a historic site. As there would be no noticeable change post-construction, there are no visual impacts due to the proposed project. There would be negligible impacts during construction due to the slight increase in truck traffic through the community.

3.5 BIOLOGICAL RESOURCES

In order to fully assess biological resources within and near the project area, Parametrix biologists reviewed available data sources and conducted a site visit on June 10, 2014. During the site visit, Parametrix biologists assessed habitat conditions within the project area.

The project area consists of existing buildings, storage tanks, gravel access roads, patches of grass/weeds that are regularly mowed, a small depressional area that collects stormwater, and scattered shore pines (*Pinus contorta* var. *contorta*). Thus, biological resources within the project area are limited.

Treated wastewater from the WWTP is discharged through Outfall 001 to the Nestucca River at river mile 1.5, approximately 0.5 mile south (off site) of the project area. The outfall’s associated 36-foot total length diffuser pipe is located approximately 180 feet off the west shore of the Nestucca River at a point where the river is approximately 350 feet wide. The diffuser is approximately 8 feet below low water level in the river. However, no changes are planned for the outfall or any of the transmission lines to or from the WWTP.

3.5.1 Biological Resources Information

During the June 10, 2014 site visit, a Parametrix biologist observed black-tailed deer (*Odocoileus hemionus columbianus*) and various song birds adjacent to the project area within the forested land. The forested land may also support small mammals (e.g., raccoons [*Procyon lotor*]) and reptiles (e.g., common garter snake [*Thamnophis sirtalis*]).

Off-site data collection efforts involved a search and review of existing information related to fish and wildlife distribution and habitat within and surrounding the proposed project area. To determine species presence, existing data covering the project area were accessed from USFWS and National Marine Fisheries Service (NMFS) websites. The species lists from these websites were most recently accessed in June 2014. Furthermore, the Oregon Biodiversity Information Center (ORBIC) produced a database search on June 11, 2014, for rare, threatened, and endangered plant and animal records for species that may occur within a 2-mile radius of the proposed project. Records of two federally listed species were returned from the database search: Oregon Coast (OC) coho salmon (*Oncorhynchus kisutch*) and Western snowy plover (*Charadrius alexandrinus nivosus*).

Federally listed species identified by USFWS, NMFS, and ORBIC that may be present within the project vicinity are listed in Table 1 and are addressed within Exhibit B – Determination of No Effect for Listed Species.

Table 1. Federally Listed Species within Vicinity of Project Area

Species[a] ***(Scientific Name)***	**ESA[b] Status**	**Critical Habitat Designated?**
Marbled murrelet *(Brachyramphus marmoratus)*	Threatened	Yes; not present in project area
Northern spotted owl *(Strix occidentalis caurina)*	Threatened	Yes; not present in project area
Western snowy plover (*Charadrius alexandrinus nivosus*)	Threatened	Yes; not present in project area
Short-tailed albatross (*Phoebastria [=Diomedea] albatrus*)	Endangered	No
Coho salmon (Oregon Coast ESU) (*Oncorhynchus kisutch*)	Threatened	Yes; not present in project area
Green sturgeon (Southern DPS) (*Acipenser medirostris)*	Threatened	Yes; not present in project area

a ESU = Evolutionarily Significant Unit; DPS=Distinct Population Segment

b ESA= Endangered Species Act

Salmonids found within the Nestucca River that are not federally listed as threatened or endangered include chum salmon (*O. keta*), Chinook salmon (*O. tshawytscha*), steelhead (*O. mykiss*), and coastal cutthroat trout (*O. clarki clarki*) (USFWS 2013). Of these, Chinook salmon, chum salmon, and steelhead returned from the ORBIC database search. Other species found in the Nestucca River include, but are not limited to, Western brook lamprey (*Lampetra richardsonii*), river lamprey (*L. ayersii*), Pacific lamprey (*Entosphenus tridentatus*), daces (*Rhinichthys* spp.), and sculpins (*Cottus* spp.).

The Nestucca River Bay area supports six subspecies of geese, including the Aleutian cackling goose (*Branta hutchinsii leucopareia*) and the only coastal wintering population of dusky Canada goose (*Branta canadensis occidentalis*). It is also an important rest stop for migrating shorebirds and other waterfowl and is used by peregrine falcons (*Falco peregrinus*) and bald eagle (*Haliaeetus leucocephalus*) (USFWS 2013). Of these, records of Aleutian cackling goose, peregrine falcon, and bald eagle were returned from the ORBIC database search as well as tufted puffin (*Fratercula cirrhata*) and fork-tailed storm-petrel (*Oceanodroma furcata*).

The ORBIC database search returned records of two plant species that have been observed within 2 miles of the project site: short-stemmed sedge (*Carex brevicaulis*) and Henderson's sidalcea (*Sidalcea hendersonii*). Neither of these plants, nor their habitats, occurs within the project area.

Additionally, Parametrix biologists contacted Martin Nugent from the Oregon Department of Fish and Wildlife on June 17, 2014, to discuss habitat conditions, species presence, potential project impacts, and other project details, but a response to the queries was not received.

3.5.2 Biological Resources Summary

The proposed project would have negligible impacts to wildlife species or habitats based upon the following:

- Activities would occur within the existing footprint of the WWTP which does not provide suitable habitat for wildlife species.

- The distance where construction noise becomes indistinguishable from background (ambient) noise is less than the distance from the project area to suitable habitat for federally listed wildlife species (See Exhibit B).
- Forested areas would not be disturbed; approximately three shore pines with diameters at breast height of less than 6 inches may be removed from within the existing facility.
- No jurisdictional wetlands would be impacted.

The proposed project would have negligible impacts to fish species or habitats based upon the following:

- No changes would occur to the treated wastewater outfall (the outfall is sized for 1 MGD, the upgraded facility would not approach this flow amount) or any of the transmission lines to or from the WWTP.
- No in-water work would be required.
- No jurisdictional wetlands would be impacted.

3.6 WATER QUALITY

The WWTP has experienced permit violations for exceedances in water quality parameters of the NPDES permit for TSS, BOD, and pH on several occasions in 2011, 2012, and 2013. Therefore, PCJWSA plans to upgrade the WWTP by implementing selected projects from an existing wastewater master plan improvement list. These upgrades are described and addressed within this document. The proposed upgrades are anticipated to meet discharge permit requirements as well as to provide dependable treatment for the future.

Furthermore, the proposed project would not impact existing or potential beneficial uses of groundwater. All wastewater and process-related residuals would be managed and disposed of in a manner that would prevent violation of the Groundwater Protection Rules (OAR 340-040).

3.7 WILD AND SCENIC RIVERS ACT

The Wild and Scenic Rivers Act of 1968 preserves “certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations.” The Nestucca River is not designated as a wild or scenic river (NWSRAS 2014), so this act does not apply to the project.

3.8 COASTAL ZONE MANAGEMENT ACT

Oregon implements the Coastal Zone Management Act through the adoption of statewide planning goals and administrative rules, adoption and amendment of local comprehensive plans, and ensuring local land use decisions are in conformance with state-approved comprehensive plans. Proposed projects that meet the land use and zoning requirements of the local jurisdiction’s comprehensive plan are in compliance with the Coastal Zone Management Act. The proposed project is consistent with the applicable regulations including the Tillamook Comprehensive Plan; therefore the proposed project is consistent with the Coastal Zone Management Act. The Consistency Determination is included in Exhibit C.

3.9 SOCIO-ECONOMIC ISSUES/ENVIRONMENTAL JUSTICE

The 2010 Census population for the Pacific City Census-designated place (CDP) was 1,035, a slight increase from 2000 when the population was 1,027 (American FactFinder 2010). Using the 2010 census results, the median age was 55.4 years and the majority of residents identified as white (92 percent). Approximately 2 percent of the residents classified themselves as "some other race," and 1 percent identified as American Indian/Native Alaskan. A small percentage identified themselves as Hispanic (6 percent). Approximately 56 percent of the housing units are identified as seasonal, recreational, or occasional use where approximately three-quarters of the housing is owner-occupied.

The community is served by Nestucca Valley School District #101 with an elementary and high school in Cloverdale, which is approximately 6 miles away, and a middle school in Beaver, which is approximately 11 miles away (Pacific City 2014).

There are several parks within the project area including Woods Park at the north end of the community, Mugg Park also at the north end, and Presbyterian Community Park located near the center of town (Pacific City 2014). Bob Straub State Park is located on the spit created by the Nestucca River. Cape Kiwanda State Park and Natural Area is located on the spit to the west of town. Webb Park Campground is also located in this area.

Pacific City has a medical and dental building in the city limits with the nearest full service hospital is the Tillamook County Hospital in the City of Tillamook. The Pacific City community utilizes the Tillamook County Sheriff Department for police services but maintains its own fire and rescue department.

3.9.1 Socioeconomic Issues

The project area is located in an unincorporated portion of Tillamook County. As demonstrated by the census information above, the area is lightly populated with little change over 10 years, maintaining a rural character. Population projections indicate little change is anticipated in the population of the area for permanent and seasonal residents and visitors. The proposed project would not change the area's socioeconomic makeup, as the proposed project would serve the current needs of the community.

3.9.2 Environmental Justice Issues

Environmental justice is a two-step process to determine if there is a potential environmental justice concern. The first step is to determine if there is a protected minority or low-income population in the project area. The second step is to determine if there is a disproportionately high or adverse human or environmental impact on that protected population.

According to the American Fact Finder, the community was approximately 92 percent white and that 100 percent spoke English as their primary language (American FactFinder 2010). A minority population was not identified in the community.

The community had approximately 24 percent of households identified as below the poverty level (American FactFinder 2010). While the poverty level is a sliding scale depending on the number of people in the household, for 2010 the poverty threshold for a two-adult, two-child household was $22,113. This finding indicates a low-income population in the Pacific City/Woods community.

As negative permanent environmental impacts are negligible, there is not a disproportionately high and adverse health impact on environmental justice populations. The construction impacts are negligible for all populations, and impacts would be the same for all populations.

3.10 AIR QUALITY

The project is not located in a non-attainment area for air quality (EPA 2014). The WWTP currently has no odor control facilities, but odor complaints are very infrequent (Owen 2014). The current practice is to minimize potential odor issues by restarting the digester when there are strong winds, which would usually be blowing onshore. This is away from populations and has been an effective means of minimizing odors and odor complaints.

The proposed project would not add odor control facilities. However, improved performance with the project would better treat organic loads, which would coincidentally reduce the potential for odor creation. Therefore, no direct project impacts are anticipated on air quality.

Negligible air quality impacts are noted for construction due to the use of heavy equipment and trucks. However, onshore winds prevent air quality from exceeding thresholds, so no mitigation is required.

3.11 TRANSPORTATION

The community is accessed from the north via Cape Kiwanda Drive/Sandlake Road and from the west via US 101 and Brooten Road or Resort Drive. These roads are well-traveled during the summer months and holidays. The main roadways are used by many motorized and nonmotorized users, especially in the tourist season. Nonmotorized users include pedestrians and bicyclists. The Pacific City State Airport is located within the community and is suited to smaller private airplanes with a 1,875-foot-long runway. A traffic study was not performed.

Roads within the community are paved as are many parking areas. The major roads are two-lane roadways with shoulders through the community. Many of the side streets are single-lane without striping, as well as there being many driveways for access to multiple residences. Exterior lighting is minimal and mostly restricted to parking lot areas with no street lighting in the project area. There are street lights at some intersections.

Local roadways and transportation would not be impacted by the project. No roadway work is proposed. During construction, trucks would use the roadways for access to the project site, but the likely travel routes have wide shoulders and good site distances for truck mobility.

There would be no permanent transportation impacts due to the proposed project. Negligible construction impacts may occur due to the minor increase in truck traffic. However, truck traffic would be limited to major roadways, and there is sufficient capacity and site distance for turning into and out of the facility.

3.12 NOISE

The project is located within a resort community and adjacent to BLM land. Current conditions of very low levels of noise would be maintained after upgrades to the WWTP. The primary source of noise pre- and post-construction is from backup alarms on vehicles. During construction, there would be more truck and heavy equipment activity, including the associated backup alarms and noise from large equipment. Additionally, there would be truck traffic through residential neighborhoods and potentially near sensitive park and recreation sites. Truck traffic may use Cape Kiwanda Drive/McPhillips Drive/Sandlake Road from the north or access the site from US 101 via Resort Drive or Brooten Road. There would be no change in noise levels from current conditions during operation and negligible noise levels during construction of the proposed project.

3.13 CUMULATIVE EFFECTS

Cumulative effects result from the incremental effect of a proposal when added to other past, present, and future actions regardless of who undertakes such other actions. The project area has been developed since the early 1900s with fluctuations in population over time. The community has been a resort destination with moderate residential and commercial development. However, in the last 5 years there has been no new commercial development and minimal new housing stock added (Tupper 2014). Utilizing available data from real estate sources, the average age of homes is 27 years with few to no new building permits issued in the last few years and infrequent sales of existing stock. This housing trend summary is supported by the minimal change to the census figures for permanent residents (+0.01 percent) from 2000 to 2010.

The direct and indirect permanent and construction impacts from the project are none to negligible with the majority of impacts being negligible construction impacts. In combination with the past development and future development, the project would not have a cumulative impact.

4. SUMMARY OF MITIGATION

No mitigation is proposed for this project. There are negligible effects anticipated from construction of the project but none that require mitigation.

Due to the lack of data concerning archaeological and buried human remains, the contractor should use caution during construction and immediately stop work in areas where archaeological and/or human remains are encountered until a professional archaeologist can evaluate the discovery.

5. AGENCY CORRESPONDENCE

A letter was sent to SHPO on June 12, 2014, requesting a review of available data for archaeological sites. The response dated July 7, 2014, indicated there were no known archaeological sites and/or buried human remains reported in the general project vicinity but that the “project area lies within an area generally perceived to have a high probability for possessing archaeological sites and/or buried human remains.” However, few surveys have been conducted near the project area. SHPO recommends extreme caution during ground-disturbing activities.

An email was sent to Patrick Wingard with Department of Land Conservation and Development (DLCD) on June 16, 2014, regarding the coastal zone consistency determination procedure. During a phone conversation on June 16, 2014, it was indicated that Coastal Zone Management Act consistency is covered if the comprehensive plan is followed.

An email was sent to Debbie Tupper at the Tillamook County Permit Counter on June 25, 2014, regarding the number of building permit applications and issued permits over last 5 years.

On August 27, 2014, letters were sent to the Confederated Tribes of the Grand Ronde and the Confederated Tribes of Siletz Indians regarding initiation of the Section 106 process. These letters included a description of the project and communication between project staff, USDA, and SHPO. See Exhibit D for a copy of the letter sent to the Confederated Tribes of the Grand Ronde. A response from Jordan Mercier of the Confederated Tribes of the Grand Ronde

Community of Oregon Cultural Protection Program was received by email on September 24, 2014, requesting additional project details regarding the depths of the excavations and depth of the fill layer at the site. Additional detail will be provided with the submittal of the pedestrian survey report to both tribes.

5.1 RESPONSE TO AGENCY COMMENTS

Pending comments.

6. LIST OF PREPARERS

The following sections were prepared by Jennifer Lundberg, CEP. Jennifer has over 22 years of experience in environmental documentation. She has been the author for environmental assessments meeting USDA Rural Development projects in Alaska as well as has served as a technical expert for numerous subject areas for environmental assessments and environmental impact statements for various federal projects.

- Land use
- Floodplains
- Historic properties and archaeology including visual aesthetics
- Wild and scenic rivers act
- Coastal zone management act
- Socio-economic
- Environmental justice
- Air quality
- Transportation
- Noise
- Cumulative effects

The following sections were prepared by Cyrus Bullock of Parametrix. Cyrus has over 17 years of experience in environmental science and specifically in fisheries, ecological function, and wetlands. He is certified to author biological assessments by the Oregon Department of Transportation.

- Wetlands
- Biological resources
- Water quality
- Determination of Effect for ESA- and other listed species

7. REFERENCES

American Fact Finder 2010. 2010 US Census. Accessed 10 June 2014. Available at http://factfinder2.census.gov/faces/nav/jsf/pages/community_facts.xhtml.

EPA 2010. EnviroMapper. Accessed 10 June 2010. Available at http://www.epa.gov/emefdata/em4ef.html?ve=12,45.20193099975586,-123.9626235961914&pText=Pacific City, OR.

Federal Emergency Management Agency (FEMA) 1978. Flood Insurance Rate Maps (FIRMs). Accessed 11 June 2014. Available at https://msc.fema.gov/webapp/wcs/stores/servlet/CategoryDisplay?catalogId=10001&storeId=10001&categoryId=12001&langId=-1&userType=G&type=1&dfirmCatId=12009&future=false.

Murphy, Tim. Personal Communication. Planner with Tillamook County. Contacted 12 June 2014.

National Wild and Scenic Rivers System (NWSRAS) 2014. Access 10 June 2014. Available at http://www.rivers.gov/washington.php.

NRCS (Natural Resources Conservation Service). 2013. Web Soil Survey. Available at: http://websoilsurvey.nrcs.usda.gov/app/. Last Modified December 6, 2013. Accessed April May 22, 2014

ORBIC (Oregon Biodiversity Information Center). 2014. Data System Search for Rare, Threatened and Endangered Plants and Animal Records for PCJWSA.

Oregon Department of Geology and Mineral Industries, State of (DOGAMI). 2014. Oregon Tsunami Clearinghouse evacuation brochures and apps. Access 16 June 2014. Available at http://www.oregongeology.org/pubs/tsubrochures/PacificCityEvacBrochure-12-12-12_onscreen.pdf

Oregon State Parks and Recreation Department (OPRD). 2014a. State parks history. Accessed 11 June 2014. Available at http://www.oregonstateparks.org/index.cfm?do=parkPage.dsp_parkHistory&parkId=130.

Oregon State Parks and Recreation Department (OPRD). 2014b. Oregon Heritage: National Register database. Accessed 11 June 2014. Available at http://heritagedata.prd.state.or.us/historic/.

Owen, Tony. Personal Communication with Tom Nielsen. Pacific City Joint Water-Sanitary Authority Manager. Contacted 13 June 2014.

Pacific City 2014. Pacific City, Oregon Visitor's Guide. Accessed 10 June 2014. Available at http://pacificcity.org/.

Tillamook County. Comprehensive Plan 1982 with various updates. Accessed 12 June 2014. Available at http://www.co.tillamook.or.us/gov/ComDev/Planning/compplan.htm.

Tupper, Debbie. Personal Communication via email. Permit Technician, Tillamook County Department of Community Development. 26 June 2014.

USDA 2014. Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Web Soil Survey. Accessed 12 June 12, 2014. Available online at http://websoilsurvey.nrcs.usda.gov/.

USFWS (U.S. Fish and Wildlife Service). 2013. Nestucca Bay National Wildlife Refuge. Available at: http://www.fws.gov/oregoncoast/nestuccabay/index.htm. Last Updated September 13, 2013. Accessed June 17, 2014.

USFWS. 2014. National Wetlands Inventory. Available at: http://www.fws.gov/wetlands/Data/Mapper.html. Last Updated May 7, 2014. Accessed May 22, 2014.

FIGURES

Parametrix Date: 9/29/2014 Document Path: P:\3300_PacificCity_WWTP\Fig1_PacificCity_ProjectLocation.mxd

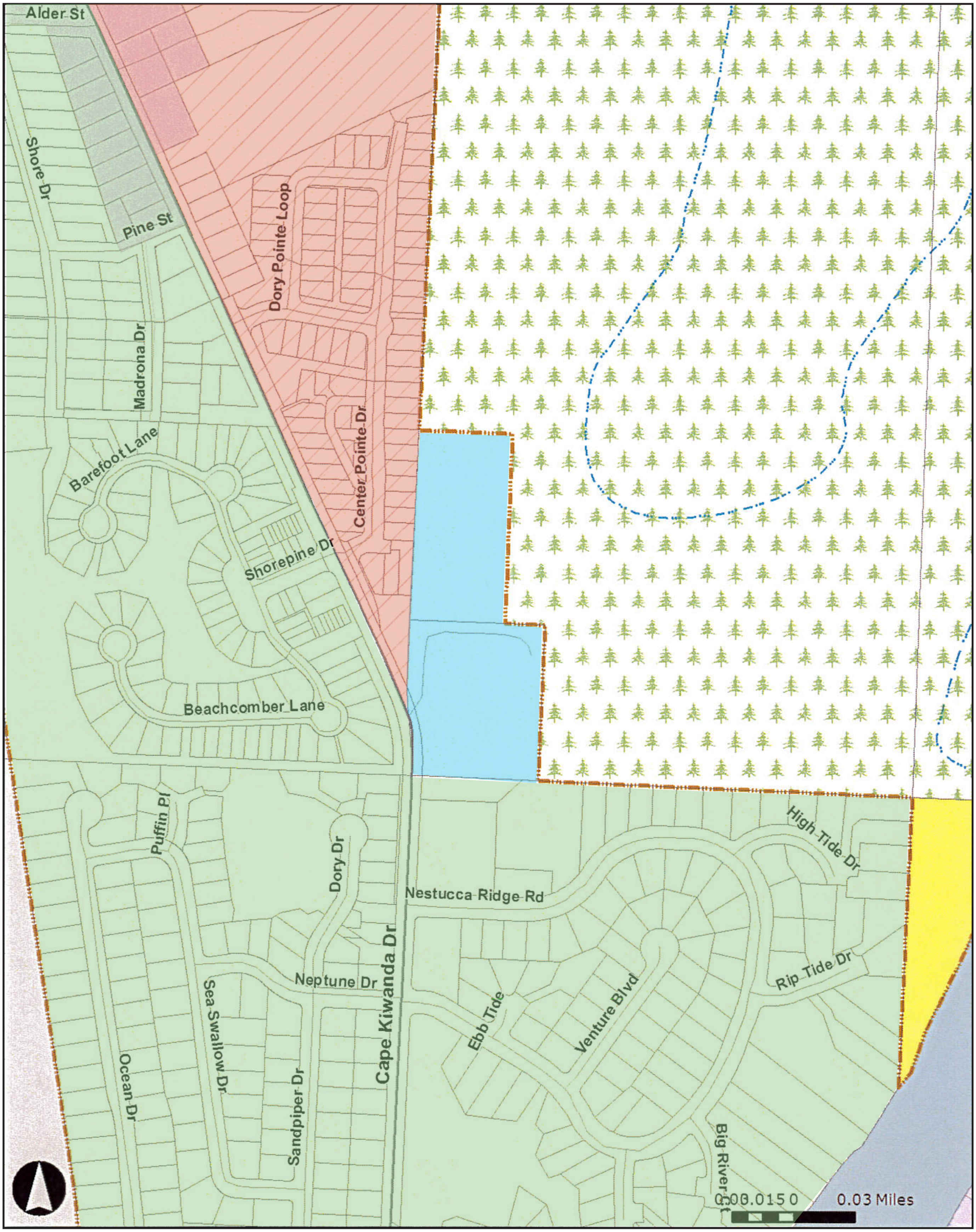
N

0 0.25 0.5

Miles

Figure 1.
Study Location and Vicinity Map

PCJWSA Wastewater
Treatment Plant Upgrades



Parametrix

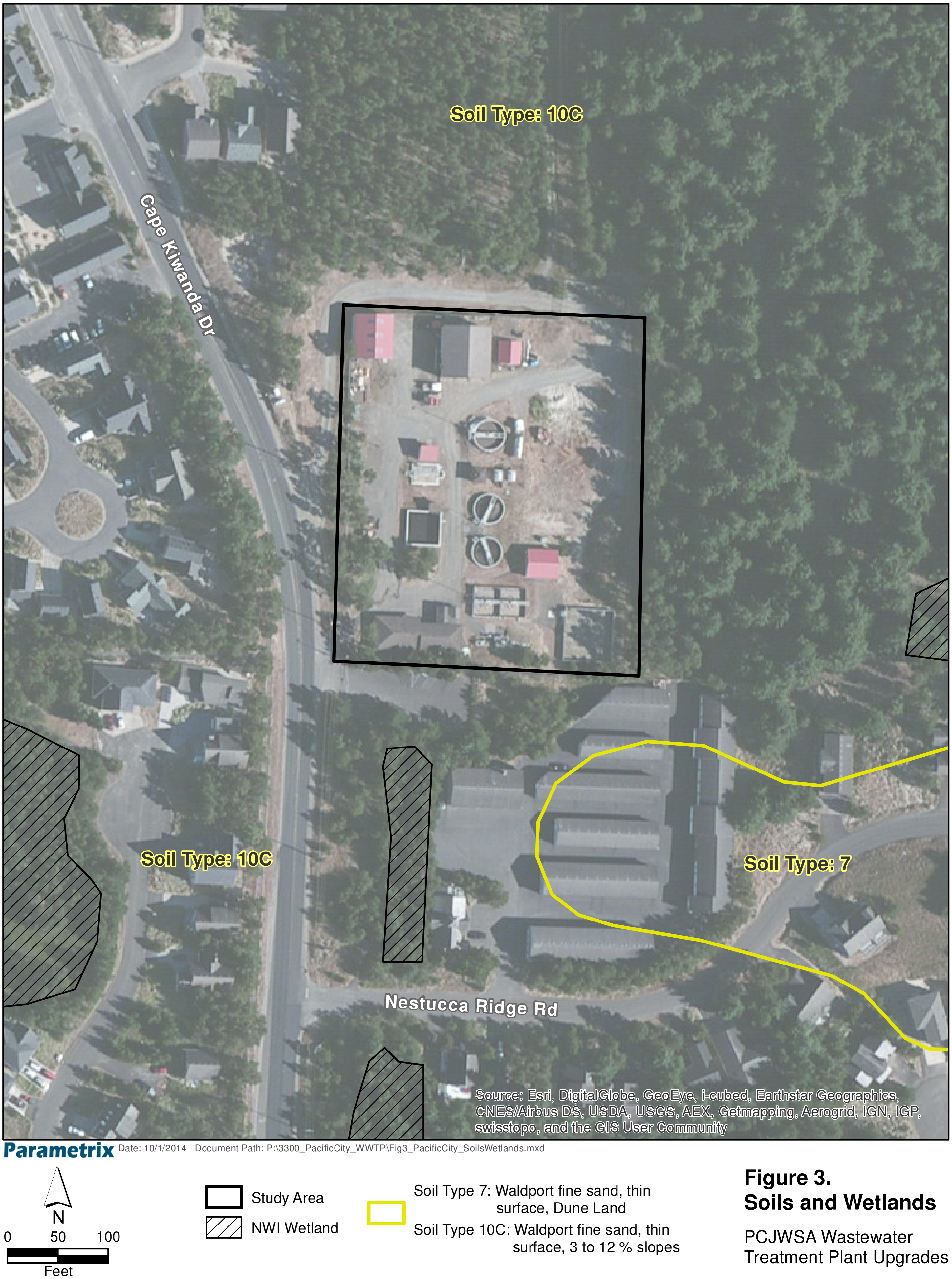
N

	PCW-P Pacific City/Woods Park Zone
	PCW-R2 Pacific City/Woods Medium Density Residential
	PCW-R3 Pacific City/Woods High Density Residential
	F (Forest)

Figure 2.

Pacific City Zoning Designations

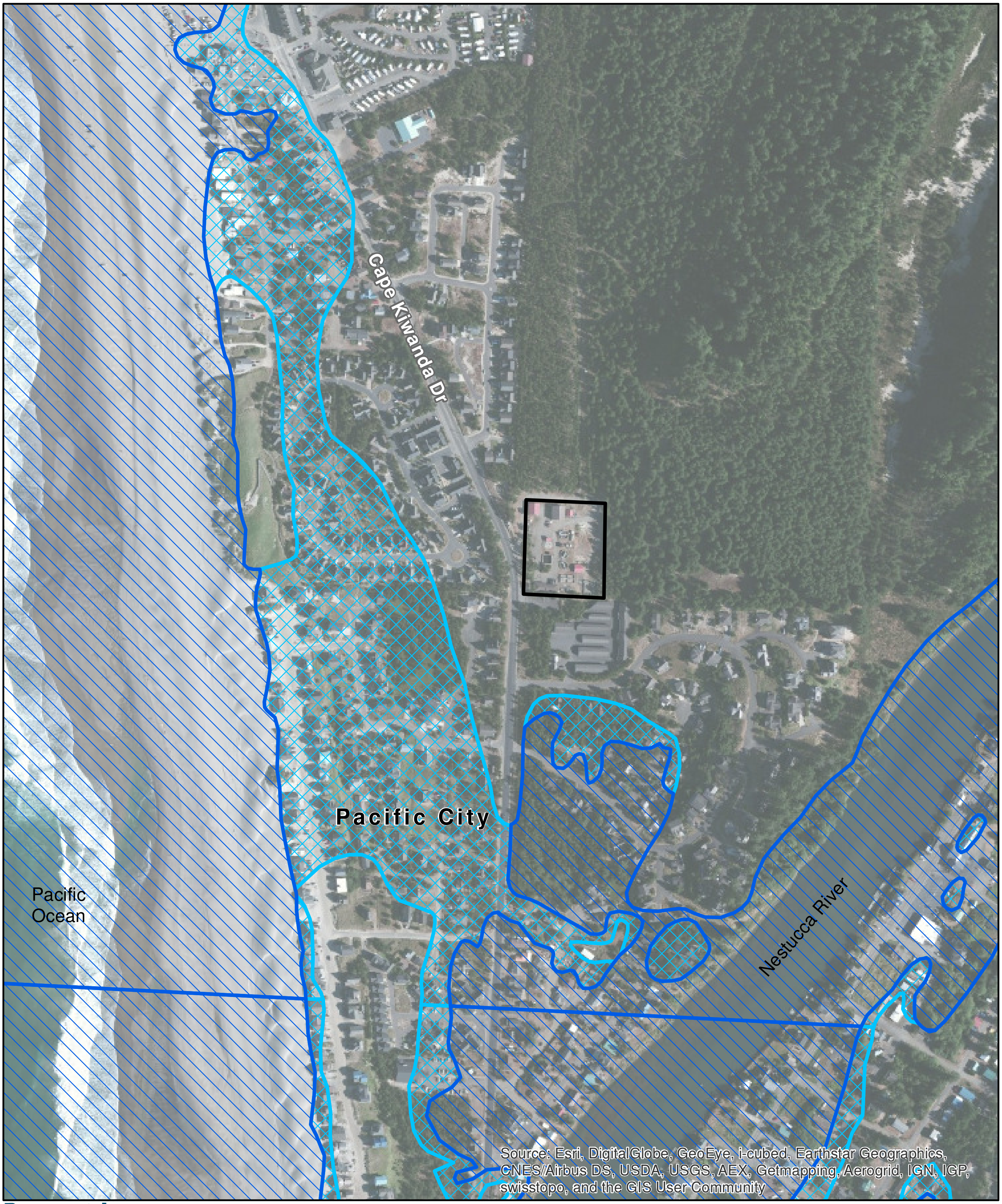
PCJWSA Wastewater
Treatment Plant Upgrades



Parametrix Date: 10/1/2014 Document Path: P:\3300_PacificCity_WWTP\Fig3_PacificCity_SoilsWetlands.mxd

Figure 3.
Soils and Wetlands

PCJWSA Wastewater Treatment Plant Upgrades



Parametrix Date: 10/1/2014 Document Path: P:\3300_PacificCity_WWTP\Fig4_PacificCity_Floodplain.mxd

N

0 250 500

Feet

Study Area

FEMA Floodplain (100-Year)

FEMA Floodplain (500-Year)

Figure 4.
Floodplain

PCJWSA Wastewater Treatment Plant Upgrades

EXHIBIT A

Findings of Archaeological Survey

STATE OF OREGON
CULTURAL RESOURCES SURVEY COVER

Please submit reports unbound.

Author(s) Name: Thomas E. Becker and Bill R. Roulette

Title of Report: Results of a Cultural Resources Study of the Proposed Pacific City Joint Water-Sanitary Authority Expansion Project Area, Pacific City, Tillamook County, Oregon
Applied Archaeological Research, Inc. Report No. 1382

Date: October 2, 2014 District/Contractor: Applied Archaeological Research, Inc.
Agency/Client: Parametrix, Inc. Agency Report Number:

County (ies): Tillamook Township: 4S, Range:10W Section: 19
Quad(s): 1985 Nestucca Bay, OR Project Acres: 1.3 Survey Acres: 1.3

CD Submitted? X Yes No Does this replace a draft? Yes X No
Project activity: monitoring Archaeological Permit No.: n/a
Field note location: Curation Location: Accession #:
Sites Found? Yes X No Prehistoric #: Historic #:
Historic Properties. Found? Yes X No Historic Property #:
TCP(s) found? Yes X No Isolates Found? Yes X No Isolate #:

Keywords: ______________________

SHPO Trinomial #:	Temporary site #
______	______
______	______
______	______
______	______
______	______
______	______
______	______
______	______
______	______

REPORT CHECK LIST

Report should contain the following items:

- Location, legal description (T,R,S) with USGS map
- Clear objectives and methods
- A summary of the results of the survey
- A report of where the survey records and data are stored
- A research design that:
  - Details survey objectives
  - Details specific methods
  - Details expected results
  - Details area surveyed including map(s) and legal location information
  - Details how results will feedback in the planning process (i.e., recommendations, future work)

Please be sure that any electronic version of a report submitted to Oregon SHPO has its figures, appendices, attachments, correspondence, graphic elements, etc., compiled into one single PDF file. Thank you!

RESULTS OF A CULTURAL RESOURCES STUDY OF THE PROPOSED PACIFIC CITY JOINT WATER-SANITARY AUTHORITY EXPANSION PROJECT AREA, PACIFIC CITY, TILLAMOOK COUNTY, OREGON

By
Thomas E. Becker, M.A., R.P.A.
And
Bill R. Roulette, M.A., R.P.A.

Prepared for
Parametrix, Inc.
Portland, Oregon

October 2, 2014

APPLIED ARCHAEOLOGICAL RESEARCH, INC. REPORT NO. 1382

APPLIED ARCHAEOLOGICAL RESEARCH, INC.

Cultural Resource Management and Historic Preservation

4001 NE Halsey Street, Suite 3 Portland, OR 97232 Phone (503) 281 9451 Fax (503) 281 9504

INTRODUCTION

The Pacific City Joint Water-Sanitary Authority (PCJWSA), located in Pacific City, Oregon, proposes to expand and upgrade its wastewater treatment plant. The United States Department of Agriculture - Rural Services group is the lead federal agency on the project, and requires the PCJWSA to comply with the cultural resources protection requirements of Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulations, 36 CFR 800. Under contract to Parametrix, the consulting firm providing engineering services to the PCJWSA, Applied Archaeological Research, Inc. (AAR) conducted a cultural resources study of the proposed project's area of potential effect (APE) to assist the PCJWSA in its compliance with the requirements of Section 106. This report presents the results of background research and archaeological reconnaissance survey designed to assess the likelihood that cultural resources are present within the project APE. AAR personnel involved in conducting the cultural resources study included Kendal McDonald, M.A., who performed document and record research at the Oregon State Historic Preservation Office (SHPO) and Tom Becker, M.A., RPA, who conducted background research related to the project, conducted the fieldwork, and is the primary author of the report. The survey was conducted on September 17, 2014. The project was under the technical supervision of Bill R. Roulette, M.A., RPA, who served as the Principal Investigator.

Project APE and Area Description

The project APE is located in Section 19, Township 4 South, Range 10 West, Willamette Meridian (Figure 1), in the Tillamook sub-basin of the North Coast basin, in the North Coast Region of Oregon. It is located in the northwestern part of Pacific City, between the Pacific Ocean and River Mile 2 of the Nestucca River, on the northern end of the sand spit extending south from Cape Kiwanda. From Cape Kiwanda, hills of the Coast Range rise to the east and northeast from the project area. The sand spit extends to the south. The project APE is located on a relatively flat area with elevations between 25-30 feet above mean sea level.

The property adjoining the project APE to the north and east are federally-owned lands managed by the U.S. Bureau of Land Management. The current APE was part of this BLM parcel (Caruso 1994), before it was transferred to the PCJWSA. The APE is bounded to the west by Cape Kiwanda Drive, and by a residential community to the south.

The proposed project would include new construction and upgrades within the existing PCJWSA wastewater treatment plant (Figure 2). It is an approximately 2.3-acre property. The majority of the current operations are located in its central and western parts. Most of the proposed construction activity would occur on the eastern third of the property, which is primarily undeveloped and has been used for staging and stockpiling (Figures 3 and 4). The APE defined for the current project encompasses approximately 1.3 acres. It includes the entire area to be developed for a new digester, clarifier, aeration basin, dewatering system, lime handling system, generator, grit system, and filters, as well as the necessary utility trenches. All proposed construction will occur within the existing property boundary. Project elements that require excavation are listed in Table 1 and depicted in Figure 2.

Conventions

By convention, in this report, measurements for common distances, elevations, and areas are provided in inches and feet without metric conversion. Measurements used in describing archaeological procedures, findings, and observations are in metric units without English unit equivalents. Commas are used between the thousands place and the hundreds place for numbers but not calendar dates or years before the present (B.P.).

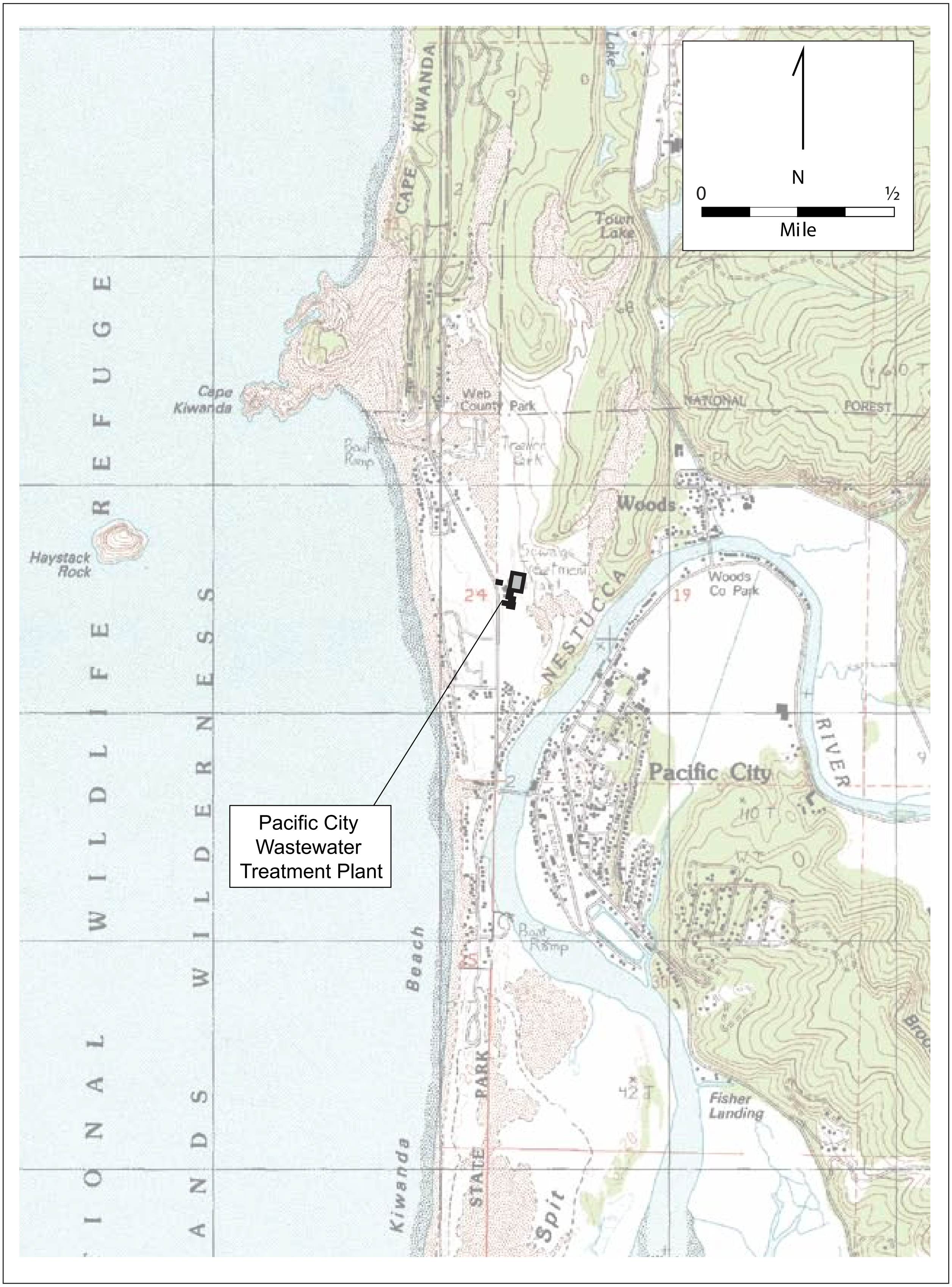


Figure 1. Location of the Pacific City Wastewater Treatment Plant Improvement APE as depicted on the USGS 1985 (Provisional Edition) Nestucca Bay, Oreg., 7.5-minute topographic quadrangle.

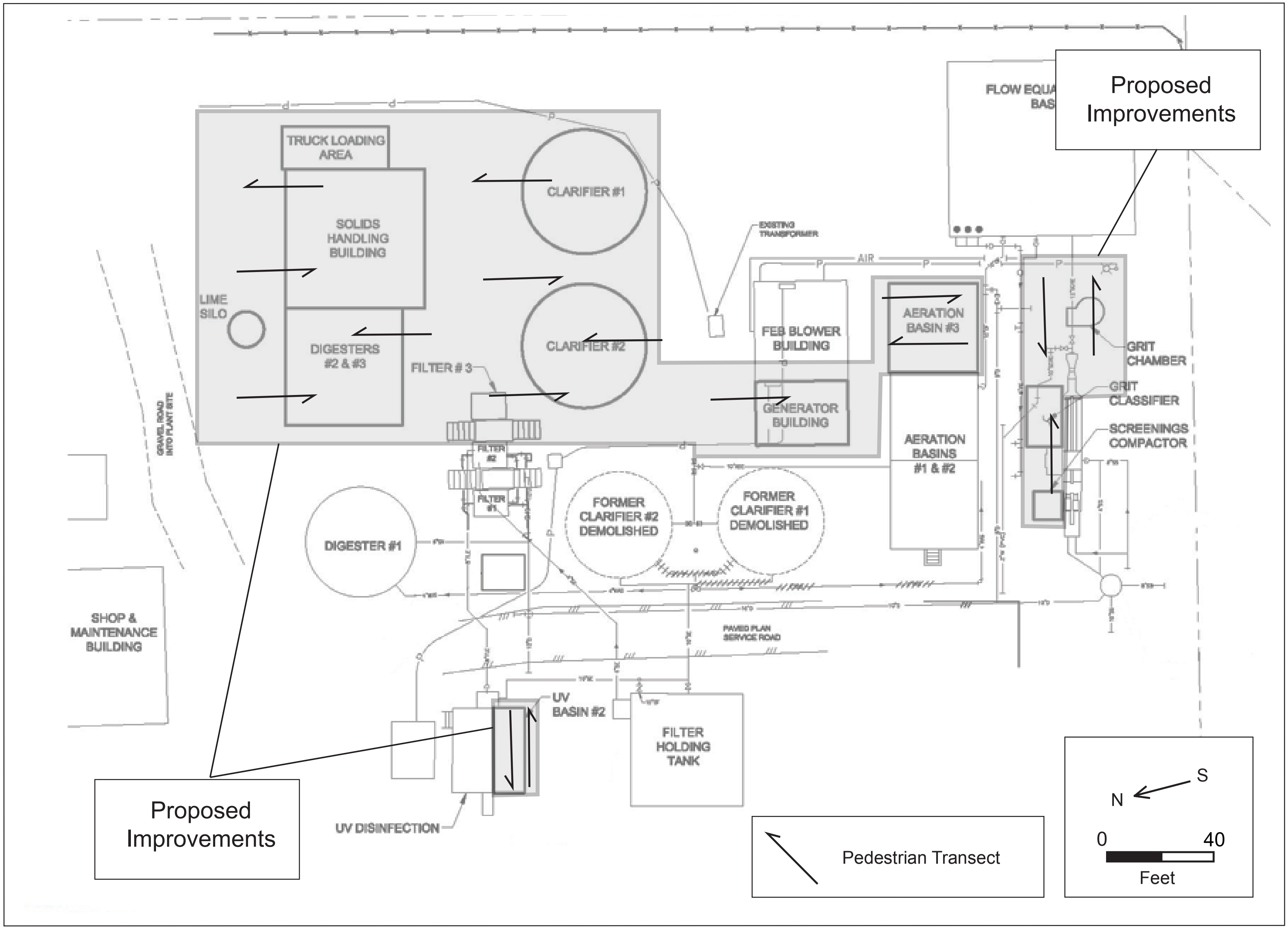


Figure 2. Configuration of the proposed improvement APE, including the exisitng compound, showing the location of pedestrian transects.

Figure 3. View of the APE looking southward from the northeast corner of the property.

Figure 4. View north of APE from the southeast corner. The wooded area in the upper right corner of the frame is on BLM land.

Table 1. Depths of proposed impacts within the project APE.

Proposed Construction	Dimensions (feet)	Estimated Depth (feet)
Screenings Compactor	10x10	2
Grit Classifier	12x19	2
Generator Building	20x28	2
Filter #3	8x10	2
Solids Handling Building	39.3x39.3	2
Lime Silo	11x11	3
Grit Chamber	12-foot diameter	10.2
Aeration Baasin #3	35x35	12.5
Digesters #2 & #3	43x43	12.5
Clarifier #1	45-foot diameter	15
Clarifier #2	45-foot diameter	15

ENVIRONMENTAL, ARCHAEOLOGICAL, AND CULTURAL OVERVIEW

Environmental Overview

The project APE is located approximately .3 mile inland from the Pacific Ocean, and .22 mile northwest of the Nestucca River. The Nestucca River originates approximately 53 miles northeast of the project area near the crest of the Coast Range and flows mostly west to southwest where it ultimately drains into Nestucca Bay and the Pacific Ocean. It drains an approximately 258-square-mile area (Barczak 1998). The current project area is situated in the center of the northern end of the sand spit, just south of Cape Kiwanda, where the river turns south along the spit before entering into Nestucca Bay.

The APE is in an ecotonal setting consisting of the transitional zone between the Pacific Ocean to the west, the Nestucca River to the east, uplands to the north and northeast, and the Nestucca sandspit to the south. A little more than .3 mile west is the Pacific littoral, which in Oregon is a long, narrow zone between the open ocean and the Coast Range. It is known for diverse and highly productive microenvironments (Franklin and Dyrness 1988). The coast itself has long sandy beaches punctuated by rocky bluffs and headlands as well as estuaries where the ocean and river mouths meet, such as Nestucca Bay, which is fed by both the Nestucca and the Little Nestucca rivers. Sediments deposited by northward flowing longshore currents have created a large spit across the mouth of the bay, with an opening at the south end through which the bay fills and drains with the tides. The Nestucca Bay Spit is a large but transient landform that is occasionally breached by ocean waves (Barczak 1998). To the north, east, and south, the bay is enclosed by low, steep hills and large floodplains created by the tributary rivers.

The Coast Range is a narrow belt of moderately high mountains and coastal headlands extending from the Columbia River on the north to the Middle Fork of the Coquille River on the south. The Coast Range has been described as "simply a big slab of sea floor raised high and dry, tilted ever so gently eastward, and broken up a bit by a few faults" (Alt and Hyndman 1992:71). Uplift of the sea floor began during the Miocene, a period of prolific volcanism that produced the lava flows of eastern Oregon as the ocean retreated to the west (Orr et al. 1992:169). During the subsequent Pliocene and Pleistocene epochs erosion shaped the mountains and rivers and streams cut drainages that give the range its characteristic dissected appearance.

The project area lies in an area that developed post-Pleistocene sea level stabilization, which Lyman (1991) suggests was around 6,500 plus/minus 1,000 years ago. Nestucca Bay is a drowned river estuary, initially formed nearly 9,000 years ago as sea level rose and submerged the mouths of the tributary rivers. The shape and configuration of the coastline has been influenced to an unknown extent by tectonic activity. At least 11 earthquakes during the Holocene along the Oregon coast have resulted in differential subsidence, uplift, sedimentation, and erosion along the coast (Charland and Reckendorf 1998:5-14). The last large quake occurred approximately 300 years ago (Atwater et al. 2005).

The APE is within the Sitka spruce forest zone. Major tree species of this forest zone include Sitka spruce, western hemlock, Douglas-fir, western redcedar, and red alder (Franklin and Dyrness 1988). Understory vegetation is dense and includes a variety of shrubs, herbs, and ferns including sword fern, wood sorrel, red and evergreen huckleberry, salal, red elderberry, and western rhododendron (Franklin and Dyrness 1988). This forest zone extends inland from the coast several miles and along major river valleys to an elevation of approximately 500 feet. Some variation in forest composition occurs in relation to microenvironmental factors such that areas with high water tables (e.g., lowland valley floodplains) feature a prevalence of water-tolerant species such as red alder, big leaf maple, and black cottonwood. The current project lies in such a zone.

This vegetative zone supports a wide array of terrestrial mammals including deer and elk, coyote, black bear, mountain lion, bobcat, beaver, snowshoe hare, raccoon, and a wide variety of species in the *Mustelidae* family such as weasels, minks, martens, and skunks. Bird species include varieties of blue and ruffed grouse, mountain quail, and owls such as the great horned and long-eared owls (Bailey 1936). Additionally, at least three species of salmon, as well as numerous other species of fish, inhabit the Nestucca River drainage (Barczak 1998). Historically, the Nestucca Bay area did not have significant native shellfish populations (Starr 1979).

In a soil survey published in 1964 (Bowlsby and Swanson 1964), the soil mapped for the project APE was described as Active Dunes. This type of deposit consists of wind-drifted sand in the form of dunes, ridges, or hummocks. "Dunes are either bare of vegetation, or the growth is not dense enough to protect the sand and to prevent it from blowing. Consequently, the dunes are constantly shifting under the influence of strong ocean winds, and in some places, are advancing slowly over the forest" (Bowlsby and Swanson 1964:36). A geotechnical study conducted within the wastewater treatment plant in 1996 provides data on subsurface deposits present in the project area (AGRA 1996). The study included excavation of four bores in the southeast corner of the current project area. Analysis of the sediments from the bores showed a top layer 6 to 12 inches thick of dark brown, organic sandy topsoil that capped 30 feet of uniform, wet, light brown fine sand. The sand was poorly sorted and contained little finer-grained material. That is, there was no evidence for soil formation below the surface indicating a constant buildup of sand without significant period of interruption. The water table was encountered at 2 to 3 feet below surface.

The current soil survey for Tillamook County lists the soil mapped in the project area as Waldport fine sands, 3-12 percent slope (USDA 2014). This soil is found on dunes, foredunes, and in blowouts. The typical profile consists of 1 inch of decomposing organic material, overlying 2 inches of fine sands that comprise the A horizon. From 3 to 60 inches below surface are more fine sands that comprise the C horizon (USDA 2014).

Ethnographic Overview

Prior to Euroamerican contact, the project APE was within the homeland of the Nestucca Indians, a Salish-speaking people. The Nestucca occupied the region between Cape Lookout and Cascade Head, primarily living around Sand Lake, Nestucca Bay, and Neskowin.

The Nestucca were a subdivision of the Tillamook Indians. The Tillamook occupied the river valleys along the coast from Tillamook Head south to the Siletz River. Local groups, like the Nestucca, were mostly politically autonomous (Seaburg and Miller 1990).

Like other Tillamook groups, the Nestucca lived in permanent winter villages, dispersing in the spring, summer, and fall to more distant locations to gather and process resources for storage and later consumption. Winter villages were usually located at the mouths or confluences of major rivers, but also in estuaries and bays (Jacobs 2003:2; Seaburg and Miller 1990:561). Houses were rectangular, made of upright cedar plank walls and gabled roofs, and included both semi-subterranean and aboveground styles (Jacobs 2003:2; Seaburg and Miller 1990:561). House interiors usually featured a central fire pit and raised sleeping platforms along the sides (Seaburg and Miller 1990:561). Floors were covered with mats and goods were stored in baskets under the platforms or hung from the house rafters for smoking and drying. Besides houses, villages had sweat lodges, menstrual huts, and cemeteries.

Subsidiary residential sites were occupied seasonally from late spring to late autumn at fishing, hunting, and plant gathering sites. Structures were sometimes constructed at these locations, but were not as substantial as winter houses (Jacobs 2003:2-3). These secondary sites were the centers of resource procurement and processing and likely featured hearths, ovens, drying racks, and associated artifacts, depending on the specific resources and range of activities. Fish weirs and traps were often constructed to trap fish in areas of shallow water where they were easier to catch (Sauter and Johnson 1974:54). However, such subsidiary sites were considered to be open to the community, as well as to outsiders (Jacobs 2003, Sauter and Johnson 1974).

Several Nestucca villages and campsites are reported to have been located around Nestucca Bay. Villages were located on the western edge of Sand Lake, at Tierra del Mar, along the Nestucca River near the present towns of Woods and Pacific City, and near Neskowin, where Hawk and Slab creeks meet (Sauter and Johnson 1974:175-177). Stella Falls, located on the Little Nestucca River, was an especially productive fishing site due to the narrowing river and height of the falls (Sauter and Johnson 1974:175).

Fish, roots, berries, terrestrial and sea mammals, and shellfish formed the basis of the Nestucca subsistence (Jacobs 2003:75, 80-81; Seaburg and Miller 1990:562). Resources were taken when available and either consumed directly or processed and stored for future use. In the spring salmonberry sprouts were gathered and camas, huckleberries, and salal berries were collected and processed for storage during the early summer. Some roots such as fern, lily, and wild carrots were collected in the winter months (Jacobs 2003:80-81). Men hunted alone year round, and groups of men hunted together during the fall elk season. Bow and arrow, spear, traps, and pitfalls were used to capture and kill elk, deer, bear, beaver, muskrat, and other small mammals (Jacobs 2003:75). Sea mammals such as sea lion and seals were hunted and large amounts of shellfish gathered and dried. Fresh and saltwater fish were widely used and salmon was an important staple. Salmon were taken from August through December (Seaburg and Miller 1990:564).

Like other Tillamook peoples, Nestucca society had free and slave classes with a fluid ranking in the free class based on acquisition of spirit powers (Jacobs 2003:96). Each village had a headman, but leadership was often a looser, task related responsibility (Seaburg and Miller 1990:565) with knowledgeable individuals taking the lead in specific tasks.

Infectious diseases against which they had no resistance spread among the Nestucca and other Tillamook groups and other Indian communities along the Oregon coast, in the lower Columbia River Valley, and in the Willamette Valley beginning in the late eighteenth century. A smallpox outbreak occurred around 1775 and probably affected the entire coastal region (Boyd 1990:137). All groups lost at least a third of their members in this epidemic, which may have spread from a Spanish expedition ship (Boyd 1990:138). A second epidemic followed in 1801, spread from the Great Plains through the Columbia Plateau. Various other epidemics of measles or small pox or other infectious diseases occurred periodically between the 1820s and the 1860s. The cumulative effect of the epidemics was to reduce the population of the Tillamook from an estimated 4,320 in the early 1800s to 193 in 1854 (Boyd 1990:136, 146).

Treaties negotiated in 1851, but never ratified, led to the Tillamook ceding their traditional lands. However, no concerted effort was made by white settlers or the military to remove the Tillamook to either the Siletz Reservation, established in 1855, or to the Grand Ronde Reservation, established in 1858. The United States Congress disposed of land claim cases raised by the Tillamook in 1897 and 1912 and the courts dismissed a lands claim case in 1945. The Tillamook received awards from the Indian Claims Commission in 1958 and 1962 (Seaburg and Miller 1990:561).

Archaeological Context

After 100 years of archaeological research, the prehistory of the Pacific coast of Oregon and Washington remains poorly defined and understood (Lyman 1991:18, 76-77; Lyman and Ross 1988:104; Wessen 1990:412-413). It has only been in the past 20 years that attempts have been made to synthesize the coastal research and to integrate the prehistory of the area into the larger context of the Northwest Coast (Ames and Maschner 1999; Lyman 1991; Lyman and Ross 1988; Moss and Erlandson 1998), and only in the last 10 years that researchers have begun research to identify sites from the late Pleistocene/early Holocene (Hall and Davis 2002; Hall et al. 2003, 2005). The following overview uses the broad framework of Ames and Maschner (1999) supplemented by local chronologies and synthetic material, as appropriate.

<u>Archaic (11,000-5500 B.P.)</u>

Prior to 5,000 years ago, the Pacific coast was characterized by lower, and slowly rising, sea levels that hindered stable development of the productive estuarine environments attractive to hunting and gathering groups. Sites located along or close to ancient shorelines were likely inundated by the rising sea levels, leaving only the sites further inland to be found by archaeologists. The inundation of these sites hampers our ability to fully understand the settlement and subsistence patterns of the period. Although sites from this period have been found along other parts of the Northwest Coast (Ames and Maschner 1999; Lyman 1991), until recently few definitively Archaic period sites were known on the Washington or Oregon coasts. This in part reflects the unstable coastal environments linked to sea level rise, but it also likely reflects a narrow focus on the discovery of more recent shell midden sites at the expense of the non-inundated Archaic period sites that were located away from the water, and generally lack thick shell deposits (Lyman 1991).

The few known Archaic period sites, found at higher level landforms and mostly on the southern and central Northwest Coast (Ames and Maschner 1999:67), commonly contain leaf shaped, stemmed, and side notched projectile points, as well as scrapers, blades, and groundstone (Ross 1990:554). On the northern Oregon coast, components of the Youngs River Complex, comprised of shouldered and leaf shaped points, are found on high terraces near the mouth of the Columbia River (Ames and Maschner 1999:67; Minor 1983, 1984).

<u>Early Pacific (5500-3500 B.P.)</u>

The beginning of the Early Pacific period coincides roughly with cooler and wetter environmental conditions (Ames and Maschner 1999:83) and sea level stabilization along the Oregon coast (Lyman 1991:80). Archaeological sites from this period typically contain lanceolate projectile points and scrapers. Bone tools increase in frequency and diversity of forms compared to preceding period assemblages, but this may be in part a function of preservation (Lyman 1991:80). While a diverse suite of resources was used during this period, suggesting a continuation of the broad-spectrum foraging adaptation seen in the Archaic period, resources captured or harvested in the intertidal and coastal zones, including sea mammals, increased in importance. Lyman (1991:80) calls this period the early Littoral to emphasize the apparent increase in exploitation of coastal resources concomitant with sea level stabilization. Increased biological diversity and productivity related to sea level stabilization and the development of estuaries was followed by increased sedentism by pre-contact populations and some increased logistical organization.

Middle Pacific (3500-1500 B.P.)

On the northern Northwest Coast, villages first appear during this period and at Oregon coastal sites shell middens become much larger than in the preceding period (Ames and Maschner 1999). At the same time, a variety of site types are recognized, suggesting increasing logistical organization of economic activities. More use of storage technology is evident, as is intensification of salmon in some areas (Ames and Maschner 1999:108). More types of bone and antler tools appear in assemblages, including unilaterally barbed harpoons and multipart tools such as the composite toggling harpoon (Ross 1990:555).

Late Pacific (1500-200 B.P.)

Modern climatic conditions were in place by 2000 B.P. On the Northwest Coast generally, the Native American lifeways seen at the time of European and American contact were fully in place by the beginning of this period. Settlement patterns seen archaeologically suggest a developed system of logistical movements with winter villages located around estuaries and a variety of field camps where economic resources were procured and processed in bulk. Faunal remains are highly variable in Late Pacific sites and a wide array of bone and flaked stone tools is found.

Previous Archaeology in the Project Vicinity

Based on a review of records obtained from the Oregon SHPO in Salem, the project area appears to have been previously examined for cultural resources but does not contain any recorded archaeological sites.

In 1994, Caruso (1994) conducted a pedestrian survey of an 80-acre parcel of BLM land. The parcel included 3 acres in its southwest corner that are described as having been leased to Pacific City for a sewage treatment plant. The 3 acres mentioned in the survey report may have included the current 1.3-acre APE. As the project report did not include a map showing the location or configuration of the surveyed area, it cannot be stated unequivocally that the current project area was surveyed at the time. In any case, no cultural resources were identified during the survey although ground surface visibility was poor and much of the area was described as impenetrable due to thick vegetation (Caruso 1994:2). It was recommended that the area be resurveyed as part of future projects.

In 2014, Greatorex (2014) surveyed 80 acres of BLM land that included much of the same area surveyed by Caruso in 1994. The current project APE does not appear to have been surveyed at that time. Shovel scrapes, consisting of squares 1 meter (m) on a side in which surface vegetation was removed to expose mineral soil, were excavated at either 10 to 15 or 20 to 25 m intervals (depending upon the topography) to search for archaeological deposits. None were observed. The author recommended "that prior to any excavation for building foundations, intense sub-surface testing be accomplished by Pacific City in the southern half of the property" (Greatorex 2014:4).

Swanson (1976) may have also surveyed part of the project APE, although based on maps and descriptions of surveyed areas included in the project report, her survey of the current project area cannot be confirmed. The cultural resource study was conducted for the Pacific City Sanitary District in advance of the installation of 59,000 feet of sewer pipeline and associated manholes, cleanouts, and four lift stations (Swanson 1976). No cultural deposits were identified during the study, but the area was identified as having a high probability to contain subsurface cultural material.

Aside from the BLM-managed lands, there has been relatively little archaeological research conducted in the area. The nearest recorded sites, 35TI25, 35TI26, and 35TI27, are located approximately a half mile east of the project area in the town of Woods and were recorded by Lloyd Collins more than 50 years ago during a survey of the Oregon coast (Collins 1953). As recorded, each site consists of a small shell midden. Site 35TI25 is the largest, described as 63 by 42 paces. It was observed to contain shell, fire-cracked rock (FCR), charcoal, animal bone, iron, and hammerstone fragments (Collins 1951a). Site 35TI26 is recorded as 10 by 20 paces in size. It was noted to contain shell, charcoal, animal bone, and an iron nail (Collins 1951b). Site 35TI27 is recorded as 10 by 10 paces in size and to include shell, animal bone, FCR, cut wood, and a bent iron rod (Collins 1951c).

Collins also recorded site 35TI28, which is located on the west side of the Nestucca River where it meets the northern base of Brooten Mountain. When recorded in 1951, the site was located under the "Dodge's Cabins," and little information is recorded other than the site consists of shell and charcoal, and is approximately 110 by 75 paces in size (Collins 1951d).

Although not corresponding to recorded archaeological sites, in her 1976 report Swanson (1976:6) mentions several general areas where archaeological deposits have been found including projectile points in the dunes around Cape Kiwanda, burials along Brooten Road, a midden atop Cape Kiwanda, and hand mauls found at Nestucca Spit.

Two other surveys have been conducted within one mile of the project APE. Tasa et al. (2003) conducted a pedestrian survey of approximately 80 acres at Cape Kiwanda State Park. The nearest part of the surveyed area is located .5 mile northwest of the project APE. No cultural resources were identified. Becker (2008) conducted a survey in the lower part of the Horn Creek valley where it joins the Nestucca River valley about 0.8 mile southwest of the project APE. The survey examined a linear route of where a new water line was to be installed. The study included the excavation of 73 shovel test probes (STPs), but no cultural resources were found.

Harris and Roulette (2013) conducted a pedestrian survey and excavated 12 STPs along a 1,500-foot long section of Resort Drive located approximately 1.5 miles southeast of the project APE. No cultural resources were identified.

Historical Background

The first Euroamericans on the northern Oregon coast may have been Spanish explorers (Ruby and Brown 1976:26-31). Captain Robert Gray, an American, and his ship *Columbia* were the first Euroamerican ship and crew to cross the bar at the mouth of Tillamook Bay in 1788. George Vancouver arrived later that same year, exploring the Columbia River to upstream of the Willamette River (Silverstein 1990:535). In 1805, Lewis and Clark reached the mouth of the Columbia, over wintering at Fort Clatsop, and traveling as far south as Seaside, Oregon. These initial visits helped to open the region to further exploration and to trade.

Most early Euroamericans on the northern Oregon coast were engaged in the fur trade. Traders exchanged guns, powder, shot, items of Euroamerican clothing, knives, beads, and tobacco, as well as metal implements such as copper and brass kettles for furs provided by native groups (Silverstein 1990:535). The coastal fur trade focused on sea otters and resulted in the near annihilation of those animals by the early 1830s. Thereafter, the focus shifted to inland mammals such as beaver (Cole and Darling 1990:131). With production of sea otter furs declining, ship-based, coastal trading moved to land-based posts at Astoria, Fort Vancouver, and in the Columbia Basin of eastern Oregon and Washington.

As more Euroamericans settled the Willamette Valley in the mid 1800s, many settlers came overland to the coast, following the Yamhill River drainage over the Coast Range into the Salmon River or Nestucca River drainages, and then north up the coast to Tillamook. Indians living at the village at Pacific City used their canoes to ferry travelers across the river. Eventually a trail was established on the north side of the river that led upriver to Hebo, and could be used to bypass Cape Kiwanda for those heading north (Dicken 1971:35). In 1854, the Nestucca Bay area was bypassed completely when settlers cleared a trail from Tillamook to Hebo, and from Hebo over the coast range to Grand Ronde (Dicken 1971:33).

The town of Pacific City was first platted as Ocean Park in 1893 by Thomas Malaney, but was replatted in 1910 as Pacific City to avoid confusion with another Ocean Park in Washington. Beginning in the 1910s, Pacific City became a popular resort destination for people from the Willamette Valley. In fact, so many people from McMinnville owned second homes in Pacific City, that a section of the hill above town was known as McMinnville Heights (Boge 1979:135). Proximity to the Willamette Valley continued to make Pacific City a very popular vacation destination into the mid-century (Swanson 1976b).

Cartographic Research

Historical and modern-era maps dating from 1879 to 1985 were examined to trace the physical development of the project area. The earliest map was produced by the General Land Office (GLO) in 1879 and shows the Nestucca River in the same approximate location as at present. The map shows no structures or developments within or near to the project APE. Structures owned by T. Malaney and John Malaney are shown across the Nestucca River from the project APE (GLO 1879).

A real estate atlas from 1930 shows property ownership in the APE and vicinity and other municipal-level features but not developments on private lands. The atlas shows that the project APE was owned by the United States (Metsker 1930:40). In 1942 the Army Map Service (AMS) published a 15-minute topographic map of the region that contains the project APE (AMS 1942). The map was based on aerial photographs taken in 1937. The map shows no structures in or adjoining the project area.

The United States Geological Survey (USGS) published its Hebo, Oreg., 15-minute topographic quadrangle in 1955 (USGS 1955). The map was compiled based on aerial photographs taken in 1953. It shows the project area as undeveloped with structures concentrated in and around Woods and Pacific City. A 1985 7.5-minute USGS topographic quadrangle of the Nestucca Bay area shows the Sewage Treatment Plan in its current location (USGS 1985).

Summary of the Archaeological Potential of Project Lands

Based on the current configuration of the landscape, the project APE is located in an area situated between hills, a river, the ocean, and a sand spit. Such an ecotonal setting likely made the general area attractive to peoples that made their living hunting, gathering, and fishing. Based on the ethnographic data presented, the most likely pre-contact archaeological resources that could be encountered within the current project APE would be small-scale temporary camps or small activity loci representing resource processing. If present, pre-contact archaeological materials would likely include debris from stone tool manufacturing or maintenance, broken or discarded stone tools, and possibly FCR, charcoal, shell and other faunal remains. It is unlikely that the APE would contain a winter village site as they are known to have been primarily situated along bays and estuaries and at the confluence of major streams.

The above generalization is based on the current landscape configuration. Coastal areas are notoriously dynamic natural settings. Tectonic uplift and/or subsidence, fluctuating sea level, estuary drowning and bay and estuary in-siltation, among other factors, may or would have altered the configuration of many elements of the local landscape. A potential effect of different landscape configurations would be enhanced or decreased biological productivity of ecotones and adjoining areas, which in turn would have made any particular location more or less attractive through time.

Also, although the general area may have been attractive to pre-contact inhabitants of the area, data collected during a geotechnical study of the PCJWSA wastewater treatment plant that included the current project area (AGRA 1996) indicates that any evidence for such use could be buried more than 30 feet below dune sand, well below the vertical axis of the APE.

The historical overview and cartographic research suggest that the project APE has low potential to contain historic-era archaeological resources. Its location has always been rural and removed from population centers. The earliest development in the area appears to be the treatment plant itself, which is not old enough for any related deposits to be considered historical.

FIELD METHODS AND RESULTS

Archaeological investigations began with a pedestrian survey that employed transects spaced no more than 10 m apart, where possible (Figure 2). All exposures of mineral soil were closely inspected for the presence of artifacts and other indicators of archaeological resources, such as FCR or charcoal stained sediment. Mineral soil exposures were limited to small areas where surface vegetation had been disturbed, as well as several piles of dirt.

Ground surface visibility was approximately 5 percent, with most of the project APE developed, or covered with grasses or gravels. No artifacts or other archaeological material were observed during the pedestrian survey. Exposed soils generally consisted of sandy deposits which is consistent with the type of soil mapped in the area. Much of the expansion area appears to have been disturbed by construction and day-to-day operations, although much of the disturbance is likely limited to the near surface.

SUMMARY AND RECOMENDATIONS

This report has presented the results of a cultural resource study designed to locate historic properties within the defined APE and to assess the likelihood for such resources to be present. AAR conducted its study to assist the project funding agency in complying with Section 106 of the National Historic Preservation Act of 1966, as amended, and its implementing regulations, 36 CFR 800. The study included a record and literature review, and an archaeological reconnaissance survey.

The record and literature review showed that the current project APE may have been part of two previous surveys, but that no subsurface investigations have been conducted, and it contained no documented archaeological sites. No cultural resources were identified during AAR's pedestrian survey. Based on ethnographic and archaeological background, the project area is considered to have moderate or better potential to contain pre-contact archaeological resources. However, the best available evidence, obtained from a geotechnical report (AGRA 1996), suggests that archaeological resources, if present, may be buried beneath up to 30 feet of undifferentiated sands.

The prehistoric use of actively-forming sand dunes cannot be precluded and the time needed for 30 feet of sand to accumulate is not known. Studies of dune movement and formation elsewhere, especially on the Clatsop Plains along the northernmost part of the Oregon coast, indicate that once destabilization occurs, and depending upon local conditions, sands can move and accumulate at a rapid pace. On the Clatsop Plains devegetation of the native dune grass caused by cattle grazing, and the initiation of construction of the jetty at the mouth of the Columbia River up the coast from the Plains, caused the Clatsop Spit to grow .4 mile over a roughly 50 year period (Rankin 1983). Based on this example, it is at least possible that the 30-plus feet of sand that underlay the ground surface in the APE represents less than a century of sand accumulation. If this is the case, prehistoric archaeological deposits in the sands are not expected to be present within the sand matrix. The fact that ground water was encountered 2 to 3 feet below the surface ground is very curious and could indicate that the dune landform in the APE formed in an area that was formally an inter-dune trough or even an open body of water. In any case, while the general area that contains the APE is considered to have at least moderate potential to contain archaeological resources, the specific project area appears to have lower potential.

For that reason, AAR recommends that no further archaeological investigations are necessary. This recommendation is made on the basis of the study described in this report. Despite the best evidence to the contrary, there is always potential for an inadvertent discovery to be made during project implementation. If during construction activities discolored soils, rocks, buried soil horizons, artifacts (prehistoric or historical), or cultural features are encountered, all activities should cease immediately and the Oregon SHPO should be promptly notified and Oregon Revised Statue 358.920 and 36 CFR 800.13 consulted to ensure compliance with applicable state and federal laws.

If during excavations human remains, funerary objects, sacred objects, and/or items of cultural patrimony are identified, all work will halt immediately. The Oregon SHPO, Tillamook County, affected tribes, and Parametrix representatives will be contacted. Procedures outlined under Oregon State law (ORS 97.740-760 and ORS 358.905-955) will be followed and work will not resume until mitigation measures have been agreed upon by all parties.

REFERENCES CITED

AGRA Earth & Environmental, Inc. (AGRA)
1996 *Geotechnical Engineering Study: Proposed Equalization Basin, Pacific City Sanitary District, Pacific City, Oregon*. AGRA Earth & Environmental, Inc., Portland, Oregon.

Alt, David D., and Donald W. Hyndman
1992 *Roadside Geology of Oregon*. Mountain Press Publishing Company, Missoula, Montana.

Ames, Kenneth M. and Herbert D. G. Maschner
1999 *Peoples of the Northwest Coast*. Thames and Hudson, London.

Army Map Service
1942 Nestucca Bay, Oreg. 15-minute topographic quadrangle. Electronic document, http://nationalmap.gov/historical/, accessed April 10, 2013.

Atwater, Brian F., Musumi-Rokkaku Satoko, Satake Kenji, Tsuji Yoshinobu, Ueda Kazue, and David K. Yamaguchi
2005 *The Orphan Tsunami of 1700: Japanese Clues to a Parent Earthquake in North America.* United States Geological Service, Reston, Virginia, and University of Washington Press, Seattle.

Barczak, Mary J.
1998 Nestucca-Neskowin Watershed Assessment. Coastal Watershed Resource Center, Tillamook, Oregon. Electronic document accessed May 19, 2008: Http://www.tbnep.org/docsccmp/Nestucca/Neskowin

Boge, Lila V. Cooper, editor
1979 *Tillamook Lest We Forget*. Tillamook County Pioneer Association, Tillamook, Oregon.

Bowlsby, Clyde C., and Richard C. Swanson
1964 *Soil Survey of the Tillamook Area*. USDA Soil Conservation Service, Salem.

Boyd, Robert T.
1990 *The Coming of the Spirit of Pestilence: Introduced Infectious Diseases and Population Decline among Northwest Coast Indians, 1774-1874.* UBC Press, Vancouver and Toronto, and University of Washington, Seattle and London.

Caruso, John
1994 *Cultural Resources Inventory Report, Pacific City 80 Land Parcel Exchange Proposal, Pre-project Survey*. Tillamook Resource Area, Salem BLM District, USDI Bureau of Land Management, Salem.

Charland, Jay and Frank Reckendorf
1998 Chapter 5: Sedimentation. In *Tillamook Bay National Estuary Project, Environmental Characterization: A Scientific and Technical Summary*. US Environmental Protection Agency.

Cole, Douglas and David Darling
1990 History of the Early Period. In *Northwest Coast*, edited by Wayne Suttles, pp. 119-134. Handbook of North American Indians, Volume 7, W. G. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Collins, Lloyd R.
1951a Oregon Archaeological Survey Form for Site 35TI25. On file, Oregon State Historic Preservation Office, Salem.
1951b Oregon Archaeological Survey Form for Site 35TI26. On file, Oregon State Historic Preservation Office, Salem.
1951c Oregon Archaeological Survey Form for Site 35TI27. On file, Oregon State Historic Preservation Office, Salem
1951d Oregon Archaeological Survey Form for Site 35TI28. On file, Oregon State Historic Preservation Office, Salem.
1953 *Archaeological Survey of the Oregon Coast 1951-1952*. Manuscript on file at the Oregon State Historic Preservation Office, Salem.

Dicken, Samuel N.
1971 *Pioneer Trails of the Oregon Coast*. Oregon Historical Society, Portland.

Franklin Jerry. F. and C. T. Dyrness
1988 *Natural Vegetation of Oregon and Washington*. Second edition. Oregon State University Press, Corvallis, Oregon.

General Land Office (GLO)
1879 Plat of Survey, T4S, R10W, Willamette Meridian. Microfiche on file, US Bureau of Land Management, Oregon State Office, Portland.

Greatorex, Fred M.
2014 *Cultural Resource Inventory Report for PC 80 RMPP Lease*. USDI Bureau of Land Management, Salem District.

Hall, Roberta L., and Loren Davis
2002 Locating Sites of the Pleistocene-Holocene Transition on Oregon's Southern Coast. *CAHO* (27) 3/4:7-11.

Hall, Roberta L., Loren G. Davis, and Michele L. Punke
2003 A Late Pleistocene Site on Oregon's Southern Coast. *The Midden* 35(1):5-8.

Hall, Roberta, Loren G. Davis, Samuel Willis, and Matthew Fillmore
2005 Radiocarbon, Soil, and Artifact Chronologies for an Early Southern Oregon Coastal Site. *Radiocarbon* 47(3):383-394.

Jacobs, Elizabeth, D.
2003 *The Nehalem Tillamook*. Edited by William R. Seaburg, Oregon State University Press, Corvallis.

Lyman, R. Lee
1991 *Prehistory of the Oregon Coast*. Academic Press, San Diego, California.

Lyman, R. Lee and Richard E. Ross
1988 Oregon Coast Prehistory: A Critical History and a Model. *Northwest Anthropological Research Notes* 22:1,67-119.

Metsker Maps
1930 *Oregon, Tillamook County 1930.* Electronic document, http://beta.historicmapworks.com/Atlas/US/29644/Tillamook+County+1930/, accessed March 22, 2013.

Minor, Rick
1983 *Aboriginal Settlement and Subsistence at the Mouth of the Columbia River*. Unpublished Ph.D. Dissertation, Anthropology Department, University of Oregon, Eugene.
1984 An Early Complex at the Mouth of the Columbia River. *Northwest Anthropological Research Notes*, 18(1):1-22.

Moss, Madonna L. and Jon M. Erlandson
1998 Early Holocene Adaptations on the Southern Northwest Coast. *Journal of California and Great Basin Archaeology*, 20:1;13-25.

Orr, Elizabeth L., William N. Orr, and Ewart M. Baldwin
1992 *Geology of Oregon*. Kendall/Hunt Publishing, Dubuque, Iowa.

Rankin, D. K.
1983 *Holocene Geologic History of the Clatsop Plains Foredune Ridge Complex*. Unpublished Master's Thesis, Portland State University.

Ross, Richard E.
1990 Prehistory of the Oregon Coast. In *Northwest Coast*, edited by Wayne Suttles, pp. 554-559. Handbook of North American Indians, Volume 7, W. G. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Ruby, Robert H. and John A. Brown
1976 *The Chinook Indians*. The University of Oklahoma Press, Norman.

Sauter, John, and Bruce Johnson
1974 *Tillamook Indians of the Oregon Coast*. Binfords & Mort, Portland, Oregon.

Seaburg, William R. and Jay Miller
1990 The Tillamook. In *Handbook of North American Indians*, edited by Wayne. P. Suttles. vol. Vol. 7. Smithsonian Institution, Washington, D. C.

Silverstein, Michael
1990 Chinookans of the Lower Columbia. In *Northwest Coast*, edited by Wayne Suttles, pp. 533-546. Handbook of North American Indians, Volume 7, W. G. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Starr, Richard M.
1979 *Natural Resources of Nestucca Estuary*. Oregon Department of Fish and Wildlife, Portland.

Swanson, Cynthia R.
1976a *The Archaeological Reconnaissance of the Proposed Waste-Water Facilities at Pacific City, Oregon*. Department of Anthropology, Western Washington State College, Bellingham, Washington.
1976b *Archaeological Reconnaissance of the North Fork Nehalem, Nehalem, Miami, Kichis, Wilson, Trask, Nestucca and Little Nestucca Rivers, Stream Restoration Project*. Western Washington State College, Bellingham.

United States Geological Survey
1955 Hebo, Oreg., 15 minute topographic quadrangle. Map on file Oregon Historical Society, Portland.
1985 Nestucca Bay, Oreg., 7.5 minute topographic quadrangle. Map on file Oregon Historical Society, Portland.

USDA Soil Conservation Service
2014 *Web Soil Survey*. Available online at http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx accessed September 29, 2014.

Wessen, Gary
1990 Prehistory of the Ocean Coast of Washington. In *Northwest Coast*, edited by Wayne Suttles, pp. 412-421. Handbook of North American Indians, Volume 7, W. G. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

EXHIBIT B

Determination of No Effect for ESA-listed Species

Parametrix
ENGINEERING . PLANNING . ENVIRONMENTAL SCIENCES

700 NE MULTNOMAH, SUITE 1000 | PORTLAND, OR 97232 | P 503.233.2400, 360.694.5020

TECHNICAL MEMORANDUM

DATE:	October 2, 2014
TO:	Drew Davis, USDA RD
FROM:	Cyrus Bullock, Parametrix William Hall, Parametrix
SUBJECT:	DRAFT Statement of No Effect
CC:	
PROJECT NUMBER:	276-3300-014 1401/102
PROJECT NAME:	Pacific City Joint Water-Sanitary Authority Wastewater Treatment Plant Upgrade

INTRODUCTION

The Pacific City Joint Water-Sanitary Authority (PCJWSA) owns and operates a wastewater treatment plant (WWTP) that serves approximately 1,000 full time residents and approximately 3,000 seasonal residents in the unincorporated communities of Pacific City and Woods. Both communities are located within Tillamook County, Oregon.

The PCJWSA plans to upgrade the WWTP by implementing selected projects from an existing Wastewater Master Plan (WWMP) improvement list. The proposed upgrades are anticipated to simplify operational requirements, meet discharge permit requirements, provide dependable treatment for the future, and minimize impacts to natural resources. The WWTP is located within the town of Pacific City, Oregon (Figure 1).

To construct these improvements, PCJWSA is receiving funding assistance from four organizations: the Oregon Department of Environmental Quality (DEQ), the Oregon Business Development Department of Infrastructure Finance Authority (IFA), the U.S. Department of Agriculture Rural Development (USDA-RD), and the Rural Community Assistance Corporation (RCAC).

Because the proposed project will be funded by USDA-RD, which is a federal entity, the PCJWSA is required to analyze the effects of its actions on species listed under the Endangered Species Act of 1973 as amended (ESA). This memorandum documents that the proposed project will have no effect upon species or critical habitat listed or designated under the ESA. Making a No Effect Determination is the appropriate conclusion when the proposed action will not affect a listed species or designated critical habitat.

PROJECT LOCATION AND SITE CHARACTERISTICS

The proposed project site is located in Pacific City, Oregon within an existing PCJWSA WWTP facility at 34005 Cape Kiwanda Drive. The facility is located approximately 0.25 miles northwest of the Nestucca River and approximately 0.30 miles east of the Pacific Ocean (Figure 1).

In order to fully assess the existing condition and potential for impact from the proposed project, Parametrix biologists reviewed available data sources and conducted a site visit on June 10, 2014. During the site visit, Parametrix biologists assessed habitat conditions within the project site.

Land use within the vicinity of the proposed project consists of residential development and small commercial buildings to the south and west, and forested land, mostly managed by the U.S. Forest Service, to the north and east.

The project site consists of existing buildings, storage tanks, gravel access roads, patches of grass/weeds that are regularly mowed, and scattered shore pines (*Pinus contorta* var. *contorta*) (Photographs 1 through 4).

Within the northeast portion of the project site, stormwater appears to collect in a small rivulet that flows between a gravel access road and a mowed area dominated by grass. From the rivulet, the stormwater discharges to a small, human-made, depressional area through a 4-inch pipe constructed beneath the gravel road turnout. The depressional area is approximately 400 square feet in area and is dominated by grass/weeds (Photographs 5 through 7).

According to the United States Fish and Wildlife Service (USFWS) National Wetlands Inventory, no wetlands or waters of the U.S. occur within the project site (USFWS 2014). Furthermore, according to the United States Department of Agriculture Natural Resources Conservation Service Web Soil Survey, hydric soils are not present within the project site (NRCS 2013). A Local Wetlands Inventory is not available for the project site.

Treated wastewater from the WWTP is discharged through Outfall 001 to the Nestucca River at river mile 1.5, approximately 0.5 miles south (off-site) of the project area (Figure 2). The outfall's associated 36-foot total length diffuser pipe is located approximately 180 feet off the west shore of the Nestucca River at a point where the river is approximately 350 feet wide. The diffuser is approximately 8-feet below low water level in the river. The Nestucca River is a low-gradient river that is tidally influenced within the vicinity of the outfall.

PROJECT DESCRIPTION

The proposed action is to upgrade the existing WWTP. Three engineering options approaches evaluated for upgrading the existing WWTP are listed below:

- Upgrading the existing activated sludge WWTP, in general as described in the 2005 WWMP.
- Converting the existing WWTP to a sequencing batch reactor plant (SBR).
- Converting the existing WWTP to a membrane bioreactor (MBR) plant.

For each option, flow and loading under current and future conditions were estimated to develop the size of treatment processes. The activated sludge option affects the largest footprint on the site, and is not significantly different in construction, operation, or long-term environmental effects from the other options. The activated sludge was used for the analysis in this environmental report. An overview of the improvements needed to implement the activated sludge option, and the approximate areas and volumes of excavation are described below.

- Headworks improvements. The current WWTP does not have grit removal equipment. A new grit tank, grit pump, grit classifier/washer, and screenings compactor are recommended. This involves shallow 2-foot excavation for installation of three concrete foundations on grade for some components and for the concrete grit tank excavation to a depth of 10 feet and total excavation volume of 67 cubic yards.

- Replacement of pumps in the flow equalization basin and discharge piping and valves. This involves 3-foot deep excavation for the new piping for a volume of approximately 15 cubic yards.
- Construction of a third concrete aeration basin encompassing an area of 625 square feet on the east side of the existing aeration basins. Replace existing mechanical aeration system with fine bubble diffusers and associated air piping, valves, and blowers. Raise the concrete walls in the two existing aeration basins. This involves 3-foot deep excavation for the air piping and 13-foot deep excavation for the third aeration basin for a total excavation of approximately 1,072 cubic yards.
- Construction of two new 35-foot diameter circular secondary clarifiers and supporting equipment such as sludge pumps, piping, valves, and flow meters. This involves 3-foot deep excavation for the piping and 15-foot deep excavation for the clarifiers for a total excavation of approximately 2,460 cubic yards.
- Filter Feed Holding Tank improvements would involve constructing a new sloped floor. No excavation is needed.
- Construction of third tertiary cloth media filter and associated piping and valves is needed to accommodate future flows and provide needed redundancy. The filter will be on an 8- by 12-foot concrete foundation on grade and requires 2-foot deep excavation of 6 cubic yards.
- Two ultraviolet (UV) light disinfection banks would be installed in an existing basin. No excavation is needed.
- Improvements to the existing aerobic digester consisting of new aeration system, two new blowers, and associated piping and valves. This involves 3-foot deep excavation for new piping for a volume of approximately 8 cubic yards.
- New aerobic digesters in a 1,089 square foot concrete tank, coarse bubble diffusers, blowers, pumps, piping, valves. The tank will have an excavation depth of 13 feet, and a total approximate excavation volume of 1,450 cubic yards.
- A new biosolids dewatering system housed in a new 35- by 40-foot building. The building would require 2-foot deep excavation for installation of a concrete foundation on grade and total excavation volume of 141 cubic yards.
- A new standby diesel generator and automatic transfer switch housed in an expansion of the existing blower building. The building would require 2-foot deep excavation over a 26- by 17-foot area for the concrete foundation on grade and total excavation of 42 cubic yards.
- Instruments and Controls will be provided on new equipment. Various electrical conduits would be installed in shallow trenches 2-feet deep for a total excavation volume of 15 cubic yards.

Construction is scheduled to begin in August 2015 and be completed in September 2016. No in-water work will occur during proposed project activities.

Construction equipment may include bulldozers, scrapers, excavators/backhoes, dump trucks, cement trucks, and front-loaders. General construction activities are described below:

- Sensitive Areas: No sensitive habitat areas or buffers are present within the project limits. Trees to be preserved will be identified and marked.
- Erosion Control: Appropriate temporary erosion and sediment control measures will be installed in all work areas prior to the initiation of ground disturbing construction activities.

- Clearing and Grubbing: Small areas of existing grasses/weeds will be cleared as well as the removal of up to three shore pines, each with a diameter at breast height (DBH) of less than 6-inches.
- Earthwork: Earthwork will include excavation of approximately 3,400 cubic yards of material (native soil and existing fill). Blasting or pile driving will not be required.
- Impervious Surfaces: A total of approximately 6,235 square feet of impervious surfaces will be constructed, none of which would be considered pollutant-generating, these include:
    - four concrete tanks totaling approximately 5,400 square feet
    - one 96 square foot concrete pad
    - two new buildings totaling 442 square feet
    - one silo on a 324 square foot concrete pad

Excavated material will remain on-site and/or transported to an approved upland facility.

ACTION AREA

An action area includes all areas to be affected directly and indirectly by the federal action and not merely the immediate area involved in the action. The terrestrial portion of the project's action area includes the existing WWTP facility and habitat within an approximately 1,991-foot radius. The aquatic portion of the action area occurs within the Nestucca River and is defined by a 10-foot Zone of Immediate Dilution from the point of discharge at Outfall 001. This action area is based upon the National Pollutant Discharge Elimination System (NPDES) regulatory mixing zone adopted for the outfall (Figure 2).

Construction-related noise is the primary factor establishing the terrestrial portion of the action area. Because the project is not located near a roadway with a high level of traffic volume and because Pacific City is a resort town, noise generated by population density per square mile was considered to be the baseline noise level within the project site. The population density for Pacific City ranges from 1,000 full time residents to approximately 3,000 seasonal residents within an approximately 2.7 square mile area, which equates to approximately 370 to 1,111 people per square mile. According to a 2006 Federal Transit Administration Transit assessment, noise generated by a population density of 300 to 1,000 people per square mile was calculated to be 45 dBA (FTA 2006). Ambient noise within the project site includes wind and surf; however, these are not considered to generally generate higher noise levels than baseline levels generated by population density.

The noisiest construction equipment anticipated for use in this project includes a dozer, which generates up to 82 dBA at 50 feet. The next noisiest equipment anticipated are an excavator and a cement pump truck, which generate up to 81 dBA each at 50 feet. Utilizing the rules for decibel addition, 3 dBA is added to the higher decibel value, resulting in a combined total noise level for all equipment of 85 dBA at 50 feet (WSDOT 2014). The standard reduction for point source (construction) noise over soft ground (i.e., ground that is not paved) is 7.5 dB per doubling of distance from the source. Based on the attenuation of point source noise from construction, noise levels will be elevated above pre-project ambient levels for a distance of just over 1,600 feet (Table 1). Mathematically, the distance that construction noise at 85 dBA would travel over soft ground to the assumed ambient noise level of 45 dBA is approximately 1,991 feet (Figure 2). This point represents the distance where construction noise is indistinguishable from background ambient noise.

Table 1. Terrestrial Noise Attenuation for PCJWSA Project

Distance from Noise Source (feet)	Noise from Equipment (dBA)a
50	85
100	77.5
200	70
400	62.5
800	55
1,600	47.5
3,200	40

a Assumes equipment point source noise of 84 dBA at 50 feet and a 7.5 dB reduction per doubling of distance.

SPECIES OCCURRENCE

Off-site data collection efforts involved a search and review of existing information related to fish and wildlife distribution and habitat within and surrounding the proposed project site. To determine species presence, existing data covering the project site were accessed from USFWS and National Marine Fisheries Service (NMFS) websites.[1] The species lists from these websites were most recently accessed in June 2014.

Furthermore, the Oregon Biodiversity Information Center (ORBIC) produced a database search on June 11, 2014 for rare, threatened and endangered plant and animal records for species that may occur within a two-mile radius of the proposed project. Two federally listed species returned from the database search: Oregon Coast (OC) coho salmon (*Oncorhynchus kisutch*) and Western snowy plover (*Charadrius alexandrinus nivosus*).

Federally listed species identified by USFWS, NMFS, and ORBIC that may be present within the project vicinity are listed in Table 2 and discussed below.

Table 2. Species Addressed

Species[a] *(Scientific Name)*	ESA Status	Critical Habitat Designated?	Effect of the Project
Marbled murrelet *(Brachyramphus marmoratus)*	Threatened	Yes; not present in project site	No Effect
Northern spotted owl *(Strix occidentalis caurina)*	Threatened	Yes; not present in project site	No Effect
Western snowy plover (*Charadrius alexandrinus nivosus*)	Threatened	Yes; not present in project site	No Effect
Short-tailed albatross (*Phoebastria* [=*Diomedea*] *albatrus*)	Endangered	No	No Effect

[1] http://ecos.fws.gov/ipac/wizard/chooseLocation!prepare.action;jsessionid=B1883E86D7611B82D7C645141CF2C282; http://www.westcoast.fisheries.noaa.gov/protected_species/species_list/species_lists.html

Species[a] (Scientific Name)	ESA Status	Critical Habitat Designated?	Effect of the Project
Coho salmon (Oregon Coast ESU) (*Oncorhynchus kisutch*)	Threatened	Yes; not present in project site	No Effect
Green sturgeon (Southern DPS) (*Acipenser medirostris*)	Threatened	Yes; not present in project site	No Effect

a ESU = Evolutionarily Significant Unit; DPS=Distinct Population Segment

Additionally, Parametrix biologists contacted Martin Nugent from the Oregon Department of Fish and Wildlife on June 17, 2014 to discuss habitat conditions, species presence, potential project impacts, and other project details, but a response to the query was not received.

Federally listed species that may occur within Tillamook County but are not located within the project vicinity, thus are not addressed in this document, include:

- Nelson's checker-mallow (*Sidalcea nelsoniana*)
- Oregon Silverspot butterfly (*Speyeria zerene hippolyta*)
- Green sea turtle (*Chelonia mydas*)
- Leatherback sea turtle (*Dermochelys coriacea*)
- Loggerhead sea turtle (*Caretta caretta*)
- Olive Ridley sea turtle (*Lepidochelys olivacea*)

The federally listed species addressed in this document are discussed in more detail below.

Marbled Murrelet

The marbled murrelet (*Brachyramphus marmoratus*) is a small seabird which nests in the coastal, old-growth forests of the Pacific Northwest, and feeds in pelagic offshore areas. Preferred nesting habitat consists of large trees with mossy, platform-like limbs in unfragmented stands of old growth forest. In Oregon, nesting stands are dominated by Douglas fir (*Pseudotsuga menziesii*) trees (USFWS 2011).

Wooded habitat adjacent to the project site is dominated by young pine trees. As a result of the young age classes and simplified habitat structure, the forested areas adjacent to the project site do not provide nesting habitat for marbled murrelets. In addition, human disturbance in and near the project site (i.e., existing facility, housing developments, the town of Pacific City) make the area unsuitable for marbled murrelets.

Northern Spotted Owl

Preferred nesting, roosting, and foraging habitat for northern spotted owls (*Strix occidentalis caurina*) typically consists of older forest stands with a mosaic of age classes and spatial distribution. Suitable forest stands include multi-layered canopies of several tree species of varying size and age, both standing and fallen dead trees, and open space among the lower branches to allow flight under the canopy. Northern spotted owls nest in cavities or on platforms in large trees and will use abandoned nests of other species. Forest stands with these attributes are usually at least 200 years old (USFWS 2014).

Wooded habitat adjacent to the project site is dominated by young pine trees. As a result of the young age classes and simplified habitat structure, the forested areas adjacent to the project site do not provide nesting habitat for northern spotted owl. In addition, human disturbance in and near the project site makes the area unsuitable for northern spotted owl.

Western Snowy Plover

The western snowy plover is a small shorebird that nests near tidal waters on the mainland coast, peninsulas, offshore islands, and adjacent bays and estuaries. The Pacific coast population of western snowy plover breeds on coastal beaches from southern Washington to southern Baja California, Mexico (USFWS 2013). Nest sites are in open, flat, sparsely vegetated beaches and sand spits above the high tide line. Western snowy plovers are known to exhibit site fidelity and return to the same breeding sites year after year. Plovers forage on invertebrates in the wet sand and among surf-cast kelp within the intertidal zone, in dry, sandy areas above the high tide, on salt pans, and along the edges of salt marshes, salt ponds, and lagoons. According to ORBIC data, western snowy plovers have been documented at Nestucca Spit State Park, approximately one mile south of Pacific City between the Pacific Ocean and Nestucca Bay (ORBIC 2014).

Short-Tailed Albatross

The short-tailed albatross (*Phoebastria* [=*Diomedea*] *albatrus*) was once found in large numbers in the North Pacific Ocean around the seas of Taiwan and Japan. Currently, the short-tailed albatross breeds mainly on two isolated islands in the Pacific Ocean, the Torishima and Minami-kojima Islands of Japan. A pelagic species for most of the year, the short-tailed albatross is occasionally sighted off the Pacific Coast of the United States (USFWS 2008).

Coho Salmon

The OC coho salmon was listed as threatened under the ESA on February 4, 2008 and retained is listing as a threatened species in June 2011. This ESU includes all naturally spawned populations of coho salmon originating from coastal streams south of the Columbia River and north of Cape Blanco, and also the progeny of one artificial propagation program (Cow Creek).

Coho salmon on the west coast of the contiguous United States and much of British Columbia spend approximately 18 months rearing in freshwater before beginning their migration to sea and another 18 months in the ocean before returning to spawn (Weitkamp et al. 1995).

Coho salmon typically enter freshwater streams beginning in late September or October with the onset of fall freshets and spawn from October to January. Spawning females prefer areas with flows generally ranging between 1 foot per second (fps) to 2 fps and gravels ranging from 1.5 inches to 5 inches in diameter. Spawning typically occurs in low-gradient (less than three percent) tributary streams at a water depth that averages approximately 7 inches (Sandercock 1991).

Following emergence, fry congregate in backwaters, quiet pool margins, and side channels in areas with overhanging vegetation, adequate cover, and food for rearing (Bjornn and Reiser 1991).

Green Sturgeon

The Southern Distinct Population Segment (DPS) of green sturgeon (*Acipenser medirostris*) includes coastal and Central Valley populations south of the Eel River in California, with the only known spawning population in the

Sacramento River (71 FR 17757, April 7, 2006). As adults, Southern DPS green sturgeon migrate seasonally along the West Coast, congregating in bays and estuaries in Washington, Oregon, and California during the summer and fall months. During winter and spring months they congregate off of northern Vancouver Island, British Columbia.

EFFECTS DETERMINATIONS

The project site is located outside the range or does not provide suitable habitat for the federally listed species shown within Table 1 above. Furthermore, during the proposed project:

- activities will occur within an existing facility and will have minimal impact to natural resources.
- no in-water work will be required.
- no jurisdictional wetlands or waters will be impacted.
- the distance where construction noise becomes indistinguishable from background (ambient) noise is less than the distance from the project site to suitable habitat for federally listed avian species.
- forested areas will not be disturbed; approximately three shore pines with DBHs of less than 6 inches may be removed.
- no changes will occur to the treated wastewater outfall (the outfall is sized for 1 MGD, the upgraded facility will not approach this flow amount), or any of the transmission lines to or from the WWTP.

Based on the above project description, the proposed project will have no effect on federally listed species or designated critical habitat, as discussed in more detail below:

Marbled Murrelet

Due to the project implementation's expected low levels of disturbance, the lack of species presence (according to ORBIC data, marbled murrelets have not been documented within two miles of the project site [ORBIC 2014]), and the lack of nesting habitat within two-miles of the project site, the proposed project will have no effect upon marbled murrelet.

Marbled Murrelet Critical Habitat

No critical habitat for marbled murrelet exists within five miles of the project site, and the project will not affect any of the primary constituent elements (PCEs) required for marbled murrelet survival. Therefore, the proposed project will have no effect upon marbled murrelet critical habitat.

Northern Spotted Owl

Due to the project implementation's expected low levels of disturbance to natural resources, the lack of species presence (according to ORBIC data, northern spotted owls have not been documented within two miles of the project site [ORBIC 2014]), and the lack of nesting habitat within two miles of the project site, the proposed project will have no effect upon northern spotted owls.

Northern Spotted Owl Critical Habitat

No critical habitat for northern spotted owls exists within three miles of the project site, and the project will not affect any of the PCEs required for northern spotted owl survival. Therefore, the proposed project will have no effect upon northern spotted owl critical habitat.

Western Snowy Plover

The project site does not contain suitable habitat for western snowy plovers, and project construction will have no impact on snowy plover habitat. Therefore, the proposed project will have no effect upon western snowy plovers.

Western Snowy Plover Critical Habitat

No critical habitat for western snowy plovers exists within 20 miles of the project site, and the project will not affect any of the PCEs required for western snowy plover survival. Therefore, the proposed project will have no effect upon western snowy plover critical habitat.

Short-Tailed Albatross

Based on a lack of short-tailed albatross presence within the project site (according to ORBIC data, short-tailed albatross have not been documented within two miles of the project site [ORBIC 2014]), and that project activities will have no impact on short-tailed albatross habitat, the proposed project will have no effect upon short-tailed albatross.

Short-Tailed Albatross Critical Habitat

Critical habitat has not been designated for the short-tailed albatross.

Coho Salmon

Because there will be no changes to the treated wastewater outfall, or in-water work within the Nestucca River, its tributaries, or any other associated waters or wetlands, and because NPDES water quality standards established for the WWTP are anticipated to be met, the proposed project will have no effect upon OC coho salmon.

Coho Salmon Critical Habitat

Critical habitat for OC coho salmon was designated on February 4, 2008. Critical habitat for OC coho salmon is not present within the project site, and the project will not affect any of the PCEs required for OC coho survival. Therefore, the proposed project will have no effect upon OC coho salmon critical habitat.

Green Sturgeon

Because there will be no changes to the treated wastewater outfall, or in-water work within the Nestucca River, its tributaries, or any other associated waters or wetlands, the proposed project will have no effect upon Southern DPS green sturgeon.

Green Sturgeon Critical Habitat

Critical habitat was designated for the green sturgeon Southern DPS on October 9, 2009 (74 FR 52300). The Nestucca River is not designated as critical habitat for green sturgeon, and the project will not affect any of the PCEs required for green sturgeon survival. Therefore, the proposed project will have no effect upon green sturgeon critical habitat.

Essential Fish Habitat Consultation

Essential Fish Habitat (EFH) is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" 16 U.S.C. §1802(10). Because the proposed project will not impact waters, wetlands, or riparian areas, the project will not adversely affect EFH.

CONCLUSION

As described above, federally listed species or associated critical habitat will not be impacted during the proposed project; therefore, the proposed project will have no effect upon federally listed species or designated critical habitat and will not adversely affect EFH.

REFERENCES

Bjornn, T.C. and D.W. Reiser. 1991. Habitat Requirements of Salmonids in Streams – Influences of Forest and Rangeland Management on Salmonid Fishes and Their Habitats. Pp. 83-138. American Fisheries Society Special Publication #19.

Federal Transit Administration (FTA). 2006. Transit Noise and Vibration Impact Assessment Guidance FTA-VA-90-1003-06 May.

NRCS (Natural Resources Conservation Service). 2013. Web Soil Survey. Available at: http://websoilsurvey.nrcs.usda.gov/app/. Last Modified December 6, 2013. Accessed April May 22, 2014

ORBIC (Oregon Biodiversity Information Center). 2014. Data System Search for Rare, Threatened and Endangered Plants and Animal Records for PCJWSA.

Sandercock, F.K., 1991. Life History of Coho Salmon (*Oncorhynchus kisutch*). Pages 395-445 In: Groot, C., and L. Margolis (eds.). 1991. Pacific Salmon Life Histories. Vancouver, British Columbia: University of British Columbia Press.

USFWS (U.S. Fish and Wildlife Service). 2008. Species Fact Sheet, Short-Tailed Albatross (*Phoebastria albatrus*). Available at: http://www.fws.gov/oregonfwo/Species/Data/ShortTailedAlbatross/. Last Updated April 17, 2008. Accessed June 13, 2014.

USFWS. 2011. Species Fact Sheet, Marbled Murrelet (*Brachyramphus marmoratus*). Available at: http://www.fws.gov/oregonfwo/Species/Data/MarbledMurrelet/. Last Updated April 11, 2011. Accessed June 13, 2014.

USFWS. 2013. Species Fact Sheet, Western Snowy (Coastal) Plover (*Charadrius alexandrinus nivosus*). Available at: http://www.fws.gov/oregonfwo/Species/Data/WesternSnowyPlover/. Last Updated July 29, 2013. Accessed June 13, 2014.

USFWS. 2014. Species Fact Sheet, Northern Spotted Owl (*Strix occidentalis caurina*). Available at: http://www.fws.gov/oregonfwo/Species/Data/NorthernSpottedOwl/. Last Updated May 27, 2014. Accessed June 13, 2014.

USFWS. 2014. National Wetlands Inventory. Available at: http://www.fws.gov/wetlands/Data/Mapper.html. Last Updated May 7, 2014. Accessed May 22, 2014.

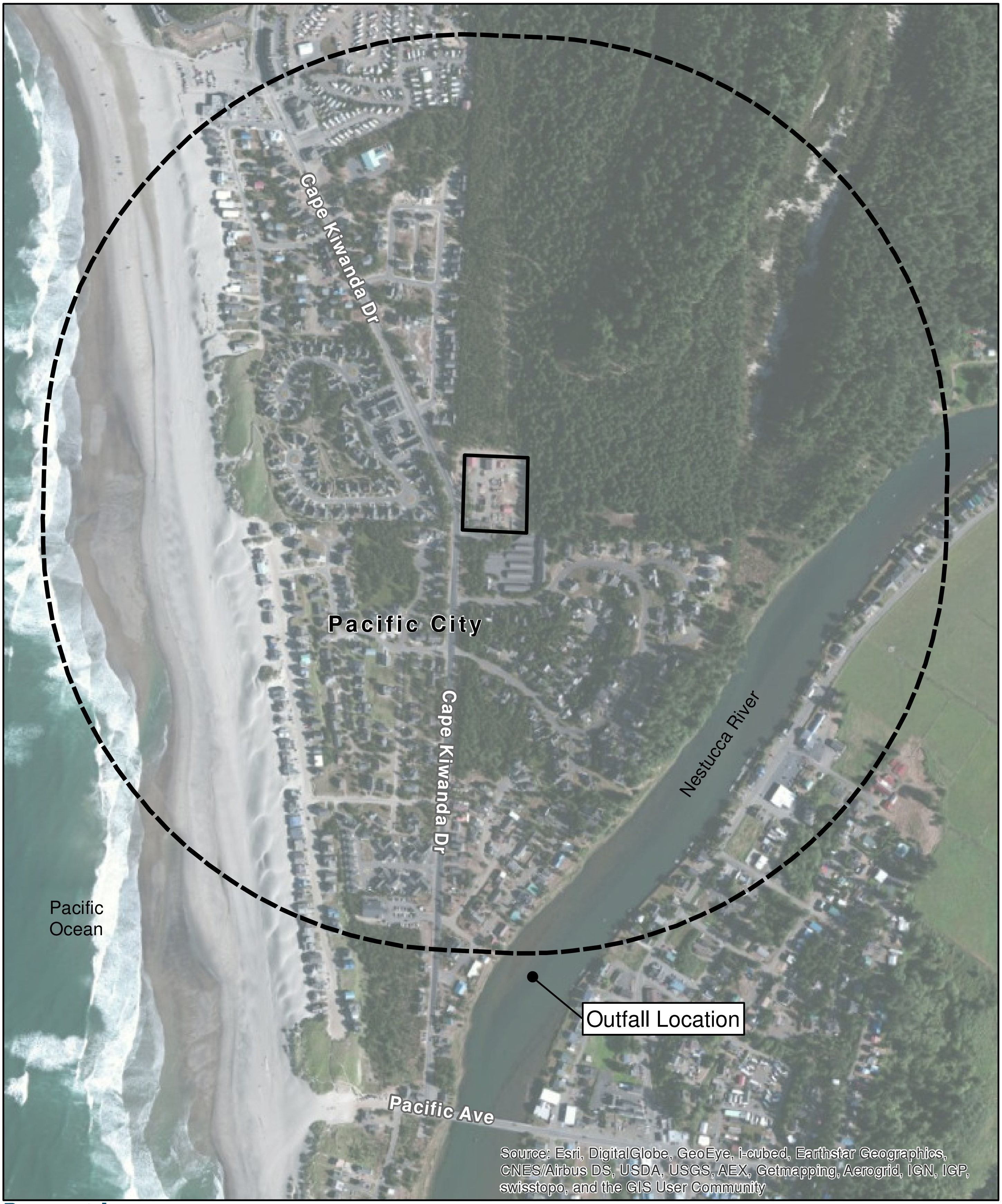
WSDOT (Washington State Department of Transportation). 2014. Biological Assessment Preparation – Advanced Training Manual Version 02-2014.

Weitkamp, L.L.A., T.C. Wainwright, G.J. Bryant, G.B. Milner, D.J. Teel, R.G. Kope, and R.S. Waples. 1995. Status Review of Coho Salmon from Washington, Oregon, and California. NOAA Technical Memorandum NMFS-NWFSC-24.

Parametrix Date: 7/2/2014 Document Path: P:\3300_PacificCity_WWTP\Fig1_PacificCity_ProjectLocation.mxd

Figure 1.

PCJWSA Wastewater Treatment Plant Upgrades
Study Location and Vicinity Map



Parametrix Date: 9/29/2014 Document Path: P:\3300_PacificCity_WWTP\Fig2_PacificCity_ActionArea.mxd

N

0 250 500

Feet

Study Area

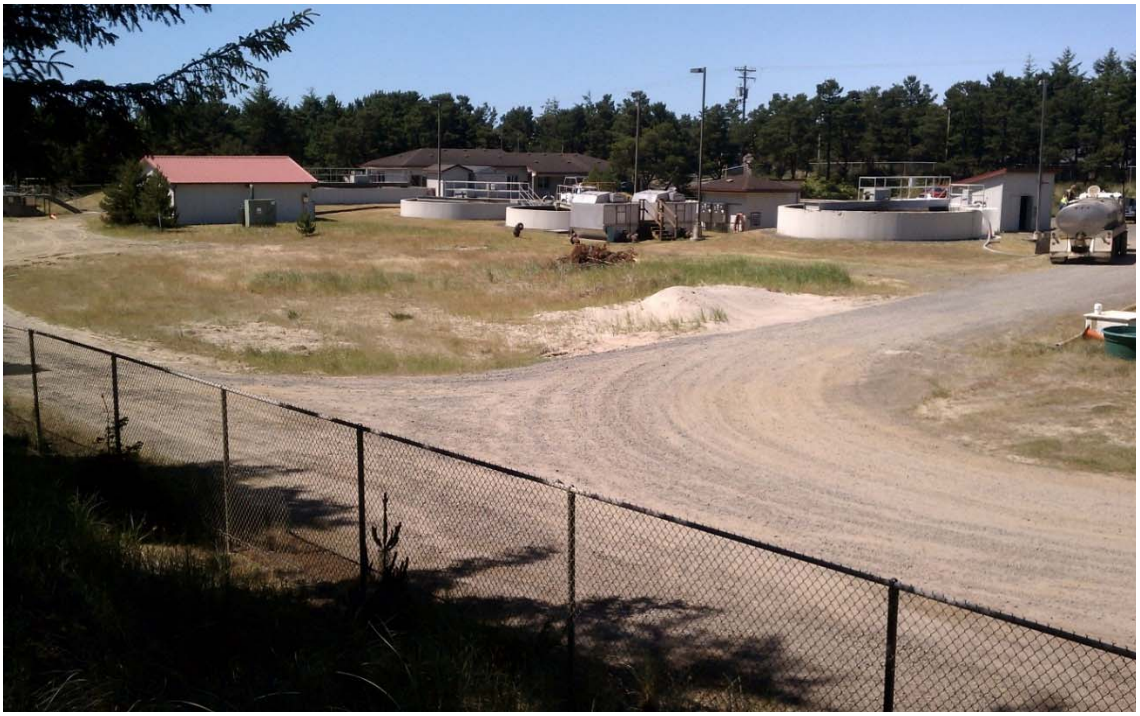
Action Area

Figure 2.
Action Area

PCJWSA Wastewater Treatment Plant Upgrades

Photograph 1. Project area; looking north from eastern boundary.

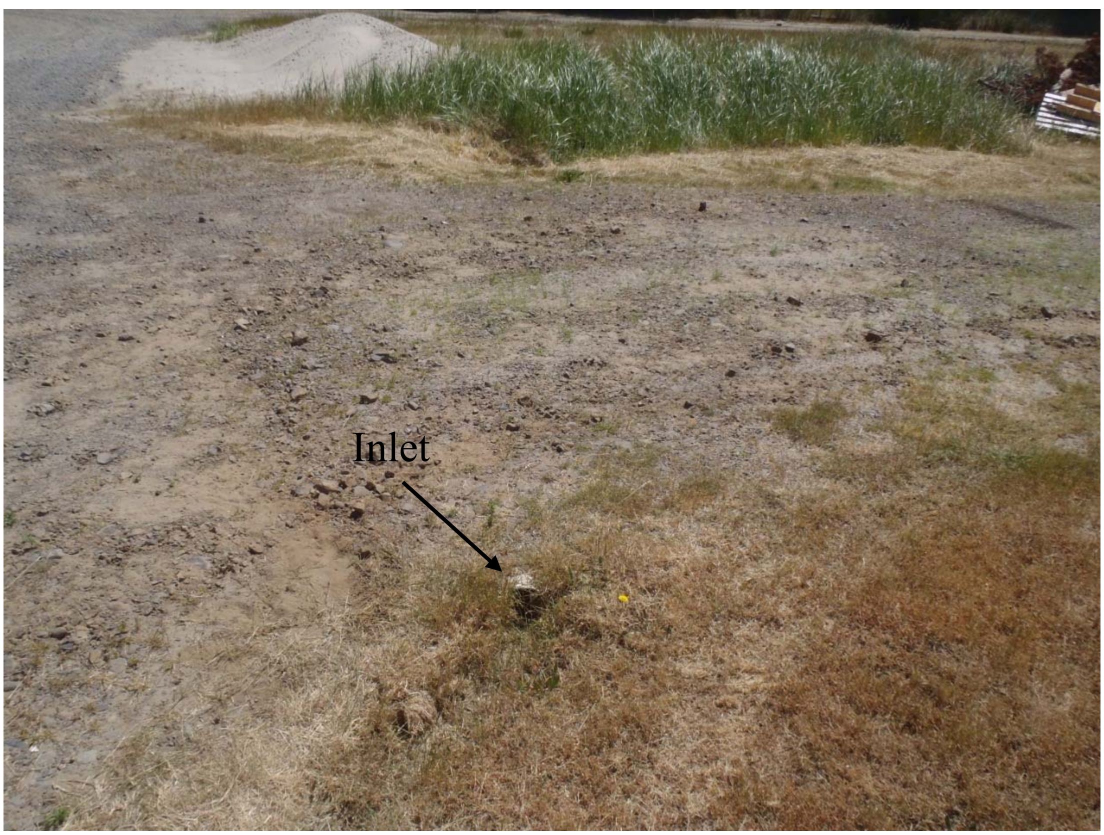
Photograph 2. Project area; looking northwest from eastern boundary.



Photograph 3. Project area; looking southwest from eastern boundary.

Photograph 4. Project area; looking south from northeast corner of site.

Photograph 5. Stormwater outlet; northeast portion of project site.



Photograph 6. Stormwater pipe.

Photograph 7. Stormwater inlet area.

EXHIBIT C

Coastal Zone Management Act Consistency Determination

COASTAL ZONE MANAGEMENT ACT CONSISTENCY DETERMINATION

For the Proposed Upgrade of the Existing Pacific City Joint Water-Sanitary Authority Wastewater Treatment Plant (WWTP) at Pacific City, Tillamook County, Oregon

Prepared June 17, 2014

INTRODUCTION

The Pacific City Joint Water-Sanitary Authority (PCJWSA) owns and operates the wastewater treatment plant (WWTP) that serves approximately 1,000 full time residents and up to approximately 3,000 seasonal residents in the unincorporated communities of Pacific City and Woods.

The WWTP has experienced permit violations and recently PCJWSA was fined by the Oregon Department of Environmental Quality (DEQ) for exceedances in water quality parameters of the National Pollutant Discharge Elimination System (NDPES) permit for total suspended solids (TSS), biochemical oxygen demand (BOD), and pH on several occasions in 2011, 2012, and 2013. The purpose of this proposal is to upgrade existing facilities to bring the facility into compliance for the water discharge permit.

PROJECT SITE DESCRIPTION AND HISTORY

The PCJWSA is located in Pacific City and serves a 2.7 square mile area that includes the unincorporated communities of Pacific City and Woods. It is located in the southern portion of Tillamook County at the mouth of the Nestucca River.

The site of the WWTP is owned by the PCJWSA. The Pacific City Sanitary District was organized in 1974. The Pacific City Water District was formed in 1959. The two offices were joined in 1998. The WWTP went into operation in 1970-1980 to resolve water quality issues in the Nestucca River and surrounding area due to failed and failing septic systems.

PROPOSED PROJECT

The proposed project is to upgrade the facility, as identified in the Environmental Report. The facility has experienced several water quality discharge violations due to the facility currently being at capacity. Additional treatment capacity is necessary to meet Clean Water Act discharge requirements as required by the NPDES permit.

JURISDICTION AND CONSISTENCY REQUIREMENTS

The Coastal Zone Management Act of 1972 (CZMA) was passed by Congress to encourage coastal states to develop and implement coastal zone management plans. In Oregon, this law is implemented through the Oregon Coastal Management Program (OCMP). The Land Conservation and Development Commission (LCDC) oversees the OCMP. The enforceable policies include (1) statewide planning goals, (2) applicable comprehensive plans, and (3) state agencies with permitting authority.

CONSISTENCY REVIEW

In the State of Oregon, compliance with the applicable state-approved Comprehensive Plan ensures consistency with the CZMA. The Tillamook County Comprehensive Plan was originally approved in 1982 and has undergone updates to several sections since. The section applicable is the Urban Unincorporated Community of Pacific City and Woods, which was updated in 1999.

The Statewide Planning Goals must also be reviewed. Statewide Planning Goals 1, 2, 3, 7, 11, 12 and 14 are met through compliance with the Tillamook County Comprehensive Plan. Under Goal 14, Urbanization, Pacific City and Woods are listed as Urban Unincorporated Communities and development is subject to the Pacific City/Woods Community Plan as amended in 1999.

Per the Tillamook County Comprehensive Plan, Pacific City is a "rural development" that meets the intent of several state-wide goals. Tillamook County characterizes a rural development as having the following:

> Individual or small community sewage disposal systems and enough land to operate them properly, wells or small community water system, sufficient land to accommodate storm water runoff from pavement and roads. (Comprehensive Plan page 2-20).

The Pacific City Joint Water-Sewer Authority is the subject of Policy 4 of the Pacific City Community Plan. This Policy states that the PCJWSA is an important feature in the community and the County and PCJWSA shall work collaboratively to assure that the water and sewer service is available for current and future development. Under the Community Plan, the County established a Community Growth Boundary (CGB), which is limited by the PCJWSA service area and also limits the PCJWSA service area.

The DEQ reviews and approves development and operation of WWTP including issuance of the NPDES permit. The outfall is located in the Nestucca River about 1.5 miles upstream of Nestucca Bay. The discharge is within a portion of the river that is tidally influenced. Compliance with the discharge limits of the NPDES permit is required for the WWTP to remain in regulatory compliance.

STATEMENT OF CONSISTENCY

Based upon the above evaluation, PCJSWA has determined that the proposed action to upgrade the WWTP to meet NPDES discharge requirements is consistent with the OCMP.

EXHIBIT D

Initiation of Section 106 Process with Confederated Tribes of the Grand Ronde

Date: August 27, 2014

Project Number: 14-0939

To: Confederated Tribes of Grand Ronde

9615 Grand Ronde Road
Grand Ronde, OR 97347
ATTN: David Harrelson
david.harrelson@grandronde.org

From: Jennifer Lundberg, CEP, Parametrix, Inc.

Subject: Initiation of Section 106 Review Process

Project Name Pacific City Wastewater Treatment Plant Improvement Project

Our client, the Pacific City Joint Sanitary and Water Authority, has applied to the USDA Rural Development for federal financial assistance and we have been authorized by that Agency to initiate the consultation process required under Section 106 of the National Historic Preservation Act (NHPA) (see attached authorization). Section 106 of the NHPA requires federal agencies to take into account the effects of their undertakings on historic properties.

You have been identified as a possible consulting party under 36 CFR Part 800, Section 800.2(c). Therefore, we provide you with the attached information regarding their proposed project and respectfully request your comments with regard to the potential for the project to impact historic properties. Specifically, we would appreciate any comments you may have on the following issues:

- The proposed project;
- The described area of potential effect (APE);
- The potential effects of the undertaking on any historic property we have thus far identified;
- Information on other historic properties which might be present and could be effected by the proposed project, including properties which have religious or cultural significance to one or more Indian Tribes;
- Any additional parties we should consider consulting; and
- Any other comments or information related to historic preservation which you believe are relevant to the proposed project's Section 106 review.

Please be as specific as you can with any comments or information. Since this review is time sensitive and must adhere to the provisions in 36 CFR Part 800, we request that you submit comments within 30 days from receipt of this letter.

Please be aware that the project owner, PCJSWA, has elected to conduct a pre-construction survey and is currently in the process of contracting a registered professional archaeologist. This survey will include an existing information research and a reconnaissance level cultural resources survey by an archaeologist. Our initial review indicates no known historic or pre-historic archaeological resources.

Any comments received from your office will be incorporated into the final project design submitted to USDA Rural Development for review and approval, including a copy of your reply to our inquiry. Assuming no additional Historic Property or Tribal issues are identified, a final letter with the USDA "finding of effects" will be sent by the State Environmental Coordinator for your comment.

If you have any questions regarding this letter please contact Jennifer Lundberg, 4660 Kitsap Way, Ste A, Bremerton, WA 98312, jlundberg@parametrix.com, or 360-265-1582 or you may contact Rural Development directly by calling Charlotte Rollier, State Environmental Coordinator, at (503) 414-3356.

Sincerely,

Jennifer Lundberg

Jennifer Lundberg, CEP
Planner

Attachments:

- Oregon SHPO consultation letter
- USDA-RD Instructions letter
- APE and Project Description

United States Department of Agriculture
Rural Development
Oregon State Office

Section 106 Consultation Authorization and Instructions to Applicant

DATE: November 17th, 2008

TO: Parametrix, Inc.
C/O Tom Nielsen and Jennifer Lundberg
700 NE Multnomah, Ste 1000
Portland, OR 97232

FROM: USDA Rural Development
1201 NE Lloyd Boulevard, Suite 801
Portland, OR 97232-1274

SUBJECT: Initiating Consultations under the Section 106 Process

In order for Rural Development to make a decision on your application, an environmental review must first be completed. Among other items, this environmental review includes an analysis of the potential for your proposed project to impact sites that are listed, or eligible for listing, on the National Register of Historic Places. This analysis is required by Section 106 of the National Historic Preservation Act (NHPA) and its implementing regulations located in the 36 CFR Part 800. NHPA requires Rural Development to work closely with the State Historic Preservation Office (SHPO), the Tribal Historic Preservation Officer(s), or tribal cultural resource protection programs, and other consulting parties to take into account the effects of your project on historic properties, and to attempt to find ways to avoid, minimize, or mitigate adverse effects, to the extent practicable.

Receipt of this letter from Rural Development authorizes you to initiate consultation under the Section 106 process. Please proceed as follows:

1. Review the attached letter (Attachment 1) and the required supporting documentation (Attachment 2).

2. Send the completed letter (Attachment 1) and the supporting documentation (contained in Attachment 2) to each of the consulting parties on the supplied contact list (retain a dated copy of each letter for your records).

3. Include a copy of this Authorization/Instructions document with your letter to the SHPO, the THPO, or applicable tribal cultural resource contacts. *

5. Allow 30 days for receipt of comments. Incorporate any comments received into the environmental information/report (depending on Rural Development program) being prepared as part of your application to Rural Development, and attach copies of each letter you sent out, with comments received, to the environmental information/report.

To assist you in completing this process your Rural Development representative will:

- Answer any questions you have about completing the letter and the supporting documentation;
- Assist you in a preliminary description of the area of potential effects (APE); **
- Assist you in developing a preliminary list of the consulting parties.

The initiation of consultation is the first step in the Section 106 process. This authorization permits you, as an applicant (or, by proxy, the applicant's consultant), to initiate this consultation process and to assist Rural Development in collecting and evaluating information to facilitate timely compliance with Section 106 requirements. Rural Development remains legally responsible for making all formal "determinations and findings" under the Section 106 process.

Please be aware that some proposals require the services of a professional consultant. For example, an archeological survey may be needed before the Section 106 process can be concluded. Your Rural Development representative can provide you further guidance, if there is a need for such services. As an applicant, you are still responsible for the requirements of this letter, even though you have hired a consultant to assist you.

This authorization to initiate consultation under the Section 106 process does not constitute Rural Development approval of your request for financial assistance. All costs incurred by the applicant, in compliance with the Section 106 process, are incurred at the applicant's risk.

Do not take any actions which might have an adverse effect on historic property or cultural resources until the Section 106 review process is completed. Section 110(k) of the National Historic Preservation Act **may prohibit** federal agencies from providing federal financial assistance to any applicant who "... with intent to avoid the requirements of Section 106, has intentionally significantly adversely affected a historic property..."

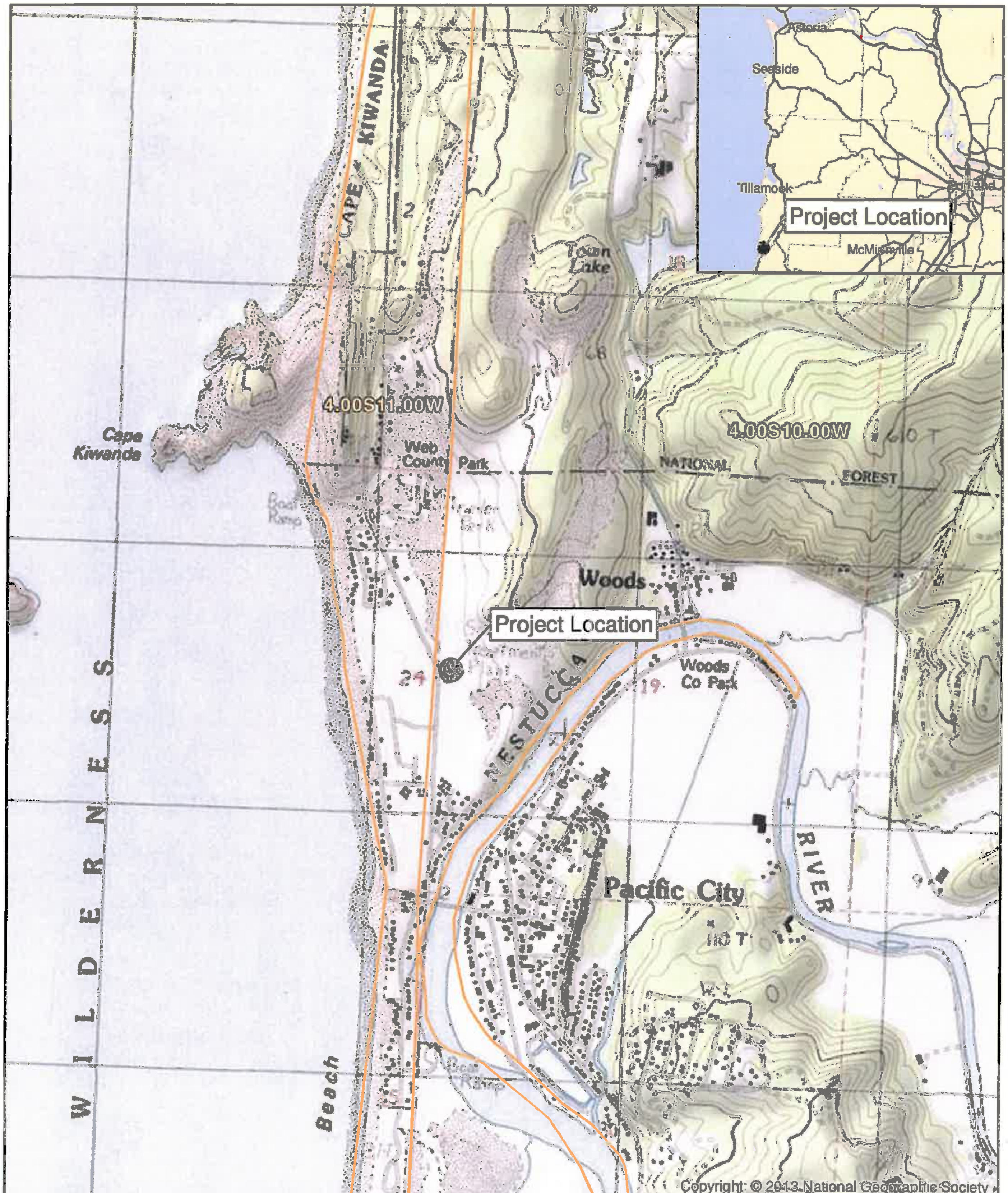
Please contact your Rural Development representative should you have any questions.

Charlotte Rollier
State Environmental Coordinator

Attachments (2)

* The Tribal Historic Preservation Officer, or THPO, has assumed the role of the SHPO when projects are to be located on tribal-owned lands. When this is the case, the THPO will review and comment on the proposed project and SHPO does not need to be contacted. There are only two THPOs in Oregon: Carey Miller for the Confederated Tribes of the Umatilla and Robert Brunoe (acting THPO) for the Confederated Tribes of the Warm Springs. For projects other than those located on Umatilla or Warm Springs tribal lands (or where the tribe has no designated THPO to review projects proposed to be located on their lands), consultation letters should be addressed to the tribal cultural resource contacts. See www.leg.state.or.us/cis for a complete list of key tribal cultural resource contacts.

** The area of potential effects (APE) is defined by 36 CFR Part 800, Section 800.16(d) as follows: "Area of potential effects means the geographic area or areas within which an undertaking may directly or indirectly cause changes in the character or use of historic properties, if any such properties exist. The area of potential effects is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking."



Parametrix Date: 7/2/2014 Document Path: P:\3300_PacificCity_WWTP\Fig1_PacificCity_ProjectLocation.mxd

N

0 0.25 0.5

Miles

Figure 1.

PCJWSA Wastewater Treatment Plant Upgrades
Study Location and Vicinity Map

— = property boundary

16 = clarifier
16B = digester
15 = generator
7 = grit system
5 = aeration basin
13 = filters

16a + 16c = Dewatering & lime

Supporting Documentation to be Submitted by Applicant to Consulting Parties*

1. A copy of the Authorization/Instructions to Applicant dated and completed by Rural Development.

   Included.

2. Detailed description of the proposed project, including related activities to be carried out in conjunction with the project, and the status of property acquisition, if applicable.

   The Pacific City Joint Water-Sanitary Authority (PCJWSA) owns and operates the wastewater treatment plant (WWTP) that serves approximately 1,000 full time residents and up to approximately 3,000 seasonal residents in the unincorporated communities of Pacific City and Woods.

   The WWTP has experienced permit violations and recently PCJWSA was fined by the Department of Environmental Quality (DEQ) for exceedances in water quality parameters of the National Pollutant Discharge Elimination System (NDPES) permit for total suspended solids (TSS), biochemical oxygen demand (BOD), and pH on several occasions in 2011, 2012, and 2013. The purpose of this proposal is to upgrade existing facilities to bring the facility into compliance with the water discharge permit.

   Below is a listing of the proposed activities to upgrade the existing wastewater treatment plant serving the communities of Pacific City and Woods. The numbers correspond to the attached site plan numbers for locations of proposed structures. Minor changes in site layout may occur as design progresses, however, all project elements will remain within the APE boundaries as shown. The list also provides estimated excavation amounts. Total excavation is not expected to exceed 3,500 cubic yards. Except as noted, structures will be placed at grade with minimal grading required to ensure a flat surface. All proposed work occurs within the existing wastewater treatment plant boundaries so no acquisition is required. No upgrades to the outfall or transmission lines are required.

   5. Activated Sludge Diffused Aeration System. Replace mechanical aeration system with a fine bubble diffused aeration system. Provide three new blowers and associated air piping. **No excavation or new concrete structures.**
   7. Clarifier Improvements. Provide a new larger scum beach. Provide a new concrete scum collection box, a new pump, and piping to route scum to the digester. Provide full diameter skimmers. Provide new return/waste sludge pumps, a flow meter, and modify sludge pump piping and valves. **No excavation or new concrete structures.**

8. Grit System. Provide a 2 mgd vortex type grit removal system with air lift in a concrete basin. Provide a grit classifier and storage hopper. **Involves excavation of approximately 60 cubic yards and construction of 2 concrete tanks that will be vertically stacked – one with 8-ft diameter (64 sf) and the other with 4-ft (20 sf) diameter.**
11. Aerobic Digester Aeration Improvements. Replace existing aeration system and blowers with a new coarse bubble aeration system and two 20-hp blowers. **No excavation or new concrete structures.**
13. Expand Tertiary Filters. Add third filter to allow firm treatment capacity of 2 mgd. **Involves construction of an approxmiately 120-sf concrete pad.**
15. WWTP Standby Generator. Provide a new 500 kW/625 kVA standby generator capable of running the electrical load of the entire WWTP. Provide 800 ampere automatic transfer switch. **Involves construction of 500-sf building expansion on a slab on grade.**
16. Biosolids Dewatering System. Conduct predesign evaluation to select the most cost effective dewatering technology. For the purposes of costing for this CIP Update, a belt filter press was assumed. **No excavation or new concrete structures.**

16A. Dewatering System. Provide a 0.7 meter, 230 pound per hour belt filter press with a lobe type solids feed pump, access platform of FRP grating, polymer feed system, and a lime storage hopper. House the system in a 26' x 20' block building with a metal roof. Provide a 40 cubic yard roll off container. **Involves construction of new 520-sf building on a slab on grade.**

16B. Second Aerobic Digester. Construct a second new aerobic digester, 50-foot diameter, 12-foot deep with a coarse bubble aeration system, two 50 hp blowers, and 100 gpm decant pump. Enclose digester an FRP cover and collect and route foul air with an FRP fan and buried FRP ducts. **Involves excavation of approximately 1,200 cubic yards and construction of a 50-ft diameter concrete tank (2290 sf).**

16C. Lime Handling System. Construct modular system for lime application contained in a 12' diameter 34' high 1,000 cubic foot silo, bin vibrator, slurry screw feeder, 750 gallon slurry mix tank, two centrifugal slurry pumps, and NEMA 4 enclosure. Mounted on a 18' x 18' concrete foundation. **Involves construction of a 12-ft diameter silo (113 sf) and 324-sf slab on grade.**

17. Third Clarifier & RAS/WAS sludge pump. Construct a third clarifier. **Involves excavation of 2,200 cubic yards and construction of a 60-ft diameter concrete tank (3019 sf).**

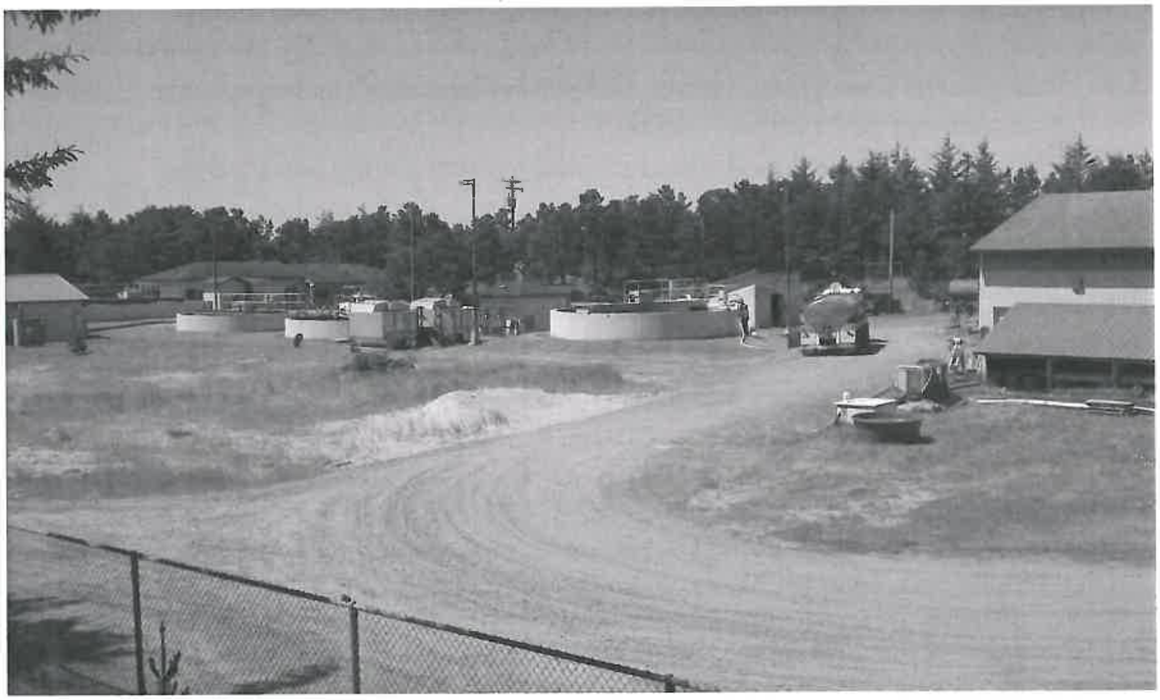
3. Describe all federal, state and community involvement in the project, including identification of the specific Rural Development program from which you have requested financial assistance. If there are other federal, state or community agencies involved, specify the agency and the type of assistance requested (for example: financial, permit, license).

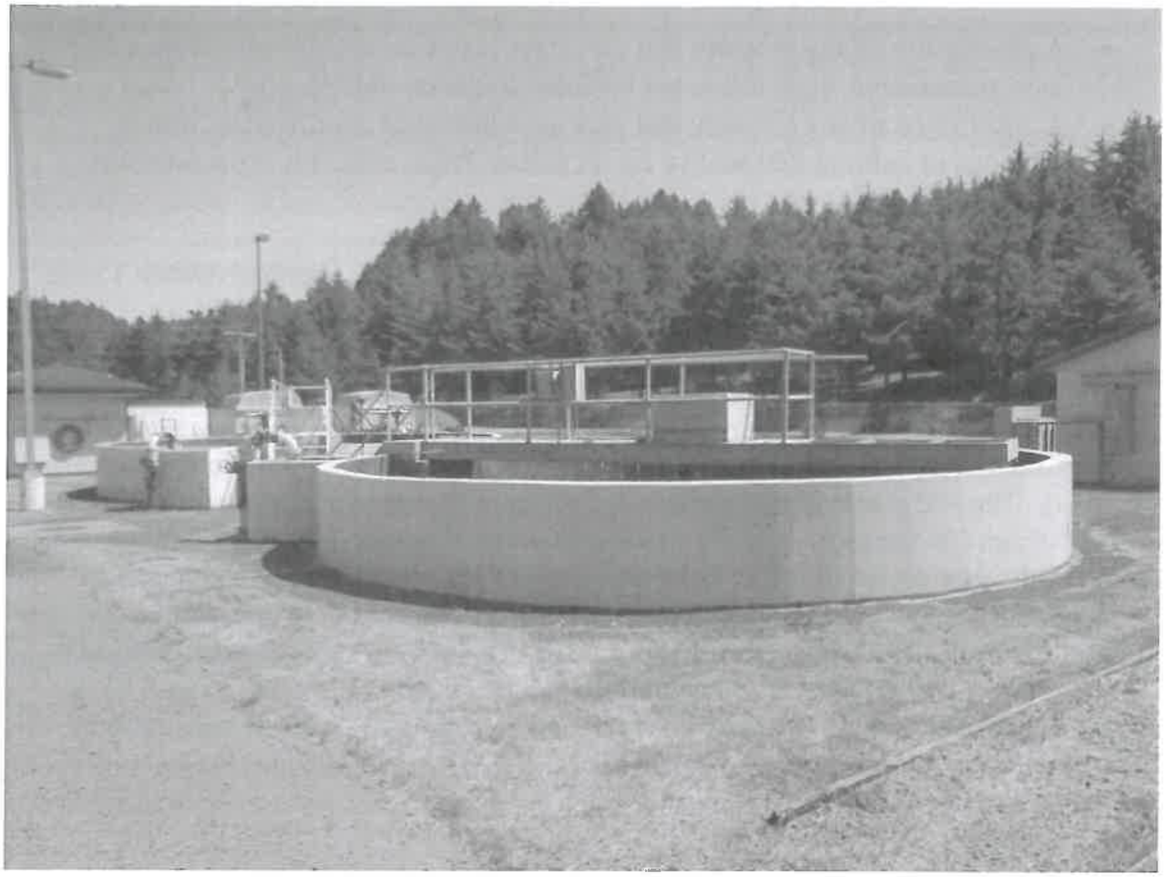
   - Rural Development – Oregon is providing a loan for permitting, design and construction.
   - PCJSWA is self funding portions of the project.

4. Provide the following information regarding the proposed project site(s):

- Describe the size (acres), terrain, and present land uses (including current zoning designations) of the project site(s);
- Describe the adjacent land uses, including current zoning designations;
- A map with the boundaries of the project site(s) clearly marked, preferably a U.S. Geological Survey (USGS) 7.5 quadrangle map (digital maps are fine: try http://terraserver.microsoft.com (free public access); and
- Photos of the site(s) and adjacent properties with clear description of the location the photo was taken from (e.g. photo taken from proposed building site) and the orientation of the camera when the photo was taken (e.g. northeast looking towards adjacent state forest lands).

The proposed project is located on a relatively flat terrace of 3.2 acres above the Pacific Ocean. The site is currently a wastewater treatment plant and zoned Pacific City/Woods Park Zone (PCW-P). The lot to the north of the WWTP is zoned PCW-P and is currently forested. The property to the east is the Siuslaw National Forest and is forested. To the northwest is PCW-R3 and the remainder is PCW-R2, high density and medium density residential, respectively. The uses west of the facility are residential and the use to the south is mini storage.





5. Provide a written description of the proposed boundaries of the project's area of potential effect (APE), supplemented by a clearly marked map showing the APE and project site footprint.

   The APE is defined as the existing property boundary of the wastewater treatment plant.

6. Describe any **efforts** (research, surveys, etc.) that have been made, or are in progress, to identify and evaluate properties (including structures and archaeological resources) within the proposed APE and are listed or eligible for listing on the National Register of Historic Places.

   Parametrix reviewed the available online information for historic properties through the Oregon Historic Sites Database website. Consultation with the Oregon SHPO was completed.

7. Describe any **results** from the efforts outlined in item 6. Such results may include:

   - A description of historic properties found and a discussion of their current status (listed, eligible for listing or in need of further evaluation);

- A description of any property that may have historical significance from a State or local perspective, even if it is not National Register-eligible; and
- A description of any property that may have historical significance from a religious or cultural perspective for an Indian Tribe, even if it is not National Register-eligible.

Two properties were identified on the Oregon Historic Sites Database within 1 mile of the project; only one site was eligible for listing on the National Register of Historic Places. Cape Kiwanda is a park/plaza area located at the end of Beach Rd and approximately 1 mile northwest of the WWTP. Its historic name was Sand Cape. The site is listed in the Tillamook County Comprehensive Plan as being significant to the County for its association with travel and recreation (Tillamook Comprehensive Plan). The site is also identified as a dory launching site, which is of cultural significance to the area. The original construction occurred circa 1910 with an update possibly constructed in 1972. The site is eligible and a contributing element for a potentially eligible site for listing on the National Register of Historic Places. The site will not be directly impacted by the proposed action. There are no indirect impacts including visual impacts of the view from and to the park because there will be no noticeable changes to the view of or to the park. Negligible indirect construction impacts may occur due to the visual impact of construction vehicles but noise is not expected to impact park activities.

No other sites, historic or pre-historic, were identified in the project.

8. If your research has progressed far enough, state your expectation regarding USDA's "finding(s)" regarding the project's impact on identified historic properties within the APE and explain why. State your expected USDA determination as "no affect, may affect or will affect" along with any proposed mitigation measures identified to date to minimize the projects impact within the APE.

   Based on current information regarding historic and pre-historic use of the site as well as the minimal amount of shallow excavation proposed, PCS&WA anticipates an USDA determination of may affect due to the limited existing data regarding the site and the project lying "within an area generally perceived to have a high probability for possessing archaeological sites and/or buried human remains" (Oregon SHPO letter dated July 7, 2014). PCJSWA is currently contracting with a registered professional archaeologist to provide a pre-construction reconnaissance level survey.

9. Provide a list of other parties or agencies currently being consulted regarding the proposed project's potential impacts within the APE.

   Parametrix has initiated consultation with the Confederated Tribes of the Grand Ronde and the Confederated Tribes of Siletz Indians. Consultation has been completed with the Oregon SHPO.

10. List any other information pertinent to this project which would be helpful in understanding the project and its potential for impacts to historic property.

    N/A

Oregon
John A. Kitzhaber, MD, Governor

Parks and Recreation Department
State Historic Preservation Office
725 Summer St NE, Ste C
Salem, OR 97301-1266
(503) 986-0671
Fax (503) 986-0793
www.oregonheritage.org

July 7, 2014

Ms. Jennifer Lundberg
Parametrix
4660 Kitsap Wy STE A
Bremerton, WA 98312-2357

RE: SHPO Case No. 14-0939
Pacific City Wastewater Treatment Plan Improvement Proj
FOE/improvement to existing wastewater treatement plant
Parametrix/USDA RD/Pacific City JS&WA
4S 10W 19, Pacific City, Tillamook County

Dear Ms. Lundberg:

Our office recently received a request to review your application for the project referenced above. In checking our statewide archaeological database, it appears that there have been few surveys completed near the proposed project area and visibility was always quite poor. However, the project area lies within an area generally perceived to have a high probability for possessing archaeological sites and/or buried human remains and archaeological sites have been reported.

In the absence of sufficient knowledge to predict the location of cultural resources within the project area, extreme caution is recommended during project related ground disturbing activities. Under state law (ORS 358.905 and ORS 97.74) archaeological sites, objects and human remains are protected on both state public and private lands in Oregon. If archaeological objects or sites are discovered during construction, all activities should cease immediately until a professional archaeologist can evaluate the discovery. If you have not already done so, be sure to consult with all appropriate Indian tribes regarding your proposed project. If the project has a federal nexus (i.e., federal funding, permitting, or oversight) please coordinate with the appropriate lead federal agency representative regarding compliance with Section 106 of the National Historic Preservation Act (NHPA).

If you have any questions about the above comments or would like additional information, please feel free to contact our office at your convenience. In order to help us track your project accurately, please reference the SHPO case number above in all correspondence.

Sincerely,

Dennis Griffin

Dennis Griffin, Ph.D., RPA
State Archaeologist
(503) 986-0674
dennis.griffin@oregon.gov

B2. Response to USDA Comments

December 9, 2014

Janice Roderick
1835 Black Lake Boulevard SW, Suite B
Olympia, WA 98512

Re: PCJWSA Environmental Report - Responses to USDA Comments

Dear Janice:

Thank you for providing the U.S. Department of Agriculture's (USDA) input regarding the proposed project in a letter dated October 28, 2014. This letter provided comments on the Environmental Report for the Pacific City, Oregon Wastewater Treatment Facility Improvement project proposed by the Pacific City Joint Water-Sanitary Authority (PCJWSA). Per our conversation on November 21, 2014, we are providing responses to those comments and requested supplemental information in this letter.

The USDA comment letter is attached and individual comments and responses are listed below:

Comment #1: Current level of assessment – Environmental Report

Response: No action required by PCJWSA or Parametrix.

Comment #2: A civil rights impact analysis should be completed as a part of the environmental review documents. Please submit the CRIA for review.

Response: To be completed by USDA loan specialist. No action required by PCJWSA or Parametrix.

Comment #3: Four alternatives are considered in the report with one being the No-Action alternative. The activated sludge process was used for the environmental report analysis. The environmental report should have more detail as to why the activated sludge process was determined to be the most desirable process. This may be detailed in the engineering report but the environmental should be a stand-alone document.

Response: The activated sludge process and sequencing batch reactor (SBR) are those most feasible for construction out of the four alternatives identified. The activated sludge process option was selected for analysis in the Environmental Report because it affects a slightly larger footprint and has a slightly higher construction disturbance than the others; but all four have no significant differences in terms of individual or cumulative impacts overall. Because the activated sludge alternative with a larger footprint and greater construction impact is shown in the Environmental Report to meet the classification of a Categorical Exclusion (CE), then the SBR and other alternatives, with slightly less construction impact, would meet the classification of a CE.

Comment #4: There are three parks located within ½ mile from the treatment site. There is no documentation that the parks were contacted for comments. Although it is mentioned that the benefits of the upgrade are positive, it is unknown traffic/noise could impact the parks during construction.

Response: Woods County Park, Webb County Park, and Bob Straub State Park are all approximately 0.5 mile from the WWTP. Woods County Park is a very small, 12-site campground for RVs and tents abutting the intersection of Resort Drive, Brooten Road, and Ferry Street east of the WWTP. Webb County Park is a 38-site campground for RVs and tents located north of the WWTP. Bob Straub State Park is a day use park located south of the WWTP.

The parks are not located on the same road as the project site, the roadways within Pacific City are often used by logging trucks, and numerous residential and commercial complexes are being constructed within Pacific City, resulting in increased level of ambient noise not related to this project near the parks.

As described in the No Effect document (Exhibit B of the Environmental Report), the noisiest construction equipment anticipated for use during the proposed project are a dozer, an excavator, and a cement pump truck. Mathematically, the distance that construction noise is anticipated to travel from the project site is approximately 1,991 feet. This point represents the distance where construction noise is indistinguishable from background ambient noise. Each of the three parks; Woods County Park, Webb County Park, and Bob Straub State Park, are all further than 1,991 feet from the project area.

Comment #5: The project location is on the current wastewater treatment facility site. The project will not convert prime farmland or forestland. No further action needed.

Response: No action required by PCJWSA or Parametrix.

Comment #6: The project will not impact any Wild and Scenic Rivers, National Parks or National/State wildlife refuges. No further action needed.

Response: No action required by PCJWSA or Parametrix.

Comment #7: It is stated the project is not within the 100-year floodplain area. A FEMA map should be included in the report.

Response: Please see attached FIRMette map (Figure 1).

Comment #8: The project does not affect any wetlands area. Oregon has county mapping of wetlands areas. Please provide a wetlands map of the area showing the area to verify lack of wetlands near the treatment plant location.

Response: Local Wetland Inventory maps for Pacific City or county wetland maps for Tillamook County are not available. Figure 3 within the Preliminary Environmental Report contains a GIS-generated soils and wetlands map, developed from the National Wetland Inventory, which shows no wetlands within the project area.

Comment #9: The applicant has reviewed the species for effect. The list includes Marbled Murrelet, Northern spotted owl, Western Snowy plover, Short-Tailed Albatross, Coho salmon, Green sturgeon. There is no in-water working being completed so there has been a determination of No Effect for Coho salmon and Green sturgeon. A letter to US Fish and Wildlife and US National Marine Fisheries Service should be sent requesting comments on the proposed project. These are not documented in the environmental report.

Response: Off-site data collection efforts involved a search and review of existing information related to fish and wildlife distribution and habitat within and surrounding the proposed project site. To determine species presence, existing data covering the project site were accessed from US Fish and Wildlife Service (USFWS) and National Marine

Fisheries Service (NMFS) websites. A wildlife biologist also characterized the habitat in and near the WWTP site as not suitable for listed wildlife species.

As described in the No Effect document (Exhibit B of the Environmental Report), federally listed species or associated critical habitat will not be impacted during the proposed project; therefore, the proposed project will have no effect upon federally listed species or designated critical habitat and will not adversely affect Essential Fish Habitat. As a result of a no effect determination, further consultation with USFWS or NMFS is not required. Per request, please see the attached map showing marbled murrelet and spotted owl critical habitat and any recent spotted owl survey results (Figure 2).

Comment #10: The environmental report has some documentation dated 2008 instructing the applicant to contact the Tribes regarding their comments. A letter also was received from the Oregon State Archeologist in July 2014 stating that if the project has a federal nexus, please coordinate with the appropriate lead agency regarding Section 106 of the NHPA. There is discussion that more recent letters have been sent but they are not included in the environmental documentation.

Based on the information in the environmental review and in support of RD guidance, Tribal letters and the cultural report should be sent from RD to the Grande Ronde Tribe and the Siletz Tribe requesting comments on the project. RD cannot delegate the responsibility unless there is agreement by the Tribe to do so (per RD memo dated 7/16/2009 from Mark Plank and Richard Davis). Also a letter to the State Historic Preservation Office should be sent by RD with the results of the cultural report, outlining actions taken to comply with Section 106 and RD's decision whether Historic/Cultural properties are affected.

Response: No action required by PCJWSA or Parametrix.

Comment #11: Water quality is addressed in the report. The project is to improve the water quality standards for the effluent of the treatment plant. A letter from Oregon's Department of Environmental Quality should be included in the report concurring with the improvements.

Response: Please see attached letter dated November 14, 2014 from the Oregon Department of Environmental Quality (DEQ). In summary, the letter states the following:

- The department [DEQ] agrees with the conclusions of the report.
- Because the treatment plant is near its capacity, and time is of the essence, DEQ recommends to keep moving forward with the project and proceed with arrangements to finance the project.
- To continue with the choice of treatment desired and prepare design documents.

Comment #12: The project is within a county governed by the Coastal Zone Management Act. Correspondence (letter or e-mail) from Oregon Department of Land Conservation and Development should be included that they concur that the proposed project meets the Coastal Zone Management Act Program.

Response: Please see attached letter dated July 3, 2014 from the Oregon Department of Land Conservation and Development stating that "If the federal nexus is limited to providing project funding, DLCD does not object to the federal funding under CZMA authority, provided the applicant receives and complies with the conditions of all necessary local, state, and federal permits". The proposed project is currently and will continue to comply with the conditions of all necessary local, state, and federal permits.

Comment #13: Air quality is addressed in the report. A letter should be sent to Oregon's Department of Environmental Quality Air Quality Program requesting comments on the project and any mitigation needed during construction.

Response: The project area is not within a nonattainment or maintenance area; therefore, a letter to DEQ is not required (USDA 2008). Please see the Oregon Nonattainment/Maintenance Status for Each County by Year for all Criteria Pollutants, located:

http://www.epa.gov/oaqps001/greenbk/anayo_or.html

Comment #14: Social Economic/Environmental Justice Issues are addressed in the report. The improvements will be at the same location as the current facility. The project appears to not have a disproportionate impact on minority or low-income populations.

Response: No action required by PCJWSA or Parametrix.

I hope the above responses adequately address your comments. Please feel free to contact me at (503) 416-6193 or whall@parametrix.com if you have any additional questions or comments.

Sincerely,

Parametrix

WE Hall

William Hall

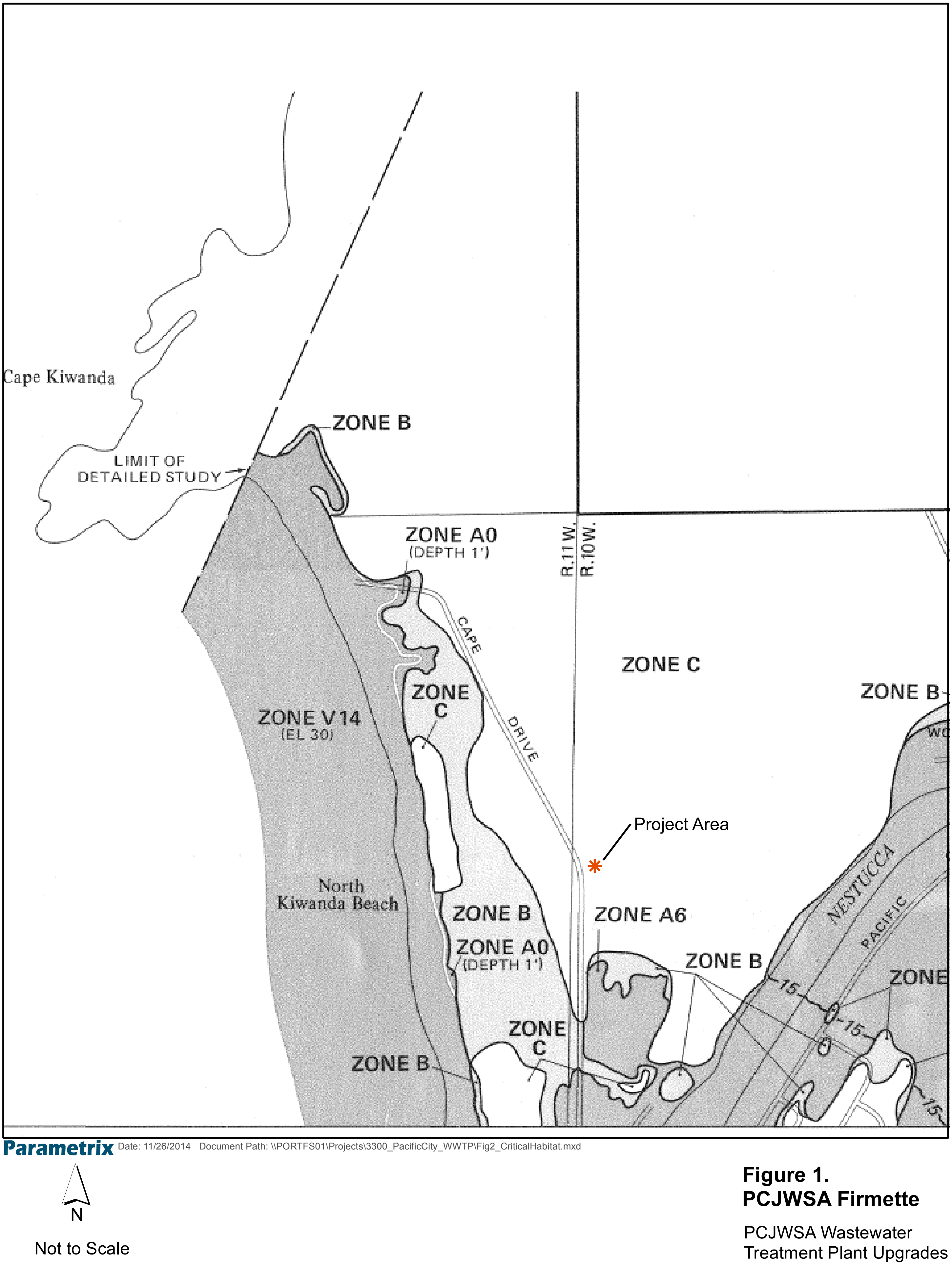
Senior Scientist

CC:

Tony Owen – Pacific City Joint Water-Sanitary Authority
Tom Nielsen - Parametrix

REFERENCES:

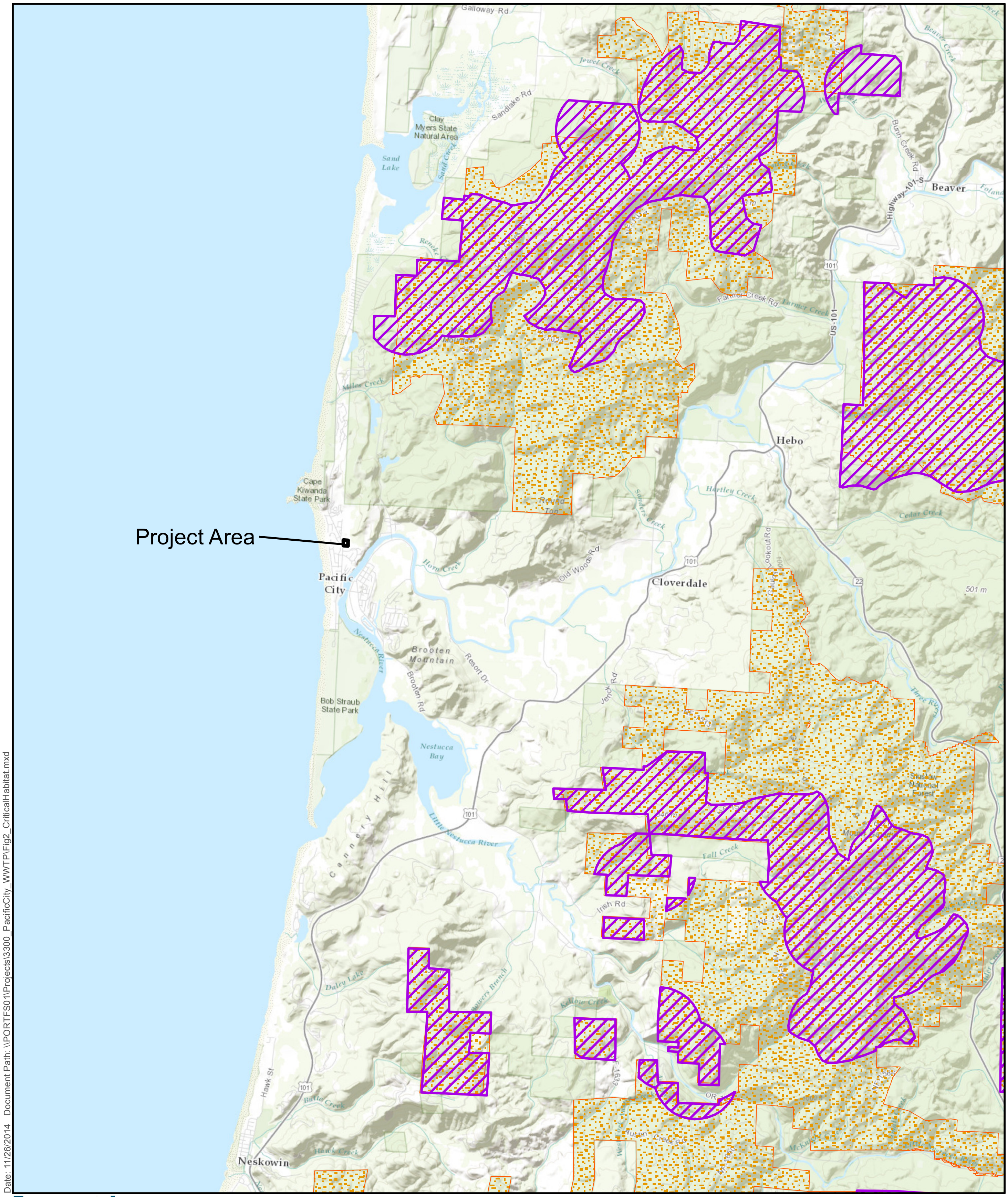
USDA (U.S. Department of Agriculture). 2008. Guide for Preparing the Environmental Report for Water and Environmental Program Proposals. RUS Bulletin 1794A-602, Version 1.2, Revised: March 2008.



Parametrix Date: 11/26/2014 Document Path: \\PORTFS01\Projects\3300_PacificCity_WWTP\Fig2_CriticalHabitat.mxd

Figure 1.
PCJWSA Firmette

PCJWSA Wastewater
Treatment Plant Upgrades



Date: 11/26/2014 Document Path: \\PORTFS01\Projects\3300_PacificCity_WWTP\Fig2_CriticalHabitat.mxd

Parametrix

N

0 2

Miles

Study Area

Critical Habitat

Marbled murrelet

Northern spotted owl

Figure 2.
Wildlife Critical Habitat Locations

PCJWSA Wastewater Treatment Plant Upgrades

United States Department of Agriculture
Rural Development
Washington State Office

October 28, 2014

SUBJECT: Environmental Report for Pacific City, Oregon
Wastewater Treatment Facility Improvements

TO: Rachel Reister, CP Specialist
Portland, Oregon

The environmental information submitted has been reviewed with the following items noted. Pacific City Joint Water-Sanitary Authority is planning to construct new wastewater treatment facilities on the existing treatment plant site. The City has been experiencing permit violations and fines.

Review Comments

1. Current level of assessment –Environmental Report.

2. A civil rights impact analysis should be completed as a part of the environmental review documents. **Please submit the CRIA for review**.

3. Four alternatives are considered in the report with one being the No-Action alternative. The activated sludge process was used for the environmental report analysis. **The environmental report should have more detail as to why the activated sludge process was determined to be the most desirable process. This may be detailed in the engineering report but the environmental should be a stand-alone document.**

4. There are three parks located within ½ mile from the treatment plant site. **There is no documentation that the parks were contacted for comments. Although it is mentioned that the benefits of the upgrade are positive, it is unknown traffic/noise could impact the parks during construction.**

5. The project location is on the current wastewater treatment facility site. The project will not convert prime farmland or forestland. No further action needed.

6. The project will not impact any Wild and Scenic Rivers, National Parks or National/State wildlife refuges. No further action needed.

7. It is stated that the project is not within the 100-year floodplain area. **A FEMA map should be included in the report.**

8. The project does not affect any wetlands area. **Oregon has county mapping of wetlands areas. Please provide a wetlands map of the area showing the area to verify lack of wetlands near the treatment plant location.**

9. The applicant has reviewed the species for effect. The list includes Marbled Murrelet, Northern spotted owl, Western Snowy plover, Short-Tailed Albatross, Coho salmon, Green sturgeon. There is no in-water working being completed so there has been a determination of No Effect for Coho salmon and Green sturgeon. **A letter to US Fish and Wildlife and US National Marine Fisheries Service should be sent requesting comments on the proposed project. These are not documented in the environmental report.**

10. The environmental report has some documentation dated 2008 instructing the applicant to contact the Tribes regarding their comments. A letter also was received from the Oregon State Archeologist in July 2014 stating that if the project has a federal nexus, please coordinate with the appropriate lead agency regarding Section 106 of the NHPA. There is discussion that more recent letters have been sent but they are not included in the environmental documentation.

    Based on the information in the environmental review and in support of RD guidance, Tribal letters and the cultural report should be sent from RD to the Grande Ronde Tribe and the Siletz Tribe requesting comments on the project. RD cannot delegate the responsibility unless there is agreement by the Tribe to do so (per RD memo dated 7/16/2009 from Mark Plank and Richard Davis). Also a letter to the State Historic Preservation Office should be sent by RD with the results of the cultural report, outlining actions taken to comply with Section 106 and RD's decision whether Historic/Cultural properties are affected.

11. Water quality is addressed in the report. The project is to improve the water quality standards for the effluent of the treatment plant. **A letter from Oregon's Department of Environmental Quality should be included in the report concurring with the improvements.**

12. The project is within a county governed by the Coastal Zone Management Act. **Correspondence (letter or e-mail) from Oregon Department of Land Conservation and Development should be included that they concur that the proposed project meets the Coastal Zone Management Act Program.**

13. Air quality is addressed in the report. **A letter should be sent to Oregon's Department of Environmental Quality Air Quality Program requesting comments on the project and any mitigation needed during construction.**

14. Social Economic/Environmental Justice Issues are addressed in the report. The improvements will be at the same location as the current facility. The project appears to not have a disproportionate impact on minority or low-income populations.

<u>DRAFT Mitigation Measures (may change pending final review of environmental)</u>

Mitigation measures recommended are reasonable and follow regulatory agencies direction to minimize adverse comments and concerns. Mitigation measures must appear in the LOC, or other financing instruments which offer RD's commitment for this project. In addition, please send a copy of the mitigation measures to the engineer or other representatives of the applicant, to help ensure that these measures are incorporated into the project development plans as appropriate.

1. Construction activities will be scheduled to reduce traffic, dust and noise impacts in residential areas.

2. Construction activities will use best practices for prevention of stormwater runoff during construction.

3. An Unanticipated Discovery Plan (UDP) must be "in place" before construction. If earth disturbing activities during project construction uncover cultural materials such as shell midden, faunal remains, stone tools, human remains), all work shall cease and the UDP plan outlined in the cultural resource report will be followed. Applicable laws pertaining to archaeological resources are required to be followed.

4. If earth disturbing activities during any area of the project uncover human remains, all work shall cease immediately and the area around the discovery shall be secured. The Oregon SHPO, Tillamook County, affected tribes, funding agencies and the applicant shall be immediately notified. Procedures outlined under Oregon State law (ORS 97.740 and ORS 358.905.955) will be followed and work will not resume until mitigation measures have been agreed upon by all parties.

Janice Roderick
State Environmental Coordinator

Oregon

John A. Kitzhaber, MD, Governor

Department of Environmental Quality
Northwest Region
2020 SW 4th Ave, Suite 400
Portland, OR 97201
(503) 229-5263
FAX (503) 229-6945
TTY 711

November 14, 2014

COPY

Tony Owen
Pacific City Joint Water-Sanitary Authority
Box 520
Pacific City, OR 97135

Re: WQ-Pacific City
Approval of Preliminary Engineering Report Wastewater Treatment Plant Upgrade
File 66100
PCJWSA, Tillamook County

Dear Mr. Owen:

The Department of Environmental Quality (Department) has reviewed of the above referenced document received in our Portland Office in October 9, 2014 as prepared by Thomas Nielsen PE, of Parametrix of Portland, OR.

The Department agrees with the conclusions of the report. A Sequencing Batch Reactor (SBR) would be most likely the least expensive alternative choice for an upgrade of the wastewater treatment plant. An SBR would produce a high quality, biologically nutrient-reduced effluent, low in nitrogen containing constituents. Although there are no specific rules for nutrient reduction proposed, there are several possible that may be imposed in the future. Also, an SBR also allows the facility to grow in increments, with the addition of SBR basins, as flows increase.

Something else for PCJWA to be aware of is the outfall in the Nestucca River. The tidal influence and seasonal fluctuations can create unstable and possibly poor mixing at times. The fact that the highest WWTP influent flow levels occur during the lowest river flows (July and August) demands that the WWTP perform to a high level of treatment and stability. A detailed mixing zone study will likely be required as part of a renewed permit..

One change coming with the 2016 permit renewal will be the monitoring of effluent bacteria to enterococcus and fecal coliform from the current ecoli.

Time is of the essence. The treatment plant is near its capacity and regularly has difficulty meeting the permit. Keep moving forward. Proceed with arranging financing for the project.

Continue with the choice of treatment desired and design documents. Technical review fees will be applied at that point.

INQUIRIES

If there is anything I can do to assist in the treatment choice questions and future needs, please don't hesitate to contact me. I can be reached at (503) 229-5310. I may emailed at pinney.mike@deq.state.or.us.

We appreciate the City's many efforts to comply with our water quality regulations and endeavor to assist you through the process.

Respectfully,

Michael L. Pinney PE
Senior Environmental Engineer
Northwest Region Water Quality

Cc : Thomas Nielson PE, Parametrix, 700 NE Multnomah, Ste.1000, Portland Or., 97232-4110
Tiffany Yelton-Bram, NWR-WQ
Randy Baily, NWR-WQ

Oregon
John A. Kitzhaber, MD, Governor

Oregon Coastal Management Program
Department of Land Conservation and Development
635 Capitol Street, Suite 150
Salem, Oregon 97301-2540
Phone (503) 373-0050
FAX (503) 378-6033
http://www.oregon.gov/LCD/OCMP

Electronic Delivery

July 3, 2014

Ms. Jennifer Lundberg
Parametrix

Project:	Pacific City Wastewater Treatment Plant
Location:	Pacific City, Tillamook County
Federal Assistance:	USDA Rural Development

Dear Ms. Lundberg,

Thank you for your consistency determination request related to funding for the Pacific City wastewater treatment plant. The Department of Land Conservation and Development (DLCD) is the state's designated coastal zone management agency, and conducts consistency reviews to ensure that federal activities and funding for projects affecting any coastal use or resource are consistent with the enforceable policies of the Oregon Coastal Management Program (OCMP). To be consistent with the enforceable policies of the OCMP, proposed activities must be consistent with: 1) the statewide planning goals; 2) the applicable acknowledged city or county comprehensive plan and implementing regulations; and 3) selected state authorities (e.g. those governing removal-fill, water quality, and fish & wildlife protections).

This project is located in Oregon's coastal zone and may affect coastal resources. If the federal nexus is limited to providing project funding DLCD does not object to the federal funding under our CZMA authority, provided the applicant receives and complies with the conditions of all necessary local, state, and federal permits. If the project will require a federal license or permit, such as one from the U.S. Army Corps of Engineers, DLCD will conduct a full consistency review as part of the permitting phase.

If you have any questions about the federal consistency review process or the coastal management program, please contact me at 503-934-0029 or by e-mail at: *juna.hickner@state.or.us*.

Sincerely,

/s/

Juna Hickner, Coastal State-Federal Relations Coordinator

Cc: Patrick Wingard, DLCD

APPENDIX C

Agency Required Data

C1. Existing WWTP Design Criteria and Hydraulic Profile
C2. Effluent Data Summary Table and Graph, 2010-2014
C3. Rainfall Statistics (Cloverdale)
C4. Zoning Map

C1. Existing WWTP Design Criteria and Hydraulic Profile

EXISTING PCJWSA WWTP DESIGN CRITERIA

BASIS OF DESIGN (1979)

DESIGN FLOW	360,000 GPD
MINIMUM FLOW	11 GPM
MAXIMUM FLOW	815 GPM
BOD_5	185 MG/L
SS	200 MG/L

INFLUENT LIFT STATION (2013)

SUBMERSIBLE PUMPS	2
PUMPING RATE	400 GPM
TDH	24 FT

5 HP, CONSTANT SPEED

FLOW EQUALIZATION BASIN (1998)

CONCRETE TANK
51’x48’x6’ SWD, 1 FT FREE BOARD
18,311 GAL PER FOOT DEPTH
EFFECTIVE VOLUME 82,000 GAL

FEB DISCHARGE PUMPS
3 EACH AT 170 GPM, 9’ TDH
2 HP, VARIABLE SPEED
4” MAGNETIC FLOW METER ON DISCHARGE

FEB MIXING
COARSE BUBBLE, FLEXIBLE DIAPHRAGM
DIFFUSERS, 64 @ 15-20 SCFM EACH
TWO REGENERATIVE HELICAL BLOWERS
320 SCFM, 20 HP EACH
21.8 SCFM/1000 CF, 1.4 HP/1000 CF

AERATION BASINS (1979)

QUANTITY	2
TOTAL VOLUME	12,000 FT^3
LOADING	0.30# BOD_5/# MLSS
MLSS CONC.	2500 MG/L
DETENTION TIME	6 HOURS
SIZE	24.5’x24.5’x13’ SWD

CLARIFIERS (1979)

QUANTITY	2
SIZE	25’ DIA. x 8’ SWD
OVERFLOW RATE	400 GPDSF
DETENTION TIME	3.9 HOURS

SUBMERSIBLE SLUDGE PUMPS (2)-5 HP

FILTER PUMPING STATION (1979)

HORIZ. CENTRIF. PUMPS	2
PUMPING RATE	250 GPM
TDH	40 FEET

5 HP, CONSTANT SPEED

FILTER HOLDING TANK (1979)

32’x32’x13.5’ SWD
38,000 GAL @ 5’ EFFECTIVE DEPTH

CLOTH MEDIA FILTERS (2005)

QUANTITY	2
EFFLUENT	AVG 30 DAY – 10 MG/L
	AVG 7 DAY – 15 MG/L
AVG. FLOW	0.16 MGD
PEAK FLOW	1.0 MGD

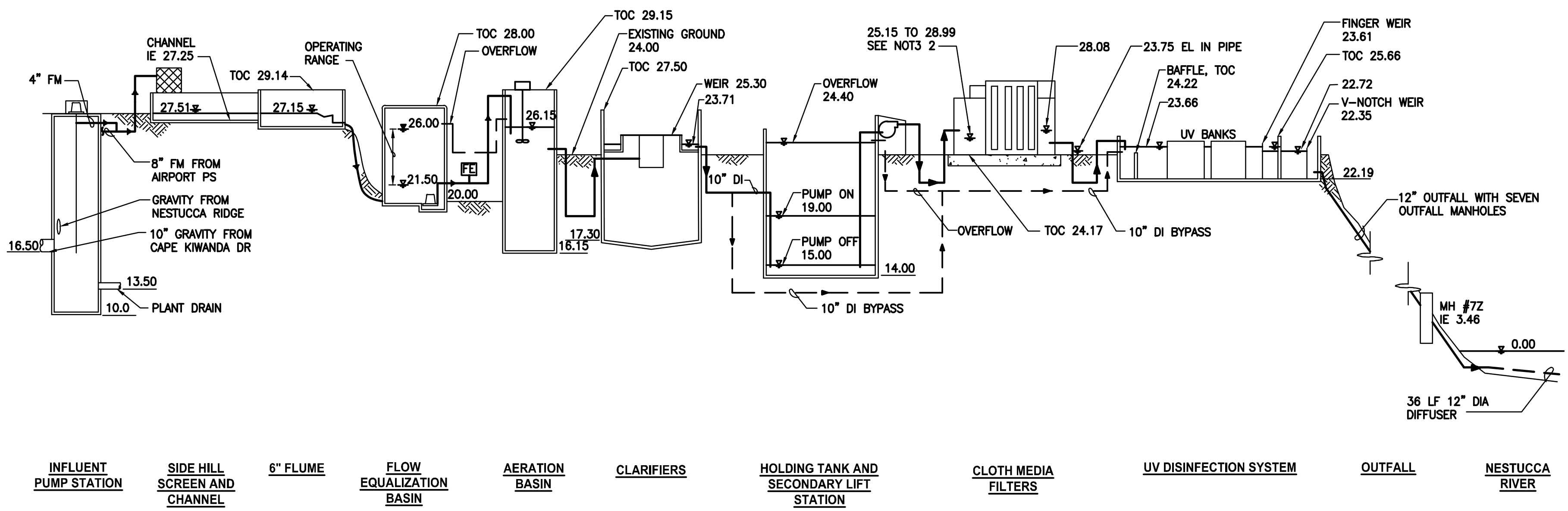
DIGESTER (1979)

SIZE	29’ DIA. x 12’ SWD
AIR SUPPLY	50 SCFM @ 6 PSI
LOADING	560#/DAY
DETENTION TIME	16 DAYS
WASTE SLUDGE PUMP	5 HP, CONSTANT SPEED

UV DISINFECTION (2001)

PRE-UV SST SCREEN WITH 1”x1” OPENINGS
UV DESIGN DOSAGE: 30,500 MICROWATTS/CM^2 AT 1.0 MGD
CONFIGURATION: TWO BANKS IN SERIES WITH 5 MODULES PER BANK AND 6 LAMPS PER MODULE. 5^{TH} MODULE REDUNDANT – ACHIEVES DESIGN DOSE WITH 4 MODULES/BANK
LEVEL SENSOR AT V-NOTCH WEIR CONTROLS UV BANKS
POWER: 208Y/120 VOLT THREE PHASE TO UV SYSTEM. STANDBY POWER – 11.5 KW DIESEL GENERATOR WITH AUTOMATIC TRANSFER SWITCH

NOTE: YEARS INDICATE YEAR OF CONSTRUCTION



NOTES:

1. LIQUID ELEVATIONS SHOWN AT 0.16 MGD, 2003 MMDWF.

Parametrix

Figure C1
Existing WWTP Hydraulic Profile

C2. Effluent Data Summary Table and Graph, 2010-2014

PCJWSA WWTP PERFORMANCE DATA SUMMARY BY YEAR

DATE	Precip	FLOW	30 d run	WWTP INFLUENT DATA							WWTP EFFLUENT DATA						
	Inches	MGD	average	PH	BOD	PPD	30 d run avg	TSS	PPD	30 d run avg	BOD	%BOD	# BOD	TSS	% TSS	# S.S.	Ph
							PPD			PPD							
2010		C5:C369															
Min	0.000	0.047	0.072	7.00	143.0	107.3	133.4	77.0	64.9	136.5	3.36	84.2	2.71	0.80	90.1	0.00	6.90
Max	2.436	0.256	0.191	7.90	484.0	698.3	644.8	703.0	737.6	421.8	30.00	99.0	24.27	29.00	100.0	23.96	8.10
Average	0.258	0.122	0.121	7.55	290.7	274.6	281.3	270.6	248.4	247.6	8.53	96.8	7.88	6.97	97.4	5.86	7.40
Max:Avg							2.29			1.70							
2011		C370:C734															
Min	0.000	0.047	0.084	6.300	119.0	56.6	135.7	127.0	95.0	155.7	3.00	92.4	2.08	1.00	89.8	0.00	6.30
Max	3.450	0.377	0.196	7.900	457.0	739.9	558.1	684.0	722.1	414.5	20.00	99.0	23.76	22.00	99.3	30.25	7.90
Average	0.228	0.133	0.133	7.394	275.0	292.0	292.6	271.4	270.9	268.5	9.22	96.4	9.52	9.01	96.6	8.36	7.33
							1.91			1.54							
2012		C735:C1100															
Min	0.000	0.019	0.107	6.80	112.0	99.9	200.6	91.0	46.8	231.9	3.00	15.4	2.87	0.80	86.6	0.00	5.60
Max	3.299	0.324	0.199	7.80	482.0	675.5	622.4	1087.0	2083.4	719.2	24.00	99.3	382.01	32.00	100.0	388.69	8.10
Average	0.281	0.148	0.145	7.34	301.0	329.5	333.5	315.5	392.3	386.6	9.82	92.3	26.16	9.53	96.7	13.58	6.85
							1.87			1.86							
2013		C1101:C1465															
Min	0.000	0.073	0.098	7.10	190.0	175.1	220.6	128.0	109.6	238.5	3.00	91.5	1.88	1.00	83.6	0.00	5.70
Max	2.536	0.310	0.192	7.80	491.0	613.0	588.8	2150.0	2707.6	709.7	30.00	99.3	44.74	24.60	99.7	26.97	7.60
Average	0.179	0.133	0.136	7.41	322.9	332.9	352.1	362.6	399.7	401.6	9.38	97.1	10.21	9.03	97.2	9.54	6.63
							1.67			1.77							
2014		C1466:C1677															
Min	0.000	0.075	0.098	7.10	181.0	183.8	223.1	133.0	155.8	303.0	5.00	90.6	0.00	0.80	91.0	0.00	5.80
Max	2.688	0.314	0.161	7.70	413.0	509.8	351.0	925.0	1504.3	593.7	27.00	98.2	24.77	34.00	99.7	31.43	7.60
Average	0.245	0.137	0.131	7.40	289.5	278.7	272.1	386.7	432.4	431.6	9.58	96.7	7.59	8.32	97.6	9.24	6.66

PCJWSA WWTP PERFORMANCE DATA SUMMARY BY YEAR

DATE	E. coli	UV INTENSITY BANK A	UV INTENSITY BANK B	AEROBIC DIGESTER MLVSS	AEROBIC DIGESTER PH	BIO-SOLIDS APPLICATION DATA SITE	GALLONS	START PH	END PH	HAULER	LIME
2010											
Min	1.00	0.90	0.50	3320	6.80		6,000	% VSS 70%			2,000
Max	116.00	8.30	7.50	14640	12.50		27,000				2,000
Average	6.82	4.13	3.47	8839	10.07		15,115	MGD	Pounds Solids		2,000
Max:Avg						Sum	393,000	0.393	105,309 per year		
						Per Month	32,750		8,776 per month		
2011											
Min	1.00	0.00	0.00	3,373	6.80		3,000				2,000
Max	209.00	7.80	7.60	14,930	12.60		66,000				2,000
Average	6.91	3.21	2.48	8,735	10.24		14,081	MGD	Pounds Solids		2,000
							873,000	0.873	104,070 per year		
						Per Month	72,750		8,673 per month		
2012											
Min	1.00	1.90	1.20	3,910	5.50		3,000				1,000
Max	28.00	8.20	7.00	17,090	12.60		66,000				2,000
Average	3.31	4.11	3.48	8,933	10.40		15,500	MGD	Pounds Solids		1,889
							837,000	0.837	106,431 per year		
						Per Month	69,750		8,869 per month		
2013											
Min	1.00	0.00	0.00	4,720	6.10		3,000				2,000
Max	60.00	6.50	9.20	13,010	12.70		21,000				2,000
Average	6.12	3.51	3.54	8,301	10.11		12,500	MGD	Pounds Solids		2,000
							450,000	0.45	98,896 per year		
						Per Month	37,500		8,241 per month		
2014											
Min	1.00	1.20	1.50	620	6.90						
Max	16.00	6.70	7.00	15,320	12.70						
Average	2.85	3.71	3.64	10,143	9.13						

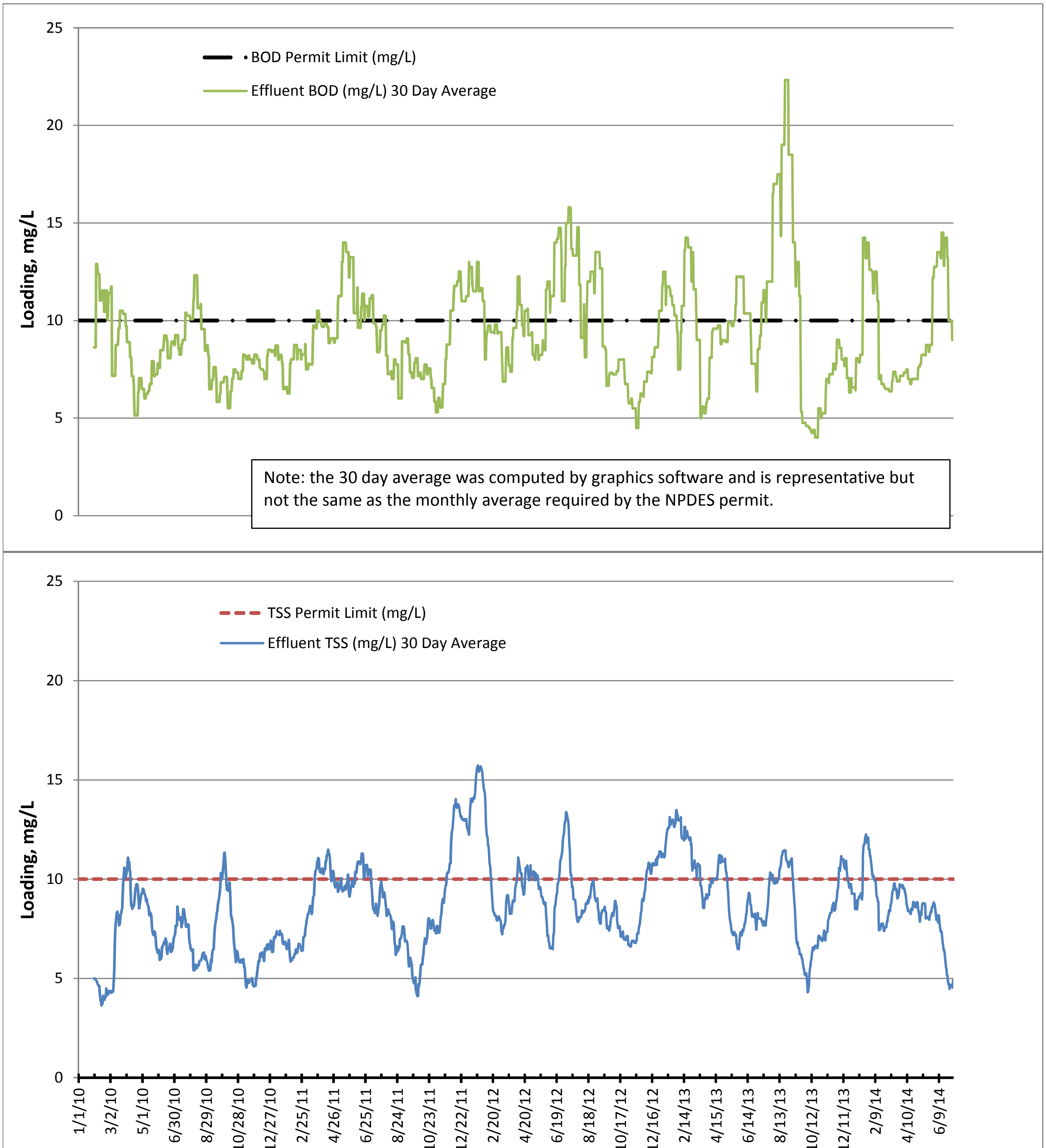


Figure C2. Effluent BOD and TSS

C3. Rainfall Statistics (Cloverdale)

Cloverdale, Oregon: Precipitation Data, 2009-2014

DATE	PRCP inches	DATE	PRCP inches	DATE	PRCP inches	DATE	PRCP inches
1/1/2009	0.24	2/10/2009	0.46	3/22/2009	0.26	5/1/2009	0.00
1/2/2009	0.36	2/11/2009	0.00	3/23/2009	0.36	5/2/2009	0.56
1/3/2009	0.05	2/12/2009	0.30	3/24/2009	0.46	5/3/2009	0.00
1/4/2009	1.22	2/13/2009	0.00	3/25/2009	0.71	5/4/2009	1.07
1/5/2009	0.66	2/14/2009	0.00	3/26/2009	0.00	5/5/2009	0.46
1/6/2009	0.41	2/15/2009	0.15	3/27/2009	0.05	5/6/2009	0.86
1/7/2009	2.23	2/16/2009	0.00	3/28/2009	1.22	5/7/2009	0.10
1/8/2009	0.71	2/17/2009	0.00	3/29/2009	0.15	5/8/2009	0.00
1/9/2009	0.00	2/18/2009	0.00	3/30/2009	0.00	5/9/2009	0.00
1/10/2009	0.61	2/19/2009	0.00	3/31/2009	0.10	5/10/2009	0.05
1/11/2009	0.10	2/20/2009	0.00	4/1/2009	1.11	5/11/2009	0.26
1/12/2009	0.00	2/21/2009	0.41	4/2/2009	0.41	5/12/2009	0.05
1/13/2009	0.00	2/22/2009	0.15	4/3/2009	0.15	5/13/2009	0.66
1/14/2009	0.00	2/23/2009	0.51	4/4/2009	0.00	5/14/2009	0.05
1/15/2009	0.00	2/24/2009	0.51	4/5/2009	0.00	5/15/2009	0.00
1/16/2009	0.00	2/25/2009	0.61	4/6/2009	0.00	5/16/2009	0.00
1/17/2009	0.00	2/26/2009	0.10	4/7/2009	0.00	5/17/2009	0.00
1/18/2009	0.00	2/27/2009	0.00	4/8/2009	0.10	5/18/2009	0.00
1/19/2009	0.00	2/28/2009	0.05	4/9/2009	0.10	5/19/2009	0.30
1/20/2009	0.00	3/1/2009	1.11	4/10/2009	0.00	5/20/2009	0.00
1/21/2009	0.00	3/2/2009	0.36	4/11/2009	0.10	5/21/2009	0.00
1/22/2009	0.00	3/3/2009	0.10	4/12/2009	1.11	5/22/2009	0.00
1/23/2009	0.00	3/4/2009	0.00	4/13/2009	0.51	5/23/2009	0.00
1/24/2009	0.26	3/5/2009	0.36	4/14/2009	0.10	5/24/2009	0.00
1/25/2009	0.05	3/6/2009	0.00	4/15/2009	0.00	5/25/2009	0.00
1/26/2009	0.00	3/7/2009	0.51	4/16/2009	0.00	5/26/2009	0.00
1/27/2009	0.51	3/8/2009	0.26	4/17/2009	0.46	5/27/2009	0.00
1/28/2009	0.10	3/9/2009	0.36	4/18/2009	0.00	5/28/2009	0.00
1/29/2009	0.00	3/10/2009	0.00	4/19/2009	0.00	5/29/2009	0.00
1/30/2009	0.00	3/11/2009	0.00	4/20/2009	0.00	5/30/2009	0.00
1/31/2009	0.15	3/12/2009	0.00	4/21/2009	0.00	5/31/2009	0.00
2/1/2009	0.00	3/13/2009	0.00	4/22/2009	0.10	6/1/2009	0.00
2/2/2009	0.00	3/14/2009	0.61	4/23/2009	0.05	6/2/2009	0.00
2/3/2009	0.00	3/15/2009	0.36	4/24/2009	0.00	6/3/2009	0.00
2/4/2009	0.00	3/16/2009	0.26	4/25/2009	0.20	6/4/2009	0.20
2/5/2009	0.41	3/17/2009	0.10	4/26/2009	0.05	6/5/2009	0.10
2/6/2009	0.10	3/18/2009	0.00	4/27/2009	0.00	6/6/2009	0.10
2/7/2009	0.00	3/19/2009	0.10	4/28/2009	0.15	6/7/2009	0.00
2/8/2009	0.20	3/20/2009	0.26	4/29/2009	0.05	6/8/2009	0.00
2/9/2009	0.61	3/21/2009	0.56	4/30/2009	0.00	6/9/2009	0.05

DATE	PRCP	DATE	PRCP	DATE	PRCP	DATE	PRCP
	inches		inches		inches		inches
6/10/2009	0.00	7/20/2009	0.00	8/29/2009	0.00	10/8/2009	0.00
6/11/2009	0.15	7/21/2009	0.00	8/30/2009	0.00	10/9/2009	0.00
6/12/2009	0.00	7/22/2009	0.00	8/31/2009	0.00	10/10/2009	0.00
6/13/2009	0.05	7/23/2009	0.00	9/1/2009	0.00	10/11/2009	0.00
6/14/2009	0.00	7/24/2009	0.00	9/2/2009	0.00	10/12/2009	0.00
6/15/2009	0.00	7/25/2009	0.00	9/3/2009	0.00	10/13/2009	0.61
6/16/2009	0.00	7/26/2009	0.00	9/4/2009	0.00	10/14/2009	0.26
6/17/2009	0.00	7/27/2009	0.00	9/5/2009	0.41	10/15/2009	0.10
6/18/2009	0.26	7/28/2009	0.00	9/6/2009	0.26	10/16/2009	0.10
6/19/2009	0.36	7/29/2009	0.00	9/7/2009	0.05	10/17/2009	0.36
6/20/2009	0.10	7/30/2009	0.00	9/8/2009	0.00	10/18/2009	0.05
6/21/2009	0.05	7/31/2009	0.00	9/9/2009	0.05	10/19/2009	0.00
6/22/2009	0.00	8/1/2009	0.00	9/10/2009	0.00	10/20/2009	0.00
6/23/2009	0.00	8/2/2009	0.00	9/11/2009	0.00	10/21/2009	0.81
6/24/2009	0.20	8/3/2009	0.00	9/12/2009	0.10	10/22/2009	0.10
6/25/2009	0.05	8/4/2009	0.00	9/13/2009	0.05	10/23/2009	0.66
6/26/2009	0.00	8/5/2009	0.00	9/14/2009	0.00	10/24/2009	0.00
6/27/2009	0.00	8/6/2009	0.10	9/15/2009	0.00	10/25/2009	0.00
6/28/2009	0.00	8/7/2009	0.00	9/16/2009	0.26	10/26/2009	1.93
6/29/2009	0.00	8/8/2009	0.00	9/17/2009	0.00	10/27/2009	0.20
6/30/2009	0.00	8/9/2009	0.05	9/18/2009	0.00	10/28/2009	0.00
7/1/2009	0.00	8/10/2009	0.00	9/19/2009	0.30	10/29/2009	1.01
7/2/2009	0.00	8/11/2009	1.07	9/20/2009	0.00	10/30/2009	0.61
7/3/2009	0.00	8/12/2009	0.20	9/21/2009	0.00	10/31/2009	0.05
7/4/2009	0.00	8/13/2009	0.05	9/22/2009	0.00	11/1/2009	0.00
7/5/2009	0.00	8/14/2009	0.00	9/23/2009	0.00	11/2/2009	0.00
7/6/2009	0.10	8/15/2009	0.00	9/24/2009	0.00	11/3/2009	0.00
7/7/2009	0.00	8/16/2009	0.00	9/25/2009	0.00	11/4/2009	0.00
7/8/2009	0.05	8/17/2009	0.00	9/26/2009	0.00	11/5/2009	1.11
7/9/2009	0.00	8/18/2009	0.00	9/27/2009	0.00	11/6/2009	0.66
7/10/2009	0.00	8/19/2009	0.00	9/28/2009	0.26	11/7/2009	1.57
7/11/2009	0.00	8/20/2009	0.00	9/29/2009	0.51	11/8/2009	0.20
7/12/2009	0.41	8/21/2009	0.00	9/30/2009	0.05	11/9/2009	0.91
7/13/2009	0.10	8/22/2009	0.00	10/1/2009	0.10	11/10/2009	0.61
7/14/2009	0.00	8/23/2009	0.00	10/2/2009	0.05	11/11/2009	0.71
7/15/2009	0.00	8/24/2009	0.00	10/3/2009	0.02	11/12/2009	2.28
7/16/2009	0.00	8/25/2009	0.15	10/4/2009	0.00	11/13/2009	0.81
7/17/2009	0.00	8/26/2009	0.00	10/5/2009	0.00	11/14/2009	0.00
7/18/2009	0.00	8/27/2009	0.00	10/6/2009	0.00	11/15/2009	0.41
7/19/2009	0.00	8/28/2009	0.15	10/7/2009	0.00	11/16/2009	1.93

DATE	PRCP inches	DATE	PRCP inches	DATE	PRCP inches	DATE	PRCP inches
11/17/2009	0.36	12/27/2009	0.05	2/5/2010	0.00	3/17/2010	0.00
11/18/2009	0.61	12/28/2009	0.00	2/6/2010	0.30	3/18/2010	0.00
11/19/2009	1.01	12/29/2009	0.56	2/7/2010	0.00	3/19/2010	0.00
11/20/2009	0.51	12/30/2009	0.56	2/8/2010	0.00	3/20/2010	0.30
11/21/2009	0.76	12/31/2009	1.11	2/9/2010	0.00	3/21/2010	0.30
11/22/2009	0.05	1/1/2010	0.71	2/10/2010	0.30	3/22/2010	0.15
11/23/2009	0.00	1/2/2010	0.10	2/11/2010	0.81	3/23/2010	0.00
11/24/2009	0.00	1/3/2010	0.00	2/12/2010	0.46	3/24/2010	0.00
11/25/2009	0.00	1/4/2010	1.01	2/13/2010	0.46	3/25/2010	0.86
11/26/2009	1.32	1/5/2010	1.73	2/14/2010	0.00	3/26/2010	0.10
11/27/2009	0.05	1/6/2010	0.10	2/15/2010	0.41	3/27/2010	0.00
11/28/2009	0.00	1/7/2010	0.15	2/16/2010	0.00	3/28/2010	1.22
11/29/2009	0.00	1/8/2010	0.41	2/17/2010	0.00	3/29/2010	0.96
11/30/2009	0.00	1/9/2010	0.00	2/18/2010	0.00	3/30/2010	0.91
12/1/2009	0.00	1/10/2010	0.20	2/19/2010	0.00	3/31/2010	0.10
12/2/2009	0.00	1/11/2010	1.27	2/20/2010	0.00	4/1/2010	0.00
12/3/2009	0.00	1/12/2010	0.41	2/21/2010	0.00	4/2/2010	1.27
12/4/2009	0.00	1/13/2010	0.41	2/22/2010	0.00	4/3/2010	0.66
12/5/2009	0.00	1/14/2010	0.00	2/23/2010	1.01	4/4/2010	0.41
12/6/2009	0.00	1/15/2010	1.98	2/24/2010	0.41	4/5/2010	0.91
12/7/2009	0.00	1/16/2010	0.20	2/25/2010	0.51	4/6/2010	0.15
12/8/2009	0.00	1/17/2010	1.52	2/26/2010	0.51	4/7/2010	0.66
12/9/2009	0.00	1/18/2010	0.41	2/27/2010	0.10	4/8/2010	0.46
12/10/2009	0.00	1/19/2010	0.15	2/28/2010	0.00	4/9/2010	0.15
12/11/2009	0.00	1/20/2010	0.10	3/1/2010	0.05	4/10/2010	0.00
12/12/2009	0.00	1/21/2010	0.05	3/2/2010	0.20	4/11/2010	0.56
12/13/2009	0.26	1/22/2010	0.10	3/3/2010	0.10	4/12/2010	0.20
12/14/2009	1.01	1/23/2010	0.00	3/4/2010	0.00	4/13/2010	0.00
12/15/2009	0.81	1/24/2010	0.81	3/5/2010	0.00	4/14/2010	0.00
12/16/2009	0.30	1/25/2010	0.10	3/6/2010	0.00	4/15/2010	0.66
12/17/2009	0.00	1/26/2010	0.10	3/7/2010	0.56	4/16/2010	0.00
12/18/2009	0.05	1/27/2010	0.00	3/8/2010	0.10	4/17/2010	0.05
12/19/2009	0.10	1/28/2010	0.00	3/9/2010	0.66	4/18/2010	0.00
12/20/2009	0.71	1/29/2010	0.10	3/10/2010	0.10	4/19/2010	0.20
12/21/2009	0.71	1/30/2010	0.51	3/11/2010	2.03	4/20/2010	0.20
12/22/2009	0.10	1/31/2010	0.05	3/12/2010	0.46	4/21/2010	0.05
12/23/2009	0.00	2/1/2010	0.51	3/13/2010	0.10	4/22/2010	0.00
12/24/2009	0.00	2/2/2010	0.00	3/14/2010	0.00	4/23/2010	0.00
12/25/2009	0.00	2/3/2010	0.71	3/15/2010	0.00	4/24/2010	0.41
12/26/2009	0.00	2/4/2010	0.46	3/16/2010	0.61	4/25/2010	0.00

DATE	PRCP inches	DATE	PRCP inches	DATE	PRCP inches	DATE	PRCP inches
4/26/2010	1.93	6/5/2010	0.00	7/15/2010	0.00	8/24/2010	0.00
4/27/2010	0.51	6/6/2010	1.42	7/16/2010	0.00	8/25/2010	0.00
4/28/2010	0.36	6/7/2010	0.00	7/17/2010	0.00	8/26/2010	0.00
4/29/2010	0.30	6/8/2010	0.30	7/18/2010	0.00	8/27/2010	0.00
4/30/2010	0.26	6/9/2010	0.61	7/19/2010	0.00	8/28/2010	0.00
5/1/2010	0.10	6/10/2010	0.10	7/20/2010	0.00	8/29/2010	0.00
5/2/2010	0.00	6/11/2010	0.05	7/21/2010	0.00	8/30/2010	0.30
5/3/2010	1.11	6/12/2010	0.00	7/22/2010	0.00	8/31/2010	0.86
5/4/2010	0.15	6/13/2010	0.00	7/23/2010	0.00	9/1/2010	0.05
5/5/2010	0.15	6/14/2010	0.00	7/24/2010	0.00	9/2/2010	0.00
5/6/2010	0.00	6/15/2010	0.15	7/25/2010	0.00	9/3/2010	0.00
5/7/2010	0.00	6/16/2010	0.15	7/26/2010	0.00	9/4/2010	0.00
5/8/2010	0.00	6/17/2010	0.10	7/27/2010	0.00	9/5/2010	0.00
5/9/2010	0.00	6/18/2010	0.00	7/28/2010	0.00	9/6/2010	0.00
5/10/2010	0.30	6/19/2010	0.00	7/29/2010	0.00	9/7/2010	0.05
5/11/2010	0.00	6/20/2010	0.10	7/30/2010	0.00	9/8/2010	0.05
5/12/2010	0.00	6/21/2010	0.00	7/31/2010	0.00	9/9/2010	0.02
5/13/2010	0.00	6/22/2010	0.00	8/1/2010	0.00	9/10/2010	0.00
5/14/2010	0.00	6/23/2010	0.00	8/2/2010	0.00	9/11/2010	0.00
5/15/2010	0.00	6/24/2010	0.00	8/3/2010	0.00	9/12/2010	0.00
5/16/2010	0.00	6/25/2010	0.00	8/4/2010	0.00	9/13/2010	0.00
5/17/2010	0.05	6/26/2010	0.00	8/5/2010	0.00	9/14/2010	0.00
5/18/2010	0.10	6/27/2010	0.00	8/6/2010	0.00	9/15/2010	1.52
5/19/2010	0.56	6/28/2010	0.00	8/7/2010	0.00	9/16/2010	0.46
5/20/2010	0.66	6/29/2010	0.00	8/8/2010	0.00	9/17/2010	0.20
5/21/2010	0.30	6/30/2010	0.00	8/9/2010	0.00	9/18/2010	0.61
5/22/2010	0.15	7/1/2010	0.61	8/10/2010	0.00	9/19/2010	0.36
5/23/2010	0.30	7/2/2010	0.05	8/11/2010	0.00	9/20/2010	0.05
5/24/2010	0.46	7/3/2010	0.00	8/12/2010	0.00	9/21/2010	0.00
5/25/2010	0.36	7/4/2010	0.00	8/13/2010	0.00	9/22/2010	0.00
5/26/2010	0.20	7/5/2010	0.00	8/14/2010	0.00	9/23/2010	0.15
5/27/2010	0.00	7/6/2010	0.00	8/15/2010	0.00	9/24/2010	0.00
5/28/2010	0.20	7/7/2010	0.00	8/16/2010	0.00	9/25/2010	0.00
5/29/2010	0.05	7/8/2010	0.00	8/17/2010	0.00	9/26/2010	0.76
5/30/2010	0.30	7/9/2010	0.00	8/18/2010	0.00	9/27/2010	0.00
5/31/2010	0.05	7/10/2010	0.00	8/19/2010	0.00	9/28/2010	0.00
6/1/2010	1.22	7/11/2010	0.00	8/20/2010	0.00	9/29/2010	0.00
6/2/2010	0.66	7/12/2010	0.00	8/21/2010	0.00	9/30/2010	0.00
6/3/2010	1.11	7/13/2010	0.00	8/22/2010	0.00	10/1/2010	0.00
6/4/2010	0.05	7/14/2010	0.00	8/23/2010	0.00	10/2/2010	0.00

DATE	PRCP inches	DATE	PRCP inches	DATE	PRCP inches	DATE	PRCP inches
10/3/2010	0.00	11/12/2010	0.00	12/22/2010	0.15	1/31/2011	0.00
10/4/2010	0.00	11/13/2010	0.61	12/23/2010	0.00	2/1/2011	0.00
10/5/2010	0.00	11/14/2010	0.15	12/24/2010	0.46	2/2/2011	0.00
10/6/2010	0.00	11/15/2010	0.26	12/25/2010	0.71	2/3/2011	0.00
10/7/2010	0.00	11/16/2010	0.10	12/26/2010	0.56	2/4/2011	0.61
10/8/2010	0.00	11/17/2010	2.13	12/27/2010	2.03	2/5/2011	0.20
10/9/2010	2.03	11/18/2010	0.71	12/28/2010	1.52	2/6/2011	0.41
10/10/2010	0.15	11/19/2010	0.66	12/29/2010	0.30	2/7/2011	0.46
10/11/2010	0.00	11/20/2010	0.00	12/30/2010	0.00	2/8/2011	0.10
10/12/2010	0.00	11/21/2010	0.46	12/31/2010	0.00	2/9/2011	0.00
10/13/2010	0.00	11/22/2010	0.51	1/1/2011	0.00	2/10/2011	0.00
10/14/2010	0.00	11/23/2010	0.00	1/2/2011	0.00	2/11/2011	0.00
10/15/2010	0.00	11/24/2010	0.00	1/3/2011	0.00	2/12/2011	0.71
10/16/2010	0.00	11/25/2010	0.00	1/4/2011	0.00	2/13/2011	0.25
10/17/2010	0.00	11/26/2010	0.71	1/5/2011	0.20	2/14/2011	0.81
10/18/2010	0.00	11/27/2010	0.41	1/6/2011	0.00	2/15/2011	0.56
10/19/2010	0.00	11/28/2010	0.20	1/7/2011	0.46	2/16/2011	0.61
10/20/2010	0.00	11/29/2010	0.36	1/8/2011	0.56	2/17/2011	0.20
10/21/2010	0.20	11/30/2010	1.37	1/9/2011	0.36	2/18/2011	0.15
10/22/2010	0.00	12/1/2010	0.05	1/10/2011	0.00	2/19/2011	0.00
10/23/2010	1.17	12/2/2010	0.51	1/11/2011	0.20	2/20/2011	0.00
10/24/2010	0.51	12/3/2010	0.00	1/12/2011	1.57	2/21/2011	0.00
10/25/2010	0.36	12/4/2010	0.00	1/13/2011	0.41	2/22/2011	0.41
10/26/2010	0.36	12/5/2010	0.00	1/14/2011	0.15	2/23/2011	0.30
10/27/2010	0.26	12/6/2010	0.00	1/15/2011	2.23	2/24/2011	0.00
10/28/2010	0.05	12/7/2010	1.47	1/16/2011	3.45	2/25/2011	0.00
10/29/2010	0.00	12/8/2010	1.01	1/17/2011	0.20	2/26/2011	0.00
10/30/2010	0.66	12/9/2010	1.73	1/18/2011	1.17	2/27/2011	2.03
10/31/2010	0.00	12/10/2010	0.46	1/19/2011	0.00	2/28/2011	1.62
11/1/2010	2.44	12/11/2010	0.91	1/20/2011	0.00	3/1/2011	0.51
11/2/2010	0.00	12/12/2010	1.27	1/21/2011	0.71	3/2/2011	0.51
11/3/2010	0.00	12/13/2010	0.81	1/22/2011	0.00	3/3/2011	0.15
11/4/2010	0.00	12/14/2010	0.56	1/23/2011	0.00	3/4/2011	0.71
11/5/2010	0.00	12/15/2010	0.46	1/24/2011	0.15	3/5/2011	0.00
11/6/2010	1.01	12/16/2010	0.00	1/25/2011	0.00	3/6/2011	0.00
11/7/2010	0.26	12/17/2010	0.00	1/26/2011	0.00	3/7/2011	0.00
11/8/2010	0.56	12/18/2010	1.11	1/27/2011	0.00	3/8/2011	0.51
11/9/2010	0.66	12/19/2010	0.30	1/28/2011	0.20	3/9/2011	1.73
11/10/2010	0.00	12/20/2010	0.51	1/29/2011	0.05	3/10/2011	0.30
11/11/2010	0.30	12/21/2010	0.20	1/30/2011	0.00	3/11/2011	0.00

DATE	PRCP inches	DATE	PRCP inches	DATE	PRCP inches	DATE	PRCP inches
3/12/2011	0.41	4/21/2011	0.20	5/31/2011	0.05	7/10/2011	0.00
3/13/2011	0.76	4/22/2011	0.00	6/1/2011	0.02	7/11/2011	0.00
3/14/2011	0.30	4/23/2011	0.00	6/2/2011	0.18	7/12/2011	0.41
3/15/2011	0.61	4/24/2011	1.52	6/3/2011	0.00	7/13/2011	0.20
3/16/2011	0.41	4/25/2011	0.71	6/4/2011	0.00	7/14/2011	1.07
3/17/2011	0.25	4/26/2011	0.56	6/5/2011	0.00	7/15/2011	0.00
3/18/2011	0.20	4/27/2011	0.41	6/6/2011	0.00	7/16/2011	0.51
3/19/2011	0.10	4/28/2011	0.91	6/7/2011	0.10	7/17/2011	0.05
3/20/2011	0.30	4/29/2011	0.25	6/8/2011	0.03	7/18/2011	0.00
3/21/2011	0.41	4/30/2011	0.00	6/9/2011	0.00	7/19/2011	0.00
3/22/2011	0.15	5/1/2011	0.00	6/10/2011	0.00	7/20/2011	0.00
3/23/2011	0.25	5/2/2011	0.20	6/11/2011	0.00	7/21/2011	0.25
3/24/2011	0.20	5/3/2011	0.10	6/12/2011	0.25	7/22/2011	0.00
3/25/2011	0.00	5/4/2011	0.00	6/13/2011	0.20	7/23/2011	0.00
3/26/2011	0.81	5/5/2011	0.10	6/14/2011	0.10	7/24/2011	0.00
3/27/2011	0.86	5/6/2011	0.66	6/15/2011	0.05	7/25/2011	0.00
3/28/2011	0.25	5/7/2011	0.61	6/16/2011	0.00	7/26/2011	0.00
3/29/2011	1.22	5/8/2011	0.05	6/17/2011	0.00	7/27/2011	0.00
3/30/2011	0.25	5/9/2011	0.05	6/18/2011	0.41	7/28/2011	0.00
3/31/2011	0.25	5/10/2011	0.00	6/19/2011	0.05	7/29/2011	0.00
4/1/2011	0.61	5/11/2011	0.56	6/20/2011	0.01	7/30/2011	0.00
4/2/2011	0.20	5/12/2011	0.05	6/21/2011	0.00	7/31/2011	0.00
4/3/2011	0.10	5/13/2011	0.00	6/22/2011	0.00	8/1/2011	0.00
4/4/2011	1.42	5/14/2011	0.00	6/23/2011	0.10	8/2/2011	0.00
4/5/2011	0.30	5/15/2011	0.46	6/24/2011	0.00	8/3/2011	0.00
4/6/2011	0.56	5/16/2011	0.00	6/25/2011	0.00	8/4/2011	0.00
4/7/2011	0.05	5/17/2011	0.30	6/26/2011	0.00	8/5/2011	0.00
4/8/2011	0.00	5/18/2011	0.00	6/27/2011	0.15	8/6/2011	0.00
4/9/2011	0.00	5/19/2011	0.00	6/28/2011	0.05	8/7/2011	0.00
4/10/2011	0.91	5/20/2011	0.00	6/29/2011	0.56	8/8/2011	0.00
4/11/2011	0.10	5/21/2011	0.00	6/30/2011	0.10	8/9/2011	0.00
4/12/2011	0.00	5/22/2011	0.05	7/1/2011	0.00	8/10/2011	0.00
4/13/2011	0.86	5/23/2011	0.00	7/2/2011	0.00	8/11/2011	0.00
4/14/2011	1.11	5/24/2011	0.00	7/3/2011	0.05	8/12/2011	0.00
4/15/2011	1.01	5/25/2011	0.76	7/4/2011	0.00	8/13/2011	0.00
4/16/2011	0.00	5/26/2011	0.51	7/5/2011	0.00	8/14/2011	0.00
4/17/2011	0.00	5/27/2011	0.76	7/6/2011	0.00	8/15/2011	0.00
4/18/2011	0.00	5/28/2011	0.05	7/7/2011	0.00	8/16/2011	0.00
4/19/2011	0.00	5/29/2011	0.10	7/8/2011	0.00	8/17/2011	0.00
4/20/2011	0.00	5/30/2011	0.20	7/9/2011	0.00	8/18/2011	0.00

DATE	PRCP inches	DATE	PRCP inches	DATE	PRCP inches	DATE	PRCP inches
8/19/2011	0.00	9/28/2011	0.00	11/7/2011	0.15	12/17/2011	0.00
8/20/2011	0.00	9/29/2011	0.00	11/8/2011	0.05	12/18/2011	0.10
8/21/2011	0.00	9/30/2011	0.00	11/9/2011	0.00	12/19/2011	0.00
8/22/2011	0.25	10/1/2011	0.10	11/10/2011	0.00	12/20/2011	0.05
8/23/2011	0.02	10/2/2011	0.25	11/11/2011	0.46	12/21/2011	0.00
8/24/2011	0.00	10/3/2011	0.10	11/12/2011	0.51	12/22/2011	0.00
8/25/2011	0.00	10/4/2011	0.71	11/13/2011	0.05	12/23/2011	0.10
8/26/2011	0.00	10/5/2011	0.46	11/14/2011	0.15	12/24/2011	0.00
8/27/2011	0.00	10/6/2011	0.02	11/15/2011	0.00	12/25/2011	0.36
8/28/2011	0.00	10/7/2011	0.25	11/16/2011	1.22	12/26/2011	0.15
8/29/2011	0.00	10/8/2011	0.30	11/17/2011	0.56	12/27/2011	1.47
8/30/2011	0.00	10/9/2011	0.20	11/18/2011	0.61	12/28/2011	1.27
8/31/2011	0.02	10/10/2011	0.66	11/19/2011	0.05	12/29/2011	1.57
9/1/2011	0.00	10/11/2011	0.10	11/20/2011	0.00	12/30/2011	0.15
9/2/2011	0.00	10/12/2011	0.00	11/21/2011	1.42	12/31/2011	0.00
9/3/2011	0.00	10/13/2011	0.13	11/22/2011	3.29	1/1/2012	0.00
9/4/2011	0.00	10/14/2011	0.05	11/23/2011	0.71	1/2/2012	0.25
9/5/2011	0.00	10/15/2011	0.00	11/24/2011	0.46	1/3/2012	0.00
9/6/2011	0.00	10/16/2011	0.00	11/25/2011	0.05	1/4/2012	0.61
9/7/2011	0.00	10/17/2011	0.00	11/26/2011	0.00	1/5/2012	0.00
9/8/2011	0.00	10/18/2011	0.00	11/27/2011	1.17	1/6/2012	0.20
9/9/2011	0.00	10/19/2011	0.00	11/28/2011	0.00	1/7/2012	0.00
9/10/2011	0.00	10/20/2011	0.00	11/29/2011	0.46	1/8/2012	0.00
9/11/2011	0.00	10/21/2011	0.05	11/30/2011	0.00	1/9/2012	0.15
9/12/2011	0.00	10/22/2011	0.25	12/1/2011	0.00	1/10/2012	0.00
9/13/2011	0.00	10/23/2011	0.00	12/2/2011	0.05	1/11/2012	0.00
9/14/2011	0.00	10/24/2011	0.00	12/3/2011	0.00	1/12/2012	0.00
9/15/2011	0.03	10/25/2011	0.00	12/4/2011	0.00	1/13/2012	0.00
9/16/2011	0.01	10/26/2011	0.00	12/5/2011	0.00	1/14/2012	0.61
9/17/2011	0.43	10/27/2011	0.00	12/6/2011	0.00	1/15/2012	1.01
9/18/2011	0.61	10/28/2011	0.56	12/7/2011	0.00	1/16/2012	1.01
9/19/2011	0.00	10/29/2011	0.00	12/8/2011	0.00	1/17/2012	1.77
9/20/2011	0.00	10/30/2011	1.37	12/9/2011	0.00	1/18/2012	2.79
9/21/2011	0.00	10/31/2011	0.20	12/10/2011	0.00	1/19/2012	1.22
9/22/2011	0.00	11/1/2011	0.00	12/11/2011	0.05	1/20/2012	1.01
9/23/2011	0.00	11/2/2011	0.91	12/12/2011	0.00	1/21/2012	0.20
9/24/2011	0.00	11/3/2011	0.15	12/13/2011	0.00	1/22/2012	0.56
9/25/2011	0.46	11/4/2011	0.56	12/14/2011	0.25	1/23/2012	0.00
9/26/2011	0.46	11/5/2011	0.10	12/15/2011	0.05	1/24/2012	1.27
9/27/2011	0.02	11/6/2011	0.00	12/16/2011	0.00	1/25/2012	0.36

DATE	PRCP inches	DATE	PRCP inches	DATE	PRCP inches	DATE	PRCP inches
1/26/2012	0.05	3/6/2012	0.10	4/15/2012	0.91	5/25/2012	0.00
1/27/2012	0.00	3/7/2012	0.00	4/16/2012	0.15	5/26/2012	0.00
1/28/2012	0.00	3/8/2012	0.00	4/17/2012	0.15	5/27/2012	0.00
1/29/2012	1.57	3/9/2012	0.00	4/18/2012	0.05	5/28/2012	0.00
1/30/2012	0.05	3/10/2012	0.81	4/19/2012	1.01	5/29/2012	0.00
1/31/2012	0.00	3/11/2012	0.61	4/20/2012	0.10	5/30/2012	0.00
2/1/2012	0.20	3/12/2012	1.27	4/21/2012	0.00	5/31/2012	0.05
2/2/2012	0.00	3/13/2012	0.71	4/22/2012	0.00	6/1/2012	0.15
2/3/2012	0.00	3/14/2012	1.57	4/23/2012	0.00	6/2/2012	0.05
2/4/2012	0.00	3/15/2012	0.56	4/24/2012	0.00	6/3/2012	0.00
2/5/2012	0.00	3/16/2012	0.86	4/25/2012	1.01	6/4/2012	0.61
2/6/2012	0.00	3/17/2012	0.56	4/26/2012	0.51	6/5/2012	0.05
2/7/2012	0.00	3/18/2012	0.15	4/27/2012	0.05	6/6/2012	0.00
2/8/2012	0.81	3/19/2012	0.20	4/28/2012	0.00	6/7/2012	1.01
2/9/2012	0.00	3/20/2012	0.56	4/29/2012	0.00	6/8/2012	0.61
2/10/2012	0.25	3/21/2012	0.46	4/30/2012	0.76	6/9/2012	0.00
2/11/2012	0.00	3/22/2012	0.05	5/1/2012	0.56	6/10/2012	0.00
2/12/2012	0.41	3/23/2012	0.00	5/2/2012	1.22	6/11/2012	0.00
2/13/2012	0.00	3/24/2012	0.00	5/3/2012	0.56	6/12/2012	0.30
2/14/2012	0.61	3/25/2012	0.46	5/4/2012	0.25	6/13/2012	0.05
2/15/2012	0.00	3/26/2012	0.00	5/5/2012	0.01	6/14/2012	0.00
2/16/2012	0.15	3/27/2012	0.61	5/6/2012	0.00	6/15/2012	0.00
2/17/2012	0.30	3/28/2012	1.11	5/7/2012	0.00	6/16/2012	0.00
2/18/2012	0.20	3/29/2012	1.62	5/8/2012	0.00	6/17/2012	0.30
2/19/2012	0.25	3/30/2012	1.32	5/9/2012	0.00	6/18/2012	0.26
2/20/2012	0.91	3/31/2012	0.51	5/10/2012	0.00	6/19/2012	0.20
2/21/2012	1.42	4/1/2012	0.46	5/11/2012	0.00	6/20/2012	0.00
2/22/2012	0.20	4/2/2012	0.00	5/12/2012	0.00	6/21/2012	0.00
2/23/2012	0.00	4/3/2012	0.51	5/13/2012	0.00	6/22/2012	0.51
2/24/2012	0.56	4/4/2012	0.81	5/14/2012	0.00	6/23/2012	0.05
2/25/2012	0.15	4/5/2012	0.05	5/15/2012	0.00	6/24/2012	0.05
2/26/2012	0.20	4/6/2012	0.10	5/16/2012	0.00	6/25/2012	0.26
2/27/2012	0.00	4/7/2012	0.00	5/17/2012	0.00	6/26/2012	0.02
2/28/2012	1.01	4/8/2012	0.00	5/18/2012	0.00	6/27/2012	0.00
2/29/2012	0.76	4/9/2012	0.00	5/19/2012	0.00	6/28/2012	0.05
3/1/2012	0.36	4/10/2012	0.02	5/20/2012	0.30	6/29/2012	0.10
3/2/2012	0.20	4/11/2012	0.10	5/21/2012	0.38	6/30/2012	0.15
3/3/2012	0.10	4/12/2012	0.23	5/22/2012	0.56	7/1/2012	0.00
3/4/2012	0.00	4/13/2012	0.05	5/23/2012	0.78	7/2/2012	0.00
3/5/2012	0.76	4/14/2012	0.00	5/24/2012	0.23	7/3/2012	0.30

DATE	PRCP	DATE	PRCP	DATE	PRCP	DATE	PRCP
	inches		inches		inches		inches
7/4/2012	0.00	8/13/2012	0.00	9/22/2012	0.03	11/1/2012	0.41
7/5/2012	0.00	8/14/2012	0.00	9/23/2012	0.00	11/2/2012	0.81
7/6/2012	0.00	8/15/2012	0.00	9/24/2012	0.00	11/3/2012	0.10
7/7/2012	0.00	8/16/2012	0.00	9/25/2012	0.00	11/4/2012	0.15
7/8/2012	0.00	8/17/2012	0.00	9/26/2012	0.00	11/5/2012	0.00
7/9/2012	0.00	8/18/2012	0.00	9/27/2012	0.00	11/6/2012	0.26
7/10/2012	0.00	8/19/2012	0.00	9/28/2012	0.00	11/7/2012	0.20
7/11/2012	0.00	8/20/2012	0.00	9/29/2012	0.00	11/8/2012	0.05
7/12/2012	0.00	8/21/2012	0.00	9/30/2012	0.00	11/9/2012	0.36
7/13/2012	0.00	8/22/2012	0.00	10/1/2012	0.00	11/10/2012	0.00
7/14/2012	0.02	8/23/2012	0.00	10/2/2012	0.00	11/11/2012	1.07
7/15/2012	0.13	8/24/2012	0.00	10/3/2012	0.00	11/12/2012	0.15
7/16/2012	0.02	8/25/2012	0.00	10/4/2012	0.00	11/13/2012	0.05
7/17/2012	0.10	8/26/2012	0.10	10/5/2012	0.00	11/14/2012	0.00
7/18/2012	0.03	8/27/2012	0.00	10/6/2012	0.00	11/15/2012	0.00
7/19/2012	0.00	8/28/2012	0.00	10/7/2012	0.00	11/16/2012	0.26
7/20/2012	0.10	8/29/2012	0.05	10/8/2012	0.00	11/17/2012	1.11
7/21/2012	0.00	8/30/2012	0.00	10/9/2012	0.00	11/18/2012	2.03
7/22/2012	0.00	8/31/2012	0.00	10/10/2012	0.00	11/19/2012	1.37
7/23/2012	0.00	9/1/2012	0.00	10/11/2012	0.00	11/20/2012	0.71
7/24/2012	0.00	9/2/2012	0.00	10/12/2012	2.03	11/21/2012	0.30
7/25/2012	0.00	9/3/2012	0.00	10/13/2012	0.05	11/22/2012	0.00
7/26/2012	0.00	9/4/2012	0.00	10/14/2012	1.47	11/23/2012	2.08
7/27/2012	0.00	9/5/2012	0.00	10/15/2012	1.17	11/24/2012	0.00
7/28/2012	0.00	9/6/2012	0.00	10/16/2012	0.00	11/25/2012	0.00
7/29/2012	0.00	9/7/2012	0.00	10/17/2012	0.00	11/26/2012	0.00
7/30/2012	0.00	9/8/2012	0.00	10/18/2012	0.00	11/27/2012	0.00
7/31/2012	0.00	9/9/2012	0.00	10/19/2012	1.17	11/28/2012	0.36
8/1/2012	0.00	9/10/2012	0.26	10/20/2012	0.36	11/29/2012	0.61
8/2/2012	0.00	9/11/2012	0.00	10/21/2012	0.20	11/30/2012	1.57
8/3/2012	0.00	9/12/2012	0.00	10/22/2012	0.51	12/1/2012	0.71
8/4/2012	0.00	9/13/2012	0.00	10/23/2012	0.96	12/2/2012	0.81
8/5/2012	0.00	9/14/2012	0.00	10/24/2012	0.41	12/3/2012	1.32
8/6/2012	0.00	9/15/2012	0.00	10/25/2012	0.00	12/4/2012	1.37
8/7/2012	0.00	9/16/2012	0.00	10/26/2012	0.00	12/5/2012	0.00
8/8/2012	0.00	9/17/2012	0.00	10/27/2012	1.32	12/6/2012	0.36
8/9/2012	0.00	9/18/2012	0.00	10/28/2012	1.07	12/7/2012	0.20
8/10/2012	0.00	9/19/2012	0.00	10/29/2012	0.61	12/8/2012	0.26
8/11/2012	0.00	9/20/2012	0.00	10/30/2012	1.62	12/9/2012	0.26
8/12/2012	0.00	9/21/2012	0.00	10/31/2012	1.52	12/10/2012	0.00

DATE	PRCP inches	DATE	PRCP inches	DATE	PRCP inches	DATE	PRCP inches
12/11/2012	1.32	1/20/2013	0.00	3/1/2013	0.02	4/10/2013	0.30
12/12/2012	0.05	1/21/2013	0.00	3/2/2013	0.15	4/11/2013	0.00
12/13/2012	0.00	1/22/2013	0.00	3/3/2013	0.01	4/12/2013	0.30
12/14/2012	0.61	1/23/2013	0.56	3/4/2013	0.00	4/13/2013	0.26
12/15/2012	0.96	1/24/2013	0.15	3/5/2013	0.71	4/14/2013	0.46
12/16/2012	1.37	1/25/2013	0.20	3/6/2013	0.28	4/15/2013	0.18
12/17/2012	0.46	1/26/2013	0.71	3/7/2013	0.00	4/16/2013	0.00
12/18/2012	0.20	1/27/2013	1.42	3/8/2013	0.00	4/17/2013	0.00
12/19/2012	3.30	1/28/2013	1.37	3/9/2013	0.00	4/18/2013	0.00
12/20/2012	0.61	1/29/2013	0.30	3/10/2013	0.10	4/19/2013	1.07
12/21/2012	0.46	1/30/2013	0.86	3/11/2013	0.10	4/20/2013	0.05
12/22/2012	1.01	1/31/2013	0.00	3/12/2013	0.01	4/21/2013	0.03
12/23/2012	0.41	2/1/2013	0.00	3/13/2013	0.00	4/22/2013	0.00
12/24/2012	0.00	2/2/2013	0.00	3/14/2013	0.19	4/23/2013	0.00
12/25/2012	0.86	2/3/2013	0.03	3/15/2013	0.13	4/24/2013	0.00
12/26/2012	0.61	2/4/2013	0.00	3/16/2013	0.66	4/25/2013	0.00
12/27/2012	0.10	2/5/2013	0.32	3/17/2013	0.23	4/26/2013	0.00
12/28/2012	0.05	2/6/2013	0.51	3/18/2013	0.02	4/27/2013	0.00
12/29/2012	0.05	2/7/2013	0.02	3/19/2013	0.74	4/28/2013	0.48
12/30/2012	0.00	2/8/2013	0.00	3/20/2013	0.26	4/29/2013	0.13
12/31/2012	0.00	2/9/2013	0.10	3/21/2013	0.46	4/30/2013	0.02
1/1/2013	0.00	2/10/2013	0.00	3/22/2013	0.10	5/1/2013	0.00
1/2/2013	0.00	2/11/2013	0.30	3/23/2013	0.00	5/2/2013	0.00
1/3/2013	0.56	2/12/2013	0.36	3/24/2013	0.00	5/3/2013	0.00
1/4/2013	0.00	2/13/2013	0.02	3/25/2013	0.07	5/4/2013	0.00
1/5/2013	0.36	2/14/2013	0.00	3/26/2013	0.10	5/5/2013	0.00
1/6/2013	0.00	2/15/2013	0.00	3/27/2013	0.02	5/6/2013	0.00
1/7/2013	1.52	2/16/2013	0.34	3/28/2013	0.00	5/7/2013	0.00
1/8/2013	0.66	2/17/2013	0.03	3/29/2013	0.00	5/8/2013	0.00
1/9/2013	1.17	2/18/2013	0.48	3/30/2013	0.00	5/9/2013	0.00
1/10/2013	0.26	2/19/2013	0.00	3/31/2013	0.00	5/10/2013	0.00
1/11/2013	0.00	2/20/2013	0.66	4/1/2013	0.03	5/11/2013	0.00
1/12/2013	0.00	2/21/2013	0.61	4/2/2013	0.00	5/12/2013	0.17
1/13/2013	0.00	2/22/2013	1.22	4/3/2013	0.00	5/13/2013	0.08
1/14/2013	0.15	2/23/2013	0.10	4/4/2013	0.56	5/14/2013	0.00
1/15/2013	0.00	2/24/2013	0.00	4/5/2013	0.48	5/15/2013	0.15
1/16/2013	0.00	2/25/2013	0.48	4/6/2013	0.64	5/16/2013	0.03
1/17/2013	0.00	2/26/2013	0.00	4/7/2013	0.71	5/17/2013	0.15
1/18/2013	0.00	2/27/2013	0.23	4/8/2013	0.10	5/18/2013	0.18
1/19/2013	0.00	2/28/2013	1.27	4/9/2013	0.00	5/19/2013	0.00

DATE	PRCP inches	DATE	PRCP inches	DATE	PRCP inches	DATE	PRCP inches
5/20/2013	0.00	6/29/2013	0.00	8/8/2013	0.00	9/17/2013	0.00
5/21/2013	0.91	6/30/2013	0.00	8/9/2013	0.00	9/18/2013	0.02
5/22/2013	2.03	7/1/2013	0.00	8/10/2013	0.00	9/19/2013	0.00
5/23/2013	1.42	7/2/2013	0.00	8/11/2013	0.00	9/20/2013	0.00
5/24/2013	0.26	7/3/2013	0.00	8/12/2013	0.00	9/21/2013	0.20
5/25/2013	0.20	7/4/2013	0.00	8/13/2013	0.00	9/22/2013	1.22
5/26/2013	0.41	7/5/2013	0.00	8/14/2013	0.36	9/23/2013	0.22
5/27/2013	0.66	7/6/2013	0.00	8/15/2013	0.05	9/24/2013	0.81
5/28/2013	0.73	7/7/2013	0.00	8/16/2013	0.00	9/25/2013	0.02
5/29/2013	0.28	7/8/2013	0.00	8/17/2013	0.00	9/26/2013	0.00
5/30/2013	0.07	7/9/2013	0.00	8/18/2013	0.00	9/27/2013	2.03
5/31/2013	0.00	7/10/2013	0.00	8/19/2013	0.00	9/28/2013	2.03
6/1/2013	0.03	7/11/2013	0.00	8/20/2013	0.00	9/29/2013	2.54
6/2/2013	0.00	7/12/2013	0.00	8/21/2013	0.00	9/30/2013	0.51
6/3/2013	0.00	7/13/2013	0.00	8/22/2013	0.00	10/1/2013	0.48
6/4/2013	0.00	7/14/2013	0.00	8/23/2013	0.07	10/2/2013	0.71
6/5/2013	0.00	7/15/2013	0.00	8/24/2013	0.00	10/3/2013	0.00
6/6/2013	0.00	7/16/2013	0.00	8/25/2013	0.02	10/4/2013	0.00
6/7/2013	0.00	7/17/2013	0.00	8/26/2013	1.01	10/5/2013	0.00
6/8/2013	0.00	7/18/2013	0.00	8/27/2013	0.05	10/6/2013	0.00
6/9/2013	0.00	7/19/2013	0.00	8/28/2013	0.07	10/7/2013	0.81
6/10/2013	0.00	7/20/2013	0.00	8/29/2013	0.34	10/8/2013	0.41
6/11/2013	0.10	7/21/2013	0.00	8/30/2013	0.00	10/9/2013	0.00
6/12/2013	0.86	7/22/2013	0.00	8/31/2013	0.00	10/10/2013	0.01
6/13/2013	0.10	7/23/2013	0.00	9/1/2013	0.00	10/11/2013	0.00
6/14/2013	0.00	7/24/2013	0.00	9/2/2013	0.03	10/12/2013	0.26
6/15/2013	0.00	7/25/2013	0.00	9/3/2013	0.00	10/13/2013	0.00
6/16/2013	0.00	7/26/2013	0.00	9/4/2013	0.00	10/14/2013	0.00
6/17/2013	0.15	7/27/2013	0.00	9/5/2013	0.41	10/15/2013	0.00
6/18/2013	0.07	7/28/2013	0.00	9/6/2013	0.12	10/16/2013	0.00
6/19/2013	0.36	7/29/2013	0.00	9/7/2013	0.00	10/17/2013	0.00
6/20/2013	0.10	7/30/2013	0.00	9/8/2013	0.00	10/18/2013	0.00
6/21/2013	0.00	7/31/2013	0.00	9/9/2013	0.00	10/19/2013	0.00
6/22/2013	0.00	8/1/2013	0.12	9/10/2013	0.00	10/20/2013	0.00
6/23/2013	0.48	8/2/2013	0.03	9/11/2013	0.00	10/21/2013	0.00
6/24/2013	0.26	8/3/2013	0.00	9/12/2013	0.00	10/22/2013	0.00
6/25/2013	0.28	8/4/2013	0.00	9/13/2013	0.00	10/23/2013	0.00
6/26/2013	0.07	8/5/2013	0.00	9/14/2013	0.00	10/24/2013	0.00
6/27/2013	0.02	8/6/2013	0.00	9/15/2013	0.15	10/25/2013	0.00
6/28/2013	0.00	8/7/2013	0.00	9/16/2013	0.23	10/26/2013	0.00

DATE	PRCP inches	DATE	PRCP inches	DATE	PRCP inches	DATE	PRCP inches
10/27/2013	0.15	12/6/2013	1.01	1/15/2014	0.00	2/24/2014	0.12
10/28/2013	0.00	12/7/2013	0.00	1/16/2014	0.00	2/25/2014	0.00
10/29/2013	0.00	12/8/2013	0.00	1/17/2014	0.00	2/26/2014	0.00
10/30/2013	0.00	12/9/2013	0.00	1/18/2014	0.00	2/27/2014	0.20
10/31/2013	0.10	12/10/2013	0.02	1/19/2014	0.00	2/28/2014	0.00
11/1/2013	0.00	12/11/2013	0.00	1/20/2014	0.00	3/1/2014	0.20
11/2/2013	0.10	12/12/2013	0.46	1/21/2014	0.00	3/2/2014	0.81
11/3/2013	0.44	12/13/2013	0.03	1/22/2014	0.00	3/3/2014	0.10
11/4/2013	0.56	12/14/2013	0.00	1/23/2014	0.00	3/4/2014	0.00
11/5/2013	0.30	12/15/2013	0.17	1/24/2014	0.00	3/5/2014	2.69
11/6/2013	0.46	12/16/2013	0.00	1/25/2014	0.00	3/6/2014	0.61
11/7/2013	0.76	12/17/2013	0.00	1/26/2014	0.00	3/7/2014	0.00
11/8/2013	0.08	12/18/2013	0.05	1/27/2014	0.18	3/8/2014	1.93
11/9/2013	0.00	12/19/2013	0.00	1/28/2014	1.52	3/9/2014	0.10
11/10/2013	0.00	12/20/2013	1.42	1/29/2014	0.30	3/10/2014	0.05
11/11/2013	0.00	12/21/2013	0.15	1/30/2014	0.51	3/11/2014	0.00
11/12/2013	0.28	12/22/2013	0.10	1/31/2014	0.15	3/12/2014	0.00
11/13/2013	0.00	12/23/2013	0.41	2/1/2014	0.00	3/13/2014	0.00
11/14/2013	0.10	12/24/2013	0.00	2/2/2014	0.00	3/14/2014	0.30
11/15/2013	0.81	12/25/2013	0.00	2/3/2014	0.20	3/15/2014	0.00
11/16/2013	0.41	12/26/2013	0.00	2/4/2014	0.00	3/16/2014	1.73
11/17/2013	0.10	12/27/2013	0.00	2/5/2014	0.00	3/17/2014	0.03
11/18/2013	0.88	12/28/2013	0.00	2/6/2014	2.03	3/18/2014	0.00
11/19/2013	0.08	12/29/2013	0.00	2/7/2014	2.03	3/19/2014	0.15
11/20/2013	0.00	12/30/2013	0.00	2/8/2014	0.76	3/20/2014	0.05
11/21/2013	0.00	12/31/2013	0.02	2/9/2014	0.00	3/21/2014	0.00
11/22/2013	0.00	1/1/2014	0.00	2/10/2014	0.66	3/22/2014	0.00
11/23/2013	0.00	1/2/2014	0.36	2/11/2014	1.22	3/23/2014	0.00
11/24/2013	0.00	1/3/2014	0.00	2/12/2014	0.22	3/24/2014	0.00
11/25/2013	0.00	1/4/2014	0.00	2/13/2014	1.30	3/25/2014	0.58
11/26/2013	0.00	1/5/2014	0.00	2/14/2014	0.05	3/26/2014	1.07
11/27/2013	0.00	1/6/2014	0.15	2/15/2014	1.47	3/27/2014	0.71
11/28/2013	0.00	1/7/2014	0.96	2/16/2014	0.91	3/28/2014	0.61
11/29/2013	0.07	1/8/2014	0.56	2/17/2014	0.26	3/29/2014	0.61
11/30/2013	0.00	1/9/2014	0.51	2/18/2014	0.81	3/30/2014	0.10
12/1/2013	2.03	1/10/2014	0.56	2/19/2014	0.66	3/31/2014	0.30
12/2/2013	0.18	1/11/2014	0.46	2/20/2014	0.28	4/1/2014	0.02
12/3/2013	0.00	1/12/2014	0.51	2/21/2014	0.02	4/2/2014	0.00
12/4/2013	0.00	1/13/2014	0.02	2/22/2014	0.00	4/3/2014	0.59
12/5/2013	0.00	1/14/2014	0.00	2/23/2014	0.18	4/4/2014	0.23

DATE	PRCP	DATE	PRCP	DATE	PRCP	DATE	PRCP
	inches		inches		inches		inches
4/5/2014	0.48	5/15/2014	0.00	6/24/2014	0.23	8/3/2014	0.00
4/6/2014	0.12	5/16/2014	0.00	6/25/2014	0.00	8/4/2014	0.00
4/7/2014	0.00	5/17/2014	0.00	6/26/2014	0.63	8/5/2014	0.00
4/8/2014	0.30	5/18/2014	0.46	6/27/2014	0.26	8/6/2014	0.00
4/9/2014	0.00	5/19/2014	0.05	6/28/2014	0.03	8/7/2014	0.00
4/10/2014	0.00	5/20/2014	0.00	6/29/2014	0.01	8/8/2014	0.00
4/11/2014	0.00	5/21/2014	0.00	6/30/2014	0.00	8/9/2014	0.00
4/12/2014	0.00	5/22/2014	0.00	7/1/2014	0.00	8/10/2014	0.00
4/13/2014	0.00	5/23/2014	0.05	7/2/2014	0.00	8/11/2014	0.00
4/14/2014	0.00	5/24/2014	0.00	7/3/2014	0.00	8/12/2014	0.00
4/15/2014	0.00	5/25/2014	0.17	7/4/2014	0.00	8/13/2014	0.00
4/16/2014	0.38	5/26/2014	0.00	7/5/2014	0.00	8/14/2014	0.08
4/17/2014	0.51	5/27/2014	0.00	7/6/2014	0.00	8/15/2014	0.00
4/18/2014	0.00	5/28/2014	0.28	7/7/2014	0.00	8/16/2014	0.00
4/19/2014	0.23	5/29/2014	0.00	7/8/2014	0.00	8/17/2014	0.00
4/20/2014	0.00	5/30/2014	0.00	7/9/2014	0.00	8/18/2014	0.00
4/21/2014	0.30	5/31/2014	0.00	7/10/2014	0.00	8/19/2014	0.00
4/22/2014	0.71	6/1/2014	0.00	7/11/2014	0.00	8/20/2014	0.00
4/23/2014	1.11	6/2/2014	0.00	7/12/2014	0.00	8/21/2014	0.00
4/24/2014	0.34	6/3/2014	0.00	7/13/2014	0.10	8/22/2014	0.00
4/25/2014	0.05	6/4/2014	0.00	7/14/2014	0.00	8/23/2014	0.00
4/26/2014	0.91	6/5/2014	0.00	7/15/2014	0.00	8/24/2014	0.00
4/27/2014	0.30	6/6/2014	0.00	7/16/2014	0.00	8/25/2014	0.00
4/28/2014	0.00	6/7/2014	0.00	7/17/2014	0.00	8/26/2014	0.00
4/29/2014	0.00	6/8/2014	0.00	7/18/2014	0.00	8/27/2014	0.00
4/30/2014	0.00	6/9/2014	0.00	7/19/2014	0.00	8/28/2014	0.00
5/1/2014	0.00	6/10/2014	0.00	7/20/2014	0.00	8/29/2014	0.00
5/2/2014	0.00	6/11/2014	0.00	7/21/2014	0.00	8/30/2014	0.18
5/3/2014	0.61	6/12/2014	0.56	7/22/2014	0.00	8/31/2014	0.00
5/4/2014	0.30	6/13/2014	0.15	7/23/2014	1.29		
5/5/2014	0.03	6/14/2014	0.00	7/24/2014	0.00		
5/6/2014	0.00	6/15/2014	0.20	7/25/2014	0.00		
5/7/2014	0.00	6/16/2014	0.18	7/26/2014	0.00		
5/8/2014	1.42	6/17/2014	0.00	7/27/2014	0.00		
5/9/2014	0.78	6/18/2014	0.00	7/28/2014	0.00		
5/10/2014	0.03	6/19/2014	0.00	7/29/2014	0.00		
5/11/2014	0.00	6/20/2014	0.00	7/30/2014	0.00		
5/12/2014	0.00	6/21/2014	0.00	7/31/2014	0.00		
5/13/2014	0.00	6/22/2014	0.00	8/1/2014	0.00		
5/14/2014	0.00	6/23/2014	0.00	8/2/2014	0.00		

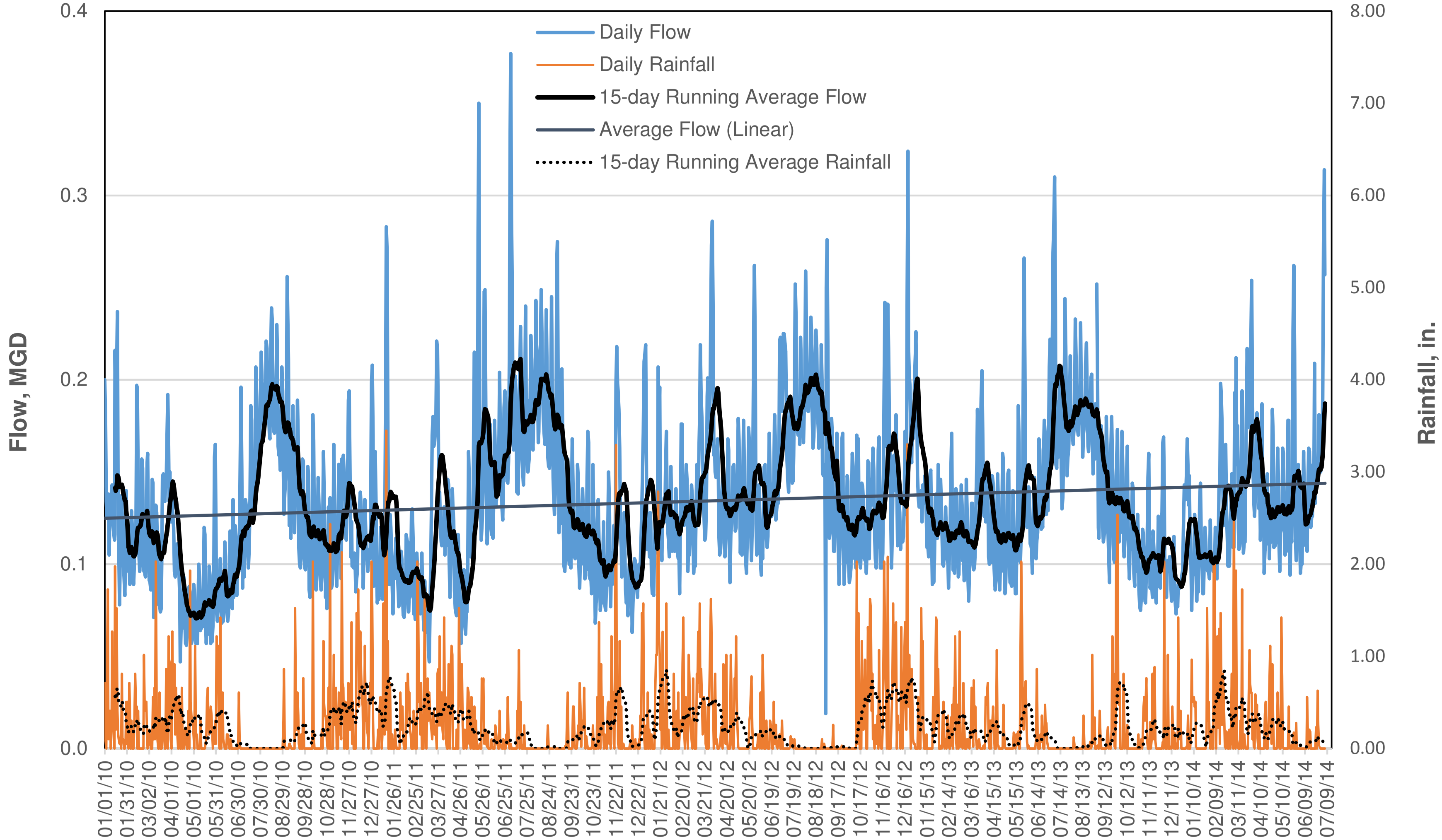
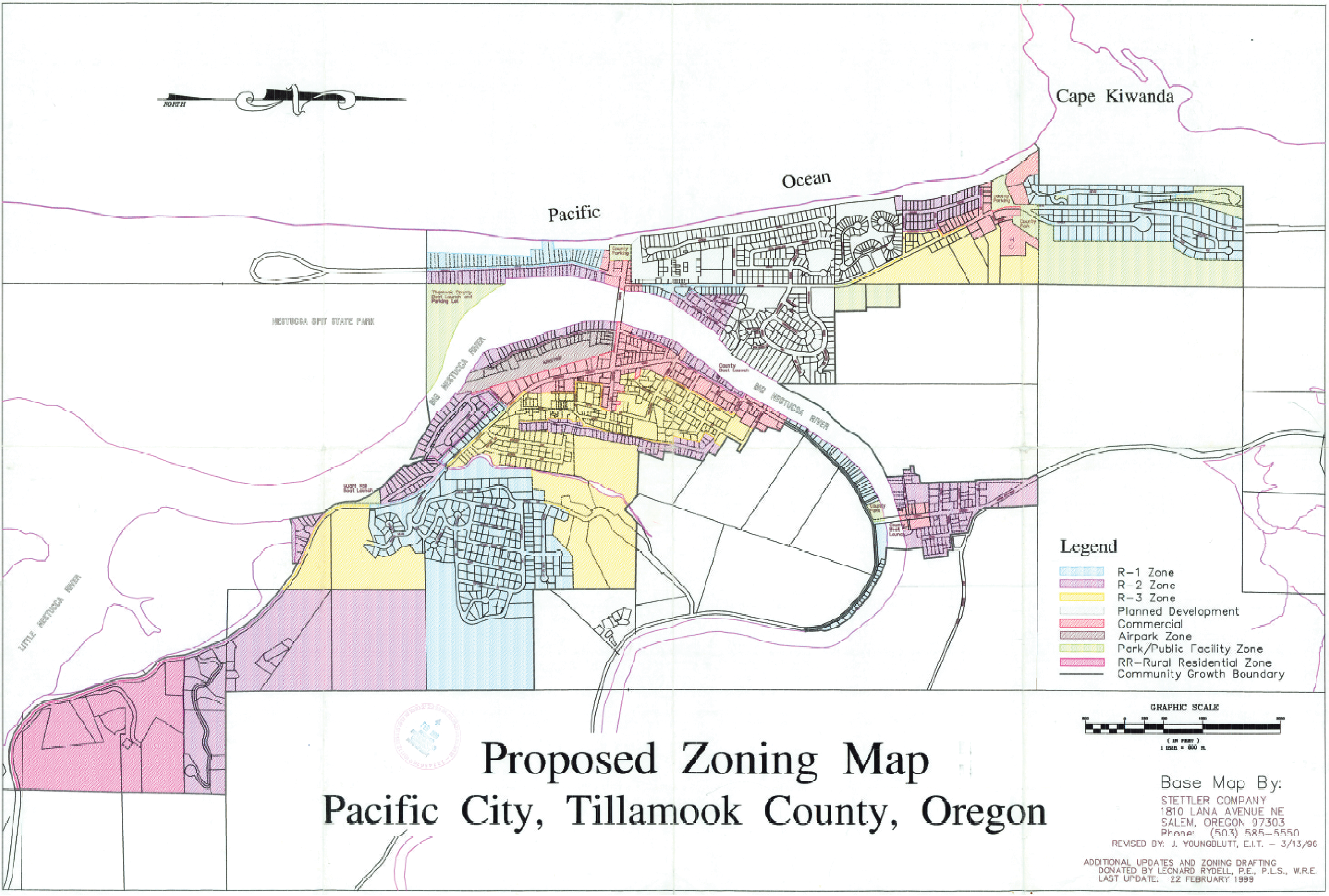


Figure C3. PCJWSA Wastewater Flow and Rainfall Data 2010-2014

C4. Zoning Map


Proposed Zoning Map
Pacific City, Tillamook County, Oregon
NORTH
Cape Kiwanda
Pacific
Ocean
NESTUCCA SPIT STATE PARK
BIG NESTUCCA RIVER
LITTLE NESTUCCA RIVER
Legend
R-1 Zone
R-2 Zone
R-3 Zone
Planned Development
Commercial
Airpark Zone
Park/Public Facility Zone
RR-Rural Residential Zone
Community Growth Boundary
GRAPHIC SCALE
Base Map By:
STETTLER COMPANY
1810 LANA AVENUE NE
SALEM, OREGON 97303
Phone: (503) 585-5550
REVISED BY: J. YOUNGBLUTT, E.I.T. - 3/13/96
ADDITIONAL UPDATES AND ZONING DRAFTING
DONATED BY LEONARD RYDELL, P.E., P.L.S., W.R.E.
LAST UPDATE: 22 FEBRUARY 1999

APPENDIX D

DEQ Approval of Draft PER and NPDES Permit

D1. DEQ Approval of Draft PER

D2. NPDES Permit

D1. DEQ Approval of Draft PER

Oregon
John A. Kitzhaber, MD, Governor

Department of Environmental Quality
Northwest Region
2020 SW 4th Ave, Suite 400
Portland, OR 97201
(503) 229-5263
FAX (503) 229-6945
TTY 711

November 14, 2014

COPY

Tony Owen
Pacific City Joint Water-Sanitary Authority
Box 520
Pacific City, OR 97135

Re: WQ-Pacific City
Approval of Preliminary Engineering Report Wastewater Treatment Plant Upgrade
File 66100
PCJWSA, Tillamook County

Dear Mr. Owen:

The Department of Environmental Quality (Department) has reviewed of the above referenced document received in our Portland Office in October 9, 2014 as prepared by Thomas Nielsen PE, of Parametrix of Portland, OR.

The Department agrees with the conclusions of the report. A Sequencing Batch Reactor (SBR) would be most likely the least expensive alternative choice for an upgrade of the wastewater treatment plant. An SBR would produce a high quality, biologically nutrient-reduced effluent, low in nitrogen containing constituents. Although there are no specific rules for nutrient reduction proposed, there are several possible that may be imposed in the future. Also, an SBR also allows the facility to grow in increments, with the addition of SBR basins, as flows increase.

Something else for PCJWA to be aware of is the outfall in the Nestucca River. The tidal influence and seasonal fluctuations can create unstable and possibly poor mixing at times. The fact that the highest WWTP influent flow levels occur during the lowest river flows (July and August) demands that the WWTP perform to a high level of treatment and stability. A detailed mixing zone study will likely be required as part of a renewed permit..

One change coming with the 2016 permit renewal will be the monitoring of effluent bacteria to enterococcus and fecal coliform from the current ecoli.

Time is of the essence. The treatment plant is near its capacity and regularly has difficulty meeting the permit. Keep moving forward. Proceed with arranging financing for the project.

Continue with the choice of treatment desired and design documents. Technical review fees will be applied at that point.

INQUIRIES

If there is anything I can do to assist in the treatment choice questions and future needs, please don't hesitate to contact me. I can be reached at (503) 229-5310. I may emailed at pinney.mike@deq.state.or.us.

We appreciate the City's many efforts to comply with our water quality regulations and endeavor to assist you through the process.

Respectfully,

Michael L. Pinney PE
Senior Environmental Engineer
Northwest Region Water Quality

Cc : Thomas Nielson PE, Parametrix, 700 NE Multnomah, Ste.1000, Portland Or., 97232-4110
Tiffany Yelton-Bram, NWR-WQ
Randy Baily, NWR-WQ

D2. NPDES Permit

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
WASTE DISCHARGE PERMIT

Department of Environmental Quality
Northwest Region – Portland Office
2020 SW 4th Ave., Suite 400, Portland, OR 97201
Telephone: (503) 229-5263

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

ISSUED TO:
Pacific City Joint Water-Sanitary Authority
P O Box 520
Pacific City, OR 97135

FACILITY TYPE AND LOCATION:
Activated Sludge
34005 Cape Kiwanda Drive
Pacific City

Treatment System Class: Level III
Collection System Class: Level II

EPA REFERENCE NO: OR-003006-6

SOURCES COVERED BY THIS PERMIT:

Type of Waste	Outfall Number	Outfall Location
Treated Wastewater	001	R.M. 1.5

RECEIVING STREAM INFORMATION:
Basin: North Coast
Sub-Basin: Wilson-Trask-Nestucca
Receiving Stream: Nestucca River
LLID: 1239555451826-1.5 D
County: TILLAMOOK

Issued in response to Application No. 967581 received 3/3/2011.
This permit is issued based on the land use findings in the permit record.

Greg Geist, Manager
Water Quality Source Control Section
Northwest Region

September 26, 2011
Date

PERMITTED ACTIVITIES

Until this permit expires or is modified or revoked, the permittee is authorized to construct, install, modify, or operate a wastewater collection, treatment, control and disposal system and discharge to public waters adequately treated wastewaters only from the authorized discharge point or points established in Schedule A and only in conformance with all the requirements, limitations, and conditions set forth in the attached schedules as follows:

Unless 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

Waste Discharge Limitations not to be exceeded after permit issuance.

1. Treated Effluent Outfall 001

a. Year round:

Parameter	Average Effluent Concentrations Monthly	Average Effluent Concentrations Weekly	Monthly* Average lb/day	Weekly* Average lb/day	Daily* Maximum lbs
BOD_5	10 mg/L	15 mg/L	30	45	60
TSS	10 mg/L	15 mg/L	30	45	60

* Average dry weather design flow to the facility equals 0.36 MGD. Mass load limits are based upon average dry weather design flow to the facility.

b.

Other parameters (year-round)	Limitations
E. coli Bacteria	Shall not exceed 34 organisms per 100 mL monthly geometric mean. No more than 10% of the samples shall exceed 110 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.

c. Permittee shall not discharge wastes or conduct activities that violate Water Quality Standards adopted in OAR 340-041 for the North Coast basin except in the regulatory mixing zone and as provided for in OAR 340-045-0080. The regulatory mixing zone is defined as:

That portion of the Nestucca River contained within a hundred (100) foot radius of the outfall diffuser. The Zone of Immediate Dilution (ZID) shall be defined as that portion of the allowable mixing zone that is within ten (10) feet of the point of discharge.

d. Permittee is prohibited from using chlorine or chlorine compounds as a disinfecting agent of the treated effluent and no chlorine residual is allowed in Permittee's discharged effluent.

2. Groundwater:

Permittee's activities must not cause an adverse impact on existing or potential beneficial uses of groundwater. All wastewater and process related residuals must be managed and disposed in manner that will prevent violation of the Groundwater Protection Rules (OAR 340-040).

NOTES:

1. If a single sample exceeds 110 organisms per 100 mL, then the permittee must evaluate the previous 9 bacteria sample results to determine if the 10% requirement has been met.

SCHEDULE B

1. Minimum Monitoring and Reporting Requirements

The permittee shall monitor the parameters specified below at the locations indicated. The laboratory used by the permittee to analyze samples must 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 must be included in the monitoring 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 locations are the following:
-Influent grab samples and measurements and composite samples are taken just after the headworks screen and just before the flow equalization basin.

Item or Parameter	Minimum Frequency	Type of Sample
Total Flow (MGD)	Daily	Measurement
Flow Meter Calibration	Annually	Verification(See Note 1)
BOD_5	Weekly	24-hr Composite
TSS	Weekly	24-hr Composite
pH	2/Week	Grab

b. Treated Effluent Outfall 001

The facility effluent sampling locations are the following:
Effluent grab samples and measurements are taken from the UV effluent channel. Composite samples are taken from the same location.

Item or Parameter	Minimum Frequency	Type of Sample
BOD_5	Weekly	24-hrComposite
TSS	Weekly	24-hr Composite
pH	2/Week	Grab
Temperature (May 1 through October 31)	2/Week	Grab
E. coli	Weekly	Grab
UV Radiation Dosage	Daily	Reading (See Note 2)
Pounds Discharged (BOD_5 and TSS)	Weekly	Calculation
Average Percent Removed (BOD_5 and TSS)	Monthly	Calculation
Nutrients: TKN, NH_3-N, NO_2+NO_3-N, Total Phosphorous	(See Note 3)	24-hr Composite
Dissolved Oxygen	(See Note 3)	Grab
Oil and Grease	(See Note 3)	Grab
Total Dissolved Solids (TDS)	(See Note 3)	24-hr Composite
Alkalinity	Quarterly	Grab

c. Biosolids Management

Item or Parameter	Minimum Frequency	Type of Sample
Biosolids 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) Sludge metals content for: As, Cd, Cu, Hg, Mo, Ni, Pb, Se & Zn, measured as total in mg/kg	Annually	Composite sample to be representative of the product to be land applied from the Digester withdrawal line (See Note 4)
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 biosolids were applied recorded on site location map.
Quantity and type of alkaline product used to stabilize biosolids (when required to meet federal pathogen and vector attraction reduction requirements in 40 CFR 503.32(b)(3) and 40 CFR 503.33(b)(6))	Each occurrence	Measurement
Initial time when solids that received alkaline agent ascended to pH >= 12	Each batch	Date, time, and actual pH measurement (corrected to standard at 25°C)
2 hours after initial alkaline addition and sustained at pH >= 12	Each batch	Date, time, and actual pH measurement (corrected to standard at 25°C)
24 hours after initial alkaline addition and pH >= 11.5 was sustained	Each batch	Date, time, and actual pH measurement (corrected to standard at 25°C)

2. Reporting Procedures

a. Permitee must report monitoring results on approved forms. The reporting period is the calendar month. Permittee must submit reports to the Department's Northwest Region - Portland office by the 15th day of the following month.

b. Discharge monitoring reports (DMRs) must 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. DMRs must also identify each system classification as found on page one of this permit.

c. DMRs must also include a record of the quantity and method of use of all biosolids 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. Permittee must submit an annual report to the Department by February 1 each year that details sewer collection maintenance activities which reduce inflow and infiltration. The report must state those activities that have been done in the previous year and those activities planned for the following year. In addition any Sanitary Sewer Overflows from the previous year must be noted and tabulated as part of this annual report.

b. For any year in which biosolids are land applied, Permittee must submit a report to the Department 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 340-050-0035(6)(a)-(e).

NOTES:

1. Flow meter calibration records must be kept at the plant site for review upon request.

2. 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/cm^2. The daily UV radiation dosage must be determined by reading the meter each day and calculating a dosage to be reported in mWatts-sec/cm^2. If more than one meter is used, the daily recording will be an average of all meter readings each day.

3. Composite samples from the digester withdrawal line shall consist of at least 4 aliquots of equal volume collected over an 8 hour period and combined.

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

4. In order to comply with renewal application requirements, at minimum, testing data for these parameters must be based on at least three pollutant scans and completed no more than 4 ½ years prior to the next renewal application submission.

SCHEDULE D

Special Conditions

1. Permittee must manage all biosolids 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.

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. The permittee shall comply with Oregon Administrative Rules (OAR), Chapter 340, Division 49, "Regulations Pertaining To Certification of Wastewater System Operator Personnel" and accordingly:

   a. The permittee shall have its wastewater system supervised by one or more operators who are certified in a classification and grade level (equal to or greater) that corresponds with the classification (collection and/or treatment) of the system to be supervised as specified on page one of this permit.

Note: **A "supervisor" is defined as the person exercising authority for establishing and executing the specific practice and procedures of operating the system in accordance with the policies of the permittee and requirements of the waste discharge permit. "Supervise" means responsible for the technical operation of a system, which may affect its performance or the quality of the effluent produced. Supervisors are not required to be on-site at all times.**

   b. The permittee's wastewater system may not be without supervision (as required by Special Condition 3.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 must notify the Department of Environmental Quality in writing within thirty (30) days of replacement or redesignation of certified operators responsible for supervising wastewater system operation. Permittee must file the notice 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 Department may grant the permittee reasonable time, not to exceed 120 days, to obtain the services of a qualified person to supervise the wastewater system. The written request must include justification for the time needed, a schedule for recruiting and hiring, the date the system supervisor availability ceased and the name of the alternate system supervisor(s) as required by Special Condition 3.b. above.

4. Permittee must have an adequate contingency plan for prevention and handling of spills and unplanned discharges in force at all times. Permittee must maintain a continuing program of employee orientation and education to ensure awareness of the necessity of good in-plant control and quick and proper action in the event of a spill or accident.

5. Prior to the next permit renewal application, the permittee must inspect, clean and/or repair, as necessary, the multi-port effluent diffuser in the Nestucca River. Permittee must include an inspection report regarding this diffuser with the permit renewal application materials. Permittee must also conduct a mixing zone modeling analysis which used the instream findings as described in the Department's 2007 Regulatory Mixing Zone Internal Management Directive.

6. The permittee must notify the DEQ Northwest Region - Portland Office (phone: (503) 229-5263) in accordance with the response times noted in the General Conditions, Schedule F, Section D of this permit, of any malfunction so that corrective action can be coordinated between the permittee and the Department.

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

APPENDIX E

Infiltration/Inflow Report

May 6, 2014

Randy Bailey
DEQ/NWR
2020 SW 4th Ave.
Suite 400
Portland, OR 97201-4987

RE: Permit # 101519, File # 66100
Inflow and Infiltration Summary
I & I & STEP System Summary

Dear Mr. Bailey,

During calendar year 2013, PCJWSA I&I inspection consisted of the following actions:

- Repaired cracked sewer main on Cape Kiwanda Dr. at the intersection of Ella Ave.
- Found plugged culvert running storm water directly into Hana Way lift station. Corrected and diverted water to appropriate discharge area.
- Repaired leaking pump station wet well at WWTP.
- Discovered broken service line at 6th and Haystack. Repaired by private contractor.
- Inspected various manholes during rain events and found water running in through lids. Diverted water away from manholes.
- Suspected infiltration on Ocean Dr. North. Cleaned and TV'd. No breaks or leaks discovered.
- Found 4" service line that had been bored through by contractor. Repaired by private contractor.
- Suspected broken joint in sewer main on Fisher Rd. Cleaned and TV'd. No leaks or broken joints found.
- Additional I&I inspections and repairs within the STEP system along the Nestucca River.
- Inspected several septic tanks with only two that required pumping.

PCJWSA intends to perform more collection system cleaning and TV work in 2014. The main focus will continue to be the STEP system along the Nestucca River and continue to investigate and correct problems in other areas of the collection system.

If you have any questions or need additional information please contact me.

Sincerely,

Tony Owen
PCJWSA Manager

Cc: PCJWSA Board of Director
File

APPENDIX F

Biosolids Management Plan

February 12, 2014

Tony Owen
Pacific City Joint Water-Sanitary Authority
PO Box 520
Pacific City, OR 97135

Dear Mr. Owen,

Pacific City Joint Water-Sanitary Authority collected a biosolids sample on August 6, 2013 and submitted it to Pyxis Laboratories to be analyzed for the EPA 503 Land Application parameters. We received the sample on August 8 and entered it in our database as Order Number 3080806.

Nitrate-Nitrite was analyzed by method EPA 9056 on August 15. Prior to receiving your sample, another client's biosolids sample had compromised the column used for this analysis. This led our analyst Maya Hristov to be overly cautious when preparing the sample, and she used a 100-fold dilution in order to protect the column. The 100-fold dilution yielded an analytical result of "None Detected" with a reporting limit of 0.2%. With a Total Solids result of 1.58%, the dry-weight basis Nitrate-Nitrite result calculated to <12.7%.

We understand that this data is not useable, and we apologize for the inconvenience this has caused. In the future, we will be careful to analyze samples at a lower dilution in order to obtain useful data. If you have any other questions or concerns, please do not hesitate to contact me, or our Quality Assurance Director, Ragheda Kaady. We may both be reached at (503) 254-1794.

Sincerely,

Mark W. Leed

Mark W. Leed
Customer Services
Pyxis Laboratories LLC

Pyxis Laboratories, LI
12423 N.E. Whitaker Way • Portland, OR • 97230 • (503) 254-1794 • FAX (503) 254-1·

Biosolids Annual Report Form

Facility Information

DEQ File Number: 66100 **Permit Number:**

Name PCJWSA Permit Type: NPDES 101519

Location Address 34005 CAPE KIWANDA DR WPCF

Mailing Address PO BOX 520 PACIFIC CITY, OR 97135

Contact name TONY OWEN Telephone: 503-965-6636

E-mail TOWEN@PCJWSA.COM Fax: 503-965-6056

Biosolids Process Descriptions

Generation

Wastewater Sources & Volumes:

	Gallons/yr
Municipal	618,000
Industrial	
Septage	
Total Gallons	618,000

INCLUDES 30,000 GALLONS FROM CLOVERDALE

Solids Produced:

	Dry Tons (DT)/yr
primary	
secondary	6.43
other	
Total DT	

WT=40.72 DT= $\frac{40.72 \times 15800}{100,000}$ = 6.4

Preparation

Mark applicable processes and on separate sheet describe the processes and equipment used for:

screening
grit removal
settling
thickening
digestion
dewatering

Storage

For each container type, list numbers, sizes, materials (i.e. steel, etc.) and volume.

Containers	X number of units	X volumes of each storage container	(material)	= total volume
tanks	1	66,000	CONCRETE	66,000
clarifiers	2	30,000	CONCRETE	60,000
lagoons				
drying beds				
other				
other				
TOTAL CAPACITY:				126,000

Application

List transport equipment used from facility to sites (e.g. 3,000 gal. tanker truck).

→ 3,300 GALLON TANKER TRUCK

List application method and equipment used to apply at sites

MANURE SPREADER TANKSPREADER

Biosolids Annual Report Form

Biosolids Quality

EQ		Class A		Class B	

Testing frequency (times/yr)	1	4	6	12
[in Metric Tons]	[<290]	[290>1,500]	[1,500>15,000]	[≤ 15,000]
[in U.S. Tons]	[<319]	[319>1,650]	[1,650>16,500]	[≤ 16,500]

[Choose one, based on dry weight of biosolids produced and land applied annually.]

[Use Tables below to record quarterly or annual testing results; use average column for annual test data. If testing monthly or bi-monthly, use separate spreadsheet for data.]

Item	1st quarter	2nd quarter	3rd quarter	4th quarter	Average
TKN			7.28%		
NO^3-N			<12.7%		
NH^4-N			1.11%		
P			2.01%		
K			6770%		
pH			7.5		
TS			1.58%		
VS			75.9%		

Test data is expressed in % dry weight (dw), except pH which is standard units.

Pollutant Monitoring

Metals	1st quarter	2nd quarter	3rd quarter	4th quarter	Average
As			<3.1		
Cd			<1.24		
Cr			13.2		
Cu			447		
Pb			11.6		
Hg			0.215		
Mo			6.71		
Ni			<3.1		
Se			<6.2		
Zn			517		

Test data is expressed in mg/kg (ppm) based on dry weight.

Biosolids Annual Report Form

Pathogen Reduction Monitoring & Records

Circle selected pathogen reduction alternative below and on a separate sheet:

- Describe process used to reduce pathogens
- State operational parameters met (e.g. time & temperature)
- Attach monitoring data and certification statement

Part 503.32 Pathogen Reduction Alternatives

Class A Alternatives

[requires tests for fecal coliform &/or *Salmonella* sp.]

1. time & temperature
2. pH >12, 72 hr;@52°C,12hr, >50%TS
3. pre- & post-testing for enteric virus & helminth ova
4. post-testing for enteric virus & helminth ova
5. PFRP: 1 composting
   2 heat drying
   3 heat treatment
   4 thermophilic aerobic
   5 beta ray irradiation
   6 gamma ray irradiation
   7 pasteurization
6. PFRP equivalent

Class B Alternatives

1. 7 samples, geometric mean < 2,000,000 MPN or CFU/g TS
2. PSRP: 1 aerobic digestion
   2 air drying
   3 anaerobic digestion
   4 composting
   5 lime stabilization
3. PSRP equivalent

Vector Attraction Reduction (VAR) Monitoring & Records

Circle selected alternative and on separate sheet:

- Describe VAR process used
- Describe operational parameters met (e.g. pH & time)
- Attach monitoring data and certification statement

Part 503.33 Vector Reduction Alternatives

In-plant alternatives

1. 38% min. reduction of volatile solids
2. anaerobic bench scale digestion
3. aerobic bench scale digestion
4. SOUR aerobic 1.5mg O^2/hr/g TS (dw)
5. aerobic 14 days>45°C average temp.
6. pH ≥ 12 for 2 hr, + 22 hr ≥ 11.5 pH
7. secondary solids ≥ 75% solids
8. primary solids ≥ 90% solids

Site management alternatives

9. subsoil injection within 8 hr
10. soil incorporation within 6-8 hr

Other alternatives

11. (for disposal units only)
12. septage only
    pH ≥ 12 for at least 30 min.

Biosolids Annual Report Form

Land Application Site Information

For all sites used during the reporting year period, provide the following information:
(This information can be provided on a separate spreadsheet if available.)

Site Name (resident)	Site ID No.	Location (Sec,Twn,Rge)	Crop(s)	Acres applied	N lb/ac applied	Application rate DT/ac	Total DT/site	Seasonal restrictions
Beaver		35S 30 7W	Grass Hay	40+	307	0.161	6.43	

NOTE: Attach the following items if applicable.

Soil test data if site is proposed for application for third consecutive year.
This will apply to all sites used in 1998 that were applied to in 1996 & 1997.
See **OAR 340-50-080(5)**

Cumulative loadings & site life information for sites receiving biosolids with any trace pollutants exceeding Table 3 values.
See **OAR 340-50-035(6)(b)**

Pyxis Laboratories
12423 NE Whitaker Way
Portland, OR 97230
503-254-1794

Job Number:	3080806
Report Date:	08/30/2013
Purchase Order:	
Project Name:	
Project No:	2013 Bio-Solids File

PCJWSA
SEP 06 2013
RECEIVED

Cover Letter

Tony Owen
Pacific City Joint Water-Sanitary Authority
P.O. Box 520
Pacific City, OR, 97135

Dear Tony Owen,

Enclosed please find Pyxis Laboratories analytical report for order number 3080806. Should you have any questions about this report or any other matter, please do not hesitate to contact us. We are here to help you.

The samples listed on the following pages were received at the Portland branch of Pyxis Laboratories on 08/08/2013 as order 3080806.

Test results relate only to the parameters tested and to the samples as received by the laboratory. Test results meet all requirements of NELAC and the Pyxis quality assurance plan unless otherwise noted. This report shall not be reproduced, except in full, without the written consent of this laboratory. Samples will be kept a maximum of 15 days from the report date unless prior arrangements have been made.

Thank you for allowing Pyxis to be of service to you, we appreciate your business.

Sincerely,

Signed
Richard Reid
Project Manager

Pyxis Laboratories
12423 NE Whitaker Way
Portland, OR 97230
503-254-1794

Job Number: 3080806
Report Date: 08/30/2013
Purchase Order:
Project Name:
Project No: 2013 Bio-Solids File

Sample Results

Bio-Solids Collected: 08/06/13 02:00 PM By: Client Matrix: Other

Parameter	Method	As Received	Dry Weight	Units
Ammonia Nitrogen	SM 4500-NH3-B/C	0.0175	1.11	%
Nitrate-Nitrite	EPA 9056	<0.2	<12.7	%
Zinc	EPA6020	8.17	517	mg/Kg
Silver	EPA6020	0.0341	2.16	mg/Kg
Selenium	EPA6020	< 0.098	< 6.2	mg/Kg
Nickel	EPA6020	< 0.049	< 3.1	mg/Kg
Molybdenum	EPA6020	0.106	6.71	mg/Kg
Lead	EPA6020	0.184	11.6	mg/Kg
Copper	EPA6020	7.07	447	mg/Kg
Chromium	EPA6020	0.209	13.2	mg/Kg
Cadmium	EPA6020	< 0.0196	< 1.24	mg/Kg
Arsenic	EPA6020	< 0.049	< 3.1	mg/Kg
Phosphorus	EPA6020	0.0318	2.01	%
Fecal Coliform	SM 9222-D	24300	1540000	/g
pH	EPA9045	7.5		SU
Total Solids	EPA 160.3	1.58		%
Total Kjeldahl Nitrogen	SM 4500-Norg-B	0.115	7.28	%
Mercury	EPA 7471A	0.0034	0.215	mg/Kg
Total Volatile Solids	EPA 160.4	1.2*	75.9**	%
Potassium	EPA 6010 B	107	6770	mg/Kg

Notes:

* Reported as % of total sample.
** Reported as % of Total Solids.
SM means Standard Methods for the Examination of Water and Wastewater, 1995, 19th Edition.
The less then "<" symbol means none detected at or above the indicated value and represents the reporting limit for the method.
This analysis is not covered under ORELAP scope of accreditation.

Abbreviations

ND	None Detected at or above the MRL

Units of Measure:

%	Percent
/g	Per Gram
SU	S.U.
mg/Kg	Milligrams Per Kilogram

AMMONIA NH_4-N

$1.11\% \times 10,000 = \frac{11,1000 \text{ mg/KG}}{1,000,000} = .011 \times 81436$ TS#

$= 895\# \times 0.5$

$= 447\#$ NH_4-N

NITRATE-NITRITE NO_3-N

$12.7\% \times 10000 = \frac{127,000 \text{ mg/KG}}{1,000,000} = 0.127 \times 81436$ TS#

$= 10,342\#$ NO_3-N

$TKN = 7.28\% \times 10,000 = \frac{72800 \text{ mg/KG}}{1,000,000} = .073 \times 81436$ TS#

$= 5944 \times .03$

$= 1783\#$ TKN

ORGANIC N

TKN = 1783#
NH_4-N = 447#
1336#

TKN NH_4-N
72800 mg/KG − 11,100 mg/K = 61,700 mg/K

$\frac{61,700}{1,000,000} = 0.0617 \times 81436$
$= 5024\# \times .03 = 1507\#$

TS = 15,800 mg/l
618,000 GALLONS APPLIED

$= \frac{81,435\#}{2000}$

= 40.72 WET TONS

DRY TONS = $\frac{40.72 \times 15,800}{1,000,000}$

= 6.43 DRY TON

447# NH_4-N + 10,342# NO_3-N + 1507# ORGANIC = $\frac{12,296\# \text{ N}}{40 \text{ ACRE}}$

= 307# N/ACRE

PCJWSA Biosolids 2013

DATE	Gallons
1/2/13	15000
1/3/13	18000
1/4/13	15000
4/1/13	18000
4/2/13	18000
4/3/13	21000
4/30/13	9000
5/1/13	18000
5/2/13	15000
5/3/13	6000
6/5/13	12000
6/6/13	9000
6/7/13	6000
6/10/13	12000
6/11/13	6000
6/12/13	6000
6/20/13	6000
6/26/13	12000
6/27/13	9000
6/28/13	3000
7/1/13	18000
7/2/13	18000
7/3/13	3000
7/10/13	9000
7/11/13	12000
7/12/13	15000
7/15/13	6000
8/9/13	6000
8/12/13	15000
8/13/13	18000
8/14/13	18000
8/15/13	12000
9/4/13	12000
9/5/13	18000
9/9/13	6000
9/10/13	18000
9/11/13	21000
9/12/13	18000
9/16/13	15000
9/26/13	21000
9/27/13	6000
10/2/13	12000
10/3/13	18000

10/4/13	12000
11/14/13	18000
11/15/13	15000
11/21/13	6000
11/26/13	9000
11/27/13	9000
Total	618000

APPENDIX G

WWTP Alternatives: Design Criteria and Technical Data

G1. Vendor Data Common to All Alternatives

G2. Activated Sludge Design Criteria, BioWin Model Results, and Vendor Data

G3. Sequencing Batch Reactor Design Criteria, Vendor Data, and EPA Bulletin

G4. Membrane Bioreactor Design Criteria, Vendor Data, and EPA Bulletin

G5. Biosolids Dewatering Equipment

G1. Vendor Data Common to All Options

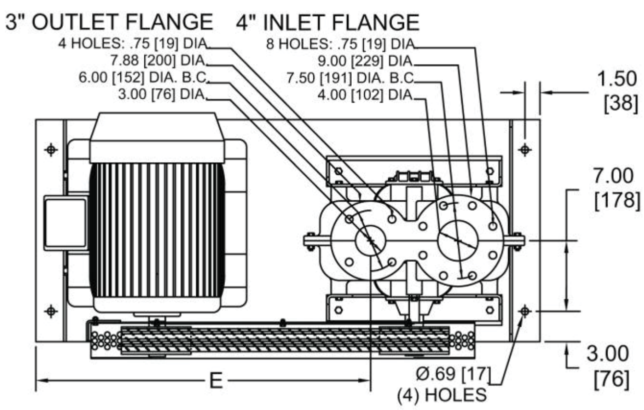
TurboTron Blowers
Flygt FEB Pumps
WEMCO Hydrogritter
Hallsten Digester Covers
PISTA Grit Removal
Stahly Sludge Truck
Trojan UV
Sanitaire Digester Diffusers
Lime System

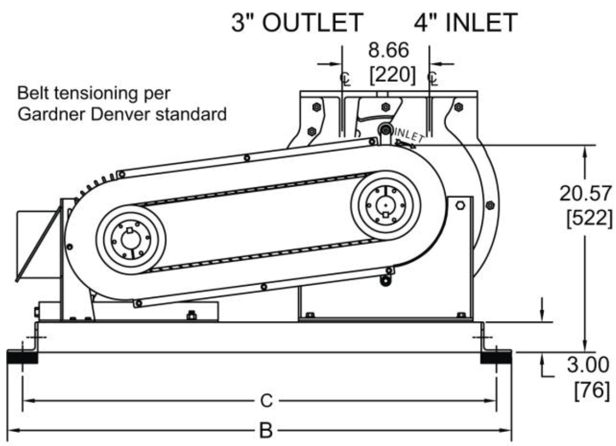
Dimensional Data

LAMSON TurboPak™ A & B

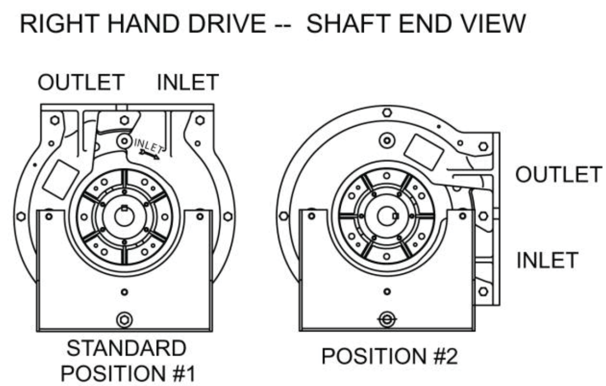
Centrifugal Products

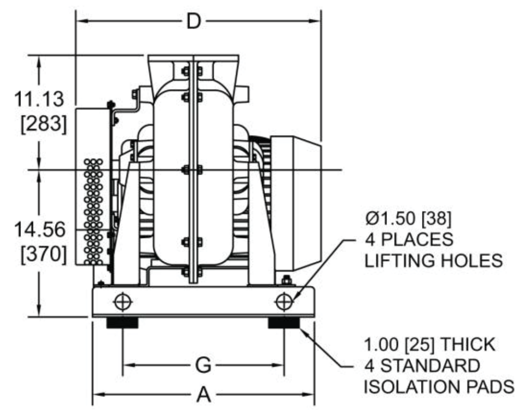
GENERAL ARRANGEMENT





FLANGE ORIENTATIONS





DIMENSIONAL DATA – inches [millimeters]

WEIGHTS – lb (kg) & INERTIA – lb-ft² [kg-m²]

	FRAME	A	B	C	D	E	G	PACKAGE	BARE UNIT	WK^2
TurboPak™ A	184T	22.0 [559]	50.0 [1270]	47.0 [1194]	14.9 [377]	33.2 [843]	16.0 [406]	476 [216]	240 [109]	5.2 [0.22]
	213T	22.0 [559]	50.0 [1270]	47.0 [1194]	18.1 [459]	33.2 [843]	16.0 [406]	565 [256]	240 [109]	5.2 [0.22]
	215T	22.0 [559]	50.0 [1270]	47.0 [1194]	19.6 [499]	33.2 [843]	16.0 [406]	565 [256]	240 [109]	5.2 [0.22]
	254T	22.0 [559]	50.0 [1270]	47.0 [1194]	24.3 [617]	33.2 [843]	16.0 [406]	695 [315]	240 [109]	5.2 [0.22]
	256T	22.0 [559]	50.0 [1270]	47.0 [1194]	24.3 [617]	33.2 [843]	16.0 [406]	695 [315]	240 [109]	5.2 [0.22]
TurboPak™ B	284TS	26.0 [660]	57.0 [1448]	54.0 [1372]	25.1 [637]	39.2 [996]	20.0 [508]	844 [383]	240 [109]	5.2 [0.22]
	286TS	26.0 [660]	57.0 [1448]	54.0 [1372]	26.6 [675]	39.2 [996]	20.0 [508]	844 [383]	240 [109]	5.2 [0.22]
	324TS	26.0 [660]	57.0 [1448]	54.0 [1372]	28.4 [722]	39.2 [996]	20.0 [508]	1028 [466]	240 [109]	5.2 [0.22]
	326TS	26.0 [660]	57.0 [1448]	54.0 [1372]	29.9 [758]	39.2 [996]	20.0 [508]	1028 [466]	240 [109]	5.2 [0.22]
	364TS	26.0 [660]	57.0 [1448]	54.0 [1372]	30.8 [781]	39.2 [996]	20.0 [508]	1045 [474]	240 [109]	5.2 [0.22]
	365TS	26.0 [660]	57.0 [1448]	54.0 [1372]	31.8 [807]	39.2 [996]	20.0 [508]	1045 [474]	240 [109]	5.2 [0.22]

PRODUCT NOTES

1. Information is approximate, subject to change without notice, and not for construction use unless certified
2. Position #1 is standard inlet and outlet orientation

Gardner Denver Nash
PO Box 130, Bentleyville, PA 15314
Phone: +1 800-982-3009 / +1 724-239-1500
Fax: +1 724-239-1502
E-mail: info.HoffmanLamson@gardnerdenver.com
Web: www.**Hoffman**and**Lamson**.com

All Nash facilities are ISO 9001 certified.

Typical Arrangement Drawing

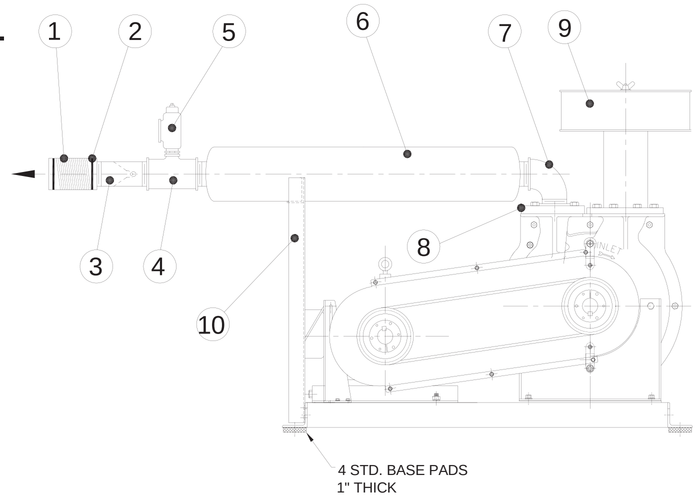
TurboPak™ A & B

Centrifugal Products

STANDARD ACCESSORIES – Pressure

ITEM No.	QTY.	PART NUMBER	DESCRIPTION
1	1	BC3023030000	3” RUBBER SLEEVE
2	2	BA1008010000	3” SLEEVE CLAMP
3	1	BA1006220000	3” CHECK VALVE
4	1	007827150ACO	3” x 3” x 1.5” PIPE TEE
5	1	007882010_ _ _	PRESSURE RELIEF VALVE
6	1	HF00895968	3” THD. OUTLET SILENCER
7	1	007847550AEO	3” 90° STREET ELBOW
8	1	BA1009010000	3” THD. COMPANION FLANGE
9	1	007573250FAO	4” INTAKE FILTER SILENCER
10	1	302RFC165	SUPPORT BRACKET

ARRANGEMENT – Pressure



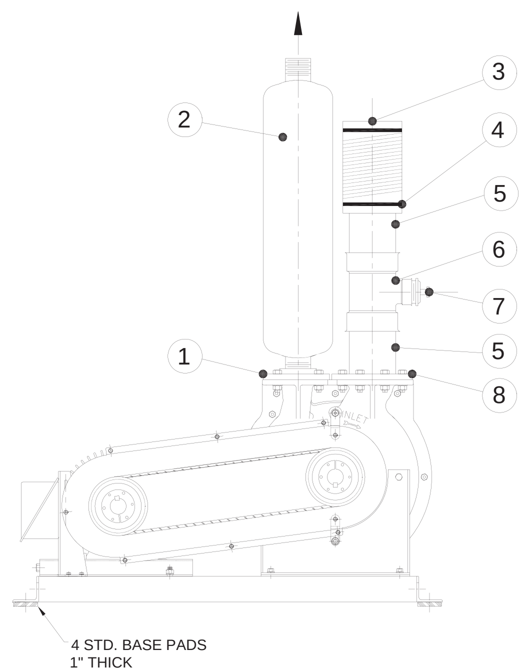
STANDARD ACCESSORIES – Vacuum (Tube)

ITEM No.	QTY.	PART NUMBER	DESCRIPTION
1	1	BA1009010000	3” FLANGE, THREADED TYPE
2	1	HF00895968	3” THD. OUTLET SILENCER
3	1	BC3023040000	4” RUBBER SLEEVE - TUBE
4	2	BA1008010000	4” SLEEVE CLAMP
6	1	SFAT-402-Z	4” x 4” x 2” FEM ADAPTER TEE
7	1	007881000AAO	2” VACUUM RELIEF VALVE
8	1	HF10391878	4” FLANGE, TUBE TYPE
	1	SF2084-QT	QUART, METAL SEALANT

STANDARD ACCESSORIES – Vacuum (Pipe)

ITEM No.	QTY.	PART NUMBER	DESCRIPTION
1	1	BA1009010000	3” FLANGE, THREADED TYPE
2	1	HF00895968	3” THD. OUTLET SILENCER
3	1	BC3023050000	4” RUBBER SLEEVE - PIPE
4	2	BA1008010000	4” SLEEVE CLAMP
5	2	007855050BGO	4” x 6” PIPE NIPPLE
6	1	007827150AEO	4” x 4” x 2” PIPE TEE
7	1	007881000AAO	2” VACUUM RELIEF VALVE
8	1	BA1009020000	4” FLANGE, THREADED TYPE

ARRANGEMENT – Vacuum



PRODUCT NOTES

1. Variable pressures / constant flow – pulse free air
2. Typical noise levels ≤ 82 dBA without an acoustical cover
3. Outboard mounted bearings assure lubricant free air
4. Only two bearings – easy maintenance access
5. Single rotating impeller and non-contact, non-wearing shaft seals
6. Aluminum casing and impeller provides corrosion resistance
7. Utilizes non-ferrous components and is spark resistant

Gardner Denver, Inc.
100 Gardner Park, Peachtree City, GA 30269
Phone: 800-982-3009 / 770-632-5000
Fax: 770-486-5628
E-mail: cf.blowers@gardnerdenver.com
Web: www.**Hoffman**and**Lamson**.com

“Over 150 Years of Leadership”

Julia Sheets

From:	Allan Maas
Sent:	Friday, September 26, 2014 1:56 PM
To:	Allan Maas
Subject:	Turbotron blower price

Turbotron 15 HP blower for aeration tank
$15,000 ea including motor and base. Valves not included.

Per Todd Nelson at the Hoffman Lamson regional office in Salt Lake City
Today 2:50 9-26-14

Parametrix
ENGINEERING . PLANNING . ENVIRONMENTAL SCIENCES

Allan Maas, P.E.
Facility Group
253.604.6600 | desk
253-302-1448 | cell
amaas@parametrix.com

NP 3085 MT 3~ 466

Performance curve

Pump

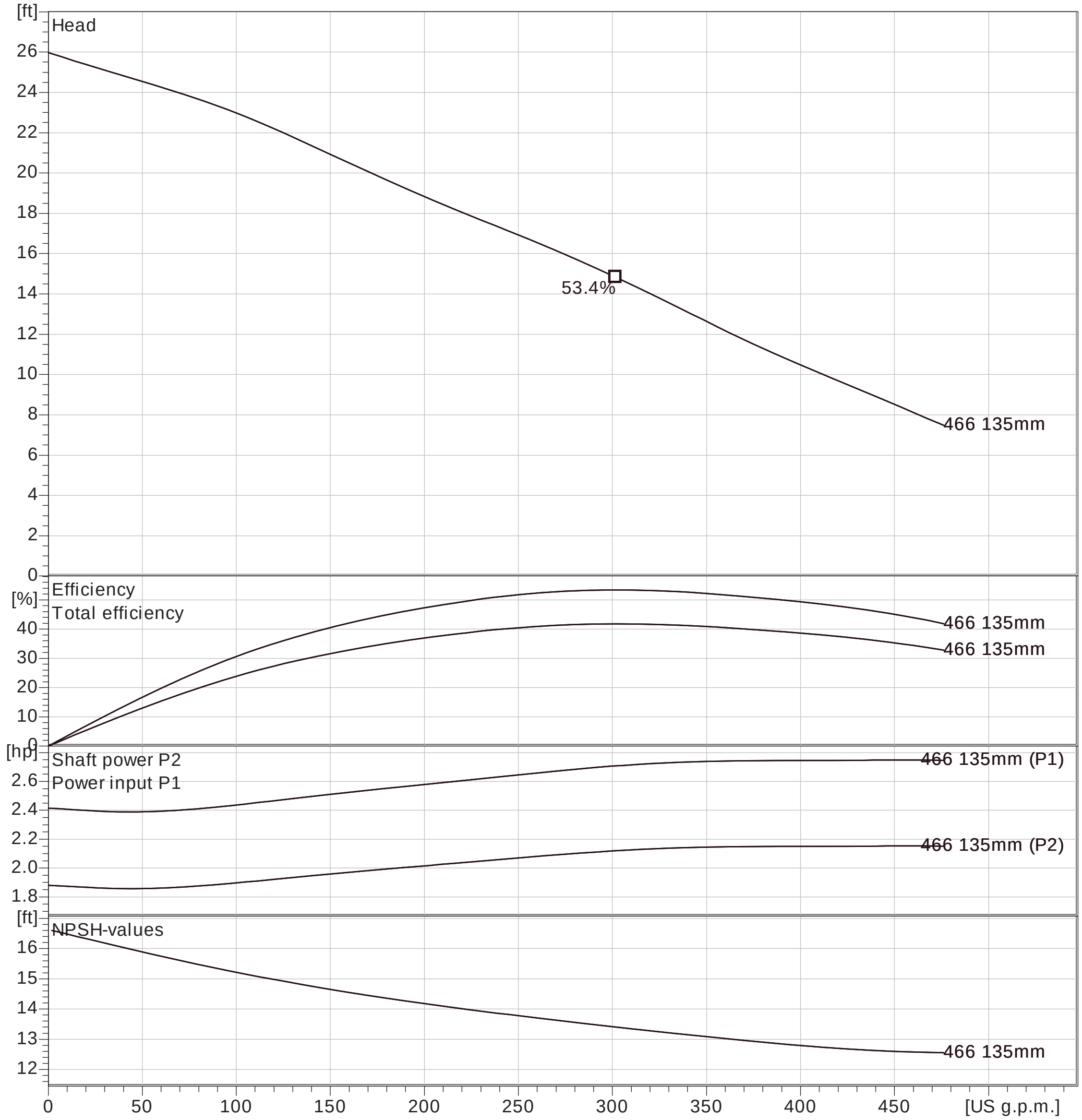
Discharge Flange Diameter	3 1/8 inch
Suction Flange Diameter	80 mm
Impeller diameter	5 5/16"
Number of blades	2

Motor

Motor #	N3085.092 15-10-4AL-W 3hp
Stator variant	61
Frequency	60 Hz
Rated voltage	460 V
Number of poles	4
Phases	3~
Rated power	3 hp
Rated current	4.5 A
Starting current	25 A
Rated speed	1705 1/min

Power factor	
1/1 Load	0.81
3/4 Load	0.74
1/2 Load	0.62

Efficiency	
1/1 Load	77.5 %
3/4 Load	78.0 %
1/2 Load	76.0 %

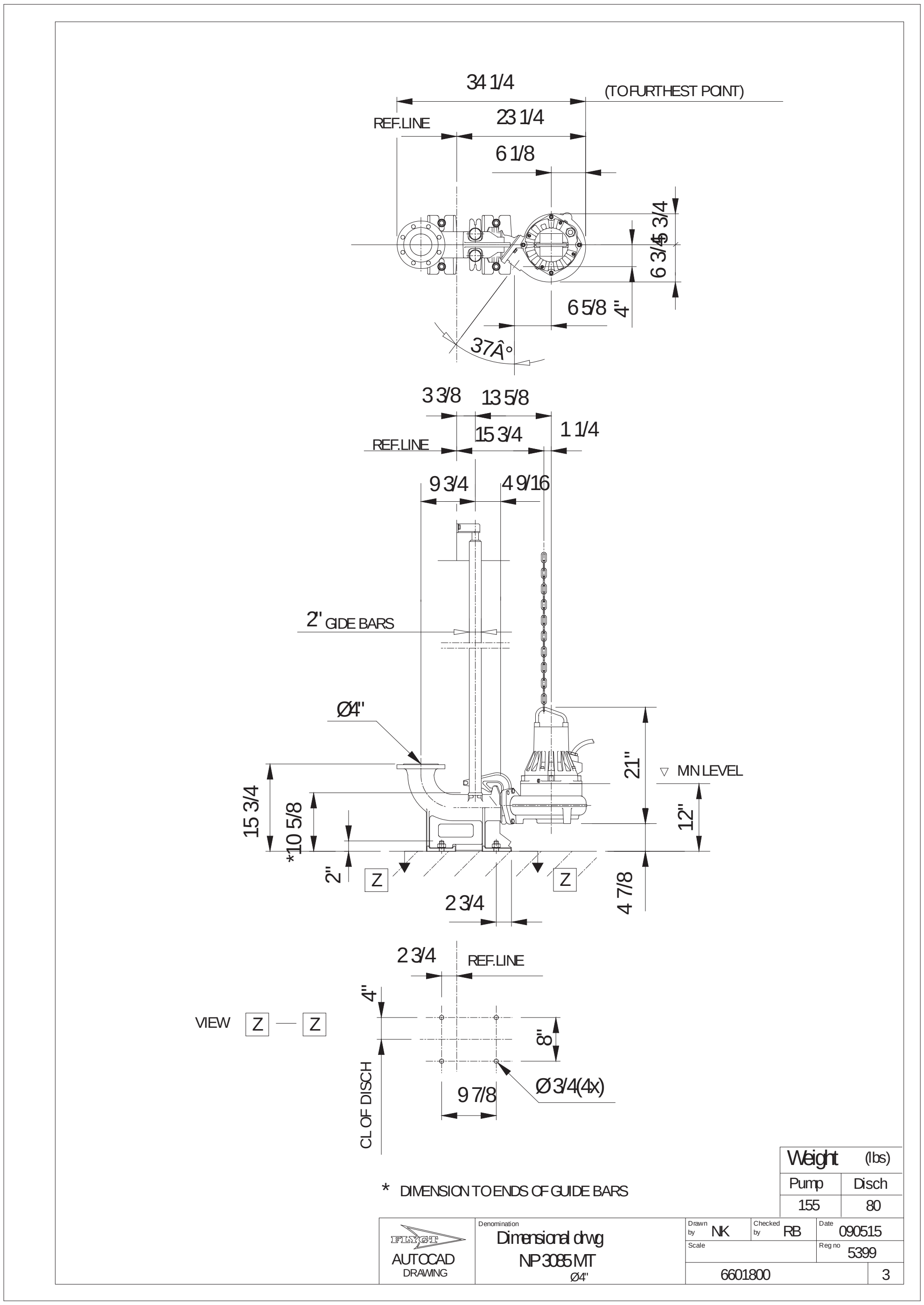


Water, pure *Curve according to: ISO 9906 grade 2 annex 1 or 2*

Project	Project ID	Created by	Created on	Last update
			2014-08-05	

NP 3085 MT 3~ 466

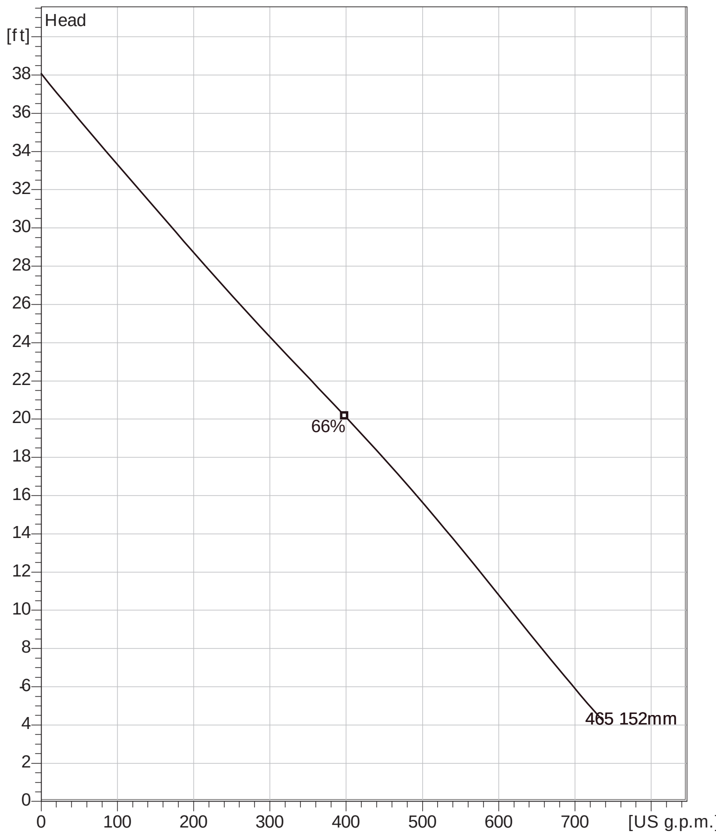
Dimensional drawing



Project	Project ID	Created by	Created on	Last update
			2014-08-05	

NP 3102 MT 3~ 465

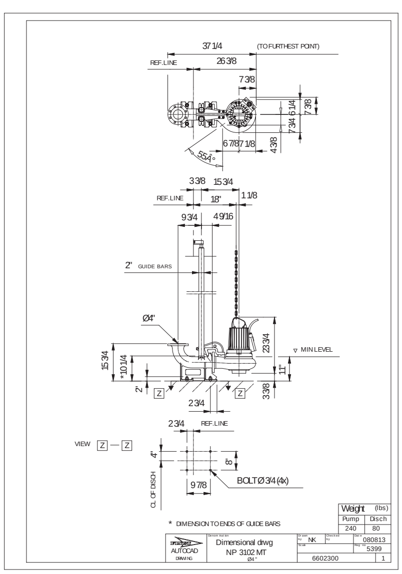
Technical specification



Water, pure *Curve according to: ISO 9906 grade 2 annex 1 or 2*

Note: Picture might not correspond to the current configuration.

Installation: P - Semi permanent, Wet



General

Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Possible to be upgraded with Guide-pin® for even better clogging resistance. Modular based design with high adaptation grade.

Impeller

Impeller material	Hard-Iron ™
Discharge Flange Diameter	3 15/16 inch
Suction Flange Diameter	100 mm
Impeller diameter	152 mm
Number of blades	2

Motor

Motor #	N3102.095 18-11-4AL-W 5hp
Stator variant	1
Frequency	60 Hz
Rated voltage	460 V
Number of poles	4
Phases	3~
Rated power	5 hp
Rated current	6.8 A
Starting current	42 A
Rated speed	1745 1/min
Power factor	
1/1 Load	0.81
3/4 Load	0.75
1/2 Load	0.63
Efficiency	
1/1 Load	85.0 %
3/4 Load	85.0 %
1/2 Load	83.5 %

Configuration

Project	Project ID	Created by	Created on	Last update
			2014-07-31	

xylem
Let's Solve Water

NP 3102 MT 3~ 465

FLYGT

Performance curve

Pump

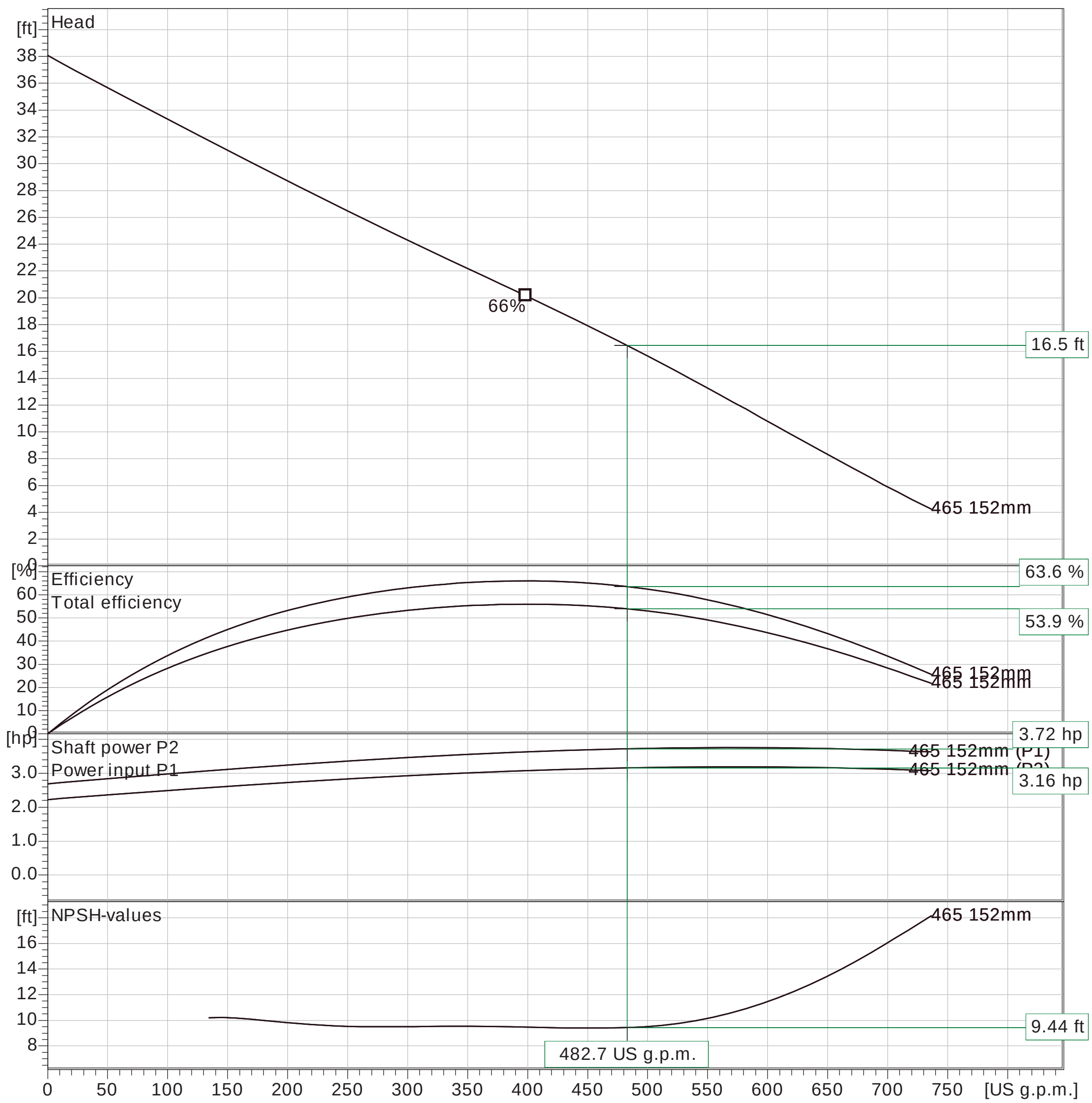
Discharge Flange Diameter	3 15/16 inch
Suction Flange Diameter	100 mm
Impeller diameter	6"
Number of blades	2

Motor

Motor #	N3102.095 18-11-4AL-W 5hp
Stator variant	1
Frequency	60 Hz
Rated voltage	460 V
Number of poles	4
Phases	3~
Rated power	5 hp
Rated current	6.8 A
Starting current	42 A
Rated speed	1745 1/min

Power factor	
1/1 Load	0.81
3/4 Load	0.75
1/2 Load	0.63

Efficiency	
1/1 Load	85.0 %
3/4 Load	85.0 %
1/2 Load	83.5 %



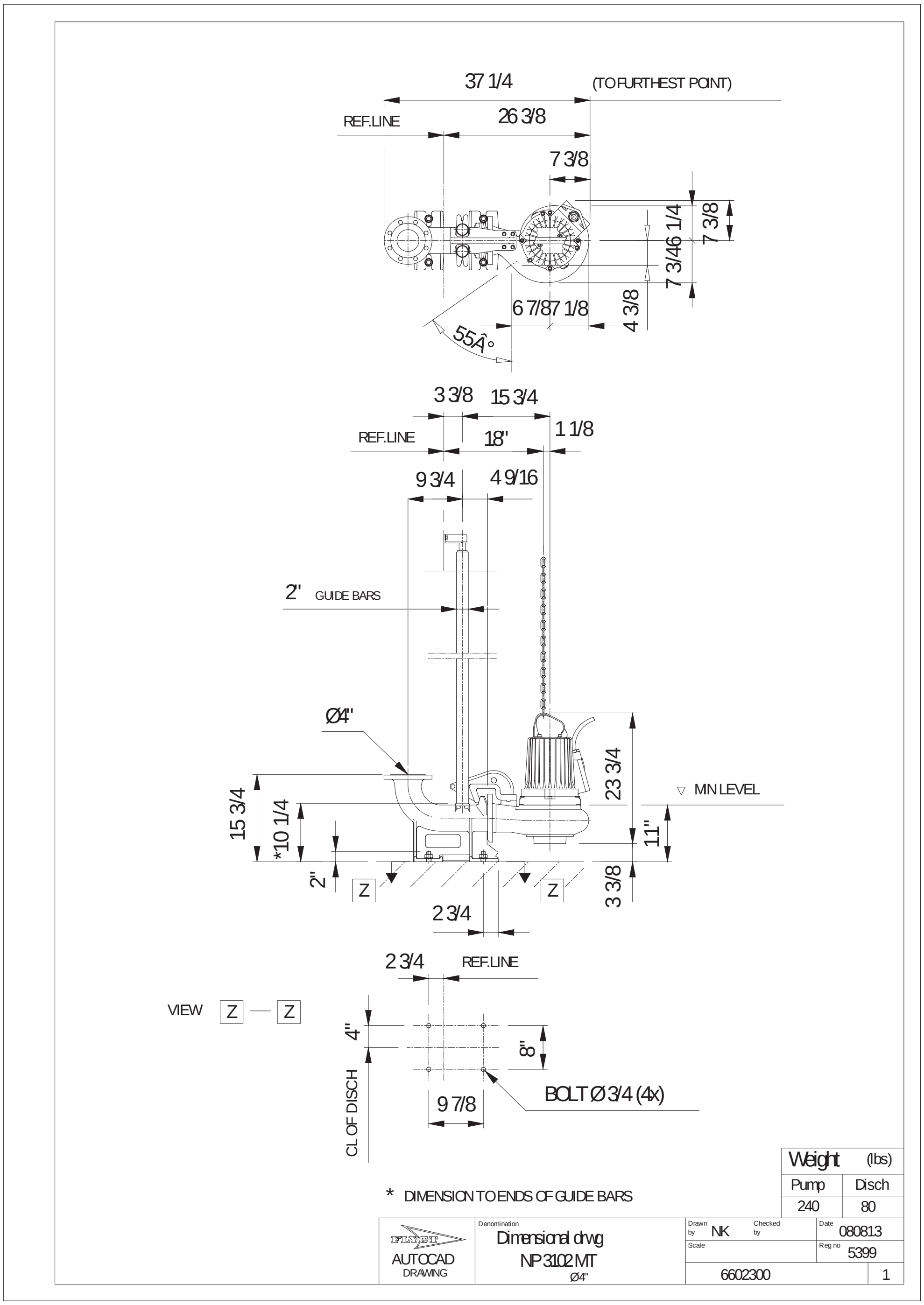
Water, pure

Curve according to: ISO 9906 grade 2 annex 1 or 2

Project	Project ID	Created by	Created on	Last update
			2014-07-31	

NP 3102 MT 3~ 465

Dimensional drawing



Project	Project ID	Created by	Created on	Last update
			2014-07-31	

Construction Datasheet

Customer	: APSCO - Municipal
Project	:
Item number	: 001
Service	: Grit Separation
Quantity of pumps	: 1

Quote Number	: 363342
Model / Size	: WEMCO Hydrogritter 12" Full Flare - Grit End
Stages	: 1
Pump speed	: 0
Date last saved	: 08 Aug 2014 10:38 AM

Construction

Nozzle	Size	Rating (ANSI)	Face	Pos'n
Suction	0 in	-	-	Left
Discharge	0 in	-	-	Right

Wemclone Number	: Single Wemclone
Wemclone Size	: 1000C Wemclone
Vortex Finder Size	: 4"
Inlet Size	: 4" inlet
Overflow Size	: 6" overflow
Apex Size	: 2" apex

Materials

Tank	: Steel
Spiral	: -
Spiral Guard	: Fiberglass
Driven Assembly	: Steel
Wemclone Material	: Aluminum
Wemclone Liner	: Rubber

Materials (continued)

Tank Support	: Steel
Wemclone Support	: Steel
Wear Shoes	: ARS
Belt Guard	: Fiberglass
-	: -

Weights (Approx.)

Bareshaft pump	: 745.0 lb
Baseplate	: 650.0 lb
Driver	: 30.00 lb
Total weight	: 1,425.0 lb

Driver Information

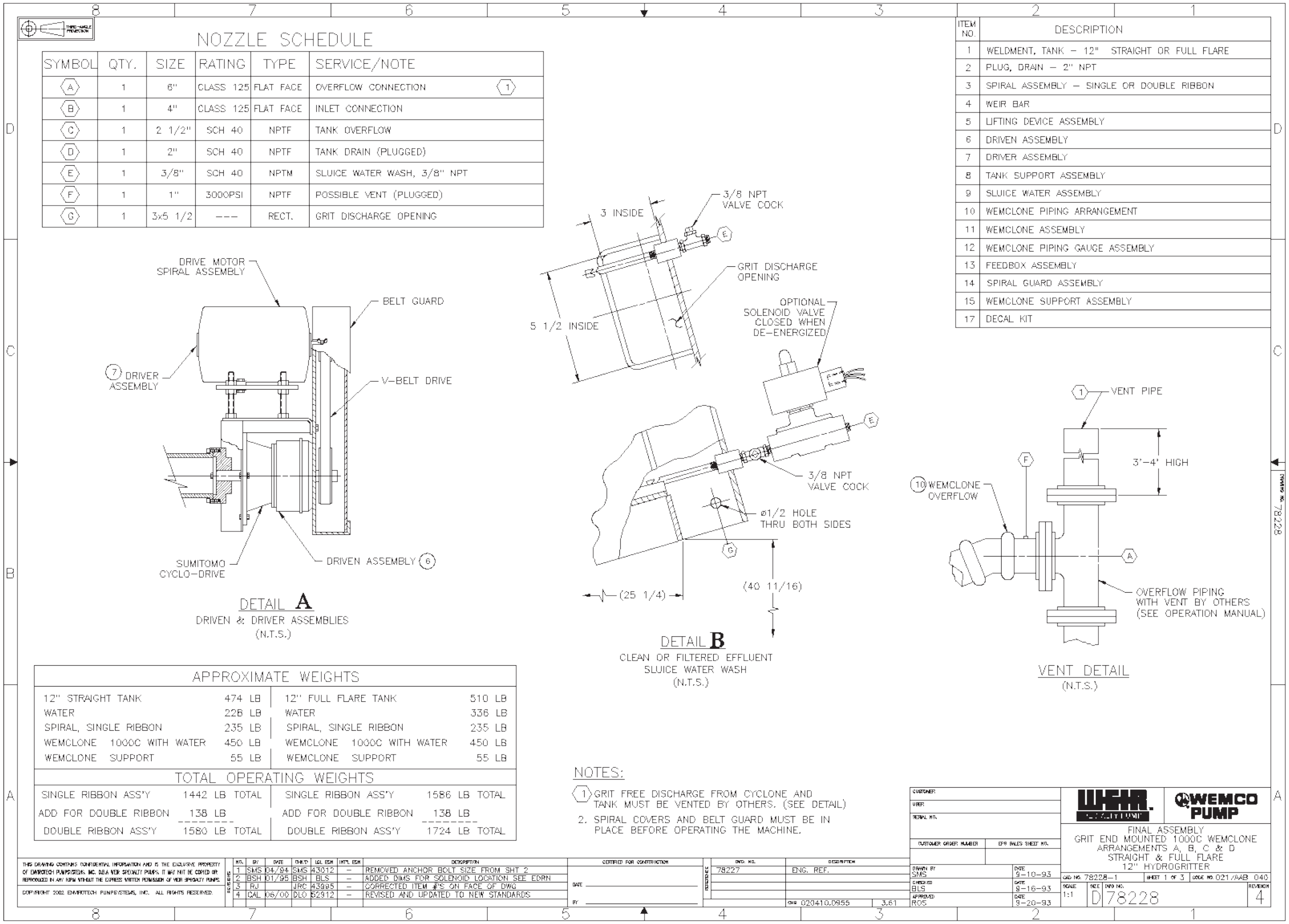
Manufacturer	: WSP Choice
Power	: 0.5 hp
Service factor	: -
Speed	: 1800
Orientation / Mounting	: N/A
Driver type	: -
Frame-size	: 56
Enclosure	: TENV
Hazardous area class	: -
Explosion rating	: -
Volts / Phase / Hz	: -
Insulation	: -
Temperature Rise	: -
Motor mounted by	: WSP

Accessories

Torque Limiter	: No torque limiter
Zero Speed	: -
Manufacturer	: -
Gland Material	: -
Seal Face Mat'l	: -
Throat Bushing	: N/A
Seal Flush Plan	: -
Seal Flush Construction	: -

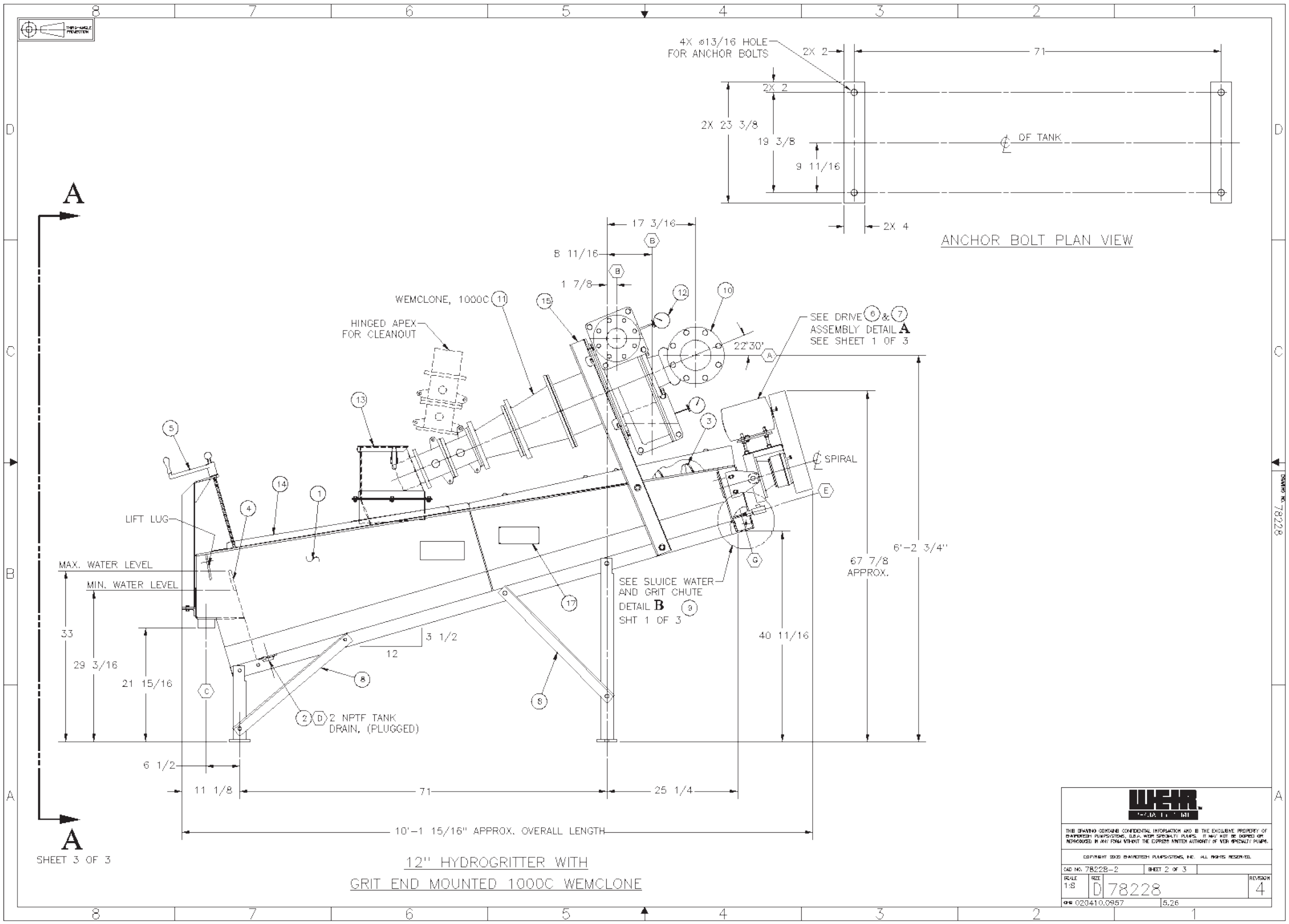
General Arrangement Drawing

Customer	: APSCO - Municipal	Quote number	: 363342
Customer reference	:	Size	: WEMCO Hydrogritter 12" Full Flare - Grit End
Item number	: 001	Stages	: 1
Service	: Grit Separation	Pump speed	: 0
Quantity of pumps	: 1.0	Date last saved	: 08 Aug 2014 10:38 AM



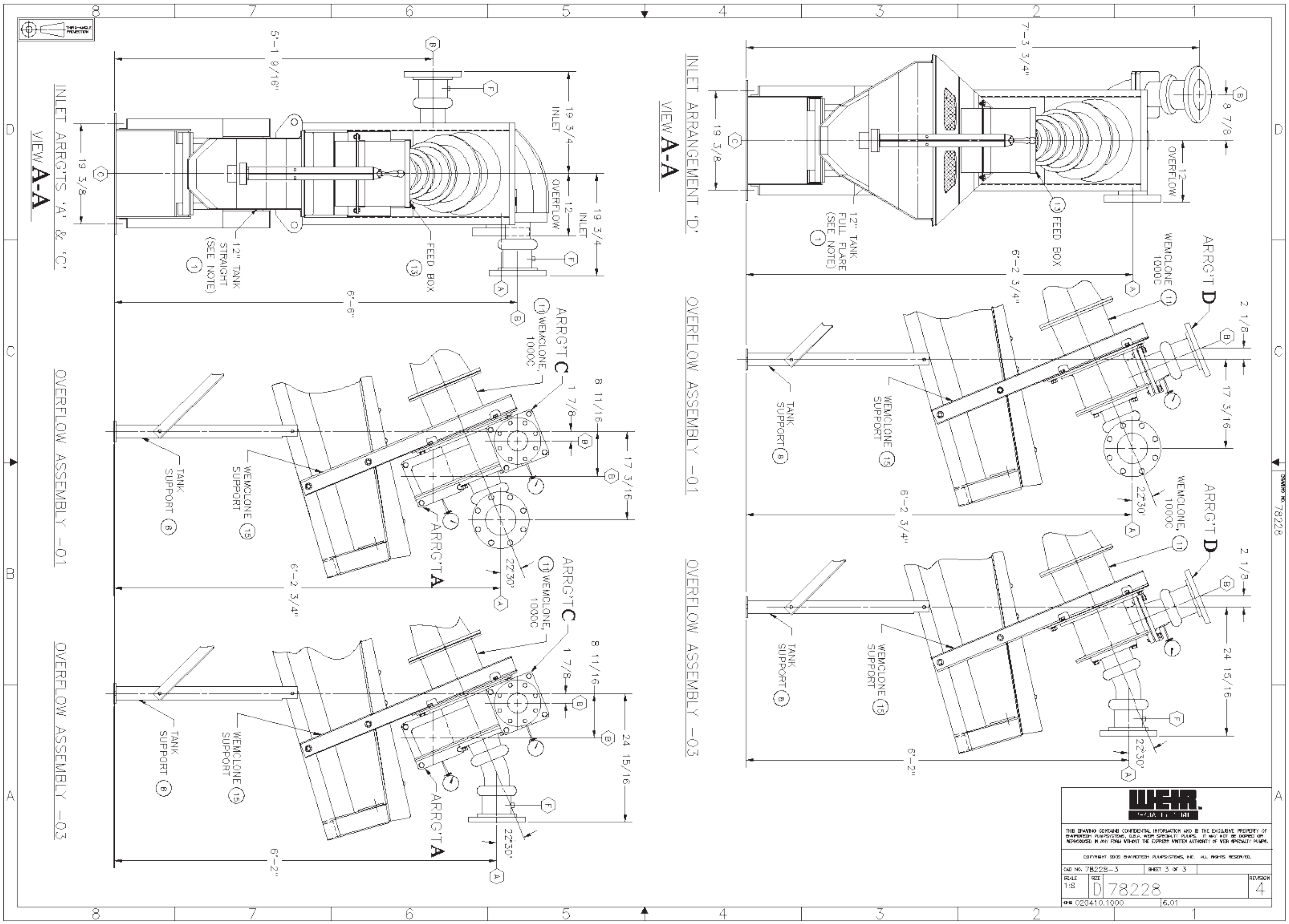
General Arrangement Drawing

Customer	: APSCO - Municipal	Quote number	: 363342
Customer reference	:	Size	: WEMCO Hydrogritter 12" Full Flare - Grit End
Item number	: 001	Stages	: 1
Service	: Grit Separation	Pump speed	: 0
Quantity of pumps	: 1.0	Date last saved	: 08 Aug 2014 10:38 AM



General Arrangement Drawing

Customer	: APSCO - Municipal	Quote number	: 363342
Customer reference	:	Size	: WEMCO Hydrogritter 12" Full Flare - Grit End
Item number	: 001	Stages	: 1
Service	: Grit Separation	Pump speed	: 0
Quantity of pumps	: 1.0	Date last saved	: 08 Aug 2014 10:38 AM



Julia Sheets

From:	Joe Kernkamp <jkernkamp@apsco-llc.com>
Sent:	Friday, August 08, 2014 9:48 AM
To:	Allan Maas
Subject:	Pacific City Hydrogritter
Attachments:	rsz_1apsco-logo-notexture.jpg; ATT00001.htm; Pacific City Parametrix WSP.pdf; ATT00002.htm

Allan,

Please find data for WEMCO Hydrogritter attached.
Budget Price is 55,000

Regards,

Joe

JOE KERNKAMP
PRESIDENT
APSCO LLC
T 425-822-3335
C 206-890-4039
www.apsco-llc.com
jkernkamp@apsco-llc.com

Lite-Span® Aluminum Covers

ALUMINUM STRUCTURES BY
HALLSTEN
CORPORATION
INDUSTRIAL • MARINE • ENVIRONMENTAL
SACRAMENTO, CA (800) 473-7440

Quality•Integrity•Ingenuity

www.hallsten.com

Aluminum Covers

AIR TIGHT

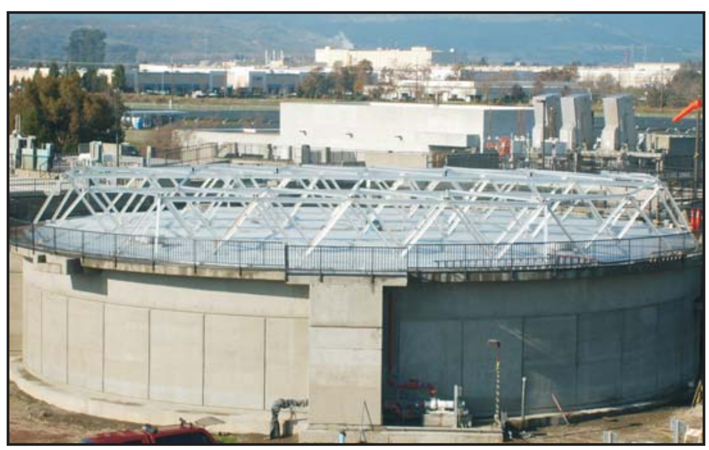
Once installed, the patented double interlocking deck component combined with interlocking beams form a substantially air tight structure. Our unique fabrication techniques and the close design tolerances assure that gases and odors are safely contained. Polymer seals are used between adjoining panels and at the cover perimeter. These replaceable seals allow the thermal expansion and contraction of the cover without compromising the integrity of the joints. Our unique hatch and penetration details provide minimal leakage through these normally troublesome components.

VISUALLY APPEALING

The low profile of the Hallsten Corporation Aluminum Lite-Span Cover provides for a very clean aesthetic appearance. Each component of the system has been designed with an eye towards this aesthetic. A camber is designed into every cover to assure proper drainage of rainwater. This camber can be increased or decreased to vary the aesthetic appearance. The standard mill finish of the aluminum surface components includes a ribbed texture that disguises the unwanted metal appearance common with bent sheet metal covers. Optionally, the cover can be sandblast finished or anodized.

STRUCTURALLY SUPERIOR

The patented design of the Hallsten Corporation Aluminum Lite-Span Cover is structurally superior to any competing cover. Each modular panel can be individually constructed to provide for high load pedestrian paths and working areas. Only Hallsten Corporation can provide a cover with sufficient strength to withstand concentrated loads in excess of 1000 pounds without permanent deformation. Surface dishing from concentrated load over-stressing, so common with bent metal or inferior component based covers, is eliminated with the Hallsten Corporation Aluminum Lite-Span Cover system. The panel and beam configuration allows Hallsten Corporation to design cover structures with extremely high distributed load capacity. The modular configuration provides for unlimited geometric options. Covers can be configured in any shape or size; circular, rectangular or irregular.



Quality•Integrity•Ingenuity

ALUMINUM STRUCTURES BY
HALLSTEN
CORPORATION
INDUSTRIAL • MARINE • ENVIRONMENTAL
SACRAMENTO, CA (800) 473-7440

CHEMICAL RESISTANT

The Hallsten Corporation Aluminum Lite-Span Cover is fabricated entirely of 6061–T6 alloy corrosion resistant aluminum extrusions. Every seal used between adjoining panels is of a corrosion resistant polymer. Even the patented connector between the beam and the panel is a structural polymer that is chemical resistant and will not weaken or corrode. A mechanical and replaceable Santoprene seal isolates the cover perimeter from the concrete or steel tank wall. No foam tape or caulk is used.

ENERGY SAVING

A flat cover, when used with odor control units such as scrubbers and other air handling equipment significantly reduces energy costs. By reducing the volume of the enclosed gases, the size of blowers, fans, ducts and scrubbers can be reduced with a proportional savings in power consumption. This creates an overall savings, both in initial construction cost and operation. If required, the Hallsten Corporation Aluminum Lite-Span Cover can be provided with insulation to minimize heat losses in thermally sensitive processes.

MAINTENANCE FRIENDLY

The modular design of the Hallsten Corporation Aluminum Lite-Span Cover makes maintenance substantially easier than our competitors bent metal or inferior component based covers. The Hallsten Corporation Aluminum Lite-Span Cover's modular sections can be easily removed because there are no corroded sheet metal screws, frozen nuts or wedged seals to hinder access. Each panel can be lifted by hand with only the force of its weight unlike some of our competitors units that require special lifting equipment to pry each panel loose. Each Hallsten Corporation Aluminum Lite-Span Cover is as easy to remove as it is to install assuring total access to process equipment. An optional temporary handrail system is available to protect maintenance workers.

The Hallsten Corporation Aluminum Lite-Span Cover includes an integral non-skid surface. Every panel and beam, regardless of position or load capacity, incorporates this surface. Slip resistance is critical to the safety of all personnel.

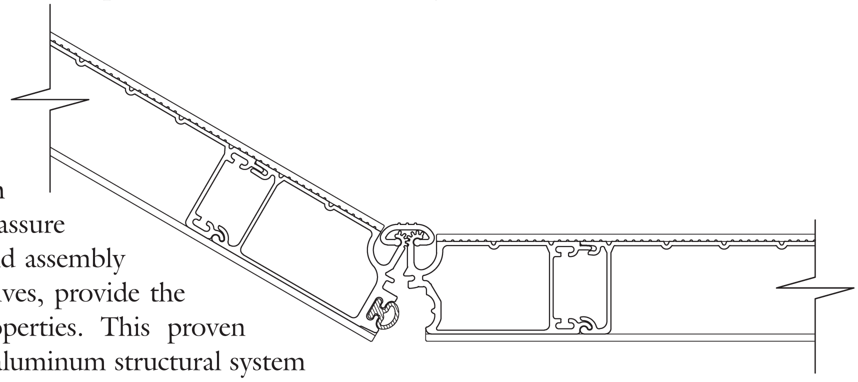
EASY TO INSTALL

The installation of bent metal and inferior component based covers is labor intensive and demands intricate field assembly. By combining fewer parts with modular panel design, Hallsten Corporation is able to reduce installation costs significantly over competitor's designs. This results in a tremendous savings, not only during initial installation, but also in long-term maintenance. A cover that is initially easy to install is also easy to remove and reinstall by plant maintenance personnel should the need ever arise.

SPEC — BID — BUILD, COMPETITION MAKES US COST EFFECTIVE

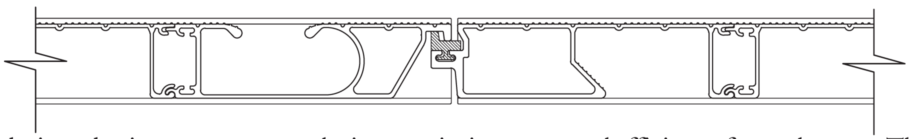
The combination of superior structural design, unique features and easy installation makes the Hallsten Corporation Aluminum Lite-Span Cover the most cost effective cover system available. Structural efficiency, born as a result of the rigorous competition found in municipal projects, results in a design that maximizes performance while considering the bottom line cost to construct.

Efficient and cost effective, the Hallsten Corporation Aluminum Lite-Span Cover is truly an innovation in structural technology. This unique system, the result of years of development, has been awarded numerous United States Patents. Each component has been carefully designed to assure maximum performance. Unique manufacturing and assembly techniques, including the use of specialized adhesives, provide the optimal use of aluminum's special physical properties. This proven technology is a direct descendent of the weld less aluminum structural system developed and patented by Hallsten Corporation for use in the rugged marine environment. With proven performance since 1966, the quality of Hallsten Corporation engineering has passed the test of time.



EFFICIENT

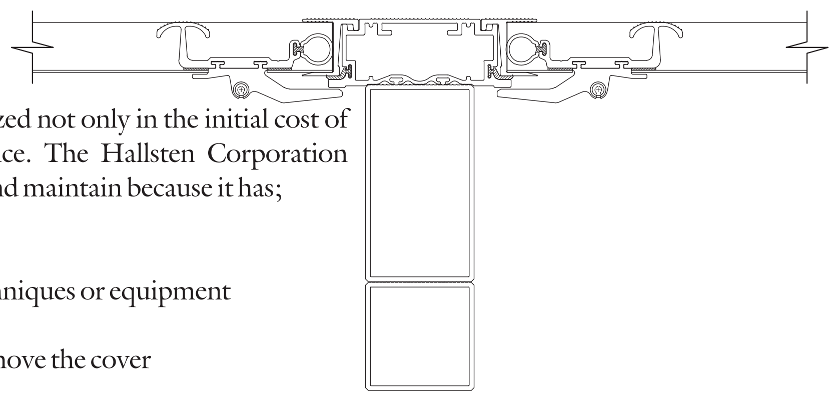
The Hallsten Corporation Aluminum Lite-Span Cover utilizes the efficiencies and simplicity of modular design. Although each cover is individually engineered, each shares a family of common components. This allows Hallsten Corporation to manufacture the cover system in a factory environment employing assembly line techniques and batch processing. The primary structural components, the beams, are sized and designed using computer analysis to optimize structural efficiency for each cover. The stacked beam assembly technique provides the ability to individually optimize each beam on every unique cover structure. Along with the patented Gear Hinged Access Hatch Panel, deck penetrations and other cover accessories are designed and constructed as an integral part of the cover structure. Deck penetration kits can be field installed to assure that there are no mistakes in the coordination of the trades. Course of construction changes can be easily accommodated with this combination of modular factory construction and field installable accessories and penetrations. The Hallsten Corporation Aluminum Lite-Span Cover system has been designed and is manufactured with real world construction in mind.



COST EFFECTIVE

Efficient design results in cost savings. Savings are realized not only in the initial cost of the cover but also in the installation and maintenance. The Hallsten Corporation Aluminum Lite-Span Cover is less expensive to install and maintain because it has;

- No expensive threaded structural fasteners or rivets
- No special labor-intensive installation or removal techniques or equipment
- No independent support system to install or assemble
- No specially trained personnel needed to install or remove the cover



Bottom line, the Hallsten Corporation Aluminum Lite-Span® Cover is less expensive to purchase, install and maintain.

Quality•Integrity•Ingenuity

ALUMINUM STRUCTURES BY
HALLSTEN
CORPORATION
INDUSTRIAL • MARINE • ENVIRONMENTAL
SACRAMENTO, CA (800) 473-7440

Tom Nielsen

From: Allan Maas
Sent: Friday, August 29, 2014 9:12 AM
To: Allan Maas
Subject: Digester covers Hallsten

http://www.hallsten.com/2010_Aluminum_Cover_Brochure.pdf

Budget quote form Mark at 800-473-7440

Digesters 30' dia and 31' by 31' by
For both covers $115,000 including onsite installation

Parametrix
ENGINEERING . PLANNING . ENVIRONMENTAL SCIENCES

Allan Maas, P.E.
Facility Group
253.604.6600 | desk
253-302-1448 | cell
amaas@parametrix.com

1.0 GENERAL DESCRIPTION

One Model 2.5B **PISTA®** grit removal systems, suitable for installation in a concrete structure. Each **PISTA®** shall be complete with the following: drive motor, spur gear final drive head, air bell, propeller, fluidizer vanes, **V-FORCE BAFFLE™**, drive tube, top mounted grit pump, second stage concentrator, and dewatering screw conveyor. Automatic electrical controls in NEMA 4X enclosure and remotely located vacuum priming panel in NEMA 4Xs also included.

2.0 PISTA® GRIT REMOVAL EQUIPMENT

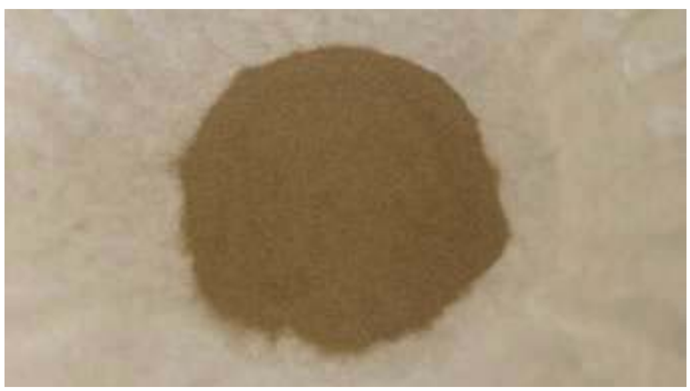
The flow in the removal chamber shall travel between the inlet and outlet a minimum of 360 degrees, providing maximum travel of the liquid for effective grit removal. Each **PISTA®** system shall handle all flows equal to or less than the hydraulic peak flow of 2.5 MGD.

The fluidizing vanes provide mechanical fluidization of the lower hopper and eliminate the need for additional water lines to the chamber. This eliminates at least 20 gpm of continuous water addition or requirement to re-treat of over 10 million gallons per year.

The headloss through the unit with the **V-FORCE BAFFLE™** controlling water levels is less than 2" at the peak flow of 1.7 MGD. Other configurations possible but not recommended.

The **PISTA®** with **V-FORCE BAFFLE ™** shall be capable of removing 95% of grit particles down to 140 mesh (105 micron) particle size.

Fine grit removed by **PISTA®** system.



The standard dimensions of the Model 2.5B **PISTA®** are as follows:

Upper Chamber Diameter	8'-0"
Upper Chamber Depth	4'-8"
Lower Chamber Diameter	3'-0"
Lower Chamber Depth	5'-0"
Inlet & Outlet Channel Widths	2'-0"

3.0 CORROSION PROTECTION

All fabricated steel components shall be commercial blasted and prime coated by the Manufacturer with one 3-mil DFT coat of Tnemec 66-1211 prior to shipment. All motors and gearboxes shall be furnished with the original manufacturer's coating. Final touch up and finish painting is the responsibility of the purchasing contractor. Components in 304 or 316 stainless steel available.

4.0 ITEMS NOT INCLUDED

- Field assembly/erection or installation
- Interconnecting piping, wiring and conduit
- Field paint, painting, and final surface preparation
- Lubricants
- Anchorage, anchor bolts
- Field testing, if required
- Grouting
- All concrete work

Complete **PISTA**® Grit Removal System Installation Photo

5.0 DELIVERY, TERMS, BUDGET PRICING

Submittal drawings and other technical engineering details are expected to be complete in 4-6 weeks after receipt of a purchase order. Once Smith & Loveless receives approved drawings, manufacturing would take 14-16 weeks.

Payment Terms - To be determined

Budget Price List (FOB, Factory) – Offer Valid for 90 days.

One Model 2.5B **PISTA**® System	$140,000
One Carbon Steel Grit Chamber Mechanism	Included
One Top Mounted Turbo Grit Pump with Ni-Hard impeller and volute	Included
One Ni-Hard Concentrator	Included
One Carbon Steel Screw Conveyor	Included
Adder for 304SS Grit Washer in lieu of Carbon Steel Screw Conveyor	$40,000
Freight	Included
Start-up	Included

Stahly Home

About Stahly

What's New

Products

GPS Systems

Used Equipment

Parts/Accessories

Services

Customer Support

Truck Equipment

Contact Us

Map/Directions

Employment Opportunities

New Equipment from Stahly

Stahly Home

Knight Manure Spreader

back to New Equipment

Stahly Peterbilt Knight 8132

click for larger picture

click for larger picture

click for larger picture

Spread

Spreads most types of vegetable waste, paper, gin trash, bio-solids and many other farm and industrial waste.

Bed

The Bedder Spreader is ideal for filling open housing with straw, corn fodder or other bedding materials.

Mulch

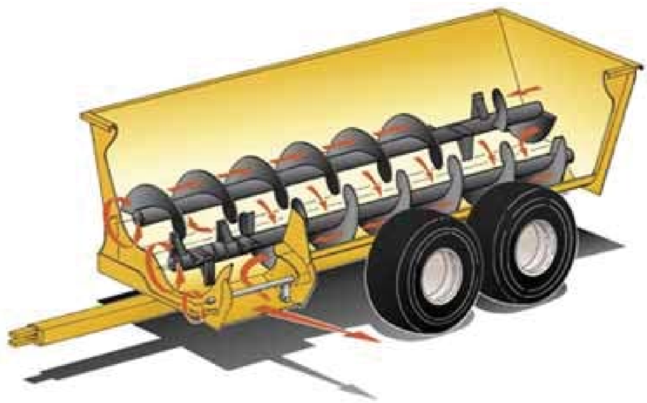
Mulch can be applied to orchards, nursery shrubs, new seeding, golf courses or any other application.

Now more versatile with the Bedder Spreader

- Saves time, labor and bedding
- Fast, efficient and convenient operation
- Even distribution of bedding
- Adjustable spread width Dual purpose - Spreader or Bedder

Farm Equipment with Innovative Material-Flow Design

Examine the material flow in the illustration below and note that the left auger moves material forward to the discharge hammers. The slightly raised right auger moves the material rearward while keeping the left auger evenly charged with material. It is this patented circulating action that makes the ProTwin so effective in handling the toughest material encountered in most applications.



Hammer Discharge with Forged-Steel Hammers

This Manure Spreader features the patented discharge design includes forge-steel, free-swinging hammers that fold back to absorb shock from most foreign objects.

More NEW Systems Available from Stahly
ExtraLite 1200XL 4x4 Sprayer | Pre / Post / Dry Combo | Aggressor Systems | Split System
QuadTrax 4x4 Sprayer | Pull Type Trailers | Peterbilt 4340 | Navistar
Sludge, Biosolids, Compost, Manure, Knight | Lime Wagons and Stabilization
New Leaders: L4000G4 | L5034G4 Compost Spreader | L4000G MultiBin Spreader

---

Stahly New Equipment • Setting the Standard Since 1976
P.O. Box 1425 • Bloomington, Illinois 61702 • **Telephone:** 1-800-678-2459 • Fax: 1-309-662-5409
Contact Us • **www.Stahly.com**

Julia Sheets

From: Julia Sheets
Sent: Wednesday, September 03, 2014 9:37 AM
To: Tom Nielsen
Cc: Allan Maas
Subject: Stahly Manure Spreader

Tom and Allan,

Spoke with Terry Stahly, and he gave me a price range for the Peterbuilt Knight 8132 of $270,000 to $300,000 depending on if we want the truck to be hydrostatic (adds about $15,000 to the price). This price range includes everything – the box, truck, and installation. He gave me a size range of 323 cf to 435 cf.

He said he will send me a more accurate quote tomorrow morning, which I will forward along to both of you.

Let me know if you have any questions.

Julia

Parametrix
ENGINEERING . PLANNING . ENVIRONMENTAL SCIENCES

Julia Sheets, EIT
Water Solutions Engineer
503.233.2400 | main
503.416.6107 | direct

Tom Nielsen

From: Bill Reilly <bill@whreilly.com>
Sent: Friday, September 05, 2014 1:09 PM
To: Tom Nielsen
Cc: Kim Batiste
Subject: Pacific City Trojan UV3000B

Tom,

As a follow up to our conversation today, current budget pricing for a 64 lamp, 3000B system with 2 banks at 32 lamps per bank is $85,000. This includes the UV modules, System Control Center, level control weir, two intensity sensors, two mounting racks, two Power Distribution Centers, maintenance/cleaning rack, freight and one day start up service.

I hope this helps. Please let me know if you need anything else at this time.

Thanks.

Bill

Bill Reilly | Wm. H. Reilly & Co.
503-223-6197 Office | 503-223-0845 Fax | 503-314-8386 Cell
Bill@whreilly.com

TROJANUV3000™PTP | TROJANUV3000™B

Robust, operator-friendly solutions designed for economical disinfection

System Monitor/Control Center

TrojanUV3000™PTP – Optional

The optional System Monitor includes a submersible UV sensor, and provides digital output of UV intensity at each bank. Elapsed time display provides continuous readout of actual hours of operation (lamp hours). A dry contact enables a remote low UV intensity alarm.

TrojanUV3000™B

The System Control Center (SCC) provides control of all UV functions, tracks lamp hours, and uses a submersible UV sensor (one per bank) to monitor UV intensity. The SCC is capable of “flow pacing” – automatically turning banks of UV lamps off or on in response to changes in the flow rate in order to conserve power and prolong lamp life.

Water Level Control

TrojanUV3000™PTP

A fixed weir maintains the correct channel effluent depth over different flow rates, with maximum headloss of 1.5 inches (3.8 cm) at peak flow. Equipped with a drain for easy channel cleaning, and available for both concrete channels and stainless steel channel option.

TROJANUV3000™PTP | TROJANUV3000™B

System Specifications

System Characteristics	TrojanUV3000™PTP	TrojanUV3000™B
Typical Applications	Up to 3 MGD (473 m^3/hr)	1 – 5 MGD (158 – 789 m^3/hr)
Lamp Type	Low-pressure	
Ballast Type	Electronic; non-variable	
Input Power Per Lamp	45 or 87.5 Watts	87.5 Watts
Lamp Configuration	Horizontal, parallel to flow	
Module Configuration	2 or 4 lamps per module	4, 6 or 8 lamps per module
Bank Configuration	Up to 10 modules per bank	Up to 20 modules per bank
Channel Configurations		
Lamp Banks in Series	Up to 2	Up to 3
Channel Options	Stainless Steel (Trojan option) or Concrete (by others)	Concrete (by others)
Flanged Transition Connections	Optional for stainless steel channels	—
U-Turn Connector Box	Optional for stainless steel channels	—
Level Control Device Options	Fixed weir	ALC gate or fixed weir
Enclosure Ratings		
System Monitor/Control Center	304 stainless steel	
Ballast Enclosure	TYPE 6P (IP67)	
Ballast Cooling Method	Convection; no air conditioning or forced air required	
Installation Location	Indoor or outdoor	
System Monitoring & Controls		
Controller	Optional; Monitoring only	Monitoring and bank control
UV Intensity Monitoring	Optional	Optional
Flow Pacing	—	Optional
Inputs Required	None	4-20 mA flow signal for Flow Pacing
Local Status Indication	Lamp Age (hours) UV Intensity (mW/cm^2) Bank Status (on/off) Low Intensity Alarm Lamp Failure Alarm	
Remote Alarms	UV Intensity (4-20 mA) Common Alarm (discrete)	
Location	Indoor or outdoor	
Maximum Distance from UV Channel	15 ft. (4.5 m)	20 ft. (6 m)
Electrical Requirements		
Power Distribution	Individual GFI Receptacles	Power Distribution Centre
Quantity Required	1 receptacle per 2 modules	1 PDC per bank
Power Input	120V, single phase	120V, single phase 208V, 3-phase 240V, single phase

Find out how your wastewater treatment plant can benefit from the TrojanUV3000™PTP or TrojanUV3000™B – call us today.

Head Office (Canada)
3020 Gore Road
London, Ontario
Canada N5V 4T7
Telephone: (519) 457-3400
Fax: (519) 457-3030

www.trojanuv.com

Trojan UV Technologies UK Limited (UK): +44 1905 77 11 17
Trojan Technologies (The Netherlands): +31 70 391 3020
Trojan Technologies (France): +33 442 53 18 21
Trojan Technologies Italia (Italy): +39 02 39231431
Trojan Technologies Espana (Spain): +34 91 564 5757
Trojan Technologies Deutschland GmbH (Germany): +49 6024 634 75 80
Hach/Trojan Technologies (China): 86-10-65150290

Diffused Aeration Equipment

for

Pacific City, OR

Digester 1

Sanitaire #25256-14s

August 1, 2014

sm - 2014.07.31 Dig1 D24 Setup.aer

Sanitaire Aeration Design Inputs for: Pacific City, OR, Sanitaire #25256-14s

Tank Geometry

1 Train Consisting of:

Parameter	Units	Pass 1
Parallel Reactors		1
Pass Process		Aerobic
SWD	ft	10.5
Submergence	ft	9.5
Volume	ft³	6,935.5
Reactor Geometry:		Circle
Diameter	ft	29.0

Oxygen/Air Distribution

	Zone	1
	Pass	1
Default		100.0%

Oxygenation

Parameter	Units	Air Rate
No. Trains Operating		1
Air Rate	scfm	240.0

Standard Oxygen Correction Factor Parameters

Parameter	Units	Air Rate
Site Elevation	FASL	10
Ambient Pressure	PSIA	14.70
Water Temperature	°C	20

Notes:

Bold, Italicized text indicate assumptions made by Sanitaire

A - Indicates Actual (AOR) Requirement.

S - Indicates Standard Condition (SOR) Oxygen requirement.

If the AOR/SOR parameter is not given, then its value will be evaluated later if suitable alpha, beta, D.O., theta, pressure, and temperature data is supplied.

Round tanks are evaluated as rectangular tanks diameter equal to length and equal surface area.

Annular tanks are evaluated as rectangular tanks of width equal to the annular width and equal surface area.

Sanitaire Project Name: Pacific City, OR
Sanitaire Project #25256-14s
Design Summary

	Units	Air Rate Default
No. Trains in Operation		1
No. Grids in Operation		1
No. Operating Diffusers		12
SOR	lb/day	406.8
SOTE	%	6.8
Total Air Rate	scfm	240.0
Min.Diffuser Air Rate	scfm/diff.	20.0
Max. Diffuser Air Rate	scfm/diff.	20.0
Static Pressure	psig	4.11
Diffuser DWP @ Min Air	psig	0.16
Diffuser DWP @ Max Air	psig	0.16
Pressure @ Top of Dropleg	psig	4.31
Est. Blower Efficiency		70%
Est. Motor Efficiency		90%
Shaft Power	Bhp	6.22
Est. Motor Electrical Load	kW	5.15
Est. Standard Aeration Efficiency	#SOR/BHP-hr	2.73

Notes:

(1) Design air is the maximum of process air or mixing air

(2) Delivered oxygen based on design air

(3) Brake Horsepower based on adiabatic compression, 70% mechanical efficiency and 0.30 psi lineloss

(4) Performance based on diffuser density (At/Ad), submergence, and diffuser unit air flow.

(5) Diffuser Air Flow based on Active Valve Modulation

(6) Blower Pressure Capability also requires consideration of:

A. The Air Main headloss (piping, fittings, valves, instrumentation, etc.) between the blower and the aeration assembly dropleg connections.

B. Potential for increased headloss resulting from diffuser fouling and/or aging. Please refer to the US EPA Fine Pore Design Manual (EPA/625/1-89/023), WEF Manual of Practice FD-13, and other

technical publications for a detailed discussion on this subject. Note that this headloss consideration relates to all Fine Pore systems regardless of supplier or type of diffuser element.

C. Increased diffuser submergence during Peak Flow conditions.

(7) Air Flow defined at 20°C

scfm/ft^2

Sanitaire Project Name: Pacific City, OR
Sanitaire Project #25256-14s
Consulting Engineer:
Operating Condition: Air Rate
Oxygen Distribution: Default

Aeration System Design

Parameter	Units	Zone 1	Totals/Overall
Pass		1	
SWD	ft	10.50	
Subm	ft	9.50	
Volume	ft^3	6,935.5	6,935.5
No. Parallel Tanks		1	
No. Trains in Operation		1	
Grid Count		1	1
Dropleg Diameter	inches	4	
Bandwidth	ft	12.8503	
Header Placement		Midwidth	
Diffusers/Grid		12	12

Oxygen Transfer

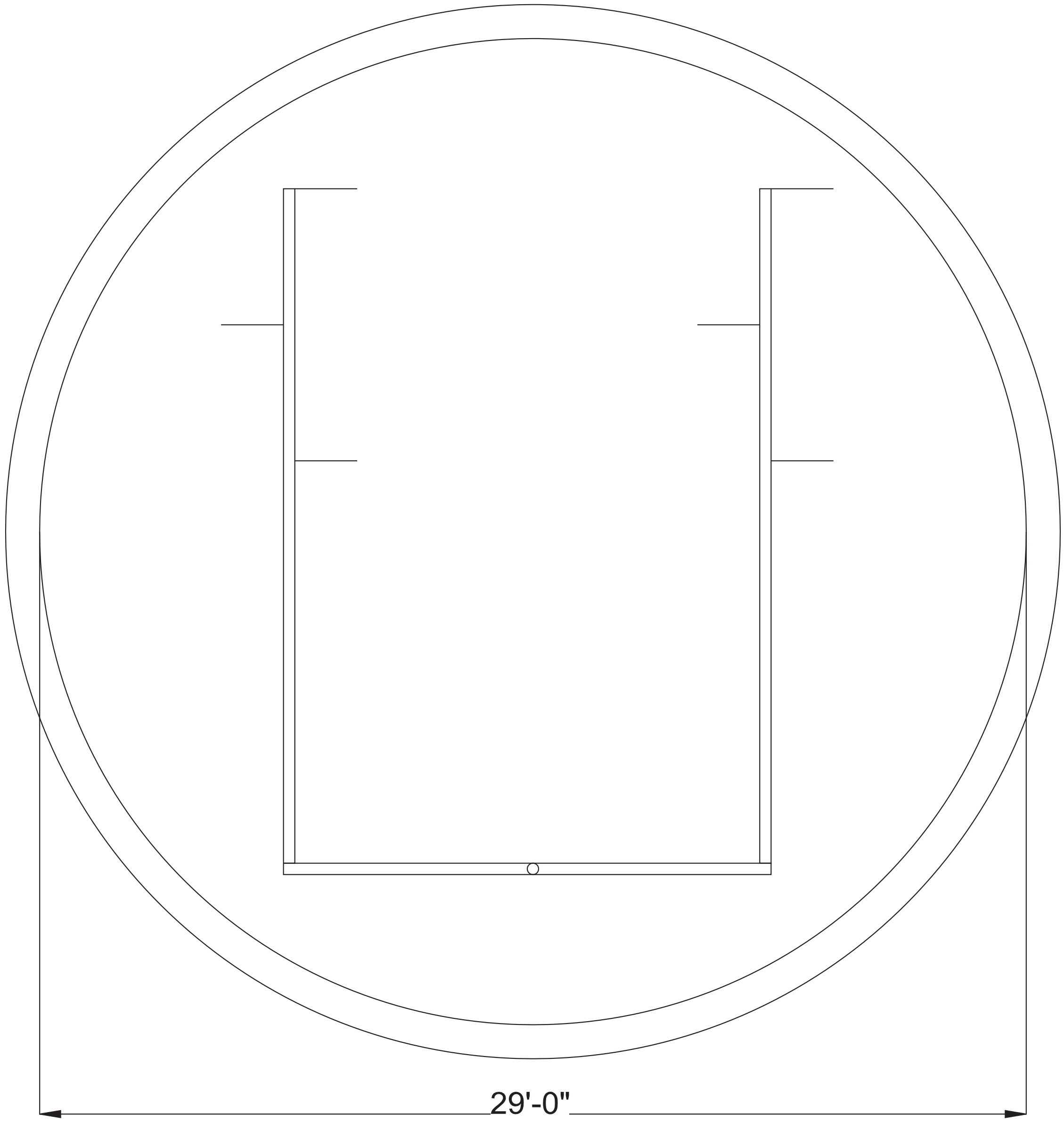
Diffuser Type		D24-FH	
Alpha			
Beta			
Theta			
D.O.	mg/l		
Water Temp	°C	20	
AOR/SOR			
Oxygen Distribution	%/Zone	100.0%	100.0%
AOR	lb/day		
SOR	lb/day		
Air Rate (7)	scfm	240.0	240.0

Performance

Mixing Criteria	$scfm/ft^2$		
Safety Factor	%		
Mixing Air (8)	scfm		
Process Air (for SOR)	scfm	240.0	
Design Air (1,7)	scfm	240.0	240.0
Diffuser Air Rate	scfm/Diff.	20.00	20.00
Delivered SOR	lb/day	406.8	406.8
Delivered SOTE	%	6.8%	6.8%
Pressure @ Top of Dropleg	psig	4.31	4.31
Shaft Power	Bhp	6.2	6.2

Notes:

(1) Design air is the maximum of process air or mixing air
(2) Delivered oxygen based on design air
(3) Brake Horsepower based on adiabatic compression, 70% mechanical efficiency and 0.30 psi lineloss
(4) Performance based on diffuser density (At/Ad), submergence, and diffuser unit air flow.
(5) Diffuser Air Flow based on Active Valve Modulation
(6) Blower Pressure Capability also requires consideration of:
A. The Air Main headloss (piping, fittings, valves, instrumentation, etc.) between the blower and the aeration assembly dropleg connections.
B. Potential for increased headloss resulting from diffuser fouling and/or aging.
Please refer to the US EPA Fine Pore Design Manual (EPA/625/1-89/023), WEF Manual of Practice FD-13, and other technical publications for a detailed discussion on this subject. Note that this headloss consideration relates to all Fine Pore systems regardless of supplier or type of diffuser element.
C. Increased diffuser submergence during Peak Flow conditions.
(7) Air Flow defined at 20°C
$scfm/ft^2$



Dropleg	11'-6"@4"Ø	
Manifold	14'-0"@4"Ø	
Header(s) 1,2	20'-0"@4"Ø	6 D-24 Diffusers

12 D-24 Diffusers/Tank

Note: Connectors spaced at 4'-0"

PRELIMINARY - THIS DRAWING IS NOT INTENDED FOR CONTRACT DOCUMENTS, SUBMITTALS, OR CONSTRUCTION

Sanitaire a xylem brand BROWN DEER, WISCONSIN 53223	CUST NO.	THIS DRAWING IS THE PROPERTY OF XYLEM AND IS SUBMITTED IN CONFIDENCE. IT IS NOT TO BE DISCLOSED, USED OR DUPLICATED WITHOUT PERMISSION OF XYLEM.	Pacific City, OR Stainless Steel Header Aeration System	DRAWN BY	DATE 8/1/14	JOB 25256-14s
	DWG NO.			CHKD BY	DATE	SHEET
				APPVD BY	DATE	

Diffused Aeration Equipment

for

Pacific City, OR

Digester 2

Sanitaire #25256-14s
August 1, 2014
sm - 2014.07.31 Dig2 D24 Setup.aer

Sanitaire Aeration Design Inputs for: Pacific City, OR, Sanitaire #25256-14s

Tank Geometry

1 Train Consisting of:

Parameter	Units	Pass 1
Parallel Reactors		1
Pass Process		Aerobic
SWD	ft	12.0
Submergence	ft	11.0
Volume	ft^3	13,467.0
Reactor Geometry:		Square
Length	ft	33.5
Width	ft	33.5

Oxygen/Air Distribution

	Zone	1
	Pass	1
Default		100.0%

Oxygenation

Parameter	Units	Air Rate
No. Trains Operating		1
Air Rate	scfm	420.0

Standard Oxygen Correction Factor Parameters

Parameter	Units	Air Rate
Site Elevation	FASL	10
Ambient Pressure	PSIA	14.70
Water Temperature	°C	20

Notes:

Bold, Italicized text indicate assumptions made by Sanitaire

A - Indicates Actual (AOR) Requirement.

S - Indicates Standard Condition (SOR) Oxygen requirement.

If the AOR/SOR parameter is not given, then its value will be evaluated later if suitable alpha, beta, D.O., theta, pressure, and temperature data is supplied.

Round tanks are evaluated as rectangular tanks diameter equal to length and equal surface area.

Annular tanks are evaluated as rectangular tanks of width equal to the annular width and equal surface area.

Sanitaire Project Name: Pacific City, OR
Sanitaire Project #25256-14s
Design Summary

	Units	Air Rate Default
No. Trains in Operation		1
No. Grids in Operation		1
No. Operating Diffusers		20
SOR	lb/day	805.2
SOTE	%	7.7
Total Air Rate	scfm	420.0
Min.Diffuser Air Rate	scfm/diff.	21.0
Max. Diffuser Air Rate	scfm/diff.	21.0
Static Pressure	psig	4.76
Diffuser DWP @ Min Air	psig	0.17
Diffuser DWP @ Max Air	psig	0.17
Pressure @ Top of Dropleg	psig	4.97
Est. Blower Efficiency		70%
Est. Motor Efficiency		90%
Shaft Power	Bhp	12.28
Est. Motor Electrical Load	kW	10.18
Est. Standard Aeration Efficiency	#SOR/BHP-hr	2.73

Notes:

(1) Design air is the maximum of process air or mixing air

(2) Delivered oxygen based on design air

(3) Brake Horsepower based on adiabatic compression, 70% mechanical efficiency and 0.30 psi lineloss

(4) Performance based on diffuser density (At/Ad), submergence, and diffuser unit air flow.

(5) Diffuser Air Flow based on Active Valve Modulation

(6) Blower Pressure Capability also requires consideration of:

A. The Air Main headloss (piping, fittings, valves, instrumentation, etc.) between the blower and the aeration assembly dropleg connections.

B. Potential for increased headloss resulting from diffuser fouling and/or aging. Please refer to the US EPA Fine Pore Design Manual (EPA/625/1-89/023), WEF Manual of Practice FD-13, and other

technical publications for a detailed discussion on this subject. Note that this headloss consideration relates to all Fine Pore systems regardless of supplier or type of diffuser element.

C. Increased diffuser submergence during Peak Flow conditions.

(7) Air Flow defined at 20°C

scfm/ft²

Sanitaire Project Name: Pacific City, OR
Sanitaire Project #25256-14s
Consulting Engineer:
Operating Condition: Air Rate
Oxygen Distribution: Default

Aeration System Design

Parameter	Units	Zone 1	Totals/Overall
Pass		1	
SWD	ft	12.00	
Subm	ft	11.00	
Volume	ft³	13,467.0	13,467.0
No. Parallel Tanks		1	
No. Trains in Operation		1	
Grid Count		1	1
Dropleg Diameter	inches	6	
Bandwidth	ft	16.75	
Header Placement		Midwidth	
Diffusers/Grid		20	20

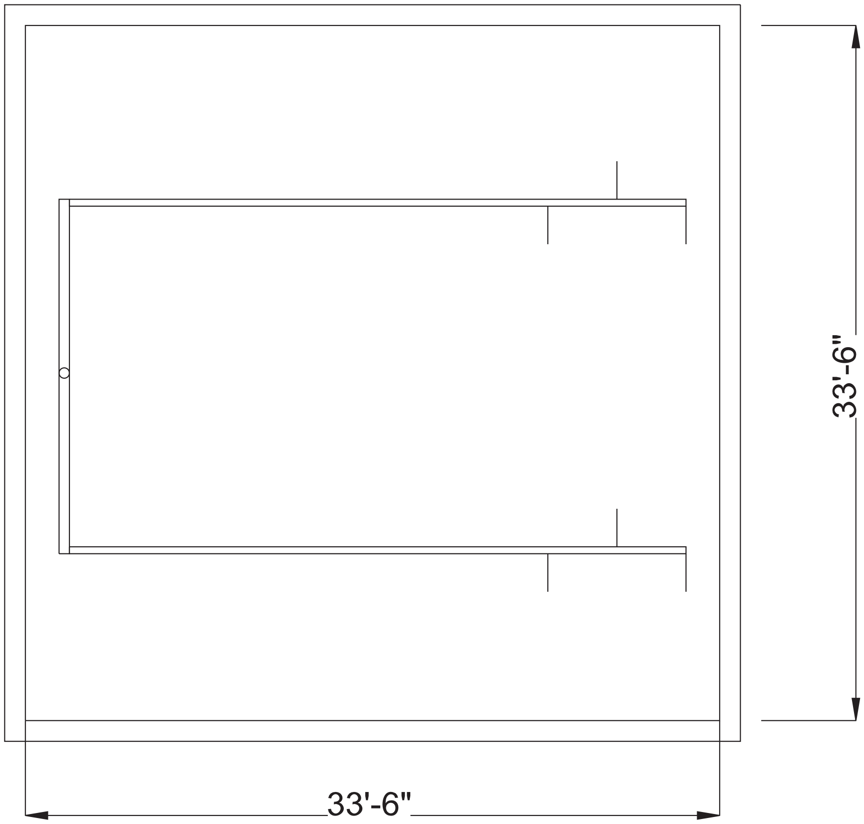
Oxygen Transfer

Parameter	Units	Zone 1	Totals/Overall
Diffuser Type		D24-FH	
Alpha			
Beta			
Theta			
D.O.	mg/l		
Water Temp	°C	20	
AOR/SOR			
Oxygen Distribution	%/Zone	100.0%	100.0%
AOR	lb/day		
SOR	lb/day		
Air Rate (7)	scfm	420.0	420.0

Performance

Parameter	Units	Zone 1	Totals/Overall
Mixing Criteria	scfm/ft²		
Safety Factor	%		
Mixing Air (8)	scfm		
Process Air (for SOR)	scfm	420.0	
Design Air (1,7)	scfm	420.0	420.0
Diffuser Air Rate	scfm/Diff.	21.00	21.00
Delivered SOR	lb/day	805.2	805.2
Delivered SOTE	%	7.7%	7.7%
Pressure @ Top of Dropleg	psig	4.97	4.97
Shaft Power	Bhp	12.3	12.3

Notes:
(1) Design air is the maximum of process air or mixing air
(2) Delivered oxygen based on design air
(3) Brake Horsepower based on adiabatic compression, 70% mechanical efficiency and 0.30 psi lineloss
(4) Performance based on diffuser density (At/Ad), submergence, and diffuser unit air flow.
(5) Diffuser Air Flow based on Active Valve Modulation
(6) Blower Pressure Capability also requires consideration of:
A. The Air Main headloss (piping, fittings, valves, instrumentation, etc.) between the blower and the aeration assembly dropleg connections.
B. Potential for increased headloss resulting from diffuser fouling and/or aging.
Please refer to the US EPA Fine Pore Design Manual (EPA/625/1-89/023), WEF Manual of Practice FD-13, and other technical publications for a detailed discussion on this subject. Note that this headloss consideration relates to all Fine Pore systems regardless of supplier or type of diffuser element.
C. Increased diffuser submergence during Peak Flow conditions.
(7) Air Flow defined at 20°C
scfm/ft²



Dropleg	13'-0"@6"Ø	
Manifold	16'-9"@6"Ø	
Header(s) 1,2	30'-0"@4"Ø	10 D-24 Diffusers

20 D-24 Diffusers/Tank

Note: Connectors spaced at 3'-3"

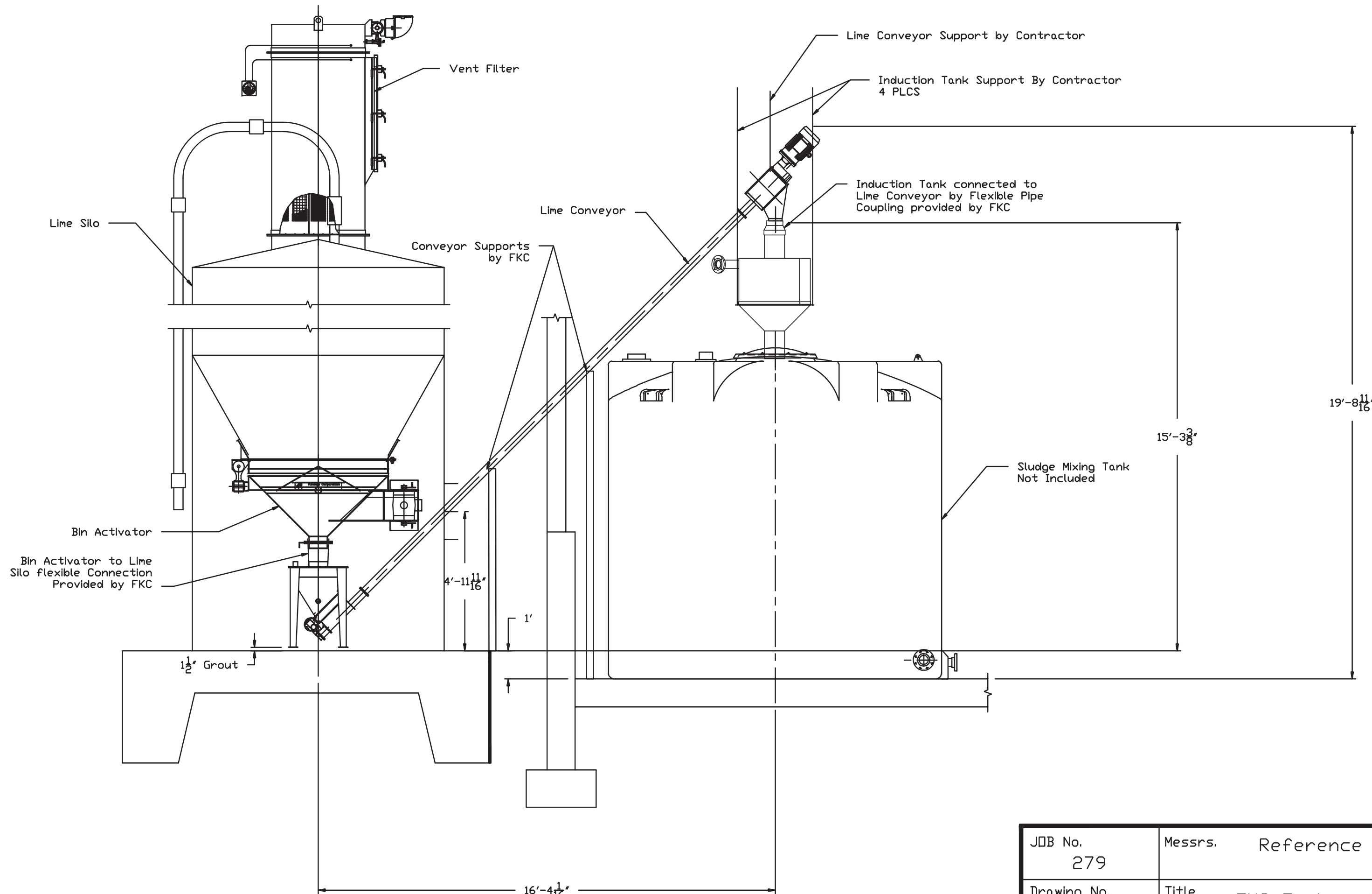
PRELIMINARY - THIS DRAWING IS NOT INTENDED FOR CONTRACT DOCUMENTS, SUBMITTALS, OR CONSTRUCTION

Sanitaire a xylem brand BROWN DEER, WISCONSIN 53223	CUST NO. / DWG NO.	THIS DRAWING IS THE PROPERTY OF XYLEM AND IS SUBMITTED IN CONFIDENCE. IT IS NOT TO BE DISCLOSED, USED OR DUPLICATED WITHOUT PERMISSION OF XYLEM.	Pacific City, OR Stainless Steel Header Aeration System	DRAWN BY / CHKD BY / APPVD BY	DATE 8/1/14 / DATE / DATE	JOB 25256-14s / SHEET

A. Proposed Equipment –

4. Ancillary Equipment

Ancillary Equipment	**<u>Unit Price Delivered</u>**
<u>Quicklime Storage and Feed System including:</u> Columbia TecTank 9 feet x 25.19 feet straight wall high 5 foot diameter Metalfab bin activator Three (3) Bin Level Indicators Fill Pipe – 4” pipe and fittings as required IAC Shaker Style Bin Vent Filter Metalfab FSC4-20 Flexable Screw Conveyor FKC Inductor Tank	**US$ 150,000**



No.	Alteration	Date	Sign.

JOB No. 279	Messrs. Reference	Quantity 1	Wt Lbs.
Drawing No. L279-102	Title FKC Equipment	Date 2/4/13	
		Drawn by RTB	Ref. JOB No.
FKC CO., LTD.	2708 W, 18TH ST. PORT ANGELES, WA 98363 (360) 452-9472 FAX (360) 452-6880	REVISION 2	SHEET 1 OF 1

G2. Activated Sludge Design Criteria, BioWin Model Results, and Vendor Data

G2.1. Activated Sludge Design Criteria

Activated Sludge Process Design Criteria

	2035	2024
	Phase 2	Phase 1
Design Flow		
Avg Day	0.230 MGD	0.175 MGD
Max Mon	0.315 MGD	0.24 MGD
Max Day	0.633 MGD	0.483 MGD
Max Hr	1.70 MGD	1.30 MGD
Max hr Post FEB	1.01 MGD	1.01 MGD
Design Load		
Avg BOD_5	767 lbs/day	584 lbs/day
Max Mo BOD_5	1,029 lbs/day	783 lbs/day
Max Mon TSS	1,242 lbs/day	909 lbs/day
Max Mon NH_3	100 lbs/day	76 lbs/day
Screen		
Qty	2	
Capacity		
Washer Compactor	1	
Influent Pump Stn		
Pump Qty	2	2
Capacity gpm ea.	425	425
Grit Chamber		
Dia, ft	8	
Capacity (MGD)	2.5	
Grit Classifier	1	
Parshall Flume		
Throat, inches	6	
FEB		
Volume, ft^3	8,128	
Pump Qty	3	4
Pump Capacity (gpm ea.)	400	400
Blowers	2	
Aeration Tanks		
Aeration Tanks	4	3
Aeration ft^3 total	34,425	25,819
Aeration MLSS (mg/l)	2,900	
Blower, Qty	5	4
CFM/tank	150	
Mixers (1/tank)	4	3

Activated Sludge Process Design Criteria

	2035	2024
	Phase 2	Phase 1
Secondary Clarifiers		
Qty	2	
Avg Depth	15	
Diameter	35	
Peak Hr Overflow Rate gpd/ft2	610	
RAS Pumps	3	
Capacity (gpm each)	240	
WAS Pumps	3	
Capacity (gpm each)	34	
Effluent Holding Tank		
Volume (ft^3)	4000	
Pump Qty	3	
Pump Capacity (gpm ea.)	350	
Effluent Cloth Filters		
Qty	3	
Capacity, MGD	2	
UV Disinfection		
Capacity (MGD)	2	2
Channels =2, banks per channel = 2		
Dosage per Bank = 30,500 microwatts sec/cm^2		
Digesters		
Qty	3	
No. 1 Volume (ft^3)	7,926 existing	
Blower HP	15	
No. 2 &3 Volume Total (ft^3)	21,694 new	
Blower HP	25	
lbs biosolids/day, Max Month	554	
Days of Detention, Max Month	40	
Biosolids Dewatering		
Belt Press Width (meters)	0.5	
Capacity (dry lbs/hr)	230	
Capacity (gpm)	30	
Lime Mixing System		
Lime (lb/lb dry solids)	0.35	
Storage Volume (ft^3)	1,200	
Spreader Truck		
Capacity, cubic yards	10	

G2.2. Activated Sludge BioWin Model Results

BioWin user and configuration data

Project details

Project name: MLE Process **Project ref.: BW4**

Plant name: Pacific City **User name: Dr K**

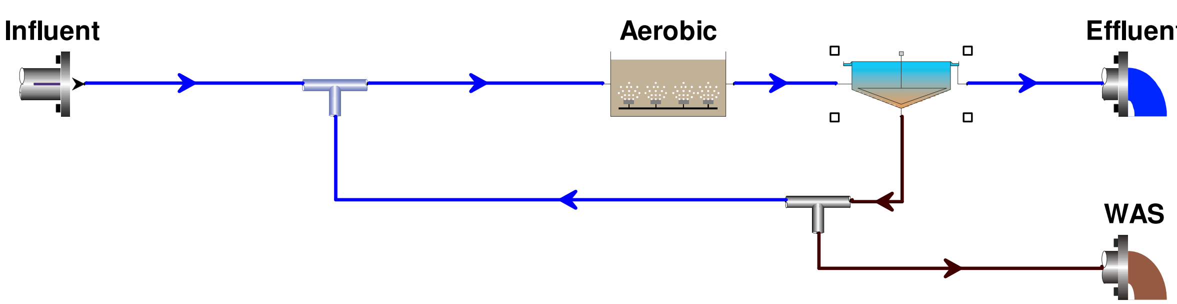
Created: 9/30/2014 **Saved: 9/30/2014**

Steady state solution

SRT: 7.18 days

Temperature: 20.0℃

Flowsheet



Configuration information for all Bioreactor units

Physical data

Element name	Volume [gallons]	Area [ft2]	Depth [ft]	# of diffusers
Aerobic	260,000	2482.6390	14.000	563

Operating data Average (flow/time weighted as required)

Element name	Average Air flow rate [ft3/min (20C, 1 atm)]
Aerobic	600.0

Aeration equipment parameters

Element name	k1 in C = k1(PC)^0.25 + k2	k2 in C = k1(PC)^0.25 + k2	Y in Kla = C Usg ^ Y - Usg in [m3/(m2 d)]	Area of one diffuser	% of tank area covered by diffusers [%]
Aerobic	2.5656	0.0432	0.8200	0.4413	10.0000

600 cfm air feed

Configuration information for all Model clarifier units

Physical data

Element name	Volume[gallons]	Area[ft2]	Depth[ft]	Number of layers	Top feed layer	Feed Layers
Clarifier	213,000	1900.0000	15.000	10	6	1

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
Clarifier	Flowrate [Under]	150000

Element name	Average Temperature	Reactive
Clarifier	Uses global setting	No

Configuration information for all Effluent units

Configuration information for all COD Influent units

Operating data Average (flow/time weighted as required)

Element name	Influent
Time	0
Flow (gpd)	315000
Total COD mgCOD/L	800.00
Total Kjeldahl Nitrogen mgN/L	40.00
Total P mgP/L	12.00
Nitrate N mgN/L	0
pH	7.30
Alkalinity mmol/L	6.00
ISS Influent mgISS/L	15.00
Calcium mg/L	160.00
Magnesium mg/L	20.00
Dissolved oxygen mg/L	0

Element name	Influent
Fbs - Readily biodegradable (including Acetate) [gCOD/g of total COD]	0.1600
Fac - Acetate [gCOD/g of readily biodegradable COD]	0.1500
Fxsp - Non-colloidal slowly biodegradable [gCOD/g of slowly degradable COD]	0.7500
Fus - Unbiodegradable soluble [gCOD/g of total COD]	0.0500
Fup - Unbiodegradable particulate [gCOD/g of total COD]	0.1300
Fna - Ammonia [gNH3-N/gTKN]	0.6600
Fnox - Particulate organic nitrogen [gN/g Organic N]	0.5000
Fnus - Soluble unbiodegradable TKN [gN/gTKN]	0.0200
FupN - N:COD ratio for unbiodegradable part. COD [gN/gCOD]	0.0350
Fpo4 - Phosphate [gPO4-P/gTP]	0.5000
FupP - P:COD ratio for unbiodegradable part. COD [gP/gCOD]	0.0110
FZbh - OHO COD fraction [gCOD/g of total COD]	0.0200
FZbm - Methylotroph COD fraction [gCOD/g of total COD]	1.000E-4
FZaob - AOB COD fraction [gCOD/g of total COD]	1.000E-4
FZnob - NOB COD fraction [gCOD/g of total COD]	1.000E-4
FZamob - ANAMMOX COD fraction [gCOD/g of total COD]	1.000E-4
FZbp - PAO COD fraction [gCOD/g of total COD]	1.000E-4
FZbpa - Propionic acetogens COD fraction [gCOD/g of total COD]	1.000E-4
FZbam - Acetoclastic methanogens COD fraction [gCOD/g of total COD]	1.000E-4
FZbhm - H2-utilizing methanogens COD fraction [gCOD/g of total COD]	1.000E-4
FZe - Endogenous products COD fraction [gCOD/g of total COD]	0

Configuration information for all Sludge units

Configuration information for all Splitter units

Operating data Average (flow/time weighted as required)

Element name	Split method	Average Split specification
WAS Split	Flowrate [Side]	12,000 gpd

BioWin Album

Album page - Tables

Elements	Influent	Aerobic	Effluent
Total COD [mg/L]	800.00	3789.52	45.29
Total COD [lb /d]	2103.04	14326.17	114.52
Total Carbonaceous BOD [mg/L]	393.28	1191.43	2.50
Total Carbonaceous BOD [lb /d]	1033.86	4504.15	6.33
Total suspended solids [mgTSS/L]	332.46	2859.83	2.41
Total suspended solids [lb TSS/d]	873.98	10811.50	6.10
Volatile suspended solids [mgVSS/L]	316.42	2560.98	2.16
Volatile suspended solids [lb VSS/d]	831.80	9681.71	5.46
Total Kjeldahl Nitrogen [mgN/L]	40.00	231.27	2.46
Total Kjeldahl Nitrogen [lb N/d]	105.15	874.31	6.23
Total P [mgP/L]	12.00	75.85	3.70
Total P [lb P/d]	31.55	286.74	9.36
Ammonia N [mgN/L]	26.40	0.38	0.38
Ammonia N [lb N/d]	69.40	1.44	0.97
Nitrate N [mgN/L]	0	9.21	9.21
Nitrate N [lb N/d]	0	34.82	23.29
Total N [mgN/L]	40.00	240.57	11.76
Total N [lb N/d]	105.15	909.45	29.74
PO4-P (Sol. & Me Complexed) [mgP/L]	6.00	3.64	3.64
PO4-P (Sol. & Me Complexed) [lb P/d]	15.77	13.76	9.20

Album page - Tables

Elements	Total COD [lb /d]	Total Carbonaceous BOD [lb /d]	Total suspended solids [lb TSS/d]	Volatile suspended solids [lb VSS/d]	Total Kjeldahl Nitrogen [lb N/d]	Total N [lb N/d]	Soluble PO4-P [lb P/d]	Total P [lb P/d]
Influent	2103.04	1033.86	873.98	831.80	105.15	105.15	15.77	31.55
Aerobic	14326.17	4504.15	10811.50	9681.71	874.31	909.45	13.76	286.74
Effluent	114.52	6.33	6.10	5.46	6.23	29.74	9.20	9.36
WAS	1136.93	359.83	864.43	774.10	69.45	70.38	0.36	22.19

Global Parameters

AOB

Name	Default	Value	
Max. spec. growth rate [1/d]	0.9000	0.9000	1.0720
Substrate (NH4) half sat. [mgN/L]	0.7000	0.7000	1.0000
Byproduct NH4 logistic slope [-]	50.0000	50.0000	1.0000
Byproduct NH4 inflection point [mgN/L]	1.4000	1.4000	1.0000
AOB denite DO half sat. [mg/L]	0.1000	0.1000	1.0000
AOB denite HNO2 half sat. [mgN/L]	5.000E-6	5.000E-6	1.0000
Aerobic decay rate [1/d]	0.1700	0.1700	1.0290
Anoxic/anaerobic decay rate [1/d]	0.0800	0.0800	1.0290
KiHNO2 [mmol/L]	0.0050	0.0050	1.0000

OHO

Name	Default	Value	
Max. spec. growth rate [1/d]	3.2000	3.2000	1.0290
Substrate half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Anoxic growth factor [-]	0.5000	0.5000	1.0000
Denite N2 producers (NO3 or NO2) [-]	0.5000	0.5000	1.0000
Aerobic decay rate [1/d]	0.6200	0.6200	1.0290
Anoxic decay rate [1/d]	0.2330	0.2330	1.0290
Anaerobic decay rate [1/d]	0.1310	0.1310	1.0290
Hydrolysis rate [1/d]	2.1000	2.1000	1.0290
Hydrolysis half sat. [-]	0.0600	0.0600	1.0000
Anoxic hydrolysis factor [-]	0.2800	0.2800	1.0000
Anaerobic hydrolysis factor (AS) [-]	0.0400	0.0400	1.0000
Anaerobic hydrolysis factor (AD) [-]	0.2000	0.2000	1.0000
Adsorption rate of colloids [L/(mgCOD d)]	0.1500	0.1500	1.0290
Ammonification rate [L/(mgN d)]	0.0400	0.0400	1.0290
Assimilative nitrate/nitrite reduction rate [1/d]	0.5000	0.5000	1.0000

Fermentation rate [1/d]	1.6000	1.6000	1.0290
Fermentation half sat. [mgCOD/L]	5.0000	5.0000	1.0000
Fermentation growth factor (AS) [-]	0.2500	0.2500	1.0000
Endogenous products decay rate[1/d]	0	0	1.0000
Free nitrous acid inhibition [mmol/L]	1.000E-7	1.000E-7	1.0000

Common

Name	Default	Value
Biomass volatile fraction (VSS/TSS)	0.9200	0.9200
Endogenous residue volatile fraction (VSS/TSS)	0.9200	0.9200
N in endogenous residue [mgN/mgCOD]	0.0700	0.0700
P in endogenous residue [mgP/mgCOD]	0.0220	0.0220
Endogenous residue COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Particulate substrate COD:VSS ratio [mgCOD/mgVSS]	1.6000	1.6000
Particulate inert COD:VSS ratio [mgCOD/mgVSS]	1.6000	1.6000

AOB

Name	Default	Value
Yield [mgCOD/mgN]	0.1500	0.1500
AOB denite NO2 fraction as TEA [-]	0.5000	0.5000
Byproduct NH4 fraction to N2O [-]	0.0025	0.0025
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

NOB

Name	Default	Value
Yield [mgCOD/mgN]	0.0900	0.0900
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Fraction to endogenous residue [-]	0.0800	0.0800
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200

OHO

Name	Default	Value
Yield (aerobic) [-]	0.6660	0.8000
Yield (fermentation, low H2) [-]	0.1000	0.1000
Yield (fermentation, high H2) [-]	0.1000	0.1000
H2 yield (fermentation low H2) [-]	0.3500	0.3500
H2 yield (fermentation high H2) [-]	0	0
Propionate yield (fermentation, low H2) [-]	0	0
Propionate yield (fermentation, high H2) [-]	0.7000	0.7000
CO2 yield (fermentation, low H2) [-]	0.7000	0.7000
CO2 yield (fermentation, high H2) [-]	0	0
N in biomass [mgN/mgCOD]	0.0700	0.0700
P in biomass [mgP/mgCOD]	0.0220	0.0220
Endogenous fraction - aerobic [-]	0.0800	0.0800
Endogenous fraction - anoxic [-]	0.1030	0.1030
Endogenous fraction - anaerobic [-]	0.1840	0.1840
COD:VSS ratio [mgCOD/mgVSS]	1.4200	1.4200
Yield (anoxic) [-]	0.5400	0.5400
Yield propionic (aerobic) [-]	0.6400	0.6400
Yield propionic (anoxic) [-]	0.4600	0.4600
Yield acetic (aerobic) [-]	0.6000	0.6000
Yield acetic (anoxic) [-]	0.4300	0.4300
Yield methanol (aerobic) [-]	0.5000	0.5000
Adsorp. max. [-]	1.0000	1.0000

Max fraction to N2O at high FNA over nitrate [-]	0.0500	0.0500
Max fraction to N2O at high FNA over nitrite [-]	0.1000	0.1000

Aeration

Name	Default	Value
Alpha (surf) OR Alpha F (diff) [-]	0.5000	0.5000
Beta [-]	0.9500	0.9500
Surface pressure [kPa]	101.3250	101.3250
Fractional effective saturation depth (Fed) [-]	0.3250	0.3250
Supply gas CO2 content [vol. %]	0.0350	0.0350
Supply gas O2 [vol. %]	20.9500	20.9500
Off-gas CO2 [vol. %]	2.0000	2.0000
Off-gas O2 [vol. %]	18.8000	18.8000
Off-gas H2 [vol. %]	0	0
Off-gas NH3 [vol. %]	0	0
Off-gas CH4 [vol. %]	0	0
Surface turbulence factor [-]	2.0000	2.0000
Set point controller gain []	1.0000	1.0000

Modified Vesilind

Name	Default	Value
Maximum Vesilind settling velocity (Vo) [ft/min]	0.387	0.387
Vesilind hindered zone settling parameter (K) [L/g]	0.370	0.370
Clarification switching function [mg/L]	100.000	100.000
Specified TSS conc.for height calc. [mg/L]	2500.000	2500.000
Maximum compactability constant [mg/L]	15000.000	15000.000

Double exponential

Name	Default	Value
Maximum Vesilind settling velocity (Vo) [ft/min]	0.934	0.934
Maximum (practical) settling velocity (Vo') [ft/min]	0.615	0.615
Hindered zone settling parameter (Kh) [L/g]	0.400	0.400
Flocculent zone settling parameter (Kf) [L/g]	2.500	2.500
Maximum non-settleable TSS [mg/L]	20.0000	20.0000
Non-settleable fraction [-]	0.0010	0.0010
Specified TSS conc. for height calc. [mg/L]	2500.0000	2500.0000

G2.3. Activated Sludge Vendor Data

Ovivo Clarifiers
Flygt RAS and WAS Pumps
Kruger Filter
Sanitaire Aeration Diffusers
IPEC Screen Washer Compactor and Screw Press
TurboTron Blowers (Please refer to G1.)

Ovivo USA, LLC
4246 Riverboat Road, Suite 300
Salt Lake City, Utah
84123
USA

Telephone: 801.931.3000
Facsimile: 801.931.3080

www.ovivowater.com

OVIVO
Bringing water to life

To: Ken Black, Beaver Equipment Specialty Inc.

From: Ryan Clark, Product Manager Sedimentation Group

Phone: 801-931-3061 Email: ryan.clark@ovivowater.com

Date: 8/04/2014

Subject: Pacific City WWTP, OR

Ken,

I have prepared budget pricing for the clarifiers for Pacific City WWTP, OR. The budget pricing is based on the following parameters:

Number of Clarifiers	2
Clarifier Diameter:	35 ft
SWD:	15 ft
Freeboard:	2 ft
Clarifier Types:	C3S (suction pipe)
Material:	316 Stainless Steel

The preliminary budget pricing is as follows:

Two (2) 35 ft Type C3S (suction pipe) clarifier	$314,000
Optional Add:	
FRP weirs and baffles for (2) 35 ft clarifiers	$10,000

Please see Table 1 for a more detailed scope of supply.

Let me know if you need any additional information.

Sincerely,

Ryan Clark, P.E.
Product Manager
Sedimentation Group
(801) 931-3061 (Direct)

TABLE 1

PACIFIC CITY WWTP, OR
(2) 35' diameter clarifier type C3S
COLUMN SUPPORTED UNITS

This budget price includes per clarifier:

- Construction materials as noted above.
- C30HT Clarifier Drive.
- 36" wide walkway extending from tank wall to center platform
- 1 1/2" square FRP grating covering the walkway.
- 8' square drive platform with 1 1/2" square FRP grating
- FRP 2-rail handrail, 1 ½" square tubing
- Influent column.
- Flocculating feedwell.
- Center cage.
- Rake arms, two full radius square box truss design with rake blades, and 316 stainless steel squeegees.
- Surface scum skimming equipment. Type: Standard Skimmer: 4' scum box with 1 skimming arm.
- Anchor bolts, 316 stainless steel.
- Assembly fasteners, 316 stainless steel.
- Drive finish painted per manufacturer standard painting scheme.
- Freight FOB jobsite.
- Services 2d/2t total
- O&M manuals

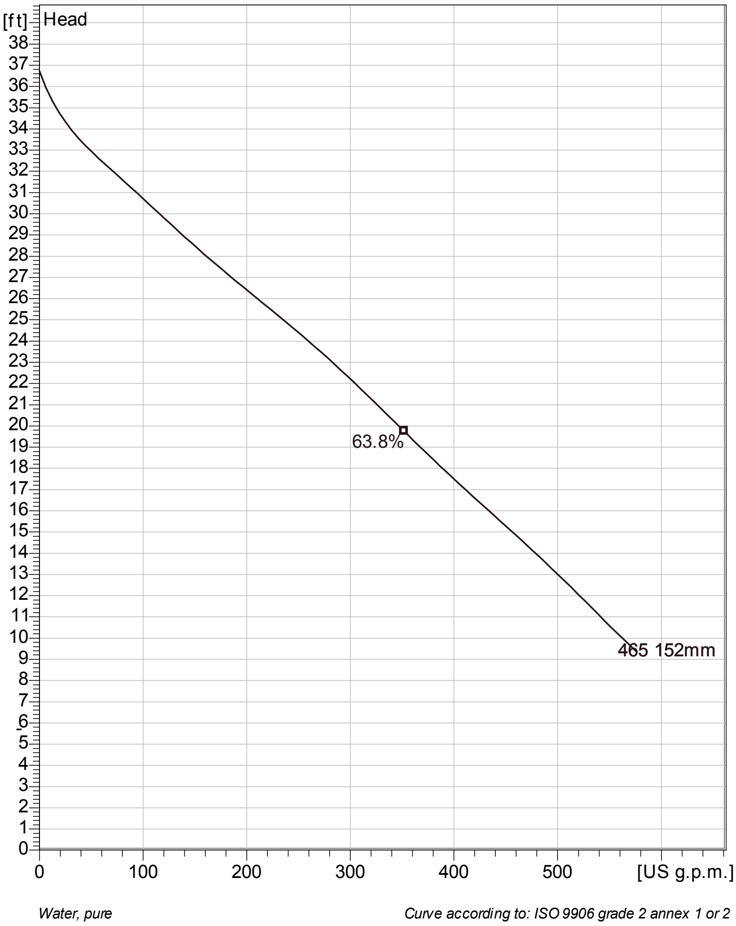
Items not included in the budget pricing:

- FRP Effluent weir plates and scum baffle (see optional add)
- FRP Density current baffles.
- Control panel.
- Energy dissipating inlet
- Launder covers.
- Demolition or installation.
- Tank or tank modifications.
- Unloading.
- Field welding.
- Finish painting.
- Lamp posts.
- VFD controller.
- Lubricants.
- Electrical controls.
- Handrail around tank.

xylem
Let's Solve Water

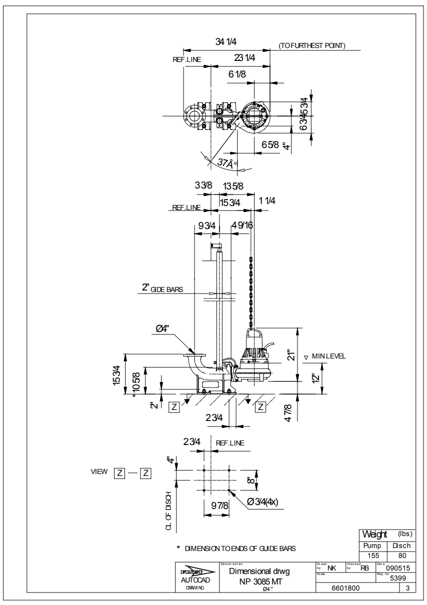
NP 3085 MT 3~ 465
Technical specification

FLYGT



Note: Picture might not correspond to the current configuration.

Installation: P - Semi permanent, Wet



General
Patented self cleaning semi-open channel impeller, ideal for pumping in waste water applications. Possible to be upgraded with Guide-pin® for even better clogging resistance. Modular based design with high adaptation grade.

Impeller

Impeller material	Hard-Iron ™
Discharge Flange Diameter	3 1/8 inch
Suction Flange Diameter	80 mm
Impeller diameter	152 mm
Number of blades	2

Motor

Motor #	N3085.092 15-10-4AL-W 3hp
Stator variant	61
Frequency	60 Hz
Rated voltage	460 V
Number of poles	4
Phases	3~
Rated power	3 hp
Rated current	4.5 A
Starting current	25 A
Rated speed	1705 1/min
Power factor	
1/1 Load	0.81
3/4 Load	0.74
1/2 Load	0.62
Efficiency	
1/1 Load	77.5 %
3/4 Load	78.0 %
1/2 Load	76.0 %

Configuration

Project	Project ID	Created by	Created on	Last update
			2014-07-31	

NP 3085 MT 3~ 465

Performance curve

Pump

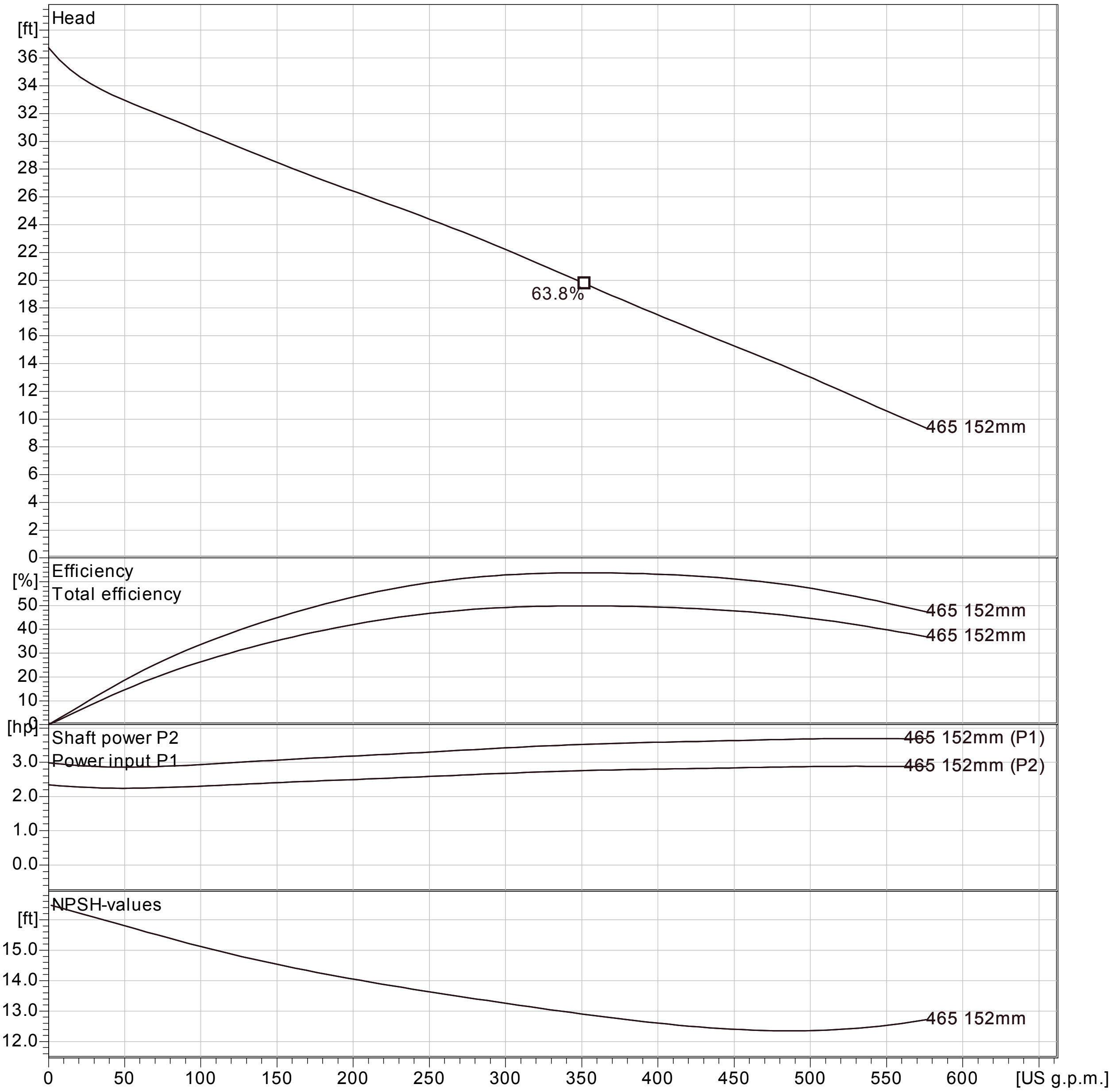
Discharge Flange Diameter	3 1/8 inch
Suction Flange Diameter	80 mm
Impeller diameter	6"
Number of blades	2

Motor

Motor #	N3085.092 15-10-4AL-W 3hp
Stator variant	61
Frequency	60 Hz
Rated voltage	460 V
Number of poles	4
Phases	3~
Rated power	3 hp
Rated current	4.5 A
Starting current	25 A
Rated speed	1705 1/min

Power factor	
1/1 Load	0.81
3/4 Load	0.74
1/2 Load	0.62

Efficiency	
1/1 Load	77.5 %
3/4 Load	78.0 %
1/2 Load	76.0 %



Water, pure

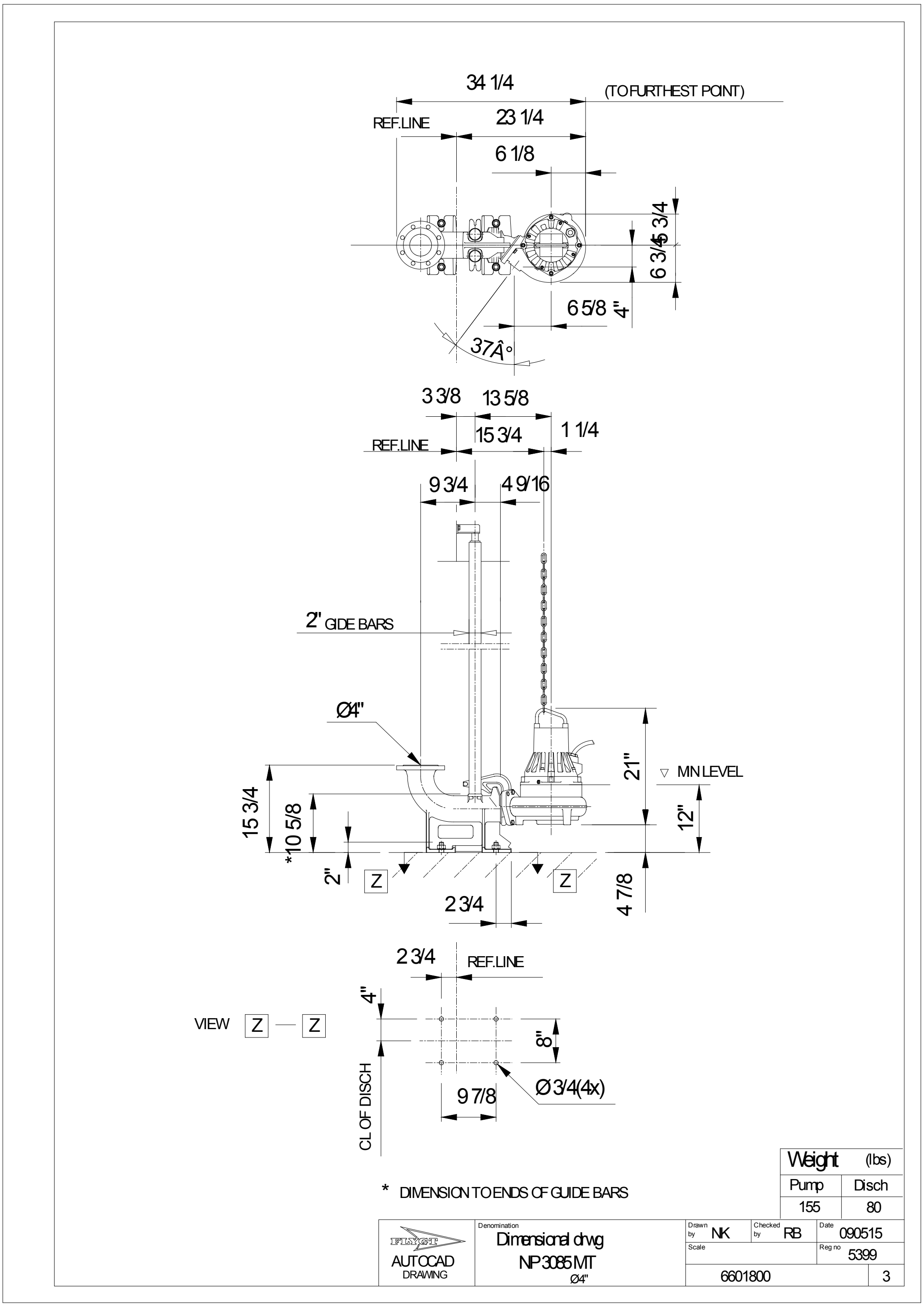
Curve according to: ISO 9906 grade 2 annex 1 or 2

Project	Project ID	Created by	Created on	Last update
			2014-07-31	

NP 3085 MT 3~ 465

Dimensional drawing

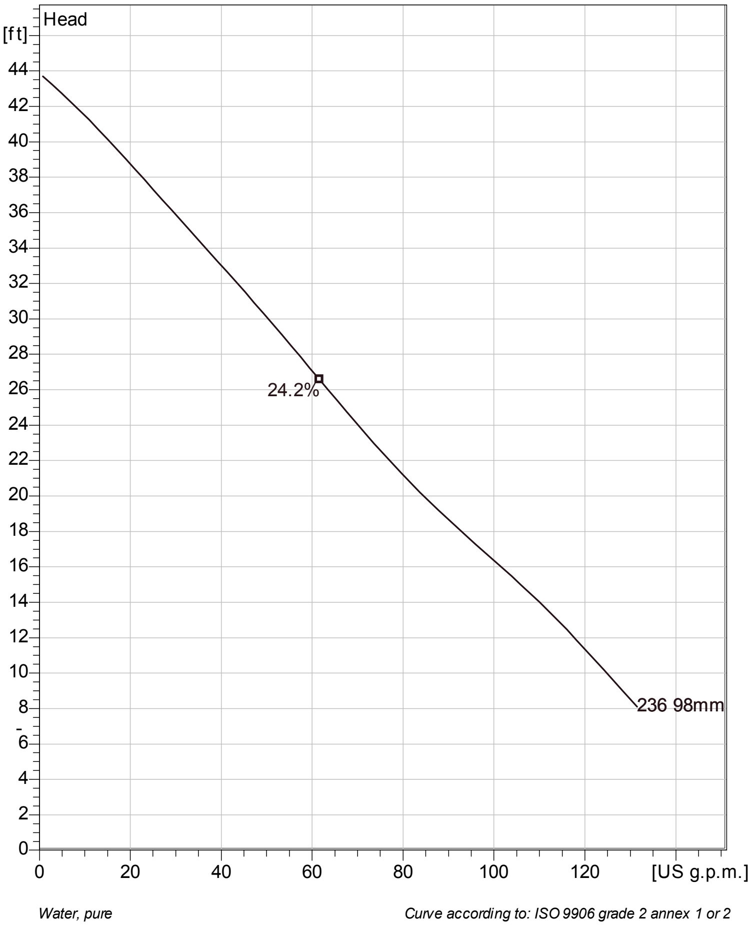
FLYGT



Project	Project ID	Created by	Created on	Last update
			2014-07-31	

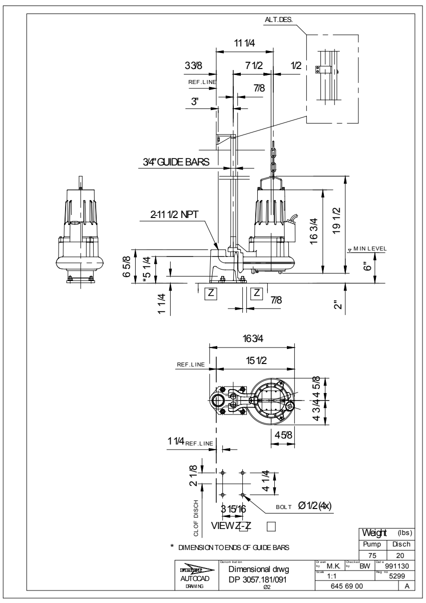
DP 3057 MT 3~ 236

Technical specification



Water, pure *Curve according to: ISO 9906 grade 2 annex 1 or 2*

Installation: P - Semi permanent, Wet



Note: Picture might not correspond to the current configuration.

General

Portable pumps with vortex impellers ideal for applications in which the water or liquid contains concentrations of abrasives when clogging problems can occur.

Impeller

Impeller material	Grey cast iron
Discharge Flange Diameter	1 15/16 inch
Suction Flange Diameter	50 mm
Impeller diameter	98 mm
Number of blades	6
Throughlet diameter	1 7/8 inch

Motor

Motor #	D3057.091 13-08-2BB-W 2.7hp
Stator variant	1
Frequency	60 Hz
Rated voltage	460 V
Number of poles	2
Phases	3~
Rated power	2.7 hp
Rated current	3.6 A
Starting current	0 A
Rated speed	3325 1/min
Power factor	
1/1 Load	0.89
3/4 Load	0.84
1/2 Load	0.75
Efficiency	
1/1 Load	77.5 %
3/4 Load	80.5 %
1/2 Load	81.0 %

Configuration

Project	Project ID	Created by	Created on	Last update
			2014-07-31	

DP 3057 MT 3~ 236

Performance curve

Pump

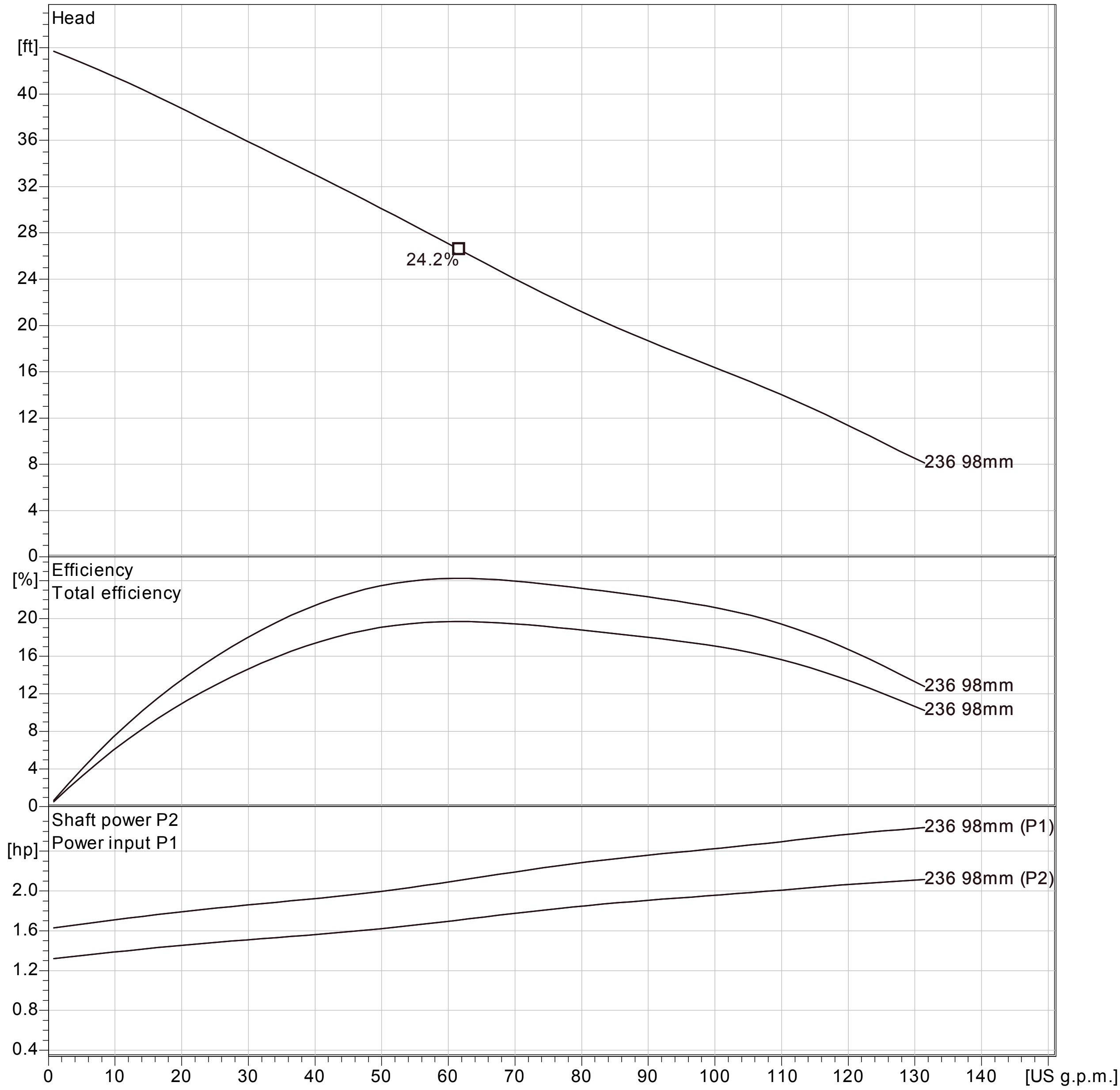
Discharge Flange Diameter	1 15/16 inch
Suction Flange Diameter	50 mm
Impeller diameter	3 7/8"
Number of blades	6
Throughlet diameter	1 7/8 inch

Motor

Motor #	D3057.091 13-08-2BB-W 2.7hp
Stator variant	1
Frequency	60 Hz
Rated voltage	460 V
Number of poles	2
Phases	3~
Rated power	2.7 hp
Rated current	3.6 A
Starting current	0 A
Rated speed	3325 1/min

Power factor	
1/1 Load	0.89
3/4 Load	0.84
1/2 Load	0.75

Efficiency	
1/1 Load	77.5 %
3/4 Load	80.5 %
1/2 Load	81.0 %

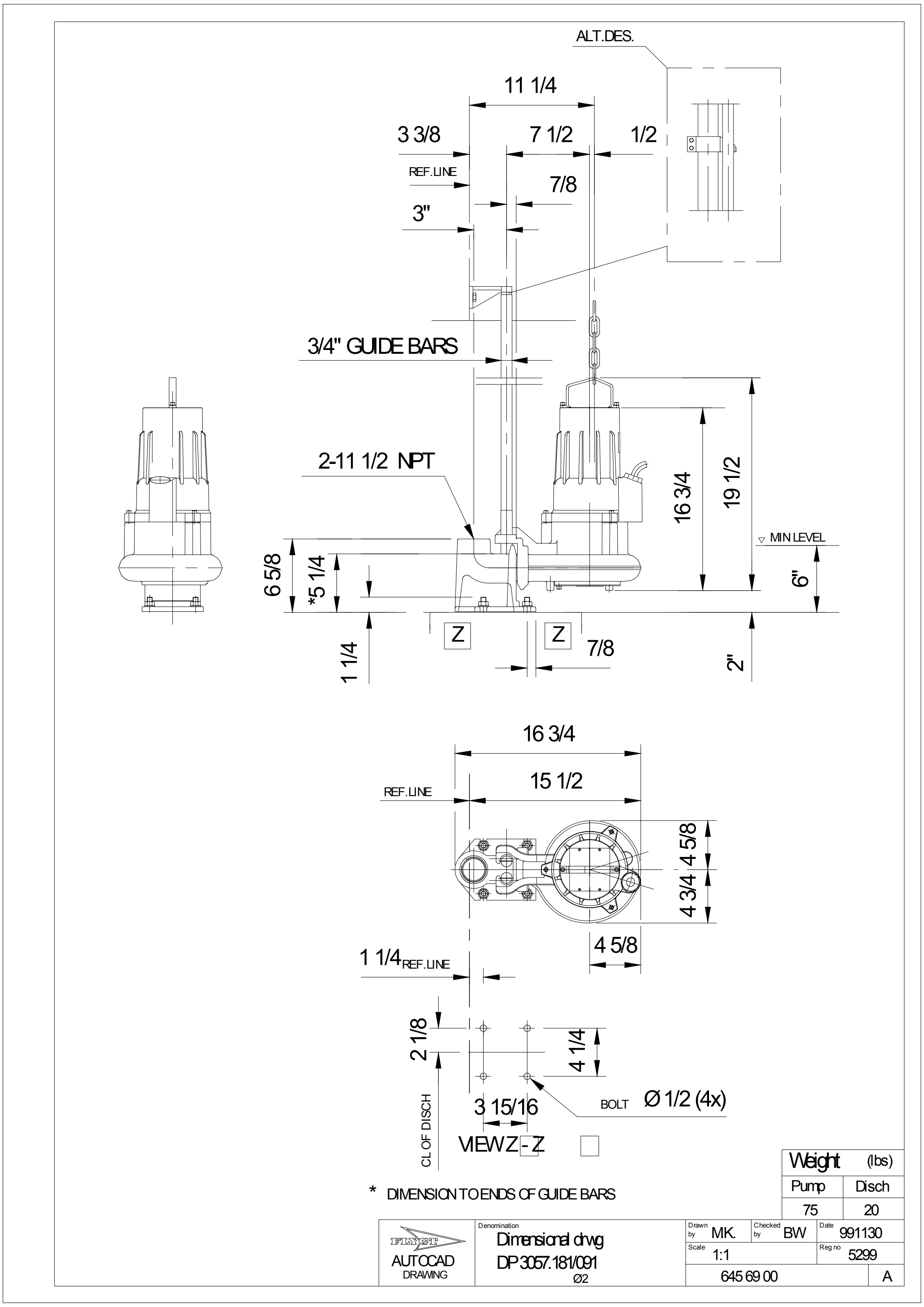


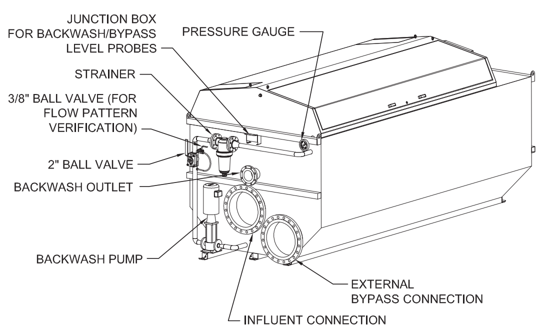
Water, pure *Curve according to: ISO 9906 grade 2 annex 1 or 2*

Project	Project ID	Created by	Created on	Last update
			2014-07-31	

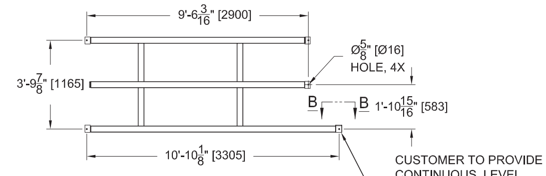
DP 3057 MT 3~ 236

Dimensional drawing

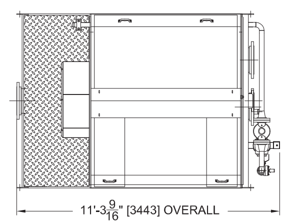




ISOMETRIC VIEW
RH BACKWASH

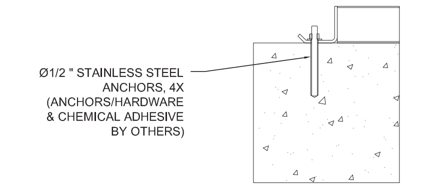


SECTION A-A

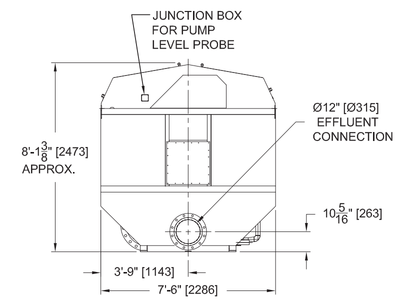


TOP VIEW

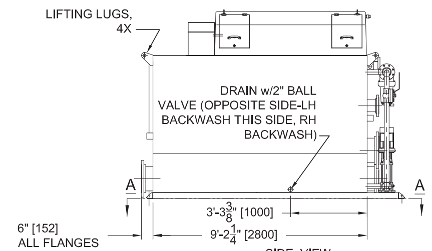
1. MATCH DRILL ANCHORS AFTER FINAL PLACEMENT OF UNIT IS DETERMINED
2. ANCHOR SIZE, EMBEDMENT, AND FASTENING METHOD MAY REQUIRE MODIFICATION DEPENDING ON SEISMIC REQUIREMENTS.
3. FOLLOW ANCHOR MANUFACTURERS GUIDELINES FOR SPECIFIC INSTALLATION REQUIREMENTS INCLUDING ANCHOR EMBEDMENT AND EDGE DISTANCE.
4. ALL ANCHORS AND FASTENERS TO BE STAINLESS STEEL. APPLY ANTI-SEIZE TO ALL CONNECTIONS.



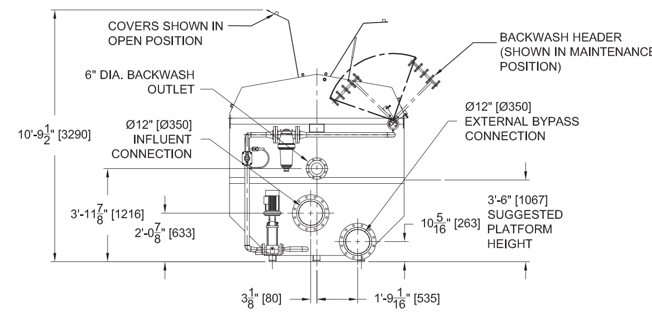
SECTION B-B
ANCHOR DETAIL
NTS



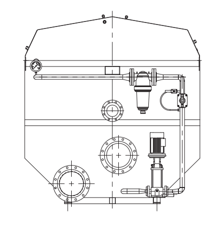
EFFLUENT SIDE VIEW



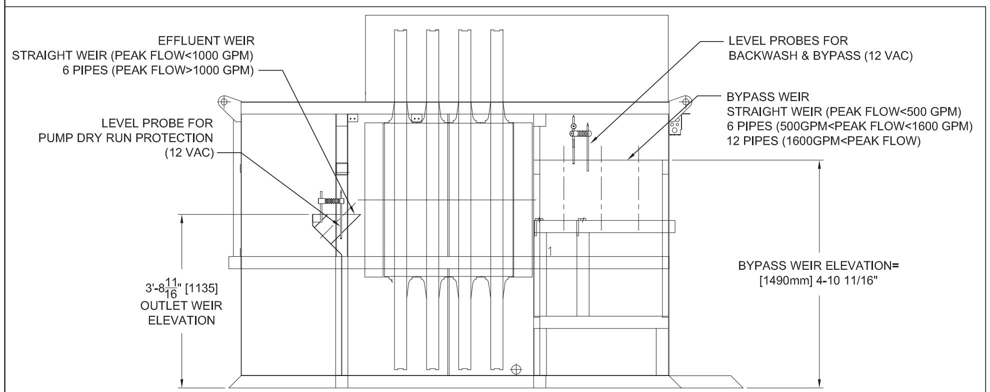
SIDE VIEW



INFLUENT SIDE VIEW
RH BACKWASH (STD)



INFLUENT SIDE VIEW
LH BACKWASH (OPTIONAL)



INTERNAL CROSS SECTION
(PUMP & FLANGES REMOVED FOR CLARITY)

PRELIMINARY
NOT FOR CONSTRUCTION

NOTES :
1. QUANTITY OF FILTER DISKS, MODEL 2204 = 4 (112 FILTER PANELS)
MODEL 2204/3= 3 (84 FILTER PANELS)
2. UNIT WEIGHT (DRY) = 5,512 LBS (2,500 KG) APPROX.
3. UNIT WEIGHT(OPERATIONAL) = 22,708 LBS (10,300 KG) APPROX.
4. BACKWASH PUMP: MODEL 2204 = GRUNDFOS CR5-10, 3.0 HP, 480V/3PH/60HZ, 1-1/4" ANSI FLANGE
MODEL 2204/3=GRUNDFOS CR5-9, 3.0 HP, 480V/3PH/60HZ, 1-1/4" ANSI FLANGE
5. DRIVE MOTOR: 1.5HP, 480V/3PH/60HZ
6. INLET, OUTLET & BYPASS CONNECTIONS: SLIP ON PLATE FLANGE, BOLT PATTERN MATCHES 12" ANSI B16.5 (OTHER SIZES AVAILABLE)
FLANGE MATERIAL = GALVANIZED
FLANGE STUB END MATERIAL =AISI 304
7. BACKWASH CONNECTION: SLIP ON PLATE FLANGE, BOLT PATTERN MATCHES 6" ANSI B16.5
FLANGE MATERIAL = GALVANIZED
FLANGE STUB END MATERIAL = AISI 304
8. DRUM, WALLS & FRAME MATERIAL = AISI 304 (AISI 316 OPTIONAL)
9. COVER MATERIAL: FIBERGLASS REINFORCED PLASTIC (FRP)
10. DIMENSIONS IN [ ] ARE MILLIMETERS
11. WORK PLATFORM GRATING AND SUPPORT NOT ATTACHED TO FILTERS AND DESIGNED/PROVIDED BY OTHERS. DO NOT SUPPORT PLATFORMS OR OTHER LOAD BEARING MEMBERS FROM THE DISCFILTER.
12. RECOMMEND 24" MINIMUM MAINTENANCE ACCESS AROUND ENTIRE PERIMETER OF DISCFILTER.

REV	DESCRIPTION	DRAWN	APPR	DATE
B	RELOCATED STRAINER	CDP	MHS	01.04.11
A	RELEASED	DSD	CDP	08.18.10

KRÜGER
I. KRUGER, INC.
401 HARRISON OAKS BLVD
CARY, NC 27513
(919) 677-8310

STANDARD

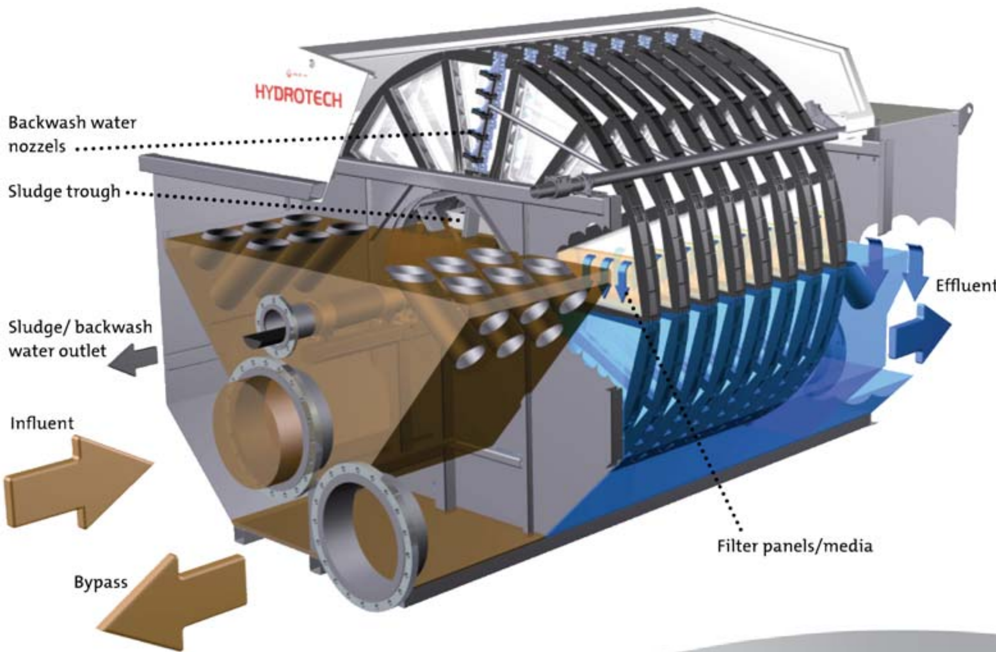
DISCFILTER
2204-1F
UNIT DETAILS

DRAWN	CHECKED	SCALE	DRAWING NO	SHEET	REV
CDP	DSD	1:64	675M-0001	1 of 1	B

Hydrotech Discfilter

The Discfilter Process

The Hydrotech Discfilter provides proven experience for today's demanding wastewater treatment applications through an efficient, yet easy-to-operate design. Influent flows by gravity into the center drum and then passes through the filter media mounted on both sides of the discs. The solids are retained on the media within the discs. Only purified water flows to the collection tank. The inside-out flow path prevents solids accumulation in the tank.



As solids collect on the inside of the media the influent water level rises. Maximum head loss through the media is <12 inches. The inlet water level is measured and the control system automatically initiates backwashing. The filtered effluent is pumped to the backwash spray nozzles, washing solids into the sludge trough as the discs rotate. The backwash water is typically 1% to 2% of the total flow to the filter, while the sludge return is typically <1%. Filtration is continuously maintained, even during backwash.

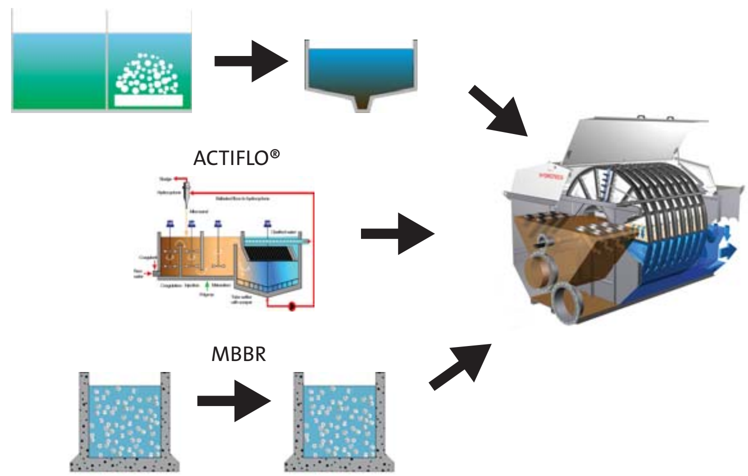
HYDROTECH ADVANTAGES

- Unmatched experience and performance
- Innovation: patented designs offer real savings
- Robust construction with 304 or 316 SSTL
- Proven media: durable and chemically resistant
- Meets or exceeds Title 22 requirements at hydraulic loading rates up to and above 6 gpm/ft²
- Consistently produces high quality effluent despite high-solids loadings and upset conditions
- Ideal for "retro-fit" projects in existing basins
- Compact design requires far less space
- Simplified control system and lower installation costs than other filtration technologies
- Improved backwash efficiency reduces operating costs and carbon footprint

Proven Performance

The compact Hydrotech Discfilter is used in a wide range of applications:

- Effluent polishing of wastewater
- Phosphorus removal
- Water reuse (Title 22 approved)
- Retrofit/replacement of existing systems
- CSO, SSO, and primary treatment
- Process water filtration
- Membrane pre-treatment



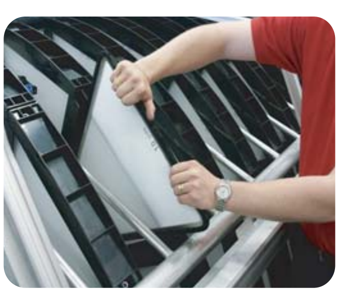
The Hydrotech Discfilter is ideal for treating effluent from a variety of processes (e.g., activated sludge, fixed film, etc.). Kruger offers full-scale pilots to demonstrate performance.

Designed To Save

Hydrotech systems enable customers to achieve performance with lower cost and straight-forward maintenance. Hydrotech Discfilters provide a large filter area in a small footprint; up to 75% smaller than sand filters and up to 20% smaller than other cloth filters.

The discfilter is delivered as an assembled unit. Other cloth filters require substantial labor for site assembly and a larger footprint for backwash pumps and valves. The discfilter eliminates these concerns and costs. Installation is as simple as off-loading from a trailer, anchoring the unit, and completing mechanical and electrical connections.

O&M is simple and reduces operating costs. Fabrication is in 304 or 316 SSTL for trouble-free operation in the toughest conditions. Durable filter media provides long life without frequent and costly replacement. The efficient backwash process reduces energy costs.



Hydrotech Discfilters are easy to inspect and maintain, saving time and money.

KRÜGER

Parametrix

Pacific City Expansion, OR

8/8/2014

Hydrotech Discfilter

Kruger Project No.: 5700137402

Submitted to:

Allan Maas, P.E.
Parametrix
1019 39th Avenue SE, Suite 100
Puyallup, WA 98374
Ph: 253.604.6600

Submitted by:

Brandon Ray
Hydrotech Filtration Applications Engineer
I Kruger Inc.
4001 Weston Parkway
Cary, NC 27513

VEOLIA WATER

Solutions & Technologies

Design Summary

The following Kruger/Hydrotech Discfilter design is based on the information listed below.

Table 1: Influent Design Basis

Parameter	Initial Phase	Expansion Phase
Influent Source	Secondary Clarification following Activated Sludge	
Peak Hour Flow, MGD (gpm)	1.0 (694)	2.0 (1,389)
Average Day Flow, MGD (gpm)	0.16 (111)	0.28 (194)
Peak Influent TSS, mg/L	30	30
Average Influent TSS, mg/L	20	20
7-Day Average Effluent TSS, mg/L	15	15
30-Day Average Effluent TSS, mg/L	10	10

Scope of Supply

Kruger is pleased to present our scope of supply which includes process engineering design, equipment procurement, and field services required for the proposed treatment system, as related to the equipment specified. The work will be performed to Kruger's high standards under the direction of a Project Manager. All matters related to the design, installation, or performance of the system shall be communicated through the Kruger representative giving the Engineer and Owner ready access to Kruger's extensive capabilities.

Process and Design Engineering

Kruger will provide process engineering and design support for the system as follows:

- Equipment specifications for equipment supplied by Kruger
- Technical instructions for operation and start-up of the system
- Equipment location drawings and installation plans
- Project specific O&M manuals

Field Services

Kruger will furnish a Service Engineer as specified at the time of start-up to inspect the installation of the completed system, place the system in initial operation, and to instruct operating personnel on the proper use of the equipment. Specifically, Kruger will provide:

- Field Service Engineer/Technician – Four (4) days on site in not more than two (2) site visits to assist with inspection check-out, start-up, and operator training.

Equipment Supply

Table 2: Equipment Supply

Proposed Discfilter System	Initial Phase	Expansion Phase
Example Photograph (for information only; not necessarily actual unit)		
Discfilter Model Number	HSF2204-1F	HSF2204-1F
Total units (duty/standby)	2 (1/1)	3 (2/1)
Total filter area per unit, ft^2	241	241
Submerged filter area per unit, ft^2	157	157
Peak hydraulic loading rate, gpm/ft^2	4.43*	4.43*
Number of Discs per unit	4	04
Media Pore Size, μm	10	10
Chassis Material	304 SS	304 SS
Cover Material	Aluminum	GRP
Self Enclosed Tank Material	304 SS	304 SS
SEW drive motor, hp	1.5	1.5
Backwash water pump, hp	3	3
Backwash pump rated flow, gpm	26	26
Influent and Effluent Flange	ANSI 10"	ANSI 10"

* Hydraulic loading rate does not include standby unit.

An instrumentation and control system will be included with the Kruger equipment. The control system will be designed and supplied according to Kruger standards. It will include the following:

- NEMA4X local control panel for each Discfilter unit

Pricing

The price for the Hydrotech Discfilter system, as defined herein, including process and design engineering, field services, and equipment supply is: **$233,500.00**.

Pricing is FOB shipping point, with freight allowed to the job site. This pricing does not include any sales or use taxes. In addition, pricing is valid for ninety (90) days from the date of issue and is subject to negotiation of a mutually acceptable contract.

Please note that the above pricing is expressly contingent upon the items in this proposal and are subject to I. Kruger Inc. Standard Terms of Sale detailed herein.

Kruger Standard Terms of Payment

The terms of payment are as follows:

- 10% on receipt of fully executed contract
- 15% on submittal of shop drawings
- 75% on the delivery of equipment to the site

Payment shall not be contingent upon receipt of funds by the Contractor from the Owner. There shall be no retention in payments due to I. Kruger Inc. All other terms per our Standard Terms of Sale are attached.

All payment terms are net 30 days from the date of invoice. Final payment not to exceed 120 days from delivery of equipment.

Diffused Aeration Equipment

for

Pacific City, OR

Aeration Tanks

Sanitaire #25256-14s

August 1, 2014

sm - 2014.07.31 AB 9in_SSII Setup.aer

Sanitaire Aeration Design Inputs for: Pacific City, OR, Sanitaire #25256-14s

Tank Geometry

3 Trains each Consisting of:

Parameter	Units	Pass 1
Parallel Reactors		1
Pass Process		Aerobic
SWD	ft	17.0
Submergence	ft	16.2
Volume	ft³	8,606.3
Reactor Geometry:		Square
Length	ft	22.5
Width	ft	22.5

Oxygen/Air Distribution

	Zone	1
	Pass	1
Default		100.0%

Oxygenation

Parameter	Units	Air Rate
No. Trains Operating		1
Air Rate	scfm	150.0

Standard Oxygen Correction Factor Parameters

Parameter	Units	Air Rate
Site Elevation	FASL	10
Ambient Pressure	PSIA	14.70
Water Temperature	°C	20

Notes:

Bold, Italicized text indicate assumptions made by Sanitaire

A - Indicates Actual (AOR) Requirement.

S - Indicates Standard Condition (SOR) Oxygen requirement.

If the AOR/SOR parameter is not given, then its value will be evaluated later if suitable alpha, beta, D.O., theta, pressure, and temperature data is supplied.

Round tanks are evaluated as rectangular tanks diameter equal to length and equal surface area.

Annular tanks are evaluated as rectangular tanks of width equal to the annular width and equal surface area.

Sanitaire Project Name: Pacific City, OR
Sanitaire Project #25256-14s
Design Summary

	Units	Air Rate Default
No. Trains in Operation		1
No. Grids in Operation		1
No. Operating Diffusers		108
SOR	lb/day	1,246
SOTE	%	33.2
Total Air Rate	scfm	150.0
Min.Diffuser Air Rate	scfm/diff.	1.39
Max. Diffuser Air Rate	scfm/diff.	1.39
Static Pressure	psig	7.01
Diffuser DWP @ Min Air	psig	0.51
Diffuser DWP @ Max Air	psig	0.51
Pressure @ Top of Dropleg	psig	7.61
Est. Blower Efficiency		70%
Est. Motor Efficiency		90%
Shaft Power	Bhp	6.28
Est. Motor Electrical Load	kW	5.20
Est. Standard Aeration Efficiency	#SOR/BHP-hr	8.27

Notes:

(1) Design air is the maximum of process air or mixing air

(2) Delivered oxygen based on design air

(3) Brake Horsepower based on adiabatic compression, 70% mechanical efficiency and 0.30 psi lineloss

(4) Performance based on diffuser density (At/Ad), submergence, and diffuser unit air flow.

(5) Diffuser Air Flow based on Active Valve Modulation

(6) Blower Pressure Capability also requires consideration of:

A. The Air Main headloss (piping, fittings, valves, instrumentation, etc.) between the blower and the aeration assembly dropleg connections.

B. Potential for increased headloss resulting from diffuser fouling and/or aging. Please refer to the US EPA Fine Pore Design Manual (EPA/625/1-89/023), WEF Manual of Practice FD-13, and other

technical publications for a detailed discussion on this subject. Note that this headloss consideration relates to all Fine Pore systems regardless of supplier or type of diffuser element.

C. Increased diffuser submergence during Peak Flow conditions.

(7) Air Flow defined at 20°C

(8) Fine Mixing air based on MOP/8 0.12 scfm/ft²

Sanitaire Project Name: Pacific City, OR
Sanitaire Project #25256-14s
Consulting Engineer:
Operating Condition: Air Rate
Oxygen Distribution: Default

Aeration System Design

Parameter	Units	Zone 1	Totals/Overall
Pass		1	
SWD	ft	17.00	
Subm	ft	16.19	
Volume	ft^3	8,606.3	8,606.3
No. Parallel Tanks		1	
No. Trains in Operation		1	
Grid Count		1	1
Dropleg Diameter	inches	4	
At/Ad		11.4329	
Diffuser Density	% Floor	8.75%	
Diffusers/Grid		108	108

Oxygen Transfer

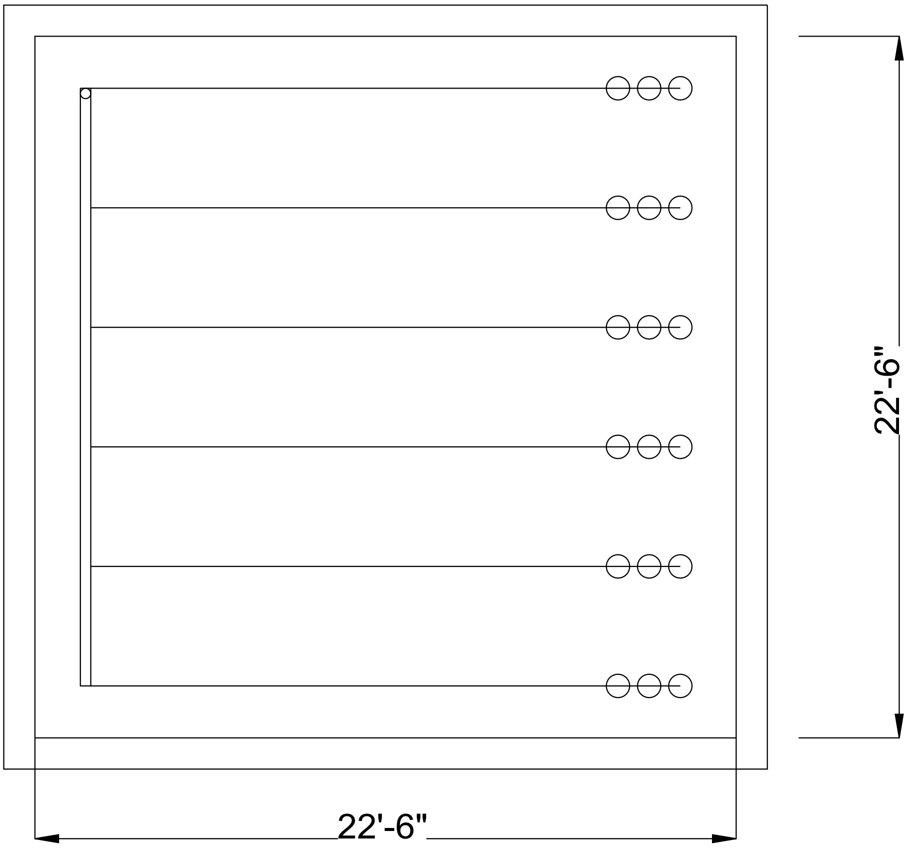
Parameter	Units	Zone 1	Totals/Overall
Diffuser Type		SSII-9	
Alpha			
Beta			
Theta			
D.O.	mg/l		
Water Temp	°C	20	
AOR/SOR			
Oxygen Distribution	%/Zone	100.0%	100.0%
AOR	lb/day		
SOR	lb/day		
Air Rate (7)	scfm	150.0	150.0

Performance

Parameter	Units	Zone 1	Totals/Overall
Mixing Criteria	$scfm/ft^2$	0.12	
Safety Factor	%		
Mixing Air (8)	scfm	60.8	
Process Air (for SOR)	scfm	150.0	
Design Air (1,7)	scfm	150.0	150.0
Diffuser Air Rate	scfm/Diff.	1.39	1.39
Delivered SOR	lb/day	1,246.3	1,246.3
Delivered SOTE	%	33.2%	33.2%
Pressure @ Top of Dropleg	psig	7.61	7.61
Shaft Power	Bhp	6.3	6.3

Notes:

(1) Design air is the maximum of process air or mixing air
(2) Delivered oxygen based on design air
(3) Brake Horsepower based on adiabatic compression, 70% mechanical efficiency and 0.30 psi lineloss
(4) Performance based on diffuser density (At/Ad), submergence, and diffuser unit air flow.
(5) Diffuser Air Flow based on Active Valve Modulation
(6) Blower Pressure Capability also requires consideration of:
A. The Air Main headloss (piping, fittings, valves, instrumentation, etc.) between the blower and the aeration assembly dropleg connections.
B. Potential for increased headloss resulting from diffuser fouling and/or aging.
Please refer to the US EPA Fine Pore Design Manual (EPA/625/1-89/023), WEF Manual of Practice FD-13, and other technical publications for a detailed discussion on this subject. Note that this headloss consideration relates to all Fine Pore systems regardless of supplier or type of diffuser element.
C. Increased diffuser submergence during Peak Flow conditions.
(7) Air Flow defined at 20°C
(8) Fine Mixing air based on MOP/8 0.12 $scfm/ft^2$



Single Train Information

Grid No	Grid Count	Drop Leg Ø"	Header Count	Header Spc,ft.	Header Len,ft.	Discs/ Grid	At/ Ad	Discs/ Train
1	1	4	6	3.83	19.25	108	11.43	108

Total Discs/Train 108

Note: Some headers may be omitted for clarity

PRELIMINARY - THIS DRAWING IS NOT INTENDED FOR CONTRACT DOCUMENTS, SUBMITTALS, OR CONSTRUCTION

Sanitaire a xylem brand BROWN DEER, WISCONSIN 53223	CUST NO. / DWG NO.	THIS DRAWING IS THE PROPERTY OF XYLEM AND IS SUBMITTED IN CONFIDENCE. IT IS NOT TO BE DISCLOSED, USED OR DUPLICATED WITHOUT PERMISSION OF XYLEM.	Pacific City, OR 9" Disc Aeration System	DRAWN BY / CHKD BY / APPVD BY	DATE 8/1/14 / DATE / DATE		JOB 25256-14s / SHEET

WASTEWATER SCREENING EQUIPMENT

IPEC Ltd., a privately-owned Canadian company, has been designing and manufacturing quality wastewater screening equipment since 1979. All IPEC equipment is designed and manufactured in Vancouver, British Columbia.

IPEC EQUIPMENT INCLUDES:

BAG	Bagger	Stainless steel bagger with continuous bag feeder.
CLT	In-Channel Conveyor Screen	Shaftless screw conveyor with washer/compactor.
CLT-A	In-Channel Conveyor Screen c/w Agitator	Shaftless screw conveyor with top-mounted drive and agitator.
CGH	De-Gritter	Designed for final stage of grit removal in municipal effluent. Suitable for most grit collection and concentration systems, including the IPEC bowl cyclones.
IFC	Internally-fed cantilevered rotary screen	Suitable for high temperature, low flow applications.
IFM	Internally-fed municipal screen	Developed specifically for municipal fine screening applications and is available with a variety of drum screening material, including wedgewire, perforated plate and stainless steel mesh.
IFO	Internally-fed rotary - top drive	Suitable for screening flume waters.
IFS	Internally-fed rotary - frame base	Versatile screen that can handle high flows and/or high solids.
IFT	Internally-fed rotary - thickener	Sludge thickening, municipal primary and secondary.
IFU	Internally-fed rotary - unitary body	Compact enclosed screen, perfect for effluents containing moderate to low solids loadings.
PLT	Shaftless screw press	Shaftless conveyor screw with compaction head.
PLB	Shaftless screw press with press gate	Push-driven shaftless screw with compaction head and spring-tensioned discharge gate.
PPS	Shafted screw press	Screw press with shafted screw and pneumatic press plate.
RSS	Externally-fed rotary screen	Best for flows that have high oil or grease loadings.
SHS	Static sidehill screen	Suited for effluent where the solids are easily separated from the liquid.
SLB	Screenings Conveyor/Compactor	Auger style screen ideally suited for small WWTP systems in rural housing complexes, resorts and remote camps.
TLT	Receiving Station	Shaftless screw conveyor mounted in a tank with a washer/compactor.
ULT	Conveyor	Shaftless screw conveyor.
UST	Conveyor	Shafted screw conveyor.

CONTACT IPEC

Toll Free: (800)663-8409 • Tel: (604)291-7150 • Fax: (604)291-7190 • Email: sales@ipec.ca • Web Site: ipec.ca

PLB SERIES

SHAFTLESS SCREW PRESS

The PLB is a mechanical device to wash and compact wet solids and sludges collected in waste treatment processes and reduce the volume of solids to be handled or disposed of. They are ideally suited to treat solids from most screening devices.

METHOD OF OPERATION

The PLB consists of a spiral, mechanical geardrive, U-trough housing, screen sections, cleaning shower, and a mechanical tensioning device.

The PLB utilizes a shaftless spiral to provide the driving force to transport and compact solids. The PLB is always aligned at a slope to provide a counter current movement with the solids being elevated while extracted fluids and wash water drain by gravity. The driving force is “push style” with gearbox mounted on lower end.

Solids are fed into a receiving hopper at the lower end. Free water is removed through a drainage zone screen. The spiral draws solids along a trough section and forced into a screen cylinder for extraction of water. A spring tensioned gate on the end of the housing provides the back pressure that creates a plug of compacted solids. An active shower on the compaction zone screen with a special selection of nozzles washes the solids and aids in flushing away fine solids that are expelled through the screen.

The solids plug is driven through the screen cylinder and drops into solids receiving bin or conveyor.

APPLICATION

The PLB are used in many food industry and pulp and paper processes to extract liquid from solids wastes. They are ideally suited for municipal collections containing volatile, putrescent, and fecal compounds that need to be removed before the solids can be disposed of in an environmentally safe manner. In most applications the solids volume is reduced to a third.

Standard units are available in 6, 9 and 12 inch models to handle from .75 – 5 cubic yards/hour of wet solids. Units may be lengthened to allow transport of solids.

FEATURES

- 304 stainless steel construction
- shaft-mounted, TEFC, motor and geardrive
- spray bar

OPTIONS

- 316 stainless steel construction
- control panel
- compacted solids bagger, continuous plastic sleeve
- extensions as required for conveying

Washed & Compacted Screenings from IPEC PLB

PLB Series Press Capabilities

PLB	Diameter	Cubic Yd/Hr	Length
6**	6”	.75	2.5 - 8ft
9**	9”	2.5	4 - 24ft
12**	12”	5	5 - 40ft

CONTACT IPEC

Toll Free: (800)663-8409 • Tel: (604)291-7150 • Fax: (604)291-7190 • Email: sales@ipec.ca • Web Site: ipec.ca

PLT SERIES

SHAFTLESS SCREW PRESS

PLT series of presses are designed to convey, dewater, wash and compact solids captured from waste treatment screening devices. The presses are used to remove free liquids from solids. The PLT can either be built as a stand alone press or a transport and press system.

METHOD OF OPERATION

The PLT press utilizes a shaftless spiral to transport solids. The spiral axis is aligned in an upward slope, typically in a range 5° - 35°angle.

The solids are fed into a receiving hopper where free liquid is removed through a drainage zone screen. The spiral draws solids along a transport section. At the end of the transport section solids are forced into a screen cylinder for compaction and extraction of water. An active shower cycle with a special selection of nozzles is applied over the outside surface of the screen cylinder. After compacting, the solids plug is broken up and discharged by gravity through a chute.

During the transport and compaction process the solids are washed. A small fraction of the shower water flows down the transport tube counter current to the solids creating a sluice box effect. In the compaction zone, solids fines and waste effluent are flushed away with fresh water during active showering and compaction.

APPLICATION

The PLT press is available in a variety of sizes with screws ranging from 8 to 16 inches in diameter. The transport zone can be lengthened to suit site conveying requirements.

The capacity of the PLT may vary due to characteristics of the solids material and the slope of the unit.

PLT Series Press Capacities

PLT	Diameter	Cubic Yard/Hour
8***	8”	2
12***	12”	6
16***	16”	12

FEATURES

- 304 stainless steel construction
- solids chute
- shaft-mounted, TEFC, geardrive motor
- spray bar

OPTIONS

- 316 stainless steel construction
- control panel
- compressed solids bagger, continuous plastic sleeve
- extensions as required for conveying

Washed & Compacted Screenings from IPEC PLT

CONTACT IPEC

Toll Free: (800)663-8409 • Tel: (604)291-7150 • Fax: (604)291-7190 • Email: sales@ipec.ca • Web Site: ipec.ca

G3. Sequencing Batch Reactor Design Criteria, Vendor Data, and EPA Bulletin

G3.1. Sequencing Batch Reactor Design Criteria

SBR Process Design Criteria

	2035	2024
	Phase 2	Phase 1
Design Flow		
Avg Day	0.230 MGD	0.175 MGD
Max Mon	0.315 MGD	0.24 MGD
Max Day	0.633 MGD	0.483 MGD
Max Hr	1.70 MGD	1.30 MGD
Max hr Post FEB	1.01 MGD	1.01 MGD
Design Load		
Avg BOD_5	767 lbs/day	584 lbs/day
Max Mo BOD_5	1,029 lbs/day	783 lbs/day
Max Mon TSS	1,242 lbs/day	909 lbs/day
Max Mon NH_3	100 lbs/day	76 lbs/day
Screen		
Qty	2	
Capacity		
Washer Compactor	1	
Influent Pump Stn		
Pump Qty	2	2
Capacity gpm ea.	425	425
Grit Chamber		
Dia, ft	8	
Capacity (MGD)	2.5	
Grit Classifier	1	
Parshall Flume		
Throat, inches	6	
FEB		
Volume, ft^3	8,128	
Pump Qty	3	4
Pump Capacity (gpm ea.)	400	400
Blowers	2	
SBRs		
SBR Tanks, Qty	3	2
SBR ft^3 total	52,920	35,280
Aeration MLSS (mg/l)	4,500	4,500
Blower, Qty	4	3
CFM/tank	161	161
Mixers (1/tank)	3	3
WAS Pumps	3	2
Capacity (gpm each)	35	35

SBR Process Design Criteria

	2035	2024
	Phase 2	Phase 1
Effluent Holding Tank		
Volume (ft^3)	4,000	
Pump Qty	3	3
Pump Capacity (gpm ea.)	350	350
Effluent Cloth Filters		
Qty	3	
Capacity, MGD	2	
UV Disinfection		
Capacity (MGD)	2	2
Channels =2, banks per channel = 2		
Dosage per Bank = 30,500 microwatts sec/cm^2		
Digesters		
Qty	3	
No. 1 Volume (ft^3)	7,926 existing	
Blower HP	15	
No. 2 &3 Volume Total (ft^3)	21,694 new	
Blower HP	25	
lbs biosolids/day, Max Month	554	
Days of Detention, Max Month	40	
Biosolids Dewatering		
Belt Press width (M)	0.5	
Capacity (dry lbs/hr)	230	
Capacity (gpm)	30	
Lime Mixing System		
Lime (lb/lb dry solids)	0.35	
Storage Volume (ft^3)	1,200	
Spreader Truck		
Capacity, cubic yards	10	

G3.2. Sequencing Batch Reactor Vendor Data

AquaSBR

Kruger Filter (Please refer to G2.3.)

IPEC Screen Washer Compactor and Screw Press (Please refer to G2.3.)

Julia Sheets

From:	Doug Allie <dallie@goblesampson.com>
Sent:	Saturday, August 02, 2014 8:36 AM
To:	Allan Maas
Subject:	RE: Pacific City WWTP Upgrade - AquaSBR
Attachments:	2014-08-01 Prelim Design 137952.pdf

Allan,

Attached is a preliminary design (Design #137952) for Pacific City, OR. Based on the information provided, we recommend a dual-basin AquaSBR® Sequencing Batch Reactor system. This design includes the following equipment for each SBR basin: influent valve, mixer, decanter, pump, retrievable fine bubble diffuser equipment, and level sensor. One (1) duty blower and one (1) standby blower are also included. A control panel has been included for the AquaSBR® system. A pump repair kit and two (2) spare blower belts have been included. Stainless steel materials of construction have been included where necessary per request. Flow meters have not been included, as the AquaSBR® does not require them for any functional purpose. Preliminary pricing for the recommended equipment in this design, including freight to the job site and our standard startup supervision services, is $365,000.

Please let us know if you have any questions or need any additional information.

Douglas Allie
GOBLE SAMPSON ASSOCIATES
22526 SE 64th Place, #240
Issaquah, WA 98027
dallie@goblesampson.com
P: (425) 392-0491
C: (206) 999-8436
www.goblesampson.com

From: Allan Maas [mailto:AMaas@parametrix.com]
Sent: Friday, July 25, 2014 1:34 PM
To: Doug Allie
Subject: FW: Pacific City WWTP Upgrade

We are in the planning stage of upgrading a WWTP in Pacific OR. It is an existing activated sludge plant. One option we will review is changing the process to SBR. Based on the design info below, please provide a preliminary proposal for a 2 tank Aqua Aerobic System SBR system including:

SBR tank equipment
SBR tank piping
SBR blowers
SBR WAS pumps
SBR tank diffusers, decanters & mixers
SBR Control panel w Wonderware
MCC panels for the complete SBR system (show cost separately)
Process valves
Flow meters
other instruments
Spare blower belts
Spare pump bearings

PROCESS DESIGN REPORT

PACIFIC CITY (PCJWSA) OR

Design#: 137952

Option: Preliminary SBR Design

Designed By: Dawn Brady on Friday, August 1, 2014

The enclosed information is based on preliminary data which we have received from you. There may be factors unknown to us which would alter the enclosed recommendation. These recommendations are based on models and assumptions widely used in the industry. While we attempt to keep these current, Aqua-Aerobic Systems, Inc. assumes no responsibility for their validity or any risks associated with their use. Also, because of the various factors stated above, Aqua-Aerobic Systems, Inc. assumes no responsibility for any liability resulting from any use made by you of the enclosed recommendations.

Design Notes

Pre-SBR

- Neutralization is recommended/required ahead of the SBR if the pH is expected to fall outside of 6.5-8.5 for significant durations.

- Coarse solids removal/reduction is recommended prior to the SBR.

SBR

- The maximum flow, as shown on the design, has been assumed as a hydraulic maximum and does not represent an additional organic load.

- When flows are in excess of the maximum daily flow of 0.483 MGD, the SBR system has been designed to advance cycles in order to process a peak hydraulic flow of 1.3 MGD.

- Depending upon the magnitude and duration of the peak flow, effluent quality may be degraded.

- The decanter performance is based upon a free-air discharge following the valve and immediately adjacent to the basin. Actual decanter performance depends upon the complete installation including specific liquid and piping elevations and any associated field piping losses to the final point of discharge. Modification of the high water level, low water level, centerline of discharge, and / or cycle structure may be required to achieve discharge of full batch volume based on actual site installation specifics.

Aeration

- The aeration system has been designed to provide 1.25 lbs. O2/lb. BOD5 applied and 4.6 lbs. O2/lb. NH3-N applied at the design average loading conditions.

Process/Site

- Elevation and temperature have been assumed as displayed on the design and are to be verified by the engineer.

- The anticipated effluent NH3-N requirement is predicated upon an influent waste temperature of 10° C or greater. While lower temperatures may be acceptable for a short-term duration, nitrification below 10° C can be unpredictable, requiring special operator attention.

- Sufficient alkalinity is required for nitrification, as approximately 7.1 mg alkalinity (as CaCO3) is required for every mg of NH3-N nitrified. If the raw water alkalinity cannot support this consumption, while maintaining a residual concentration of 50 mg/l, supplemental alkalinity shall be provided (by others).

Equipment

- The basin dimensions reported on the design have been assumed based upon the required volumes and assumed basin geometry. Actual basin geometry may be circular, square, rectangular or sloped with construction materials including concrete, steel or earthen.

- Rectangular or sloped basin construction with length to width ratios greater than 1.5:1 may require alterations in the equipment recommendation.

- The basins are not included and shall be provided by others.

- Influent is assumed to enter the reactor above the waterline, located appropriately to avoid proximity to the decanter, splashing or direct discharge in the immediate vicinity of other equipment.

- If the influent is to be located submerged below the waterline, adequate hydraulic capacity shall be made in the headworks to prevent backflow from one reactor to the other during transition of influent.

- The motor control center (MCC) shall be provided by others.

- A minimum freeboard of 2.0 ft. is recommended for diffused aeration.

- Aqua-Aerobic Systems, Inc. (AASI) is familiar with the Buy American provision of the American Recovery and Reinvestment Act of 2009 as well as other Buy American provisions (i.e. FAR 52.225, EXIM Bank, USAid, etc.). AASI can provide a system that is in full compliance with Buy American provisions. As the project develops AASI can work with you to ensure full compliance with a Buy American provision, if required. Please contact the factory should compliance with a Buy American provision be required.

AquaSBR - Sequencing Batch Reactor - Design Summary

DESIGN INFLUENT CONDITIONS

Avg. Design Flow	= 0.24 MGD	= 908 m3/day
Max Design Flow	= 0.483 MGD	= 1828 m3/day
Peak Hyd. Flow	= 1.3 MGD	= 4921 m3/day (with advancing cycles)

DESIGN PARAMETERS

			Effluent			
	Influent	**mg/l**	**Required**	**<= mg/l**	**Anticipated**	**<= mg/l**
Bio/Chem Oxygen Demand:	BOD5	188	BOD5	10	BOD5	10
Total Suspended Solids:	TSS	218	TSS	10	TSS	10
Inf. Ammonia Nitrogen:	NH3-N	19	--	--	--	--

SITE CONDITIONS

	Maximum		Minimum		Design		Elevation (MSL)
Ambient Air Temperatures:	70 F	21.1 C	40 F	4.4 C	70 F	21.1 C	30 ft
Influent Waste Temperatures:	68 F	20.0 C	50 F	10.0 C	68 F	20.0 C	9.1 m

SBR BASIN DESIGN VALUES

			Water Depth			Basin Vol./Basin		
No./Basin Geometry:	= 2 Rectangular Basin(s)		**Min**	= 13.3 ft	= (4.1 m)	**Min**	= 0.084 MG	= (316.7 m³)
Freeboard:	= 2.0 ft	= (0.6 m)	**Avg**	= 17.1 ft	= (5.2 m)	**Avg**	= 0.108 MG	= (407.5 m³)
Length of Basin:	= 35.0 ft	= (10.7 m)	**Max**	= 21.0 ft	= (6.4 m)	**Max**	= 0.132 MG	= (499.5 m³)
Width of Basin:	= 24.0 ft	= (7.3 m)						

Number of Cycles:	= 5 per Day/Basin	
Cycle Duration:	= 4.8 Hours/Cycle	
Food/Mass (F/M) ratio:	= 0.060 lbs. BOD5/lb. MLSS-Day	
MLSS Concentration:	= 4500 mg/l @ Min. Water Depth	
Hydraulic Retention Time:	= 0.897 Days @ Avg. Water Depth	
Solids Retention Time:	= 17.5 Days	
Est. Net Sludge Yield:	= 0.902 lbs. WAS/lb. BOD5	
Est. Dry Solids Produced:	= 339.6 lbs. WAS/Day	= (154.0 kg/Day)
Est. Solids Flow Rate:	= 40 GPM (4071 GAL/Day)	= (15.4 m³/Day)
Decant Flow Rate @ MDF:	= 755.0 GPM (as avg. from high to low water level)	= (47.6 l/sec)
LWL to CenterLine Discharge:	= 1.0 ft	= (0.3 m)
Lbs. O2/lb. BOD5	= 1.25	
Lbs. O2/lb. NH3-N	= 4.60	
Actual Oxygen Required:	= 645 lbs./Day	= (292.7 kg/Day)
Air Flowrate/Basin:	= 161 SCFM	= (4.6 Sm3/min)
Max. Discharge Pressure:	= 10.7 PSIG	= (74 KPA)
Avg. Power Required:	= 178.0 KW-Hrs/Day	

AquaSBR

Influent Valves

2 Influent Valve(s) will be provided as follows:

- 10 inch electrically operated plug valve(s).

Mixers

2 AquaDDM Direct Drive Mixer(s) will be provided as follows:

- 3 HP Aqua-Aerobic Systems Endura Series Model FSS DDM Mixer(s).

Mixer Mooring

2 Mixer pivotal mooring assembly(ies) consisting of:

- 304 stainless steel pivotal mooring arm(s).
- #12 AWG-four conductor electrical service cable(s).
- Electrical cable strain relief grip(s), 2 eye, wire mesh.

2 Mixer De-Watering Support(s) will be provided as follows:

- Stainless steel de-watering support post(s).
- Stainless steel support angle(s).
- 316 stainless steel anchors.

Decanters

2 Decanter Assembly(ies) consisting of:

- 6x4 Aqua-Aerobics decanter(s) with fiberglass float, 304 stainless steel weir, 304 stainless steel restrained mooring frame, and painted steel power section with #14-10 conductor power cable.
- 8 inch diameter decant hose assembly.
- 4" schedule 40 304 stainless steel restrained mooring post(s) with base plate.
- 8 inch electrically operated butterfly valve(s) with actuator.

Transfer Pumps/Valves

2 Submersible pump assembly(ies) consisting of the following items:

- 2.4 HP Submersible Pump(s) with painted cast iron pump housing, discharge elbow, and multi-conductor electrical cable.
- Manual plug valve(s).
- 3 inch diameter swing check valve.
- 304 stainless steel upper guide bar bracket(s).
- 304 stainless steel slide rail assembly(ies).

Retrievable Fine Bubble Diffusers

1 Diffuser Electric Winch(es) will be provided as follows:

- Portable electric winch.

4 Retrievable Fine Bubble Diffuser Assembly(ies) consisting of:

- 10 diffuser tubes consisting of two flexible EPDM porous membrane sheaths mounted on a rigid support pipe with 304 stainless steel band clamps.
- 304 stainless steel manifold weldment.
- 304 stainless steel leveling angles.
- 304 stainless steel leveling studs.
- 304 stainless steel vertical support beam.
- 304 stainless steel vertical air column assembly.
- Galvanized upper vertical beam and pulley assembly.
- Galvanized top support bracket.
- 3" EPDM flexible air line with ny-glass quick disconnect end fittings.

- Galvanized threaded flange.
- 3" manual isolation butterfly valve with cast iron body, EPDM seat, aluminum bronze disk and one-piece steel shaft.
- Ny-glass quick disconnect cam lock adapter.
- 316 stainless steel adhesive anchors.
- Brace angles.

Positive Displacement Blowers

2 Positive Displacement Blower Package(s), with each package consisting of:

- Sutorbilt 5H Positive Displacement Blower Package with common base, V-belt drive, enclosed drive guard, pressure gauge, pressure relief valve, and vibration pads.
- 316 stainless steel anchors.
- 15 HP motor with slide base.
- Inlet filter and inlet silencer.
- Discharge silencer, check valve, manual butterfly isolation valve, and flexible discharge connector.

Air Valves

2 Air Control Valve(s) will be provided as follows:

- 3 inch electrically operated butterfly valve(s) with actuator.

Level Sensor Assemblies

2 Pressure Transducer Assembly(ies) each consisting of:

- Submersible pressure transducer(s).
- Mounting bracket weldment(s).
- Transducer mounting pipe weldment(s).
- 316 stainless steel anchors.

2 Level Sensor Assembly(ies) will be provided as follows:

- Float switch(es).
- Float switch mounting bracket(s).
- 316 stainless steel anchors.

Misc/Spare Parts

1 Set(s), Spare Parts will be provided as follows:

- Set(s), 15 HP Blower V-Belts.
- Pump rebuild kit(s).

Controls

Controls wo/Starters

1 Controls Package(s) will be provided as follows:

- NEMA 12 panel enclosure suitable for indoor installation and constructed of painted steel.
- Fuse(s) and fuse block(s).
- Allen Bradley 1769-L30ER Compactlogix integral programmable controller.
- Operator interface(s).
- Remote Access Ethernet Modem.

G3.3. Sequencing Batch Reactor EPA Bulletin

United States Environmental Protection Agency
Office of Water Washington, D.C.
EPA 832-F-99-073 September 1999

Wastewater Technology Fact Sheet
Sequencing Batch Reactors

DESCRIPTION

The sequencing batch reactor (SBR) is a fill-and-draw activated sludge system for wastewater treatment. In this system, wastewater is added to a single "batch" reactor, treated to remove undesirable components, and then discharged. Equalization, aeration, and clarification can all be achieved using a single batch reactor. To optimize the performance of the system, two or more batch reactors are used in a predetermined sequence of operations. SBR systems have been successfully used to treat both municipal and industrial wastewater. They are uniquely suited for wastewater treatment applications characterized by low or intermittent flow conditions.

Fill-and-draw batch processes similar to the SBR are not a recent development as commonly thought. Between 1914 and 1920, several full-scale fill-and-draw systems were in operation. Interest in SBRs was revived in the late 1950s and early 1960s, with the development of new equipment and technology. Improvements in aeration devices and controls have allowed SBRs to successfully compete with conventional activated sludge systems.

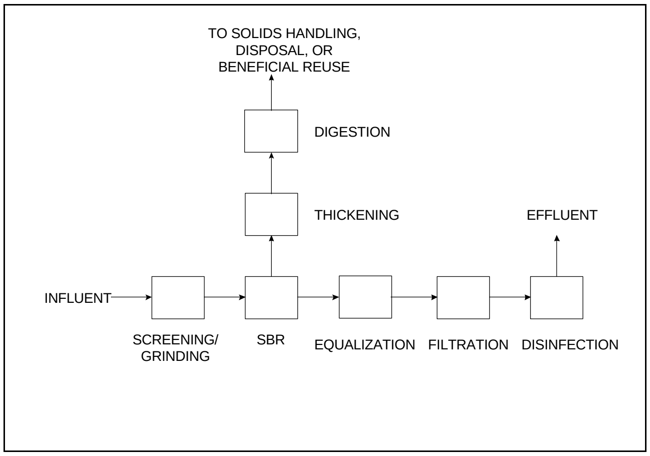
The unit processes of the SBR and conventional activated sludge systems are the same. A 1983 U.S. EPA report, summarized this by stating that "the SBR is no more than an activated sludge system which operates in time rather than in space." The difference between the two technologies is that the SBR performs equalization, biological treatment, and secondary clarification in a single tank using a timed control sequence. This type of reactor does, in some cases, also perform primary clarification. In a conventional activated sludge system, these unit processes would be accomplished by using separate tanks.

A modified version of the SBR is the Intermittent Cycle Extended Aeration System (ICEAS). In the ICEAS system, influent wastewater flows into the reactor on a continuous basis. As such, this is not a true batch reactor, as is the conventional SBR. A baffle wall may be used in the ICEAS to buffer this continuous inflow. The design configurations of the ICEAS and the SBR are otherwise very similar.

Description of a Wastewater Treatment Plant Using an SBR

A typical process flow schematic for a municipal wastewater treatment plant using an SBR is shown in Figure 1. Influent wastewater generally passes through screens and grit removal prior to the SBR. The wastewater then enters a partially filled reactor, containing biomass, which is acclimated to the wastewater constituents during preceding cycles. Once the reactor is full, it behaves like a conventional activated sludge system, but without a continuous influent or effluent flow. The aeration and mixing is discontinued after the biological reactions are complete, the biomass settles, and the treated supernatant is removed. Excess biomass is wasted at any time during the cycle. Frequent wasting results in holding the mass ratio of influent substrate to biomass nearly constant from cycle to cycle. Continuous flow systems hold the mass ratio of influent substrate to biomass constant by adjusting return activated sludge flowrates continually as influent flowrates, characteristics, and settling tank underflow concentrations vary. After the SBR, the "batch" of wastewater may flow to an equalization basin where the wastewater flowrate to additional unit processed can be is controlled at a determined rate. In some cases the wastewater is filtered to remove additional solids and then disinfected.

As illustrated in Figure 1, the solids handling system may consist of a thickener and an aerobic digester. With SBRs there is no need for return activated sludge (RAS) pumps and primary sludge (PS) pumps like those associated with conventional activated sludge systems. With the SBR, there is typically only one sludge to handle. The need for gravity thickeners prior to digestion is determined



Source: Parsons Engineering Science, 1999.

FIGURE 1 PROCESS FLOW DIAGRAM FOR A TYPICAL SBR

on a case by case basis depending on the characteristics of the sludge.

An SBR serves as an equalization basin when the vessel is filling with wastewater, enabling the system to tolerate peak flows or peak loads in the influent and to equalize them in the batch reactor. In many conventional activated sludge systems, separate equalization is needed to protects the biological system from peak flows, which may wash out the biomass, or peak loads, which may upset the treatment process.

It should also be noted that primary clarifiers are typically not required for municipal wastewater applications prior to an SBR. In most conventional activated sludge wastewater treatment plants, primary clarifiers are used prior to the biological system. However, primary clarifiers may be recommended by the SBR manufacturer if the total suspended solids (TSS) or biochemical oxygen demand (BOD) are greater than 400 to 500 mg/L. Historic data should be evaluated and the SBR manufacturer consulted to determine whether primary clarifiers or equalization are recommended prior to an SBR for municipal and industrial applications.

Equalization may be required after the SBR, depending on the downstream process. If equalization is *not* used prior to filtration, the filters need to be sized in order to receive the batch of wastewater from the SBR, resulting in a large surface area required for filtration. Sizing filters to accept these “batch” flows is usually not feasible, which is why equalization is used between an SBR and downstream filtration. Separate equalization following the biological system is generally not required for most conventional activated sludge systems, because the flow is on a continuous and more constant basis.

APPLICABILITY

SBRs are typically used at flowrates of 5 MGD or less. The more sophisticated operation required at larger SBR plants tends to discourage the use of these plants for large flowrates.

As these systems have a relatively small footprint, they are useful for areas where the available land is limited. In addition, cycles within the system can be easily modified for nutrient removal in the future, if it becomes necessary. This makes SBRs extremely flexible to adapt to regulatory changes for effluent parameters such as nutrient removal. SBRs are also very cost effective if treatment beyond biological treatment is required, such as filtration.

ADVANTAGES AND DISADVANTAGES

Some advantages and disadvantages of SBRs are listed below:

Advantages

- Equalization, primary clarification (in most cases), biological treatment, and secondary clarification can be achieved in a single reactor vessel.

- Operating flexibility and control.

- Minimal footprint.

- Potential capital cost savings by eliminating clarifiers and other equipment.

Disadvantages

- A higher level of sophistication is required (compared to conventional systems), especially for larger systems, of timing units and controls.

- Higher level of maintenance (compared to conventional systems) associated with more sophisticated controls, automated switches, and automated valves.

- Potential of discharging floating or settled sludge during the DRAW or decant phase with some SBR configurations.

- Potential plugging of aeration devices during selected operating cycles, depending on the aeration system used by the manufacturer.

- Potential requirement for equalization after the SBR, depending on the downstream processes.

DESIGN CRITERIA

For any wastewater treatment plant design, the first step is to determine the anticipated influent characteristics of the wastewater and the effluent requirements for the proposed system. These influent parameters typically include design flow, maximum daily flow BOD_5, TSS, pH, alkalinity, wastewater temperature, total Kjeldahl nitrogen (TKN), ammonia-nitrogen (NH_3-N), and total phosphorus (TP). For industrial and domestic wastewater, other site specific parameters may also be required.

The state regulatory agency should be contacted to determine the effluent requirements of the proposed plant. These effluent discharge parameters will be dictated by the state in the National Pollutant Discharge Elimination System (NPDES) permit. The parameters typically permitted for municipal systems are flowrate, BOD_5, TSS, and Fecal Coliform. In addition, many states are moving toward requiring nutrient removal. Therefore, total nitrogen (TN), TKN, NH_3-N, or TP may also be required. It is imperative to establish effluent requirements because they will impact the operating sequence of the SBR. For example, if there is a nutrient requirement and NH_3-N or TKN is required, then nitrification will be necessary. If there is a TN limit, then nitrification and denitrification will be necessary.

Once the influent and effluent characteristics of the system are determined, the engineer will typically consult SBR manufacturers for a recommended design. Based on these parameters, and other site specific parameters such as temperature, key design parameters are selected for the system. An example of these parameters for a wastewater system loading is listed in Table 1.

TABLE 1 KEY DESIGN PARAMETERS FOR A CONVENTIONAL LOAD

	Municipal	Industrial
Food to Mass (F:M)	0.15 - 0.4/day	0.15 - 0.6/day
Treatment Cycle Duration	4.0 hours	4.0 - 24 hours
Typically Low Water Level Mixed Liquor Suspended Solids	2,000-2,500 mg/L	2,000 - 4,000 mg/L
Hydraulic Retention Time	6 - 14 hours	varies

Source: AquaSBR Design Manual, 1995.

Once the key design parameters are determined, the number of cycles per day, number of basins, decant volume, reactor size, and detention times can be calculated. Additionally, the aeration equipment, decanter, and associated piping can then be sized.

Other site specific information is needed to size the aeration equipment, such as site elevation above mean sea level, wastewater temperature, and total dissolved solids concentration.

The operation of an SBR is based on the fill-and-draw principle, which consists of the following five basic steps: Idle, Fill, React, Settle, and Draw. More than one operating strategy is possible during most of these steps. For industrial wastewater applications, treatability studies are typically required to determine the optimum operating sequence. For most municipal wastewater treatment plants, treatability studies are not required to determine the operating sequence because municipal wastewater flowrates and characteristic variations are usually predictable and most municipal designers will follow conservative design approaches.

The Idle step occurs between the Draw and the Fill steps, during which treated effluent is removed and influent wastewater is added. The length of the Idle step varies depending on the influent flowrate and the operating strategy. Equalization is achieved during this step if variable idle times are used. Mixing to condition the biomass and sludge wasting can also be performed during the Idle step, depending on the operating strategy.

Influent wastewater is added to the reactor during the Fill step. The following three variations are used for the Fill step and any or all of them may be used depending on the operating strategy: static fill, mixed fill, and aerated fill. During static fill, influent wastewater is added to the biomass already present in the SBR. Static fill is characterized by no mixing or aeration, meaning that there will be a high substrate (food) concentration when mixing begins. A high food to microorganisms (F:M) ratio creates an environment favorable to floc forming organisms versus filamentous organisms, which provides good settling characteristics for the sludge. Additionally, static fill conditions favor organisms that produce internal storage products during high substrate conditions, a requirement for biological phosphorus removal. Static fill may be compared to using “selector” compartments in a conventional activated sludge system to control the F:M ratio.

Mixed fill is classified by mixing influent organics with the biomass, which initiates biological reactions. During mixed fill, bacteria biologically degrade the organics and use residual oxygen or alternative electron acceptors, such as nitrate-nitrogen. In this environment, denitrification may occur under these anoxic conditions. Denitrification is the biological conversion of nitrate-nitrogen to nitrogen gas. An anoxic condition is defined as an environment in which oxygen is not present and nitrate-nitrogen is used by the microorganisms as the electron acceptor. In a conventional biological nutrient removal (BNR) activated sludge system, mixed fill is comparable to the anoxic zone which is used for denitrification. Anaerobic conditions can also be achieved during the mixed fill phase. After the microorganisms use the nitrate-nitrogen, sulfate becomes the electron acceptor. Anaerobic conditions are characterized by the lack of oxygen and sulfate as the electron acceptor.

Aerated Fill is classified by aerating the contents of the reactor to begin the aerobic reactions completed in the React step. Aerated Fill can reduce the aeration time required in the React step.

The biological reactions are completed in the React step, in which mixed react and aerated react modes are available. During aerated react, the aerobic reactions initialized during aerated fill are completed and nitrification can be achieved. Nitrification is the conversion of ammonia-nitrogen to nitrite-nitrogen and ultimately to nitrate-nitrogen. If the mixed react mode is selected, anoxic conditions can be attained to achieve denitrification. Anaerobic conditions can also be achieved in the mixed react mode for phosphorus removal.

Settle is typically provided under quiescent conditions in the SBR. In some cases, gentle mixing during the initial stages of settling may result in a clearer effluent and a more concentrated settled sludge. In an SBR, there are no influent or effluent currents to interfere with the settling process as in a conventional activated sludge system.

The Draw step uses a decanter to remove the treated effluent, which is the primary distinguishing factor between different SBR manufacturers. In general, there are floating decanters and fixed decanters. Floating decanters offer several advantages over fixed decanters as described in the Tank and Equipment Description Section.

Construction

Construction of SBR systems can typically require a smaller footprint than conventional activated sludge systems because the SBR often eliminates the need for primary clarifiers. The SBR never requires secondary clarifiers. The size of the SBR tanks themselves will be site specific, however the SBR system is advantageous if space is limited at the proposed site. A few case studies are presented in Table 2 to provide general sizing estimates at different flowrates. Sizing of these systems is site specific and these case studies do not reflect every system at that size.

TABLE 2 CASE STUDIES FOR SEVERAL SBR INSTALLATIONS

Flow	Reactors			Blowers	
(MGD)	No.	Size (feet)	Volume (MG)	No.	Size (HP)
0.012	1	18 x 12	0.021	1	15
0.10	2	24 x 24	0.069	3	7.5
1.2	2	80 x 80	0.908	3	125
1.0	2	58 x 58	0.479	3	40
1.4	2	69 x 69	0.678	3	60
1.46	2	78 x 78	0.910	4	40
2.0	2	82 x 82	0.958	3	75
4.25	4	104 x 80	1.556	5	200
5.2	4	87 x 87	1.359	5	125

Note: These case studies and sizing estimates were provided by Aqua-Aerobic Systems, Inc. and are site specific to individual treatment systems.

The actual construction of the SBR tank and equipment may be comparable or simpler than a conventional activated sludge system. For Biological Nutrient Removal (BNR) plants, an SBR eliminates the need for return activated sludge (RAS) pumps and pipes. It may also eliminate the need for internal Mixed Liquor Suspended Solid (MLSS) recirculation, if this is being used in a conventional BNR system to return nitrate-nitrogen.

The control system of an SBR operation is more complex than a conventional activated sludge system and includes automatic switches, automatic valves, and instrumentation. These controls are very sophisticated in larger systems. The SBR manufacturers indicate that most SBR installations in the United States are used for smaller wastewater systems of less than two million gallons per day (MGD) and some references recommend SBRs only for small communities where land is limited. This is not always the case, however, as the largest SBR in the world is currently a 10 MGD system in the United Arab Emirates.

Tank and Equipment Description

The SBR system consists of a tank, aeration and mixing equipment, a decanter, and a control system. The central features of the SBR system include the control unit and the automatic switches and valves that sequence and time the different operations. SBR manufacturers should be consulted for recommendations on tanks and equipment. It is typical to use a complete SBR system recommended and supplied by a single SBR manufacturer. It is possible, however, for an engineer to design an SBR system, as all required tanks, equipment, and controls are available through different manufacturers. This is not typical of SBR installation because of the level of sophistication of the instrumentation and controls associated with these systems.

The SBR tank is typically constructed with steel or concrete. For industrial applications, steel tanks coated for corrosion control are most common while concrete tanks are the most common for municipal treatment of domestic wastewater. For mixing and aeration, jet aeration systems are typical as they allow mixing either with or without aeration, but other aeration and mixing systems are also used. Positive displacement blowers are typically used for SBR design to handle wastewater level variations in the reactor.

As previously mentioned, the decanter is the primary piece of equipment that distinguishes different SBR manufacturers. Types of decanters include floating and fixed. Floating decanters offer the advantage of maintaining the inlet orifice slightly below the water surface to minimize the removal of solids in the effluent removed during the DRAW step. Floating decanters also offer the operating flexibility to vary fill-and-draw volumes. Fixed decanters are built into the side of the basin and can be used if the Settle step is extended. Extending the Settle step minimizes the chance that solids in the wastewater will float over the fixed decanter. In some cases, fixed decanters are less expensive and can be designed to allow the operator to lower or raise the level of the decanter. Fixed decanters do not offer the operating flexibility of the floating decanters.

Health and Safety

Safety should be the primary concern in every design and system operation. A properly designed and operated system will minimize potential health and safety concerns. Manuals such as the Manual of Practice (MOP) No. 8, Design of Municipal Wastewater Treatment Plants, and MOP No. 11, Operation of Municipal Wastewater Treatment Plants should be consulted to minimize these risks. Other appropriate industrial wastewater treatment manuals, federal regulations, and state regulations should also be consulted for the design and operation of wastewater treatment systems.

PERFORMANCE

The performance of SBRs is typically comparable to conventional activated sludge systems and depends on system design and site specific criteria. Depending on their mode of operation, SBRs can achieve good BOD and nutrient removal. For SBRs, the BOD removal efficiency is generally 85 to 95 percent.

SBR manufacturers will typically provide a process guarantee to produce an effluent of less than:

- 10 mg/L BOD
- 10 mg/L TSS
- 5 - 8 mg/L TN
- 1 - 2 mg/L TP

OPERATION AND MAINTENANCE

The SBR typically eliminates the need for separate primary and secondary clarifiers in most municipal systems, which reduces operations and maintenance requirements. In addition, RAS pumps are not required. In conventional biological nutrient removal systems, anoxic basins, anoxic zone mixers, toxic basins, toxic basin aeration equipment, and internal MLSS nitrate-nitrogen recirculation pumps may be necessary. With the SBR, this can be accomplished in one reactor using aeration/mixing equipment, which will minimize operation and maintenance requirements otherwise be needed for clarifiers and pumps.

Since the heart of the SBR system is the controls, automatic valves, and automatic switches, these systems may require more maintenance than a conventional activated sludge system. An increased level of sophistication usually equates to more items that can fail or require maintenance. The level of sophistication may be very advanced in larger SBR wastewater treatment plants requiring a higher level of maintenance on the automatic valves and switches.

Significant operating flexibility is associated with SBR systems. An SBR can be set up to simulate any conventional activated sludge process, including BNR systems. For example, holding times in the Aerated React mode of an SBR can be varied to achieve simulation of a contact stabilization system with a typical hydraulic retention time (HRT) of 3.5 to 7 hours or, on the other end of the spectrum, an extended aeration treatment system with a typical HRT of 18 to 36 hours. For a BNR plant, the aerated react mode (oxic conditions) and the mixed react modes (anoxic conditions) can be alternated to achieve nitrification and denitrification. The mixed fill mode and mixed react mode can be used to achieve denitrification using anoxic conditions. In addition, these modes can ultimately be used to achieve an anaerobic condition where phosphorus removal can occur. Conventional activated sludge systems typically require additional tank volume to achieve such flexibility. SBRs operate in time rather than in space and the number of cycles per day can be varied to control desired effluent limits, offering additional flexibility with an SBR.

COSTS

This section includes some general guidelines as well as some general cost estimates for planning purposes. It should be remembered that capital and construction cost estimates are site-specific.

Budget level cost estimates presented in Table 3 are based on projects that occurred from 1995 to 1998. Budget level costs include such as the blowers, diffusers, electrically operated valves, mixers, sludge pumps, decanters, and the control panel. All costs have been updated to March 1998 costs, using an ENR construction cost index of 5875 from the March 1998 Engineering News Record, rounded off to the nearest thousand dollars.

TABLE 3 SBR EQUIPMENT COSTS BASED ON DIFFERENT PROJECTS

Design Flowrate (MGD)	Budget Level Equipment Costs ($)
0.012	94,000
0.015	137,000
1.0	339,000
1.4	405,000
1.46	405,000
2.0	564,000
4.25	1,170,000

Source: Aqua Aerobics Manufacturer Information, 1998.

In Table 4, provided a range of equipment costs for different design flowrates is provided.

TABLE 4 BUDGET LEVEL EQUIPMENT COSTS BASED ON DIFFERENT FLOW RATES

Design Flowrate (MGD)	Budget Level Equipment Costs ($)
1	150,000 - 350,000
5	459,000 - 730,000
10	1,089,000 - 1,370,000
15	2,200,000
20	2,100,000 - 3,000,000

Note: Budget level cost estimates provided by Babcock King - Wilkinson, L.P., August 1998.

Again the equipment cost items provided do not include the cost for the tanks, sitework, excavation/backfill, installation, contractor's overhead and profit, or legal, administrative, contingency, and engineering services. These items must be included to calculate the overall construction costs of an SBR system. Costs for other treatment processes, such as screening, equalization, filtration, disinfection, or aerobic digestion, may be included if required.

The ranges of construction costs for a complete, installed SBR wastewater treatment system are presented in Table 5. The variances in the estimates are due to the type of sludge handling facilities and the differences in newly constructed plants versus systems that use existing plant facilities. As such, in some cases these estimates include other processes required in an SBR wastewater treatment plant.

TABLE 5 INSTALLED COST PER GALLON OF WASTEWATER TREATED

Design Flowrate (MGD)	Budget Level Equipment Cost ($/gallon)
0.5 - 1.0	1.96 - 5.00
1.1 - 1.5	1.83 - 2.69
1.5 - 2.0	1.65 - 3.29

Note: Installed cost estimates obtained from Aqua-Aerobics Systems, Inc., August 1998.

There is typically an economy of scale associated with construction costs for wastewater treatment, meaning that larger treatment plants can usually be constructed at a lower cost per gallon than smaller systems. The use of common wall construction for larger treatment systems, which can be used for square or rectangular SBR reactors, results in this economy of scale.

Operations and Maintenance (O&M) costs associated with an SBR system may be similar to a conventional activated sludge system. Typical cost items associated with wastewater treatment systems include labor, overhead, supplies, maintenance, operating administration, utilities, chemicals, safety and training, laboratory testing, and solids handling. Labor and maintenance requirements may be reduced in SBRs because clarifiers, clarification equipment, and RAS pumps may not be necessary. On the other hand, the maintenance requirements for the automatic valves and switches that control the sequencing may be more intensive than for a conventional activated sludge system. O&M costs are site specific and may range from $800 to $2,000 dollars per million gallons treated.

REFERENCES

1. *AquaSBR Design Manual*. Mikkelson, K.A. of Aqua-Aerobic Systems. Copyright 1995.

2. Arora, Madan L. *Technical Evaluation of Sequencing Batch Reactors*. Prepared for U.S. EPA. U.S. EPA Contract No. 68-03-1821.

3. *Engineering News-Record*. A publication of the McGraw Hill Companies, March 30, 1998.

4. Irvine, Robert L. *Technology Assessment of Sequencing Batch Reactors*. Prepared for U.S. EPA. U.S. EPA Contract No. 68-03-3055.

5. Liu, Liptak, and Bouis. *Environmental Engineer's Handbook*, 2nd edition. New York: Lewis Publishers.

6. *Manufacturers Information.* Aqua-Aerobics, Babcock King-Wilkinson, L.P., Fluidyne, and Jet Tech Systems, 1998.

7. Metcalf & Eddy, Inc. *Wastewater Engineering: Treatment, Disposal, Reuse.* 3rd edition. New York: McGraw Hill.

8. Parsons Engineering Science, Inc. *Basis of Design Report - Urgent Extensions to Maray Sewer Treatment Works*, Abu Dhabi, UAE, 1992.

9. Norcross, K.L., *Sequencing Batch Reactors - An Overview*. Technical Paper published in the IAWPRC 1992 (0273-1221/92). Wat. Sci. Tech., Vol. 26, No. 9-11, pp. 2523 - 2526.

10. Peavy, Rowe, and Tchobanoglous: *Environmental Engineering.* New York: McGraw-Hill, Inc.

11. U.S. EPA. *Innovative and Alternative Technology Assessment Manual*, EPA/430/9-78-009. Cincinnati, Ohio, 1980.

12. U.S. EPA. EPA Design Manual, Summary Report *Sequencing Batch Reactors*. EPA/625/8-86/011, August 1986.

13. Manual of Practice (MOP) No. 8, Design of Municipal Wastewater Treatment Plants,

14. Manual of Practice (MOP) No. 11, Operation of Municipal Wastewater Treatment Plants.

ADDITIONAL INFORMATION

Brad Holtsinger, Chief Operator
City of Stockbridge WWTP
4545 North Henry Boulevard
Stockbridge, GA 30281

Gary Hooder, Operator
Martinsburg WWTP
133 East Allegheny
Martinsburg, PA 16662-1112

Mitchell Meadows, Lead Operator
1300 Recker Highway
Auburndale, FL 33823

Teresa Schnoor, Administrator
Antrim TWP
P.O. Box 130
Greencastle, PA 17225

Charles Sherrod, Chief Operator
Blountstown WWTP
125 West Central Avenue
Blountstown, FL 32424

For more information contact:

Municipal Technology Branch
U.S. EPA
Mail Code 4204
401 M St., S.W.
Washington, D.C., 20460

OWM MTB
Excellence in compliance through optimal technical solutions
MUNICIPAL TECHNOLOGY BRANCH

G4. Membrane Bioreactor Design Criteria, Vendor Data, and EPA Bulletin

G4.1. Membrane Bioreactor Design Criteria

MBR Process Design Criteria

	2035	2024
	phase 2	phase 1
Design Flow		
Avg Day	0.230 MGD	0.175 MGD
Max Mon	0.315 MGD	0.24 MGD
Max Day	0.633 MGD	0.483 MGD
Max Hr	1.70 MGD	1.30 MGD
Max hr Post FEB	0.8 MGD	0.8 MGD
Design Load		
Avg BOD_5	767 lbs/day	584 lbs/day
Max Mo BOD_5	1,029 lbs/day	783 lbs/day
Max Mon TSS	1,242 lbs/day	909 lbs/day
Max Mon NH_3	100 lbs/day	76 lbs/day
Fine 2 mm Screen		
Qty	2	
Capacity ea. MGD	1.7	
Washer Compactor	included	
Influent Pump Stn		
Pump Qty	2	2
Capacity gpm ea.	425	425
Grit Chamber		
Dia, ft	8	
Capacity (MGD)	2.5	
Grit Classifier	1	
Parshall Flume		
Throat, inches	6	
FEB		
Volume, ft^3	16,256	8,128
Pump Qty	4	3
Pump Capacity (gpm ea.)	400	400
Blowers	3	2
MBR Anoxic Tank		
Qty	1	1
Volume Total, ft^3	1,740	1,740
MBR Pre-aearation		
Pre-aeration Tanks	2	2
Volume Total, ft^3	13,200	13,200
MLSS	8,800	8,800

MBR Process Design Criteria

	2035	2024
	phase 2	phase 1
MBRs		
MBR Tanks	2	2
MBR Volume, (ft^3) Total	3,465	3,465
MLSS	10,000	10,000
Blower, Qty	3	3
CFM, ea Tank	304	304
Mixers, 1/Tank (HP)	3	3
Permeate Pumps	3	3
Capacity (gpm each)	309	309
Blowers	3	3
CFM (ea Tank)	284	284
Feed Forward Pumps	2	2
Capacity (gpm each)	1,235	1,235
WAS Pumps	3	2
Capacity (gpm each)	100	100
UV Disinfection		
Capacity (MGD)	2	2
Channels =2, banks per channel = 2		
Dosage per Bank = 30,500 microwatts sec/cm^2		
Digesters		
Qty	3	
No. 1 Volume (ft^3)	7,926 existing	
Blower HP	15	
No. 2 &3 Volume Total (ft^3)	21,694 new	
Blower HP	25	
lbs biosolids/day, Max Month	554	
Days of Detention, Max Month	40	
Biosolids Dewatering		
Belt Press Width (meters)	0.5	
Capacity (dry lbs/hr)	230	
Capacity (gpm)	30	
Lime Mixing System		
Lime (lb/lb dry solids)	0.35	
Storage Volume (ft^3)	1,200	
Spreader Truck		
Capacity, cubic yards	10	

G4.2. Membrane Bioreactor Vendor Data

Huber Screen
Ovivo MBR

HUBER TECHNOLOGY
WASTE WATER Solutions

Rotary Drum Fine Screen ROTAMAT® Ro 2

Rotating cylindrical fine screen

– integrated screenings washing
– integrated screenings press
– frost protection (optional)
– thousands of installations

Applications

- municipal wastewater
- industrial wastewater
- process water
- drinking water intakes

Features

The ROTAMAT® Rotary Drum Fine Screen Ro 2 is either installed in a channel or supplied in a tank.

It performs the functions of fine screening, conveying, washing, dewatering, compaction and bagging on a small footprint and with a single drive.

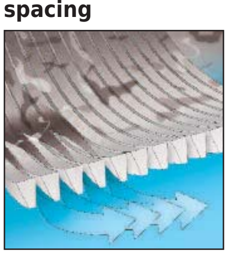
Water or wastewater flows through the open front into the inclined screen basket and then through the screen. Debris and other solids are retained within the screen basket. Carry-over of screenings cannot occur-making the Ro2 an exceptional choice for protecting technologies susceptable to screenings bypass (such as MBR).

A screenings mat forms on the face of the screen. Very fine solids that could pass the clean screen are retained by the screenings mat. This filtering effect of the screenings mat further improves the screen's capture rate.

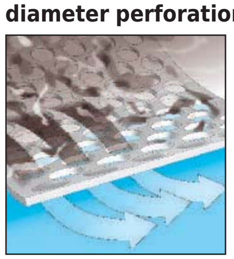
When the upstream water level reaches a certain height, a cleaning cycle starts and the screen basket begins to rotate. The screen surface that has been covered with a screenings mat is replaced with a clean screen surface. When the screenings reach the 12 o' clock position, they are cleaned off the screen by the combined action of a spray bar and a brush. They drop down into a screenings hopper at the basket's central axis and are conveyed by a screw.

The screw and the screen basket are driven by the same motor. The inclined screw pushes the screenings through an auger tube, where they are subsequently washed , dewatered and compacted, before they drop through a chute into a container or bag. Odor emission is minimal, particularly where a bagger is provided.

Wedge wire with ≥ 0.5 mm (0.02") spacing



Perforated plate with ≥ 2 mm (0.08") diameter perforations



Woven mesh wire basket ≥ 2 mm (0.08") is also available as HUBER ROTAMAT® RoMem

Integrated Screenings Washing (IRGA)

A spray bar is installed directly above the screenings hopper. Three additional spray nozzles are installed around the auger tube. The screenings are washed before and while they enter the auger tube. Wash water drains back into the hopper and screen basket. Retrofitting any type of ROTAMAT® screen with an integrated screenings wash system (IRGA) is easily possible.

Excellent screenings washing provides several benefits:

- Removal of fecal matter from the screenings
- Carbon in fecal matter remains available for denitrification process
- Reduced health and safety concerns
- Improved screenings compaction to about 40 % DS
- Volume, weight and disposal cost reduction by over 50 %

Four ROTAMAT® Rotary Drum Fine Screens provided with integrated screenings washing (IRGA)

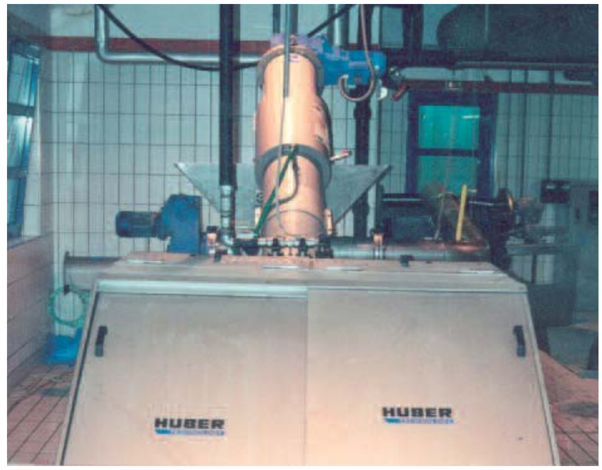
Benefits

- **Multi-functional and compact unit**
  A single unit with a small footprint and a single drive performs many functions: The screenings are simultaneously retained, removed, conveyed, washed (optional), dewatered, compacted and bagged (optional)
- **Excellent capture rate**
  Selection of fine wedge wire spacing, small perforations or wire mesh permits excellent capture rate
- **Low head loss even at high flow**
  Due to the basket's shape and 35° inclination, the screen area is much larger than that of a vertical or steeply inclined conventional screen
- **High screenings load**
  High screenings removal capacity due to the possibility of continuous rotation and cleaning of the screen basket
- **Reliable, self-cleansing operation**
  Screen cleaning with spray bar and brush
- **No carry-over of screenings**
  Removed screenings remain within the rotating basket
- **Disposal cost savings**
  Volume, weight and disposal costs of the screenings are reduced by over 50 % after screenings washing (IRGA) and compaction
- **No odor nuisance**
  Fully enclosed units equipped with a bagger, emit virtually no odor
- **Easy operation and maintenance**
  Maintenance-free ceramic shaft bearing; regular checking of controls and visual inspection are sufficient
- **Outdoor installation**
  Optional frost-protection permits outdoor installation
- **Long life**
  Made of stainless steel, pickled in an acid bath for perfect finishing and corrosion protection
- **Experience**
  Thousands of installations

HUBER TECHNOLOGY
WASTE WATER Solutions

A few Examples from Thousands of Installations

ROTAMAT® Rotary Drum Fine Screens Ro 2, directly installed in channels; available with basket diameters from 2 to 10 ft (0.6 to 3 m)



Large ROTAMAT® Rotary Drum Fine Screen Ro 2 installed in a channel, enclosure with sliding access covers

Tank-mounted ROTAMAT® Rotary Drum Fine Screen Ro 2 ...

... available with basket diameters from 2 to 8 ft (0.6 to 2.4 m)

Screen Sizes

Wedge wire spacing:	0.02” to $^1/_4$” (0.5 to 6 mm)
Perforation diameter:	0.08” to $^1/_4$” (2 to 6 mm)
Mesh spacing: as RoMem screen	< 2 mm (0.08”) is also available
Screen diameter:	2’ to 10’ (600 to 3,000 mm)
Inclination:	35°

HUBER TECHNOLOGY, Inc.

9735 NorthCross Center Court STE A · Huntersville, NC 28078
Phone: (704) 949 - 1010 · Fax: (704) 949 - 1020
huber@hhusa.net · http://www.huber-technology.com

Subject to technical modification
0,15 / 7 – 9.2010 – 9.2003

ROTAMAT® Rotary Drum Fine Screen Ro 2

SCOPE OF SUPPLY

Project Name: Pacific City, OR

Huber Proposal Number: Budgetary

Equipment: RPPS/1000/2

Bid Date: August 4, 2014

Huber Contact: John Lewis, Western Regional Sales Manager

(704) 995 5451

Represented By: Doug Allie, Goble Sampson Associates

(425) 392 0491

HUBER TECHNOLOGY
WASTE WATER Solutions

Huber Technology, Inc.

9735 NorthCross Center Court
Suite A
Huntersville, NC 28078

Phone: (704) 949-1010
Fax: (704) 949-1020

DESCRIPTION
ROTAMAT® RPPS Perforated Plate Screen Including: • One (1) x RPPS/1000/2 • Channel mounted design • 304 Stainless Steel Construction; pickled and passivated in acid bath • Shafted screw with integrated maintenance free bearing • 35º inclined auger tube • 35º inclined screen basket; width: Approximately 3.3 ft (1000 mm) • Perforated plate opening: .08" (2mm) • Polyurethane Seal to prevent screenings bypass • Class 1 Division 1 Drive motor, 2-HP, 460 VAC, 3 phase, 60 Hz VFD Controlled • Wall mounted or stand-alone NEMA 4X stainless steel control panel suitable for controlling equipment in a Class 1 Division 1 environment • Integrated screenings washing system IRGA is included • One (1) solenoid valve for compaction zone, 1-inch, 120 VAC, 2-way brass body, Class 1 Division 1 • One (1) solenoid valve for spraybar, 1-inch, 120VAC, 2-way brass body, Class 1 Division 1 • Frost protection kit for outdoor installation is optional • Standard manufacturer's services have been included. Additional manufacturer's services are available on a per diem rate upon request. **Price: RPPS/1000/2 = $115,000** **As above, but in 316L = + $10,000 ADDER** **Optional Frost Protection = + $12,000 ADDER**

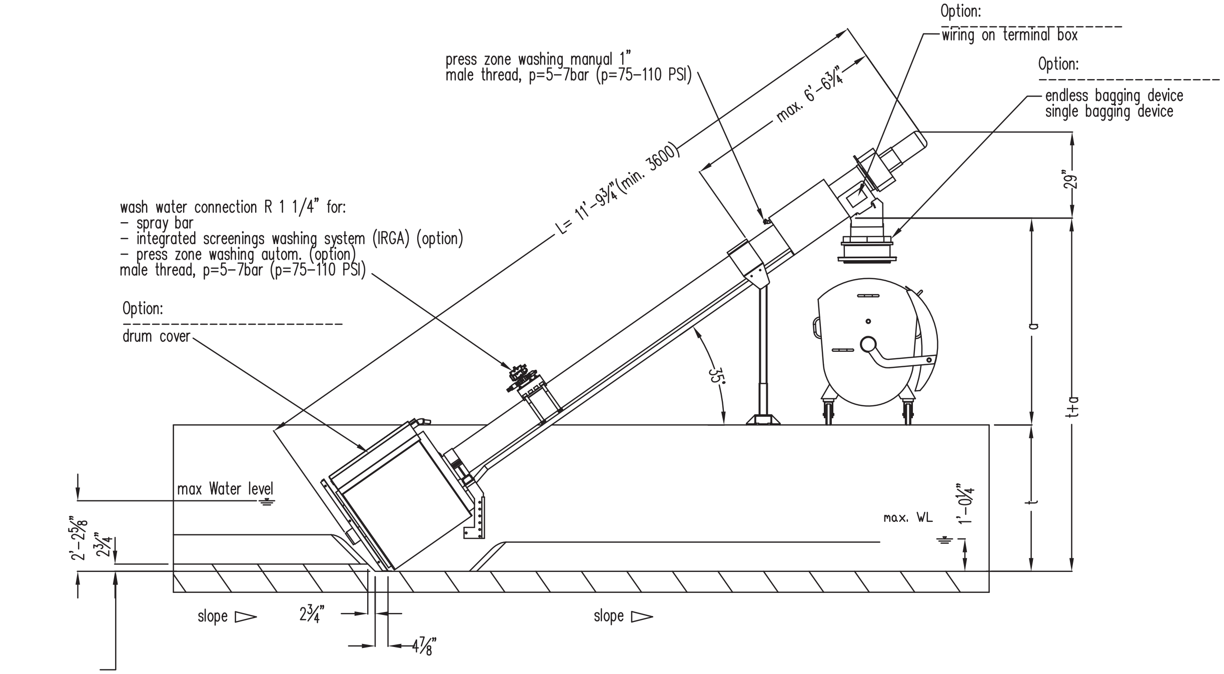
Notes

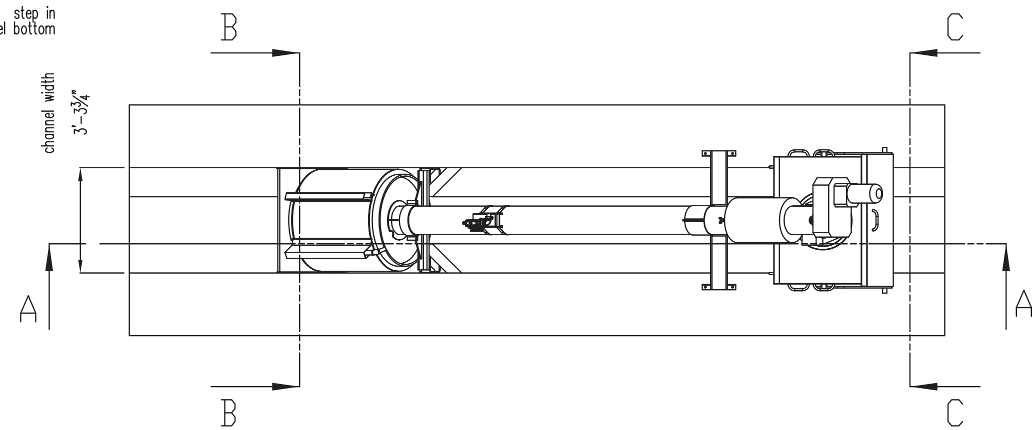
1. Detailed Equipment Specification, Drawing, and Formalized Proposal are available upon request.
2. If there are site-specific hydraulic constraints that must be applied, please consult Huber Technology's representative to ensure compatibility with the proposed system.
3. Budget estimate is based upon Huber Technology's Standard Design, Terms, & Conditions. Any deviation from these standards may result in a price adder.
4. Budget estimate is quoted in US$ unless otherwise stated.
5. Quotation based upon minimum screening of 10mm prior to these screens in the process
6. All of Huber's standard machines and systems are manufactured from 304L stainless steel. Huber makes no representation or warranties concerning the service life of the equipment against such abrasion or corrosion. The concentration of chloride and hydrogen sulfide (H2S) in the equipment operating environment shall be kept below the following values:

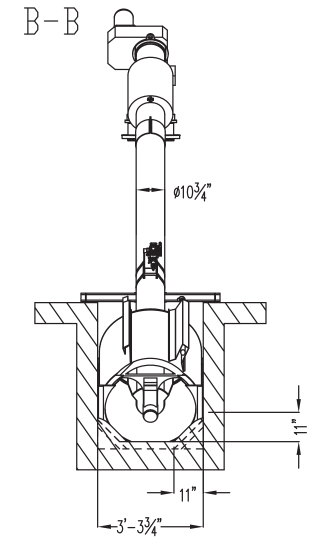
    a. Chloride < 200 mg/l

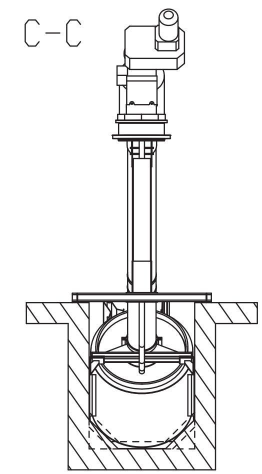
    b. Hydrogen sulfide H2S < 6 ppm

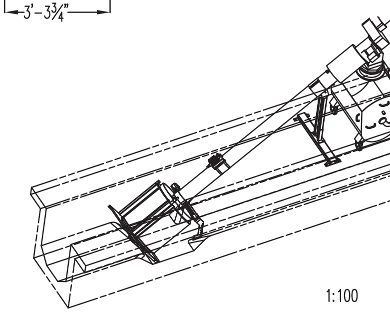
    Machines made from 316L stainless steel or Duplex are available for a price adder for extremely harsh











1:100

Accident prevention acc. GUV and machine directives (raillings, guards, etc. ...) or country specific regulations on site.

Note:
If the machine is equipped with frost protection some dimensions may differ from those shown.

Provide a trapezoidal channel in front of/behind the machine (Don't provide a trapezoidal channel in the basket area!)

Dimensions are for reference only!
For binding dimensions please refer to the final installation drawings

HUBER TECHNOLOGY 9735 NorthCross Center Court, Suite A Huntersville, NC 28078 Tel. 704-949-1010 info@huber-technology.com	Rotamat®Perforated Plate Screen RPPS / 1000		
	Fig No. 1/1	DIMENSIONAL SHEET	Scale: 1/4" = 1'-0"
	Project No.		Dwg No. RPPS_1000_2013.dwg Rev. Date: 4 JUN 2013

Julia Sheets

From:	Khare Ashwini <Ashwini.Khare@ovivowater.com>
Sent:	Monday, August 04, 2014 11:07 AM
To:	Allan Maas
Cc:	Jim Gleason
Subject:	RE: Pacific City WWTP Upgrade
Attachments:	Pacific City, OR-Ovivo MBR Proposal#072914-1-AK-R0.pdf

Allan,
I have attached the budgetary proposal. Let me know if you have any questions.

Best regards,

ASHWINI KHARE
Regional Manager, MBR systems

OVIVO
Bringing water to life

2404 Rutland Drive, Austin,
TX 78758-5238, USA
Tel: +1 512 834 6000
Direct: +1 512 834 6036
Cell: +1 512 962 9526

Email: ashwini.khare@ovivowater.com
Web: www.ovivowater.com

From: Allan Maas [mailto:AMaas@parametrix.com]
Sent: Thursday, July 31, 2014 1:40 PM
To: Khare Ashwini
Cc: Jim Gleason
Subject: RE: Pacific City WWTP Upgrade

I just got important info on the Pacific City project.
All bolts, nuts throughout the project need to be 316 SS. The ocean environment is tough on fasteners. All in tank equipment needs to be corrosion resistant also (i.e. fiberglass, PVC or 316 SS)

From: Khare Ashwini [mailto:Ashwini.Khare@ovivowater.com]
Sent: Wednesday, July 30, 2014 9:50 AM
To: Allan Maas
Cc: Jim Gleason
Subject: RE: Pacific City WWTP Upgrade

Ovivo USA, LLC
2404 Rutland Drive
Austin TX
78758
USA
Telephone: 512.834.6000
Facsimile: 512.834.6039
www.ovivowater.com

MBR Budgetary Proposal

Pacific City, OR

August 4th, 2014

Ovivo Proposal #072914-1-AK-R0

Prepared For

Parametrix

Allan Maas, P.E.
1019 39th Ave. SE, Suite 100
Puyallup,WA98374
phone: 253.604.6600

Ovivo USA, LLC
2404 Rutland Drive
Austin TX
78758
USA

Telephone: 512.834.6000
Facsimile: 512.834.6039

www.ovivowater.com

August 4th, 2014

Allan Maas
Parametrix
1019 39th Ave. SE, Suite 100
Puyallup,WA98374
phone: 253.604.6600

RE:Pacific City, OR – Preliminary Proposal #072914-1-AK-R0, Membrane Bioreactor System

Mr Maas,
Thank you very much for your interest in the Ovivo Membrane Bioreactor (MBR) system. Enclosed you will find a Preliminary Cost, Design Summary, Scope of Supply, and Layout Drawing.

For over 15 years, Ovivo has been supplying our MBR technology to the world offering simple membrane equipment packages to meet project specification or complete solutions to wastewater treatment problems. Ovivo's multidisciplinary staff brings more true MBR system experience than any other company. Our MBR systems include multiple, proven technologies allowing flexible, adaptable operation. This adaptability to operate over a range of different conditions improves overall system performance compared to conventional treatment processes and MBRs, which use hollow-fiber membranes. At Ovivo, our goal is to provide customers with comprehensive system solutions to their wastewater problems.

The benefits that the Ovivo MBR system offers include:

- Demonstrated lowest total installed cost.
- Sustainable (green) solutions with reduced equalization, concrete, energy, and chemical requirements.
- The easiest system to operate, troubleshoot, and optimize.

For the WWTP for Pacific City, OR, we are proposing retrofitting existing two aeration tanks into two Pre-Aeration basins and build new membrane tanks and a small anoxic basin to meet the biological and hydraulic needs of the project as delineated in our design summary attached.

The estimated cost of the attached preliminary proposal is **approximately $1,180,000**. This Preliminary Proposal constitutes a non-binding estimate of price for certain goods and/or services. We look forward to working with you on this project. Please do not hesitate to contact me or our local representative, Jim Gleason of Treatment Equipment Company at 425.641.4306, jim@tec-nw.com if you have any questions.

Ashwini Khare
Regional Manager, MBR Systems
2404 Rutland Drive
Austin Texas, 78758 U.S.A.
Tel: 512.834.6036
Fax: 512.834.6039
Email: ashwini.khare@ovivowater.com

Cc: **Jim Gleason, TEC**

OVIVO
Bringing water to life

Design Summary
Pacific City, OR (MMF 0.32 MGD)

Basis of Design

Parameter	Flow	Temperature	Typical Event Duration	Design Durations
Average Annual Flow (AAF)	0.24 MGD *	15 °C *	9 consecutive months	9.0 months *
Max Month Flow (MMF)	0.32 MGD	10 °C	3 consecutive months	3.0 months *
Peak Week Flow (PWF) **	0.38 MGD *	10 °C *	3 non-consecutive weeks	3.0 weeks *
Peak Day Flow (PDF) **	0.63 MGD	10 °C *	8 non-consecutive days	8.0 days *
Peak Hourly Flow (PHF) **	0.80 MGD	10 °C *	4 hrs with 24 hrs between PHF	4.0 hours *

Parameter	Influent	Effluent Limits
BOD	392 mg/L	< 10 mg/L
TSS	473 mg/L	< 10 mg/L
TKN	55 mg/L *	Not specified
NH_3	39 mg/L	Not specified
TP	8 mg/L *	Not specified
TN	54.6 mg/L *	Not specified
Alkalinity	300 mg/L *	Not specified
Maximum Wastewater Temperature	25 °C *	
Elevation	30 ft	

* Value assumed by Ovivo, to be verified by consulting engineer.

** Peak values assumed to occur during MMF, to be verified by consulting engineer.

MBR Zone (Membrane) Design

Parameter	Value	Notes
No. of Membrane Basins	2	
No. of Membrane Rows per Basin	1	
No. of Membrane Units per Basin	4	8 units total
Membrane Unit Type	OV400	Cassette: C100
No. of Cassettes per Unit	4	32 membrane Cassettes total
Surface Area per Cassette	1076.39 ft2/cartridge	34,445 sq ft total
Flux @ 0.24 MGD (AAF)	7.04 gal/(ft2 x day)	
Flux @ 0.32 MGD (MMF)	9.15 gal/(ft2 x day)	
Flux @ 0.38 MGD (PWF)	10.97 gal/(ft2 x day)	
Flux @ 0.63 MGD (PDF)	18.38 gal/(ft2 x day)	
Flux @ 0.80 MGD (PHF)	23.23 gal/(ft2 x day)	
Membrane Basin Volume	12,959 gal/basin	7.5ft x 21ft x 11ft SWD
Membrane Air Scour Rate for Sizing	76.0 scfm/unit	@ 6.2 PSIG discharge
Total System AOR	1,380 lb O2/day	
AOR Satisfied by Air Scour	229 lb O2/day	
MBR Basin MLSS	10,984 mg/L	

Anoxic Zone Design

Parameter	Value	Notes
Basin Volume	13,016 gal/basin	13,016 gal total
Basin Dimensions	14.5ft x 12ft x 10ft SWD	Includes 7,875gal EQ volume to handle the PDF
Anoxic MLSS	8,788 mg/L	
Recycle Rate	4 Q	From MBR to Anoxic Basin

PA Zone Design

Parameter	Value	Notes
Basin Volume	49,391 gal/basin	98,782 gal total
Basin Dimensions	24.5ft x 24.5ft x 11ft SWD	(2) Existing Aeration basins can be utilized
Pre-Aeration MLSS	8,788 mg/L	
Fine Bubble Diffuser AOR	1,151 lb O2/day	

MBR Waste Activated Sludge Production Parameters

Parameter	Value	Notes
Total Sludge Production	753 lbs sludge / day	
Sludge Concentration	1.1%	solids
Sludge Flow	8,216 gal sludge / day	
WAS Volatile Fraction	0.75	Assumed

System Design Parameters

Parameter	Value	Notes
Plant HRT	10.4 hrs	
Design Plant SRT	11 days	
F:M ratio	0.10	

Feed Forward Pump Design

Parameter	Value	Notes
Feed Forward Pumps	2	1 Duty, 1 Stdby
Type	SUBMERSIBLE	
Unit Capacity	1,235 GPM	
TDH	20.0 ft	

Permeate Pump-Assisted Gravity Flow Control Valve Design

Parameter	Value	Notes
Permeate Flow Control Valves	2	
Flow Control Valve	4'' valve	(MODULATING BALL)
Max Design Flow Capacity per FCV	309 GPM	

Permeate Pump Design

Parameter	Value	Notes
Permeate Pumps	2	2 Duty, 0 Stdby
Type	CENTRIFUGAL	Pump-Assisted Gravity Design
Unit Permeate Pump Capacity	309 GPM	
TDH	32.0 ft	

Blower Design

Parameter	Value	Notes
MBR Blowers	3	2 duty, 1 Common Stdby
Type	POSITIVE DISPLACEMENT	
Unit MBR Blower Capacity	304 SCFM	
MBR Blower Discharge Pressure	6.17 PSIG discharge	
Pre-Aeration (PA) Blowers	2	2 duty
Type	POSITIVE DISPLACEMENT	
Unit PA Blower Capacity	284 SCFM	
PA Blower Discharge Pressure	6.22 PSIG discharge	

Chemical Cleaning Design

Parameter	Value	Notes
Cleaning chemical (organic fouling)	Sodium Hypochlorite	2 times/yr
Typical Cleaning Schedule	1-2	cleanings/basin/yr
Volume per Membrane	39.63 gal/cassette	
Volume of Cleaning Solution	634.01 gal/basin	
Cleaning Solution Concentration	0.001	
Volume of 12.5% Stock solution	5 gal/basin/cleaning	
Cleaning chemical (inorganic fouling)	Oxalic Acid	2 times/yr
Typical Cleaning Schedule	1-2	cleanings/basin/yr
Volume per Membrane	39.63 gal/cassette	
Volume of Cleaning Solution	634.01 gal/basin	
Cleaning Solution Concentration	0.01	
Volume of 100.0% Stock solution	6 gal/basin/cleaning	

Scope of Supply
Pacific City, OR (MMF 0.32 MGD)

Headworks General Equipment Information

Function	Name	Type	Size or Unit Capacity	Value	Material	Manufacturer	Model or Specification	Motor HP	QTY
SCREENING	FINE SCREEN	1mm BAR SCREEN	700	gpm	SS bars and rakes	ENVIROQUIP	FM-1400	0.25	2
INFLUENT FLOW MEASUREMENT	FLOW METER	ELECTROMAGNETIC	8	Inch	POLYURETHANE	ENDRESS & HAUSER	PROMAG 10W2H-ULGA1RA0B4AA	N/A	1
LEVEL MEASUREMENT	LEVEL SWITCH	FLOAT	N/A	N/A	POLYURETHANE	CONERY	2900B1S1	N/A	3

Anoxic Zone General Equipment Information

Function	Name	Type	Size or Unit Capacity	Value	Material	Manufacturer	Model or Specification	Motor HP	QTY
BASIN MIXING	MIXER	SUBMERSIBLE	12,875	gallons	SS304	WILO	TR36-.89-8/8	1.65	1
MIXER SUPPORT	MIXER SUPPORT HARDWARE & GUIDE RAIL	RAIL MOUNT	SS	N/A	N/A	N/A	N/A	N/A	1
LEVEL MEASUREMENT	LEVEL TRANSMITTER	HYDROSTATIC	23	feet	SS	BLUE RIBBON	BC001-10-40	N/A	1
LEVEL MEASUREMENT	LEVEL SWITCH	FLOAT	N/A	N/A	POLYURETHANE	CONERY	N/A	N/A	2

Internal Recycle General Equipment Information

Function	Name	Type	Size or Unit Capacity	Value	Material	Manufacturer	Model or Specification	Motor HP	QTY
Feed Forward	PUMP	SUBMERSIBLE	1,235	gpm	CAST IRON	WILO	FA25.32-14.8HP	14.8	2
PUMP ISOLATION	VALVE	PLUG	12	Inch	CAST IRON	PRATT	PBPV-120	N/A	2
FLOW DIRECTION	VALVE	SWING CHECK	12	Inch	CAST IRON	KEYSTONE	810-120	N/A	2
PUMP INLET PRESSURE	GAUGE	COMPOUND	-30-+15	Inch Hg/PSI	SS	MCDANIEL	MPB/SCA-GF	N/A	2
PUMP OUTLET PRESSURE	GAUGE	PRESSURE	0-15	PSI	SS	MCDANIEL	MPB/SCU-GF	N/A	2
Feed Forward FLOW METER	FLOW METER	ELECTROMAGNETIC	12	Inch	POLYURETHANE	ENDRESS & HAUSER	PROMAG 10W3H-ULGA1RA0B4AA	N/A	1
MBR BASIN ISOLATION	VALVE	PLUG	12	Inch	CAST IRON	PRATT	PBPV-120	N/A	2

PRE-AERATION General Equipment Information

Function	Name	Type	Size or Unit Capacity	Value	Material	Manufacturer	Model or Specification	Motor HP	QTY
AERATION	DIFFUSER SYSTEM	FINE BUBBLE	284	SCFM / basin	N/A	AEROSTRIP	N/A	N/A	2
DIFFUSER CIP	AUTOMATED VALVE	SOLENOID	1.5	Inch	BRASS	ASCO	TBD	N/A	2
DISSOLVED OXYGEN MEASURMENT	DO PROBE	LDO	0-10	mg/L DO	SS	HACH	57900-00	N/A	2
DO TRANSMITTER	ANALOG TRANSMITTER	SC200	N/A	N/A	N/A	HACH	LXV404.99.70112	N/A	2

MBR Zone General Equipment Information

Function	Name	Type	Size or Unit Capacity	Value	Material	Manufacturer	Model or Specification	Motor HP	QTY
MEMBRANE FILTRATION	SUBMERGED MEMBRANE UNIT	FLAT PLATE	N/A	N/A	TBD	OVIVO	OV400	N/A	8
DIFFUSER CIP	AUTOMATED VALVE	SOLENOID	1.5	Inch	BRASS	ASCO	TBD	N/A	2
DIFFUSER INLET ISOLATION	VALVE	BUTTERFLY	3	Inch	CAST IRON	KEYSTONE	221-030	N/A	8
PERMEATE BRANCH ISOLATION	VALVE	BALL	4	Inch	PVC	ASAHI	1602-040	N/A	8

LEVEL MEASUREMENT	LEVEL SWITCH	FLOAT	N/A	N/A	POLYURETHANE	CONERY	N/A	N/A	4
CHEMICAL CLEANING ISOLATION	VALVE	BALL	2	Inch	PVC	ASAHI	1601-020	N/A	3
CIP VENT	VALVE	BALL	2	Inch	PVC	ASAHI	1601-020	N/A	2
SLUDGE RETURN	TELESCOPING VALVE	SLIP TUBE+ Hand Wheel ASSY	10	Inch	SS	ENVIROQUIP	TV-ST-10	N/A	2
SLUDGE RETURN	TELESCOPING VALVE	RECEIVING TUBE	11	Inch	CARBON STEEL	ENVIROQUIP	TV-RT-11	N/A	2
PERMEATE HEADER ISOLATION	VALVE	BUTTERFLY	8	Inch	PVC	ASAHI	3730-080	N/A	2
FABRICATION	FASTENERS	N/A	N/A	N/A	SS316	ENVIROQUIP	N/A	N/A	8
FABRICATION	STRUCTURAL GUIDES & STABILIZER PIPES	N/A	N/A	N/A	SS316	ENVIROQUIP	N/A	N/A	8
FABRICATION	IN-BASIN PIPING & SUPPORTS	N/A	N/A	N/A	SS316	ENVIROQUIP	N/A	N/A	8
FABRICATION	IN-BASIN PIPING & SUPPORTS	N/A	N/A	N/A	PVC	ENVIROQUIP	N/A	N/A	8

Permeate Control General Equipment Information

Function	Name	Type	Size or Unit Capacity	Value	Material	Manufacturer	Model or Specification	Motor HP	QTY
TMP MEASUREMENT	PRESSURE TRANSMITTER	DIAPHRAGM	-15-+15	PSI	N/A	ENDRESS & HAUSER	CERABAR T PMC 131-A22F1V6N/Q4H	N/A	2
PERMEATE PUMP	PUMP	CENTRIFUGAL	309	gpm	GRAY IRON	GORMAN RUPP	14A20-B 5HP	5	2
VIBRATION ISOLATION	EXPANSION JOINT	BULB	4	Inch	SYNTHETIC RUBBER / SS	API	AMS204	N/A	4
PUMP ISOLATION	VALVE	BALL	4	Inch	PVC	ASAHI	1602-040	N/A	4
VENT	VALVE	Solenoid	1	Inch	TBD	TBD	TBD	N/A	2
PUMP INLET PRESSURE	GAUGE	COMPOUND	-30-+15	Inch Hg/PSI	SS	MCDANIEL	MPB/SCA-GF	N/A	2
PUMP OUTLET PRESSURE	GAUGE	PRESSURE	0-15	PSI	SS	MCDANIEL	MPB/SCU-GF	N/A	2
FLOW DIRECTION (PUMPED)	VALVE	BALL CHECK	4	Inch	PVC	ASAHI	1210-040	N/A	2
FLOW DIRECTION (GRAVITY)	VALVE	BALL CHECK	4	Inch	PVC	ASAHI	1210-040	N/A	2
ON/OFF	VALVE	NEEDLE	0.25	Inch	POLYPROPYLENE	ASAHI	5313.002	N/A	1
FLOW MEASUREMENT	FLOW METER	ELECTROMAGNETIC	4	Inch	POLYURETHANE	ENDRESS & HAUSER	PROMAG 10W1H-ULGA1RA0B4AA	N/A	2
FLOW CONTROL	AUTOMATED VALVE	MODULATING BALL	4	Inch	PVC	ASAHI / BETTIS	1601-040 / EM500F-15-C4-02-102	N/A	2
TURBIDITY MEASUREMENT	TURBIDITY METER	OPTICAL	0-100	NTU	N/A	HACH	60101-01	N/A	1
TURBIDITY / PH TRANSMITTER	ANALOG TRANSMITTER	SC200	N/A	N/A	N/A	HACH	LXV404.99.70112	N/A	1

MBR Aeration General Equipment Information

Function	Name	Type	Size or Unit Capacity	Value	Material	Manufacturer	Model or Specification	Motor HP	QTY
MBR BLOWER	BLOWER	POSITIVE DISPLACEMENT	304	SCFM	CAST IRON	AERZEN	GM10S-20	20	3
MBR NOISE SUPPRESSION	SOUND ENCLOSURE	WITH BLOWER	N/A	N/A	N/A	AERZEN	N/A	N/A	3

MBR BLOWER TEMP	TEMPERATURE GAUGE	WITH BLOWER	N/A	N/A	N/A	AERZEN	N/A	N/A	3
MBR BLOWER PRESSURE	PRESSURE GAUGE	WITH BLOWER	N/A	N/A	N/A	AERZEN	N/A	N/A	3
MBR BLOWER TEMP SWITCH	TEMPERATURE SWITCH	WITH BLOWER	N/A	N/A	N/A	AERZEN	N/A	N/A	3
MBR BLOWER FLOW CONTROL	VALVE	CHECK (WITH BLOWER)	N/A	N/A	N/A	AERZEN	N/A	N/A	3
MBR BLOWER PRESSURE RELIEF	VALVE	PRESSURE RELIEF (WITH BLOWER)	N/A	N/A	N/A	AERZEN	N/A	N/A	3
MBR BLOWER PRESSURE	PRESSURE TRANSMITTER	DIAPHRAGM	-15-+15	PSI	N/A	ENDRESS & HAUSER	CERABAR T PMC 131-A22F1V6N/Q4H	N/A	3
MBR AIR ISOLATION	VALVE	BUTTERFLY	6	Inch	CAST IRON	KEYSTONE	221-060	N/A	5
MBR AIR FLOW MEASUREMENT	FLOW METER	MASS AIR FLOW	6	Inch	SS	ENDRESS & HAUSER	65I-60AA0AD1ACBBBA	N/A	2

PA Air Supply General Equipment Information

Function	Name	Type	Size or Unit Capacity	Value	Material	Manufacturer	Model or Specification	Motor HP	QTY
PA BLOWER	BLOWER	POSITIVE DISPLACEMENT	284	SCFM	CAST IRON	AERZEN	GM10S-20	20	2
PA NOISE SUPPRESSION	SOUND ENCLOSURE	WITH BLOWER	N/A	N/A	N/A	AERZEN	N/A	N/A	2
PA BLOWER TEMP	TEMPERATURE GAUGE	WITH BLOWER	N/A	N/A	N/A	AERZEN	N/A	N/A	2
PA BLOWER PRESSURE	PRESSURE GAUGE	WITH BLOWER	N/A	N/A	N/A	AERZEN	N/A	N/A	2
PA BLOWER TEMP SWITCH	TEMPERATURE SWITCH	WITH BLOWER	N/A	N/A	N/A	AERZEN	N/A	N/A	2
PA BLOWER FLOW CONTROL	VALVE	CHECK (WITH BLOWER)	N/A	N/A	N/A	AERZEN	N/A	N/A	2
PA BLOWER PRESSURE RELIEF	VALVE	PRESSURE RELIEF (WITH BLOWER)	N/A	N/A	N/A	AERZEN	N/A	N/A	2
PA BLOWER PRESSURE	PRESSURE TRANSMITTER	DIAPHRAGM	-15-+15	PSI	N/A	ENDRESS & HAUSER	CERABAR T PMC 131-A22F1V6N/Q4H	N/A	2
PA AIR FLOW MEASUREMENT	FLOW METER	MASS AIR FLOW	6	Inch	SS	ENDRESS & HAUSER	65I-60AA0AD1ACBBBA	N/A	2
PA BLOWER FLOW CONTROL	AUTOMATED VALVE	MODULATING BUTTERFLY	6	N/A	CAST IRON	KEYSTONE / BETTIS	221-060 / EM830-18-C4-02-001	N/A	2
PA AIR ISOLATION	VALVE	BUTTERFLY	4	Inch	CAST IRON	KEYSTONE	221-040	N/A	2

SMU CIP General Equipment Information

Function	Name	Type	Size or Unit Capacity	Value	Material	Manufacturer	Model or Specification	Motor HP	QTY
MAZZIE INJECTOR	INJECTOR	VENTURI	2	Inch	POLYPROPYLENE	MAZZEI INJECTOR CORP	2081	N/A	1
WATER SUPPLY VALVE	AUTOMATED VALVE	2 POSITION BALL	2	Inch	PVC	ASAHI / BETTIS	1601-020 / EM310F-10-C4-02-102	N/A	1
CIP THROTTLING	VALVE	BALL	2	Inch	PVC	N/A	N/A	N/A	2
INJECTOR PRESSURE	GAUGE	PRESSURE	0-15	PSI	SS	MCDANIEL	MPB/SCU-GF	N/A	2
DRAIN	VALVE	BALL CHECK	1	Inch	PVC	ASAHI	1210-010	N/A	1
CHEMICAL ISOLATION	VALVE	BALL	2	Inch	PVC	ASAHI	1601-020	N/A	1
PRESSURE CONTROL	VALVE	PRESSURE REGULATOR VALVE	2	Inch	N/A	WILKINS	600/DUC	N/A	1

CHEMICAL FLOW	FLOW METER	ROTOMETER	1	gpm	POLYSULPHONE	KOBOLD	KSM-4005	N/A	1
FLOW MEASUREMENT	FLOW METER	ELECTROMAGNETIC	2	Inch	POLYURETHANE	ENDRESS & HAUSER	PROMAG 10W50-ULGA1RA0B4AA	N/A	1
INJECTOR ASSEMBLY	PIPE SPOOL	SUCTION	N/A	N/A	N/A	ENVIROQUIP	N/A	N/A	1
CHEMICAL TRANSFER TO MBR	HOSE	SUCTION	1	Inch	PVC	TIGERFLEX	W100	N/A	1

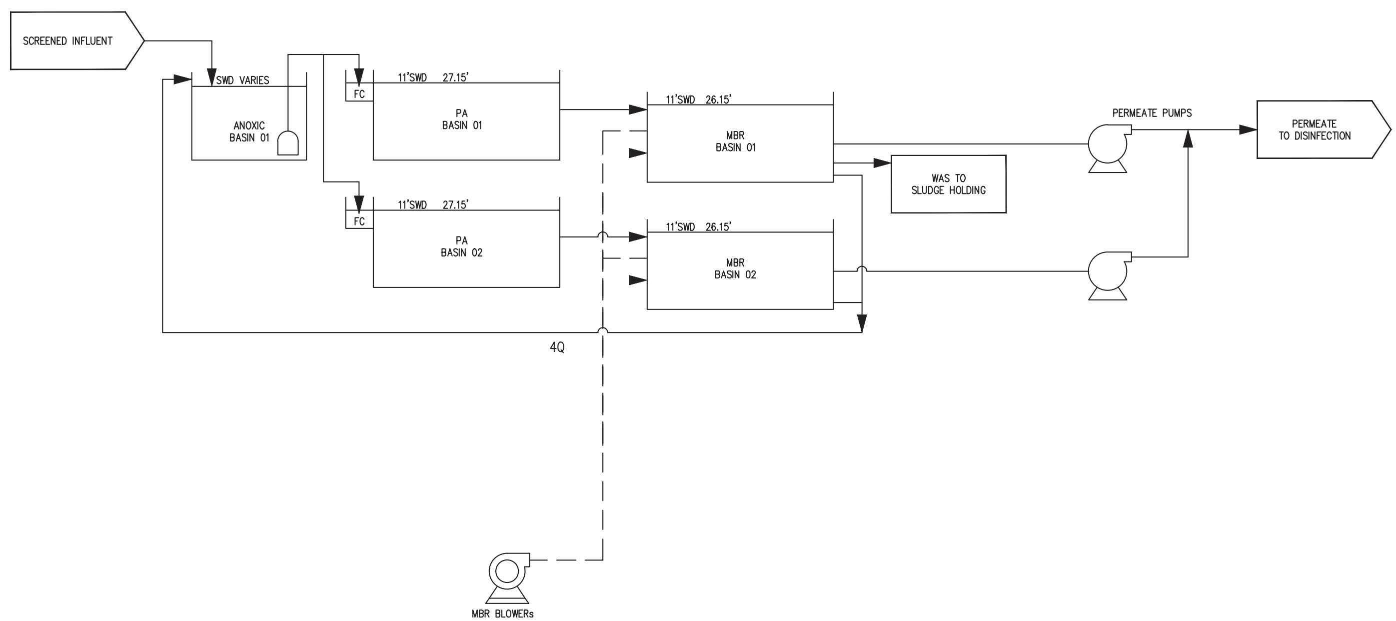
Controls General Equipment Information

Function	Name	Type	Size or Unit Capacity	Value	Material	Manufacturer	Model or Specification	Motor HP	QTY
PLANT CONTROL	SCADA	SOFTWARE	N/A	N/A	N/A	WONDERWARE	N/A	N/A	1
PLANT CONTROL	HMI	PANEL MOUNT/DESKTOP PC	N/A	N/A	N/A	N/A	N/A	N/A	1
PLANT CONTROL	PLC PANEL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1
PLANT CONTROL	MOTOR CONTROL PANEL	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1

Miscellaneous General Equipment Information

Function	Name	Type	Size or Unit Capacity	Value	Material	Manufacturer	Model or Specification	Motor HP	QTY
PROJECT KICKOFF MEETING	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	3
MECHANICAL INSPECTION	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	5
START-UP / COMMISSIONING / TRAINING	N/A	N/A	20	days	N/A	N/A	N/A	N/A	1
QC & INSPECTION	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1
SHIPPING & RECEIVING	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1
INBOUND FREIGHT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1
OUTBOUND FREIGHT	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1

PACIFIC CITY, OR PFD



INITIAL RELEASE					
REVISION	EN	BY	CHECK'D	DATE	

DO NOT SCALE PRINTS

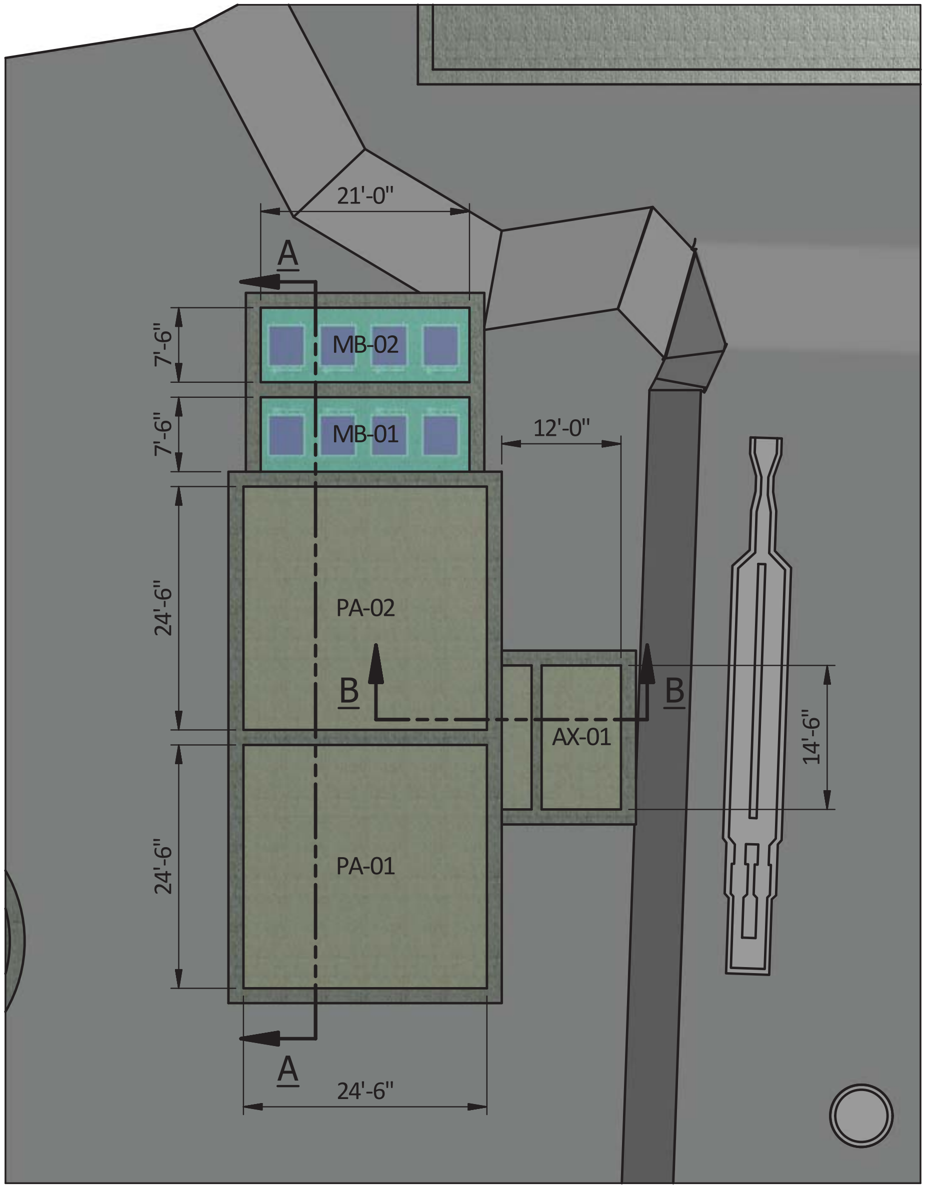
WORKMANSHIP STANDARD ES0001 APPLIES

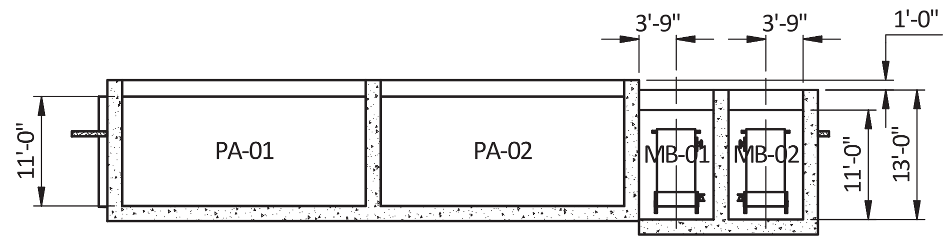
OVIVO
Bringing water to life

PACIFIC CITY WWTP

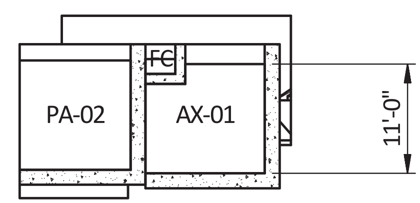
P F D

DATE	08/04/14	BY	DLA	CHECK'D	AK
DWG SCALE	NONE				
JOB N□MBER	PFD-0□2□14-1-AK-R0				
SHEET	1	OF	1		





SECTION A-A



SECTION B-B

INITIAL RELEASE					A
REVISION DESCRIPTION	EN/ECO	BY	CHECK'D	DATE	REV

THIRD ANGLE PROJECTION

REF. FROM		DO NOT SCALE PRINTS
DATE (mm/dd/yy)	8/1/2014	WORKMANSHIP STANDARD WI-7501-01 APPLIES
DRAWN	DLA	ORIGINAL S.O.
CHECK'D	AK	

OVIVO
Bringing water to life

PACIFIC CITY WWTP
PACIFIC CITY, OR
MBR BASIN LAYOUT

DWG NO.	SHEET	REV
PL-072914-1-AK-R0	1 OF 1	A

G4.3. Membrane Bioreactor EPA Bulletin

United States Environmental Protection Agency

Wastewater Management Fact Sheet

Membrane Bioreactors

INTRODUCTION

The technologies most commonly used for performing secondary treatment of municipal wastewater rely on microorganisms suspended in the wastewater to treat it. Although these technologies work well in many situations, they have several drawbacks, including the difficulty of growing the right types of microorganisms and the physical requirement of a large site. The use of microfiltration membrane bioreactors (MBRs), a technology that has become increasingly used in the past 10 years, overcomes many of the limitations of conventional systems. These systems have the advantage of combining a suspended growth biological reactor with solids removal via filtration. The membranes can be designed for and operated in small spaces and with high removal efficiency of contaminants such as nitrogen, phosphorus, bacteria, biochemical oxygen demand, and total suspended solids. The membrane filtration system in effect can replace the secondary clarifier and sand filters in a typical activated sludge treatment system. Membrane filtration allows a higher biomass concentration to be maintained, thereby allowing smaller bioreactors to be used.

APPLICABILITY

For new installations, the use of MBR systems allows for higher wastewater flow or improved treatment performance in a smaller space than a conventional design, i.e., a facility using secondary clarifiers and sand filters. Historically, membranes have been used for smaller-flow systems due to the high capital cost of the equipment and high operation and maintenance (O&M) costs. Today however, they are receiving increased use in larger systems. MBR systems are also well suited for some industrial and commercial applications. The high-quality effluent produced by MBRs makes them particularly applicable to reuse applications and for surface water discharge applications requiring extensive nutrient (nitrogen and phosphorus) removal.

ADVANTAGES AND DISADVANTAGES

The advantages of MBR systems over conventional biological systems include better effluent quality, smaller space requirements, and ease of automation. Specifically, MBRs operate at higher volumetric loading rates which result in lower hydraulic retention times. The low retention times mean that less space is required compared to a conventional system. MBRs have often been operated with longer solids residence times (SRTs), which results in lower sludge production; but this is not a requirement, and more conventional SRTs have been used (Crawford et al. 2000). The effluent from MBRs contains low concentrations of bacteria, total suspended solids (TSS), biochemical oxygen demand (BOD), and phosphorus. This facilitates high-level disinfection. Effluents are readily discharged to surface streams or can be sold for reuse, such as irrigtion.

The primary disadvantage of MBR systems is the typically higher capital and operating costs than conventional systems for the same throughput. O&M costs include membrane cleaning and fouling control, and eventual membrane replacement. Energy costs are also higher because of the need for air scouring to control bacterial growth on the membranes. In addition, the waste sludge from such a system might have a low settling rate, resulting in the need for chemicals to produce biosolids acceptable for disposal (Hermanowicz et al. 2006). Fleischer et al. 2005 have demonstrated that waste sludges from MBRs can be processed using standard technologies used for activated sludge processes.

Membrane Filtration

Membrane filtration involves the flow of water-containing pollutants across a membrane. Water permeates through the membrane into a separate channel for recovery (Figure 1). Because of the cross-flow movement of water and the waste constituents, materials left behind do not accumulate at the membrane surface but are carried out of the system for later recovery or disposal. The water passing through the membrane is called the *permeate*, while the water with the more-concentrated materials is called the *concentrate* or *retentate*.

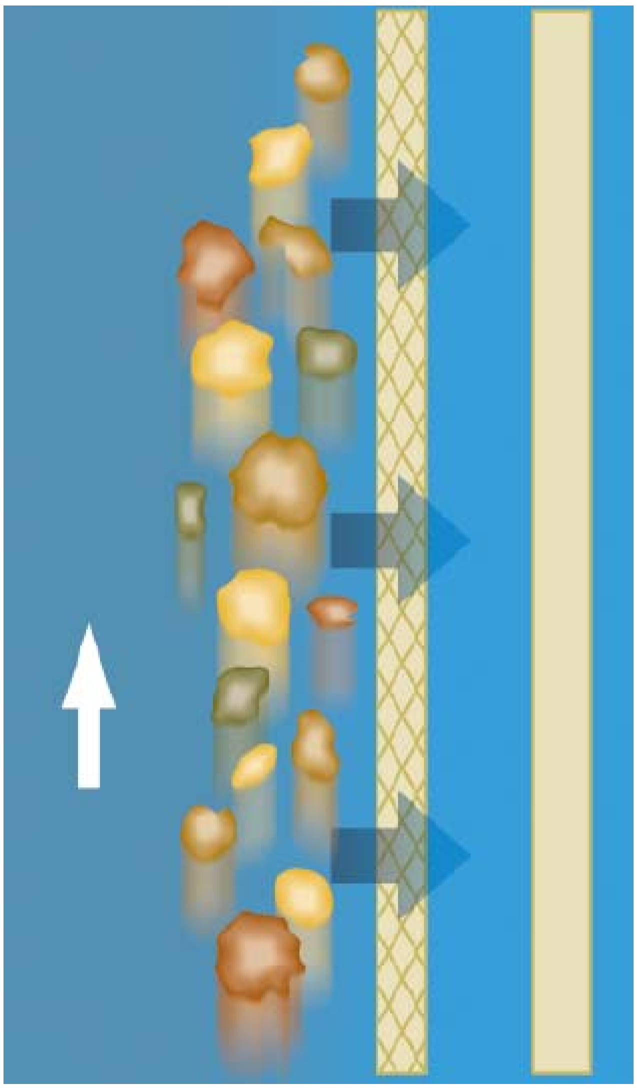


Figure 1. Membrane filtration process (Image from Siemens/U.S. Filter)

Membranes are constructed of cellulose or other polymer material, with a maximum pore size set during the manufacturing process. The requirement is that the membranes prevent passage of particles the size of microorganisms, or about 1 micron (0.001 millimeters), so that they remain in the system. This means that MBR systems are good for removing solid material, but the removal of dissolved wastewater components must be facilitated by using additional treatment steps.

Membranes can be configured in a number of ways. For MBR applications, the two configurations most often used are hollow fibers grouped in bundles, as shown in Figure 2, or as flat plates. The hollow fiber bundles are connected by manifolds in units that are designed for easy changing and servicing.

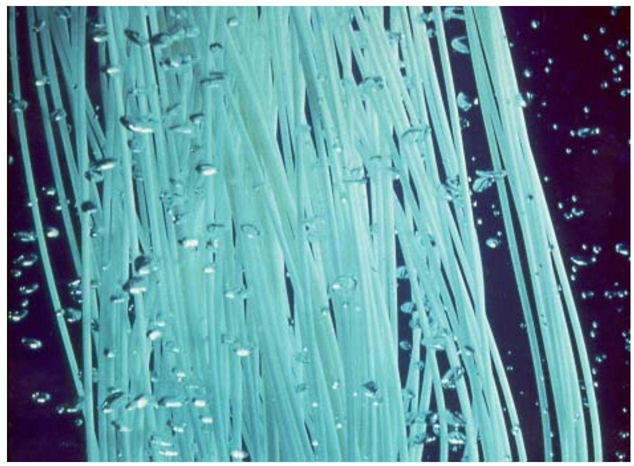


Figure 2. Hollow-fiber membranes (Image from GE/Zenon)

Design Considerations

Designers of MBR systems require only basic information about the wastewater characteristics, (e.g., influent characteristics, effluent requirements, flow data) to design an MBR system. Depending on effluent requirements, certain supplementary options can be included with the MBR system. For example, chemical addition (at various places in the treatment chain, including: before the primary settling tank; before the secondary settling tank [clarifier]; and before the MBR or final filters) for phosphorus removal can be included in an MBR system if needed to achieve low phosphorus concentrations in the effluent.

MBR systems historically have been used for small-scale treatment applications when portions of the treatment system were shut down and the wastewater routed around (or bypassed) during maintenance periods.

However, MBR systems are now often used in full-treatment applications. In these instances, it is recommended that the installation include one additional membrane tank/unit beyond what the design would nominally call for. This "N plus 1" concept is a blend between conventional activated sludge and membrane process design. It is especially important to consider both operations and maintenance requirements when selecting the number of units for MBRs. The inclusion of an extra unit gives operators flexibility and ensures that sufficient operating capacity will be available (Wallis-Lage et al. 2006). For example, bioreactor sizing is often limited by oxygen transfer, rather than the volume required to achieve the required SRT—a factor that significantly affects bioreactor numbers and sizing (Crawford et al. 2000).

Although MBR systems provide operational flexibility with respect to flow rates, as well as the ability to readily add or subtract units as conditions dictate, that flexibility has limits. Membranes typically require that the water surface be maintained above a minimum elevation so that the membranes remain wet during operation. Throughput limitations are dictated by the physical properties of the membrane, and the result is that peak design flows should be no more than 1.5 to 2 times the average design flow. If peak flows exceed that limit, either additional membranes are needed simply to process the peak flow, or equalization should be included in the overall design. The equalization is done by including a separate basin (external equalization) or by maintaining water in the aeration and membrane tanks at depths higher than those required and then removing that water to accommodate higher flows when necessary (internal equalization).

DESIGN FEATURES

Pretreatment

To reduce the chances of membrane damage, wastewater should undergo a high level of debris removal prior to the MBR. Primary treatment is often provided in larger installations, although not in most small to medium sized installations, and is not a requirement. In addition, all MBR systems require 1- to 3-mm-cutoff fine screens immediately before the membranes, depending on the MBR manufacturer. These screens require frequent cleaning. Alternatives for reducing the amount of material reaching the screens include using two stages of screening and locating the screens after primary settling.

Membrane Location

MBR systems are configured with the mem-

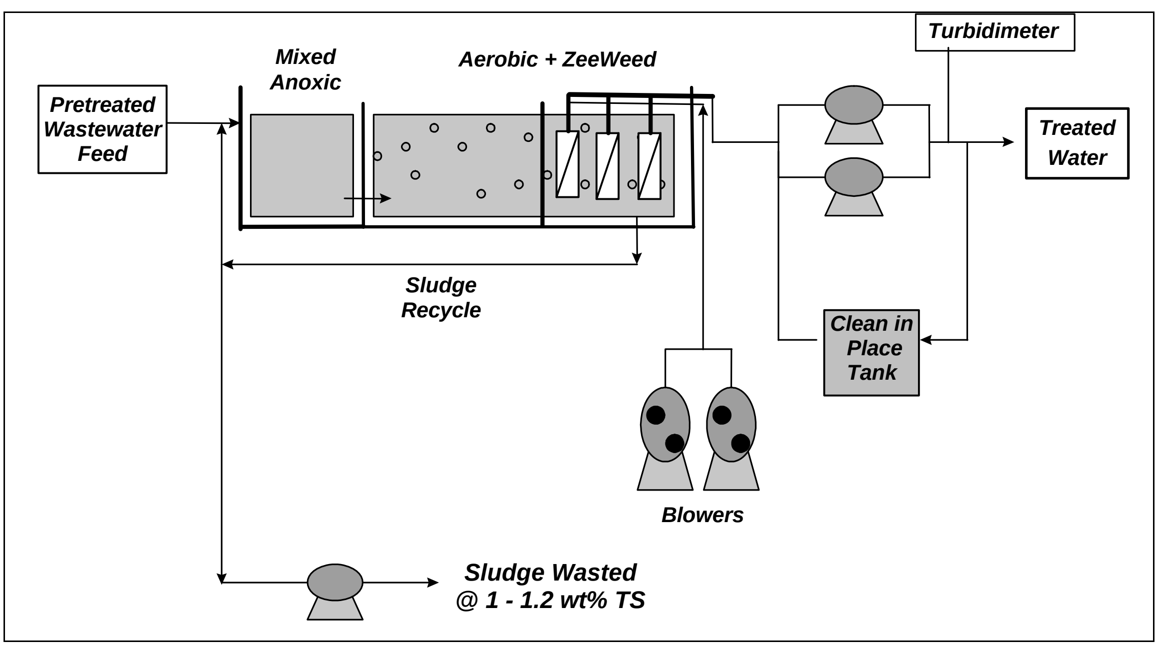


Figure 3. Immersed membrane system configuration (Image from GE/Zenon)

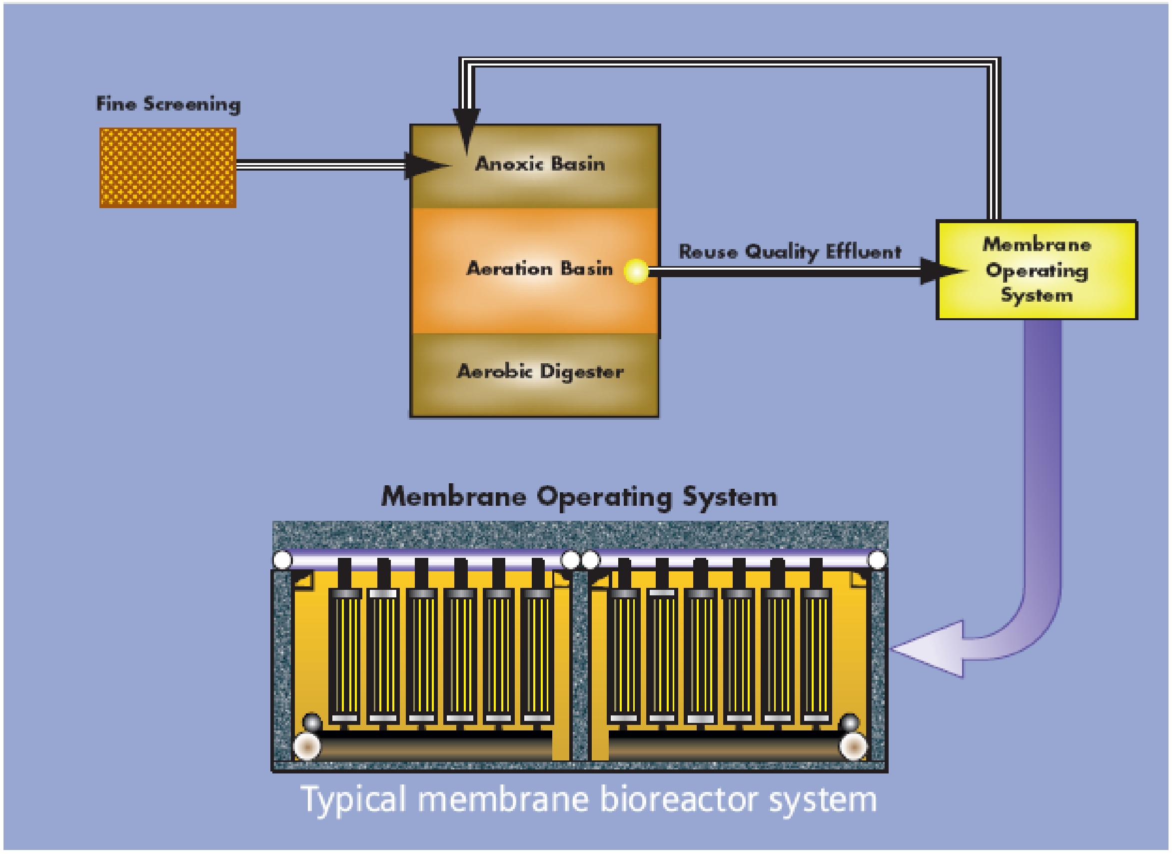


Figure 4. External membrane system configuration (Image from Siemens/U.S. Filter)

branes actually immersed in the biological reactor or, as an alternative, in a separate vessel through which mixed liquor from the biological reactor is circulated. The former configuration is shown in Figure 3; the latter, in Figure 4.

Membrane Configuration

MBR manufacturers employ membranes in two basic configurations: hollow fiber bundles and plate membranes. Siemens/U.S.Filter's Memjet and Memcor systems, GE/Zenon's ZeeWeed and ZenoGem systems, and GE/Ionics' system use hollow-fiber, tubular membranes configured in bundles. A number of bundles are connected by manifolds into units that can be readily changed for maintenance or replacement. The other configuration, such as those provided by Kubota/Enviroquip, employ membranes in a flat-plate configuration, again with manifolds to allow a number of membranes to be connected in readily changed units. Screening requirements for both systems differ: hollow-fiber membranes typically require 1- to 2-mm screening, while plate membranes require 2- to 3-mm screening (Wallis-Lage et al. 2006).

System Operation

All MBR systems require some degree of pumping to force the water flowing through the membrane. While other membrane systems use a pressurized system to push the water through the membranes, the major systems used in MBRs draw a vacuum through the membranes so that the water outside is at ambient pressure. The advantage of the vacuum is that it is gentler to the membranes; the advantage of the pressure is that throughput can be controlled. All systems also include techniques for continually cleaning the system to maintain membrane life and keep the system operational for as long as possible. All the principal membrane systems used in MBRs use an air scour technique to reduce buildup of material on the membranes. This is done by blowing air around the membranes out of the manifolds. The GE/Zenon systems use air scour, as well as a back-pulsing technique, in which permeate is occasionally pumped back into the membranes to keep the pores cleared out. Back-pulsing is typically done on a timer, with the time of pulsing accounting for 1 to 5 percent of the total operating time.

Downstream Treatment

The permeate from an MBR has low levels of suspended solids, meaning the levels of bacteria, BOD, nitrogen, and phosphorus are also low. Disinfection is easy and might not be required, depending on permit requirements..

The solids retained by the membrane are recycled to the biological reactor and build up in the system. As in conventional biological systems, periodic sludge wasting eliminates sludge buildup and controls the SRT within the MBR system. The waste sludge from MBRs goes through standard solids-handling technologies for thickening, dewatering, and ultimate disposal. Hermanowicz et al. (2006) reported a decreased ability to settle in waste MBR sludges due to increased amounts of colloidal-size particles and filamentous bacteria. Chemical addition increased the ability of the sludges to settle. As more MBR facilities are built and operated, a more definitive understanding of the characteristics of the resulting biosolids will be achieved. However, experience to date indicates that conventional biosolids processing unit operations are also applicable to the waste sludge from MBRs.

Membrane Care

The key to the cost-effectiveness of an MBR system is membrane life. If membrane life is curtailed such that frequent replacement is required, costs will significantly increase. Membrane life can be increased in the following ways:

- Good screening of larger solids before the membranes to protect the membranes from physical damage.

- Throughput rates that are not excessive, i.e., that do not push the system to the limits of the design. Such rates reduce the amount of material that is forced into the membrane and thereby reduce the amount that has to be removed by cleaners or that will cause eventual membrane deterioration.

- Regular use of mild cleaners. Cleaning solutions most often used with MBRs include regular bleach (sodium) and citric acid. The cleaning should be in accord with manufacturer-recommended maintenance protocols.

Membrane Guarantees

The length of the guarantee provided by the membrane system provider is also important in determining the cost-effectiveness of the system. For municipal wastewater treatment, longer guarantees might be more readily available compared to those available for industrial systems. Zenon offers a 10-year guarantee; others range from 3 to 5 years. Some guarantees include cost prorating if replacement is needed after a certain service time. Guarantees are typically negotiated during the purchasing process. Some manufacturers' guarantees are tied directly to screen size: longer membrane warranties are granted when smaller screens are used (Wallis-Lage et al. 2006). Appropriate membrane life guarantees can be secured using appropriate membrane procurement strategies (Crawford et al. 2002).

SYSTEM PERFORMANCE

Siemens/U.S. Filter Systems

Siemens/U.S.Filter offers MBR systems under the Memcor and Memjet brands. Data provided by U.S. Filter for its Calls Creek (Georgia) facility are summarized below. The system, as Calls Creek retrofitted it, is shown in Figure 5. In essence, the membrane filters were used to replace secondary clarifiers downstream of an Orbal oxidation ditch. The system includes a fine screen (2-mm cutoff) for inert solids removal just before the membranes.

The facility has an average flow of 0.35 million gallons per day (mgd) and a design flow of 0.67 mgd. The system has 2 modules, each containing 400 units, and each unit consists of a cassette with manifold-connected membranes. As shown in Table 1, removal of BOD, TSS, and ammonia-nitrogen is excellent; BOD and TSS in the effluent are around the detection limit. Phosphorus is also removed well in the system, and the effluent

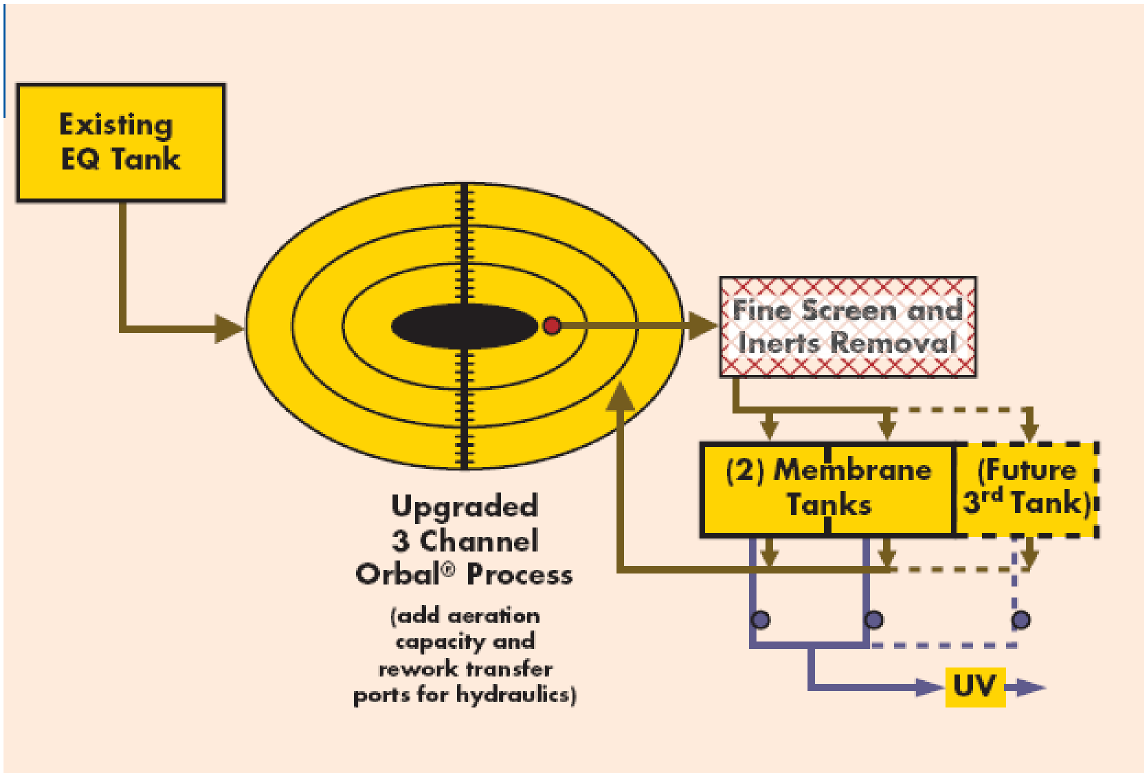


Figure 5. Calls Creek flow diagram (courtesy of Siemens/U.S. Filter)

Table 1.
Calls Creek results 2005

Parameter	Influent Average	Effluent Average	Effluent Max Month	Effluent Min Month
Flow (mgd)	0.35	--	0.44	0.26
BOD (mg/L)	145	1	1	1
TSS (mg/L)	248	1	1	1
Ammonia-N (mg/L)	14.8	0.21	0.72	0.10
P (mg/L)	0.88	0.28	0.55	0.12
Fecal coliforms (#/100 mL)	--	14.2	20	0
Turbidity (NTU)	--	0.30	1.31	0.01

has very low turbidity. The effluent has consistently met discharge limits.

Zenon Systems

General Electric/Zenon provides systems under the ZenoGem and ZeeWeed brands. The ZeeWeed brand refers to the membrane, while ZenoGem is the process that uses ZeeWeed.

Performance data for two installed systems are shown below.

Cauley Creek, Georgia. The Cauley Creek facility in Fulton County, Georgia, is a 5-mgd wastewater reclamation plant. The system includes biological phosphorus removal, mixed liquor surface wasting, and sludge thickening using a ZeeWeed system to minimize the required volume of the aerobic digester, according to information provided by GE. Ultraviolet disinfection is employed to meet regulatory limits. Table 2 shows that the removal for all parame-

Table 2.
Cauley Creek, Georgia, system performance

Parameter	Influent	Effluent		
	Average	Average	Max Month	Min Month
Flow (mgd)	4.27	--	4.66	3.72
BOD (mg/L)	182	2.0	2.0	2.0
COD (mg/L)	398	12	22	5
TSS (mg/L)	174	3.2	5	3
TKN (mg/L)	33.0	1.9	2.9	1.4
Ammonia-N (mg/L)	24.8	0.21	0.29	0.10
TP (mg/L)	5.0	0.1	0.13	0.06
Fecal coliforms (#/100 mL)	--	2	2	2
NO3-N (mg/L)	--	2.8		

ters is over 90 percent. The effluent meets all permit limits, and is reused for irrigation and lawn watering.

Traverse City, Michigan. The Traverse City Wastewater Treatment Plant (WWTP) went through an upgrade to increase plant capacity and produce a higher-quality effluent, all within the facility's existing plant footprint (Crawford et al. 2005). With the ZeeWeed system, the facility was able to achieve those goals. As of 2006, the plant is the largest-capacity MBR facility in North America. It has a design average annual flow of 7.1 mgd, maximum monthly flow of 8.5 mgd, and peak hourly flow of 17 mgd. The membrane system consists of a 450,000-gallon tank with eight compartments of equal size. Secondary sludge is distributed evenly to the compartments. Blowers for air scouring, as well as permeate and back-pulse pumps, are housed in a nearby building.

Table 3 presents a summary of plant results over a 12-month period. The facility provides excellent removal of BOD, TSS, ammonia-nitrogen, and phosphorus. Figure 6 shows the influent, effluent, and flow data for the year.

Operating data for the Traverse City WWTP were obtained for the same period. The mixed liquor suspended solids over the period January to August averaged 6,400 mg/L, while the mixed liquor volatile suspended solids averaged 4,400 mg/L. The energy use for the air-scouring blowers averaged 1,800 kW-hr/million gallons (MG) treated.

COSTS

Capital Costs

Capital costs for MBR systems historically have tended to be higher than those for conventional systems with comparable throughput because of the initial costs of the membranes. In certain situations, however, including retrofits, MBR systems can have lower or competitive capital costs compared with alternatives because MBRs have lower land requirements and use smaller tanks, which can reduce the costs for concrete. U.S. Filter/Siemen's Memcor package plants have installed costs of $7–$20/gallon treated.

Fleischer et al. (2005) reported on a cost comparison of technologies for a 12-MGD design in Loudoun County, Virginia. Because of a chemical oxygen demand limit, activated carbon adsorption was included with the MBR system. It was found that the capital cost for MBR plus granular activated carbon at $12/gallon treated was on the same order of magnitude as alternative processes, including multiple-point alum addition, high lime treatment, and post-secondary membrane filtration.

Operating Costs

Operating costs for MBR systems are typically higher than those for comparable conventional systems. This is because of the higher energy

Table 3.
Summary of Traverse City, Michigan, Performance Results

Parameter	Influent Average	Effluent Average	Effluent Max Month	Effluent Min Month
Flow (mgd)	4.3	--	5.1	3.6
BOD (mg/L)	280	< 2	< 2	< 2
TSS (mg/L)	248	< 1	< 1	< 1
Ammonia-N (mg/L)	27.9	< 0.08	< 0.23	< 0.03
TP (mg/L)	6.9	0.7	0.95	0.41
Temperature (deg C)	17.2	--	23.5	11.5

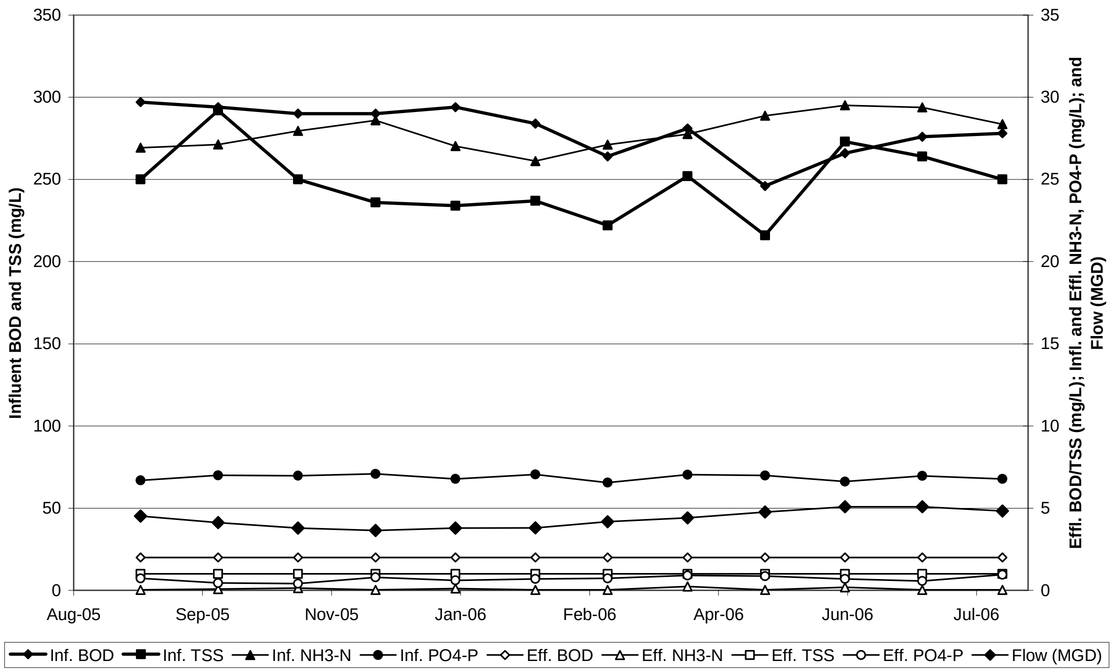


Figure 6. Performance of the Traverse City plant

costs if air scouring is used to reduce membrane fouling. The amount of air needed for the scouring has been reported to be twice that needed to maintain aeration in a conventional activated sludge system (Scott Blair, personal communication, 2006). These higher operating costs are often partially offset by the lower costs for sludge disposal associated with running at longer sludge residence times and with membrane thickening/dewatering of wasted sludge.

Fleischer et al. (2005) compared operating costs. They estimated the operating costs of an MBR system including activated carbon adsorption at $1.77 per 1,000 gallons treated. These costs were of the same order of magnitude as those of alternative processes, and they compared favorably to those of processes that are chemical-intensive, such as lime treatment.

ACKNOWLEDGMENTS

The authors acknowledge Dr. Venkat Mahendraker, GE/Zenon, Mr. John Irwin, Siemens/U.S. Filter, and Mr. Scott Blair and Mr. Leroy Bonkoski of the Traverse City WWTP for their assistance in obtaining data and system information. EPA acknowledges external peer reviewers Pat Brooks, Alan Cooper, and Glenn Daigger for their contribution.

PRODUCT LITERATURE USED

Enviroquip/Kubota. Sales literature.

Siemens. Product literature. <http://www.usfilter.com/en/Product+Lines/Envirex_Products/Envirex_Products/envirex_mbr_xpress_packaged_plant.htm>.

Zenon. Case studies: Cauley Creek, Georgia. <http://www.zenon.com/resources/case_studies/water_reuse/CauleyCreek.shtml>.

Zenon. Case studies: Traverse City, Michigan. <http://www.zenon.com/resources/case_studies/wastewater/TraverseCity.shtml>.

REFERENCES

Crawford, G., G. Daigger, J. Fisher, S. Blair, and R. Lewis. 2005. Parallel Operation of Large Membrane Bioreactors at Traverse City. In *Proceedings of the Water Environment Federation 78th Annual Conference & Exposition*, Washington, DC, CD-ROM, October 29–Nov 2, 2005.

Crawford, G., A. Fernandez, A. Shawwa, and G. Daigger. 2002 Competitive Bidding and Evaluation of Membrane Bioreactor Equipment—Three Large Plant Case Studies. In *Proceedings of the Water Environment Federation 75th Annual Conference & Exposition*, Chicago, IL, CD-ROM, September 28–Oct 2, 2002.

Crawford, G., D. Thompson, J. Lozier, G. Daigger, and E. Fleischer. 2000. Membrane Bioreactors—A Designer's Perspective. In *Proceedings of the Water Environment Federation 73rd Annual Conference & Exposition on Water Quality and Wastewater Treatment*, Anaheim, CA, CD-ROM, October 14-18, 2000.

Fleischer, E.J., T.A. Broderick, G.T. Daigger, A. D. Fonseca, R.D. Holbrook, and S.N. Murthy. 2005. Evaluation of Membrane Bioreactor Process Capabilities to Meet Stringent Effluent Nutrient Discharge Requirements. *Water Environment Research* 77:162–178.

Fleischer, E. J., T. A. Broderick, G. T. Daigger, J. C. Lozier, A. M. Wollmann, and A. D. Fonseca. 2001. Evaluating the Next Generation of Water Reclamation Processes. In *Proceedings of the Water Environment Federation 74th Annual Conference & Exposition*, Atlanta, GA, CD-ROM, October 13–17, 2001.

Hermanowicz, S.W., D. Jenkins, R.P. Merlo, and R.S. Trussell. 2006. *Effects of Biomass Properties on Submerged Membrane Bioreactor (SMBR) Performance and Solids Processing*. Document no. 01-CTS-19UR. Water Environment Federation.

Metcalf & Eddy. 2003. *Wastewater Engineering, Treatment and Reuse*. 4th ed. McGraw-Hill, New York.

Wallis-Lage, C., B. Hemken, et al. 2006. *MBR Plants: Larger and More Complicated*. Presented at the Water Reuse Association's 21st Annual Water Reuse Symposium, Hollywood, CA, September 2006.

United States Environmental Protection Agency
September 2007

G5. Biosolids Dewatering Equipment

G5.1. Belt Filter Press

Date: Thursday, September 11, 2014

Allan Maas, Parametrix Engineering C/O
Goble Sampson, Douglas Allie
22526 SE 64th Place, Suite 240
Issaquah, WA 98027
Bus: (425) 392-0491
Mobile: (206) 999-8436
Bus Fax: (425) 392-9615
E-mail: dallie@goblesampson.com

Re: Pacific City WWTP Sludge Dewatering

Dear Allan:

From the email forwarded to me, by the company's agent, Doug Allie, you want budget scope and pricing to dewater 30gpm of waste activated sludge at an influent of 1.2% representing 230 dry lbs. /hr. BDP would offer the company's model 3DP Belt Press.

BDP Industries would recommend a 0.75 meter model 3DP. This unit would have the following capacity:

• Solids Loading:	600lb/hr.
• Hydraulic Load @ 1.2% influent:	100 gpm
• Discharge Solids Concentration:	18 wt%
• Polymer Dosage:	12lb/ton
• Solids Capture:	98%

From the email you are going to lime stabilize the discharge. BDP Industries has provided lime metering and mixing systems. I will work up a budget price for a system and get this to you shortly as well, along with photos of lime systems the company has done.

Before going into the scope of our offering it is important to point out the features of the model 3DP that provide performance superior to any other belt press in the industry:

- Overall Layout: Gravity zone at floor level and vertical arrangement and high cake discharge from the pressure zone eliminates costly platforms and improves operator / maintenance access for improved control and maintenance. Benefit to clients, reduced installation cost and lower maintenance costs.

- Feed Distributor: Variable speed paddle wheel up flow conditioning tank and overflow weir design eliminates dead areas, while insuring a full belt width uniform cake thickness. Uneven cake distribution is similar to running tires on a car over inflated or out of alignment. The Paddle Wheel feed box insures even cake distribution resulting in longer cloth and roll coating life.
- Independent Gravity Zone: Allows operating the gravity zone at high belt speeds, spreading the cake over more filter area, decreasing the cake thickness thereby lowering resistance to filtrate flow. The independent drive of the pressure zone can be operated slower, increasing the time under pressure of the cake. Bottom line both production capacity and discharge cake solid concentration will be higher.

- Vertical Pressure Section: Vertical arrangement allows filtrate pans under each roll, preventing expressed filtrate from falling on adjacent rolls and being reabsorbed, thereby improving discharge cake solids.

- Perforated Roll: Design eliminates re-absorption of filtrate, increasing cakes solids and improves structural strength of the roll.

- Curved Wedge Zone: Curved design applies increasing cake pressure over the entire length, more effectively expressing filtrate, while encapsulating the cake and reducing cake extrusion from the edges of the filter belt. Improves cleanliness of operation, reduces clean up time and increases cake solids.

- Tubular Steel Frame Construction: Superior structural strength over channel and "I" beam construction, and enhanced cleanliness. The tubular steel significantly reduces the number of corners, ledges and hard to access areas that collect process slurry and cause corrosion. Hot dip galvanized inside and out, affords maximum corrosion-resistance resulting in longer life of machinery and lower maintenance costs.

- Machined Mounting Pads: All bearings and structural bolted connections incorporate a machined pad welded to frame. These pads are machined to provide precision alignment of bearing with roll journal. Structural strength and corrosion-resistance are enhanced. Bearing life is improved and the time to replace and align a bearing is reduced.

Please click on the link below and view the 3 minute video on the project we recently finished for the city of Roselle Illinois. The model 3DP Belt Press operates at six times the solids loading of their previous belt press and yet gets a drier cake.

http://www.youtube.com/watch?v=rld712QYGMg

In addition the web link below is a 15 minute video that goes over in detail the features mentioned above:

http://www.youtube.com/watch?v=ASmLfkilP3M

On our web site, "BDPIndustries.com", there are other testimonials you can view that will testify of the outstanding performance of the model 3DP. I have also attached a list of references and product brochure.

EQUIPMENT SCOPE OF SUPPLY

0.75 meter Model 3DP Belt Press:

One (1) 0.75 meter Model 3DP Belt Filter Presses, the equipment package includes a complete press and appurtenant equipment described as follows:

1) One (1) 316L stainless steel polymer injection and polymer/sludge mixing system consisting of an injection ring, variable vortex mixer and reducing fittings.

2) One (1) 0.75 meter model 3DP Belt Presses with the following design features:

   a.) Tubular steel frame hot dip galvanized per ASTM 123.
   b.) Machined bearing pads.
   c.) Up-flow, high solids feedbox with variable speed paddle wheel.
   d.) 10ft long **independent**, variable speed gravity section at operator level.
   e.) ¼" x 3" stainless steel gravity deck support spaced every 6 inches.
   f.) Six (6) rows of adjustable, furrowing plows with HDG steel support bars.
   g.) Curved wedge section.
   h.) 304 stainless steel, 20" diameter, perforated roller.
   i.) Eight s-wrap pressure section.
   j.) UHMW scraper blades.
   k.) Nylon covered roller.
   l.) 304 stainless steel wetted parts.
   m.) 304 stainless steel hardware.
   n.) 50 PLI hydraulic tensioning and tracking.
   o.) Corrosion resistant composite cylinders with 316 stainless steel rods and stainless steel hardware.
   p.) Self-cleaning, adjustable angle belt showers with Victualic connections.
   q.) Dodge bearings rated for 1,000,000 hours at 50 PLI at 15 ft/min.

r.) TEFC, severe duty variable speed motors.
s.) PVC conduit.
t.) Zero speed switches for the gravity and press belts.

3) One (1) complete NEMA 4X, wall mount, 304 stainless steel electrical control panel for all the dewatering system control functions and drives. The control panel shall include Allen Bradley Power Flex 40 series variable frequency drives and an Allen Bradley Compact Logix PLC with Ethernet communication. The panel will include a 12" color Panel View Plus Allen Bradly OIT for all control of the complete dewatering system.

4) One (1) Fluid Dynamics or equal emulsion polymer metering and make up system rated for a capacity of up to 1.5gph emulsion polymer and 400gph of dilution water.

5) One (1) Boerger Rotary Lobe Cavity Feed Pumps rated for 100gpm.

6) One (1) 2 hp hydraulic power unit with 20-gallon, 304 stainless steel reservoir.

7) One (1) 10 HP Gould's model 3656 Wash Water Booster pump capable of boosting from 15 to 120 PSI at a flow rate of 75 GPM.

8) Seven Days of service over two trips to site.

9) Freight to the Job site.

The model 3DP Belt Press will come completely factory-assembled, tested and will be shipped in two pieces. The polymer injection device, hydraulic unit, belt media and booster pump will be shipped separately. This quotation is for furnishing equipment only and does not include any other installation labor or field services other than checkout, start up and testing services as listed above. All installation, on-site assembly, anchorage, pads and other work required to facilitate the setting of the equipment is to be by others. All labor and material for interconnecting between the press and the auxiliary equipment is to be completed by others.

SUBMITTAL DATA

Submittals will be made in the number of copies specified and will be available within 4 to 8 weeks after firm purchase order and all information is received at the factory.

SHIPMENT

Approximate shipping weight of each belt press 9,000 lbs. Estimated shipping time is 18 to 24 weeks after receipt of submittal approval.

FIELD SERVICE

Installation observation, testing and operator instruction services can be supplied at a service rate of $900 per day plus travel expenses.

PRICING

Prices for the above equipment items are:

0.75 meter Belt Filter Press:	**Price**
• One (1) In line Polymer / Sludge Mixer:	$3,500
• One (1) 0.75 meter 3DP Belt Press:	$130,000
• One (1) Hydraulic Power unit:	Included with Press
• One (1) Control Panel	$25,000
• One (1) Polymer Make up System:	$13,500
• One (1) Feed Pump, Boerger or equal:	$15,000
• One (1) Wash Water Booster Pump:	$4,000
• (7) Days of Service (2) trips to site:	$8,500
• Freight to Job Site:	$9,000
• Total:	$208,500

TERMS

Terms of payment are 30% with order 60% upon shipment of equipment and 10% upon startup. The attached Conditions of Sale are hereby made a part of this proposal.

We appreciate this opportunity to extend our quotation and if we can answer questions or supply additional information, please do not hesitate to contact me.

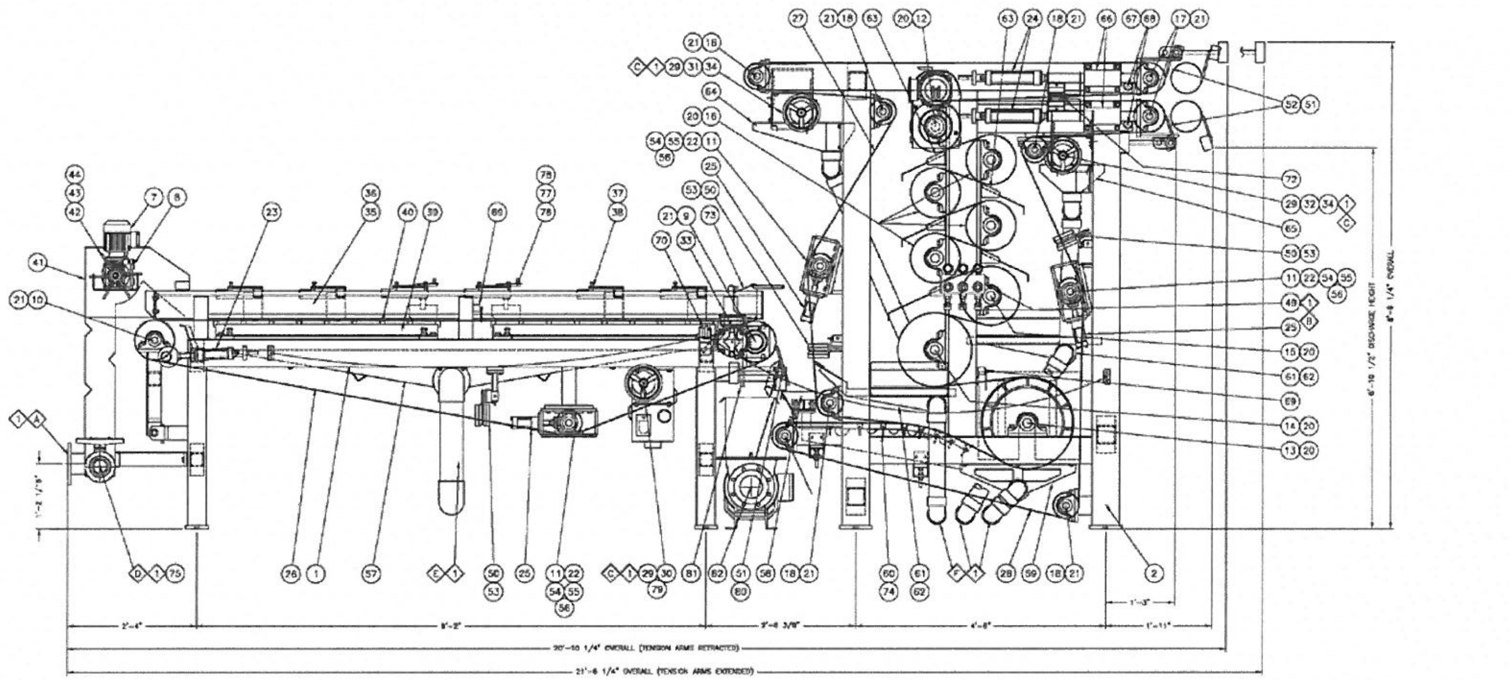
Sincerely,

N Kelly Brown

Director

BDP Industries, Inc.

Cc: A J Schmidt, President BDP Industries, Inc.



QTY.	DESCRIPTION	MAT.	ITEM	REMARKS

BDP INDUSTRIES, INC.
GREENWICH, N.Y. 12834

.75m 3DP

PROPOSAL

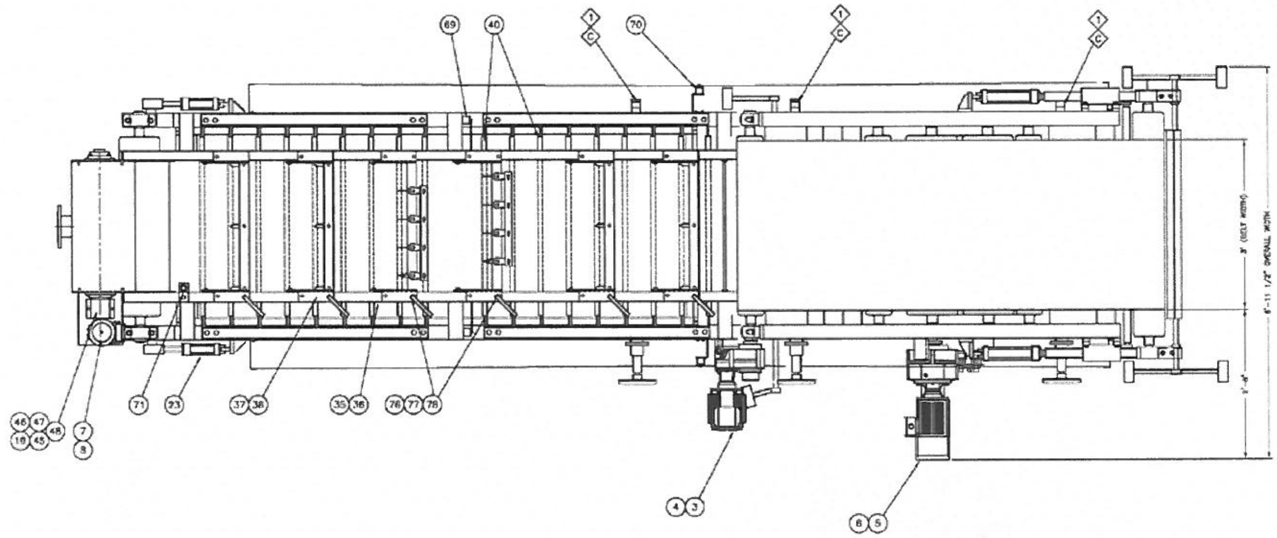
MJC

GENERAL ARRANGEMENT
.75m DUAL MODE 3DP W/10' GBT

1 3

1-700-689

1



QTY.	DESCRIPTION	MAT.	ITEM	REMARKS

BDP INDUSTRIES, INC.
GREENWICH, N.Y. 12834

MACHINE: .75m 3DP
BDP JOB NO.: PROPOSAL
DWN BY: MJC
SHT. 2 OF 3

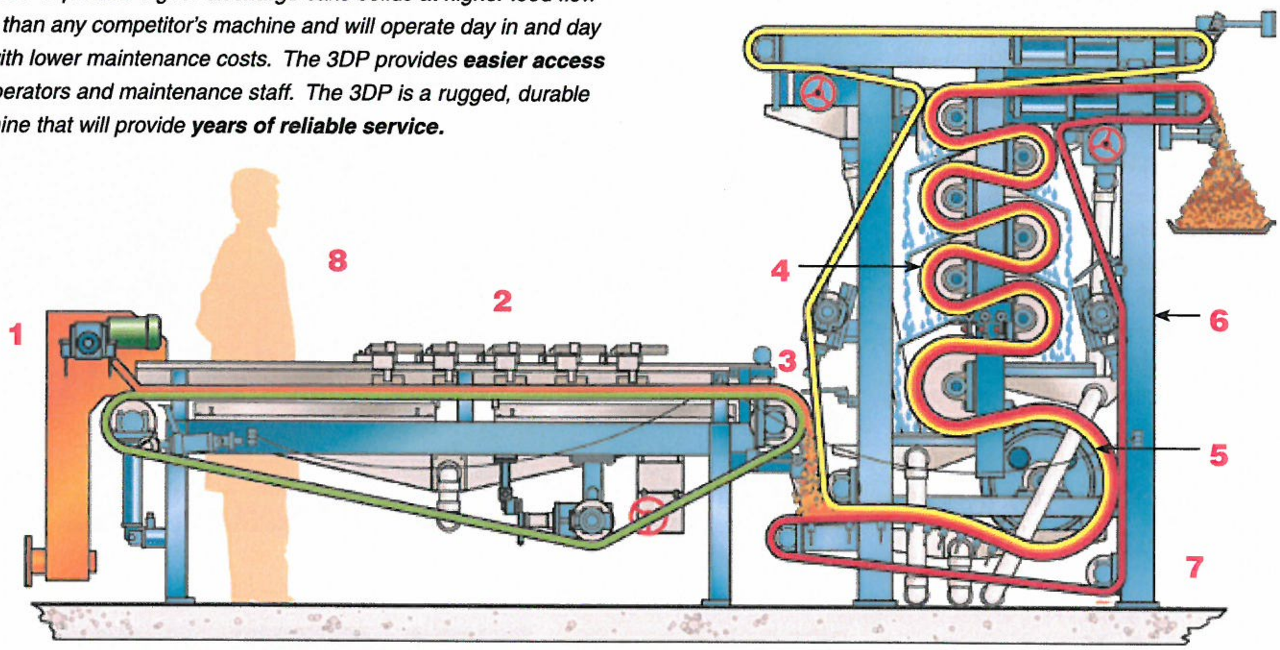
DWG TITLE: GENERAL ARRANGEMENT .75m DUAL MODE 3DP W/10' GBT

DWG NO. 1-700-609
REV. 1

Higher Cake Solids and Feed Rate

— with LOWER Maintenance Costs.

BDP Industries' ***Model 3DP Belt Press*** *was designed with* ***unique features*** *to provide higher discharge cake solids at higher feed flow rates than any competitor's machine and will operate day in and day out with lower maintenance costs. The 3DP provides* ***easier access*** *for operators and maintenance staff. The 3DP is a rugged, durable machine that will provide* ***years of reliable service.***



Design Features

1 **Feed Distributor:** Unique, variable speed paddle wheel provides full belt-width distribution and uniform thickness .

2 **Independent Gravity Zone:** Allows for higher production capacity as well as higher cake solids. ***Available in standard lengths from 6 - 16 ft in 2 ft intervals.***

3 **Spiral Wedge:** Applies increasing cake pressure over the entire length for effective expressing of filtrate with excellent cake retention.

4 **Vertical Pressure Rolls:** Vertical arrangement allows for filtrate pans under each roll to keep filtrate from falling on adjacent rolls. This eliminates reabsorbtion of filtrate and improves discharge cake solids. Discharge height adequate for conveyor without raising press. ***Up to 12 pressure rolls are available.***

5 **Perforated Roll:** Unique design and stainless steel construction improves dewatering and structural strength of roll.

6 **Tubular Frame Construction:** Provides superior structural strength over channel and I-beam construction. Enhanced cleanliness. Hot-dip galvanized coating inside and out affords maximum corrosion resistance. ***Also available in stainless steel.***

7 **Machined Mounting Pads:** All bearing and structural bolted connections are machined, tapped pads which are welded to frame. This enhances structural strength and corrosion resistance.

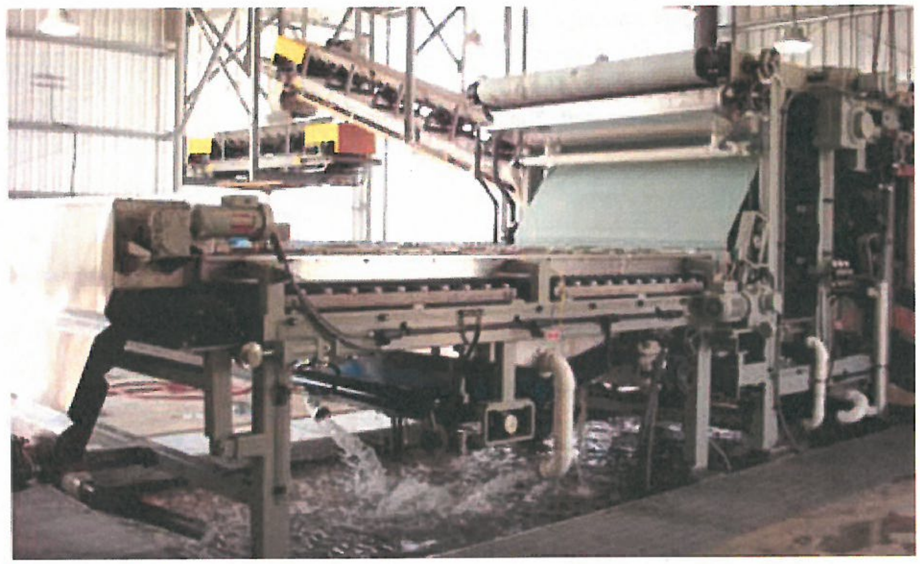
8 **Overall Layout:** Gravity zone and controls located at operator level simplifies process optimization and eliminates costly platforms.

Unique Features and How They Work

Standard two belt technology employed by most manufacturers forces a compromise in either through-put capacity or discharge cake solid concentration, because belt speed in the two zones must be the same. Three belt technology used by BDP overcomes this limitation by allowing independent speed control in each zone.

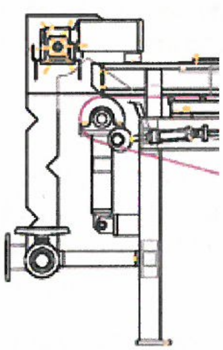
In addition significant improvements in feed distribution, wedge zone pressure gradation and effectiveness and elimination of filtrate pooling/rewetting in the pressure zone *MAXIMIZES PERFORMANCE*. The unique low profile gravity zone, tubular steel frame, machined mounting pads for bearings, and bolted connections all provide easier access for maintenance. In photo at right: notice the unique layout and lack of platforms, allowing easy access for maintenance.

The unique designs of the Gravity and Pressure Zones provide MAXIMUM PERFORMANCE.



3DP Belt Filter Press

Upflow Adjustable Speed Paddle Wheel Feed Box



This unique design produces extremely uniform slurry distribution. Sludge enters horizontally at floor level, then transitions to vertical in the upflow conditioning tank and spreads to full belt width. Then the slurry overflows the vertical tank into the paddle wheel distributor weir trough. The adjustable speed paddle wheel pushes the slurry out of the weir trough onto the belt.

Pictured (at right) is 3.5% concentration anaerobically digested sludge; notice the even, full width distribution immediately upon leaving the feed distributor.

Feed box side view

Paddle wheel

Uniform slurry distribution

G5.2. Centrifuge

Skid-Mounted Centrifuge Systems

Scope of Supply

ANDRITZ designs and supplies complete skid-mounted and trailer-mounted dewatering systems including:

- Andritz decanter centrifuge
- Positive displacement sludge feed pump with variable frequency drive
- Sludge grinder (optional)
- Sludge magnetic flow meter
- Polymer makeup system for mixing and supplying emulsion polymer
- Wash water pump (optional)
- Discharge chutes and flex connections
- Solids discharge screw conveyor
- Interconnecting piping and electrical on skid
- Single control/starter panel for centrifuge and dewatering system

ANDRITZ Separation

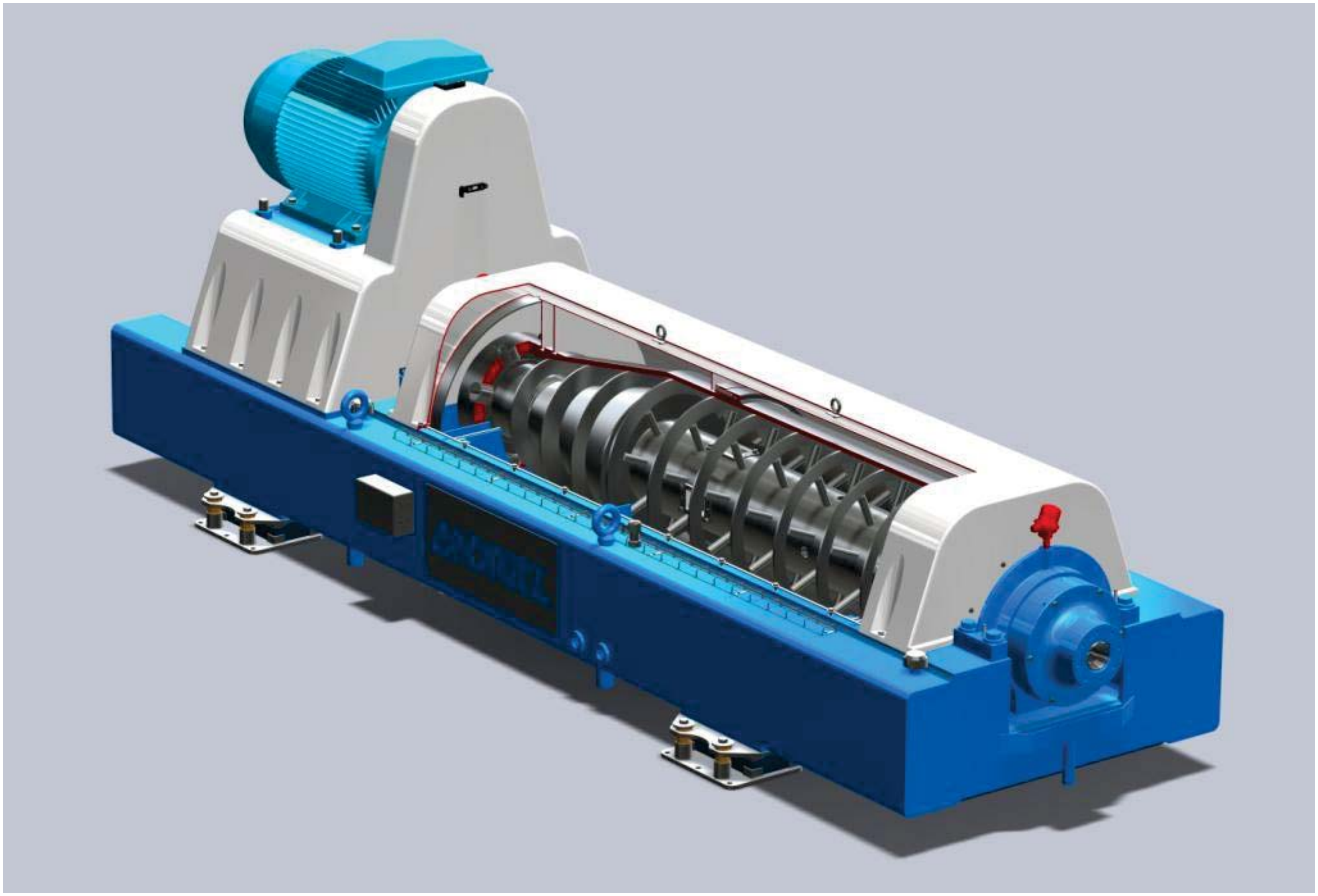
Skid-Mounted Centrifuge Systems

Features and Advantages

Some of the key advantages of installing an ANDRITZ skid-mounted centrifuge system:

- Dewatering system is ready to “plug and play”
- Andritz is responsible for design and supply of fully operable system
- Automatic control of dewatering system from single control panel
- Control system can be connected to plant SCADA system for monitoring
- Single electrical connection
- Single water connection
- Compact installation can fit into small building
- Can be easily relocated to permanent installation

Andritz High Performance Centrifuge



Separation

ANDRITZ Skid-Mounted Centrifuge Systems

D5LX Skid – Clackamas County Tri-City WWTP, Oregon

ANDRITZ Separation

Pacific City WWTP Plant Upgrade
Budget Information - Sludge Dewatering Centrifuge

September 2, 2014

<u>Design Data for Dewatering System</u>

Description:	Aerobically digested sludge / no primary clarifiers
Design flow to centrifuge:	35 gpm
Feed solids concentration:	1.2% TS
Design solids loading:	240 lb/hr

<u>Centrifuge Sizing</u>

Recommended Model:	Andritz D3L
Hydraulic capacity:	50 gpm
Solids loading capacity:	300 lb/hr
Discharge cake solids:	20 ± 2% TS
Solids capture efficiency:	>96% TSS
Active polymer consumption:	20 lb/ton TS

Note: Performance values based on Andritz experience with sludge as described, subject to confirmation by lab testing

<u>Budget Pricing</u>

Option 1 – D3L centrifuge with control panel: $ 210,000 USD FOB Jobsite

Option 2 – D3L dewatering skid with centrifuge, sludge feed pump, emulsion polymer system, 6 ft long inclined discharge screw, control panel: $300,000 USD FOB Jobsite

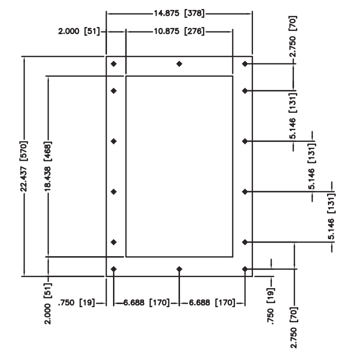
Denis Piché
Regional Manager
Andritz Separation
Tel: 403-995-2071
Email: denis.piche@andritz.com

Local Representative:
APSCO LLC
Joe Kernkamp
Tel: 206-890-4039
Email: jkernkamp@apsco-llc.com

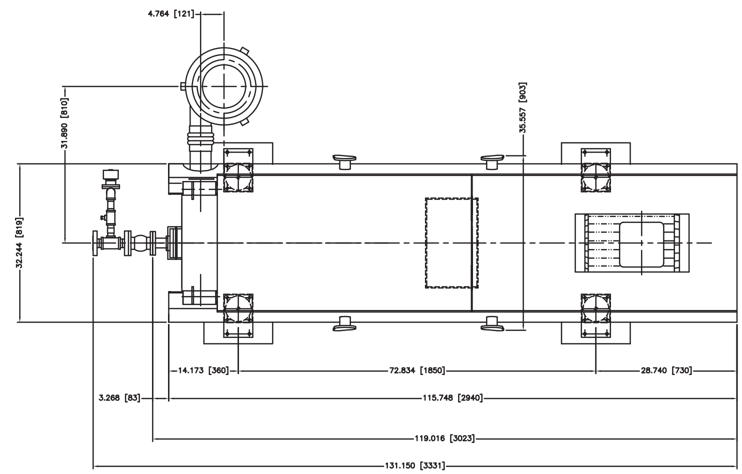
ANDRITZ SEPARATION INC.
1010 Commercial Blvd. S.
Arlington, Texas 76001
Tel. (817) 465-5611
Fax (817) 468-3961
separation.us@andritz.com

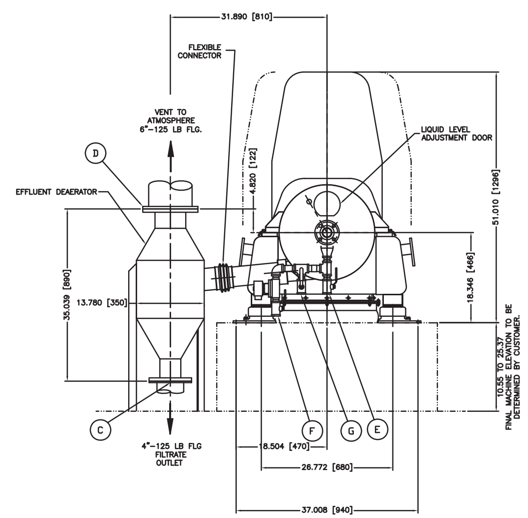
PIPING CONNECTIONS

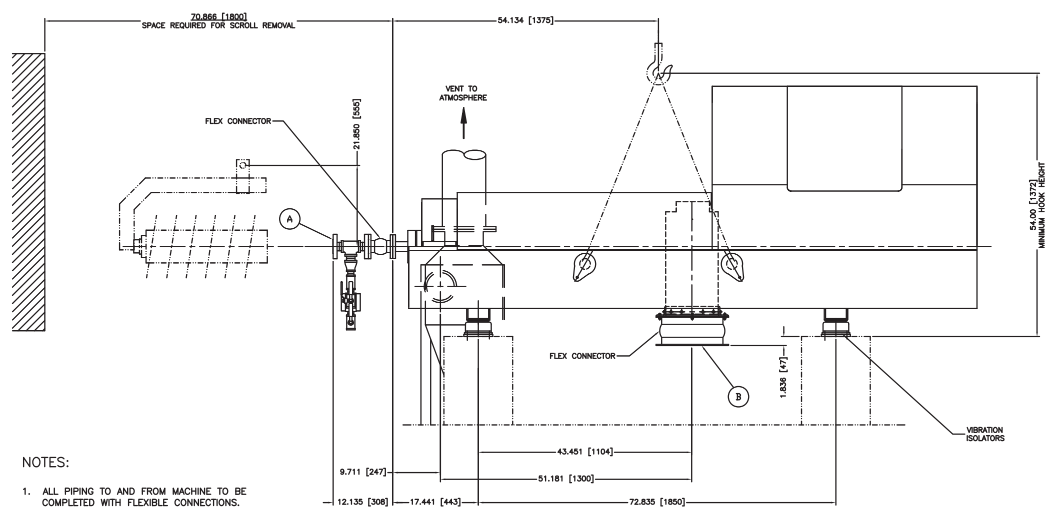
PORT	SIZE	DESCRIPTION
A	1-1/2"-150 LB ANSI FLANGE	FEED INLET
B	RECTANGULAR 14.81" X 22.38"	SOLIDS DISCHARGE
C	4"-125 LB ANSI FLANGE	FILTRATE OUTLET
D	6"-125 LB ANSI FLANGE	VENT
E	1" NPT	SLUDGE SAMPLE
F	1" NPT	WASHWATER CONNECTION
G	1" NPT	POLYMER CONNECTION



SOLIDS DISCHARGE FLANGE
SCALE: 2X







NOTES:

1. ALL PIPING TO AND FROM MACHINE TO BE COMPLETED WITH FLEXIBLE CONNECTIONS.
2. SEE FOUNDATION DETAILS FOR DESIGN LOADS AND CONNECTION DETAILS.
3. ALL DIMENSIONS ARE IN INCHES WITH mm IN [ ].
4. DRY WEIGHT OF MACHINE 3968LB [1800Kg].
5. SCROLL WEIGHT 551LB [250Kg].
6. PROCESS REQUIREMENTS

   WASHWATER: 45GPM @ 20-30PSI
   SHUTDOWN: 15min
   CIP: 10min
   AIR FLOW: 60CFM

PRELIMINARY
FOR REVIEW ONLY

REFERENCE DRAWING 29272 REV. 6

ESTIMATED WEIGHT IN LBS:	DRAWN BY: MW	DATE 12/08/04
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN INCHES	CHECKED BY:	DATE
FABRICATION TOLERANCES	APPROVED BY:	DATE 01/05/05
MACHINING TOLERANCES	THIRD ANGLE PROJECTION	
MILL FINISH ALL OVER		

ANDRITZ
ANDRITZ-RUTHNER, INC.
1010 COMMERCIAL BLVD. SOUTH
ARLINGTON, TEXAS 76001
PHONE: (817) 465-5611

TITLE: D3 SERIES - FILE D/31 GENERAL ARRANGEMENT

SIZE: E | DRAWING NUMBER: DMA1668 | REV: 0
SCALE: 1/8 | FILE: DMA1668 | SHEET 1 OF 1

G5.3. Screw Press

FKC CO., LTD.

FKC

2708 West 18th Street
Port Angeles, WA 98363

(360) 452-9472
FAX (360) 452-6880

August 29, 2014

Allan Maas, P.E.
Parametrix
Facility Group

RE: QT082914WB – Proposal for FKC Dewatering Equipment

Mr. Maas,

Attached is a proposal for dewatering **Waste Activated Sludge** at a rate of 240 dry lbs. per hour. The sludge can be limed or un-limed. FKC has also included a budget proposal for a lime delivery system.

Please note that these prices only include the equipment listed. The equipment listed is shipped loose and will require field installation. This proposal does not include any other materials needed for a dewatering installation, i.e. piping, valves, field wiring, polymer totes, polymer hoses, etc. These prices do not include taxes or bonding.

I hope this information is helpful. Please contact this office if you have questions or if you need any further information.

Sincerely,

Wes

Wesley Bond
FKC COMPANY, LTD.

Table of Contents

A. Proposed Equipment

1. Screw Press

Qty.	Description		Unit Price Delivered
1	**FKC Screw Press** **Model BHX-700x5000L**		**US$ 185,000**
	Material:	WAS or WAS with Lime Addition	
	Capacity:	240 dry pounds per hour 2.88 dry tons per 24 hour day 35 GPM at 1.2%(Assumed)inlet	
	Inlet consistency:	0.8% or higher	
	Outlet consistency:	16% or higher with polymer addition **Sample Required to confirm results**	
	Nonvolatile solids content:	40% or higher	
	Materials of construction:	SS-304 wetted parts, Base coated CS Non-wetted parts coated CS	
	Screw design:	Suitable for dewatering only	
	Screens:	Punched SS-304	
	Speed reducer:	Sumitomo Cyclo reducer	
	Motor:	2.0 1800 rpm, NEMA B, 480 VAC, 3 Ph, 60 Hz, included Suitable for variable speed operation w/ PWM constant torque inverter	
	Other:	1 set standard tools 1 set drum covers 1 motor coupling 4 spare screens	
	Approx. shipping weight:	13 tons	
	Delivery:	Delivery within 5 (five) months after receipt of written purchase order	

B. Proposed Equipment

2. Flocculation Tank

Qty.	Description	Unit Price Delivered
1	Flocculation Tank 150 gal, with variable speed agitator	**Included**

Drive:	SEW Eurodrive Varimot gearmotor with mechanical speed variator
Motor:	1.5 HP, 1800 rpm, manufactured by SEW 480 VAC, 3 Ph, 60 Hz included
Materials of construction:	SS-304 wetted parts
Approx. shipping size/ weight:	100 cubic feet / 750 Lbs
Delivery:	Delivery within 5 (five) months after receipt of written purchase order

A. Proposed Equipment –

3. Ancillary Equipment

Ancillary Equipment	**Unit Price Delivered**
Control Panel including:	**US$ 50,000.00**
Enclosure, NEMA 4X	
PLC – Automation Direct DL05	
Operator Interface – Maple System	
Software, Programming, & Documentation	
Screw Press VFD – Danfoss (FC-202 AQUA Drive)	
Flocculation Tank VFD – Danfoss (FC-202 AQUA Drive)	
Polymer System Analog Outputs	
Headbox Level Transmitter Aqua Tape	
Omega Level Switch	
Solenoid Valve for Screw Press Wash Water – 1, 2, 3	
All Discrete Output for System	
All Analog Output for System	
All Discrete Input for System	
All Discrete Outputs for System	
Includes field testing and start-up labor	
Polymer Make Down System:	**US$ 17,500**
Velodyne – VM-2.5P-600-Dx	
Veloblend polymer blending system	
Progressive Cavity – Neat Polymer Pump	
304 SS Construction	
NEMA 4X Enclosure	
Two (2) Sludge Pumps	**US$ 8,500 Each**
NETZSCH Inc.	**US$ 17,000 Total**
NEMO Pump	
10 – 50 GPM	
5 HP, 480 VAC 3P	
Pump Temperature Sensor	

A. Proposed Equipment –

4. Ancillary Equipment

Ancillary Equipment	Unit Price Delivered
Quicklime Storage and Feed System including: Columbia TecTank 9 feet x 25.19 feet straight wall high 5 foot diameter Metalfab bin activator Three (3) Bin Level Indicators Fill Pipe – 4" pipe and fittings as required IAC Shaker Style Bin Vent Filter Metalfab FSC4-20 Flexable Screw Conveyor FKC Inductor Tank	**US$ 150,000**

B. Miscellaneous

1. Delivery

The screw press and flocculation tank will be ready to ship within four (4) months after receipt of written purchase order. Delivery will be within five (5) months after receipt of purchase order to your facility.

Delivery of ancillary equipment will also be within five (5) months.

2. Shipping Arrangements

The FKC screw press will be shipped via 40' and/or 20' open top container from Fukoku Kogyo's (FKC Japan) Ishinomaki, Japan factory to a local port then best way overland to the WWTP.

The flocculation tank and ancillary will be shipped best way from Port Angeles, WA.

All Ancillary equipment is FOB OR and is shipped best way from point of manufacturer.

3. Price Summary

	35 GPM @ 1.2%
Screw Press	185,000
Flocculation Tank	Included
Polymer System	17,500
Sludge Pumps	17,000
Control Panel	50,000
Lime System	150,000
Total	US$ 419,500

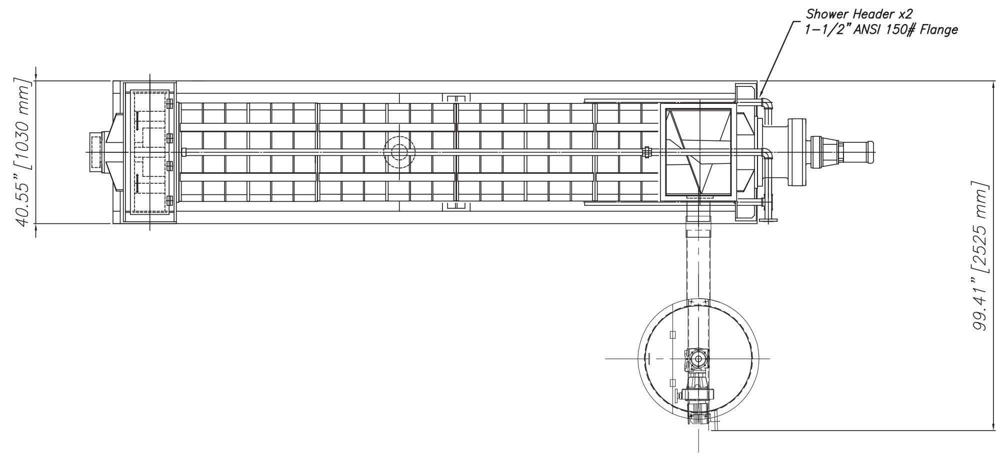
4. Effective Period

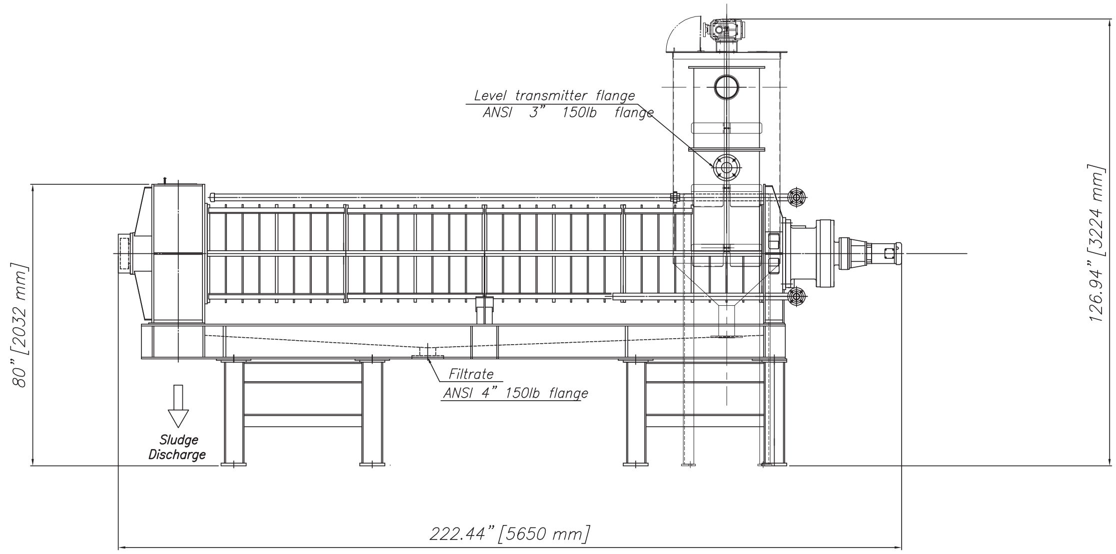
This proposal shall remain valid **60** days from the date of the proposal.

5. Payment Terms

30% with certified drawings
30% with shipment
30% with delivery
10% with performance or within 6 months of delivery if the equipment has yet to start-up due to the schedule of the customer, whichever occurs first.

Net 30 days

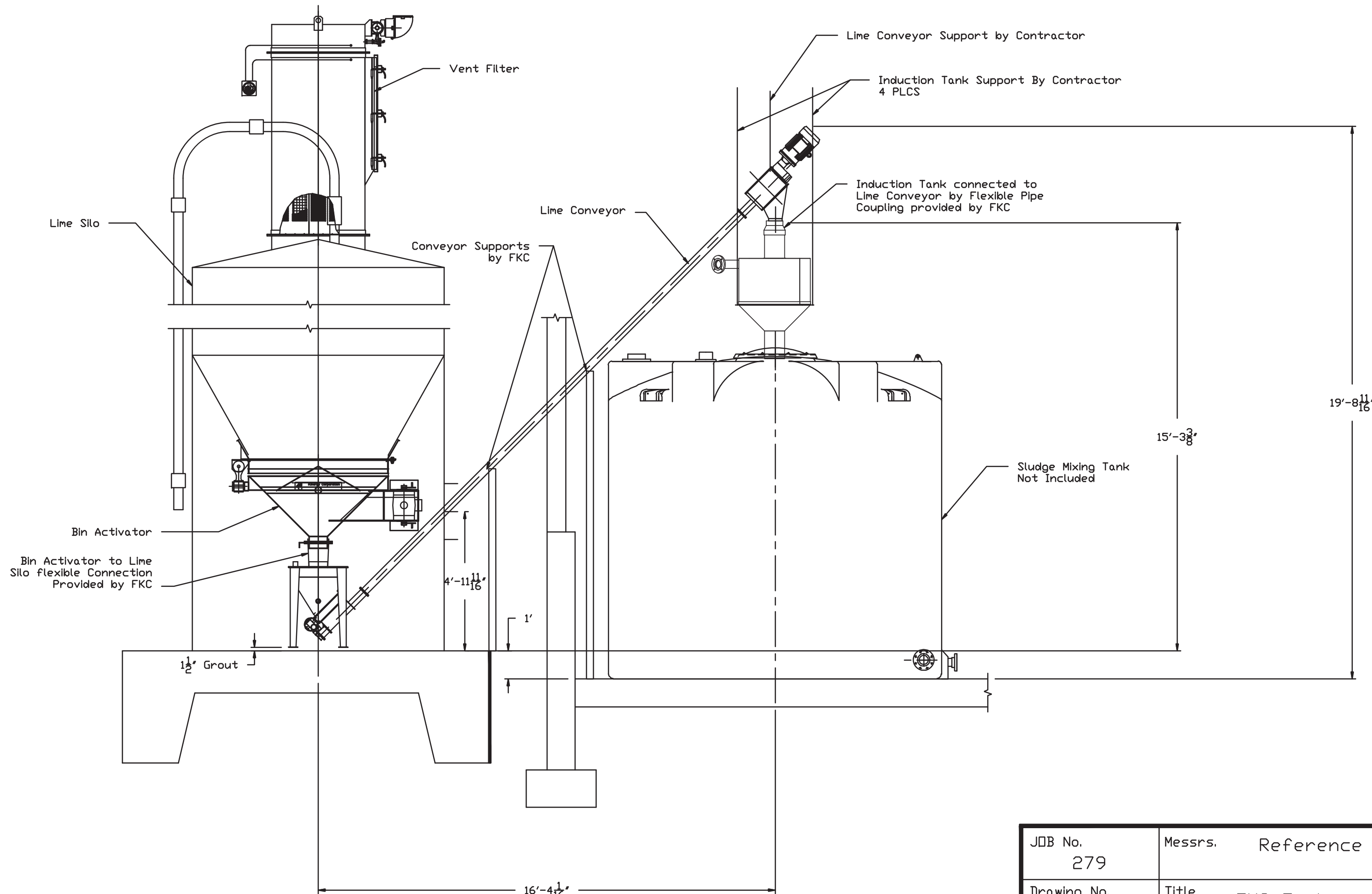




NOTE: POLYMER TOTE/HOSES, STAIRS/LADDERS NOT INCLUDED

Mark	Description	Material	Pcs.	Weight	Remarks
Purchaser	Reference		Quantity: 1		F K C
End user			Scale: 1/20		
Job name	SHX-700X4000L DEWATERING SKID				
Dwg. name	LAYOUT				
Job No.					
Dwg. No.	A700x4000L		Ref. job No.		

FKC CO., LTD.



JOB No.	Messrs.	Reference	Quantity	Wt Lbs.
279			1	
Drawing No.	Title	FKC Equipment	Date	
L279-102			2/4/13	
			Drawn by	
			RTB	Ref. JOB No.

FKC CO., LTD.

2708 W, 18TH ST.
PORT ANGELES, WA 98363
(360) 452-9472 FAX (360) 452-6880

REVISION	SHEET
2	1 OF 1

No.	Alteration	Date	Sign.

APPENDIX H

Project Improvement List

1. WWTP Influent Pump Station and Outfall Modeling.
    a. Influent Pump Station project was completed.
    b. Outfall Hydraulic Modeling. Conduct hydraulic modeling of outfall pipe to confirm its capacity and the extent of surcharging.

2. Generator Deployment Plan. Project completed.

3. Tertiary Filters. Project completed.

4. Hay Baler. Purchase to remove hay from biosolids application fields.

5. Activated Sludge Diffused Aeration System. Current project.

6. Vactor Truck. Purchase for collection system cleaning.

7. Clarifier Improvements. Current project.

8. Grit System. Current project.

9A. Airport Pump Station. Project completed.

9B Woods Pump Stations Upgrade. Upgrade the Woods Pump Station by replacing the pumps to match existing capacity, provide new discharge piping to a buried vault to house valves. Upgrade the electrical panel, controls, security, and safety features. Replace the Woods Pump Station generator and provide an automatic transfer switch. Provide a 15'x25' block building to house the generator and controls.

9C Airport Force Main Upgrade. Replace 2,900 linear feet of 6-inch force main with a 12-inch diameter pipeline along Cape Kiwanda Drive. Provide controlled density backfill and asphalt patch where the pipeline is in Cape Kiwanda. Replace 13 STEP ejector pumps and their discharge pipelines where they connect to the new force main. Provide an air/vacuum release valve in buried vault.

10. River crossing pipelines – Slough and Woods Avenue Bridges. Replace pipelines with ductile iron pipe with flexible seismic joints. Provide an air release valve on Woods Bridge.

11. Aerobic Digester Aeration Improvements. Current project.

12. Expand UV System. Current project.

13. Expand Tertiary Filters. Current project.

14. Upgrade the Ella, Madrona, and Kiwanda Pump Stations. Upgrade the pump station by replacing the pumps to match existing capacity, provide new discharge piping to a 4'x4' vault to house new valves. Upgrade the electrical panel, controls, security, and safety features. Relocate the Ella Pump Station electrical panel above the high water level.

15. WWTP Standby Generator. Current project.

16. Biosolids Dewatering, Aerobic Digesters, and Lime Blending System. Current projects.

17. Third Aeration Basin & Blower and Two Clarifiers & RAS/WAS sludge pumps. Current project.

18. Headworks/Centralized Biofilter Odor Control. Enclose headworks in a 45’x15’x10’ high FRP structure. Provide a 6-foot diameter x 14-foot tall synthetic media biofilter with duct and blowers to serve as a centralized facility for odor control. Biofilter is sized to accept air flow from future processes.

19. Storage Building. Construct a new 40’x35’x12’ high pole frame building for storage of materials, equipment, and vehicles. Features to match existing pole storage building.

20. Cover Existing Digester and Equalization Basin – Odor Control. Enclose digester and equalization basin with FRP covers to collect foul air and direct air with FRP fan and buried FRP ducts to the centralized odor control facility.

21. The Brooten North/Resort Drive and Nestucca Manor STEP Systems. Replace each STEP system with a 100 gpm submersible pump station in a 6-foot diameter precast wet well. On Brooten North/Resort Drive, provide 4,000 feet of new 8-inch gravity sewer. At Nestucca Manor, provide 2,000 feet of 8-inch gravity sewer.

22. Filter Feed Pumps. Current project.

23. Upgrade the Roger and Beachy Pump Stations. Upgrade the pump station by replacing the pumps to match existing capacity, provide new discharge piping to a 4’x4’ vault to house new check valves. Upgrade the electrical panel, controls, security, and safety features.

25. Second Equalization Basin with Odor Control. Construct a second flow equalization basin with coarse bubble aeration and a new 20 hp blower. Interconnect to existing basin using gates. Provide three submersible pumps with variable frequency drives and level control. Enclose new basin with an FRP cover and collect and route foul air with an FRP fan and buried FRP ducts to the centralized odor control facility.

26. Pump Station Telemetry. Provide a system-wide radio telemetry system to monitor key functions of each pump station. Central system will consist of a base station with personal computer, software and transceiver. At each pump station to provide intrusion alarms, pump on/off sensor, level sensors, control panel, PLC, radio, and antennae. Includes programming by systems contractor.

27. WWTP Monitoring. Optional current project.

29. Upgrade the Straub and Cindy Lane Pump Stations. Upgrade the pump station by replacing the pumps to match existing capacity, provide new discharge piping to a 4’x4’ vault to house new check valves. Upgrade the electrical panel, controls, security, and safety features.

PCJWSA Wastewater System Improvements Update - 2009 to2014

Below are projects identified in 2005 and 2009 Wastewater Master Plan not included in 2014 Improvements.

Project	Description	Project Total 2009 Dollars	Update for 2014	Update for 2015
1	WWTP Influent Pump Station (completed) & Outfall Hydraulic Modeling.	$ 97.0	$ 12.5	$ 12.9
4	Hay Baler.	$ 109.0	$ 123.7	$ 127.5
6	Vactor Truck.	$ 352.5	$ 400.2	$ 412.2
9B	Woods Pump Station Upgrade	$ 538.6	$ 611.5	$ 629.9
9C	Replace Airport PS Force Main in Cape Kiwanda, Replace STEP pumps	$ 605.8	$ 687.7	$ 708.4
10	River Crossing Pipelines - Slough, Woods Bridges	$ 270.6	$ 307.2	$ 316.4
14	Upgrade Ella, Madrona, Kiwanda PSs	$ 446.9	$ 507.4	$ 522.6
18	Headworks/Centralized Biofilter Odor Control	$ 391.8	$ 444.8	$ 458.1
19	Storage Building.	$ 169.0	$ 191.9	$ 197.7
20	Cover Digester & Equalization - Odor Control	$ 437.7	$ 496.9	$ 511.9
21	Brooten N/Resort Dr and Nestucca Manor PSs to replace STEP systems.	$ 1,565.3	$ 1,777.1	$ 1,830.4
23	Upgrade Roger and Beachy PSs	$ 319.4	$ 362.6	$ 373.4
25	Second Equalization Basin with Cover and Odor Control.	$ 716.2	$ 813.1	$ 837.5
26	Pump Station Telemetry System	$ 554.6	$ 629.6	$ 648.5
29	Upgrade Straub and Cindy Lane PSs	$ 318.5	$ 361.6	$ 372.4
TOTAL		$ 13,463.7	$ 7,727.8	$ 7,959.7

Costs were updated to 2014 based on Engineering News Record Building Cost Indices from Sept 2009 of 4764 and Sept 2014 of 5408.5

Cost were updated from 2014 to 2015 with a 3% inflation

APPENDIX I

Opinion of Probable Construction Cost and O&M Cost Detail

Opinion of Probable Construction Costs
Pacific City WWTP Improvements - Activated Sludge Alternative

A Maas, T. Nielsen - Oct 2014; J. Sheets Jan 2015

Div/ Area	Description	Qty	Unit	Unit Price Installed	Estimated Cost	Subtotals
	MOBILIZATION AND DEMOBILIZATION					
	Mobilization and Demobilization	7	5,984,723	418,940	$ 418,940	
						$ 418,940
2	**Civil**				$ -	
	Aeration Tank Excavation & haul	1070	CY	$35	$ 37,450	
	Clarifier Excavation & haul	2450	CY	$25	$ 61,250	
	Digester Excavation & haul	2010	CY	$25	$ 50,250	
	Other Excavation	270	CY	$26	$ 7,020	
	Dewatering	1	LS	$100,000	$ 100,000	
	Shoring	1	LS	$ 60,000	$ 60,000	
	Structural Fill	200	CY	$30	$ 6,000	
	Crushed Surfacing	1	LS	$5,000	$ 5,000	
	Asphalt Pavement 4" thick	1	LS	$ 20,000	$ 20,000	
	Erosion Control	1	LS	$6,000	$ 6,000	
	Sidewalks	1	LS	$7,000	$ 7,000	
	Finish grading	1	LS	$5,000	$ 5,000	
	Site Hydro seeding	1	LS	$5,000	$ 5,000	
	Subtotal					$ 369,970
	Yard Piping					
	Headworks	1	LS	$45,000	$ 45,000	
	EQ Basin	1	LS	$10,000	$ 10,000	
	Aeration Piping Water	240	LF	$75	$ 18,000	
	Aeration Piping Air	25	LF	$46	$ 1,150	
	Clarifier Effluent & RAS	310	LF	$75	$ 23,250	
	Clarifier WAS	140	LF	$52	$ 7,280	
	Kruger Filter & Holding tank	210	LF	$75	$ 15,750	
	Digester	20	LF	$75	$ 1,500	
	Drain pipe	150	LF	$75	$ 11,250	
	Water reuse and spray pipe	320	LF	$22	$ 7,040	
	Reuse water pump skid and piping	1	LS	$ 25,000	$ 25,000	
	Subtotal					$ 165,220
3	**Concrete**					
	Headworks	1	LS	$9,800	$ 9,800	
	Aeration Tanks	1	LS	$158,300	$ 158,300	
	Clarifiers	1	LS	$157,600	$ 157,600	
	Kruger Filter	1	LS	$10,000	$ 10,000	
	Aerobic Digester/Lime Stabilization & Screw Press	1	LS	$142,650	$ 142,650	
	Subtotal					$ 478,350
	Facility Areas					
I	***Influent Pump Stn***					
	Modifications	1	LS	$5,000	$ 5,000	$ 5,000
H	***Headworks***					
	Grit Chamber Equip	1	LS	$147,000	$ 147,000	
	Grit Chamber Metals	1	LS	$5,000	$ 5,000	
	Grit Classifier	1	LS	$55,000	$ 55,000	
	Grit Chamber Piping	1	LS	$8,000	$ 8,000	
	Washer Compactor	1	LS	$45,000	$ 45,000	
	Conveyor	1	LS	$19,000	$ 19,000	
	Contractor Install, Overhead and Profit	%	15	$ 279,000	$ 41,900	
	Sampler	1	EA	$7,000	$ 7,000	
	Subtotal					$ 327,900
EQ	***Equalization Tank***					
	Pumps	1	LS	$24,700	$ 24,700	
	Piping	1	LS	$12,000	$ 12,000	
	Control Panel	1	LS	$42,000	$ 42,000	
	Contractor Install, Overhead and Profit	%	30	$ 78,700	$ 23,700	
	Subtotal					$ 102,400
AR	***Aeration Tanks***					
	Diffusers & In-basin Pipe & Install	1	LS	$48,000	$ 48,000	
	Blowers	1	LS	$73,914	$ 73,914	
	Mixers	3	EA	$ 7,700	$ 23,100	
	Contractor Install, Overhead and Profit	%	30	$ 145,014	$ 43,600	
	Handrail	150	LF	$ 100	$ 15,000	
	Gates	1	LS	$25,000	$ 25,000	
	Valves	1	LS	$ 10,000	$ 10,000	
	Spray piping	1	LS	$ 9,000	$ 9,000	
	Drains	1	LS	$ 10,000	$ 10,000	
	Magnesium Hydroxide Pumping System	1	LS	$ 15,000	$ 15,000	
	Subtotal					$ 272,614

Opinion of Probable Construction Costs
Pacific City WWTP Improvements - Activated Sludge Alternative

A Maas, T. Nielsen - Oct 2014; J. Sheets Jan 2015

Div/ Area	Description	Qty	Unit	Unit Price Installed	Estimated Cost	Subtotals
CL	***Clarifiers***					
	Clarifier Mechanisms w baffles & install	1	LS	$ 372,600	$ 372,600	
	Steps & Handrail	1	LS	$ 6,000	$ 6,000	
	Baffles, weir, paint, controls	1	LS	$ 65,000	$ 65,000	
	RAS - WAS Pumps and Pipe & Install	1	LS	$ 32,028	$ 32,028	
	Scum Pump	1	LS	$ 10,000	$ 10,000	
	Contractor Overhead and Profit	%	15	$ 475,628	$ 71,400	
	RAS-WAS Pump Vaults	1	LS	$ 12,000	$ 12,000	
	Control Panel	1	LS	$42,000	$ 42,000	
	Subtotal					**$ 611,028**
HT	***Holding Tank***					
	Pumps and Pipe (filter feed)	1	LS	$ 25,850	$ 25,850	
	Control Panel	1	LS	$35,000	$ 35,000	
	Contractor Install, Overhead and Profit	%	30	$ 60,850	$ 18,300	
	Change floor slope	1	LS	$15,000	$ 15,000	
	Subtotal					**$ 94,150**
EF	***Effluent Filters***					
	Filter	1	LS	$ 233,500	$ 233,500	
	Contractor Install, Overhead and Profit	%	30	$ 233,500	$ 70,100	
	Piping and Metals	1	LS	$ 6,000	$ 6,000	
	Effluent Sampler	1	LS	$ 7,000	$ 7,000	
	Subtotal					**$ 316,600**
UV	***Ultraviolet Light***					
	Trojan UV System	1	LS	$ 85,000	$ 85,000	
	Subtotal					**$ 85,000**
DI	***Digesters***					
	Diffusers & In-basin Pipe	1	LS	$20,000	$ 20,000	
	Digester covers & Install	1	LS	$ 115,000	$ 115,000	
	Blowers Dig 1	1	LS	$36,957	$ 36,957	
	Blowers Dig 2 & 3	1	LS	$55,435	$ 55,435	
	Air Piping, BFV	1	LS	$30,000	$ 30,000	
	Gates	1	LS	$17,000	$ 17,000	
	Contractor Install, Overhead and Profit	%	30	$ 274,392	$ 82,400	
	Handrail	70	LF	$ 100	$ 7,000	
	Valves	1	LS	$ 6,000	$ 6,000	
	Spray piping, 1.5"	1	LS	$ 6,000	$ 6,000	
	Drains	1	LS	$ 10,000	$ 10,000	
	Digester 1 cleanup	1	LS	$ 3,000	$ 3,000	
	Wall insulation	1	LS	$ 8,000	$ 8,000	
	Subtotal					**$ 396,792**
SB	***Solids Building***					
	FKC Screw Press Alternative					
	Piloting Dewatering Systems	1	LS			
	Building - CMU, 35'x40'	1	LS	$ 259,000	$ 259,000	
	Cover area for Truck - 12'x30'	1	LS	$ 16,200	$ 16,200	
	Screw Press System	1	LS	$254,500	$ 254,500	
	Lime System	1	LS	$ 165,000	$ 165,000	
	Conveyors	1	LS	$25,000	$ 25,000	
	Piping	1	LS	$28,000	$ 28,000	
	Sludge pumps & piping	1	LS	$ 35,000	$ 35,000	
	Contractor Install, Overhead and Profit	%	30	$ 507,500	$ 152,250	
	Building drains, water & piping	1	LS	$ 20,000	$ 20,000	
	HVAC	1	LS	$ 20,000	$ 20,000	
	Drain Pump Stn	1	LS	$ 13,000	$ 13,000	
	Subtotal					**$ 987,950**
SG	***Standby Generator Building***					
	Building - wood frame, 17'x25'	1	LS	$ 59,500	$ 59,500	
	Standby Generator and Fuel tank	1	LS	$125,000	$ 125,000	
	Standby Generator OH, P & Installation	1	LS	$41,250	$ 41,250	
	Subtotal					**$ 225,750**
ST	***Sludge Spreader Truck***					
	Spreader Truck	1	LS	$ 300,000	$ 300,000	**$ 300,000**
EL	***Electrical***					
	Electrical & Instruments (25% of non-electrical cost)	1	LS	$ 1,246,000	$ 1,246,000	
	Subtotal					**$ 1,246,000**
	Subtotal					**$ 6,403,663**
	Tax			0%	$ -	
	Subtotal					**$ 6,403,700**
	Contingency			30%	$ 1,921,100	
	1 year Inflation adjustment to fall 2015			3%	$ 249,700	
	Engineer's Opinion of Probable Construction Cost					**$ 8,574,500**
	SCADA Programming and Owner CA not included					

Opinion of Probable Construction Costs
Pacific City WWTP Improvements - SBR Alternative

A Maas, T. Nielsen - Oct 2014; J. Sheets Jan 2015

Div/ Area	Description	Qty	Unit	Unit Price Installed	Estimated Cost	Subtotals
	MOBILIZATION AND DEMOBILIZATION					
	Mobilization and Demobilization	7	5,380,022	376,610	$ 376,610	
						$ 376,610
2	**Civil**				$ -	
	SBR Excavation and Haul	2400	CY	$35	$ 84,000	
	Digester Excavation & haul	2010	CY	$25	$ 50,250	
	Other Excavation	270	CY	$26	$ 7,020	
	Dewatering	1	LS	$80,000	$ 80,000	
	Shoring	1	LS	$ 10,000	$ 10,000	
	Structural Fill	130	CY	$30	$ 3,900	
	Crushed Surfacing	1	LS	$5,000	$ 5,000	
	Asphalt Pavement 4" thick	1	LS	$ 20,000	$ 20,000	
	Erosion Control	1	LS	$6,000	$ 6,000	
	Sidewalks	1	LS	$7,000	$ 7,000	
	Finish grading	1	LS	$5,000	$ 5,000	
	Site Hydro seeding	1	LS	$5,000	$ 5,000	
	Subtotal					$ 283,170
	Yard Piping					
	Headworks	1	LS	$45,000	$ 45,000	
	EQ Basin	1	LS	$10,000	$ 10,000	
	Aeration Piping Water	140	LF	$75	$ 10,500	
	Aeration Piping Air	70	LF	$46	$ 3,220	
	SBR Effluent	120	LF	$75	$ 9,000	
	SBR WAS	100	LF	$52	$ 5,200	
	Kruger Filter & Holding tank	210	LF	$75	$ 15,750	
	Digester	20	LF	$75	$ 1,500	
	Drain pipe	150	LF	$75	$ 11,250	
	Water reuse and spray pipe	320	LF	$22	$ 7,040	
	Reuse water pump skid and piping	1	LS	$ 25,000	$ 25,000	
	Subtotal					$ 143,460
3	**Concrete**					
	Headworks	1	LS	$9,800	$ 9,800	
	SBR Tanks	1	LS	$181,800	$ 181,800	
	Kruger Filter	1	LS	$10,000	$ 10,000	
	Digester	1	LS	$142,650	$ 142,650	
	Subtotal					$ 344,250
	Facility Areas					
I	***Influent Pump Stn***					
	Modifications	1	LS	$5,000	$ 5,000	$ 5,000
H	***Headworks***					
	Grit Chamber Equip	1	LS	$147,000	$ 147,000	
	Grit Chamber Metals	1	LS	$5,000	$ 5,000	
	Grit Classifier	1	LS	$55,000	$ 55,000	
	Grit Chamber Piping	1	LS	$8,000	$ 8,000	
	Washer Compactor	1	LS	$45,000	$ 45,000	
	Conveyor?	1	LS	$19,000	$ 19,000	
	Contractor Install, Overhead and Profit	%	15	$ 279,000	$ 41,900	
	Sampler	1	EA	$7,000	$ 7,000	
	Subtotal					$ 327,900
EQ	***Equalization Tank***					
	Pumps	1	LS	$24,700	$ 24,700	
	Piping	1	LS	$12,000	$ 12,000	
	Control Panel	1	LS	$42,000	$ 42,000	
	Contractor Install, Overhead and Profit	%	30	$ 78,700	$ 23,700	
	Subtotal					$ 102,400
AR	***SBR Tanks***					
	Complete SBR System	1	LS	$365,000	$ 365,000	
	Other	1	LS	$65,000	$ 65,000	
	Contractor Install, Overhead and Profit	%	30	$ 430,000	$ 129,000	
	Handrail	266	LF	$ 100	$ 26,600	
	Valves	1	LS	$ 16,000	$ 16,000	
	Spray piping	1	LS	$ 9,000	$ 9,000	
	Drains	1	LS	$ 10,000	$ 10,000	
	Magnesium Hydroxide Pumping System	1	LS	$ 15,000	$ 15,000	
	Subtotal					$ 635,600

Opinion of Probable Construction Costs
Pacific City WWTP Improvements - SBR Alternative

A Maas, T. Nielsen - Oct 2014; J. Sheets Jan 2015

Div/ Area	Description		Qty	Unit	Unit Price Installed	Estimated Cost	Subtotals
HT	***Holding Tank***						
	Pumps and Pipe (filter feed)		1	LS	$ 25,850	$ 25,850	
	Control Panel		1	LS	$35,000	$ 35,000	
	Contractor Install, Overhead and Profit		%	30	$ 60,850	$ 18,300	
	Change floor slope		1	LS	$15,000	$ 15,000	
		Subtotal					**$ 94,150**
EF	***Effluent Filters***						
	Filter		1	LS	$ 233,500	$ 233,500	
	Contractor Install, Overhead and Profit		%	30	$ 233,500	$ 70,100	
	Piping and Metals		1	LS	$ 6,000	$ 6,000	
	Effluent Sampler		1	LS	$ 7,000	$ 7,000	
		Subtotal					**$ 316,600**
UV	***Ultraviolet Light***						
	Trojan UV System		1	LS	$ 85,000	$ 85,000	
		Subtotal					**$ 85,000**
DI	***Digesters***						
	Diffusers & In-basin Pipe		1	LS	$20,000	$ 20,000	
	Digester covers & Install		1	LS	$ 115,000	$ 115,000	
	Blowers Dig 1		1	LS	$36,957	$ 36,957	
	Blowers Dig 2 & 3		1	LS	$55,435	$ 55,435	
	Air Piping, BFV		1	LS	$30,000	$ 30,000	
	Gates		1	LS	$17,000	$ 17,000	
	Contractor Install, Overhead and Profit		%	30	$ 274,392	$ 82,400	
	Handrail		70	LF	$ 100	$ 7,000	
	Valves		1	LS	$ 6,000	$ 6,000	
	Spray piping, 1.5"		1	LS	$ 6,000	$ 6,000	
	Drains		1	LS	$ 10,000	$ 10,000	
	Digester 1 cleanup		1	LS	$ 3,000	$ 3,000	
	Wall insulation		1	LS	$ 8,000	$ 8,000	
		Subtotal					**$ 396,792**
SB	***Solids Building***						
	FKC Screw Press Alternative						
	Building - CMU, 35'x40'		1	LS	$ 259,000	$ 259,000	
	Cover area for Truck - 12'x30'		1	LS	$ 16,200	$ 16,200	
	Screw Press System		1	LS	$254,500	$ 254,500	
	Lime System		1	LS	$ 165,000	$ 165,000	
	Conveyors		1	LS	$25,000	$ 25,000	
	Piping		1	LS	$28,000	$ 28,000	
	Sludge pumps & piping		1	LS	$ 35,000	$ 35,000	
	Contractor Install, Overhead and Profit		%	30	$ 507,500	$ 152,250	
	Building drains, water & piping		1	LS	$ 20,000	$ 20,000	
	HVAC		1	LS	$ 20,000	$ 20,000	
	Drain Pump Stn		1	LS	$ 13,000	$ 13,000	
		Subtotal					**$ 987,950**
SG	***Standby Generator Building***						
	Building - wood frame, 17'x25'		1	LS	$ 59,500	$ 59,500	
	Standby Generator and Fuel tank		1	LS	$125,000	$ 125,000	
	Standby Generator OH, P & Installation		1	LS	$41,250	$ 41,250	
		Subtotal					**$ 225,750**
ST	***Sludge Spreader Truck***						
	Spreader Truck		1	LS	$ 300,000	$ 300,000	**$ 300,000**
EL	***Electrical***						
	Electrical & Instruments (25% of non-electrical cost)		1	LS	$ 1,132,000	$ 1,132,000	
		Subtotal					**$ 1,132,000**
	Subtotal						**$ 5,756,632**
	Tax				0%	$ -	
	Subtotal						**$ 5,756,600**
	Contingency				30%	$ 1,727,000	
	1 year Inflation adjustment to fall 2015				3%	$ 224,500	
	Engineer's Opinion of Probable Construction Cost						**$ 7,708,100**

SCADA Programming and Owner CA not included

Opinion of Probable Construction Costs
Pacific City WWTP Improvements - MBR Alternative

A Maas, T. Nielsen - Oct 2014; J. Sheets Jan 2015

Div/ Area	Description	Qty	Unit	Unit Price Installed	Estimated Cost	Subtotals
	MOBILIZATION AND DEMOBILIZATION					
	Mobilization and Demobilization	7	6,337,352	443,620	$ 443,620	
						$ 443,620
2	**Civil**				$ -	
	MBR Excavation and Haul	400	CY	$35	$ 14,000	
	Shoring	870	SF	$40	$ 34,800	
	Digester Excavation & haul	2010	CY	$25	$ 50,250	
	Other Excavation	270	CY	$26	$ 7,020	
	Dewatering	1	LS	$50,000	$ 50,000	
	Shoring	1	LS	$ 40,000	$ 40,000	
	Structural Fill	95	CY	$30	$ 2,850	
	Crushed Surfacing	1	LS	$5,000	$ 5,000	
	Asphalt Pavement 4" thick	1	LS	$ 20,000	$ 20,000	
	Erosion Control	1	LS	$3,000	$ 3,000	
	Sidewalks	1	LS	$7,000	$ 7,000	
	Finish grading	1	LS	$4,000	$ 4,000	
	Site Hydro seeding	1	LS	$4,000	$ 4,000	
	Subtotal					$ 241,920
	Yard Piping					
	Headworks	1	LS	$45,000	$ 45,000	
	EQ Basin	1	LS	$10,000	$ 10,000	
	Aeration Piping Water	100	LF	$75	$ 7,500	
	Aeration Piping Air	70	LF	$46	$ 3,220	
	MBR Effluent	200	LF	$75	$ 15,000	
	MBR WAS	140	LF	$52	$ 7,280	
	Digester	20	LF	$75	$ 1,500	
	Drain pipe	150	LF	$75	$ 11,250	
	Water reuse and spray pipe	220	LF	$22	$ 4,840	
	Reuse water pump skid and piping	1	LS	$ 25,000	$ 25,000	
	Subtotal					$ 130,590
3	**Concrete**					
	Headworks	1	LS	$9,800	$ 9,800	
	MBR Tanks	1	LS	$98,000	$ 98,000	
	Clean and Coat Existing Aeration Tanks	1	LS	$70,000	$ 70,000	
	Digester	1	LS	$142,650	$ 142,650	
	EQ Tank	1	LS	$120,000	$ 120,000	
	Aerobic Digester/Lime Stabilization & Screw Press					$ 440,450
	Facility Areas					
I	***Influent Pump Stn***					
	Modifications	1	LS	$5,000	$ 5,000	$ 5,000
H	***Headworks***					
	New Huber Screens	1	LS	$254,000	$ 254,000	
	Grit Chamber Equip	1	LS	$147,000	$ 147,000	
	Grit Chamber Metals	1	LS	$5,000	$ 5,000	
	Grit Classifier	1	LS	$55,000	$ 55,000	
	Grit Chamber Piping	1	LS	$8,000	$ 8,000	
	Conveyor	1	LS	$19,000	$ 19,000	
	Contractor Install, Overhead and Profit	%	15	$ 488,000	$ 73,200	
	Sampler	1	EA	$7,000	$ 7,000	
	Subtotal					$ 314,200
EQ	***Equalization Tank***					
	Pumps	1	LS	$24,700	$ 24,700	
	Piping	1	LS	$12,000	$ 12,000	
	Control Panel	1	LS	$42,000	$ 42,000	
	Pumps New EQ	1	LS	$24,700	$ 24,700	
	Piping New EQ	1	LS	$12,000	$ 12,000	
	Control Panel	1	LS	$42,000	$ 42,000	
	Contractor Install, Overhead and Profit	%	30	$ 157,400	$ 47,300	
	Subtotal					$ 204,700

Opinion of Probable Construction Costs
Pacific City WWTP Improvements - MBR Alternative
A Maas, T. Nielsen - Oct 2014; J. Sheets Jan 2015

Div/ Area	Description	Qty	Unit	Unit Price Installed	Estimated Cost	Subtotals
AR	***MBR Tanks***					
	Complete MBR System	1	LS	$1,180,000	$ 1,180,000	
	Other	1	LS	$40,000	$ 40,000	
	Contractor Install, Overhead and Profit	%	30	$ 1,220,000	$ 366,000	
	Handrail	270	LF	$ 100	$ 27,000	
	Valves	1	LS	$ 16,000	$ 16,000	
	Spray piping	1	LS	$ 9,000	$ 9,000	
	Drains	1	LS	$ 8,000	$ 8,000	
	Magnesium Hydroxide Pumping System	1	LS	$ 15,000	$ 15,000	
	Effluent Sampler	1	LS	$ 7,000	$ 7,000	
	Subtotal					**$ 1,668,000**
UV	***Ultraviolet Light***					
	Trojan UV System	1	LS	$ 85,000	$ 85,000	
	Subtotal					**$ 85,000**
DI	***Digesters***					
	Diffusers & In-basin Pipe	1	LS	$20,000	$ 20,000	
	Digester covers & Install	1	LS	$ 115,000	$ 115,000	
	Blowers Dig 1	1	LS	$36,957	$ 36,957	
	Blowers Dig 2 & 3	1	LS	$55,435	$ 55,435	
	Air Piping, BFV	1	LS	$30,000	$ 30,000	
	Gates	1	LS	$17,000	$ 17,000	
	Contractor Install, Overhead and Profit	%	30	$ 274,392	$ 82,400	
	Handrail	70	LF	$ 100	$ 7,000	
	Valves	1	LS	$ 6,000	$ 6,000	
	Spray piping, 1.5"	1	LS	$ 6,000	$ 6,000	
	Drains	1	LS	$ 10,000	$ 10,000	
	Digester 1 cleanup	1	LS	$ 3,000	$ 3,000	
	Wall insulation	1	LS	$ 8,000	$ 8,000	
	Subtotal					**$ 396,792**
SB	***Solids Building***					
	FKC Screw Press Alternative					
	Building - CMU, 35'x40'	1	LS	$ 259,000	$ 259,000	
	Cover area for Truck - 12'x30'	1	LS	$ 16,200	$ 16,200	
	Screw Press System	1	LS	$254,500	$ 254,500	
	Lime System	1	LS	$ 165,000	$ 165,000	
	Conveyors	1	LS	$25,000	$ 25,000	
	Piping	1	LS	$28,000	$ 28,000	
	Sludge pumps & piping	1	LS	$ 35,000	$ 35,000	
	Contractor Install, Overhead and Profit	%	30	$ 507,500	$ 152,250	
	Building drains, water & piping	1	LS	$ 20,000	$ 20,000	
	HVAC	1	LS	$ 20,000	$ 20,000	
	Drain Pump Stn	1	LS	$ 13,000	$ 13,000	
	Subtotal					**$ 987,950**
SG	***Standby Generator Building***					
	Building - wood frame, 17'x25'	1	LS	$ 59,500	$ 59,500	
	Standby Generator and Fuel tank	1	LS	$125,000	$ 125,000	
	Standby Generator OH, P & Installation	1	LS	$41,250	$ 41,250	
	Subtotal					**$ 225,750**
ST	***Sludge Spreader Truck***					
	Spreader Truck	1	LS	$ 300,000	$ 300,000	**$ 300,000**
EL	***Electrical***					
	Electrical & Instruments (25% of non-electrical cost)	1	LS	$ 1,337,000	$ 1,337,000	
	Subtotal					**$ 1,337,000**
	Subtotal					**$ 6,780,972**
	Tax			0%	$ -	
	Subtotal					**$ 6,781,000**
	Contingency			30%	$ 2,034,300	
	1 year Inflation adjustment to fall 2015			3%	$ 264,500	
	Engineer's Opinion of Probable Construction Cost					**$ 9,079,800**
	SCADA Programming and Owner CA not included					

Opinion of Probable Construction Costs
Pacific City WWTP Improvements - Biosolids Dewatering Alternatives

A Maas, T. Nielsen - Oct 2014

Description	Qty	Unit	Unit Price Installed	Estimated Cost	Subtotals
Aerobic Digester & Belt Press					
Solids Building					
Building - CMU, 35'x53'-4"	1	LS	$ 326,340	$ 326,340	
Cover area for Truck - 12'x30'	1	LS	$ 16,200	$ 16,200	
Belt Press System	1	LS	$208,000	$ 208,000	
Lime System	1	LS	$ 165,000	$ 165,000	
Conveyors	1	LS	$25,000	$ 25,000	
Piping	1	LS	$20,000	$ 20,000	
Sludge pumps & piping	1	LS	$ 35,000	$ 35,000	
Contractor Install, Overhead and Profit	%	30	$ 453,000	$ 135,900	
Builiding drains, water & piping	1	LS	$ 20,000	$ 20,000	
HVAC	1	LS	$ 15,000	$ 15,000	
Drain Pump Stn	1	LS	$ 13,000	$ 13,000	
Subtotal					**$ 979,440**
Aerobic Digester & Centrifuge					
Solids Building					
Building - CMU, 35'x37'	1	LS	$ 233,100	$ 233,100	
Cover area for Truck - 12'x30'	1	LS	$ 16,200	$ 16,200	
Centrifuge	1	LS	$300,000	$ 300,000	
Lime System	1	LS	$ 165,000	$ 165,000	
Conveyors	1	LS	$25,000	$ 25,000	
Piping	1	LS	$20,000	$ 20,000	
Sludge pumps & piping	1	LS	$ 35,000	$ 35,000	
Contractor Install, Overhead and Profit	%	30	$ 545,000	$ 163,500	
Builiding drains, water & piping	1	LS	$ 20,000	$ 20,000	
HVAC	1	LS	$ 15,000	$ 15,000	
Drain Pump Stn	1	LS	$ 13,000	$ 13,000	
Subtotal					**$ 1,005,800**
Aerobic Digester/Lime Stabilization & Screw Press					
Solids Building					
Building - CMU, 35'x40'	1	LS	$ 259,000	$ 259,000	
Cover area for Truck - 12'x30'	1	LS	$ 16,200	$ 16,200	
Screw Press System	1	LS	$254,500	$ 254,500	
Lime System	1	LS	$ 165,000	$ 165,000	
Conveyors	1	LS	$25,000	$ 25,000	
Piping	1	LS	$28,000	$ 28,000	
Sludge pumps & piping	1	LS	$ 35,000	$ 35,000	
Contractor Install, Overhead and Profit	%	30	$ 507,500	$ 152,300	
Builiding drains, water & piping	1	LS	$ 20,000	$ 20,000	
HVAC	1	LS	$ 20,000	$ 20,000	
Drain Pump Stn	1	LS	$ 13,000	$ 13,000	
Subtotal					**$ 988,000**

Operations and Maintenance Costs by Category

#	Category Name	O&M Cost in 2015					
		Activated Sludge		SBR		MBR	
1	Labor	$	347,066	$	347,066	$	347,066
2	Admin, accounting, training	$	30,100	$	30,100	$	30,100
3	Telephone	$	5,500	$	5,500	$	5,500
4	Insurance, Legal	$	28,500	$	28,500	$	28,500
5	Laboratory Testing, Uniforms	$	9,750	$	9,750	$	9,750
5A	Lab Supplies	$	7,500	$	7,500	$	7,500
6	Chemicals	$	1,250	$	1,250	$	1,250
7	WWTP Short Lived Assets	$	74,158	$	78,051	$	152,715
8	Pumping, STEP Systems, Collections Repair &Maintenance	$	65,500	$	65,500	$	65,500
9	Biosolids Mgt, Solid Waste Disposal	$	3,000	$	3,000	$	3,000
10	Buildings, Grounds, Generator Repair & Maintenance	$	20,000	$	20,000	$	20,000
11	Transportation	$	15,000	$	15,000	$	15,000
12	Customer Assistance, Community Events	$	3,000	$	3,000	$	3,000
13	NPDES Permit	$	2,500	$	2,500	$	2,500
14	Contingency	$	20,000	$	20,000	$	20,000
15	Professional Services	$	7,500	$	7,500	$	7,500
16	Electricity	$	53,467	$	48,696	$	59,133
	Total O&M 2015	$	693,792	$	692,913	$	778,014
	Membrane replacement present worth	$	-	$	-	$	1,581,214
	O&M costs uniform series present worth USPW	$	11,794,860	$	11,779,915	$	13,226,684
	Total O&M Present Worth	**$**	**11,794,860**	**$**	**11,779,915**	**$**	**14,807,898**

Assumptions:

Costs for individual categories based on PCJWSA budget for 2013, adapted for wastewater only.

Short Lived Assets for activated sludge and SBR, see pages I-10 to I-13.

Short Lived Assets for MBR determined by taking 5% of the equipment cost.

Discount rate of 1.6% and 20 year planning period

J.Sheets, T. Nielsen - Oct 2014/Jan 2015

Estmated Electrical Loads and Power Costs for 2024 and 2015

Activated Sludge	Operating kw	Standby	Percent	Total (kw-hr/yr)
Influent Pump Stn	10	5	60%	19,597
Screen washer	2		5%	653
conveyor	*2*		5%	653
Grit Chamber	1		5%	327
pump	5		5%	1,633
Parshall flume	0.1		100%	653
FEB	10	5	55%	17,964
Aeration Tanks	45	15	30%	88,186
Secondary Clarifiers	3		60%	11,758
RAS Pumps	6	3	40%	15,678
WAS Pumps	5.4	2.7	5%	1,764
Effluent Holding Tank	10	5	20%	13,065
Effluent Cloth Filters	4.5		100%	29,395
UV Disinfection	14		75%	68,402
Digesters	40	40	65%	261,293
Biosolids Dewatering	10		10%	6,532
Lime Mixing System	*15*		10%	9,798
HVAC	*HP*	*KW*		
FEB Blower & Genset	*10*	*7.5*	*25%*	*16,425*
Effluent	*3*	*2*	*25%*	*4,380*
Maintenance	*29*	*22*	*25%*	*48,180*
Other	*16*	*12*	*25%*	*26,280*
Total (kw-hr)	241			642,617
Other Loads	40			350,400
Total Loads				**993,017**
Cost ($/kw-hr)				0.0697
Total Power Cost ($/yr) - 2024				**$ 69,213**
Total Power Cost ($/yr) - 2015				**$ 53,467**

SBR	Operating kw	Standby	Percent	Total (kw-hr/yr)
Influent Pump Stn	10	5	60%	19,597
Screen	2		5%	653
	2		5%	653
Grit Chamber	1		5%	327
	5		5%	1,633
Parshall flume	0.1		100%	653
FEB	10	5	55%	17,964
SBRs blower	45	15	40%	117,582
mix	9			
pump				
WAS Pumps	7.5		5%	2,450
Effluent Holding Tank	10	5	20%	13,065
Effluent Cloth Filters	4.5		100%	29,395
UV Disinfection	14		75%	68,589
Digesters	40	40	65%	169,841
Biosolids Dewatering	10		10%	6,532
Lime Mixing System	*15*		10%	9,798
HVAC	*HP*	*KW*		
FEB Blower & Genset	*10*	*7.5*	*25%*	*16,425*
Effluent	*3*	*2*	*25%*	*4,380*
Maintenance	*29*	*22*	*25%*	*48,180*
Other	*16*	*12*	*25%*	*26,280*
	243			553,998
Other Loads	40			350,400
				904,398
				0.0697
				$ 63,037
				$ 48,696

MBR	Operating kw	Standby	Percent	Total (kw-hr/yr)
Influent Pump Stn	10	5	60%	19,597
Screen	2	2	5%	653
	2		5%	653
Grit Chamber	1		5%	327
	5		5%	1,633
Parshall flume	0.1		100%	653
FEB			55%	
Anoxic Tank	3		90%	17,637
Feed Forward Pumps	30		50%	97,985
Preaearation	40		60%	156,776
MBRs	40	20	20%	52,259
Permeate Pumps	15	7.5	50%	48,992
WAS Pumps	2	2	5%	653
UV Disinfection	14		75%	68,589
Digesters	40	40	65%	169,841
Biosolids Dewatering	10		10%	6,532
Lime Mixing System	*15*		10%	9,798
HVAC	*HP*	*KW*		
FEB Blower & Genset	*10*	*7.5*	*25%*	*16,425*
Effluent	*3*	*2*	*25%*	*4,380*
Maintenance	*29*	*22*	*25%*	*48,180*
Other	*16*	*12*	*25%*	*26,280*
	287			747,845
Other Loads	40			350,400
				1,098,245
				0.0697
				$ 76,548
				$ 59,133

Notes:

Power estimates for Activated Sludge, SBR, and MBR are for the year 2024 (i.e., used average flow from 2024)

Other loads include administration, maintenance, and storage buildings and site lighting.

Deflated costs to 2015 using -2.5% growth rate and -3.0% inflation. No cost adjustment was made as used current cost per kw-hr

Short Life Assets - Activated Sludge
Pacific City WWTP Improvements

T. Nielsen, J. Sheets - Dec 2014/Jan 2015

Description	Exist Equip[1]	Qty	Replacement Value	Replacement Frequency	Annual Cost
Influent Pump Stn					
Submersible pumps	x	2	$8,230	15	$1,097
Headworks					
Grit Pump		1	$25,000	15	$1,667
Grit Classifier		1	$40,000	15	$2,667
Washer Compactor		1	$35,000	15	$2,333
Conveyor		1	$15,000	15	$1,000
Sampler		1	$6,000	10	$600
Equalization Tank					
Pumps	x	3	$8,230	15	$1,646
Blowers	x	2	$15,700	15	$2,093
Diffusers	x	64	$502	15	$2,141
VFD for FEB pumps	x	3	$4,867	15	$973
Pump/Blower MCC	x	1	$40,000	15	$2,667
Flow Meter	x	1	$8,000	15	$533
Aeration Tanks					
Diffusers		1	$35,000	15	$2,333
Blowers		1	$50,000	15	$3,333
Magnesium Hydroxide System					
Mixer		1	$2,000	15	$133
Chemical Pump		1	$5,000	10	$500
Clarifiers					
Drive Motor		2	$15,000	15	$2,000
RAS & WAS Pumps		1	$10,935	15	$729
Scum Pump		2	$3,985	15	$531
Holding Tank					
Filter Feed Pumps		2	$8,230	15	$1,097
Effluent Filters					
Drive Motor	2/3	3	$3,000	15	$600
Cloth Media	2/3	330	$150	10	$4,950
Effluent Sampler		1	$6,000	10	$600
Ultraviolet Light					
Lamps	1/2	60	$50	5	$600
UV Sensor	1/2	2	$1,200	5	$480
Quartz Sleeve	1/2	60	$200	10	$1,200
Digesters					
Diffusers		1	$20,000	15	$1,333
Blowers Dig 1		1	$36,957	15	$2,464
Blowers Dig 2 & 3		1	$55,435	15	$3,696

Short Life Assets - Activated Sludge
Pacific City WWTP Improvements

T. Nielsen, J. Sheets - Dec 2014/Jan 2015

Description	Exist Equip[1]	Qty	Replacement Value	Replacement Frequency	Annual Cost
Screw Press					
Polymer System		1	$17,500	15	$1,167
Sludge pumps		1	$17,000	15	$1,133
Lime System		1	$150,000	15	$10,000
Conveyors		1	$18,000	15	$1,200
Instruments and Control					
Level sensors	1/2	6	$3,000	15	$1,200
Flow Meter		1	$8,000	15	$533
Lab instruments		1	$30,000	10	$3,000
Computer, Printer, UPS		1	$3,400	5	$680
Wonderware/PLC Configuration		1	$46,233	5	$9,247
Total					$74,158

Notes:

1. Existing equipment identified with an "x" will be fully utilized in future. Items identified with a fraction indicates fraction of items that are existing.

Short Life Assets - SBR
Pacific City WWTP Improvements
T. Nielsen, J. Sheets - Dec 2014/Jan 2015

Description	Exist Equip[1]	Qty	Replacement Value	Replacement Frequency	Annual Cost
Influent Pump Stn					
Submersible pumps	x	2	$8,230	15	$1,097
Headworks					
Grit Pump		1	$25,000	15	$1,667
Grit Classifier		1	$40,000	15	$2,667
Washer Compactor		1	$35,000	15	$2,333
Conveyor		1	$15,000	15	$1,000
Sampler		1	$6,000	10	$600
Equalization Tank					
Pumps	x	3	$8,230	15	$1,646
Blowers	x	2	$15,700	15	$2,093
Diffusers	x	64	$502	15	$2,141
VFD for FEB pumps	x	3	$4,867	15	$973
Pump/Blower MCC	x	1	$40,000	15	$2,667
Flow Meter	x	1	$8,000	15	$533
SBR					
Blower belts, rebuild at 5 yr, blowers at 15 yrs		2	$11,982	15	$1,598
Diffuser membranes		80	$62	5	$992
Sludge pump rebuild at 5 yr, pump repl at 15 yr		2	$4,924	15	$657
Mixers		2	$12,280	15	$1,637
Decanter weir and valve actuators		2	$5,275	15	$703
Influent valve actuators		2	$4,560	15	$608
Air control valve actuator		2	$3,290	15	$439
Controller		1	$32,500	15	$2,167
Misc: oil, grease, filters, fuses, switches, batteries		1	$686	1	$686
Magnesium Hydroxide System					
Mixer		1	$2,000	15	$133
Chemical Pump		1	$5,000	10	$500
Holding Tank					
Filter Feed Pumps		2	$8,230	15	$1,097
Effluent Filters					
Drive Motor	2/3	3	$3,000	15	$600
Cloth Media	2/3	330	$150	10	$4,950
Effluent Sampler		1	$6,000	10	$600

Short Life Assets - SBR
Pacific City WWTP Improvements
T. Nielsen, J. Sheets - Dec 2014/Jan 2015

Description	Exist Equip[1]	Qty	Replacement Value	Replacement Frequency	Annual Cost
Ultraviolet Light					
Lamps	1/2	60	$50	5	$600
UV Sensor	1/2	2	$1,200	5	$480
Quartz Sleeve	1/2	60	$200	10	$1,200
Digesters					
Diffusers		1	$20,000	15	$1,333
Blowers Dig 1		1	$36,957	15	$2,464
Blowers Dig 2 & 3		1	$55,435	15	$3,696
Screw Press					
Polymer System		1	$17,500	15	$1,167
Sludge pumps		1	$17,000	15	$1,133
Control Panel		1	$50,000	15	$3,333
Lime System		1	$150,000	15	$10,000
Conveyors		1	$18,000	15	$1,200
Instruments and Control					
Level sensors	1/2	6	$3,000	15	$1,200
Flow Meter		1	$8,000	15	$533
Lab instruments		1	$30,000	10	$3,000
Computer, Printer, UPS		1	$3,400	5	$680
Wonderware/PLC Configuration		1	$46,233	5	$9,247
Total					$78,051

Notes:

1. Existing equipment identified with an "x" will be fully utilized in future. Items identified with a fraction indicates fraction of items that are existing.