Pendleton Wastewater Treatment Facility Plan

August 7, 2007

City of Pendleton, Oregon

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City of Pendleton
WWTP Facility Plan

FINAL

August 6, 2007

REGISTERED PROFESSIONAL ENGINEER
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OREGON
JANUARY 2, 1999
PRESTON VAN METER
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Executive Summary

Based upon a Mutual Agreement and Order (MAO) signed between the City of Pendleton, Oregon (City) and the Oregon Department of Environmental Quality (DEQ), the City is required to upgrade its existing wastewater treatment plant (WWTP) by December of 2009 to address changes to the City's renewed National Pollutant Discharge Elimination System (NPDES) permit for ammonia-nitrogen, chlorine residual, and thermal load effluent discharge to the Umatilla River. In order to comply with this MAO, the City has prepared a facility plan according to the guidelines published by DEQ.

This facility plan covers the following elements:

- Study Area Characteristics;
- Wastewater Characteristics, including projected flows and loads;
- Existing Wastewater System, including a condition assessment;
- Basis of Planning;
- Unit Process Alternative Evaluation;
- Complete Alternative Evaluation;
- Recommended Plan; and
- Preliminary Financial Plan.

Study Area Characteristics

Located in the Umatilla River Watershed, the City is typical of other high desert, eastern Oregon communities. The City has a population of approximately 17,265 and has a long-ranging future growth rate of approximately 1.4%.

The City's WWTP, located at the confluence of McKay Creek at River Mile 52.0 of the Umatilla River, serves the City and surrounding areas. The last plant upgrade was in 1970, when a major plant expansion increased the peak flow capacity of the plant to 16.3 million gallons per day (MGD) according to the original design documents. Due to an exodus of industry shortly after the completion of the plant, the current flows are much less than projected flows.

The plant is configured as a complete-mix secondary treatment plant originally constructed in 1952. A single outfall (Outfall 001) discharges treated effluent into McKay Creek above the existing fish barrier, approximately 1000 feet upstream of the confluence of McKay Creek and the Umatilla River.

Wastewater Characteristics

Wastewater flow and loads were projected using the DEQ prescribed methods based on WWTP records from 2001 through 2006 and the population growth rate of 1.4%. Flow discrepancies due to ongoing issues with the influent flow meter led to the 2004 data being omitted from the projections. Table EC 1 is provided as a summary to the projections.

Table EC 1: Future Projected Flows (MGD)

Flow Event	2006	2010	2015	2020	2025	2030
ADWF	2.44					
AAF	2.53	2.71	2.90	3.11	3.34	3.58
AWWF	2.63	2.82	3.02	3.24	3.47	3.72
MMDWF	2.88	3.09	3.31	3.55	3.80	4.08
MMWWF	2.90	3.11	3.33	3.57	3.83	4.11
Pweek	3.21	3.44	3.69	3.96	4.24	4.55
PDF	3.47	3.72	3.99	4.27	4.58	4.91
PIF	4.34	4.65	4.99	5.35	5.73	6.14

Notes:

(a) AAF = average annual flow.
(b) ADWF = average dry weather flow.
(c) AWWF = average dry weather flow.
(d) MMDWF = maximum month dry weather flow.
(e) MMWWF = maximum month wet weather flow.
(f) Pweek = peak week flow
(g) PDF = peak daily average flow.
(h) PIF = peak instantaneous flow.

Similar to the current flow estimation methodology, WWTP daily monitoring reports (DMRs) were analyzed for the evaluation period of 2001-2006 (excluding 2004) for monthly average and maximum month influent biochemical oxygen demand (BOD_5) and total suspended solids (TSS) concentrations and mass loads. Future loading rates were developed through a population loading factor based on current loading and future population projections. Tables EC 2 and EC 3 display the current and future loadings, respectively.

Table EC 2: Current BOD_5 & TSS Loads

		Monthly Average			Monthly Max		
Parameter	2006 Population	Concentration (mg/l)	Load (ppd)	Load Factor (ppcd)	Concentration (mg/l)	Load (ppd)	Load Factor (ppcd)
Summer Season (May 1 through October 31)							
BOD_5	17,265	230	4,710	0.273	260	5,620	0.326
TSS	17,265	260	5,350	0.310	310	6,510	0.377
Winter Season (November 1 through April 30)							
BOD_5	17,265	230	5,090	0.295	270	6,090	0.353
TSS	17,265	250	5,450	0.316	290	6,700	0.388

Notes:

(a) BOD_5 = biochemical oxygen demand.
(b) mg/l = milligrams per liter.
(c) ppcd = pounds per capita per day.
(d) ppd = pounds per day.
(e) TSS = total suspended solids.

Table EC 3: 2030 BOD_5 and TSS Loading Projections

			Monthly Average		Monthly Max	
Parameter	Population	Flow (MGD)	Load Factor (ppcd)	Load (ppd)	Load Factor (ppcd)	Load (ppd)
Summer Season (May 1 through October 31)						
TSS	24,100	3.46	0.310	7,470	0.377	9,090
Winter Season (November 1 through April 30)						
BOD_5	24,100	3.72	0.295	7,110	0.353	8,500
TSS	24,100	3.72	0.316	7,610	0.388	9,350

Notes:

(a) BOD_5 = biochemical oxygen demand.
(b) MGD = million gallons per day.
(c) ppcd = pounds per capita per day
(d) ppd = pounds per day.
(e) TSS = total suspended solids.

Existing Wastewater System

The existing City wastewater system consists of a collection system serving an approximate area of 6,500 acres with pipes ranging from 4 inches upwards to 36 inches and a complete-mix secondary WWTP originally constructed in 1952.

The collection system includes a total of five pump stations located throughout the City including:

- **Rieth Pump Station** – A recently connected pump station serving the small community of Rieth (located on Old Pendleton Road southwest of Pendleton). This pump station became online in June 2007.
- **Westgate Pump Station** – A 250-gpm lift station near the Westgate Avenue (Highway 30) overpass.
- **Barch Pump Station** – A 260-gpm lift station serving the industrial area near Murietta Road.
- **McKay Creek Pump Station** – A 255-gpm lift station serving the Western McKay Creek drainage.
- **Treatment Plant Pump Station** – A 350-gpm pump station serving the northwest area of the City.

The pump stations are generally in good condition, with Westgate and McKay having been constructed in 2003 and 2005, respectively. Based on expected growth patterns, the treatment plant pump station could require an upgrade in the future. This upgrade would most likely require an increase in pump size.

The WWTP was last upgraded in 1970, when a major plant expansion increased the peak flow hydraulic capacity to 16.3 MGD. Shortly after the 1970 upgrades, several large industrial discharges shut down operations, and consequently, influent flows never climbed to the plant design capacity. Although WWTP staff has made several in-house WWTP improvements such as replacing a primary clarifier drive mechanism and installing a fine screen at the headworks, the plant has had no major upgrades since 1970.

The major unit processes found at the treatment plant pump station include:

- **Headworks:** Influent Screening and Grit Removal
- **Primary Treatment:** Primary Clarifiers and In-plant Pump Station
- **Secondary Treatment:** Aeration Basins and Secondary Clarifiers
- **Disinfection & Outfall:** Chlorine Contact Chamber, Flow Monitoring and River Outfall
- **Solids Treatment:** Solids Thickening, Solids Pumping, Anaerobic Digesters, Sludge Storage Basin, Solids Drying Beds, and Septage Receiving Station
- **Electrical, Instrumentation and Controls:** Electrical Service, Motor Control Centers, Existing Electrical Equipment, and Plant Instrumentation and Automation
- **Support Facilities:** Laboratory and Operations Building, and Maintenance and Storage Facilities.

An existing Condition Assessment was conducted at the treatment plant pump station to establish a baseline assessment for each unit process and the associated equipment. The field evaluation consisted of a detailed review of all existing WWTP facilities and a summary of design data that could be recovered from equipment name plates, existing equipment manuals, and City staff knowledge. Overall, mechanical and electrical equipment has outlived its useful service life and requires replacement.

Information from the WWTP Condition Evaluation was used to develop a list of recommended improvements to the existing facility based on equipment and facilities that have outlived their useful service life.

A detailed description of each process facility, including existing condition, capacity, and recommendation for incorporation into the plant upgrade, is provided in Chapter 4. Based on the Condition Assessment, Kennedy/Jenks Consultants recommends the following Improvements summarized in Table EC 4:

Table EC 4: Summary of Recommended Improvements

Headworks Improvements

- Upgrade Grit System
- Replace metal Headworks building with larger building

Primary Treatment Improvements

- Replace Primary Clarifier 1 drive mechanism
- Replace Pumps 2 and 3 at In-plant Pump Station

Secondary Treatment Improvements

- Repair concrete in both ABs
- Replace surface aerators in AB 1
- Replace Secondary Clarifier Drive Mechanisms in Clarifiers 1 & 2
- Install scum baffles in Secondary Clarifiers
- Install Stamford baffles in Secondary Clarifiers

Disinfection & Flow Monitoring Improvements

- Install baffle walls in chlorine contact chamber (CCC)
- Relocate chemical metering controls
- Install redundant chlorine dosing pump
- Install influent flow monitoring system
- Install effluent Parshall flume

Solids Pumping Improvements

- Install return activated sludge (RAS) Pumps with variable frequency drives (VFDs)
- Automate waste-activated sludge (WAS) Pumping Control
- Provide RAS chlorination
- Install two new larger buildings to house primary sludge pumps

Solids Digestion Improvements

- Install system for alkalinity addition

- Provide redundancy for Critical Primary Digester Equipment
- Replace seals on mixer of Primary Digester

Solids Drying Beds Improvements

- Reconfigure six smaller drying beds into two larger beds
- Consider addition of mechanical dewatering equipment

Septage Receiving Station Improvements

- Relocate and reconfigure Septage Receiving Station

Electrical and I&C Improvements

- Upgrade grit washer building electrical enclosures from National Electrical Manufacturers Association (NEMA) 3 to NEMA 7
- Replace all motor control centers (MCCs)
- Bring all electrical components up to code
- Replace Generator Set
- Replace Generator Manual Transfer Switch with Auto Transfer Switch
- Replace Boiler Room MCC
- Replace Boiler Room lighting
- Replace Primary Clarifier Panel Board with new MCC
- Install safety disconnects to Headworks equipment
- Expand the supervisory control and data acquisition (SCADA) System
- Replace underground conduits
- Install safety switches in accordance with National Electric Code (NEC) at each motor

Basis of Planning

The Basis of Planning summarizes the requirements and design criteria for the City WWTP for a 20-year planning period. Due to the inclusion of the Umatilla River Basin total maximum daily load (TMDL), wasteload allocations for point source dischargers, like the City WWTP, were developed. The TMDL addresses 1998 303(d) pollutants including, temperature, sediment, aquatic weeds, algae, and pH, nitrate-nitrogen, ammonia-nitrogen, and bacteria.

Discharge from the Pendleton WWTP to the Umatilla River was required to meet the NPDES Permit limits by a 3 February 2005 deadline. However, the City was unable to comply with the new limits for temperature, ammonia-N or residual chlorine. As a result, the City and DEQ signed an MAO to bring the City into conformance with the Permit.

Based on regulatory requirements for effluent discharge and biosolids, along with EPA Plant Reliability Criteria Requirements, the Design Criteria, shown in Table EC 5, has been established.

Table EC 5: Final Effluent Design Criteria

Parameter	Monthly Average Concentration (mg/l)	Daily Maximum Concentration (mg/l)
Summer Season (May 1 – October 31)		
Effluent BOD_5	15	30
Effluent TSS	15	30
Effluent Ammonia-Nitrogen	1.0	2.0
Effluent Nitrate-Nitrogen	7.0	10.0
Effluent E. Coli	126 counts/100ml	406 counts/100ml
Effluent Residual Chlorine	0.02 mg/l	0.05 mg/l
Winter Season (November 1 – April 30)		
Effluent BOD_5	20	40
Effluent TSS	20	40
Effluent Ammonia-Nitrogen	3.0	5.2
Effluent E. Coli	126 counts/100ml	406 counts/100ml
Effluent Residual Chlorine	0.01 mg/l	0.04 mg/l

Notes:

(a) BOD_5 = biochemical oxygen demand.
(b) mg/l = milligrams per liter
(c) ml = milliliter
(d) TSS = total suspended solids.

Treatment Options were developed to meet the design criteria and were evaluated using a matrix-based approach incorporating economic and non-economic evaluation criteria. Scores to select the best option for the City were calculated by ranking each option relative to others and assigning a relative importance, or Weighting, to each criterion. The option with the highest Score represents the best option for the City. The scoring equation is as follows:

$$Score = \sum_{Criteria} (Rank * Weighting)$$

Evaluation Criteria used in the option evaluation include:

- Capital Cost (30%);
- 20-year Life Cycle Cost (20%);
- Regulatory Compliance (30%);
- Environmental and Permitting (10%); and
- Constructability (10%).

Unit Process Option Evaluation

Five unit processes were identified in the facility condition assessment that require upgrades either to meet the treatment requirements of the new NPDES permit limits or to replace aging facilities. Options were developed and evaluated based upon capital and life-cycle costs to determine a recommended upgrade for each process. The unit

processes and recommended improvements are discussed below:

- **Preliminary Treatment** – Improvements are required to address corrosion of the existing prefabricated metal building over the influent screens and severe corrosion of electrical equipment in the adjacent grit processing building.

  Recommended Option – Construct a new headworks building with a properly-sized ventilation system for the existing screening equipment and grit system. Convert the existing grit building into a storage room.

- **Secondary Treatment** – In order to meet new summer-season and winter-season effluent ammonia-nitrogen permit limits, a new secondary treatment process is required.

  Recommended Option – Two options have been recommended for City consideration: a Plug Flow Modified Ludzack-Ettinger (MLE) Process and a new Membrane Bioreactor (MBR). The Plug Flow MLE Process provides the most process control flexibility and future expandability. In addition, the Plug Flow MLE Process could be retrofitted into an MBR in the future increasing process capacity from 4.1 mgd to 6.5 mgd. An MBR installation would also provide increased flexibility for meeting future regulatory requirements. Each of these options is considered viable and discussed in more detail in the Recommended Plan.

- **Solids Processing** – Additional solids processing capacity is required to provide adequate capacity for increased solids production from the secondary treatment process improvements.

  Recommended Option – Install mechanical dewatering equipment and a new dewatering building with a covered cake storage area for year-round solids processing.

- **Underground Electrical Conduits** – Electrical conduits and systems throughout the treatment plant are in need of replacement. Throughout the plant, underground galvanized steel conduits installed in previous plant upgrades are severely corroded and much of the electrical equipment is in need of replacement;

  Recommended Option – Install a pre-manufactured polymer concrete trench along the major conduit bank alignment. This system will provide a dielectric, high-strength, H-20 load-rated cable trench that can be accessed at all locations. Feeder conduits will be installed from the conduit trench to the individual buildings or equipment.

- **Outfall** – Due to new regulatory requirements, it is anticipated that the current WWTP outfall will need to be relocated closer to the confluence of the Umatilla River and McKay Creek to maintain the current mixing zone that includes dilution flows from both streams.

Recommended Option – Construct a new outfall to a location closer to the confluence without crossing McKay Creek. This location will maximize available mixing flows throughout the calendar year.

Complete Alternative Evaluation

Four Complete Alternatives have been developed to address upgrades identified in the Condition Evaluation and improvements required to meet the renewed NPDES Permit. In order for each alternative to be considered viable, the alternatives must address the following issues:

- **Ammonia-Nitrogen Limits in NPDES Permit** – The City's recently renewed NPDES Permit contains new summer- and winter-season effluent discharge limits for ammonia-nitrogen. Meeting the low summer and winter ammonia-nitrogen limits on a consistent basis will require significant upgrades to the WWTP secondary process.
- **Temperature Limits in NPDES Permit** – The City's renewed NPDES Permit also contains new effluent discharge limits for temperature. The City has prepared a Temperature Management Plan and completed modeling to address temperature issues through offsets from the Thorn Hollow Springs water right transfer. However, WWTP improvements for diurnal effluent storage may be required and are included in the Recommended Plan.
- **WWTP Outfall Location** – It is anticipated that the current WWTP outfall will need to be relocated closer to the confluence of the Umatilla River and McKay Creek to maintain the current mixing zone that includes dilution flows from both streams.
- **Additional Solids Processing Capacity** – Meeting the new ammonia-nitrogen effluent discharge limits requires secondary process upgrades that will significantly increase the solids produced at the WWTP and require upgrades to solids dewatering facilities;
- **Aging WWTP Facilities and Equipment** - An evaluation of the existing WWTP completed as part of the WWTP facilities planning process indicates most of the mechanical and electrical systems have reached the end of their useful service life. Replacement of this equipment is required to assure reliable WWTP operation.

Four Complete Alternatives have been developed based on these key requirements. The four alternatives prepared cover a range of costs representing varying levels of treatment plant upgrades. These alternatives include:

Alternative 1. Minimum for Permit Issues – Construct improvements to address only the three major NPDES Permit issues summarized in the Basis of Planning: ammonia-nitrogen; temperature; and the outfall. This alternative is the least-cost option, but assumes that required upgrades to aging WWTP facilities and solids processing capacity would be conducted concurrently by City staff and paid for under a separate Capital Improvements Program (CIP) budget. Without the concurrent CIP, Alternative 1 cannot be considered a complete and viable alternative.

Alternative 2. Minimum for Current Issues – Construct minimum process and mechanical improvements to address all WWTP issues summarized in the Facilities Plan while maximizing use of the existing facilities and tank storage.

Alternative 3. Best for Current Issues – Construct more reliable process and mechanical improvements to address all WWTP issues summarized in the Facilities Plan by adding new tank storage, resulting in more efficient operations and better process control flexibility.

Alternative 4. Best for Current and Future Issues – Construct new secondary treatment process using MBR technology, replacing the existing aeration basins and secondary clarifiers.

Each alternative has been evaluated on the economic and non-economic criteria presented in the Basis of Planning. Based on the scoring criteria, Alternatives 3 and 4 scored very closely and are considered for establishing the apparent best alternative. With the MBR scoring the highest, it is recommended as the best alternative. Although Alternative 4 has the highest capital cost, it provides superior treatment quality, higher reliability in meeting current and future regulatory requirements, and is relatively easy to build while keeping the existing treatment plant operational during construction.

Recommended Plan

In order to maximize the City's investment in the WWTP, provide the most reliable facility, provide an option that would potentially address future regulatory issues, and reduce the impacts of the project on the City's rate payers, it is recommended the City implement Alternative 4 in a two-phased approach as follows:

- **Phase 1:** Construct the secondary process in a new concrete tank as proposed in Alternative 3 for projected 2017 flows and loads, and complete WWTP upgrades to address aging facilities, outfall relocation, and increase solids-handling capacity. The new concrete basin would include three downstream cells that would initially serve as part of the secondary process, but would ultimately be used for conversion to an MBR in Phase 2.
- **Phase 2:** Convert the secondary process completed in Phase 1 into a MBR by adding the membranes in the three downstream cells in the new secondary process. Phase 2 also includes the installation of fine screens required for MBR systems and conversion of secondary clarifiers to effluent storage basins to address NPDES temperature requirements, if required.

The Recommended Plan also incorporates other improvements across the plant as described in the Unit Process Alternatives Evaluation. Along with the secondary improvements discussed above, other phased improvements include:

Phase 1

- **Headworks.** Headworks improvements will include a new building and heating, ventilation, and air conditioning (HVAC) system with a new equipment hoist, relocation of grit chamber electrical to the new building, or an exterior mounting. No additional screening will be provided during Phase 1.

- **Primary Clarifiers.** Plant staff has recently replaced all the mechanical components of Primary Clarifier No. 2; therefore, to provide needed redundancy, replacement of Primary Clarifier No. 1 mechanical components is included in the Phase 1 improvements.
- **In-plant Pump Station.** Two of the three existing pumps at the in-plant pump station will be replaced with new pumps and one additional VFD to provide needed redundancy.
- **Secondary Process.** The new secondary process basin will be located in the existing AB2. The new 1.4-million-gallon concrete basin will be operated in Phase 1 as a Modified Ludzack-Ettinger (MLE) secondary process. This basin will be designed and constructed to allow conversion to an MBR installation during Phase 2.
- **Solids Dewatering Improvements.** Increasing loads to the treatment plant and increasing solids production from the secondary process will necessitate the installation of a mechanical dewatering facility, covered cake storage area, and alkalinity addition in the primary digester.
- **Secondary Clarifier Scum Mechanisms.** The existing secondary clarifiers will be decommissioned during Phase 2, so full rehabilitation is not recommended. However, it is recommended that scum removal systems be added to both secondary clarifiers to address potential scum issues related to the new MLE process.
- **Electrical Upgrades.** Upgrades to the existing deteriorating electrical systems include installation of an automatic transfer switch, installation of a new generator set capable of running all critical plant unit processes, new direct-buried conduits, and replacement of motor control centers with standard available parts.
- **Disinfection.** Improvements to the chlorine contact chamber (CCC) include the addition of a redundant chlorine solution feed pump, rechanneling of the basin floor to aid in cleaning, and addition of baffles to minimize short-circuiting in the basin.
- **New Outfall.** A new outfall will be constructed closer to the confluence of the Umatilla River and McKay Creek. Improvements associated with the new outfall include extension of the existing outfall pipe and a new outfall structure.
- **SCADA.** Improvements to the SCADA system will include additional instrumentation in each process area for all upgrades, additional start/stop and setpoint control, a second LCD screen, improved historical data gathering and reporting, and the addition of HMI at select points in the facility to allow user interface at the process location.

Phase 2

- **Fine-Screening Building.** A new building downstream of the primary clarifiers and upstream of the MBR will be constructed. Two fine screens will be installed with a capacity equal to the peak design flow through the membrane system. The fine screens are required to prevent small floatables such as hair from collecting in the downstream MBR basins.

- **MBR Conversion.** The concrete basin constructed in Phase 1 for the MLE process will be converted to an MBR. The MBR conversion includes all permeate pumps, blowers, piping, cleaning systems, hardware, and instrumentation for a complete and operable system. By converting the MLE process to an MBR, the flow and treatment capacity of the process will increase from 4.1 mgd to 6.5 mgd.
- **Secondary Clarifier Conversion.** Mechanical equipment will be removed from the secondary clarifiers and a pump station installed to allow the clarifiers to be used for diurnal storage of effluent during the hottest periods of the day in the summer. These upgrades may not be required, but will depend on the final outcome of the City's proposed temperature trading approach involving thermal credits from the Thorn Hollow Springs water rights transfer.

Capital costs for each phase of the Recommended Plan are provided below in Table EC 6. Capital costs are presented in 2009 dollars for Phase 1 and 2017 dollars for Phase 2, respectively. In order to provide a comparative capital cost estimate, the total capital cost of Phase 1 and Phase 2 is presented in 2007 dollars as a net present worth (NPW). In the net present worth calculation, capital costs are adjusted to 2007 dollars assuming an escalating rate of 3 percent per year.

Table EC 6: Recommended Plan Capital Cost Summary

Phase	Capital Cost
Phase 1 (2010)	$15.8 million
Phase 2 (2017)	$13.3 million
NPW TOTAL	**$24.8 million**

Phase 1 Project Schedule and Next Steps

A Preliminary Project Schedule showing the plan for completing preliminary design, final design, bidding and construction for Phase 1 improvements is presented in Exhibit 8.4. Major milestone deadlines for each of the planned periods are as follows:

- **Final Facilities Plan/Initial Preliminary Design** August 8, 2007 through September 4, 2007 has been reserved for DEQ Facilities Plan review. During this time the City will also negotiate the Consultant's Scope of Work for preliminary and final design of recommended Phase 1 improvements to be presented for approval by the Pendleton City Council on October 2, 2007.
- **Preliminary Design** will begin October 3, 2007 or after City Council approval of the Consultant's Scope of Work. Preliminary Design is scheduled for approximately 7 months and will include seven detailed technical memoranda for various WWTP unit processes to be upgraded. Approximately one month has been reserved for DEQ

review of the Preliminary Design Report for the Phase 1 WWTP Improvements Project.

- **Final Design** for the Phase 1 WWTP Improvements Project will begin after final approval of the Preliminary Design Report by the City and DEQ. Intermediate design submittals will be prepared at 60% (September 2008) and 90% (February 2009) design. Final contract documents are scheduled to be submitted in June 2009.
- **Bidding and Contracting** is scheduled for approximately 3 months. The project is currently planned for advertisement in June 2009 with final contracts to be approved by the City in August 2009.
- **Construction** is currently scheduled for approximately 18 months with facility startup and contract closeout by April 2011.

As noted at the bottom of Exhibit 8.4, the anticipated project completion date on April 6, 2011 will require re-negotiation of the dates in the City's current MAO with DEQ. The MAO extension is necessary to implement the proposed WWTP Phase 1 improvements, which are more extensive than anticipated when the current MAO was negotiated. It is recommended that the re-negotiated MAO contain intermediate dates at DEQ review points for the Facilities Plan, Preliminary Design, 90% and Final Design. This is a typical approach for MAO compliance used by DEQ throughout Oregon so that communities are not penalized for longer than anticipated DEQ review periods.

Preliminary Financial Plan

Chapter 9 of the facility plan examines the various options available to the City for financing the recommended plan. Preliminary options available to the City for funding the Recommended Plan include:

- General Obligation Bonds;
- Revenue Bonds;
- Federal Appropriations (Earmarks); and
- State and Federal Grant and Loan Programs.

Loans would be repaid with City revenues collected through wastewater utility rates, system development charges (SDCs), or property taxes, depending on the funding option; or through a combination of options selected by the City. Grants available from some state and federal programs would not be repaid, but may have other requirements that the City would need to comply with for eligibility.

There are two basic revenue streams used by communities to pay for wastewater system upgrades:

- Monthly wastewater utility usage fees; and
- Wastewater system development charges.

The City's current monthly wastewater utility rate is $13.95 per household connection. Based on a survey completed by the City, this is the second-lowest wastewater utility rate for similar-size communities in Oregon. The impact of the WWTP Recommended Plan on wastewater rates will depend on many factors, including revenue from wastewater utility rates and, potentially, a new wastewater SDC, as well as short- and long-term growth if an SDC is implemented.

Based on the City's currently low wastewater rates, it is anticipated that the project will most likely be funded primarily through loans. The program with the lowest interest rates and most favorable terms and conditions is the Clean Water State Revolving Fund (CWSRF) loan program administered by the DEQ. Although the City has a relatively high priority ranking, the program does not currently have adequate funds for all of the projects on the 2008 Project Priority list. Therefore, bonds or other loan programs may need to be considered by the City to augment available funds through the CWSRF program to assure Phase 1 improvements are completed as required in the City's MAO with DEQ.

The following steps are recommended to finalize the project financial plan for recommended WWTP upgrades:

- Set up and attend a "one-stop" meeting of funding agencies, which is typically held at the Oregon Division of State Lands headquarters in Salem;
- Continue to move forward with funding applications submitted to the CWSRF program;
- Pursue potential grant and low-interest loans through the Oregon Economic and Community Development Department (OECDD);
- Complete a Wastewater Utility Rate Study to establish anticipated wastewater rates for Phases 1 and 2, and develop a Wastewater Utility System Development Charge; and
- Pursue bond obligation with increase in sewer rates.

Chapter 1: Introduction & Background

1.1 Authority and Purpose

Kennedy/Jenks Consultants, Inc. was retained by the City of Pendleton on 16 January 2007 to complete the Pendleton Wastewater Treatment Plant Facility Plan. The purpose of the Facility Plan is to summarize Kennedy/Jenks' evaluation of current and future needs, a projection of future flows and loads, an evaluation of the existing treatment plant, an options analysis, recommended facility improvements, and a Capital Improvement Plan. This document is intended to comply with the Oregon DEQ requirements for wastewater facility plans.

1.2 Acknowledgements

Kennedy/Jenks appreciates the input and support from City staff, including Bob Patterson, Mark Milne and Sue Lawrence. Their efforts were critically important in assuring the study methodology, conclusions, and recommendations are consistent with City of Pendleton goals and objectives.

1.3 Background

The City of Pendleton WWTP is located at the confluence of McKay Creek at river mile 52.0 of the Umatilla River. The existing plant is a complete-mix secondary treatment plant originally constructed in 1952. The WWTP currently has one outfall (Outfall 001) that discharges into McKay Creek above the existing fish barrier and approximately one-half mile upstream of the confluence of McKay Creek and the Umatilla River. The last plant upgrade was in 1970, when a major plant expansion increased the peak flow capacity of the plant to 16.3 MGD according to the original design documents. Due to an exodus of industry shortly after the completion of the plant, the current flows are much less than projected flows.

Currently the plant treats an Average Annual flow of approximately 2.5 MGD. Peak Instantaneous Flow projected for design year 2030 is 6.14 MGD. Current and projected design flows are summarized in Chapter 3 of this Plan. Based upon current flow projections for the next planning phase, it appears that the Pendleton WWTP has more capacity than necessary. As a result, the capacity upgrades will be minimal, and recommended upgrades focus on replacing mechanical treatment processes that have outlived their useful service life and are becoming ongoing maintenance issues.

Required upgrades are also being driven by the City's NPDES Permit which regulates the WWTP discharge at the confluence of the Umatilla and McKay Creek. This permit was recently renewed, increasing the strict effluent limits for temperature and Ammonia consistent with point source waste load allocations included in the Umatilla River Basin TMDL.

The City originally planned to meet the strict effluent limits for temperature and Ammonia-N through full-scale implementation of Soil Aquifer Treatment with Surface Water Recharge (SAT-SWR). However, a SAT-SWR demonstration project revealed hydraulic capacity limitations due to the flood control dike around the perimeter of the WWTP grounds along the Umatilla River and a portion of McKay Creek. This hydraulic limitation resulted in insufficient capacity required for SWR to be the primary option for meeting NPDES limits for temperature and Ammonia-N.

As such, a combination of continued SAT-SWR and trading of water quality thermal credits will be required to meet the temperature limit described by the NPDES permit. A complete analysis and discussion of this discharge method is presented in the Temperature Compliance Evaluation Project Final Report dated 12 September 2006.

Effluent limits described in the NPDES Permit, especially pertaining to Ammonia, will be met through facility upgrades at the plant. The evaluations developed and analyzed through this Facility Plan are used to develop the recommended facility upgrades necessary.

1.4 Facility Plan Organization

This Facility Plan summarizes the City's issues related to the existing treatment plant and recommended facility upgrades required to meet effluent limits specified in the NPDES Permit. The Wastewater Treatment Plant Facility Plan Final Report includes the following Chapters:

Chapter 1 – Introduction & Background. Introduction to the project, including the authority and purpose, background, acknowledgements, Facility Plan, organization, abbreviations and references. Chapter 1 also includes background information relating to the purpose of the project.

Chapter 2 – Study Area Characteristics. Overview of the City, including discussion on the planning area, climate and rainfall, soil and geology, and City land use.

Chapter 3 – Wastewater Characteristics. Summary of the wastewater characteristics including current WWTP flows and loads, projected 2030 WWTP flows and loads, and projected wastewater characterization.

Chapter 4 – Existing Wastewater System. Summary of the existing WWTP facilities, including the current condition assessment and recommendations for the collection system, treatment plant unit processes, and treatment plant electrical system.

Chapter 5 – Basis of Planning. An overview of the NPDES Permit and other regulatory constraints, a review of the EPA plant reliability requirements, summary of the WWTP design criteria, and definition of the basis for cost estimating.

Chapter 6 – Unit Process Options Analysis. A summary of the development of unit process options addressing the deficiencies summarized in Chapter 4. This Chapter includes discussion on the development and evaluation of each unit process option for Preliminary Treatment, Secondary Treatment, Solids Processing, Underground Electrical Conduits, and the WWTP Outfall.

Chapter 7 – Complete Options Evaluation. This Chapter includes discussion on the development and evaluation of each option and requirements necessary to meet future flow and load projections.

Chapter 8 – Recommended Plan. A summary of the recommended options for inclusion in the City's Capital Improvements Program Plan, a detailed cost estimate for the Recommended Plan, a summary of the implementation schedule, and summary of the funding options and potential rate impacts.

Chapter 9 – Preliminary Financial Plan. This section summarizes available funding alternatives for the Pendleton WWTP improvements. Alternatives are based on providing funding for Phase 1 and Phase 2 improvements as summarized in the Recommended Plan.

1.5 Abbreviations

AAF	average annual flow
ADWF	average dry weather flow
AFD	adjustable frequency drives
AMMONIA	ammonia as nitrogen (ammonia-N)
ATS	automatic transfer switch
AWWF	average wet weather flow
BMP	best management plan
BNR	biological nutrient removal
BOD	biological oxygen demand
CCC	chlorine contact chamber
CDBG	Community Development Block Grant
CF	cubic feet
CFS	cubic feet per second
CIP	Capital Improvements Project
CTUIR	Confederated Tribes of the Umatilla Indian Reservation
CWA	Federal Clean Water Act of 1972
CWSRF	Clean Water State Revolving Fund
CY	cubic yard
DEQ	Oregon Department of Environmental Quality
DMR	discharge monitoring report
EDU	equivalent dwelling unit
EPA	Federal Environmental Protection Agency
EQC	Oregon Environmental Quality Commission
ETL	excess thermal load
ETO	Energy Trust of Oregon
F/M	food-to-microorganism ratio
FOG	fat, oil, and grease
FRP	fiberglass reinforced plastic
FTE	full-time employee
FT/S	feet per second
Gal	gallon
GPD	gallons per day
GPD/ft^2	gallons per square foot of surface area per day
GPM	gallons per minute
GRS	galvanized rigid steel
HMI	human machine interface
HP	horsepower
HUD	Housing and Urban Development
I/I	infiltration and inflow
IMD	Internal Management Directive (DEQ Guidance)
IMST	Independent Multi-disciplinary Science Team
Kcal	kilocalorie
KWh	kilowatt hour

MKcal	million kilo-calories
LCD	liquid crystal display
MAO	Mutual Agreement Order
MBR	membrane bioreactor
MCC	motor control centers
MG	million gallons
mg/L	milligrams per liter
MGD	million gallons per day
MHI	median household income
MLE	Modified Ludzack-Ettinger
MLSS	mixed liquor suspended solids
MMDWF	Maximum month cry weather flow
MMWWF	Maximum month wet weather flow
NCDC	National Climate Data Center
NEC	National Electrical Code
NEMA	National Electric Manufacturers Association
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NPW	net present worth
NRCS	National Resources Conservation Service
O&M	Operations and Maintenance
OAR	Oregon Administrative Rules
OECDD	Oregon Economic and Community Development Department
ODFW	Oregon Department of Fish and Wildlife
ODOE	Oregon Department of Energy
PDAF	peak day average flow
PIF	peak instantaneous flow
PLC	programmable logic controller
PPD	pounds per day
PPL	Pacific Power and Light
PSU-PRC	Portland State University Population Research Center
PVC	polyvinyl chloride
RAS	return activated sludge
RMZ	Regulatory Mixing Zone
RPM	revolutions per minute
RUS	Rural Utility Service
SAT	soil aquifer treatment
SCADA	Supervisory Control and Data Acquisition
SCS	Soil Conservation Service
SDC	system development charge
SOR	surface overflow rate
SPWF	Special Public Works Fund
SRT	solids retention time
SSB	sludge storage basin
SSS	solid-state soft starters
SVI	sludge volume index
SWR	surface water recharge
TDH	total dynamic head
TIR	thermal infrared radiometry

TMDL	total maximum daily load
TMP	Temperature Management Plan
TSS	total suspended solids
UGB	urban growth boundary
USACE	United States Army Corps of Engineers
USBR	United States Bureau of Reclamation
USDA-RUS	U.S. Department of Agriculture Rural Services
USGS	United States Geological Survey
VFD	variable frequency drive
WAS	waste activated sludge
WOR	weir overflow rate
WQS	Water Quality Standards
WRD	Water Resources Department of the State of Oregon
W/W	Water/Wastewater Financing Program
WWTP	wastewater treatment plant
ZID	zone of immediate dilution
°C	degrees Celsius
°F	degrees Fahrenheit
7DADM	7-day average of the daily maximum
7Q10	7-day, consecutive low stream flow with a 10-year return frequency

1.6 References

The following references were used in the preparation of this report:

- Climatology of the United States No. 20 Monthly Station Climate Summaries for Oregon, 1971-2000. National Oceanic and Atmospheric Administration Climate Data Center, February 2004.

- Confederated Tribes of the Umatilla Indian Reservation Water and Wastewater System Master Plan. Anderson Perry and Associates, Inc, June 2006.

- Contract Documents for the Construction of a Sewage Treatment Plant Expansion for the City of Pendleton, Oregon. CH2M, September 1969

- Monthly Discharge Monitoring Reports for the Pendleton WWTP. City of Pendleton, October 2002 through November 2006.

- Engineering Report on the Preliminary Design of Waste Treatment Facilities for the City of Pendleton, Oregon. CH2M, February 1964

- EPA Region 10 Guidance for Pacific Northwest State and Tribal Temperature Water Quality Standards. EPA Document 910-B-03-002, April 2003.

- Hydromet Historical Data for Station PDTO (Umatilla River at Pendleton) and MCKO (McKay Creek at Pendleton). USBR, www.usbr.gov/pn/hydromet.

- Oregon Temperature Criteria - Oregon Administrative Rules (OAR), Chapter 340-Division 41 (Water Quality Standards), -Section 007.

- Operations Manual-Sewage Treatment Plant, CH2M, February 1971
- Pendleton WWTP NPDES Compliance Recommendations and Conceptual Costs, Technical Memorandum 001. Kennedy/Jenks Consultants, September 2006
- A Report on an Engineering Investigation of Sewage Collections and Treatment Facilities. Cornell, Howland, Hayes and Merryfield, November 1962
- Umatilla River Basin TMDL and Water Quality Management Plan. DEQ, March 2001.
- Waste Treatment Facilities Predesign Study, CH2M, March 1969
- Water Quality Trading Internal Management Directive. DEQ, January 2005.
- Water Quality Trading Policy. USEPA Office of Water, January 2003.

Chapter 2: Study Area Characteristics

2.1 Planning Area

The City of Pendleton is located in the center of Umatilla County in the valley of the Umatilla River within the southeastern part of the Columbia Basin (see Exhibit 2.1, Regional & Vicinity Maps). According to the United States Census Bureau, the City has a total area of 10.1 square miles. The altitude of Pendleton is 1,069 feet above mean sea level.

Pendleton is located at the junction of three major highways. Interstate Highway 84 north is the primary east-west highway that connects with Interstate Highway 82 approximately 30 miles west of the City. Oregon State Highways 37 and 395 are the main north-south routes. Portland, Oregon is located 211 miles to the west; Spokane, Washington is located 204 miles to the northeast; and Boise, Idaho is located 229 miles to the southeast.

2.1.1 Climate and Rainfall

The Columbia Basin is bounded on the south by the high country of central Oregon, on the north by the mountains of western Canada, on the west by the Cascade Range, and on the east by the Blue Mountains and north Idaho plateau. The gorge through which the Columbia River flows is the most important break in the barriers surrounding this basin. These physical features have significant influences on the general climate of Pendleton and the surrounding territory.

The wettest month is typically December, and the driest is July. Precipitation is seasonal in occurrence with an average of only 10 percent of the annual total occurring from July through September. The lighter summertime precipitation usually accompanies thunderstorms originating from the south or southwest. On occasion, these storms cause flash flooding. Snow falls occasionally in the City during the winter, but rarely remains over 3 days or accumulates to more than a few inches.

The lowest monthly average temperature typically occurs in January and the highest monthly typically occurs in July. Temperature extremes range from below freezing in winter to 100 °F in summer.

The National Weather Service monitors 4 weather stations. Data from three of the stations are included in the table below. Appendix A contains additional Pendleton, Oregon Climate Summary Statistics.

Table 2.1: National Weather Service Data for Pendleton, Oregon

Station Name	Elevation	Max Temp (ºF)	Min Temp (ºF)	Ave Temp (ºF)	Precipitation (inches)	Snowfall (inches)
Downtown (fire station)	1040'	65.3	39.9	52.6	14.14	3.4
Experimental (Hwy 11)	1487'	63.3	37.5	50.4	17.47	17.4
Regional Airport	1486'	62.7	41.5	52.1	12.77	16.4

Pendleton is mostly unprotected from wind. Winds come predominantly from the west and southeast. Southeast winds are usually less than 10 knots and occur during spring and summer. West winds may exceed 10 knots and occur during the fall and winter.

U.S. Weather Bureau records indicate that the average annual growing season is 152 days long. This, combined with low precipitation, results in farming of primarily dryland (non-irrigated) crops.

2.1.2 Surface Waters

Pendleton is located in the Umatilla River watershed, which encompasses approximately 2,300 square miles. Within the Pendleton vicinity, the Umatilla River is intersected by five tributaries: Nelson Creek, Wildhorse Creek, Tutuilla Creek-Patawa Creek, McKay Creek, and Birch Creek. Flows from Nelson Creek are negligible and the Birch Creek confluence is located downstream from Pendleton.

After converging with Wildhorse Creek, the Umatilla River flows through Pendleton, receives drainage from McKay Creek, and continues westward. The Pendleton WWTP discharges to McKay Creek.

Portions of the Umatilla River passing through the City limits are protected by a U.S. Army Corp of Engineers levee. The Umatilla River flood stage is 7.8 feet. (1996 floods reached 11 feet). Flows are seasonal, with the highest occurring in late winter and spring, and the lowest in summer and fall.

The nearest USGS monitoring station is located on McKay Creek. The Confederated Tribes of Umatilla also monitors a river gauge at the West Boundary. The Bureau of Reclamation monitors a gauge located at River Mile 55 in downtown Pendleton and a gauge immediately downstream of the McKay Reservoir Dam. A summary of Umatilla River Surface Water Flow Statistics can be found in Appendix B.

The Umatilla River and its tributaries are subject to Section 404 Federal Clean Water Act, which requires a permit for any activity in the waterway or its adjacent banks. The Division of State Lands requires a permit for any fill or removal in excess of 50 cubic yards.

The Umatilla River and McKay Creek head waters are located east of Pendleton in the Blue Mountains. The McKay Creek waters are impounded at the McKay Reservoir, and flows from the McKay Dam are regulated. Flows from McKay Creek are used to augment Umatilla River flows during the growing season, when water is diverted from the river for agricultural use. The McKay Reservoir and land immediately surrounding it are designated as the McKay Creek National Wildlife Refuge. The Tutuilla Creek monitoring station is located upstream from the McKay Reservoir Dam. The two wetlands that exist within the Pendleton City Limits are near the WWTP and the Westgate industrial Park.

2.1.3 Soil, Geology, and Habitat

The City is situated on the Umatilla valley floor, nearby hillsides, and adjacent valleys. Approximately 55% of the area is flat with slopes of 5% or less. Nine distinct hills are in the area. Tabulated National Resources Conservation Service (NRCS) data indicates slopes ranging from 2% - 15% are located within the area, but other information indicates slopes as steep as 45% are also present. The City and surrounding area are part of the Columbia River Basaltic Lava Flow. The depths of basalt flows range from hundreds to thousands of feet.

The NRCS classifies most soil types in the Pendleton vicinity as silty or stony loam, which are prime agriculture conditions. An NRCS soil survey of the Pendleton area is included in the Appendix C.

Approximately 8 miles south of Pendleton is the McKay National Wildlife Refuge, which consists of 1,837 acres of open water (reservoir), marsh, and grasslands. The area is a common resting and feeding ground for migrating fowl. Other surrounding wilderness areas support elk and deer. The Umatilla National Forest supports one of the largest herds of Rocky Mountain elk found on any National Forest in the nation. The Umatilla River and its tributaries are sources of game and non-game fish species, both natural and stocked.

2.1.4 Air Quality

The City consistently meets clean air levels set by the EPA. DEQ maintains an air monitoring station in the McKay area. Meteorological and atmospheric conditions are monitored during winter and used for pollution prevention programs, such as wood burning advisories.

The City has been proactive in addressing air quality issues. In 1991, the City formed the Pendleton Air Quality Commission, a citizen-based group whose goal is to educate the public about air quality. The City sponsored two wood stove change-out programs that provided no-interest loans to homeowners, encouraging them to replace older, less-efficient wood stoves with cleaner, more efficient sources of heat. The City also provides a daily air quality forecast from October through March to alert citizens to local air quality conditions and discourage the use of wood stoves during periods of air stagnation.

2.1.5 Public Health Hazards

The Department of Humane Health and Human Services Agency for Toxic Substances and Disease does not list Pendleton on their registry as a Public Health Hazard. Data from public health assessments classify sites according to the following categories:

- Category 1: Urgent Public Health Hazard: Sites that pose a serious risk to the publics health as the result of short-term exposures to hazardous substances.
- Category 2: Public Health Hazard: Sites that pose a public health hazard as the result of long-term exposures to hazardous substances.
- Category 3: Indeterminate Public Health Hazard: Sites for which no conclusions about public health hazard can be made because data are lacking.
- Category 4: No Apparent Public Health Hazard: Sites where human exposure to contaminated media is occurring or has occurred in the past, but the exposure is below a level of health hazard.
- Category 5: No Public Health Hazard: Sites for which data indicate no current or past exposure or no potential for exposure and therefore no health hazard.

According to Oregon State Department of Human Services, no Super Fund Sites or Hazardous Waste Sites are in the Pendleton vicinity.

The Department of Energy's Hanford Site is located approx 130 miles from Pendleton, well out of the Plume Zone (10 mi radius from Hanford) and Ingestion Zone (50 mi radius from Hanford).

2.2 Land Use

2.2.1 Zoning

The original City Comprehensive Plan was adopted in 1964. After subsequent revisions and expansions to the Comprehensive Plan, the most current edition was adopted in 1990. The 1997 and 1999 Pendleton Urban Fringe Land Use Study further analyzed the area's 20-year land use needs and potential for expansion. See Exhibit 2.2, Zoning Map, for current City limit delineations, UGB, and land use designations. See Appendix D for figures from the Fringe Study.

Table 2.2, City of Pendleton Area Characteristics, presents the total area within the City limits and UGB. Table 2.3, City of Pendleton Area within UGB, includes the current total acreage for all zone classifications within the current Pendleton Urban Growth Boundary. The City is currently in the process of requesting an additional 438 acres of land to incorporate into the current UGB for economic development purposes.

Table 2.2: City of Pendleton Area Characteristics

Description	Acreage
Pendleton City Limits	6,433
Urban Growth Boundary	7,544

Table 2.3: City of Pendleton Area within UGB

Zone	Description	Acreage
EFU	Exclusive Farm Use	1,627
R1	Low Density Residential	1,396
R2	Medium Density Residential	1,670
R3	High Density Residential	261
C1	Commercial Tourist	355
C2	Commercial Service	124
C3	Commercial	370
M1	Light Industrial	1,240
M2	Heavy Industrial	346
AA	Aviation Activities	516

2.3 Population, Housing and Job Projections

2.3.1 Existing Population

As of the 2000 census, there were 16,354 people, 5,964 households, and 3,727 families living in the City. The population density was 1,627.2/mi² and the average housing density was 632.0/mi². According to data available from the PSU-PRC, Pendleton's population as of 1 July 2005 was 17,025.

Table 2.4, Historical Population, and Figure 2.1, Population from 1970 to 2005, summarize Pendleton's population growth from 1970 through 2005. The annual population growth rate over that time was approximately 0.73%.

Table 2.4: Historical Population

Year	Population	Annual Growth Rate from 1970
1970	13,200	-
1980	14,520	0.96%
1990	15,130	0.41%
2000	16,350	0.79%
2005	17,025	0.81%
	Average Growth Rate	**0.73%**

Sources: Census and PSU-PRC data.

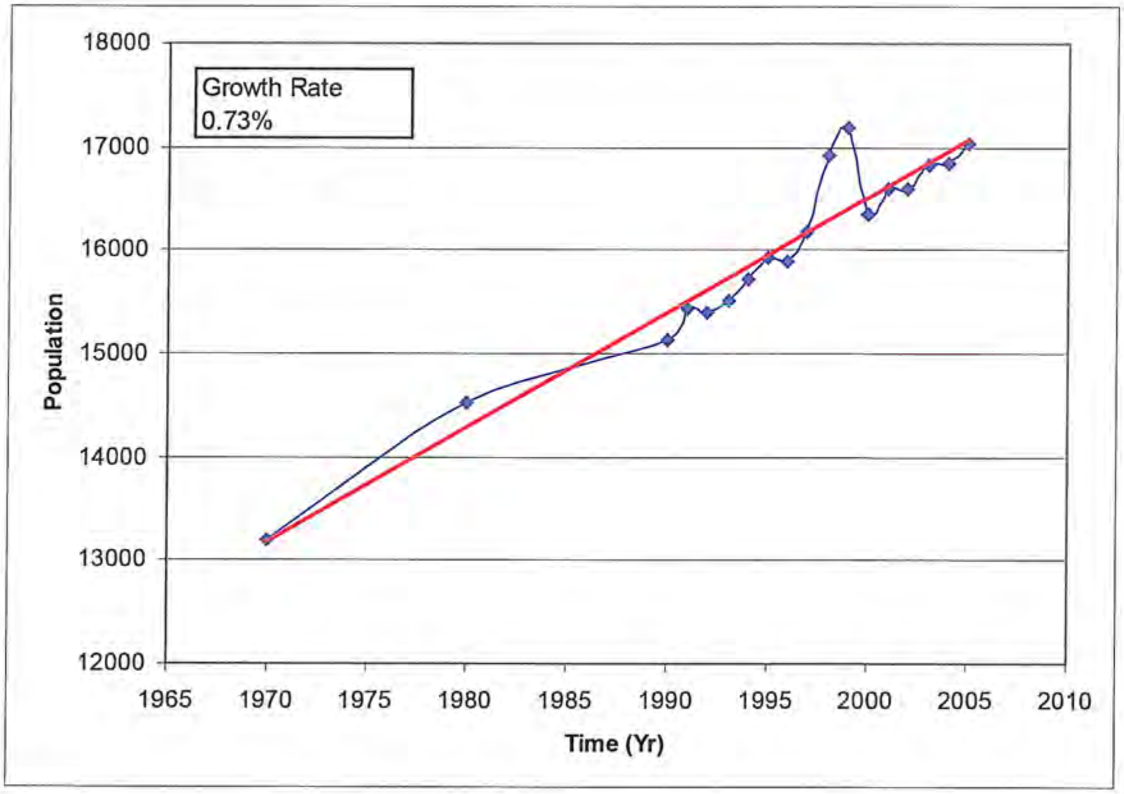


Figure 2.1: Pendleton Population from 1970 to 2005

2.3.2 Population Projections

The City has used an assumed future growth rate of 1.4% for long-range planning. To be consistent with all other City planning, this more conservative growth rate will be used for WWTP flow and load projections. Table 2.5, Projected Population, illustrates the projected population growth over the 25-year planning period.

Table 2.5: Projected Population

Year	Population
2005	17,025
2010	18,250
2015	19,560
2020	20,970
2025	22,480
2030	24,100

2.3.3 Employment Projections

Pendleton is the primary market center for the region, with freeway access and services necessary for a focused regional labor supply. In 1995, Pendleton's employment was 26.5% of the region. According to the Fringe Study, there are no official employment projections for the City. However, the Fringe Study estimated an employment growth rate of 52.52% from 1995 to 2020 by using the City's regional employment percentage from 1995. The region's estimated growth resulted in approximately 10,632 projected jobs (an increase of 3,661 jobs since 1995). The estimated employment distribution is shown below in Table 2.6, City of Pendleton Projected Employment Distribution.

Table 2.6: City of Pendleton Projected Employment Distribution

Classification	Percentage
Industrial, Light	23
Industrial, Heavy	8
Non-industrial, Central/Service	52
Non-industrial, Tourist	17
Non-industrial, Aviation	1

Source: 1999 Pendleton Urban Fringe Land Use Study. The Beckendorf Associates Corporation.

In efforts to seek industrial and commercial development, the City has designated an Enterprise Zone, and is offering tax abatements and incentives to attract new business.

2.3.4 Housing Projections

Assumptions made in the Fringe Study include the following:

- 5.5 units per net acre for new single-family and manufactured home units (equivalent average lot size of 8,000 square feet)

- 9.0 units per net acre density for new multi-family units (equivalent average lot size of 4,800 square feet)
- A projected total of 517.2 acres of net buildable residential land will be needed in 2020 to accommodate projected residential growth
- A projected total of 245.2 acres of net buildable land will be required in 2020 to accommodate projected job growth
- Recommended expansion of the 1999 UGB by approximately 451 buildable acres to accommodate projected growth requirements.

Table 2.7, City of Pendleton Buildable acreage Inside UGB, includes the gross and buildable acreage within the Pendleton UGB in 1999. By comparison, Table 2.3, City of Pendleton Area within UGB, includes the total acreage for all zone classifications within the current Pendleton UGB.

Table 2.7: City of Pendleton Buildable Acreage Inside UGB

	Gross Acreage	Buildable Acreage
Residential	961.4	361.1
Commercial	273.7	106.2
Industrial	771.4	203.1
Total	1,946.6	670.4

Source: 1999 Pendleton Urban Fringe Land Use Study. The Beckendorf Associates Corporation.

Chapter 3: Wastewater Characteristics

3.1 Introduction

This Chapter summarizes wastewater characteristics for the Pendleton WWTP, including:

- Current WWTP flows and loads;
- Projected 2030 WWTP flows and loads; and
- WWTP wastewater characterization.

Flow projections and peak flow estimates to be used as design criteria for recommended facility improvements are for the year 2030, providing an estimated 20-year capacity expansion for WWTP improvements planned for completion by November 2009 to comply with the Mutual Agreement and Order between the City and DEQ.

The WWTP wastewater characterization included in this Chapter is an evaluation of water quality characteristics through the unit processes in the plant. The characterization will be used for treatment process design to assure the low ammonia limits will be met by proposed facility improvements. The wastewater characterization is based on a sampling and testing program developed by Kennedy/Jenks staff and implemented by Pendleton WWTP staff.

Where applicable, DEQ guidelines were consulted in developing flow and load projections at the wastewater treatment plant. However, the guidelines were developed for wastewater treatment plants in Western Oregon, and are not entirely applicable to the east side of the state. Wastewater flows in the City of Pendleton are relatively constant throughout the year due to rainfall in the winter season and irrigation in the summer season. Therefore, DEQ guidelines were modified as required to develop reasonable flow and load projections for the City of Pendleton and Eastern Oregon.

3.2 Definitions

DEQ Guidelines. *Guidelines for Making Wet-Weather and Peak Flow Projections for Sewage Treatment in Western Oregon* (Oregon Department of Environmental Quality 1996).

Evaluation Period. The updated flow projections for the WWTP are based on WWTP DMRs from January 2001 through November 2006, excluding 2004. Observation of the DMRs and discussions with City staff indicate that an industry came online for only1 year that raised plant flows by approximately 25%. As this industry shut down at the end of 2004 and does not contribute to plant flow, this year was excluded from the evaluation period.

Average Dry Weather Flow. The daily average WWTP flow from May 1 through October 31.

Maximum Month Dry Weather Flow. The WWTP flow associated with a 10-year return rainfall event during the dry weather period. The design 10-year return (10-percent occurrence probability) rainfall event for the month of May is 2.4 inches, as published for the "Pendleton

Municipal Airport" gauging station in "Climatography of the United States No. 81, Supplement No. 1," produced and distributed by the NOAA, and NCDC.

Average Annual Flow. The daily average WWTP flow for the calendar year, including the wet and dry seasons.

Average Wet Weather Flow. The daily average WWTP flow from November 1 through April 30.

Maximum Month Wet Weather Flow. The WWTP flow associated with a 5-year return rainfall event for the wettest month during the wet weather season. Typically this definition corresponds to a January flow event; however, Pendleton monthly precipitation probabilities indicate November to have a greater 5-year return event. For this reason, the design November 5-year return (20-percent occurrence probability) rainfall event, 2.32 inches, will be used to define the MMWWF. Rainfall probabilities sites are as published for the "Pendleton Municipal Airport" gauging station in "Climatography of the United States No. 81, Supplement No. 1."

Peak Daily Average Flow. The WWTP flow associated with a 5-year return, 24-hour rainfall event during a period with high groundwater and saturated soils. The design annual 5-year return, 24-hour rainfall event in the City of Pendleton is 1.2 inches, as published in Oregon NOAA Atlas 2 rainfall isopluvial maps.

Peak Instantaneous Flow. The highest peaked WWTP flow attained during a 5-year peak day flow event.

3.3 Evaluation of Existing WWTP Flow Data

Pendleton DMRs were reviewed to establish current flows for the Pendleton WWTP. Following are several observations related to the DMR review:

- Monthly WWTP flows are relatively consistent throughout the summer and winter permit seasons. This is different from Western Oregon, where winter season flows are typically higher due to winter rainfall and minimal impacts from summer irrigation on groundwater elevations. Therefore, some modification of DEQ Guidelines was required to develop reasonable flow projections for the City of Pendleton in Eastern Oregon.
- The WWTP has had ongoing issues with the influent flow meter used for reporting daily flows over the evaluation period. In October 2006, WWTP staff installed a new, higher accuracy magnetic flow meter. The new flow meter is providing more reliable and accurate WWTP flow data, but there is an insufficient period of record with the new meter to adjust the flow projections. WWTP flows should be monitored and design flows re-evaluated during Preliminary Design for proposed WWTP improvements.
- WWTP flows in 2004 are approximately 25% higher than other years in the evaluation period. Discussions with WWTP staff indicate the higher than average flows during this period were the result of an industrial discharge online for only 2004. As this condition no longer reflects current system conditions, 2004 flow data was not used for flow projections.

3.3.1 Current Wastewater Flows

3.3.1.1 Current WWTP Average Annual, Wet and Dry Season Flows

Current annual, summer (dry) season and winter (wet) season Pendleton WWTP flows and annual rainfall are summarized in Table 3.1, City of Pendleton 2001-2006 Rain and Flow History. Flow data were analyzed from 2001 through November 2006 to represent full range of dry and wet weather seasons observed at the WWTP at the present time. As stated previously, 2004 flow data were not used in the development of current WWTP flows.

Based on the information in Table 3.1, the current AAF, ADWF and AWWF for the Pendleton WWTP are 2.53 MGD, 2.44 MGD and 2.63 MGD, respectively.

Table 3.1: City of Pendleton 2001-2006 Rain and Flow History

Season	Year	Rainfall (in)	Average Flow (MGD)	Maximum Flow (MGD)
Annual	2001	10.42	2.54	
	2002	9.79	2.33	
	2003	12.76	2.85	
	2004	13.57	4.21	
	2005	11.66	2.52	
	2006^(a)	8.15	2.43	
	Average		**2.53**	
Dry Weather (May 1-Oct 30)	2001	3.80	2.44	2.51
	2002	3.38	2.24	2.59
	2003	1.92	2.93	3.49
	2004	5.96	4.61	4.80
	2005	5.24	2.54	2.78
	2006^(a)	4.00	2.06	2.30
	Average		**2.44**	
Wet Weather (Nov 1- April 30)	00/01	6.56	2.50	3.20
	01/02	5.48	2.61	4.80
	02/03	9.90	2.81	2.78
	03/04	9.81	3.77	4.58
	04/05	4.28	2.48	3.48
	05/06^(a)	8.76	2.77	3.48
	Average		**2.63**	

Notes:

(a) 2006 data through November.
*shading represents 2004 data not used in current flow analysis.

3.3.1.2 Current WWTP Maximum Monthly Flows

DEQ guidelines developed for Western Oregon suggest a method to calculate maximum month flows for wet and dry seasons based on the probability of exceeding a particular design storm event. Current maximum monthly flows for the winter and summer seasons were then estimated as summarized in the Definitions for Maximum Month Dry Weather Flow and Maximum Month Wet Weather Flow. The summer and winter seasons in the City's NPDES Permit correspond to the dry and wet seasons, respectively.

Maximum Month Dry Weather Flow

DEQ guidelines suggest that MMDWF is to be calculated by correlating rainfall and observed plant data. However, Pendleton WWTP flows during the summer (dry) season are relatively stable compared with the winter (wet) season.

Figure 3.1 summarizes observed monthly average WWTP flows and rainfall from 2001 through 2006, along with historical average rainfall. As shown, average monthly flows to the Pendleton WWTP are relatively consistent throughout the year, even though rainfall is typically lower in the dry season. This could be the result of a well-maintained wastewater collection system, low groundwater impacts on collection system flows or irrigation during the summer months.

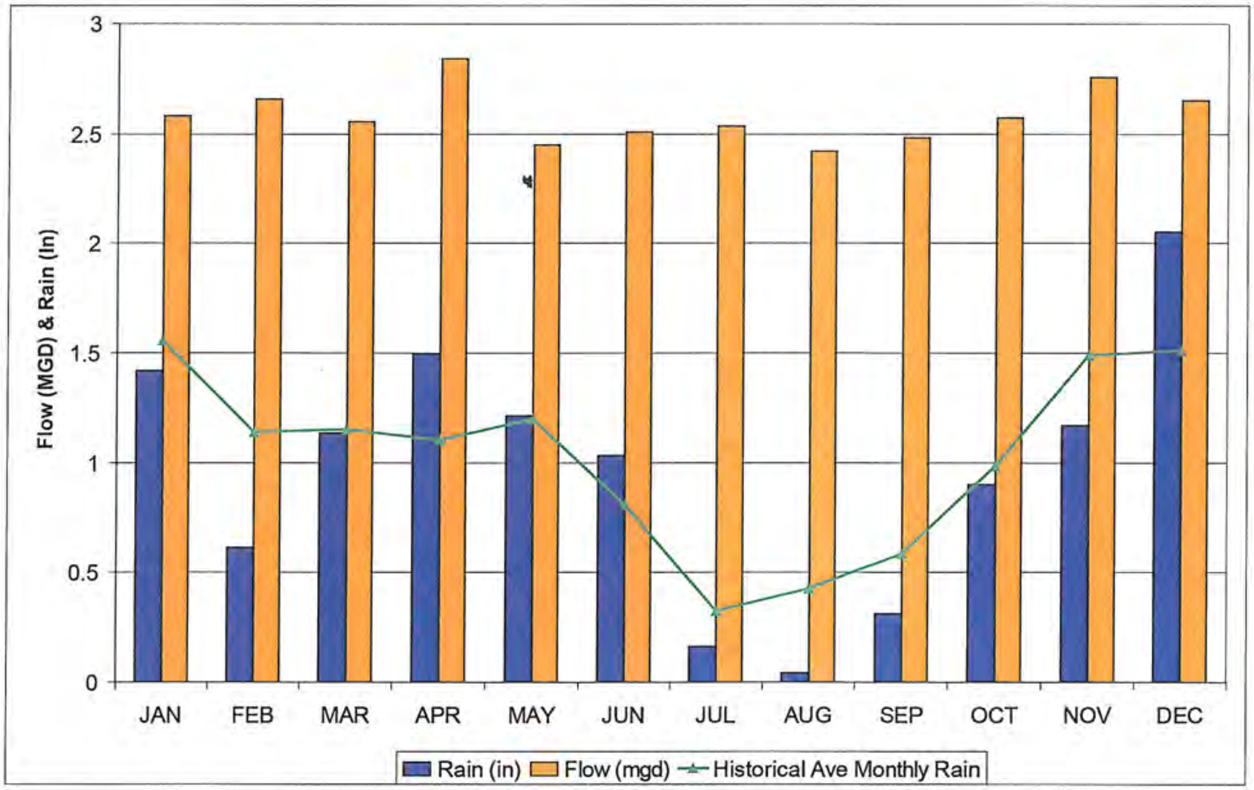


Figure 3.1: Pendleton Average WWTP Flow vs. Average Monthly Precipitation 2001-2006

It is apparent that DEQ Guidelines developed for making WWTP flow projections in Western Oregon will not accurately predict summer (dry) season flows for the Pendleton WWTP, and an alternate methodology for estimating the current MMDWF is proposed.

WWTP summer (dry) season flows during the Evaluation Period were tabulated and sorted from highest to lowest flow and the events were ranked according to the percentage of monthly dry weather flow events greater than the individual event. The percentile of each event was then plotted versus plant flow. Using DEQ definitions regarding plant reliability for the summer (dry) season, the flow event with a 10% exceedence probability based on the rankings was selected as the current MMDWF. Figure 3.2 is a graph of the actual plant dry weather flow events sorted and plotted against percentile of flow events greater.

Based on this alternate methodology, the current MMDWF for the Pendleton WWTP is 2.88 MGD.

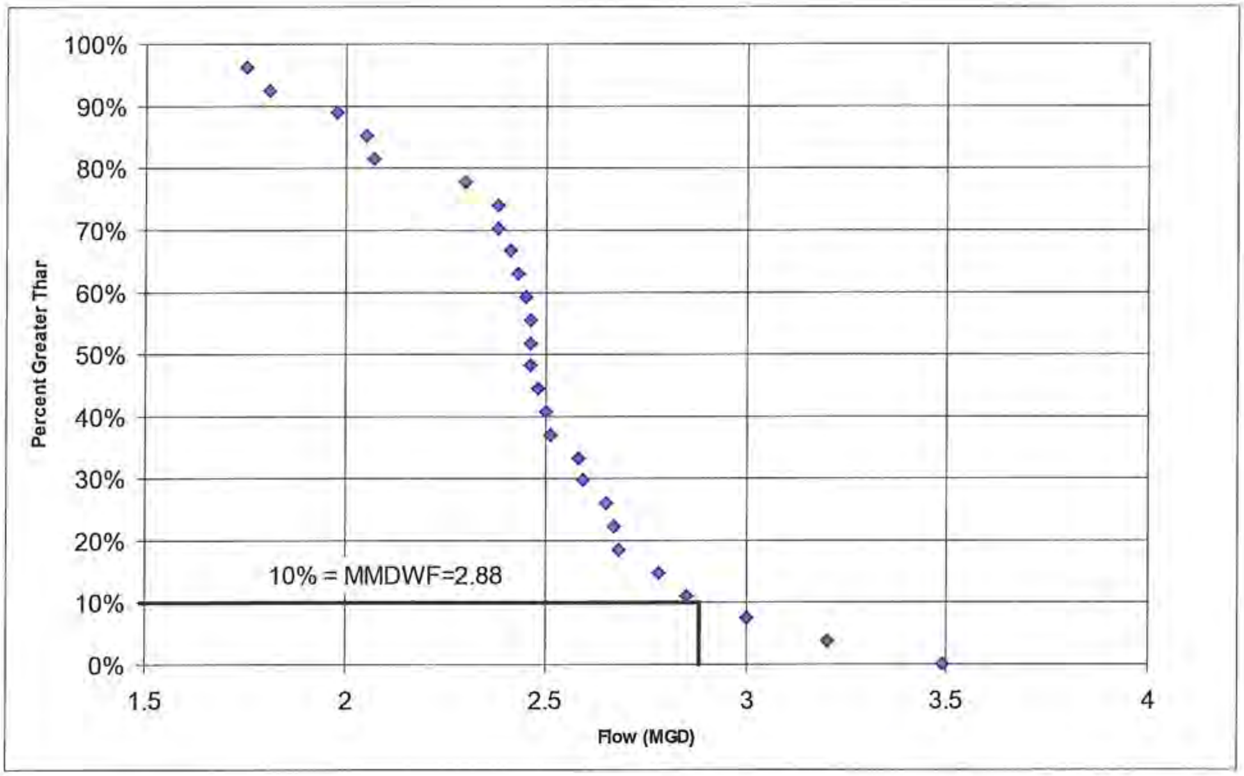


Figure 3.2: Pendleton WWTP Dry Weather Flow vs. Ranked Flow Percentile

Maximum Month Wet Weather Flow

Current MMWWF was estimated following DEQ Guidelines by plotting monthly WWTP flows from 2001 through 2006 versus monthly rainfall. A statistical trendline was then developed based on the scatter plot and the design flow was calculated based on the trendline equation and the design monthly average rainfall for the winter (wet) season from May 1 through October 31.

Figure 3.3 is a graph of the City WWTP winter (wet) season monthly average daily flow versus rainfall. The maximum monthly winter (wet) season rainfall quantity for the City of Pendleton used to estimate the MMWWF is 2.32" for the month of November. Based on this evaluation, the current MMWWF for the Pendleton WWTP is 2.81 MGD.

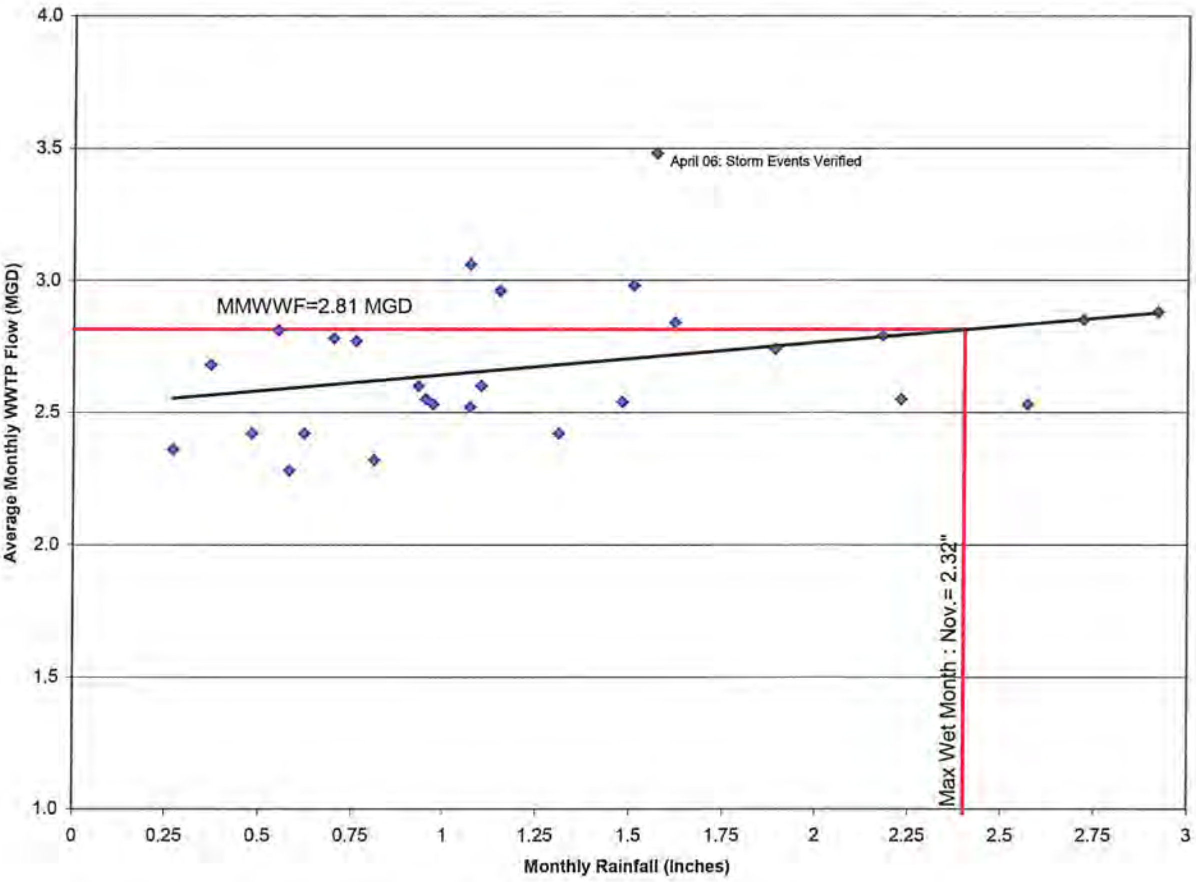


Figure 3.3: Pendleton WWTP Wet Weather Flow vs. Monthly Precipitation

Recommended Current MMDWF and MMWWF

As a means of verifying the reliability of the alternative methodology used for estimating the MMDWF, the same procedure recommended for determining the MMDWF by ranking maximum monthly flows was used to estimate and confirm the estimated MMWWF. Figure 3.4 is a graph of winter (wet) season flow events sorted and plotted versus percentile of flow events greater.

Based on this methodology the MMWWF based on the 20% winter (wet) season reliability criteria, is estimated to be 2.9 MGD. This is close to MMWWF of 2.81 MGD estimated using DEQ Guidelines. As the alternate methodology method for estimating MMWWF produced a result only 3% greater than the DEQ method for estimating MMWWF, the ranking method appears to be comparable and acceptable method for projecting MMDWF.

To maintain consistency in the methodology for estimating the current MMDWF and MMWWF, the alternate methodology will be used for both flow events. Therefore, the current MMDWF and MMWWF for the Pendleton WWTP will be 2.88 MGD and 2.90 MGD, respectively.

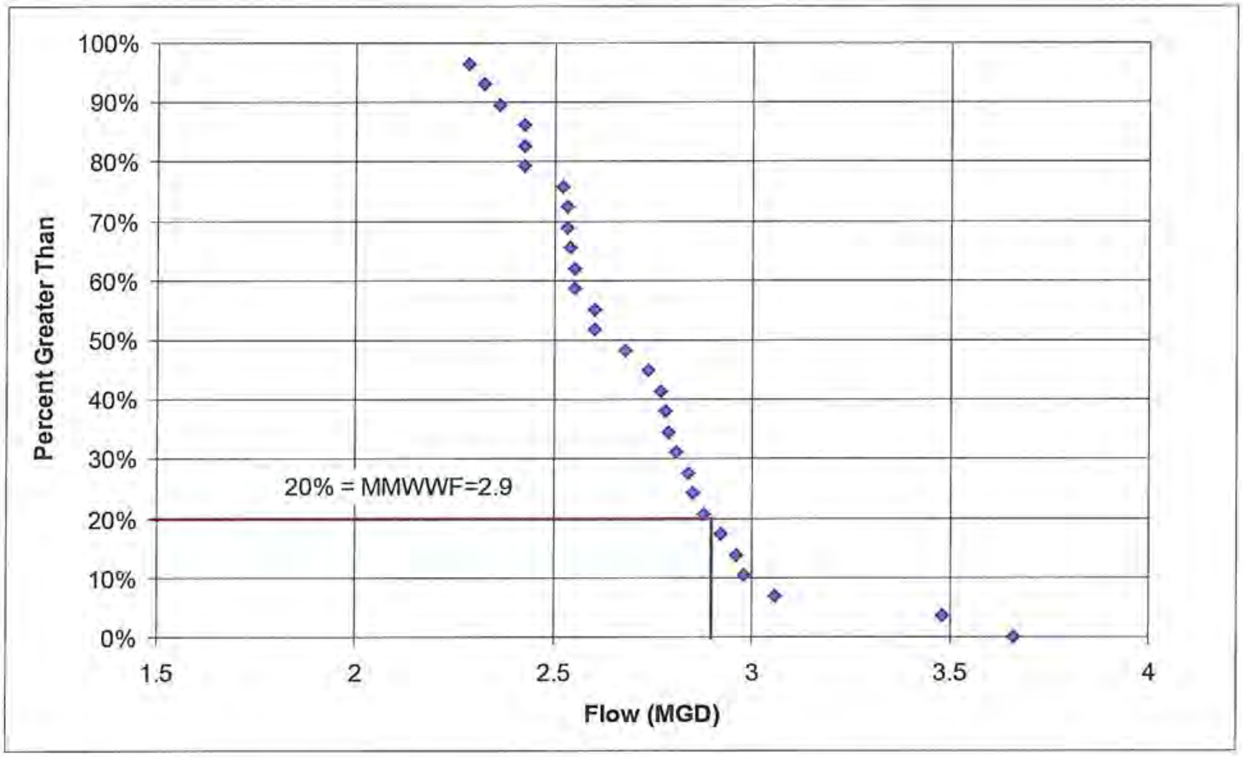


Figure 3.4: Pendleton WWTP MMWWF vs. Ranked Flow Percentile

3.3.1.3 Current WWTP Peak Daily Average Flow

The current Pendleton WWTP PDAF was estimated by evaluating WWTP peak flows and rainfall events during the Evaluation Period. The peak rainfall event used to estimate the current WWTP PDAF was 1.2" which is the annual 5-year return, 24-hour rainfall event for the City of Pendleton from Oregon NOAA Atlas 2 rainfall isopluvial maps.

In order to review historical data, the current WWTP PDAF was estimated by plotting WWTP flows of greater than 1.75 MGD and periods with rainfall greater than 0.23 inches. Figure 3.5 is a graph of Pendleton WWTP peak flow events meeting these criteria from 2001 through 2006. Based upon the evaluation, the estimated current Pendleton WWTP PDAF is 3.47 MGD.

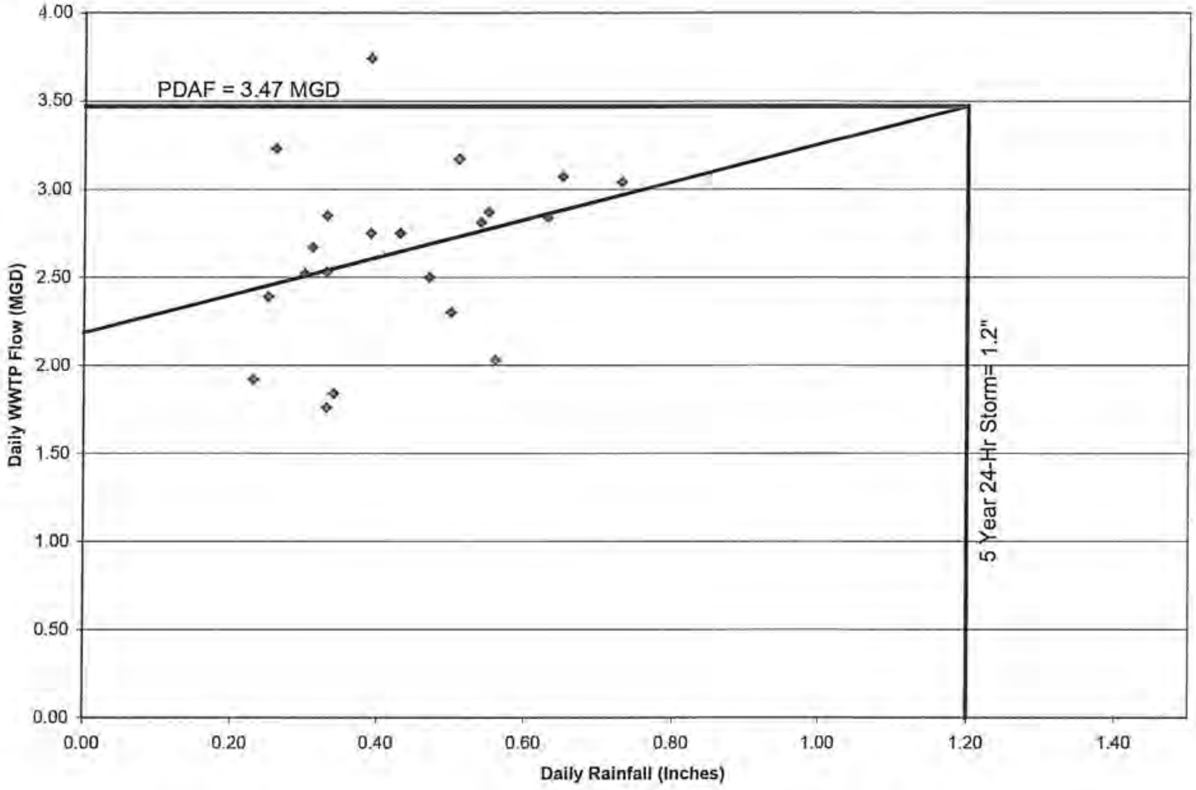


Figure 3.5: Pendleton WWTP Peak Flow Events vs. Daily Precipitation

3.3.1.4 Current WWTP Peak Instantaneous Flow

Current PIF was estimated using the statistical probability procedure specified in the DEQ Guidelines. The procedure is an analytical evaluation assuming certain exceedence probabilities for design flow events:

- The exceedence probability for the AAF is 50 percent. The AAF used to determine the current PIF was 2.53 MGD.
- The exceedence probability for the MMWWF is 8.3 percent. The MMWWF used to determine the current PIF was 2.90 MGD.
- The exceedence probability for the PDAF is 0.27 percent. The PDAF used to determine the current PIF was 3.47 MGD.
- The exceedence probability for the PIF is 0.011 percent.

Figure 3.6 is a probability chart used to estimate the current PIF. The AAF, MMWWF, and PDF were plotted, and the current PIF was estimated by extrapolation. Based on the evaluation, the current PIF for the Pendleton WWTP is 4.34 MGD.

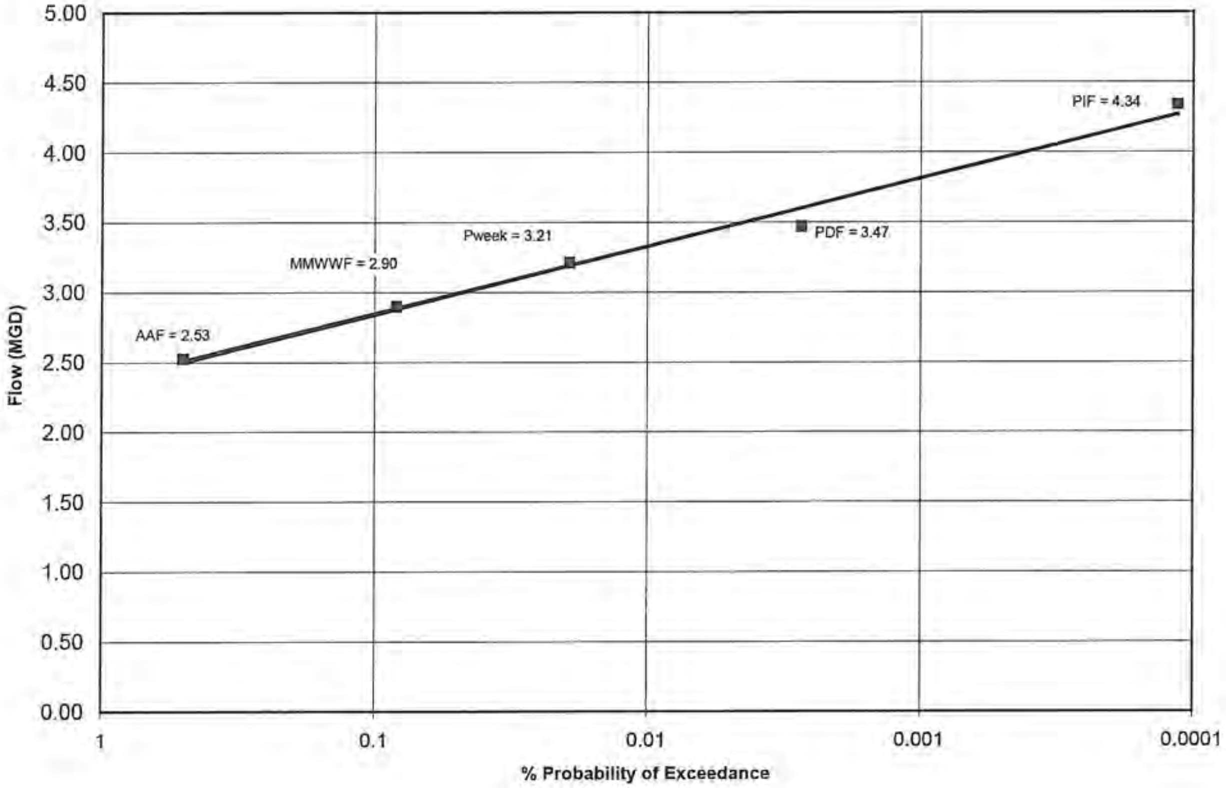


Figure 3.6: Pendleton WWTP Flow vs. Event Probability

3.3.2 Projected (Design) WWTP Flows

Per capita flow contributions and peaking factors for current design WWTP flow events and the estimated 2005 population of 17,025 are summarized in Table 3.2. Per capita flow factors were also developed. The PDF/AAF and PIF/AAF peaking factors are 1.37 and 1.72, respectively.

Table 3.2: Per Capita Flow Contributions for Design Flow Events

Flow Event	Current Flows (MGD)	Peaking Factors	Per Capita Flow (gpcpd)
ADWF	**2.44**	0.97	143
AAF	**2.53**	1.00	149
AWWF	**2.63**	1.04	154
MMDWF	**2.88**	1.14	169
MMWWF	**2.90**	1.15	170
PWF	**3.21**	1.27	189
PDF	**3.47**	1.37	204
PIF	**4.34**	1.72	255

The PDF/AAF and PIF/AAF peaking factors are lower than typically expected for an older wastewater collection system. Potential explanations for the lower than typical peaking factors may include:

- The existing collection system was well constructed and has been well maintained over time, resulting in low I/I.
- I/I that does enter the system is relatively consistent due to rain events in the winter season and irrigation practices in the summer season. This results in a more uniform flow across the year and dampens the peaking events.
- Storm events in Pendleton are typically short duration, high intensity storms, resulting in events that produce high volumes of surface runoff and lower infiltration.

Current per capita flow factors are used to project estimated future flows. Using a 1.4% yearly population increase, future populations have been multiplied with the per capita flow factors to develop estimates of future flow events in 5-year increments as presented below in Table 3.3.

Table 3.3: Future Projected Flows (MGD)

Flow Event	2006	2010	2015	2020	2025	2030
ADWF	2.44					
AAF	2.53	2.71	2.90	3.11	3.34	3.58
AWWF	2.63	2.82	3.02	3.24	3.47	3.72
MMDWF	2.88	3.09	3.31	3.55	3.80	4.08
MMWWF	2.90	3.11	3.33	3.57	3.83	4.11
Pweek	3.21	3.44	3.69	3.96	4.24	4.55
PDF	3.47	3.72	3.99	4.27	4.58	4.91
PIF	4.34	4.65	4.99	5.35	5.73	6.14

3.4 Wastewater BOD and TSS Loads

Similar to the current flow estimation methodology, WWTP DMRs were analyzed for the evaluation period of 2001-2006 (excluding 2004) for monthly average and maximum month influent BOD_5 and TSS concentrations and mass loads. The calculated average and maximum monthly loads were divided by the 2006 projected population of 17,265 people to establish population loading factors for the Pendleton WWTP. Table 3.4, Current BOD_5 & TSS Loads, summarizes the seasonal average and maximum monthly concentrations, loads, and population loading factors.

As can be seen in Table 3.4, Average BOD_5 concentrations are approximately 230 mg/l for both summer and winter seasons, whereas current average monthly TSS concentrations are typically 260 mg/l in the summer and 250 mg/l in the winter.

Table 3.4: Current BOD$_5$ & TSS Loads

		Monthly Average			Monthly Max		
Parameter	2006 Population	Concentration (mg/l)	Load (ppd)	Load Factor (ppcd)	Concentration (mg/l)	Load (ppd)	Load Factor (ppcd)
Summer Season (May 1 through October 31)							
BOD$_5$	17,265	230	4,710	0.273	260	5,620	0.326
TSS	17,265	260	5,350	0.310	310	6,510	0.377
Winter Season (November 1 through April 30)							
BOD$_5$	17,265	230	5,090	0.295	270	6,090	0.353
TSS	17,265	250	5,450	0.316	290	6,700	0.388

Population loading factors developed in Table 3.4 were used in conjunction with estimated population projections for 2030 to estimate future BOD and TSS loads. These projected loads were converted to average and maximum monthly concentrations by using the projected 2030 ADWF and AWWF. Table 3.5 presents 2030 BOD and TSS loading projections for the summer (dry) and winter (wet) weather seasons.

Table 3.5: 2030 BOD and TSS Loading Projections

			Monthly Average		Monthly Max	
Parameter	Population	Flow (MGD)	Load Factor (ppcd)	Load (ppd)	Load Factor (ppcd)	Load (ppd)
Summer Season (May 1 through October 31)						
BOD$_5$	24,100	3.46	0.273	6,580	0.326	7,850
TSS	24,100	3.46	0.310	7,470	0.377	9,090
Winter Season (November 1 through April 30)						
BOD$_5$	24,100	3.72	0.295	7,110	0.353	8,500
TSS	24,100	3.72	0.316	7,610	0.388	9,350

Table 3.6 and Table 3.7 present the projected BOD and TSS summer season and winter season loading projections respectively throughout the design life of the facility.

Table 3.6: Future BOD & TSS Summer Season Loading Projections

		BOD Load (ppd)		TSS Load (ppd)	
Year	Population	Monthly Ave	Monthly Max	Monthly Ave	Monthly Max
Summer Season (May 1 through October 31)					
2006	17,265	4,710	5,620	5,350	6,510
2010	18,250	4,980	5,940	5,660	6,880
2015	19,560	5,340	6,370	6,060	7,380
2020	20,970	5,720	6,830	6,500	7,910
2025	22,480	6,130	7,320	6,970	8,480
2030	24,100	6,580	7,850	7,470	9,090

Table 3.7: Future BOD & TSS Winter Season Loading Projections

		BOD Load (ppd)		TSS Load (ppd)	
Year	Population	Monthly Ave	Monthly Max	Monthly Ave	Monthly Max
Winter Season (November 1 through April 30)					
2006	17,265	5,090	6,090	5,450	6,700
2010	18,250	5,380	6,440	5,760	7,080
2015	19,560	5,770	6,900	6,180	7,590
2020	20,970	6,180	7,400	6,620	8,140
2025	22,480	6,630	7,930	7,100	8,720
2030	24,100	7,110	8,500	7,610	9,350

3.5 WWTP Wastewater Characterization

WWTP staff completed an extensive sampling and testing program to characterize plant influent, primary effluent and recycle streams. These data were used for process design and modeling of secondary alternatives to meet effluent design criteria included in the City's new NPDES Permit. Table 3.8 contains a summary of the parameters sampled in the WQ sampling and testing program used to develop in-plant water quality characteristics.

Table 3.8. Wastewater Sampling and Testing Program

Location	Parameters Sampled
Raw Influent	COD, BOD, Filtered BOD, CBOD, TSS, VSS, NH_3-N, NO_3-N, TKN, Total-P, Ortho-P, Alkalinity, Ca, Mg, Temperature, pH
North Digester and SSB Supernate	COD, Soluble COD, Filtered COD, Filtered BOD, TSS, VSS, NH_3-N, NO_3-N, TKN, Total-P, Ortho-P, Alkalinity, Ca, Mg, pH
Primary Effluent	COD, Soluble COD, Filtered COD, BOD, CBOD, TSS, VSS, NH_3-N, TKN, Total-P, Ortho-P, Alkalinity, Temperature, pH

A summary of minimum, maximum and average concentrations of the parameters for samples collected and tested from April 2006 through February 2007 are summarized in Table 3.9.

Table 3.9. Wastewater Water Quality Characteristics

Parameter	Minimum Concentration (mg/l)	Maximum Concentration (mg/l)	Average Concentration (mg/l)
Raw Influent (10 Samples)			
COD	350	490	445
BOD	221	250	235
Filtered BOD	37	49	45
CBOD	121	204	157
TSS	94	256	183
VSS	94	232	168
NH_3-N	15.0	27.0	21.1
NO_3-N	3.8	5.1	4.5
TKN	15.7	38.0	28.9
Total-P	4.8	20.4	13.0
Ortho-P	2.6	12.6	7.4
Alkalinity	152	184	163
Ca	13.2	18.0	15.6
Mg	4.8	20.4	13.0
Temperature (°C)	15	16	15.2
pH	7.4	7.7	7.5

North Digester Supernate (5 Samples)			
COD	1,650	3,030	2,845
Soluble COD	223	363	283
Filtered COD	1,328	1,376	1,356
Filtered BOD	31	122	53
TSS	960	1,680	1,352
VSS	100	932	1,440
NH_3-N	972	1,260	1,124
NO_3-N	3.6	5.7	4.3
TKN	959	1,250	1,130
Total-P	157.0	183.0	167.7
Ortho-P	107.0	122.0	113.7
Alkalinity	3,800	3,944	3,884
Ca	69.2	82.5	74.8
Mg	31.5	32.3	31.9
pH	*N/C*	*N/C*	*N/C*
SSB Supernate (8 Samples)			
COD	1,583	3,044	2,517
Soluble COD	285	381	342
Filtered COD	1,119	1,402	1,247
Filtered BOD	39	169	77
TSS	260	930	498
VSS	88	820	400
NH_3-N	680	1,032	847
NO_3-N	2.7	3.6	3.1
TKN	600	1080	892
Total-P	97.6	103.0	97.6
Ortho-P	64.6	74.6	69.7
Alkalinity	2,352	3,516	2,950
Ca	56.3	64.0	59.0
Mg	10.2	15.8	12.5
pH	8.0	8.3	8.1

Primary Effluent (12 Samples)			
COD	250	312	285
Soluble COD	67	96	83
Filtered COD	94	157	123
BOD	110	126	116
CBOD	72	105	96
TSS	90	104	99
VSS	87	102	93
NH_3-N	94	157	123
TKN	24	40	33
Total-P	16.1	22.3	18.9
Ortho-P	12.0	17.8	14.3
Alkalinity	152	200	170
Temperature (°C)	13.0	15.0	13.8
pH	7.4	7.7	7.5

Chapter 4: Existing Wastewater System

4.1 Introduction

This Chapter summarizes the City's existing wastewater collection and treatment system, including recommendations developed by Kennedy/Jenks for necessary upgrades of the existing WWTP. The City's wastewater system includes domestic, commercial, and industrial wastewater from the incorporated areas of the City, the CTUIR, the community of Rieth, and the area surrounding the Pendleton Airport.

This Chapter includes:

- Existing Wastewater Collection System;
- Existing Wastewater Treatment Plant;
- WWTP Condition Evaluation Recommendations;
- Unit Process Capacity Evaluation; and
- Summary of Recommended Improvements to the Existing WWTP.

4.2 Existing Wastewater Collection System

The City's existing wastewater collection system dates to the early 1900s when private landowners developed a collective sanitary sewer system. These initial sewer mains were designed without a long term sewer plan and installed under little construction supervision. As the City continued to grow, the private system was eventually turned over to the City and major additions to the sewer system were added along with the Pendleton WWTP. Initial upgrades to the collection system were concrete pipe construction with mortar joints. Major upgrades of the collection system over time included major trunk lines along Court Avenue, 37th Avenue and Dorian Avenue as well as the inverted siphon crossing under the Umatilla River east of the WWTP. Today, the City's wastewater collection system serves an approximate area of 6,500 acres with pipelines ranging in size from 4-inch to 36-inch diameter. The City's existing collection system map including the location of pump stations and the WWTP are shown in Exhibit 4.1.

The City's wastewater collection system serves several areas outside the City limits, including the community of Rieth and the CTUIR. All wastewater flows in CTUIR developed areas are collected via a private collection system that serves approximately 1,020 people. The CTUIR wastewater collection system discharges to the City's wastewater collection system at Manhole 14 of the City's Mission Trunkline, located at Riverside Avenue and N.E. 42nd Avenue. The City both owns and maintains this line upstream of Manhole 14 to the BIA campus where the trunk line terminates.

The Mission Trunkline that collects CTUIR wastewater flows has a maximum capacity of 1 MGD. This is a total allowable flow including all I/I. Agreements between the City and CTUIR stipulate that once the flow in the Mission Trunkline at Manhole 14 (MH 14) reaches 1 MGD, no further service connections upstream of MH 14 are allowed. Based on the recently completed CTUIR sanitary master plan, the flow at MH 14 is anticipated to reach 1 MGD in 2014. CTUIR is currently exploring their own WWTP facility options for when flows reach 1 MGD, thus they may discontinue use of the Cities collection and treatment facilities.

4.2.1 Collection System Planning Documents

The City's Wastewater Collection System Master Plan completed in November 1962 continues to guide the overall development of the collection system throughout the City's wastewater service area. The Master Plan remains applicable to the City because population projections included in the plan estimated a 1990 Pendleton population of approximately 32,000; whereas the estimated 2006 Pendleton population based on Population Research Data maintained by Portland State University is only 17,265, well under the Master Plan projections. Since collection system recommendations were staged with City growth, and the current population has not grown beyond the projected populations, the Master Plan is still a valuable tool for City staff.

4.2.2 Collection System Maintenance and Replacement

The City's Maintenance Division is responsible for the ongoing operation, maintenance and repair of the City's wastewater collection system. Portions of the City's collection system are 80 years old and ongoing work is required to maintain the facilities. To address the aging collection system, the City is in the process of developing a collection system cleaning and replacement program. This program will aim at annual inspection of 33 percent of the system and replacement as necessary. To facilitate this inspection process, the City upgraded its CCTV equipment in December 2006, allowing City staff to continue to provide their own inspection services.

4.2.3 Pump Stations

The City owns, operates, and maintains four pump stations throughout the wastewater collection system. The existing pump stations were evaluated to confirm they have adequate capacity through the end of the planning period in 2030. The City's pump stations include:

- **Westgate Pump Station** – A 250 GPM lift station near the Westgate Avenue (Highway 30) overpass.
- **Barch Pump Station** – A 260 GPM lift station serving the industrial area near Murietta Road.
- **McKay Creek Pump Station** – A 255 GPM lift station serving the Western McKay Creek drainage.
- **Treatment Plant Pump Station** – A 350 GPM pump station serving northwest Pendleton.

- **Rieth Pump Station** – A small pump station serving the community of Rieth came online in June of 2007. The City of Pendleton is now owns, operates, and maintains this new pump station.

4.2.3.1 Pump Station Evaluation Methodology

Current and future flow estimates for each of the four pump stations was determined based upon service area and land use zoning. An average residential density of 3.4 people per household was used to estimate the population served by each pump station. Current AAF and PIF were then calculated using the per capita flows summarized in Chapter 3 Wastewater Characteristics.

The current AAF for pump stations serving primarily commercial and/or industrial areas were estimated based on area flows recommended in the latest version of Wastewater Collection, Treatment and Reuse (Metcalf and Eddy 2003). Peaking factors developed in Chapter 3 Wastewater Characteristics were then used to determine the current PIF.

Projected 2030 pump station AAF and PIF were projected based on the basin area for each pump station and the population projections in Chapter 3. Future AAF and PIF were then used to evaluate the long range capacity of each pump station.

4.2.3.2 Westgate Pump Station

Westgate Pump Station is a lift station installed in 2003 to replace an existing pump station due to the construction of the new Western Avenue (Highway 30) overpass. The pump station is a Hydromatic duplex, submersible package station supplied by Pump Tech. Westgate Pump Station Design Data is summarized in Table 4.1.

Table 4.1: Westgate Pump Station Design Data

Item	Value
Pump type	Submersible
Number of Pumps	2
Firm Capacity (GPM)	250
TDH (ft)	20
Force Main Size (in)	4
Force Main Length (ft)	30
Pump Horsepower	5
Level Control	Ultrasonic
Installation Date	2003

A locked control panel adjacent to the pump station houses the pump controls and alarms. Overflow alarms are transmitted by radio to the Public Works Department. Standby power is provided through a portable diesel engine generator located at the public works shops. In the event of a power failure, wastewater flows back up into the influent sewer until the portable generator is connected. There is a potential issue with an upstream crack in the influent sewer planned for future repair by City maintenance crews.

Potential safety issues with the pump station include a lack of fall protection measures and lack of a safety grate on the wet well lid.

Projected 2030 AAF and PIF for Westgate Pump Station are 62 GPM and 151 GPM, respectively, which is under the pump station firm capacity of 250 GPM.

4.2.3.3 Barch Pump Station

Barch Pump Station is a Cornell Duplex Submersible posi-prime package pump station with integral pump station and wet well constructed in 1990 to serve the industrial area south of I-84 along Murietta Road. Barch Pump Station Design Data is summarized in Table 4.2.

Table 4.2: Barch Pump Station Design Data

Type	Duplex Submersible
Pump Type	Submersible
Number of Pumps	2
Firm Capacity (GPM)	260
TDH (ft)	20
Force Main Size (in)	4
Force Main Length (ft)	450
Pump Horsepower	3
Level Control	Mercury Floats
Installation Date	1990

Pump controls are located in a chamber approximately 4 feet below ground and within the wet structure. An elevated platform allows maintenance crews to access the controls. Electrical enclosures in the hazardous wet well environment are explosion-proof as required by NEMA-7.

The pump station electrical service is overhead and adjacent to the wet well. Radio telemetry is mounted on the electrical service panels, and transmits alarms and basic pump station data to the Public Works Department. The main power switch is easily accessible and unlocked. Public Works staff indicates there has never been a problem with the accessible power switch, but it is recommended that site access be limited or the switch be otherwise secured. Standby power is provided through a portable diesel engine generator located at the public works shops.

Projected 2030 AAF and PIF for Barch Pump Station are 66 GPM and 110 GPM, respectively, which is under the pump station firm capacity of 260 GPM.

4.2.3.4 McKay Creek Pump Station

The McKay Creek Pump Station is a Duplex, submersible lift station constructed in 2005 on the west side of McKay Creek that replaced the 41st Street Pump Station. McKay Creek Pump

Station serves the western McKay Creek drainage, including anticipated future development up the McKay Creek valley. Approximately 500 lineal feet of 18-inch diameter gravity sewer was installed along with the pump station to serve McKay Community Park and adjacent parcels. McKay Creek Pump Station Design Data is summarized in Table 4.3.

Table 4.3: McKay Creek Pump Station Design Data

Type	Duplex Submersible
Pump Type	Submersible
Number of Pumps	2
Firm Capacity (GPM)	255
TDH (ft)	35
Force Main Size (in)	4
Force Main Length (ft)	600
Pump Horsepower	5
Level Control	Mercury Floats
Installation Date	2005

Pump station controls are located in locked panels adjacent to the pump station. Overflow alarms are transmitted by radio to the Public Works Department. Standby power is provided through a portable diesel engine generator located at the public works shops. In the event of a power failure, wastewater flows back up into a new 18" gravity sewer until the portable generator is connected.

Potential safety issues with the pump station include a lack of fall protection measures and lack of a safety grate on the wet well lid.

Projected 2030 AAF and PIF for McKay Creek Pump Station are 127 GPM and 210 GPM, respectively, which is under the pump station firm capacity of 255 GPM.

4.2.3.5 Treatment Plant Pump Station

The Treatment Plant Pump Station is a dry pit, wet well type pump station originally installed in 1970 to transport wastewater from the northwest part of the City to the WWTP, including the area served by Barch Pump Station. An 18-inch influent gravity sewer of unknown material runs under the Umatilla River, feeding the Treatment Plant Pump Station. The pump station is composed of a concrete wet well and a galvanized steel dry pit. Treatment Plant Pump Station Design Data is summarized in Table 4.4.

Table 4.4: Treatment Plant Pump Station Design Data

Type	Vertical Mounted Duplex
Pump Type	Submersible
Number of Pumps	2
Capacity (GPM)	350
TDH (ft)	26
Force Main Size (in)	8
Force Main Length (ft)	1250
Pump Horsepower	5
Level Control	Mercury Floats
Installation Date	1970/1998

The pumps are operated in duplex mode based on float switches in the wet well. A high alarm level switch signals the operators that a high level condition exists. This pump station is powered by a dedicated electrical service. Standby power is provided through a portable diesel engine generator located at the WWTP.

The pump station has a 1,250 foot-long, 8-inch diameter ductile iron force main which discharges to an 8-inch diameter gravity sewer line. The gravity sewer line then connects into the 36-inch diameter influent sewer upstream of the WWTP headworks. Forcemain flows discharging into the gravity line of the same size create a potential flow capacity issue.

Projected 2030 AAF and PIF for Treatment Plant Pump Station are 260 GPM and 441 GPM, respectively. Based on the flow projections, future peak flows are expected to exceed the current capacity of the pump station by approximately 2013. Since the wet well and dry pit appear to be in good condition, it is anticipated that the existing pumps will be upsized and the existing pump station structures re-used when upgrade is required.

4.2.3.6 Rieth Pump Station and Force Main

A fifth pump station serving the small community of Rieth (located on Old Pendleton Road southwest of Pendleton) was connected to the City of Pendleton's wastewater collection system in June 2007. Rieth is a residential community with approximately 70 homes and several restaurants. The Rieth Sewer District is not responsible for any required replacement or repair; however, the City is responsible for all operation, repair and maintenance of the pump station and force main. The force main will connect into the City's gravity system along Murietta Road.

Blue Mountain Forest Products will have two connections to the Rieth force main. An onsite grinder pump will discharge collected wastewater into the force main and through the City of Pendleton collection system.

4.3 Existing Wastewater Treatment Plant

The Pendleton WWTP is located at the confluence of the Umatilla River and McKay Creek at the southern end of the City. The WWTP is a complete-mix secondary treatment plant originally constructed in 1952. The plant was last upgraded in 1970, when a major plant expansion increased the peak flow capacity to 16.3 MGD, according to the original design documents. Shortly after the 1970 upgrades, several large industrial discharges shut down operations, and consequently, influent flows never climbed to the plant design capacity. Although WWTP staff has done several in-house WWTP improvements such as replacing a secondary clarifier drive mechanism and installing a fine screen at the headworks, the plant has had no major upgrades since 1970.

Currently the plant treats an AAF of approximately 2.5 MGD. PIF projected for design year 2030 is 6.14 MGD (4265 GPM). Current and projected design flows are summarized in Chapter 3 of this Facility Plan. Based upon current flow projections for the next planning phase, it appears that the Pendleton WWTP has more capacity than necessary. As a result, the capacity upgrades will be minimal, and recommended upgrades focus on replacing mechanical treatment processes that have outlived their useful service life and are becoming ongoing maintenance issues.

A discussion of the major WWTP facilities are summarized below and described in detail along with maximum design capacity in the sub-sections that follow.

- **Headworks:** Influent Screening and Grit Removal
- **Primary Treatment:** Primary Clarifiers and In-Plant Pump Station
- **Secondary Treatment:** Aeration Basins and Secondary Clarifiers
- **Disinfection & Outfall:** Chorine Contact Chamber, flow monitoring and river outfall
- **Solids Treatment:** Solids Thickening, Solids Pumping, Anaerobic Digesters, Sludge Storage Basin, Solids Drying Beds, and Septage Receiving Station
- **Electrical, Instrumentation and Controls:** Electrical Service, Motor Control Centers, Existing Electrical Equipment, and Plant Instrumentation and Automation
- **Support Facilities:** Laboratory and Operations Building, and Maintenance and Storage Facilities.

None of the Pendleton WWTP as-builts or original design plans available included a hydraulic profile of the existing facilities. Therefore, a preliminary hydraulic profile was developed for the facility plan based upon a survey conducted on 13 December 2006, existing as-builts, and flows developed in Chapter 3 of this Facility Plan. The future peak design flow of 6.14 MGD (4,265 GPM) is approximately 40 percent of the 1970 WWTP design peak flow capacity of 16.3 MGD (11315 GPM). Therefore, existing unit processes will likely have adequate hydraulic and treatment capacity for projected 2030 design flows. However, additional treatment requirements summarized in Chapter 5, Basis of Planning, will require treatment upgrades to meet new effluent Ammonia-Nitrogen NPDES Permit limits.

The Existing WWTP Site Plan and the Existing Process Schematic are summarized in Exhibits 4.2 and 4.3, respectively. The Existing Hydraulic Profile for the WWTP is included as Exhibit 4.4.

4.3.1 Existing WWTP Condition Evaluation

Due to the lack of available information on existing WWTP facilities, a field evaluation of existing facilities was conducted by treatment plant staff and Kennedy/Jenks Consultants on 15 and 16 November 2006. The evaluation consisted of a detailed review of all existing WWTP facilities and a summary of design data that is known by City staff such as:

- Installation Date
- Manufacturer
- Equipment Type
- Model Number
- Serial Number(s)
- Design Operating Point Data
- Motor Nameplate Data
- Condition Description.

Information from the WWTP Condition Evaluation was used to develop a list of recommended improvements to the existing facility based on equipment and facilities that have outlived their useful service life.

Following is a summary of WWTP unit processes including design data tables, estimated unit process capacity, condition assessment and any recommendations for upgrades.

4.3.2 Headworks

Raw sewage from a 36-inch interceptor sewer enters the WWTP at the headworks structure. The original headworks consisted of a 19 MGD comminutor set in a 4-foot-wide influent channel, a 4-foot-wide bar screen bypass channel, and a horizontal flow grit chamber with a circular grit collector. Bypasses are provided for both the comminutor and the grit chamber independently of one another. Both the influent channel and bypass channel have a capacity of 23.2 MGD (16,110GPM), which is greater than the current projected 2030 flow of 6.14 MGD (4265 GPM).

4.3.2.1 Influent Screening

In 1998, plant staff replaced the 19 MGD influent comminutor with a 5.2 MGD JWC Environmental *Auger Monster*, which is a combination of a *Channel Monster* grinder followed by an auger fine screen. The grinder was installed to handle sheets and other items that occasionally arrive at the headworks from the prison facility. In 2004, plant staff installed another *Channel Monster* grinder in the bypass channel upstream of the bar screen to prevent debris from entering the plant when the main influent channel was down for service. Although the capacity of the *Channel Monster* and *Auger Monster* grinder and screen is less than the projected PIF of 6.14 MGD, it is greater than the projected PDAF of 4.91 MGD. Should flows exceed the capacity of the fine screen for part of the peak day, the WWTP staff can use the bypass channel and installed grinder.

The mechanical fine screen, installed in 1998, is a perforated-plate ¼-inch stainless steel drum screen, a dual shafted grinder and a spiral lifting screw. Screenings are lifted up the auger where they are washed and dropped into a collection bag. Dewatering occurs as the screened materials rise out of the channel and are conveyed along the auger screw towards the dumpster.

Table 4.5 presents the design data of the influent grinder and fine screen.

Table 4.5: Grinding and Screening Design Data

Grinders	
Number	2
Manufacturer	JWC Environmental "Channel Monster"
Capacity, EA	5.2 MGD
Installation Year	1998 & 2004
Horsepower, EA	5 HP
Fine Screen	
Number	1
Manufacturer	JWC Environmental "Auger Monster"
Opening Size	¼-inch
Peak Capacity	5.2 MGD
Installation Year	1998
Manual Screen	
Opening Size	1.5 inch
Peak Capacity	23.2 MGD

Condition Assessment & Recommendations – Influent Screening

- The *Channel Monster* installed in the bypass channel is in almost new condition as it is only 3 years old and rarely used.
- The *Channel Monster* and the *Auger Monster* installed in the influent channel also appear to be in good condition after being installed for approximately 9 years. Although the influent *Channel Monster* and *Auger Monster* will likely need to be replaced or refurbished within 10 to 15 years as they approach the end of their design life, no improvements are recommended at this time.
- The existing metal building enclosing the headworks is deteriorating due to the corrosive environment. This metal building needs to be replaced with a building that allows removal of equipment and contains HVAC and odor control.

- Electrical controls to the fine screen and two grinders are via 480 Volt-rated plugs and sockets. These connections should be upgraded to be hard-wired with flexible conduit.

4.3.2.2 Grit Removal

The grit removal system consists of a 9-foot 9-inch channel that directs flow from the headworks through flow vanes and into a 20-foot square horizontal-flow grit chamber. The concrete chamber has a 20-foot diameter grit collection rake mechanism that directs settled particles into a grit hopper located along the centerline of the walkway. The downstream corners of the tank are sloped to prevent accumulation in areas unreachable by the circular arms.

Typically, horizontal-flow grit chambers like the one at the Pendleton WWTP are designed to operate at a flow velocity of approximately 1 FT/S, allowing heavier inert particles to settle while maintaining organics in suspension. Calculating velocities at projected minimum and maximum flows expected through 2030 gives the following velocity range:

- Maximum Velocity @ PIF 2030 = 0.39 FT/S

- Minimum Velocity @ Average Dry Weather Flow (ADWF) 2006 = 0.16 FT/S.

In all flow ranges, velocities appear to be lower than typical design velocity of 1 FT/S, most likely due to the original grit chamber design for a peak flow of 16.3 MGD. Therefore, it appears the grit chamber may collect significant organics due to lower settling velocities, but the majority of these organics are likely returned to the liquid stream through grit washing and compaction. Table 4.6 presents the design data for the grit removal system.

Table 4.6: Grit Removal System Design Data

Grit Chamber		
Length	20 feet	
Width	20 feet	
Max Velocity @ 2030 PIF	0.39 FT/S	
Min Velocity @ 2006 ADWF	0.16 FT/S	
Grit Separator		
Manufacturer	Wemco	
Installation Date	1970±	
Serial No.	7097053	
Motor HP & RPM	1/2 HP, 1720 RPM	
Voltage & Phase	430 v, 3 ø	
Comments	Appears at end of service life	
Grit Chamber Drive		
Manufacturer	Eimco	
Installation Date	1970±	
Serial No.	72886-01A	
Motor HP & RPM	3/4 HP, 1800 RPM	
Voltage & Phase	430 v, 3 ø	
Comments	Original motor	
Grit Pump		
Manufacturer	PACO	
Installation Date	2003	
Serial No.	1969702B	
Design Operating Point	250 GPM, 15 Ft Head	
Pump Speed	350 RPM	
Pump Impeller Size	8.25 inches	
Motor HP & RPM	3/4 HP, 1800 RPM	
Voltage & Phase	430 v, 3 ø	
Grit Removal Data		
Plant Grit Removal Rate	2	CY/MGD of flow
Typical Design Removal Rate	0.5-5.0	CY/MGD of flow

A grit removal system with inadequate performance will result in a build up of grit and other heavier particulates in the primary clarifiers and aeration basins. The Pendleton plant typically disposes of approximately 2 CY of grit per week, equating to approximately 2 CF per million gallons of flow. Typical values range from 0.5 - 5.0 CF per million gallons of flow. Grit removal appears to be adequate.

A grit pump takes the captured grit to the grit washer building. This concrete block building houses a Paco grit pump and 12-inch Wemco Grit Auger. The Paco pump capacity is approximately 250 GPM at 15 feet total head and pumps the grit chamber slurry into the grit auger. The Paco pump was replaced in 2003 while the Wemco Grit Auger appears to be quite a bit older.

Condition Assessment & Recommendations – Grit Removal Facilities

- The grit chamber appears to be oversized for projected flows, and settling of organics may be a problem due to velocities less than 1 FT/S
- The grit chamber mechanism and drive have outlived their useful service life
- The Paco Grit Pump is new and in good shape
- The Wemco Grit Auger is older but appears to be operating adequately
- The grit washer building houses the NEMA 3 electrical controls for both units which should be upgraded to NEMA 7 enclosures to meet electrical code.

Based on the above assessment, the following improvements are recommended for the Grit Removal Facilities:

- The grit chamber mechanism, drive, and grit auger appear to have outlived their service life and should be upgraded with newer facilities.
- Electrical enclosures in the grit washer building should be upgraded from NEMA 3 to NEMA 7 to meet electrical code.
- New NEMA 7 electrical enclosures should be located outside the grit building and either mounted on the outside wall of the existing building or located in a new building adjacent to the existing grit building. If the grit classifier could be relocated to the new building recommended to house the headworks facilities, the electrical enclosures would not need to be relocated.

Downstream Conveyance Facilities to Primary Clarifiers

Grit captured in the grit chamber and subsequent grit processing equipment is collected in disposal bags and removed to a landfill. Grit washings are also collected and returned into the 36-inch pipe to primary clarifier No. 2.

Three flow control structures are used to direct flow from the headworks to the primary clarifiers. Slide gate #1 to the east of the grit chamber, when open, directs flows to Primary Clarifier No. 1. Slide gate #12 to the west of the headworks sends flow to Primary Clarifier No. 2 via the Primary Clarifier junction box. This junction box, #13, has a slide gate set at a fixed elevation which allows high flows to overtop and bypass primary clarification. This slide gate has also been bypassed at times when aeration basin F/M ratios were too low in an attempt to bring more BOD into the treatment basin.

Pipes to Primary Clarifier No 1 and No. 2 are 30-inch and 36-inch diameter, respectively. Each conveyance pipe is sized adequately for future projected flows.

4.3.3 Primary Treatment

The Pendleton WWTP has two existing 90-foot diameter primary clarifiers that are 8.6 feet deep. The primary clarifiers have full redundancy with only one primary clarifier in service at a time.

Primary sludge and WAS from the secondary clarifiers are co-thickened in the primary clarifiers. Because the primary clarifiers are used for co-thickening, the typical SOR design values are lower than for primary clarifiers used for thickening only primary sludge. Although the WAS flow is small and has little impact on the total flow through the primary clarifiers, the lower SOR values compensate for the significant increase in solids loading to the clarifiers as a result of the introduction of secondary WAS.

4.3.3.1 Primary Clarifiers

Primary clarifier No. 1, east of the secondary digester complex, was the original clarifier when the plant was constructed in 1952 and is located on the west side of the digester complex. Clarifier No. 2, west of the secondary digester complex, was added during the 1970 improvements and is on the east side of the digester complex.

Primary clarifier No. 1 has not been updated since 1970. The major components of this clarifier, including the center well, drive unit, rake arms, scum skimmer, and launder walls are old and exhibit a serious rusting problem. The interior launder walls are in good condition and appear to have had a coating system applied. The clarifier drive unit is a chain system by the Dorr Company.

Primary clarifier No. 2 has recently (Spring 2006) had a major overhaul. The major components of the clarifier have been upgraded, including – center well, drive unit, arm rakes, scum skimmer, launder weirs, and launder wall coatings. The new drive unit is an Eimco C30HT.

Primary clarifiers are normally designed on the basis of surface loading rates (commonly termed "overflow rate") expressed as GPD/ft^2. Typical design overflow rates presented in Table 4.7 range from 600-800 GPD/ft^2 for average flow and 1200-1500 GPD/ft^2 for peak flow. As the primary clarifiers were originally designed to accommodate a peak flow of 9.5 MGD each, only one primary clarifier is required to service the projected design flows, allowing the other clarifier to serve as a redundant unit. Surface overflow rates with one unit out of service fall within the typical design range for average flows and fall under the typical design range observed for peak flows. The primary clarifiers are estimated to have an ultimate capacity of 19 MGD with both units in service. Table 4.7 presents design parameters for the Pendleton WWTP primary clarifiers along with typical design parameters for clarifiers with co-thickening.

Co-thickening within the primary clarifiers combines primary influent sludge with WAS from the secondary clarifiers. This increased solids loading is compensated by the lower SOR. Typical average and peak SORs are 600-800, and 1,200-1,500, respectively. Comparing SORs with one clarifier out of service (full redundancy) to these typical values, it appears that average SOR falls within the expected range and peak SOR is a lower than the expected range. However, the overall performance of the primary clarifiers is in the acceptable range.

Table 4.7: Primary Clarifier Design Data

No.	2	
Diam, Ea	90	Lin.Ft.
Depth, Ea	8.6	Lin.Ft.
Vol, Ea	0.41	MG
Total Surface Area	12717	ft^2
Total Weir Length	565	Lin.Ft.
Detention Time @ MMWWF, Full Redundancy	2.4	Hr
Surface Overflow Rate, Full Redundancy		
SOR @ MMWWF	646	GPD/ft^2
SOR @ PIF	966	GPD/ft^2
Surface Overflow Rate, Combined		
SOR @ MMWWF	323	GPD/ft^2
SOR @ PIF	483	GPD/ft^2
Weir Overflow Rate, Full Redundancy		
WOR @ MMWWF	14540	GPD/Lin.Ft.
WOR @ PIF	21730	GPD/Lin.Ft.
Weir Overflow Rate, Combined		
WOR @ MMWWF	7270	GPD/Lin.Ft.
WOR @ PIF	10865	GPD/Lin.Ft.
Ultimate Capacity @ Peak SOR of 1500 GPD/Sq.Ft.		
Each	9.5	MGD
Total	19	MGD
Typical Design Data		
Typical Detention Time	1.5-2.5	Hrs
Typical Average SOR	600-800	GPD/ft^2
Typical Peak SOR	1,200-1,500	GPD/ft^2
Typical WOR	10,000-40,000	GPD/Lin.Ft.

Condition Assessment & Recommendations – Primary Clarifiers

Following are conclusions from the condition assessment related to the Primary Clarifiers:

- Current incoming flows are well below the primary clarifier design flowrates, requiring only one unit during normal operation. Performance through one clarifier has been above normal with an average removal rate between 40 and 60 percent

- Primary clarifier No. 1 is in poor mechanical condition and in need of equipment replacement. Rusting has corroded the majority of available surface area across the exposed equipment

- Co-thickening in the primary clarifiers can lead to septic conditions and odors during the warm summer season, and also can increase the organic loading on the aeration basins due to organic acid carry-over. If it becomes an operational issue, this can be remedied by separate WAS thickening. However, based strictly on capacity, separate WAS thickening is not required at this time.

Based on the above assessment, the following improvements are recommended for the primary clarifiers:

- Replacement of drive mechanism in primary clarifier No. 1; and
- Based strictly on capacity, the co-thickening operations in the primary clarifiers appear satisfactory. If it becomes an operational issue in the future, separate WAS thickening should be considered.

Upstream Conveyance to In-Plant Pump Station

Primary effluent is collected in each clarifier launder and sent onwards to the plant pump station. Flows from each clarifier are collected in a mutual pipe and carried to Junction Box #13 located to the north of Primary Clarifier No. 2. A 36-inch concrete pipe moves towards another junction box that allows flows to bypass the remaining plant and are sent directly to the outfall. Typically, this gate is closed and primary effluent is sent to the plant pump station.

In the event the lower plant is offline, the two primary clarifiers can be operated in series to allow an increased solids capture rate prior to discharge.

4.3.3.2 In-Plant Pump Station

The original in-plant pump station is located between the two secondary clarifiers. The concrete structure houses three vertical turbine solids handling pumps. Each pump sits on a 4-foot concrete base above the wet well. The well is partitioned into three cells, each feeding an individual pump. The 1970s improvements installed three vertical turbine pumps, each with a capacity of 7,000 GPM at 16 feet of head. It appears that one of these pumps was replaced in 1986 and another in 2003. No records could be found on the third pump, therefore it is assumed to be the original 1970 installation.

Pump 1 is a Cascade vertical turbine pump installed in 2003. The pump is a model 16-P with an estimated capacity of 7,000 GPM at 17.5 feet total head. This pump has a red base and is closest to the chlorine contact chamber. A 2003 upgraded added a variable frequency drive to the pump.

Pump 2 is also a Cascade vertical turbine pump installed in 1986. This is a model 12-Mixed Flow pump with an estimated capacity of 3,000 GPM at 16 feet total head. This pump is in the middle of the three installations.

Pump 3 is a Layne and Bowler, Inc. vertical turbine pump. The only information available on the stainless steel pump nameplate is the pump number given as 54195. The lack of information suggests that the pump was installed in 1970, with a design capacity of 7,000 GPM at 16 feet of head.

Under a power outage situation when the pump station is unable to operate, the redundant primary clarifier will provide approximately 1.5 hours of storage at future peak hour flows. Local power officials have stipulated that 95 percent of the time, all power will be restored within an hour of outage. Available storage provides a level of safety, however, upgrades to the generator set to provide redundant power are recommended. Further discussion of recommended electrical upgrades can be found in Chapter 4.3.7.

Table 4.8 summarizes the design data for the in-plant pump station.

Table 4.8: In-Plant Pump Station Design Data

Number of Pumps	3
Type	Vertical Turbine
Station Firm Capacity	
GPM	10,000
TDH (ft)	16
Wet Well	
Chambers	3
Volume/Chamber (gal)	3,875
Pump 1	
Installation Year	2003
Flow (GPM)	7,000
TDH (ft)	17.5
HP	50
Pump 2	
Installation Year	1986
Flow (GPM)	3,000
TDH (ft)	16
HP	20
Pump 3	
Installation Year*	1970
Flow (GPM)(a)	7,000
TDH (ft)*	16
HP	40

Note:
(a) Assumed, as no other records available.

Condition Assessment & Recommendations – In-Plant Pump Station

The following summarizes the condition assessment of the in-plant pump station:

- The concrete structure and associated visible pipe and valves appear to be in good condition
- The splitter box used to control incoming flows also appears to be in good condition.
- Pump 1 appears to be in good condition and has a long service life
- Pump 2 and Pump 3 appear to be at the end of their service life

- Existing secondary process and discharge piping appears to be in satisfactory and serviceable condition

- Current average and maximum monthly flows are less than original pump design flows reducing the efficiency at which the pumps are able to operate

- Reports from plant staff indicate the slide gate at the bypass control structure has been removed due to a rust buildup problem. Plant staff have installed a steel plate set to a specific elevation with allows water to overflow and bypass during extremely high flow events.

Based on the above assessment, the following improvements are recommended for the In-Plant Pump Station:

- Replace Vertical Turbine Pumps 2 and 3, along with associated valves, piping, and process control requirements. This replacement should include optimization of the pump station, allowing Pump 1 to be used during larger flow events.

- Add an additional VFD to either Pump 2 or 3.

Downstream Conveyance to Aeration Basins

The in-plant pump station lifts primary effluent into an elevated concrete structure where flows are then directed to one of two aeration basins. Downstream concrete gravity pipelines to Aeration Basin 1 and Aeration Basin 2 are 36-inch and 48-inch diameter, respectively.

4.3.4 Secondary Treatment

The 1970 secondary treatment system improvements consisted of two complete-mix aeration basins with surface mixers and two secondary clarifiers. Aeration Basin 1 is the smaller basin currently in service. Aeration Basin 2 has been out of service for many years. The two secondary clarifiers are in service and provide full redundancy with only one clarifier in service at a time.

4.3.4.1 Aeration Basins

The plant currently has two aeration basins with a combined total volume of approximately 3.88 MG. Aeration Basin 1 is a smaller basin approximately 115 feet by 155 feet with a maximum side water depth of 10 feet, creating a total storage volume of approximately 0.93 MG. Aeration Basin 2 is approximately 310 feet by 155 feet with a maximum side water depth of 10 feet, equaling an approximate volume of 2.95 MG. Adjustable weirs allow operation at varying water depths and plant staff have indicated a typical operating depth of 9.5 feet as shown in Table 4.9 which summarizes the design data for Aeration Basins 1 and 2.

Table 4.9: Aeration Basin Design Data

Aeration Basin No. 1		Aeration Basin No. 2	
Overall Basin Data		Overall Basin Data	
Length (ft)	155	Length (ft)	310
Width (ft)	115	Width (ft)	155
Water Depth (ft)	9.5	Water Depth (ft)	10
Basin Side Slopes	2 H: 1V	Basin Side Slopes	2 H: 1V
Total Volume (MG)	0.93	Total Volume (MG)	2.95
Hydraulic Retention Time, 2006 ADWF	9 hrs	Hydraulic Retention Time, 2006 ADWF	21.7 hrs
Hydraulic Retention Time, 2030 ADWF	6.4 hrs	Hydraulic Retention Time, 2030 ADWF	18.7 hrs

Basin Capacity	Aeration Basin 1	Aeration Basin 2	Total Capacity
Current Operation (MGD)	3	9	12
Ultimate Capacity (MGD)	4.7	15.3	20.0

Based on the influent flows, Pendleton is only required to operate Aeration Basin 1. Process performance data on Aeration Basin 1 is presented in Table 4.10, along with typical design data. As can be seen, average force main ratio of 0.4 falls within the typical design data range, and the average sludge age of 3.2 days falls on the low end of normal design range. Hydraulic detention times fall on the higher end of the expected range for current day ADWF, but fall within the typical expected range of design MMWWF. However, average MLSS concentrations of 724 mg/L are much lower than the typical design range of 1,500-3,500 mg/L.

Based upon current plant operation of an average sludge age of 3.2 days and average MLSS concentration of 724 mg/l, it is estimated that Aeration Basin 1 has a capacity of 3 MGD and Aeration Basin 2 has a capacity of 9 MGD. Process capacity could be increased by boosting average sludge age to a more typical number such as 10 days and MLSS concentrations up to 3500 mg/l. It is estimated that with these changes, the aeration basins have an ultimate capacity based upon volume of 4.7 MGD for Aeration Basin 1 and 15.3 MGD for Aeration Basin 2. This gives a total theoretical capacity of 20.0 MGD.

Table 4.10: Aeration Basin No. 1 Performance Data

Performance Data	
Average Sludge Age	3.2 days
Average MLSS	724 mg/l
Average F/M Ratio	0.4
Detention Time @ ADWF 2006	9.0 hours
Detention Time @ MMWWF 2030	5.4 hours
Typical Design Data Range	
Typical Sludge Age Range	3-15 days
Typical MLSS Range	1500 - 3500 mg/L
Typical F/M Range	0.2-0.6 1/days
Typical Detention Time Range	4-8 hours

Reports from WWTP staff indicate that they've had trouble with filamentous bacteria, and this is a likely reason why the MLSS and solids retention time are at the low end of the design spectrum, as a higher F/M would likely increase filament growth. A potential cause of high filamentous bacteria is the WWTP's practice of co-thickening in the primary clarifiers. Co-thickening increases the amount of readily biodegradable substrate, and when this substrate is fed into the aeration basin, it encourages the growth of filamentous bacteria over floc-forming bacteria. Options for discouraging the growth of the filamentous bacteria, such as selector basins will be discussed in Chapter 5 of this plan.

Currently Aeration Basin 1 has two surface aerators that were installed back in the 1970s upgrades. Plant staff keeps all required maintenance parts for the aerators onsite and regularly service the units. The aerators appeared to be functioning adequately when the Plant condition assessment was performed in December 2006, however they have reached the end of their service life. Additionally, plant staff has indicated that the aerators are not able to meet the dissolved oxygen requirements during the summer season. While a diffused air grid typically increases the oxygen transfer capabilities of the basin, these installations require water depths greater than 10 feet. Table 4.11 summarizes the design data of the surface aerators.

Table 4.11: Aeration Basin No. 1 Surface Aerators Design Data

Design Data	Aerator 1	Aerator 2
Manufacturer	Unknown	Unknown
Installation Date	1970	1970
Serial No.	70-8-204	70-8-204
Motor Nameplate	General Electric Triclad	General Electric Triclad
Motor Horsepower	75 HP	60 HP
Voltage & Phase	460 v, 3 ø	460 v, 3 ø

Condition Assessment & Recommendations – Aeration Basins

The following summarizes the condition assessment of the aeration basins:

- Both basins were installed during the 1970 improvements. Onsite evaluations have uncovered areas where the concrete has significant deterioration. Areas within Aeration Basin 2 have exposed rebar and significant concrete cracking.
- Since significant improvements are proposed for the two aeration basins, with repairs, both basins can be returned to adequate operational condition.

Based on the above assessment, the following improvements are recommended for Aeration Basins:

- Verify that Aeration Basin 2 does not have cracks or other structural deficiencies to limit future use. Check integrity of hydrostatic relief and drain valves and repair as necessary.
- Complete structural repairs on the existing concrete in both Aeration Basins.
- Replace existing low efficiency surface aerators in Aeration Basin 1 with modern high efficiency models or a submerged air diffuser system and blowers.

Downstream Conveyance to Secondary Clarifiers

Mixed liquor suspended solids from the aeration basins are sent downstream via gravity towards the secondary clarifiers. Both aeration basins have individual 36-inch concrete outlet pipes that are tee connected within aeration basin 2 where the pipe transitions to a 48-inch concrete pipe. This 48-inch pipe moves MLSS flows into the secondary clarifier control structure, where two gate valves are used to direct flow to one of the two clarifiers.

Aeration basin effluent flows into a concrete splitter structure located just northeast of the plant pump station. This splitter box has two slide gates that can direct flows to either secondary clarifier. These slide gates are badly rusted, allowing leakage and making operation difficult and should be replaced.

4.3.4.2 Secondary Clarifiers

The plant has two existing 115-foot diameter secondary clarifiers, both of which have a side water depth of 11 feet. The secondary clarifiers were installed as part of the 1970 improvements. Neither clarifier has a Stamford baffle on the interior vertical walls, which prevents short circuiting of the clarifier. Both clarifiers have fiberglass weirs with a brush system connected to the mechanism arms to provide continuous cleaning. The brushes and weirs appear to be in good conditions. Algae buildup does not appear to be a significant problem, likely due to the brush system. Neither clarifier is fitted with a scum baffle wall, resulting in floating particles reaching the effluent weirs.

Secondary Clarifier No. 1 has a Rex Chainbelt clarifier drive with 1 HP Reliance Type P motor. The paint is worn and the unit appears old. Secondary Clarifier No. 2 has a Winsmith/Rex

Chainbelt drive with 1 HP Reliance motor. The unit's paint system is aged and the unit appears worn. The center well is in adequate condition. New stairs have been installed at the walkway.

Typical side water depths on secondary clarifiers are between 12 to 20 feet. A deeper depth provides greater operational flexibility as well as improved performance especially at plants with low-density activated sludge. While the existing depths are not ideal, with the improvements made in the aeration basins, the clarifiers will continue to be used.

Secondary clarifiers are normally designed on the basis of surface loading rates (commonly termed "overflow rate") expressed as gallons per square foot of surface area per day (GPD/ft^2). Typical design overflow rates presented in Table 4.12 range from 400 - 700 GPD/ft^2 for average flows and 1,300 GPD/ft^2 for peak flow. However, given the shallow side water depths of the clarifiers and the potential for solids carry-over at high flow rates, peak overflow rates are only estimated as 1,000 GPD/ft^2.

Based upon the peak overflow rate of 1,000 GPD/ft^2 it is estimated that the secondary clarifiers each have a maximum capacity of 10.4 MGD and have a combine total capacity of 20.8 MGD. As current projected PIF is 6.14 MGD (4,265 GPM), only one secondary clarifier is required to be in operation, which allows the WWTP to use the other clarifier as a redundant unit. Surface overflow rates with one unit out of service fall within the typical design range for average flows and fall under the typical design range observed for peak flows.

Typical solids loading rates for secondary clarifiers on conventional activated sludge systems range from 20 - 40 pounds per day per square foot (lbs/day/ft^2). Based on a MLSS loading rate of approximately 724 mg/l and a future projected peak flow of 6.14 MGD (4,265 GPM), each clarifier would receive an estimated 6.0 lbs/day/ft^2 load with one unit out of service. The existing clarifiers are adequately sized and will not require any capacity improvements.

Table 4.12: Secondary Clarifier Design Data

Number	2	
Diam, Ea	115	ft
Depth, Ea	13	ft
Vol, Ea	1.0	MG
Total Surface Area	20760	ft^2
Total Weir Length	722	Lin.Ft.
Average MLSS Concentration	724	mg/l
Detention Time @ MMWWF, Full Redundancy	5.9	Hr
Surface Overflow Rate, Full Redundancy		
SOR @ MMWWF	400	GPD/ ft^2.
SOR @ PIF	590	GPD/ ft^2.
Surface Overflow Rate, Combined		
SOR @ MMWWF	200	GPD/ ft^2
SOR @ PIF	300	GPD/ ft^2
Weir Overflow Rate, Full Redundancy		
WOR @ MMWWF	11380	GPD/Lin.Ft.
WOR @ PIF	17000	GPD/Lin.Ft.
Solids Loading Rate, Full Redundancy		
SLR @ MMWWF	4.8	lbs/day/ft^2
SLR @ PIF	6.0	lbs/day/ft^2
Ultimate Capacity @ SOR of 1000 GPD/Sq.Ft.		
Each	10.4	MGD
Total	20.8	MGD
Typical Design Data		
Typical Detention Time	1.5-2.5	Hrs
Typical SOR @ MMWWF	400-700	GPD/ ft^2
Typical SOR @ PIF	1,000	GPD/ ft^2
Typical WOR @ PIF	20,000-30,000	GPD/Lin.Ft.
Typical SLR @ MMWWF	20-30	lbs/day/ft^2
Typical SLR @ PIF	40	lbs/day/ft^2

Design values for the Pendleton WWTP secondary clarifiers compare favorably with the typical design values at the bottom of Table 4.12; therefore, no additional secondary capacity is required. However, the 11-foot side water depth on the existing secondary clarifiers is less than the typical design depth of 12 to 20 feet. Tanks with less depth can have difficulty containing low-density activated sludge (i.e., high SVI) and low-density activated sludge blankets are more easily disturbed by hydraulic fluctuations in shallow clarifiers. It is anticipated that the proposed aeration basin improvements will help control the activated sludge SVI; therefore, improvements to the secondary clarifier side water depths are not recommended at this time.

Both secondary clarifier drive mechanisms are Winsmith Rex Chainbelt models installed during the 1970s upgrades. Although observations indicate that clarifier drive mechanisms operate adequately, they are old and worn, and are at the end of their useful life. However, ancillary features of the secondary clarifiers such as FRP weirs, brushes, walkways, stairs, and center feed wells appear to be in good condition. Table 4.13 summarizes the secondary clarifier drive mechanism design data.

Table 4.13: Secondary Clarifier Drive Mechanisms Design Data

Secondary Clarifier 1 Drive Mechanism	
Manufacturer	Winsmith Rex Chainbelt
Installation Date	1970
Serial No.	B556-154A
Motor HP & RPM	1.0 HP, 1730 RPM
Voltage & Phase	230/460 v, 3 ø
Comments	FRP Weirs, Brushes & Walkway good. No Baffle walls. Old, worn paint.
Secondary Clarifier 2 Drive Mechanism	
Manufacturer	Winsmith Rex Chainbelt
Installation Date	1970
Serial No.	B556-154A
Motor HP & RPM	1.0 HP, 1730 RPM
Voltage & Phase	440 v, 1 ø
Comments	Drive Mechanism has outlived service life New stairs, good brush system No baffle walls or FRP weirs Center well & walkway okay

Condition Assessment & Recommendations – Secondary Clarifiers

The following summarizes the condition assessment of the secondary clarifiers:

- Both clarifiers' drive mechanisms were installed 37 years ago and are at the end of their design lives. Mechanisms appear old and worn, and paint and protective coatings are in poor condition

- Ancillary clarifier features such as center feed wells, walkways, stairs, brushes, and FRP weirs are in good condition and can continue to be used.

- Both clarifiers lack Stamford baffles. The current configuration of the effluent launders could allows velocity and density currents in the clarifier to carry solids directly up the side wall of the clarifier to the effluent weir. The addition of Stamford baffles will redirect these currents back toward the center of the clarifier at a downward angle, thereby reducing the amount of solids reaching the effluent weir.

- Both clarifiers lack an interior scum baffle. While scum collection on secondary clarifiers is usually less than that found on primary clarifiers, a scum baffle and skimming system will significantly reduce, and nearly eliminate, scum carryover into the launders. This scum system could be connected into the primary clarifier scum system.
- Reports from plant staff indicate the two 36-inch slide gates in the influent splitter box leak and the gate operators are deteriorating. Both gates need to be replaced.

Since the secondary clarifiers exhibit good settling characteristics, very minimal floating debris, and little particle carry-over, Stamford baffles and Scum Baffles will not be recommended.

Kennedy/Jenks recommends the following improvements to the existing secondary clarifiers to enhance performance and improve process control flexibility:

- Replacement of both drive mechanisms.
- Installation of Stamford baffles & Scum Baffles.
- Replace two leaking 36-inch slide gates in secondary clarifier influent splitter box.

Downstream Conveyance to Chlorine Contact Chamber

Each secondary clarifier is filled with MLSS from the aeration basin. MLSS flows into the secondary clarifier control structure via a 48-inch concrete pipe where flows can be directed to one of the two clarifiers. Piping from the control structure to each clarifier is through 36-inch concrete pipe.

Secondary effluent overflows the clarifier weirs and falls into a 36-inch concrete pipe. Both clarifier effluent lines are T-connected and continue into the CCC via a 36-inch concrete pipe. This pipe discharges into the CCC splitter box located at the east end of the chamber. Two 36-inch slide gates control flow into one of the two contact basins.

The west Secondary Clarifier can bypass the splitter box and drop directly into the north cell of the chlorine contact chamber. This bypass line also has a chlorine injection port allowing for continued disinfection during bypass.

4.3.5 Disinfection and Outfall

Disinfection facilities include the existing chlorine contact chamber. Chlorine gas and calcium thiosulfate (CaS_2O_3) are stored onsite for chlorination and dechlorination. The CCC connects to the outfall pipeline that discharges into a side channel of McKay Creek and ultimately into the Umatilla River. The edge of the Regulatory Mixing Zone for the WWTP outfall is the downstream confluence of McKay Creek and the Umatilla River.

4.3.5.1 Chlorine Contact Chamber

The CCC is 145-feet long, 60-feet wide and 8.2-feet deep and has a total volume of 0.54 MG. The CCC is divided into two 30-foot-wide channels, which allows one channel to be out of service for maintenance or repairs. Flow enters the chamber via a header channel with multiple inlet ports. Each inlet port has steel plate six-inches from the concrete wall to help dissipate velocity. Table 4.14 summarizes the CCC design data.

Table 4.14: Chlorine Contact Chamber Design Data

Overall Basin Data	
Length (ft)	145
Width	Two 30' Sections
Water Depth (ft)	8.2
Total Volume (MG)	0.54
Length:Width Ratio	5
Detention Times, 2030	
ADWF	3.7 Hrs
MMWWF	3.2 Hrs
PIF	2.1 Hrs
Ultimate Design Capacity(a)	38.9 MGD

Note:
(a) Estimated by providing 20 minutes contact time.

The capacity of the existing CCC is adequate for design flows. At the design PIF, the hydraulic retention time is 2.1 hours, which is greater than the typical design value of 20 minutes. The CCC has an ultimate capacity of 38.2 MGD, which is estimated as the maximum flow that would receive a detention time of 20 minutes, as required by DEQ guidelines.

Conveyance Facilities

The 2-foot-wide effluent launder collects final effluent at the downstream end of the basin and directs flows into the four-foot collection box leading into the 36-inch concrete outfall pipe. The outfall pipe carries flows through a chlorine residual reader and flow meter prior to discharging into McKay Creek/Umatilla River.

Condition Assessment & Recommendations - Chlorine Contact Chamber

The contact chamber appears to be in good structural condition. However, the existing CCC is constructed as two long, wide channels with no baffling, resulting in significant potential for short-circuiting as observed by WWTP plant staff. Therefore, lengthwise baffles are recommended to create flow channels to improve plug flow conditions and minimize short-circuiting. Typical design length:width ratios for optimum plug flow conditions range from 10:1 to 40:1. Configuring each side of the chamber into five flow channels provides a length:width ratio of approximately 26:1. In addition, plant staff reports that the contact basin is sloped away from the sludge pump used to dewater the chamber making it difficult to clean. Modifications to the contact basin should include a method for improving contact basin cleaning.

Kennedy/Jenks recommends the following improvements to the existing chorine contact chamber to enhance performance and improve process control flexibility:

- Baffle walls could be added to eliminate any short circuiting with the current set up. An ideal length to width ratio of 40:1 could be achieved using a serpentine flow path with the installation of two full-length baffles.
- Slope basin floor from east to west towards the sump location to allow ease of cleaning.
- Add piping from the CCC to the SSB to facilitate solids removal during a cleaning and dewatering process.

4.3.5.2 Disinfection Chemicals & Storage

The Pendleton WWTP uses gaseous chlorine for disinfection and calcium thiosulfate (CaS_2O_3) for dechlorination. Chlorine gas is stored in the chlorine storage building, located east of the chlorine contact chamber while calcium thiosulfate is stored in the building at the west end of the contact chamber. Bulk storage of calcium thiosulfate is stored in the machine shed adjacent to Primary Clarifier No. 2.

The 1970s upgrades included a gaseous chlorination system for effluent disinfection that consisting of four 150-pound cylinders and scales, and six reserve cylinders. Each cylinder and scale has its own regulator. Chlorine residual is set by a chlorinator that is paced based upon the plant flow meter. As no other information is available about the chlorination system, it is assumed that there have been no upgrades to the 1970s chlorination facilities upgrades with the exception of the chlorine solution pump that was installed in April of 2000.

Plant staff installed a dechlorination system in 2006 consisting of two 2,000-pound totes of CaS^2O^3 with two peristaltic metering pumps. In January 2007, plant staff installed a storage tank for CaS^2O^3 to replace the totes. Table 4.15 summarizes the disinfection chemicals design data.

Table 4.15: Disinfection Chemicals Design Data

Gaseous Chlorine Storage System	
Cylinder No	10 lb
Cylinder Size (EA)	150 lbs
Total System Storage	1500
No Scales & Regulators (EA)	4
Scale Manufacturer	Wallace & Tiernan
Regulator Manufacturer	US Filter
Chlorine Monitor	Toxguard
Installation Date	1970
Chlorine Solution Pump	
Manufacturer	Paco
Serial No.	00B00248
Capacity	Unknown
Installation Date	April, 2000
Chlorine Demand	
Demand @ 2006 AAF	41 PPD
Residual @ 2006 AAF	0.41 mg/l
Dechlorination System	
Dechlorination chemical	CaS^2O^3
Storage Tank Capacity	(2) 275 gal Totes
Storage Tank Installation Date	January, 2007
Pump No.	2
Pump Type	Peristaltic Metering Pump
Pump Manufacturer	LMI Chemical
Pump Capacity (EA)	1 GPH
Pump Capacity (Total)	2 GPH
Pump Installation Date	Unknown

Existing chlorine demand was estimated from DMR summaries from July 2003 through November 2006 provided by the plant. From this dataset, the average annual chlorine demand was 41 PPD and average annual residual is estimated to be 0.4 mg/L.

Chorine Gas Injection

The plant's chorine gas injection system includes four 150-pound chlorine gas connections that feed into a Wallace and Tiernan V10K chlorine solution pump. Although only one 150-pound cylinder is online at one time, the chlorine building houses six reserve cylinders, for a total on-site storage capacity of 1,500 pounds. Monitoring of chlorine gas is performed using a Toxguard chlorine monitor. Chlorine gas is injected into the secondary clarifier effluent carrier water, and the chlorine solution is injected into the 36-inch gravity line that feeds the chlorine contact chamber.

Condition Assessment & Recommendations – Disinfection Chemicals & Storage

The following summarizes the existing condition assessment:

- The chemical storage building is in good condition.
- The existing chlorine solution feed pump is only 7 years old and is expected to have a service life of another 10 to 15 years. A second chlorine solution feed pump is required for system redundancy, and this pump can be sized to meet the range of future projected chemical demands in conjunction with the existing feed pump.
- There needs to be effluent flow measurement for automatic control of the feed equipment.
- Metering equipment controls are mounted on the interior of the building and controlled by a vacuum system. No scrubbing equipment is installed; however, in the event of a chlorine gas leak plant staff would not have a need to enter the chlorine building.
- Depending upon future chlorine demands, a chlorine gas scrubbing system may be required for the system to be in compliance with IBC/IFC. Onsite generation could also be considered and would not require a gas scrubbing system.

Kennedy/Jenks recommends the following improvements to the existing chemical dosing system to enhance performance and improve process control flexibility:

- Installation of a second chlorine solution feed pump for system redundancy

Depending upon future chemical demands and the quantity of chlorine gas online, a chlorine gas scrubbing system may be required. However, this will be examined in more detail in Options Analysis.

4.3.5.3 Outfall Piping and Discharge

The existing WWTP outfall is a 36-inch pipe originating from the effluent sampling and flow meter manhole. The outfall pipe discharges into a concrete box structure which discharges flows into a side channel of McKay Creek. This outfall structure was originally located directly on the banks of McKay Creek. Over time, the creek has migrated to the south, moving the main channel flows away from the discharge location.

Condition Assessment & Recommendations – Outfall Piping & Discharge

The existing WWTP outfall piping is in good structural condition and has adequate capacity for projected peak flows. Recommended outfall improvements include relocating further downstream to a location closer to the confluence of McKay Creek and the Umatilla River to maintain the existing outfall mixing zone.

4.3.5.4 Sampling and Flow Monitoring

Influent

The Pendleton WWTP does not currently have any influent flow monitoring. This will be required by DEQ in the plant upgrades. Options and recommendations for influent flow monitoring will be developed in the Options Analysis.

Effluent

Effluent water quality testing is performed in the manhole south of the chlorine contact chamber. A small enclosed shed houses the effluent meter. Approximately 100 feet downstream of the effluent quality meter is a second manhole housing the water flow meter. This meter was previously placed much closer to the effluent quality meter at a location with high turbulence causing inaccurate readings. The new location downstream is more favorable and appears to produce more accurate metering.

Condition Assessment & Recommendations

The existing effluent flow monitor is a new ultra-sonic level sensing gauge with integral velocimeter installed in a manhole along the outfall pipeline downstream of the chlorine contract chamber. Effluent sampling is through a composite sampler located in the manhole immediately downstream of the chlorine contact chamber. Although, each of these facilities is in good condition, consideration of installing an effluent Parshall flume may provide more accurate effluent flow monitoring than the combination of a level sensor and a velocimeter.

Kennedy/Jenks recommends the following improvements to the existing flow monitoring:

- Replace combination effluent flow monitoring system consisting of a level sensor and velocimeter with a Parshall flume located downstream of the chlorine contact chamber
- Install method of influent flow monitoring.

Solids Treatment

Solids treatment includes pumping, thickening anaerobic digestion, storage, dewatering, and septage receiving. Normally, WAS is pumped from the RAS splitter box to the headworks. Alternately, WAS can be drawn directly from the secondary clarifiers and can also be discharged to the SSB. WAS is co-thickened with primary sludge in the primary clarifiers. Thickened sludge is pumped to the primary anaerobic digester, which displaces digested sludge to the two secondary anaerobic digesters. Digested sludge in the secondary anaerobic digesters is thickened through settling and decanting. Decant is either returned to the headworks or conveyed to the SSB, depending on characteristics of the waste stream. Digested sludge is pumped from the secondary anaerobic digesters to the SSB. Digested sludge is further thickened in the SSB through settling and decanting. Contents of the SSB are periodically pumped to the sludge drying beds for dewatering. Dewatered sludge is then excavated from the drying beds and hauled away for land application during the summer months.

Solids Thickening

As mentioned previously, the existing WWTP combines thickening of primary sludge and WAS within the existing primary clarifiers. Although co-thickening is not an uncommon practice and the existing primary clarifiers appear to have sufficient capacity for this function (based on a typical solids loading rate of 8 lbs/ft^2 of clarifier area), performance depends heavily on settling characteristics of the WAS and the retention time of solids in the primary clarifiers. If the SRT is excessive, significant biological activity can occur leading to release of odors due to septic conditions, rising sludge due to formation of gases, and an increase in readily biodegradable substrate due fermentation of the raw waste.

Increased readily biodegradable substrate can cause greater growth of filamentous bacteria and a surge in the initial air demand at the front of plug flow aeration basins, unless the primary effluent is first introduced into an anoxic selector. During the warmer summer months when biological activity is typically greater, these problems can become more pronounced. It was reported that during the summer months the existing aeration basins often need to be operated at a lower concentration of MLSS to control filamentous bacteria. This could be due in part to both the surface aerators inability to provide the required dissolved oxygen concentrations and greater biological activity in the primary clarifiers causing fermentation of the raw waste and heavier loading of readily biodegradable substrate.

The current loading of about 4,650 pounds of sludge per day for co-thickening produces a loading rate of about 0.4 pounds lbs/ft^2/day. Based on a maximum solids loading rate to the primary clarifiers of 8 lbs/ft^2/day and assuming a direct correlation between flow and sludge produced, the maximum sludge loading to the primary clarifiers for co-thickening is well in excess of the hydraulic capacity of the clarifiers. Therefore, hydraulics will limit primary clarifier capacity.

Currently, co-thickened sludge from the primary clarifiers typically has a solids concentration of 2.6 to 3.0 percent. This is common for co-thickening applications in clarifiers with a 1:12 floor slope and operating at a low sludge blanket depth to minimize SRT in the clarifiers. Throughout a number of site visits to the WWTP, no odors or rising sludge associated with the primary clarifiers were observed, suggesting that the SRT in the primary clarifiers is not excessive. Planned improvements to the aeration basins, which include the addition of initial anoxic zones, will select against the growth of filamentous bacteria, even with higher loads of readily biodegradable substrate during the warmer summer months. Based on this information, it appears that continued use of the primary clarifiers for co-thickening is feasible for a period of time. It is possible that a deeper sludge blanket (allowing greater compaction of solids) could be maintained during the cooler winter months to improve co-thickening performance.

Solids Pumping

Solids pumping includes pumping of WAS, primary sludge, and digested sludge. Currently, there are no RAS pumps. Instead, RAS is conveyed from the secondary clarifiers to the RAS splitter box by gravity. Plant staff uses the splitter box head to control the return rate, which limits process control flexibility. Similarly, there are no pumps used to transfer sludge solids from the primary anaerobic digester to the secondary anaerobic digesters. As sludge is pumped into the primary anaerobic digester, it displaces digested sludge that is conveyed to the secondary digesters by gravity through an overflow pipe, thereby maintaining a constant level in the primary anaerobic digester.

4.3.5.4.1 WAS Pumping

The Secondary Sludge Pump Station, located in between the two secondary clarifiers and just south of the In Plant Pump Station, houses a single WAS pump (also termed "Waste Sludge Pump") and a single sludge transfer pump (also termed "Sludge Feed Pump"). The WAS pump is used to convey WAS either directly from the secondary clarifier sludge hoppers or from the RAS splitter box to the WWTP headworks for co-thickening in the primary clarifiers. Alternately, discharge from the WAS pump can be conveyed to the SSB. Digested Sludge stored in the SSB is conveyed to the drying beds using the sludge transfer pump. Alternately, discharge from this pump can be directed to the anaerobic digesters. Additionally, the sludge transfer pump can serve as a backup to the WAS pump. Design criteria for the existing WAS and sludge transfer pumps are displayed in Table 4.16 below.

Table 4.16: WAS and Sludge Transfer Pump Design Criteria

Service	WAS	Digested Sludge/WAS
Type	Centrifugal	Positive Displacement
Manufacturer	PACO	Moyno
Number	1	1
Capacity		
Flow (GPM)	250	85
TDH (ft)	15	-
Motor HP	3	10

Assuming the improved secondary treatment process will have a similar sludge yield, the required WAS flow to match the influent load projections will be in the range of 25 to 50 GPM, on a continuous basis. Therefore, the existing WAS pump has plenty of capacity. However, existing SCADA controls are limited. Control of the WAS pump should be automated so that sludge wasting can be performed frequently and at routine intervals to maintain stable biology in the secondary treatment process. The existing sludge transfer pump also appears to have sufficient capacity. Assuming suspended solids removal in the primary clarifiers, sludge yield in the secondary treatment process, co-thickened solids concentration, and volatile solids destruction in the anaerobic digesters remains similar to recent performance, loading from the secondary digesters to the SSB would be on the order of 20,000 GPD, which is equivalent to about 15 GPM on a continuous basis.

4.3.5.4.2 Primary Sludge Pumping

There are two primary sludge pumps, one for each primary clarifier. Each is located in a separate Sludge Pump Station building. These pumps are used to convey co-thickened primary sludge from the primary clarifiers to the primary anaerobic digester. Overall, the primary sludge pumping equipment appears to be in good condition and capable of being utilized for many more years. However, when maintenance on the sludge pumps is necessary, there is very little space available for the staff to work within each Primary Sludge Pump Station building. The only means to remove a pump from each building is via hand up a flight of stairs.

Design criteria for the existing primary sludge pumps are displayed in Table 4.17 below.

Table 4.17: Primary Sludge Pump Design Criteria

Service	Primary Sludge
Type	Positive Displacement
Manufacturer	Carter Pump
Number	2
Capacity	
Flow (GPM)	85
TDH (ft)	80
Motor HP	5

Similar to WAS pumping, existing SCADA controls are limited. Control of primary sludge pumping should be automated to maintain a relatively constant sludge feed into the primary digester, which will promote stability and may improved overall performance in the anaerobic digestion process.

Currently, the flow of sludge into the primary digester averages about 20,000 GPD total, or about 10,000 GPD per clarifier. This is equivalent to less than 10 GPM on a continual basis. Assuming the flow of sludge remains proportional to the influent load, the projected sludge flow at the end of the planning horizon is estimated to be about 30,000 GPD on average and 35,000 GPD for the maximum month (or around 20 GPM and 25 GPM on a continual basis, respectively). Therefore, even when running only one clarifier, it appears that the existing primary sludge pumps have sufficient capacity.

4.3.5.4.3 Digested Sludge Pumping

In addition to the sludge transfer pump mentioned previously, which is used as a backup to the main WAS pump, there are three other pumps that are used to pump digested sludge. There is a chopper pump and old piston pump in the control building next to the primary anaerobic digester. Both pumps can pump digested sludge from the secondary digesters to the SSB, drying beds, or a loading station when hauling liquid sludge. However, the old piston pump is worn out and used only when there is difficulty priming the chopper pump. The chopper pump is also used to pump septage from the receiving station. The remaining digested sludge pump is a recirculation pump located in the building adjacent to the secondary anaerobic digesters. This pump is used to provide recirculation for mixing and heating for both secondary digesters. In addition, current piping arrangements allow the recirculation pump to pump secondary digester sludge to the SSB or into the aeration basins. Design criteria for the existing digested sludge pumps are displayed in Table 4.18 below. The old piston pump is excluded from the table since it is rarely used.

Table 4.18: Digested Sludge Pump Design Criteria

Service	Digested Sludge/WAS	Digested Sludge	Digested Sludge/WAS
Type	Positive Displacement	Chopper	Vortex
Manufacturer	Moyno	Vaughn	ITT Marlow
Number	1	1	1
Capacity			
Flow (GPM)	85	100	200 – 300
TDH (ft)	-	35	30 – 40
Motor HP	10	7.5	7.5

Both the chopper pump and the positive displacement sludge transfer pump appear to have capacity well in excess of the approximately 20,000 GPD (equal to about 15 GPM on a continuous basis) of digested sludge that is projected to be pumped from the secondary anaerobic digesters and SSB at the end of the planning horizon. In addition, each pump is capable of serving more than one role, such that if one pump is out of service, there is another means available by which solids can be pumped to the appropriate location. Although the vortex recirculation pump has sufficient capacity to pump solids from the secondary anaerobic digesters, it has insufficient capacity to mix either or both of the digesters, assuming a criterion of complete turnover every 30 minutes and given that each digester has a maximum volume of about 230,000 gallons. However, the size of the primary anaerobic digester is such that it has historically provided all of the digestion, and the function of the secondary anaerobic digesters is storage and to thicken the digested sludge through decanting. Therefore, mixing of the secondary digesters is not critical.

4.3.5.4.4 Solids Conveyance Pipelines

The following are the main sludge conveyance pipelines:

- WAS is conveyed to the WAS pump through either two 6-inch cast iron pipelines from each secondary clarifier, or an 8-inch cast iron pipeline from the RAS splitter box. WAS is discharged through a 6-inch cast iron pipeline to the headworks.
- Primary sludge is conveyed to the primary sludge pumps through 6-inch cast iron pipelines from each primary clarifier. Primary sludge is discharged through 4-inch glass-lined cast iron pipelines to the primary digester.
- Conveyance of digested sludge using the Vaughn chopper pump is through a 6-inch cast iron pipeline to the SSB, drying beds, or a loading station.
- Conveyance of digested sludge using the ITT Marlow vortex recirculation pump is through a 6-inch cast iron pipe to the SSB.
- Conveyance from the SSB to the sludge transfer pump and from the sludge transfer pump to the drying beds or headworks is through 6-inch cast iron pipelines.

Given the relatively low flows associated with the pump applications, the sizes of the main conveyance pipelines appear to be adequate.

4.3.5.4.5 Condition Assessment & Recommendations – Solids Pumping

The following is a brief assessment of the condition of each of the sludge pumps:

- The PACO WAS pump was installed in 2003 and appears to be in like new condition.
- The Moyno sludge transfer pump was installed in 2000 and appears to be in good condition.
- The Carter primary sludge pump for Primary Clarifier No. 1 was installed in 1999 and appears to be in satisfactory condition. The condition of the motor is like new.
- The Carter primary sludge pump for Primary Clarifier No. 2 was installed in 2004 and appears to be in good condition. The condition of the motor is like new.
- The condition of the Vaughn chopper pump appears to be satisfactory.
- The ITT Marlow vortex pump was acquired used from the City of Ashland. It was rebuilt and placed into service in 2002. It appears to be in satisfactory condition.

Overall, the sludge pumping equipment appears to be in good condition and capable of being utilized for many more years. However, when maintenance on the WAS or sludge transfer pumps is required, there is very little space available for the staff to work within the Secondary Sludge Pump Station building. The only means to remove a pump from this room is via hand up a flight of stairs. Similarly, the buildings housing the primary sludge pumps are very cramped, leaving little room for maintenance, and have no means of readily removing the pump from the building for maintenance.

Based on the above assessment, the following improvements are recommended for Solids Pumping:

- Add RAS pumps with VFDs and magnetic flow meters to improve control of RAS return flows from the secondary clarifiers to the aeration basins and overall process control flexibility.
- Automated control of WAS and primary sludge pumping should be added to the solids pumping facilities. This would include at a minimum, timers or programmable logic that would turn the pumps on at set intervals for specified periods of time. Further automation could also include flow meters and VFDs that could automatically adjust pump discharge rates.
- RAS pumping upgrades should include control of WAS discharge as a side stream from the RAS discharge pipeline through a modulating valve and flow meter.
- Potential modifications for RAS chlorination or the addition of a selector basin to control filamentous bacteria growth.

- Provide means to extract sludge pumps from the buildings (e.g., davit crane) for maintenance.

Anaerobic Digesters

The anaerobic digestion process consists of a single primary digester and two secondary digesters, which operate together as a two-stage mesophilic digestion process. Sludge from the primary clarifiers is pumped into the primary digester. Nearly all of the volatile solids destruction occurs in the primary digester, which is operated within the mesophilic temperature range (typically 35 to 40 degrees Celsius).

The secondary digesters are used primarily for sludge storage and decanting. The primary digester is a concrete tank with brick facing on the walls, a fixed concrete cover, and three roof-mounted draft tube mixers. The secondary digesters are also concrete tanks with brick facing on the walls, but have floating steel covers and minimal mixing. As discussed previously, although only a minor amount of mixing is achieved via circulation of sludge through the heat exchanger to maintain temperature, complete mixing of the secondary digesters is not a necessity, since sufficient destruction of volatile solids occurs in the primary digester. Design criteria for the existing primary and secondary anaerobic digesters are displayed in Tables 4.19 and 4.20 below, respectively.

Table 4.19: Primary Anaerobic Digester Design Criteria

Number	1
Diameter (ft)	56
Height (ft)	31.25
Max Water Height (ft)	28.50
Average SRT (d)	25
Max Water Volume (MG)	0.52
Estimated Plant Capacity @ 20 day SRT (MGD)	3.4
Mixers	
Number	3
HP	7.5

Table 4.20: Secondary Anaerobic Digester Design Criteria

Number	2
Diameter (ft)	45
Height (ft)	21.50
Max Water Height (ft)	19.00
Total Max Water Volume (MG)	0.45
Average Total SRT (d)	20

Note:

(a) Average SRT does not factor decanting.

When the digester supernatant looks "good" (i.e., adequate separation of solids from the liquid), decant from the secondary digesters is conveyed by gravity to the primary influent stream. However, if the digester decant is "black", it is instead sent by gravity to the SSB. This decant strategy has reduced the amount of solids that are returned to the liquid treatment stream, such that primary sludge pumping has decreased approximately 25 percent since this strategy has been in effect. On days when decanting is performed, it produces about 25,000 gallons of supernatant that typically contains about 0.25 percent solids and 1,500 mg/l to 2,400 mg/l of ammonia.

Currently, SRT in the primary digester averages about 28.5 days and the operating temperature averages between 36 and 37 degrees Celsius. The current SRT is longer than the typical design value of 15 to 20 days and exceeds the time and temperature requirements for Class B biosolids of between 15 days at 35 to 55 degrees Celsius and 60 days at 20 degrees Celsius. As would be expected with a 25 day SRT, volatile solids destruction in the primary digester has historically exceeded 50 percent, which is more than the minimum 38 percent destruction required for biosolids vector attraction reduction. Loading of volatile solids to the primary digester currently averages about 60 pounds per 1,000 cf, which is well below the typical design range of 100 to 200 pounds of volatile solids per 1,000 cf. It appears that SRT is currently the limiting criteria. Based on current operating parameters and maintaining a minimum 20 day SRT in the primary digester, it is estimated that digestion capacity would be exceeded at an influent flow of approximately 3.4 MGD.

Equipment supporting operation of the primary digester includes a Bryan boiler, Taco boiler water pump, heat exchanger, three Eimco draft tube mixers and a waste gas burner. Water is heated in the boiler and that heat is transferred to the sludge through the heat exchanger. Digester gas produced during anaerobic digestion is used to power the boiler. Excess digester gas is flared off using the waste gas burner. The three draft tube mixers are each rated at 7.5 HP, for a total of 22.5 HP. Typical power requirements for mechanical mixing systems in anaerobic digesters is 0.025 to 0.04 HP per 1,000 cf, which is equivalent to 13 to 21 HP for the existing primary digester. Based on this criterion, it appears the mixers have sufficient capacity and redundancy. Current configuration of the primary and secondary digesters allows for the secondary digester boiler to heat the primary digester if the primary digester boiler was to go out. However, there is no redundancy for the other supporting equipment associated with the primary digester. While this is not a regulatory requirement, consideration should be given to providing redundancy or developing a contingency plan if a critical piece of equipment (e.g., heat exchanger) is taken out of service.

Equipment supporting the two secondary digesters includes the ITT Marlow vortex recirculation pump and a single boiler and heat exchanger. Although there is also no redundancy for equipment supporting the secondary digesters, this equipment is less critical since very little volatile solids destruction occurs in these digesters. Furthermore, boilers are already in place to convert the secondary digesters to primary digesters if required.

All three digesters are typically flushed on a yearly basis. Routine inspection of each digester is not currently scheduled; however, the primary digester was inspected by plant staff in 2002 and appeared in satisfactory condition.

4.3.5.4.6 Conveyance Facilities

The main conveyance pipelines associated with the anaerobic digesters are a 6-inch cast iron pipeline conveying digested sludge from the primary digester to the secondary digesters by gravity and 6-inch cast iron pipeline for conveying digester supernatant. Other associated conveyance facilities are included in the Chapter on solids pumping. Given the relatively low flows associated with operation of the digesters, the sizes of the main conveyance pipelines appear to be adequate.

4.3.5.4.7 Condition Assessment & Recommendations – Anaerobic Digesters

Overall, the digesters appeared to be in relatively good condition, considering that the secondary digesters are over 50 years old and the primary digester is over 35 years old. Overall, the equipment associated with the digesters appears to be in satisfactory condition and working adequately. As mentioned previously, the vortex recirculation pump was originally purchased by the City of Ashland around 1990 and was rebuilt when it was acquired by the City and placed into service in 2002. It appears to be in satisfactory condition. The three draft tube mixers for the primary digester were installed in 2000 and appear to be in operating adequately. However, the mechanical seal on one of the draft tube mixers leaks, which has been a maintenance issue. In addition, noticeable vibration of one of the mixers was observed during operation. It is not known if the vibration observed is considered excessive, such that it may be detrimental to the performance or longevity of the mixer.

The equipment and structures appear to be suitable for continued use, assuming that the leaking seal on the draft tube mixer can be replaced, and should be sufficient in size and capacity to continue producing Class B biosolids throughout the planning horizon. If the leaking seal cannot be fixed, a new mixer may need to be acquired. There appears to be no need for additional digestion tanks or equipment, except as it pertains to redundancy. The primary digester concrete cover should be carefully examined to ensure that there are no significant cracks or leaking digester gas.

Process simulations conducted as part of the work described in Kennedy Jenks' 20 April 2006 Technical Memorandum indicated potential acidic conditions in the anaerobic digesters at sludge solids concentrations of less than 3 percent from the primary clarifiers. This suggests that the current concentration of sludge solids from the primary clarifiers may be near the borderline for maintaining a stable process. If Pendleton is to continue the practice of co-thickening, provisions for alkalinity addition to the primary digester need to be included as part of the solids improvements.

Based on the above assessment, the following improvements are recommended for Anaerobic Digesters:

- Consideration should be given to providing redundancy or developing a contingency plan for operation of the primary digester if a critical piece of equipment (e.g., heat exchanger) is taken out of service.
- Replacement of the mechanical seal on the leaking mixer for the primary digester or a complete upgrade of the primary digester mixing system.

- Examine the primary digester concrete cover and repair cracks as needed. If any issues develop, the required maintenance and repair tasks should be added to the CIP. These inspections should begin on an annual basis and can be adjusted as needed.

- Installation of alkalinity addition at the primary digester.

Sludge Storage Basin

The SSB was originally constructed in 1970 as an aerobic digester that would be used exclusively during the canning season. After the major canneries departed from the City, the aerobic digester was converted to the SSB due to reduced influent loading. The SSB is similar in construction to the aeration basins on site, consisting of short concrete wall atop an earthen dike. Two of the original three 60 HP floating mechanical aerators are still intact and installed in the SSB. While these mixers are old, plant staff has salvaged sufficient spare parts from aerators removed from AB 2. Spare parts for the mixer electrical breakers are lacking however.

Normally, only one floating aerator is in operation to provide mixing and aeration within the SSB. As discussed earlier, digested sludge is generally pumped to the SSB from the secondary digesters using the Vaughn chopper pump and pumped from the SSB to the drying beds using the Moyno sludge transfer pump. Design criteria for the existing SSB are displayed in Table 4.21 below.

Table 4.21: Sludge Storage Basin Design Criteria

Overall Basin Data	
Length (ft)	220
Width (ft)	100
Water Depth (ft)	10
Total Volume (MG)	1.42
Estimated Plant Capacity @ 120 days, including Secondary Digesters (MGD)	4.0

Solids loading rates to sludge storage basins should normally be less than 20 pounds of volatile suspended solids per 1,000 square feet of area per day (lbs/1,000 sf/day) to maintain aerobic conditions at the surface, without mechanical aeration, to avoid odors. Currently, loading to the SSB is about 80 lbs/1,000 sf/day, which indicated that mechanical aeration is required for odor control. This is consistent with the fact that at least one of the two mechanical aerators is normally in operation. Aeration may also help reduce some ammonia loading back to the liquid stream through decanting. Depth of sludge storage basins are normally 10 to 16 feet deep, which is consistent with the 10-foot depth of the existing SSB.

During periods where digester decant is sent to the SSB, the SSB is typically decanted to thicken the solids before being conveyed to the drying beds and SSB supernatant is returned by gravity to the primary effluent. Alternately, supernatant can also be returned to the headworks. On days when decanting is performed, 5,000 to 15,000 gallons of supernatant is produced containing about 0.25 percent solids and 1,200 mg/l of ammonia, similar to the characteristics of the digester supernatant. Whether supernatant originates from the secondary digesters or the SSB appears to have no significant impact on the overall performance of the WWTP.

With decanting, the concentration of solids in the SSB averages around 4 percent solids, with a range of about 3 to 6 percent. Periodically, magnesium hydroxide is added to the SSB as a lime (i.e., caustic soda) substitute to increase particle density and settling and improve sludge dewaterability. Magnesium hydroxide is added as a batch feed by dumping bags over the sidewall into the SSB before a settling and decanting cycle. Historically, there has not been a significant increase in percent solids within the SSB when magnesium hydroxide has been dosed. Currently, magnesium hydroxide is not being used with the SSB. A recent change to the SSB that may have a significant impact on its performance was the relocation of the influent pipeline outlet to the far end of the basin opposite the decant pipeline inlet.

4.3.5.4.8 Conveyance Facilities

The main conveyance pipeline associated with the SSB is an 8-inch concrete pipeline for conveying supernatant. Other associated conveyance facilities are included in the Chapter on solids pumping. Given the relatively low flows associated with operation of the SSB, the size of the main conveyance pipeline appears to be adequate.

4.3.5.4.9 Condition Assessment & Recommendations – Sludge Storage Basin

The basin and associated piping appear to be in satisfactory condition, although the condition of the shotcrete basin lining is currently unknown. Likewise, the condition of the existing mechanical aerators is unknown, but since normally only one is used for mixing, the remaining mixer is currently available as a backup.

No improvements are required for the SSB to function properly or to improve its performance. All basin walls and floor should be inspected and evaluated if reuse of the SSB is included in the plant upgrade. Additionally, the seasonal availability of the drying beds, projections of sludge production, and the need for seasonal sludge storage should be discussed with the City to confirm that the existing volume of storage will be sufficient throughout the planning horizon.

Solids Drying Beds

The solids drying beds were initially installed as a sand and gravel drainage bed. This allowed water to both evaporate and drain for solids dewatering. After years of use, the WWTP staff decided to have the sand and gravel drainage material removed and cover the drying beds with asphalt cement paving. This eliminated the need for periodic replacement of the drainage material. With the paving in place, dewatering in the drying beds is now accomplished solely through evaporation. Removal of dried solids typically occurs during the summer when there is a demand for land application of biosolids. Biosolids are hauled off site using a City truck that is jointly used throughout the City. Consequently, the truck is not always available. When the truck is unavailable, WWTP staff use an onsite tractor to remove and store dried biosolids onsite adjacent to the beds until they can be hauled away. There is one large drying bed and six smaller drying beds. One discharge header feeds the six smaller beds. Prior to feeding sludge to the drying beds, individual valves at each bed need to be opened or closed to direct sludge to the appropriate drying bed. Design data for the existing drying beds are displayed in Table 4.22 below.

Table 4.22: Solids Drying Bed Design Data

Total Number	7
Beds 1-6	
Length (ft)	100
Width (ft)	50
Bed 7	
Length (ft)	250
Width (ft)	50
Total Area (sf)	42,500
Estimated Plant Capacity @ 20 lb/sf/yr (MGD)	3.5

Based on historical operating data, it appears that the WWTP produces on the order of 10,000 pounds of dry sludge solids per week on a year round basis, such that the total solids production is 520,000 pounds per year. Therefore, the current solids loading rate to the drying beds is about 12 pounds per square foot per year (lbs/sf/yr). Assuming sludge yield from the secondary treatment process and volatile solids destruction in the anaerobic digesters do not change drastically, it appears that solids loading to the drying beds would remain within the typical range of 12 to 20 lbs/sf/yr at influent flows up to approximately 3.5 MGD.

Based on current operating procedures, the hydraulic loading on the drying beds is approximately 3 gallons per square foot per yr (GAL/sf/yr). Future hydraulic loading, assuming similar operations and sludge concentrations, will require additional drying beds. Using the same loading rate, an additional 1.5 acres of drying beds are required. However, given the climate in Pendleton, it is quite possible that allowable solids loading rates can exceed the typical criteria. This will be evaluated more closely using historical application rates, frequencies, and time periods to compare with this initial assessment.

4.3.5.4.10 Condition Assessment & Recommendations

The drying beds appear to be in satisfactory condition. The paving has no obvious cracks or gaps and the exposed piping and valves remain functional. Plant staff has noted that the larger drying bed to the east is easier to operate than the six smaller beds.

It appears that the existing drying beds should have sufficient solids loading capacity throughout the planning horizon; however the hydraulic loading capacity appears insufficient.

Based on the above assessment, the following improvements are recommended for Solids Drying Beds:

- Future capacity issues will arise and require improvements necessary to handle the additional sludge production. These improvements could include additional drying beds or a mechanical dewatering facility.

- The six smaller beds are difficult to manage and should be modified to create two larger drying beds. One potential combination would be to combine beds 1, 2, 3, and 4 to create the new west bed and to combine beds 5 and 6 to create a new east bed. The design of these new solids drying beds should allow easy access for plant vehicles during solids loading for subsequent land application.

Septage Receiving Station

The septage receiving station consists of the unloading area, a septage storage tank, septage pumping and associated piping. Trucks hauling septage enter the WWTP and travel to the rear of the primary digester adjacent to the sludge storage beds. A gravel ramp leads up to the back of the digester where the septage receiving bay is located. As discussed previously, the piston pump is used to pump septage from the receiving station into the primary digester and the Vaughn copper pump is available as redundancy. Design criteria for the existing septage receiving station are displayed in Table 4.23 below.

Table 4.23: Septage Receiving Station Design Criteria

Average Monthly Receiving Volume	15,000 gal
Receiving Unit	
Number	1
Receiving Tank (gal)	8,000 gal

Since septage includes the liquid, scum, sludge, and trash from septic systems, a manually cleaned bar screen should be provided with the septic receiving station so that unwanted material is kept out of the digesters. This will improve quality of the biosolids by removing much of the trash. Alternatively, septage could be discharged to the WWTP headworks for screening and grit removal, but potential heavy loads of grease and oil could clog the screen and create a maintenance problem. Furthermore, septage has often already progressed through the first two stages of anaerobic digestion (hydrolysis and acidogenesis), such that it is ready for the final stage (methanogenesis) that is responsible for the production of methane. Therefore, continued discharge to the primary digester is recommended.

Plant staff has discussed the desire to potentially upgrade the existing septage station into a FOG receiving station. Since typical monthly septage pumping is limited and many local businesses and restaurants could benefit from a FOG station, the improvement could replace an unused facility and provide a new service that could reach a larger customer base.

Disadvantages to the FOG station include higher potential for digester upsets as well as reduced digester capacity. Since future upgrades are likely to bring the digester up to the design capacity, additional loading created with by a FOG station may push the digester beyond its available capacity.

4.3.5.4.11 Condition Assessment & Recommendations – Septage Receiving Station

The septage receiving station is very difficult to operate and is located within the fenced enclosure area of the treatment plant, limiting access for septage haulers to the plant operating hours. WWTP staff is dissatisfied with the current configuration and operation of the septage receiving station.

Based on the above assessment, the following improvements are recommended for Septage Receiving Station:

- Abandon the existing septage receiving station;
- Construct a new septage receiving station with manually cleaned bar screen that discharges to the Primary Digester; and
- The new septage receiving station should be located outside the WWTP fenced enclosure with a metering sign-in station.

4.3.6 Plant Maximum Capacity Summary

Table 4.24 summarizes the maximum plant capacity as described in the plant condition assessment. Although the plant has a minimum hydraulic capacity of 16.3 MGD based upon flow limitation in the headworks channels, actual treatment capacity is currently set by the digesters which can handle a maximum of 3.5 MGD. Discussions of calculations and assumptions regarding maximum capacities presented in table 4.24 can be found in the relevant condition assessment descriptions in Chapter 4.3.

Table 4.24: Treatment Plant Maximum Capacity

Treatment Process Unit	Maximum Capacity (MGD)
Headworks Screen	5.2
Grit Chamber	16.3
Primary Clarifier	
Each	9.5
Total	19.0
Aeration Basin	
Basin No. 1	4.7
Basin No. 2	15.3
Total	20.0
Secondary Clarifier	
Each	10.4
Total	20.8
Chlorine Contact Chamber	38.9
Digesters	3.4
Sludge Storage Basin	4.0
Sludge Drying Beds	3.5

4.3.7 Electrical Instrumentation and Controls

Electrical instrumentation and controls include all supply, conduit runs, unit processes connections, and SCADA system inputs and outputs across the entire site. An overall Existing Electrical Site Plan is provided in Exhibit 4.5 and displays these major components. Additionally, known major instrumentation and control functions are labeled on the Existing Process Schematic in Exhibit 4.3.

4.3.7.1 Plant Electrical Service

The WWTP is served at 12.4 kV from PPLs distribution system. Incoming service is fed to a 1000 KVA pad-mounted transformer adjacent to the main electrical building and secondary conductors are fed from the transformer to the electrical controls building using an above ground bus duct. Plant staff has indicated that reliability of power to the WWTP is good.

Condition Assessment & Recommendations – Plant Electrical Service

Original plant design required far greater service capacity than that which is currently used. As such, the Main Distribution Board is rated at 2000 Amps, well in excess of the peak plant usage of about 420 Amps. Due to this over capacity, it is possible that the plant is not properly protected against over current faults.

Since primary power to the plant is reported as good, the utility transformer and the primary power cable can be left in place, unless process improvements require excavation of the cable route.

The following improvements are recommended for Plant Electrical Service:

- A review of the electrical load requirements for the plant (described below) may suggest that the above ground bus duct be replaced with buried secondary conductors, especially if the electrical controls building is replaced completely.

4.3.7.2 Electrical Controls Building

The electrical building is located just north of the In-Plant pump station and contains a 2000-Amp-rated Main Distribution Board, four MCCs, a PLC cabinet, and two AFDs.

Condition Assessment & Recommendations – Electrical Controls Building

The Main Distribution Board and MCCs were built and installed in about 1970, and appear to be in excellent condition. However, plant staff report increasing difficulty in maintaining the equipment because the manufacturer (Square D) no longer supports this particular MCC product line (Model 4), and replacement parts are difficult to obtain. Modifications have been made to the MCCs to support SSSs for some motors, which had to be installed on the outside of the building. Some MCC compartments therefore were empty, except for a circuit breaker and disconnect handle. Of the five SSSs installed, only two are still used, with the other three being abandoned.

The PLC (Allen-Bradley CompactLogix) cabinet and AFDs (Allen-Bradley PowerFlex) were installed more recently and plant staff have not indicated any known problems.

The electrical building is only just large enough to house the required electrical equipment. Due to space limitations, certain MCC compartments do not meet the clearance rule in the current version of the NEC. The current rule (NEC 110.26) requires a minimum of 36" working clearance in front of all electrical equipment operating at less than 600 Volts.

The following improvements are recommended for the Electrical Controls Building:

- Onsite electrical buildings should be modified to replace the MCCs and bring all new and existing electrical components up to code. A complete review of the plant's electrical load requirements would be performed and equipment sized appropriately. All electrical upgrades should conform to the City's standards with Allen Bradley being the preferred component manufacturer.

4.3.7.3 Generator Building

The generator building, located south of the Secondary Clarifier houses the 75 kVA standby generator capable of serving the WWTP with 60 kW, and a Manual Transfer Switch for connecting the generator to the supported loads and drives.

Condition Assessment & Recommendations – Generator Building

The standby generator by ILI Engine Generator Systems was installed in 1970. Due to the age, maintenance problems such as leaking oil have been problematic. During a primary power fail situation, standby power provided by the generator is inadequate to operate the necessary treatment equipment, severely reducing the plant's available treatment capability.

The following improvements are recommended for the Generator Building:

- To meet required permits, the generator set must be replaced with a unit sized to provide full WWTP treatment capability for a period of approximately 24 hours; and

- The Manual Transfer Switch should be replaced with an Automatic Transfer Switch (ATS). The ATS would detect loss of primary power, start the generator, and then transfer the plant's electrical load to the generator. Upon recovery of the primary power, the ATS would transfer the plant load back to primary power and shut down the generator in a controlled manner.

4.3.7.4 Boiler Room Electrical System

The Boiler Room is in the Primary Digester Complex and contains MCC 5, which is the same type as the MCCs in the electrical building, and another PLC cabinet.

Condition Assessment & Recommendations – Boiler Room

As with the MCCs in the Electrical Controls Building, MCC-5 was installed in 1970 and replacement parts are difficult to obtain. Clearances in front of this MCC are acceptable. It was noted that lighting in the Boiler Room is incandescent lighting and lighting levels are marginal. The boiler control panel appears to be in good condition.

The following improvements are recommended for the Boiler Room Electrical System:

- The MCC should be replaced

- The lights should be replaced with energy efficient fluorescent lighting.

4.3.7.5 Primary Clarifiers Distribution Board

A Square D I-Line panel board located in a small electrical/storage room provides power for the primary clarifiers. This panel board was installed in 1970.

Condition Assessment & Recommendations – PC Distribution Board

One of the seven breakers within this panel board is faulty and no longer used. There is no nameplate on the panel board that would indicate its function, and the interior breaker schedule has not been filled in.

The following improvements are recommended for the PC Distribution Board:

- The panel board should be removed as part of the overall electrical improvements. The primary clarifiers would then be fed from one of the new MCCs.

4.3.7.6 Grit System Building

The Grit System building is located to the north of Primary Clarifier No. 1 and contains a Grit System control panel and a PLC cabinet.

Condition Assessment & Recommendations – Grit System Building

The Grit System panel is FRP rather than stainless steel, and plant staff indicates it has stood up to the building environment well. The PLC cabinet is similar to the PLC cabinets in the plant. Due to the enclosed nature of the building, hazardous fumes can accumulate. With control panels inside the building, plant staff is required to enter the noxious, if not hazardous, area.

The following improvements are recommended for the Grit System Building:

- The grit building electrical systems are working satisfactorily; however, the electrical panels should be moved out of the corrosive environment to the outside of the building or a new adjacent electrical building.

4.3.7.7 Headworks Building

A steel sided building and roof house the headworks. Within this building, the fine screen and the two grinders are connected via 480 Volt-rated plugs and sockets, rather than being hard-wired with flexible conduit.

Condition Assessment & Recommendations – Headworks Building

These plug and socket combinations require that plant staff use a ladder or similar for access, which does not meet the current NEC rule for safety disconnect accessibility.

The following improvements are recommended for the Headworks Building:

- The plugs and sockets should be replaced with heavy duty safety disconnects mounted on the wall or a stanchion.

4.3.7.8 SCADA System

The plant SCADA System consists of single personal computer connected to a master PLC. The tower-style Dell PC runs Windows XP and the RSView Human Machine Interface (HMI) by Rockwell Systems. The HMI communicates to an Allen-Bradley Logix555 PLC which in turn acquires data from the CompactLogix PLCs in the plant and four remote wastewater lift stations. Communications to the plant PLCs uses Ethernet at 10 Mbps; communications to the remote sites uses VHF radios at 450 MHz on the City's licensed radio network. Emergency alarms are connected to a SentriMax (by Zetron) autodialer; this is currently being replaced with autodialer software and hardware that will be added to the SCADA PC.

The SCADA PC has one 19" LCD screen. In general the SCADA System provides for monitoring of the plant only, although some limited start/stop control is available. Trending of analog data is provided. The City has elected to standardize on the use of Allen-Bradley PLCs and RSView for its HMI software with their recent (2001) installation at the Water Treatment Plant. The City is also in the process of installing RS Historian which will allow a trending database to assign tags for required upgrades at the plant.

Condition Assessment & Recommendations – SCADA System

The SCADA System and the PLCs in the Plant are working well and in good condition. Plant staff indicates that the SCADA System provides a fairly limited view of plant operations, and more instrumentation would be desirable.

The following improvements are recommended for the SCADA System:

- Additional instrumentation in each process area for all plant upgrades
- Additional capability for start/stop and setpoint control from the SCADA screens
- The addition of a second LCD screen for enhanced viewing of process areas and alarms
- Improved historical data gathering and reporting
- Add HMI at select points in the facility to allow user interface at the process location.

4.3.7.9 Underground Electrical Conduits

Various conduit runs are required across the site. Major conduit runs are shown in the attached electrical site plan, Exhibit 4.5. Conduit runs installed in 1970 used direct buried GRS conduits. More recent underground conduit runs used rigid PVC.

Condition Assessment & Recommendations – Underground Conduits

Plant staff report they have experienced severe problems with the GRS conduit. Corrosion of these conduits has apparently occurred (probably due to the soil chemistry) to the point where some conduits have almost corroded away. This could lead to potential failures of the power, control and signal cables.

The following improvements are recommended for the Underground Electrical Conduits:

- Today's practice for buried conduits is to use PVC Schedule-40 or Schedule-80 conduit in direct buried situations, or use GRS only when installing the conduits in a concrete duct bank. An additional method to provide conduit runs is through a prefabricated high density polymer concrete trench. These systems provide long lasting, easily accessible means to route cable. It is recommended that all existing conduit runs be replaced by one of these means.

4.3.7.10 Safety Disconnects

Motor disconnect switches are required by NEC rule 430.101 to be within sight of any motor. Very few of the motors at the plant have such a safety disconnect; only those pumps installed in recent years meet this requirement.

The following improvements are recommended for Motor Safety Disconnects:

- Install heavy duty horsepower rated safety switches in accordance with NEC.

4.3.8 Support Facilities

WWTP support facilities include the Laboratory and Operations Building, the lunch room and several storage buildings and maintenance sheds located on the WWTP grounds.

4.3.8.1 Laboratory and Operations Building

The laboratory and operations building is situated along the paved entrance just east of the Secondary Digesters. This building was added during the 1970 improvements and provides offices, locker rooms, and break rooms for operations staff as well as the onsite laboratory facilities. Plant staff currently performs most of their own lab work, including BOD and TSS testing. The lab, although somewhat small, is adequate for current and future needs. The Operations building should be adequate to support the plant through the next phase of upgrades.

4.3.8.2 Maintenance Storage Building

Two onsite storage buildings are located at the south end of the plant near the Sludge Drying Beds. The larger of the two storage buildings is used to house large equipment, spare blower and aerator parts, and large chemical totes. This facility appears to be in good condition, providing sufficient storage space for onsite equipment.

The second similar, but smaller, storage building is located behind the primary digester. This building also houses maintenance equipment and supplies. The building appears to be in good condition and is expected to remain operational through the next phase of upgrades.

4.4 Summary of Existing WWTP Recommendations

Table 4.25 includes a summary of recommended improvements summarized through Chapter 4.3 for the existing WWTP. Certain recommendations will be addressed through required WWTP upgrades to meet new effluent limits. Those improvements not addressed through other upgrades in the recommended plan are included in the Capital Improvement Plan.

In general, the Pendleton WWTP is not limited by hydraulic capacity, as it was originally designed for flows of 16.3 MGD and future projected flows are only 6.14 MGD (4,265 GPM) majority of recommended improvements involve retiring mechanical and electrical components that have outlived their service life, and replacing them with modern, high efficiency treatment units.

Table 4.25: Summary of Recommended Improvements

Headworks Improvements

- Upgrade Grit System
- Replace Metal Headworks building with larger building

Primary Treatment Improvements

- Replace Prim. Clarifier 1 Drive Mechanism
- Replace Pumps 2 and 3 at In-Plant Pump Station

Secondary Treatment Improvements

- Repair Concrete in both AB's
- Replace Surface Aerators in AB 1
- Replace Secondary Clarifier Drive Mechanisms in Clarifiers 1 & 2
- Install Scum Baffles in Secondary Clarifiers
- Install Stamford Baffles in Secondary Clarifiers

Disinfection & Flow Monitoring Improvements

- Install Baffle Walls in CCC
- Relocate chemical metering controls.
- Install redundant chlorine dosing pump.
- Install influent flow monitoring system
- Install effluent Parshall flume

Solids Pumping Improvements

- Install RAS Pumps with VFDs
- Automate WAS Pumping Control
- Provide RAS chlorination
- Install two new larger buildings to house primary sludge pumps

Solids Digestion Improvements

- Install system for alkalinity addition
- Provide Redundancy for Critical Primary Digester Equipment
- Replace Seals on mixer of Primary Digester

Solids Drying Beds Improvements

- Reconfigure Six Smaller Drying Beds into Two Larger Beds
- Consider addition of mechanical dewatering equipment

Septage Receiving Station Improvements

- Relocate and Reconfigure Septage Receiving Station

Electrical and I&C Improvements

- Upgrade grit washer building electrical enclosures from NEMA 3 to NEMA 7
- Replace all MCCs
- Bring all Electrical Components up to Code
- Replace Generator Set
- Replace Generator Manual Transfer Switch with Auto Transfer Switch
- Replace Boiler Room MCC
- Replace Boiler Room Lighting
- Replace Primary Clarifier Panel Board with new MCC
- Install Safety Disconnects to Headworks Equipment
- Expand the SCADA System
- Replace Underground Conduits
- Install safety switches in accordance with NEC at each Motor

Chapter 5: Basis of Planning

This chapter summarizes the planning requirements and design criteria for the Pendleton WWTP to meet the wastewater needs of the City of Pendleton for a 20 year planning period. This chapter includes:

- Umatilla River receiving water quality;
- Regulatory Requirements for effluent discharge and biosolids;
- EPA Plant Reliability Criteria Requirements;
- Basis of Cost Estimating; and
- Options Evaluation Methodology.

5.1 Receiving Water Quality

The Pendleton WWTP is located at the confluence of the Umatilla River and McKay Creek at Umatilla River Mile 52.0. Pendleton WWTP Outfall 001 is a direct discharge into McKay Creek approximately one-half mile upstream of the confluence of McKay Creek and the Umatilla River. Exhibit 5.1 is a Location Map showing the Pendleton WWTP, Umatilla River and McKay Creek.

The Umatilla River upstream of McKay Creek and the Pendleton WWTP is located primarily within the CTUIR tribal boundary. Summer season flows in this upstream reach of the Umatilla River drop to as low as 20 CFS and peak daily river temperatures often exceed 80 °F during the late afternoon and evening. Cooler summer flows from McKay reservoir help to moderate the flow and temperature of the Umatilla River downstream of Pendleton.

McKay Reservoir was originally constructed as part of the Umatilla Basin Project by the USBR intended to support beneficial uses like irrigation, recreation and endangered species Umatilla River Basin. In the spring, summer and fall seasons, Umatilla River flows are augmented with cooler flows stored in McKay Reservoir to support downstream irrigation and in the spring and fall to support salmonid spawning, rearing and migration.

In March 2001 the Umatilla River Basin TMDL was adopted providing for wasteload allocations (discharge limits) for point sources like the Pendleton WWTP that discharge to the Umatilla River. The Umatilla TMDL was prepared to address water quality impairments in the Umatilla River included in the Oregon CWA Section 303(d) list of impaired water bodies prepared by DEQ. The TMDL addressed 1998 303(d)-listed pollutants including; temperature; sediment; aquatic weeds, algae and pH; Nitrate-Nitrogen; Ammonia-Nitrogen; and, Bacteria.

TMDL wasteload allocations for temperature and Ammonia-Nitrogen discharge from the Pendleton WWTP were included in the City's February 2005 NPDES Permit Renewal discussed in the following Chapter. Other TMDL pollutants are addressed through surrogate measures or otherwise don't impact the Pendleton WWTP discharge.

5.1.1 2004/06 Integrated Report 303(d) List

Oregon's 303(d) list is updated every two years. There are five categories of listings in the 303(d) list, with the highest Category 5 listing indicating a TMDL is required. Following, Table 5.1 is a summary of 303(d) list categories:

Table 5.1: 303(d) List Categories

Category 1	*All standards are met. This category is not used.*
Category 2	*Attaining - Some of the pollutant standards are met.*
Category 3	*Insufficient data to determine whether a standard is met.*
Category 3B	*Potential concern - Some data indicate non-attainment of a criterion, but data are insufficient to assign another category.*
Category 4	*All standards are met. This category is not used.*
Category 4A	*TMDL approved - TMDLs needed to attain applicable water quality standards have been approved.*
Category 4B	*Other pollution control requirements are expected to address all pollutants and will attain water quality standards.*
Category 4C	*Impairment is not caused by a pollutant (e.g., flow or lack of flow is not considered a pollutant.)*
Category 5	*Water is water quality limited and a TMDL is required.*

Iron is the only Category 5 TMDL pollutant identified in the 2004/06 Interim Report requiring at TMDL. However, many other pollutants of concern included as Category 2 or 3 pollutants will be monitored over time by DEQ, including: Alkalinity, Antimony, Arsenic, Beryllium, Cadmium, Chlorophyll A, Chromium, Chloride, Copper, Dissolved Oxygen, Lead, Manganese, Nickel, Phosphate, Silver, Thallium and Zinc.

It may become increasingly important for the City to monitor both effluent and receiving water quality in the future for the Category 2 or 3 listings to address potential issues that may impact discharge from the Pendleton WWTP to the Umatilla River in the future. Potential future regulations are discussed in Chapter 5.2.6.

5.2 Regulatory Requirements

This Chapter includes a discussion of the City's NPDES Permit for the Pendleton WWTP, MAO, Umatilla River mixing zone, biosolids management and future regulations that could impact WWTP operations.

5.2.1 Pendleton WWTP NPDES Permit

DEQ has delegated authority from the EPA to enforce the federal CWA to regulate the discharge of treated effluent from wastewater treatment plants through the NPDES program. Oregon NPDES Permit requirements are included in OAR Chapter 340, Division 45 (OAR 340-45), whose purpose is to "prescribe limitations on discharge of wastes and the requirements and procedures for obtaining NPDES and WPCF permits from the Department of Environmental Quality." NPDES Permit limits must comply with Oregon water quality standards and biosolids management regulations included in OAR Chapter 340, Division 41 (OAR 340-041) and OAR Chapter 340, Division 50 (OAR 340-050), respectively.

City of Pendleton NPDES Permit #100982 was renewed 3 February 2005, allowing the discharge of treated effluent to the Umatilla River meeting seasonal concentration and/or mass load limits for BOD, TSS, *E.Coli* bacteria, chlorine residual, ammonia-nitrogen and temperature. A copy of the City's NPDES Permit and the Permit Evaluation Report are included in Appendix E. Table 5.2 summarizes the waste discharge limitations for the Pendleton WWTP Umatilla River Outfall contained in Schedule A of the City's NPDES Permit. The NPDES Permit expires on 31 January 2010.

The City originally planned to meet new NPDES pollutant discharge limits for Ammonia-Nitrogen, Temperature and Residual Chlorine through a SAT. Initial field pilot testing of the SAT system in 2005 was promising, but a larger demonstration project conducted over a 12-month period in 2005 and 2006 indicated the area of planned SAT facilities was hydraulically limited due to the perimeter flood-control dike surrounding the facilities along the Umatilla River and a portion of McKay Creek. The dike limited capacity of SAT facilities to between 175 and 250 GPM, which is inadequate for meeting effluent Ammonia-N, Temperature and Residual Chlorine limits included in the City's NPDES Permit.

Table 5.2: Outfall 001 NPDES Waste Discharge Limits(a)
City of Pendleton WWTP

Parameter	Monthly Average Concentration (mg/L)	Weekly Average Concentration (mg/L)	Monthly Average Load (b) (lb/day)	Weekly Average Load (b) (lb/day)	Daily Maximum Load (b) (lb/day)
Summer Season (May 1 through October 31)					
BOD_5	20	30	920	1,400	1,800
TSS	20	30	920	1,400	1,800
Ammonia-N		2.0 mg/l (96 lb/day) daily maximum 1.0 mg/l (48 lb/day) monthly average			
Residual Chlorine		0.05 mg/l (2.0 lb/day) daily maximum 0.02 mg/l (0.80 lb/day) monthly average			

Parameter	Monthly Average Concentration (mg/L)	Weekly Average Concentration (mg/L)	Monthly Average Load [(b)] (lb/day)	Weekly Average Load [(b)] (lb/day)	Daily Maximum Load [(b)] (lb/day)
Winter Season (November 1 through April 30)					
BOD_5	30	45	1,400	2,100	2,800
TSS	30	45	1,400	2,100	2,800
Ammonia-N		5.2 mg/l (240 lb/day) daily maximum 3.0 mg/l (140 lb/day) monthly average			
Residual Chlorine		0.04 mg/l (1.7 lb/day) daily maximum 0.01 mg/l (0.60 lb/day) monthly average			
Other Parameters (year-round)					
E.Coli Bacteria		Shall not exceed 126 counts/100mL monthly geometric mean or 406 org/100mL for a single sample.			
pH		Shall be within range of 6.0 – 9.0.			
BOD_5 and TSS Monthly Average Removal Efficiency		Shall not be less than 85% monthly average.			

Notes:

(a) From current Pendleton WWTP NPDES Permit #100982 for File Number 68260.

(b) Mass load limits are based upon WWTP average dry weather design flow of 5.5 MGD.

Abbreviations:

mg/L = Milligrams per liter.
lb/day = Pounds per day.
org/100mL = organisms per 100 milliliters

5.2.1.1 BOD/TSS Mass Load Limits

Table 5.3 is a summary of estimated 2030 Pendleton WWTP BOD_5 and TSS mass loads discharged to the Umatilla River based on the Design 2030 ADWF and AWWF or 3.46 MGD and 3.72 MGD, respectively, and concentration limits summarized in Table 5.2. As shown, the estimated 2030 BOD_5 and TSS mass loads are lower than the mass load limits included in the City's existing NPDES Permit. Therefore, no additional Umatilla River water quality impairment analyses related to BOD_5 and TSS are anticipated as part of the Facilities Plan.

Table 5.3: Calculated BOD_5 & TSS Mass Loads
City of Pendleton WWTP

Parameter	Monthly Average Concentration (mg/L)	Weekly Average Concentration (mg/L)	Monthly Average Load [(b)] (lb/day)	Weekly Average Load [(b)] (lb/day)	Daily Maximum Load [(b)] (lb/day)
Summer Season (May 1 through October 31)					
BOD_5	20	30	580	870	1,160
TSS	20	30	580	870	1,160
Winter Season (November 1 through April 30)					
BOD_5	30	45	930	1,395	1,860
TSS	30	45	930	1,395	1,860

As a result of the lower design ADWF and the planned secondary treatment process upgrades to meet effluent Ammonia-N nutrient limits will result in no required increase of the current BOD and TSS mass load limits included in the City's NPDES Permit.

5.2.1.2 Ammonia Mass Load Limits

Table 5.4 is a summary of estimated 2030 Pendleton WWTP Ammonia-N mass loads discharged to the Umatilla River based on the Design 2030 ADWF and AWWF or 3.46 MGD and 3.72 MGD, respectively, and Ammonia-N concentration limits summarized in Table 5.2. As shown, the estimated 2030 Ammonia-N mass loads are lower than the mass load limits included in the City's existing NPDES Permit. Therefore, no additional Umatilla River water quality impairment analyses related to Ammonia-N are anticipated as part of the Facilities Plan.

Table 5.4: Calculated Ammonia-N Mass Loads
City of Pendleton WWTP

Parameter	Monthly Average Concentration (mg/L)	Daily Maximum Concentration (mg/L)	Monthly Average Load [(b)] (lb/day)	Daily Maximum Load [(b)] (lb/day)
	Summer Season (May 1 through October 31)			
Ammonia-N	1.0	2.0	30	60
	Winter Season (November 1 through April 30)			
Ammonia-N	3.2	5.0	100	200

5.2.1.3 Residual Chlorine Permit Limits

The Pendleton WWTP has installed dechlorination onsite storage, handling and injection facilities using Calcium Thiosulfate (CaS_2O_3) to meet the existing concentration and mass load limits summarized in Table 5.2. While some modifications of the existing dechlorination facilities related to plant automation and dosing may be recommended in the Facilities Plan, there are no anticipated long term planning issues associated with meeting the Residual Chlorine Permit Limits.

5.2.2 Mutual Agreement and Order

Discharge from the Pendleton WWTP to the Umatilla River was required to meet the NPDES Permit limits summarized in Table 5.2 on the date of Permit issuance, 3 February 2005. However, the City was unable to comply with the new limits for Temperature, Ammonia-N or Residual Chlorine. As a result, the City and DEQ signed an MAO with the following compliance schedules and timeframes:

1. *"Submit an approvable mixing zone study for McKay Creek and the Umatilla River for Department review and approval by no later than eighteen (18) months after issuance of the Permit."*

   Due to the limited capacity of the planned SAT natural treatment system, the City intends to relocate the existing outfall to a location closer to the confluence of the Umatilla River and McKay Creek. The MAO deadline was extended and the proposed outfall location and design are included in Chapter 7, and the preliminary mixing zone study is included Appendix F.

2. *"Submit an approvable TMP (Temperature Management Plan) for Department review and approval by no later than eighteen (18) months after issuance of Permit."*

   The City submitted the Pendleton WWTP Temperature Compliance Evaluation Project Final Report containing the Temperature Management Plan for DEQ review in October 2006. At the present time, the pending *Cumulative Effects Document* is expected to allow use of 100% of streamflow for compliance with the effluent temperature limits in the NPDES Permit. Pending approval of this legislation, it appears that the City of Pendleton will be able to meet the new temperature limits set forth in the new NPDES permit. However, the City is still planning to pursue thermal credit trading through the conversion of Thorn Hollow Springs for instream uses. In addition, the existing SAT demonstration facility will be maintained and used to provide additional cooling flows and thermal credits immediately upstream of the City's proposed outfall.

3. *"By no later than six (6) months after Permit issuance, submit to the Department for approval a planning, design and construction schedule for necessary facility modifications to meet effluent limitations for residual chlorine and ammonia in the Permit."*

   The City submitted an original schedule to meet this MAO requirement, which has since been modified to reflect the change in compliance approach for Chlorine Residual and Ammonia-N.

4. *"By no later than twenty-four (24) months after issuance of the Permit, complete construction and initiate operation of the Department approved facility modifications related to chlorine (residual)."*

The City completed the construction of chemical storage and feed systems for dechlorination facilities to meet the Residual Chlorine limit included in the NPDES Permit in January 2007.

5. *"By no later than Fifty-eight (58) months after issuance of the Permit, complete construction and initiate operation of the Department approved facility modifications related to ammonia."*

   Planned facility upgrades related to compliance with the Ammonia-N permit limit are summarized in this Facility Plan. The implementation schedule for recommended plan is included in Chapter 8. A copy of the MOA is included in Appendix I.

5.2.3 Umatilla River Mixing Zone

Schedule A(4) in the Permit states the allowable mixing zone for the WWTP discharge includes *"that portion of McKay Creek contained with a band extending out fifteen (15) feet from the bank of the creek at the outfall and extending to the Umatilla River. In addition, the mixing zone includes that segment of the Umatilla River that extends 200 feet downstream to the point where McKay Creek enters the river. The Zone of Immediate Dilution (ZID) shall be defined as that portion of the allowable mixing zone that is within 10% of the distance to the mixing zone boundary in any direction from the point of discharge."*

Over time, the physical location of the confluence of McKay Creek and the Umatilla River has moved, therefore moving the outfall location further upstream of the confluence. Due to inadequate mixing flows in McKay Creek, the City is proposing to move the outfall further downstream and closer to the current stream confluence. An evaluation of outfall options and the recommended outfall option are included in Chapters 6 and 8, respectively, and mixing zone study for the new outfall is included in Appendix F.

5.2.4 Biosolids Management

Biosolids are the solids derived from primary, secondary, or advanced treatment of domestic wastewater which have been treated to significantly reduce pathogens and reduce volatile solids to the extent that they do not attract vectors. This term refers to domestic wastewater treatment facility solids that have undergone adequate treatment to permit their land application. In Oregon, the term "biosolids" has the same meaning as the term "sludge" in state statute and the term "sewage sludge" found elsewhere in state administrative rules as well as the code of federal regulations.

Most wastewater treatment plants in Oregon beneficially use their biosolids through agricultural land application on pasture, hay, wheat, and a variety of other crops. A small, but increasing number of communities further treat their biosolids such as through composting or high-temperature lime stabilization so that the end product can be sold or given away to the public.

5.2.4.1 Biosolids Regulations

DEQ implements regulatory oversight of biosolids beneficial use practices (e.g. land application) in Oregon. Although DEQ does not have formal delegation authority to implement the federal biosolids regulations, the EPA supports DEQ's regulatory oversight by providing funds, technical assistance and occasional compliance assistance to DEQ. Furthermore, the EPA does not currently conduct permitting activities for the beneficial use of biosolids in Oregon. This includes all beneficial use activities such as land application, composting, lime stabilization and air drying. The EPA maintains sole authority for biosolids management activities involving municipal sewage sludge incineration.

DEQ implements their regulatory authority in accordance with OAR 340-050 *(Land Application of Domestic Wastewater Treatment Facility Biosolids, Biosolids Derived Products, And Domestic Septage)* which references and is consistent with EPA's biosolids regulations Title 40 CFR Part 503 *(Standards for the Use and Disposal of sewage Sludge)*. DEQ implements regulatory requirements through a wastewater facilities' NPDES or WPCF permit depending on whether the facility has a surface water discharge. A Biosolids Management Plan is a component of the permit and contains a complete description of a facilities biosolids beneficial use process including: flows, treatment processes, quantity and quality, hauling procedures, spill response plans, land application site information, and site authorizations.

The state biosolids regulations define three measures for biosolids quality:

- Pathogen Reduction
- Vector Attraction Reduction
- Pollutants.

5.2.4.2 Pathogen Reduction Requirements

Pathogens are disease causing organisms such as viruses, parasites and certain types of bacteria. These organisms are significantly reduced during the biosolids treatment process so that they can be beneficially used. Pathogen reduction requirements define two classifications of biosolids – Class A and Class B. These classifications indicate the density (number per unit mass) of pathogens in biosolids. Class A requirements necessitate almost the complete destruction of pathogens. Class B requirements call for significantly reducing the density of pathogens and land applying biosolids by implementing specific site management practices such as buffers from rivers and streams. A third classification of biosolids is Class A EQ (Exceptional Quality). This refers to biosolids that have met the Class A pathogen reduction requirements and have met the lower concentrations standards for pollutants or "metals."

To be classified as Class A, biosolids must be treated using one of EPA's six pathogen reduction alternatives which include several treatment methods known as Processes to Further Reduce Pathogens, or an equivalent process. These processes include composting, heat drying, heat treatment, thermophilic aerobic digestion, beta ray irradiation, gamma ray irradiation and pasteurization. In addition to using one of the prescribed pathogen reduction alternatives, Class A biosolids must not exceed maximum allowable fecal coliform density or salmonella bacteria density.

Class B biosolids must be treated using one of EPA's three pathogen reduction alternatives which include several treatment methods known as Processes to Significantly Reduce

Pathogens, or an equivalent process. These processes include aerobic digestion, air drying, anaerobic digestion, and lime stabilization.

5.2.4.3 Vector Attraction Requirements

Vector attraction refers to the tendency of biosolids to attract rodents, insects and other organisms that can spread disease. Biosolids must meet one of the following requirements for reducing vector attraction if they are to be applied to land without restrictions:

- Volatile solids in the biosolids must be reduced by a minimum of 38 percent.
- The specific oxygen uptake rate for biosolids treated by aerobic digestion must be less than or equal to 1.5 mg oxygen per hour per gram of total solids at a temperature of 20 C.
- Aerobic processes shall treat the biosolids for a minimum of 14 days with an average temperature of at least 45° C and a minimum temperature of 40 °C.
- Lime or other alkali addition must raise the pH of the biosolids to a minimum of 12 for 2 hours and maintain the pH at a minimum of 11.5 for an additional 22 hours without additional lime.

5.2.4.4 Site Management Practices

In addition to meeting pathogen reduction and vector attraction reduction requirements, Class B biosolids land application activities must implement certain site management practices. These practices include maintaining setback distances to drinking water wells and streams, controlling public access to the land application site, grazing or harvest restrictions based on the type of crop and biosolids application method, agronomic application rate calculations, and providing for public notification of the land application activity. There are also additional regulatory considerations that DEQ employs for what are called "Certain Lands." These considerations apply to land under the federal Conservation Reserve Program, land in proximity to airports, and land with easements. Specific information on these "Certain Lands" as well as detailed explanation of DEQ's biosolids regulations can be found in their guidance document titled, "Implementing Oregon's Biosolids Program -- Internal Management Directive, December 2005."

The use of Class A EQ biosolids do not have any of the site management practices and are essentially free of regulatory restrictions once the pathogen reduction and vector attraction reduction standards have been met in the wastewater treatment plant.

5.2.4.5 Pollutants

Wastewater facilities that generate and beneficially use (e.g. agricultural land application) biosolids must monitor for and meet concentration limits for nine pollutants. These pollutants commonly referred to as "metals," include: Arsenic, Cadmium, Copper, Lead, Mercury, Molybdenum, Nickel, Selenium, and Zinc. In addition to the nine pollutants, several other parameters must be monitored. The parameters include nitrogen, phosphorus, potassium, pH, total solids and volatile solids.

Four limits have been set for the nine pollutants, as follows:

1. Ceiling Concentrations – All biosolids applied to the land must meet the ceiling concentrations for pollutants listed in Table 5.5 (40 CFR §503.13, Table 1). The ceiling concentrations are the maximum concentration limits for the nine regulated pollutants in biosolids. If a limit for any one of the pollutants is exceeded, the biosolids can not be applied to the land until such a time that the ceiling concentration limits are no longer exceeded.
2. Pollutant Concentrations – Biosolids that are to be sold or given away; or applied to the land and not be required to calculate cumulative pollutant loading (see below) must meet the concentrations listed in Table 5.7 (40 CFR §503.13, Table 3). If the pollutant concentrations for the nine regulated metals in biosolids are exceeded then the facility must track the cumulative loading of the metals until such a time that the pollutant concentration limits fall below Table 5.7 levels.
3. Cumulative Pollutant Loading Rates – Biosolids that exceed the pollutant concentrations listed in Table 5.7 but are below Table 5.5, must be tracked and not exceed the cumulative pollutant loading rates per hectare in accordance with Table 5.6 (40 CFR §503.13, Table 2).
4. Annual Pollutant Loading Rates – Biosolids that meet Class A requirements with respect to pathogen and vector attraction reduction requirements, are bagged, but do not meet the pollutant concentrations in Table 3 must not exceed the annual pollutant loading rates prescribed in Table 5.8 (40 CFR §503.13, Table 4).

5.2.4.6 Biosolids Management Plan

Biosolids Management Plans serve as the planning and operation tool for the production, storage, transportation, and land application of biosolids for beneficial use in Oregon. All wastewater treatment facilities that apply biosolids to the land must have a Biosolids Management Plan approved by DEQ. Once approved by DEQ, the management plan becomes part of a facilities NPDES permit.

The City has a Biosolids Management Plan that was revised in July 2005 and approved by DEQ. The plan currently includes Class B pathogen reduction and vector attraction reduction via anaerobic digestion. Pathogen reduction requirements are met with a an average mean cell residence time in the primary digester of 28 days at an average temperature of 98 degrees F and an average mean cell residence time in the secondary digesters of 24 days at an average temperature of 91 degrees F. Volatile solids reduction averaged 73% with the lowest average monthly reduction of 64%. This meets the minimum 38% volatile solids reduction requirements of 40 CFR §503.33(b)(1).

In 2005, 192,500 gallons of septage was received from DEQ licensed septage disposal services and 90,000 gallons of partially digested biosolids were received from the cities of Stanfield and Weston combined. The City anticipates continuing to receive septage and biosolids but not at significantly greater volumes than what is currently accepted.

In 2006, the City land applied 307 dry tons of Class B biosolids to approximately 155 acres of winter-summer fallow wheat. The amount of biosolids that were applied per acre was calculated using a yield value of 55-70 bushels and 11% protein content requiring between 132 and 302 pounds of available nitrogen per acre. After accounting for residual soil nitrogen, the City could have applied up to 70 pounds of nitrogen per acre and actually applied 67 pounds of nitrogen per acre or 2 dry tons of biosolids per acre. Application rate information to help determine appropriate nitrogen requirements for the City's biosolids land application program is based on the Oregon State University's fertilizer guide #FG 80-E, *"Winter Wheat in Summer Fallow Systems (low precipitation zone)."*

The City is required to monitor the nine regulated pollutants (Arsenic, Cadmium, Copper, Lead, Mercury, Molybdenum, Nickel, Selenium, and Zinc) and several other parameters (nitrogen, phosphorus, potassium, pH, total solids and volatile solids) based on the mass of biosolids applied to the land per year as prescribed in Table 5.9 (40 CFR §503.16, Table 1). The City land applied 278 dry metric tons (307 dry tons) in 2006 and thus was only required to monitor for these pollutants once during the calendar year. The pollutant concentrations were below the limits found in Table 5.7 and are considered "high quality" with respect to pollutant concentrations. For example, assuming the City was to continue to land apply at the current application rate and biosolids quality it would take hundreds of years to meet the cumulative pollutant loading rates for the most limiting element of Zinc. Because the City has high quality biosolids they are not required to track pollutant loading rates however in practice staff account for pollutant loading rates as a best management practice. It is recommended that the City continues to track pollutant loading rates because it will help address potential metals or nutrient questions that may arise over the life of their biosolids land application program.

Table 5.5: 40 CFR §503.13, Table 1

	Concentrations
Pollutant	**Ceiling Concentration** (milligrams per kilogram)[1]
Arsenic	75
Cadmium	85
Copper	4300
Lead	840
Mercury	57
Molybdenum	75
Nickel	420
Selenium	100
Zinc	7500

1 Dry weight basis.

Table 5.6: 40 CFR §503.13, Table 2

Cumulative Pollutant Loading Rates	
Pollutant	Annual Pollutant Loading Rate (kilograms per hectare per 365 day period)
Arsenic	41
Cadmium	39
Copper	1500
Lead	300
Mercury	17
Nickel	420
Selenium	100
Zinc	2800

Table 5.7: 40 CFR §503.13, Table 3

Pollutant Concentrations	
Pollutant	Ceiling Concentration (milligrams per kilogram)[1]
Arsenic	41
Cadmium	39
Copper	1500
Lead	300
Mercury	17
Nickel	420
Selenium	100
Zinc	2800

[1] Dry weight basis.

Table 5.8: 40 CFR §503.13, Table 4

Annual Pollutant Loading Rates	
Pollutant	Annual Pollutant Loading Rate (kilograms per hectare per 365 day period)
Arsenic	2.0
Cadmium	1.9
Copper	75
Lead	15
Mercury	0.85
Nickel	21.0
Selenium	5.0
Zinc	140

Table 5.9: 40 CFR §503.16, Table 1

Frequency of Monitoring - Land Application

Amount of Sewage Sludge[1] (metric tons per 365 day period)	Frequency
Greater than zero but less than 290	Once per year.
Equal to or greater than 290 but less than 1,500	Once per quarter (four times per year).
Equal to or greater then 1,500 but less than 15,000	Once per 60 days (six times per year).
Equal to or greater than 15,000	Once per month (12 times per year).

1 Either the amount of bulk sewage sludge applied to the land or the amount of sewage prepared for sale or give-away in a bag or other container for application to the land (dry weight basis).

Based on the pollutant loading concentrations and quality data of the other biosolids parameters the City should have ample capacity at their existing land application sites over the next planning horizon.

5.2.5 Future Water Quality Regulations

Potential future regulatory issues and requirements that may impact the Pendleton WWTP discharge to the Umatilla River in the future include:

- Toxic Substances Criteria
- Turbidity Criteria
- Reclaimed Water Regulations
- Future Ammonia-Nitrogen NPDES Permit Limits
- Increase in OAR 430-045 Permit Renewal Fees.

5.2.5.1 Toxics Substances Criteria (OAR 340-041-0033)

Allowable acute and chronic concentrations of Toxic Substances in fresh and marine waters for protection of aquatic life and human health are summarized in Table 20 attached by reference to the Oregon Water Quality Standards. The Toxic Substances Criteria and Table 20 were updated by DEQ in 2004, approved by the EQC in May 2004 and were originally planned to become effective on 15 February 2005. Tables 33A, 33B and 33C of the current Oregon Water Quality Standards summarize Oregon's proposed Toxic Substances Criteria.

At issue is the assumed fish consumption rate of 17.5 grams per day (0.6 ounces per day) used as the basis to develop the allowable concentrations protecting human health. EPA has suggested that a higher consumption rate of approximately 100 to 110 grams per day (3.5 to 3.9 ounces per day). This higher fish consumption rate could have a significant impact on the allowable concentrations of toxic substances for protecting human health.

To address the issue related to the fish consumption rate, DEQ has partnered with the EPA and CTUIR to complete the Oregon Fish Consumption Rate Project. The Project is a series of workshops with targeted subjects over a period of 8 months from January to August 2007. A final report resulting from the workshops will recommend targeted fish consumption rates in Oregon and opportunities to reduce exposure to toxic substances from fish consumption.

Ultimately, it is anticipated that the final report from the Oregon Fish Consumption Rate Project will form the basis of a rule-making for the Toxic Substances Criteria and modification of allowable concentrations of toxic substances for protection of human health. The potential impacts on all WWTP discharges in Oregon, including the Pendleton WWTP, could be significant, but are difficult to quantify at this time. It is recommended that the City participate in the workshops associated with the Oregon Fish Consumption Rate Project and evaluate the potential impact of modified Toxic Substances Criteria when proposed by DEQ following in a subsequent rule-making.

5.2.5.2 Turbidity Criteria (OAR 340-041-0036)

DEQ initiated a rule-making in December 2005 to modify the Turbidity Criteria included in the Oregon Water Quality Standards. The current Turbidity Criteria provides for an allowable increase in turbidity from point sources of 10 NTU above the background turbidity concentration in a receiving stream. Updated Turbidity Criteria include:

- Maximum Turbidity increase above background concentration of 5 NTU;
- Monthly Average Turbidity increase above background concentration of 3 NTU;
- Visual contrast criteria; and
- Allowable limited duration exceedences of the maximum and monthly average turbidity criteria.

An independent review of the technical basis for the proposed Turbidity Criteria by the Independent Multi-disciplinary Science Team resulted in recommendations to the proposed criteria and has delayed submittal to the EQC and EPA for approval. The recommendations from the IMST are extensive and suggest that there are significant deficiencies in the criteria.

Although DEQ has staff working on revisions to the Turbidity Criteria they have not committed to a date in which new criteria will be promulgated. Potential impacts of the new Criteria on the Pendleton WWTP discharge should be quantified, but should not be an issue if TSS concentration limits in the City's NPDES Permit are met. It is recommended that the City monitor effluent and receiving stream turbidity to verify potential impacts of the proposed Turbidity Criteria.

5.2.5.3 Reclaimed Water Regulations

Oregon is currently in a rule-making process to update OAR 340-055 Regulations Pertaining to the Use of Reclaimed Water (Treated Effluent) from Sewage Treatment Plants, otherwise known as the Water Reuse Regulations. An advisory committee comprised of municipal, industrial and other groups has been meeting regularly over the past year to assist DEQ in updating the Water Reuse Regulations. It is anticipated that the advisory committee will finish its work by March 2007, after which a final draft of the proposed rule-making will be prepared for formal public comment and promulgated by the EQC by approximately February of 2007.

It is anticipated that the proposed Water Reuse Regulations will reduce the barriers and other issues in the current standard related to implementation of reclaimed water projects. However, due to the location of the Pendleton WWTP in a valley with limited opportunities for nearby reclaimed water irrigation, the updated reclaimed water regulations are not likely to provide significant opportunities for beneficial reuse.

5.2.5.4 Future Ammonia-Nitrogen NPDES Permit Limits

DEQ has indicated informally that consideration will be given in the future to include standard NPDES Permit limits for Ammonia-Nitrogen. The proposed limits would be similar to the current concentration and mass load limits for BOD and TSS included in all NPDES Permits for municipal and industrial wastewater treatment plants. The implementation timeline for standard Ammonia-Nitrogen NPDES Permit Limits is unknown, but is not likely to impact the Pendleton WWTP due to the Ammonia-Nitrogen wasteload allocation already included in the City's NPDES Permit.

5.2.5.5 Increase in NPDES Permit Renewal Fees

Based on recommendations of a Blue Ribbon Panel of industry experts convened by DEQ, the fees for NPDES Permit fees included in OAR 340-045-0075 have been increased. Table 70C included in Appendix G and Table 5.10 summarizes the fees for 2007 related to the Pendleton WWTP NPDES Permit and planned WWTP upgrades. It is anticipated that the fees summarized in Table 5.10 will be increased again by DEQ in 2008.

Table 5.10: Pendleton WWTP 2007 NPDES Permit Fees

Item	Description/Cost
Facility Type C1a	2.0 MGD < Design ADWF < 5.0 MGD
New Permit Application	$27,706
Base Annual Fee (5-Year Permits)	$7,165
Additional Annual Population Fee (15,000-24,999)	$2,032
Major Modification	$13,887
Minor Modification	$760

5.3 EPA Plant Reliability Criteria

The Pendleton WWTP is required to meet the Reliability Class I standards, as defined in EPA's Technical Bulletin: *"Design Criteria for Mechanical, Electrical, and Fluid System Component Reliability," EPA 430-99-74-001*. Table 5.11 includes a summary of the reliability criteria and requirements to be considered as part of the Options Evaluation and Recommended Plan. These requirements are required to be met for design flows and loads summarized in Chapter 3.

Table 5.11: EPA Class I Reliability Criteria

Treatment Unit Process	Reliability Class I Requirements
Influent Screening	*A backup bar screen designed for mechanical or manual cleaning shall be provided. Facilities with only two bar screens shall have at least one bar screen designed to permit manual cleaning.*
Pumps (Liquids, Solids & Chemical Feed)	*A backup pump shall be provided for each set of pumps performing the same function. The capacity of the pumps shall be such that, with any one pump out of service, the remaining pumps will have the capacity to handle the peak flow.*
Secondary Clarification	*The units shall be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units shall have a design flow capacity of at least 75% of the total design flow.*
Aeration Basin	*A backup basin will not be required; however, at least two equal-volume basins shall be provided. (For the purpose of this criterion, the two zones of a contact stabilization process are considered as only one basin.)*
Aeration Blowers and/or Mechanical Aerators	*There shall be a sufficient number of blowers or mechanical aerators to enable the design oxygen transfer to be maintained with the largest-capacity-unit out of service. It is permissible for the backup unit to be an uninstalled unit, provided that the installed units can be easily removed and replaced. However, at least two units shall be installed.*
Air Diffuser Systems (if applicable)	*The air diffusion system for each aeration basin shall be designed so that the largest section of diffusers can be isolated without measurably impairing the oxygen transfer capability of the system.*
Chlorine Contact Chamber	*The units shall be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units shall have a design flow capacity of at least 50% of the total design flow.*
Electrical Power Supply	*Two separate and independent power sources, either from two separate utility substations or from a single substation and an on-site generator. The backup power supply shall be sufficient to operate all vital components during peak wastewater flow conditions, including critical lighting and ventilation.*

5.4 WWTP Design Criteria

WWTP Design Criteria for meeting effluent Permit limits are summarizes in Table 5.12. Individual process design and evaluation criteria are summarized in the various Chapters of the WWTP Facilities Plan. Design criteria for effluent BOD5 and TSS concentrations are based on maintaining the existing mass load limits included in the NPDES Permit. Design flows and loads for the Pendleton WWTP are summarized in Chapter 3 along with the wastewater characterization for existing WWTP unit processes.

Summer criteria for Nitrate-Nitrogen are included for operation of the SAT outfall in the future as well as for denitrification to recover Alkalinity and help reduce the chemical costs for alkalinity addition (methanol or other).

Table 5.12: Final Effluent Design Criteria

Parameter	Monthly Average Concentration (mg/l)	Daily Maximum Concentration (mg/l)
Summer Season (May 1 – October 31)		
Effluent BOD_5	15	30
Effluent TSS	15	30
Effluent Ammonia-Nitrogen	1.0	2.0
Effluent Nitrate-Nitrogen	7.0	10.0
Effluent E.Coli	126 counts/100mL	406 counts/100mL
Effluent Residual Chlorine	0.02 mg/l	0.05 mg/l
Winter Season (November 1 – April 30)		
Effluent BOD_5	20	40
Effluent TSS	20	40
Effluent Ammonia-Nitrogen	3.0	5.2
Effluent E.Coli	126 counts/100mL	406 counts/100mL
Effluent Residual Chlorine	0.01 mg/l	0.04 mg/l

5.5 Options Evaluation Methodology

This Chapter summarizes the methodology for the evaluation and selecting options to be included in the Recommended Plan.

5.5.1 Evaluation Procedure

Options were evaluated using a matrix-based approach incorporating economic and non-economic evaluation criteria. Scores to select the best option for the City were calculated by ranking each option relative to others and assigning a relative importance, or Weighting, to each criterion. The option with the highest Score represents the best option for the City. The scoring equation is as follows:

$$Score = \sum_{Criteria}(Rank * Weighting)$$

5.5.1.1 Rank

Options are ranked from best to worst based on the number of options being evaluated. An evaluation of three options will have rankings for each criterion from 4 (best) to 1 (worst). Options tied for a specific rank are each assigned the higher rank and the next best option is assigned a rank two positions lower. For example, two options tied for the best option are assigned a rank of "4" and the third option is assigned a rank of "2."

5.5.1.2 Weighting

The Weighting factor is a percentage-based multiplier allowing the City to place greater emphasis on specific criteria of greater importance for the city. For example, life cycle and capital costs are important to the City and are given a higher weighting in the overall evaluation. All Evaluation Criteria and Weightings were developed with input from City staff, and are equal to 100%.

5.6 Evaluation Criteria

Evaluation Criteria used in the option evaluation include:

- Capital Cost;
- 20-year Life Cycle Cost;
- Regulatory Compliance;
- Environmental and Permitting; and
- Constructability.

Following is an introductory description of each criterion used in the options evaluation along with the Weighting factor in parentheses.

5.6.1 Capital Cost (30%)

Capital costs are those costs associated with constructing facilities and appurtenances required for each option. Capital improvements may include treatment plant upgrades, pumping facilities, pipelines and discharge or holding facilities. Recommended facilities were sized for 2025 design flows.

Capital costs estimates for options are summarized in Chapter 7 and estimate spreadsheets included in Appendix H. The basis of cost estimates used to develop the estimated capital construction cost for each option is summarized in Chapter 5.7.

5.6.2 Life Cycle Cost (20%)

The life cycle cost includes initial capital costs as well as annual O&M costs for required facilities. Annual O&M costs include WWTP personnel, energy (electricity and natural gas), chemicals, groundwater monitoring and other miscellaneous costs. The Net Present Value of annual O&M costs for determining the Life Cycle Cost was calculated based on the following criteria:

- Labor Rate: $50/hour
- Energy Rate: $0.06/kilowatt-hour (kWh)
- Discount Rate: 5%
- Evaluation Period: 20 years
- Residual Value: $0.

5.6.3 Regulatory Compliance (30%)

Regulatory compliance is based on the reliability of each option for meeting effluent discharge limits included in the City's NPDES Permit for the Pendleton WWTP. Each selected must reliably meet all NPDES requirements, but certain options may have more variability or higher risk in terms of long term compliance.

5.6.4 Environmental and Permitting Requirements (10%)

Environmental and permitting is based on the relative environmental and permitting requirements for each option. This criterion is most critical for the evaluation of outfall and discharge options and is equal for treatment options.

5.6.5 Constructability (10%)

Constructability relates to the complexity and potential issues for constructing the proposed option and meeting critical deadlines. For example, construction of a new outfall diffuser in the Umatilla River will be difficult to construct within a short in-water work period which could require two construction seasons, which could delay the completion of improvements beyond deadlines included in the MAO.

5.7 Basis of Cost Estimates

Construction costs for each option were estimated based on recent construction costs for similar facilities, RS Means construction cost data and the Engineer's experience on similar projects. Standard mark-ups applied to conceptual construction cost estimates are summarized in Table 5.13.

Table 5.13: Applied Mark-ups for Conceptual Cost Estimates

Item	Markup as Percent of Construction Cost
Annual Escalation to Midpoint of Construction	3%
General Conditions and Mobilization	9%
Overhead and Profit	15%
Construction Contingency	30%
Engineering/Surveying/Legal/Administrative	25%

Chapter 6: Unit Process Option Analysis

6.1 Introduction

Based upon the existing facilities condition assessment presented in Chapter 4 and the Basis of Planning requirements summarized in Chapter 5 of the Facility Plan, five unit processes were identified that require upgrades. The five unit processes include:

- **Preliminary Treatment** – Improvements are required to address corrosion of the existing prefabricated metal building over the influent screens and severe corrosion of electrical equipment in the adjacent grit processing building;
- **Secondary Treatment** – Upgrade of the existing secondary treatment process is required to meet new summer- and winter-season effluent ammonia-nitrogen permit limits;
- **Solids Processing** – Additional solids processing capacity is required to provide adequate capacity for increased solids product ion from the secondary treatment process improvements;
- **Underground Electrical Conduits** – Electrical conduits and systems throughout the treatment plant are in need of replacement. Underground galvanized steel conduits installed throughout the plant in previous plant upgrades are severely corroded, and much of the electrical equipment is in need of replacement; and
- **Outfall** – It is anticipated that the current WWTP outfall will need to be relocated closer to the confluence of the Umatilla River and McKay Creek to maintain the current mixing zone that includes dilution flows from both streams.

This chapter presents a preliminary analysis of the options available for each unit process identified above. Each option includes a description of the unit process and installation requirements and a comparison of the capital costs and the lifecycle costs (if applicable). The recommended option for each unit process is identified for inclusion in Chapter 7, *Complete Alternatives Evaluation*, and Chapter 8, *Recommended Plan*. Due to the cost and complexity of the required secondary treatment process upgrades, multiple secondary treatment process options are identified for inclusion in the *Complete Alternatives Evaluation* presented in Chapter 7 of the Facility Plan.

Aging mechanical and electrical equipment noted in Chapter 4, *WWTP Condition Evaluation*, requires equipment replacement or mechanical upgrades with only one option. Therefore, the majority of the upgrades recommended to address the aging facilities are included only in the *Recommended Plan*. These improvements are required to assure reliable WWTP operations over the 20-year planning horizon.

6.2 Preliminary Treatment Options

Existing WWTP preliminary treatment facilities, or headworks, include influent screening and grit removal as described in Chapter 4. The existing screening equipment is housed in a metal building enclosure set on top of the two concrete influent channels. The metal building was installed in 1999, but due to the corrosive environment in the headworks, the building is severely corroded and in need of replacement. In addition, the existing building does not provide adequate space for WWTP staff to access and maintain the screening equipment. The existing auger-type mechanical screen is in relatively good condition and does not require replacement.

The grit processing building is adjacent to the headworks building. This concrete masonry unit (CMU) building houses the grit classifier and pumps along with electrical controls. Due to the inadequate ventilation system in the building and highly corrosive environment, the electrical controls in the building are also severely deteriorated and in need of replacement. Much like the headworks building, the existing building does not provide adequate space for WWTP staff to access and maintain the grit classifier equipment or the electrical controls.

Preliminary treatment options to address the deficiencies in the headworks and grit removal buildings include:

Option PT1. Construct a new, larger headworks building with a properly-sized ventilation system for the existing screening equipment, grit classifier, and all electrical equipment. Convert the existing grit building into a storage room.

Option PT2. Construct a new, smaller headworks building with a properly-sized ventilation system for the existing screening equipment and grit classifier. Convert the existing grit building into a storage room.

Option PT3. Construct a new, smaller headworks building with a properly-sized ventilation system for the existing screening equipment only. Leave the existing grit equipment in the grit building and relocate the existing electrical controls to outside the building.

Life-cycle costs were not considered for preliminary treatment options, since each will have approximately the same annual operations and maintenance cost.

6.2.1 Option PT1 – New Headworks & Grit Removal Building with Electrical Room

Option PT1 consists of demolishing the existing headworks building and constructing a new larger CMU block building. The new headworks building would be sized to enclose the existing screening and grit classifier equipment. The grit classifier would be relocated to the new headworks building, and a new electrical room meeting current electrical code requirements would be constructed to house all headworks electrical equipment. The existing grit building would be converted to a storage room. The new headworks building would have a properly sized heating, ventilation, and air conditioning (HVAC) system to inhibit the corrosive environment currently contributing to premature aging of electrical and mechanical equipment.

The new headworks building would include installation of a portable gantry crane to allow in-channel equipment to be taken offline for maintenance. The building would be designed to provide adequate space between equipment for maintenance access.

The estimated capital cost for Option PT1 is $372,000.

6.2.2 Option PT2 – New Headworks & Grit Removal Building without Electrical Room

Option PT2 consists of demolishing the existing headworks building and constructing a new, but smaller, CMU block building. The new headworks building would be sized to enclose the existing screening and grit classifier equipment. The grit classifier would be relocated to the new headworks building. and the existing grit building would be converted to an electrical room meeting all current electrical code requirements. The new headworks building would have a properly sized HVAC system to inhibit the corrosive environment currently contributing to premature aging of mechanical and electrical equipment.

The new building would allow for required maintenance space and a portable gantry crane would be included for removal of in-channel equipment. Since the grit equipment would be removed from the existing grit building, the existing electrical controls would be updated, but not require relocation. Relocating the grit-classifying equipment to the new headworks building would remove the source of the current corrosive atmosphere, thereby protecting the new electrical equipment from corrosion.

The estimated capital cost for Option PT2 is $278,000.

6.2.3 Option PT3 – New Headworks Building with Outside Electrical Enclosures

Option PT3 consists of demolishing the existing headworks building and constructing a new CMU building of approximately the same size. The building footprint for the new headworks building would be sufficient for adequate maintenance access to the screening equipment and a portable gantry crane would be included for removal of in-channel equipment. No grit classifier equipment or controls would be relocated to the new headworks building.

The electrical controls in the grit building would be replaced and relocated to the outside of the existing building in weatherproof enclosures. Locating the electrical controls on the exterior of the building would remove them from the corrosive environment in the grit building and bring the electrical system up to code. The grit classifier would remain as currently installed in the grit building.

The estimated capital cost for Option PT3 is $205,000.

6.2.4 Preliminary Treatment Option Evaluation

Table 6.1 summarizes the capital costs, advantages, and disadvantages of Options PT1, PT2, and PT3. Option PT1 has the highest capital cost and Option PT3 the lowest capital cost.

Options PT1 and PT2 provide increased maintenance access to headworks screening and grit removal equipment, Option PT3 provides minimal improvements to access for screening equipment.

Table 6.1: Preliminary Treatment Options Summary

	Option PT1	Option PT2	Option PT3
Capital Cost	$372,000	$278,000	$205,000
Advantages	Improved access to screen & grit equipment	Lower Capital Cost	Lowest Capital Cost
	Electrical room in new building with HVAC	Improved Access to screen & grit equipment	Improved access to screen equipment
	Convert grit building to storage room	Convert grit building to electrical room	
Disadvantages	Highest Capital Cost		No improved access to grit equipment
		Does not provide additional storage room	Electrical panels to be in outside enclosures

Recommended Option

Option PT2 is the recommended preliminary treatment option. Although Option PT2 is more expensive than the least costly option, it provides the advantages of increased maintenance access to the screening and grit removal equipment and addresses the electrical issues by converting the existing grit building to an electrical room and relocating the source of the corrosive atmosphere – the grit classifying equipment – to the new headworks building.

6.3 Secondary Treatment Options

As noted in Chapter 5, *Basis of Planning*, the renewal NPDES Permit (Permit) for the Pendleton WWTP contains stringent summer and winter discharge limits for ammonia-nitrogen. The monthly average concentration limits in the Permit are 1 mg/l during the summer season (from May through October) and 3 mg/l during the winter season (from November through April). In addition, the secondary process needs to be designed to meet a maximum nitrate-nitrogen concentration of 10 mg/l during the summer season when the subsurface discharge outfall may be used in the future. Major secondary process upgrades are required to meet these new nitrogen limits.

Current technologies available to reach the nitrogen removal limits described above use a process called biological nutrient removal (BNR). BNR processes can be designed to remove nitrogen and phosphorus from wastewater. For the Pendleton WWTP, the BNR process will be designed to remove nitrogen only. Biological nitrogen removal is a sequential process that first nitrifies ammonia-nitrogen to nitrate-nitrogen in an aerobic environment, then denitrifies nitrate-nitrogen to nitrogen gas in an anoxic or anaerobic environment. The reactions are dependent upon the specific environmental conditions in the reactor, including pH, temperature, alkalinity, dissolved oxygen concentration, substrate concentration, and the presence of toxic compounds.

Four secondary process treatment systems were evaluated to address the new effluent nitrogen limits:

Option ST 1. Leave the current treatment process in place as designed and construct a subsurface discharge facility to treat nitrogen year-round.

Option ST2. Install a new Biolac© secondary treatment process in Aeration Basin 2.

Option ST3. Install a new BNR system based on the Modified Ludzack-Ettinger (MLE) treatment process.

Option ST4. Install a membrane bioreactor (MBR) with an upstream MLE process.

All of these processes rely on the biological nutrient removal processes described above and represent a range of capital cost investment, process reliability and control, and future expandability. A fifth process for biological nitrogen removal, an oxidation ditch, was discounted due to its inability to accommodate future expansion and large footprint that rendered it less cost-effective compared to the Biolac© process.

6.3.1 Option ST1 – Subsurface Discharge Outfall

Subsurface discharge showed promise for in situ ammonia-nitrogen removal during the subsurface discharge demonstration project completed in 2005 on an 8-acre site adjacent to the WWTP. However, the process did not demonstrate reliable ammonia treatment required to consistently meet the NPDES permit, and the process is unlikely to be unsustainable as a long-term solution due to the likelihood of decreasing permeability due to plugging of the subsurface.

Option ST1 would consist of constructing a full-scale subsurface discharge system to meet Permit limits for effluent ammonia-nitrogen and temperature. The City would continue to use its existing activated sludge treatment system for BOD removal, and treated effluent would be directed to the subsurface discharge facility following secondary treatment and disinfection.

The subsurface discharge outfall would require an alternative site across McKay Creek from the existing demonstration site due to hydraulic restrictions of the perimeter flood control dike. A new site would require significant testing to characterize soils and install monitoring gauges for proper facility design and operation. There are concerns that the winter season ammonia-nitrogen limits will be difficult to meet and, as with any natural treatment system, the City would have little control over the treatment process and would likely be required to implement an in-plant option like the MLE process if effluent nitrogen limits could not be consistently met with the subsurface discharge outfall.

6.3.1.1 Conceptual Facility Design

An effluent subsurface discharge demonstration project was conducted by the City in 2005 on an 8-acre site adjacent to the WWTP and Umatilla River. The pilot used five 150-foot discharge headers that were able to discharge a sustained flow of 250,000 gallons per day (gpd).

However, the flow was severely inhibited by the perimeter flood control dike surrounding the property. Therefore, it is reasonable to assume the soils could sustain a flow of approximately double the sustainable demonstration flows. For full-scale installation this would require approximately 80 acres on an alternative site along McKay Creek.

Installation of the full-scale subsurface discharge outfall would include a new effluent pump station downstream of the existing chlorine contact chamber, an 18" effluent pipeline for the McKay Creek crossing, and two parallel perforated 18" headers that would convey effluent to the subsurface discharge site for the subsurface treatment system. Two separate pipelines would be required to provide for adequate dose-rest cycles for each portion of the system. Each pipeline would be approximately 6,750 feet in length. A preliminary layout of the Subsurface Discharge System is presented in Exhibit 6.1.

The perforated pipeline trench would be dug approximately 6 feet deep, or approximately the depth to bedrock in the treatment plant vicinity. Monitoring wells would be required throughout the subsurface discharge site with upgradient and downgradient monitoring to verify effluent limits are being met prior to discharge into the hyporheic zone of the Umatilla River.

6.3.1.2 Capital and Lifecycle Costs

The estimated capital cost of the subsurface discharge facility is $5.1 million, including land acquisition, pipeline, and monitoring well installation. These capital costs do not include any required improvements to address the deteriorating condition of the existing WWTP.

Estimated annual operations and maintenance costs are $84,000 for the subsurface discharge outfall only. These annual costs include effluent pumping and staff time to operate and monitor the system.

The 20-year net present worth of these capital and annual operation and maintenance (O&M) costs, assuming a discount rate of 5% per year, is $6.1 million for the subsurface discharge outfall only.

6.3.2 Option ST2 – Biolac© Treatment Process

The Biolac© process is a proprietary complete-mix BNR process. The system consists of a series of floating aeration headers that support suspended diffused air units. Through a controlled aeration process, the complete system claims to be able to provide both biological nitrification and denitrification. The Biolac© process is typically installed in facultative lagoon-type treatment systems in smaller communities. These basins are typically large in footprint to support the alternating aerobic and anoxic zones used in the Biolac© process to achieve nitrification and denitrification without the internal recycle typically required of other BNR processes. Wave Ox™, the Biolac© trademark for this oscillating aeration pattern, is intended to produce effluent BOD/TSS less than 10 mg/l and claims to be able to achieve ammonia concentrations of less than 1 mg/l.

To verify the manufacturer's claims, Kennedy/Jenks contacted five of the northwest installations. Operator feedback on this process was very positive, with all plants recommending the system, and with all plants meeting effluent BOD/TSS requirements withtypical concentrations of less than 10/10 mg/l, respectively. However, only two of the plants (both operated by the same utility) have the Wave Ox™ process online and neither Plant had an ammonia permit limit. Therefore, it does not appear that there is sufficient installation performance data to confirm that the Biolac© process would be able to reliably meet the stringent winter and summer ammonia limits in the City's NPDES permit. In addition, there appears to be little operational control of the Wave Ox™ process compared to other process options. Furthermore, the Biolac© process requires approximately 40% larger basin volume than the MLE and MBR process described in Options ST3 and ST4.

Based on flow and load characteristics presented in Chapter 3, the required basin volume for a Biolac© process would be achieved by converting both the existing Sludge Storage Basin and Aeration Basin No. 1 (AB1). Although existing Aeration Basin 2 would also provide sufficient volume, it is considered a more suitable location for potential diurnal effluent storage for meeting effluent temperature limits due to its proximity to the chlorine contact basin. Basin AB1 and the sludge storage basin (SSB) would be rehabilitated and outfitted with floating aeration headers and diffusers. Electrical control of the air distribution system cycles the air through the headers and diffuser units forcing the hanging diffusers to swing. The swinging diffusers force the aeration header to oscillate across the basin surface. The oscillating header and swinging diffuser units and the waves of aerobic and anoxic zones required for simultaneous nitrification and denitrification allow for continual mixing without an internal recycle.

Extended sludge age combined with the large basin application allows for increased process stability during average and peak events. Maintenance of the Biolac© process tends to be straightforward, allowing plant staff to repair or replace air headers or diffuser units without draining the basin. Although it is possible to do in-water repairs, discussions with other Northwest plant operators with Biolac© process installations indicate this tends to be more problematic and repairs are typically done on land.

6.3.2.1 Conceptual Facility Design

Based on design Pendleton WWTP flows and loads, the required basin volume for the Biolac© process is a Biolac© installation can be achieved in AB1 and the SSB. These two basins would be piped together in series as shown in Exhibit 6.2.

Each of these proposed basins were originally lined during the 1970 upgrades. Based on an expected liner life of 20-40 years, rehabilitation of the lining systems for AB1 and the SSB is required during the planning horizon. Relining of the basins will include removal of the existing PVC liner and shotcrete overcoat and installation of new liner subgrade, new 60-mil PVC liner system, shotcrete cover, and the liner anchoring trench. Other necessary basin modifications will include new discharge piping from the in-plant pump station to the head of the current SSB, influent and effluent collection boxes, and effluent piping modifications required to tie into the existing secondary clarifier splitter box.

A new building is included to house the 100 hp blowers and controls for the Biolac© system. To minimize total air piping, the building will be located between the two basins.

6.3.2.2 Capital and Lifecycle Costs

The estimated capital cost of the new Biolac® secondary treatment process, including the aeration headers and diffuser units, blowers, basin modifications, new blower and control building, and all piping modifications for aeration and process piping, is $3.7 million.

Estimated annual operations and maintenance costs for the Biolac® secondary treatment process are $130,000. These annual costs include effluent pumping and staff time to operate and monitor the system. These costs include an additional 0.5 FTE operator at the treatment plant.

The 20-year net present worth of these capital and annual O&M costs, assuming a 5% discount rate per year, is $5.3 million for the Biolac® only.

6.3.3 Option ST3 – New MLE Secondary Process

The MLE process is a BNR process used throughout the world to efficiently remove nitrogenous compounds from wastewater effluent. A multiple-stage reactor consisting of anoxic and aerobic zones is designed to achieve low effluent ammonia and nitrate-nitrogen limits. The efficient process, coupled with internal recycle pumping, provides for a more economical installation than single-stage reactors like the Biolac© process that don't have recycle pumping. The MLE process can also be upgraded to provide an anaerobic zone should biological phosphorus removal be required in the future.

The MLE process uses anoxic zones ahead of the aerobic zone and a mixed-liquor recycle stream from the aerobic zone to the anoxic zones to achieve both nitrification and denitrification. The addition of the internal recycle stream combined with the influent BOD to the anoxic stage serves as an exogenous electron donor. The MLE process allows control over the fraction of nitrate removed though variation of the internal recycle ratio. Furthermore, higher denitrification rates are attained because the anoxic reactor receives a source of readily biodegradable chemical oxygen demand (COD). This allows smaller anoxic volumes for a given nitrate removal requirement compared to the original Ludzack-Ettinger, and Wuhrmann processes.

6.3.3.1 Conceptual Facility Design

An MLE process can take many forms with varying degrees of operational flexibility and control. For the City of Pendleton, two different configurations were considered:

- Conversion of the existing sludge storage basin to a complete-mix MLE process; and
- Installation of a new concrete basin for a more efficient plug-flow MLE process.

Complete-mix basins are large open basins with inflow entering on one end and the outflow exiting on the opposite end of the basin. Typically, complete-mix basins develop dead zones in the corners where mixing and oxygen transfer tend to be insufficient; however, they are more economical to build because they require fewer partition walls. A plug-flow MLE installation takes the complete-mix basin and adds partition walls to direct the flow path. These baffle walls force flows through a serpentine path, maintaining better particle suspension and allowing improved oxygen transfer. Installation of the baffle walls also allows sampling at locations along the plug-flow pathway, providing WWTP operations staff the ability to vary flows and aeration as required to control the treatment process.

The complete-mix MLE process would be a retrofitted design located in the existing SSB that would reuse of the existing basins at the treatment plant. Conversely, the plug-flow MLE process would require construction of a new concrete basin located at the site of existing AB1. Preliminary layouts for both options are presented in Exhibits 6.3 and 6.4, respectively.

The complete-mix MLE configuration would require continued use of surface aerators for aeration and mixing due to the shallow depth of the existing basins. However, the plug-flow MLE configuration would be designed with a sufficient side-water depth to use more energy-efficient aeration blowers and fine-bubble diffusers. Although both the complete-mix and plug-flow MLE processes are expected to be operational through the 20-year planning horizon, the plug-flow MLE process would provide longer useful life, lower operational costs for aeration, and improved process control flexibility for meeting the low effluent ammonia-nitrogen effluent limits.

6.3.3.2 Capital and Lifecycle Costs

Capital and lifecycle costs have been estimated for both the complete-mix MLE configuration and the plug-flow MLE configuration. Capital cost estimates include recycle pumps, air and mixing systems, basin relining or new concrete basin construction, and all associated piping. The estimated capital cost for the Complete Mix MLE configuration is $4.9 million; the estimated capital cost for the Plug Flow MLE configuration is $7.2 million. Estimated annual operations and maintenance costs are $173,000 for the complete-mix MLE configuration and $164,000 for the plug-flow MLE configuration. These costs include salary for one additional full-time operator at the treatment plant, which would be required for both options.

The 20-year net present worth of these capital and annual O&M costs, assuming a 5% discount rate per year, is $7.5 million for the Complete Mix MLE configuration and $9.6 million for the Plug Flow MLE configuration.

6.3.4 Option ST4 – New Membrane Bioreactor

An MBR process combines the MLE process described in Option ST3 for BNR along with microfiltration to produce a high-quality permeate. Membrane effluent is highly reliable due to the consistency across the membrane pores. Typical effluent quality results in BOD and TSS below 5 mg/l, total nitrogen less than 5 mg/l, and turbidity of less than 1 nephelometric turbidity unit (NTU).

Identical to the MLE process described in Option ST3, the unit process includes anoxic basins to achieve denitrification followed by aeration basins that achieve BOD removal and nitrification. Treatment cells housing the membrane units are located downstream of the aeration basins, and are furnished with coarse-bubble air diffusers for membrane cleaning, mixing, and further biological treatment. Permeate pumps draw permeate through the membranes under suction. As permeate is removed, return activated sludge (RAS) is returned to the anoxic basin at the head of the treatment train to complete the BNR process.

The physical barrier provided by the membrane allows the activated sludge basin to be operated at a higher mixed-liquor concentration – typically in the range of 8,000 to 10,000 mg/l – than conventional activated sludge basins. This increased mixed-liquor concentration allows for a decreased basin footprint, which reduces capital costs for excavation, concrete, piping, and related improvements. Furthermore, the MBR combines secondary and tertiary treatment into one process unit. This eliminates the need for the existing secondary clarifiers, and therefore eliminates the capital cost expenditure required to replace the secondary clarifier drive mechanisms that is required in options ST1, ST2, and ST3.

6.3.4.1 Conceptual Facility Design

The proposed location for the MBR secondary treatment process is in the footprint of existing AB2. This site has several advantages, including sufficient space to construct an MBR tank to handle projected flows through the design life of the facility and space for modular expansion. Furthermore, because the tank is currently unused, construction of the MBR tank would not interrupt current WWTP operation.

The conceptual MBR facility layout is shown in Exhibit 6.5. The MBR layout consists of an upstream MLE process with downstream basins for the membranes. A flow control structure between the aeration basins and MBR basins would provide process and flow control flexibility and allow each of the three membrane basins to be fed independently. Also shown are two swing cells located between the anoxic and aeration basins. The swing cells would be configured for either anoxic or aerobic conditions, providing increased flexibility to match needs of the incoming flows.

The expected water depth of the new MBR basin is approximately 20 feet, allowing for optimum oxygen transfer efficiency within the aeration basins. This depth provides for compatible installation of either type of commonly available submerged membrane systems, flat plate or hollow fiber, which would be examined further in pre-design. The treatment basin would be capped with a concrete slab and an operations center for instrumentation and controls would be constructed above the membrane basin.

6.3.4.2 Capital and Lifecycle Costs

The estimated capital cost of the new MBR is $12.9 million and includes the new concrete basins, secondary process and MBR equipment, pumping, membrane cassettes, and all related appurtenances. A new operator's office and electrical control building is also included, to be located on top of the treatment basin.

Estimated annual operations and maintenance costs are $368,000 for the new MBR secondary and tertiary treatment processes. These annual costs include an additional 0.5 FTE operator at the treatment plant and an annual membrane replacement fund.

The 20-year net present worth of these capital and annual O&M costs, assuming a 5% discount rate, is $18.4 million for the MBR treatment process only.

6.3.5 Secondary Treatment Option Evaluation

Table 6.2 presents a summary of the capital costs, lifecycle costs, and advantages and disadvantages for each secondary treatment option.

Table 6.2: Secondary Treatment Options Summary

	Alt ST1 Subsurface Discharge	Alt ST2 Biolac©	Alt ST3(A) MLE Complete Mix	Alt ST3(B) MLE Plug Flow	Alt ST4 MBR
Capital Cost	$5.1 million	$3.7 million	$4.9 million	$7.2 million	$12.9 million
Lifecycle Cost	$6.1 million	$5.3 million	$7.5 million	$9.6 million	$18.4 million
Advantages	Low Capital Cost Also provides effluent cooling	Lowest Capital Cost Proven nutrient removal process	In-plant BNR Process Lower Capital Cost than Plug Flow MLE	In-plant BNR Process Best for Process Control	Highest Quality Effluent Best for future regulations
Disadvantages	Limited Process Control Performance unknowns	Performance Unknowns Limited Process Control Large Footprint Limited Future Expandability	Less Reliable than Plug Flow Difficult to Operate	Higher Cost than Complete Mix MLE	Highest Cost

Recommended Option

As shown in Table 6.2, Option ST2, the Biolac© process is the most economical secondary treatment option for capital and life cycle costs. However, it has not been confirmed that the Biolac© process would be able to consistently meet the low summer and winter effluent ammonia-nitrogen limits. Preliminary process modeling completed by Kennedy/Jenks indicates a single-stage process might not be sufficient to achieve these low limits. Option ST1, the new subsurface discharge outfall, is the second lowest-cost option, but it would be a natural treatment process with very limited process control flexibility. There are also concerns over long-term attenuation of nitrogen in the soil and potential issues with long-term performance. For these reasons, Options ST1 and ST2 are not recommended for the secondary treatment process as processes to meet the very stringent effluent ammonia-nitrogen permit limits.

Option ST3A, the Complete Mix MLE Process, is the next lowest cost option. It is possible that this option could meet the low effluent ammonia-nitrogen limits, but it would be a very difficult process to operate and would require considerable attention from WWTP staff. In addition, consistently meeting the effluent nitrate-nitrogen design criteria would be difficult. The Complete Mix MLE Process would also continue to use lower efficiency surface aerators that are more energy intensive than most diffused aeration systems and would provide limited future expandability.

Therefore, Kennedy/Jenks recommends the City consider either Option ST3B, a Plug Flow MLE Process; or Option ST4, a new MBR. Option ST3B provides the most process control flexibility and future expandability. In addition, the Plug Flow MLE Process could be retrofitted into an MBR in the future if the cost of a new MBR is prohibitive at the present time. This would also provide increased flexibility for meeting future regulatory requirements summarized in the Basis of Planning. Each of these options is considered in the *Complete Options Evaluation* in Chapter 7, along with the more economical Option ST3A.

6.4 Solids Processing Options

The existing solids processing and storage system consists of the primary and secondary digesters, the SSB and the solids drying beds. As discussed in Chapter 4, nearly all of the volatile solids destruction occurs in the Primary Digester. The digested solids are stored and thickened by decanting in the Secondary Digesters and SSB prior to being pumped to the existing solids drying beds.

A solids balance was completed for the two recommended secondary process options, the Plug Flow MLE Process or an MBR. Both of the secondary process options would result in significantly higher solids generation. Although it appears the Primary Digester has adequate digestion capacity for the next 20 years, the storage and drying capacity is limited and will need to be expanded. The largest bottleneck in the solids process is solids drying over the winter, which takes approximately 8 months. The following section discusses two options available for additional solids dewatering: construction of additional solids drying beds and a new mechanical dewatering facility.

Two solids dewatering options were considered:

Option SP1. Construct additional solids drying beds.

Option SP2. Install mechanical dewatering equipment and a new dewatering building with a covered cake storage area for year-round solids processing.

6.4.1 Option SP1 – Additional Solids Drying Beds

Solids drying beds rely on a simple natural process in which stabilized solids from the secondary process and digesters are dewatered through drainage and evaporation. Typically, solids drying beds are constructed from asphalt and sealed to provide an impermeable surface with collection points for water to be removed to a controlled discharge point in the plant. The existing solids drying beds at the treatment plant do not have a drainage system, so all drying is accomplished through evaporation and by turning the solids frequently using a bulldozer.

Depending on the weather cycle, an average of three complete loading cycles can be achieved in Pendleton. These cycles include two 2-month cycles from June-July and August through September. A third cycle is typically started in October, but is not completed until May. Upon the arrival of the wetter winter season when evaporation does not overcome precipitation, each drying bed is "topped-off" and allowed to sit until spring.

Incorporating additional drying beds into the plant would be a relatively straightforward process due to the operator's existing familiarity with drying bed operations. An increased area would increase the labor required during the solids removal process; however, the day-to-day operation of the beds would require minimal operator time. Assuming the new beds are operated similar to the existing beds, a total drying bed area of 4.3 acres would be required to meet future solids loading demands. With an existing drying bed area of 1.4 acres, an additional 2.9 acres would be required.

6.4.1.1 Conceptual Facility Design

The proposed location for the additional drying beds is shown in Exhibit 6.6. The drying beds would be constructed with an asphalt liner and sloped side walls to a depth of approximately 24 inches for easy maintenance. Due to the increased area for the new solids drying beds, the existing perimeter fence would need to be expanded. Although plant staff is familiar with the operation of the solids drying beds, the additional solids drying beds would double the size of the facility and would require significantly more staff time for operation in the summer months.

6.4.1.2 Capital and Lifecycle Costs

The estimated capital cost of the new solids drying beds is $810,000, including all excavation and paving costs associated with the new beds. Additional property acquisition or modification of the existing sludge drying beds with concrete side walls is not included.

Estimated annual operations and maintenance costs are $41,000 for the new solids drying beds and include an additional 0.5 FTE operator at the treatment plant.

The 20-year net present worth of these capital and annual O&M costs, assuming a 5% discount rate, is $1.4 million for the new solids drying beds.

6.4.2 Option SP2 – Mechanical Dewatering

A new mechanical dewatering facility is the second solids dewatering option considered to add solids drying capacity at the Pendleton WWTP. Mechanical dewatering would relieve additional loading on the existing drying beds and allow complete operational control over the dewatering process. Mechanical dewatering could also be used full time during the winter and in conjunction with the existing solids drying beds in the summer.

Mechanical dewatering is a process in which equipment with a relatively small footprint is used to remove liquids from the solids for storage and disposal or beneficial reuse. There are many options for solids dewatering technology, each with its own advantages and disadvantages. The options considered for the Pendleton WWTP centered on a centrifuge and a screw press, each discussed in greater detail below.

6.4.2.1 Centrifuge Mechanical Dewatering

Centrifuges use a process in which a centrifugal force is applied to stabilized solids (sludge) to separate the solids and liquid fractions, relying on the same theory as a gravity thickener. The centrifuge creates a force 500 to 3,000 times the force of gravity, which substantially accelerates liquid separation and can achieve solids concentrations of 18% to 30% for municipal sludge.

In a centrifuge, sludge is introduced into a spinning bowl, where centrifugal force concentrates the solids onto the periphery. An internal screw conveyor spinning at a different rate from that of the bowl moves the concentrated sludge along the periphery to the discharge. Because the process is enclosed, it releases fewer odors than other dewatering options.

Maintenance costs and energy consumption for centrifugal dewatering equipment can be substantial, so this process is usually considered only when other dewatering methods cannot achieve the desired performance. Because of its complexity, the process is typically monitored whenever it operates. Solids capture rates are generally high, but vary depending on sludge characteristics, flow rate, and centrifuge manufacturer. Polymer is typically required for centrifugal dewatering, and is usually desired to improve solids capture and increase solids concentration.

6.4.2.2 Screw Press Mechanical Dewatering

A screw press uses pressure to separate liquids from sludge. Sludge conditioned with polymer is fed into a screw press where a rotating bowl forces the sludge through a gradually decreasing opening, forcing liquids to be separated from the solids in the process. The screw press (and similar technologies) is growing in popularity because it has a lower capital cost and uses less energy than a centrifuge while requiring only a slightly larger footprint and producing a solids concentration of 15% to 25% solids for municipal wastewater sludge.

There are several options for this press-type technology that should be considered fully during preliminary design.

6.4.2.3 Conceptual Facility Design

The location of the new metal building for the solids dewatering and covered cake storage is shown in Exhibit 6.7. The dewatering building would be a butler-type building with the equipment enclosed in the dewatering room and a covered cake storage area with open sides for ventilation. The conveyor from the dewatering room would transfer solids from the dewatering equipment and drop them in the cake storage area, allowing plant staff to move the dried cake to a desired location in the storage area with a front-end loader as required.

Ancillary equipment required with solids dewatering facility would include a centrate pumping system, polymer feed system, and electrical and controls equipment. The polymer feed system typically consists of a polymer feed tank and a mixing tank for polymer make-up along with a polymer feed pump. The dewatering equipment also requires a water source (potable or plant non-potable water [NPW]) for cleaning the equipment on a regular basis.

6.4.2.4 Capital and Life Cycle Costs

The estimated capital cost of the new solids dewatering facility is $1.76 million, including the new dewatering equipment, dewatering building and cake storage area, pumping systems, polymer feed system, water service and ancillary facilities. This cost is based on a centrifuge, which has a higher capital cost than a screw press.

Estimated annual operations and maintenance costs are $37,000 for energy consumption and polymer. These costs do not include any additional plant operations staff. This cost is also based on a centrifuge, which has a higher energy demand than a screw press.

The 20-year net present worth of these capital and annual O&M costs, assuming a 5% discount rate, is $2.2 million for the new mechanical dewatering facility. This cost should be evaluated fully during preliminary design and could be lowered considerably if a screw press or other press technology is selected rather than a centrifuge.

6.4.3 Solids Processing Options Evaluation

Table 6.3 presents a summary of the capital costs, lifecycle costs, and the advantages and disadvantages for the two solids dewatering options.

Table 6.3 Solids Processing Options Summary

	Option SP1 Drying Beds	Option SP2 Mechanical Dewatering
Capital Cost	$810,000	$1.76 million
Lifecycle Cost	$ 1.4 million	$ 2.2 million
Advantages	Easy to Operate & low mechanical requirements	Dewater sludge year-round
	Low O&M costs	Small footprint with covered storage area
	Staff familiar with process	Small footprint maximizes future expandability
Disadvantages	Large footprint with limited future expandability	Highest Capital and Lifecycle Cost
	Natural process with minimal process control	New process with a learning curve for plant staff

Recommended Option

As is evident from Table 6.2, Option SP1, expansion of the solids drying beds, is the most economical solids dewatering option. However, this option has significant disadvantages, including using most of the available space on the existing WWTP site, higher O&M costs, and significant operating requirements in the summer season. Therefore, considering these drawbacks, Option SP2, mechanical dewatering is the recommended option.

Mechanical dewatering provides the ability to dewater stabilized sludge year-round, reducing impact on plant staff and providing some protection against natural conditions during the summer drying season. The cost for mechanical dewatering will also be less if a screw press or similar "press-type" technology is considered in lieu of a centrifuge.

6.5 Underground Electrical Conduits

Major electrical conduit runs installed during and prior to the 1970 WWTP upgrade used direct-buried galvanized rigid steel (GRS) conduits. Due to soil chemistry, many of these GRS conduits are experiencing severe corrosion problems. In fact, many of the conduit runs are so completely corroded that new wiring cannot be pulled through them.

New conduit runs are recommended to address this issue and provide reasonable assurance that electrical systems can be upgraded as required during construction. Three options for replacing the primary electrical utility conduits are evaluated in this section: direct-buried conduit, a concrete-encased conduit bank, and a prefabricated conduit trench system. Although overhead power is also a possibility, it is not recommended due to the potential interference with cranes for accessing and removing equipment.

For the purposes of this evaluation, it is assumed that two primary electrical conduit runs shown in Exhibit 6.8 would be serviced with a major conduit bank with either additional direct-buried conduits or additional space in the conduit trench for future electrical installations and expansion. From this bank, it is anticipated that individual direct-buried conduits would be installed to the various motor control centers, instrumentation panels, and other electrical equipment located throughout the WWTP.

The estimated total length of the conduit bank is 850 lineal feet along an alignment connecting the existing electrical building to the laboratory and operations building and the digester complex.

6.5.1 Option EC1 – Direct-Buried Conduit Bank

Direct-buried conduit consists of electrical and instrumentation lines pulled through larger carrier conduits directly buried in the ground. Typically, carrier conduits are constructed of a GRS or PVC material. Since existing GRS conduits have exhibited corroding, it is recommended that future conduit installations utilize PVC conduits.

The alignment for the conduit bank would allow multiple conduits to be buried in a common trench. At locations where feeder conduits would be required to run from the conduit bank to individual buildings or equipment, conduit junctions would be required. All junctions would be similarly direct buried and could be located within utility boxes, which would allow access to the conduits.

Direct-buried conduits are typically located between 2 and 4 feet below grade depending on the location and expected vehicular traffic. Installation is similar to that of piping installations, requiring trenching, backfilling, and compacting, as well as pulling of the electrical and instrumentation cables through the conduits.

6.5.2 Option EC2 – Concrete-Encased Conduit Bank

A concrete-encased conduit bank allows multiple conduits to be aligned in a formation that is then encased in concrete. The concrete-encased conduit bank is similar to the direct-buried method; however, it prevents the conduits from corrosion due to soil chemistry. Since access to the conduits is essentially lost due to the encasement, access junction boxes are typically installed at 100-foot increments along the alignment. Each junction box allows an entry point where feeder conduit can be connected to the main supply lines.

An important consideration for concrete-encased conduit banks is the number of spare conduits that are installed. Provisions for future conduit pulls should be made such that future electrical or instrumentation needs at the plant can be meet.

Concrete encasements can vary in depth; however, since concrete is used, shallow alignments are possible. Typical installations require trenching and conduit placement prior to concrete cover. Once constructed, electrical and instrumentation cables are pulled through.

6.5.3 Option EC3 - Pre-Manufactured Conduit Trench

A recent addition to buried conduit options is the pre-manufactured trench. Typically, these trenches are constructed from a high-density polymer concrete, a mixture of coarse and fine aggregates that are bonded together with a resin. Although called concrete, there is no water or Portland cement involved. The bonding created between the resin and aggregates is able to attain compression strength upwards of 20,000 pounds per square inch (psi). Furthermore, this material is dielectric, requiring no grounding, and exhibits exceptional resistance to freeze/thaw cycles. The trench systems are H-20 rated, allowing for vehicle traffic without any additional concrete requirements.

An H-20 loading cover sits on top of the channel allowing easy access to any point along the conduit run. At locations where side conduits are required, either a junction box or direct penetration into the prefabricated trench will allow feeder conduits to run from the conduit bank to individual buildings or equipment.

Installation requirements include trench excavation, a structural gravel-base backfill, and compaction. Electrical and instrumentation cables can be laid directly in the trench. An additional benefit to the conduit trench is the ability to partition the trench segments and separate electrical cables from instrumentation cables, thus minimizing peripheral interference to the instrumentation from electrical cables.

6.5.4 Capital and Lifecycle Costs for All Three Options

Based on the expected 850 lineal feet of electrical conduit required, the estimated capital costs for direct-buried, concrete-encased conduit, and prefabricated conduit trench are $166,000, $319,000, and $244,000, respectively.

6.5.5 Underground Electrical Conduit Option Evaluation

Table 6.4 presents a summary of the capital costs, lifecycle costs, and advantages and disadvantages for the three underground electrical conduit options.

Table 6.4 Underground Electrical Conduit Options Summary

	Option EC1 Direct-Buried Conduit	Option EC2 Concrete-Encased Conduit	Option EC3 Prefabricated Conduit Trench
Capital Cost	$166,000	$319,000	$244,000
Advantages	Lowest Cost	Lower Capital Cost	Easy installation & access at all locations
	Can provide additional conduits for future	Junction boxes provide easier access	More flexible than other options
Disadvantages	Difficult to access conduits	Highest Cost	Higher cost than direct-buried conduits
	Have to estimate future conduit needs now	Have to estimate future conduit needs now	

Recommended Option

Although the direct-buried conduits are the lowest cost option for the WWTP upgrade, it is difficult to estimate future conduit needs because electrical, instrumentation, and controls requirements are constantly changing in treatment plants. Additional conduits placed in a direct-buried conduit trench or concrete-encased conduit trench are difficult to access and are often not in an accessible location to the point of service in the plant for future electrical installations.

The cost of a pre-manufactured conduit trench is not prohibitive and is less than a concrete-encased conduit trench. This option would maximize flexibility for future expansion and would allow wiring to be accessed at all locations for future expandability. Therefore, Option EC3, a pre-manufactured conduit trench, is the recommended underground electrical conduit option.

6.6 Outfall Relocation

The mixing zone for the Pendleton WWTP outfall is located at the confluence of the Umatilla River and McKay Creek. Over time, the physical location of the confluence has accreted downstream due to sediment and rock deposition, and true location of the outfall is into McKay Creek upstream of the USBOR fish barrier. Due to inadequate mixing flows in McKay Creek during portions of the calendar year, the City is considering options to modify and/or relocate the existing outfall to maintain the current permitted mixing zone.

The three Outfall Relocation options shown in Exhibit 6.9 include:

Option OF1. Construct a new outfall to a location closer to the confluence without crossing McKay Creek.

Option OF2. Construct a new outfall downstream on the southerly bank of the Umatilla River, by crossing under McKay Creek.

Option OF3. Continue to use the existing outfall at the same location.

Following is a summary of these options along with the capital cost and anticipated regulatory issues associated with each. Lifecycle costs were not considered for outfall relocation options, since the operations costs for each will be approximately equal.

6.6.1 Option OF1 – Construct New Outfall without McKay Creek Crossing

The confluence of the Umatilla River and McKay Creek is located at the end of the narrow peninsula leading away from the plant, as shown in Exhibit 6.9. Installation of an outfall at this location would allow for effluent to be discharged directly into the confluence of the two streams. This maximizes available mixing flows throughout the calendar year. Umatilla River flows are lowest in summer and highest in the winter when they can reach as much as 5,000 cfs, while managed flows in McKay Creek maintain a minimum flow of 10 cfs in the winter and provide as much as 300 cfs to downstream irrigators in the summer growing season.

The City is considering relocating the existing outfall further downstream to a new submerged outfall location at the interior point of the Umatilla River and McKay Creek as shown in Exhibit 6.9. A new outfall structure would be placed at the confluence of the two rivers to provide increased mixing directly upstream of the mixing zone. Effluent flows would then be directed downstream between the flows of both rivers with a "ribbon effect" that would provide for longitudinal mixing primarily through dispersion down to the mixing zone location.

6.6.1.1 Capital Costs

The estimated capital cost for relocating the outfall to the confluence of the Umatilla River and McKay Creek without crossing McKay Creek is $1.0 million, including all necessary trench excavation and backfill, pipeline installation, and outfall costs. This estimate does not consider additional costs for permitting over and above the standard markup of 25% for engineering, legal, and administrative costs.

6.6.2 Option OF2 – Construct New Outfall with McKay Creek Crossing

The second option for relocating the outfall to a location closer to the currently permitted mixing zone is to construct a new outfall under McKay Creek and obtain an easement from an adjacent property owner to extend the pipeline downstream to a new outfall where flows from the Umatilla River and McKay Creek are fully mixed. This option would require a costly river crossing through basalt rock, a much longer pipeline, an effluent pump station, and a new outfall diffuser in the Umatilla River.

Since the original outfall location was at the confluence of the two rivers and the confluence has since migrated downriver, it is possible that a continued migration could occur. With continued migration, it is possible that any upstream outfall location, such as at the existing confluence, could one day be on the banks of the river. By locating the outfall across McKay Creek and directly within the Umatilla River, it is unlikely that downstream migration of the confluence will affect the mixing capacities of the outfall.

6.6.2.1 Capital Costs

The estimated capital cost for relocating the outfall downstream of the confluence of the Umatilla River and McKay Creek, including crossing McKay Creek, is $2.5 million. This estimate includes all necessary trench excavation and backfill, pipeline installation, and outfall costs. An effluent pump station is also expected to be required for this option. This estimate does not consider additional costs for permitting over and above the standard markup of 25% for engineering, legal, and administrative costs.

6.6.3 Option OF3 – Use Existing Outfall

Using the existing outfall would require moving the permitted mixing zone to McKay Creek, where winter flows drop to as low as 10 cfs. Although the United States Bureau of Reclamation (USBOR) has a goal to maintain 10 cfs, there is also no guarantee that this flow would be maintained in perpetuity, as flow augmentation is a lower operational goal than is storage for summer irrigation supply. Therefore, this option is only considered viable if an MBR is constructed. The high-quality effluent would meet Oregon Level IV reclaimed water standards and could then be used for flow augmentation, which is an allowable beneficial use for reclaimed water in Oregon under the OAR 340-055 currently be re-written by DEQ.

6.6.3.1 Capital Costs

There are no capital costs associated with Option OF3, since the existing outfall would be maintained without modification.

6.6.4 Outfall Relocation Option Evaluation

Table 6.5 presents a summary of the capital costs, lifecycle costs, and advantages and disadvantages for the three outfall relocation options.

Table 6.5 Outfall Relocation Options Summary

	Option OF1 New Outfall Without McKay Creek Crossing	Option OF2 New Outfall with McKay Creek Crossing	Option OF3 Existing Outfall
Capital Cost	$1.0 million	$2.5 million	$0
Advantages	Lowest cost for outfall relocation	Relocation to true river mixing zone location	Lowest Cost
	Can provide additional conduits for future		No outfall modifications required
Disadvantages	Innovative mixing zone upstream of river	Highest Cost	Requires MBR installation now
	Subject to continued river accretion over time	Property & easement acquisition required	Moves mixing zone to McKay Creek only

Recommended Option

The mixing zone study included in Appendix F shows that Option OF1, relocating the outfall without crossing McKay Creek, provides adequate dilution in the river. Therefore, the recommended option is OF1. Option OF2, new outfall with McKay Creek crossing, is considerably more costly than Option OF1, and involves pumping treated effluent further downstream with minimal incremental environmental benefit over relocating the outfall to the end of the peninsula on which the Pendleton WWTP sits.

Chapter 7: Complete Alternatives Evaluation

Based upon recommendations from the unit process options evaluation completed in Chapter 6 and the results of the existing equipment condition evaluation summarized in Chapter 4, four complete alternatives were developed to address the needs of the future Pendleton WWTP. The four alternatives address the following key issues:

- Ammonia-Nitrogen Limits in NPDES Permit
- Temperature Limits in NPDES Permit
- WWTP Outfall Location
- Additional Solids Processing Capacity
- Aging WWTP Facilities and Equipment.

The four alternatives represent a range of capital cost investment, varying levels of upgrades to the aging facility, and different degrees of operational and process control. These alternatives include:

Alternative 1. Minimum for Permit Issues – Construct improvements to address only the three major NPDES Permit issues summarized in the Basis of Planning: Ammonia-Nitrogen; Temperature; and the Outfall. This is the least-cost option, but does not address the aging WWTP facilities or the additional required solids processing capacity.

Alternative 2. Minimum for Current Issues – Construct minimum process and mechanical improvements to address all WWTP issues summarized in the Facilities Plan while fully utilizing the existing facilities and tankage.

Alternative 3. Best for Current Issues – Construct more reliable process and mechanical improvements to address WWTP issues summarized in the Facilities Plan by adding new tankage, resulting in more efficient operations and better process control flexibility.

Alternative 4. Best for Current and Future Issues – Construct new secondary treatment process using MBR technology, replacing the existing aeration basins and secondary clarifiers.

It is also recommended that the City consider future regulatory issues and TMDL considerations in planning for WWTP upgrades. Although the impacts of future regulations are uncertain at this time, it is recommended that the City consider the potential impacts of future regulations like the new turbidity and ammonia rules, fish consumption rate and human health toxics criteria, CWA 303(d) listings for dissolved oxygen and metals, compounds of emerging concern like pharmaceuticals and personal care products, and ongoing review of mixing zones by the Oregon legislature.

The following is a more detailed overview of each alternative, including a discussion and evaluation matrix based on the evaluation criteria presented in Chapter 5, *Basis of Planning*.

7.1 Alternative 1 – Minimum for Permit Issues

Alternative 1 addresses only the needs of the current NPDES Permit – secondary process upgrades, temperature, and relocation of the existing outfall – in order to minimize the capital cost of the proposed upgrades. Solids improvements necessary after the secondary, mechanical, and electrical upgrades to address aging equipment would be undertaken by plant staff as part of a separate capital improvements program (CIP). Alternative 1 can only be considered a complete alternative by adding the solids improvements and mechanical and electrical upgrades to the short-term CIP for the WWTP.

7.1.1 Headworks

No improvements to the headworks building are included in Alternative 1. These improvements would be undertaken as part of a separate CIP.

7.1.2 In-Plant Pump Station

No improvements to the in-plant pump station are included in Alternative 1. These improvements would be undertaken as part of a separate CIP.

7.1.3 Secondary Treatment

The secondary treatment process for Alternative 1 would involve converting the existing SSB to a complete mix MLE process as described in Chapter 6. The conversion would involve relining the existing SSB with a new 3-inch layer of shotcrete. Directly upstream of the aeration basin, a new anoxic pre-treatment concrete cell would be constructed outside of the existing basin. This new concrete structure would increase treatment control. The conversion would also involve construction of a new internal recycle pump station located to the east of the aeration basin. With the existing SSB converted to the aeration basin, the existing aeration basin would be converted to the new SSB. This conversion would also include new 3-inch shotcrete rehabilitation across the existing basin, new basin side walls, and all necessary yard piping.

7.1.4 Temperature

Temperature issues in Alternative 1 would be addressed by converting the currently unused AB2 into an effluent cooling and storage basin. The existing basin would require shotcrete relining along with eight new surface mixers to provide evaporative cooling. During the discharge shoulder season when river temperatures rise and prohibit the discharge of effluent, the effluent cooling basin would be used to store flows during the day. A gate would be installed in the existing secondary effluent junction box that when closed would allow flows to be transferred to the effluent cooling basin rather than to the CCC. The detention time in the basin would be approximately 48 hours, providing two diurnal cycles for cooling effluent. Effluent would be discharged to the Umatilla River during the late evening and early morning through a new effluent pump station for approximately 10 hours per day.

7.1.5 Outfall

Outfall relocation is also included in Alternative 1. The new outfall would include a new structure and outfall pipe located at the confluence of McKay Creek and the Umatilla River as recommended in Chapter 6.

7.1.6 Electrical

A new generator set sized to provide electrical capacity for major treatment processes is included. Removal of the existing manual transfer switch and upgrades to a new automatic transfer switch are also included. General electrical upgrades across the plant including addressing the deteriorating buried conduits are addressed in this Alternative.

7.1.7 Solids Dewatering

The solids dewatering requirements discussed in Chapter 6 have been removed from Alternative 1, although they are still required to provide solids processing capacity due to the secondary process upgrades. It is assumed that the solids dewatering improvements would be completed by plant staff under a separate capital improvement project budget, so as to reduce the capital costs of the facility plan improvements. However, the installation of a solids dewatering facility is required immediately upon the upgrade of the secondary process. Without solids improvements, Alternative 1 cannot be considered a complete alternative.

7.1.8 Disinfection

No disinfection improvements are included in Alternative 1. These improvements would be made through a separate CIP.

7.1.9 Aging Equipment

Although the existing process mechanical and electrical equipment throughout the WWTP has been well maintained by plant staff, most of the equipment is beyond its useful service life and in need of major upgrade or replacement. The Condition Assessment conducted in Chapter 4 of the facility plan recommends replacement of most of the existing equipment. Although replacement of equipment beyond its useful service life is necessary for reliable performance, it is assumed that these replacements will be conducted by plant staff in a separate CIP. Without major equipment upgrades, the WWTP will have increasing operational costs, lower reliability and energy efficiency, and higher maintenance costs over time.

7.1.10 Capital and Life-Cycle Costs

Alternative 1, summarized in Exhibit 7.1, will only address the current permit ammonia limits and effluent temperature requirements and provide a relocated outfall. By reusing the existing facility tankage it provides the least-cost alternative. However, this option does not include any provisions for solids handing capacities or address any of the improvements to aging equipment. Since improvements in this alternative do not encompass all of the improvements required to ensure an operational plant throughout the design life, this improvement alternative cannot be recommended.

The estimated capital cost for Alternative 1 is $9.8 million. Annual operating costs, including 1.0 FTE of additional WWTP staff, are $250,000. Based on these capital and annual costs, the 20-year life cycle cost for Alternative 1 is $13.5 million.

7.2 Alternative 2 – Minimum for Current Issues

Alternative 2 addresses all current WWTP issues associated with the NPDES Permit, all solids processing capacity issues, and the aging equipment identified in the condition assessment. Similar to Alternative 1, Alternative 2 includes conversion of the existing SSB to a complete mix MLE process to meet secondary treatment requirements. While Alternative 2 is a complete alternative, a complete mix MLE process will be less-reliable and a more energy-intensive treatment process than other potential alternatives.

Improvements included in Alternative 2 are summarized as follows:

7.2.1 Headworks

A new, larger headworks building including a HVAC system is proposed for Alternative 2. The building would house the existing screening equipment as well as the relocated grit equipment. Increasing the building footprint would also allow greater maintenance access and a new gantry crane for removal of in-channel equipment. Although the existing electrical controls at the grit building would remain in the current location, the corroded panels would be replaced per recommendations in the condition assessment.

7.2.2 In-Plant Pump Stations Improvements

Improvements to the In-plant pump station include replacement of the two older existing pumps as well as providing one VFD. Having two pumps with VFDs would increase the operational efficiency of the pump station and provide better flow matching capabilities.

7.2.3 Secondary Treatment

Alternative 2 includes converting the existing SSB to a complete mix MLE process as described in Chapter 6, similar to Alternative 1. The conversion would involve relining the existing SSB with a new 3-inch layer of shotcrete. Directly upstream of the aeration basin, a new anoxic pre-treatment concrete cell would be constructed outside of the existing basin. This new concrete structure would provide increased treatment control. The conversion would also involve construction of a new internal recycle pump station located to the east of the aeration basin. With the existing SSB converted to the aeration basin, the existing aeration basin would be converted to the new SSB. This conversion would also include new 3-inch shotcrete rehabilitation across the existing basin, new basin side walls, and all necessary yard piping.

Rehabilitation of Primary Clarifier No 2 and both secondary clarifiers is included in Alternative 2. New upgrades, including equipment drives, mechanisms, and scum skimming systems, would be installed. Since no current scum system is installed at the secondary clarifiers, scum piping modifications are also included.

7.2.4 Temperature

Similar to Alternative 1, diurnal storage and intermittent effluent discharge would be provided in Aeration Basin 2 using new surface mixers for evaporative cooling. The existing basin would require shotcrete relining. During the discharge shoulder season when river temperatures rise and prohibit the discharge of effluent, the effluent cooling basin would be used to store flows during the day. A gate would be installed in the existing secondary effluent junction box that, when closed, would allow flows to be transferred to the effluent cooling basin rather than to the CCC. The detention time in the basin would be approximately 48 hours, providing two diurnal cycles for cooling effluent. Effluent would be discharged to the Umatilla River during the late evening and early morning through a new effluent pump station for approximately 10 hours per day.

7.2.5 Outfall

Alternative 2 proposes a new outfall at the confluence of the Umatilla River and McKay Creek. Improvements associated with the new outfall include extension of the existing outfall pipe and a new outfall structure.

7.2.6 Electrical

A new diesel engine generator and automatic transfer switch sized to provide electrical capacity for major treatment processes is included. By code, removal of the existing manual transfer switch and upgrades to a new automatic transfer switch are also included. In addition, electrical upgrades across the plant, including addressing the deteriorating buried conduits, are included.

7.2.7 Solids Dewatering

Alternative 2 includes installation of a new solids dewatering facility located adjacent to the existing solids drying beds. This facility would include a butler building to provide a storage area for dried cake and the new solids dewatering equipment. It is expected that the dewatering equipment would be used regularly during the winter and could complement the operation of the existing drying beds during the summer.

Improvements at both of the primary sludge pump houses are included in this alternative. Both pump houses currently provide minimal operational and maintenance space, making pump removal operations potentially dangerous. A new equipment hoist and rollup doors to facilitate maintenance activities, are included.

7.2.8 Disinfection

Disinfection process improvements in Alternative 2 include a redundant chlorine solution pump and the addition of basin partition walls within the chlorine contact basin to promote plug flow.

The basin bottom would also be re-sloped to provide drainage toward the existing sump pump at the west end of the basin, facilitating maintenance cleaning.

7.2.9 Capital and Lifecycle Costs

Alternative 2, summarized in Exhibit 7.2, presents the least-cost complete alternative that addresses new permit requirements through upgrades to the secondary process system, required mechanical and electrical upgrades, outfall relocation, and temperature and solids drying capacity issues. However, this alternative uses a complete mix MLE basin, which lacks operational control and flexibility and is prone to inefficient oxygen transfer and mixing.

The estimated capital cost for Alternative 2 is $16.4 million. Annual operating costs, including 1.5 FTE of additional WWTP staff are $283,000. Based on these capital and annual costs, the 20-year life cycle cost for Alternative 2 is $20.6 million.

7.3 Alternative 3 Best for Current Issues

Alternative 3 presents a complete alternative addressing all improvements incorporated in Alternative 2, including the current NPDES Permit issues, temperature limits, solids processing capacity, relocated outfall, aging equipment, and a plug-flow MLE process in a new concrete basin that will provide better treatment performance and process control flexibility compared to Alternative 2.

Alternative 3 is essentially the same as Alternative 2 with the exception of a new concrete basin for the secondary process. Therefore, the only discussion in this section is for secondary treatment.

7.3.1 Secondary Treatment

In Alternative 3, a new concrete plug-flow MLE basin would be built in the footprint of the unused AB2. Both the anoxic and aeration zones would be incorporated into the new concrete basin with an expected footprint of approximately 136 feet by 63 feet and 20 feet deep. Flows from the in-plant pump station would be pumped to the anoxic cells followed by swing zones. The swing zones between the anoxic and aeration zones would be constructed with both oxygen diffuser grids and mixers to allow plant staff the flexibility to vary air requirements throughout the design life of the facility. Downstream of the anoxic cells, the aeration zones would be configured as a plug-flow basin and would be aerated with fine-bubble diffusers. These design features would eliminate the problems associated with poor oxygen transfer and mixing typically associated with complete mix basins.

The basin layout would also include provisions for a new blower building and all necessary piping. A partition wall would be installed in the aerobic basin, defining three distinct aerobic cells. These cells would be configured to allow the MLE process to be converted to an MBR process in the future, providing flexibility for future regulatory compliance.

All of the additional improvements included in Alternative 2 would also be included in Alternative 3.

7.3.2 Capital and Lifecycle Costs

Alternative 3, summarized in Exhibit 7.3, provides a well-constructed treatment basin using today's technologies to produce a reliable and efficient secondary process treatment system. Site improvements across the plant address deteriorated equipment and the electrical corrosion issues. These improvements, combined with a relocated outfall at the confluence and new solids dewatering equipment, make Alternative 3 the best option for current issues. Lastly, this option provides forethought into tomorrow's regulatory climate, providing flexibility to expand to a membrane system within the secondary basin.

The estimated capital cost for Alternative 3 is $19.2 million. Annual operating costs, including 1.5 FTE of additional WWTP staff are $274,000. Based on these capital and annual costs, the 20-year life cycle cost for Alternative 3 is $23.3 million.

7.4 Alternative 4 – Best for Current and Future Issues

Alternative 4 includes installation of an MBR secondary process, which is the best technology able to potentially address future regulatory issues. The MBR process combines secondary treatment and tertiary filtration, creating an effluent quality well beyond the capabilities of an MLE process. In doing so, the MBR also gives the City the greatest capacity to meet future regulatory restrictions described in Chapter 5, *Basis of Planning*.

As with Alternatives 2 and 3, Alternative 4 is a complete alternative that addresses all Permit compliance, increased solids capacity, and improvements to aging WWTP facilities across the plant. Many of the improvements proposed for Alternative 4 are similar to those proposed for Alternatives 2 and 3. Following is a summary of those elements of Alternative 4 that are different from the previously described alternatives.

7.4.1 Headworks

MBRs require fine screens with small apertures to remove fine particles that can collect around the membranes and cause damage or premature membrane failure. The headworks building proposed in Alternative 4 would remain the same as proposed in Alternatives 2 and 3, but the new headworks building would be outfitted with two new 2 mm fine screens. The redundancy provided in the dual screens would be required to obtain the extended warranty offered by the membrane manufacturer as well as maximize the actual service life of the membranes.

In addition to the fine screens, the building would contain the relocated grit equipment and controls. A new HVAC system would be installed to prevent noxious fumes from accumulating in the building. Also, the addition of a gantry crane would facilitate removal of in-channel equipment.

The improved headworks building would utilize the existing headworks channel, but allow improved equipment access space to facilitate maintenance requirements.

7.4.2 Secondary Treatment

The MBR system would be constructed in the currently unused Aeration Basin No. 2. The new concrete treatment basin would be similar to the MLE basin described in Alternative 3, with side water depths of 20 feet and anoxic zones upstream of the aeration basins. All oxygen would be supplied through a series of air headers with diffusers while each anoxic basin would be equipped with a mixer. Swing cells would be provided and outfitted with both the diffuser grids and mixers, allowing for either anoxic or aerobic conditions to be developed. These swing cells, along with valve controls throughout the diffuser grid, would provide the greatest operational flexibility.

The new basin is expected to have a useful life well beyond the expected life of a relined basin. In addition, construction of this facility within the currently empty AB2 would allow all current treatment processes to remain uninterrupted during construction.

7.4.3 Temperature

Because MBRs do not require secondary clarification, the existing secondary clarifiers would be converted to effluent storage and cooling basins. The storage tanks would be employed during hot summer days when the elevated river temperature prevents the plant from discharging effluent. During these shoulder seasons, the secondary clarifier tankage could be used to store and cool effluent until it could be discharged during the evening and night hours. Improvements necessary to transition the existing clarifiers into cooling basins include demolition of the existing clarifier equipment, installation of a new effluent pump station, and installation of new surface mixers for evaporative cooling.

7.4.4 Capital and Lifecycle Costs

Alternative 4, summarized in Exhibit 7.4, uses an MBR process to provide the best treatment capabilities and operational flexibility. This option not only meets the current NPDES Permit issues, provides for additional solids processing capacity, and addresses the aging facilities at the plant, but also provides the City with the ability to create quality effluent capable of addressing future regulatory issues. A new concrete basin, combined with the modular expandability of the MBR system would allow this alternative to provide the City with a valuable treatment capacity well beyond the 20-year planning period.

The estimated capital cost for Alternative 4 is $24.8 million. Annual operating costs, including 1.5 FTE of additional WWTP staff and a yearly membrane replacement fund, are $508,000. Based on these capital and annual costs, the 20-year life cycle cost for Alternative 4 is $32.3 million.

7.5 Comparison of Complete Alternatives

A complete summary of the elements included in each alternative is outlined in Table 7.1. As shown, the breadth of process reliability, operational flexibility, and treatment quality ranges from marginal for Alternative 1 to excellent for Alternative 4.

Table 7.1: Summary of Elements Included in Alternatives

		Minimum for Permit Issues	Minimum for Current Issues	Best for Current Issues	Best for Current & Future Issues
Headworks	Relocate Grit Chamber Mechanism		x	x	x
	Replace Corroded Headworks Building with Larger Building		x	x	x
Primary Treatment	Replace Prim. Clarifier 2 Drive Mechanism		x	x	x
Secondary Treatment	Repair Concrete in Both AB's	x	x	N/A	N/A
	Replace Surface Aerators in AB 1	x	x	N/A	N/A
	Rehabilitate existing Basin for Complete Mix MLE	x	x		
	New MLE Basin			x	
	New Secondary Basin with MBR				x
	Replace Secondary Clarifier Drive Mechanisms in Clarifiers 1 & 2	x	x	x	N/A
	Install Scum Baffles in Secondary Clarifiers	x	x	x	N/A
	Install Stamford Baffles in Secondary Clarifiers	x	x	x	N/A
Disinfection & Flow Monitoring	Install Baffle Walls in CCC		x	x	x
	Install Redundant Chlorine Dosing Pump		x	x	x
	Install Influent Flow Monitoring System		x	x	x
	Install Effluent Parshall Flume		x	x	x
Temperature	Aeration Basin No. 2 Improvements	x	x	x	
	Secondary Clarifier Retrofit for Effluent Storage				x
	Effluent Storage Pump Station	x	x	x	x
Pumping	Replace Pumps 2 and 3 at In-plant Pump Station		x	x	x

		Minimum for Permit Issues	Minimum for Current Issues	Best for Current Issues	Best for Current & Future Issues
Solids Digestion	Replace Seals on Mixer of Primary Digester & Add Alkalinity Addition	x	x	x	x
Solids Dewatering Facility	New Dewatering Building and Equipment		x	x	x
Electrical and I&C	Upgrade Grit Washer Building Electrical Enclosures from NEMA 3 to NEMA 7	x	x	x	x
	Replace all MCCs	x	x	x	x
	Bring all Electrical Components up to Code	x	x	x	x
	Replace Generator Set	x	x	x	x
	Replace Generator Manual Transfer Switch with Auto Transfer Switch	x	x	x	x
	Replace Boiler Room MCC	x	x	x	x
	Replace Boiler Room Lighting	x	x	x	x
	Replace Primary Clarifier Panel Board with New MCC	x	x	x	x
	Install Safety Disconnects to Headworks Equipment	x	x	x	x
	Expand the SCADA System	x	x	x	x
	Replace Underground Conduits	x	x	x	x
	Install Safety Switches in Accordance with NEC at Each Motor	x	x	x	X

Notes:
x = Item Included in Alternative.
N/A = Not Applicable.

Evaluation of each alternative with regard to annual costs and the evaluation matrix was performed based on requirements laid forth in *Basis of Planning* (Chapter 5) and outlined in this Chapter. *Alternative 1: Minimum for Permit Issues* does not address the solids capacity issues or provide for rehabilitation or improvements to equipment found to be deteriorating. As such, Alternative 1 fails to provide a system that can meet the treatment needs of the City throughout the complete design period, and therefore cannot be considered a viable alternative. Analysis provided hereafter does not include Alternative 1.

7.5.1 Complete Alternative Evaluation

The three complete alternatives were evaluated based on the economic and non-economic criteria and weighting factors summarized in the *Basis of Planning* (Chapter 5). The relative importance of each alternative was used to develop a score; the highest representing the apparent best alternative for the City of Pendleton.

These alternatives vary widely in terms of capital costs, reliability, process control flexibility, and proven system installation. Each alternative was evaluated in terms of capital and lifecycle cost, reliability (ability to consistently meet ammonia limits in the NPDES Permit), environmental and permitting requirements to construct the system, and ease of construction during continued plant operation.

Table 7.2 summarizes the results of the Complete Alternative Evaluation. Scoring was developed using a scale of 1-5, with 5 being the highest.

Table 7.2: Complete Alternatives Evaluation

		Alternative 2: Minimum for Current Issues		**Alternative 3:** Best for Current Issues		**Alternative 4:** Best for Current & Future Issues	
Evaluation Criteria	Weighted Percentile	Assigned Value	Total	Assigned Value	Total	Assigned Value	Total
Capital Cost	30%	5	1.5	4	1.2	3	0.9
20-Year Life Cycle	20%	4	0.8	5	1	3	0.6
Reliability	30%	2	0.6	3	0.9	5	1.5
Environmental and Permitting	10%	2	0.2	3	0.3	5	0.5
Constructability	10%	2	0.2	5	0.5	5	0.5
Total	**100%**		**3.3**		**3.9**		**4.0**

Based on the matrix evaluation of economic and non-economic factors, Alternatives 3 and 4 scored the highest. Alternative 4, installation of an MBR system, is the recommended option with a score of 4.0, which is slightly higher than Alternative 3's score of 3.9.

Although Alternative 4 has the highest capital cost of all the complete alternatives, it outranked the other alternatives in the non-economic criteria because it provides superior treatment quality and higher reliability in meeting current and future regulatory requirements, and it is relatively easy to build as a stand-alone treatment process, allowing the existing treatment plant to remain fully operational during construction.

7.5.2 Complete Alternative Phasing

Should the capital cost of Alternative 4 make it prohibitive for the City to build at one time, it would be possible to implement a phased approach whereby Alternative 3 would first be constructed, followed by converting the MLE basin constructed in Alternative 3 to an the MBR basin in the near future.

This phasing would be a relatively simple process, as both Alternative 3 and Alternative 4 require a new concrete basin to be constructed for the MLE process. The conversion to the MBR would involve installing membranes, along with all ancillary components such as a coarse bubble aeration system and permeate pumps for membrane operation. Space for membrane mechanical components would be designed into the Phase 1 installation of Alternative 3 for ease of future conversion to Alternative 4. Furthermore, the phased approach would allow the City to investigate the intriguing possibility of installation of retired drinking water membranes at the WWTP to serve as wastewater MBR membranes. This "membrane retirement program" would be an economical way for the City to build an MBR, as they would not need to purchase new wastewater MBR membranes, but could instead install their drinking water membranes when they reach the end of their projected water production design life (estimated to be 2017).

This phased approach would have an alternative evaluation score of 3.95 (the average of the 3.9 score allotted to Alternative 3 and the 4.0 score allotted to Alternative 4), and would provide a superior treatment process for the removal of Ammonia throughout the entire project design life through the installation of the MLE basin in Phase 1. Conversion to the MBR process in Phase 2 in the future would give the City the highest reliability in meeting current and future regulatory requirements, and the possibility of installing retired drinking water membranes from the City Water Treatment Plant would make conversion of Alternative 3 to Alternative 4 even more affordable.

Chapter 8: Recommended Plan

The apparent best alternative from the complete alternatives evaluation completed in Chapter 7 is Alternative 4 - upgrading the WWTP secondary process to an MBR along with associated improvements to replace aging plant equipment, relocating the plant outfall, and addressing temperature and solids processing capacity issues. However, as the capital cost of installation of the complete Alternative 4 is prohibitive for the City, it is recommended that the City construct the MBR expansion in two phases over the next 10 years, as follows:

> **Phase 1:** Construct a new concrete basin for an MLE process as proposed in Complete Alternative 3. The MLE process would be designed to provide adequate hydraulic and treatment capacity for projected 2017 flows and loads. Phase 1 would also include WWTP upgrades to address aging facilities and increase solids processing capacity. The new concrete basin for the secondary MLE process, as shown in Exhibit 8.1, would include three downstream aerobic zones that would ultimately be converted from part of the secondary MLE process to membrane basins in Phase 2. Proposed Phase 1 improvements to be completed by 2010 are shown in Exhibit 8.2.
>
> **Phase 2:** Convert secondary process completed in Phase 1 into an MBR by adding membrane cassettes in the three downstream aeration basins. This would require the purchase of an MBR System with blowers and ancillary equipment as well as modifications to the fine bubble aeration system installed in Phase 1. Phase 2 also would include the installation of two new fine screens in a new screening building upstream of the in-plant pump station. Proposed Phase 2 improvements to be completed by 2017 are shown in Exhibit 8.3.

One important consideration for the City is the potential reuse of the Zenon membranes currently installed at the City's drinking water plant. When these membranes reach the end of their warranty period or are unable to pass the membrane integrity testing required of drinking water membranes, they could potentially be removed from the drinking water plant and installed at the WWTP. These reused membranes would be installed in the three downstream aeration cells as described above for the planned conversion of the MLE process into an MBR. Although, the reuse of drinking water membranes is a promising idea, it is a relatively new concept for Zenon, and there is no guarantee that the used drinking water membranes would last an additional 10 years in a wastewater environment. Conversations with Zenon representatives indicate there are a handful of similar installations in the United States that should be monitored by the City. A full evaluation of this option should be considered more carefully during preliminary design for Phase 2 improvements.

8.1 Preliminary Secondary Process Design

Preliminary process design results for Phases 1 and 2 are included in Appendix L and the process improvements are shown in Exhibits 8.2 and 8.3. The proposed location for the new 1.4-million-gallon concrete basin for the Phase 1 secondary MLE process upgrades and future MBR is in existing Aeration Basin 2 (AB2). AB2 is currently unused and in disrepair, which will allow the new concrete basin and other improvements to be constructed with minimal disruption of WWTP operations during construction until startup and switch-over to the new secondary process.

In Phase 1, the new concrete basin will operate as a typical MLE secondary process using the existing secondary clarifiers. This will involve the installation of blowers, mixers, diffusers, internal recycle pumps, piping, and other appurtenances for a complete and operable MLE system with capacity for design flows and loads through 2017. The basin will be compartmentalized such that half the basin can be taken offline at one time for ongoing maintenance as well as for future conversion to an MBR in Phase 2. In Phase 2, conversion to the MBR will include installation of membranes, permeate pumps, piping, coarse air scouring systems, additional blowers, membrane cleaning systems, instrumentation and all other appurtenances required for a complete an operable MBR system.

Exhibit 8.1 shows the configuration of the new concrete basin for the Phase 1 MLE process and Phase 2 MBR conversion. The concrete basin is approximately 136 feet long with two parallel trains that are each 30 feet wide with sidewater depths of 20 feet. Downstream of the two parallel trains is a third basin divided into three compartments (labeled "Aerobic 2" in the Exhibit). These three compartments will be aerated and operate as part of the standard MLE process installed in Phase 1. In Phase 2, these three downstream compartments will be taken offline, and membranes and associated appurtenances installed to convert the basin into an MBR. The upstream parallel trains with the anoxic, swing, and aerobic zones will continue to operate the same as the MLE process, although at a higher MLSS concentration. Treated MBR effluent will be directed to the chlorine contact chamber and the existing secondary clarifiers will be decommissioned and used for temperature compliance, if required.

The size of the concrete basin for the secondary process is driven by design criteria for the Phase 1 MLE process. The ultimate capacity of the concrete basin, if filled with membranes, is approximately 6.5 MGD, which is approximately 58% higher than the design MMWWF flow of 4.11 MGD. As the ultimate capacity is limited by the process biology, not by the hydraulic capacity of the membranes, equalization storage is not anticipated for the MBR.

8.2 Recommended Phase 1 Improvements

Recommended Phase 1 improvements to be completed in 2010 are summarized in Exhibit 8.2 and include:

- **Headworks.** The existing headworks building will be demolished and a new 800-square-foot butler building will be constructed. Existing screening equipment and relocated grit classifier equipment will be located in the new building. An HVAC system will be installed in the new headworks building to prevent the corrosive environment currently seen at the headworks and grit building from developing. All existing grit electrical controls will remain in the existing grit building; however, the existing controls will be upgraded to meet current electrical code requirements.

  A larger headworks building will allow for appropriate maintenance access space and the addition of a gantry crane system will facilitate the removal of in-channel equipment. No additional screening equipment will be included in Phase 1.

- **Primary Clarifiers.** Existing 90-ft-diameter Primary Clarifier No. 1 will be upgraded with new equipment, including a new mechanical drive, new mechanical rake arms, and replaced scum collection system.

  Plant staff has recently replaced all of the mechanical components of Primary Clarifier No. 2; therefore, no additional improvements are necessary.

  No additional improvements to either of the primary sludge pumps or pump houses are included in Phase 1. Recommendations identified in the Conditions Assessment to improve maintenance access to the primary sludge pumps will be performed by City staff under a separate CIP.

- **In-Plant Pump Station.** Two new vertical-turbine pumps with capacities of 3,000 gpm each will be installed at the in-plant pump station, replacing existing Pump 2 installed in 1986 and existing Pump 3 installed in 1970. The new pumps with VFDs will provide a more efficient and reliable system, and will be able to consistently match incoming flows that will typically range between AAF of 1,740 gpm to MMWWF of 2,850 gpm. PIF flows will be handled through a combination of the two new pumps or by the existing vertical turbine pump.

  With the installation of the new equipment, minor wet well modifications are likely and have also been included in Phase 1.

- **Secondary Process Improvements – MLE/MBR Basin.** Phase 1 Secondary Improvements will include a new 1.4 MGD concrete basin located in the footprint of the existing Aeration Basin No. 2. The treatment basin will be constructed in a plug flow layout, utilizing basin walls and baffles to develop a serpentine flow path, providing efficient oxygen transfer and solids suspension. Two anoxic basins followed by two plug flow aeration basin cells will comprise the treatment basin. Swing cells, areas configured for either anoxic or aerobic conditions, will also be provided and furnished with diffusers and air piping to supply additional oxygen for ammonia removal, if required. The dual configuration will allow increased flexibility in optimizing the treatment process, maintaining the basin, and transitioning the basin during construction upgrades in Phase 2.

  Each anoxic zone will be baffled to enhance plug flow, and each compartment will have a floating mixer to keep solids in suspension for a total of eight mixers throughout the anoxic portion of the basin. The aerated basin will consist of a grid of fine-bubble diffusers to achieve energy-efficient oxygen transfer and maintain a dissolved oxygen concentration of 2 mg/l. Dissolved oxygen probes located throughout the process will be connected by feedback loops to blowers to continually adjust air flow requirements to maintain a steady dissolved oxygen concentration of 2 mg/l.

  A new 1,225-square-foot building will house three 100-hp hidrostal internal recycle pumps for the MLE process and three 125-hp blowers. Process modeling indicates that a 4Q recycle is needed to achieve ammonia discharge limits. Based upon design MMWWF of 4.1 MGD, a 3Q recycle flow of 16.4 MGD is required. This maximum internal recycle flow will be achieved with two pumps in parallel. The third pump will serve as a redundant pump in case of pump failure. Each pump will have a capacity of

8.2 MGD. VFDs installed on each pump will allow operators to control the rate of internal recycle to match changes to incoming flows throughout the design life of the facility.

Process modeling indicates design MMWWF in the MBR configuration has air requirements of approximately 6,200 SCFM. Each blower will be sized to provide 3,100 SCFM, such that peak demands will be met with two blowers in parallel, and a third blower would serve as a redundant unit. Each blower will have controls linked to dissolved oxygen probes located in the aeration basins. Air flow rates will be adjusted to maintain a dissolved oxygen concentration of 2 mg/l. Sizing and selection of all mechanical equipment, with special consideration for energy savings, will be further refined during preliminary design.

Construction of the new MLE concrete basin within AB2 will allow continued operation of the plant as well as ample area for expansion. Phase 1 design will incorporate features to allow Phase 2 construction of the MBR facility. Final results of process modeling for the MLE and MBR conversions are found in Appendix L.

- **Solids Dewatering Improvements.** A new mechanical dewatering facility, located in the current solids storage area, will be constructed in Phase 1. The facility will include a new 1,600-square-foot building that will serve as both the dewatering equipment room and a covered cake storage area. The dewatering equipment will feed a conveyor that will move and pile the dried cake in the storage area. The building will be constructed with open sides to allow ventilation.

  Capital cost estimates in this facility plan are based upon providing a centrifuge for mechanical dewatering, as this is currently the most expensive dewatering option. However, installation of a screw press in place of a centrifuge both for capital cost savings and reduced energy consumption will be examined during preliminary design. Mechanical dewatering equipment will be sized to handle future MBR solids flows through year 2030, of approximately 18,100 gallons per day of 3% digested solids based on an influent MMWWF of 4.11 MGD. At these flow rates, assuming 22% cake solids concentration, the existing Pendleton WWTP drying bed area of 1.4 acres will provide 6 months of cake storage through Year 2030.

  The storage area will provide a space where plant staff can work and move the cake to a desired location with the solids truck. Ancillary equipment in this facility will include the centrate pumping system, polymer feed system, and all electrical and control equipment.

- **Secondary Clarifier Scum Mechanisms.** The existing secondary clarifiers will be decommissioned during Phase 2, so full rehabilitation is not recommended. However, it is recommended that scum removal systems be added to both secondary clarifiers to address potential scum issues associated with the new MLE process. Phase 1 will include the installation of the scum removal system.

- **Electrical Upgrades.** Upgrades to the existing deteriorating plant electrical systems include installation of an automatic transfer switch, installation of a new diesel generator set capable of running all critical plant unit processes, new direct buried conduits, and replacement of motor control centers. In addition, electrical upgrades will add automation to the disinfection process as well as the new secondary process through a new SCADA system.

- **Disinfection.** Improvements at the Chlorine Contact Basin include the addition of a redundant chlorine solution feed pump, rechanneling of the basin floor to aid in cleaning, and addition of baffles to minimize short-circuiting in the basin.
- **New Outfall.** A new outfall will be constructed closer to the confluence of the Umatilla River and McKay Creek. Improvements associated with the new outfall include extension of the existing outfall pipe and a new outfall structure.

8.2.1 Phase 1 Capital and Lifecycle Costs

Table 8.1 presents capital costs for the Phase 1 recommended improvements. As can be seen in Table 1, Phase 1 improvement costs, including engineering, legal, and administrative costs, are estimated to be $15.8 million.

Table 8.1: Phase 1 Capital Cost Estimate

ITEM NO.	ITEM DESCRIPTION	Total
1	Headworks	$ 662,000
2	Clarifier Rehabilitation (1 PC)	$ 462,900
3	In Plant PS Improvements	$ 448,000
4	Secondary Treatment Process Improvements (Ammonia)	$ 6,340,500
5	Solids Dewatering (Plant Staff modify drying beds)	$ 1,982,100
6	Secondary Clarifier Scum System (Both)	$ 456,900
7	Electrical (GenSet, ATS, Conduits)	$ 1,159,900
8	Disinfection Improvements	$ 135,900
9	Outfall Relocation	$ 1,010,600
	Capital Costs	**$12,660,000**
10	Engineering/Legal/Admin @ 25%	$3,165,000
	Total Project Costs	**$15,830,000**

Notes:

1. The Estimate represents the Engineer's opinion of probable cost using current and best available information.
2. The Level of Accuracy is -20%/+30%, but does not consider factors like material price escalation and bidding climate.
3. Estimates include the following markups:
    - 9% General Conditions and Mobilization
    - 15% Overhead and Profit
    - 30% Estimate and Construction Contingency
    - 3% Annual Escalation to Midpoint of Construction

Phase 1 additional operations and maintenance costs and Phase 1 total lifecycle costs are summarized in Table 8.2. It is assumed that Phase 1 improvements will require an additional

O&M budget of approximately $274,000 per year above current operations. Other O&M costs include electrical demands, chemical requirements, and parts replacement. Total lifecycle costs for Phase 1 improvements, assuming a 20 year design life, are estimated to be $19.9 million. Phase 1 O&M costs presented are only costs in addition to what the WWTP incurs at the present time, and therefore do not include costs for such items as chemical disinfection or solids land application.

Table 8.2: Phase 1 O&M and Lifecycle Cost Estimate

Summary	**Phase 1 Lifecycle Costs**	
Headworks	$	9,000
Secondary Process Upgrade	$	99,000
Effluent Storage (Temp)	$	19,000
Solids Dewatering	$	19,000
Additional Staff (1 FTE = $65,000)	$	98,000
Maintenance Sinking Fund	$	30,000
Total Annual O&M Cost	**$**	274,000
20 Year O&M NPW i=3%	$	4,080,000
Phase 1 Capital Cost	$	15,800,000
20 Year Lifecycle Cost	**$**	**19,900,000**

8.2.2 Phase 1 WWTP Staffing Requirements

Based upon the Phase 1 upgrades, it is estimated that an additional 1.5-full time employees will be required – 1 FTE for running the new secondary MLE process and 0.5 FTE for managing the new mechanical solids dewatering process.

8.3 Recommended Phase 2 Improvements

Recommended Phase 2 improvements to be completed by 2017 are summarized in Exhibit 8.3 and include:

- **Fine Screening Building.** A new screening building downstream of the primary clarifiers and upstream of the MBR will be constructed. Two new 2-mm fine screens will be installed with a capacity equal to the peak design flow through the membrane system. The fine screens will remove the fine particles that can cause damage or premature membrane failure. The existing headworks building and screening equipment will remain in place.

- **MBR Conversion.** The concrete basin constructed in Phase 1 for the MLE process will be converted to an MBR. Membrane cassettes will be added to the secondary basin along with all permeate pumps, blowers to provide coarse-bubble air for membrane scouring, piping, cleaning systems, hardware, and instrumentation for a complete and operable system. The secondary basin constructed in Phase 1 will not require major modifications during Phase 2.

- **Secondary Clarifier Conversion.** Mechanical equipment will be removed from the secondary clarifiers and a pump station will be installed to allow the clarifiers to be used for diurnal storage of effluent during the hottest periods of the day in the summer. Mechanical mixers will be added to the tanks to provide mixing and promote cooling. These upgrades may not be required, but will depend upon the final outcome of the City's proposed temperature trading approach involving thermal credits from the Thorn Hollow Springs water rights transfer.

8.3.1 Phase 2 Capital and Lifecycle Costs

Table 8.3 presents the Phase 2 Capital Cost Estimate. As can be seen in the Table, Phase 2 capital costs, including engineering, legal and administrative costs, are estimated to be $13.3 million. Costs are presented in 2017 dollars, by assuming an annual escalation percentage of 3 percent per year.

Table 8.3: Phase 2 Capital Cost Estimate

ITEM NO.	ITEM DESCRIPTION		Total
1	Fine Screen Facility		$ 1,568,800
2	Secondary Treatment MBR Conversion		$ 8,338,500
3	Effluent Cooling Modifications		$ 758,200
	Capital Costs		**$10,670,000**
4	Engineering/Legal/Admin @	25%	$2,670,000
	Total Project Costs		**$13,340,000**

Notes:

1. The Estimate represents the Engineer's opinion of probable cost using current and best available information.
2. The Level of Accuracy is -20%/+30%, but does not consider factors like material price escalation and bidding climate.
3. Estimates include the following markups:
   - 9% General Conditions and Mobilization
   - 15% Overhead and Profit
   - 30% Estimate and Construction Contingency
   - 3% Annual Escalation to Midpoint of Construction (2017)

Phase 2 additional operations and maintenance and life cycle costs are presented in Table 8.4. It is estimated that the MBR process will require an additional $475,000 O&M annually. Phase 2 has a total lifecycle cost of $20.4 million.

Table 8.4: Phase 2 O&M and Lifecycle Cost Estimate

Summary	Phase 2 Lifecycle Costs	
Headworks	$	9,000
Secondary Process Upgrade	$	215,000
Effluent Storage (Temp)	$	7,000
Solids Dewatering	$	19,000
Staffing 1 FTE = $65,000	$	65,000
Maintenance Sinking Fund	$	40,000
Membrane Replacement Fund (10% per year)	$	120,000
Total Annual O&M Cost	**$**	**475,000**
20 Year O&M NPW i=3%	$	7,070,000
Phase 2 Capital Cost	$	13,300,000
20 Year Lifecycle Cost	**$**	**20,400,000**

8.3.2 Phase 2 WWTP Staffing Requirements

Phase 2 upgrades to the MBR will require 1 additional FTE compared to the present WWTP operations. The Phase 2 upgrade will require 0.5 FTE for monitoring the MBR process and 0.5 FTE to manage the solids dewatering program. The MBR requires less operator attention compared to the MLE process due to additional automation.

8.4 Overall Project Cost Summary

Capital costs for Phases 1 and 2 are summarized below. Capital costs presented in Table 8.5 are presented in 2009 dollars for Phase 1 (midpoint of construction in 2009 with facility online at 2010) and 2017 dollars for Phase 2, respectively. In order to provide a comparison of the total costs, the total combined project cost is presented in 2007 dollars as a net present worth. In the net present worth calculation, capital costs are adjusted to 2007 dollars, assuming an annual inflation rate of 3 percent per year.

Table 8.5: Recommended Plan Capital Cost Summary

Phase	New Membranes	Retired Membranes
Phase 1 (2010)	$15.8 Million	$15.8 Million
Phase 2 (2017)	$13.3 Million	$9.8 Million
NPW TOTAL (2007)	**$24.8 Million**	**$22.2 Million**

As shown in Table 8.5, installation of retired membranes from the City's drinking water plant in 2017 for Phase 2 would save approximately $3.5 million. It should be noted that the above capital costs do not include membrane replacement costs required as part of the O&M budget. The life expectancy of the retired drinking water plant membranes is unknown, but could be as little as 2-5 years and would not likely be warranted by Zenon. New wastewater membranes would have a life expectancy of at least 10 years and would have a full system warranty. It is recommended that membrane options for the MBR System be fully evaluated during Preliminary Design for Phase 2 improvements.

8.5 Recommended Plan Summary

Phase 1 improvements will provide the City with a treatment plant capable of meeting the stringent effluent discharge limits for ammonia-nitrogen specified in the new NPDES Permit and address many of the current issues with aging equipment at the WWTP. The result will be a more efficient plant fully capable of consistently meeting NPDES Permit limits for ammonia-nitrogen removal with maximum process control flexibility and future expandability. The new solids storage facility will allow year-round solids drying capacity, and the electrical upgrades will bring existing equipment into conformance with required electrical codes.

Phase 2 improvements will convert the improved secondary MLE process constructed in Phase 1 into a MBR capable of producing the high quality effluent. Additional concrete basin construction is not expected, because the Phase 1 secondary basin will be designed for the future addition of membranes/MBR conversion. A new fine screening building downstream of the primary clarifiers will be installed to remove finer particulates and hair that can damage wastewater membranes. The ultimate capacity of the new concrete basin will also provide 58% additional treatment capacity above 2030 design flows and loads. The Phase 2 MBR conversion will allow for the removal of the existing secondary clarifiers, providing an ideal option for diurnal effluent storage and cooling for temperature compliance, while saving the cost of rehabilitating the secondary clarifiers in Phase 1.

8.6 Preliminary Phase 1 Project Schedule & Next Steps

As discussed in this Recommended Plan Section, Kennedy/Jenks recommends the City move forward with recommended Phase 1 WWTP improvements to address issues with aging WWTP facilities and meet current NPDES Permit limits for direct discharge to the Umatilla River. Exhibit 8.4 is a Preliminary Project Schedule showing the plan for completing preliminary design, final design, bidding and construction for Phase 1 improvements. The planned periods for each of these phases are as follows:

- **Final Facilities Plan/Initial Preliminary Design** efforts will include discussions with DEQ about the City's Temperature Management Plan and DEQ review of the WWTP Facilities Plan. Approximately one month has been reserved for DEQ Facilities Plan review (August 8, 2007 through September 4, 2007). During this period, the City will also negotiate the Consultant's Scope of Work for preliminary and final design of recommended Phase 1 improvements to be presented for approval by the Pendleton City Council on October 2, 2007.

- **Preliminary Design** will begin October 3, 2007 or after City Council approval of the Consultant's Scope of Work. Preliminary Design will bring the design to 30% completion and is scheduled for approximately 7 months. Seven detailed technical memoranda will be prepared for various WWTP unit processes to be upgraded. City staff will be actively involved in preliminary design with several planned workshops. Approximately one month has been reserved for DEQ review of the Preliminary Design Report for the Phase 1 WWTP Improvements Project.

- **Final Design** for the Phase 1 WWTP Improvements Project will begin after final approval of the Preliminary Design Report by the City and DEQ. Intermediate design submittals will be prepared at 60% and 90% design. City staff will be actively involved in final design with planned meetings or workshops every two weeks. Approximately one month has been reserved for DEQ review of the 90% Design submittal for the Phase 1 WWTP Improvements Project.
- **Bidding and Contracting** is scheduled for approximately 3 months. The project is currently planned for advertisement in June 2009 with final contracts to be approved by the City in August 2009.
- **Construction** is currently scheduled for approximately 18 months with facility startup and contract closeout by April 2011.

As noted at the bottom of Exhibit 8.4, the anticipated project completion date on April 6, 2011 will require re-negotiation of the dates in the City's current MAO with DEQ. The MAO extension is necessary to implement the proposed WWTP Phase 1 improvements, which are more extensive than anticipated when the current MAO was negotiated. It is recommended that the re-negotiated MAO contain intermediate dates at DEQ review points for the Facilities Plan, Preliminary Design, 90% and Final Design. This is a typical approach for MAO compliance used by DEQ throughout Oregon so that communities are not penalized for longer than anticipated DEQ review periods.

Chapter 9: Preliminary Financial Plan

This section summarizes the costs of the Recommended Plan, the City's existing wastewater revenues, and alternatives for funding the Recommended Plan. It is recommended that a detailed Financial Plan including a Wastewater Rate and SDC Study be completed by the City after review and adoption of the Recommended Plan.

9.1 Recommended Plan Funding Requirements

Following are the funding requirements for the Recommended Plan:

Phase 1 in year 2010 will cost $15.8 Million

Phase 2 in year 2017 will cost $13.3 Million.

9.2 Existing City of Pendleton Wastewater Rates and SDCs

There are two basic revenue streams used by communities to pay for wastewater system upgrades:

- Monthly wastewater utility usage fees; and
- Wastewater System Development Charges.

9.2.1 Pendleton Monthly Wastewater Utility Rates

The City of Pendleton's current monthly wastewater utility rate is $13.95 per household connection. Based on a survey completed by the City of Pendleton, this is the second-lowest wastewater utility rate for similar-size communities in Oregon.

It is anticipated that much of the recommended WWTP upgrades will be financed through grants or loans backed by wastewater rate increases.

9.2.2 Pendleton Wastewater SDC

System development charges (SDCs) are connection fees for new connections levied by Cities to offset the costs for serving growth in a community. Wastewater SDCs in Oregon range from no charge to as high as $12,000 per residential connection, with a median Wastewater SDC of approximately $4,000 per residential connection. The City does not currently have a Wastewater SDC, but does have one for transportation.

Residential, commercial, and industrial connections are defined in terms of Equivalent Dwelling Units (EDUs). An EDU is defined as a single residential connection with a standard ¾" water meter. A typical residential community has a household population of 2.5 persons per EDU.

As of January 2007, Pendleton's estimated population was 17,310, or 6,924 EDUs, not including commercial and industrial connections. Population projections included in Chapter 2, *Study Area Characteristics*, estimated Pendleton's population at the end of the planning period in 2030 will be 24,100 or an increase of 6,790 people over the next 23 years.

Based on anticipated residential growth only, the increasing population will result in an additional 118 EDUs per year over the next 23 years. This growth will result in additional infrastructure and treatment costs for the wastewater collection system and WWTP, for which an offset can be implemented by the City in the form of a Wastewater SDC levied at the time a new connection is made to the City's wastewater system.

Because a portion of the Recommended Plan will provide additional capacity to serve future growth in the City, an SDC could be implemented by the City. Based on an SDC of $4,000 per new residential connection and 118 new connections in a typical year, a Wastewater SDC would provide approximately $472,000 in annual revenue. A portion of the revenue from the Wastewater SDC could then be used to offset the costs for the recommended WWTP upgrades.

The actual amount of the SDC must be supported by actual costs attributable to growth and should also include an estimate of commercial and industrial connections over the planning horizon in addition to residential growth. A formal Rate and SDC Study is recommended if the City elects to establish a Wastewater SDC.

9.3 Preliminary Funding Options

Preliminary options available to the City for funding the Recommended Plan include:

- General Obligation Bonds;
- Revenue Bonds;
- Federal Appropriations (Earmarks); and
- State and Federal Programs.

Loans would be repaid with City revenues collected through wastewater utility rates, SDCs, or property taxes, depending on the funding option or through a combination of options selected by the City. Grants available from some State and Federal programs would not be repaid, but may have other requirements that the City would need to comply with for eligibility.

9.3.1 General Obligation Bonds

Oregon communities have taxing authority, which allows projects to be funded through General Obligation (GO) Bonds. Security for GO Bonds approved by a public vote is provided by the full faith and authority of the taxing entity. A city utilizing GO bonds may collect funds to make annual payments of principal and interest solely from taxes, solely from user fees, or from a combination of taxes and user fees. Since GO Bonds are backed by the power of ad valorem taxation, they inherently present less risk and offer more favorable interest rates. GO bonds issued by cities in Oregon enjoy good competition at public sale, obtaining a favorable interest rate because of their high degree of security, tax-exempt status, and history in the marketplace.

No limitation is placed on the amount of GO Bonds a city may issue. Generally speaking, the financial capability of the residents in a community limits funding authority for GO bonds to 30% of the city's true cash value. Oregon Revised Statutes limit the maximum term of GO bonds to 40 years, but many communities elect to limit the term of approved GO bonds to approximately 25 to 30 years to obtain the most favorable terms and interest rates.

9.3.2 Wastewater Revenue Bonds

Revenue bonds are backed by user fees, rather than by property taxes as in the case of GO bonds. For wastewater revenue bonds, the user fee is monthly wastewater utility rates. Unlike a GO bond, no funds levied from taxes can be used to make annual payments of principal and interest. While revenue bonds do lack the security of taxation provided by voter-approved GO bonds, they are backed by rate increases and, potentially, SDCs that are typically a very stable investment. As such, terms and interest rates for typical revenue bonds are just slightly higher than GO bonds. The stability and financial performance history of a community are key to providing an assurance of repayment for revenue bonds.

9.4 Federal Appropriations (Earmarks)

Federal appropriations or "earmarks" are funds designated for a specific project or community in an approved piece of federal legislation. Earmarks are acquired through lobbying and are not constrained by population, income, or need. In order to obtain the funding, a City typically hires a lobbyist to work with Oregon's Federal delegation as well as others in Washington D.C. There is no guarantee that funds would be obtained by the City, but if successful, the earmark funds would likely be available without additional requirements and could be spread out over several years.

The City can explore options for federal earmark funding through Oregon's federal delegation in the United States Senate and House of Representatives. Kennedy/Jenks has in the past hired a lobbyist who has successfully secured federal earmark funds for several clients. These services could be provided to the City of Pendleton, if desired.

9.5 State and Federal Programs

There are three state and federal agencies that administer five funding programs for wastewater improvement projects in Oregon. These include Clean Water State Revolving Fund (CWSRF), United States Department of Agriculture Rural Utilities Service (USDA-RUS), Oregon Economic and Community Development Department (OECDD), and Oregon Energy Trust (OET). Funding programs are the standard programs outlined for all communities in Oregon. Other region-specific funding programs and financing options may be available.

9.5.1 Oregon Clean Water State Revolving Fund

Oregon's CWSRF program is administered by DEQ, providing long-term low-interest loans for planning, design, and construction of water pollution control facilities like the Pendleton WWTP. The program is focused on providing funding for projects to communities with wastewater facilities that have NPDES Permits for surface water discharges to Waters of the United States. Any public agency within the state is eligible for a CWSRF loan provided that agency is publicly owned. Applicants are prioritized in terms of relative project need during a pre-application process.

CWSRF Planning Loans are repaid over 5 years at an annual interest rate of 1.10% with no annual fee. CWSRF Design and Construction Loans can be repaid over 5, 10, 15, or 20 years. Most communities elect a 20-year repayment period, for which the annual interest rate is 2.85% with an annual fee of 0.50% (3.35% total annual interest rate).

The City of Pendleton submitted a CWSRF loan application for Planning as well as Design and Construction. CWSRF Design and Construction loans are funded based on Oregon statutory requirements, and are summarized in the CWSRF Intended Use Plan prepared by DEQ. Submitted projects are ranked and assigned a Project Priority. The City's proposed WWTP project is included in the 2008 Intended Use Plan prepared by DEQ, and has a project priority ranking of #6. However, available CWSRF funds for the coming fiscal year will most likely be fully used by projects ranked higher than Pendleton or by existing projects currently under construction. As these projects are completed, it is anticipated that CWSRF funds will become available for final design and construction in the next 1-2 years.

Planning loan funds are typically available to all eligible communities, and funds should be available for the City to begin Preliminary Design for recommended Phase 1 WWTP improvements while the City waits for Design and Construction funds to become available.

More information on the DEQ CWSRF loan program is available at:

Oregon Department of Environmental Quality
811 SW Sixth Avenue
Portland, OR 97204-1390

http://www.deq.state.or.us/wq/wqgrant/wqgrant.htm

Primary Contact: Ms. Elizabeth Hutchison
Phone: (541) 278-8681

9.5.2 USDA Rural Utilities Services

USDA-RUS provides water and waste disposal loans and grants to rural municipalities, counties, special districts, Indian tribes, and non-profit organizations to construct, enlarge, or modify water treatment and distribution systems and wastewater collection and treatment systems. Preference is given to projects in low-income communities with populations below 10,000. Grant and loan assistance is based on a tiered schedule, with the loan rate calculated using percent of Median Household Income (MHI). Lowest loan rates require that the City MHI be less than 80% of Oregon MHI. Eligibility for grants is also based on the user rate, which must fall within a "similar system cost" for communities served by the program that have completed improvements – currently about $45 per month. Given that the Pendleton City population is greater than the 10,000 threshold, it is unlikely that Pendleton would quality for the USDA-RUS loan and grant program.

Information on USDA-RUS loan and grant programs is available at:

Oregon Rural Development
Water and Environmental Programs
101 SW Main, Suite 1410
Portland, OR 97204-3222

http://www.usda.gov/rus/water/programs.htm

Primary Contact: Ms. Colleen Hewes
Phone: (503) 278-8049

9.5.3 Oregon Economic and Community Development Department

Oregon Economic Community Development Department (OECDD) offers a number of funding programs including the Community Development Block Grant, Special Public Works Fund, and the Water/Wastewater Financing Program.

More information on OECDD programs is available at:

OECDD Headquarters (Salem)
775 Summer Street, NE
Suite 200
Salem, OR 97301-1280

http://www.econ.state.or.us/index.htm

Primary Contact: Mr. Del Little
Phone: (503) 986-0261

9.5.3.1 Community Development Block Grant Program

The rules of the program are established by the U.S. Department of Housing and Urban Development (HUD) and include compliance with Davis-Bacon Wage Rates. Federal eligibility standards are also established for implementation by OECDD. These standards take the form of "national policy objectives," such as assisting low- and moderate-income families, prevention or elimination of slums and blight, and etc. To meet the national policy objective for low and moderate income, 51% of the people served by the project must fall in this income range.

CDBG grants of up to $750,000 are available for planning, design, and construction of wastewater system improvements. An eligible project must demonstrate need by achieving compliance with the Safe Drinking Water Act, the Clean Water Act, and/or compliance requirements established by the Oregon Health Department or DEQ.

9.5.3.2 Special Public Works Fund

The Special Public Works Fund (SPWF) program was created in 1985 by the Oregon State Legislature. It is capitalized through the issuance of state revenue bonds and through Oregon State lottery proceeds. The SPWF is intended to promote the creation of jobs for Oregonians.

Loans and grants are issued through this program to facilitate the construction of public infrastructure to support industrial/manufacturing and eligible commercial development. Eligible commercial development is defined as activity that is marketed nationally or internationally and attracts business from outside of Oregon.

The program is open to municipalities as described in the SPWF *Applicant's Handbook* and generally includes cities, counties, water supply districts, water and wastewater authorities, sanitary districts, port authorities, water control districts, county service districts, and tribal councils of Indian tribes. It does not appear that the Pendleton WWTP expansion would be eligible for funding under this program, because the upgrade would not bring new industries or jobs to the City.

9.5.3.3 Water/Wastewater Financing Program

The Water/Wastewater Financing Program was created by the Oregon State Legislature in 1993. It is capitalized via the sale of state revenue bonds and a portion of Oregon's State lottery proceeds. The primary purpose of the program is to provide financing for the construction of public infrastructure required to ensure compliance with the Safe Drinking Water Act or the Clean Water Act. Specifically, it is intended to assist local governments facing state and federal mandates pertaining to public drinking water systems and wastewater systems.

The program is available to cities, counties, water supply districts, water and wastewater authorities, sanitary districts, port authorities, water control districts, county service districts, and tribal councils of Indian tribes. Funding levels awarded to qualified applicants are determined by a financial analysis based on demonstrated need and an inability to afford additional loans. Communities exhibiting low and moderate income receive priority. The maximum grant from this program is approximately $500,000; the maximum available loan amount is $10 million.

9.5.4 Energy Trust of Oregon (ETO) and Oregon Department of Energy (ODOE) Programs

Between the ETO and ODOE, there are two programs that the City is qualified for, they are:

1) The ETO Production Efficiency Program, under which the City has already submitted an application for participation, which has been approved, and
2) The ODOE BETC program.

More information on both the ETO and ODOE programs is available at:

ODOE Headquarters (Portland)
851 SW Sixth Avenue,
Suite 1200
Portland, OR 97204
Phone: (503) 493-8888

ETO Production Efficiency
http://www.energytrust.org/productionefficiency/participate.html
ODOE BETC
http://egov.oregon.gov/ENERGY/CONS/BUS/BETC.shtml

Primary Contact: Mr. Martin Shain
Phone: (206) 933-8233 or 206-550-9995

9.5.4.1 Oregon Energy Trust Production Efficiency Program

This program provides incentive based funding to improve process and energy efficiency within fresh water and wastewater facilities. The City has already applied for and been accepted for this funding opportunity; with specific capital allocations on hold pending project specifics, project net energy efficiency detail and timelines. All of which will need to be clarified by working with the primary contact. The project incentives are directly tied to the modeled and projected kWh savings that are estimated from in-depth studies and engineering models of the improved design developed for the Energy Trust by BacGen, as compared to the original design. Incentives are up to $0.26/annual kWh saved or 50% of the total project cost, whichever is less, with a maximum incentive of $500,000, in any one calendar year.

BacGen serves to cover all administrative work, forms, follow-up, engineering docs, etc., thereby limiting the time and cost investment necessary on the part of City and Facilities management.

9.5.4.2 Oregon Department of Energy BETC Program

The BETC tax credit program, which may be used on a "pass-through" basis by non-profit municipalities/districts, is used to help cover the incremental cost's involved with a facility's upgrade to a new, more energy efficient design and or the utilization of more energy efficient equipment. The "gross" tax credit paid by ODOE may be up to 35% of the total approved project cost, with the net sum of 25.5% of the approved project cost paid to the non-profit by a "for-profit pass-through" partner, which BacGen will work to locate. Once a project is approved, the City would pay for the plant upgrades, and upon completion, receive a tax credit certificate that BacGen/ODOE would then look to transfer to "for-profit" entities interested in tax credits. The 35% tax credit is then discounted to a net value of 25.5% (by State regulation) and the net funds received from the sale of the tax credits are then paid to the City to reimburse a portion of the cost of the efficiency improvements. There is a nominal application fee of 0.75% of the qualified project cost, which, should the application be rejected, the fee is refunded. The BETC pass-through can be a very effective tool but can be time consuming to procure, sometimes taking upwards of 2 years to fully complete.

BacGen serves to cover all administrative work, forms, follow-up, engineering docs, etc., thereby limiting the time and cost investment necessary on the part of City and Facilities management.

9.5.5 Summary of Loan and Grant Programs

Table 9.1 contains a summary of the City's eligibility for loan and grant programs based on conversations with the above-listed contacts.

Table 9.1: Preliminary Funding Eligibility Summary

Program	Eligibility
Oregon Department of Environmental Quality (DEQ)	
Clean Water State Revolving Fund	**Eligibility: Yes - Loans Only.** Pendleton is currently ranked #6 on the 2008 Project Priority List for Design and Construction funding. Planning loans should be available in FY 2008. Current Loan Rates are 3.35% based on a 20 year repayment schedule.
U.S. Department of Agriculture Rural Utilities Services (USDA-RUS)	
Water and Waste Disposal Loans and Grants:	**Eligibility: Loans - Unlikely; Grants - Unlikely.** USDA-RUS funding is geared towards communities with populations of 10,000 people or less. As the existing population of Pendleton is approximately 17,500, it is unlikely the City will qualify for this program.
Oregon Economic and Community Development Department (OECDD)	
Community Development Block Grant Program	**Eligibility: No.** The 2000 Census data indicates the City has only 48.1% low and moderate income households and is, therefore, ineligible (51% is required) for the CDBG grant monies.
Special Public Works Fund	**Eligibility: Unlikely.** Funding of projects is linked to creation of jobs in the private sector. Wastewater improvements are not typically eligible for this type of funding unless they provide for private sector business growth.
Water/Wastewater Financing Program	**Eligibility: Loans - Yes; Grants - Unlikely.** User rates on the order of $45.39/mo are required before the City would be eligible for grant funding.
Oregon Energy Trust (OET) & Oregon Department of Energy (ODOE)	
OTE Production Efficiency Program	**Eligibility: Grants – Yes.** The City has the opportunity for incentive based on the modeled energy savings expected from using the new, energy efficient, upgrades.
ODOE BETC Program	**Eligibility: Tax Credits – Yes.** If the City does not receive grant money from ETO, this tax credit incentive program is available to implement energy efficient upgrades.

9.6 Preliminary Financial Plan & Next Steps

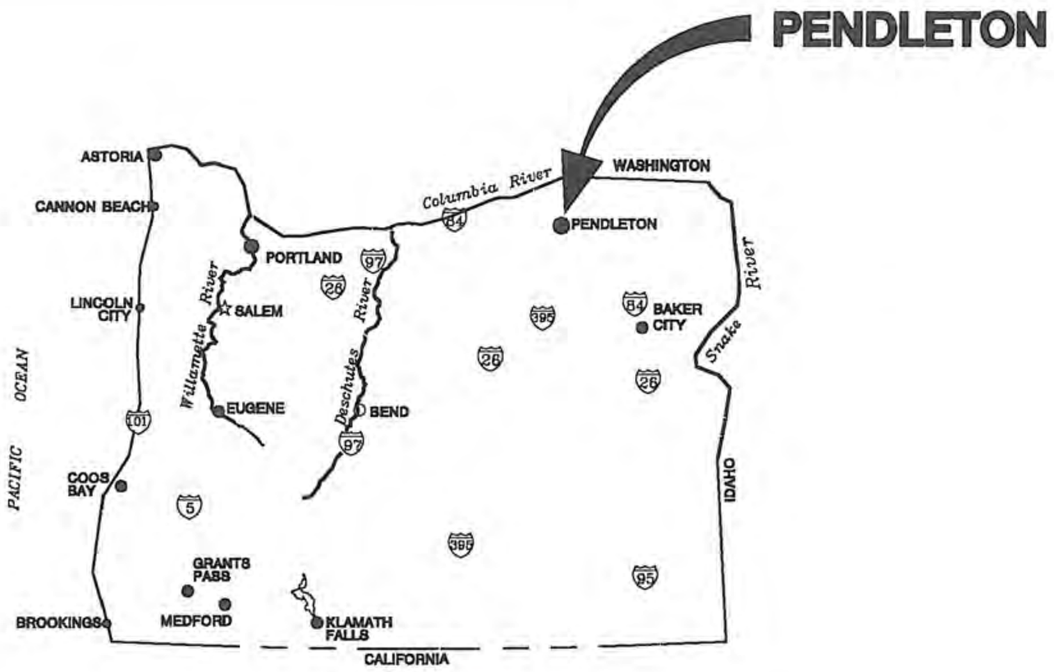
The impact of the WWTP Recommended Plan on wastewater rates will depend on many factors, including revenue from wastewater utility rates and, potentially, a new Wastewater SDC, as well as short- and long-term growth if an SDC is implemented. Population projections presented in Chapter 2 used to develop flow and load projections for the 20-year planning horizon were based on the City's historical average annual population growth of 1.3%.

Based on the City of Pendleton's currently low wastewater rates, it is anticipated the project will most likely be funded primarily through loans. The program with the lowest interest rates and most favorable terms and conditions is the CWSRF loan program administered by DEQ. The City currently has a relatively high priority ranking, but the program does not currently have adequate funds for all of the projects on the 2008 Project Priority list. Therefore, bonds or other loan programs may need to be considered by the City to augment available funds through the CWSRF program to assure Phase 1 improvements are completed as required in the City's MAO with DEQ.

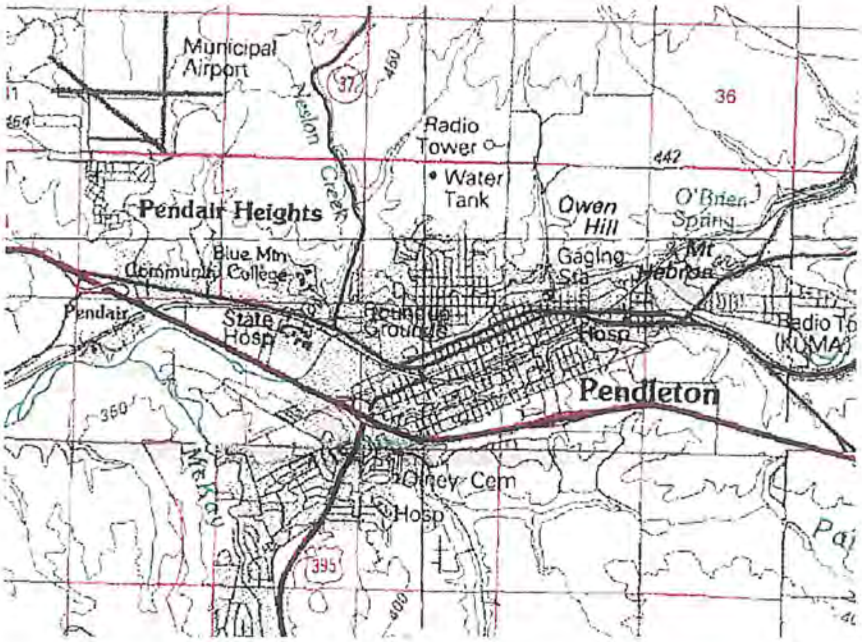
The City has completed two preliminary 20-year plans for two funding scenarios using Full Faith and Credit Obligation securities to address Phase 1 and Phase 2 improvements. One plan assumes a level debt scenario; whereby, the principal and interest payments are held at a fairly constant rate. The second repayment plan includes a 2% annual increase scenario; whereby, the principal and interest payments increase annually to match our Consumer Price Index annualized adjustment (assumed to be an average of 2.5% per year). Both preliminary funding plans are included in Appendix M.

The following next steps are recommended to finalize the project financial plan for recommended WWTP upgrades:

- Set up and attend a "one stop" meeting of funding agencies, which is typically held in at the Oregon Division of State Lands headquarters in Salem;
- Continue to move forward with funding applications submitted to the CWSRF program:
- Pursue potential grant low-interest loans through OECDD; and
- Complete a Wastewater Utility Rate Study to establish anticipated wastewater rates for Phases 1 and 2, and develop a Wastewater Utility System Development Charge.
- Move forward with full faith and credit obligation bond.



REGION MAP



VICINITY MAP

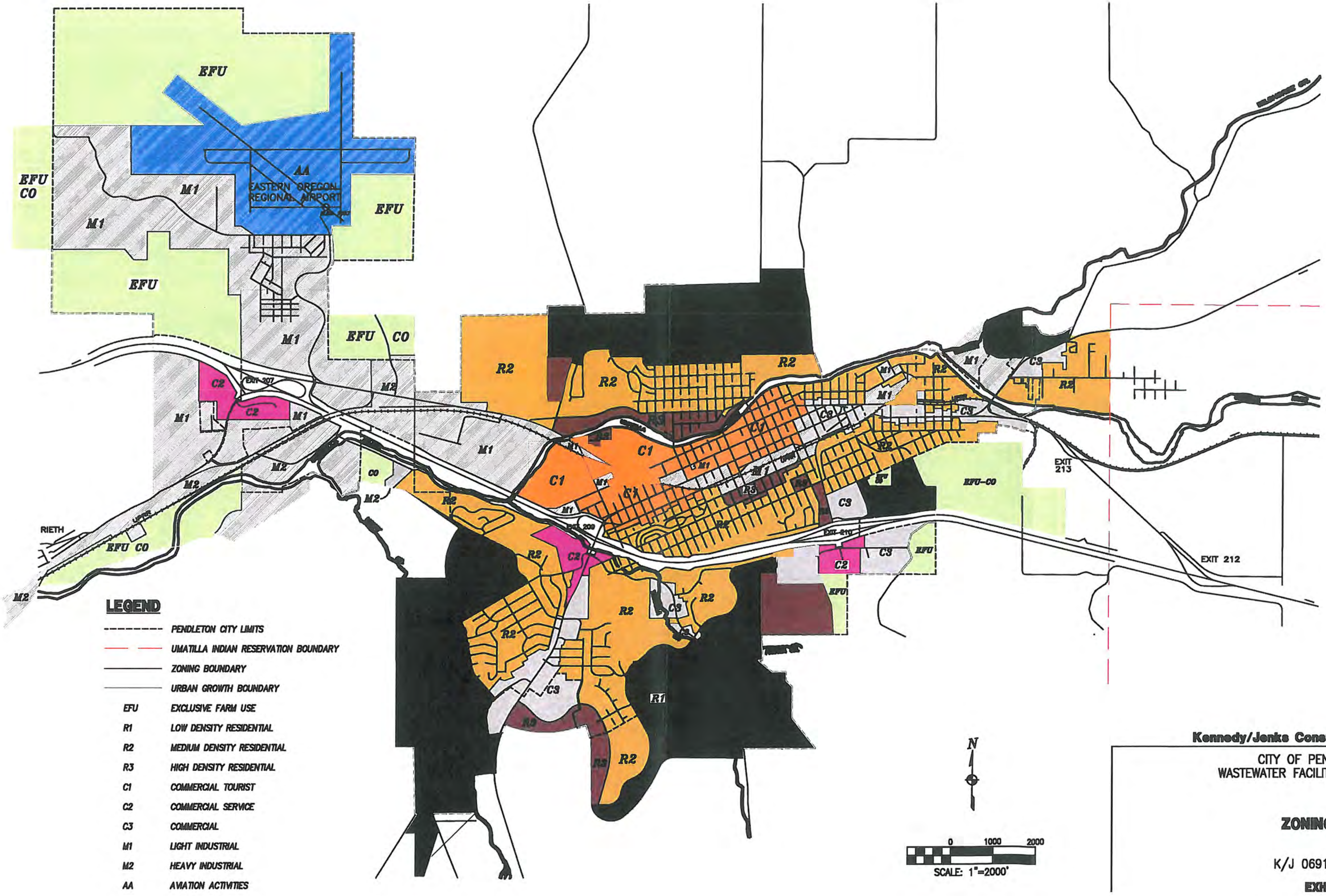
Kennedy/Jenks Consultants

CITY OF PENDLETON
WASTEWATER FACILITY PLAN

REGION & VICINITY MAPS

K/J 0691027*00

EXHIBIT 2.1



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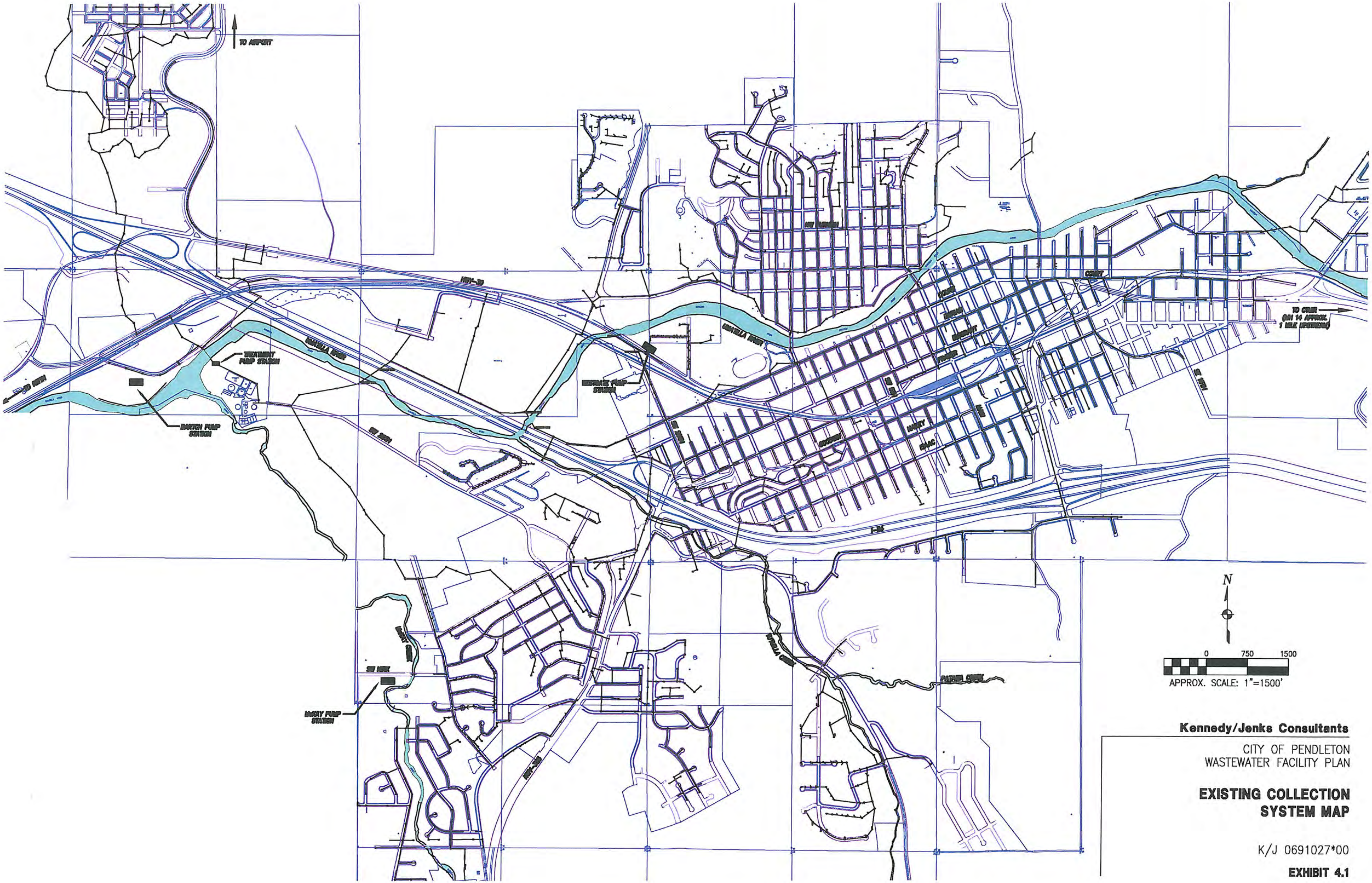
CITY OF PENDLETON
WASTEWATER FACILITY PLAN

ZONING MAP

K/J 0691027*00

EXHIBIT 2.2



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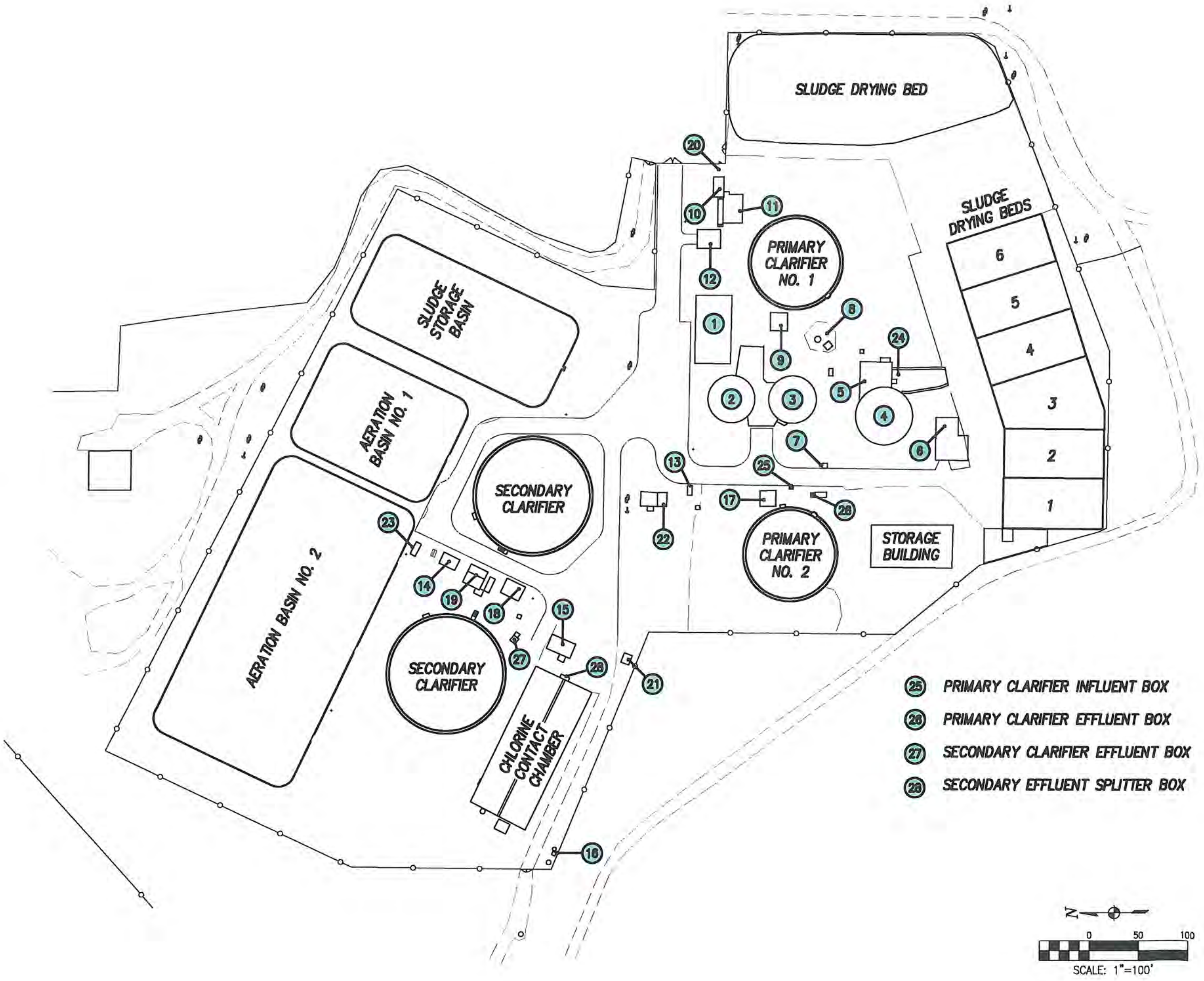
CITY OF PENDLETON
WASTEWATER FACILITY PLAN

EXISTING COLLECTION SYSTEM MAP

K/J 0691027*00

EXHIBIT 4.1



LEGEND

①	LAB & OPERATIONS BUILDING
②	NORTH SECONDARY DIGESTER
③	SOUTH SECONDARY DIGESTER
④	PRIMARY DIGESTER
⑤	PRIMARY DIGESTER COMPLEX
⑥	STORAGE BUILDING
⑦	LOADING DOCK
⑧	WASTE HEAT INCINERATOR
⑨	PRIMARY SLUDGE PUMP HOUSE NO. 1
⑩	HEADWORKS
⑪	GRIT CHAMBER
⑫	GRIT REMOVAL BUILDING & HEADWORKS CONTROLS
⑬	JUNCTION BOX
⑭	PLANT ELECTRICAL CONTROLS
⑮	CHLORINE GAS BUILDING
⑯	EFFLUENT METER BOX
⑰	PRIMARY SLUDGE PUMP HOUSE NO. 2
⑱	SECONDARY SLUDGE PUMP HOUSE
⑲	INPLANT PUMP STATION
⑳	36" INFLUENT PIPE
㉑	BYPASS CONTROL STRUCTURE
㉒	GENERATOR BUILDING
㉓	CONTROL STRUCTURE
㉔	SEPTAGE RECEIVING STATION
㉕	PRIMARY CLARIFIER INFLUENT BOX
㉖	PRIMARY CLARIFIER EFFLUENT BOX
㉗	SECONDARY CLARIFIER EFFLUENT BOX
㉘	SECONDARY EFFLUENT SPLITTER BOX

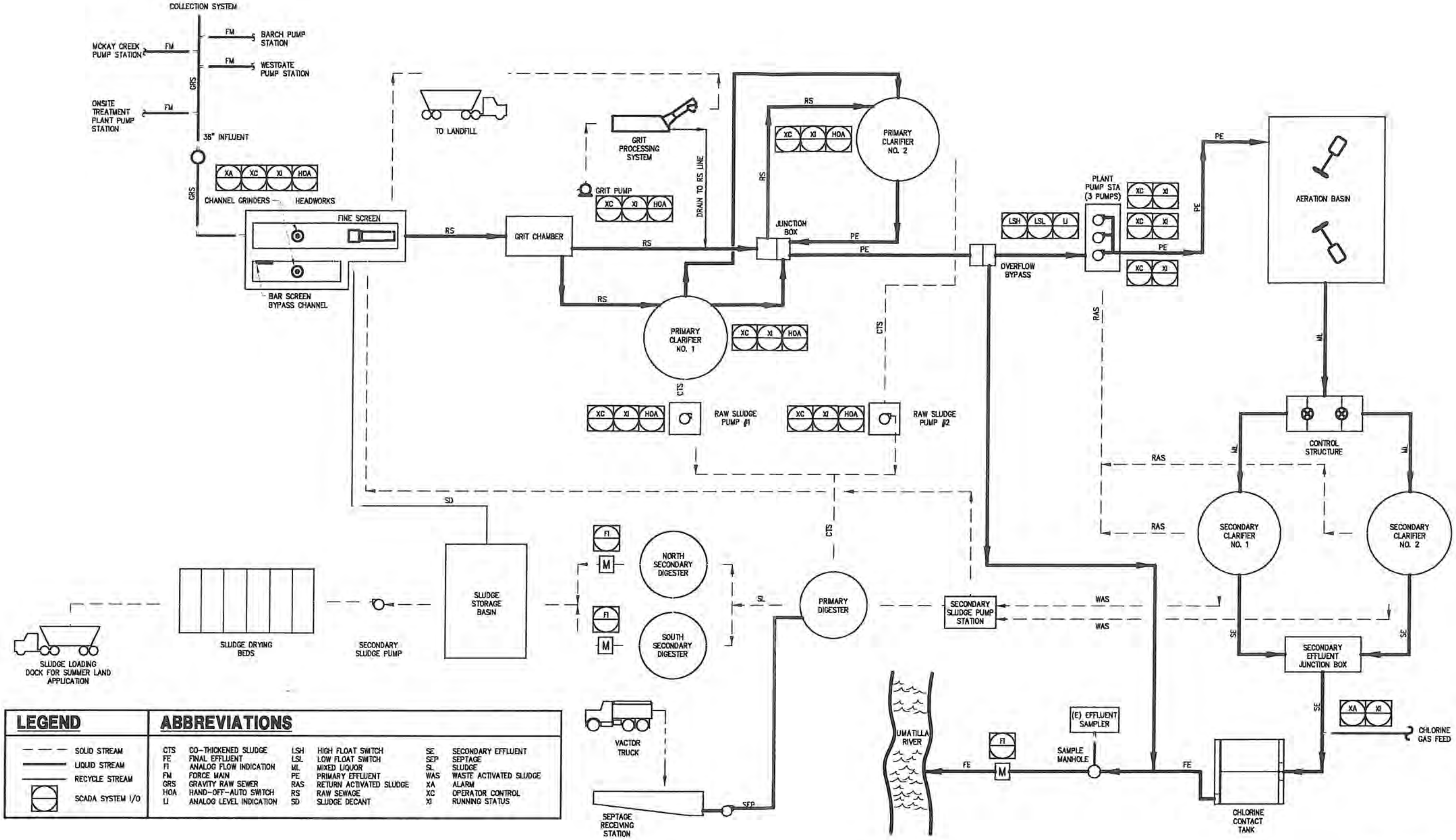
Kennedy/Jenks Consultants

CITY OF PENDLETON
WASTEWATER FACILITY PLAN

EXISTING WWTP SITE PLAN

K/J 0691027*00

EXHIBIT 4.2



LEGEND

— — —	SOLID STREAM
━━━	LIQUID STREAM
───	RECYCLE STREAM
⊖	SCADA SYSTEM I/O

ABBREVIATIONS

CTS	CO-THICKENED SLUDGE	LSH	HIGH FLOAT SWITCH	SE	SECONDARY EFFLUENT
FE	FINAL EFFLUENT	LSL	LOW FLOAT SWITCH	SEP	SEPTAGE
FI	ANALOG FLOW INDICATION	ML	MIXED LIQUOR	SL	SLUDGE
FM	FORCE MAIN	PE	PRIMARY EFFLUENT	WAS	WASTE ACTIVATED SLUDGE
GRS	GRAVITY RAW SEWER	RAS	RETURN ACTIVATED SLUDGE	XA	ALARM
HOA	HAND-OFF-AUTO SWITCH	RS	RAW SEWAGE	XC	OPERATOR CONTROL
LI	ANALOG LEVEL INDICATION	SD	SLUDGE DECANT	XI	RUNNING STATUS

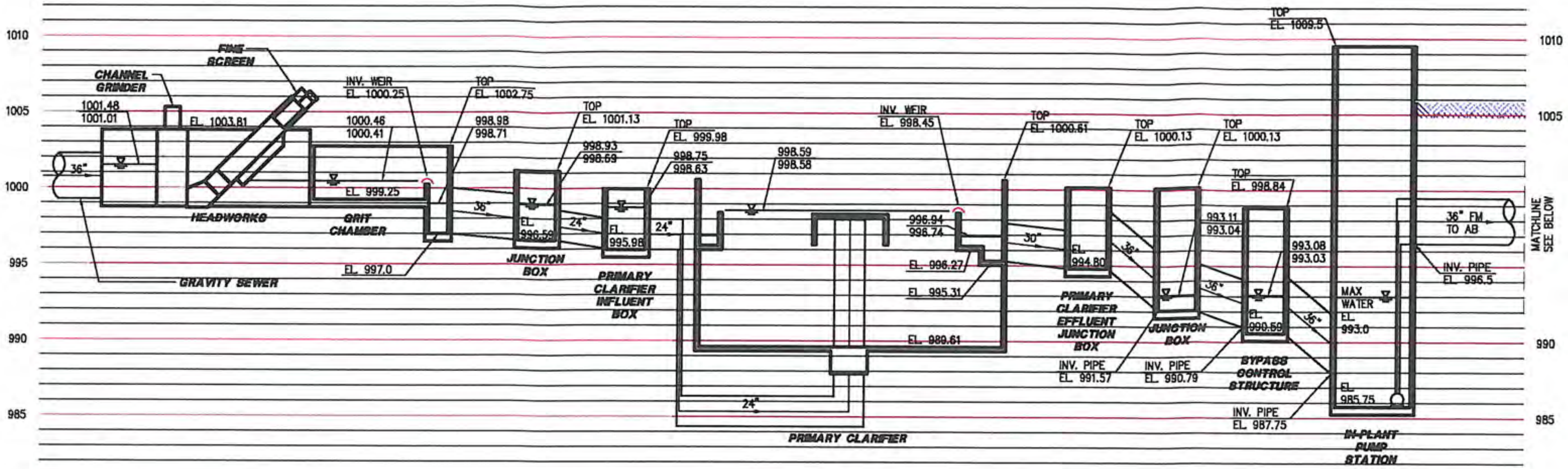
Kennedy/Jenks Consultants

CITY OF PENDLETON
WASTEWATER FACILITY PLAN

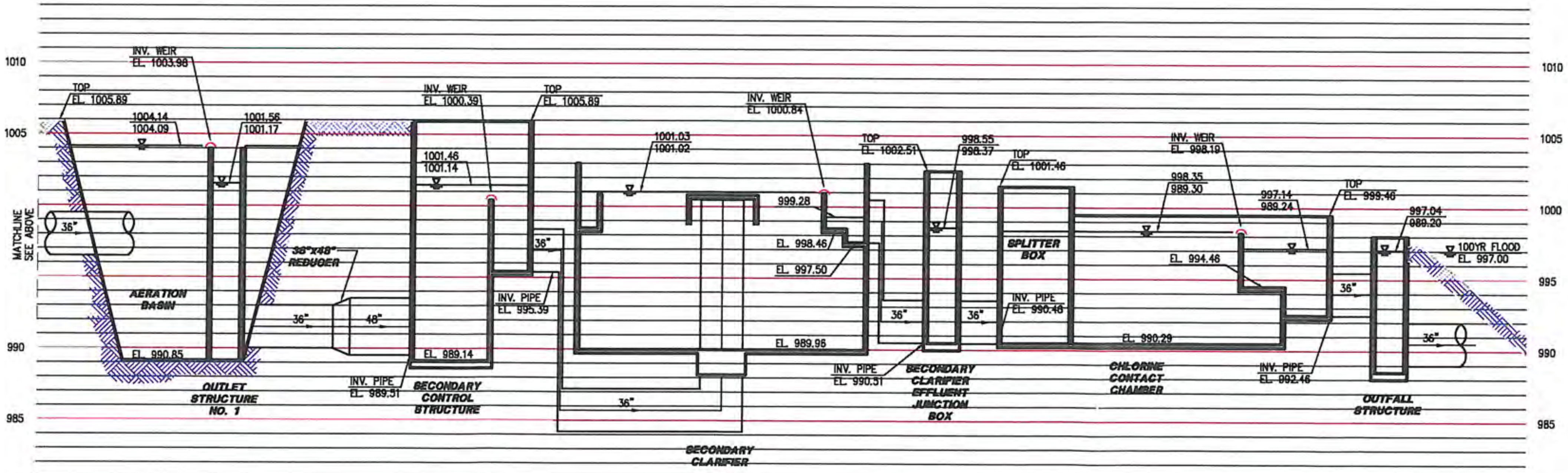
EXISTING PROCESS SCHEMATIC

K/J 0691027*00

EXHIBIT 4.3



HYDRAULIC PROFILE



HYDRAULIC PROFILE (CONTINUED)

LEGEND

XXX.XX — WATER SURFACE ELEVATION AT CURRENT PIF
XXX.XX — WATER SURFACE ELEVATION AT CURRENT AAF

Kennedy/Jenks Consultants

CITY OF PENDLETON
WASTEWATER FACILITY PLAN

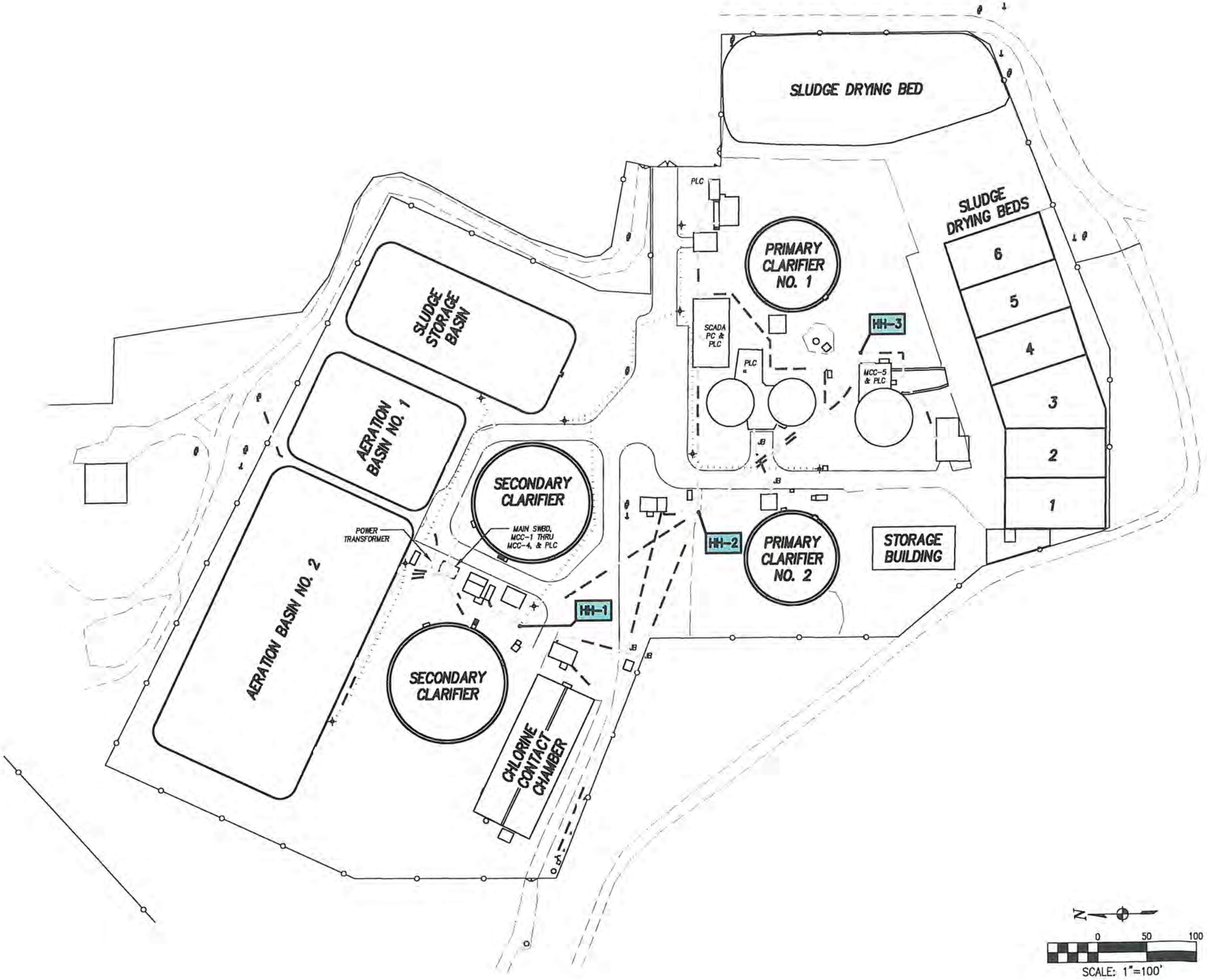
EXISTING HYDRAULIC PROFILE

K/J 0691027*00

EXHIBIT 4.4

LEGEND

- HH-1 HANDHOLE-1
- HH-2 HANDHOLE-2
- HH-3 HANDHOLE-3
- – – – BURIED CONDUIT
- ······ BURIED LIGHTING CONDUIT
- ✦ YARD LIGHT
- ▪JB JUNCTION BOX



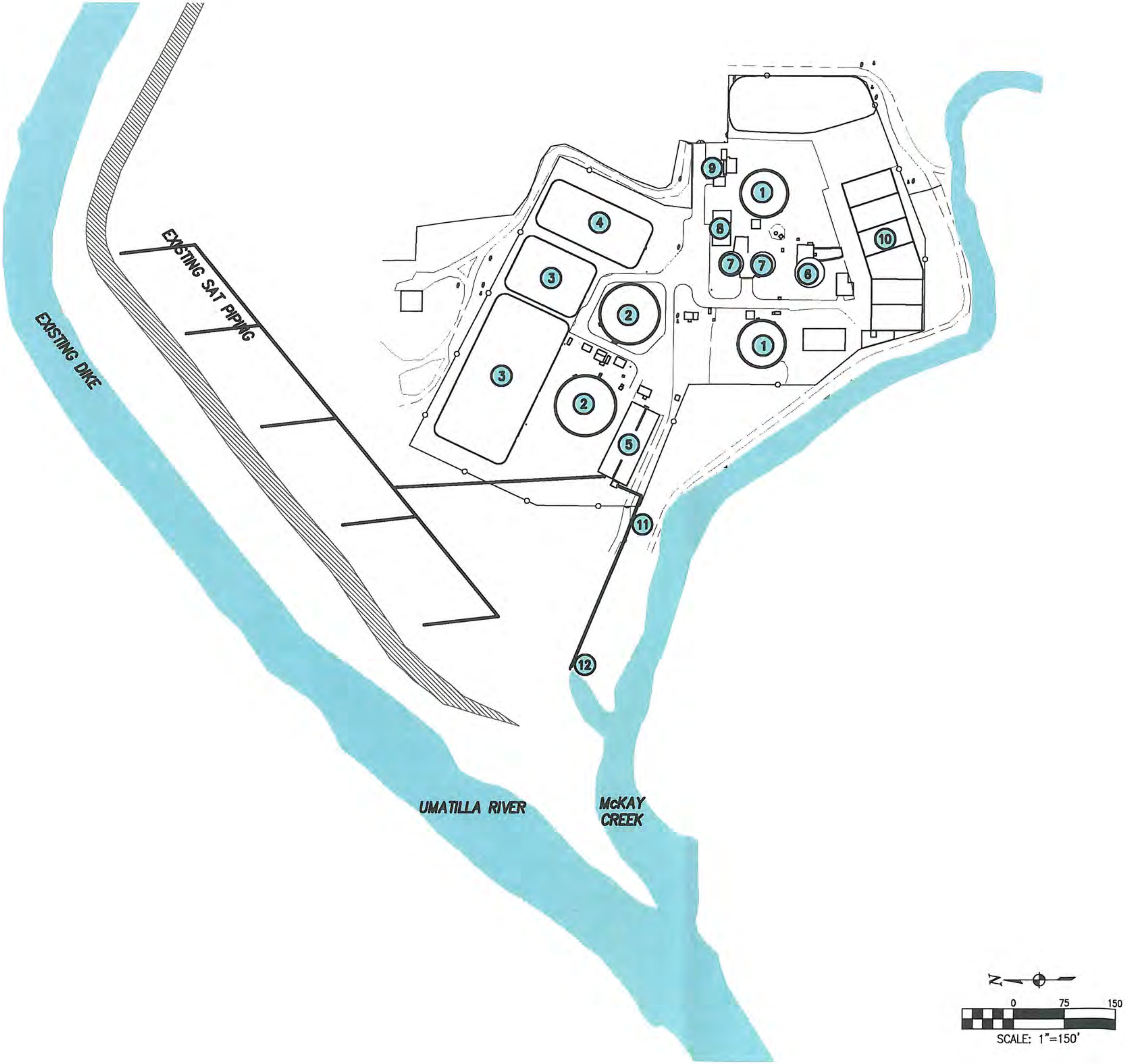
Kennedy/Jenks Consultants

CITY OF PENDLETON
WASTEWATER FACILITY PLAN

EXISTING ELECTRICAL SITE PLAN

K/J 0691027*00

EXHIBIT 4.5



LEGEND

① PRIMARY CLARIFIER
② SECONDARY CLARIFIER
③ AERATION BASIN
④ SLUDGE STORAGE BASIN
⑤ CHLORINE CONTACT CHAMBER
⑥ PRIMARY DIGESTER
⑦ SECONDARY DIGESTER
⑧ LAB AND OPS BUILDING
⑨ HEADWORKS
⑩ SLUDGE DRYING BEDS
⑪ EFFLUENT METERING
⑫ EXISTING OUTFALL

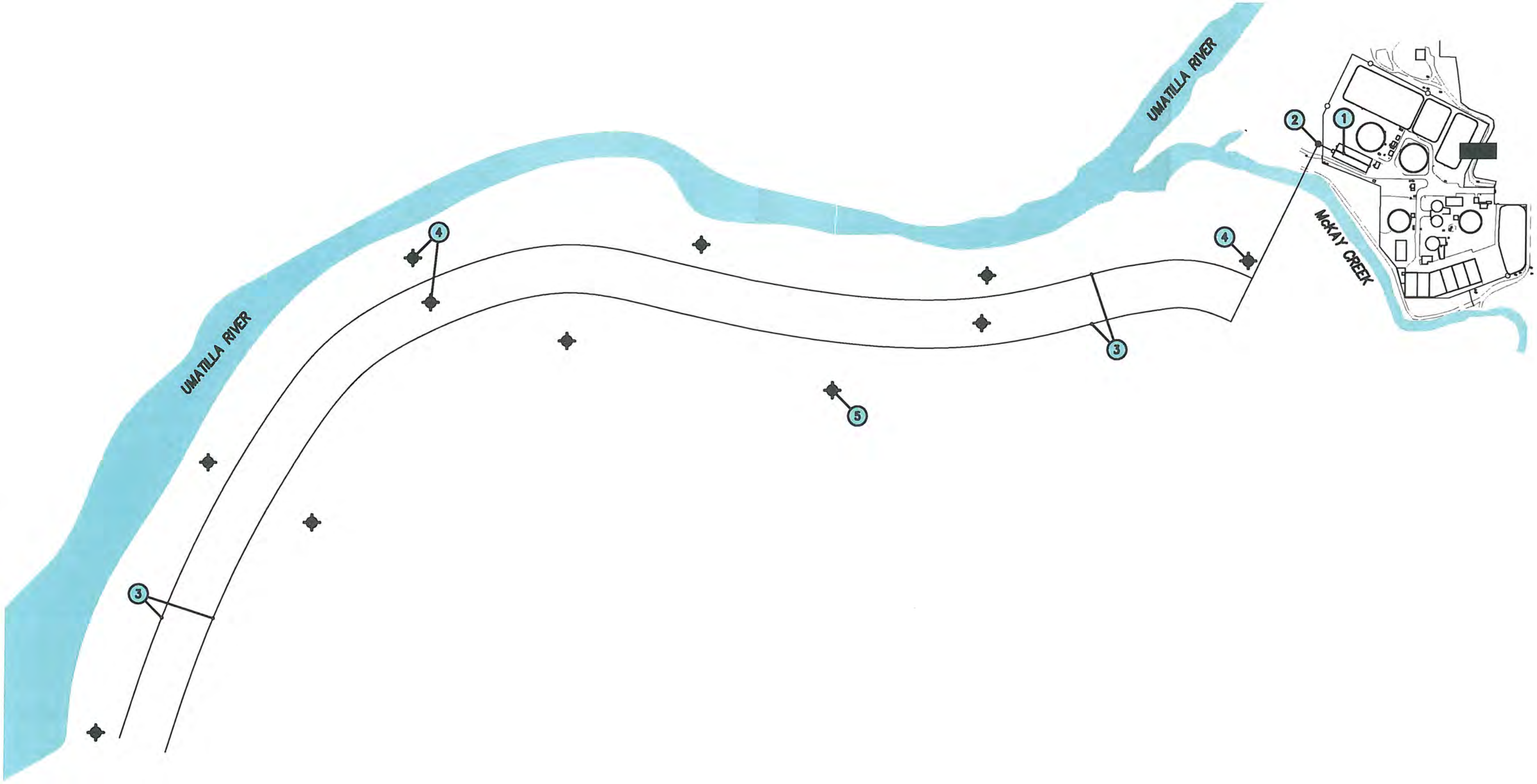
Kennedy/Jenks Consultants

CITY OF PENDLETON
WASTEWATER FACILITY PLAN

LOCATION MAP

K/J 0691027*00

EXHIBIT 5.1



LEGEND

- ① EXISTING CHLORINE CONTACT CHAMBER
- ② NEW PUMP STATION
- ③ NEW DISCHARGE PIPING
- ④ NEW MONITORING WELLS
- ⑤ NEW UPGRADIENT MONITORING WELLS

N

0 200 400

SCALE: 1"=400'

Kennedy/Jenks Consultants

CITY OF PENDLETON
WASTEWATER FACILITY PLAN

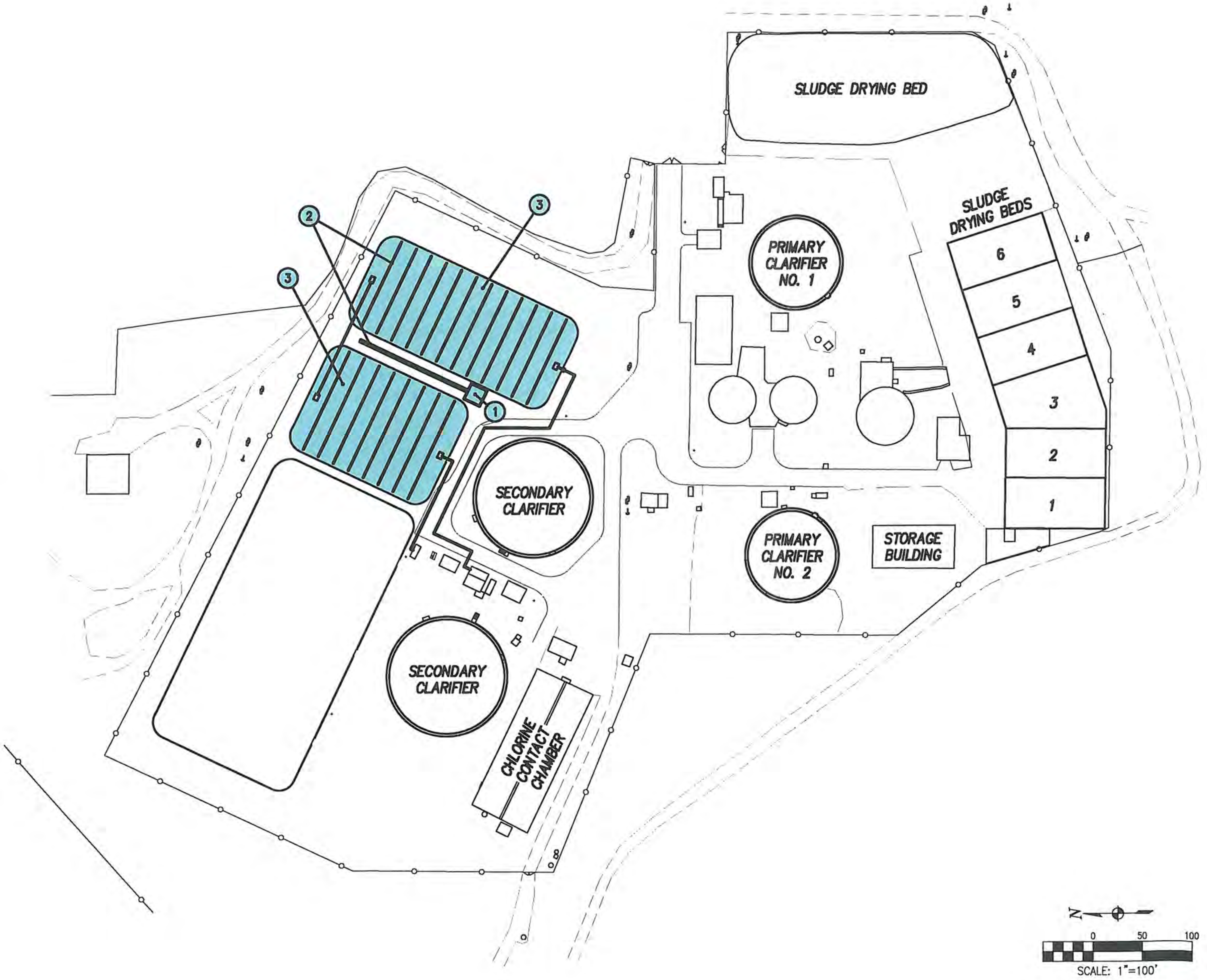
SUB-SURFACE DISCHARGE LAYOUT

K/J 0691027*00

EXHIBIT 6.1

LEGEND

- ① NEW BLOWER BUILDING
- ② NEW AIR HEADERS
- ③ NEW BNR OXIC/ANOXIC BASIN



Kennedy/Jenks Consultants

CITY OF PENDLETON
WASTEWATER TREATMENT IMPROVEMENTS

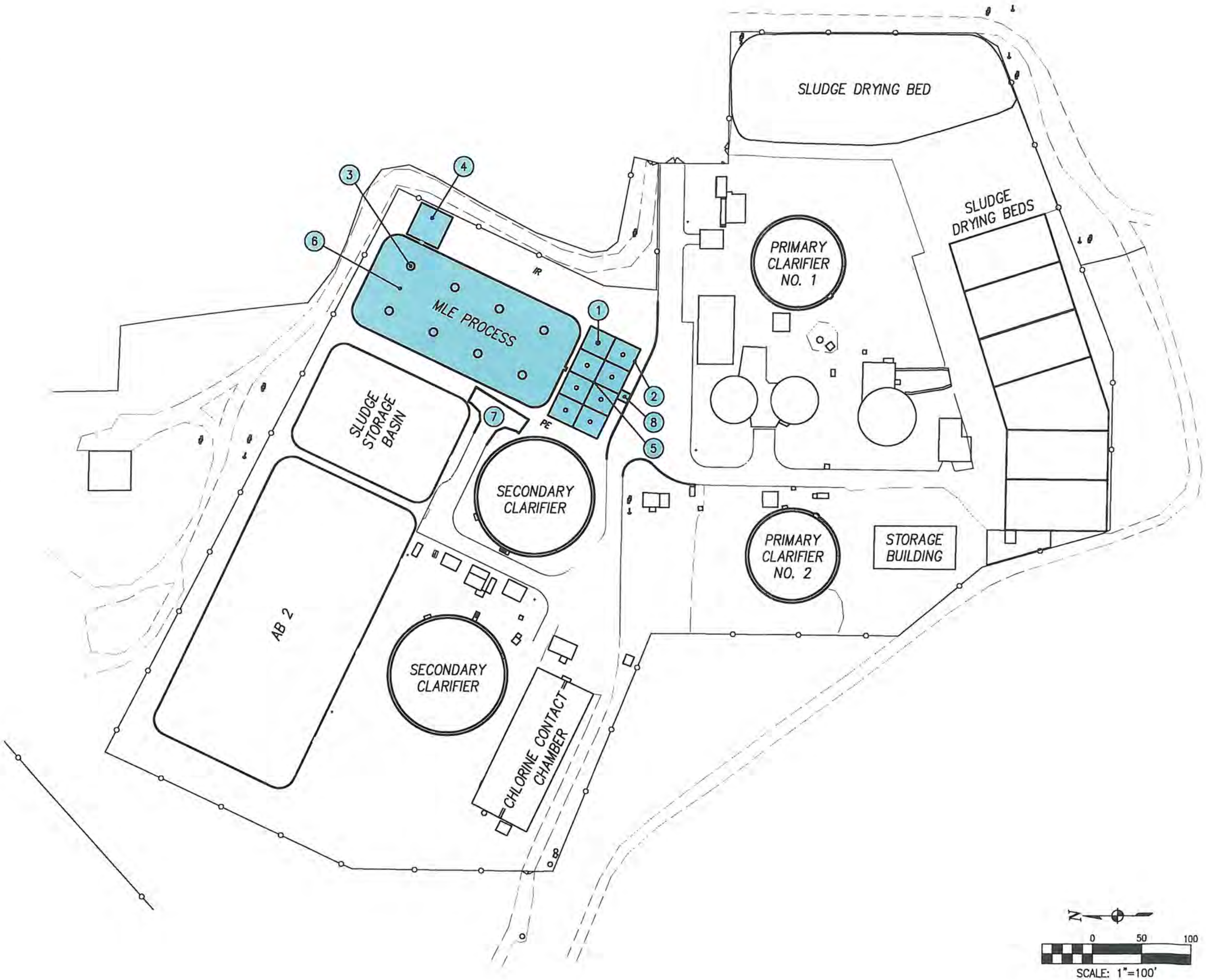
BIOLAC LAYOUT

K/J 0691027*00

EXHIBIT 6.2

LEGEND

- ① NEW MIXERS
- ② NEW 100FT x 55FT x 11.5FT CONCRETE BASIN
- ③ NEW FLOATING AERATORS
- ④ NEW INTERNAL RECYCLE PUMP STATION
- ⑤ BNR ANOXIC ZONE
- ⑥ BNR AEROBIC ZONE
- ⑦ NEW HAMMERHEAD TURNAROUND
- ⑧ JUNCTION BOX



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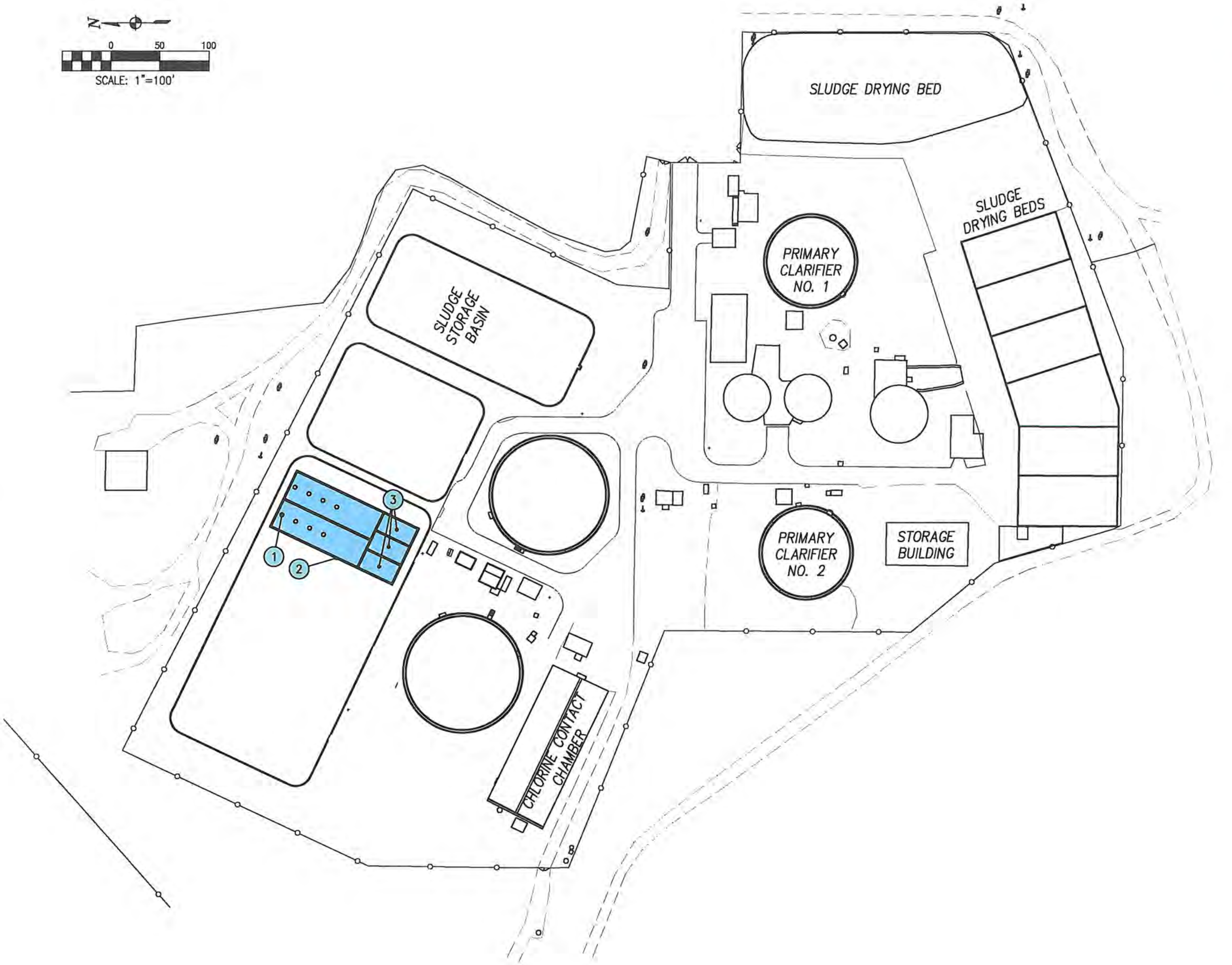
CITY OF PENDLETON
WASTEWATER TREATMENT IMPROVEMENTS

MLE RETROFIT LAYOUT

K/J 0691027*00

EXHIBIT 6.3



PHASE 1 IMPROVEMENTS LEGEND

① NEW MIXERS
② NEW 136' X 63' X 22' CONCRETE BASIN
③ NEW AEROBIC CELLS

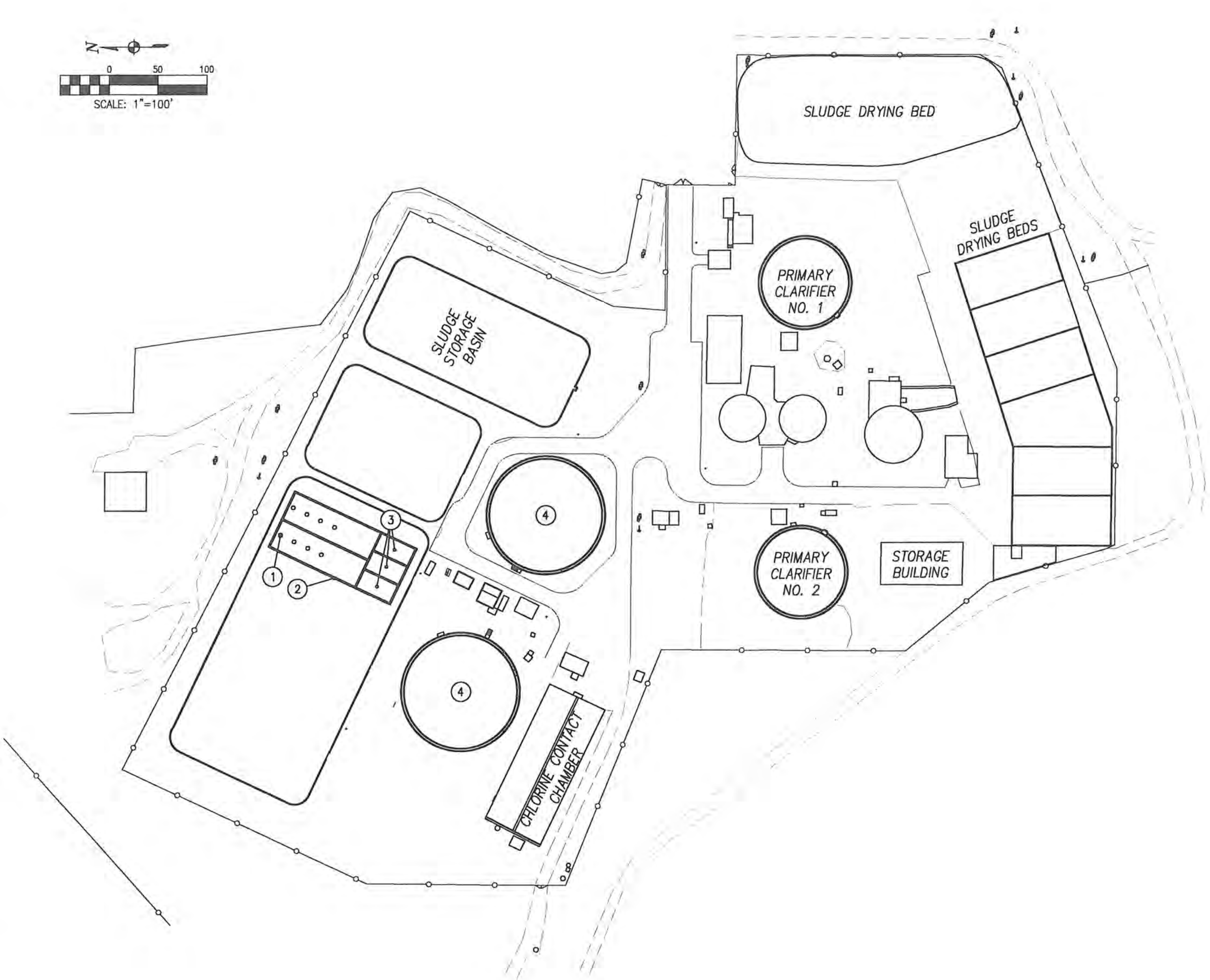
Kennedy/Jenks Consultants

CITY OF PENDLETON
WASTEWATER TREATMENT IMPROVEMENTS

MLE NEW BASIN LAYOUT

K/J 0691027*00

EXHIBIT 6.4



PHASE 1 IMPROVEMENTS LEGEND

① *NEW MIXERS*

② *NEW 136' X 63' X 22' CONCRETE BASIN*

③ *NEW MBR CELLS*

④ *ABONDON SECONDARY CLARIFIERS*

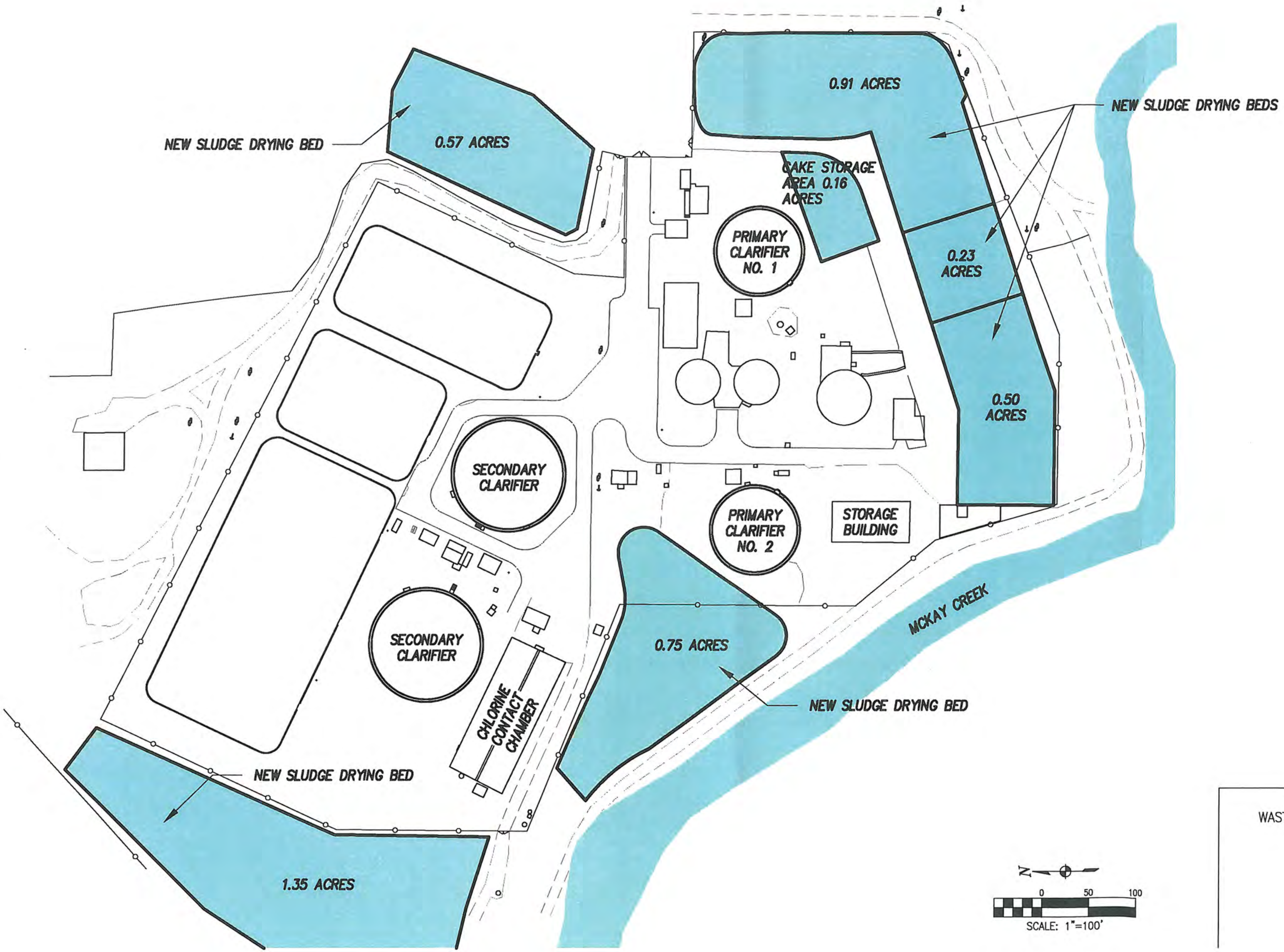
Kennedy/Jenks Consultants

CITY OF PENDLETON
WASTEWATER TREATMENT IMPROVEMENTS

MBR BASIN
LAYOUT

K/J 0691027*00

EXHIBIT 6.5



Kennedy/Jenks Consultants

CITY OF PENDLETON
WASTEWATER TREATMENT IMPROVEMENTS

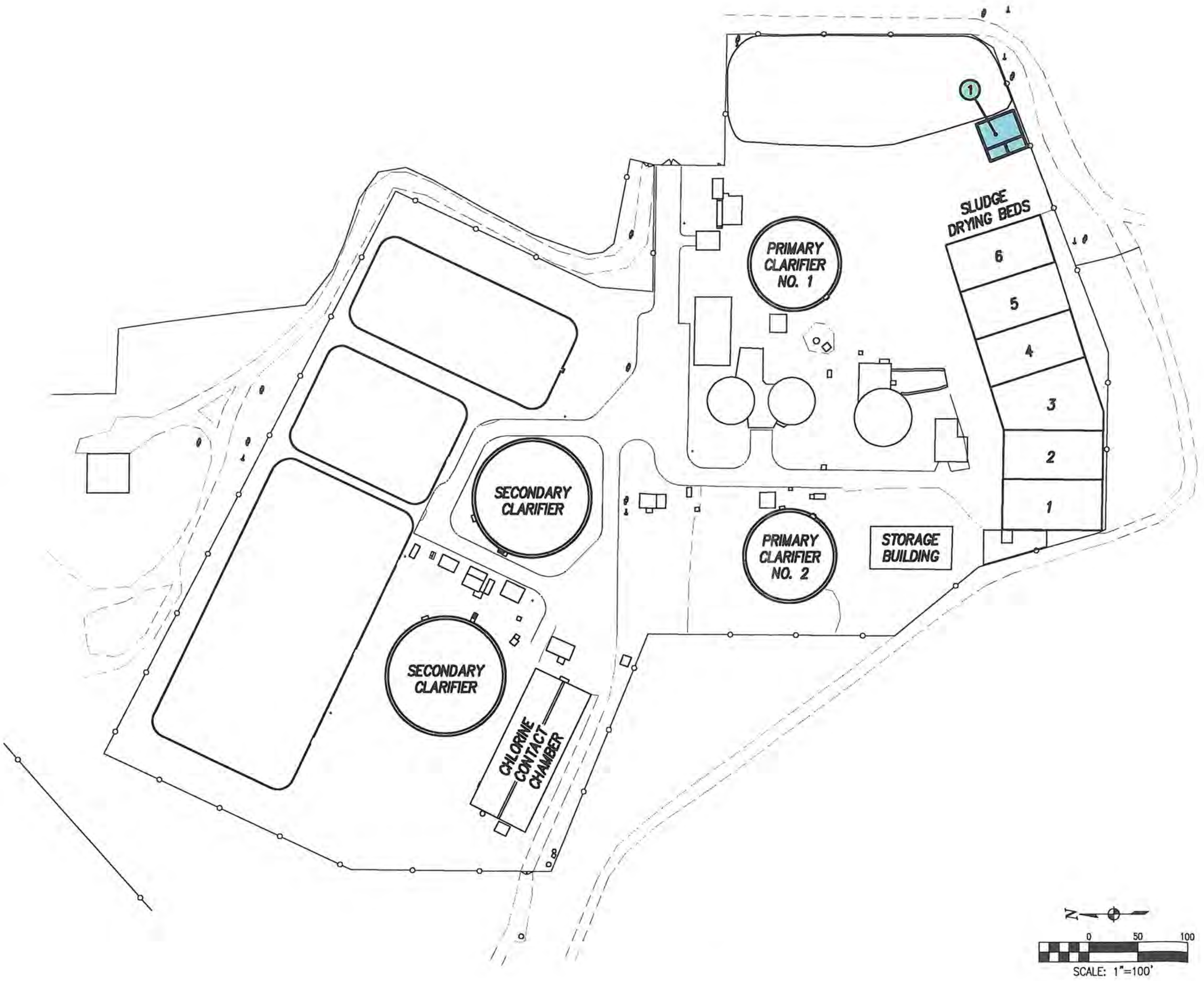
ADDITIONAL SLUDGE DRYING BED LOCATIONS

K/J 0691027*00

EXHIBIT 6.6

LEGEND

① *NEW DEWATERING BUILDING*



Kennedy/Jenks Consultants

CITY OF PENDLETON
WASTEWATER TREATMENT IMPROVEMENTS

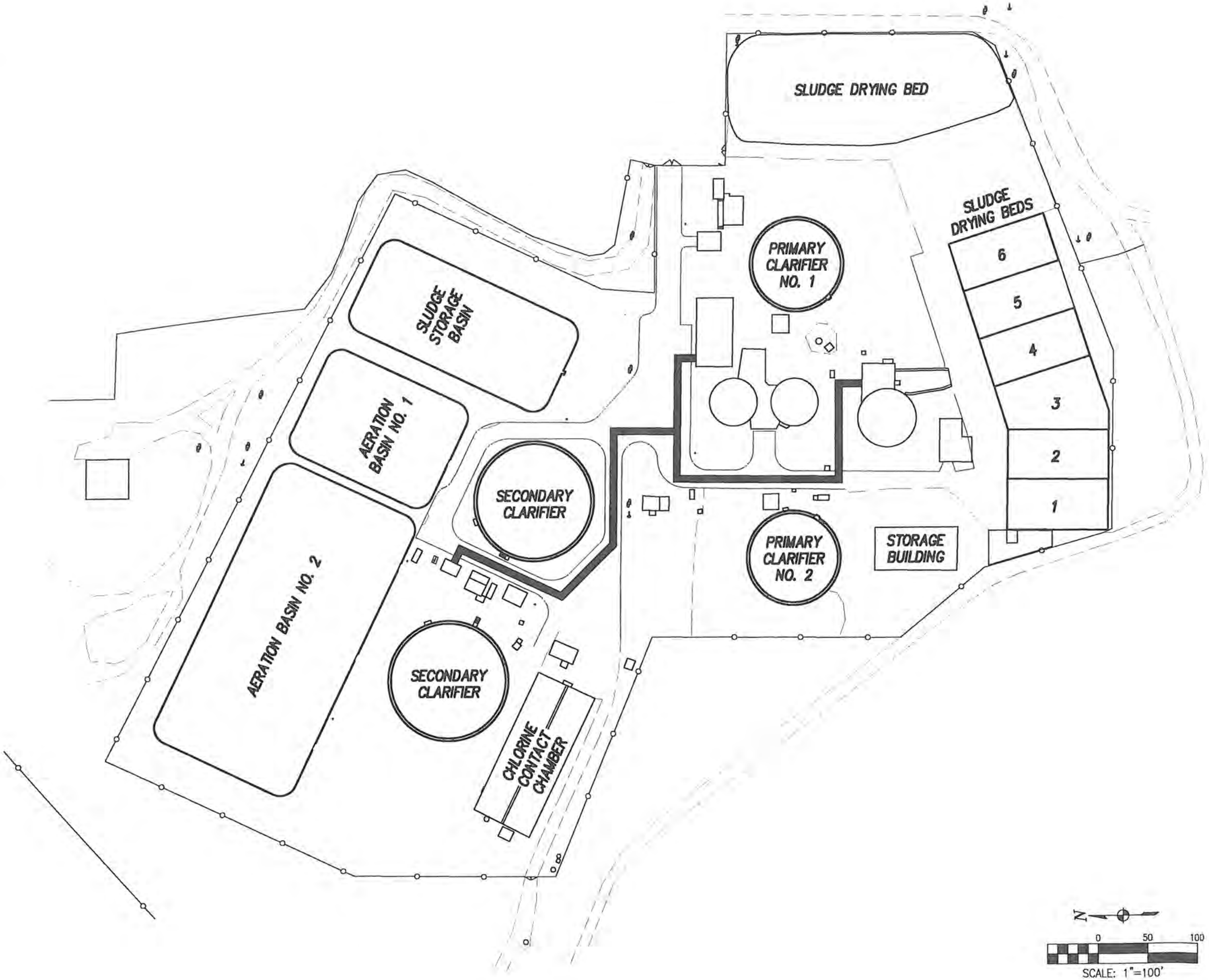
SLUDGE DEWATERING BUILDING LAYOUT

K/J 0691027*00

EXHIBIT 6.7

LEGEND

▬ NEW CONDUIT TRENCH



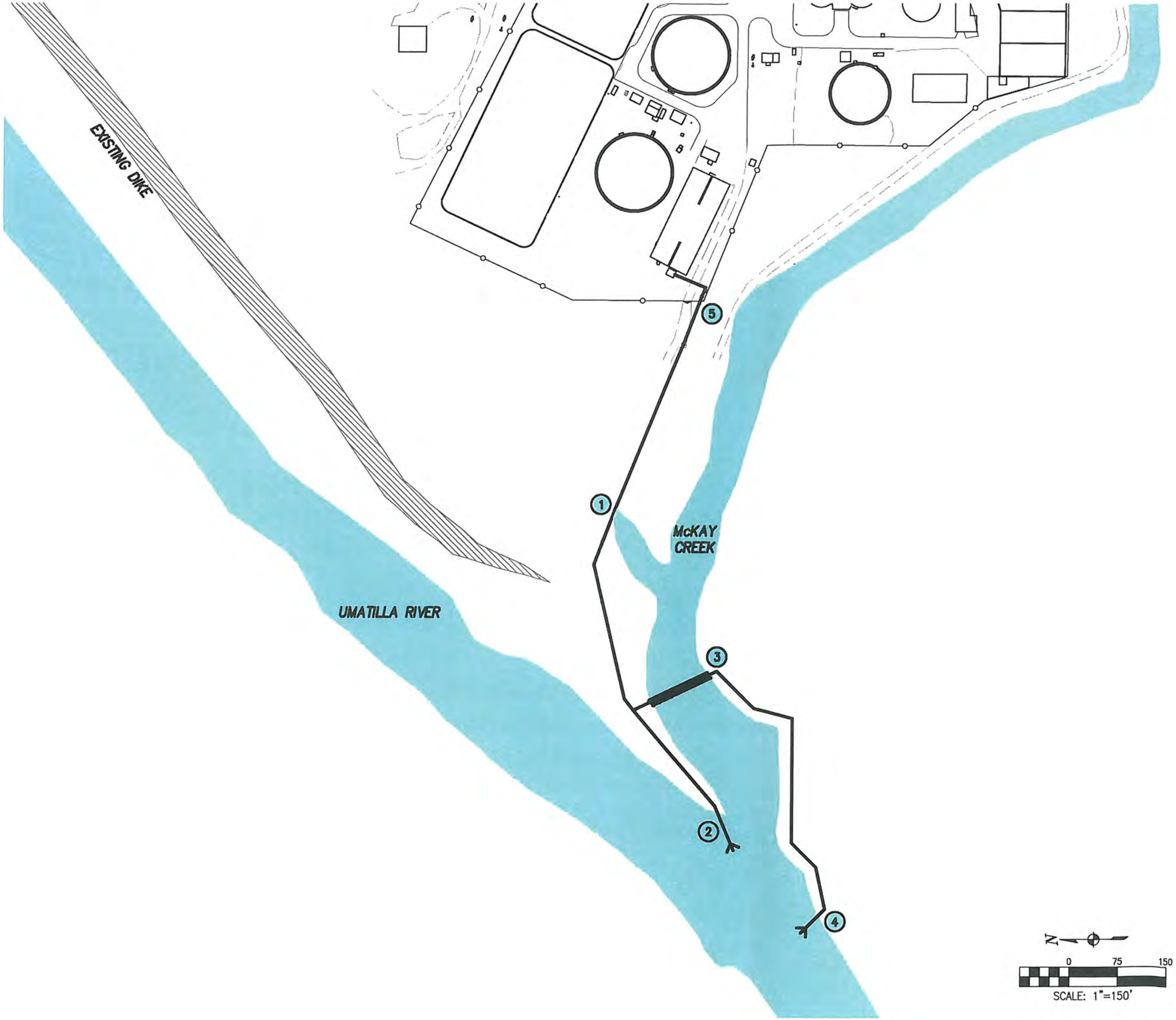
Kennedy/Jenks Consultants

CITY OF PENDLETON
WASTEWATER TREATMENT IMPROVEMENTS

ELECTRICAL CONDUIT TRENCH LAYOUT

K/J 0691027*00

EXHIBIT 6.8



LEGEND

- ① EXISTING OUTFALL
- ② PROPOSED CONFLUENCE OUTFALL
- ③ EXISTING FISH BARRIER
- ④ PROPOSED SOUTH BANK OUTFALL
- ⑤ EFFLUENT METERING

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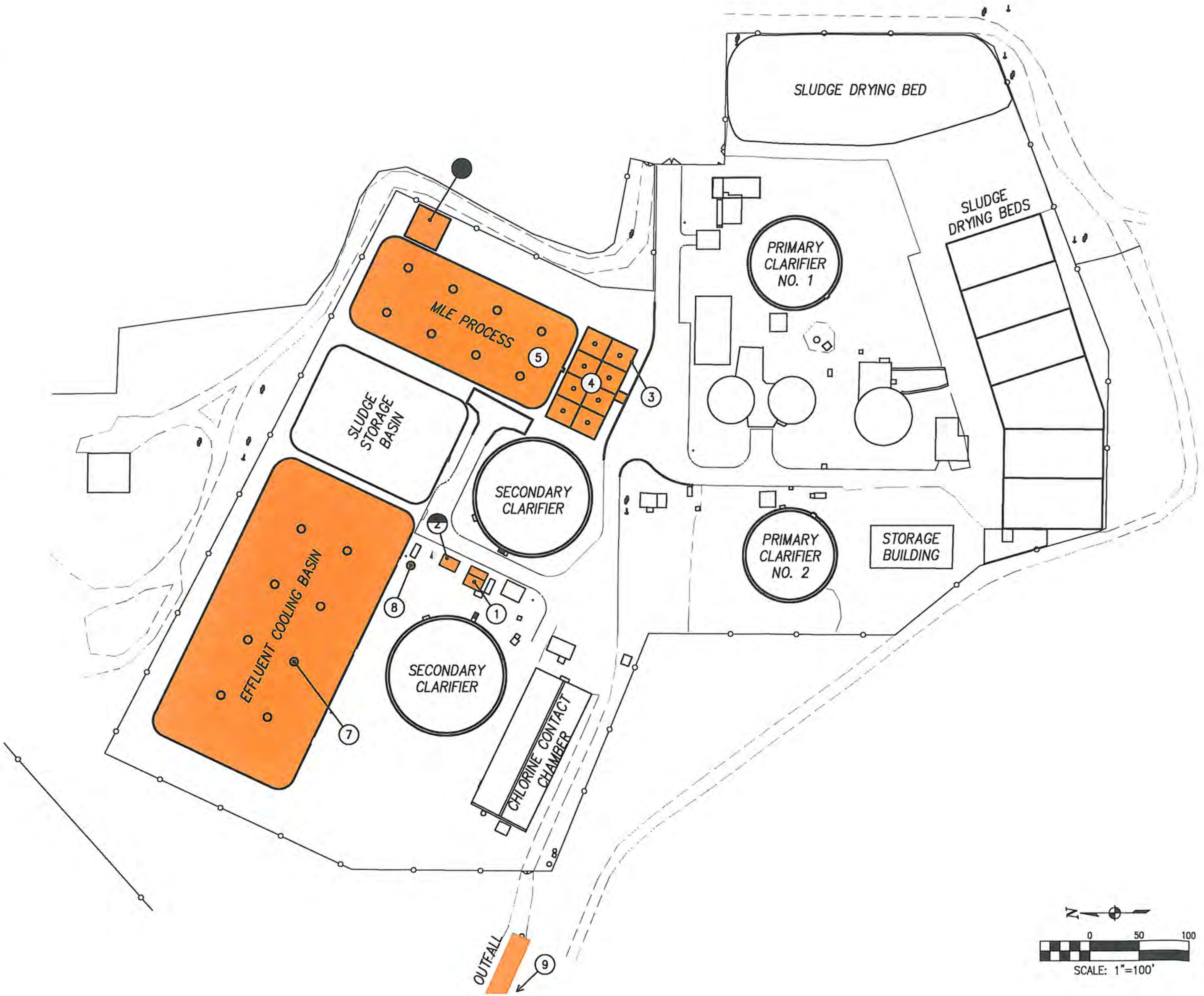
CITY OF PENDLETON
WASTEWATER TREATMENT IMPROVEMENTS

OUTFALL ALTERNATIVE LAYOUTS

K/J 0691027*00

EXHIBIT 6.9



LEGEND

① IN-PLANT PUMP STATION IMPROVEMENTS
② ELECTRICAL BUILDING IMPROVEMENTS
③ NEW ANOXIC CONCRETE BASIN
④ MLE-ANOXIC ZONE
⑤ MLE-COMPLETE MIX AERATION ZONE
⑥ MLE-INTERNAL RETURN PUMP STATION
⑦ EFFLUENT COOLING BASIN
⑧ EFFLUENT COOLING PUMP STATION
⑨ NEW OUTFALL

🟧 NPDES PERMIT ISSUES

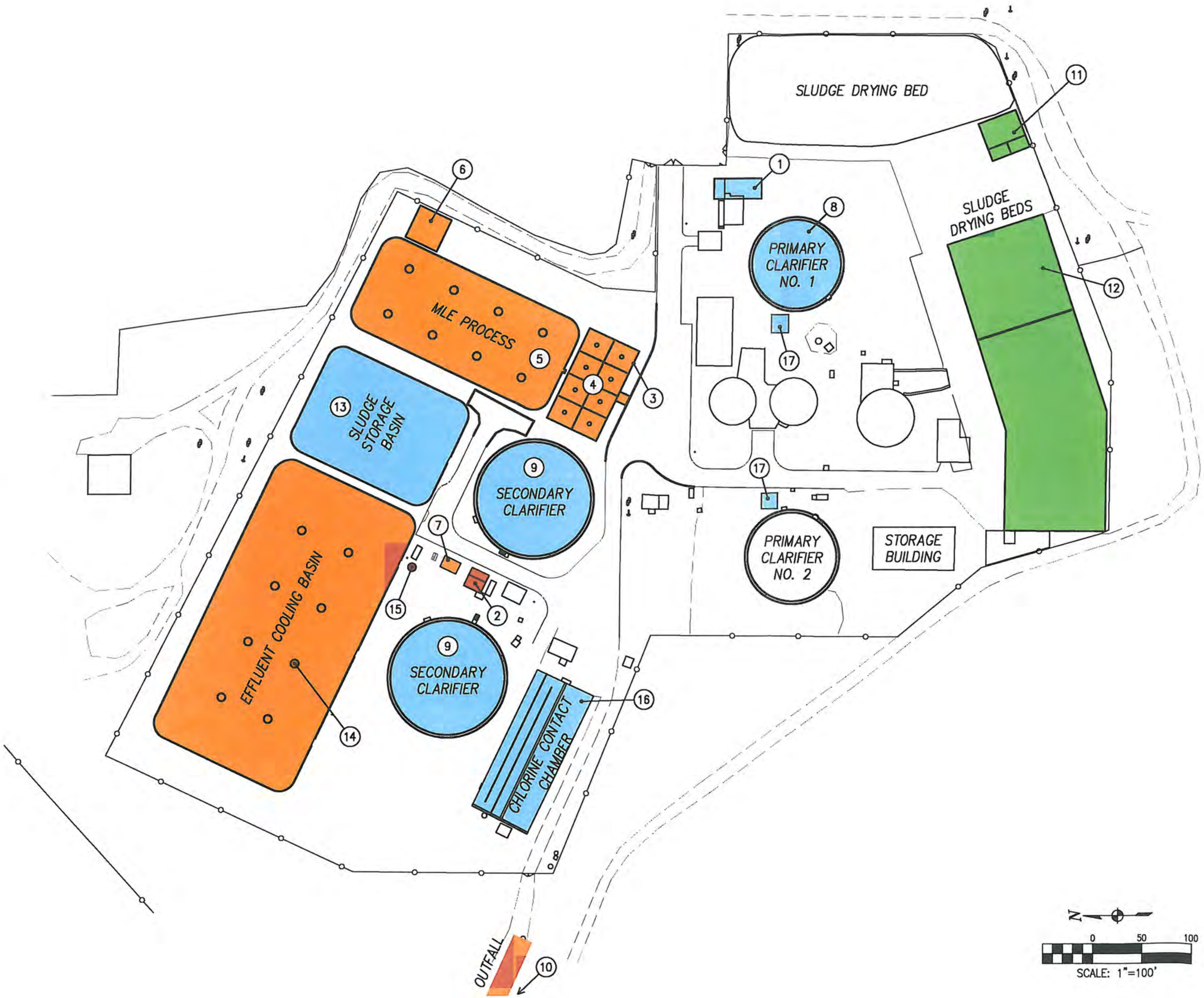
Kennedy/Jenks Consultants

CITY OF PENDLETON
WASTEWATER FACILITY PLAN

MINIMUM FOR
PERMIT ISSUES

K/J 0691027*00/ALT_EXHIBITS

EXHIBIT 7.1



LEGEND

① NEW HEADWORKS BUILDING
② IN-PLANT PUMP STATION IMPROVEMENTS
③ NEW ANOXIC CONCRETE BASIN
④ MLE-ANOXIC ZONE
⑤ MLE-COMPLETE MIX AERATION ZONE
⑥ MLE-INTERNAL RETURN PUMP STATION
⑦ ELECTRICAL BUILDING IMPROVEMENTS
⑧ PRIMARY CLARIFIER NO.1 REHAB
⑨ SECONDARY CLARIFIER REHABS
⑩ NEW OUTFALL
⑪ SOLIDS DEWATERING FACILITY
⑫ SLUDGE DRYING BED MODIFICATIONS
⑬ REHAB NEW SSB
⑭ EFFLUENT COOLING BASIN
⑮ EFFLUENT COOLING PUMP STATION
⑯ CCC IMPROVEMENTS
⑰ PRIMARY SLUDGE PUMP BLDG IMPROVEMENTS

🟧 NPDES PERMIT ISSUES
🟦 PLANT REHABILITATION
🟩 SOLIDS IMPROVEMENTS

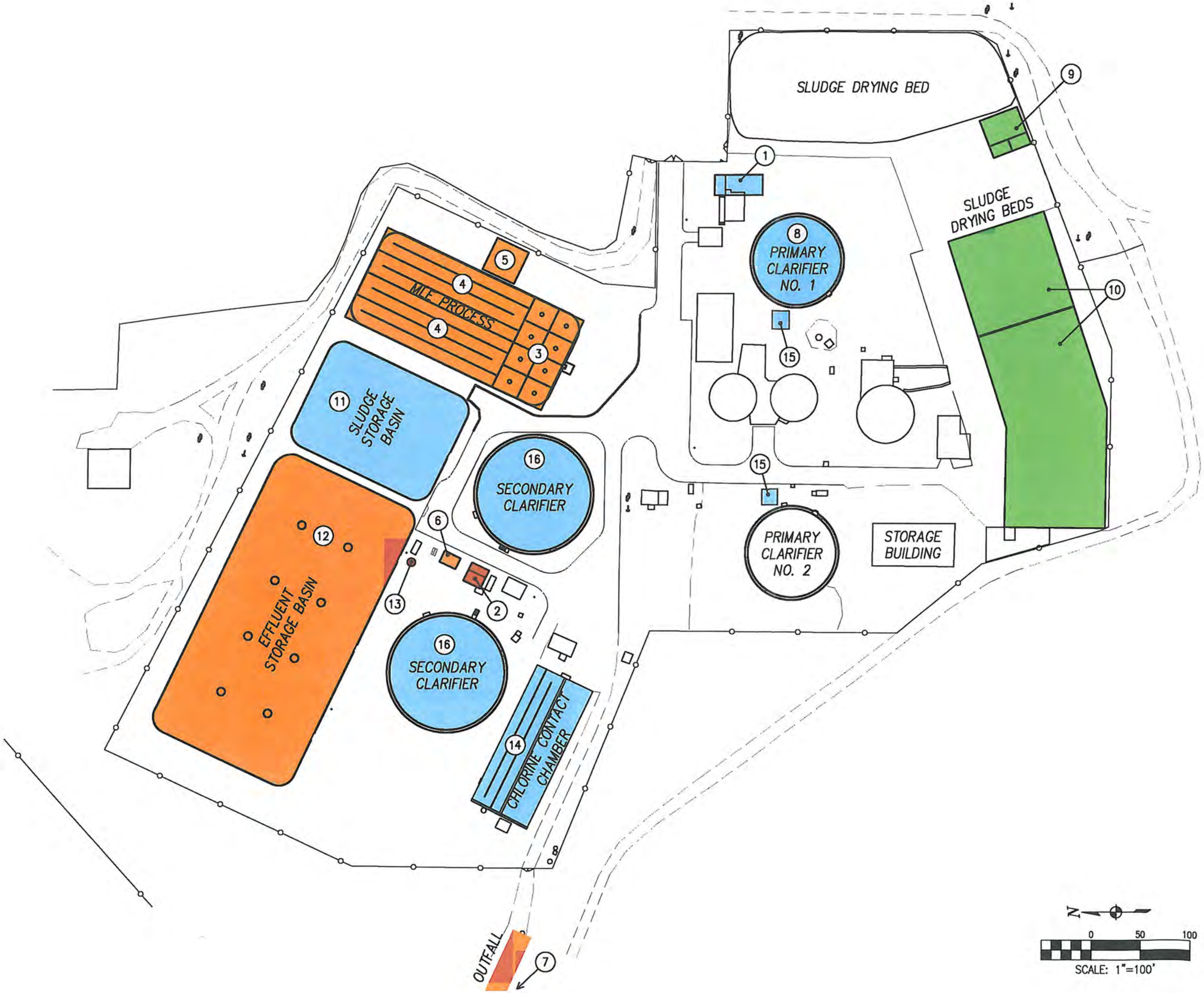
Kennedy/Jenks Consultants

CITY OF PENDLETON
WASTEWATER FACILITY PLAN

MINIMUM FOR
FOR CURRENT ISSUES

K/J 0691027*00/ALT_EXHIBITS

EXHIBIT 7.2



LEGEND

① NEW HEADWORKS BUILDING
② IN-PLANT PUMP STATION IMPROVEMENTS
③ MLE-ANOXIC ZONE
④ MLE-AERATION ZONE
⑤ MLE-INTERNAL RETURN PUMP STATION
⑥ ELECTRICAL BUILDING IMPROVEMENTS
⑦ NEW OUTFALL
⑧ PRIMARY CLARIFIER NO. 1 REHAB
⑨ SOLIDS DEWATERING FACILITY
⑩ SLUDGE DRYING BED MODIFICATIONS
⑪ REHAB NEW SSB
⑫ EFFLUENT COOLING BASIN
⑬ EFFLUENT COOLING PUMP STATION
⑭ CCC IMPROVEMENTS
⑮ PRIMARY SLUDGE PUMP BLDG IMPROVEMENTS
⑯ SECONDARY CLARIFIER REHAB

🟧 NPDES PERMIT ISSUES
🟦 PLANT REHABILITATION
🟩 SOLIDS IMPROVEMENTS

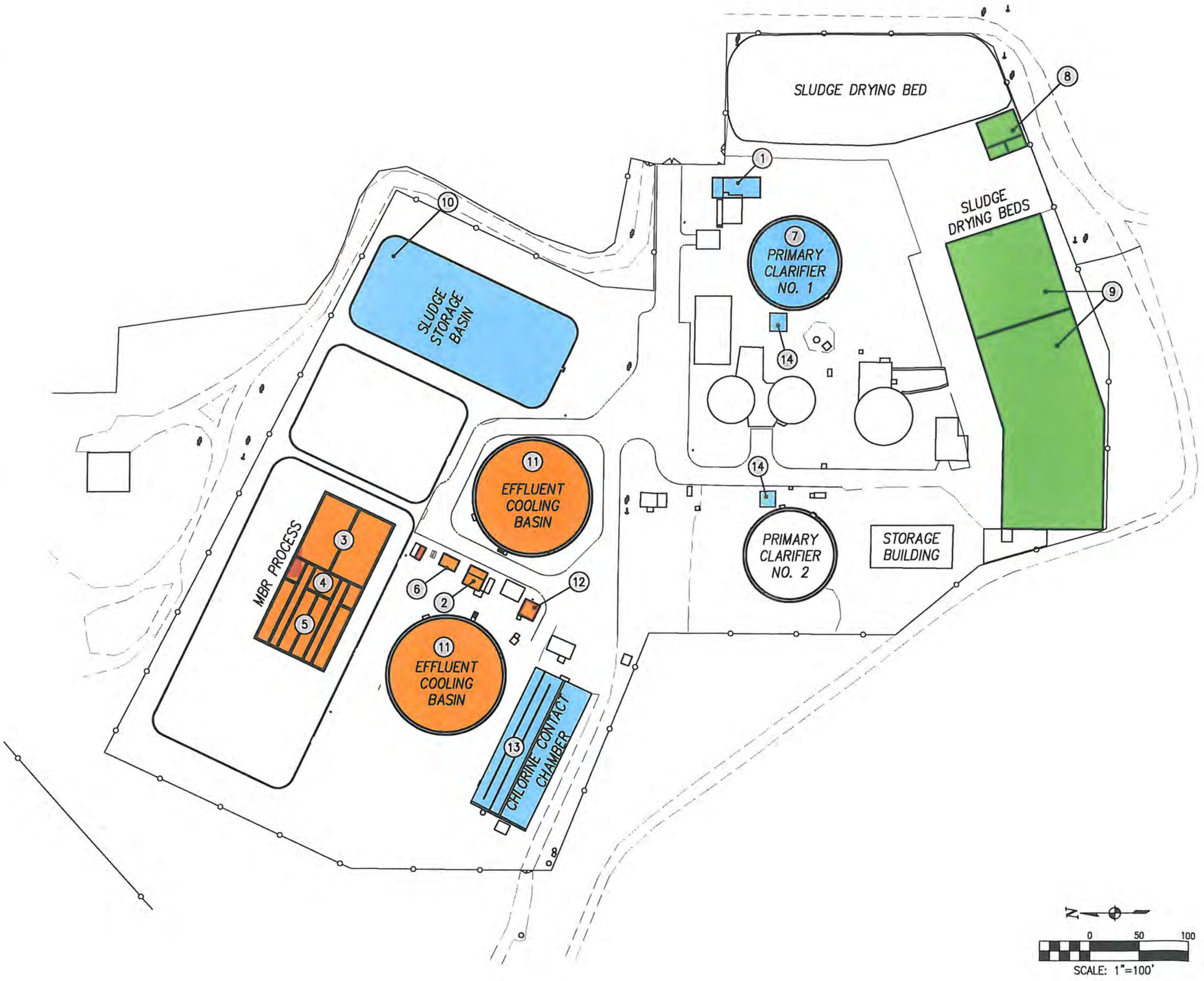
Kennedy/Jenks Consultants

CITY OF PENDLETON
WASTEWATER FACILITY PLAN

BEST FOR
CURRENT ISSUES

K/J 0691027*00/ALT_EXHIBITS

EXHIBIT 7.3



LEGEND

① NEW HEADWORKS BUILDING
② IN-PLANT PUMP STATION IMPROVEMENTS
③ MBR-ANOXIC ZONE
④ MBR-PRE-AERATION ZONE
⑤ MBR-MEMBRANE BASIN
⑥ ELECTRICAL BUILDING IMPROVEMENTS
⑦ PRIMARY CLARIFIER NO. 1 REHAB
⑧ SOLIDS DEWATERING FACILITY
⑨ SLUDGE DRYING BED MODIFICATIONS
⑩ REHAB EXISTING SSB
⑪ EFFLUENT COOLING BASIN MODIFICATIONS
⑫ EFFLUENT COOLING PUMP STATION
⑬ CCC IMPROVEMENTS
⑭ PRIMARY SLUDGE PUMP BLDG IMPROVEMENTS

🟧 NPDES PERMIT ISSUES
🟦 PLANT REHABILITATION
🟩 SOLIDS IMPROVEMENTS

Kennedy/Jenks Consultants

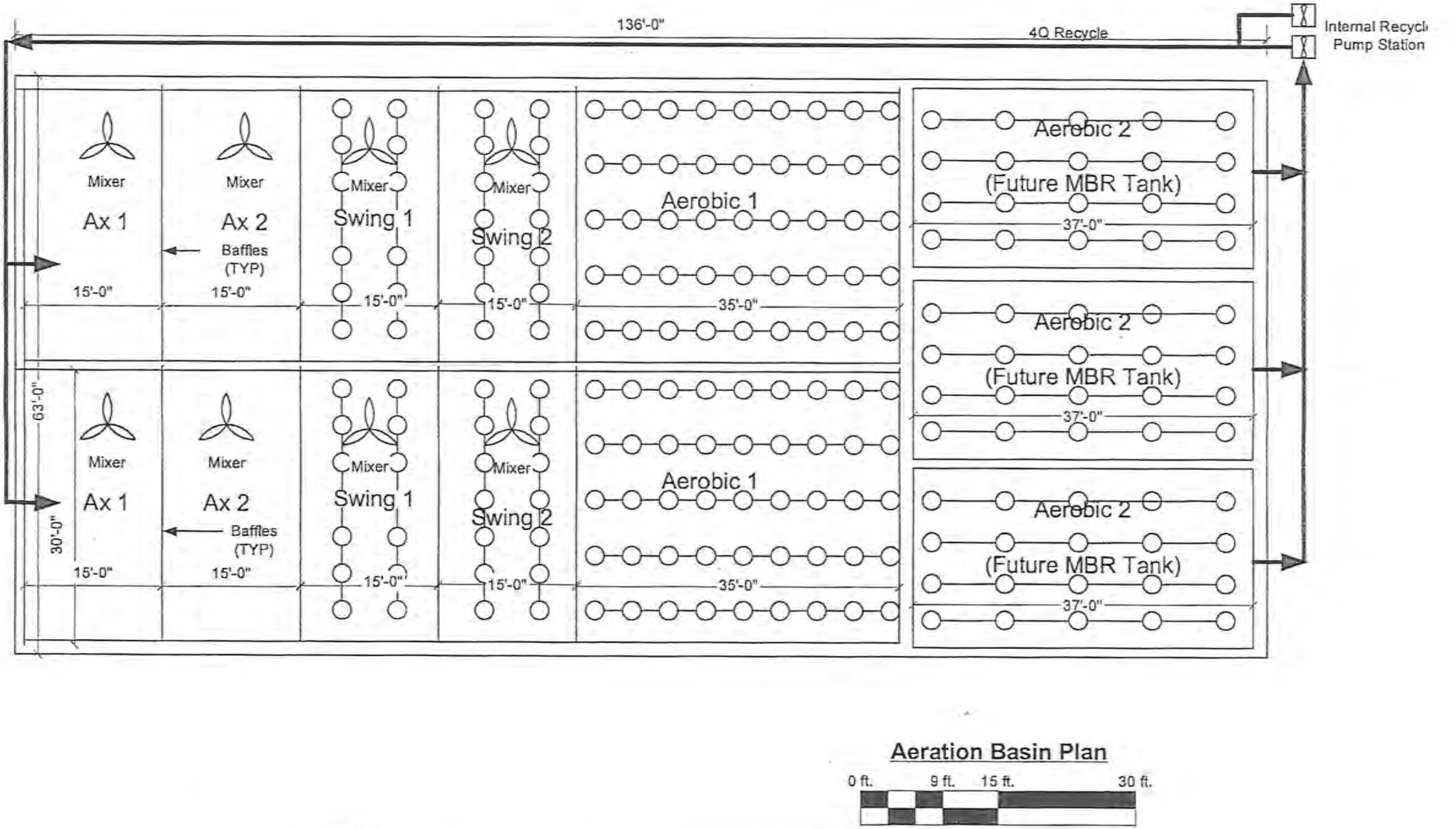
CITY OF PENDLETON
WASTEWATER FACILITY PLAN

BEST FOR CURRENT AND FUTURE ISSUES

K/J 0691027*00/ALT_EXHIBITS

EXHIBIT 7.4

City of Pendleton
WWTP Facility Plan
Recommended Alternative Layout
Exhibit 8.1



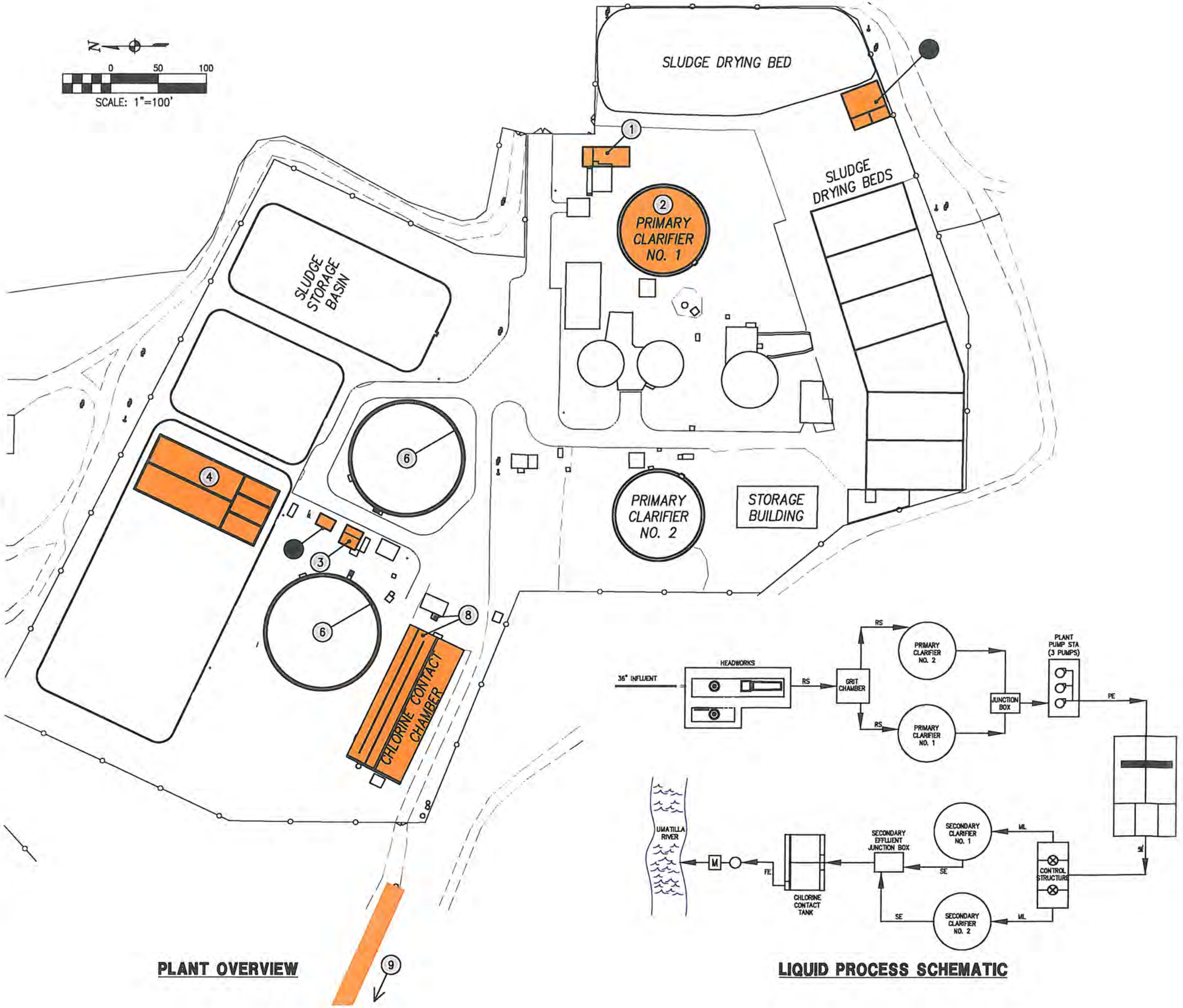
Aeration Basin Plan

Notes:
1) Side water depth of aeration basin assumed to be 20 feet.

PHASE 1 IMPROVEMENTS LEGEND

- ① NEW HEADWORKS BUILDING
- ② PRIMARY CLARIFIER NO. 1 REHAB
- ③ IN-PLANT PUMP STATION IMPROVEMENTS
- ④ MLE BASIN
- ⑤ SOLIDS DEWATERING FACILITY
- ⑥ SECONDARY CLARIFIER SCUM SYSTEM
- ⑦ ELECTRICAL BUILDING IMPROVEMENTS
- ⑧ DISINFECTION IMPROVEMENTS
- ⑨ OUTFALL RELOCATION

🟧 PHASE 1



PLANT OVERVIEW

LIQUID PROCESS SCHEMATIC

Kennedy/Jenks Consultants

CITY OF PENDLETON
WASTEWATER FACILITY PLAN

PHASE 1 PROCESS IMPROVEMENTS

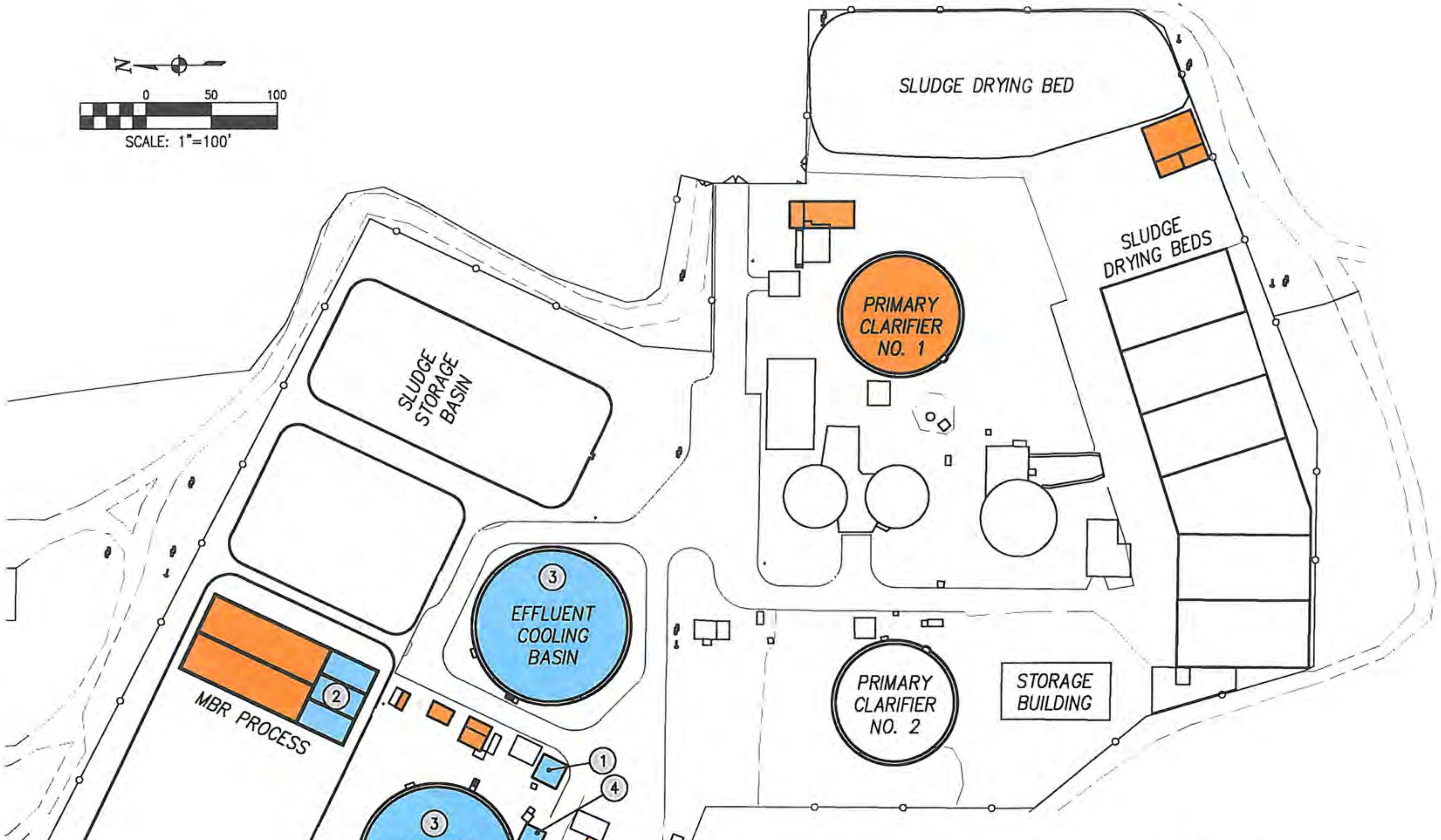
K/J 0691027*00

EXHIBIT 8.2

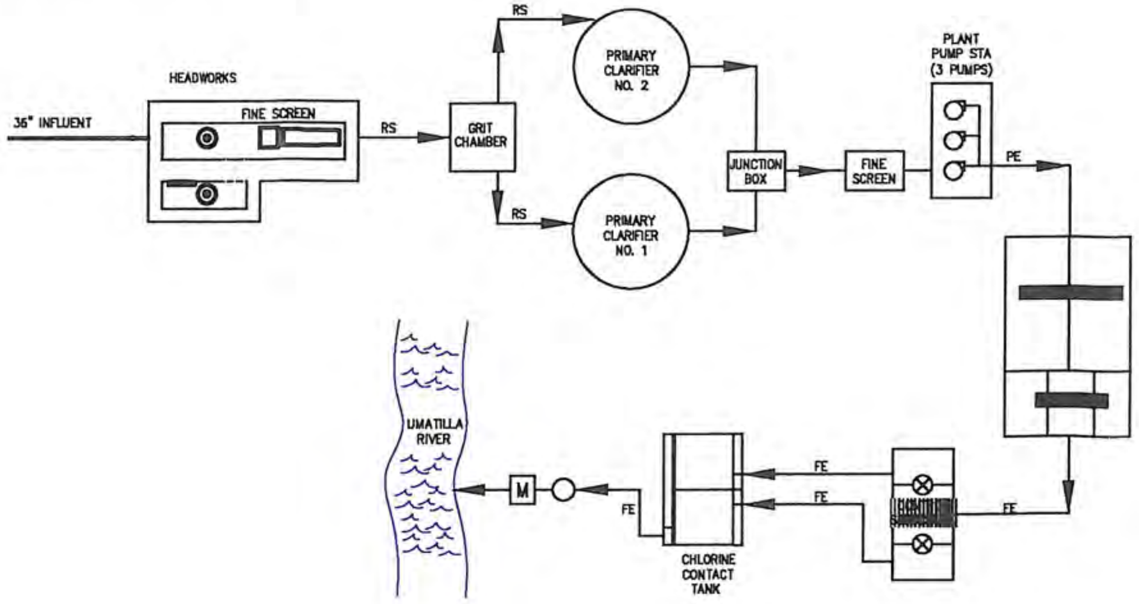
PHASE 2 IMPROVEMENTS LEGEND

① FINE SCREENING FACILITY
② MBR CONVERSION
③ EFFLUENT COOLING BASIN MODIFICATIONS
④ EFFLUENT COOLING PUMP STATION

🟧 PHASE 1 IMPROVEMENTS
🟦 PHASE 2 IMPROVEMENTS



PLANT OVERVIEW



LIQUID PROCESS SCHEMATIC

Kennedy/Jenks Consultants

CITY OF PENDLETON
WASTEWATER FACILITY PLAN

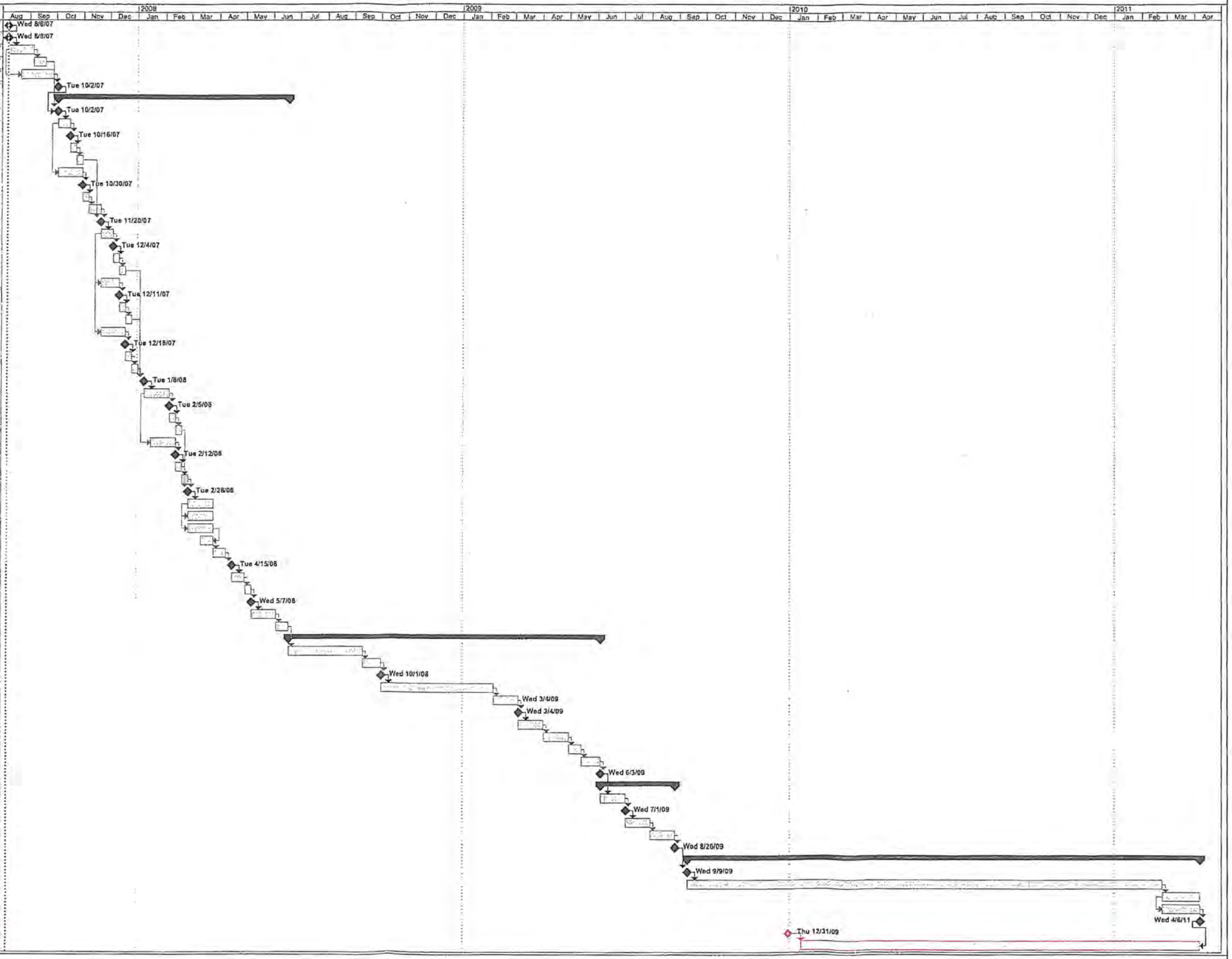
PHASE 2 PROCESS IMPROVEMENTS

K/J 0691027*00

EXHIBIT 8.3

Exhibit 8.4 - Preliminary Project Schedule
Pendleton WWTP Improvements (Phase 1 Only)
City of Pendleton, Oregon

ID	Task Name	Duration	Start	Finish
1	**Schedule Start Date - August 8, 2007**	0 days	Wed 8/8/07	Wed 8/8/07
2	WWTP Facilities Plan DEQ Submittal	0 days	Wed 8/8/07	Wed 8/8/07
3	DEQ Facilities Plan Review Period	20 days	Wed 8/8/07	Tue 9/4/07
4	Incorporate DEQ Comments & Finalize WWTP Facilities Plan	10 days	Wed 9/5/07	Tue 9/18/07
5	City/Consultant Contract Negotiations	27 days	Wed 8/22/07	Thu 9/27/07
6	Consultant Services Contract Approved by City Council	0 days	Tue 10/2/07	Tue 10/2/07
7	**WWTP 30% Preliminary Design**	186 days	Tue 10/2/07	Wed 6/18/08
8	Preliminary Design Kickoff Meeting	0 days	Tue 10/2/07	Tue 10/2/07
9	TM 01 - Headworks Preliminary Design	10 days	Wed 10/3/07	Tue 10/16/07
10	TM 01 - Submittal to City	0 days	Tue 10/16/07	Tue 10/16/07
11	TM 01 - City Review Period	5 days	Wed 10/17/07	Tue 10/23/07
12	TM 01 - Incorporate Comments & Finalize	5 days	Wed 10/24/07	Tue 10/30/07
13	TM 02 - Secondary Process Preliminary Design	20 days	Wed 10/3/07	Tue 10/30/07
14	TM 02 - Submittal to City	0 days	Tue 10/30/07	Tue 10/30/07
15	TM 02 - City Review Period	5 days	Wed 10/31/07	Tue 11/6/07
16	TM 02 - Incorporate Comments & Finalize	10 days	Wed 11/7/07	Tue 11/20/07
17	**Workshop 1 - Headworks and Secondary Process**	0 days	Tue 11/20/07	Tue 11/20/07
18	TM 03 - Disinfection Upgrades Preliminary Design	10 days	Wed 11/21/07	Tue 12/4/07
19	TM 03 - Submittal to City	0 days	Tue 12/4/07	Tue 12/4/07
20	TM 03 - City Review Period	5 days	Wed 12/5/07	Tue 12/11/07
21	TM 03 - Incorporate Comments & Finalize	5 days	Wed 12/12/07	Tue 12/18/07
22	TM 04 - Outfall Preliminary Design	15 days	Wed 11/21/07	Tue 12/11/07
23	TM 04 - Submittal to City	0 days	Tue 12/11/07	Tue 12/11/07
24	TM 04 - City Review Period	5 days	Wed 12/12/07	Tue 12/18/07
25	TM 04 - Incorporate Comments & Finalize	5 days	Wed 12/19/07	Tue 12/25/07
26	TM 05 - Solids Dewatering Preliminary Design	20 days	Wed 11/21/07	Tue 12/18/07
27	TM 05 - Submittal to City	0 days	Tue 12/18/07	Tue 12/18/07
28	TM 05 - City Review Period	5 days	Wed 12/19/07	Tue 12/25/07
29	TM 05 - Incorporate Comments & Finalize	5 days	Wed 12/26/07	Tue 1/1/08
30	**Workshop 2 - Disinfection, Solids Dewatering & Outfall**	0 days	Tue 1/8/08	Tue 1/8/08
31	TM 06 - Preliminary Piping Design & Hydraulic Profile	20 days	Wed 1/9/08	Tue 2/5/08
32	TM 06 - Submittal to City	0 days	Tue 2/5/08	Tue 2/5/08
33	TM 06 - City Review Period	5 days	Wed 2/6/08	Tue 2/12/08
34	TM 06 - Incorporate Comments & Finalize	5 days	Wed 2/13/08	Tue 2/19/08
35	TM 07 - Plant Electrical and Instrumentation	20 days	Wed 1/16/08	Tue 2/12/08
36	TM 07 - Submittal to City	0 days	Tue 2/12/08	Tue 2/12/08
37	TM 07 - City Review Period	5 days	Wed 2/13/08	Tue 2/19/08
38	TM 07 - Incorporate Comments & Finalize	5 days	Wed 2/20/08	Tue 2/26/08
39	**Workshop 3 - Piping & Electrical**	0 days	Tue 2/26/08	Tue 2/26/08
40	Preliminary Site Plan & Facility Layouts	20 days	Wed 2/27/08	Tue 3/25/08
41	Preliminary Architectural and Structural Layouts	20 days	Wed 2/27/08	Tue 3/25/08
42	Preliminary Equipment Selection & Vendor Quotes	20 days	Wed 2/27/08	Tue 3/25/08
43	Prepare 30% Engineer's Estimate	10 days	Wed 3/12/08	Tue 3/25/08
44	Prepare Preliminary Design Report (30% Completion)	10 days	Wed 3/26/08	Tue 4/8/08
45	Submit Draft PDR to City for Review	0 days	Tue 4/15/08	Tue 4/15/08
46	City Draft PDR Review Period	10 days	Wed 4/16/08	Tue 4/29/08
47	Incorporate Comments and Prepare Final PDR	5 days	Thu 5/1/08	Wed 5/7/08
48	Submit Final PDR to DEQ for Review and Approval	0 days	Wed 5/7/08	Wed 5/7/08
49	DEQ PDR Review Period	20 days	Thu 5/8/08	Wed 6/4/08
50	Incorporate DEQ Comments & Finalize PDR	10 days	Thu 6/5/08	Wed 6/18/08
51	**Phase 3 - Final WWTP Design**	250 days	Thu 6/19/08	Wed 6/3/09
52	Prepare 60% Design Submittal	60 days	Thu 6/19/08	Wed 9/10/08
53	City - 60% Design Submittal Review Period	15 days	Thu 9/11/08	Wed 10/1/08
54	**Workshop 4 - 60% Design Review Meeting**	0 days	Wed 10/1/08	Wed 10/1/08
55	Prepare 90% Design Submittal	90 days	Thu 10/2/08	Wed 2/4/09
56	City - 90% Submittal Review Period	20 days	Thu 2/5/09	Wed 3/4/09
57	**Workshop 5 - 90% Design Review Meeting**	0 days	Wed 3/4/09	Wed 3/4/09
58	DEQ - 90% Submittal Review Period	20 days	Thu 3/5/09	Wed 4/1/09
59	Prepare Review Draft of Final Contract Documents	20 days	Thu 4/2/09	Wed 4/29/09
60	City - Contract Documents Review Period	10 days	Thu 4/30/09	Wed 5/13/09
61	Incorporate Comments and Prepare Final Contract Documents	15 days	Thu 5/14/09	Wed 6/3/09
62	Complete Final Contract Documents	0 days	Wed 6/3/09	Wed 6/3/09
63	**Phase 4 - Bidding & Contracts**	60 days	Thu 6/4/09	Wed 8/26/09
64	Bid Advertisement	20 days	Thu 6/4/09	Wed 7/1/09
65	Bid Opening	0 days	Wed 7/1/09	Wed 7/1/09
66	City Council Award	20 days	Thu 7/2/09	Wed 7/29/09
67	Contracts	20 days	Thu 7/30/09	Wed 8/26/09
68	Notice to Proceed	0 days	Wed 8/26/09	Wed 8/26/09
69	**Phase 5 - Construction**	410 days	Wed 9/9/09	Wed 4/6/11
70	Start Construction	0 days	Wed 9/9/09	Wed 9/9/09
71	Notice of Substantial Completion	380 days	Thu 9/10/09	Wed 2/23/11
72	Facility Startup	30 days	Thu 2/24/11	Wed 4/6/11
73	Contract Closeout	30 days	Thu 2/24/11	Wed 4/6/11
74	**Anticipated Project Completion Date**	0 days	Wed 4/6/11	Wed 4/6/11
75	Current MAO Completion Date	0 days	Thu 12/31/09	Thu 12/31/09
76	MAO Time Extension to be Negotiated with DEQ	320 days	Thu 1/14/10	Wed 4/6/11



Date Prepared: August 8, 2007

Appendix A

Pendleton, Oregon Climate Summary Statistics

PENDLETON DOWNTOWN (356541)
Monthly Totals/Averages
Years: 1971-2000

Maximum Temperature (degrees F)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	43.6	47.8	57.0	64.7	72.4	79.9	88.0	88.3	81.2	67.1	51.9	42.0	65.3

Minimum Temperature (degrees F)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	27.5	28.1	33.6	39.7	45.7	51.0	55.3	54.3	46.4	37.4	32.9	27.4	39.9

Average Temperature (degrees F)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	35.6	37.9	45.3	52.2	59.1	65.4	71.7	71.3	63.8	52.2	42.4	34.7	52.6

Precipitation (inches)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	1.73	1.28	1.37	1.74	1.97	1.07	0.38	0.55	0.43	1.12	1.67	0.84	14.14

Snowfall (inches)

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Season
Average	0.0	0.0	0.0	0.0	0.1	1.1	0.3	1.9	0.0	0.0	0.0	0.0	3.4

PENDLETON BR EXP STN (356540)
Monthly Totals/Averages
Years: 1971-2000

Maximum Temperature (degrees F)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	40.6	46.4	54.4	61.9	69.6	78.0	88.0	87.5	77.8	65.2	49.2	40.8	63.3

Minimum Temperature (degrees F)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	25.3	28.8	32.8	36.3	42.1	47.4	51.8	51.0	43.0	34.5	31.5	25.8	37.5

Average Temperature (degrees F)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	33.0	37.6	43.6	49.1	55.8	62.7	69.9	69.3	60.4	49.8	40.3	33.3	50.4

Precipitation (inches)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	1.94	1.63	1.90	1.65	1.67	1.06	0.39	0.72	0.83	1.33	2.35	1.99	17.47

Snowfall (inches)

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Season
Average	0.0	0.0	0.0	0.2	2.3	5.4	5.4	3.3	0.6	0.1	0.0	0.0	17.4

PENDLETON E OR RGNL AP (356546)
Years: 1971-2000
Monthly Totals/Averages

Maximum Temperature (degrees F)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	40.1	46.2	54.4	61.8	69.7	78.3	87.2	86.1	76.7	63.5	48.4	40.1	62.7

Minimum Temperature (degrees F)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	27.5	30.9	35.4	39.7	45.9	52.0	57.5	57.3	49.7	40.7	33.8	27.7	41.5

Average Temperature (degrees F)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	33.8	38.6	44.9	50.7	57.8	65.1	72.4	71.7	63.2	52.1	41.1	33.9	52.1

Precipitation (inches)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average	1.46	1.22	1.26	1.13	1.22	0.78	0.41	0.56	0.63	0.99	1.63	1.48	12.77

Snowfall (inches)

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Season
Average	0.0	0.0	0.0	0.3	2.1	5.0	4.8	3.4	0.8	0.1	0.0	0.0	16.4

Appendix B

Umatilla River Surface Water Flow Statistics

6 August 2007

Appendix B

City of Pendleton, Oregon
Surface Water Flow Statistics

Summary

This appendix provides a summer of monthly surface water flow statistics for two gage stations near the City of Pendleton. One gage is located on McKay Creek (MCKO) downstream of the McKay Reservoir Dam at 45°36'34", North 118°47'55" West, Elevation = 1163 feet. The other gage is located on the Umatilla River in Pendleton (PDTO) at 45°40'20" North, 118°47'30" West, Elevation = 1054 feet. Both gages are maintained by the U.S. Bureau of Reclamation and are part of the Umatilla Project in the Pacific Northwest Region. Additional information can be found at http://www.usbr.gov/pn/hydromet/umatilla/umatea.html

The flow statistics represent monthly values representative of a period from October 2003 to October 2005.

Pendleton (PDTO) Flow Statistics at Pendleton

Month	Monthly Minimum 7-Day Average Flow	Monthly Minimum 60-Day Average Flow	Monthly Maximum	Monthly Minimum
	(cfs)	(cfs)	(cfs)	(cfs)
October	42.7	46.7	69.7	41.0
November	58.4	76.7	338.6	58.0
December	152.4	241.4	1075.4	145.0
January	119.1	262.3	1013.2	114.7
February	144.0	242.8	272.5	142.6
March	149.2	425.5	1920.0	149.2
April	365.0	590.1	1226.5	357.5
May	247.1	484.7	2211.0	232.7
June	75.0	252.7	378.0	74.7
July	28.7	49.8	81.1	28.1
August	21.6	32.8	35.2	20.6
September	32.9	41.0	46.8	32.9

McKay Creek (MCKO) Flow Statistics at McKay Reservoir Dam

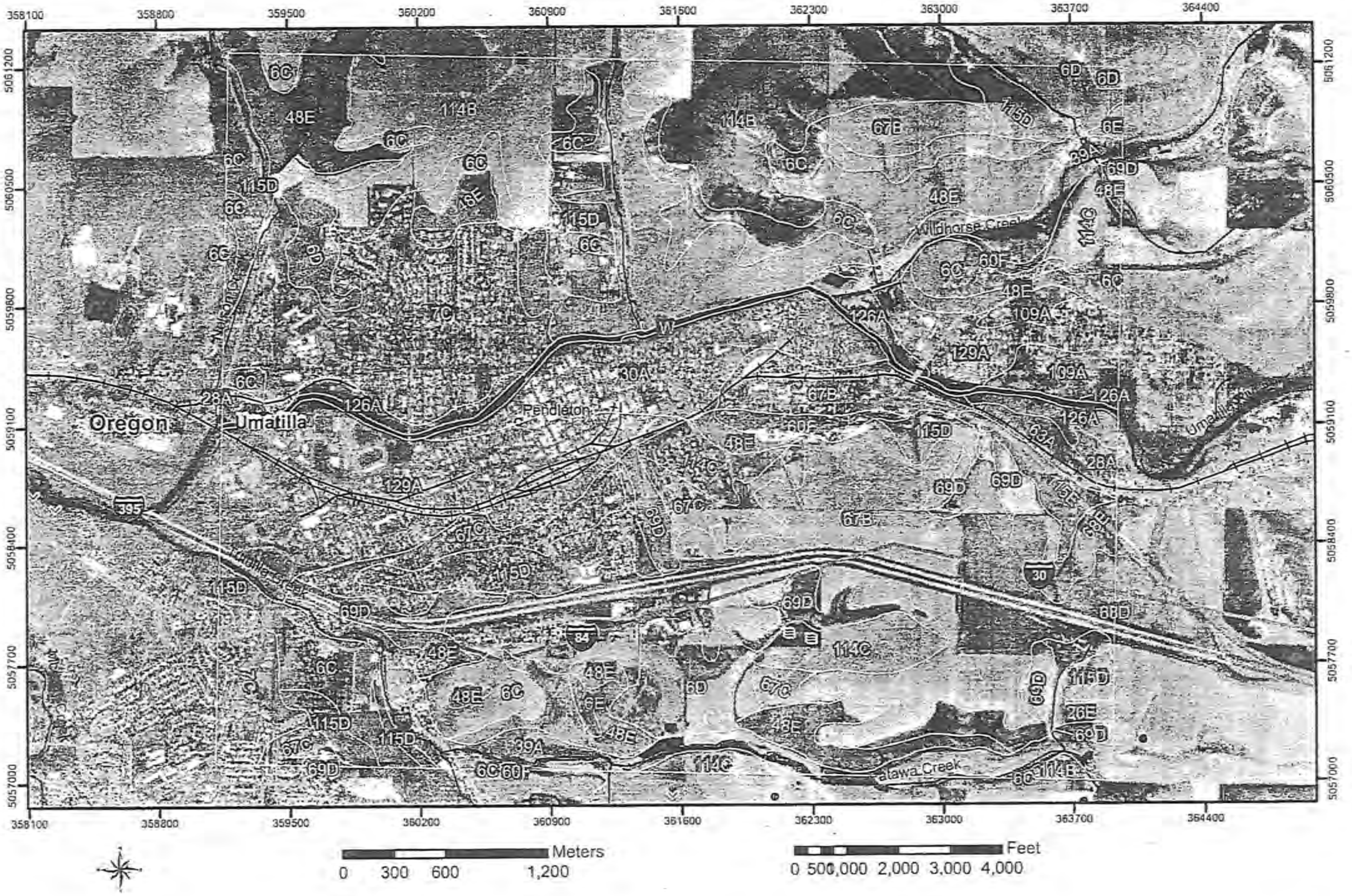
Month	Monthly Minimum 7-Day Average Flow (cfs)	Monthly Minimum 60-Day Average Flow (cfs)	Monthly Maximum (cfs)	Monthly Minimum (cfs)
October	49.0	51.0	199.0	49.1
November	10.4	63.7	150.2	10.7
December	9.4	9.8	16.2	9.2
January	9.3	9.7	11.8	9.0
February	9.2	9.7	11.0	8.9
March	9.5	9.9	190.9	9.4
April	9.2	9.9	242.4	8.7
May	9.5	54.2	1160.0	9.5
June	86.2	141.8	485.8	70.3
July	130.7	162.1	232.2	113.0
August	76.4	150.9	206.2	55.8
September	53.5	98.3	220.3	53.5

Appendix C

NRCS Soil Survey for the Pendleton Area

SOIL SURVEY OF UMATILLA COUNTY AREA, OREGON

Pendleton Area Soil Map



Map Unit Legend Summary

Umatilla County Area, Oregon

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
6C	Anderly silt loam, 7 to 12 percent slopes	399.4	7.4
6D	Anderly silt loam, 12 to 20 percent slopes	149.8	2.8
6E	Anderly silt loam, 20 to 35 percent slopes	19.0	0.4
7C	Anderly-Urban land complex, 7 to 12 percent slopes	469.5	8.7
26E	Entic Durochrepts, 20 to 40 percent slopes	62.4	1.2
28A	Freewater gravelly silt loam, 0 to 3 percent slopes	24.3	0.4
30A	Freewater-Urban land complex, 0 to 3 percent slopes	210.6	3.9
39A	Hermiston silt loam, 0 to 3 percent slopes	267.7	4.9
48E	Lickskillet very stony loam, 7 to 40 percent slopes	728.0	13.4
60F	Nansene silt loam, 35 to 70 percent slopes	39.6	0.7
63A	Onyx silt loam, 0 to 3 percent slopes	28.7	0.5
67B	Pilot Rock silt loam, 1 to 7 percent slopes	824.2	15.2
67C	Pilot Rock silt loam, 7 to 12 percent slopes	205.4	3.8
68D	Pilot Rock silt loam, 12 to 20 percent north slopes	0.0	0.0
68E	Pilot Rock silt loam, 20 to 40 percent north slopes	34.5	0.6
69D	Pilot Rock silt loam, 12 to 20 percent south slopes	158.6	2.9
109A	Veazie silt loam, 0 to 3 percent slopes	63.9	1.2
114B	Walla Walla silt loam, 1 to 7 percent slopes	473.0	8.7
114C	Walla Walla silt loam, 7 to 12 percent slopes	183.1	3.4
115D	Walla Walla silt loam, 12 to 25 percent north slopes	382.4	7.1
115E	Walla Walla silt loam, 25 to 40 percent north slopes	45.6	0.8

Umatilla County Area, Oregon

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
126A	Xerofluvents, 0 to 3 percent slopes	82.2	1.5
129A	Yakima-Urban land complex, 0 to 3 percent slopes	520.1	9.6
W	Water	50.1	0.9

Appendix D

Figures from the Fringe Study

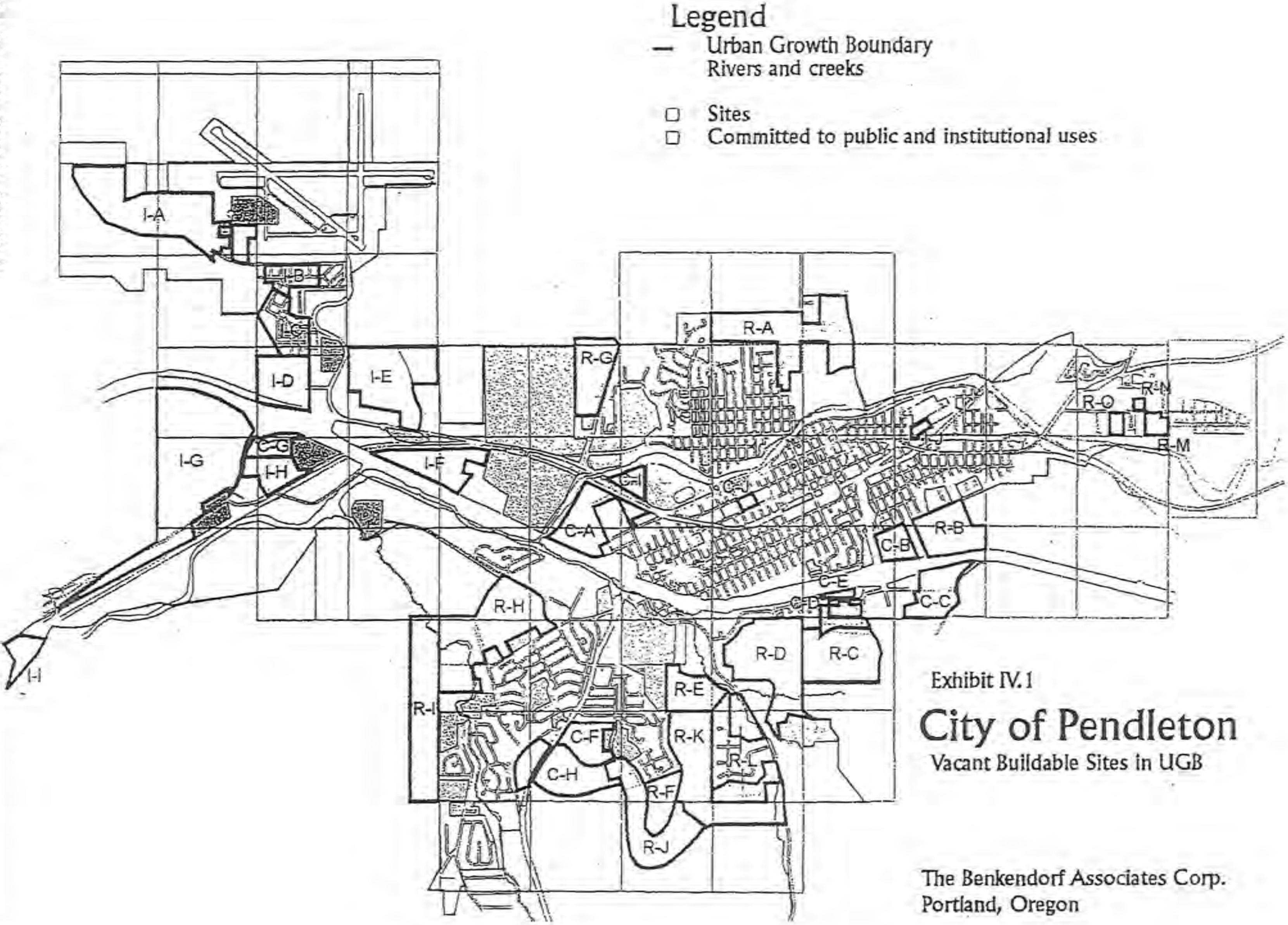


Exhibit IV.1

City of Pendleton

Vacant Buildable Sites in UGB

The Benkendorf Associates Corp.
Portland, Oregon

Legend

— Urban Growth Boundary (UGB)
Rivers and creeks
☐ Sites

☐ 0-4.99% slope
☐ 5-9.99% slope
☐ 10-14.99% slope
▨ 15-19.99% slope
■ 20-24.99% slope
■ 25.%+ slope

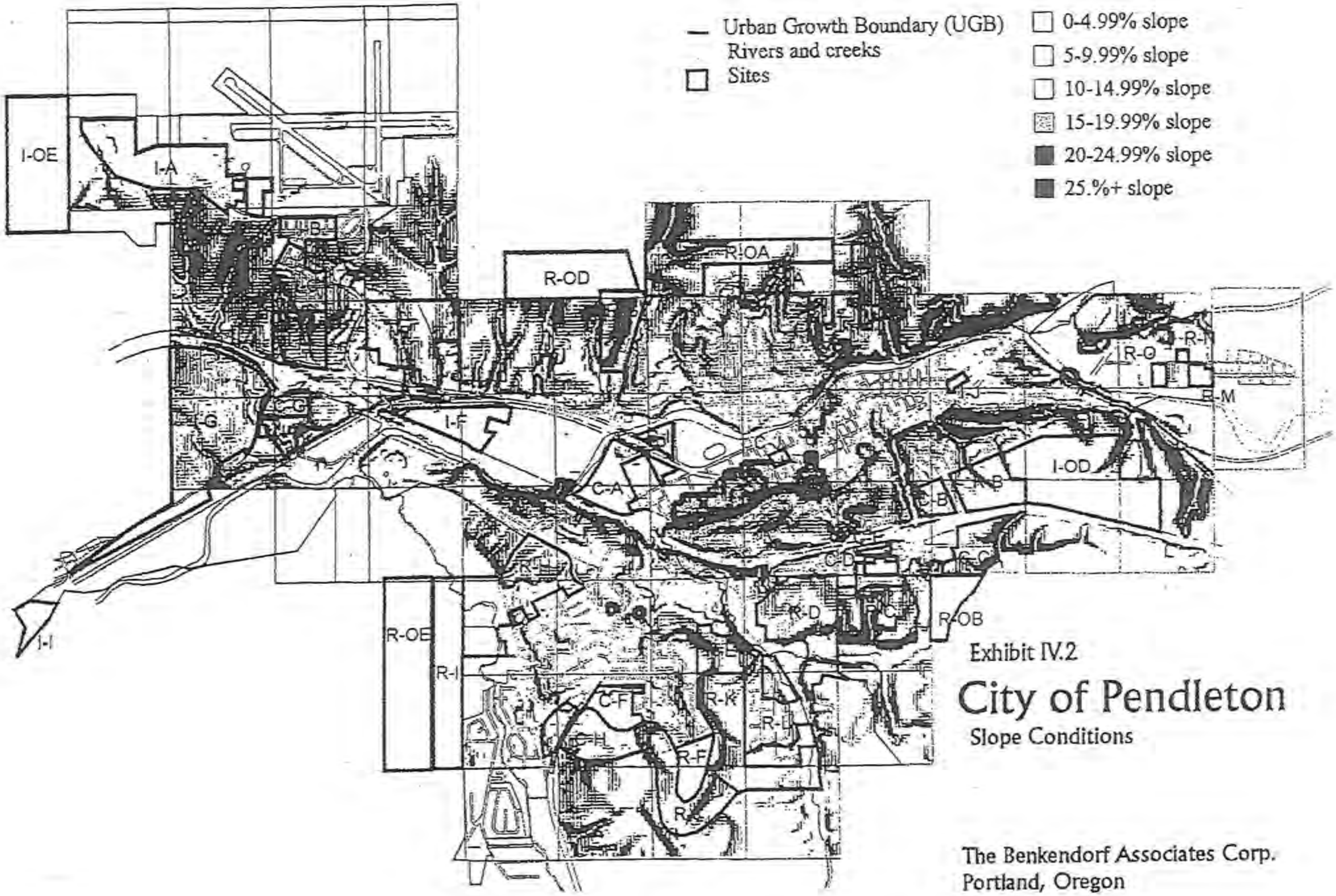


Exhibit IV.2

City of Pendleton

Slope Conditions

The Benkendorf Associates Corp.
Portland, Oregon

Appendix E

NPDES Permit and Evaluation Form

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM
WASTE DISCHARGE PERMIT

Department of Environmental Quality
Eastern Region - Pendleton Office
700 SE Emigrant, Suite 330, Pendleton, OR 97801
Telephone: (541) 276-4063

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

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ISSUED TO:

City of Pendleton
500 SW Dorion Avenue
Pendleton, Oregon 97801

SOURCES COVERED BY THIS PERMIT:

Type of Waste	Outfall Number	Outfall Location
Treated Domestic Wastewater	001	R.M. 0.1 (McKay Creek) to R.M. 52.0 (Umatilla River)
Biosolids	002	Approved sites

FACILITY TYPE AND LOCATION:

Activated Sludge
Pendleton Wastewater Treatment Plant
4255 Southwest 28th Drive
Pendleton, OR 97801

Treatment System Class: Level IV
Collection System Class: Level IV

EPA REFERENCE NO: OR-002639-5

RECEIVING STREAM INFORMATION:

Basin: Umatilla
Sub-Basin: Umatilla
Receiving Stream: McKay Creek/Umatilla River
LLID: 1193384459144 R.M. 0.1 /R.M. 52.0
County: Umatilla

Issued in response to Application No. 992123 received July 16, 1997.

This permit is issued based on the land use findings in the permit record.

D. Mitch Wolgamott, Water Quality Manager
Eastern Region

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 to waters of the state is prohibited, including discharge to an underground injection control system.

SCHEDULE A

1. Waste Discharge Limitations not to be exceeded after permit issuance.

a. Treated Effluent Outfall 001

(1) May 1 - October 31:

Parameter	Average Effluent Concentrations Monthly	Weekly	Monthly* Average lb/day	Weekly* Average lb/day	Daily* Maximum lbs
BOD_5	20 mg/L	30 mg/L	920	1400	1800
TSS	20 mg/L	30 mg/L	920	1400	1800

Parameter	Limitations
Total Ammonia- Nitrogen	2.0 mg/L (96 lb/day) daily maximum and 1.0 mg/L (48 lb/day) monthly average
Residual Chlorine	0.05 mg/L (2.0 lb/day) daily maximum and 0.02 mg/L (0.80 lb/day) monthly average

(2) November 1 - April 30:

Parameter	Average Effluent Concentrations Monthly	Weekly	Monthly* Average lb/day	Weekly* Average lb/day	Daily* Maximum lbs
BOD_5	30 mg/L	45 mg/L	1400	2100	2800
TSS	30 mg/L	45 mg/L	1400	2100	2800

Parameter	Limitations
Total Ammonia- Nitrogen	5.2 mg/L (240 lb/day) daily maximum and 3.0 mg/L (140 lb/day) monthly average
Residual Chlorine	0.04 mg/L (1.7 lb/day) daily maximum and 0.01 mg/L (0.60 lb/day) monthly average

* Average dry weather design flow to the facility equals 5.5 MGD. Mass load limits are based upon average dry weather design flow to the facility.

(3)

Other parameters (year-round)	Limitations
E. coli Bacteria	Shall not exceed 126 organisms per 100 ml monthly geometric mean. No single sample shall exceed 406 organisms per 100 ml. (See Note 1)
pH	Shall be within the range of 6.0 - 9.0
BOD_5 and TSS Removal Efficiency	Shall not be less than 85% monthly average for BOD_5 and 85% monthly average for TSS.

(4) Except as provided for in OAR 340-045-080, no wastes shall be discharged and no activities shall be conducted which violate applicable Water Quality Standards as adopted in OAR 340-041 except in the following defined mixing zone:

The allowable mixing zone is that portion of McKay Creek contained within a band extending out fifteen (15) feet from the bank of the creek at the outfall and extending to the Umatilla River. In addition, the mixing zone includes that segment of the Umatilla River that extends 200 feet downstream of the point where McKay Creek enters the river. The Zone of Immediate Dilution (ZID) shall be defined as that portion of the allowable mixing zone that is within 10% of the distance to the mixing zone boundary in any direction from the point of discharge.

(5) Maximum Allowable Effluent Temperature (See Note 2):

During the period June 1 through September 30, the effluent (end of outfall) temperature [temp., 7-Day Average of Daily Maximum °F] shall not exceed the calculated limit based on the following equation:

Effluent temp., °F = [0.25 x (0.25 x River flow / effluent flow) + 1)] + River temp., °F

where: River flow is the total flow for McKay Creek and the Umatilla River. River temperature is 7-Day Average of Daily Maximum for the Umatilla River, °F

b. Biosolids Outfall 002 (Land Application)

(1) Biosolids land application and management will comply with Oregon biosolids rules and guidelines including OAR 340-050 and all other applicable statutes, rules, and federal regulations.

(2) Land application activities shall be conducted in accordance with the approved biosolids management plan.

c. Groundwater

(1) No activities shall be conducted that could cause an adverse impact on existing or potential beneficial uses of groundwater.

(2) All wastewater shall be managed and disposed in a manner that will prevent a violation of the Groundwater Quality Protection Rules (OAR 340-040).

NOTES:

1. If a single sample exceeds 406 organisms per 100 ml, then five consecutive re-samples may be taken at intervals no greater than four-hours beginning within 28 hours after the original sample was taken. If the geometric mean of the five re-samples is less than or equal to 126 organisms per 100 ml, a violation shall not be triggered.

2. The permittee is considered to be in compliance with these limits and the applicable stream temperature criteria, provided that the permittee is complying with all terms and conditions of the Temperature Management Plan approved by the Department.

SCHEDULE B

1. **Minimum Monitoring and Reporting Requirements** (unless otherwise approved in writing by the Department).

The permittee shall monitor the parameters as specified below at the locations indicated. The laboratory used by the permittee to analyze samples shall have a quality assurance/quality control (QA/QC) program to verify the accuracy of sample analysis. If QA/QC requirements are not met for any analysis, the results shall be included in the report, but not used in calculations required by this permit. When possible, the permittee shall re-sample in a timely manner for parameters failing the QA/QC requirements, analyze the samples, and report the results.

a. Influent
The facility influent sampling location is prior to the primary clarifier.

Item or Parameter	Minimum Frequency	Type of Sample
BOD_5	2/Week	Composite
TSS	2/Week	Composite
pH	3/week	Grab

b. Treated Effluent Outfall 001
The facility effluent sampling location is after the chlorine contact chamber.

Item or Parameter	Minimum Frequency	Type of Sample
Total Flow (MGD)	Daily	Measurement
Flow Meter Calibration	Semi-Annual	Verification
BOD_5	2/Week	Composite
TSS	2/Week	Composite
pH	3/Week	Grab
E. coli	2/Week	Grab (See Note 1)
Quantity Chlorine Used	Daily	Measurement
Chlorine Residual	Daily	Grab
Pounds Discharged (BOD_5 and TSS)	2/Week	Calculation
Average Percent Removed (BOD_5 and TSS)	Monthly	Calculation
NH3-N	1/Week	24-hour Composite
Temperature	1/Week except as specified below for June 1- September 30	Grab
Bioassay (See Note 2)	As required by EPA Form 2A NPDES Application, Part E. Toxicity Testing Data	24- hour Composite for Acute & Chronic

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) Biolsolids metals content for: As, Cd, Cu, Hg, Mo, Ni, Pb, Se & Zn, measured as total in mg/kg	Quarterly During Land Application	Composite sample to be representative of the product to be land applied from the biosolids drying bed
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.
Record of % volatile solids reduction accomplished through stabilization	Monthly	Calculation
Record of digestion days (mean cell residence time)	Monthly	Calculation
Primary Digester Biosolids Temperature	3/Week	Grab

d. Temperature and Flow Monitoring (Monitored only during June 1- September 30)

Item or Parameter	Minimum Frequency	Type of Sample
Effluent Temperature, Daily Max (See Note 3)	Daily	Sort from measurement
Effluent Temperature, Average of Daily Maximums (See Note 3)	Weekly	Calculation
Maximum Allowable Effluent Temperature	Daily	Calculation (See Note 4)
Maximum Allowable Effluent Temperature, Average of Daily Allowable Maximums	Weekly	Calculation

Item or Parameter	Minimum Frequency	Type of Sample
McKay Cr. Temperature, Max Daily, Upstream (see Note 4)	Daily	Grab between 3 and 4 PM or Continuous
McKay Cr. Temperature, Average of Daily Maximums, Upstream (see Note 4)	Weekly	Calculation
Umatilla R. Temperature, Max. Daily, Upstream and Downstream of McKay Cr. Confluence (see Note 4)	Daily	Grab between 3 and 4 PM or Continuous
Umatilla River, McKay Creek and Mixing Zone Temperature (See Note 4)	Continuous	Data logger, Measured Hourly
Audit Continuous Temperature Monitors (See Note 5)	June and September	Record
Check Temperature Monitors (See Note 6)	Monthly	Visual Observation and Record
McKay Creek Flow USGS gauge	3/week	Measurement
Umatilla River Flow USGS gauge	3/week	Measurement

2. Reporting Procedures

a. NPDES monitoring results shall be reported on USEPA approved Discharge Monitoring Report (DMR) forms. The reporting period is the calendar month.

b. State monitoring reports shall identify the name, certificate classification and grade level of each principal operator designated by the permittee as responsible for supervising the wastewater collection and treatment systems during the reporting period. State monitoring reports shall also identify each system classification as found on page one of this permit.

c. State monitoring reports shall also include: (1) a record of the quantity and method of use of all biosolids removed from the treatment facility and (2) a record of all applicable equipment breakdowns and bypassing.

d. USEPA and State reports must be submitted to the Department's Eastern Region - Pendleton office by the 15th day of the following month.

3. Report Submittals

a. The permittee shall have in place a program to identify and reduce inflow and infiltration into the sewage collection system. An annual report shall be submitted to the Department by August 1 each year which details sewer collection maintenance activities that reduce inflow and infiltration. The report shall state those activities that have been done in the previous year and those activities planned for the following year.

b. For any year in which biosolids are land applied, a report shall be submitted 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 340-050-035(6)(a)-(e).

c. An industrial waste survey report shall be submitted to the Department as required by Schedule C.

d. An annual report covering temperature monitoring done in the calendar year is due to be submitted to the Department by the permittee by February 15th of the following year. The report will also include the calculated Maximum Allowable Effluent Temperature as specified in Schedule A, 1.a(5).

NOTES:

1. *E. coli* monitoring must be conducted according to any of the following test procedures as specified in **Standard Methods for the Examination of Water and Wastewater, 19th Edition**, or according to any test procedure that has been authorized and approved in writing by the Director or an authorized representative:

Method	**Reference**	**Page**	**Method Number**
mTEC agar, MF	Standard Methods, 18th Edition	9-29	9213 D
NA-MUG, MF	Standard Methods, 19th Edition	9-63	9222 G
Chromogenic Substrate, MPN	Standard Methods, 19th Edition	9-65	9223 B
Colilert QT	Idexx Laboratories, Inc.		

2. The permittee shall conduct bioassay testing in accordance with the frequency and timeframe specified. The results are due at least 6 months prior to the permit's expiration. If the bioassay tests show that the effluent samples are not toxic at the dilutions determined to occur at the Zone of Immediate Dilution and the Mixing Zone, no further bioassay testing will be required during this permit cycle. Note that bioassay test results will be required along with the next NPDES permit renewal application.

3. After two full years of temperature monitoring, and if approved in writing by the Department, monitoring may be waived for those months when the effluent temperature does not exceed the stream temperature standard.

4. The temperatures and flows as required by Schedule B are to be tabulated, analyzed and submitted in an annual report. Monitoring is to begin no later than six (6) months after permit issuance. The sites shall be located following the DEQ Procedural Guidance for Water Temperature Monitoring, and shall be located (A) just upstream from the point of discharge in McKay Creek, and in the Umatilla River (B) just upstream from the point of confluence of McKay Creek with the Umatilla River, and (C) downstream at the edge of the mixing zone along the centerline of the plume. The permittee shall keep a map clearly showing the proposed monitoring points, a description of each stream conditions

(e.g. pools or riffle) and the latitude and longitude of the sites, and have this information available for DEQ inspection upon request at the facility site.

5. If continuous temperature monitors are used either for the instream or effluent monitoring, the devices must be audited (i.e. field checked and calibrated as required) in June and September, following procedures described in DEQ Procedural Guidance for Water Temperature Monitoring.

6. If continuous temperature monitors are used, the monitors are to be checked visually monthly to insure that the devices are still in place and submerged.

SCHEDULE C

Compliance Schedules and Conditions

1. By no later than six (6) months after permit issuance, the permittee shall submit to the Department an updated biosolids management plan developed in accordance with Oregon Administrative Rule 340, Division 50, "Land Application of Domestic Wastewater Treatment Facility Biosolids, Biosolids Derived Products, and Domestic Septage". Upon approval of the plan by the Department, the plan shall be implemented by the permittee.

2. By no later than six (6) months after permit issuance, the permittee shall submit to the Department a report which either identifies known sewage overflow locations and a plan for estimating the frequency, duration and quantity of sewage overflowing, or confirms that there are no overflow points. The report shall also provide a schedule to eliminate the overflow(s), if any.

3. Industrial Waste Survey Update/Pretreatment Program

    a. By no later than eighteen (18) months after permit issuance, the permittee shall submit to the Department an update to the industrial waste survey that was completed March 30, 1993. Another update must be submitted to the Department by no later than fifty-four (54) months after permit issuance. The updates should be completed as described in 40 CFR 403.8(f)(2)(i-iii) and suitable to make a determination as to the need for development of a pretreatment program.

    b. Should the Department determine that a pretreatment program is required, the permit shall be reopened and modified in accordance with 40 CFR 403.8(e) to incorporate a compliance schedule to require development of a pretreatment program. The compliance schedule requiring program development shall be developed in accordance with the provisions of 40 CFR 403.12(k), and shall not exceed twelve (12) months.

4. The permittee shall submit an approvable mixing zone study for McKay Creek and the Umatilla River for Department review by no later than eighteen (18) months after issuance of the permit.

5. The permittee shall submit a revised Temperature Management Plan for Department review and approval by no later than eighteen (18) months after permit issuance. The permittee may conduct any pilot studies necessary to develop a final wastewater facility modification, design and construction proposal, to meet temperature requirements provided the planned studies are approved by the Department prior to implementation.

6. The permittee is expected to meet the compliance dates which have been established in this schedule. Either prior to or no later than fourteen (14) days following any lapsed compliance date, the permittee shall submit to the Department a notice of compliance or noncompliance with the established schedule. The Director may revise a schedule of compliance if it is determined that there exists a good and valid cause resulting from events over which the permittee has little or no control.

SCHEDULE D

Special Conditions

1. The Department-approved Temperature Management Plan (TMP) is considered part of this permit and is attached to the permit. The permittee is required to implement all elements of the Temperature Management Plan approved by the Department.

2. All biosolids shall be managed in accordance with the current, DEQ approved biosolids management plan, and the site authorization letters issued by the DEQ. Any changes in solids management activities that significantly differ from operations specified under the approved plan require the prior written approval of the DEQ.

   All new biosolids application sites shall meet the site selection criteria set forth in OAR 340-050-0070. All currently approved sites are located in Umatilla County. No new public notice is required for the continued use of these currently approved sites. Property owners adjacent to any newly approved application sites shall be notified, in writing or by any method approved by DEQ, of the proposed activity prior to the start of application. For proposed new application sites that are deemed by the DEQ to be sensitive with respect to residential housing, runoff potential or threat to groundwater, an opportunity for public comment shall be provided in accordance with OAR 340-050-0030.

3. 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.

4. Whole Effluent Toxicity Testing

   a. The permittee shall conduct whole effluent toxicity tests as specified in Schedule B of this permit.

   b. Bioassay tests may be dual end-point tests, only for the fish tests, in which both acute and chronic end-points can be determined from the results of a single chronic test (the acute end-point shall be based upon a 48-hour time period).

   c. Acute Toxicity Testing - Organisms and Protocols

      (1) The permittee shall conduct 48-hour static renewal tests with the *Ceriodaphnia dubia* (water flea) and the *Pimephales promelas* (fathead minnow).

      (2) The presence of acute toxicity will be determined as specified in **Methods for Measuring the Acute Toxicity of Effluents and Receiving Waters to Freshwater and Marine Organisms**, Fourth Edition, EPA-821-R-02-012, October 2002.

      (3) An acute bioassay test shall be considered to show toxicity if there is a statistically significant difference in survival between the control and 100 percent effluent, unless the permit specifically provides for a Zone of Immediate Dilution (ZID) for toxicity. If the permit specifies such a ZID, acute toxicity shall be indicated when a statistically significant difference in survival occurs at dilutions greater than that which is found to occur at the edge of the ZID.

d. Chronic Toxicity Testing - Organisms and Protocols

(1) The permittee shall conduct tests with: *Ceriodaphnia dubia* (water flea) for reproduction and survival test endpoint, *Pimephales promelas* (fathead minnow) for growth and survival test endpoint, and *Raphidocelis subcapitata* (green alga formerly known as *Selanastrum capricornutum*) for growth test endpoint.

(2) The presence of chronic toxicity shall be estimated as specified in **Short-Term Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms**, EPA-821-R-02-013, October 2002.

(3) A chronic bioassay test shall be considered to show toxicity if a statistically significant difference in survival, growth, or reproduction occurs at dilutions greater than that which is known to occur at the edge of the mixing zone. If there is no dilution data for the edge of the mixing zone, any chronic bioassay test that shows a statistically significant effect in 100 percent effluent as compared to the control shall be considered to show toxicity.

e. Quality Assurance

(1) Quality assurance criteria, statistical analyses and data reporting for the bioassays shall be in accordance with the EPA documents stated in this condition and the Department's **Whole Effluent Toxicity Testing Guidance Document**, January 1993.

f. Evaluation of Causes and Exceedances

(1) If toxicity is shown, as defined in sections c.(3) or d.(3) of this permit condition, another toxicity test using the same species and Department approved methodology shall be conducted within two weeks, unless otherwise approved by the Department. If the second test also indicates toxicity, the permittee shall follow the procedure described in section f.(2) of this permit condition.

(2) If two consecutive bioassay test results indicate acute and/or chronic toxicity, as defined in sections c.(3) or d.(3) of this permit condition, the permittee shall evaluate the source of the toxicity and submit a plan and time schedule for demonstrating compliance with water quality standards. Upon approval by the Department, the permittee shall implement the plan until compliance has been achieved. Evaluations shall be completed and plans submitted to the Department within 6 months unless otherwise approved in writing by the Department.

g. Reporting

(1) Along with the test results, the permittee shall include: 1. the dates of sample collection and initiation of each toxicity test; 2. the type of production; and 3. the flow rate at the time of sample collection. Effluent at the time of sampling for bioassay testing should include samples of required parameters stated under Schedule B, condition 1. of this permit.

(2) The permittee shall make available to the Department, on request, the written standard operating procedures they, or the laboratory performing the bioassays, are using for all toxicity tests required by the Department.

h. Reopener

(1) If bioassay testing indicates acute and/or chronic toxicity, the Department may reopen and modify this permit to include new limitations and/or conditions as determined by the Department to be appropriate, and in accordance with procedures outlined in Oregon Administrative Rules, Chapter 340, Division 45.

5. A priority pollutant scan shall be performed at least once during the term of this permit and must be submitted to the Department as part of the Permittee's NPDES permit renewal application. The permittee shall perform chemical analysis of its effluent for the specific toxic pollutants listed in Appendix J, Table 2 of 40 CFR Part 122.

6. The permittee shall comply with Oregon Administrative Rules (OAR), Chapter 340, Division 49, "Regulations Pertaining To Certification of Wastewater System Operator Personnel" and accordingly:

a. The permittee shall have its wastewater system supervised by one or more operators who are certified in a classification <u>and</u> grade level (equal to or greater) that corresponds with the classification (collection and/or treatment) of the system to be supervised as specified on page one of this permit.

Note: A "supervisor" is defined as the person exercising authority for establishing and executing the specific practice and procedures of operating the system in accordance with the policies of the permittee and requirements of the waste discharge permit. "Supervise" means responsible for the technical operation of a system, which may affect its performance or the quality of the effluent produced. Supervisors are not required to be on-site at all times.

b. The permittee's wastewater system may not be without supervision (as required by Special Condition 7.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 then the system classification.

c. If the wastewater system has more than one daily shift, the permittee shall have the shift supervisor, if any, certified at no less than one grade lower than the system classification.

d. The permittee is responsible for ensuring the wastewater system has a properly certified supervisor available at all times to respond on-site at the request of the permittee and to any other operator.

e. The permittee shall notify the Department of Environmental Quality in writing within thirty (30) days of replacement or redesignation of certified operators responsible for supervising wastewater system operation. The notice shall be filed with the Water Quality Division, Operator Certification Program, 811 SW 6th Ave, Portland, OR 97204. This requirement is in addition to the reporting requirements contained under Schedule B of this permit.

f. Upon written request, the Department may grant the permittee reasonable time, not to exceed 120 days, to obtain the services of a qualified person to supervise the wastewater system. The written request must include justification for the time needed, a schedule for recruiting and hiring, the date the system supervisor availability ceased and the name of the alternate system supervisor(s) as required by 7.b. above.

7. The permittee shall notify the DEQ Eastern Region - Pendleton Office [**phone: (541) 276-4063**] in accordance with the response times noted in the General Conditions of this permit, of any malfunction so that corrective action can be coordinated between the permittee and the Department.

8. An adequate contingency plan for prevention and handling of spills and unplanned discharges shall be in force at all times. A continuing program of employee orientation and education shall be maintained to ensure awareness of the necessity of good in-plant control and quick and proper action in the event of a spill or accident.

9. The permittee shall not be required to perform a hydrogeologic characterization or groundwater monitoring during the term of this permit provided:

   a. The facilities are operated in accordance with the permit conditions, and;

   b. There are no adverse groundwater quality impacts (complaints or other indirect evidence) resulting from the facility's operation.

If warranted, at permit renewal the Department may evaluate the need for a full assessment of the facilities impact on groundwater quality.

NPDES GENERAL CONDITIONS
(SCHEDULE F)

SECTION A. STANDARD CONDITIONS

1. Duty to Comply

The permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of Oregon Revised Statutes (ORS) 468B.025 and is grounds for enforcement action; for permit termination, suspension, or modification; or for denial of a permit renewal application.

2. Penalties for Water Pollution and Permit Condition Violations

Oregon Law (ORS 468.140) allows the Director to impose civil penalties up to $10,000 per day for violation of a term, condition, or requirement of a permit.

In addition, a person who unlawfully pollutes water as specified in ORS 468.943 or ORS 468.946 is subject to criminal prosecution.

3. Duty to Mitigate

The permittee shall take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment. In addition, upon request of the Department, the permittee shall correct any adverse impact on the environment or human health resulting from noncompliance with this permit, including such accelerated or additional monitoring as necessary to determine the nature and impact of the noncomplying discharge.

4. Duty to Reapply

If the permittee wishes to continue an activity regulated by this permit after the expiration date of this permit, the permittee must apply for and have the permit renewed. The application shall be submitted at least 180 days before the expiration date of this permit.

The Director may grant permission to submit an application less than 180 days in advance but no later than the permit expiration date.

5. Permit Actions

This permit may be modified, suspended, revoked and reissued, or terminated for cause including, but not limited to, the following:

a. Violation of any term, condition, or requirement of this permit, a rule, or a statute;

b. Obtaining this permit by misrepresentation or failure to disclose fully all material facts; or

c. A change in any condition that requires either a temporary or permanent reduction or elimination of the authorized discharge.

The filing of a request by the permittee for a permit modification or a notification of planned changes or anticipated noncompliance, does not stay any permit condition.

6. Toxic Pollutants

The permittee shall comply with any applicable effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants within the time provided in the regulations that establish those standards or prohibitions, even if the permit has not yet been modified to incorporate the requirement.

7. Property Rights

The issuance of this permit does not convey any property rights of any sort, or any exclusive privilege.

8. Permit References

Except for effluent standards or prohibitions established under Section 307(a) of the Clean Water Act for toxic pollutants and standards for sewage sludge use or disposal established under Section 405(d) of the Clean Water Act, all rules and statutes referred to in this permit are those in effect on the date this permit is issued.

SECTION B. OPERATION AND MAINTENANCE OF POLLUTION CONTROLS

1. Proper Operation and Maintenance

The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit. Proper operation and maintenance also includes adequate laboratory controls, and appropriate quality assurance procedures. This provision requires the operation of back-up or auxiliary facilities or similar systems which are installed by a permittee only when the operation is necessary to achieve compliance with the conditions of the permit.

2. Duty to Halt or Reduce Activity

For industrial or commercial facilities, upon reduction, loss, or failure of the treatment facility, the permittee shall, to the extent necessary to maintain compliance with its permit, control production or all discharges or both until the facility is restored or an alternative method of treatment is provided. This requirement applies, for example, when the primary source of power of the treatment facility fails or is reduced or lost. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit.

3. Bypass of Treatment Facilities

   a. Definitions

      (1) "Bypass" means intentional diversion of waste streams from any portion of the treatment facility. The term "bypass" does not include nonuse of singular or multiple units or processes of a treatment works when the nonuse is insignificant to the quality and/or quantity of the effluent produced by the treatment works. The term "bypass" does not

apply if the diversion does not cause effluent limitations to be exceeded, provided the diversion is to allow essential maintenance to assure efficient operation.

(2) "Severe property damage" means substantial physical damage to property, damage to the treatment facilities or treatment processes which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of a bypass. Severe property damage does not mean economic loss caused by delays in production.

b. Prohibition of bypass.

(1) Bypass is prohibited unless:

(a) Bypass was necessary to prevent loss of life, personal injury, or severe property damage;

(b) There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate backup equipment should have been installed in the exercise of reasonable engineering judgement to prevent a bypass which occurred during normal periods of equipment downtime or preventative maintenance; and

(c) The permittee submitted notices and requests as required under General Condition B.3.c.

(2) The Director may approve an anticipated bypass, after considering its adverse effects and any alternatives to bypassing, when the Director determines that it will meet the three conditions listed above in General Condition B.3.b.(1).

c. Notice and request for bypass.

(1) Anticipated bypass. If the permittee knows in advance of the need for a bypass, it shall submit prior written notice, if possible at least ten days before the date of the bypass.

(2) Unanticipated bypass. The permittee shall submit notice of an unanticipated bypass as required in General Condition D.5.

4. <u>Upset</u>

a. Definition. "Upset" means an exceptional incident in which there is unintentional and temporary noncompliance with technology based permit effluent limitations because of factors beyond the reasonable control of the permittee. An upset does not include noncompliance to the extent caused by operation error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventative maintenance, or careless or improper operation.

b. Effect of an upset. An upset constitutes an affirmative defense to an action brought for noncompliance with such technology based permit effluent limitations if the requirements of General Condition B.4.c are met. No determination made during administrative review of claims that noncompliance was caused by upset, and before an action for noncompliance, is final administrative action subject to judicial review.

c. Conditions necessary for a demonstration of upset. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed, contemporaneous operating logs, or other relevant evidence that:

(1) An upset occurred and that the permittee can identify the causes(s) of the upset;

(2) The permitted facility was at the time being properly operated;

(3) The permittee submitted notice of the upset as required in General Condition D.5, hereof (24-hour notice); and

(4) The permittee complied with any remedial measures required under General Condition A.3 hereof.

d. Burden of proof. In any enforcement proceeding the permittee seeking to establish the occurrence of an upset has the burden of proof.

5. Treatment of Single Operational Event

For purposes of this permit, A Single Operational Event which leads to simultaneous violations of more than one pollutant parameter shall be treated as a single violation. A single operational event is an exceptional incident which causes simultaneous, unintentional, unknowing (not the result of a knowing act or omission), temporary noncompliance with more than one Clean Water Act effluent discharge pollutant parameter. A single operational event does not include Clean Water Act violations involving discharge without a NPDES permit or noncompliance to the extent caused by improperly designed or inadequate treatment facilities. Each day of a single operational event is a violation.

6. Overflows from Wastewater Conveyance Systems and Associated Pump Stations

a. Definitions

(1) "Overflow" means the diversion and discharge of waste streams from any portion of the wastewater conveyance system including pump stations, through a designed overflow device or structure, other than discharges to the wastewater treatment facility.

(2) "Severe property damage" means substantial physical damage to property, damage to the conveyance system or pump station which causes them to become inoperable, or substantial and permanent loss of natural resources which can reasonably be expected to occur in the absence of an overflow.

(3) "Uncontrolled overflow" means the diversion of waste streams other than through a designed overflow device or structure, for example to overflowing manholes or overflowing into residences, commercial establishments, or industries that may be connected to a conveyance system.

b. Prohibition of overflows. Overflows are prohibited unless:

(1) Overflows were unavoidable to prevent an uncontrolled overflow, loss of life, personal injury, or severe property damage;

(2) There were no feasible alternatives to the overflows, such as the use of auxiliary pumping or conveyance systems, or maximization of conveyance system storage; and

(3) The overflows are the result of an upset as defined in General Condition B.4. and meeting all requirements of this condition.

c. Uncontrolled overflows are prohibited where wastewater is likely to escape or be carried into the waters of the State by any means.

d. Reporting required. Unless otherwise specified in writing by the Department, all overflows and uncontrolled overflows must be reported orally to the Department within 24 hours from the time the permittee becomes aware of the overflow. Reporting procedures are described in more detail in General Condition D.5.

7. Public Notification of Effluent Violation or Overflow

If effluent limitations specified in this permit are exceeded or an overflow occurs, upon request by the Department, the permittee shall take such steps as are necessary to alert the public about the extent and nature of the discharge. Such steps may include, but are not limited to, posting of the river at access points and other places, news releases, and paid announcements on radio and television.

8. Removed Substances

Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewaters shall be disposed of in such a manner as to prevent any pollutant from such materials from entering public waters, causing nuisance conditions, or creating a public health hazard.

SECTION C. MONITORING AND RECORDS

1. Representative Sampling

Sampling and measurements taken as required herein shall be representative of the volume and nature of the monitored discharge. All samples shall be taken at the monitoring points specified in this permit and shall be taken, unless otherwise specified, before the effluent joins or is diluted by any other waste stream, body of water, or substance. Monitoring points shall not be changed without notification to and the approval of the Director.

2. Flow Measurements

Appropriate flow measurement devices and methods consistent with accepted scientific practices shall be selected and used to ensure the accuracy and reliability of measurements of the volume of monitored discharges. The devices shall be installed, calibrated and maintained to insure that the accuracy of the measurements is consistent with the accepted capability of that type of device. Devices selected shall be capable of measuring flows with a maximum deviation of less than ± 10 percent from true discharge rates throughout the range of expected discharge volumes.

3. Monitoring Procedures

Monitoring must be conducted according to test procedures approved under 40 CFR Part 136, unless other test procedures have been specified in this permit.

4. Penalties of Tampering

The Clean Water Act provides that any person who falsifies, tampers with, or knowingly renders inaccurate, any monitoring device or method required to be maintained under this permit shall, upon conviction, be punished by a fine of not more than $10,000 per violation, or by imprisonment for not more than two years, or by both. If a conviction of a person is for a violation committed after a first conviction of such person, punishment is a fine not more than $20,000 per day of violation, or by imprisonment of not more than four years or both.

5. Reporting of Monitoring Results

Monitoring results shall be summarized each month on a Discharge Monitoring Report form approved by the Department. The reports shall be submitted monthly and are to be mailed, delivered or otherwise transmitted by the 15th day of the following month unless specifically approved otherwise in Schedule B of this permit.

6. Additional Monitoring by the Permittee

If the permittee monitors any pollutant more frequently than required by this permit, using test procedures approved under 40 CFR 136 or as specified in this permit, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the Discharge Monitoring Report. Such increased frequency shall also be indicated. For a pollutant parameter that may be sampled more than once per day (e.g., Total Chlorine Residual), only the average daily value shall be recorded unless otherwise specified in this permit.

7. Averaging of Measurements

Calculations for all limitations which require averaging of measurements shall utilize an arithmetic mean, except for bacteria which shall be averaged as specified in this permit.

8. Retention of Records

Except for records of monitoring information required by this permit related to the permittee's sewage sludge use and disposal activities, which shall be retained for a period of at least five years (or longer as required by 40 CFR part 503), the permittee shall retain records of all monitoring information, including all calibration and maintenance records of all original strip chart recordings for continuous monitoring instrumentation, copies of all reports required by this permit, and records of all data used to complete the application for this permit, for a period of at least 3 years from the date of the sample, measurement, report or application. This period may be extended by request of the Director at any time.

9. Records Contents

Records of monitoring information shall include:

a. The date, exact place, time and methods of sampling or measurements;

b. The individual(s) who performed the sampling or measurements;

c. The date(s) analyses were performed;

d. The individual(s) who performed the analyses;

e. The analytical techniques or methods used; and

f. The results of such analyses.

10. Inspection and Entry

The permittee shall allow the Director, or an authorized representative upon the presentation of credentials to:

a. Enter upon the permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit;

b. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this permit;

c. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this permit, and

d. Sample or monitor at reasonable times, for the purpose of assuring permit compliance or as otherwise authorized by state law, any substances or parameters at any location.

SECTION D. REPORTING REQUIREMENTS

1. Planned Changes

The permittee shall comply with Oregon Administrative Rules (OAR) 340, Division 52, "Review of Plans and Specifications". Except where exempted under OAR 340-52, no construction, installation, or modification involving disposal systems, treatment works, sewerage systems, or common sewers shall be commenced until the plans and specifications are submitted to and approved by the Department. The permittee shall give notice to the Department as soon as possible of any planned physical alternations or additions to the permitted facility.

2. Anticipated Noncompliance

The permittee shall give advance notice to the Director of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements.

3. Transfers

This permit may be transferred to a new permittee provided the transferee acquires a property interest in the permitted activity and agrees in writing to fully comply with all the terms and conditions of the permit and the rules of the Commission. No permit shall be transferred to a third party without prior written approval from the Director. The permittee shall notify the Department when a transfer of property interest takes place.

4. Compliance Schedule

Reports of compliance or noncompliance with, or any progress reports on interim and final requirements contained in any compliance schedule of this permit shall be submitted no later than 14 days following each schedule date. Any reports of noncompliance shall include the cause of noncompliance, any remedial actions taken, and the probability of meeting the next scheduled requirements.

5. Twenty-Four Hour Reporting

The permittee shall report any noncompliance which may endanger health or the environment. Any information shall be provided orally (by telephone) within 24 hours, unless otherwise specified in this permit, from the time the permittee becomes aware of the circumstances. During normal business hours, the Department's Regional office shall be called. Outside of normal business hours, the Department shall be contacted at 1-800-452-0311 (Oregon Emergency Response System).

A written submission shall also be provided within 5 days of the time the permittee becomes aware of the circumstances. If the permittee is establishing an affirmative defense of upset or bypass to any offense under ORS 468.922 to 468.946, and in which case if the original reporting notice was oral, delivered written notice must be made to the Department or other agency with regulatory jurisdiction within 4 (four) calendar days. The written submission shall contain:

a. A description of the noncompliance and its cause;

b. The period of noncompliance, including exact dates and times;

c. The estimated time noncompliance is expected to continue if it has not been corrected;

d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance; and

e. Public notification steps taken, pursuant to General Condition B.7.

The following shall be included as information which must be reported within 24 hours under this paragraph:

a. Any unanticipated bypass which exceeds any effluent limitation in this permit.

b. Any upset which exceeds any effluent limitation in this permit.

c. Violation of maximum daily discharge limitation for any of the pollutants listed by the Director in this permit.

The Department may waive the written report on a case-by-case basis if the oral report has been received within 24 hours.

6. Other Noncompliance

The permittee shall report all instances of noncompliance not reported under General Condition D.4 or D.5, at the time monitoring reports are submitted. The reports shall contain:

a. A description of the noncompliance and its cause;

b. The period of noncompliance, including exact dates and times;

c. The estimated time noncompliance is expected to continue if it has not been corrected; and

d. Steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

7. Duty to Provide Information

The permittee shall furnish to the Department, within a reasonable time, any information which the Department may request to determine compliance with this permit. The permittee shall also furnish to the Department, upon request, copies of records required to be kept by this permit.

Other Information: When the permittee becomes aware that it failed to submit any relevant facts in a permit application, or submitted incorrect information in a permit application or any report to the Department, it shall promptly submit such facts or information.

8. Signatory Requirements

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

9. Falsification of Information

A person who supplies the Department with false information, or omits material or required information, as specified in ORS 468.953 is subject to criminal prosecution.

10. Changes to Indirect Dischargers - **[Applicable to Publicly Owned Treatment Works (POTW) only]**

The permittee must provide adequate notice to the Department of the following:

a. Any new introduction of pollutants into the POTW from an indirect discharger which would be subject to section 301 or 306 of the Clean Water Act if it were directly discharging those pollutants and;

b. Any substantial change in the volume or character of pollutants being introduced into the POTW by a source introducing pollutants into the POTW at the time of issuance of the permit.

c. For the purposes of this paragraph, adequate notice shall include information on (i) the quality and quantity of effluent introduced into the POTW, and (ii) any anticipated impact of the change on the quantity or quality of effluent to be discharged from the POTW.

11. Changes to Discharges of Toxic Pollutant - **[Applicable to existing manufacturing, commercial, mining, and silvicultural dischargers only]**

The permittee must notify the Department as soon as they know or have reason to believe of the following:

a. That any activity has occurred or will occur which would result in the discharge, on a routine or frequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels:

 (1) One hundred micrograms per liter (100 μg/L);

 (2) Two hundred micrograms per liter (200 μg/L) for acrolein and acrylonitrile; five hundred micrograms per liter (500 μg/L) for 2,4-dinitrophenol and for 2-methyl-4,6-dinitrophenol; and one milligram per liter (1 mg/L) for antimony;

 (3) Five (5) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7); or

 (4) The level established by the Department in accordance with 40 CFR 122.44(f).

b. That any activity has occurred or will occur which would result in any discharge, on a non-routine or infrequent basis, of a toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels":

 (1) Five hundred micrograms per liter (500 μg/L);

 (2) One milligram per liter (1 mg/L) for antimony;

 (3) Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 CFR 122.21(g)(7); or

 (4) The level established by the Department in accordance with 40 CFR 122.44(f).

SECTION E. DEFINITIONS

1. BOD means five-day biochemical oxygen demand.

2. TSS means total suspended solids.

3. mg/L means milligrams per liter.

4. kg means kilograms.

5. m^3/d means cubic meters per day.

6. MGD means million gallons per day.

7. Composite sample means a sample formed by collecting and mixing discrete samples taken periodically and based on time or flow.

8. FC means fecal coliform bacteria.

9. Technology based permit effluent limitations means technology-based treatment requirements as defined in 40 CFR 125.3, and concentration and mass load effluent limitations that are based on minimum design criteria specified in OAR 340-41.

10. CBOD means five day carbonaceous biochemical oxygen demand.

11. Grab sample means an individual discrete sample collected over a period of time not to exceed 15 minutes.

12. Quarter means January through March, April through June, July through September, or October through December.

13. Month means calendar month.

14. Week means a calendar week of Sunday through Saturday.

15. Total residual chlorine means combined chlorine forms plus free residual chlorine.

16. The term "bacteria" includes but is not limited to fecal coliform bacteria, total coliform bacteria, and E. coli bacteria.

17. POTW means a publicly owned treatment works.

NPDES WASTEWATER DISCHARGE PERMIT EVALUATION

Department of Environmental Quality
Eastern Region - Pendleton Office
700 SE Emigrant, Suite 330, Pendleton, OR 97801
Telephone: (541) 276-4063

PERMITTEE: City of Pendleton
500 SW Dorion Avenue
Pendleton, Oregon 97801
File Number: 68260

SOURCE LOCATION: 4255 Southwest 28th Drive

SOURCE CONTACT:

Sue Lawrence Telephone Number: 541-276-3372

PERMIT WRITERS:

Al Murrey / Elizabeth Hutchison Telephone Number: 541-278-8681

PROPOSED ACTION: Renewal of a National Pollutant Discharge Elimination System (NPDES) wastewater discharge permit is proposed.

SOURCE CATEGORY: Major Domestic

TREATMENT SYSTEM CLASS: Level IV

COLLECTION SYSTEM CLASS: Level IV

PERMIT APPLICATION DATE: July 16, 1997

PERMIT APPLICATION NUMBER: 992123

BACKGROUND

Introduction

The City of Pendleton operates a wastewater treatment facility located in Pendleton, Oregon. Wastewater is treated and discharged to McKay Creek in accordance with National Pollutant Discharge Elimination System (NPDES) Permit number 100982. The Permit for the facility was issued on September 30, 1992 and expired on September 30, 1997.

The Department of Environmental Quality (Department or DEQ) received a renewal application on July 16, 1997. A renewal permit is necessary to discharge to state waters pursuant to provisions of Oregon Revised Statutes (ORS) 468B.050 and the Federal Clean Water Act. The Department proposes to renew the permit.

McKay Creek is listed by the Department as water quality limited for temperature, pH and bacteria. The Umatilla River is listed as water quality limited for temperature, pH, bacteria, aquatic weeds and algae, sedimentation, turbidity, habitat, ammonia, nitrate, and flow modification. A TMDL study was completed for the Umatilla River and its tributaries and approved by the US EPA in May 2001. Waste load allocations for temperature and bacteria were established that affect the City of Pendleton's wastewater treatment plant discharge limitations. The City submitted a temperature management plan (TMP) to the Department on November 5, 2001. As part of implementation of the TMP, a **Pendleton Subsurface Effluent Discharge Pilot Study Work Plan for 60-Day Study**, 27 June 2002, was provided to DEQ on June 28, 2002. The pilot study was completed and the **Pendleton Subsurface Effluent Discharge Pilot Study Final Report**, Kennedy/Jenks Consultants, 25 February 2003, was received by the Department on February 28, 2003. The TMP was conditionally approved on October 27, 2003.

The treatment facility receives primarily domestic wastewater from residential and commercial sources. There are no known categorical users that contribute to the wastewater flow to the facility at this time.

Facility Description

The last major expansion of the treatment facility occurred in 1970. New secondary treatment units were added which included an activated sludge process.

The major treatment process used is activated sludge. The engineer who designed the facility determined the average dry weather design flow. It is the estimated maximum flow during May 1 to October 31 (expressed as a daily average flow), at which the design engineer expects the treatment facility can still consistently meet all effluent limits.

The dry weather flows do not include groundwater infiltration and inflow that are associated with the winter in Oregon. Therefore, the dry weather design flows are used mostly to estimate how much treatment capacity there is for organic loads. For this facility, the average dry weather design flow is 5.5 million gallons/day (MGD). The peak wet weather design flow is 13.8 MGD. The current actual dry weather flow for May 1 to October 31, for the past two years, is 2.3 MGD. Based on the current flows, this facility is at 42 percent of organic treatment capacity. Based on the current low flows compared to the design flows, and the lack of recurring effluent violations, no expansion of the facility is needed at this time.

The current actual average wet weather flow (November 1 through April 30), for the past two years, is 2.73 MGD. The peak day flow over the past two years was 4.79 MGD on February 8, 2002. See the section on Inflow and Infiltration for a further discussion of winter flows and hydraulic capacity issues.

Pendleton's treatment facility consists of a headworks, primary and secondary treatment units, and sludge treatment components. All influent flow is measured at the headworks by a flow meter. The City has had problems with the influent flow meter and has requested that it no longer be a permit requirement to report influent flow. A submerged differential pressure transducer for the meter is installed in the 36-inch influent line. The headworks consist of a grinder and screen, a grit removal basin, and a grit washer. This is followed by two primary clarifiers. Two activated sludge aeration basins are followed by two secondary clarifiers to complete the secondary process. A two-cell chlorine contact basin provides an average 4-6 hours contact time before effluent is discharged to McKay Creek. A flow meter is installed to record effluent flow. Laboratory facilities are located on-site. In the event of a power outage, a standby generator is available to provide power to the primary clarifiers and the chlorination system.

Biosolids Management and Utilization

The permittee's biosolids management plan was approved on May 27, 1987 and revised in January 1995. All biosolids (waste sludge) must be managed in accordance with the Department approved updated Biosolids Management Plan to ensure compliance with the federal biosolids regulations (40 CFR Part 503). After treatment necessary to comply with vector attraction and pathogen reduction requirements, the Class B biosolids are beneficially land applied on sites that are in Umatilla County. Any future land application sites must conform to the site selection criteria in the Biosolids Management Plan and must be approved by the Department.

Primary sludge, as well as thickened waste activated sludge from the secondary clarifiers, is pumped to a primary anaerobic digester. Biosolids (sludge) from the primary anaerobic digester is then transferred to two secondary anaerobic digesters. Biosolids (sludge) from secondary digesters is either land applied to farmland, transferred to the biosolids (sludge) drying beds, or recirculated through a solids storage basin. Biosolids (sludge) from the solids storage basin is also applied to farmland. The City's current practice is to transfer all biosolids to the drying beds for drying prior to land application.

Digested wastewater facility biosolids are applied to DEQ authorized and City-owned dryland grain sites. The permittee produces and land applies about 300 dry metric tons of Class B biosolids per year.

This permit requires monthly reporting of the methods used to comply with vector attraction and pathogen reduction requirements. It also requires the submittal of an annual summary.

The proposed permit contains a condition requiring submittal of an updated Biosolids Management Plan within six (6) months of permit issuance.

The permittee conducts chemical testing of biosolids prior to land application. This includes analysis of metals. The latest application data from 2002 is listed in lbs/acre (kg/hectare) is found below:

Site	Arsenic	Cadmium	Chromium	Copper	Lead
AIR 7W	.015 (.017)	.015 (.017)	.139 (.156)	3.29 (3.69)	.30 (.34)
AIR 4W	.007 (.008)	.007 (.008)	.067 (075)	2.52 (2.82)	.14 (.16)

Site	Mercury	Nickel	Selenium	Zinc	Nitrogen
AIR 7W	.0118 (.0132)	.083 (.093)	.032 (.036)	5.23 (5.86)	53 (59)
AIR 4W	.0057 (0064)	.040 (.045)	.016 (018)	2.52 (2.82)	26 (29)

Inflow and Infiltration (I/I)

Based on an evaluation of summer and winter period flows and the peak flow, inflow and infiltration (I/I) does not appear to be a significant problem for the permittee. The Department recommends a long-term program that will completely replace the collection system based on life expectancy (usually 60 to 80 years). The replacement program should be directed at the oldest sub-basins or those in the worst condition.

Pretreatment

The permittee does not have a formal pretreatment program, nor is one required at this time. An industrial waste survey was last completed on March 30, 1993. Most major municipal permittees are required to update the industrial waste survey annually. Pendleton questioned the need to do this annually. The City stated that they would learn about any new industrial users more quickly than through an annual survey and would ensure development of a pre-treatment program if a new industrial user were to begin operating. Thus, the Department is requiring the survey only twice during the permit cycle. The proposed permit includes a requirement to update the industrial waste survey twice by no later than 18 and 54 months after permit renewal issuance. Based on the updated survey results, the permittee and/or the Department may determine that a pretreatment program is required. The Department would then reopen and modify the permit to incorporate a compliance schedule requiring development of a pretreatment program

Pollutants Discharged

The current permit allows the City of Pendleton to discharge treated effluent from the wastewater treatment plant year-round. The current permit sets limits on the following pollutants: five-day biochemical oxygen demand (BOD_5), total suspended solids (TSS), fecal coliform bacteria, and residual chlorine. The discharge is also regulated for pH and BOD_5/TSS pollutant removal efficiency.

The residual chlorine limit contained in the current permit did not go into effect since it was appealed by the City of Pendleton. In addition, a Stipulation and Final Order (SFO) proposed by the Department was never accepted by the City.

The proposed permit will regulate the same pollutants except that *E. coli* bacteria count replaces fecal coliform bacteria and there are proposed limits on effluent temperature and ammonia.

Outfalls

Treated wastewater is discharged to McKay Creek through a 36-inch outfall pipe.

Receiving Streams/Impact

The designated beneficial uses of the receiving stream are: public and private domestic water supply, industrial water supply, irrigation, livestock watering, anadromous fish passage, salmonid spawning and rearing, resident fish and aquatic life, wildlife and hunting, fishing, boating, water contact recreation, aesthetic quality, and hydro power.

The water quality standards for the Umatilla Basin, Oregon Administrative Rules (OAR) 340-041-0310, were developed to protect the beneficial uses for the basin. All other applicable water quality standards in OAR 340-041 must also be met. Treated wastewater is discharged to McKay Creek at river mile 0.1. McKay Creek is listed by the Department as water quality limited for temperature, pH, and bacteria according to the Department's 303(d) list. The Umatilla River is listed as water quality limited for temperature, pH, bacteria, aquatic weeds and algae, sedimentation, turbidity, habitat, ammonia, nitrate, and flow modification. A TMDL study was completed for the Umatilla River and its tributaries and approved by the US EPA in May 2001. Waste load allocations for temperature and bacteria were established that affect the City of Pendleton's wastewater treatment plant discharge limitations. Maximum allowable effluent temperatures for the Pendleton wastewater treatment plant are specified in Table 19 (page 76-77) in the Umatilla River Basin TMDL and WQMP report dated March 2001. The maximum allowable effluent temperatures in the Table were derived from a formula displayed on page 80 of the TMDL report. The City of Pendleton has requested that the formula be specified in the proposed permit rather than the Table. The waste load allocation (WLA) specifies an *E. coli* bacteria limit of 126 organisms per 100 ml. monthly geometric mean, and no single sample shall exceed 406 organisms per 100 ml. The effluent temperature (by formula) and bacteria TMDL requirements are included in the proposed permit.

The Oregon Department of Water Resources (ODWR), Pendleton office, was contacted to obtain flow and temperature data for McKay Creek and the Umatilla River. Information was provided by Doug Nelson, ODWR. Mr. Nelson provided flow data for Water Years 1994 through 2003. The low flow Water Year (WY) was 2003. The 2003 WY began on October 1, 2002 and ended September 30, 2003. For McKay Creek, the low flow period was during the last week of November 2002. The recorded flows were 6.3 cfs, 6.5 cfs, 7.8 cfs, 8.3 cfs, 8.3 cfs, 8.3 cfs, and 8.3 cfs. Therefore, the 7Q10 flow for McKay Creek is 7.7 cfs. The 1Q10 flow is 6.3 cfs. During this same period, the average flow in the Umatilla River was 76 cfs with a low flow of 74 cfs. In November 2002, the temperature of McKay Creek varied from 53 °F at the start of the month to 42 °F at the end of the month.

For the Umatilla River, the low flow period was at the end of July and first week of August. The recorded flows were 28 cfs, 26 cfs, 25 cfs, 24 cfs, 26 cfs, 30 cfs and 30 cfs. Therefore, the 7Q10 flow for the Umatilla River is 27 cfs. The 1Q10 flow is 24 cfs. During this same period, the average flow in McKay Creek was 171 cfs with a low flow of 163 cfs. In July and August, the temperature of the Umatilla River varied from 67 °F to 81 °F.

The mixing zone for the Pendleton effluent extends into the Umatilla River. To determine limits for toxic substances, ammonia and chlorine, the combined flows of McKay Creek and the Umatilla River at the lowest flow periods must be determined. Reviewing the flow data, it was determined that the summer low flow period for the combined stream flows occurred in September with a 7Q10 flow of 121 cfs and a 1Q10 flow of 117 cfs. It was determined that the winter low flow period occurred in December with a 7Q10 flow of 78.3 and a 1Q10 flow of 77.8 cfs.

Temperature

The applicable temperature criterion for the receiving stream is a maximum of 64°F, based on a seven-day average of maximum daily temperature readings. The standard was set to protect salmonid fish rearing. System Potential Temperature for the Umatilla River at Pendleton during the critical season (June through September) is 69.8 °F, as per the Umatilla TMDL[1].

Stream temperatures are generally rising throughout the State of Oregon and many streams violate the applicable temperature standard in the summer. Point source dischargers are required to help stop and reverse the warming trend. In order to prevent further warming, most discharge permits will identify the maximum allowable thermal discharge. The permit must also prohibit further increases.

The streams in this basin are water quality limited for temperature and may not fully support the spawning and rearing of salmonid species. The proposed permit addresses the potential impact of this discharge on stream temperature. The effluent temperature at some times of the year exceeds the applicable temperature standard for the receiving stream. However, the effluent is not expected to exceed 77° F at any time. A temperature of 77° F is considered to be lethal for salmonids.

The permittee has been assigned a waste load allocation (WLA) in the approved TMDL for the receiving stream, and these limits have been included in the proposed permit. The permittee is not currently able to meet the temperature limits. The Temperature Management Plan (TMP) conditionally approved by the

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[1] "Umatilla River Basin Total Maximum Daily Load (TMDL) and Water Quality Management Plan (WQMP)", TMDL approved May 2001, Volume 1, Sections 2.1.1.4 (critical season) and 2.1.1.6 (System Potential Temperature and Wasteload Allocations)

Department on October 27, 2003 discusses options and a strategy for coming into compliance with the temperature limit. The City will be required to submit a revised TMP within 18 months of permit issuance. Provided the permittee complies with the conditions of the approved Temperature Management Plan, the permittee is considered to be in compliance with this proposed permit and the applicable stream criteria for temperature. The proposed permit after issuance may be modified by the Department when necessary to meet the approved conditions of the revised TMP.

The effluent causes a measurable increase of temperature at times, at the edge of the mixing zone. To protect endangered and cool water species, a "measurable increase" is defined as greater than a 0.50 °F temperature increase at the edge of the mixing zone, factoring in the effluent temperature and dilution at the edge of the mixing zone, and using the applicable stream temperature standard. According to personal communication with Tim Bailey, Oregon Department of Fish & Wildlife, in October 2003, juvenile steelhead and adult bull trout which are endangered species are present in McKay Creek. Bull trout may be present from November through April and juvenile steelhead may be present any time during the year. In addition, adult bull trout and steelhead may be present in the Umatilla River during the same time periods they are present in McKay Creek. When there is a measurable temperature increase at the edge of the mixing zone and endangered species are present, the permittee may have a Department approved TMP or adequate information demonstrating that the temperature increase will not impair the biological integrity of the listed endangered species. As mentioned above, the permittee has a conditionally approved TMP.

The conditionally approved TMP calls for the permittee to conduct additional flow and temperature monitoring for the effluent and receiving waters, and for the City to continue to explore options for meeting the TMDL and endangered species temperature requirements, and implement the selected option. A Mutual Agreement and Order will be developed in cooperation with the City of Pendleton that will outline conditions and a schedule for achieving compliance with the terms and conditions of the proposed permit renewal and TMP.

Toxicity

Effluent from the City's wastewater treatment facility contains chlorine and ammonia. Chlorine is used as a disinfectant and ammonia is naturally occurring in domestic wastewater. Both of these parameters are known to have toxic impact to aquatic life at specific levels.

OAR 340-041-0033(1) and (2) states that:

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

(2) Levels of toxic substances may not exceed the criteria listed in Table 20 which were based on criteria established by EPA and published in *Quality Criteria for Water* (1986), unless otherwise noted.

OAR 340-041-0053 states, however, that the Department may allow a designated portion of a receiving water to serve as a zone of dilution for wastewaters and receiving waters to mix thoroughly and this zone will be defined as a mixing zone. The Department may suspend all or part of the water quality standards, or set less restrictive standards, in the defined mixing zone, provided that the conditions in this rule are met.

Furthermore, 40 CFR § 122.44(d) states that, in addition to the conditions established under § 122.43(a), each NPDES permit shall include any requirements in addition to or more stringent than promulgated effluent limitations guidelines or standards under sections 301, 304, 306, 307, 318 and 405 of the Clean Water Act (CWA) necessary to achieve water quality standards established under section 303 of the CWA, including state narrative criteria for water quality. Section (d) of § 122.44 also states that limitations must control all pollutants or pollutant parameters (either conventional, non-conventional, or toxic pollutants) which the Director determines are or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any state water quality standard, including state narrative criteria for water quality. Section (d) also states that when the permitting authority determines that a discharge causes, has the reasonable potential to cause, or contributes to an in-stream excursion above the allowable ambient concentration of a state numeric criteria within a state water quality standard for an individual pollutant, the permit must contain effluent limits for that pollutant.

The basis for toxic pollutant limits for chlorine and ammonia are contained in the following section.

Chlorine and Ammonia

According to EPA's 1986 Quality Criteria for Water (commonly known as the Gold Book) and OAR 340-041, Table 20, chlorine concentrations of 11 µg/l and 19 µg/l can result in chronic and acute chlorine toxicity, respectively, in fresh waters. To address toxicity due to ammonia nitrogen, establishing limits are more complex because there is an increase in variables. The toxicity of ammonia depends not only on its concentration, but also the pH and temperature.

Groundwater

Based on the Department's current information, this facility has a low potential for adversely impacting groundwater quality. Therefore, Schedule D of the proposed permit states that no groundwater evaluations will be required during this permit cycle. The permit also includes a condition in Schedule A that prohibits any adverse impact on groundwater quality.

Stormwater

General NPDES permits for stormwater are required for facilities with a design flow of greater than 1 MGD if stormwater is collected and discharged from the plant site. This facility does not discharge stormwater. Therefore, no stormwater permit is necessary.

Permit History

Shortly after issuance of the current permit, the City of Pendleton appealed the residual chlorine limit of 0.03 mg/L in the NPDES permit. The appeal was not resolved during the permit cycle; therefore, the limit was stayed.

A Permit Action Letter was issued on March 20, 1998, approving a 120-day extension to hire a Class IV collection system certified operator.

A Permit Action letter was issued on March 20, 1998, allowing operation of the system without a Class IV collection system certified operator until June 29, 1998.

On October 21, 2003, in response to the City's written request, the Department issued an extension allowing from September 28th to November 30th for the City to be without a Class IV collections system certified operator.

An Antidegradation Review was completed with a recommendation to proceed with this permit action. A copy of the review sheet is available in the source files for this permittee.

Compliance History

This facility was last inspected March 5, 2003 and was found to be operating in compliance with the existing NPDES permit.

The monitoring reports for this facility were reviewed for the existing permit period including any actions taken relating to effluent violations. The permit compliance conditions were reviewed and all inspection reports for the same period were reviewed. Based on this review, the following violations have been documented at this facility during the term of the current permit.

Date of Violation	Type of Enforcement Action	Description of Violation
July 1998	Notice of noncompliance	Exceedance of BOD monthly average conc. limit
March 27, 2000	Notice of noncompliance	Overflow of sewage from manhole

The above violations are considered to be minor and have been corrected. Therefore, the Department considers this facility to be in substantial compliance with the terms of the current permit.

The permittee notified the Department of a bypass and discharge of about 150,000 gallons of primary treated sewage to McKay Cr. and the Umatilla R. on April 2, 1997. No enforcement action was taken.

In addition, on July 31, 2001, the City notified the Department of a July 25, 2001, bypass of about 130,000 gallons of primary treated sewage that was discharged to McKay Cr. and the Umatilla R. The discharge was a result of a power outage. No enforcement action was taken by DEQ.

PERMIT DISCUSSION

Face Page

The permittee is authorized to construct, install, modify, or operate a wastewater collection, treatment, control and disposal system. It is permitted to discharge treated effluent to McKay Creek within limits set by Schedule A, and to land apply biosolids. All other discharges are prohibited.

Schedule A - Waste Discharge limitations

BOD_5 and TSS concentration and mass limits

Based on the Umatilla Basin minimum design criteria, wastewater treatment resulting in a monthly average effluent concentration of 20 mg/L for BOD_5 and TSS must be provided from May 1 - October 31. From November 1 - April 30, a minimum of secondary treatment or equivalent control is required. Secondary treatment for this facility is defined as monthly average concentration limit of 30 mg/L for BOD_5 (or 25 mg/L for $CBOD_5$) and 30 mg/L for TSS.

The Department is proposing concentration limits at least as stringent as the basin minimum design criteria. The proposed monthly average summer BOD_5 concentration limit is 20 mg/L with a weekly average limit of 30 mg/L. The proposed monthly average summer TSS concentration limit is 20 mg/L with a weekly average limit of 30 mg/L.

The proposed monthly average winter BOD_5 concentration limit is 30 mg/L with a weekly average limit of 45 mg/L. The proposed monthly average winter TSS concentration limit is 30 mg/L with a weekly average limit of 45 mg/L.

The summer mass limits for biochemical oxygen demand (BOD_5) and suspended solids (TSS) are based on the design average dry weather flow (ADWF) of 5.5 MGD and the monthly average BOD_5 and TSS concentration limits of 20 mg/L and 20 mg/L, respectively.

The winter mass load limits for the facility are based on the design ADWF of 5.5 MGD and the monthly average BOD_5 or TSS concentration limits of 30 mg/L and 30 mg/L, respectively. The limits are in accordance with OAR 340-041-0120(9)(e). All mass load limitations are rounded to two significant figures.

The winter mass limits can be based on design average wet weather flow (AWWF) but the Department does not have the necessary information to make the change. The proposed permit bases winter mass discharge limits on the monthly average dry weather design flow and are considered interim in accordance with Oregon Administrative Rule (OAR) 340-041-0120(9)(d).

<u>BOD_5 and TSS</u>

The limits are:

(1) May 1 - October 31:

	Average Effluent Concentrations		Monthly Average	Weekly Average	Daily Maximum
Parameter	Monthly	Weekly	lb/day	lb/day	lbs
BOD_5	20 mg/L	30 mg/L	920	1400	1800
TSS	20 mg/L	30 mg/L	920	1400	1800

(2) November 1 - April 30:

	Average Effluent Concentrations		Monthly Average	Weekly Average	Daily Maximum
Parameter	Monthly	Weekly	lb/day	lb/day	lbs
BOD_5	30 mg/L	45 mg/L	1400	2100	2800
TSS	30 mg/L	45 mg/L	1400	2100	2800

Calculations:

(1) Summer BOD_5

(a) 5.5 MGD x 8.34 lbs/gal x 20 mg/L monthly avg. = 920 lbs/day
(b) 920 lbs/day monthly avg. x 1.5 = 1400 lbs/day weekly avg.
(c) 920 lbs/day monthly avg. x 2.0 = 1800 lbs/day daily max.

(2) Summer TSS

- (a) 5.5 MGD x 8.34 lbs/gal x 20 mg/L monthly avg. = 920 lbs/day
- (b) 920 lbs/day monthly avg. x 1.5 = 1400 lbs/day weekly avg.
- (c) 920 lbs/day monthly avg. x 2.0 = 1800 lbs/day daily max.

(3) Winter BOD_5

- (a) MGD x 8.34 lbs/gal x 30 mg/L monthly avg. = 1400 lbs/day
- (b) 1400 lbs/day monthly avg. x 1.5 = 2100 lbs/day weekly avg.
- (c) 1400 lbs/day monthly avg. x 2.0 = 2800 lbs/day daily max.

(4) Winter TSS

- (a) MGD x 8.34 lbs/gal x 30 mg/L monthly avg. = 1400 lbs/day
- (b) 1400 lbs/day monthly avg. x 1.5 = 2100 lbs/day weekly avg.
- (c) 1400 lbs/day monthly avg. x 2.0 = 2800 lbs/day daily max.

A review of recent monitoring data indicates the City should generally be able to comply with the permit limits.

No changes from the previous permit are proposed for BOD_5 and TSS.

BOD_5 and TSS Percent Removal Efficiency

A minimum level of percent removal for BOD_5 and TSS for municipal dischargers is required by the Code of Federal Regulations (CFR) secondary treatment standards (40 CFR, Part 133). A minimum 85 percent removal efficiency limit is included in the existing and proposed permits to comply with federal requirements. An examination of the DMR data indicates the permittee will have little difficulty meeting the limit with the current facilities.

pH

The Umatilla Basin-Specific criteria are found in OAR 340-041-0310. The allowed pH range is 7.0 to 8.5. The proposed permit limits pH to the range 6.0 to 9.0. This limit is based on Federal wastewater treatment guidelines for sewage treatment facilities, and is applied to the majority of NPDES permittees in the state. Within the permittee's mixing zone, the water quality standard for pH does not have to be met. It is the Department's belief that mixing with ambient water within the mixing zone will ensure that the pH at the edge of the mixing zone meets the standard, and the Department considers the proposed permit limits to be protective of the water quality standard.

Bacteria

The proposed permit limits are based on an *E. coli* bacteria standard approved in January 1996 and the Umatilla TMDL WLA for bacteria. The proposed limits are a monthly geometric mean of 126 *E. coli* per 100 ml, with no single sample exceeding 406 *E. coli* per 100 ml. The new bacteria standard allows that if a single sample exceeds 406 *E coli* per 100 ml, then the permittee may take five consecutive re-samples. If the log mean of the five re-samples is less than or equal to 126, a violation is not triggered. The re-sampling must be done at intervals no longer than four hours, and beginning within 28 hours after the original sample was taken.

The proposed effluent limits are achievable through proper operation and maintenance.

Chlorine Residual and Ammonia

Disinfection of the effluent with chlorine is the process the permittee uses to comply with the waste discharge limitations for bacteria. Chlorine is a known toxic substance and as such is subject to limitation under Oregon Administrative Rules. The rule (OAR 340-041-0033) states in part that toxic substances shall not be introduced above natural background levels to waters of the state at levels that adversely affect public health, safety or welfare, aquatic life, wildlife, or other designated beneficial uses. In addition, levels of toxic substances shall not exceed the criteria listed in Table 20 unless otherwise noted. Criteria established by the EPA and published in Quality Criteria for Water (1986) set the levels in Table 20.

However, OAR 340-041 states that the Department may allow a designated portion of a receiving water to serve as a zone of dilution for wastewaters and receiving waters to mix thoroughly and this zone will be defined as a mixing zone. In the defined mixing zone, the Department may suspend all or part of the water quality standards, or set less restrictive standards. It may make these changes if the water within the mixing zone:

- free of materials in concentrations that will cause acute toxicity to aquatic life as measured by the acute bioassay method and
- outside the boundary of the mixing zone is free of materials in concentrations that will cause chronic toxicity.

Furthermore, 40 CFR §122.44(d) states that permit limitations must control all pollutants or pollutant parameters which are or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any state water quality standard, including state narrative criteria for water quality. The fresh water criteria for chlorine and ammonia were used to calculate permit limitations.

Compliance with acute toxicity criteria is required at the edge of the Zone of Immediate Dilution (ZID) and compliance with chronic toxicity criteria is required at the edge of the mixing zone.
The calculated 7Q10 and 1Q10 flows were used to perform a reasonable potential analysis for chlorine and ammonia (see attachment). The analysis indicated there was a reasonable potential for chlorine and ammonia to cause toxicity within the receiving stream.

Therefore, permit limits based on the acute and chronic criteria were calculated. The Department's Reasonable Potential Analysis (RPA) computer model was used to establish effluent limits for residual chlorine and ammonia-nitrogen. The variables in the model are effluent flow, 7Q10 stream flow, 1Q10 stream flow, effluent pH, stream pH, effluent temperature, stream temperature, effluent alkalinity, and stream alkalinity. Historical effluent and stream data were reviewed to obtain a range of values to be used in the RPA model. The values that were most protective for water quality were used in the model. The flow data used was the combined low summer and winter flows for McKay Creek and the Umatilla River.

For summer data, the following were used: effluent flow of 5.5 MGD, 7Q10 of 121 cfs, 1Q10 of 117 cfs, effluent pH of 7.5, stream pH of 9, effluent temperature of 24 °C, stream temperature of 24.9 °C, effluent alkalinity of 181, and stream alkalinity of 60. For winter data, the following were used: effluent flow of 5.5 MGD, 7Q10 of 78.3 cfs, 1Q10 of 77.8 cfs, effluent pH of 7.6, stream pH of 8.6, effluent temperature of 19 °C, stream temperature of 3 °C, effluent alkalinity of 181, and stream alkalinity of 60. The results for chlorine and ammonia limits are:

	PERMIT LIMITS		PERMIT LIMITS	
	Monthly mg/L	**Daily mg/L**	**Monthly lb/day**	**Daily lb/day**
summer				
Chlorine	**0.02**	**0.05**	**0.80**	**2.0**
Ammonia	**1.0**	**2.0**	**48.0**	**96.0**
winter				
Chlorine	**0.01**	**0.04**	**0.60**	**1.7**
Ammonia	**3.0**	**5.0**	**140.0**	**240.0**

In summary, for summer: for chlorine, monthly average = 0.02 mg/L, 0.80 lb/day, daily maximum = 0.05 mg/L, 2.0 lb/day, for ammonia, monthly average = 1.0 mg/L, 48 lb/day, daily maximum = 2.0 mg/L, 96 lb/day; for winter: for chlorine, monthly average =0.01 mg/L, 0.60 lb/day, daily maximum = 0.04 mg/L, 1.7 lb/day; for ammonia, monthly average = 3.0 mg/L, 140 lb/day, daily maximum = 5.0 mg/L, 240 lb/day.

The permittee does not currently have the ability to dechlorinate the discharge or reduce ammonia levels to lessen potential toxic effects on the receiving stream. Therefore, the Department is proposing to enter into a Mutual Agreement and Order (MAO) with the permittee. The MAO includes a compliance schedule for addressing chlorine and ammonia toxicity requirements. The MAO also contains interim limits of 0.5 mg/L monthly average and 0.6 mg/L daily average (based on 3 samples per day) for residual chlorine and 25 mg/L monthly average and 30 mg/L daily maximum for ammonia. These interim limits are based on the estimated ability of the treatment plant to achieve compliance with disinfection requirements and ammonia concentration levels for the effluent.

Temperature

As indicated above, the temperature WLA limits based on a formula from the Umatilla Basin TMDL are proposed as limitations in the permit. The effluent currently causes a calculated measurable increase in the Umatilla River at the edge of the mixing zone. As long as the permittee is in compliance with the conditions of the approved TMP, the permittee will be considered to be in compliance with the temperature requirements of the proposed permit.

Mixing Zone and Zone of Immediate Dilution

In the existing permit, the allowable mixing zone is that portion of McKay Creek contained within a band extending out fifteen (15) feet from the bank of the creek at the outfall and extending to the Umatilla River. In addition, the mixing zone includes that segment of the Umatilla River that extends 200 feet downstream of the point where McKay Creek enters the river. The Zone of Immediate Dilution (ZID) shall be defined as that portion of the allowable mixing zone that is within 10% of the distance to the mixing zone boundary in any direction from the point of discharge.

In 1996, the City of Pendleton conducted a mixing zone (MZ) study for McKay Creek. However, the City and the Department do not consider the results to be valid due to dredging of lower McKay Creek since the MZ study was conducted.

The Department conducted a MZ study for McKay Creek and the Umatilla River in 1999. The results indicated that the MZ extended into the Umatilla River and that ammonia and chlorine toxicity exceeded state standards criteria in the Umatilla River.

The Department believes that the beneficial uses of the receiving stream will not be affected by the discharge and this mixing zone. It also believes that the defined mixing zone meets the criteria in the rule. However, the proposed permit contains a provision requiring the City to conduct a MZ study of McKay Creek and the Umatilla River to verify the current MZ or, if necessary, modify the defined MZ.

Biosolids

Biosolids land application and management must comply with Oregon biosolids rules and guidelines including OAR 340-050 and other applicable statutes, rules and federal regulations. Land application activities are to be conducted in accordance with an approved biosolids management plan.

Groundwater

The wastewater treatment facility must be operated and maintained in accordance with OAR 340-040 so that existing or potential uses of groundwater are not impaired.

Reclaimed Water

The permittee does not use reclaimed water.

Emergency Overflows

There are no permitted overflows.

Schedule B - Minimum Monitoring and Reporting Requirements

In 1988, the Department developed a monitoring matrix for commonly monitored parameters. Proposed monitoring frequencies for all parameters are based on this matrix and, in some cases, may have changed from the current permit. The proposed monitoring frequencies for all parameters correspond to those of facilities of similar size and complexity in the state.

The permittee is required to have a laboratory Quality Assurance/Quality Control program. The Department recognizes that some tests do not accurately reflect the performance of a treatment facility due to quality assurance/quality control problems. These tests should not be considered when evaluating the compliance of the facility with the permit limitations. Thus, the Department is also proposing to include in the opening paragraph of Schedule B a statement recognizing that some test results may be inaccurate and invalid. Such test results do not adequately represent the facility's performance, and should not be used in calculations required by the permit.

Monitoring for *E. coli* must be performed in accordance with one of the methods approved by the Department.

Total chlorine residual and chlorine used must be monitored daily.

Daily monitoring of effluent flow is required in this permit. Influent flow monitoring is not required since the flow meter does not work properly and there is little variation in influent and effluent flow. In addition, calibration of the effluent flow meter is required on a regular basis. Monitoring of pH is required three times per week. Monitoring of BOD_5 and TSS for the influent and effluent is required twice a week.

The proposed permit includes a requirement to monitor effluent weekly for ammonia-nitrogen year-round.

Temperature monitoring of the effluent is required on a daily basis during the critical period. In addition, the permittee will be required to calculate the weekly average temperature of the effluent and the maximum allowable temperature based on the TMDL.

The streams in this basin are water quality limited for temperature and may not fully support the spawning and rearing of salmonid species. This discharge has a reasonable potential to contribute heat to the water quality limited sections. Therefore, the Department is proposing to include stream monitoring for temperature and flow. Monitoring sites are to be located just upstream of the point of discharge, and downstream just outside of the mixing zone. Flow monitoring can be done at the established USGS gauges for the Umatilla River and McKay Creek. If continuous monitors are installed for the stream monitoring, then the devices must be audited (field checked for accuracy of temperature readings) in June and September, and visually checked each month to ensure that the devices are still in place, and are still submerged. An annual report summarizing the weekly averages of the maximum daily temperature readings is required for the temperature data for the effluent and for each of the two stream monitoring sites. Monitoring may be waived for some months after two full years of monitoring, providing that no weekly effluent values exceed the applicable stream temperature criteria for that month.

Because this facility is classed as a major discharger, the Department has required quarterly whole effluent toxicity (WET) or bioassay tests using three species in the proposed permit. The tests are to be begun and completed in the timeframe specified by EPA Form 2A NPDES Application, Part E. Toxicity Testing Data. The results are due at least six months before expiration of this permit. Bioassay tests are to be conducted in accordance with EPA test methods and procedural requirements as defined in Schedule D. The current permit required one bioassay test to be conducted in September 1996. In summary of the statistical analyses, the Chronic IC25 values (the concentration of effluent causing a 25 percent reduction in biological growth) for the Fathead Minnow survival and the *Ceriodaphnia dubia* survival were both >100 percent. There was however some chroinic toxicity observed in the sublethal effects of growth for the Fathead Minnow and reproduction for the *Ceriodaphnia.* The IC25 value for the Fathead Minow growth data was 90.6 percent effluent, and the IC25 value for the *Ceriodaphnia* reproduction data was 61.2 percent effluent. In addition, the *Selenastrum capricornutum* Chronic IC25 value for growth was >100 percent effluent; however, a biostimulatory effect was observed in the *Selenastrum* test, which could lead to nuisance algal growth due to the increased nutrient load caused by the effluent. Acute data was derived from the chronic data in the Fathead Minnow and *Ceriodaphnia dubia* tests. The Acute Lowest-Observed-Effect-Concentration (LOEC) determined at 48 hours for the *Ceriodaphnia* and at 96 hours for the Fathead Minnow was >100 percent effluent for both species.

The Department recognizes that the bioassay tests are quite expensive to conduct. If the results of the first year's bioassay tests show that the effluent samples are not toxic at the dilutions determined to occur at the Zone of Immediate Dilution and the Mixing Zone, no further bioassay testing will be required during this permit cycle.

Volatile solids reduction in the biosolids is the process used to demonstrate compliance with vector attraction reduction requirements. Monitoring of volatile solids reduction is proposed in the renewal permit.

Digestion of the biosolids is the process used to demonstrate compliance with pathogen reduction requirements. Monitoring the duration and temperature of biosolids digestion is proposed in the renewal permit.

EPA and state discharge monitoring reports must be submitted to the Department monthly by the 15th day of the following month. The monitoring reports need to identify the principal operators designated by the Permittee to supervise the treatment and collection systems. The reports must also include records concerning application of biosolids and all applicable equipment breakdowns and bypassing.

Schedule B of the permit includes the requirement for the submittal of annual reports. The conditions are standard language requirements concerning annual reports for inflow and infiltration removal, land application of biosolids, and industrial waste survey. An annual temperature data summary report is also required.

Schedule C - Compliance Conditions

The proposed permit includes six (6) compliance conditions with compliance deadlines. The requirements include:

The permittee shall be required to submit an updated biosolids management plan within 6 months of the permit issuance date.

The permitte will be required to submit an updated industrial waste survey within 18 months of the permit issuance date, and another update within 54 months of permit issuance.

The permittee will be required to submit an approvable mixing zone study for Department review by no later than 18 months after permit issuance.

Schedule C of the Permit includes a compliance condition requiring submittal of a report identifying known raw sewage overflow points and providing a schedule to eliminate the overflows by no later than six (6) months after permit issuance.

The permittee shall be required to submit a revised Temperature Management Plan for Department review and approval by no later than eighteen (18) months after permit issuance. This condition also contains a clause that authorizes the permittee to conduct pilot studies necessary to develop a final wastewater facility modification, design and construction proposal, to meet temperature requirements provided the planned studies are approved by the Department prior to implementation.

The final condition requires the permittee to meet the compliance dates established in this schedule or notify the Department within fourteen (14) days following any lapsed compliance date.

Schedule D - Special Conditions

The proposed permit includes a number of special conditions. The requirements include:

The permittee must have the facilities supervised by personnel certified by the Department in the operation of treatment and/or collection systems.

Schedule D of this permit includes a condition specifying the necessary procedures for conducting whole effluent toxicity testing.

Schedule D includes a condition requiring the development and implementation of a contingency plan for the prevention and handling of spills and unplanned discharges.

Schedule D of this permit includes conditions requiring the permittee to manage the land application of biosolids in accordance with the approved biosolids management plan.

The permittee will be required to conduct one priority pollutant scan during the term of the permit.

The permittee will be required to notify the DEQ Eastern Region Office of any malfunction to coordinate necessary corrective actions.

The proposed permit includes a condition in Schedule D that prohibits any adverse impact on groundwater quality.

A Temperature Management Plan has been submitted by the permittee and approved by the Department. Schedule D includes a permit condition requiring the permittee to implement the provisions of the approved Temperature Management Plan.

Appendix F

Mixing Zone Study

Appendix F

City of Pendleton, Oregon
Surface Water Mixing Zone Study

Prepared for: City of Pendleton

Prepared by: Ryan Shojinaga

Reviewed by: Preston van Meter

1.0 Background and Purpose

The City of Pendleton's (City's) Wastewater Treatment Plant (WWTP) is located at River Mile 52.0 on the peninsula between McKay Creek and the Umatilla River (the Umatilla). The WWTP currently discharges to McKay Creek approximately 500 feet before the confluence of McKay Creek and the Umatilla (Outfall 001). The location of the outfall is approximately 45° 40' 06" North and 118° 50' 21" West. The City seeks to relocate its discharge location to the confluence of McKay Creek and the Umatilla so that increased receiving water flows will allow for compliance of the discharge with the stated permit mixing zone requirements throughout the year. These locations are shown on Figure 1.

The current outfall and discharge are permitted under the National Pollutant Discharge Elimination System (NPDES) P68260 (permit), which describes the WWTP mixing zones as follows:

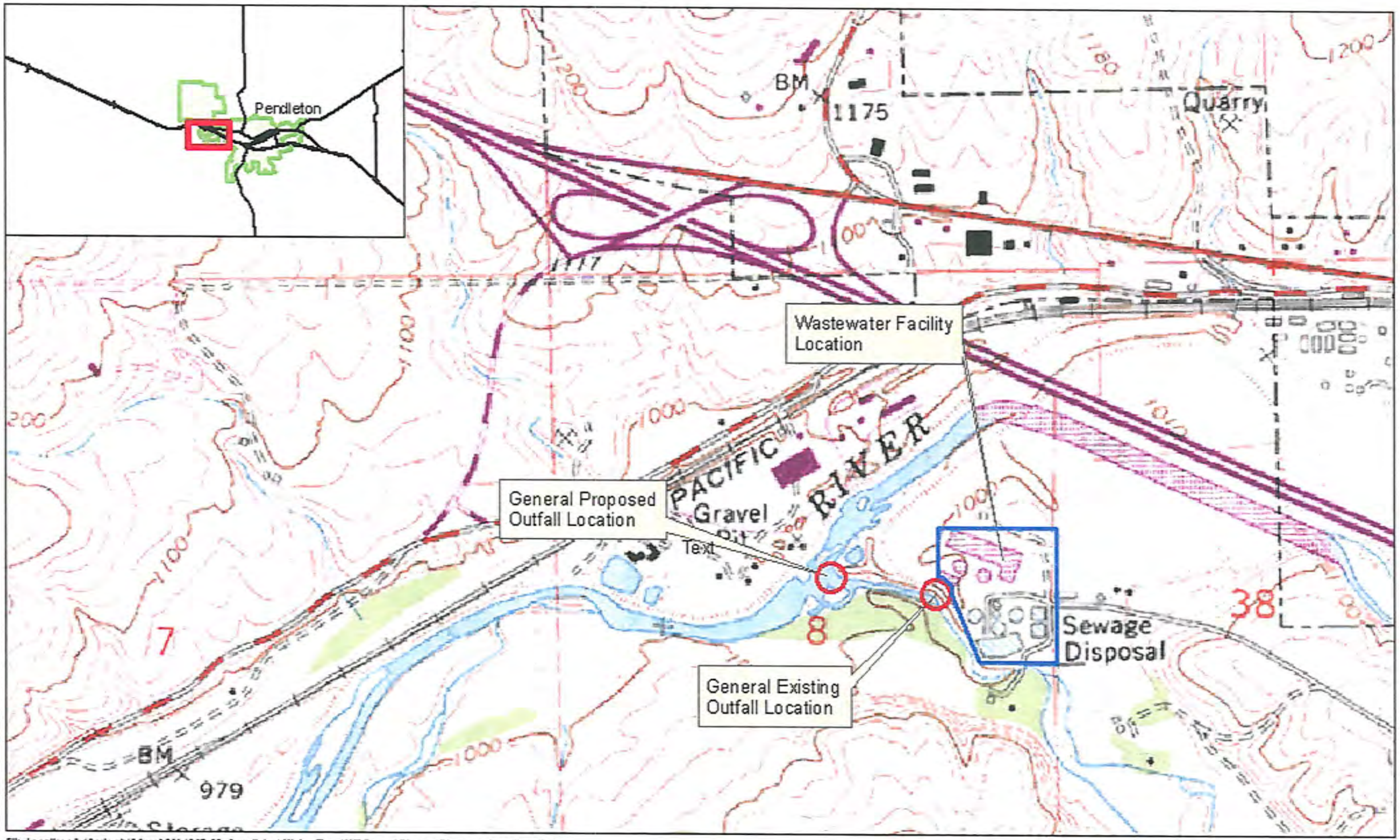
> The allowable mixing zone is that portion of McKay Creek contained within a band extending out fifteen (15) feet from the bank of the creek at the outfall and extending to the Umatilla River. In addition, the mixing zone includes that segment of the Umatilla River that extends 200 feet downstream of the point where McKay Creek enters the river. The Zone of Immediate Dilution (ZID) shall be defined as that portion of the allowable mixing zone that is within 10% of the distance to the mixing zone boundary in any direction from the point of discharge.

A previous mixing zone study was performed by Anderson Perry & Associates in 2000 for the current discharge. The previous mixing zone study predicted a dilution factor of 1 for the acute mixing zone and a dilution factor of 1 for the chronic mixing zone if the outfall were continued to be located at its current location in McKay Creek (Anderson Perry & Associates 2000).

This Mixing Zone Study provides an update to those dilution estimates given updated flow and bathymetric data in addition to estimating dilution factors and mixing area dimensions for proposed discharge facilities. Part of the additional modeling involves assessing summer and winter conditions separately due to the different seasonal flow regimes. During the summer months, McKay Creek provides the dominant flow in the Umatilla downstream of the confluence, while during winter conditions, the Umatilla provides a majority of the flows in the Umatilla downstream of the confluence.

This Mixing Zone Study has the following objectives:

1. Describe the environment into which the facility currently and proposes to discharge
2. Provide dilution factors at the Acute Mixing Zone, or Zone of Immediate Dilution (ZID), and Chronic Mixing Zone Boundary (Mixing Zone) for Outfall 001 and the proposed outfall for both summer and winter conditions
3. Provide mixing area dimensions in respect to the ZID and Mixing Zone; in particular, the percentage of stream mixing with effluent at the mixing zone
4. Describe any characteristics of mixing that have important impacts on the mixing zone
5. Conduct a reasonable potential analysis (RPA) and calculate effluent limits for constituents outlined in the permit with the updated dilution factors.



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Kennedy/Jenks Consultants

City of Pendleton Wastewater Facility Plan
Mixing Zone Study

Wastewater Facility and Outfall Location

Figure 1
K/J 0691027.00

1.1 Analysis Methodology

Kennedy/Jenks Consultants (Kennedy/Jenks) made all efforts to follow the Department of Environmental Quality's (DEQ's) *Draft Regulatory Mixing Zone Internal Management Directive* (DEQ 2006a,b). This study outlines the development of the parameters used for the modeling.

Kennedy/Jenks used CORMIX-GI Version 4.1GT to model the existing and proposed outfalls. CORMIX is not the ideal for modeling existing Outfall 001 because of the wide variability of McKay Creek bathymetry and its confluence with the Umatilla 500 feet downstream. However, for the proposed outfall, Kennedy/Jenks believes CORMIX is appropriate because of the short distances from the outfall to the ZID and mixing zone. CORMIX is reliable when used in analysis of initial momentum, which in some cases extend beyond the distance to the mixing zone.

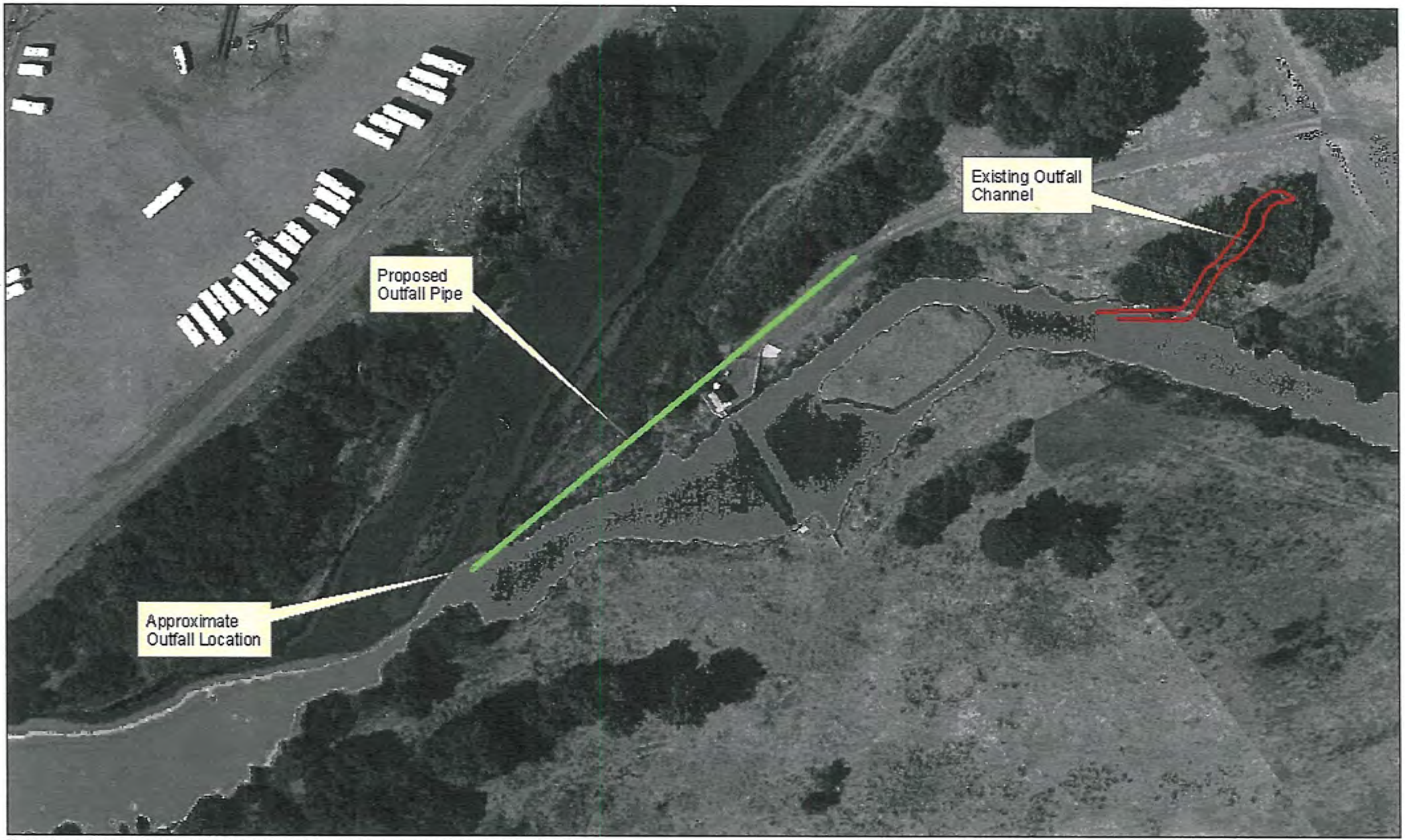
The proposed outfall will be situated at the confluence of McKay Creek and the Umatilla such that during summer months, the effluent flowpath is situated within the flow of McKay, and during the winter months, the effluent flowpath is situated within the flows of the Umatilla. The locations of the outfalls are shown on Figure 2. The modeling of the proposed outfall with regard to the ZID will require analysis of two separate flow scenarios. The first model will consist of winter conditions with flows primarily from the Umatilla and the outfall located on the left bank of the river (looking downstream). The second model will consist of the summer conditions with flows primarily from McKay and the outfall located on the right bank.

Because Outfall 001 discharges to McKay Creek, the models of Outfall 001 will consist of critical receiving water flows of McKay Creek only. For the proposed outfall, however, critical flow statistics were calculated for the combined flows of the Umatilla and McKay Creek for both winter and summer flows and conditions. Actual combined flows that were as close to the statistical flows were selected to establish seasonal flow regimes in the Umatilla River and McKay Creek.

In total, Kennedy/Jenks analyzed four different scenarios, which required four different receiving water body scenarios:

1. Existing outfall - ZID and mixing zone (winter)
2. Proposed outfall - Umatilla ZID (winter)
3. Proposed outfall - McKay Creek ZID (summer)
4. Proposed outfall - Umatilla far field for the mixing zone (winter and summer).

Kennedy/Jenks only modeled winter conditions for Outfall 001 because all real low-flow conditions in the McKay Creek during the period of record occurred during the winter (wet) months.



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Kennedy/Jenks Consultants

City of Pendleton Wastewater Facility Plan
Mixing Zone Study

Existing and Proposed Outfall Locations

Figure 2
KJ 0691027.00

2.0 Environmental Description

The designated beneficial uses of McKay Creek and the Umatilla are: public and private domestic water supply, industrial water supply, irrigation, livestock watering, anadromous fish passage, salmonid spawning and rearing, resident fish and aquatic life, wildlife and hunting, fishing, boating, water contact recreation, aesthetic quality, and hydro power.

SCWA Environmental Consultants performed an evaluation of temperature impacts to critical salmonid habitats in the areas of Outfall 001, upstream of the confluence of the Umatilla and McKay Creek, and downstream of the confluence (SCWA Consultants 2006). This evaluation included literature reviews for general and specific habitat information regarding spawning, rearing, and migration of Chinook and Coho salmon, steelhead, and bull trout. The evaluation also included a temperature model that estimated temperature increases as a result of the WWTP's discharge to the Umatilla downstream of the confluence.

The findings of the SWCA study follow:

- The areas encompassing the mixing zones contain limited or no spawning, incubation, or emergence habitat for fish. Impacts to salmonid spawning areas are likely to be minimal due to the limited quantity within the mixing zone.
- Juvenile rearing would occur within the project area based on the conditions in the river. The largest increase in temperature was modeled to occur in the fall shoulder season (October 1-15), which could result in adverse impacts to effects to rearing Coho and steelhead juveniles and adult Coho, steelhead, and fall Chinook migrants.
- All Salmonid likely migrate through the area where the WWTP's mixing zone is. Most fish complete their outmigration before 15 May, after which temperature increases may result in increased risk to juvenile migrants in the area. The largest increase in temperature was modeled to occur in the fall shoulder season (1-15 October), which could result in adverse impacts to out-migrating steelhead juveniles and adult Coho, steelhead, and fall Chinook migrants.
- Summer ambient (background) temperatures are likely already high enough to cause adverse effects to salmonids, and additional impacts resulting from WWTP would be marginal.

3.0 Model Parameters and Development

The following section discusses the development of and summarizes the CORMIX input parameters used to model mixing in the receiving water at the discharge site.

3.1 Receiving Water and Discharge Flows

For mixing analysis of the acute mixing zone, 1-day average low flows on a 10-year return period (1Q10) low flows with peak instantaneous effluent flows were modeled. The chronic mixing zone was analyzed by pairing 7-day average low flows with a return period of 10 years (7Q10) with maximum monthly effluent discharge values. Also analyzed were mixing at human health low flows at the mixing zone for both carcinogenic and non-carcinogenic constituents. For mixing of carcinogenic constituents, the 30-day average low flow with 5-year return period (30Q5) low flow was coupled with the maximum monthly effluent discharge flow values, and for non-carcinogenic constituents, the harmonic mean of the flows for the period of record were coupled with maximum monthly effluent values. The calculated statistics can be found in more detail in Attachment 1 of this document.

Kennedy/Jenks obtained surface water flow data for the critical low-flow calculations from the U.S. Bureau of Reclamation (BOR) (USBR 2007). Data for the Umatilla were gathered from the gauge in Pendleton (PDTO) upstream of the outfall, and the data for McKay Creek were collected from the gauge just downstream of the McKay Dam (MCKO).

Prior to 2001, BOR would often release very little to no water via MCKO during the winter months. In 2001, BOR began operations at MCKO with greater flows to allow for fish migration during these dry periods. Using flows in McKay Creek during these periods (2001-2006), low-flow statistics were calculated for McKay Creek alone for Outfall 001 mixing conditions. Flows for the proposed outfall consist of the combination of McKay Creek and Umatilla River flows for the same period of existing records in both water bodies (2001-2006).

3.1.1 McKay Creek for Outfall 001

The minimum flow during the period from 10/1/2001 to 9/30/2006 is 6.3 cfs. The critical low-flow statistics for McKay Creek are given in Table 1.

3.1.2 Combined Flows for Proposed Outfall

Flows in McKay Creek and the Umatilla River were coupled on a daily basis, and then statistical analysis was performed on the combined flows for critical flows in the Umatilla for the proposed outfall. For example, on 2/7/1999, average flows in McKay Creek and the Umatilla were 50.5 cfs and 100.0, respectively, for a combined flow of 150.5 cfs. Table 1 shows the critical flow statistics calculated from the combined flows from 2001 to 2006 along with the contributions from each tributary. The statistics consist of flows for summer conditions and winter conditions.

Because of the seasonal variation in flow contribution from McKay Creek and the Umatilla, and to understand how much each contributes to the flow past the confluence, each low-flow statistic was compared to flows on actual dates. The flows closest to the statistical low-flow value were selected, and the portion of contribution from McKay Creek and the Umatilla were determined. In most cases, flows were not exact, but within a small percent difference of the calculated low-flow statistic.

This method will also allow for the calculation of blended temperatures at the mixing zone. Table 1 also included the contributions from McKay Creek and the Umatilla for a given date.

Table 1: Receiving Water Flows

	Criteria	Receiving Water Flow (cfs)	Date of Flow	Flow at Date (cfs)	Umatilla Contribution (cfs)	McKay Contribution (cfs)
McKay Creek at Outfall	1Q10	6.7	11/25/02	6.5	0.0	6.5
	7Q10	7.6	12/29/00	7.8	0.0	7.8
	30Q5	9.0	11/29/05	9.5	0.0	9.5
	Human Health	20.0	11/21/01	20.0	0.0	20.0
Umatilla River Winter Conditions	1Q10	81.8	11/28/02	82.3	74.0	8.3
	7Q10	84.7	11/25/02	84.5	78.0	6.5
	30Q5	120.5	12/29/02	120.0	109.0	11.0
	Human Health	296.5	02/15/01	296.0	286.0	10.0
Umatilla River Summer Conditions	1Q10	97.5	09/25/05	97.4	44.0	53.4
	7Q10	99.7	09/18/05	99.2	45.7	53.5
	30Q5	125.6	08/27/02	125.8	33.0	92.8
	Human Health	271.1	08/31/00	271.0	41.0	230.0

Notes:

cfs - cubic feet per second.

1Q10 - Lowest 1-day average flow with a return period of 10 years.

7Q10 - Lowest 7-day average flow with a return period of 10 years.

30Q5 - Lowest 30-day average flow with a return period of 5 years.

3.1.3 Effluent Flows

Effluent flows used in this study are given in Table 2. For acute conditions, the peak instantaneous flows were used, and for chronic and human health conditions, seasonal maximum monthly flows were used (i.e., the maximum monthly wet weather flow [MMWWF] for the winter conditions, and the maximum monthly dry weather flow [MMDWF] for the summer conditions). In anticipation of growth and increased utilities demand, Kennedy/Jenks analyzed present effluent flows (Year 2006) and 20-year projected effluent flows (Year 2025).

Table 2: Effluent Flows

Season	Flow Event	Year	Effluent Flow (MGD)
Winter	MMWWF	2006	2.90
	MMWWF	2025	3.83
Summer	MMDWF	2006	2.88
	MMDWF	2025	3.80
Peak Instantaneous	PIF	2006	4.34
	PIF	2025	5.73

Notes:

MGD - Million gallons per day.
MMDWF - Maximum Monthly Dry Weather Flow.
MMWWF - Maximum Monthly Wet Weather Flow.
PIF - Peak Instantaneous Flow.

3.2 Receiving Water Channel Geometry

CORMIX requires the input of a schematized rectangular channel for its receiving water channel geometry, and this rectangular scheme consists of an average channel depth and channel width. There is the additional parameter of depth of water at the point of discharge, should it differ than the average channel depth.

The development of these receiving water body parameters was conducted using a topographic surface study of the area at and around the McKay Creek/Umatilla River confluence using a high-accuracy global positioning system (GPS) device on 2 July 2007. After creating 1-foot contours with the given topography, cross sections were developed at locations most likely to affect mixing within the channel.

Figure 3 shows the locations of these cross sections and the locations of longitudinal profiles. In most cases, cross section location coincides with location of the outfall. The exception to this is the cross section used to analyze far field mixing for the proposed outfall. The two cross sections at the proposed outfall are at different angles incident to the direction of the outfall because of the direction of flow given the different seasons and source of flow.

Figures 4 through 7 show the cross sections developed from the contours, and Figure 8 shows the longitudinal profiles of McKay Creek, the Umatilla River, and the outfall. All cross sections are shown from the perspective of looking downstream. Figures 4 through 7 also give critical flow water surface elevations for each cross section. Water surface elevations were developed by correlating flow to stage with nearby flow-stage gauges. These gauges are the same BOR gauges used for calculating low-flow statistics (PDTO and MCKO). The benchmark for each relative water surface elevation calculated by the regression analysis was the actual water surface surveyed 2 July 2007 coupled with the known flows from that day. Regression equations for the Umatilla and McKay Creek are:

$$Stage_{Umatilla} = 3.09Q^{0.078}$$

$$Stage_{McKay} = .097\sqrt{Q} - 0.08$$

where Q is the flow in the river for which the stage needs to be determined.

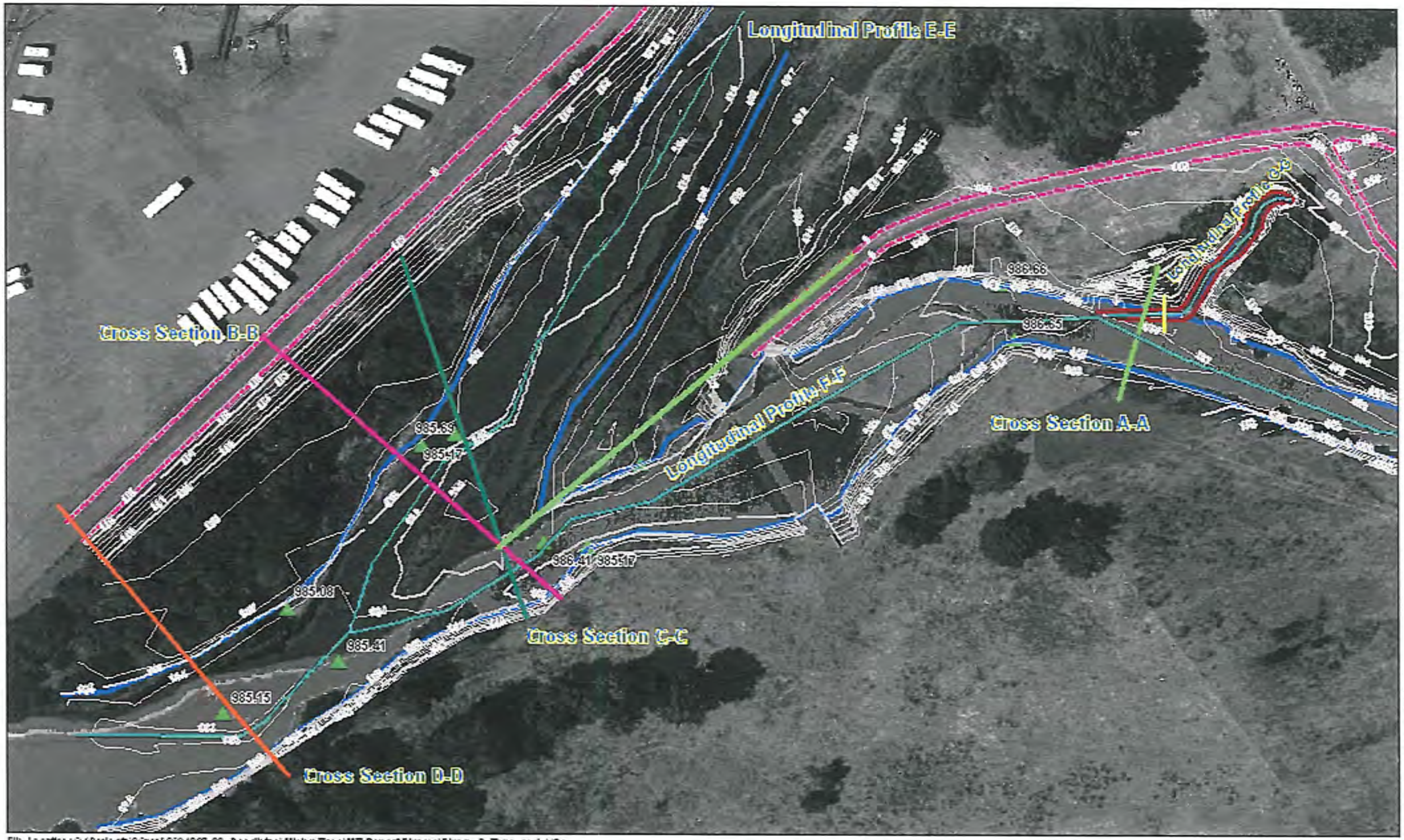
Manning's roughness coefficient was estimated to be 0.04 (Young et. al. 2001). All of the receiving water channel geometry parameters are given in Table 3.

To prevent disturbance of the surface of the water from the discharge from the pipe, Kennedy/Jenks suggests modifying the channel near the outfall due to the shallow depth of water near the location of the outfall. This will also help create a surface-impinged plume downstream, thereby creating less favorable mixing conditions. Therefore, the modeled depth of water near the outfall is likely to be approximately 2.5-3 feet during low-flow conditions.

For Outfall 001 and the far field modeling of the proposed outfall, water surface elevations also needed to be adjusted due to certain CORMIX constraints. With regard to Outfall 001, the channel depth cannot be less than the outfall channel depth, which is the case for some scenarios. Water depths for 1Q10, 7Q10, and 30Q5 scenarios were appropriately adjusted for this.

For the proposed outfall far field modeling, Kennedy/Jenks assumed the depth at discharge for all modules would be no less than 1.5 feet to accommodate the diameter of the outfall pipe. The average depth used in the ZID modeling would not be appropriate because the channel would only be excavated to a certain distance in front of the pipe (approximately 20 feet for the ZID). The channel's actual average depth would govern mixing after that. CORMIX assumes the average depth is no greater/less than 30% the depth at discharge. Average depths for 7Q10 and 30Q5 scenarios were adjusted accordingly for this.

Table 3 contains these adjusted average and discharge depths.



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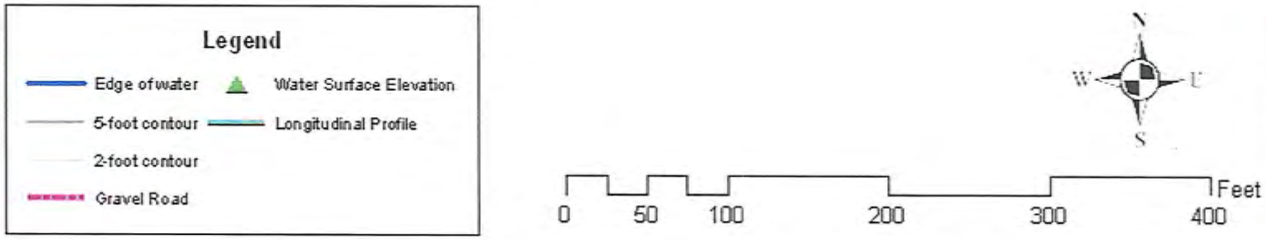


Kennedy/Jenks Consultants

City of Pendleton Wastewater Facility Plan
Mixing Zone Study

River Bathymetry and Cross Section Locations

Figure 3

KJ 0691027.00

Figure 4. Cross Section A-A - McKay Creek at Outfall

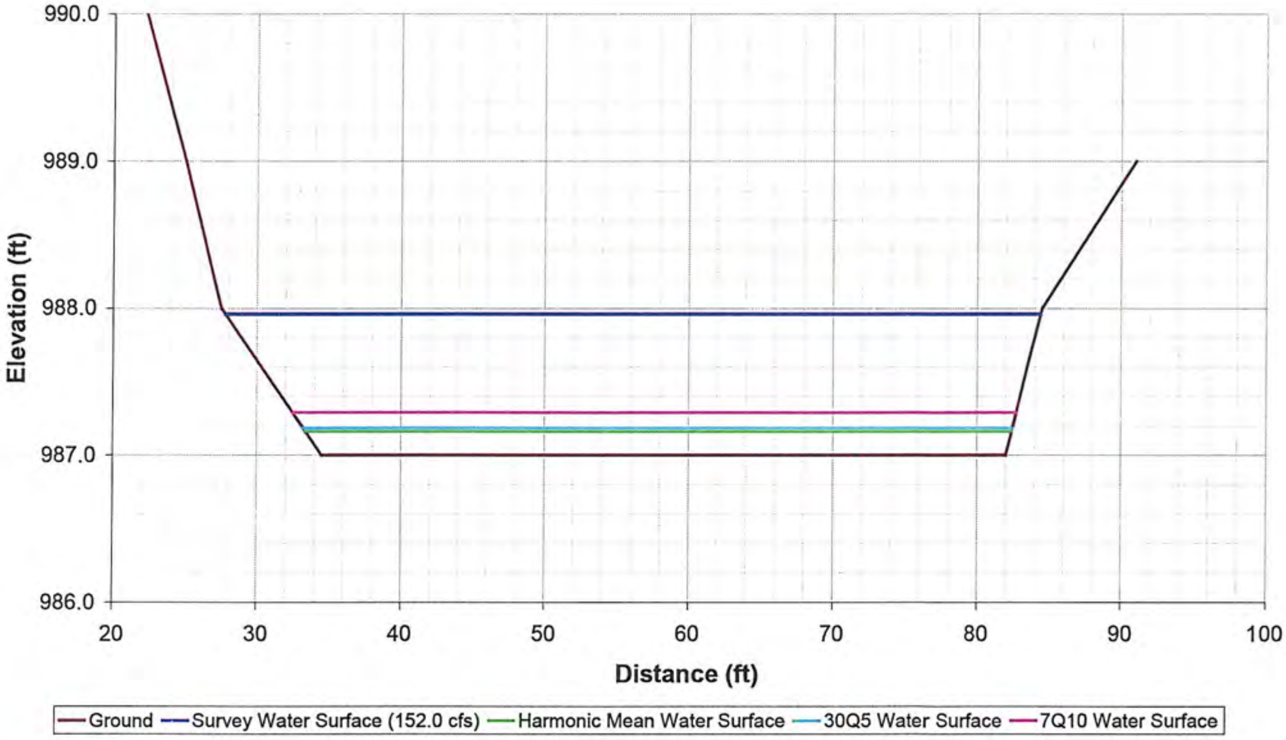


Figure 5. Cross Section B-B - Umatilla River at Proposed Outfall, ZID

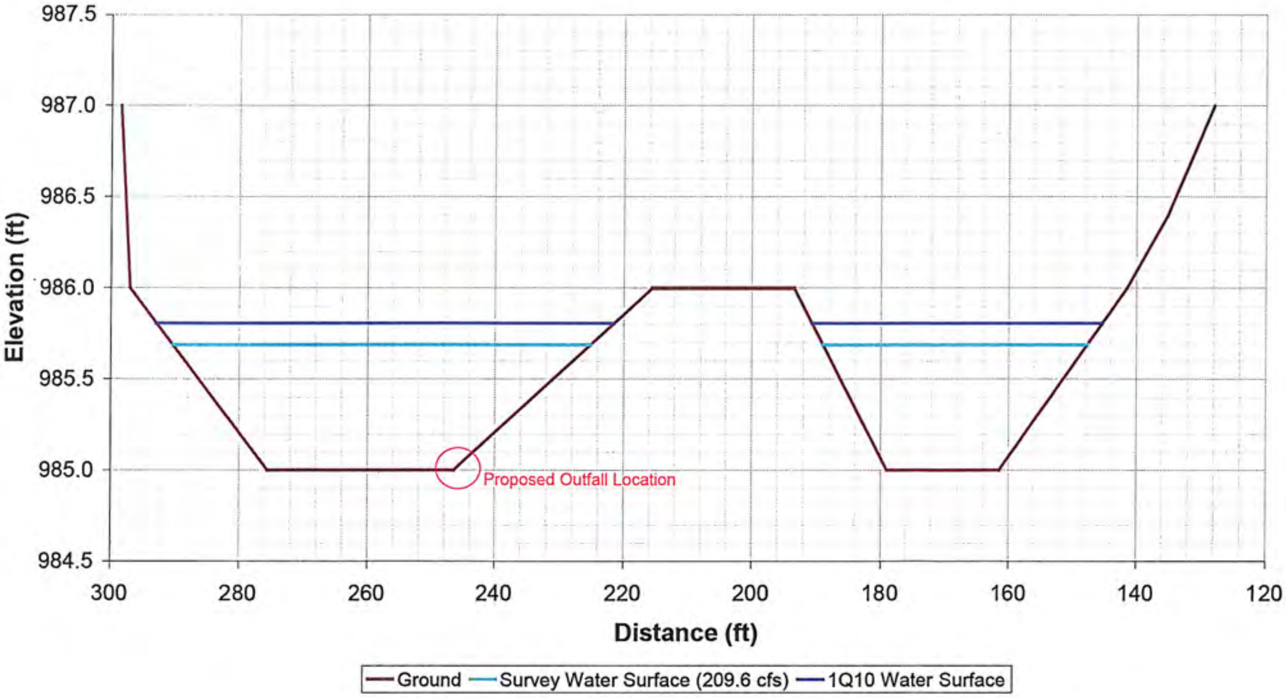


Figure 6. Cross Section C-C - McKay Creek at Proposed Outfall

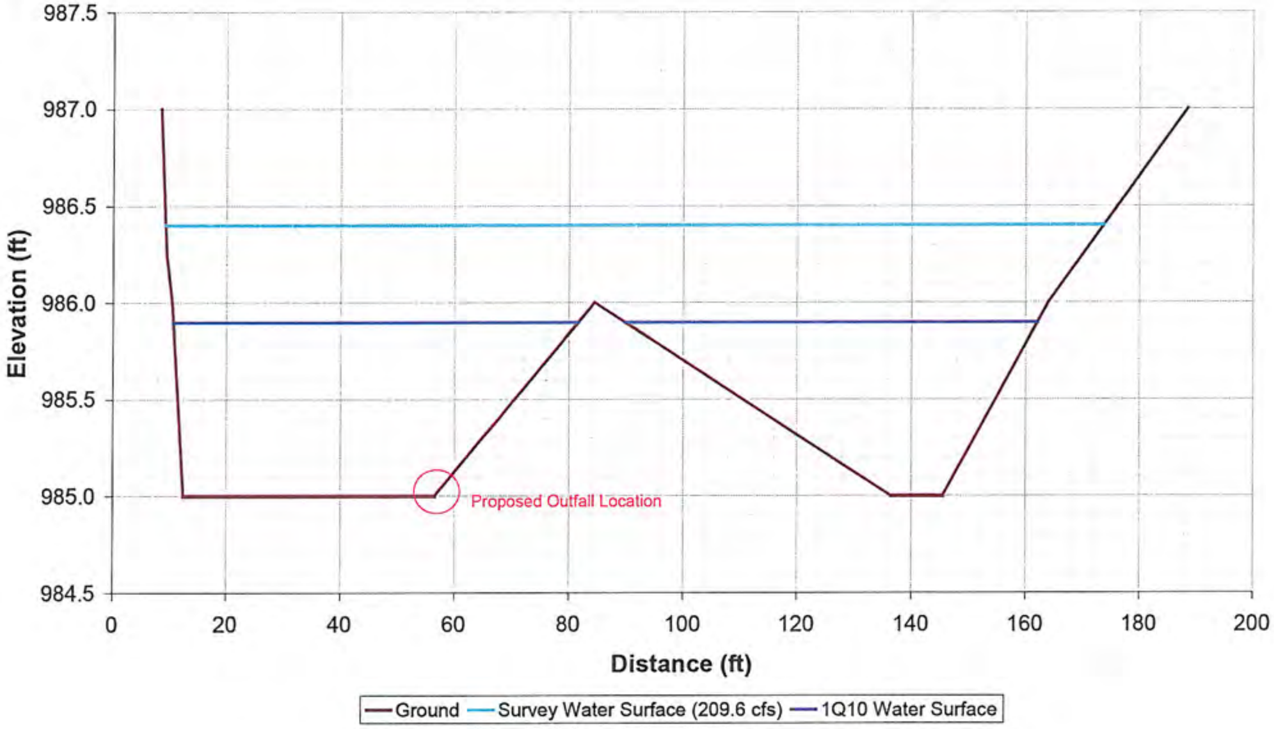


Figure 7. Cross Section D-D - Umatilla River at Mixing Zone

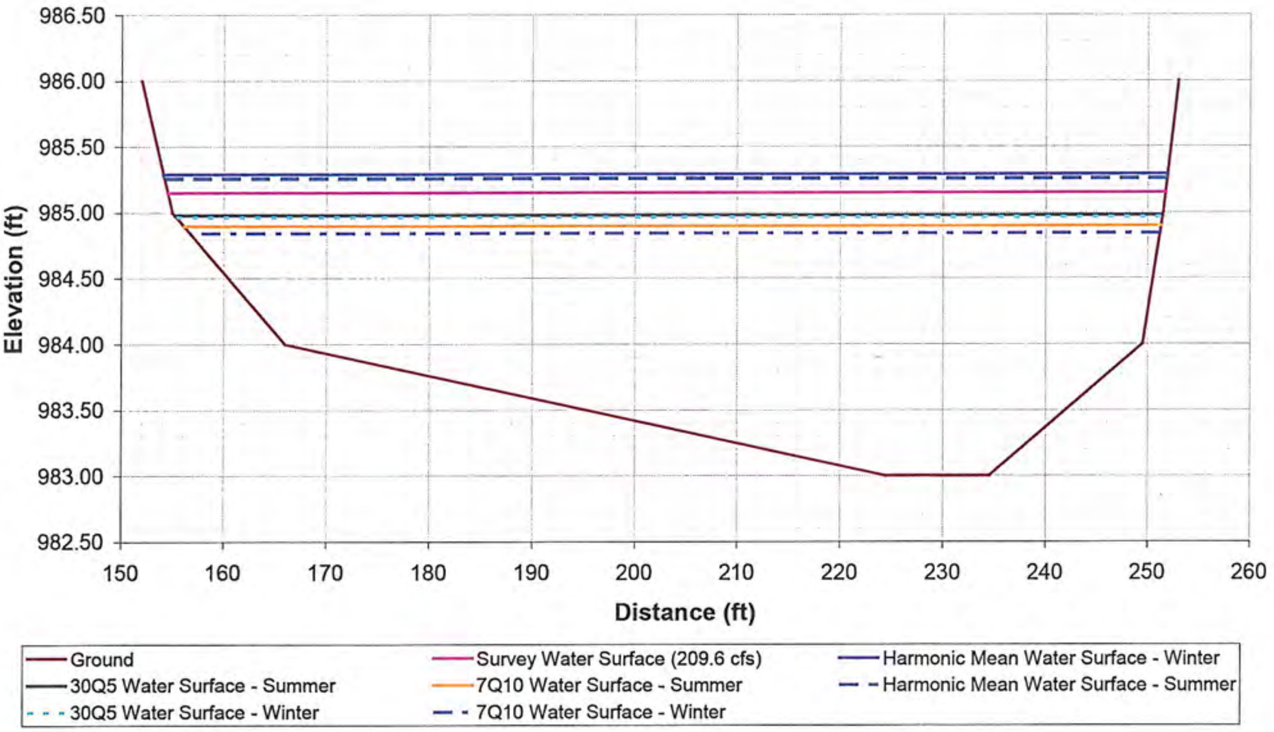


Figure 8. Longitudinal Profiles

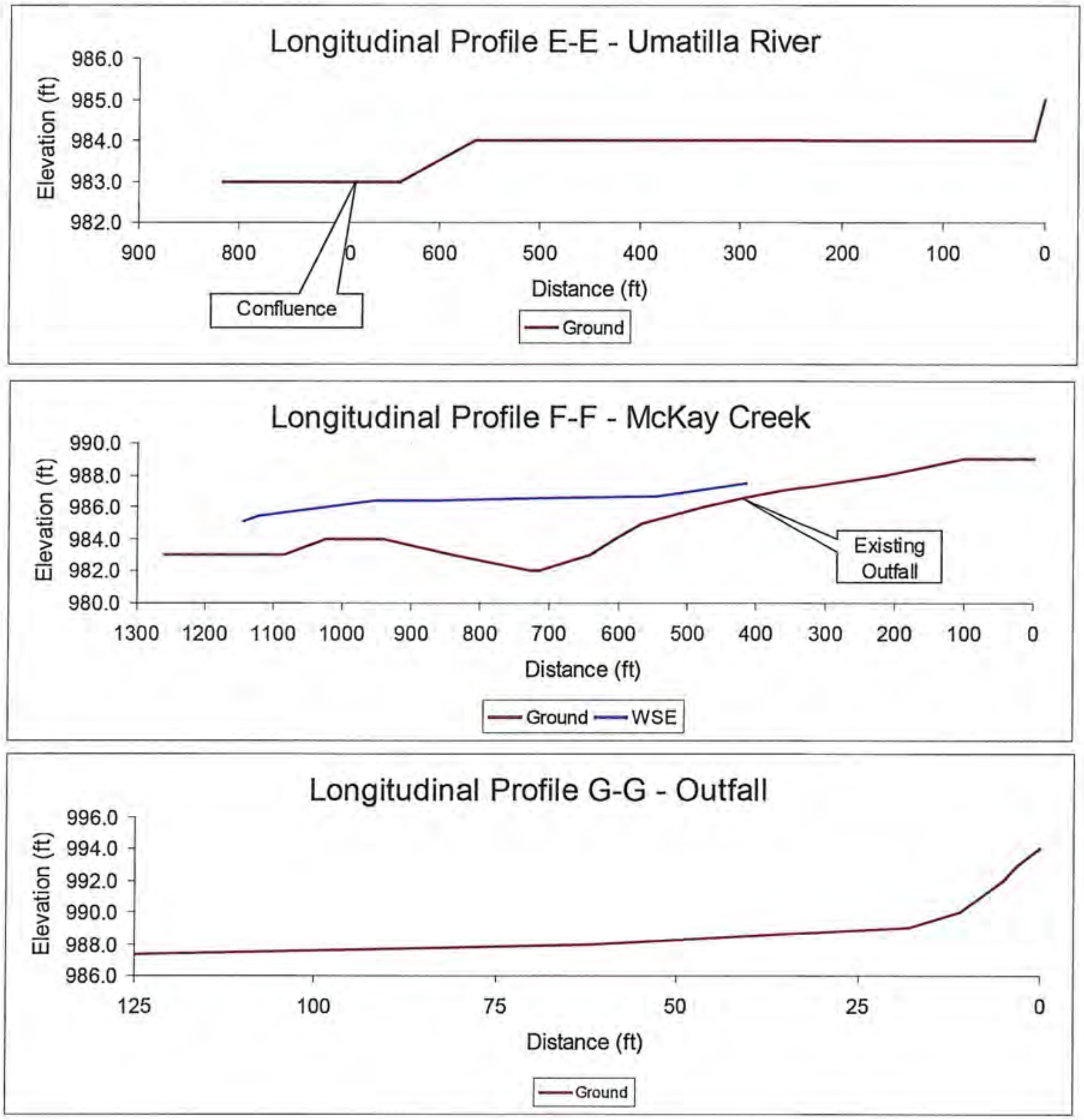


Table 3: Receiving Water Channel Geometry

Season	Criteria	Average Depth (ft)	Depth at Discharge (ft)	Width (ft)	Adjusted Average Depth (ft)	Adjusted Depth at Discharge (ft)
McKay Creek at Existing Outfall	7Q10	0.16	0.16	48.3	0.26	0.26
	30Q5	0.19	0.19	48.4	0.20	0.20
	Harmonic Mean	0.29	0.29	48.9	0.29	0.29
ZID Winter	7Q10	0.81	1.50	50.3(a)	4.50	4.50
	30Q5	0.88	1.50	52.2(a)	4.57	4.57
	Harmonic Mean	1.38	1.50	55.3(a)	5.07	5.07
ZID Summer	7Q10	0.82	1.50	56.3(a)	4.50	4.50
	30Q5	0.92	1.50	57.7(a)	4.57	4.57
	Harmonic Mean	1.40	1.50	59.6(a)	5.07	5.07
Mixing Zone	7Q10	0.86	1.50	85.9	1.16	1.50
	30Q5	1.10	1.50	87.4	1.16	1.50
	Harmonic Mean	1.90	1.90	90.9	1.90	1.90

Table 3: Receiving Water Channel Geometry

Season	Criteria	Average Depth (ft)	Depth at Discharge (ft)	Width (ft)	Adjusted Average Depth (ft)	Adjusted Depth at Discharge (ft)
McKay Creek at Existing Outfall	1Q10	0.15	0.15	48.2	0.26	0.26
	7Q10	0.16	0.16	48.3	0.26	0.26
	30Q5	0.19	0.19	48.4	0.20	0.20
	Human Health	0.29	0.29	48.9	NA	NA
Winter	1Q10	0.81	0.81	50.2[(a)]	2.50	2.50
	7Q10	1.34	1.50	89.0	NA	1.75
	30Q5	1.46	1.50	89.8	NA	1.90
	Human Health	1.79	1.79	90.7	NA	2.33
Summer	1Q10	0.90	0.90	57.5[(a)]	2.50	2.50
	7Q10	1.40	1.50	89.3	NA	1.82
	30Q5	1.48	1.50	89.9	NA	1.93
	Human Health	1.76	1.76	90.6	NA	2.29

Notes:

NA - Not adjusted.

ft - feet.

1Q10 - Lowest 1-day average flow with a return period of 10 years.

7Q10 - Lowest 7-day average flow with a return period of 10 years.

30Q5 - Lowest 30-day average flow with a return period of 5 years.

(a) Channel width modeled as unbounded.

3.2.1 Receiving Water Flow Adjustments

The velocities of the receiving water and discharge are important parameters that affect mixing efficiency. Kennedy/Jenks believes adjustments to channel geometry assuming a particular flow would warrant an adjustment of receiving water flow to maintain the same velocity within the channel. Flow is determined as the product of the cross sectional area of the wetted channel and the velocity of the fluid, or $Q = VA$, where Q is the flow in volume per unit time, V is the velocity of the fluid in distance per unit time, and A is the cross sectional area in square length units. To simulate the same velocity within the adjusted channel geometry, receiving water flows were adjusted by the ratio of the cross sectional area of the actual channel to the cross sectional area of the simplified rectangular channel.

In addition, examination of the survey and aerial photography reveal that low flow conditions during both seasons would likely produce two channels within the Umatilla at the confluence, with flow being divided between the two channels. Given the location of the proposed outfall, the ZID would be affected most by the water flowing within the inside channel and the flow from the other water body. For example, during winter months, flows would be divided into the two channels, with flows from the inside channel and McKay Creek affecting mixing. Therefore, for the winter months, flows from the Umatilla were divided according to the ratio of cross sectional area and added to the flows from McKay Creek. For the summer months, flows from McKay Creek were divided according to the ratio of cross sectional area and added to the flows from the Umatilla. For the ZID analysis, velocities were used instead of flows because the cross section at the outfall will be modeled as an unbounded channel with the outfall located approximately 50 feet from the nearest bank.

The adjusted flows are provided in Table 4.

Table 4: Adjusted Receiving Water Flows

Season	Criteria	Channel Area (sq. ft.)	Adjusted Rectangular Area (sq. ft.)	Area Ratio	Adjusted Flow (cfs)
Existing Outfall	1Q10	7.1	12.5	1.76	11.4
	7Q10	7.9	12.5	1.58	12.3
	30Q5	9.0	9.8	1.09	10.3
	Human Health	14.2	14.2	1.00	20.0
Winter	7Q10	121.7	119.5	0.98	82.9
	30Q5	133.3	131.4	0.99	118.3
	Human Health	165.2	162.5	0.98	291.2
Summer	7Q10	127.0	124.9	0.98	97.6
	30Q5	134.9	133.1	0.99	124.1
	Human Health	162.0	159.4	0.98	266.7

		Channel Area (sq. ft.)	Flow (cfs)	Velocity (ft/s)
Umatilla ZID	1Q10	40.5	53.8	1.3
McKay Creek ZID	1Q10	51.7	75.3	1.5

Notes:

cfs - cubic feet per second.

ft/s - feet per second.

sq. ft. - square feet.

1Q10 - Lowest 1-day average flow with a return period of 10 years.

7Q10 - Lowest 7-day average flow with a return period of 10 years.

30Q5 - Lowest 30-day average flow with a return period of 5 years.

3.3 Temperature, Wind Speed, and Other Environmental Data

Temperature is an important parameter for water quality, particularly with respect to habitat in the water and gravel column in surface waters. Temperature can also be an important component to hydrodynamics in mixing in surface water. Changes in temperature and differentials between effluent and receiving water temperatures are important in determining efficiency and extent of mixing.

Receiving and effluent water temperatures represent the actual average temperatures recorded in conjunction with flow data collected by BOR (USBR 2007) on the dates receiving water flows were selected.

Wind speed data were taken from the Western Regional Climate Center at Pendleton Airport's weather station (Western Regional Climate Center 2007). Wind speed data are average monthly values from the months of the dates for which receiving water flows were selected.

Table 5 provides these temperature and environment data. Kennedy/Jenks believes the variability in the summer and winter effluent and receiving waters temperatures represent a cross section of conditions sufficient to assess the variability in temperature's possible impacts to mixing.

The final two environmental parameters related to the channel are Manning's channel roughness factor, *n*, and sinuosity, or the degree to which the channel meanders within the floodplain. For Manning's roughness coefficient, we used a value of 0.04 based on literature values in combination with IMD guidance (DEQ 2006a,b). For sinuosity, CORMIX requires the input of this parameter as a qualitative measurement. The values for this are uniform, or fairly straight; slight meander with a non-uniform channel; and highly irregular. We chose slightly meandering because the channel has more sinuosity than a straight channel, but it is not highly sinuous.

Table 5: Water Temperature and Wind Speed Data

Season	Criteria	Receiving Water Temperature (°F)	Effluent Temperature (°F)	Wind Speed ft/s
Outfall 001	1Q10	54.5	61.5	3.4
	7Q10	44.2	59.7	3.3
	30Q5	54.5	61.5	3.4
	Human Health	54.5	61.5	3.4
Winter (Umatilla)	1Q10	43.6	61.5	3.4
	7Q10	49.3	61.5	3.4
	30Q5	43.7	59.7	3.3
	Human Health	43.8	56.1	3.6
Summer (McKay)	1Q10	60.2	72.9	3.8
	7Q10	68.4	72.9	3.8
	30Q5	71.2	76.5	4.1
	Human Health	69.7	76.5	4.1

Notes:

°F - Degrees Fahrenheit.

ft/s - Feet per second.

1Q10 - Lowest 1-day average flow with a return period of 10 years.

7Q10 - Lowest 7-day average flow with a return period of 10 years.

30Q5 - Lowest 30-day average flow with a return period of 5 years.

3.4 Discharge Facilities Geometry

The discharge facilities geometry is an important input parameter to the CORMIX model, which has three modules:

- CORMIX 1 simulates single-port, submerged outfalls
- CORMIX 2 simulates multi-port, submerged outfalls
- CORMIX 3 simulates open channel outfalls, and can also be applied to shallowly submerged pipe outfalls.

Each module has similar channel and environmental input parameters, but the outfall parameters are unique to each outfall type. The following sections summarize how the existing and proposed site conditions were modeled.

3.4.1 Existing Discharge Facilities

Outfall 001 is a 36-inch concrete pipe that discharges to an open channel before entering McKay Creek. During low flow conditions, the open channel is redirected by a gravel bar just prior to entering McKay Creek, as shown on Figure 9. The angle of the outfall channel incident to McKay Creek is approximately 20 degrees. The cross section of the outfall and water surface elevations is shown on Figure 10. The water surface elevations were calculated in the same manner as the receiving water channel with a Manning's *n* of 0.04. Table 6 provides a summary of the outfall input parameters, most of which are based on the effluent flow amounts in the channel.

Table 6: Existing Outfall Geometry

Critical Flow	Year	Effluent Flow (cfs)	Depth @ Disch (ft)	Channel Depth (ft)	Chan. Width (ft)	Hor. Angle, σ (degrees)
1Q10	2006	4.34	0.26	0.22	4.4	20
	2025	5.73	0.26	0.26	5.2	20
7Q10	2006	2.90	0.26	0.17	3.4	20
	2025	3.83	0.26	0.20	4.0	20
30Q5	2006	2.90	0.20	0.17	3.4	20
	2025	3.83	0.20	0.20	4.0	20
Human Health	2006	2.90	0.29	0.17	3.4	20
	2025	3.83	0.29	0.20	4.0	20

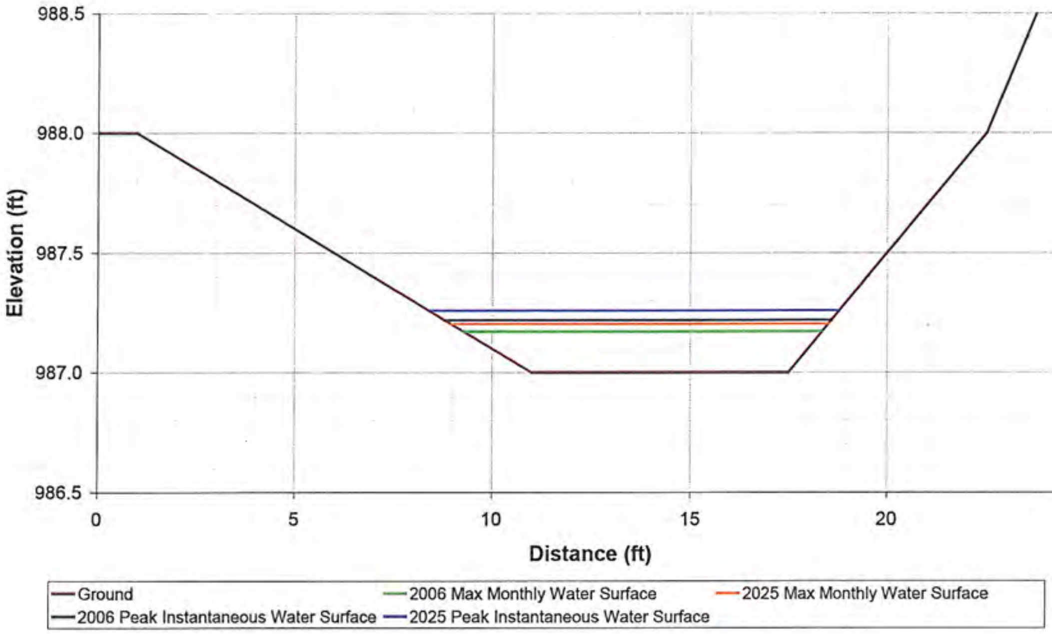
Notes:

cfs - Cubic feet per second.

ft - Feet.

Figure 9. Existing Outfall Channel

Figure 10. Cross Section H-H - Outfall



3.4.2 Proposed Discharge Facility Configurations

The proposed outfall is an 18-inch submerged pipe at the confluence of the Umatilla and McKay Creek. The angle of the outfall incident to the channel, regardless of the season, will be approximately 20 degrees. The pipe will lie horizontally, and the distance from the bank for the far field modeling will vary according to the depth of water and width of the channel. This will be maximized in CORMIX as much as possible because the location is not exactly determined. In no instance is this distance greater than 9 feet. During summer discharge, the effluent flowpath would be located on the right bank (looking downstream), and during winter discharge the effluent flowpath would be located on the left bank. Table 7 summarizes the proposed outfall input parameters.

Figure 11 shows a profile view of the outfall and the area around the outfall, including the existing ground and the area to be excavated. The distance into the stream is approximate, and will depend on a more detail survey of the area.

Table 7: Proposed Outfall Geometry

	Critical Flow	Depth @ Disch (ft)	Bottom Inv Depth (ft)	Distance from Bank (ft)	Horizontal Angle (degrees)
Winter	1Q10	2.5	2.0	8.6	20
	7Q10	1.7	1.7	6.3	20
	30Q5	1.9	1.9	5.5	20
	Harmonic Mean	2.3	2.0	4.4	20
Summer	1Q10	2.5	2.0	7.4	20
	7Q10	1.8	1.8	6.0	20
	30Q5	1.9	1.9	5.4	20
	Harmonic Mean	2.3	2.0	3.9	20

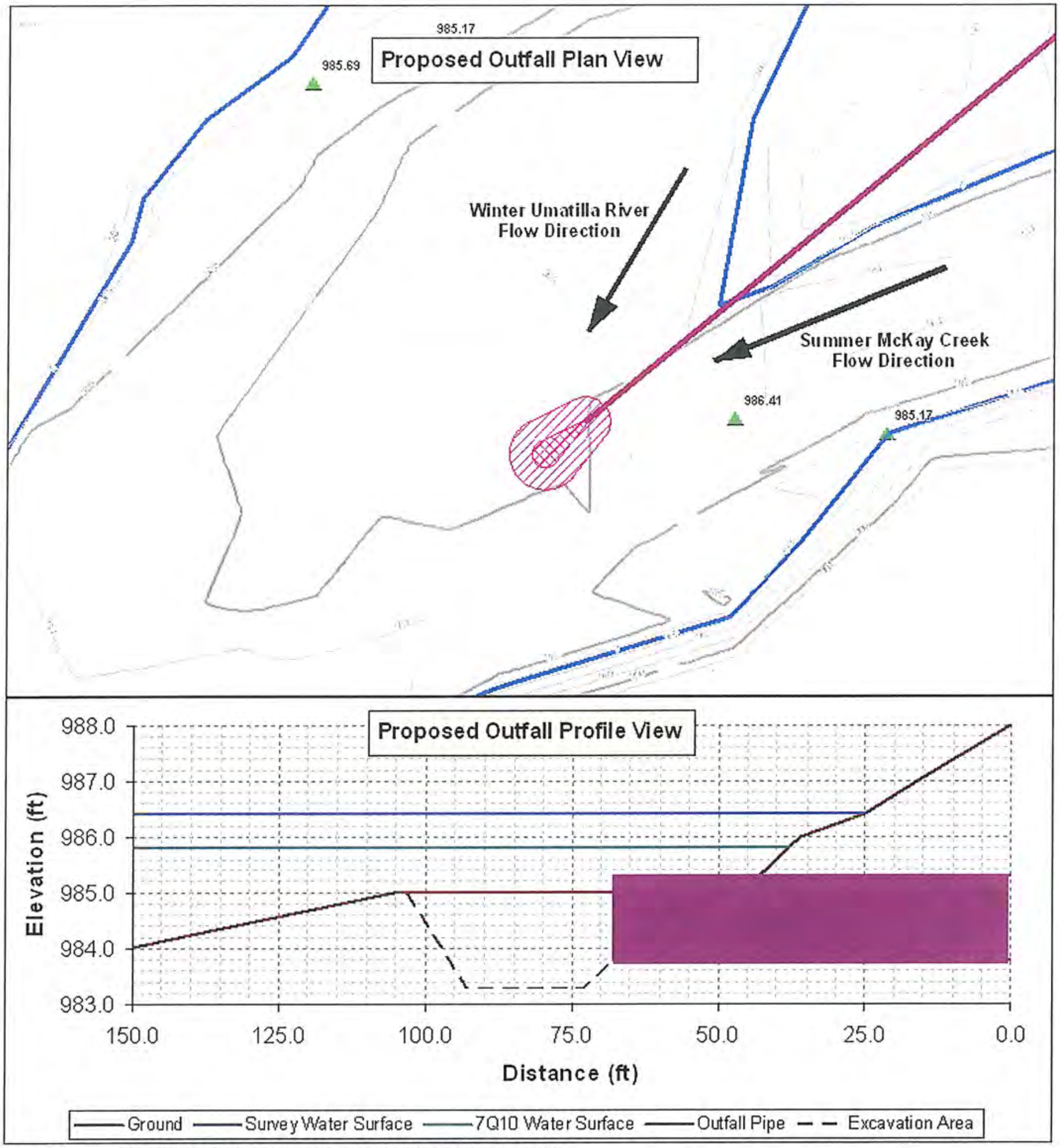
Notes:

ft - Feet.

1Q10 - Lowest 1-day average flow with a return period of 10 years.

7Q10 - Lowest 7-day average flow with a return period of 10 years.

30Q5 - Lowest 30-day average flow with a return period of 5 years.



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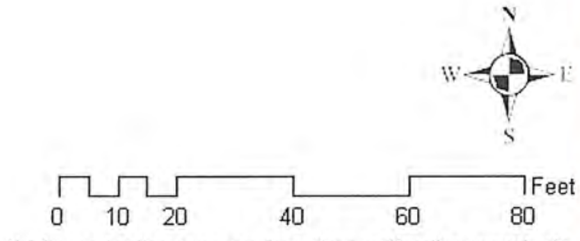


Not for construction purposes; dimensions and location approximate

Kennedy/Jenks Consultants

City of Pendleton Wastewater Facility Plan
Mixing Zone Study

Proposed Outfall
Plan and Profile Views

Figure 11
K/J 0691027.00

4.0 Model Results

The results of the mixing zone analysis are summarized in Tables 8 through 11 and represented graphically on Figures 12 and 13. The ZIDs and plume boundaries for existing and proposed outfalls are provided in Table 8. Table 9 provides the dilution factors and plume dimensions for the mixing at the confluence of the Umatilla and McKay Creek. Due to the complex hydrodynamics at the confluence, Kennedy/Jenks believes results past the confluence would be unreliable. Table 9 also reports percent of the stream mixing with discharge at the confluence, which is calculated using

$$\text{Percent Mixing} = \frac{DF * Q_e * 100}{Q_s}$$

where DF is the centerline dilution factor, Q_e is the flow of effluent (cfs), and Q_s is the receiving water flow (cfs) (Oregon DEQ 2006b). Based on the ZID results reported in Table 8, all of the plumes are fully vertically mixed within the region prior to the confluence.

Table 10 shows the mixing zone dilution factors for seasonal models and critical flow and effluent values. Again, the percentage of the stream mixing with the discharge is reported for each scenario. Unlike Outfall 001, none of the scenarios result in 100 percent of the receiving water mixing with the discharge. Three scenarios demonstrated a percent mixing with of receiving water with the effluent of greater than 25 percent at the mixing zone boundary. The shortest distance to 25 percent mixing results from the winter 2025 maximum monthly wet weather flow mixing with the 7Q10 low flow, and the distance to that is approximately 100 feet. For all scenarios, location of the 25 percent mixing and corresponding dilution factor are provided. Both present-day models of 7Q10 mixing zones demonstrated less than 25% mixing with the receiving waters at the mixing zone boundary.

Finally, Table 11 gives characteristics of the chronic mixing zone plumes for the existing and proposed outfalls. For all scenarios, long distances to the edge of near field are predicted. CORMIX accounts for buoyancy and boundary interactions in addition to initial momentum in its prediction of dilution and near field length. Stratification or persistent interaction with a boundary will likely increase the length of the near field. The likely causes of such long near-field distances for this modeling effort are due to boundary attachment and persistent buoyancy effects from temperature.

The proposed outfall will demonstrate shorter near-field distances, which suggest less attachment to the boundaries. This can be expected because the outfall is situated farther from the shore, and has greater initial momentum.

Table 8: Zone of Initial Dilution, Dilution Factors and Plume Dimensions

Season	Year	Distance to ZID (ft)	Dilution Factor	Mixing Area Width[(a)] (ft)
Existing Outfall	2006	75	1.5	FHM[(b)]
	2025	75	1.5	FHM[(b)]
Winter	2006	20	1.9	3.8
	2025	20	2.0	4.2
Summer	2006	20	1.9	3.6
	2025	20	2.0	4.0

Notes:

ft - Feet.

FHM - Fully Horizontally Mixed (mixed fully across stream width)

ZID - Zone of Immediate Dilution.

(a) Concentration at edge is 10% of the centerline concentration.

(b) All plumes demonstrate bottom attachment.

Table 9: Existing Outfall Mixing Zone Dilution Factors and Plume Dimensions

Season	Receiving Criteria	Year	Dilution Factor	At the Confluence Mixing Zone Stream % (%)	Mixing Area Width[(a)] (ft)
Winter	7Q10	2006	2.4	100%	31
	7Q10	2025	2.4	100%	37
	30Q5	2006	4.1	100%	FHM[(b)]
	30Q5	2025	5.7	100%	FHM[(b)]
	Human Health	2006	4.7	100%	42
	Human Health	2025	9.2	100%	FHM[(b)]

Notes:

ft - Feet.

FHM – Fully Horizontally Mixed (mixed fully across stream width)

7Q10 - Lowest 7-day average flow with a return period of 10 years.

30Q5 - Lowest 30-day average flow with a return period of 5 years.

(a) Concentration at edge is 10% of the centerline concentration.

(b) Fully horizontally mixed across the channel.

Table 10: Proposed Outfall Mixing Zone Dilution Factors and Plume Dimensions

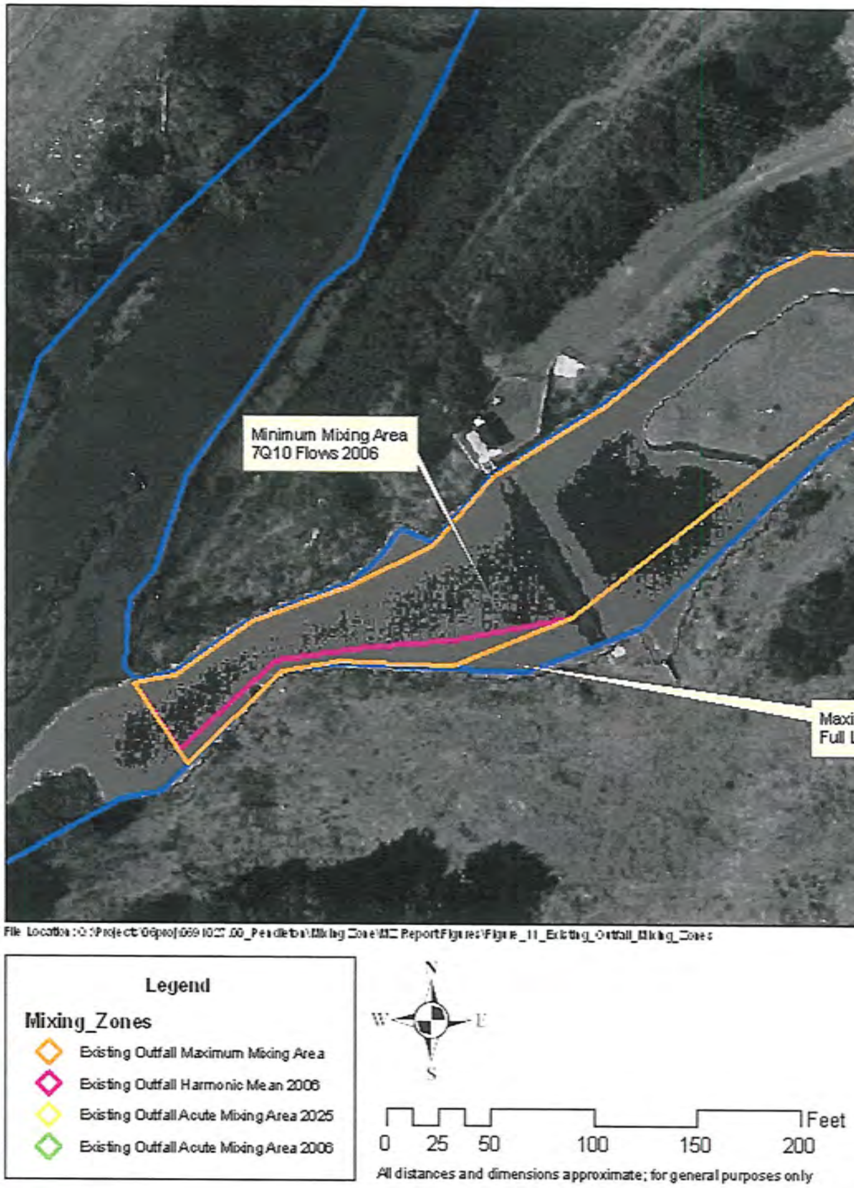
Season	Receiving Criteria	Year	Dilution Factor	Mixing Zone Stream % (%)	Distance to 25% Mixing (ft)	Dilution at 25% mixing	Mixing Area Width[(a)] (ft)	Mixing Area Depth (ft)
Winter	7Q10	2006	4.2	22%	237	4.7	32.5	1.7
	7Q10	2025	4.3	30%	105	3.6	37.0	1.7
	30Q5	2006	5.5	20%	632	6.6	33.0	1.9
	30Q5	2025	5.5	27%	192	5.0	33.0	1.9
	Human Health	2006	7.4	11%	> 1,000	> 7.4	19.9	2.3
	Human Health	2025	4.7	9%	> 1,000	> 4.7	17.3	2.3
Summer	7Q10	2006	4.1	18%	766	5.5	16.4	1.8
	7Q10	2025	4.3	25%	178	4.2	20.8	1.8
	30Q5	2006	4.7	17%	> 1,000	> 4.7	17.0	1.9
	30Q5	2025	4.3	20%	599	5.3	17.2	1.9
	Human Health	2006	6.5	11%	> 1,000	> 6.5	10.8	2.3
	Human Health	2025	4.9	11%	> 1,000	> 4.9	10.6	2.3

Notes:

ft - Feet.

7Q10 - Lowest 7-day average flow with a return period of 10 years.

30Q5 - Lowest 30-day average flow with a return period of 5 years.



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City of Pendleton Wastewater Facility Plan
Mixing Zone Study

ZID and Mixing Zone Boundaries
Existing Outfall in McKay

Figure 12

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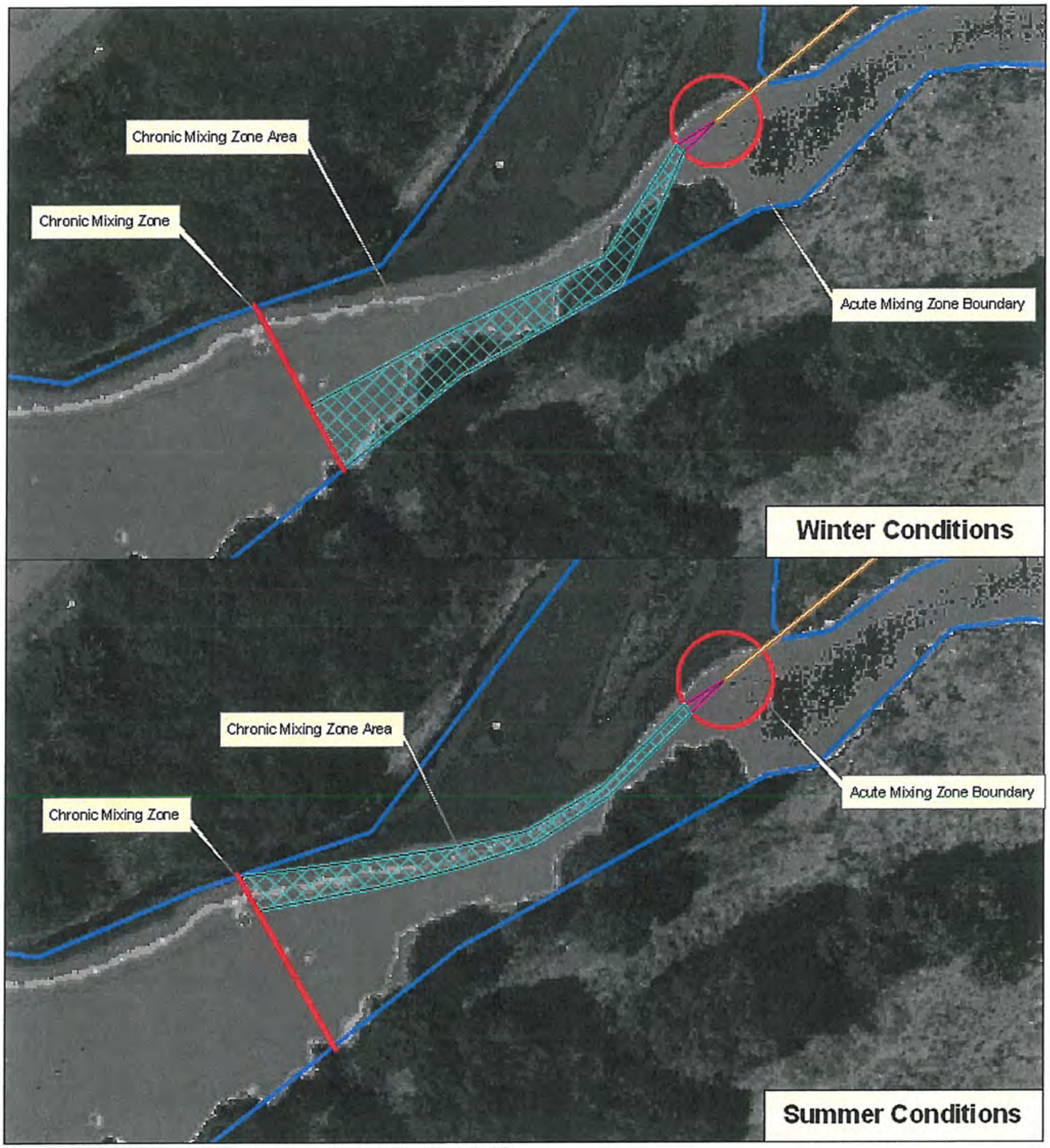

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All distances and locations approximate; for general purposes only

Kennedy/Jenks Consultants

City of Pendleton Wastewater Facility Plan
Mixing Zone Study

ZID and Mixing Zone Boundaries
Proposed Outfall in the Umatilla

Figure 13

K/J 0691027.00

Table 11: Mixing Characteristics

Season	Critical Flow	Year	Potential Bank Interaction (ft)	Edge of Near Field (ft)
Existing Outfall	**1Q10**	2006	Bottom/Bank	159
		2025	Bottom/Bank	70
	7Q10	2006	Bottom/Bank	220
		2025	Bottom/Bank	297
	30Q5	2006	Bottom/Bank	274
		2025	Bottom/Bank	274
	Human Health	2006	Bottom/Bank	205
		2025	Bottom/Bank	207
Winter	**1Q10**	2006	NA	184
		2025	NA	242
	7Q10	2006	NA	230
		2025	NA	303
	30Q5	2006	NA	178
		2025	NA	178
	Human Health	2006	NA	96
		2025	NA	126
Summer	**1Q10**	2006	NA	159
		2025	NA	210
	7Q10	2006	NA	203
		2025	NA	268
	30Q5	2006	NA	171
		2025	NA	225
	Human Health	2006	NA	96
		2025	NA	126

Notes:

ft - Feet.

NA – No attachment.

1Q10 - Lowest 1-day average flow with a return period of 10 years.

7Q10 - Lowest 7-day average flow with a return period of 10 years.

30Q5 - Lowest 30-day average flow with a return period of 5 years.

5.0 Conclusions

Outfall 001 does not meet the mixing zone requirements of 25 percent mixing of receiving water and discharge within the permit-prescribed boundaries according to the results estimated by CORMIX. The proposed outfall located at the confluence of McKay Creek and the Umatilla is predicted to meet area mixing zone requirements in most cases for current conditions, with some difficulties projected for future conditions, particularly in critical low flow conditions.

The proposed outfall performs better than Outfall 001 because the proposed outfall is located farther from the shore, has greater initial momentum, and more rapid mixing in the greater flows of the Umatilla. In addition, the new location results in a smaller percentage of the Umatilla mixing with the discharge at the mixing zone boundary. If necessary, relocation of the mixing zone to the distance from the outfall that represents the shortest distance to 25 percent mixing is a possibility.

The modeling of this complex system with CORMIX is difficult for several reasons. CORMIX is not necessarily suited to model submerged outfalls that are not deep enough to be modeled with the CORMIX 1 module or shallow enough to be modeled with the CORMIX 3 module. The consequence of that is perhaps an over-prediction of dilution within the ZID for the proposed outfall.

Kennedy/Jenks would suggest considering additional three-dimensional modeling to better capture the complex hydraulics of the system. Another possible option for increasing confidence in purported available dilution for Outfall 001 and the proposed outfall would be to conduct a tracer dye study of the two locations.

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Appendix F - Attachment 1 - Low Flow Statisctics For McKay Creek and Umatilla River

Summarized in the tables below are the statistics calculated for low flow conditions used in the mixing zone analysis. The distribution used for these calculations is the Log-Pearson Type III.

Summer Combined Flows (Umatilla River and McKay Creek)												
Flow (cfs)	Year	Rank	Probability	z value	Ln(Q)	Mean	SD	Skew	Prob	K	ln(Q)	Q
1-Day Minimum												
94.6	2005	1	0.083	-1.383	4.550	4.886	0.239	0.013	0.1	-1.28155	4.58	97.5
107.9	2002	2	0.222	-0.765	4.681							
117.0	2003	3	0.361	-0.355	4.762							
138.0	2001	4	0.500	0.000	4.927							
138.8	2004	5	0.639	0.355	4.933							
173.0	2006	6	0.778	0.765	5.153							
181.0	2000	7	0.917	1.383	5.198							
7-Day Minimum												
96.2	2005	1	0.083	-1.383	4.566	4.923	0.247	-0.103	0.1	-1.30105	4.60	99.7
111.3	2002	2	0.222	-0.765	4.712							
121.3	2003	3	0.361	-0.355	4.798							
140.0	2001	4	0.500	0.000	4.942							
150.6	2004	5	0.639	0.355	5.014							
183.3	2006	6	0.778	0.765	5.211							
184.3	2000	7	0.917	1.383	5.216							
30-Day Minimum												
100.2	2005	1	0.083	-1.383	4.608	5.049	0.273	-0.687	0.2	-0.79002	4.83	125.6
119.2	2002	2	0.222	-0.765	4.781							
153.6	2003	3	0.361	-0.355	5.034							
155.2	2001	4	0.500	0.000	5.044							
191.1	2004	5	0.639	0.355	5.253							
198.0	2006	6	0.778	0.765	5.288							
207.3	2000	7	0.917	1.383	5.334							

Winter Combined Flows (Umatilla River and McKay Creek)

Flow (cfs)	Year	Rank	Probability	z value	Ln(Q)	Mean	SD	Skew	Prob	K	ln(Q)	Q
1-Day Minimum												
80.0	2003	1	0.083	-1.383	4.382	4.799	0.310	0.112	0.1	-1.27037	4.40	81.8
88.2	2006	2	0.222	-0.765	4.479							
109.7	2004	3	0.361	-0.355	4.698							
124.1	2005	4	0.500	0.000	4.821							
133.8	2002	5	0.639	0.355	4.896							
155.2	2001	6	0.778	0.765	5.045							
194.4	2007	7	0.917	1.383	5.270							
7-Day Minimum												
80.9	2003	1	0.083	-1.383	4.393	4.909	0.355	-0.483	0.1	-1.32309	4.44	84.7
89.6	2006	2	0.222	-0.765	4.495							
128.5	2005	3	0.361	-0.355	4.856							
146.4	2004	4	0.500	0.000	4.986							
160.0	2001	5	0.639	0.355	5.075							
184.0	2002	6	0.778	0.765	5.215							
209.5	2007	7	0.917	1.383	5.345							
30-Day Minimum												
88.3	2003	1	0.083	-1.383	4.480	5.074	0.379	-1.074	0.2	-0.74537	4.79	120.5
98.3	2006	2	0.222	-0.765	4.588							
167.7	2005	3	0.361	-0.355	5.122							
199.2	2001	4	0.500	0.000	5.294							
199.8	2004	5	0.639	0.355	5.297							
213.5	2007	6	0.778	0.765	5.363							
216.0	2002	7	0.917	1.383	5.375							

Existing Outfall McKay Creek Only

Flow (cfs)	Year	Rank	Probability	z value	Ln(Q)	Mean	SD	Skew	Prob	K	ln(Q)	Q
1-Day Minimum												
6.3	2003	1	0.097	-1.300	1.841	2.102	0.149	-1.230	0.2	-1.33904	1.90	6.7
7.6	2001	2	0.258	-0.649	2.028							
8.4	2006	3	0.419	-0.204	2.128							
8.7	2005	4	0.581	0.204	2.163							
9.0	2004	5	0.742	0.649	2.194							
9.6	2002	6	0.903	1.300	2.257							
7-Day Minimum												
7.6	2001	1	0.097	-1.300	2.034	2.160	0.104	-0.315	0.2	-1.31671	2.02	7.6
7.7	2003	2	0.258	-0.649	2.039							
8.6	2006	3	0.419	-0.204	2.153							
9.2	2005	4	0.581	0.204	2.215							
9.3	2004	5	0.742	0.649	2.231							
9.8	2002	6	0.903	1.300	2.286							
30-Day Minimum												
8.2	2001	1	0.097	-1.300	2.106	2.241	0.072	-1.629	0.2	-0.65959	2.19	9.0
9.2	2006	2	0.258	-0.649	2.224							
9.4	2005	3	0.419	-0.204	2.242							
9.8	2004	4	0.581	0.204	2.279							
9.9	2002	5	0.742	0.649	2.296							
9.9	2003	6	0.903	1.300	2.296							

Appendix G

Summary of NPDES Permit Fees

OAR 340-045-0075: Permit Fee Schedule

Table 70A: Industrial NPDES & WPCF Individual Permit Application and Modification Fees

DEQ Class	New Permit Application Fee[1]	Major Modification at Permit Renewal	Major Modification Prior to Permit Expiration	Minor Modification	Permit Transfer
Tier 1	$43,459	$10,917	$21,695	$760	$69
Tier 2	$8,746	$2,775	$4,336	$760	$69
Special WPCF Permits issued pursuant to OAR 340-045-0061	$415	N/A	N/A	N/A	$69

1. New permit applications must include the annual fee specified in Table 70B in addition to the new permit application fee.

70B: Industrial NPDES & WPCF Individual Permit Annual Fees

Type	Description	NPDES Tier 1	NPDES Tier 2	WPCF Tier 1	WPCF Tier 2
B01	Pulp, paper, or other fiber pulping industry	$15,196	N/A	$14,104	N/A
	Food or beverage processing - includes produce, meat, poultry, seafood or dairy for human, pet, or livestock consumption				
B02	Washing or Packing only	N/A	$2,113	N/A	$1,943
B03	Processing – small. Flow ≤ 0.1 mgd, or $0.1 <$ flow < 1 mgd for less than 180 days per year	N/A	$3,158	N/A	$2,988
B04	Processing – medium. 0.1 mgd $<$ Flow < 1 mgd for 180 or more days per year, or flow ≥ 1 mgd for less than 180 days per year	N/A	$4,456	N/A	$4,287
B05	Processing – large. Flow ≥ 1 mgd for 180 or more days per year.	$15,196	$13,352	$14,104	$13,182
	Primary smelting or refining				

Type	Description	NPDES Tier 1	NPDES Tier 2	WPCF Tier 1	WPCF Tier 2
B06	Aluminum	$15,196	$13,352	$14,104	$13,182
B07	Non-ferrous metals utilizing sand chlorination separation facilities	$15,196	$13,352	$14,104	$13,182
B08	Ferrous and non-ferrous metals not elsewhere classified	$8,690	$6,846	$7,598	$6,676
B09	Chemical manufacturing with discharge of process wastewater	$15,196	$13,352	$14,104	$13,182
B10	Cooling water discharges in excess of 20,000 BTU per sec	$8,690	$6,846	$7,598	$6,676
	Mining Operations – includes aggregate or ore processing				
B11	Large (over 500,000 cubic yards per year or involving chemical leaching)	$15,196	$13,352	$14,104	$13,182
B12	Medium (100,000 to 500,000 cubic yards per year)	N/A	$4,675	N/A	$4,505
B13	Small (less than 100,000 cubic yards per year)	N/A	$1,422	N/A	$1,252
	All facilities not elsewhere classified which dispose of process wastewater (includes remediated groundwater)				
B14	Tier 1 sources	$15,196	N/A	$14,104	N/A
B15	Tier 2 sources	N/A	$2,942	N/A	$2,772
B16	All facilities not elsewhere classified which dispose of non-process wastewaters (for example: small cooling water discharges, boiler blowdown, filter backwash)	N/A	$1,969	N/A	$1,799
B17	Dairies, fish hatcheries and other confined feeding operations on individual permits	N/A	$1,723	N/A	$1,553
B18	All facilities which dispose of wastewater only by evaporation from watertight ponds or basins	N/A	N/A	N/A	$1,143
	Timber and Wood Products				
B19	Sawmills, log storage, instream log storage	$4,262	$2,418	$3,170	$2,248
B20	Hardboard, veneer, plywood, particle board, pressboard manufacturing, wood products	$4,508	$2,664	$3,416	$2,494
B21	Wood preserving	$3,813	$1,969	$2,721	$1,799

Table 70C: Domestic NPDES & WPCF Individual Permits

Description	Type	Classification Criteria (Based on Average Dry Weather Design Flow, or as defined in 40CFR)	Class	New Permit App.Fee[1]	Base Annual Fee, 5 year permits	Base Annual Fee, 10 year permits	Additional Annual Fees	Major Modification	Minor Modification
Nondischarging lagoons	E	Not applicable	Tier 2	$2,833	N/A	$905	Additional fees Include population and pretreatment fees. See tables 70D and 70E for determination of these fees.	$1,451	$760
Lagoons that discharge to surface waters	Db	Flow < 1 mgd	Tier 2	$5,596	$1,085	N/A		$2,833	$760
	C2b	1 mgd ≤ Flow	Tier 1	$27,706	$2,858	N/A		$13,887	$760
	C1b	2 mgd ≤ Flow < 5 mgd	Tier 1	$27,706	$3,918	N/A		$13,887	$760
	Bb	5 mgd ≤ Flow < 10 mgd	Tier 1	$27,706	$5,633	N/A		$13,887	$760
Treatment systems other than lagoons	Da	Flow < 1 mgd	Tier 2	$5,596	$1,540	$1,429		$2,833	$760
	C2a	1 mgd ≤ Flow	Tier 1	$27,706	$4,862	$4,164		$13,887	$760
	C1a	2 mgd ≤ Flow < 5 mgd	Tier 1	$27,706	$7,165	$6,467		$13,887	$760
	Ba	5 mgd ≤ Flow < 10 mgd	Tier 1	$27,706	$10,654	$9,956		$13,887	$760
	A3	10 mgd ≤ Flow < 25 mgd	Tier 1	$27,706	$16,619	N/A		$13,887	$760
	A2	25 mgd ≤ Flow < 50 mgd	Tier 1	$27,706	$35,262	N/A		$13,887	$760
	A1	≥ 50 mgd	Tier 1	$27,706	$59,998	N/A		$13,887	$760
Septage alkaline stabilization facilities	F	Not applicable	Tier 2	$760	N/A	$311	N/A	N/A	$345

Description	Type	Classification Criteria (Based on Average Dry Weather Design Flow, or as defined in 40CFR)	Class	New Permit App. Fee[1]	Base Annual Fee, 5 year permits	Base Annual Fee, 10 year permits	Additional Annual Fees	Major Modification	Minor Modification
Municipal Stormwater Permits: MS4 Phase 1, Phase 2 and UIC Permits	MS4-1	See 40 CFR §122.26	N/A	$8,746	$1,969	N/A	N/A	N/A	$760
	MS4 -2		N/A	$392	$403	N/A	N/A	N/A	$760
	UIC	As defined in 40 CFR parts 9, 144, 145 and 146	N/A	$8,746	N/A	$1,799	N/A	N/A	$760

1. New permit applications must include the annual fee in addition to the new permit application fee.

Table 70D: Domestic NPDES & WPCF Annual Population Fee

Population range	Annual fee
500,000+	$80,608
400,000 to 499,999	$61,665
300,000 to 399,999	$42,722
200,000 to 299,999	$23,779
150,000 to 199,999	$19,231
100,000 to 149,999	$12,667
50,000 to 99,999	$7,946
25,000 to 49,999	$3,570
15,000 to 24,999	$2,032
10,000 to 14,999	$1,324
5,000 to 9,999	$806
1,000 to 4,999	$242
100 to 999	$46
0 to 99	$0

Table 70E: Annual Pretreatment Fees

Pretreatment Fee	$1,382
Significant Industrial User	$461per industry

Table 70F: Technical Activity and Other Fees

Activity	Fee
New or substantially modified sewage treatment facility	$6,357
Minor sewage treatment facility modifications and pump stations	$691
Pressure sewer system or major sewer collection system expansion	$484
Minor sewer collection system expansion or modification	$138
New or substantially modified water pollution control facilities using alkaline agents to stabilize septage	$691
Permit Transfer	$69

Table 70G: General NPDES &WPCF Permits

No.	Type	Description	New Permit Application Fee[1]	Annual Fee
100-J	NPDES	Cooling water/heat pumps	$178	$403
200-J	NPDES	Filter Backwash	$178	$403
300-J	NPDES	Fish Hatcheries	$282	$403
400-J	NPDES	Log Ponds	$178	$403
500-J	NPDES	Boiler blowdown	$178	$403
600	WPCF	Offstream small scale mining – processing less than 5 cubic yards of material per day, or less than 1500 cubic yards per year	$0	$0
		Offstream small scale mining – processing 1,500 to10,000 cubic yards of material per year	$178	$0
700-PM	NPDES	Suction dredges[2]	$0	$25
900-J	NPDES	Seafood processing	$178	$403
1000	WPCF	Gravel mining	$178	$403
1200-A	NPDES	Storm Water: Sand, gravel, and other non-metallic mining	$392	$403
1200-C[3]	NPDES	Storm Water: Construction activities – 1 acre or more	$392	$403
1200-CA	NPDES	Storm Water: Construction activities performed by public agencies – 1 acre or more	$392	$403
1200-COLS[3]	NPDES	Stormwater: industrial stormwater discharge to Columbia Slough	$392	$403
1200-Z[3,4]	NPDES	Storm Water: Industrial	$392	$403

1400-A	NPDES	Wineries and seasonal fresh pack operations whose wastewater flow does not exceed 25,000 gallons per day and is only disposed of by land irrigation.	$178	$236
1400-B	WPCF	Wineries and small food processors not otherwise eligible for a 1400A general permit.	$282	$403
1500-A	NPDES	Petroleum hydrocarbon clean-up	$282	$403
1500-B	WPCF	Petroleum hydrocarbon clean-up	$282	$403
1700-A	NPDES	Vehicle & equipment wash water	$392	$403
1700-B	WPCF	Vehicle & equipment wash water	$392	$403
1900-J	NPDES	Non-contact geothermal heat exchange	$392	$403
		Other	$392	$403

1. New permit applications must include both the new permit application fee and the first year's annual fee.
2. A person registered under the 700-PM permit may pre-pay $100 for 5 years of registration in lieu of the $25 annual fee.
3. Some of these permits are administered by public agencies under contract with DEQ.
4. This permit incorporates the 1300-J permit.

Table 70H: General Permit Activity and Other Fees

Disposal system plan review[1]	$432
Site inspection and evaluation[1]	$1,082
Permit Transfer	$69

1. These fees apply when these activities are required for DEQ's review of the application.

Appendix H

Cost Estimate Spreadsheets

Estimated Annual O&M Cost Analysis

Summary	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Headworks	$ 9,000	$ 9,000	$ 9,000	$ 9,000
Secondary Process Upgrade	$ 108,000	$ 108,000	$ 99,000	$ 215,000
Effluent Storage (Temp)	$ 19,000	$ 19,000	$ 19,000	$ 7,000
Solids Dewatering	$ 19,000	$ 19,000	$ 19,000	$ 19,000
Staffing 1 FTE = $65,000	$ 65,000	$ 98,000	$ 98,000	$ 98,000
Maitenance Sinking Fund	$ 30,000	$ 30,000	$ 30,000	$ 40,000
Membrane Replacement Fund (10% per year)				$ 120,000
Total Annual Cost	**$ 250,000**	**$ 283,000**	**$ 274,000**	**$ 508,000**
20 Year O&M NPW i=3%	**$ 3,720,000**	**$ 4,210,000**	**$ 4,080,000**	**$ 7,560,000**
Total Alternative Capital Costs	**$ 9,800,000**	**$ 16,400,000**	**$ 19,200,000**	**$ 24,800,000**
20 Year NPW i=3%	**$ 13,520,000**	**$ 20,610,000**	**$ 23,280,000**	**$ 32,360,000**

Notes:

- *Estimated Annual Operations, Maintenance and Replacement Costs for Plant Upgrades Only.*
  - *Costs do not include Solids processing, land application or disinfection*
- *Surface Aeratores are more expensive to operate than blowers/diffuser grid*
- *MBR Option:*
  - *MBR option requires pre-aeration and membrane scour air=more expensive*
  - *Two headwork screens on the MBR option requires more annual electrical demand, labor, and maintenance.*
  - *Effluent temperature on MBR option requires fewer surface mixers*
- *Staffing: 1.5 FTE for Solids/MLE Options and 1.0 FTE for Solids/MBR Option*
- *Membrane Replacement: Replace 10% of membranes each year beginning in Year 10*

ENGINEER'S ESTIMATE OF PROBABLE COST **KENNEDY/JENKS CONSULTANTS**

Project: **Alternative 1, Minimum For Permit Issues**

Prepared By: MDH/JC/JE/PR

Date Prepared: 17-Jul-07

K/J Proj. No.: 0691027*00

ITEM NO.	ITEM DESCRIPTION		Total
1	Headworks		$ -
2	Clarifier Rehabilitation (1PC & 2 SCs)		$ -
3	Existing Liquids and Solids PS Improvements		$ -
4	Secondary Treatment Process Improvements (Ammonia)		$ 4,674,000
5	AB2 Temperature Improvements & PS		$ 1,048,900
6	Electrical (GenSet, ATS, Conduits)		$ 1,159,900
7	Solids Dewatering Process Upgrades		$ -
8	Disinfection Improvements		$ -
9	Outfall Relocation		$ 1,000,000
	Capital Cost Subtotal		**$7,883,000**
10	Engineering/Legal/Admin @	25%	$1,970,000
	Total Project Costs		**$9,860,000**

Notes:

1. The Estimate represents the Engineer's opinion of probable cost using current and best available information.
2. The Level of Accuracy is -20%/+30%, but does not consider factors like material price escalation and bidding climate.
3. Estimates include the following markups:
   - 9% General Conditions and Mobilization
   - 15% Overhead and Profit
   - 30% Estimate and Construction Contingency
   - 3% Annual Escalation to Midpoint of Construction

ENGINEER'S ESTIMATE OF PROBABLE COST **KENNEDY/JENKS CONSULTANTS**

Project: **Alternative 2, Minimum for Current Issue**

Prepared By: MDH/JC/JE/PR

Date Prepared: 17-Jul-07

K/J Proj. No.: 0691027*00

ITEM NO.	ITEM DESCRIPTION		Total
1	Headworks		$ 323,900
2	Clarifier Rehabilitation (1PC & 2 SCs)		$ 1,735,900
3	Existing Liquids and Solids PS Improvements		$ 511,600
4	Secondary Treatment Process Improvements (Ammonia)		$ 4,962,300
5	AB2 Temperature Improvements & PS		$ 1,048,900
6	Electrical (GenSet, ATS, Conduits)		$ 1,159,900
7	Solids Dewatering Process Upgrades		$ 2,231,400
8	Disinfection Improvements		$ 135,900
9	Outfall Relocation		$ 1,010,600
	Capital Cost Subtotal		**$13,120,000**
10	Engineering/Legal/Admin @	25%	$3,280,000
	Total Project Costs		**$16,400,000**

Notes:

1. The Estimate represents the Engineer's opinion of probable cost using current and best available information.
2. The Level of Accuracy is -20%/+30%, but does not consider factors like material price escalation and bidding climate.
3. Estimates include the following markups:
    - 9% General Conditions and Mobilization
    - 15% Overhead and Profit
    - 30% Estimate and Construction Contingency
    - 3% Annual Escalation to Midpoint of Construction

ENGINEER'S ESTIMATE OF PROBABLE COST **KENNEDY/JENKS CONSULTANTS**

Project: **Alternative 3, Best for Current Issues**

Prepared By: MDH/JC/JE/PR

Date Prepared: 17-Jul-07

K/J Proj. No.: 0691027*00

ITEM NO.	ITEM DESCRIPTION		Total
1	Headworks		$ 323,900
2	Clarifier Rehabilitation (1PC & 2 SCs)		$ 1,735,900
3	Existing Liquids and Solids PS Improvements		$ 511,600
4	Secondary Treatment Process Improvements (Ammonia)		$ 7,119,600
5	AB2 Temperature Improvements & PS		$ 1,048,900
6	Electrical (GenSet, ATS, Conduits)		$ 1,159,900
7	Solids Dewatering Process Upgrades		$ 2,231,400
8	Disinfection Improvements		$ 135,900
9	Outfall Relocation		$ 1,010,600
	Capital Cost Subtotal		**$15,280,000**
10	Engineering/Legal/Admin @	25%	$3,820,000
	Total Project Costs		**$19,100,000**

Notes:

1. The Estimate represents the Engineer's opinion of probable cost using current and best available information.
2. The Level of Accuracy is -20%/+30%, but does not consider factors like material price escalation and bidding climate.
3. Estimates include the following markups:
    - 9% General Conditions and Mobilization
    - 15% Overhead and Profit
    - 30% Estimate and Construction Contingency
    - 3% Annual Escalation to Midpoint of Construction

ENGINEER'S ESTIMATE OF PROBABLE COST **KENNEDY/JENKS CONSULTANTS**

Project: Alternative 4, Best for Current and Future Issues

Prepared By: MDH/JC/JE/PR

Date Prepared: 17-Jul-07

K/J Proj. No.: 0691027*00

ITEM NO.	ITEM DESCRIPTION		Total
1	Headworks		$ 662,000
2	Clarifier Rehabilitation (1 PC)		$ 462,900
3	Existing Liquids and Solids PS Improvements		$ 511,600
4	Secondary Treatment Process Improvements (Ammonia)		$ 12,883,500
5	Secondary Clarifier Temperature Improvements & PS		$ 598,100
6	Electrical (GenSet, ATS, Conduits)		$ 1,159,900
7	Solids Dewatering Process Upgrades		$ 2,386,000
8	Disinfection Improvements		$ 135,900
9	Outfall Relocation		$ 1,010,600
	Capital Costs		**$19,810,000**
10	Engineering/Legal/Admin @	25%	$4,953,000
	Total Project Costs		**$24,770,000**

Notes:

1. The Estimate represents the Engineer's opinion of probable cost using current and best available information.
2. The Level of Accuracy is -20%/+30%, but does not consider factors like material price escalation and bidding climate.
3. Estimates include the following markups:
    - 9% General Conditions and Mobilization
    - 15% Overhead and Profit
    - 30% Estimate and Construction Contingency
    - 3% Annual Escalation to Midpoint of Construction

ENGINEER'S ESTIMATE OF PROBABLE COST **KENNEDY/JENKS CONSULTANTS**
Project: **Pendleton WWTP Phase 1**

Prepared By: MDH/JC/JE/PR
Date Prepared: 16-Jul-07
K/J Proj. No.: 0691027*00

ITEM NO.	ITEM DESCRIPTION		Total
1	Headworks		$ 662,000
2	Clarifier Rehabilitation (1 PC)		$ 462,900
3	In Plant PS Improvements		$ 448,000
4	Secondary Treatment Process Improvements (Ammonia)		$ 6,340,500
5	Solids Dewatering (Plant Staff modify drying beds)		$ 1,982,100
6	Secondary Clarifier Scum System (Both)		$ 456,900
7	Electrical (GenSet, ATS, Conduits)		$ 1,159,900
8	Disinfection Improvements		$ 135,900
9	Outfall Relocation		$ 1,010,600
	Capital Costs		**$12,660,000**
10	Engineering/Legal/Admin @	25%	$3,165,000
	Total Project Costs		**$15,830,000**

Notes:

1. The Estimate represents the Engineer's opinion of probable cost using current and best available information.
2. The Level of Accuracy is -20%/+30%, but does not consider factors like material price escalation and bidding climate.
3. Estimates include the following markups:
   - 9% General Conditions and Mobilization
   - 15% Overhead and Profit
   - 30% Estimate and Construction Contingency
   - 3% Annual Escalation to Midpoint of Construction

ENGINEER'S ESTIMATE OF PROBABLE COST **KENNEDY/JENKS CONSULTANTS**

Project: Pendleton WWTP Phase 2: MLE/MBR Conversion

Prepared By: MDH/JC/JE/PR
Date Prepared: 16-Jul-07
K/J Proj. No.: 0691027*00

	Phase 2: NEW Membranes		
ITEM NO.	**ITEM DESCRIPTION**		**Total**
1	Fine Screen Facility		$ 1,568,800
2	Secondary Treatment MBR Conversion		$ 8,338,500
3	Effluent Cooling Modifications		$ 758,200
	Capital Costs		**$10,670,000**
4	Engineering/Legal/Admin @	25%	$2,670,000
	Total Project Costs		**$13,340,000**
	Phase 2: Reuse Existing Drinking Water Facility Membranes		
1	Fine Screen Facility		$ 1,568,800
2	Secondary Treatment MBR Conversion		$ 5,491,600
3	Effluent Cooling Modifications		$ 758,200
	Capital Costs		**$7,820,000**
4	Engineering/Legal/Admin @	25%	$1,960,000
	Total Project Costs		**$9,780,000**

Notes:

1. The Estimate represents the Engineer's opinion of probable cost using current and best available information.
2. The Level of Accuracy is -20%/+30%, but does not consider factors like material price escalation and bidding climate.
3. Estimates include the following markups:
    - 9% General Conditions and Mobilization
    - 15% Overhead and Profit
    - 30% Estimate and Construction Contingency
    - 3% Annual Escalation to Midpoint of Construction (2017)

Appendix I

Mutual Agreement Order

BEFORE THE ENVIRONMENTAL QUALITY COMMISSION

OF THE STATE OF OREGON

IN THE MATTER OF: City of Pendleton, Permittee	)	MUTUAL AGREEMENT AND ORDER NO. WQ WQ/M-ER-04-042 Umatilla COUNTY

WHEREAS:

1. On February 3, 2005, the Department of Environmental Quality (Department or DEQ) issued National Pollutant Discharge Elimination System (NPDES) Waste Discharge Permit Number 100982 (Permit) to the City of Pendleton (Permittee). The Permit authorizes the Permittee to construct, install, modify or operate wastewater treatment control and disposal facilities (facilities) and discharge adequately treated wastewaters into McKay Creek, waters of the state, in conformance with the requirements, limitations and conditions set forth in the Permit. The Permit expires on January 31, 2010.

2. Condition 1a of Schedule A of the Permit does not allow the Permittee to exceed waste discharge limitations after the Permit issuance date for total ammonia-nitrogen, residual chlorine, and effluent temperature.

3. The Permittee is not able to meet the above effluent limitations for effluent temperature, residual chlorine, and ammonia-nitrogen without making modifications to the treatment facility. Notwithstanding Permittee's efforts to meet the effluent limitations described in Paragraph 2 above, it would not be able to do so consistently

4. DEQ and the Permittee recognize that until new or modified facilities are constructed and put into full operation, the Permittee will violate the Permit effluent limitations and water quality standards at times for temperature, residual chlorine, and ammonia.

5. The Permittee presently is capable of treating its effluent so as to meet the following effluent limitations, measured as specified in the Permit: Residual Chlorine, 0.5 mg/l monthly

average, 0.6 mg/l daily average (based on 3 samples per day); and Ammonia-Nitrogen, 25 mg/l monthly average, 30 mg/l daily maximum. The Permittee is also capable of complying with all terms and conditions of the Department approved Temperature Management Plan (TMP) which is attached and incorporated into the Mutual Agreement and Order (MAO) as Attachment 1.

6. The Department and Permittee recognize that the Environmental Quality Commission has the power to impose a civil penalty and to issue an abatement order for violations of conditions of the Permit. Therefore, pursuant to ORS 183.415(5), the Department and Permittee wish to settle those past violations referred to in Paragraph 3 and to limit and resolve the future violations referred to in Paragraph 4 in advance by this MAO.

7. This MAO is not intended to settle any violation of any interim effluent limitations or requirements of the TMP set forth in Paragraph 5 above. Furthermore, this MAO is not intended to limit, in any way, the Department's right to proceed against the Permittee in any forum for any past or future violations not expressly settled herein.

NOW THEREFORE, it is stipulated and agreed that:

8. The Environmental Quality Commission shall issue a final order:

A. Requiring the Permittee to comply with the following schedule:

(1) Submit an approvable mixing zone study for McKay Creek and the Umatilla River for Department review and approval by no later than eighteen (18) months after issuance of the Permit.

(2) Submit a revised TMP for Department review and approval by no later than eighteen (18) months after issuance of permit.

(3) By no later than six (6) months after Permit issuance, submit to the Department for approval a planning, design, and construction schedule for necessary facility modifications to meet the effluent limitations for residual chlorine and ammonia in the Permit.

(4) By no later than twenty-four (24) months after issuance of the Permit, complete construction and initiate operation of the Department approved facility modifications

related to chlorine.

(5) By no later than fifty-eight (58) months after issuance of the Permit, complete construction and initiate operation of the Department approved facility modifications related to ammonia.

(6) Plan, design, construct, and initiate operation of the necessary facilities to meet the temperature limitations of the Permit in accordance with the schedule established in the Department approved, revised Temperature Management Plan.

B. Requiring Permittee to meet the interim effluent limitations set forth in Paragraph 5 above until the facilities requirements described in Paragraph 8A are constructed and begin operation.

C. Requiring the Permittee, upon receipt of a written Penalty Demand Notice from the Department, to pay the following civil penalties:

(1) $250 for each day of each violation of the compliance schedules set forth in Paragraph 8A and in the TMP or revised TMP required by Paragraph 8A(2).

(2) $100 for each violation of each daily or weekly average waste discharge limitation set forth in Paragraph 5.

(3) $500 for each violation of each monthly average waste discharge limitation set forth in Paragraph 5.

9. If any event occurs that is beyond the Permittee's reasonable control and that causes or may cause a delay or deviation in performance of the requirements of this MAO, the Permittee shall immediately notify the Department verbally of the cause of delay or deviation and its anticipated duration, the measures that have been or will be taken to prevent or minimize the delay or deviation, and the timetable by which the Permittee proposes to carry out such measures. The Permittee shall confirm in writing this information within five (5) working days of the onset of the event. It is the Permittee's responsibility in the written notification to demonstrate to the Department's satisfaction that the delay or deviation has been or will be

caused by circumstances beyond the control and despite due diligence of the Permittee. If the Permittee so demonstrates, the Department shall extend times of performance of related activities under this MAO as appropriate. Circumstances or events beyond the Permittee's control include, but are not limited to, acts of nature, unforeseen strikes, work stoppages, fires, explosion, riot, sabotage, or war. Increased cost of performance or consultant's failure to provide timely reports may not be considered circumstances beyond the Permittee's control.

10. Regarding the violations set forth in Paragraphs 3 and 4 above, which are expressly settled herein without penalty, the Permittee and the Department hereby waive any and all of their rights to any and all notices, hearing, judicial review, and to service of a copy of the final order herein. The Department reserves the right to enforce this order through appropriate administrative and judicial proceedings.

11. Regarding the schedule set forth in Paragraph 8A above, the Permittee acknowledges that the Permittee is responsible for complying with that schedule regardless of the availability of any federal or state grant monies.

12. The terms of this MAO may be amended by the mutual agreement of the Department and Permittee.

13. The Department may amend the compliance schedule and conditions in this MAO upon finding that such modification is necessary because of changed circumstances or to protect public health and the environment. The Department shall provide the Permittee a minimum of thirty (30) days written notice prior to issuing an Amended Order modifying any compliance schedules or conditions. If the Permittee contests the Amended Order, the applicable procedures for conduct of contested cases in such matters shall apply.

14. This MAO shall be binding on the parties and their respective successors, agents, and assigns. The undersigned representative of each party certifies that he or she is fully authorized to execute and bind such party to this MAO. No change in ownership or corporate or partnership status relating to the facility shall in any way alter the Permittee's obligations under

this MAO, unless otherwise approved in writing by DEQ.

15. All reports, notices and other communications required under or relating to this MAO should be directed to the source person for the City of Pendleton, currently Elizabeth Hutchison, DEQ Eastern Regional Office, 700 SE Emigrant Ave., Suite 330, Pendleton, Oregon 97801-2597, phone number 541-278-8681. The contact person for the Permittee shall be the Wastewater Treatment Plant Superintendent, currently Sue Lawrence, 500 SW Dorion Avenue, Pendleton, OR 97801, phone number 541-276-3372.

16. The Permittee acknowledges that it has actual notice of the contents and requirements of the MAO and that failure to fulfill any of the requirements hereof would constitute a violation of this MAO and subject the Permittee to payment of civil penalties pursuant to Paragraph 8C above.

17. Any stipulated civil penalty imposed pursuant to Paragraph 8C shall be due upon written demand. Stipulated civil penalties shall be paid by check or money order made payable to the "Oregon State Treasurer" and sent to: Business Office, Department of Environmental Quality, 811 S.W. Sixth Avenue, Portland, Oregon 97204. Within 21 days of receipt of a "Demand for Payment of Stipulated Civil Penalty" Notice from the Department, the Permittee may request a hearing to contest the Demand Notice. At any such hearing, the issue shall be limited to the Permittee's compliance or non-compliance with this MAO. The amount of each stipulated civil penalty for each violation and/or day of violation is established in advance by this MAO and shall not be a contestable issue.

18. Providing the Permittee has paid in full all stipulated civil penalties pursuant to Paragraph 17 above, this MAO shall terminate 60 days after the Permittee demonstrates full compliance with the requirements of the schedule set forth in Paragraph 8A above.

PERMITTEE

2-1-05
Date

Phillip W. Houk
Phillip Houk,
Mayor, City of Pendleton

DEPARTMENT OF ENVIRONMENTAL QUALITY

2-3-05
Date

Joni Hammond
Joni Hammond, Administrator
Eastern Region

FINAL ORDER

IT IS SO ORDERED:

ENVIRONMENTAL QUALITY COMMISSION

2-3-05
Date

Joni Hammond
Joni Hammond, Administrator
Eastern Region
Department of Environmental Quality
Pursuant to OAR 340-011-0136(1)

Oregon
Theodore R. Kulongoski, Governor

Department of Environmental Quality
Eastern Region
700 SE Emigrant
Suite 330
Pendleton, OR 97801
(541) 276-4063 Voice/TTY
FAX (541) 278-0168

September 14, 2006

Mark Milne, Wastewater Superintendent
City of Pendleton
500 S.W. Dorion Avenue
Pendleton, Oregon 97801

Re: PERMIT ACTION
WQ-Umatilla County
NPDES Permit 100982; File 68260
EPA OR-002639-5

Dear Mark:

The City of Pendleton (City) owns and operates a domestic wastewater treatment system in Umatilla County. Their system is regulated under the terms and conditions of the National Pollutant Discharge Elimination System (NPDES) permit number 100982 issued February 3, 2005.

Your letter of July 25, 2006 requests extensions for both the Mixing Zone Study and the revised Temperature Management Plan for City. These both were due on August 2, 2006, per Schedule C, Conditions 4 and 5 of the NPDES permit. The Department of Environmental Quality (Department) concurs with the need for each request and approves of these extensions.

The Mixing Zone Study would be of the proposed new configuration(s) of the outfalls and incorporated into the Facility Plan update. This expanded Facility Plan determines the course of any new construction which must be complete by February 2007 for chlorine compliance and December 2010 for ammonia compliance.

The revised Temperature Management Plan (TMP) would present models incorporating information from the Confederated Tribes of the Umatilla Indian Reservation. The City agreed to submit this by September 14, 2006, and *did* submit it on September 13, 2006.

Therefore, NPDES Permit # 100982, Schedule C, Conditions 4 and 5, are hereby amended to read as follows:

"4. The permittee shall submit an approvable mixing zone study for McKay Creek and the Umatilla River for Department review by no later than **November 30, 2006.**

5. The permittee shall submit a revised Temperature Management Plan for Department review and approval by no later than **September14, 2006**. The permittee may conduct any pilot studies necessary to develop a final wastewater facility modification, design and construction proposal, to meet temperature requirements provided the planned studies are approved by the Department prior to implementation."

All other conditions of the NPDES permit remain unchanged by this action. Please attach a copy of this permit action to your permit.

If you have any questions, please contact Elizabeth Hutchison at 541-278-8681.

Sincerely,

Mitch Wolgamott
Water Quality Program Manager
Eastern Region

MDW/ewh

Cc: WQ Source File (Attach to Permit)
Bob Patterson / City of Pendleton
Duane Smith / DEQ Pendleton

Appendix J

Condition Evaluation Field Notes

TRIANGLE PUMP
AND EQUIPMENT, INC.

16169 S.E. 106th St./P.O. BOX 950 CLACKAMAS, OREGON 97015 (503) 656-1473

BARTCH LIFT
STATION

11/16/90

Mr Charlie Albright
City of Pendleton
PO Box 190
Pendleton, OR 97801

Subj: Replacement Sewage Pumps

Dear Charlie:

Pursuant with your request please find the following equipment for your consideration:

Two (2) ABS model AF22-4EX-4", 3HP, 1750 RPM, 3/60/460 VAC explosion proof rated submersible sewage pumps with 30' chains.

Four (4) encapsulated mercury float switches.

One (1) Triangle Pump, UL Listed, NEMA 3R duplex pump control panel with audio/visual high water alarm.

Two (2) 4" knife gate valves & two (2) 4" PVC flanges.

Price, f.o.b. shipping point with full freight allowance to Pendleton, is $5736.00. Estimated shipment is 4 weeks after order.

Add $500.00 lot for two guide rail base elbows with sealing flanges and rail support brackets.

Please feel free to call on me should you have any questions or if I can be of further assistance.

Cordially,

Harold R. Clayton
President

/lc
attachments

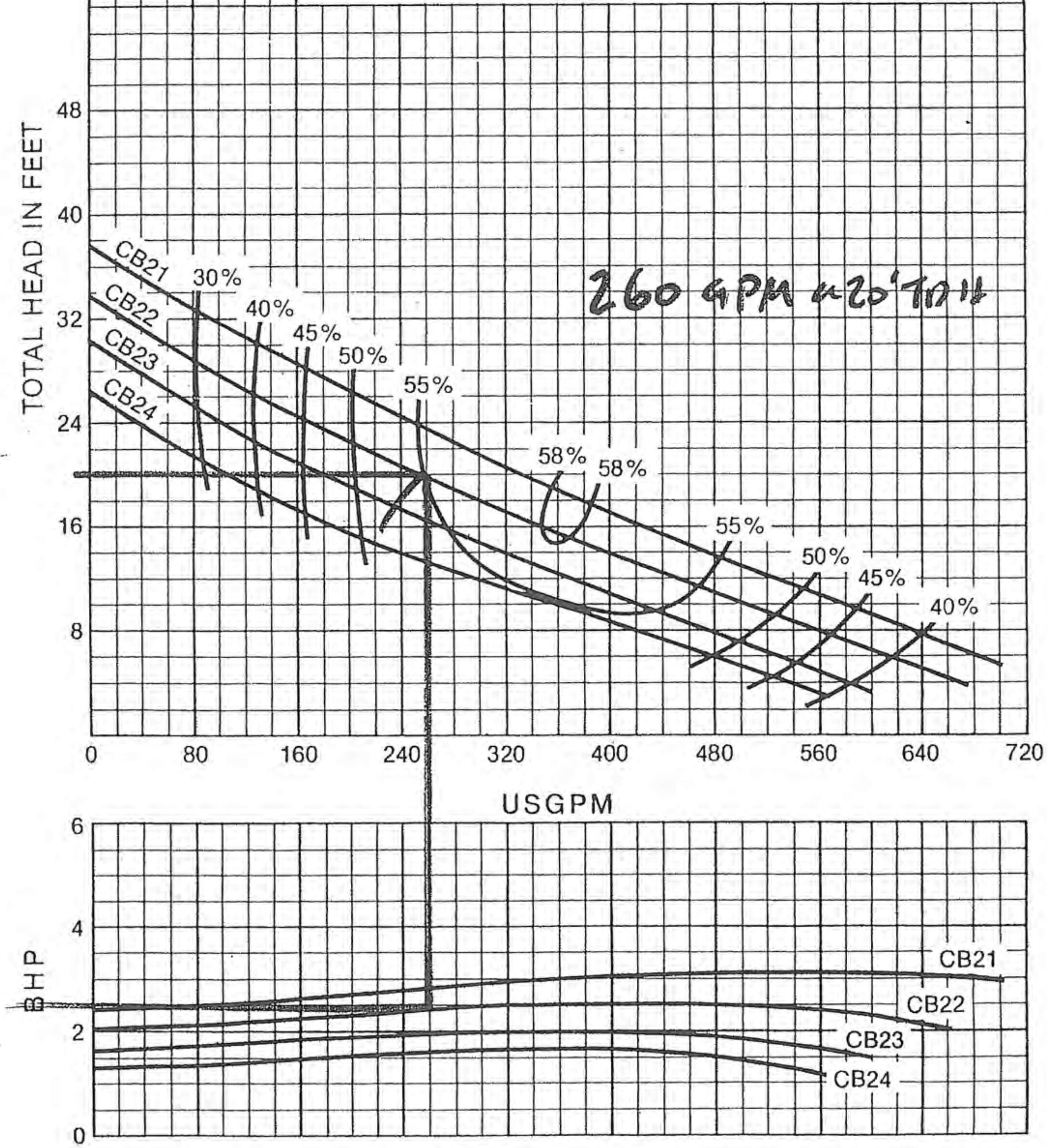
SECT. 200 TAB 4" 1750 RPM 3Ø PG. 101

DATE April 1, 1983

STANDARD & EXPLOSION PROOF

MODEL	AF	15	22					-4-4"
RATED HP		2	3					

SOLID SIZE 3½ " BLADE 1 SPEED 1750 RPM
DISCHARGE SIZE 4 " VOLTAGE 230,460,575 ; 60 Hz 3 PH



ABS Pumps Inc. 140 Pond View Drive Meriden, CT 06450

AF PUMPS STANDARD & EXPLOSION PROOF

MODEL: AF15, 22-

GENERAL

Furnish and install 2 model Af 22 ABS Submersible Pump(s) to deliver 260 USGPM against a total head of 20 feet. The motor shall be 3 HP 1750 RPM connected for operation on a 460 volt, 60 HZ 3 phase service. The motor shall be an integral part of the pumping unit. The pump discharge size shall be 4.

PUMP DESIGN

The pump(s) shall be capable of handling raw unscreened sewage, storm water, and other similar solids-laden fluids without clogging. The suction inlet shall have a wave form with the leading edge of the impeller overlapping the wave form. Should a textile or plastic sheet plug the inlet, the shearing action of the leading edge of the impeller against the wave form of the inlet will cut away enough of the material to clear the inlet.

There shall be no need for personnel to enter the wet well in order to remove or reinstall the pump(s). The pump(s) shall be automatically connected to the discharge piping when lowered into place on a guide rail system, requiring no bolts, nuts or fasteners to effect sealing to the discharge connection.

PUMP CONSTRUCTION

Impeller: The impeller shall be made of erosion-resistant chilled gray cast iron and shall be of the semi-open, non-clogging, dynamically balanced single vane design capable of passing a minimum of 3 1/2 diameter spherical solids. The impeller shall have a slip fit onto the motor shaft and drive key and shall be fastened to the shaft by a stainless steel bolt.

Pump Volute: The pump volute shall be made of gray cast iron with smooth internal surfaces free of rough spots or flashing. The volute shall have a centerline discharge.

Self Cleaning Front Plate: The pump shall be equipped with a gray cast iron front plate, mounted to the volute with four stainless steel adjusting screws to permit close tolerance adjustment between the front plate and impeller for maximum pump efficiency. The front plate shall be designed with a wave shaped inlet and an outward spiralling V-shaped groove on the side facing the impeller, to shred and force stringy solids outward from the impeller and through the pump discharge.

Mechanical Seals: Each pump shall be equipped with a tandem double mechanical seal. The oil chamber shall separate the pump from the motor and shall provide lubrication for the seals. Both the lower stationary seal face and rotating seal face shall be made of silicone carbide while the upper stationary seal shall be made of carbon and the rotating seal face of tool steel. Each stationary seal face shall be sealed with an O-Ring. The positively driven seal faces shall be held in place by individual independent springs. The seals shall require neither routine maintenance nor adjustment and shall not be damaged when the pump is run dry. When required, seal oil inspection shall be achieved without disassembly of the pump. The seal shall not require the pumped liquid as a lubricant.

Seal Failure Warning System: An electrical probe shall be provided in the oil chamber for detecting the presence of water. A solid-state device mounted in the pump control panel or in a separate enclosure shall send a low voltage, low amperage signal to the probe. If water enters the oil chamber, the probe shall close an electrical circuit and energize a warning light on the face of the control panel.

Shaft and Bearings: The pump shaft shall be made of stainless steel supported by a heavy duty lower double row ball bearing and an upper sealed single row ball bearing.

Motor and Cable: The pump motor shall be housed in an air filled watertight housing to provide good heat transfer. The motor shall be a NEMA design B suitable for continuous duty with moisture resistant Class F insulation rated for 155° C. Oil filled motors shall not be considered equal to the dry air filled type nor acceptable. Each phase of motor shall contain a bimetallic electromechanical temperature monitor embedded in the motor windings. The monitors shall be connected in series and coupled to the control circuit of the pump control panel so as to shut the pump down should any one of the monitors detect high temperature. The temperature setting of the temperature monitors shall be 140° C±5° C and shall automatically reset once the stator temperature returns to normal.

Power cables shall be 30 feet long of the Ozoflex or SO type construction suitable for submersion in sewage. Strain reliefs shall be provided at each cable entry into the pump.

O-Rings and Fasteners: All mating surfaces of the pump and motor shall be machined and fitted with Buna N O-Rings where watertight sealing is required. Sealing shall be accomplished by the proper fitting of the parts and not by compression or special torque requirements. All external screws and fasteners shall be made of stainless steel. All surfaces coming into contact with the liquid media, other than stainless steel, shall be protected by a corrosion resistant coating.

INSTALLATION

The pump(s) shall automatically connect to discharge connection(s) when lowered into place on a single guide rail system, requiring no bolts, nuts or fasteners to effect proper sealing. Each system shall consist of no more than one guide rail supported at the top by an upper guide bracket and at the bottom by the discharge connection. The guide rail base shall be equipped with a vertical straightening vane which properly aligns the slot in the pump bracket and centers the pump just prior to final sealing. Ease and quick removal of pumps from other than the vertical direction over the center of the pump shall be a requirement of the system.

Options: Each model shall be available with rubber coated hydraulic parts (impeller, volute, suction inlet and upper plate).

AF-EX:

1. The seal probe is contained in the motor housing.
2. NSSHOEU power cables shall be provided.
3. The motor shall be FM approved for Class I, Division I, Group C & D locations.

ABS Pumps Inc.
140 Pond View Drive
Meriden, Connecticut 06450
(203) 238-2700

TECHNICAL DATA
STANDARD & EXPLOSION PROOF

SECT. 200 TAB 4" 1750 RPM 30 PG. 121

MODEL: AF15,22,30-4-4"

APPLICATION DATA

MODEL	15	22	30						
SOLID SIZE - IN.	3½"	3½"	3½"						
MINIMUM FLOW - GPM	50	50	50						
MAXIMUM SUBMERGENCE - FT.	65	65	65						

PUMP WEIGHT - lbs.

STANDARD	132	143	147						
EXPLOSION PROOF	146	159	165						

PHYSICAL DATA

POWER CABLE - TYPE		AF: HO7RN Ozoflex or Type SO AF-EX: NSSHOEU
CONTROL CABLE - TYPE		Included in Power Cable
CABLE. STANDARD LENGTH		30'
MATERIALS	MOTOR HOUSING	Cast Iron - ASTM A-48, Class 30
	PUMP CAP	N/A
	OIL CHAMBER	Cast Iron - ASTM A-48, Class 30
	VOLUTE	Cast Iron - ASTM A-48, Class 30
	IMPELLER	Cast Iron - ASTM A-48, Class 30
	CUTTER DISC	Cast Iron - ASTM A-48, Class 30
	MOTOR SHAFT	420 SS
	EXTERNAL HARDWARE	304 SS
	"O" RINGS	Buna N
MECHANICAL SEAL - TYPE		Tandem Seal, Silicone Carbide, Lower; Tool Steel/ Carbon Upper
UPPER BEARING		Single Row Ball
LOWER BEARING		Double Row Angular Contact Ball - Heavy Duty
DISCHARGE SIZE		4"
IMPELLER TYPE		Open Single Vane

MODEL: AF15,22,30-4-4"

ELECTRICAL DATA

MOTOR DESIGN NEMA TYPE	B
MOTOR TYPE	Enclosed Submersible
INSULATION CLASS	F
MAXIMUM STATOR TEMP.	155°C
MOTOR PROTECTION	AF Oil Chamber Moisture Detector,AF-EX Motor Housing. Bimetallic switches in each phase. Installer must conform to N.E.C.Stds.,1981Ed.Art430
BI METALLIC TEMP. SETTING	140° C ± 5° C
RPM	1750
VOLTAGE TOLERANCE ±	10%

MODEL	VOLTAGE	HP OUTPUT	FULL LOAD AMPS	LOCKED ROTOR AMPS	NEMA CODE LETTER	SERVICE FACTOR (MOTOR SUBM.)	POWER FACTOR 100% FL	75% FL	50% FL	MOTOR EFFICIENCY 100% FL	75% FL	50% FL
15	208	2.6	8.6	38.0	F	1.20	0.81	0.73	0.59	77.6	76.4	72.1
	230	2.6	7.8	34.0	F	1.20	0.81	0.73	0.59	77.6	76.4	72.1
	460	2.6	3.9	17.0	F	1.20	0.81	0.73	0.59	77.6	76.4	72.1
	575	2.6	3.1	14.0	F	1.20	0.81	0.73	0.59	77.6	76.4	72.1
22	208	3.0	9.3	49.5	G	1.20	0.85	0.77	0.63	77.0	77.2	74.0
	230	3.0	8.4	44.8	G	1.20	0.85	0.77	0.63	77.0	77.2	74.0
	460	3.0	4.2	22.4	G	1.20	0.85	0.77	0.63	77.0	77.2	74.0
	575	3.0	3.4	18.0	G	1.20	0.85	0.77	0.63	77.0	77.2	74.0
30	208	4.0	13.6	79.0	H	1.15	0.80	0.75	0.63	76.0	79.0	76.0
	230	4.0	12.3	71.4	H	1.15	0.80	0.75	0.63	76.0	79.0	76.0
	460	4.0	6.2	35.7	H	1.15	0.80	0.75	0.63	76.0	79.0	76.0
	575	4.0	4.9	28.6	H	1.15	0.80	0.75	0.63	76.0	79.0	76.0

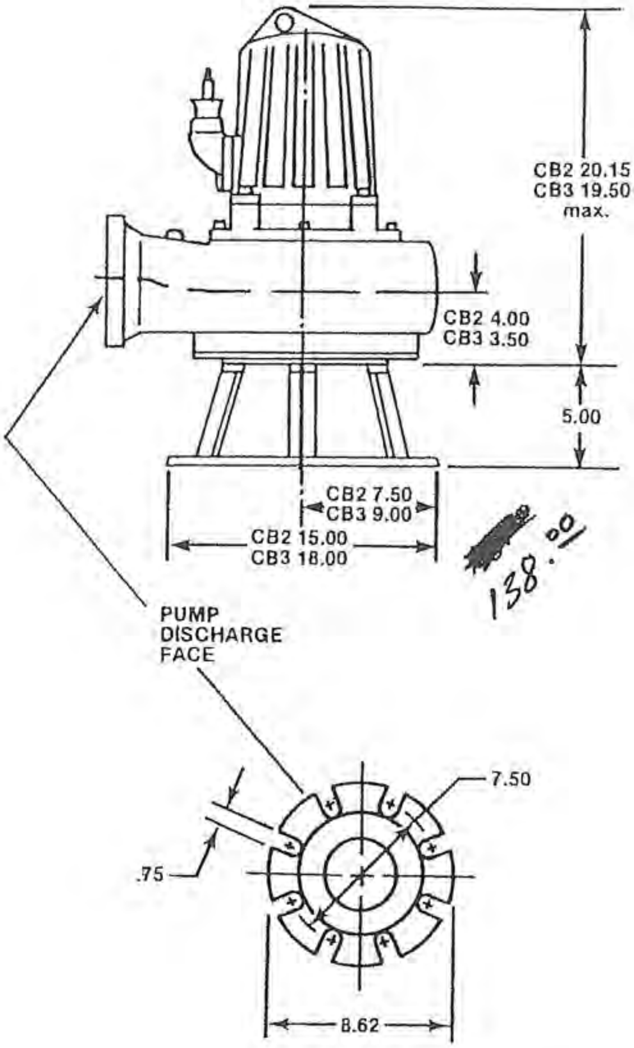
Rev. 4-1-88

PUMP DIMENSIONS

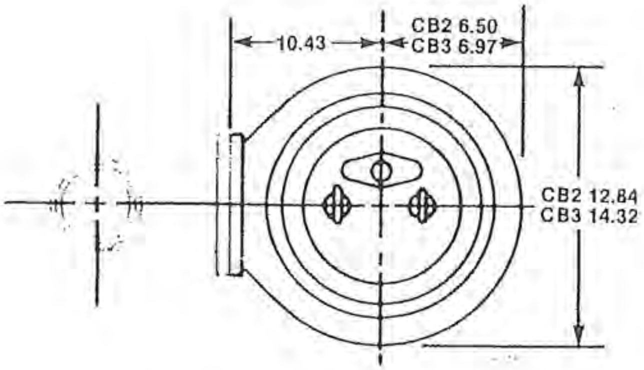
STANDARD & EXPLOSION PROOF

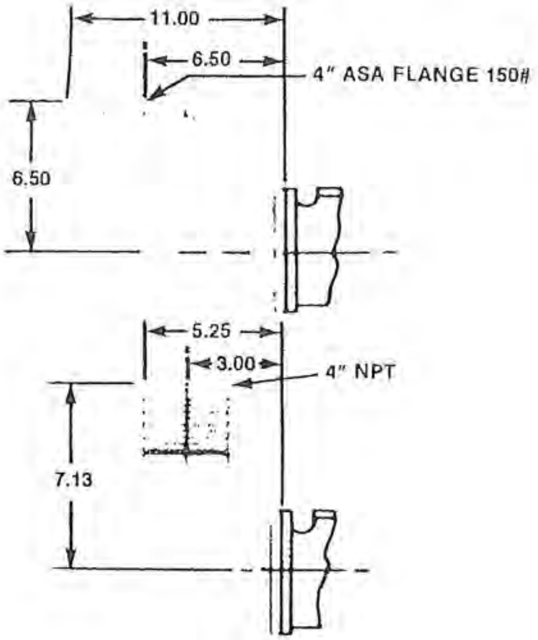
SECT. 200 TAB 4" 1750 RPM 3Ø PG. 132

MODEL: AF15,22-4-CB2-4" AF30-4-CB3-4"



138.00





Dimensions in inches.

Rev. 4/1/83

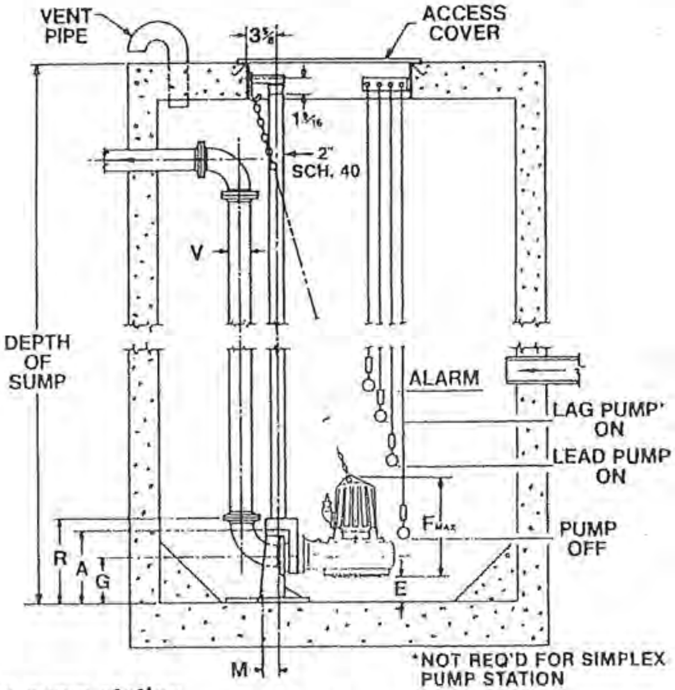
ABS Pumps Inc.
140 Pond View Drive
Meriden, Connecticut 06450
(203) 238-2700

PUMP STATION DIMENSIONS

STANDARD & EXPLOSION PROOF

SECT. 200 TAB 4" 1750 RPM 30 PG. 131

MODEL: AF15,22-4-CB2-4" AF30-4-CB3-4"

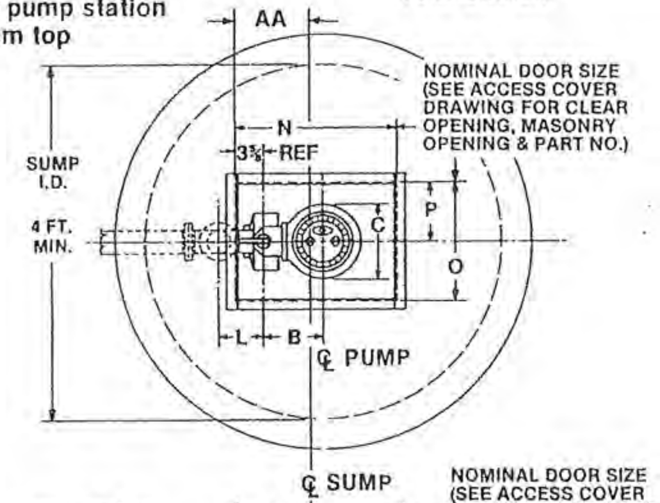


A	13.19		M	1.63
B	12.50	Simplex Pump Station	N	30.00
C	*		O	24.00
D	26.00		P	12.00
E	**		Q	3.00
F	***		R	14.50
G	8.00	Duplex Pump Station	S	24.00
H	6.50		T	48.00
I	1.00		U	30.00
J	21.25		V	4.00
K	4.75		AA	9.50
L	7.69		BB	11.50

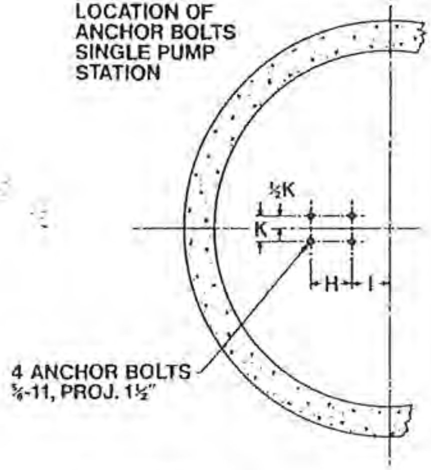
Dimensions in inches.

CB2 *12.84, **2.75, ***20.19
CB3 *14.32, **4.00, ***19.50

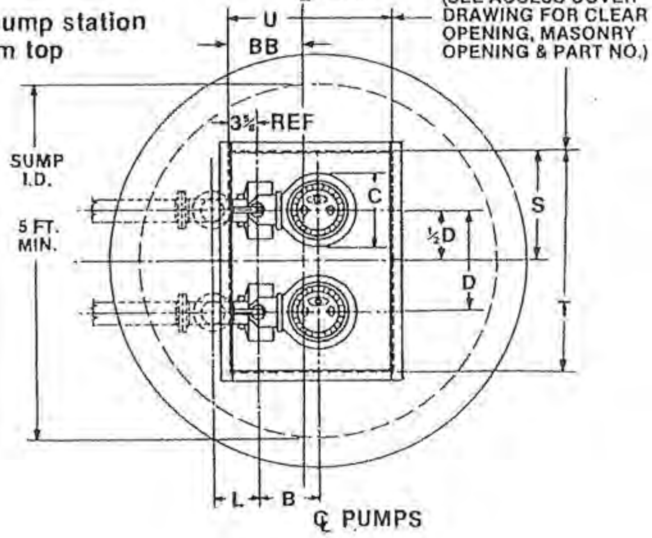
Simplex pump station View from top



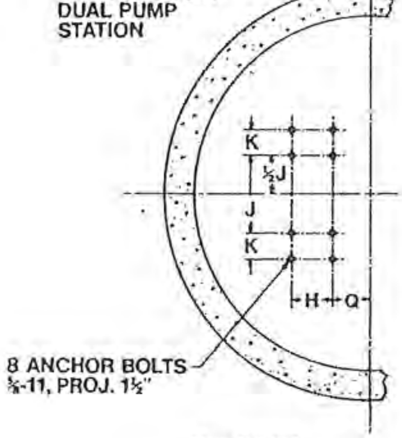
PLAN VIEW LOCATION OF ANCHOR BOLTS SINGLE PUMP STATION



Duplex pump station View from top



PLAN VIEW LOCATION OF ANCHOR BOLTS DUAL PUMP STATION



Rev. 6/1/84

WESTGATE PS

PUMP STATION DATA SHEET

LOCATION: PENDLETON, OR.

SERIAL NO. 58425

OWNER: WESTGATE SEWER P.S.

ENGINEER: CITY OF PENDLETON

CONTRACTOR:

DISTRIBUTOR: PUMPTECH, INC.

STATION TYPE: 421

DATE INSTALLED:

PUMP:

PIPING : SUCTION 4" DISCH. 4 "

STATION:

PIPING: SUCTION 4 " DISCH. 4 "

CONDITIONS OF SERVICE:

DESIGN DUTY: 250 GPM, 20' TDH,

LIQUID: SEWAGE

SOLIDS: 3"

DRIVEN RPM: 1750

PUMP DATA:

PUMP MODEL: S4HX500

SERIAL NO:

IMPELLER DIAMETER:

STUFFING BOX TYPE:

LUBRICATION:

PRIMING:

MOTOR DATA:

BRAND: BALDOR

ENCLOSURE: EXPLOSION PROOF

HORSEPOWER: 5

RPM: 1750

PHASE: 3

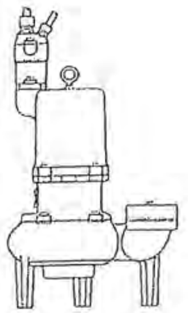
CYCLE: 60

VOLT: 230

FRAME:

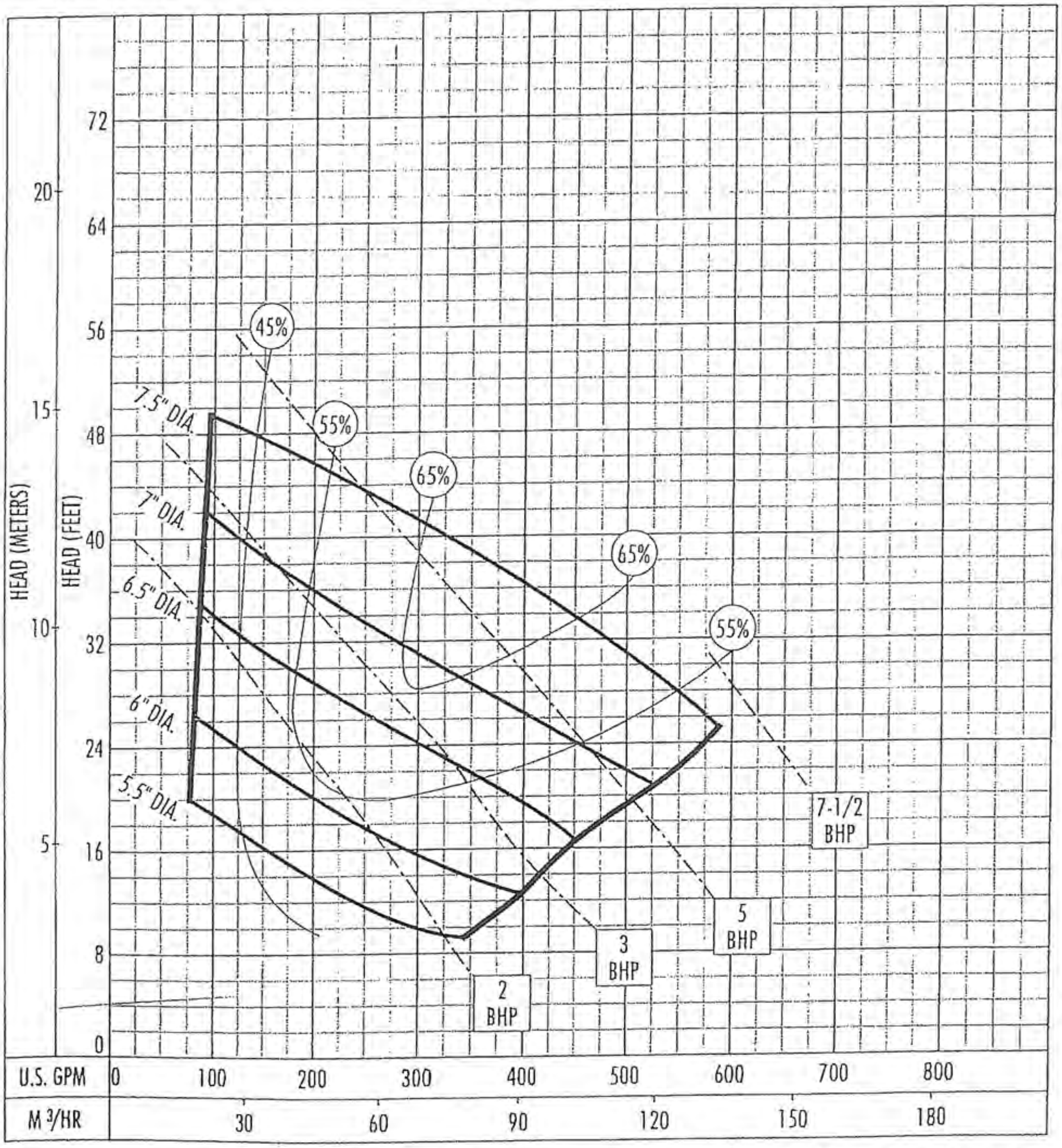
ELEVATIONS:	GROUND LEVEL	1046.8	LOW WATER	1028.96
	STATION DISCHARGE	1043.8	PUMP OFF	1029.0
	STATION FLOOR	1042.8	LEAD PUMP ON	1031.5
	WW INVERT	1030.2	2 PUMP OVERLOAD	1032.5
	WW FLOOR	1028.0	HIGH WATER	1032.9

G:HOME\O&M\421



Performance Curve S4F/S4HX

RPM: **1750** Discharge: **4"** Solids: **3"**



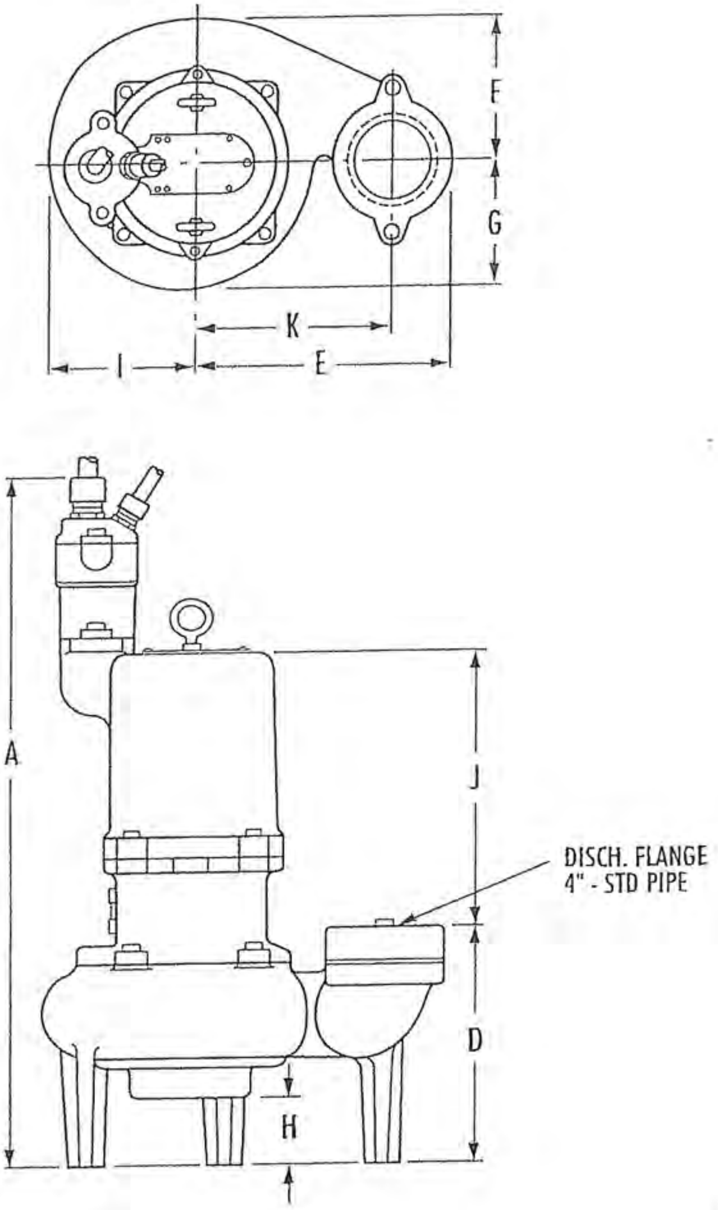
The curves reflect maximum performance characteristics without exceeding full load (Nameplate) horsepower. All pumps have a service factor of 1.2. Operation is recommended in the bounded area with operational point within the curve limit. Performance curves are based on actual tests with clear water at 70° F. and 1280 feet site elevation.

Conditions of Service:

GPM: 250 TDH: 20'

HYDROMATIC®

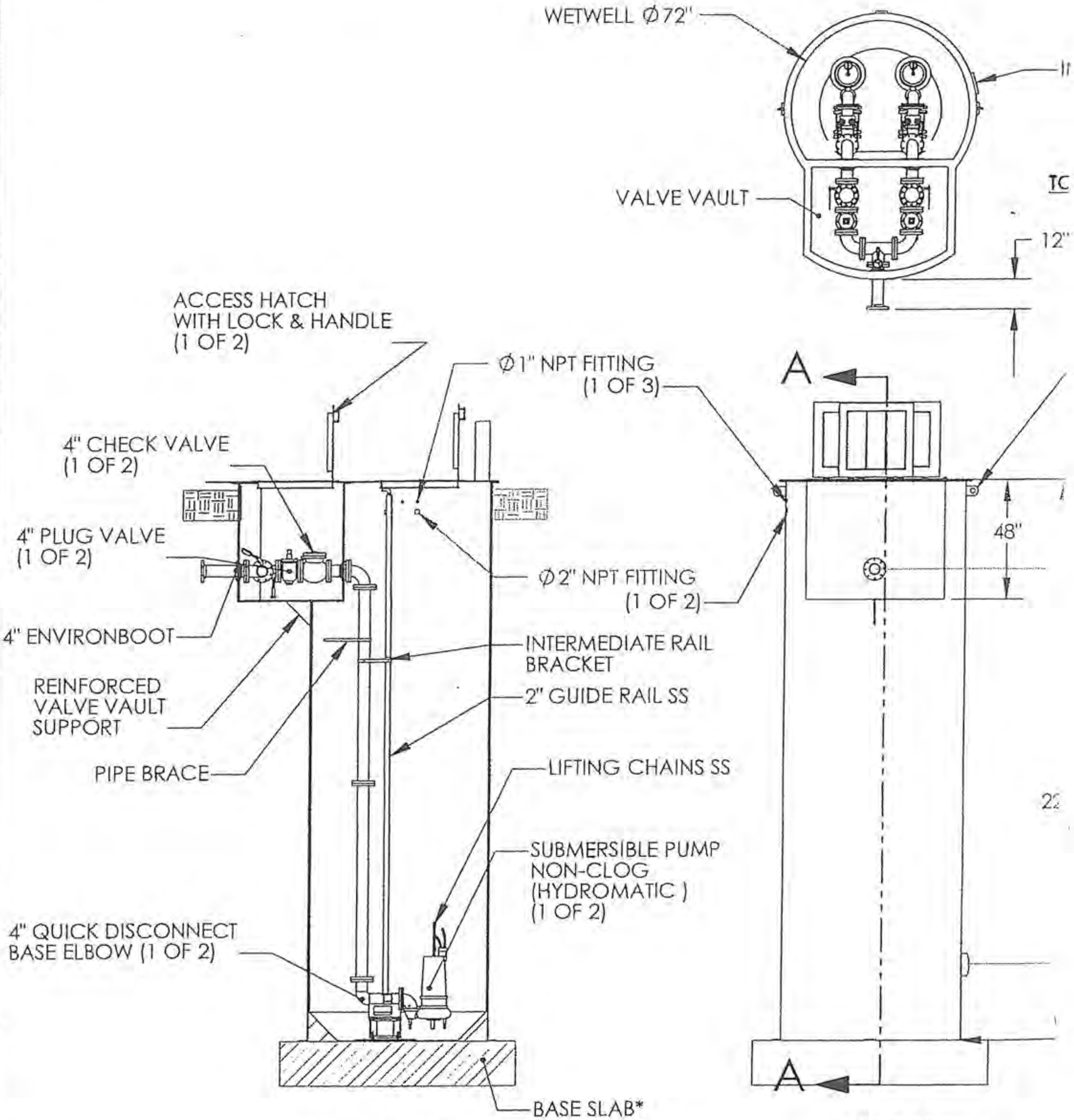
Dimensional Data S4F/S4HX



S4HX illustrated above

	A	D	E	F	G	H	I	J	K
~~S4F~~	~~28-5/8~~	~~10-3/4~~	~~12-1/8~~	~~7-1/2~~	~~6-1/4~~	~~3-1/8~~	~~7~~	~~11-3/16~~	~~9-1/4~~
S4HX	31-3/4	10-3/4	12-1/8	7-1/2	6-1/4	3-1/8	7	12-3/4	9-1/4

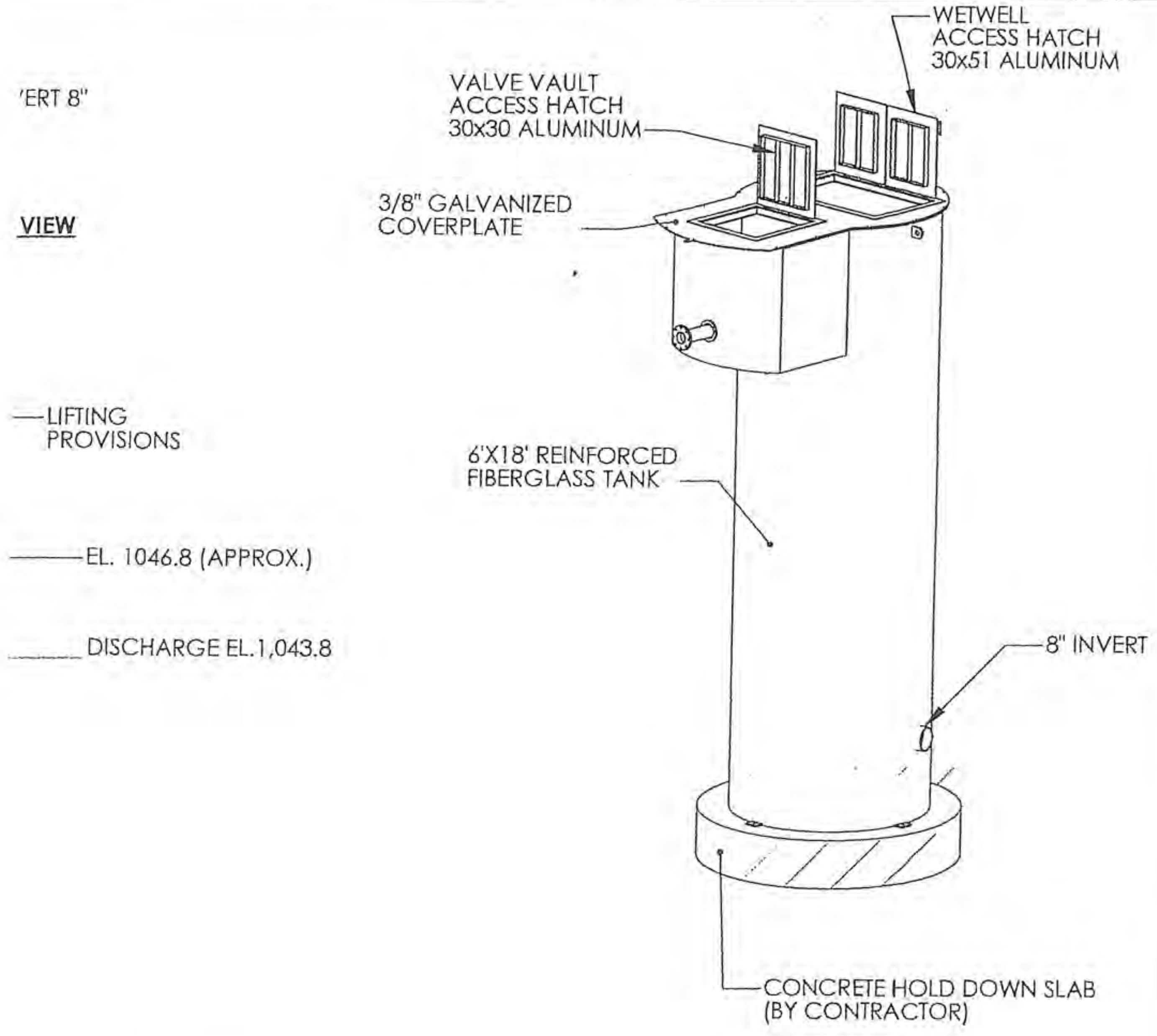
ALL DIMENSIONS IN INCHES
NOTE: CASTING DIMENSIONS MAY VARY ± 1/8"



SECTION A-A
SCALE 1 : 55

FRONT VIEW

SCALES & DIMENSIONS ARE FOR REFERENCE ONLY, DRAWING MUST BE CERTIFIED CORRECT FOR CONSTRUCTION



ISO VIEW

* BY ENGINEER/CONTRACTOR

UNLESS OTHERWISE SPECIFIED:
DIMENSIONS ARE IN INCHES
TOLERANCES:
FRACTIONAL: +/- 1/16
ANGULAR: 1 DEG
ONE PLACE DECIMAL: +/- 0.5
TWO PLACE DECIMAL: +/-0.07
INTERPRET GEOMETRIC TOLERANCING PER:
MATERIAL
FINISH
DO NOT SCALE DRAWING

	NAME	INIT.	DATE
DRAWN	MAO		10/23/03
CHECKED			
SALES APPR.	B.K.		
PURCH. APPR	S.B.		
MFG APPR.	NR/TM		

NEXT ASSY	USED ON
APPLICATION	

PumpTech Inc.

QUOTE# 2991

TITLE: **CITY OF PENDLETON**
WEST GATE P.S.
HYDRONIX MODEL 421 PS

SIZE	DWG. NO.	REV
B	M00535	A

SCALE: 1:96 WEIGHT: SHEET 1 OF 1

MC KAY CREEK

PUMP STATION DATA SHEET

LOCATION: MC KAY CREEK AREA

SERIAL NO. 59797

CONTRACTOR: MIKE BECKER CONST.

DISTRIBUTOR: PUMPTECH, INC.

STATION TYPE: **421**

STARTUP DATE:

PUMP:

STATION:

PIPING : SUCTION 4 " DISCH. "

CONDITIONS OF SERVICE:

DESIGN DUTY: 225 GPM, 35' TDH, LIQUID: SEWAGE
SOLIDS: 3"
DRIVEN RPM: 1750

PUMP DATA:

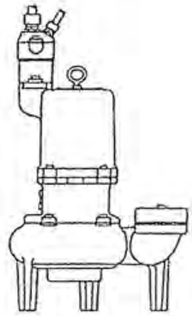
PUMP MODEL: S4HX 500JC SUBMERSIBLE PUMPS

PHASE: 3 VOLT: 230 HORSEPOWER: 5 RPM: 1750
IMP. DIA.: "

ELECTRICAL DATA:
BY OTHERS

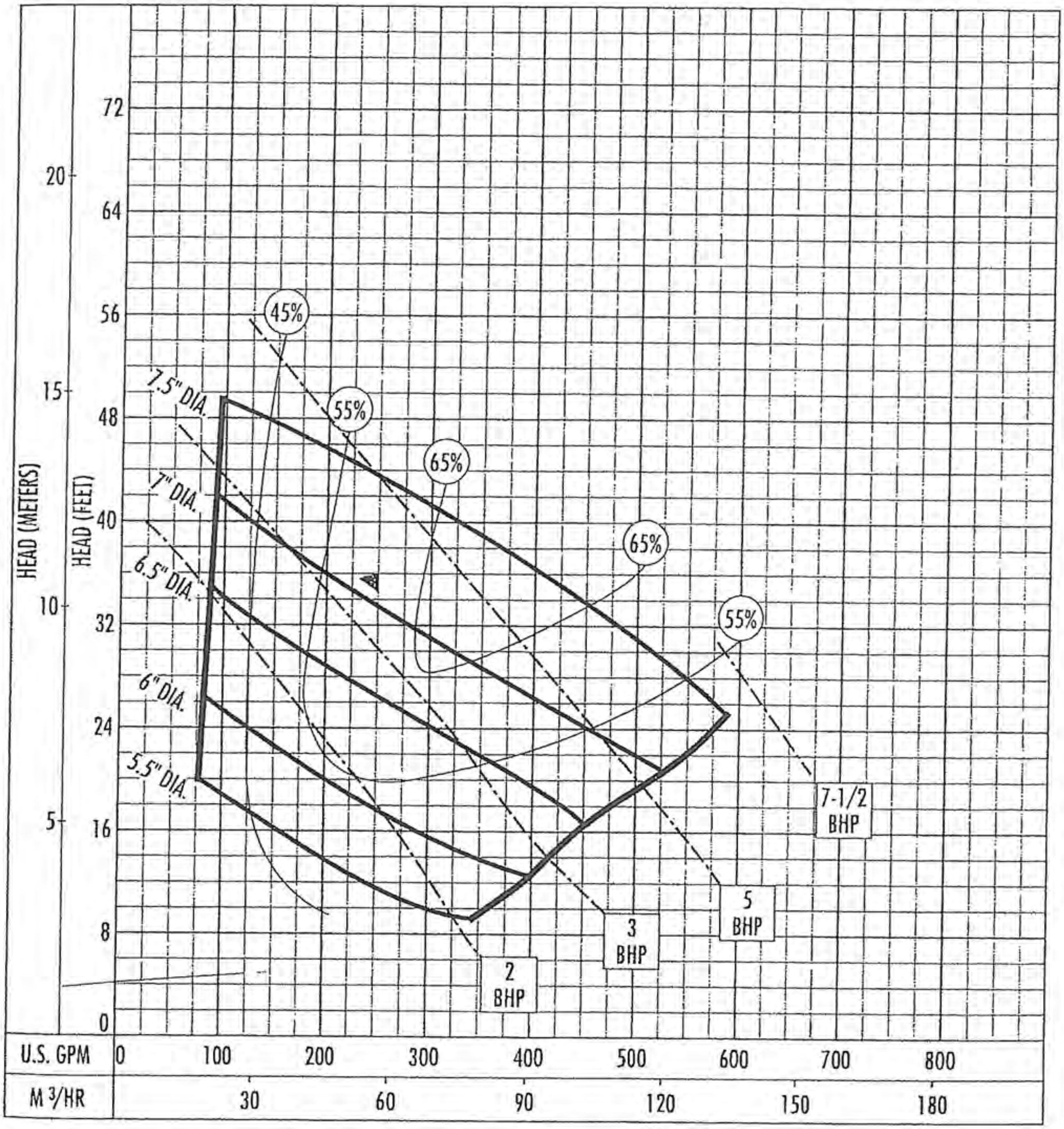
NOTES:

G:HOME\O&M\421



Performance Curve S4F/S4HX

RPM: **1750** Discharge: **4"** Solids: **3"**



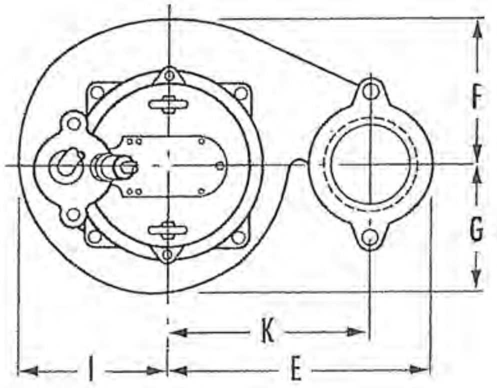
The curves reflect maximum performance characteristics without exceeding full load (Nameplate) horsepower. All pumps have a service factor of 1.2. Operation is recommended in the bounded area with operational point within the curve limit. Performance curves are based on actual tests with clear water at 70° F. and 1280 feet site elevation.

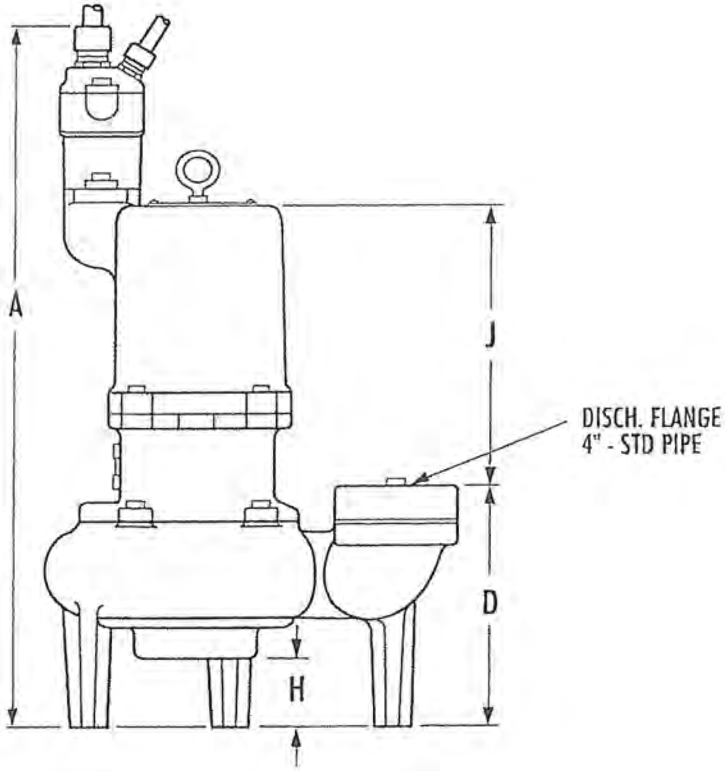
Conditions of Service:

GPM: 255 TDH: 35'

HYDROMATIC®

Dimensional Data S4F/S4HX



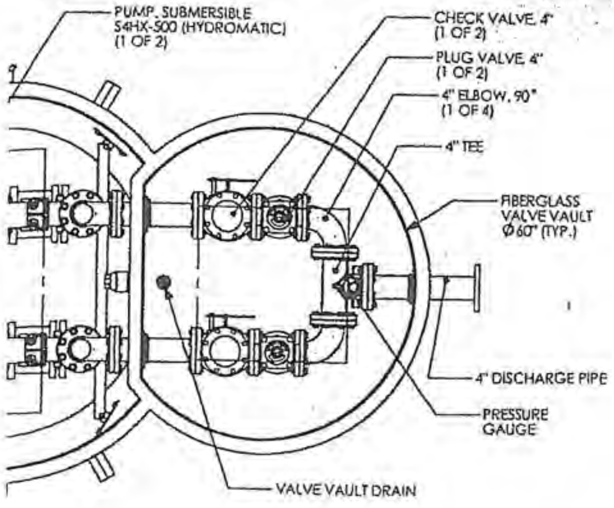


DISCH. FLANGE
4" - STD PIPE

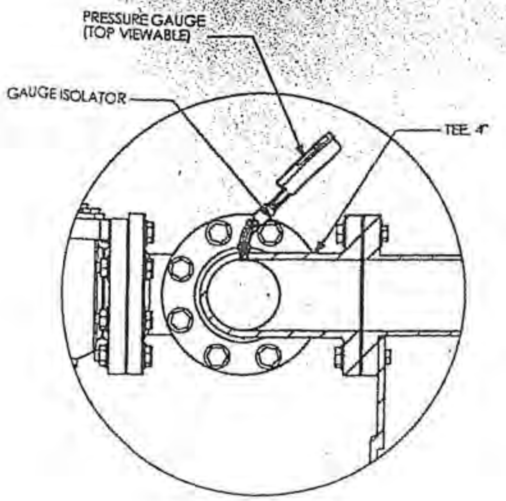
S4HX illustrated above

	A	D	E	F	G	H	I	J	K
S4F	28-5/8	10-3/4	12-1/8	7-1/2	6-1/4	3-1/8	7	11-3/16	9-1/4
S4HX	31-3/4	10-3/4	12-1/8	7-1/2	6-1/4	3-1/8	7	12-3/4	9-1/4

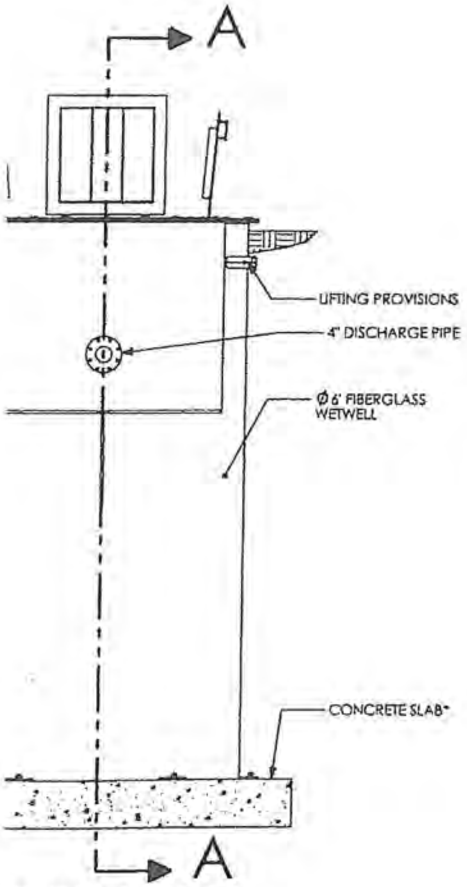
ALL DIMENSIONS IN INCHES
NOTE: CASTING DIMENSIONS MAY VARY ± 1/8"



TOP VIEW DETAIL
SCALE 1:35



DETAIL B
SCALE 1 : 10



:ONT VIEW DETAIL

NOTES:

*BY CONTRACTOR
**Ø 6' x 14.7' TALL
***INVERT SIDE LOCATION & ELEVATION TO BE CONFIRMED BY CUSTOMER
- CUSTOMER TO DETERMINED POWER HUB SIDE LOCATION

	NAME	INIT.	DATE
DRAWN	MAO		06/30/05
CHECKED			
SALES APPR.	B.K.		
PURCH. APPR.			
MFG APPR.			

JOB# 59797 - 47

TITLE:
MIKE BECKER GENERAL CONTRACTOR
MCKAY CREEK PUMP STATION
HYDRONIX MODEL 421 PUMP STATION

SIZE	DWG. NO.	REV
B	M-00839	A

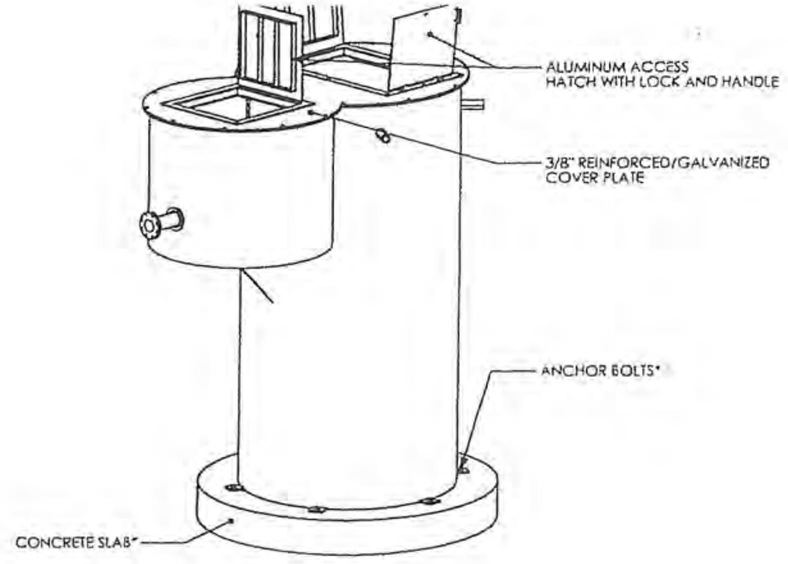
SCALE: NTS WEIGHT: SHEET 1 OF 1

DO NOT SCALE DRAWING

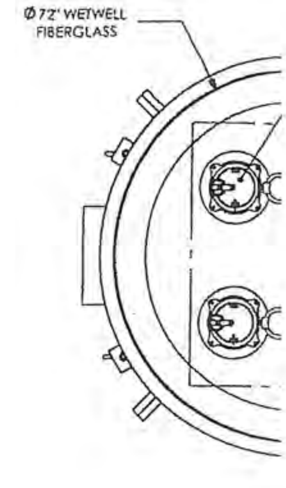
PROPRIETARY AND CONFIDENTIAL
THE INFORMATION CONTAINED IN THIS DRAWING IS THE SOLE PROPERTY OF PUMPTECH, INC. ANY REPRODUCTION IN PART OR AS A WHOLE WITHOUT THE WRITTEN PERMISSION OF PUMPTECH, INC. IS PROHIBITED.

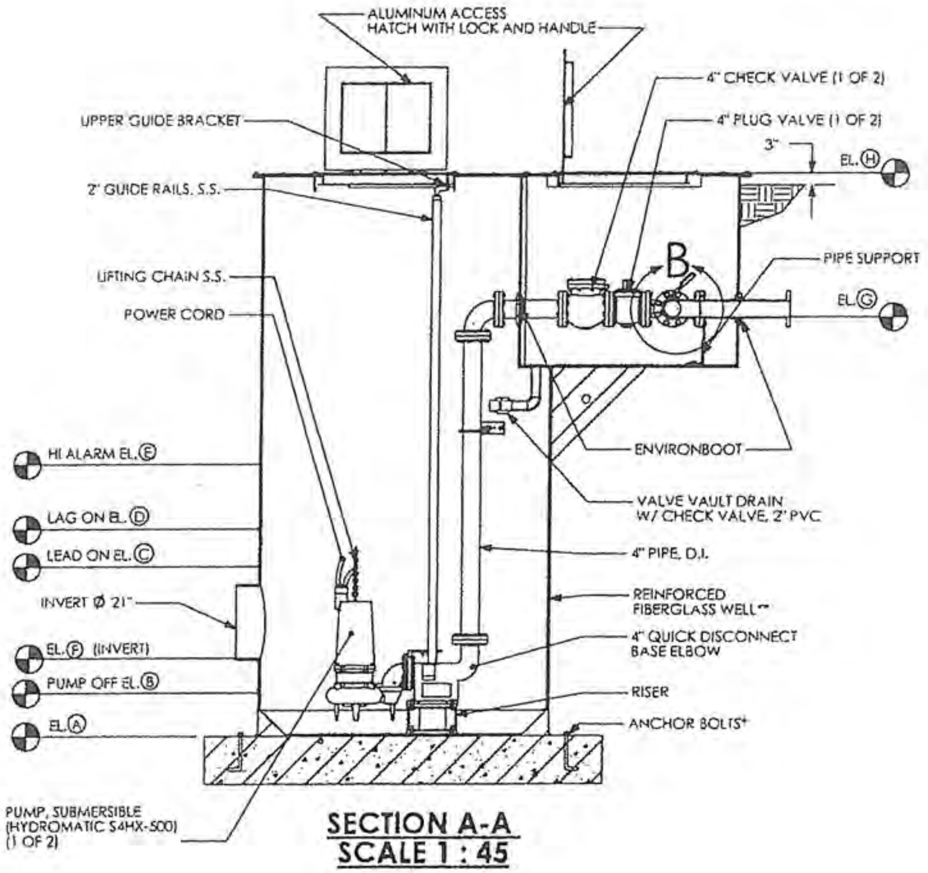
PumpTech inc.

H
44.1'

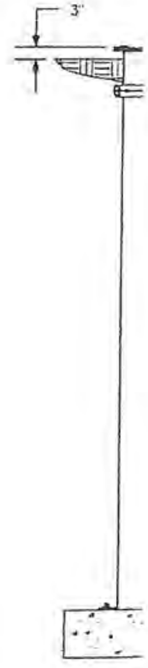


ISO VIEW
SCALE 1:60

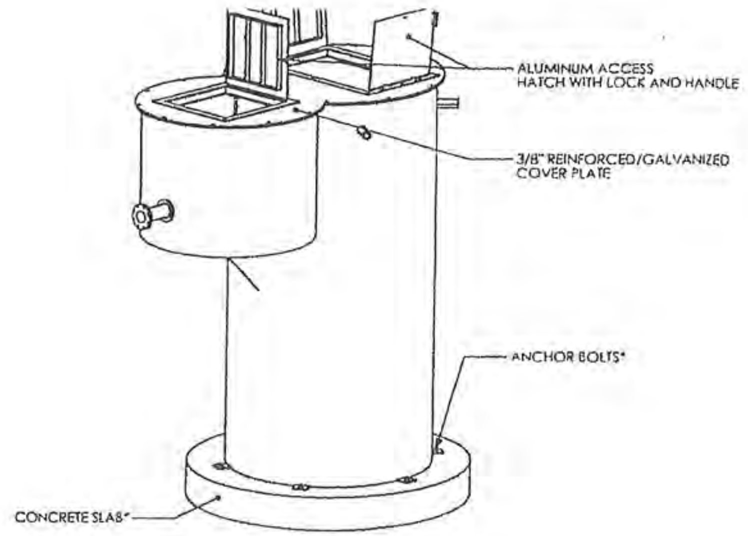




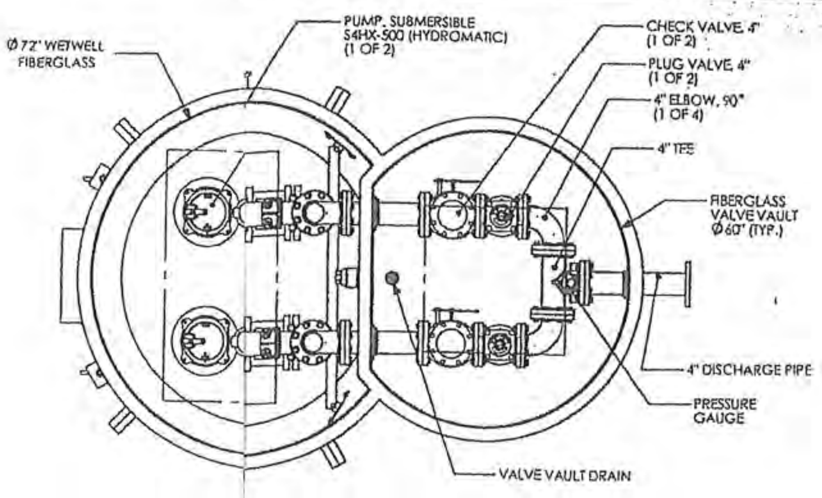
SECTION A-A
SCALE 1 : 45



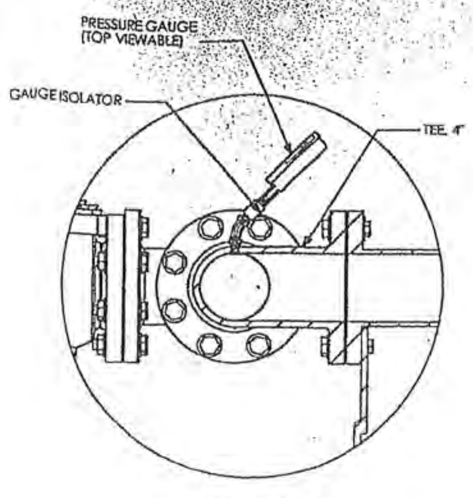
G.P.M.	T.D.H.	H.P.	R.P.M.	PHASE	VOLTS	A	B	C	D	E	F	G
225	35	5	1750	3	230	1,032.4'					1,034.0'	1,041.0'



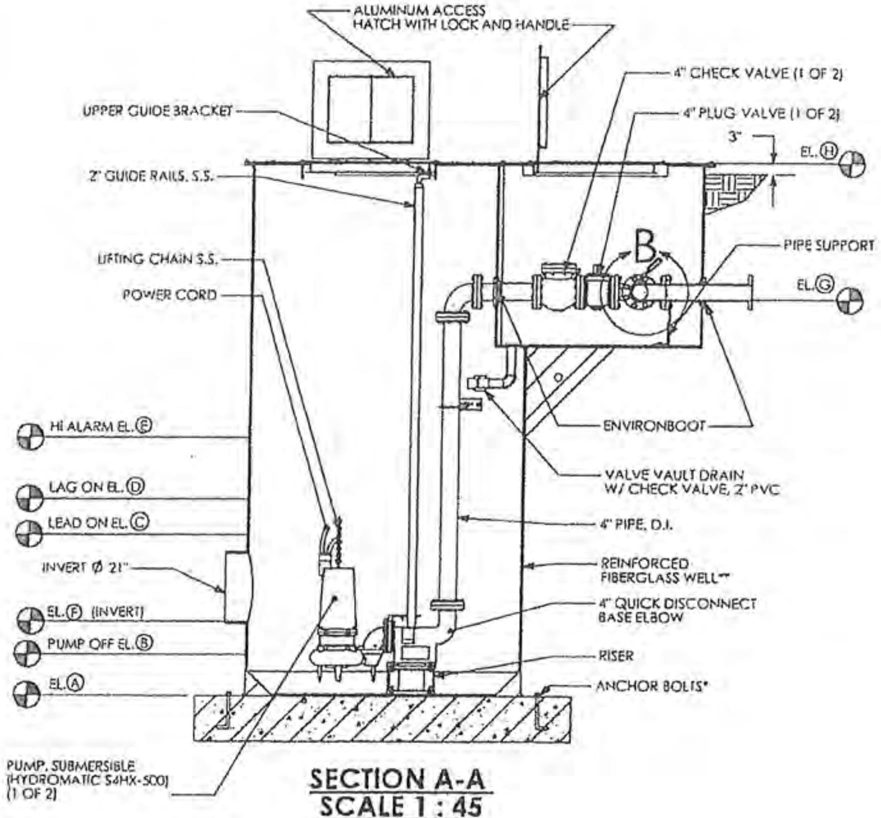
ISO VIEW
SCALE 1:60



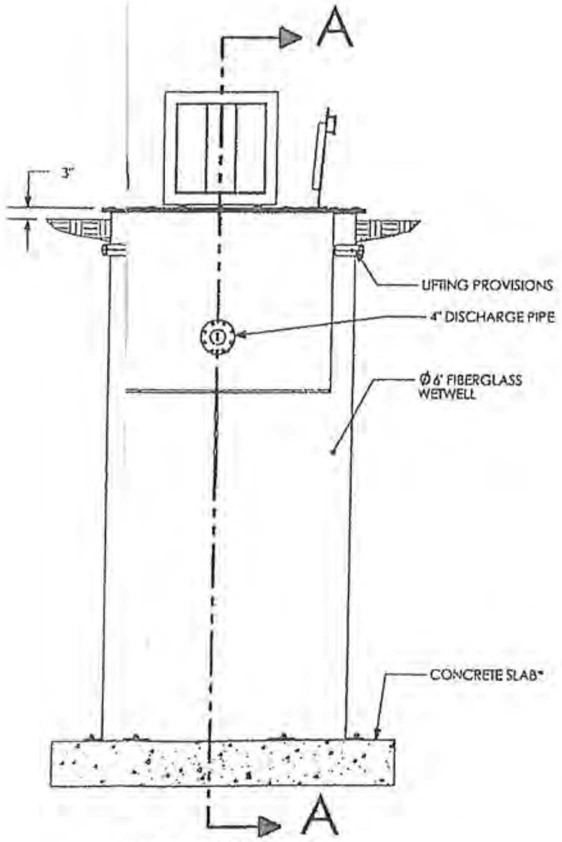
TOP VIEW DETAIL
SCALE 1:35



DETAIL B
SCALE 1 : 10



SECTION A-A
SCALE 1 : 45



ONT VIEW DETAIL

NOTES:

*BY CONTRACTOR
**Ø 6' x 14.7' TALL
***INVERT SIDE LOCATION & ELEVATION TO BE CONFIRMED BY CUSTOMER
- CUSTOMER TO DETERMINED POWER HUB SIDE LOCATION

G.P.M.	T.D.H.	H.P.	R.P.M.	PHASE	VOLTS	A	B	C	D	E	F	G	H
225	35	5	1750	3	230	1,032.4'					1,034.0'	1,041.0'	44.1'

DO NOT SCALE DRAWING

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	NAME	INIT.	DATE
DRAWN	MAO		06/30/05
CHECKED			
SALES APPR.	B.K.		
PURCH. APPR.			
MFG APPR.			

PumpTech inc.

JOB# 59797 - 47

TITLE:
MIKE BECKER GENERAL CONTRACTOR
MCKAY CREEK PUMP STATION
HYDRONIX MODEL 421 PUMP STATION

SIZE: B
DWG. NO. M-00839
REV: A
SCALE: NTS
WEIGHT:
SHEET 1 OF 1

CITY OF PENDLETON

①

11/16/2006

WESTGATE LIFT STATION
2 SUBMERSIBLE PUMPS
TRANSDUCER
FLOAT HI
SS RAILS PLATE
*LACKS A SAFETY ~~GRATE~~ GRATE IN VAULT LID OPENING
CHECK VALVE VAULT LID
SEPARATE ~~FEED~~ ELECTRICAL SERVICE /METER

BAR[illegible]CH LIFT STATION
CORNELL FIBERGLASS PS
2 ABS SUBMERSIBLE PUMPS
*CONTROL PANELS BELOW GRADE - IN EXPLOSIVE ENVIRONMENT
EXHAUST FAN
RADIO ~~[illegible]~~ ALARM SYSTEM
EXT POWER SUPPLY (METER)

SIPHON BOX - FROM KEYSTONE RV UNDER I-84
* 36" WATERMANGATE MODEL F 10
NORTH SIDE OF RIVER

BRIDGE SEWER CROSSING
10" AC + 10" DIP
3 RAISED MANHOLES GRADE + 10 ft
CONCRETE ROTTING
~~BD~~ CONCRETE BRIDGE SAGGING

②

WHERE 2 - 12" LINES COME TOGETHER TO
1 - 12" LINE IS THE WORST OVERFLOW POINT
MANHOLE OVERFLOWS TO DITCH TO MCKAY CREEK
THROUGH 15" RCP TO MCKAY

KIRK/MCKAY CR PS
FIBER GLASS
SOME GREASE
NO SAFETY GRATE
CONTROLS ABOVE GROUND
SEPARATE ELECTRICAL SERVICE

TREATMENT PLANT PUMP STATION
DRY/WET WELL ARRANGEMENT
CONCRETE WET WELL
STEEL DRY WELL
CONTROLS IN DRY WELL
LADDER 26 RUNG
PULL PUMPS W CABLE HOIST

①

COLLECTION SYSTEM ①
DISCUSSION 11/16/2006
BOB PATTERSON/TIM SIMMONS

4 MI EAST
UPPER VALLEY (TRIBE) 10" FEEDS TO DOWNTOWN
DOWNTOWN UPPER - 15"
DOWNTOWN LOWER - 24"
MEETS PLANT IN 48"

MACKAY CREEK IS SERVED IN UPPER AREA BY 12"
FEEDING INTO 2 - 12" LINES INTO 1-12" WHICH SURCHARGES
UPPER UPPER MACKAY WILL HAVE A NEW 18" LINE

TRIBE BEGINS @ MH 14 - ON MISSION TRUNK
PENDLETON HAS GUARANTEED 1.0 MGD. A
RECENT SURVEY HAS PREDICTED IT CAN
HANDLE UP TO 1.28 MGD

POSSIBLE ISSUE ALONG PATAWA CRK WITH
1:1 WHERE SEWERS CROSS
CREN

LAST MASTER PLAN COLLECTION SYSTEM MP IN 1962

PUMP STATIONS - TIM SIMMONS / MARK MILNE / JEFF

PUMP STATIONS

WESTGATE LIFT STA = FIBERGLASS WET WELL 2004
SW 18th & BYRES = PUMP TECH + HYDROMATIC PUMPS
3 OR 4 HP

BARCH LIFT STA - SMALL

MOVED FROM
SW KIRK (41st) - WEST OF MCKAY CREEK - NEW
2005 - PUMPTECH - HYDROMATIC 105gpm
2 5HP PUMPS

TREATMENT PLANT LIFT STA - LARGE

RIETH - NOT YET BUILT
BLUE MT FOREST PRODUCTS WILL PUMP INTO THE RIETH ~~PUMP STATI~~ FORCE MAIN

BLUFF ADJACENT TO I-84 HAS A BOX CULVERT THAT IS A MAIN OVERFLOW POINT

MACKAY & TUTA WILLA ARE BOB'S AREA OF MAIN CONCERN FOR I/I

COMPREHENSIVE PLAN
ZONING DEFS

CVIR-MP— CH 9/10/

Pendleton Wastewater Treatment Plant
Condition Assessment

Treatment Process Equipment Data Form

Date: 11/15 2006 K/J Staff: ______

1. Item: INFLUENT SCREEN
2. Installation Date: 3/98 Sales ORD: 30330
3. Manufacturer: JWC
4. Equipment Type: AUGER MONSTER
5. Model Number: GVFJSB3115-V154
6. Serial Number(s): F639414 30009 - serial # auger
7. Design Operating Point Data: 2008 - serial # channel grinder
    - a. Speed: 1750 RPM
    - b. Capacity: ______ gpm / other
    - c. ______: ______
8. Motor Nameplate Data: MOTOR SAY 1.5 HP
    - a. Horsepower / speed / FLA: 2.04 HP/ 1750 rpm/ ______ Amp
    - b. Voltage & Phase: 208-230/460/
    - c. NEMA Code / Service Factor: TEFC / 1.0 MOTOR SAYS 1.15
9. Photographs: YES

10. Condition: OK

11. Comments:

OP TORQUE 15,600 IN-lb

Pendleton Wastewater Treatment Plant
Condition Assessment

Treatment Process Equipment Data Form

Date: ____________ 2006   K/J Staff: ____________

1. Item: INFLUENT BYPASS SCREEN
2. Installation Date: ____________
3. Manufacturer: ____________
4. Equipment Type: ____________
5. Model Number: ____________
6. Serial Number(s): ____________
7. Design Operating Point Data:
    a. Speed: ________ RPM
    b. Capacity: ________ gpm / other
    c. ________: ________ ________
8. Motor Nameplate Data:
    a. Horsepower / speed / FLA: ____ HP/ ____ rpm/ ____ Amp
    b. Voltage & Phase: ____ / ____
    c. NEMA Code / Service Factor: ____ / ____
9. Photographs: ____________
10. Condition: ____________
11. Comments: ____________

Pendleton Wastewater Treatment Plant
Condition Assessment

Treatment Process Equipment Data Form

Date: 11 / 15 2006 K/J Staff: ROB PEACOCK

1. Item: INFLUENT COMMINUTOR #1
2. Installation Date:
3. Manufacturer: JWC
4. Equipment Type:
5. Model Number: CNV/JS 61254-R918
6. Serial Number(s): CL00 083TC
7. Design Operating Point Data:
   - a. Speed: 1750 RPM
   - b. Capacity: gpm / other
   - c. EFF :
8. Motor Nameplate Data:
   - a. Horsepower / speed / FLA: 5.04HP/ 1725rpm/ 15 Amp
   - b. Voltage & Phase: 230/460/ 30
   - c. NEMA Code / Service Factor: TEFC / 1.15 TEFC
9. Photographs:
10. Condition: OK
11. Comments: ORIGINAL MOTOR

5HP Channel Monster

Pendleton Wastewater Treatment Plant
Condition Assessment

Treatment Process Equipment Data Form

Date: 2006 K/J Staff:

1. Item: INFLUENT COMMINUTOR #2
2. Installation Date:
3. Manufacturer:
4. Equipment Type:
5. Model Number:
6. Serial Number(s): CL0007443
7. Design Operating Point Data:
   a. Speed: ______ RPM
   b. Capacity: ______ gpm / other
   c. ______: ______ ______
8. Motor Nameplate Data:
   a. Horsepower / speed / FLA: HP/ rpm/ Amp
   b. Voltage & Phase: /
   c. NEMA Code / Service Factor: /
9. Photographs:
10. Condition:
11. Comments: NEWER MOTOR (bypass)

Pendleton Wastewater Treatment Plant
Condition Assessment

Pump, Blower, Fan & Compressor - Equipment Data Form

Date: 2006 K/J Staff:

1. Item: GRIT PUMP
2. Installation Date: 2003
3. Manufacturer: PACO
4. Equipment Type: PUMP
5. Model Number: 53-409591-141000-1624
6. Serial Number(s): 1969702B
7. Design Operating Point Data:
   a. Speed: 850 RPM
   b. Impeller: 8.25 inches diameter
   c. Capacity: 250 gpm / SCFM
   d. Pressure: 15 ? [✓ feet] / psi / inches (wc)
8. Motor Nameplate Data: BALDOR
   2003 a. Serial Number: F0304022604 650907
   b. Horsepower / speed / FLA: 3 HP/ 350 rpm/ 12/6 Amp
   c. Voltage & Phase: 230/460 1 3ø
   d. NEMA Code / Service Factor: ODTF / 1.15 77% EFF
9. Photographs:
10. Condition:
11. Comments:
CAT# 53-409591-141000-1624

12. Force Main Information:

a. Length: ________ Feet

b. Size: ________ inches diameter

c. Pipe Material: ________

d. Sulfide Control Systems: ________ type

e. Air Release Valves: ________ (type/Number)

Pendleton Wastewater Treatment Plant
Condition Assessment

Treatment Process Equipment Data Form

Date: ______ 2006 K/J Staff: ______

1. Item: GRIT ~~PUMP~~ SEPARATOR
2. Installation Date: ______
3. Manufacturer: WEMCO (APSCO)
4. Equipment Type: GRIT AUGER
5. Model Number: ~~709 7053~~ 0040 12"
6. Serial Number(s): 709 7053
7. Design Operating Point Data:
   - a. Speed: ______ RPM
   - b. Capacity: ______ gpm / other
   - c. ______: ______ ______
8. Motor Nameplate Data:
   - a. Horsepower / speed / FLA: 1/2 HP/ 1920 rpm/ 1 Amp
   - b. Voltage & Phase: 230 / 3φ
   - c. NEMA Code / Service Factor: ODP / 1.0
9. Photographs: ✓
10. Condition: OLD

11. Comments: F-1106-06-170 ← MOTOR ON

Pendleton Wastewater Treatment Plant
Condition Assessment

Treatment Process Equipment Data Form

Date: 2006 K/J Staff:

1. Item: GRIT CHAMBER DRIVE
2. Installation Date:
3. Manufacturer: EIMCO [illegible]
4. Equipment Type: CHAIN DRIVE
5. Model Number: 72886 - 01A -serial #
6. Serial Number(s): BL [illegible] model #= W-13 Drive Unit
7. Design Operating Point Data:
   a. Speed: 56 RPM
   b. Capacity: gpm / other
   c. :
8. Motor Nameplate Data:
   a. Horsepower / speed / FLA: 3/4 HP/1800 rpm/ Amp
   b. Voltage & Phase: 1 3Ø
   c. NEMA Code / Service Factor: /
9. Photographs:
10. Condition:
11. Comments: Synchrogear Model F-1 univ. mt 3/4 HP 1800 RPM 460 Volts
GEAR RATIO
Op TORQUE 661
MOTOR SN P4294938 (ORIGINAL MOTOR)

CASCADE PUMP COMPANY
MANUFACTURERS OF AXIAL AND MIXED FLOW PUMPING EQUIPMENT
10107 SOUTH NORWALK BOULEVARD, P.O. BOX 2767 • SANTA FE SPRINGS, CALIFORNIA 90670-0767
E-MAIL: PUMPINFO@CASCADEPUMP.COM • WWW.CASCADEPUMP.COM
TEL:562.946.1414 • FAX:562.941.3730

facsimile transmittal

December 8, 2006

TO: KENNEDY JENKS - PORTLAND
FAX NO: 503 – 295-4901
ATTENTION: MICHAEL HUMM
FROM: BOB BROWN
NO. OF PAGES: 5

SUBJECT / REF: CASCADE SO 16256 and 12762

Per your request –

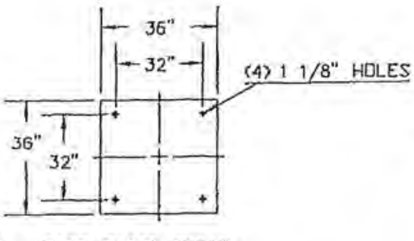
Copy of sectional drawing and curve from the original files.

If you have any questions please call our office.

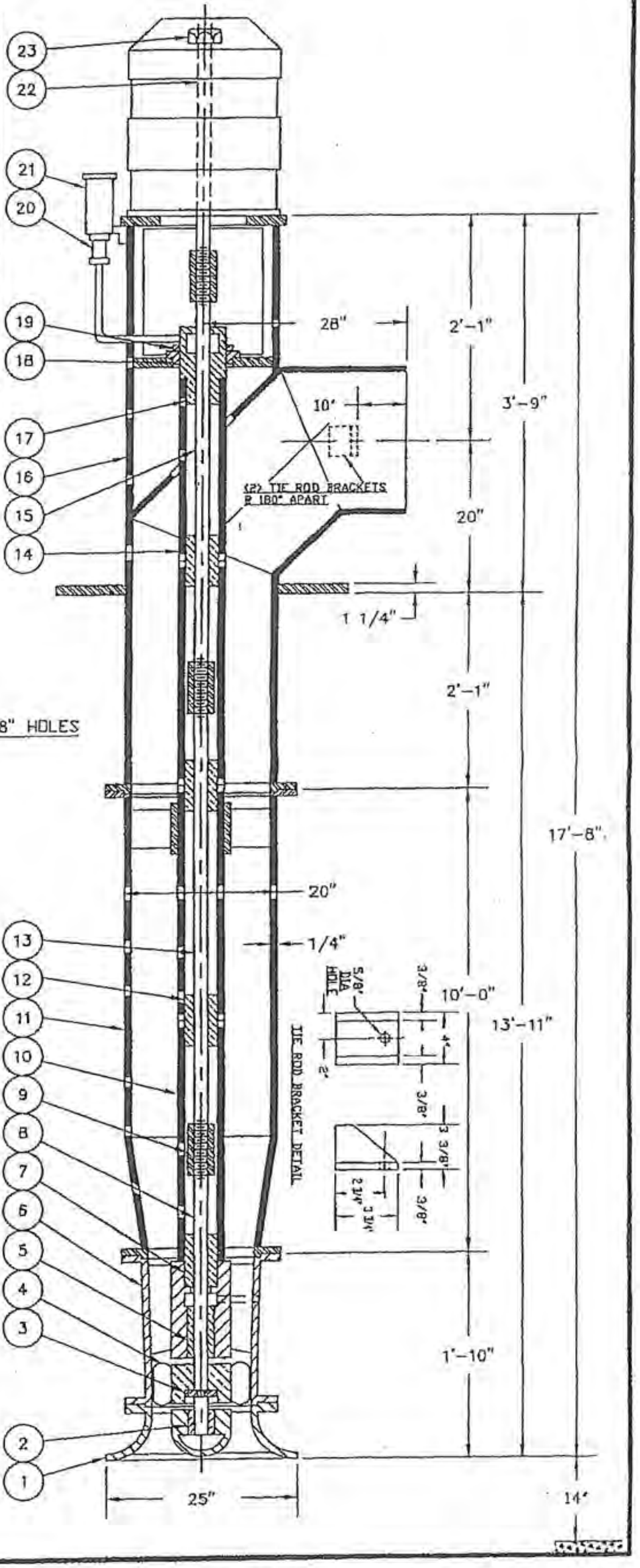
REVISIONS

ITEM	REQ'D	DESCRIPTION	MATERIAL	PART NO.
1	1	SUCTION BOWL	C.I. CL-30	16256-2
2	1	SUCT. BOWL BUSHING	BRONZE	E102
3	1	THRUST COLLAR & KEY	416 STN. STL.	H1000
4	1	PROPELLER	BRONZE	E103
5	1	DISCHARGE BOWL BUSHING	BRONZE	E102
6	1	DISCHARGE BOWL	C.I. CL-30	E100
7	1	TUBE CONNECTOR BEARING	BRONZE	D105
8	1	BOWL SHAFT	416 STN. STL.	E150
9	3	LINE SHAFT COUPLING	C-1020 STL.	S0050
10	2	BOTTOM ENCL. TUBE	EX-HVY PIPE	D108
11	1	DISCHARGE COLUMN	FAB. STEEL	T16X20-T
12	2 3	LINE SHAFT BEARING	BRONZE	D106A
13	1	BOTTOM LINE SHAFT	C-1045 STL.	S0900
14	1 1	TOP ENCL. TUBE	EX-HVY PIPE	D108
15	1	TOP LINE SHAFT	C-1045 STL.	S0900
16	1	DISCHARGE ELBOW	FAB. STEEL	16252-1
17	1	TENSION NUT BODY	BRONZE	H36H
18	1	TENSION NUT	CAST IRON	H36
19	1	LOCK RING	BRONZE	H39A
20	1	LUBRICATOR - 460 VOLT	SOLENOID	STOCK
21	1	OIL RESERVOIR - GALLON	ALUMINUM	STOCK
22	1	HEAD SHAFT	C-1045 STL.	D920
23	1	ADJUSTING NUT	STEEL	D921

ITEMS NO. 2, 5, 7, 12 & 17 ARE
RECOMMENDED SPARE PARTS



BASE PLATE DETAIL



BOWL SHAFT DIA= 1 1/2"
LINE SHAFT DIA= 1 1/2"
HEAD SHAFT DIA= 1 1/2"
ENCLOSING TUBE= 2 1/2"

SHOP ORDER - 16256

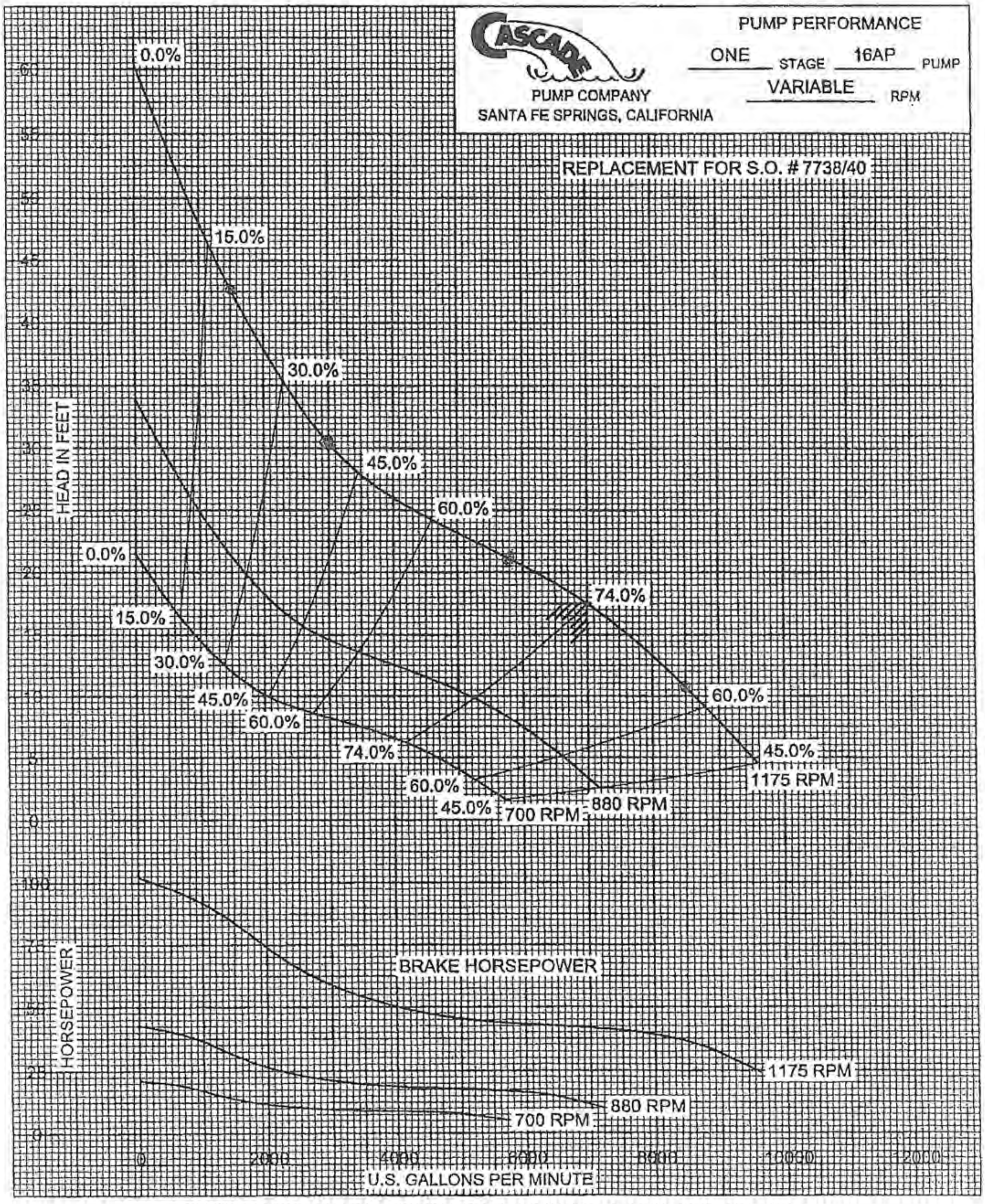
CASCADE PUMP COMPANY
SANTA FE SPRINGS, CALIFORNIA

#16AP PROPELLER PUMP
20" O.D. DISCHARGE

LAYNE OF WASHINGTON

ORDER 3260
DATE 6-3-03
SCALE
DRAWN BB
CHECKED KM
3MS5836

CURVE NO. 03-012



CASCADE PUMP COMPANY
SANTA FE SPRINGS, CALIFORNIA

PUMP PERFORMANCE
ONE STAGE 16AP PUMP
VARIABLE RPM

REPLACEMENT FOR S.O. # 7738/40

CURVES SHOW APPROXIMATELY THE CHARACTERISTICS WHEN PUMPING CLEAR NON—AERATED WATER. NO GUARANTEE IS MADE EXCEPT FOR THE RATED POINT.

Pendleton Wastewater Treatment Plant
Condition Assessment

Pump, Blower, Fan & Compressor - Equipment Data Form

Date: 2006 K/J Staff: MDH

1. Item: RAS Pump #2 PLANT PUMP #2
2. Installation Date: 1986
3. Manufacturer: CASCADE Pump
4. Equipment Type: VERT TURB. PUMP
5. Model Number:
6. Serial Number(s): 12762 12MF DD4-42 impeller
7. Design Operating Point Data:
   - a. Speed: 1150 RPM SIZE: 12MF
   - b. Impeller: DD4-42 inches diameter
   - c. Capacity: ________ gpm / SCFM
   - d. Pressure: ________ feet / psi / inches (wc)
8. Motor Nameplate Data: US Electrical
   - a. Serial Number: N1ZN2900523R-1
   - b. Horsepower / speed / FLA: 20 HP/ 1145 rpm/ 52 26 Amp
   - c. Voltage & Phase: 230 460 / 3
   - d. NEMA Code / Service Factor: /
9. Photographs: ________
10. Condition: Older
11. Comments: Cascade Pump : (562) 946-1414 BOB
    - 12 Mixed Flow

12. Force Main Information:

a. Length: ________ Feet

b. Size: ________ inches diameter

c. Pipe Material: ________

d. Sulfide Control Systems: ________ type

e. Air Release Valves: ________ (type/Number)

6019

REVISIONS	11-24-86 STRAINER DELETED HB	A

ITEM	REQ'D	DESCRIPTION	MATERIAL	PART NO
2	1	SUCTION BOWL	C.I. CL-30	MFCA 101 A
3	1	SUCT. BOWL BUSHING	SAE 660 BRZ	C102
4	1	THRUST COLLAR & KEY	416 STN. STL	M100C
5	1	IMPELLER	SAE 40 BRZ.	MFC 103CB
6	1	DISCH. BOWL BUSHING	SAE 660 BRZ.	C102
7	1	DISCHARGE BOWL	C.I. CL-30	MFC 100C
8	3	LINE SHAFT BEARING	SAE 40 BRZ.	C106A
9	1	BOWL SHAFT	416 STN STL	MFC150E
10	3	LINE SHAFT COUPLING	C1020 STL	SC950
11	2	BOTTOM ENCL. TUBE	EX-HVY PIPE	C108
12	1	BOTTOM LINE SHAFT	C1045 STL	SC1000
13	1	TOP ENCL TUBE	EX-HVY PIPE	C108
14	1	TOP LINE SHAFT	C-1045 STL	SC1000
15	1	DISCHARGE ELBOW	FAB STEEL	12762-1
16	1	TENSION NUT BODY	SAE 40 BRZ.	H366
17	1	TENSION NUT	CAST IRON	H38
18	1	LOCK RING & WASHER	BRONZE	H39
19	1	DISCHARGE COLUMN	FAB STEEL	S12X120
20	1	OILER- 460 VOLT	SOLENOID	STOCK
21	1	OIL RESERVOIR-GAL	ALUMINUM	STOCK
22	1	HEAD SHAFT	C-1045 STL.	C920
23	1	ADJUSTING NUT	STEEL	C920

ITEMS NO 3,6,8&16 ARE RECOMMENDED SPARE PARTS

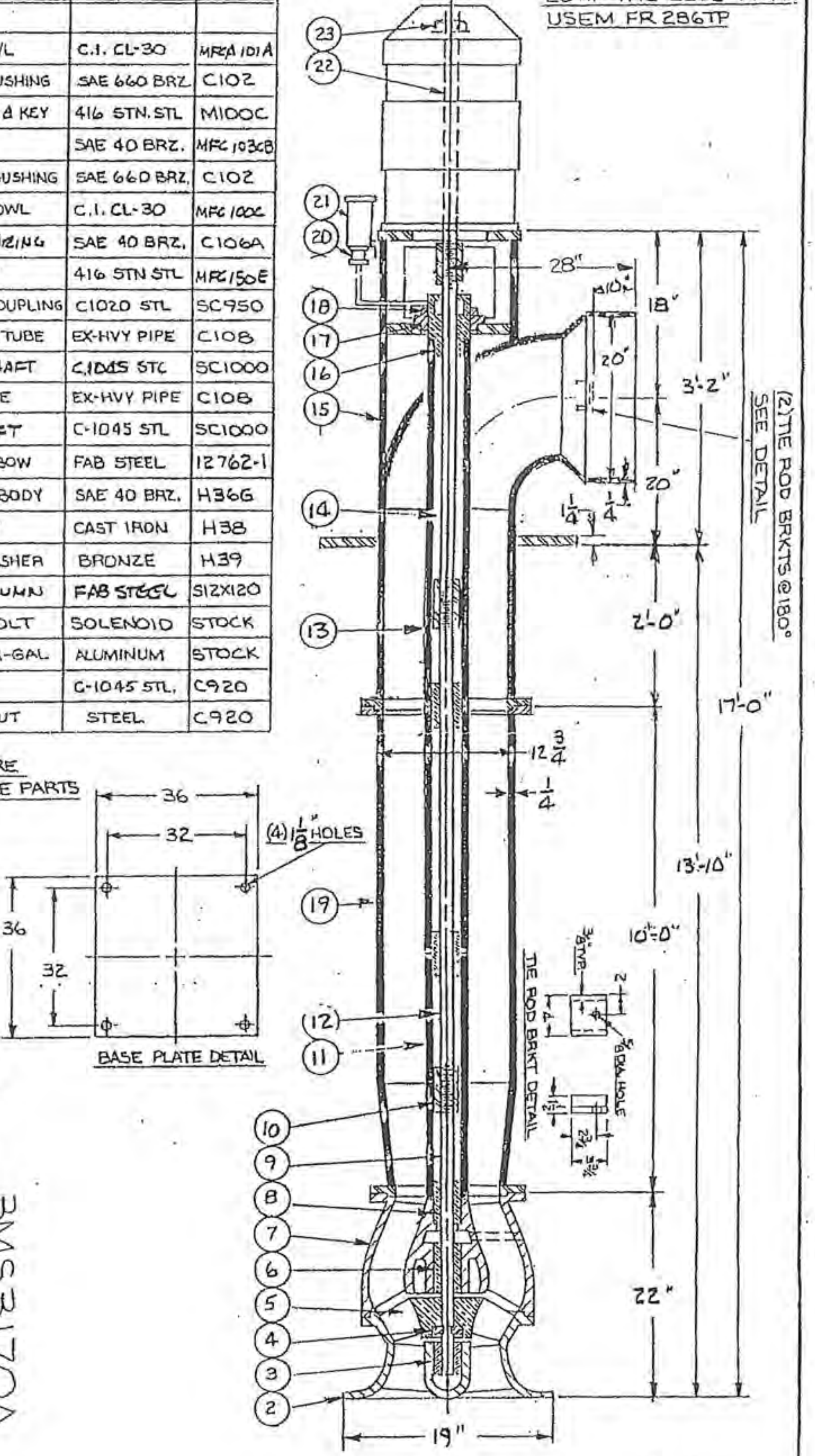
BOWL SHAFT DIA = 1 3/16

LINE SHAFT DIA = 1 3/16

ENCLOSING TUBE = 2

HEAD SHAFT DIA = 1 3/16

SHOP ORDER - 12762



3MS3170A

CASCADE PUMP CO.
SANTA FE SPRINGS, CALIFORNIA

#12CA MIXED FLOW PUMP
20" O.D. DISCHARGE

TRIANGLE PUMP
ORDER- 9926

DRAWN

CHECKED J. SMITH

CURVE NO. 12762

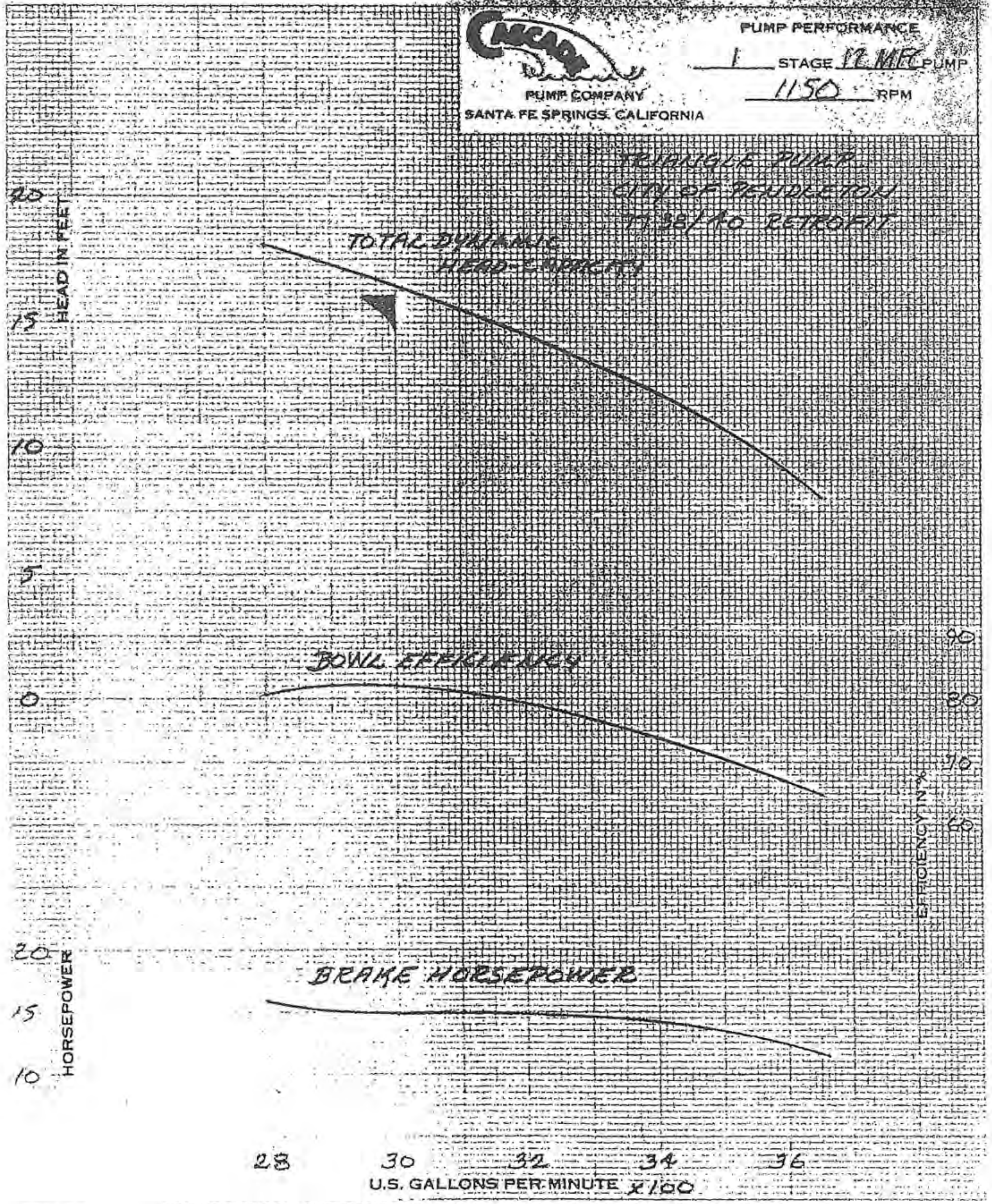
CASCADE PUMP COMPANY
SANTA FE SPRINGS, CALIFORNIA

PUMP PERFORMANCE

1 STAGE 12 MFC PUMP

1150 RPM

TRIANGLE PUMP
CITY OF PENDLETON
7738/40 RETROFIT



E061 9/84

CURVES SHOW APPROXIMATELY THE CHARACTERISTICS WHEN PUMPING CLEAR NON-AERATED WATER. NO GUARANTEE IS MADE EXCEPT FOR THE RATED POINT.

Pendleton Wastewater Treatment Plant
Condition Assessment

Pump, Blower, Fan & Compressor - Equipment Data Form

Date: 2006 K/J Staff:

1. Item: RAS PUMP #3 Plant Pump #3

2. Installation Date:

3. Manufacturer: ~~CASCADE PUMP~~ LAYNE & BOWLER INC

4. Equipment Type: VERTICAL TURBINE PUMP

5. Model Number: 54195

6. Serial Number(s):

7. Design Operating Point Data:

   a. Speed: ________ RPM

   b. Impeller: ________ inches diameter

   c. Capacity: 7000 gpm / SCFM

   d. Pressure: ________ feet / psi / inches (wc)

8. Motor Nameplate Data: US MOTORS

   a. Serial Number: P4289078

   b. Horsepower / speed / FLA: 40 HP/ 900 rpm/111/55.5Amp

   c. Voltage & Phase: 230/460 / 3 ϕ

   d. NEMA Code / Service Factor: / 1.15

9. Photographs:

10. Condition: OLDEST PUMP AT MID PUMP STA - LOOKS OK (18" DISCHARGE)

11. Comments: JEFF WARDNER 503 205 2123 cell 503 539 7331

12. Force Main Information:

a. Length: ________ Feet

b. Size: ________ inches diameter

c. Pipe Material: ________

d. Sulfide Control Systems: ________ type

e. Air Release Valves: ________ (type/Number)

Pendleton Wastewater Treatment Plant
Condition Assessment

Treatment Process Equipment Data Form

Date: 2006 K/J Staff:

1. Item: RAS WASTE PUMP FROM RAS SPLITTER BOX TO HEADWORKS
2. Installation Date: 2003 11/19/03
3. Manufacturer: PACO PUMPS
4. Equipment Type:
5. Model Number: 53-409591-141000-1624
6. Serial Number(s): 1969702C
7. Design Operating Point Data:
    - a. Speed: RPM
    - b. Capacity: 250 gpm / other TDH = 15'
    - c. Impeller: 8.25 inches
8. Motor Nameplate Data: F0304022614 SPEC: 37F223-D42961
    - a. Horsepower / speed / FLA: 3 HP/ 850 rpm/ 12/6 Amp
    - b. Voltage & Phase: 230/460 /3
    - c. NEMA Code / Service Factor: ODTF / 1.15
9. Photographs:
10. Condition: LOOKS NEW
11. Comments:

Pendleton Wastewater Treatment Plant
Condition Assessment

Treatment Process Equipment Data Form

ORIGINAL CLARIFIER

Date: 2006 K/J Staff: ______

1. Item: PRIMARY CLARIFIER #1 ~~#2~~ DRIVE (IN OPERATION)
2. Installation Date: 2/24/06 90°ϕ
3. Manufacturer: EIMCO
4. Equipment Type: CLARIFIER
5. Model Number: C30HT
6. Serial Number(s): EWT 0109 - 100A
7. Design Operating Point Data:
   a. Speed: ______ RPM
   b. Capacity: ______ gpm / other
   c. ______: ______ ______
8. Motor Nameplate Data: NORD NM 3321 22020419 installed 2005
   a. Horsepower / speed / FLA: 3/4 HP/1710 rpm/2.7/1.35Amp (0.55 KW)
   b. Voltage & Phase: 230/460 / 1ϕ
   c. NEMA Code / Service Factor: TEFC / 1.15
9. Photographs: ✓
10. Condition: GOOD CONDITION - LOOKS NEW

11. Comments: NEW ALUMINUM CATWALK, RAIL, + DRIVE AND NEW CENTER WELL

Reducer is NORD model SK22-80. 5/4 CU

serial 8505310406.00 Z

24RPM RATIO 69.81

Pendleton Wastewater Treatment Plant
Condition Assessment

Pump, Blower, Fan & Compressor - Equipment Data Form

Date: 2006 K/J Staff:

1. Item: PRIMARY CLARIFIER SLUDGE PUMP #1 RAW SLUDGE PUMP #1
2. Installation Date: June 99
3. Manufacturer: CARTER PUMP
4. Equipment Type: PUMP - PISTON SLUDGE
5. Model Number: ~~8008~~ 800S-0356
6. Serial Number(s): 0356
7. Design Operating Point Data:
   - a. Speed: 1750 RPM
   - b. Impeller: ______ inches diameter
   - c. Capacity: 85 [✓ gpm] / SCFM
   - d. Pressure: 80 [✓ feet] / psi / inches (wc)

Installed 1999

8. Motor Nameplate Data: US MOTORS UNIMOUNT 125 E194A CAT #
   - a. Serial Number: CBN2502SB3MT184T5
   - b. Horsepower / speed / FLA: 5 HP/ 1745rpm/15/13.6/6.8 Amp
   - c. Voltage & Phase: 208/230/460 3ϕ
   - d. NEMA Code / Service Factor: TE / 1.25 85.5% EFF
9. Photographs: ____________

10. Condition: MOTOR NEW

11. Comments: GEAR RATIO = 35.5

SER# RC06-98082033-6T01

12. Force Main Information:

a. Length: ________ Feet

b. Size: ________ inches diameter

c. Pipe Material: ________

d. Sulfide Control Systems: ________ type

e. Air Release Valves: ________ (type/Number)

Pendleton Wastewater Treatment Plant
Condition Assessment

Treatment Process Equipment Data Form

1970 addition

Date: 2006 K/J Staff:

1. Item: PRIMARY CLARIFIER #1. DRIVE (NOT IN OPER)
2. Installation Date:
3. Manufacturer: DORR COMPANY
4. Equipment Type: CHAIN CLARIFIER DRIVE
5. Model Number:
6. Serial Number(s): VS-17241
7. Design Operating Point Data:
   a. Speed: 25 RPM
   b. Capacity: gpm / other
   c. :
8. Motor Nameplate Data: STERLING #21664
   a. Horsepower / speed / FLA: ½ HP/ 25 rpm/ 1 Amp
   b. Voltage & Phase: 440 / 1Ø
   c. NEMA Code / Service Factor: /
9. Photographs:
10. Condition: POOR - OLD, ALOT OF RUST
11. Comments: OVERFLOW LAUNDERS CONCRETE, RECENTLY COATED. ALL STEEL EQUIP IN POOR CONDITION WITH RUST

Pendleton Wastewater Treatment Plant
Condition Assessment

Pump, Blower, Fan & Compressor - Equipment Data Form

Date: 2006 K/J Staff:

1. Item: PRIMARY CLARIFIER #2, (IN OPERATION) Sludge Pump
2. Installation Date: Raw Sludge Pump #2 2004 2/24/04
3. Manufacturer: CARTER PUMP
4. Equipment Type: SLUDGE POSITIVE DI
5. Model Number: 800 S
6. Serial Number(s): 0558
7. Design Operating Point Data:
    a. Speed: [illegible]/50 RPM
    b. Impeller: — inches diameter PISTON
    c. Capacity: 85 gpm / SCFM
    d. Pressure: 30 [✓ feet] / psi / inches (wc)
8. Motor Nameplate Data: SM-CYLCO Sumitomo
    a. Serial Number: S3F004288
    b. Horsepower / speed / FLA: 5 HP/1730 rpm/13/6.5 Amp
    c. Voltage & Phase: 230/460 13ϕ
    d. NEMA Code / Service Factor: [illegible] / 1.0 NEMA-B
9. Photographs: ✓
10. Condition: GOOD
11. Comments: GOOD SHAPE MOTOR LOOKS NEW

12. Force Main Information:

a. Length: ________ Feet

b. Size: ________ inches diameter

c. Pipe Material: ________

d. Sulfide Control Systems: ________ type

e. Air Release Valves: ________ (type/Number)

Pendleton Wastewater Treatment Plant
Condition Assessment

Pump, Blower, Fan & Compressor - Equipment Data Form

Date: 2006 K/J Staff:

1. Item: AutoSampler Primary Clar Eff
2. Installation Date:
3. Manufacturer: Sigma
4. Equipment Type: Sampler
5. Model Number: 900
6. Serial Number(s):
7. Design Operating Point Data:
   a. Speed: RPM
   b. Impeller: inches diameter
   c. Capacity: gpm / SCFM
   d. Pressure: feet / psi / inches (wc)
8. Motor Nameplate Data:
   a. Serial Number:
   b. Horsepower / speed / FLA: HP/ rpm/ Amp
   c. Voltage & Phase: /
   d. NEMA Code / Service Factor: /
9. Photographs:
10. Condition:
11. Comments:

12. Force Main Information:

- a. Length: ________ Feet
- b. Size: ________ inches diameter
- c. Pipe Material: ________
- d. Sulfide Control Systems: ________ type
- e. Air Release Valves: ________ (type/Number)

PLANT PUMP STA

CASCADE MACHINERY
& ELECTRIC, INC.
9145 SE 64TH AVENUE * PORTLAND, OR 97206
Phone 503-788-2850
Fax 503-788-3511

Date: 01-29-98

Cust # 7739
Name CITY OF PENDLETON
Address 1501 SE BYERS
P O BOX 190
PENDLETON, OR 97801

Phone# 541-276-1811

Fax# 541-276-1815

Attention: SUE L.

Quotation Number: S-81345

Job Description: CORNELL RETRO- FIT PUMPS

WE ARE PLEASED TO OFFER THE FOLLOWING EQUIPMENT FOR YOUR CONSIDERATION

LINE NO.	QUANTITY	PRODUCT NUMBER AND DESCRIPTION	UNIT PRICE	EXTENDED TOTAL
1.	2	4NNTCSV-5-6 * CORNELL VERTICAL MOUNTED PUMPS. INCLUDES: 4" SUCTION & DISCHARGE, TANGENTIAL DISCHARGE, 3" SOLIDS HANDLING CAPACITY, TUNGSTEN CARBIDE SINGLE MECHANICAL SEAL AND 5 HP, 1200 RPM, 3-PHASE WP-1 MOTORS. ADD $ 230.00 EACH FOR 7.5 HP MOTORS. THIS WOULD ALLOW FOR MORE CAPACITY IN THE FUTURE IF REQUIRED BY REPLACING THE IMPELLERS ONLY.	3,585.00	7,170.00

DELIVERY APPROX. 5-6 WEEKS.

FOB point: FACTORY

Freight terms: COLLECT

Payment terms: NET 10 DAYS

This quotation is valid for 30 days expiring on 02-28-98 and is subject to Cascade Machinery & Electric terms and conditions.

Thank you FRANK BAKER

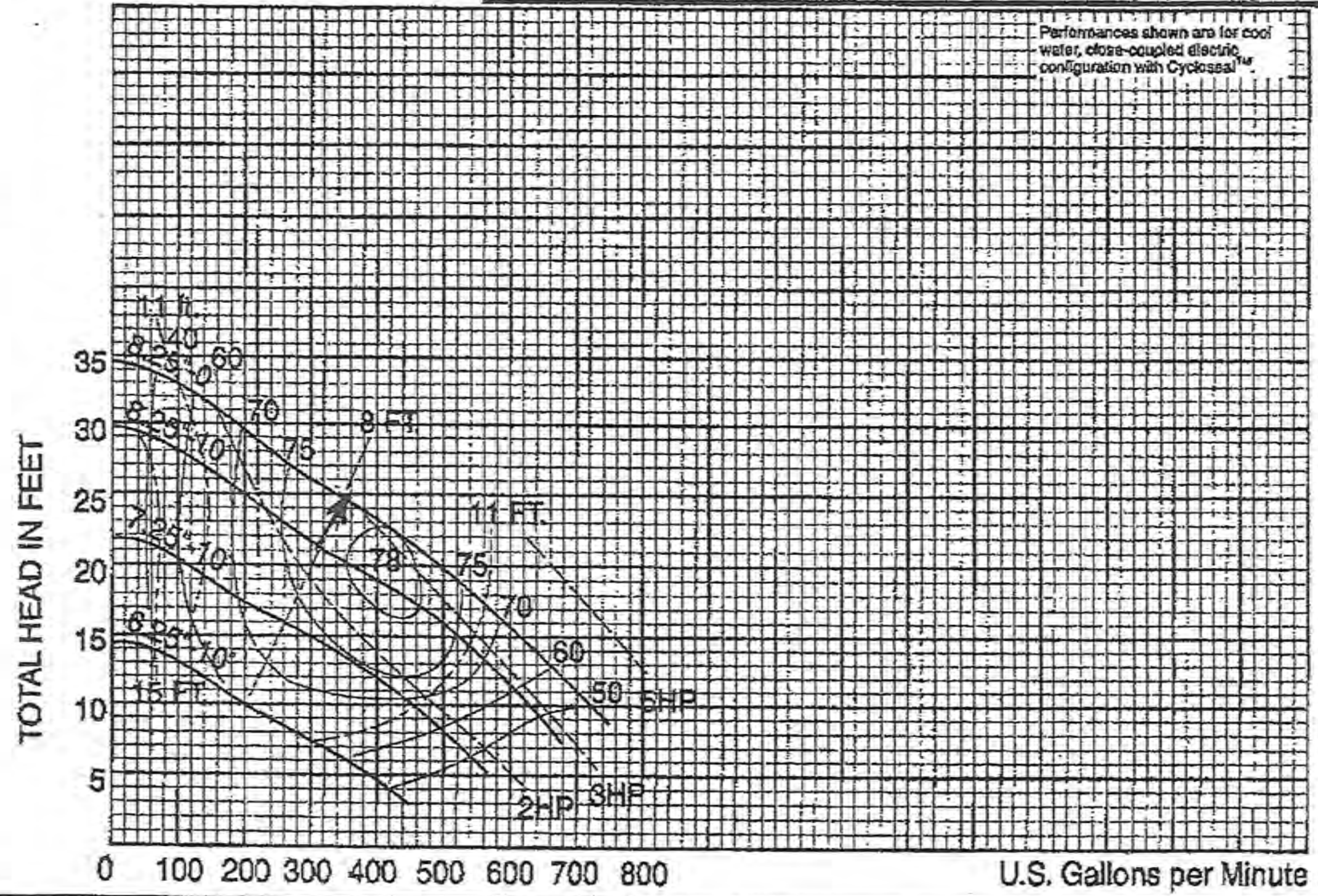
Sales representative

Accepted by: ____________________

Feet x .305 = Meters
Inches x 25.4 = Millimeters
GPM x .227 = Cubic Meters/Hour
GPM x 3.785 = Liters/Minute
HP x .746 = KW

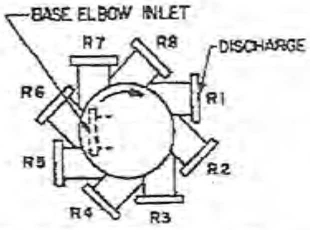
SINGLE VOLUTE

MODEL 4NNTL	CC	VM			
Speed 1140	Impeller Dia. and Style Various	Enclosed	N_S 2400	Solids Dia. 3.00"	

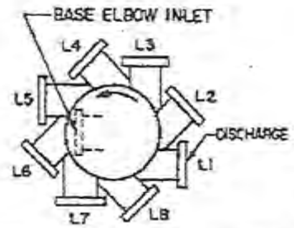


Cornell Pump Company
2323 SE Harvester Drive • Portland, Oregon 97222-7592 USA

4NNTL – 1200 RPM

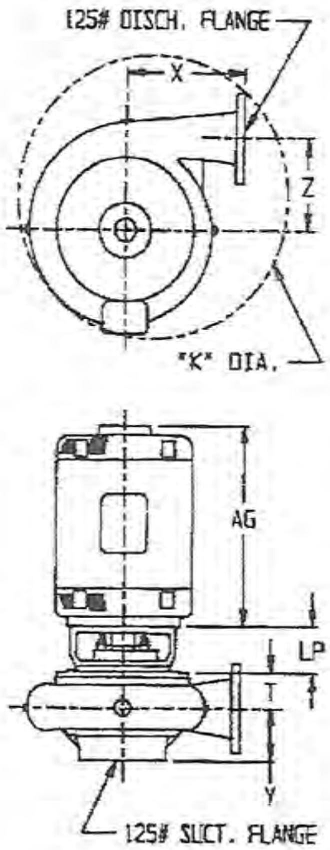


Discharge positions viewed from top end.



Discharge positions viewed from top end.

Right hand rotation shown, left hand exact opposite.



Do not use for construction unless certified.

Flange connection dimension can vary ± .12 inch.

PUMP DIMENSIONS								
Model	Disch.	Suct.	K	T	X	Y	Z	LP
3NLT	3	3	18.00	3.31	7.50	4.53	4.75	4.56
3NLA	3	3	18.00	3.34	7.50	4.44	4.75	4.56
4NNT, DL, DH, Z**	4	4	23.00	3.88	9.25	4.25	6.25	5.25
4NHTA	4	4	27.00	4.00	11.00	4.75	9.25	5.25
4x4x14T	4	4	29.00	4.00	11.00	4.75	9.25	5.25
4x4x14DL	4	4	29.00	4.00	11.00	4.88	9.25	5.25
4NHDH	4	4	29.00	3.97	11.00	4.50	9.25	5.25
6NHTA, 6NHG	6	6	35.00	4.47	15.00	5.00	10.00	5.25
6NHDL, 6NHDH	6	6	35.00	4.09	15.00	5.00	10.00	5.25
8NHG, 8NHT	8	8	38.00	6.31	14.50	6.25	12.50	7.38

**4NNT and 4NHTA also available with centerline discharge; see page 720-9.

MOTOR DIMENSIONS	
NEMA Frame	AG
182	11.00
184	12.00
213	16.00
215	17.50
254	20.75
256	22.50
284	22.69
286	24.19
324	24.56
326	26.06
364	26.00
365	26.00
404	26.81
405	28.81
444	33.00
445	33.00

"AG" dimension is for ODP motors and is approximate.

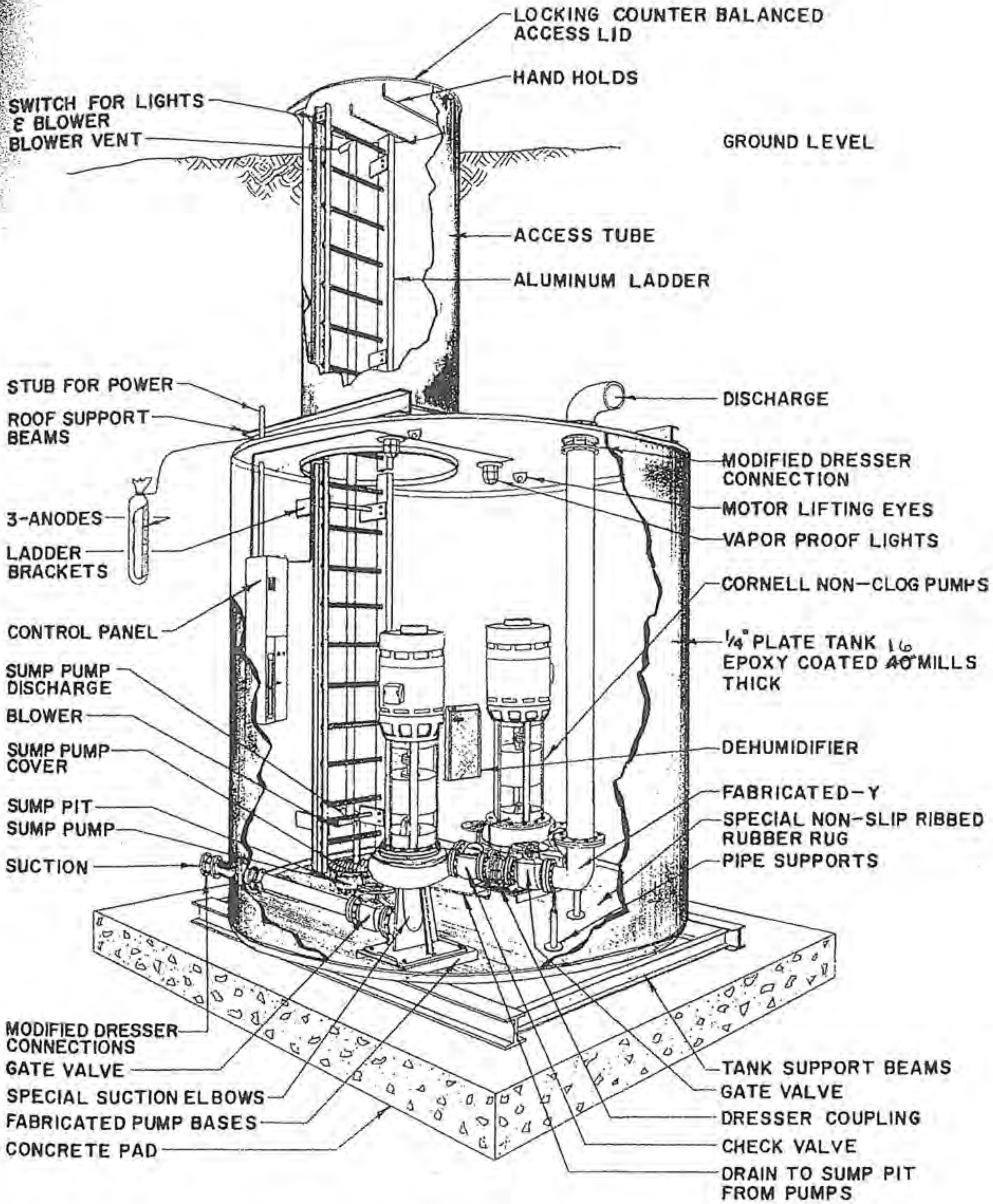
For 125# flange dimensions, see page 2020-60.
For base elbow dimensions, see page 2020-31.

CORNELL PUMP COMPANY
2323 SE Harvester Dr. Portland, OR 97222

VERTICAL CLOSE-COUPLED (VM) TANGENTIAL DISCHARGE

SEPT. 1961   150—5

CUSTOM COMPA STATION

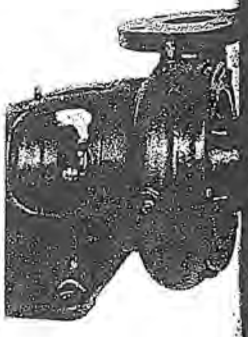


CORNELL MANUFACTURING COMPANY. PORTLAND, OREGON.

F·PUMP

line...

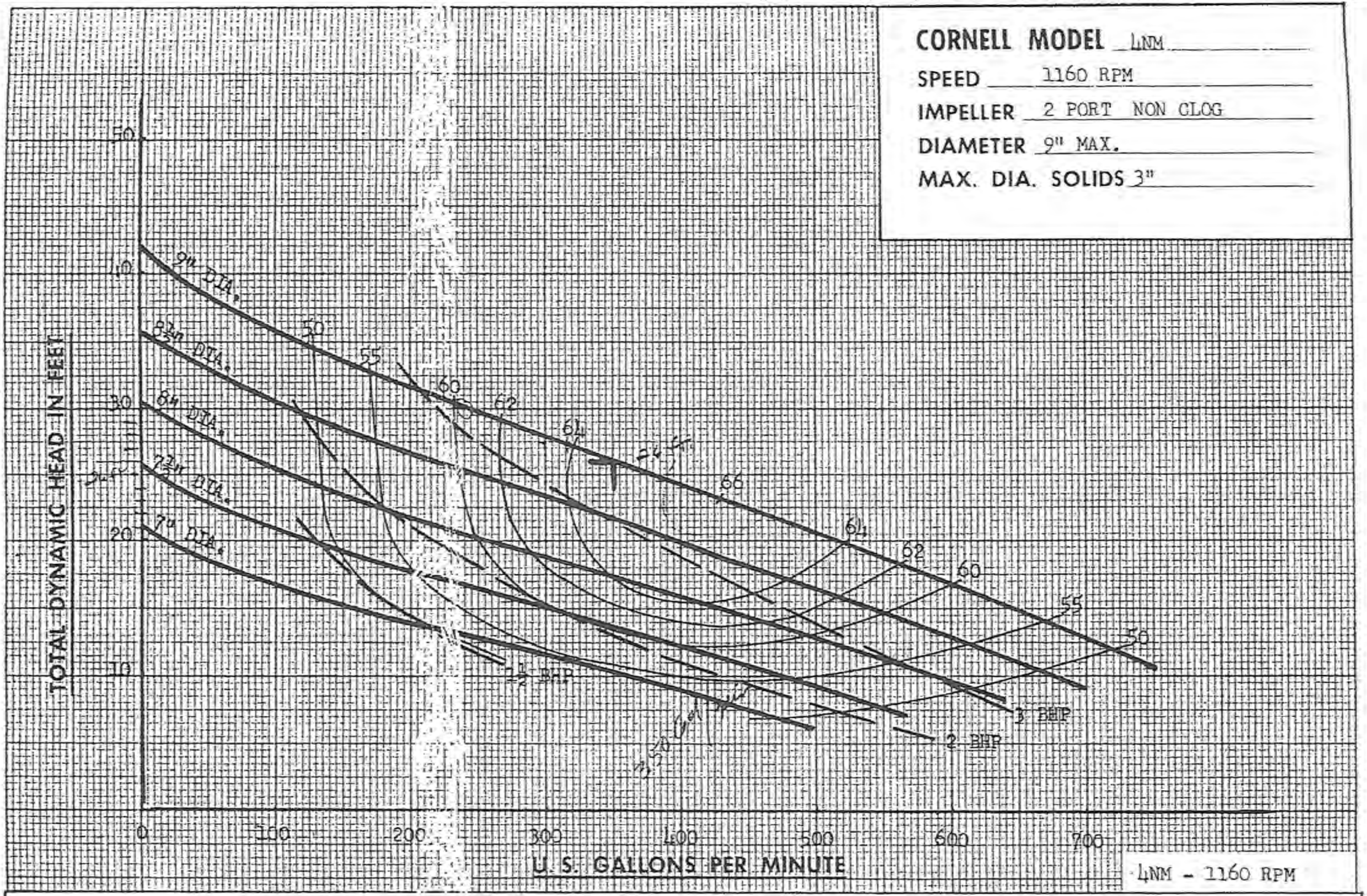
TYPE VC



MFG. C

PORTLAND 22, O

4-5425



CORNELL MODEL 4NM

SPEED 1160 RPM

IMPELLER 2 PORT NON CLOG

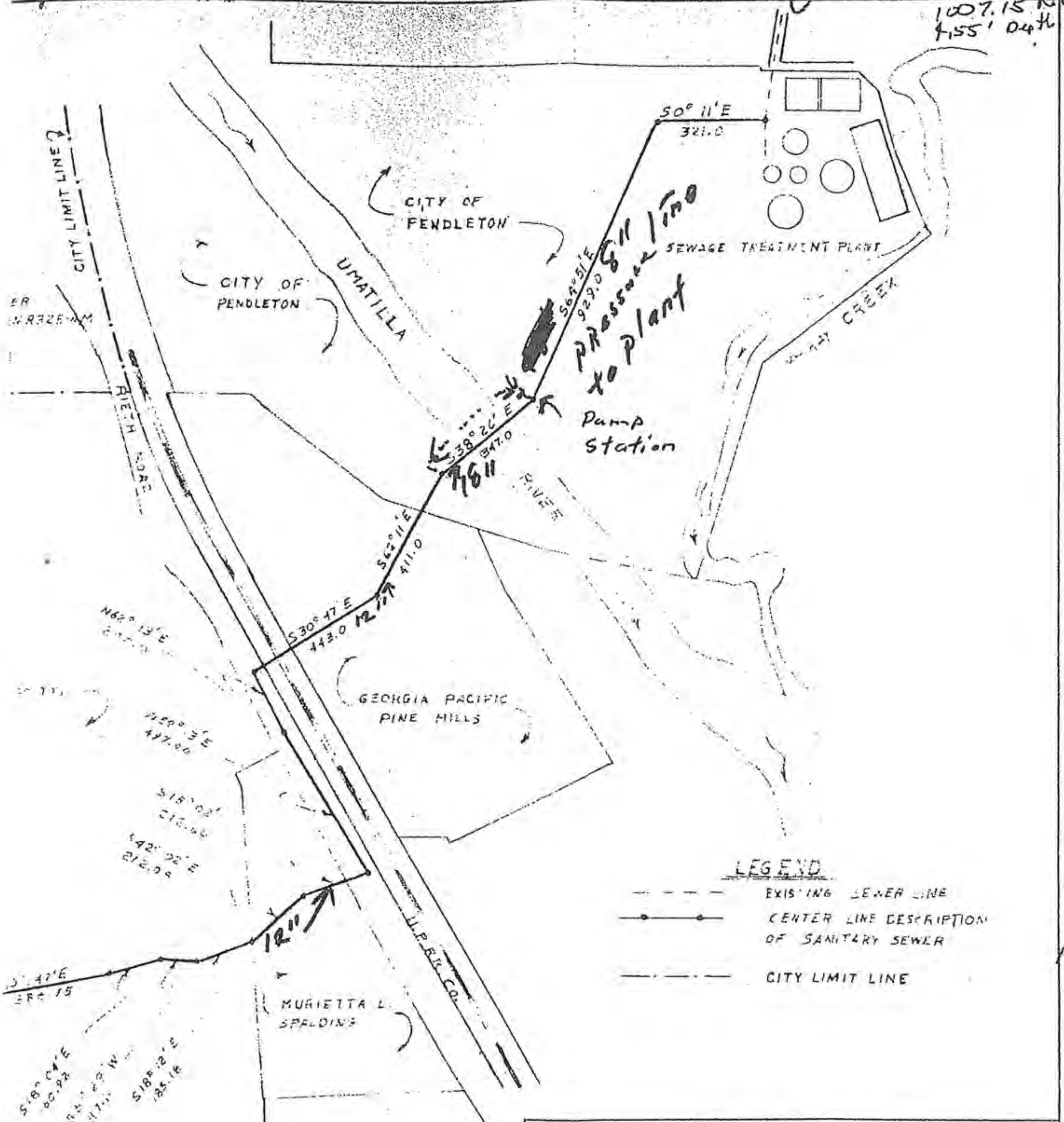
DIAMETER 9" MAX.

MAX. DIA. SOLIDS 3"

4NM - 1160 RPM

CORNELL MANUFACTURING CO. • PORTLAND, OREGON

Pend-Aer 12" River Crossing 18"



LEGEND

- - - - EXISTING SEWER LINE

—•—•— CENTER LINE DESCRIPTION OF SANITARY SEWER

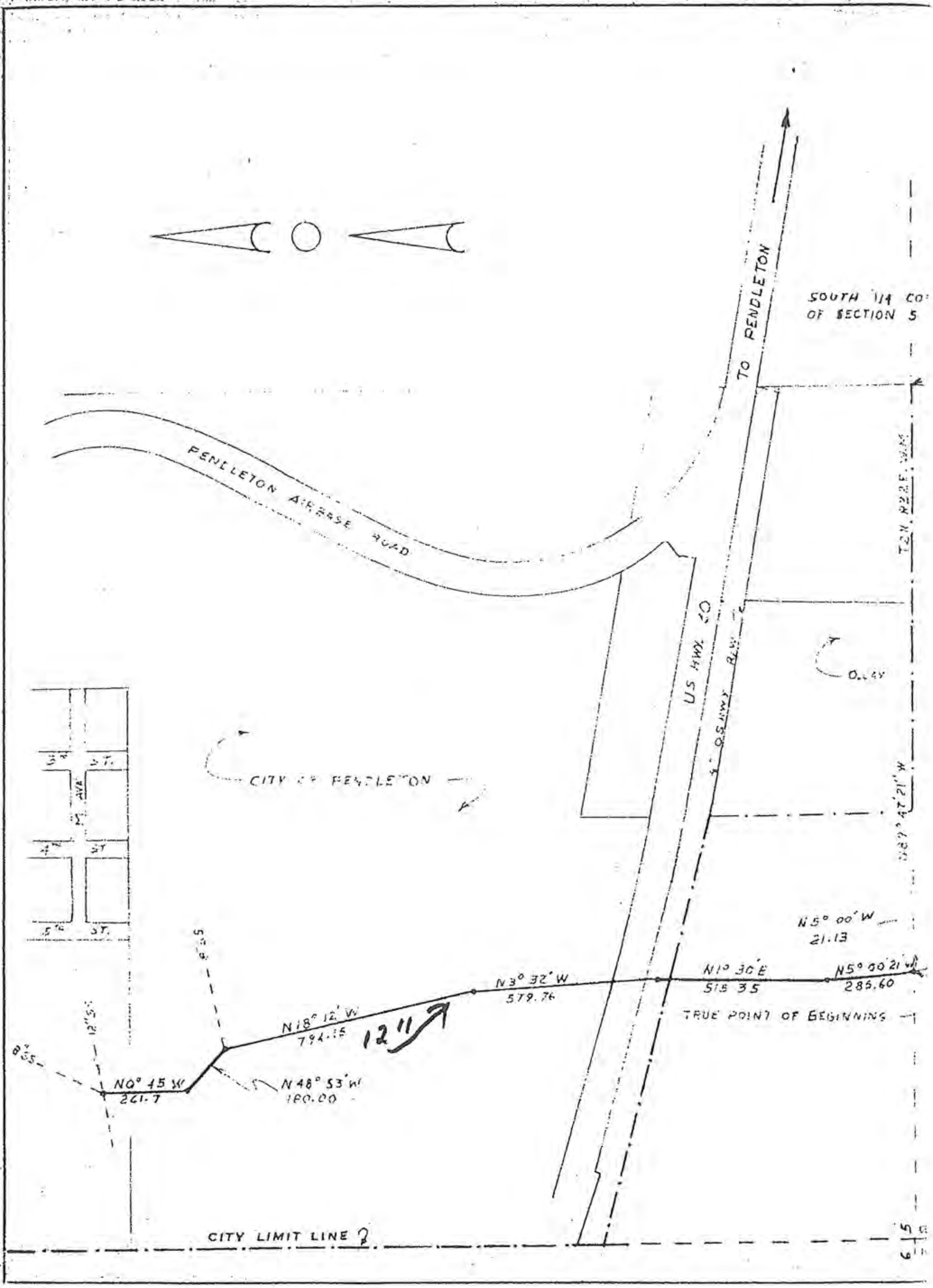
— - — - — CITY LIMIT LINE

Pressure 8"

CITY OF PENDLETON
ENGINEERING DEPT.

PENDAIR INTERCEPTOR SEWER
DESCRIPTION OF SEWER LINE

SCALE 1" = 400'	DATE 6-28-63	SHEET 1 OF 1
DRN. BY: E.H.	CHKD. BY:	DRW. NO. —


TO PENDLETON
SOUTH 1/4 CO
OF SECTION 5
T2N, R32E, W.M.
PENDLETON AIRBASE ROAD
US HWY 30
O.S.HWY
CITY OF PENDLETON
3RD ST.
4TH ST.
5TH ST.
AVE
N5° 00' W
21.13
N1° 30'E
515 35
N5° 00'21"W
285.60
TRUE POINT OF BEGINNING
N3° 32' W
579.76
N18° 12' W
794.15
12"
N48° 53' W
160.00
N0° 45 W
261.7
8"
12"
CITY LIMIT LINE
6
5

Pendleton Wastewater Treatment Plant
Condition Assessment

Pump, Blower, Fan & Compressor - Equipment Data Form

Date: 2006 K/J Staff: ______

1. Item: SURFACE AERATOR #1 (AB #1)
2. Installation Date: ______
3. Manufacturer: ______
4. Equipment Type: SURFACE AERATOR
5. Model Number: 70-8-200
6. Serial Number(s): ______
7. Design Operating Point Data:
   a. Speed: ______ RPM
   b. Impeller: ______ inches diameter
   c. Capacity: ______ gpm / SCFM
   d. Pressure: ______ feet / psi / inches (wc)
8. Motor Nameplate Data: GE model 5K6285XJ2178 8 TOTAL MOTORS
   a. Serial Number: CFJ325147
   b. Horsepower / speed / FLA: 75 HP/ 880 rpm/ 92 Amp
   c. Voltage & Phase: 460 / 3
   d. NEMA Code / Service Factor: B / 1.0
9. Photographs: ______
10. Condition: model # 5K6285XJ217A
LOOKS OKAY, A BIT OLDER
11. Comments: RUNNING in AB. NOT ABLE TO
GET close

12. Force Main Information:

a. Length: ________ Feet

b. Size: ________ inches diameter

c. Pipe Material: ________

d. Sulfide Control Systems: ________ type

e. Air Release Valves: ________ (type/Number)

Pendleton Wastewater Treatment Plant
Condition Assessment

Pump, Blower, Fan & Compressor - Equipment Data Form

Date: 2006 K/J Staff:

1. Item: SURFACE AERATOR #2 (AB 1)
2. Installation Date:
3. Manufacturer:
4. Equipment Type:
5. Model Number:
6. Serial Number(s): 70-8-204
7. Design Operating Point Data:
    a. Speed: ________ RPM
    b. Impeller: ________ inches diameter
    c. Capacity: ________ gpm / SCFM
    d. Pressure: ________ feet / psi / inches (wc)
8. Motor Nameplate Data: General electric Triclad
    a. Serial Number: GFJ318135
    b. Horsepower / speed / FLA: 60 HP/ 880 rpm/ 92 Amp
    c. Voltage & Phase: 460 / 3
    d. NEMA Code / Service Factor: /
9. Photographs: ________ model # 5K6285XJ217A
10. Condition:
11. Comments: Same comments as #1

12. Force Main Information:

a. Length: ________ Feet

b. Size: ________ inches diameter

c. Pipe Material: ________

d. Sulfide Control Systems: ________ type

e. Air Release Valves: ________ (type/Number)

Pendleton Wastewater Treatment Plant
Condition Assessment

Treatment Process Equipment Data Form

Date: 2006 K/J Staff: MDA

1. Item: SECONDARY CLARIFIER #~~A~~1 (NOT IN OPERATION 115'ϕ
2. Installation Date:
3. Manufacturer: REX CHAINBELT
4. Equipment Type: CLARIFIER DRIVE
5. Model Number: SMCTDW
6. Serial Number(s): B556-154A
7. Design Operating Point Data:
   a. Speed: ______ RPM
   b. Capacity: ______ gpm / other
   c. ______: ______ ______

Reliance Type P

8. Motor Nameplate Data: 467565-JV
   a. Horsepower / speed / FLA: 1 HP/ 1730 rpm/ 3.2 1.4 Amp
   b. Voltage & Phase: 230 460 / 3
   c. NEMA Code / Service Factor: /
9. Photographs:
10. Condition: OLD, WORN PAINT
11. Comments: FRP WEIRS, NO BAFFLE WALLS, NO ALGAE WALKWAY GOOD, BRUSHES GOOD

Speed Reducer: SMCTDW SIZE RATIO 108

Pendleton Wastewater Treatment Plant
Condition Assessment

Treatment Process Equipment Data Form

Date: 2006 K/J Staff: MOH

1. Item: SECONDARY CLARIFIER #2 (IN OPERATION)
2. Installation Date: 6/70
3. Manufacturer: WINSMITH OR REX CHAINBELT
4. Equipment Type: CLARIFIER DRIVE
5. Model Number: 5MCTDW
6. Serial Number(s): B556-154A
7. Design Operating Point Data: 115'ϕ
    - a. Speed: ______ RPM
    - b. Capacity: ______ gpm / other
    - c. ______: ______ ______

1970 Reliance mfg

8. Motor Nameplate Data: ID# 467565-F-V
    - a. Horsepower / speed / FLA: 1 HP/ 173 rpm/ 3.2 1.6 Amp
    - b. Voltage & Phase: 230/460 / 3
    - c. NEMA Code / Service Factor: /
9. Photographs: ______
10. Condition: OLDER - POOR PAINT
11. Comments: CENTER WELL OKAY. NEW STAIRS, WALKWAY OKAY NO BAFFLE WALLS, FRP WEIRS. GOOD BRUSH SYSTEM → NO ALGAE ON/OFF CONTROL STATION @ WALKWAY

Pendleton Wastewater Treatment Plant
Condition Assessment

Treatment Process Equipment Data Form

Date: 2006 K/J Staff:

1. Item: Secondary Clarifier Effluent Auto Sampler
2. Installation Date:
3. Manufacturer: Sigma 900
4. Equipment Type:
5. Model Number:
6. Serial Number(s):
7. Design Operating Point Data:
   - a. Speed: ______ RPM
   - b. Capacity: ______ gpm / other
   - c. ______: ______ ______
8. Motor Nameplate Data:
   - a. Horsepower / speed / FLA: HP/ rpm/ Amp
   - b. Voltage & Phase: /
   - c. NEMA Code / Service Factor: /
9. Photographs:
10. Condition:
11. Comments:

Pendleton Wastewater Treatment Plant
Condition Assessment

Treatment Process Equipment Data Form

Date: 2006 K/J Staff: ______

1. Item: WATER LEVEL MONITOR - 2ndary Clarifier SPLITTER Box
2. Installation Date: ______
3. Manufacturer: ______
4. Equipment Type: ______
5. Model Number: ______
6. Serial Number(s): ______
7. Design Operating Point Data:
    a. Speed: ______ RPM
    b. Capacity: ______ gpm / other
    c. ______: ______
8. Motor Nameplate Data:
    a. Horsepower / speed / FLA: HP/ rpm/ Amp
    b. Voltage & Phase: /
    c. NEMA Code / Service Factor: /
9. Photographs: ______
10. Condition: ______

11. Comments: ______

Pendleton Wastewater Treatment Plant
Condition Assessment

Treatment Process Equipment Data Form

Date: 2006 K/J Staff:

1. Item: RECIRC METER #1 & 2
2. Installation Date: 1997
3. Manufacturer: WATER SPECIALTIES
4. Equipment Type: TURBINE FLOW METER
5. Model Number: (16") 675F — not 16" ϕ, but maint. dwg says 16"?
6. Serial Number(s): 971014
7. Design Operating Point Data: meter display
   a. Speed: RPM
   b. Capacity: gpm / other
   c. :
8. Motor Nameplate Data:
   a. Horsepower / speed / FLA: HP/ rpm/ Amp
   b. Voltage & Phase: /
   c. NEMA Code / Service Factor: /
9. Photographs:
10. Condition: OK
11. Comments: 1000 gal READOUT UP TO 100,000,000 gal PULSE OUTPUTS FOR ELECTRONIC METERING

Pendleton Wastewater Treatment Plant
Condition Assessment

Pump, Blower, Fan & Compressor - Equipment Data Form

Date: 2006 K/J Staff:

1. Item: RAS WASTE FLOW METER
2. Installation Date:
3. Manufacturer: TURBO
4. Equipment Type:
5. Model Number: MG711-E PC4-D
6. Serial Number(s): 299610-A1
7. Design Operating Point Data:
   a. Speed: RPM 4" DIAM
   b. Impeller: inches diameter 3/16 SS. ELECTRODES
   c. Capacity: gpm / SCFM HARD RUBBER LINING
   d. Pressure: feet / psi / inches (wc) ↳VHE-H3B
8. Motor Nameplate Data: Readout: Model # PC4-D
   a. Serial Number: PC4-D
   b. Horsepower / speed / FLA: HP/ rpm/ Amp
   c. Voltage & Phase: /
   d. NEMA Code / Service Factor: /
9. Photographs:
10. Condition: GOOD
11. Comments: 115V 4-20mA

12. Force Main Information:

a. Length: ________ Feet

b. Size: ________ inches diameter

c. Pipe Material: ________

d. Sulfide Control Systems: ________ type

e. Air Release Valves: ________ (type/Number)

Pendleton Wastewater Treatment Plant
Condition Assessment

Chemical Systems Data Form

Date: ____________ 2006 K/J Staff: ____________

1. Chemical Name: Chlorine Solution Pump
2. Neat chemical concentration and specific gravity: ____________
3. Equipment Installation Date: 4/20/00
4. Purpose ____________
5. Target concentration in flow stream: ____________
6. Storage Capacity:

Tank Number					
Capacity (gal)					

7. Metering capacity: PACO Pump# BALDOR MOTOR DATA

Pump Number (Tag)	~~JN3158~~	1012505100061621		#	JN3158
Pump Type	Serial #	00B90248		Voltage	208/230/460
Manufacturer/Model		PACO		Amps	8.5-8/4
Serial Number	IMP DIA	5.11"		RPM	3450
Capacity				Serv Factor	1.15

1 1/2" intake
1 1/4" discharge

3 Phase

8. Photographs: ____________

9. Condition: Looks newer

Installed 4/20/00

Series F1199

10. Comments: Running. good enclosure, so probably okay

new pump same model

- identical footprint
- Same performance
- $15,20 → $1200

Pendleton Wastewater Treatment Plant
Condition Assessment

Chemical Systems Data Form

Date: ____________ 2006 K/J Staff: ____________

1. Chemical Name: Calcium Triosulfate 2 TOTES 2000 lb each
2. Neat chemical concentration and specific gravity: ____________
3. Equipment Installation Date: ____________
4. Purpose ____________
5. Target concentration in flow stream: ____________
6. Storage Capacity:

Tank Number	1				
Capacity (gal)	2000 lb	@ 10-11 lb/g			

7. Metering capacity: #1 #2

Pump Number (Tag)					
Pump Type	LMI Chemical		Same as #1		
Manufacturer/Model	P151-955				
Serial Number	0501927159-1		970716366		
Capacity	1 gph @		1 gph @ 110 psi		

110 psi 120V, 1.4A

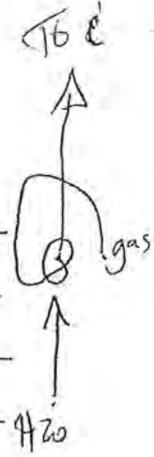
120V, 1.4A

8. Photographs: ____________
9. Condition: GOOD. Cascade Columbia 14200 SW Tualatin Sherwood
503 625 5293

10. Comments: ____________

Pendleton Wastewater Treatment Plant
Condition Assessment

Chemical Systems Data Form



Date: ____________ 2006 K/J Staff: ____________

1. Chemical Name: Chlorine Gas
2. Neat chemical concentration and specific gravity: ____________
3. Equipment Installation Date: ____________
4. Purpose 4 150lb Cylinders w/ 6 Reserves
5. Target concentration in flow stream: 4 Scales + each cylinder has a regulator
6. Storage Capacity:

Tank Number					
Capacity (gal)					

7. Metering capacity:

	(4) US Filter Regulators	Wallace + Tiernan	Chlorine monitor		
Pump Number (Tag)		manual pump			
Pump Type		V 10K			
Manufacturer/Model	AAB 3677		Toxguard 491400		
Serial Number	BH17099		110/220 V 50/60 Hz		
Capacity			10-28 VDC 12 watts		

17101
17098
17100

8. Photographs: ____________
9. Condition: Everything Looks pretty Good

____

10. Comments: Scales: Wallace + Tiernan 55-340 cylinder Scales

____

____

____

Pendleton Wastewater Treatment Plant
Condition Assessment

Treatment Process Equipment Data Form

Date: 2006 K/J Staff:

1. Item: EFFLUENT AUTO SAMPLER AFTER CCC
2. Installation Date:
3. Manufacturer: SIGMA 900
4. Equipment Type: AUTO SAMPLER
5. Model Number:
6. Serial Number(s):
7. Design Operating Point Data:
   - a. Speed: ________ RPM
   - b. Capacity: ________ gpm / other
   - c. ________: ________ ________
8. Motor Nameplate Data:
   - a. Horsepower / speed / FLA: HP/ rpm/ Amp
   - b. Voltage & Phase: /
   - c. NEMA Code / Service Factor: /
9. Photographs:
10. Condition:

11. Comments: ALSO INCLUDES FLOW METER
GREYLINE INSTRUMENTS MODEL AVFM-II

Pendleton Wastewater Treatment Plant
Condition Assessment

Pump, Blower, Fan & Compressor - Equipment Data Form

Date: 2006 K/J Staff:

1. Item: Mixer ~~B~~ A
2. Installation Date: E 1999
3. Manufacturer: EIMCO
4. Equipment Type: MIXER
5. Model Number: BAP1106-100B
6. Serial Number(s): 72686-02B
7. Design Operating Point Data:
    a. Speed: ________ RPM
    b. Impeller: ________ inches diameter
    c. Capacity: ________ gpm / SCFM
    d. Pressure: ________ feet / psi / inches (wc)
8. Motor Nameplate Data:
    a. Serial Number: 9907M02185
    b. Horsepower / speed / FLA: 7.5 HP/1740 rpm/20.4 Amp 10.2
    c. Voltage & Phase: 230/460 3Ø
    d. NEMA Code / Service Factor: H 1.15
9. Photographs: ____________

10. Condition: ____________

11. Comments: ____________

12. Force Main Information:

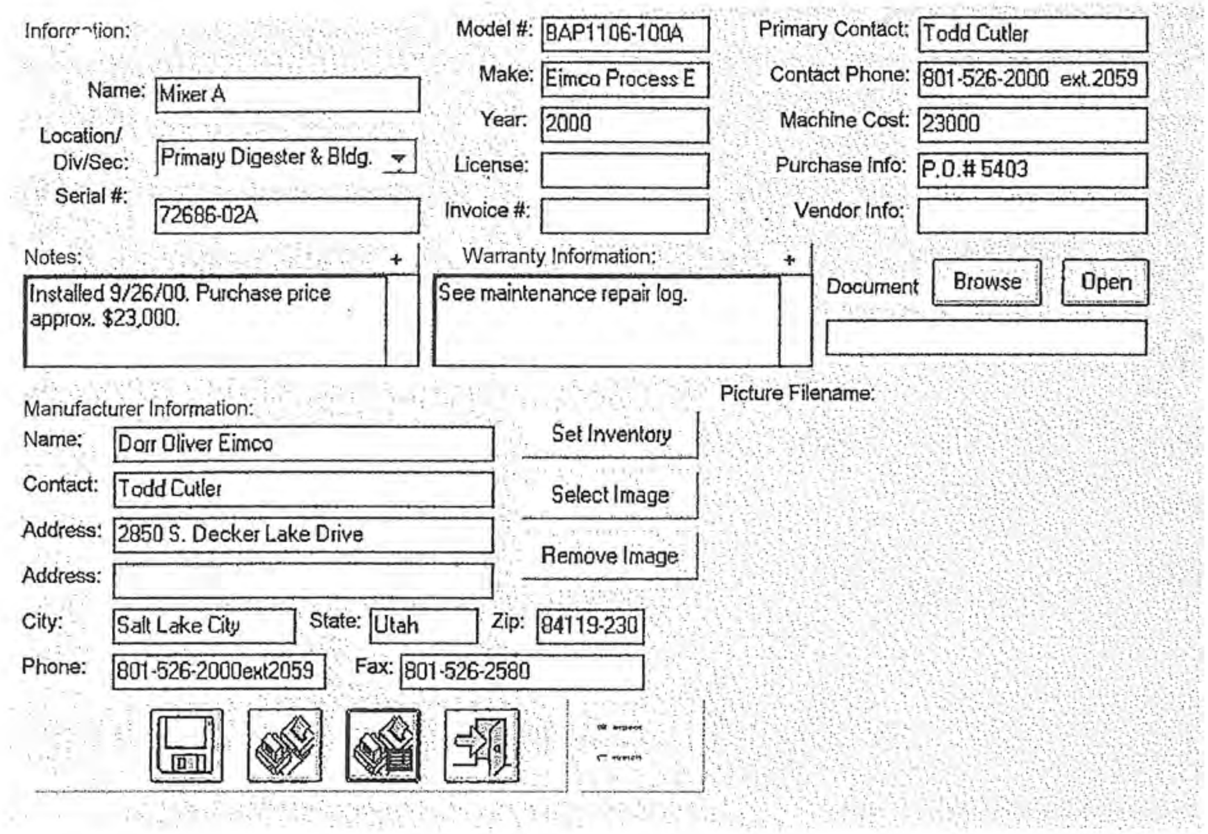
a. Length: ________ Feet

b. Size: ________ inches diameter

c. Pipe Material: ________

d. Sulfide Control Systems: ________ type

e. Air Release Valves: ________ (type/Number)



Information:

Name: Mixer A

Location/ Div/Sec: Primary Digester & Bldg.

Serial #: 72686-02A

Model #: BAP1106-100A

Make: Eimco Process E

Year: 2000

License:

Invoice #:

Primary Contact: Todd Cutler

Contact Phone: 801-526-2000 ext.2059

Machine Cost: 23000

Purchase Info: P.O.# 5403

Vendor Info:

Notes: Installed 9/26/00. Purchase price approx. $23,000.

Warranty Information: See maintenance repair log.

Document

Picture Filename:

Manufacturer Information:

Name: Dorr Oliver Eimco

Contact: Todd Cutler

Address: 2850 S. Decker Lake Drive

Address:

City: Salt Lake City

State: Utah

Zip: 84119-230

Phone: 801-526-2000ext2059

Fax: 801-526-2580

Pendleton Wastewater Treatment Plant
Condition Assessment

Pump, Blower, Fan & Compressor - Equipment Data Form

Date: 2006 K/J Staff:

1. Item: PRIMARY DIGESTER MIXER #3 B
2. Installation Date: 2000
3. Manufacturer: EIMCO
4. Equipment Type: MIXER BELT DRIVE
5. Model Number: BAPM1106 -100 A
6. Serial Number(s): 72686-02B
7. Design Operating Point Data:
   - a. Speed: ________ RPM
   - b. Impeller: ________ inches diameter
   - c. Capacity: ________ gpm / SCFM
   - d. Pressure: ________ feet / psi / inches (wc)
8. Motor Nameplate Data: MODEL: BY754YLF2AMØ2
   - a. Serial Number: 95904555
   - b. Horsepower / speed / FLA: 7.5 HP/1740 rpm/20.4 Amp/10.2
   - c. Voltage & Phase: 240/460 , 3Ø
   - d. NEMA Code / Service Factor: H / 1.15
9. Photographs: ____________
10. Condition: OK -ORIGINAL
11. Comments: VIBRATION DURING OPERATION

12. Force Main Information:

a. Length: ________ Feet

b. Size: ________ inches diameter

c. Pipe Material: ________

d. Sulfide Control Systems: ________ type

e. Air Release Valves: ________ (type/Number)

Pendleton Wastewater Treatment Plant
Condition Assessment

Pump, Blower, Fan & Compressor - Equipment Data Form

Date: ____________ 2006 K/J Staff: ____________

1. Item: PRIMARY DIGESTER MIXER #1C
2. Installation Date: ____________
3. Manufacturer: EIMCO
4. Equipment Type: BELT DRIVE
5. Model Number: BAP-1106-100C
6. Serial Number(s): 72686-02C
7. Design Operating Point Data:
    a. Speed: ________ RPM
    b. Impeller: ________ inches diameter
    c. Capacity: ________ gpm / SCFM
    d. Pressure: ________ feet / psi / inches (wc)
8. Motor Nameplate Data: MODEL: BY754YLF2AM0Z
    a. Serial Number: 990710355
    b. Horsepower / speed / FLA: 7.5 HP/ 1740 rpm/ 20.4/10.2 Amp
    c. Voltage & Phase: 230/460, 3Ø
    d. NEMA Code / Service Factor: H/ 1.15 /

Instal 2000

9. Photographs: ____________
10. Condition: OK -ORIGINAL
11. Comments: ____________

12. Force Main Information:

a. Length: ________ Feet

b. Size: ________ inches diameter

c. Pipe Material: ________

d. Sulfide Control Systems: ________ type

e. Air Release Valves: ________ (type/Number)

Pendleton Wastewater Treatment Plant
Condition Assessment

Treatment Process Equipment Data Form

Date: 2006 K/J Staff:

1. Item: BOILER (Primary)

2. Installation Date: 2001

3. Manufacturer: BRYAN

4. Equipment Type:

5. Model Number: AB200-W-FD (BO)

6. Serial Number(s): 38052

7. Design Operating Point Data: National Board No. 47481

   a. Speed: _____ RPM Heating Surface 244 ft²

   b. Capacity: _____ gpm / other Max Water Pres. 160psi

   c. _____: _____ _____ Max Temp - 250°F

   input 2000/1000 MBH

   output 1600 MBH

8. Motor Nameplate Data:

   a. Horsepower / speed / FLA: HP/ rpm/ 60 Amp

   b. Voltage & Phase: 120 / 1

   c. NEMA Code / Service Factor: /

9. Photographs: _____ OUTPUT = 1600

10. Condition:

11. Comments: Releif Valve 125psi

Control Circuit 120V, 1phase

Boiler HP 48

Pendleton Wastewater Treatment Plant
Condition Assessment

Pump, Blower, Fan & Compressor - Equipment Data Form

Date: 2006 K/J Staff:

1. Item: BOILER WATER Pump
2. Installation Date: 9/96
3. Manufacturer: TACO
4. Equipment Type:
5. Model Number:
6. Serial Number(s): 1600C3N1 4.5
7. Design Operating Point Data:
    a. Speed: RPM
    b. Impeller: inches diameter
    c. Capacity: gpm / SCFM
    d. Pressure: feet / psi / inches (wc)
8. Motor Nameplate Data: Emerson
    a. Serial Number:
    b. Horsepower / speed / FLA: 1/3 HP/ 1725 rpm/ 6.2 Amp
    c. Voltage & Phase: 115 / 1
    d. NEMA Code / Service Factor: / 1.35
9. Photographs:
10. Condition:

11. Comments:

12. Force Main Information:

a. Length: ________ Feet

b. Size: ________ inches diameter

c. Pipe Material: ________

d. Sulfide Control Systems: ________ type

e. Air Release Valves: ________ (type/Number)

Pendleton Wastewater Treatment Plant
Condition Assessment

Chemical Systems Data Form

Date: ______ 2006 K/J Staff: ______

1. Chemical Name: NUGEN BOILER WATER TREATMENT
2. Neat chemical concentration and specific gravity: ______
3. Equipment Installation Date: ______
4. Purpose ______
5. Target concentration in flow stream: ______
6. Storage Capacity:

Tank Number					
Capacity (gal)					

7. Metering capacity:

Pump Number (Tag)					
Pump Type					
Manufacturer/Model	LMI J04-198				
Serial Number	90113658				
Capacity	7gpd @ 100 psi		115V /	1.4A	

8. Photographs: ______
9. Condition: ______

10. Comments: ______

Pendleton Wastewater Treatment Plant
Condition Assessment

Pump, Blower, Fan & Compressor - Equipment Data Form

Date: 2006 K/J Staff:

1. Item: 2nd Digester Recirc Pump (Recirc Pump)
2. Installation Date: 1990 +/-
3. Manufacturer: ITT MARLOW
4. Equipment Type:
5. Model Number: ~~BEWC27SL~~ 6EWC272L Belt driven whirl flow
6. Serial Number(s): 845132
7. Design Operating Point Data: 6EW C27 SL → Coupling Connected
   - a. Speed: ________ RPM
   - b. Impeller: ________ inches diameter
   - c. Capacity: ________ gpm / SCFM
   - d. Pressure: ________ feet / psi / inches (wc)
8. Motor Nameplate Data:
   - a. Serial Number: 5832V05V078R001F
   - b. Horsepower / speed / FLA: 7.5 HP/ 1175 rpm/ 19.6 9.8 Amp → 1750 RPM
   - c. Voltage & Phase: 230 460 / 3
   - d. NEMA Code / Service Factor: H / 1.15
9. Photographs:
10. Condition:

11. Comments: Used from City of Ashland, OR
placed in Service March 8, 2002 after Rebuild

12. Force Main Information:

a. Length: ________ Feet

b. Size: ________ inches diameter

c. Pipe Material: ________

d. Sulfide Control Systems: ________ type

e. Air Release Valves: ________ (type/Number)

213 FRAME

Pendleton Wastewater Treatment Plant
Condition Assessment

Treatment Process Equipment Data Form

Date: ____________ 2006 K/J Staff: ____________

1. Item: BOILER (Secondary)
2. Installation Date: Feb. 2002
3. Manufacturer: H.B SMITH Series 28
4. Equipment Type: ____________
5. Model Number: Series # G028
6. Serial Number(s): ST # 6025-81
7. Design Operating Point Data:
   a. Speed: ________ RPM
   b. Capacity: ________ gpm / other
   c. _______: ________ ________
8. Motor Nameplate Data:
   a. Horsepower / speed / FLA: ____ HP/ ____ rpm/ ____ Amp
   b. Voltage & Phase: ____ / ____
   c. NEMA Code / Service Factor: ____ / ____
9. Photographs: ____________
10. Condition: ____________
11. Comments: ____________

Pendleton Wastewater Treatment Plant
Condition Assessment

Treatment Process Equipment Data Form

Date: 2006 K/J Staff:

1. Item: Methane Gas Flowmeter (pri. boiler)
2. Installation Date: 2002 September
3. Manufacturer:
4. Equipment Type: MAGNATROL
5. Model Number: TA2008(030
6. Serial Number(s): 007240-01-001
7. Design Operating Point Data:
   - a. Speed: ______ RPM
   - b. Capacity: ______ gpm / other
   - c. ______: ______
8. Motor Nameplate Data:
   - a. Horsepower / speed / FLA: ____ HP/ ____ rpm/ ____ Amp
   - b. Voltage & Phase: 120VAC/ 4-20mA output
   - c. NEMA Code / Service Factor: ____ / ____
9. Photographs: ______
10. Condition:
11. Comments: Max pressure = 1000 psi

Pendleton Wastewater Treatment Plant
Condition Assessment

Treatment Process Equipment Data Form

Date: 2006 K/J Staff:

1. Item: Methane Meter #1 (~~Contact~~ to Temp & Flow) (pri. dig.)
2. Installation Date: 11/97
3. Manufacturer:
4. Equipment Type:
5. Model Number: FCI Flexmaster N005 ST95
6. Serial Number(s): 174441 AA0060A20,000
7. Design Operating Point Data:
    a. Speed: ____ RPM
    b. Capacity: ____ gpm / other
    c. ____: ____ ____
8. Motor Nameplate Data:
    a. Horsepower / speed / FLA: HP/ rpm/ Amp
    b. Voltage & Phase: /
    c. NEMA Code / Service Factor: /
9. Photographs:
10. Condition:
11. Comments:

Pendleton Wastewater Treatment Plant
Condition Assessment

Treatment Process Equipment Data Form

Date: 2006 K/J Staff:

1. Item: Methane Meter #2 (sec. di)
2. Installation Date: 1997
3. Manufacturer: FCI Flexmaster
4. Equipment Type:
5. Model Number: ST95 - AA00 60AZ C000
6. Serial Number(s): 194442
7. Design Operating Point Data:
    - a. Speed: ____ RPM
    - b. Capacity: ____ gpm / other
    - c. ____: ____
8. Motor Nameplate Data:
    - a. Horsepower / speed / FLA: ____ HP/ ____ rpm/ ____ Amp
    - b. Voltage & Phase: ____ / ____
    - c. NEMA Code / Service Factor: ____ / ____
9. Photographs:
10. Condition:
11. Comments:

Pendleton Wastewater Treatment Plant
Condition Assessment

Pump, Blower, Fan & Compressor - Equipment Data Form

Date: 2006 K/J Staff:

1. Item: BIOSOLIDS Pond AERATOR #1 SSB Aerator #10

2. Installation Date: 1970

3. Manufacturer:

4. Equipment Type: SURFACE AERATOR

5. Model Number:

6. Serial Number(s): 70-8-206

7. Design Operating Point Data:

   a. Speed: ______ RPM

   b. Impeller: ______ inches diameter

   c. Capacity: ______ gpm / SCFM

   d. Pressure: ______ feet / psi / inches (wc)

8. Motor Nameplate Data: General electric

   a. Serial Number: CFJ 318155

   b. Horsepower / speed / FLA: 60 ~~75~~ HP/ 835 rpm/ [illegible] Amp

   c. Voltage & Phase: [illegible]

   d. NEMA Code / Service Factor: [illegible] /

9. Photographs:

10. Condition:

11. Comments:

12. Force Main Information:

a. Length: ________ Feet

b. Size: ________ inches diameter

c. Pipe Material: ________

d. Sulfide Control Systems: ________ type

e. Air Release Valves: ________ (type/Number)

Pendleton Wastewater Treatment Plant
Condition Assessment

Pump, Blower, Fan & Compressor - Equipment Data Form

Date: 2006 K/J Staff:

1. Item: BIOSOLIDS POND AERATOR #2 558 #1
2. Installation Date: 1970
3. Manufacturer:
4. Equipment Type: SURFACE AERATOR
5. Model Number:
6. Serial Number(s): 70-8-[illegible] 205
7. Design Operating Point Data:
   - a. Speed: ________ RPM
   - b. Impeller: ________ inches diameter
   - c. Capacity: ________ gpm / SCFM
   - d. Pressure: ________ feet / psi / inches (wc)
8. Motor Nameplate Data: General Electric
   - a. Serial Number:
   - b. Horsepower / speed / FLA: 70 HP/ 885 rpm/ Amp
   - c. Voltage & Phase: / 3
   - d. NEMA Code / Service Factor: K /
9. Photographs:
10. Condition:
11. Comments:

12. Force Main Information:

a. Length: ________ Feet

b. Size: ________ inches diameter

c. Pipe Material: ________

d. Sulfide Control Systems: ________ type

e. Air Release Valves: ________ (type/Number)

Pendleton Wastewater Treatment Plant
Condition Assessment

Treatment Process Equipment Data Form

Date: 2006 K/J Staff:

1. Item: SLUDGE DRYING BED PUMP
2. Installation Date: 2000 FROM SLUDGE STORAGE BASIN TO DRYING BEDS
3. Manufacturer: MOYNO
4. Equipment Type: SLUDGE PUMP
5. Model Number: 1F065 G1 CD Q3 AAA
6. Serial Number(s): AM16176 CJ
7. Design Operating Point Data:
   a. Speed: ________ RPM
   b. Capacity: ________ gpm / other
   c. ________: ________ ________

Impeller Trim: AAA

RPM	GPM
100	30
125	40
150	50
250	80
260	85

8. Motor Nameplate Data: # VM3714T SPEC 37A03Z50
   a. Horsepower / speed / FLA: 10 HP/ 1725 rpm/ 28-26/13 Amp
   b. Voltage & Phase: 208 230 460 1,3
   c. NEMA Code / Service Factor: TEFC / 1.0
9. Photographs: ____________
10. Condition: GOOD
11. Comments: RELIANCE REDUCER: MODEL 441-V1F-AT
    SERIAL 273 171-CV
    GEAR RATIO 5.06/1
    -VARIABLE SPEED REDUCER

Pendleton Wastewater Treatment Plant
Condition Assessment

Pump, Blower, Fan & Compressor - Equipment Data Form

Date: 2006 K/J Staff: ______

1. Item: SUMP PUMP IN WASTE PUMP BASEMENT
2. Installation Date: ______
3. Manufacturer: Myers ?
4. Equipment Type: WHRH 20-21C/108-1
5. Model Number: ______
6. Serial Number(s): ______
7. Design Operating Point Data:
    a. Speed: ______ RPM
    b. Impeller: ______ inches diameter
    c. Capacity: ______ gpm / SCFM
    d. Pressure: ______ feet / psi / inches (wc)
8. Motor Nameplate Data:
    a. Serial Number: ______
    b. Horsepower / speed / FLA: ______ HP/ ______ rpm/ ______ Amp
    c. Voltage & Phase: ______ / ______
    d. NEMA Code / Service Factor: ______ / ______
9. Photographs: ______
10. Condition: OKAY CONDITION
11. Comments: NOT SURE IF MODEL INFO IS CORRECT - FROM MAINT. MANAGER

12. Force Main Information:

a. Length: ________ Feet

b. Size: ________ inches diameter

c. Pipe Material: ________

d. Sulfide Control Systems: ________ type

e. Air Release Valves: ________ (type/Number)

Pendleton Wastewater Treatment Plant
Condition Assessment

Pump, Blower, Fan & Compressor - Equipment Data Form

Date: 2006 K/J Staff: ________

1. Item: REUSE WATER FILTER [illegible]
2. Installation Date: 2003 9/30/03
3. Manufacturer: AMIAD
4. Equipment Type: Y STRAINER / FILTER 4" PIPE
5. Model Number: 4"-S manual filter (38-04)
6. Serial Number(s): PE-25F4-081103
7. Design Operating Point Data: 200 micron
    - a. Speed: ________ RPM
    - b. Impeller: ________ inches diameter
    - c. Capacity: ________ gpm / SCFM
    - d. Pressure: ________ feet / psi / inches (wc)
8. Motor Nameplate Data:
    - a. Serial Number: ________
    - b. Horsepower / speed / FLA: ____ HP/ ____ rpm/ ____ Amp
    - c. Voltage & Phase: ____ / ____
    - d. NEMA Code / Service Factor: ____ / ____
9. Photographs: ________
10. Condition: ________
11. Comments: ordered 2 replacement brushes on 7/22/04

12. Force Main Information:

a. Length: ________ Feet

b. Size: ________ inches diameter

c. Pipe Material: ________

d. Sulfide Control Systems: ________ type

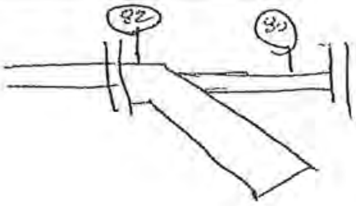
e. Air Release Valves: ________ (type/Number)

Pendleton Wastewater Treatment Plant
Condition Assessment

Pump, Blower, Fan & Compressor - Equipment Data Form

Date: 2006 K/J Staff:

1. Item: REUSE WATER PUMP
2. Installation Date: 9/30/03
3. Manufacturer: PACO
4. Equipment Type:
5. Model Number: 020709140001851
6. Serial Number(s): 28295B
7. Design Operating Point Data:



   a. Speed: RPM
   b. Impeller: 6.7 inches diameter
   c. Capacity: 200 [✓ gpm] / SCFM
   d. Pressure: 130 [✓ feet] / psi / inches (wc)
8. Motor Nameplate Data:
   a. Serial Number: model EJMM2514T / serial Z0304170052 mfg BALDOR
   b. Horsepower / speed / FLA: 20 HP/ 3510rpm/ 45 22.5Amp
   c. Voltage & Phase: 230 460 / 3
   d. NEMA Code / Service Factor: OPSB / 1.15
9. Photographs:
10. Condition: GOOD. PURPLE PIPE
11. Comments:

12. Force Main Information:

a. Length: ________ Feet
b. Size: ________ inches diameter
c. Pipe Material: ________
d. Sulfide Control Systems: ________ type
e. Air Release Valves: ________ (type/Number)

Pendleton Wastewater Treatment Plant
Condition Assessment

Equipment Data Form – Valves

Date: Nov 16, 2006 K/J Staff: RSP

1. Item: PRIMARY EFFLUENT CONTROL - BYPASS TO CCB
2. Installation Date: 1970
3. Manufacturer: ARMCO
4. Valve Type: SLIDE GATE W/ OPERATOR
5. Model Number: ________
6. Serial Number(s): ________
7. Valve:
   a. Service: PRIMARY EFF / [✓ modulating / open-close]
   b. Capacity: ________ gpm / SCFM
   c. Rating: ________ psi
   d. Size: 36" inch ~~dia.~~ SQ.
   e. C_v Factor: ________
8. Operator Nameplate Data:
   a. Type: ________ motor / pneumatic / manual
   b. Horsepower / speed / FLA: ____ HP/ ____ seconds to open/ ____ Amp
   c. Voltage & Phase: ____ / ____
   d. NEMA Code / Service Factor: ____ / ____
9. Photographs: ________
10. Condition: BADLY RUSTED. SLIDE GATE HAS BEEN REMOVED AND CHANNELS ARE RUSTED.
11. Comments: PLANT HAS INSTALLED A PLATE TO PREVENT BYPASS UNTIL WW OVERTOPS WALL TO DISCHARGE

Pendleton Wastewater Treatment Plant
Condition Assessment

Equipment Data Form – Valves

Date: Nov 16, 2006 K/J Staff: RSP

1. Item: PRIMARY EFFLUENT CONTROL - TO SECONDARY PLANT
2. Installation Date: 1970
3. Manufacturer: ARMCO
4. Valve Type: SLIDE GATE W/ OPERATOR
5. Model Number:
6. Serial Number(s):
7. Valve:
   - a. Service: PRIMARY EFF [✓ modulating / open-close]
   - b. Capacity: ________ gpm / SCFM
   - c. Rating: ________ psi
   - d. Size: 36" inch SQ.
   - e. C_v Factor:
8. Operator Nameplate Data:
   - a. Type: ________ motor / pneumatic / manual
   - b. Horsepower / speed / FLA: ____ HP/ ____ seconds to open/ ____ Amp
   - c. Voltage & Phase: ____ / ____
   - d. NEMA Code / Service Factor: ____ / ____
9. Photographs:
10. Condition: BADLY RUSTED - GATE REMOVED, DOES NOT OPERATE
11. Comments:

Pendleton Wastewater Treatment Plant
Condition Assessment

Equipment Data Form – Valves

Date: Nov 16, 2006 K/J Staff: RSP

1. Item: SECONDARY CLARIFIER SPLITTER GATE EAST (CLAR No. 1) NOT IN OPER.
2. Installation Date: 1970
3. Manufacturer: ARMCO
4. Valve Type: SLIDE GATE W/ OPERATOR
5. Model Number:
6. Serial Number(s):
7. Valve:
   a. Service: ML [✓ modulating] / [✓ open-close]
   b. Capacity: ________ gpm / SCFM
   c. Rating: ________ psi
   d. Size: 36 inch. SQUARE
   e. C_v Factor: ________
8. Operator Nameplate Data:
   a. Type: ________ motor / pneumatic / manual
   b. Horsepower / speed / FLA: ____ HP/ ____ seconds to open/ ____ Amp
   c. Voltage & Phase: ____ / ____
   d. NEMA Code / Service Factor: ____ / ____
9. Photographs: ________
10. Condition: LEAKS WHEN CLOSED
11. Comments:

Pendleton Wastewater Treatment Plant
Condition Assessment

Equipment Data Form – Valves

Date: Nov 14, 2006 K/J Staff: RSP

1. Item: CHLORINE CONTACT BASIN GATE – NORTH
2. Installation Date: 1970
3. Manufacturer: ARMCO
4. Valve Type: SLIDE GATE W/ OPERATOR
5. Model Number: ________
6. Serial Number(s): ________
7. Valve:
   a. Service: WW [✓ modulating / open-close]
   b. Capacity: ________ gpm / SCFM
   c. Rating: ________ psi
   d. Size: 30x30 inch dia.
   e. C_v Factor: ________
8. Operator Nameplate Data:
   a. Type: ________ motor / pneumatic / manual
   b. Horsepower / speed / FLA: ____ HP/ ____ seconds to open/ ____ Amp
   c. Voltage & Phase: ____ / ____
   d. NEMA Code / Service Factor: ____ / ____
9. Photographs: ________
10. Condition: OK – LEAKS. PLANT HAS REPLACED WITH NEW STAINLESS CHANNEL & ALUMINUM GATE
11. Comments: ________

Pendleton Wastewater Treatment Plant
Condition Assessment

Equipment Data Form – Valves

Date: Nov 16, 2006 K/J Staff: RSP

1. Item: CHLORINE CONTACT BASIN GATE - SOUTH
2. Installation Date: 1970
3. Manufacturer: ARMCO
4. Valve Type: SLIDE GATE w/ OPERATOR
5. Model Number:
6. Serial Number(s):
7. Valve:
    - a. Service: WASTEWATER modulating / open-close
    - b. Capacity: ________ gpm / SCFM
    - c. Rating: ________ psi
    - d. Size: 30 x 30 inch ~~dia~~.
    - e. C_v Factor: ________
8. Operator Nameplate Data:
    - a. Type: __________ motor / pneumatic / manual
    - b. Horsepower / speed / FLA: ____ HP/ ____ seconds to open/ ____ Amp
    - c. Voltage & Phase: ____ / ____
    - d. NEMA Code / Service Factor: ____ / ____
9. Photographs: ____________
10. Condition: Good - PLANT HAS REPLACED WITH NEW STAINLESS CHANNEL & ALUMINUM GATE, OPERATOR DETERIORATING
11. Comments:

Pendleton Wastewater Treatment Plant
Condition Assessment

Equipment Data Form – Valves

Date: Nov 16, 2006 K/J Staff: RSP

1. Item: SECONDARY CLARIFIER NO. 2 SPLITTER GATE WEST
2. Installation Date: 1970
3. Manufacturer: ARMCO
4. Valve Type: SLIDE GATE WITH OPERATOR
5. Model Number: ________
6. Serial Number(s): ________
7. Valve:
   a. Service: ML [✓ modulating / open-close]
   b. Capacity: ________ gpm / SCFM
   c. Rating: ________ psi
   d. Size: 36 inch SQUARE
   e. C_v Factor: ________
8. Operator Nameplate Data:
   a. Type: ________ motor / pneumatic / manual
   b. Horsepower / speed / FLA: ____ HP/ ____ seconds to open/ ____ Amp
   c. Voltage & Phase: ____ / ____
   d. NEMA Code / Service Factor: ____ / ____
9. Photographs: ________
10. Condition: OPERATOR DETERIORATING
11. Comments: ________

Pendleton Wastewater Treatment Plant
Condition Assessment

Equipment Data Form – Valves

Date: 11/16/ 2006 K/J Staff: RSP

1. Item: SLUDGE DRAWOFF VALVE - TOP DRAWOFF SOUTH SECONDARY DIG.

2. Installation Date: 1970

3. Manufacturer: ________

4. Valve Type: GATE HANDWHEEL

5. Model Number: ________

6. Serial Number(s): ________

7. Valve:
   a. Service: SLUDGE modulating / [✓ open-close]
   b. Capacity: ________ gpm / SCFM
   c. Rating: ________ psi
   d. Size: 8 inch dia.
   e. C_v Factor: ________

8. Operator Nameplate Data:
   a. Type: HANDWHEEL motor / pneumatic / [✓ manual]
   b. Horsepower / speed / FLA: ____ HP/ ____ seconds to open/ ____ Amp
   c. Voltage & Phase: ____ / ____
   d. NEMA Code / Service Factor: ____ / ____

9. Photographs: ________

10. Condition: FROZEN - WILL NOT OPEN

11. Comments: ________

Pendleton Wastewater Treatment Plant
Condition Assessment

Equipment Data Form – Valves

Date: Nov 16, 2006 K/J Staff: RSP

1. Item: SLUDGE TRANSFER VALVE - PIPE CHASE SECONDARY DIG.
2. Installation Date: 1953 ?
3. Manufacturer:
4. Valve Type: PLUG VALVE w/ NUT
5. Model Number:
6. Serial Number(s):
7. Valve:
   a. Service: 2° DIGEST. SLUDGE modulating [✓ open-close]
   b. Capacity: ____ gpm / SCFM
   c. Rating: ____ psi
   d. Size: ____ inch dia.
   e. C_v Factor:
8. Operator Nameplate Data:
   a. Type: ____ motor / pneumatic / manual
   b. Horsepower / speed / FLA: HP/ seconds to open/ Amp
   c. Voltage & Phase: /
   d. NEMA Code / Service Factor: /
9. Photographs:
10. Condition: UNDER GRATE IN PIPE CHASE BETWEEN SECONDARY DIGESTER - FROZEN VALVE
11. Comments:

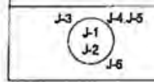
Pendleton Wastewater Treatment Plant
Condition Assessment

Equipment Data Form – Valves

Date: Nov 16, 2006 K/J Staff: RSP

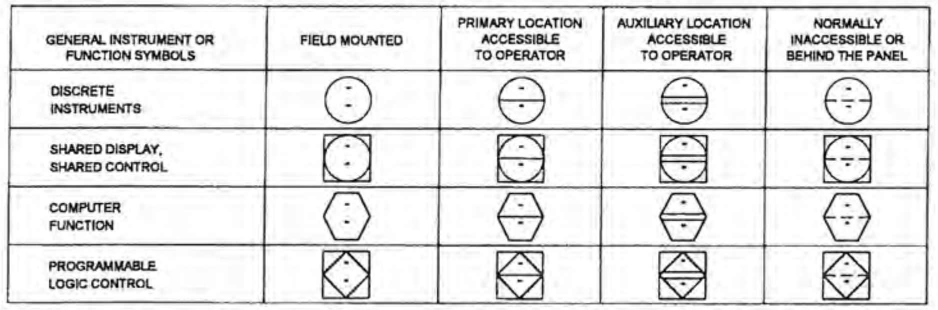
1. Item: SLUDGE TRANSFER VALVE - PIPE CHASE SECONDARY DIG.
2. Installation Date: 1953 ?
3. Manufacturer: ______
4. Valve Type: PLUG VALVE W/ NUT
5. Model Number: ______
6. Serial Number(s): ______
7. Valve:
   a. Service: 2° DIGEST. SLUDGE modulating / open-close
   b. Capacity: ______ gpm / SCFM
   c. Rating: ______ psi
   d. Size: ______ inch dia.
   e. C_v Factor: ______
8. Operator Nameplate Data:
   a. Type: ______ motor / pneumatic / manual
   b. Horsepower / speed / FLA: ______ HP/ ______ seconds to open/ ______ Amp
   c. Voltage & Phase: ___ / ___
   d. NEMA Code / Service Factor: ___ / ___
9. Photographs: ______
10. Condition: UNDER GRATE IN PIPE CHASE BETWEEN SECONDARY DIGESTER - VALVE IS FROZEN
11. Comments: ______

INSTRUMENT SYMBOL IDENTIFIERS

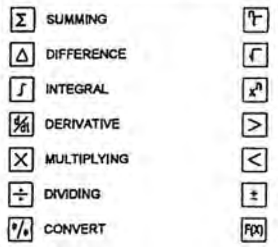


J-1. IDENTIFICATION LETTERS (SEE TABLE BELOW)
J-2 LOOP NUMBER
J-3 VENDOR DESIGNATOR (NOTE 3)
J-4. FUNCTION BLOCK (SEE TABLE BELOW)
J-5 PANEL NUMBER
J-6 HANDSWITCH DESIGNATOR (SEE BELOW)

	FIRST LETTER		SUCCEEDING LETTERS		
	MEASURED OR INITIATING VARIABLE	MODIFIER	READOUT OR PASSIVE FUNCTION	OUTPUT FUNCTION	MODIFIER
A	ANALYSIS		ALARM		
B	BURNER, COMBUSTION		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
C	~~USER'S CHOICE~~ CONDUCTIVITY			CONTROL	CLOSED
D	DENSITY	DIFFERENTIAL	DAMPER		
E	VOLTAGE		SENSOR (PRIMARY ELEMENT)		
F	FLOW RATE	RATIO (FRACTION)			
G	USER'S CHOICE		GLASS, VIEWING DEVICE		
H	HAND				HIGH
I	CURRENT (ELECTRICAL)		INDICATE		
J	POWER	~~SCAN~~	SCAN		
K	TIME, TIME SCHEDULE	TIME RATE OF CHANGE		CONTROL STATION	
L	LEVEL		LIGHT		LOW
M	MOISTURE	MOMENTARY			MIDDLE, INTERMEDIATE
N	~~USER'S CHOICE~~ TORQUE		USER'S CHOICE	USER'S CHOICE	USER'S CHOICE
O	~~USER'S CHOICE~~		ORIFICE, RESTRICTION		OPEN
P	PRESSURE, VACUUM		POINT (TEST) CONNECTION		
Q	QUANTITY	INTEGRATE, TOTALIZE	INTEGRATE, TOTALIZE		
R	RADIATION		RECORD		
S	SPEED, FREQUENCY	SAFETY	SWITCH		STOP
T	TEMPERATURE			TRANSMIT	
U	MULTI VARIABLE		MULTIFUNCTION	MULTIFUNCTION	MULTIFUNCTION
V	VIBRATION, MECHANICAL ANALYSIS			VALVE, DAMPER, OR LOUVER	
W	WEIGHT, FORCE		WELL, PROSE		
X	UNCLASSIFIED	X AXIS	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED
Y	EVENT, STATE, PRESENCE	Y AXIS		RELAY, COMPUTE, CONVERT	
Z	POSITION, DIMENSION	Z AXIS		DRIVER, ACTUATOR, UNCLASSIFIED FINAL CONTROL ELEMENT	



J-4 FUNCTION BLOCK DESIGNATORS



SUMMING
DIFFERENCE
INTEGRAL
DERIVATIVE
MULTIPLYING
DIVIDING
CONVERT
ROOT EXTRACTION
SQUARE ROOT
EXPONENTIAL
HIGH SELECTING
LOW SELECTING
BIAS
NONLINEAR OR UNSPECIFIED FUNCTION

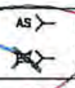
EPS

- * E - VOLTAGE
- I - CURRENT
- P - PNEUMATIC
- A - ANALOG
- B - BINARY
- H - HYDRAULIC
- O - ELECTROMAGNETIC, SONIC
- R - RESISTANCE (ELECT)
- D - DIGITAL

J-6 HANDSWITCH DESIGNATORS

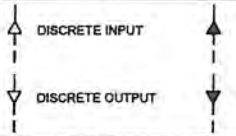
HOA	HAND-OFF-AUTO	LR	LOCAL-REMOTE
HOR	HAND-OFF-REMOTE	OC	OPEN-CLOSE
F-R	FORWARD-REVERSE	OCA	OPEN-CLOSE-AUTO
1-0	ON-OFF	A/M	AUTO-MANUAL

INSTRUMENT SERVICES



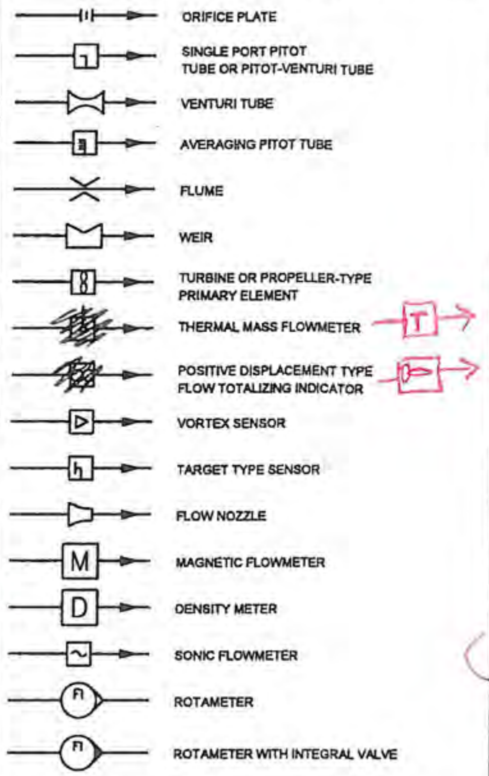
INSTRUMENT AIR SUPPLY (NOTE 4)
120 VAC ELECTRICAL ~~SERVICE~~ POWER SUPPLY
(DIFFERENT VOLTAGES ARE SPECIFICALLY NOTED)

PLC INPUT/OUTPUT



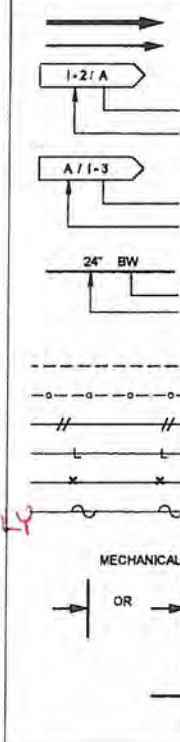
DISCRETE INPUT
ANALOG INPUT
DISCRETE OUTPUT
ANALOG OUTPUT

FLOW PRIMARY ELEMENTS



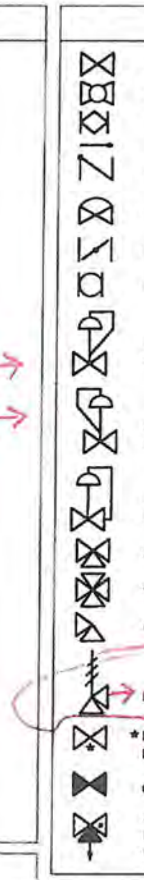
ORIFICE PLATE
SINGLE PORT PITOT TUBE OR PITOT-VENTURI TUBE
VENTURI TUBE
AVERAGING PITOT TUBE
FLUME
WEIR
TURBINE OR PROPELLER-TYPE PRIMARY ELEMENT
THERMAL MASS FLOWMETER
POSITIVE DISPLACEMENT TYPE FLOW TOTALIZING INDICATOR
VORTEX SENSOR
TARGET TYPE SENSOR
FLOW NOZZLE
MAGNETIC FLOWMETER
DENSITY METER
SONIC FLOWMETER
ROTAMETER
ROTAMETER WITH INTEGRAL VALVE

LINES



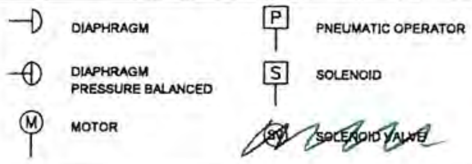
MAIN PROCESS
SECONDARY PROCESS
REFERENCES LEAVING SHEET
LINE CONTINUATION
TO DRAWING REFERENCE
REFERENCES ENTERING SHEET
FROM DRAWING REFERENCE
LINE CONTINUATION
PIPE SYSTEM
PIPE SIZE IN INCHES
ELECTRICAL SIGNAL
SOFTWARE OR DATALINK
PNEUMATIC
HYDRAULIC
CAPILLARY TUBE
ELECTROMAGNETIC OR SONIC (GUIDED)
CONNECTED
NOT CONNECTED

VALVES



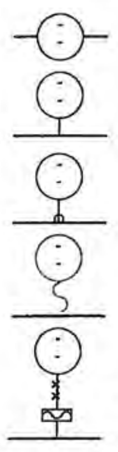
GATE VALVE
GLOBE VALVE
PLUG VALVE
CHECK VALVE
DIAPHRAGM VALVE
BUTTERFLY VALVE
BALL VALVE
PRESSURE REDUCING REGULATING VALVE SELF-CONTAINED
BACK PRESSURE REGULATING VALVE, SELF-CONTAINED
PRESSURE REDUCING REGULATOR WITH EXTERNAL PRESSURE TAP
3-WAY VALVE
4-WAY VALVE
ANGLE VALVE
PRESSURE RELIEF VALVE
* FC = FAIL CLOSED LC = LOCKED CLOSED
FO = FAIL OPEN LO = LOCKED OPEN
CLOSED DURING NORMAL OPERATION
SHADING INDICATES PORT TO BE CLOSED DURING NORMAL OPERATION. DOT INDICATES PORT TO BE CLOSED DURING ALTERNATE OPERATION.

VALVE OPERATORS



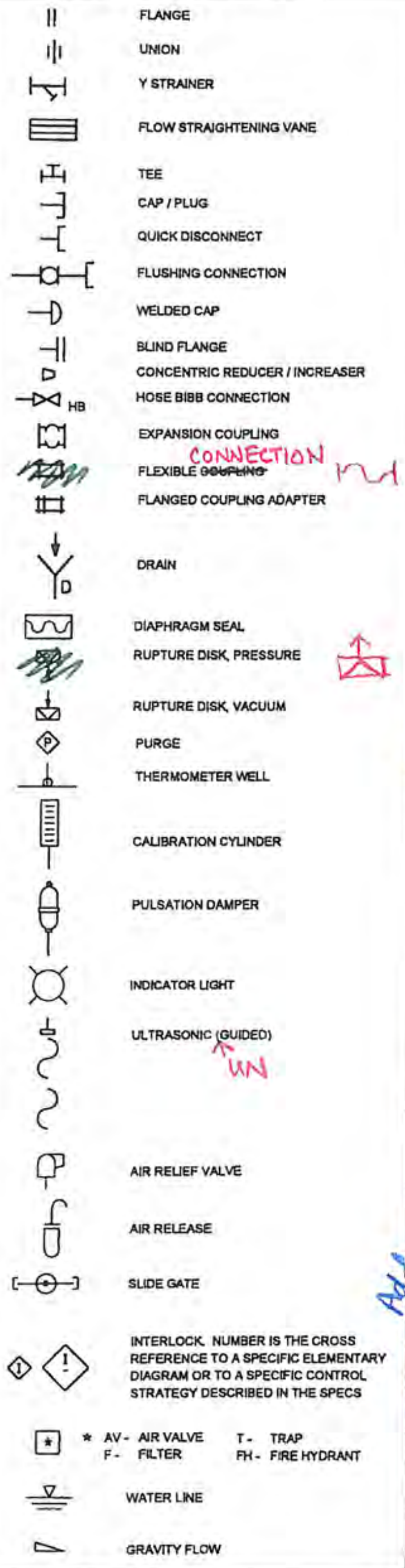
DIAPHRAGM
DIAPHRAGM PRESSURE BALANCED
MOTOR
PNEUMATIC OPERATOR
SOLENOID
~~SOLENOID VALVE~~

TYPICAL CONNECTION

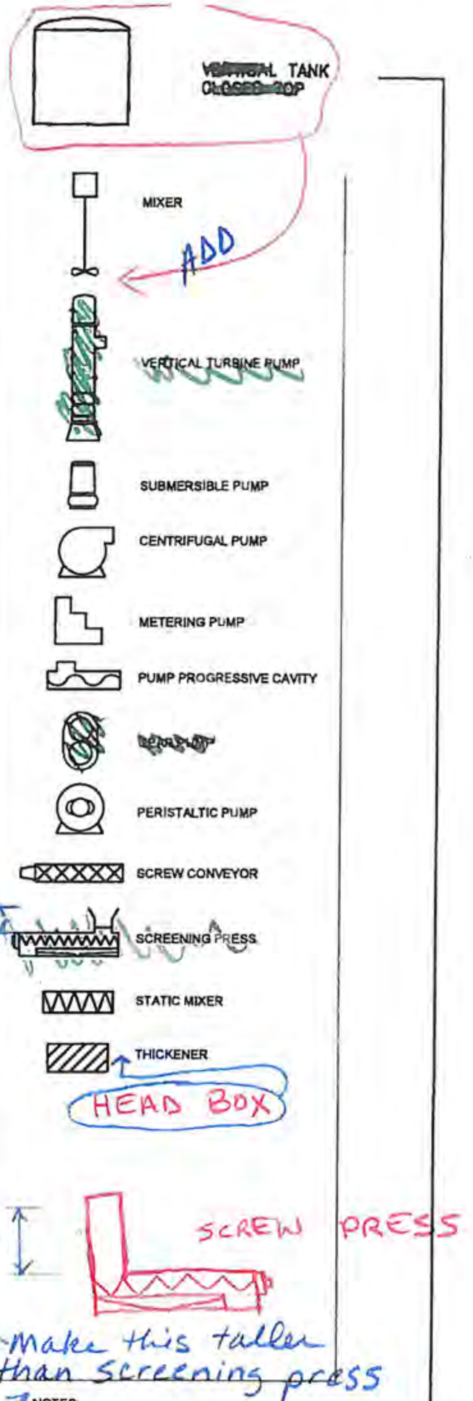


IN-LINE DEVICE
DIRECT CONNECTION TO PROCESS
TEMPERATURE ELEMENT WITH WELL
RADIATION OR SONIC SENSING
FILLED SYSTEM, DIAPHRAGM SEAL CONNECTION

MISCELLANEOUS



FLANGE
UNION
Y STRAINER
FLOW STRAIGHTENING VANE
TEE
CAP / PLUG
QUICK DISCONNECT
FLUSHING CONNECTION
WELDED CAP
BLIND FLANGE
CONCENTRIC REDUCER / INCREASER
HOSE BIBB CONNECTION
EXPANSION COUPLING
FLEXIBLE ~~COUPLING~~ CONNECTION
FLANGED COUPLING ADAPTER
DRAIN
DIAPHRAGM SEAL
RUPTURE DISK, PRESSURE
RUPTURE DISK, VACUUM
PURGE
THERMOMETER WELL
CALIBRATION CYLINDER
PULSATION DAMPER
INDICATOR LIGHT
ULTRASONIC (GUIDED)
UN
AIR RELIEF VALVE
AIR RELEASE
SLIDE GATE
INTERLOCK. NUMBER IS THE CROSS REFERENCE TO A SPECIFIC ELEMENTARY DIAGRAM OR TO A SPECIFIC CONTROL STRATEGY DESCRIBED IN THE SPECS
* AV - AIR VALVE T - TRAP
F - FILTER FH - FIRE HYDRANT
WATER LINE
GRAVITY FLOW



~~VERTICAL~~ TANK ~~CLOSED TOP~~
ADD
MIXER
~~VERTICAL TURBINE PUMP~~
SUBMERSIBLE PUMP
CENTRIFUGAL PUMP
METERING PUMP
PUMP PROGRESSIVE CAVITY
PERISTALTIC PUMP
SCREW CONVEYOR
SCREENING PRESS
STATIC MIXER
THICKENER
HEAD BOX
SCREW PRESS
Make this taller than screening press

NOTES:

1. THIS IS A GENERALIZED LEGEND SHEET.
2. SEE ALSO ISA S5.1, S5.3 AND S7.3.
3. INSTRUMENTS MARKED WITH AN ASTERISK ARE FURNISHED WITH THE EQUIPMENT.
4. REFER TO ISA RP7.7 FOR INSTRUMENT AIR QUALITY STANDARDS.

Add

~~VALVE~~ POSITIONS

NO	NORMALLY OPEN
NC	NORMALLY CLOSED
FO	FAIL OPEN
FC	FAIL CLOSE
FLP	FAIL LAST POSITION

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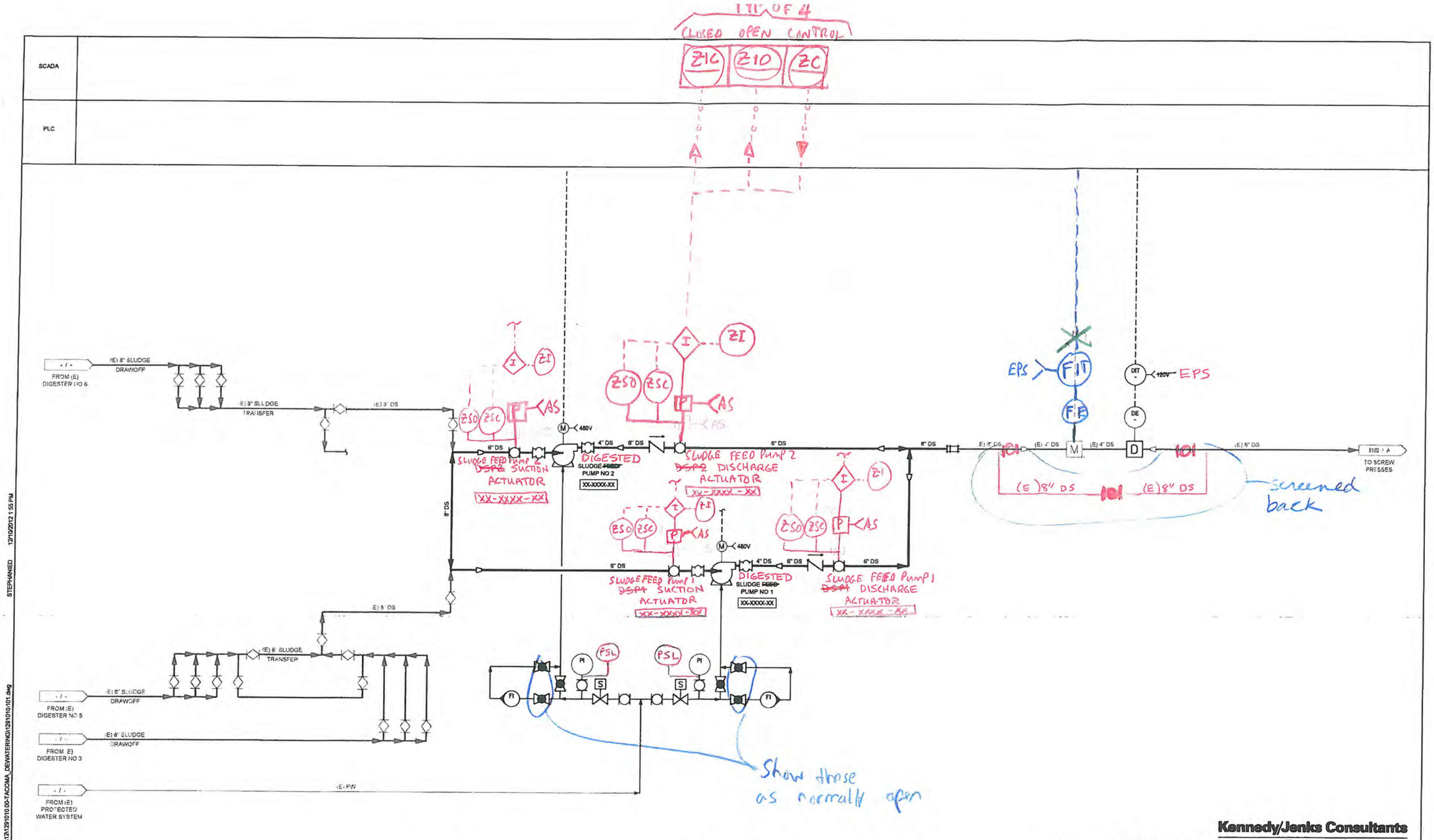
NO	REVISION	DATE	APPD	
FINAL CONSTRUCTION CHECKED	DATE 12/10/2012	SCALE -		
BY	DESIGNED SLG	CHECKED TPG		
DATE	DRAWN SLG	PROJECT NAME -		
FIELD BOOKS -	DRAWING NAME 1291010I001.dwg			

TOM P. GIESE
DRAFT

CITY OF TACOMA
ENVIRONMENTAL SERVICES DEPARTMENT
SOLIDS DEWATERING FACILITY UPGRADE
TACOMA, WASHINGTON
PROCESS AND INSTRUMENTATION DIAGRAM LEGEND

SPEC NO. PWK-???
WBS NO. ENV-04103-11-01
-
SHEET NO. I001 OF -



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FIELD BOOKS -

DATE 12/10/2012	SCALE -
DESIGNED TPC/AGS	CHECKED TPG
DRAWN SLG	PROJECT NAME -
DRAWING NAME 1291010i101.dwg	

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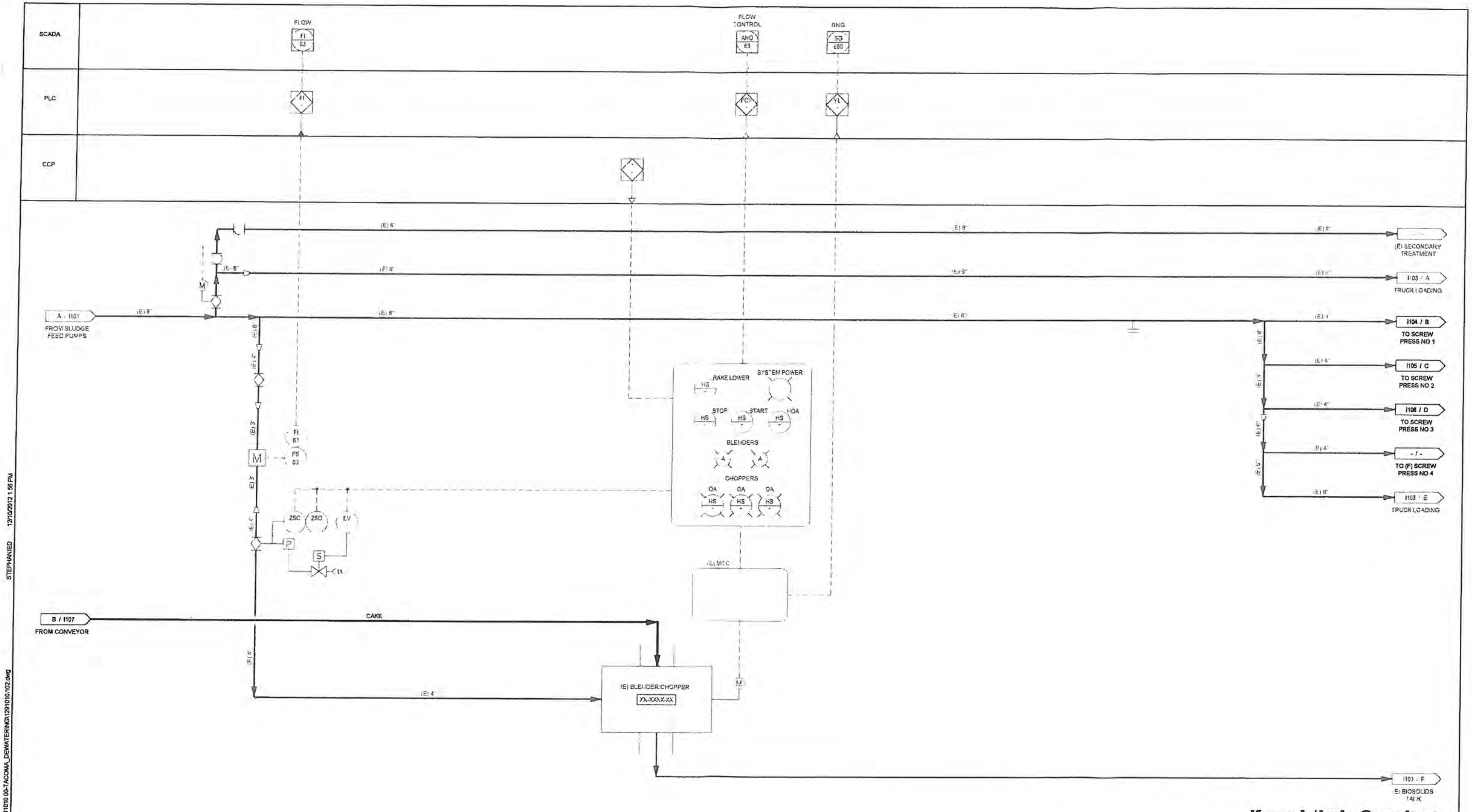
SOLIDS DEWATERING FACILITY UPGRADE
TACOMA, WASHINGTON
P&ID - DIGESTED SLUDGE PUMPS

SPEC. NO. PWK-???
WBS NO. ENV-04103-11-01
-
SHEET NO. -
SHEET I101 OF -



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FINAL CONSTRUCTION CHECKED	DATE 12/10/2012	SCALE -	
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DATE	DRAWN SLG	PROJECT NAME -	
FIELD BOOKS -	DRAWING NAME 1291010i102.dwg		

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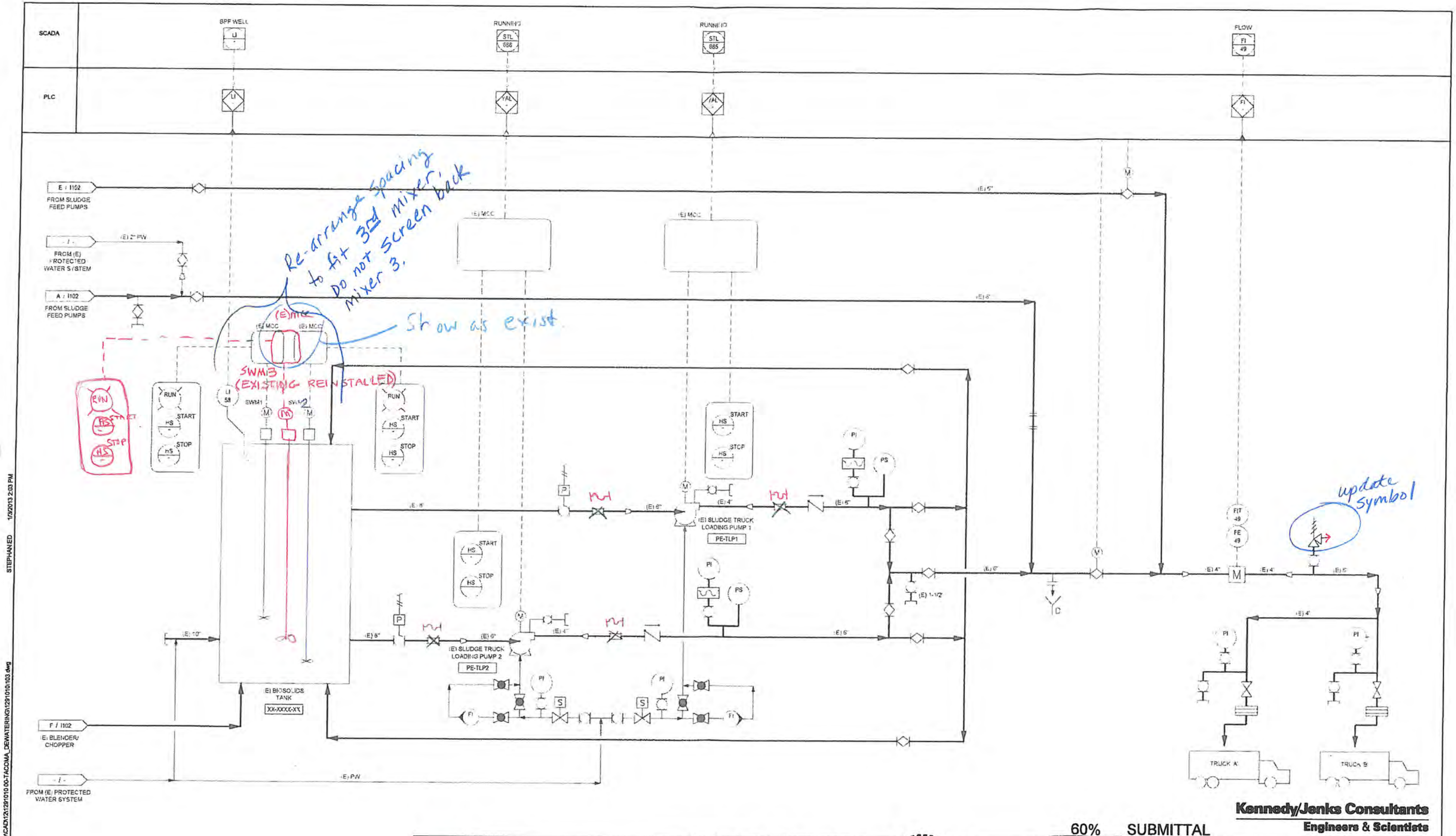
SOLIDS DEWATERING FACILITY UPGRADE
TACOMA, WASHINGTON
P&ID - BIOSOLIDS BLENDER

SPEC. NO. PWK-???
WBS NO. ENV-04103-11-01
-
SHEET NO.
SHEET I102 OF -



Re-arrange spacing to fit 3rd mixer, Do not screen back mixer 3.

Show as exist.

(E) MCC

SWM3 (EXISTING REINSTALLED)

RUN

HS START

HS STOP

update symbol

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BY
DATE
FIELD BOOKS -

DATE 1/3/2013
SCALE -
DESIGNED TPG/AGS
CHECKED TPG
DRAWN SLG
PROJECT NAME -
DRAWING NAME 1291010I103.dwg

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SOLIDS DEWATERING FACILITY UPGRADE
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P&ID - BIOSOLIDS TANK

SPEC. NO. PWK-???
WBS NO. ENV-04103-11-01
-
SHEET NO.
SHEET I103 OF -

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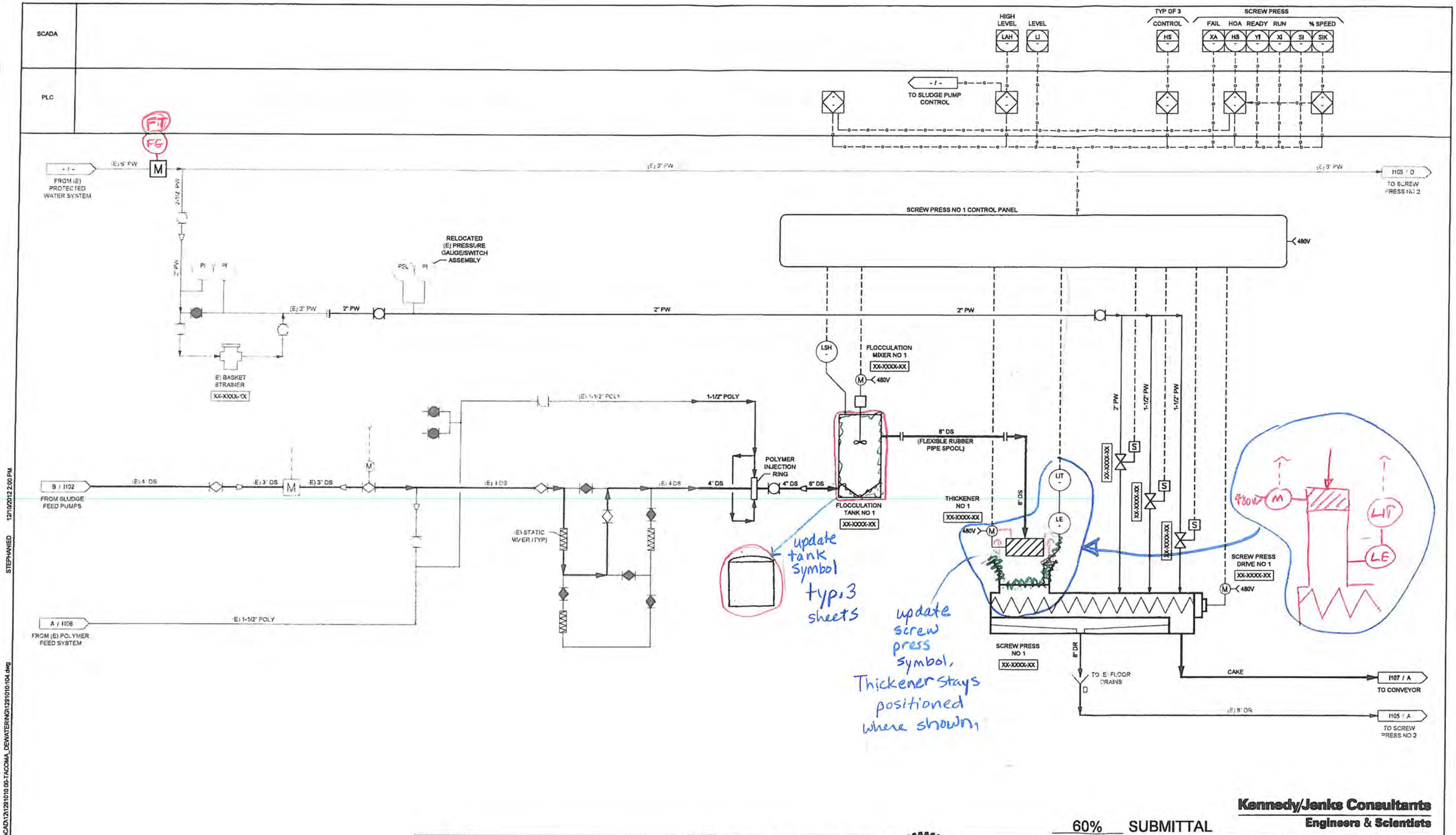

update tank symbol

typ, 3 sheets

update screw press symbol, Thickener stays positioned where shown,

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FINAL CONSTRUCTION CHECKED
BY
DATE
FIELD BOOKS -

DATE 12/10/2012
SCALE -
DESIGNED TPG/AGS
CHECKED TPG
DRAWN SLG
PROJECT NAME -
DRAWING NAME 1291010I104.dwg

TOM P. GIESE
DRAFT

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SOLIDS DEWATERING FACILITY UPGRADE
TACOMA, WASHINGTON
P&ID - SCREW PRESS NO 1

SPEC NO. PWK-???
WBS NO. ENV-04103-11-01
-
SHEET NO.
SHEET I104 OF -

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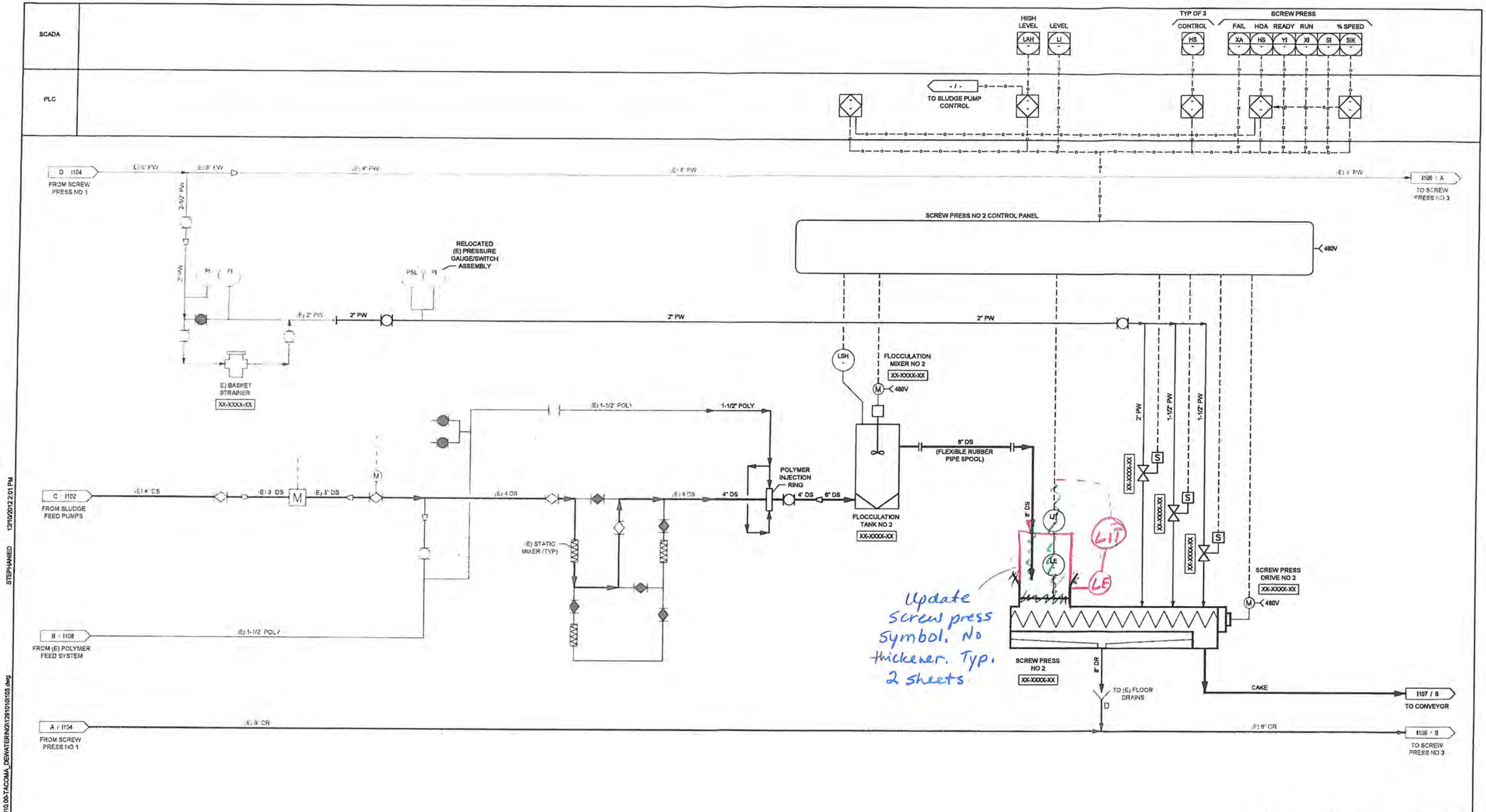

Update screw press symbol. No thickener. Typ. 2 sheets

K:\KJ-Cad\FederalWay\CAD\12\1291010.00-TACOMA_DEWATERING\1291010I105.dwg

STEPHANIED 12/10/2012 2:01 PM

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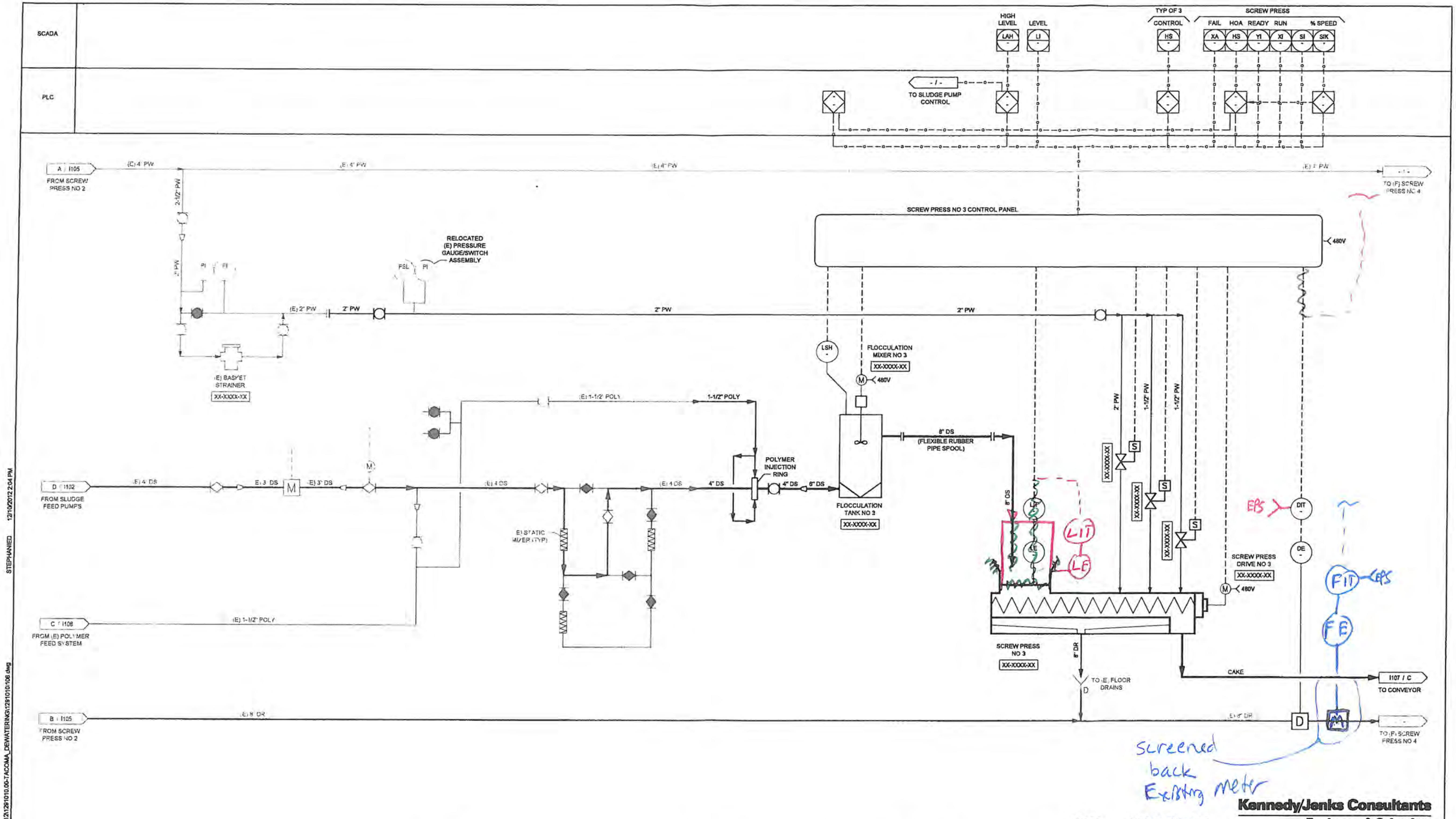
FINAL CONSTRUCTION CHECKED
BY
DATE
FIELD BOOKS -

DATE 12/10/2012
SCALE -
DESIGNED TPG/AGS
CHECKED TPG
DRAWN SLG
PROJECT NAME -
DRAWING NAME 1291010i105.dwg

TOM P. GIESE
PROFESSIONAL ENGINEER
DRAFT

CITY OF TACOMA
ENVIRONMENTAL SERVICES DEPARTMENT
SOLIDS DEWATERING FACILITY UPGRADE
TACOMA, WASHINGTON
P&ID - SCREW PRESS NO 2

SPEC NO. PWK-???
SDS NO. ENV-04103-11-01
-
SHEET NO.
SHEET I105 OF -



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BY	DESIGNED TPG/AGS	CHECKED TPG	
DATE	DRAWN SLG	PROJECT NAME -	
FIELD BOOKS -	DRAWING NAME 1291010I106.dwg		

NO | REVISION | DATE | APPD

TOM P. GIESE — DRAFT

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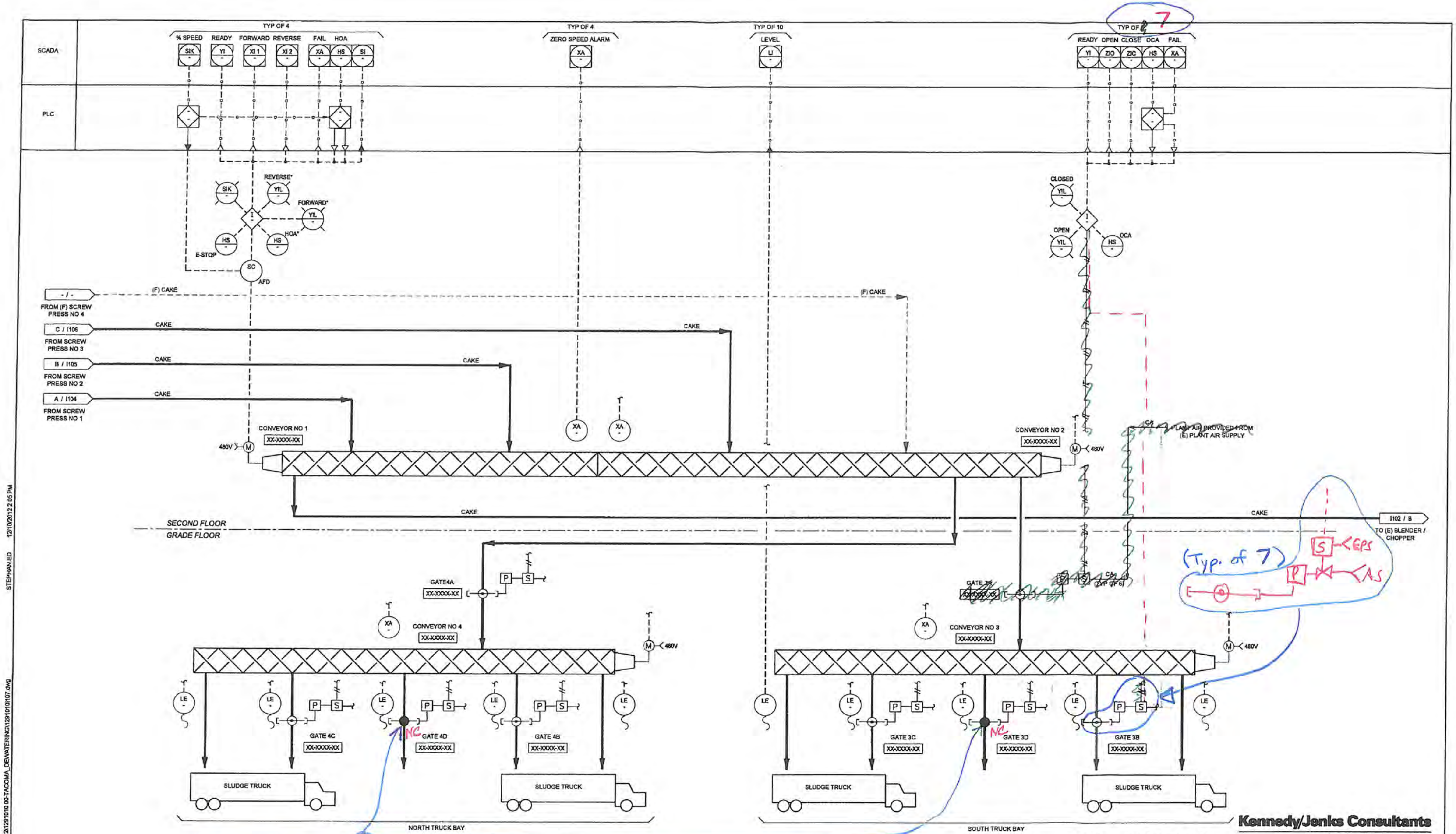
ENVIRONMENTAL SERVICES DEPARTMENT
SOLIDS DEWATERING FACILITY UPGRADE
TACOMA, WASHINGTON
P&ID - SCREW PRESS NO 3

SPEC. NO. PWK-???
WBS NO. ENV-04103-11-01
-
SHEET NO. I106 OF -



show same as other gates

K:\KJ-Cad\FederalWay\CAD\12\1291010\00-TACOMA_DEWATERING\1291010I107.dwg STEPHAN ED 12/10/2012 2:05 PM

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FINAL CONSTRUCTION CHECKED	DATE 12/10/2012	SCALE -		SPEC. NO. PWK-???
BY	DESIGNED TPG/AGS	CHECKED TPG		WBS NO. ENV-04103-11-01 -
DATE	DRAWN SLG	PROJECT NAME -		
FIELD BOOKS -	DRAWING NAME 1291010I107.dwg			SHEET NO. SHEET I107 OF -

NO | REVISION | DATE | APPD

Tacoma

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DRAFT

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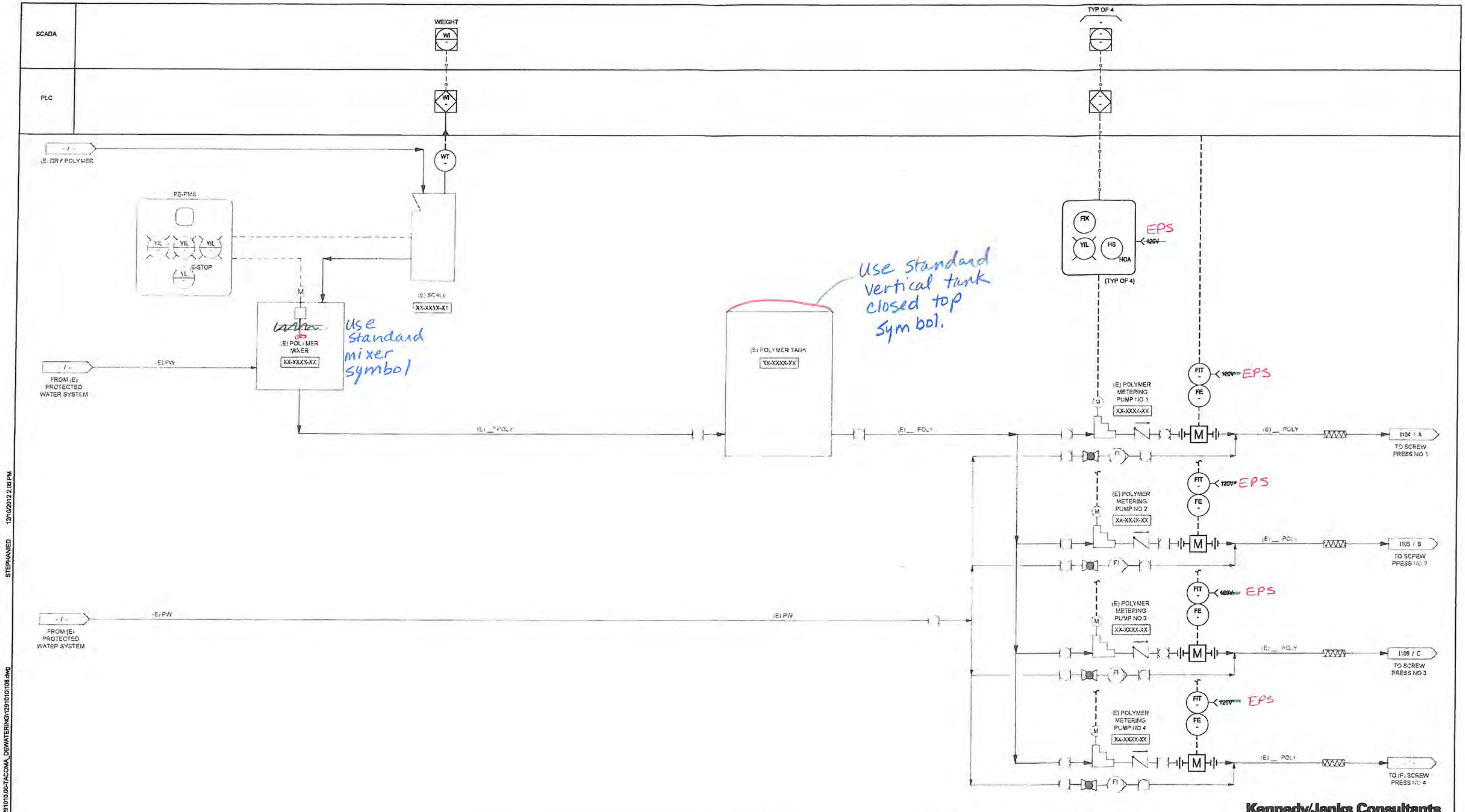
ENVIRONMENTAL SERVICES DEPARTMENT
SOLIDS DEWATERING FACILITY UPGRADE
TACOMA, WASHINGTON
P&ID - SCREW CONVEYOR SYSTEM



EPS

Use standard mixer symbol

Use standard vertical tank closed top symbol.

EPS

EPS

EPS

EPS

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Kennedy/Jenks Consultants
Engineers & Scientists

60% SUBMITTAL

Tacoma

NO	REVISION	DATE	APPD

FINAL CONSTRUCTION CHECKED
BY
DATE
FIELD BOOKS -

DATE 12/10/2012
SCALE -
DESIGNED TPG/AGS
CHECKED TPG
DRAWN SLG
PROJECT NAME -
DRAWING NAME 1291010I108.dwg

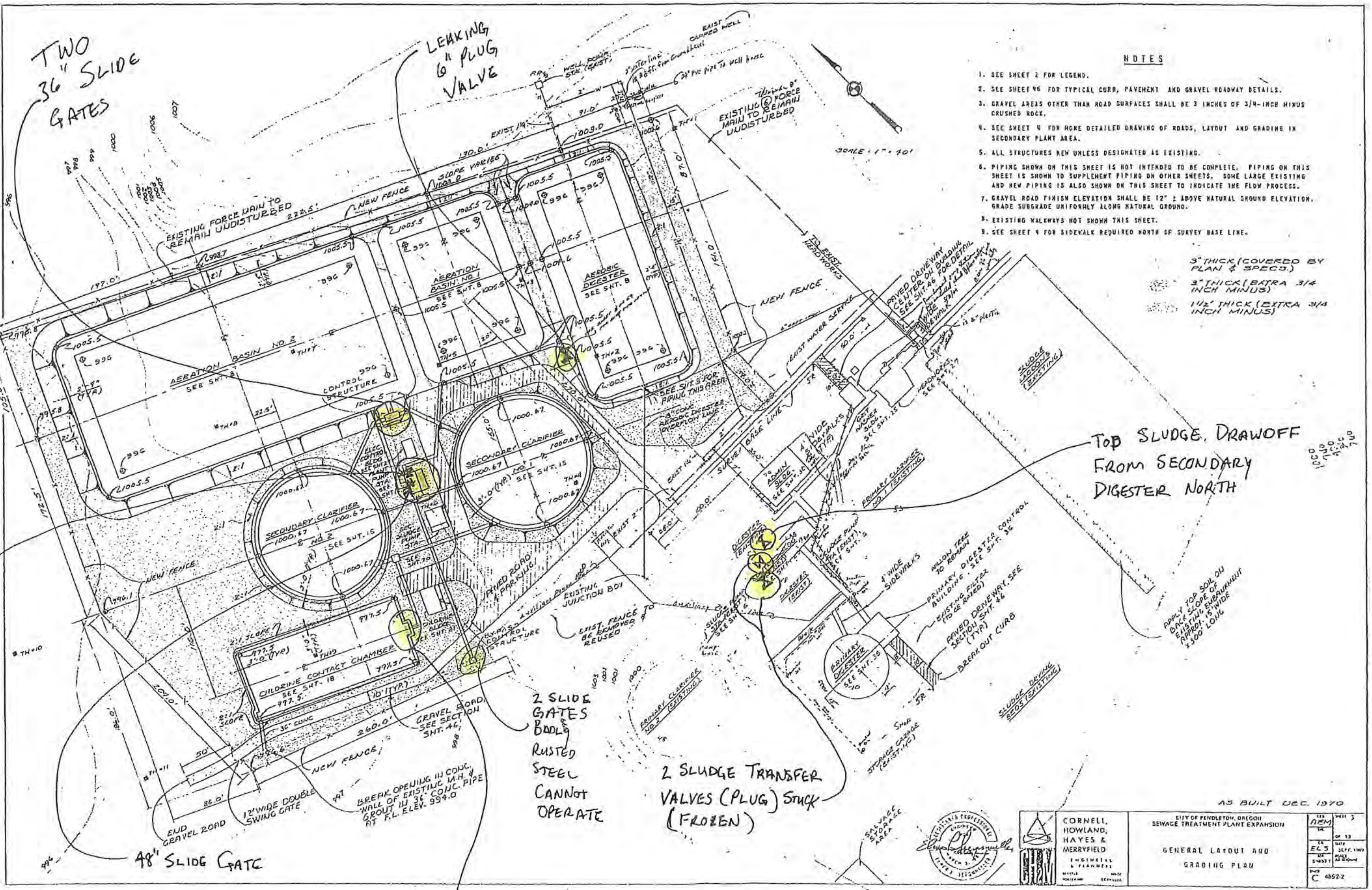
TOM P. GIESE
DRAFT

CITY OF TACOMA
ENVIRONMENTAL SERVICES DEPARTMENT
SOLIDS DEWATERING FACILITY UPGRADE
TACOMA, WASHINGTON
P&ID - POLYMER FEED SYSTEM

SPEC. NO. PWK-???
WBS NO. ENV-04103-11-01
-
SHEET NO.
SHEET I108 OF -

TWO 36" SLIDE GATES

LEAKING 6" PLUG VALVE



NOTES

1. SEE SHEET 2 FOR LEGEND.
2. SEE SHEET 46 FOR TYPICAL CURB, PAVEMENT AND GRAVEL ROADWAY DETAILS.
3. GRAVEL AREAS OTHER THAN ROAD SURFACES SHALL BE 3 INCHES OF 3/4-INCH MINUS CRUSHED ROCK.
4. SEE SHEET 4 FOR MORE DETAILED DRAWING OF ROADS, LAYOUT AND GRADING IN SECONDARY PLANT AREA.
5. ALL STRUCTURES NEW UNLESS DESIGNATED AS EXISTING.
6. PIPING SHOWN ON THIS SHEET IS NOT INTENDED TO BE COMPLETE. PIPING ON THIS SHEET IS SHOWN TO SUPPLEMENT PIPING ON OTHER SHEETS. SOME LARGE EXISTING AND NEW PIPING IS ALSO SHOWN ON THIS SHEET TO INDICATE THE FLOW PROCESS.
7. GRAVEL ROAD FINISH ELEVATION SHALL BE 12" ± ABOVE NATURAL GROUND ELEVATION. GRADE SUBGRADE UNIFORMLY ALONG NATURAL GROUND.
8. EXISTING WALKWAYS NOT SHOWN THIS SHEET.
9. SEE SHEET 4 FOR SIDEWALK REQUIRED NORTH OF SURVEY BASE LINE.

▨	3" THICK (COVERED BY PLAN & SPECS.)
▨	3" THICK (EXTRA 3/4 INCH MINUS)
▨	1½" THICK (EXTRA 3/4 INCH MINUS)

TOP SLUDGE DRAWOFF FROM SECONDARY DIGESTER NORTH

36" WEIR ~~BLIDE~~ GATE

2 SLIDE GATES BADLY RUSTED STEEL CANNOT OPERATE

2 SLUDGE TRANSFER VALVES (PLUG) STUCK (FROZEN)

48" SLIDE GATE

AS BUILT DEC. 1970

CORNELL,
HOWLAND,
HAYES &
MERRYFIELD
ENGINEERS & PLANNERS

CITY OF PENDLETON, OREGON
SEWAGE TREATMENT PLANT EXPANSION

GENERAL LAYOUT AND GRADING PLAN

AEM
ELS
SHEET 3 OF 53
DATE SEPT. 1969
SCALE AS SHOWN
C 4852-2

TWO 30" SLIDE GATES LEAK

BAD VALVES 11/14/06

Appendix K

City Council Presentation

CITY COUNCIL PRESENTATION

Wastewater Facilities Plan Update

City of Pendleton

3 April 2007

Kennedy/Jenks Consultants
Engineers & Scientists

Overview

- Treatment Plant Issues
- Past and Present Planning Steps
- Introduction to Alternatives
- City Feedback
- Next Steps

Existing Pendleton WWTP

Kennedy/Jenks Consultants
Engineers & Scientists

Existing Pendleton WWTP

- Original Date: Pre-1948
- Upgrades: 1948 & 1970
- 1970 Design Flows:
  - Average: 12.3 MGD
  - Peak: 16.5 MGD
  - Solids: 3.5 MGD
- Current Flows:
  - Average: 2.4 MGD
  - Peak: 4.3 MGD
- Limited Process Control
- Biological Issues

NPDES Permit & MAO

Renewed: February 3, 2005

Expires: January 31, 2010

Conditions:

1. New Ammonia-Nitrogen Limits
2. Temperature Management Plan in 18 months
3. Outfall Mixing Zone Study in 18 months

City under Mutual Agreement and Order (MAO) to address Conditions by 2010

1. New Ammonia Limits

- Very Stringent!
- Summer Season (May 1 – October 31)
  - Monthly Average: 1 mg/l
  - Daily Maximum: 2 mg/l
- Winter Season (Nov 1 – April 30)
  - Monthly Average: 3.0 mg/l
  - Daily Maximum: 5.2 mg/l
- Not achievable with Current Plant

2. Temperature Requirements

Period	Temp	Criteria
Winter (May15 – Oct15)	**55.4°F** (Standard)	T_R>55.4, (T_R+0.5) @ RMZ 50<T_R<55.4, (T_R+0.9) w/Full River T_R<55.4, (T_R+1.8) w/Full River
Spring (May16 – May31)	**64.4°F** (Standard)	T_R>64.4, (T_R=64.9) @ RMZ T_R<64.4, (T_R+0.5) @ RMZ
Summer (June1 – Sept 30)	**69.8°F** (TMDL)	T_R>69.8, (T_R=70.25) @ End-of-Pipe T_R<69.8, (T_R+0.25) @ RMZ
Fall (Oct1 – Oct14)	**64.4°F** (Standard)	T_R>64.4, (T_R=64.9) @ RMZ T_R<64.4, (T_R+0.5) @ RMZ

COMPLEX!

2. Temperature Management Plan

- Draft TMP Submitted in October 2006
- Based on Thermal Credits from:
  - Continued operation of SAT Demo outfall
  - Thermal Credits from Thorn Hollow Springs
- Potential Issues
  - Criteria drops from 64.4*F to 55.4*F on October 15
  - May require storage ~ 2 weeks
- Currently working on river temperature modeling and Temperature Trading Protocol

Kennedy/Jenks Consultants
Engineers & Scientists

2. Temperature Compliance

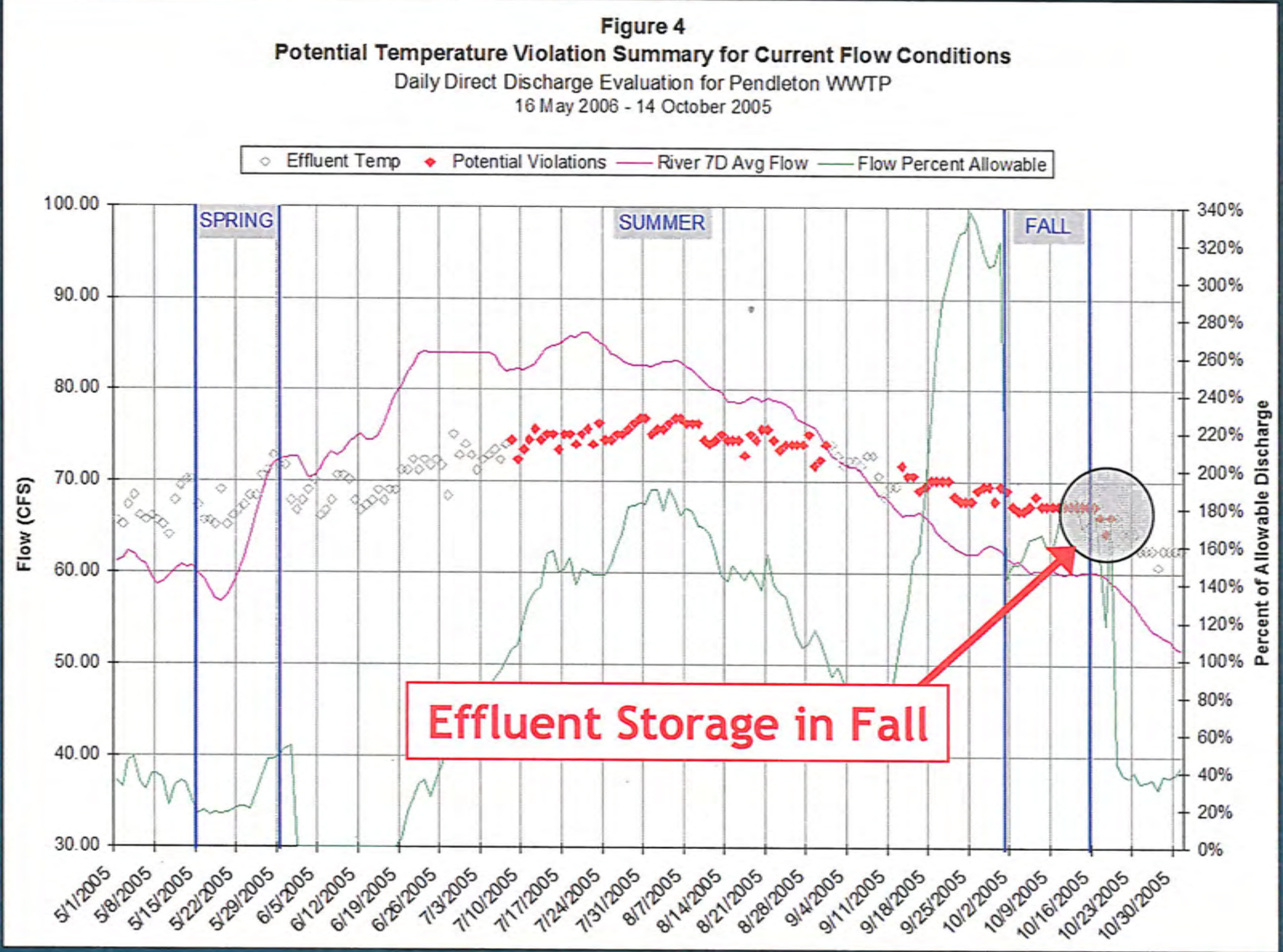
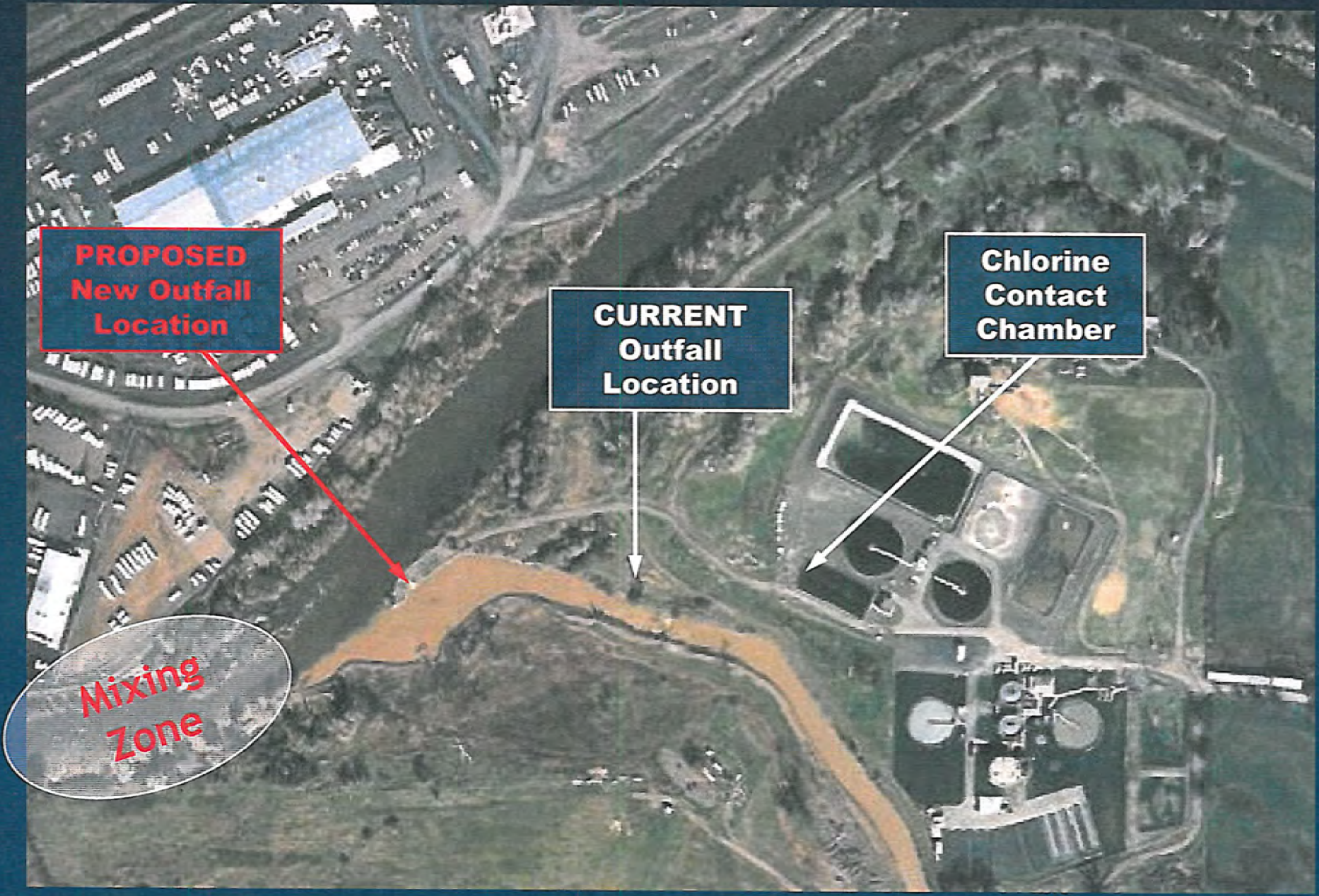


Figure 4
Potential Temperature Violation Summary for Current Flow Conditions
Daily Direct Discharge Evaluation for Pendleton WWTP
16 May 2006 - 14 October 2005

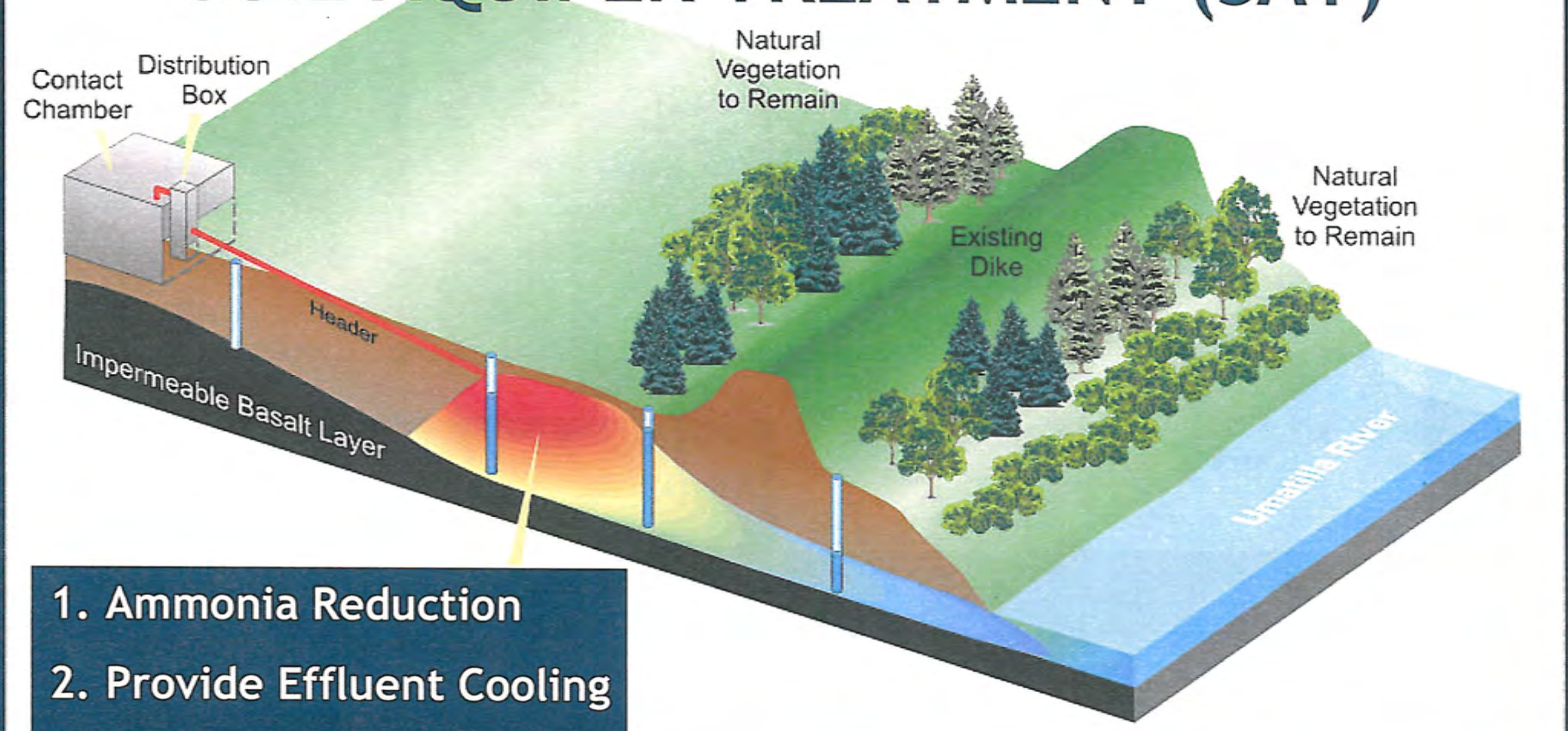
Effluent Storage in Fall

3. Outfall Relocation



Subsurface Discharge Demonstration

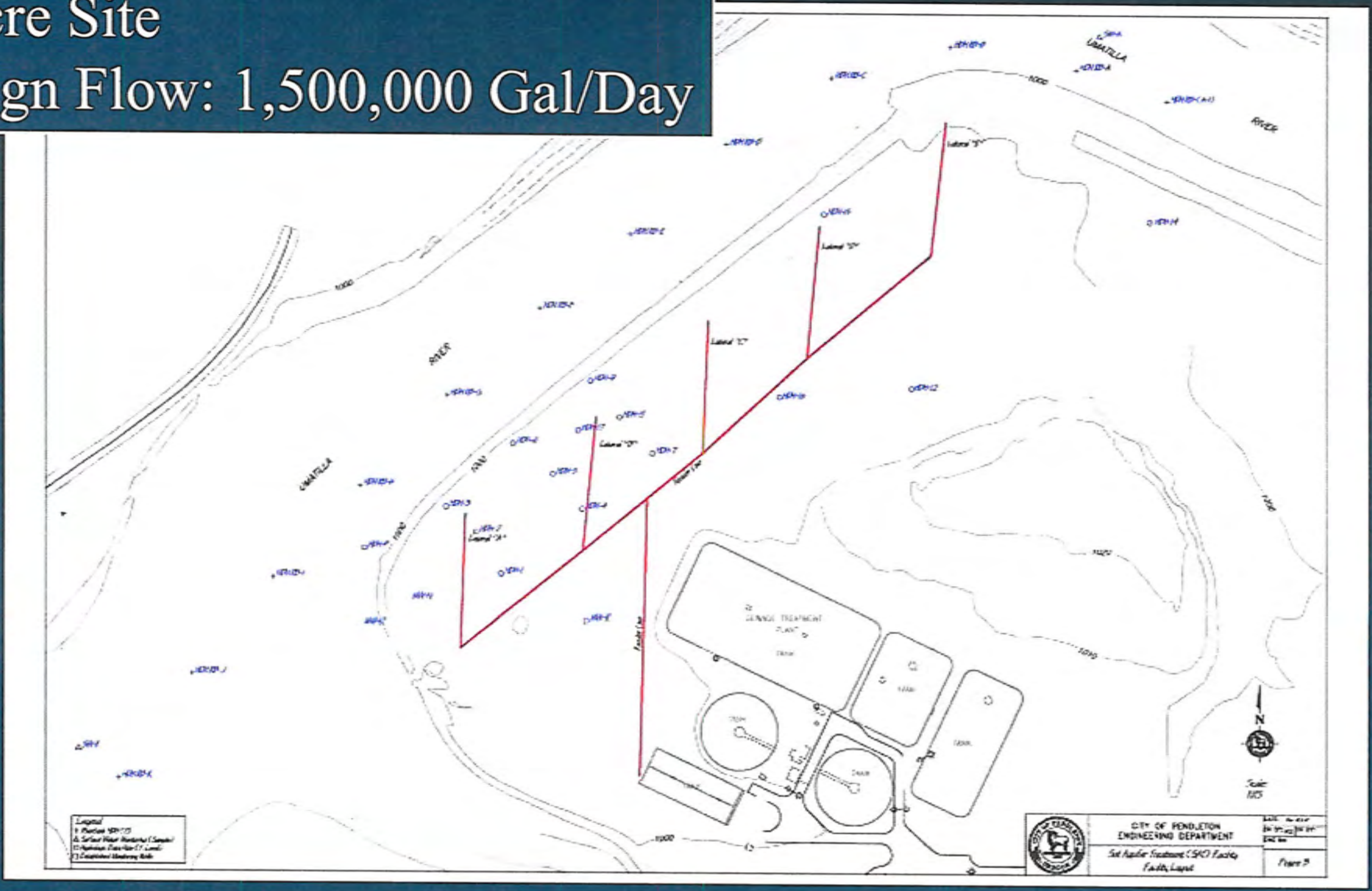
SOIL AQUIFER TREATMENT (SAT)



1. Ammonia Reduction
2. Provide Effluent Cooling
3. Indirect River Discharge

2005 Demonstration Project

8 Acre Site
Design Flow: 1,500,000 Gal/Day



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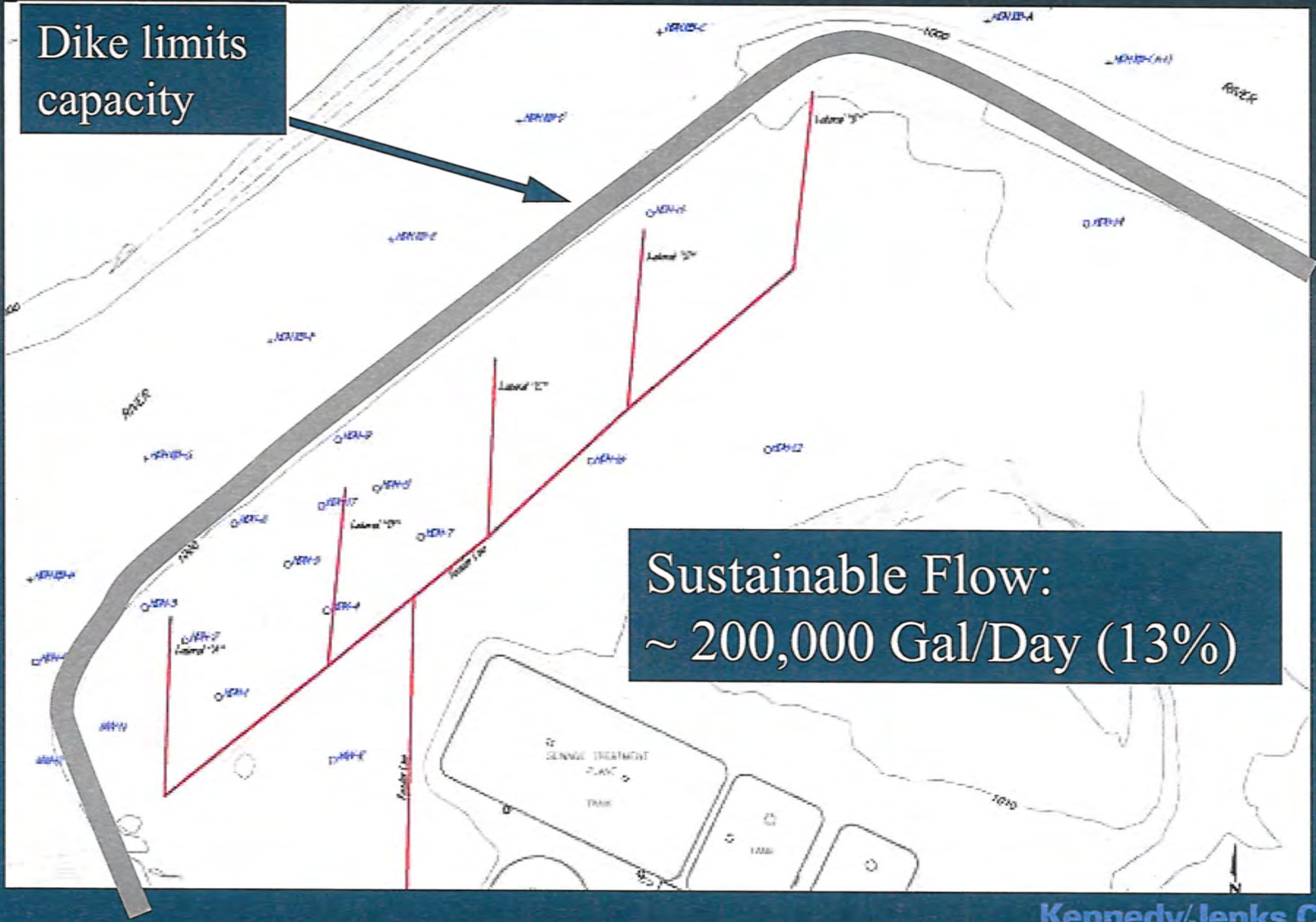
Issues with Flood Control Dike



Dike limits capacity

Sustainable Flow:
~ 200,000 Gal/Day (13%)

Comments on Subsurface Discharge

- Excellent for cooling effluent!
- Unknowns about ammonia reduction
- Demonstration site has limited capacity
- Need 80-acre site for design flow
- Appears Thermal Credits will save $$$
- Still need to address Treatment Plant

Initial Planning Study

- Completed in April 2006
- Evaluation of in-plant options for Ammonia, Temperature & Outfall
- Overall Cost Estimate ~ $9 Million
  - Ammonia ~ $6 Million
  - Temperature & Outfall ~ $3 Million
- Initial effort leading to a larger and more comprehensive WWTP Facility Plan

WWTP Facility Plan

- 20-year plan for the wastewater treatment plant
- Plan meeting DEQ requirements to assure NPDES compliance
- Capacity for current population and future growth
- Address existing treatment plant deficiencies
- Review alternatives & recommend a plan
- Evaluate Rate Structure

Existing Treatment Plant

- Original Plant in 1948 & last major upgrade 1970
- Structural, Mechanical & Electrical Deficiencies
- Biological & Process Control Issues
- Limited Solids Capacity
- Plant is wearing out!
- Plant staff have done a great job!!

Aeration Basin 2

- Unused & exposed for many years
- Deteriorated, Spalling & Cracked Concrete
- Needs significant rehabilitation for use

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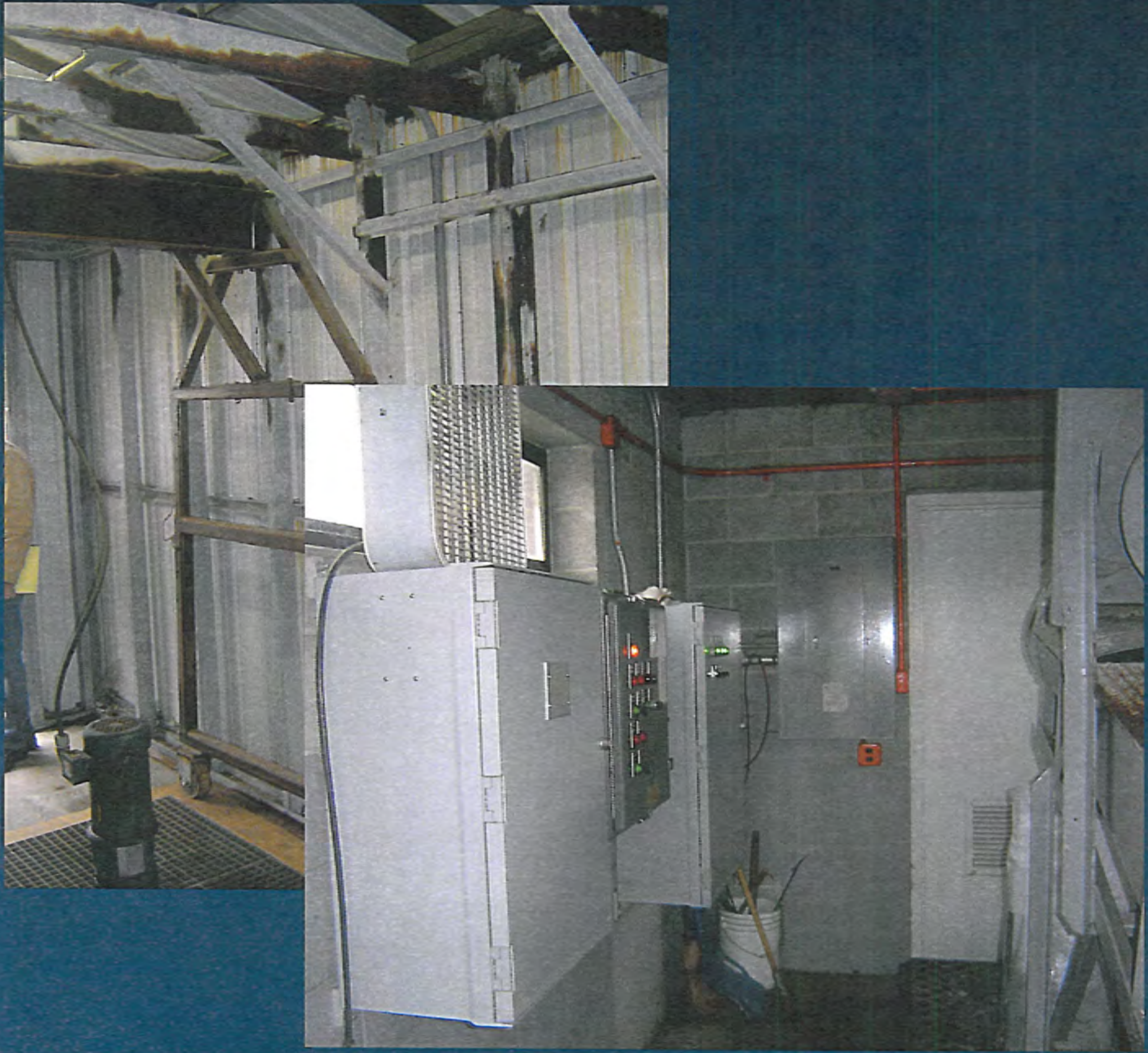
Engineers & Scientists

Headworks



- Corrosion in Headworks Building
- Electrical Panels in corrosive area
- Need better screenings removal

Mechanical Equipment

- Mechanical equipment outlived useful service life
- Pumps sized for larger flow operating at low efficiency
- Clarifiers need rehabilitation
- Issues with mixers on Primary Digester

Electrical Systems

- Electrical parts no longer available
- Corroded underground electrical conduits
- Need larger Standby Generator
- Need Automatic Transfer Switch

Current Treatment Plant Issues

1. NPDES Permit Issues
   - Ammonia Removal in Treatment Plant
   - Temperature Storage in Fall Shoulder
   - Relocate Outfall closer to Mixing Zone
2. Rehabilitate or Upgrade Treatment Plant to Address Deterioration
3. Add Solids Dewatering to increase capacity

Future Issues to Monitor

- Oregon Water Quality Standards (More Stringent)
  - Fish Consumption Rate & Human Health Toxics Criteria
  - Turbidity & Ammonia Standards
  - Temperature (Challenge to Willamette Temperature TMDL)
- Future Total Maximum Daily Loads
  - 303(d) list updated in 2004/06 Integrated Report
  - Umatilla River Level II listings: DO & metals
  - Potential TMDL Update in Future
- Compounds of Emerging Concern (CECs)
  - Pharmaceuticals & Personal Care Products
  - Endocrine Disrupting Compounds (EDCs)
  - Pesticides, Herbicides & Fungicides
- Mixing Zones (Oregon Legislature)

Four Options to Address Issues

1. Minimum for Permit Issues
2. Minimum for Current Issues
3. Best for Current Issues
4. Best for Current and Future Issues

1. Minimum For Permit Issues

Pros:

- Address Ammonia, Temperature & Outfall
- Lowest Initial Capital Cost
- Maximize Use of Existing Facilities

Cons:

- Difficult to Operate & Limited Process Control
- Least Reliable Ammonia Treatment
- Shortest Potential Lifespan
- Does not address Plant Deterioration or Future Issues

Estimated Cost : $9.5 Million

2. Minimum For Current Issues

Pros:

- Meet Current NPDES Permit Limits
- Low Initial Capital Cost
- Maximize Use of Existing Facilities
- Address Plant Deterioration

Cons:

- Difficult to Operate & Limited Process Control
- Least Reliable Ammonia Treatment
- Short Potential Lifespan
- Limited Future Expandability on Current Site

Estimated Cost : $15.8 Million

3. Best For Current Issues

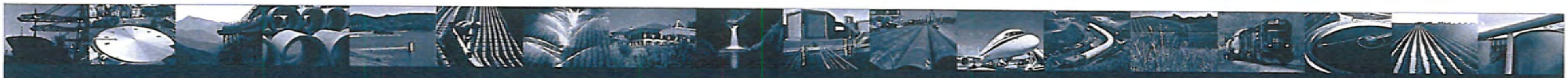
Pros:

- Meet Current NPDES Permit Limits
- Reliable Ammonia Treatment
- Longer Lifespan (new concrete)
- Address Plant Deterioration

Cons:

- Higher Initial Capital Cost than Min. Alternative
- Limited Future Expandability on Current Site
- Does not address Future Issues
- May require future tertiary filtration

Estimated Cost : $19.5 Million



4. Best For Current & Future Issues

Pros:

- Address Current & Potential Future Issues
- Reliable Ammonia Treatment
- Small Footprint, Modular and Expandable in Future
- Address Plant Deterioration
- Eliminate Some Rehabilitation Projects

Cons:

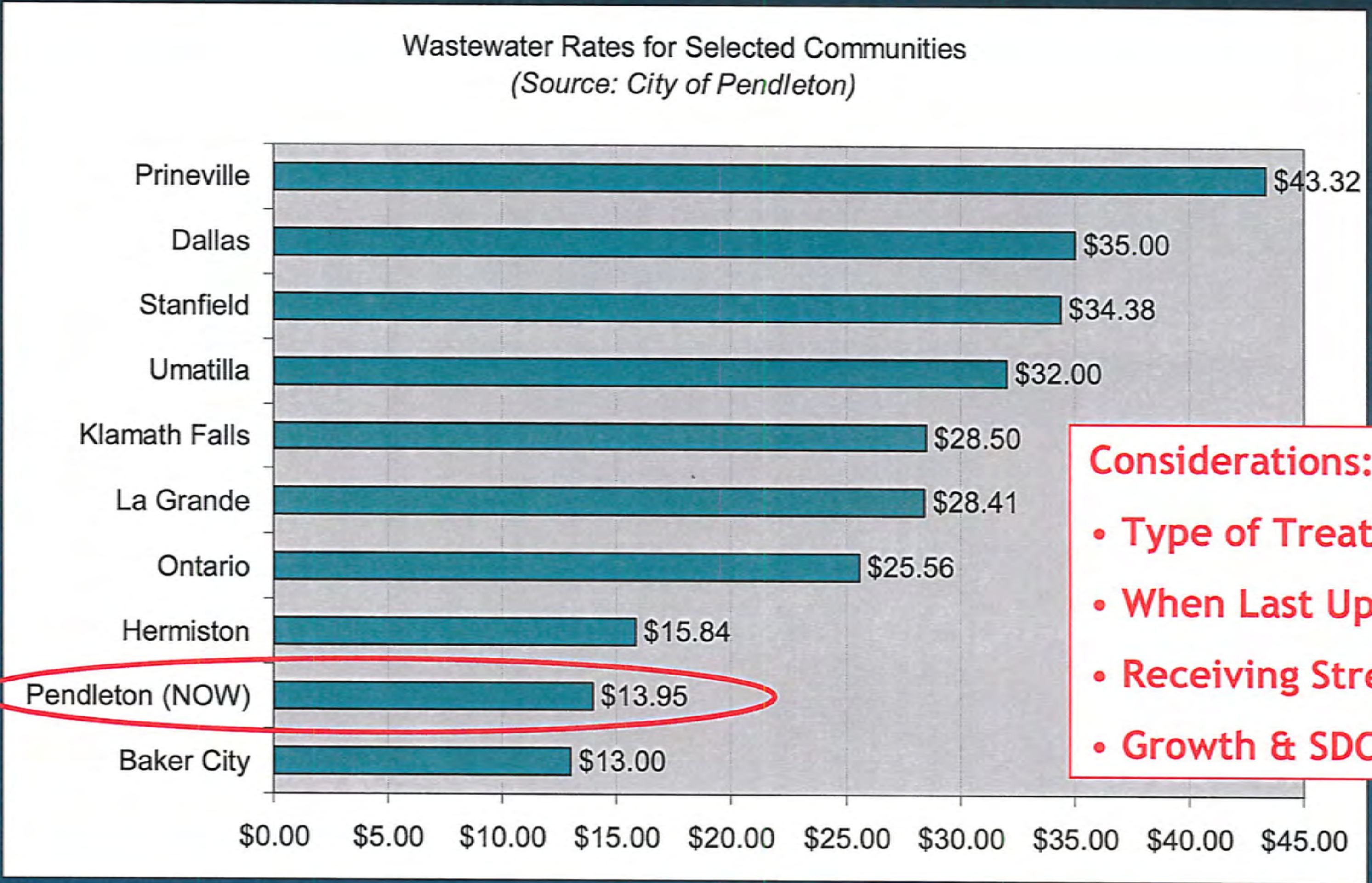
- Highest Initial Capital Cost
- Increased Operational Complexity
- Higher Annual O&M Costs

Estimated Cost : $24.8 Million

Next Steps

- Incorporate City Goals and Objectives & Develop Recommended Plan
- Develop Financial Plan: Rates & SDCs
- Review Potential Phasing and Cost Reduction Options
- Complete Temperature Trading Protocol
- Finalize WWTP Facility Plan & Submit to DEQ
- Develop overall project schedule

Wastewater Rates Comparison



Wastewater Rates for Selected Communities
(Source: City of Pendleton)

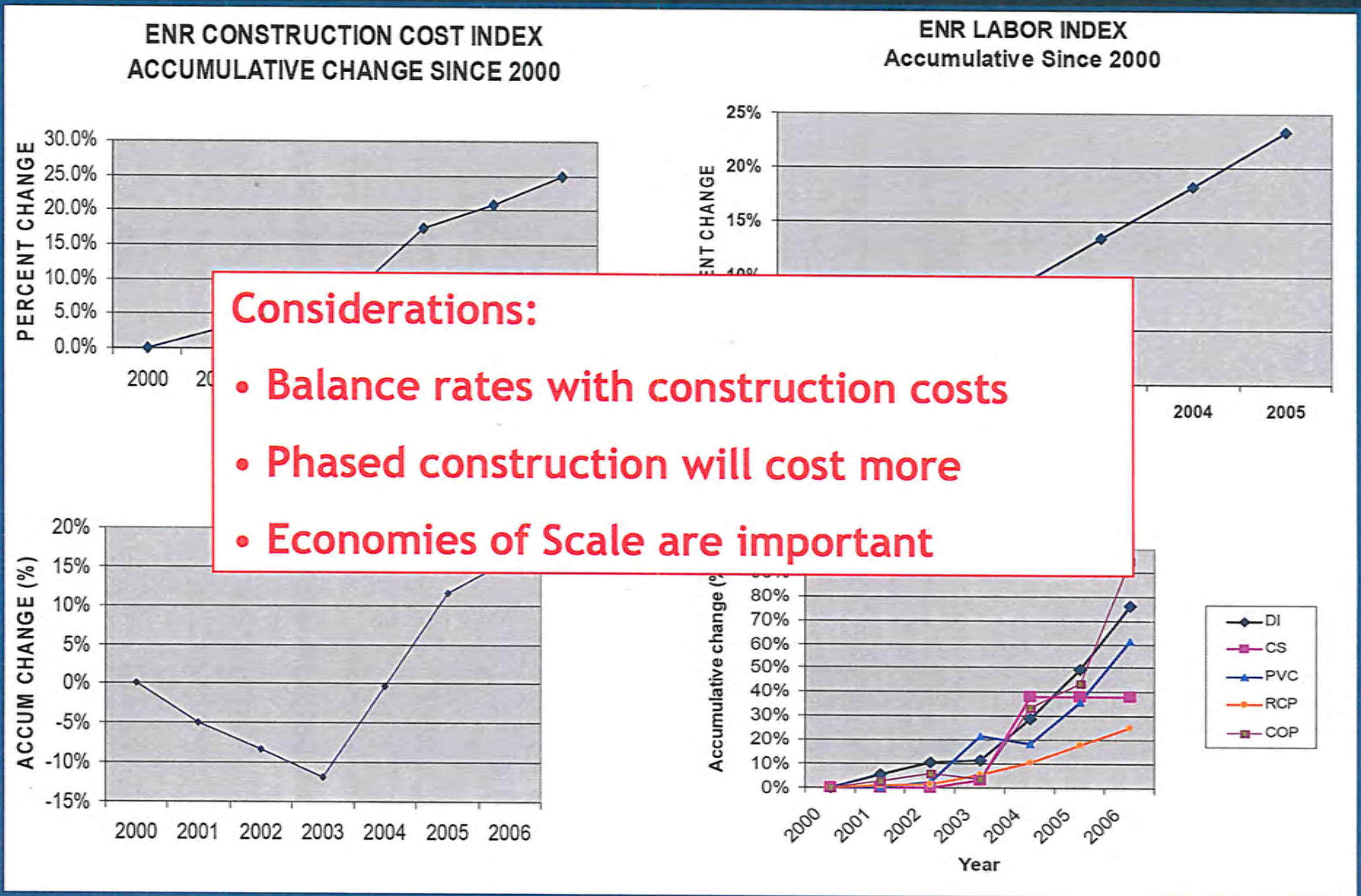
Considerations:

- Type of Treatment
- When Last Upgraded
- Receiving Stream WQ
- Growth & SDCs

Potential Cost Reduction & Phasing

- NPDES Upgrades Now to meet MAO
- Complete non-critical rehabilitation projects over time
- Delay/Eliminate Temperature Improvements
- Review timing for Solids Improvements
- For Membrane Option (4):
  - Review requirement for outfall relocation
  - Purchase membrane cassettes as required

Construction Costs are Increasing


ENR CONSTRUCTION COST INDEX ACCUMULATIVE CHANGE SINCE 2000

ENR LABOR INDEX Accumulative Since 2000

Considerations:

- Balance rates with construction costs
- Phased construction will cost more
- Economies of Scale are important

Source: Dennis Van Kirk, AACE

Kennedy/Jenks Consultants
Engineers & Scientists

Questions?

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Engineers & Scientists

Minimum for Permit Issues

Improvements for NPDES Compliance	*$ 9,510,000*
Secondary Process Upgrades	$ 5,490,000
Electrical	$ 1,450,000
Effluent Storage (Temperature)	$ 1,310,000
Outfall Relocation	$ 1,260,000

Minimum for Current Issues

Improvements for NPDES Compliance	***$ 10,440,000***
Secondary Process Upgrades	**$ 5,490,000**
Solids Dewatering	**$ 2,380,000**
Effluent Storage (Temperature)	**$ 1,310,000**
Outfall Relocation	**$ 1,260,000**
WWTP Rehabilitation & Maintenance	***$ 5,340,000***
Headworks	**$ 400,000**
Exist. Clarifier & PS Rehab	**$ 2,810,000**
Disinfection System Modifications	**$170,000**
Drying Bed Modifications	**$510,000**
Electrical	**$1,450,000**
Total	***$ 15,800,000***

Best for Current Issues

Improvements for NPDES Compliance	*$ 14,200,000*
Secondary Process Upgrades	$ 9,250,000
Solids Dewatering	$ 2,380,000
Effluent Storage (Temperature)	$ 1,310,000
Outfall Relocation	$ 1,260,000
WWTP Rehabilitation & Maintenance	*$ 5,340,000*
Headworks	$ 400,000
Primary & Secondary Clarifiers & PS Rehab	$ 2,810,000
Disinfection System Modifications	$ 170,000
Drying Bed Modifications	$510,000
Electrical	$ 1,450,000
Total	*$ 19,500,000*

Best for Current and Future Issues

Improvements for NPDES Compliance	*$ 20,580,000*
Secondary Process Upgrades	$ 16,100,000
Solids Dewatering	$ 2,470,000
Effluent Storage (Temperature)	$ 750,000
Outfall Relocation (May not be req'd)	$ 1,260,000
WWTP Rehabilitation & Maintenance	*$ 4,180,000*
Headworks	$830,000
Primary & Secondary Clarifiers & PS Rehab	$ 1,220,000
Disinfection System Modifications	$ 170,000
Drying Bed Modifications	$510,000
Electrical	$ 1,450,000
Total	*$ 24,800,000*

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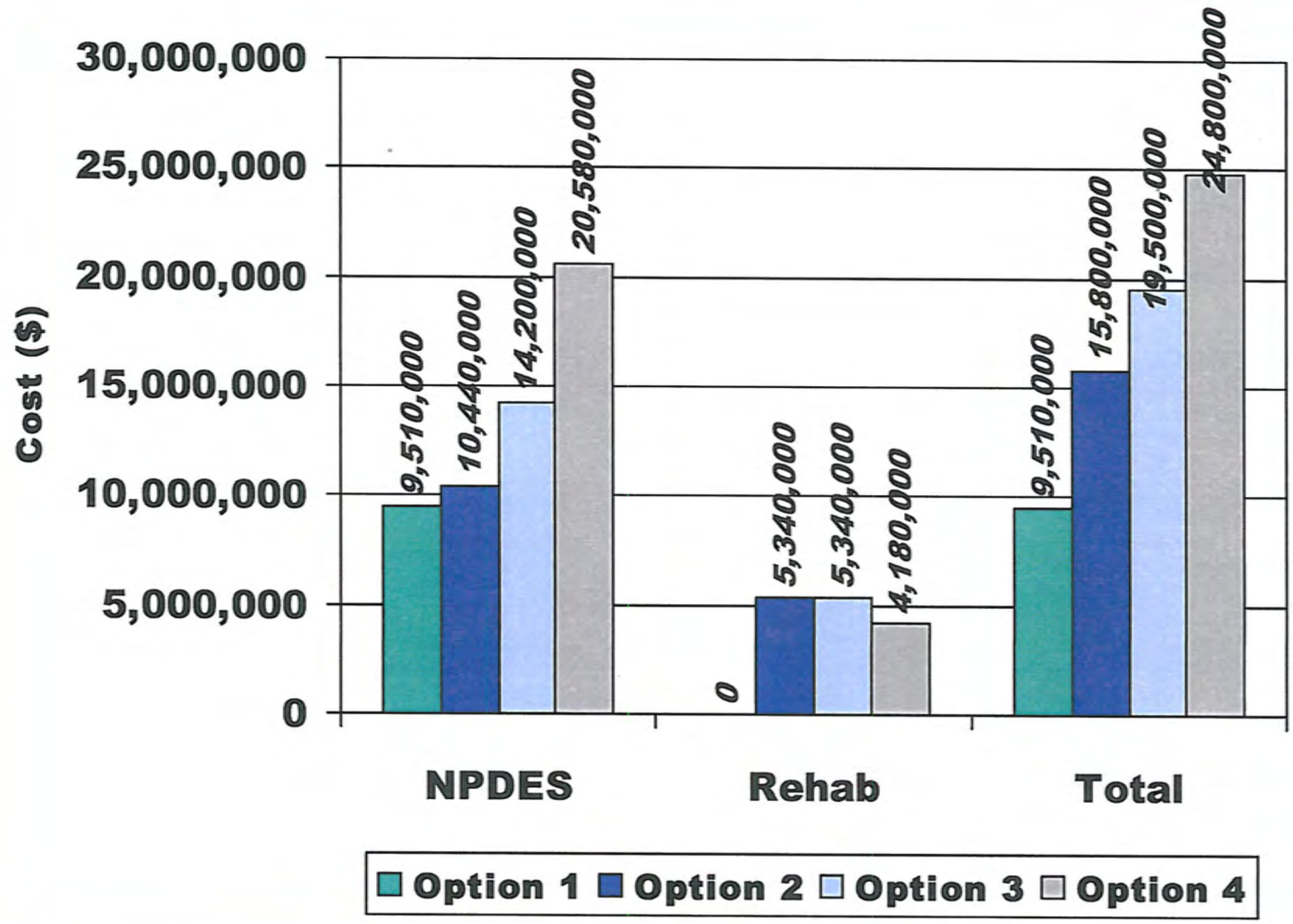
Alternative Cost Summary



MBR Alternative Considerations

- MBR now, no future tertiary filter
  - Replaces aeration basins and secondary clarifiers
  - Maybe Primary Clarifiers also
- Highest quality wastewater effluent
- Re-use existing tanks, but no rehab:
  - Secondary Clarifiers for Effluent Storage (Temperature)
- Small footprint provides future expandability
- May not require outfall relocation
- Higher annual O&M costs

Appendix L

Preliminary Process Designs

Simulation	Influent Flow	Influent Temperature	Influent CBOD	Influent TSS	Influent TKN	Influent NH3	Total Volume	Total Anoxic/Swing Volume	Anoxic/Swing Zones	Volume per Anoxic/Swing Zone	Total Aerobic Volume	Aerobic Zones	Volume per Aerobic Zone	MBR Tank	SRT	MLSS	Effluent NH3	Effluent NO3	Effluent TN	Effluent CBOD	Effluent TSS	Primary Solids	WAS Solids	Alkalinity Addition ?	Total Aeration Requirement
	MGD	C	mg/l	mg/l	mg/l	mg/l	MG	MG	#	MG	MG	#	MG		D	mg/l	mg/l	mg/l	mg/l	mg/l	mg/l	lb/d	lb/d		SCFM
MLE for 4.1 MGD	4.1	13	198	273	33	23	1.62	0.72	4	0.18	0.9	3	0.30	-	12	2470	0.88	7.06	11.21	5.24	13.35	5537	2772	YES	3224
MLE for 3.4 MGD	3.4	13	198	273	33	23	1.4	0.65	4	0.15	0.75	3	0.25	-	12	2500	0.89	7.99	11.86	4.56	11.22	4687	2352	YES	2727
MLE including MBR tank for 4.1 MGD	4.1	13	198	273	33	23	1.4	0.65	4	0.16	0.75	2	0.205	0.34	15	5458	0.3	14.41	16.47	0.94	0	5778	2840	YES	6133

Appendix M

Preliminary Funding Plan

WWTP UPGRADES - Funding Option:
Full Faith & Credit Obligation - Level Debt

PAYMENT SCHEDULE:

Phase 1: MLE — **Design @ $3,200,000 & Construction @ $12,600,000 = $15,800,000**
Phase 2: MBR conversion w/new membranes — Design @ $2,600,000 & Construction @ $10,700,000 = $13,300,000

Phase 1: Total obligation $ 15,300,000 — **Interest: 4.55%** — **Available: December 1, 2007**
Phase 2: Total obligation: $ 13,300,000 — Interest: 5.00% — Available: Future via State Loans

	Phase 1: MLE		Phase 2: MBR									
Year	P&I	O&M Increase	Design	Construction	O&M Increase	Combined	FY08 Beginning: $1,800,000	Stepped Increase	Additional Revenue	Franchise Fee: 7%	Average CPI Increase 2.50%	Additional Total Revenue
		(assumption)			(assumption)							
FY08	$ 378,800						Jan-08	25.0%	$ 225,000	$ 15,750.00	$ -	$ 240,750
FY09	$ 1,100,677					$ 1,100,677	Jul-08	25.0%	$ 1,051,875	$ 73,631.25	$ 26,297	$ 1,151,803
FY10	$ 1,151,590	$ 275,000				$ 1,426,590	Jul-09	9.0%	$ 1,417,465	$ 99,222.58	$ 35,437	$ 1,552,125
FY11	$ 1,151,609	$ 275,000				$ 1,426,609			$ 1,452,902	$ 101,703.14	$ 36,323	$ 1,590,928
FY12	$ 1,153,557	$ 275,000				$ 1,428,557			$ 1,489,225	$ 104,245.72	$ 37,231	$ 1,630,701
FY13	$ 1,150,389	$ 275,000				$ 1,425,389			$ 1,526,455	$ 106,851.86	$ 38,161	$ 1,671,468
FY14	$ 1,151,086	$ 275,000				$ 1,426,086			$ 1,564,617	$ 109,523.16	$ 39,115	$ 1,713,255
FY15	$ 1,150,531	$ 275,000				$ 1,425,531			$ 1,603,732	$ 112,261.24	$ 40,093	$ 1,756,087
FY16	$ 1,148,702	$ 275,000				$ 1,423,702			$ 1,643,825	$ 115,067.77	$ 41,096	$ 1,799,989
FY17	$ 1,145,546	$ 275,000				$ 1,420,546			$ 1,684,921	$ 117,944.47	$ 42,123	$ 1,844,988
FY18	$ 1,145,863	$ 275,000	Interest			$ 1,420,863			$ 1,727,044	$ 120,893.08	$ 43,176	$ 1,891,113
FY19	$ 1,144,483	$ 275,000	$ 208,631			$ 1,628,114			$ 1,770,220	$ 123,915.40	$ 44,256	$ 1,938,391
FY20	$ 1,146,379		$ 208,631	Interest	$ 475,000	$ 1,830,010	Jul-18	10.0%	$ 2,188,315	$ 153,182.03	$ 54,708	$ 2,396,205
FY21	$ 1,146,550		$ 208,631	$ 858,596	$ 475,000	$ 2,688,777	Jul-19	10.0%	$ 2,662,643	$ 186,385.01	$ 66,566	$ 2,915,594
FY22	$ 1,144,923		$ 208,631	$ 858,596	$ 475,000	$ 2,687,150			$ 2,729,209	$ 191,044.63	$ 68,230	$ 2,988,484
FY23	$ 1,141,575		$ 208,631	$ 858,596	$ 475,000	$ 2,683,802			$ 2,797,439	$ 195,820.75	$ 69,936	$ 3,063,196
FY24	$ 1,141,404		$ 208,631	$ 858,596	$ 475,000	$ 2,683,631			$ 2,867,375	$ 200,716.27	$ 71,684	$ 3,139,776
FY25	$ 1,139,287		$ 208,631	$ 858,596	$ 475,000	$ 2,681,514			$ 2,939,060	$ 205,734.17	$ 73,476	$ 3,218,270
FY26	$ 1,140,095		$ 208,631	$ 858,596	$ 475,000	$ 2,682,322			$ 3,012,536	$ 210,877.53	$ 75,313	$ 3,298,727
FY27	$ 1,138,702		$ 208,631	$ 858,596	$ 475,000	$ 2,680,929			$ 3,087,850	$ 216,149.47	$ 77,196	$ 3,381,195
FY28	$ 1,139,976		$ 208,631	$ 858,596	$ 475,000	$ 2,682,203			$ 3,165,046	$ 221,553.20	$ 79,126	$ 3,465,725
FY29			$ 208,631	$ 858,596	$ 475,000	$ 1,542,227			$ 3,244,172	$ 227,092.03	$ 81,104	$ 3,552,368
FY30			$ 208,631	$ 858,596	$ 475,000	$ 1,542,227			$ 3,325,276	$ 232,769.34	$ 83,132	$ 3,641,177
FY31			$ 208,631	$ 858,596	$ 475,000	$ 1,542,227			$ 3,408,408	$ 238,588.57	$ 85,210	$ 3,732,207
FY32			$ 208,631	$ 858,596	$ 475,000	$ 1,542,227			$ 3,493,618	$ 244,553.28	$ 87,340	$ 3,825,512
FY33			$ 208,631	$ 858,596	$ 475,000	$ 1,542,227			$ 3,580,959	$ 250,667.11	$ 89,524	$ 3,921,150
FY34			$ 208,631	$ 858,596	$ 475,000	$ 1,542,227			$ 3,670,483	$ 256,933.79	$ 91,762	$ 4,019,179
FY35			$ 208,631	$ 858,596	$ 475,000	$ 1,542,227			$ 3,762,245	$ 263,357.14	$ 94,056	$ 4,119,658
FY36			$ 208,631	$ 858,596	$ 475,000	$ 1,542,227			$ 3,856,301	$ 269,941.07	$ 96,408	$ 4,222,650
FY37			$ 208,631	$ 858,596	$ 475,000	$ 1,542,227			$ 3,952,708	$ 276,689.59	$ 98,818	$ 4,328,216
FY38			$ 208,631	$ 858,596	$ 475,000	$ 1,542,227			$ 4,051,526	$ 283,606.83	$ 101,288	$ 4,436,421
FY39				$ 858,596	$ 475,000	$ 1,333,596			$ 4,152,814	$ 290,697.00	$ 103,820	$ 4,547,332
FY40				$ 858,596	$ 475,000	$ 1,333,596			$ 4,256,635	$ 297,964.43	$ 106,416	$ 4,661,015
TOTAL:	$ 22,872,920	$ 2,750,000	$ 4,172,620	$ 17,171,920	$ 9,975,000	$ 56,942,460			$ 87,361,899	$ 6,115,333	$ 2,178,422	$ 95,655,654

FY08 Residential Base Rate: $13.95 / mth

FY10 Residential Base Rate: $26.00 / mth 1.8623
FY21 Residential Base Rate: $36.55 / mth 2.6198

WWTP UPGRADES - Funding Option:
Full Faith & Credit Obligation - 2% Annual Increase

PAYMENT SCHEDULE:

Phase 1: MLE	**Design @ $3,200,000 & Construction @ $12,600,000 = $15,800,000**		
Phase 2: MBR conversion w/new membranes	Design @ $2,600,000 & Construction @ $10,700,000 = $13,300,000		
Phase 1: Total obligation $ 15,300,000	**Interest: 4.56%**	**Available: December 1, 2007**	
Phase 2: Total obligation: $ 13,300,000	Interest: 5.00%	Available: Future via State Loans	

	Phase 1: MLE		Phase 2: MBR									
Year	P&I	O&M Increase (assumption)	Design	Construction	O&M Increase (assumption)	Combined	FY08 Beginning: $1,800,000	Stepped Increase	Additional Revenue	Franchise Fee: 7%	Average CPI Increase 2.50%	Additional Total Revenue
FY08	$ 382,050						Jan-08	25.0%	$ 225,000	$ 15,750.00	$ -	$ 240,750
FY09	$ 924,663					$ 924,663	Jul-08	25.0%	$ 1,051,875	$ 73,631.25	$ 26,297	$ 1,151,803
FY10	$ 997,417	$ 275,000				$ 1,272,417	Jul-09	4.5%	$ 1,284,634	$ 89,924.40	$ 32,116	$ 1,406,675
FY11	$ 1,017,748	$ 275,000				$ 1,292,748			$ 1,316,750	$ 92,172.51	$ 32,919	$ 1,441,841
FY12	$ 1,036,575	$ 275,000				$ 1,311,575			$ 1,349,669	$ 94,476.82	$ 33,742	$ 1,477,887
FY13	$ 1,058,751	$ 275,000				$ 1,333,751			$ 1,383,411	$ 96,838.74	$ 34,585	$ 1,514,835
FY14	$ 1,079,147	$ 275,000				$ 1,354,147			$ 1,417,996	$ 99,259.71	$ 35,450	$ 1,552,705
FY15	$ 1,097,731	$ 275,000				$ 1,372,731			$ 1,453,446	$ 101,741.20	$ 36,336	$ 1,591,523
FY16	$ 1,119,368	$ 275,000				$ 1,394,368			$ 1,489,782	$ 104,284.73	$ 37,245	$ 1,631,311
FY17	$ 1,143,787	$ 275,000				$ 1,418,787			$ 1,527,026	$ 106,891.85	$ 38,176	$ 1,672,094
FY18	$ 1,165,773	$ 275,000	Interest			$ 1,440,773			$ 1,565,202	$ 109,564.15	$ 39,130	$ 1,713,896
FY19	$ 1,185,238	$ 275,000	$ 208,631			$ 1,668,869			$ 1,604,332	$ 112,303.25	$ 40,108	$ 1,756,744
FY20	$ 1,207,132		$ 208,631	Interest	$ 475,000	$ 1,890,763	Jul-18	15.0%	$ 2,177,952	$ 152,456.64	$ 54,449	$ 2,384,857
FY21	$ 1,231,313		$ 208,631	$ 858,596	$ 475,000	$ 2,773,540	Jul-19	12.0%	$ 2,734,584	$ 191,420.86	$ 68,365	$ 2,994,369
FY22	$ 1,257,529		$ 208,631	$ 858,596	$ 475,000	$ 2,799,756			$ 2,802,948	$ 196,206.38	$ 70,074	$ 3,069,228
FY23	$ 1,280,683		$ 208,631	$ 858,596	$ 475,000	$ 2,822,910			$ 2,873,022	$ 201,111.54	$ 71,826	$ 3,145,959
FY24	$ 1,300,792		$ 208,631	$ 858,596	$ 475,000	$ 2,843,019			$ 2,944,848	$ 206,139.33	$ 73,621	$ 3,224,608
FY25	$ 1,327,609		$ 208,631	$ 858,596	$ 475,000	$ 2,869,836			$ 3,018,469	$ 211,292.81	$ 75,462	$ 3,305,223
FY26	$ 1,350,885		$ 208,631	$ 858,596	$ 475,000	$ 2,893,112			$ 3,093,930	$ 216,575.13	$ 77,348	$ 3,387,854
FY27	$ 1,380,367		$ 208,631	$ 858,596	$ 475,000	$ 2,922,594			$ 3,171,279	$ 221,989.51	$ 79,282	$ 3,472,550
FY28	$ 1,405,800		$ 208,631	$ 858,596	$ 475,000	$ 2,948,027			$ 3,250,561	$ 227,539.25	$ 81,264	$ 3,559,364
FY29			$ 208,631	$ 858,596	$ 475,000	$ 1,542,227			$ 3,331,825	$ 233,227.73	$ 83,296	$ 3,648,348
FY30			$ 208,631	$ 858,596	$ 475,000	$ 1,542,227			$ 3,415,120	$ 239,058.42	$ 85,378	$ 3,739,557
FY31			$ 208,631	$ 858,596	$ 475,000	$ 1,542,227			$ 3,500,498	$ 245,034.89	$ 87,512	$ 3,833,046
FY32			$ 208,631	$ 858,596	$ 475,000	$ 1,542,227			$ 3,588,011	$ 251,160.76	$ 89,700	$ 3,928,872
FY33			$ 208,631	$ 858,596	$ 475,000	$ 1,542,227			$ 3,677,711	$ 257,439.78	$ 91,943	$ 4,027,094
FY34			$ 208,631	$ 858,596	$ 475,000	$ 1,542,227			$ 3,769,654	$ 263,875.77	$ 94,241	$ 4,127,771
FY35			$ 208,631	$ 858,596	$ 475,000	$ 1,542,227			$ 3,863,895	$ 270,472.66	$ 96,597	$ 4,230,965
FY36			$ 208,631	$ 858,596	$ 475,000	$ 1,542,227			$ 3,960,493	$ 277,234.48	$ 99,012	$ 4,336,739
FY37			$ 208,631	$ 858,596	$ 475,000	$ 1,542,227			$ 4,059,505	$ 284,165.34	$ 101,488	$ 4,445,158
FY38			$ 208,631	$ 858,596	$ 475,000	$ 1,542,227			$ 4,160,993	$ 291,269.48	$ 104,025	$ 4,556,287
FY39				$ 858,596	$ 475,000	$ 1,333,596			$ 4,265,017	$ 298,551.21	$ 106,625	$ 4,670,194
FY40				$ 858,596	$ 475,000	$ 1,333,596			$ 4,371,643	$ 306,014.99	$ 109,291	$ 4,786,949
TOTAL:	$ 23,568,305	$ 2,750,000	$ 4,172,620	$ 17,171,920	$ 9,975,000	$ 57,637,845			$ 87,701,080	$ 6,139,076	$ 2,186,902	$ 96,027,058

FY08 Residential Base Rate: $13.95 / mth

FY10 Residential Base Rate: $24.85 / mth 1.7815
FY21 Residential Base Rate: $37.15 / mth 2.6635