CITY OF SOAP LAKE

GRANT COUNTY **WASHINGTON**

ENGINEERING REPORT

G&O #11041
JANUARY 2013

Gray & Osborne, Inc.
CONSULTING ENGINEERS

CITY OF SOAP LAKE

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Soap Lake

ENGINEERING REPORT

NANCY J. MORTER
STATE OF WASHINGTON
42805
REGISTERED
PROFESSIONAL ENGINEER
1-24-13

ROBERT JAMES SCOTT
STATE OF WASHINGTON
46421
REGISTERED
PROFESSIONAL ENGINEER
1-24-13

G&O #11041
JANUARY 2013

Gray & Osborne, Inc.
CONSULTING ENGINEERS

January 15, 2013

Ms. Llyn Doremus
Department of Ecology
Eastern Region Office
4601 N. Monroe
Spokane, WA 99205-1295

SUBJECT: RESPONSE TO SOAP LAKE ENGINEERING REPORT REVIEW COMMENTS
WASTEWATER FACILITY PLAN
CITY OF SOAP LAKE, GRANT COUNTY, WASHINGTON
G&O #11041.00

Dear Ms. Doremus:

Thank you for your review comments on the City of Soap Lake Wastewater Engineering Report we received from you on December 19, 2012. Our response to those comments is itemized below. Enclosed are two copies of the finalized Report for your use and files.

1. Page 3-2, paragraph 2 reference a current NPDES permit. The Facility actually operates under a State Waste Discharge Permit, which governs effluent discharges to the ground (in the case of Soap Lake, the rapid infiltration basins).

You are correct. The reference to an NPDES Permit in lieu of a State Waste Discharge Permit will be corrected in the final report.

2. Section 4 estimated the current annual average infiltration and/or inflow (I/I) as 0.07 MGD and future I/I as 0.09 MGD. While not considered to be highly excessive, reduction will help improve treatment performance. Please provide a discussion as to whether or not low cost alternatives for I/I are available for the existing collection system.

It would be in the City's best interests to identify significant sources of I/I and address them. In our experience, identifying the existing sources of I/I is a time-intensive and potentially expensive process requiring TV inspection and smoke testing. There is potential for the City to expend significant resources searching for I/I and receiving minor benefit.

The City will consider allocating resources to monitoring manhole flow in the middle of the night or during storm events. The City will continue to repair leaks as they are identified. If the City is able to identify one or more I/I projects as a result of these surveys, future budgets and loan applications may be required to address the I/I, dependent upon the scope of the project(s).

3. *Section 5 identified a leak and/or overflow around the northeast corner of the existing oxidation ditch. It was recommended that the City continue to watch for spills and possibly evaluate the structural integrity of the tank at this location. A placeholder for potential modifications was provided in Phase II. Ecology recommends this portion of the tank be evaluated during final design and modifications for potential inclusion in Phase I improvements, if needed.*

Due to the design of the oxidation ditch and plant hydraulics, the majority of the oxidation ditch structure is below grade. The structure was constructed with a trapezoidal cross section, and does not have vertical side walls. The structure was designed to experience soil bearing pressure on the outside surface of the wall, and is not designed to be freestanding while in service.

As such, it is not possible to expose the wall for its entire depth below grade without undermining the wall. Even if the structure were not in service, we would recommend that the wall be supported during excavation, and the addition of hydrostatic pressure would likely increase the scope, and therefore cost, of the required support system.

Because it is not recommended that the structure be analyzed from the outside surface of the wall while it remains in service, the alternative would be to construct coffer dams inside the structure. However, due to the trapezoidal configuration it would be difficult, and therefore expensive, to construct coffer dams that would allow portions of the structure to be taken offline while the remainder of the structure were kept in service.

The ideal time to perform this evaluation would be when the oxidation ditch was drained for other improvements. Due to the City's constrained budget in the Phase I project, the City is not able to pursue cleaning and inspection of the structure.

For these reasons, the City has chosen to postpone this analysis in lieu of addressing other deficiencies at the facility that present a more urgent need. If the urgency of the situation changes, it will revise its plans accordingly.

4. *Phase I improvements include the installation of a new effluent flow meter and adequate pipe lengths both up and downstream of the new flow meter. In addition, Phase I improvements also call for the old flow meter to be removed and calibrated. Currently, the treatment plant does not measure instantaneous influent flow. The parshall flume for influent flow measurement proposed for Phase II construction is based on the City's growth rate. Meeting the projected population based on the growth rate of 1.5% may take years beyond the estimated phasing time. Has consideration been given to installing the newly calibrated flow meter downstream of Lift Station No. 2 to add capability for instantaneous influent flow measurement during Phase I?*

A properly-calibrated effluent flow meter will adequately measure flow to the WWTF. The entire influent flow is pumped from Lift Station No. 2 to the WWTF. As such, flow through the facility will be relatively constant, and it should not matter significantly where in the plant the flow is measured.

5. *Phase I headworks modification includes the removal of the existing grinder and installation of a new fine mechanical screen. During Phase II this screen will be relocated to the new headworks channel which will also include a bar screen with 3/8" openings and a grit chamber. The estimation for Phase I improvements exceeds the loan amount awarded by the PWTF. Please provide a discussion why the installation of the 3/8" bar screen in the existing grinder structure, rather than the mechanical fine screen, would not be preferred during Phase I as a cost saving measure. The bar screen would meet the new biosolids regulation at a fraction of the capital cost of the mechanical fine screen.*

The primary reason why this option was not considered is the substantial risk of sewage overflow that it would create. The Soap Lake WWTF influent is entirely pumped from Lift Station No. 2, which is a fill and draw pump station. In our experience, it is not uncommon for lift stations to collect debris over time, and then discharge it rapidly when the lift station first turns on. Due to the bar spacing of 3/8", the manual bar screen will blind almost immediately in this situation, resulting in rapid rise of water level in the headworks just as the pump cycle is beginning. Although the headworks will be designed to allow wastewater to overtop slide gates before overtopping the structure walls, it is not uncommon for sewage spills to occur in such a situation.

The installation of a manual bar screen in the bypass channel allows the City to remove the new mechanical fine screen from service for short periods for maintenance and repairs, but manual screens with narrow bar spacing are not designed for unattended operation. It is imperative that a bar screen be monitored by the operator and cleaned often to prevent overflow conditions from arising. Therefore, the installation of a headworks utilizing only manual screens for screening would require a City employee to be present for cleaning the bar screen at all times, which would be prohibitively expensive.

6. *The bar screen was left out of the Phase II cost estimate.*

The bar screen is not considered to be a high cost item, and was included in the contingency, along with other miscellaneous metals such as stairs and handrail which are also not shown separately in the cost estimates. The bar screen will be included in final design of the Phase I improvements.

7. *The lack of redundancy in the aeration capacity of the oxidation ditch during Phase I is of concern, as it places the City's Facility at risk for not meeting permit limits. As mentioned in the report, the Facility does not meet the <u>Criteria for Sewage Works Design</u> (Department of Ecology Publication no. 98-37) that states an oxidation ditch in a Class II facility must provide sufficient aeration when/if the largest capacity unit is out of service. Please investigate whether the additional surface aerator can be moved from the Phase II to the Phase I improvement schedule.*

The City is aware of this issue, but circumstances have forced it to prioritize which of many critical upgrades to pursue in the upcoming Phase I design. At this time, the Phase I scope includes the work necessary to bring the City into compliance with various regulations pertaining to the unsanitary and potentially hazardous condition created by its RAS and scum pumps, the rapid deterioration of electrical equipment and corresponding hazard of electrical equipment in the same room as the RAS pumps, and the inability of the City to adequately aerate and dewater its biosolids as a result of the inadequate aeration and sand drying beds. The City has therefore prioritized work which will allow the facility to be operated safely and effectively.

The City will reconsider what Phase II improvements work may be included in the scope of the Phase I improvements if during design it appears that additional work may be completed with the available funds. It is estimated that to meet redundancy requirements associated with the oxidation ditch rotors, spare parts collectively costing approximately $30,000 would need to be maintained at the WWTF site.

Should you have any additional comments or questions, feel free to contact our office.

Very truly yours,

GRAY & OSBORNE, INC.

Robert J. Scott, P.E.

RJS/tlf

cc: Honorable Raymond Gravelle, Mayor, City of Soap Lake
Mr. Darrin Fronsman, Public Works Director, City of Soap Lake

EXECUTIVE SUMMARY

This Engineering Report provides a 20-year plan for maintaining adequate capacity at the City of Soap Lake's Wastewater Treatment Facility (WWTF). This Report has been prepared in accordance with the Washington State Department of Ecology's guidelines set forth in WAC 173-240-060.

The Report achieves the following objectives:

- Describes the condition of existing treatment facilities
- Projects future wastewater service area population
- Develops design wastewater flows and loadings
- Determines required capital improvements
- Presents a capital improvements financing plan, including potential sewer rate impacts

EXISTING FACILITIES

The existing WWTF is presently permitted to discharge treated wastewater to groundwater through the use of rapid infiltration basins by its State Waste Discharge Permit (Permit), which was issued on February 3, 2012. The permit will expire on February 28, 2017.

The existing wastewater treatment facilities include an influent grinder, an oxidation ditch, two secondary clarifiers, a chlorine contact tank that is not currently used because of the lack of disinfection requirements in the Permit, and six rapid infiltration basins. The solids handling facilities include activated sludge pumping, an aerobic digester, and sludge drying beds. The City's current method for providing a beneficial use of its biosolids product is to have the biosolids hauled to the Boulder Park facility in Mansfield, WA for land application.

PROJECTED WASTEWATER FLOWS AND LOADINGS

Projected wastewater flows and loadings to the WWTF for the design year 2031 are based on historical flows and loadings, and growth projections for the sewer service area. These projections assume that the population in Soap Lake's service area will grow at 1.5 percent per year during the next twenty years, to a design population of 2,067 in 2031. This growth rate is consistent with all current City planning, although the City's decision-making should be adjusted based upon the actual growth rate experienced in the future.

The estimated 2031 design wastewater flows and loadings are shown in Table ES-1.

TABLE ES-1

Projected Wastewater Flows and Loadings

Criteria	Projected Design Criteria (2031)
Average Annual Flow (MGD)	0.26
Maximum Month Flow (MGD)	0.32
Maximum Day Flow (MGD)	0.41
Peak Hour Flow (MGD)	0.93
Annual Average BOD_5 Loading (lb/d)	392
Maximum Month BOD_5 Loading (lb/d)	641
Annual Average TSS Loading (lb/d)	331
Maximum Month TSS Loading (lb/d)	661
Annual Average TKN Loading (lb/d)	78
Maximum Month TKN Loading (lb/d)	127
Design Population	2,067

RECOMMENDED IMPROVEMENTS

In 2011, the City applied for design and construction funding from the Public Works Board for improvements to the WWTF, and the application was accepted for funding. The scope of work for the funding application was based upon a letter report developed by Gray & Osborne, Inc. in 2008, and the City's priorities for WWTF needs have changed since the development of the letter report. Therefore, the scope of work to be completed with the Public Works Trust Fund (PWTF) funding will be modified. As a result, this Report identifies two phases of work to address the identified deficiencies. The first phase consists of immediate improvements recommended for funding with the PWTF loan, and the second phase consists of improvements to be completed in the future as the growth of the City necessitates increased capacity. If the City were to grow at 1.5% per year as projected in the Report, it is anticipated that the Phase II improvements would be necessary in the year 2017.

The following is a summary of improvements necessary to treat the 2031 design flows and loadings and to correct other deficiencies at the WWTF.

Phase I Improvements

- Remove influent grinder from service, modify grinder structure, and install new mechanical fine screen
- Modify the effluent sampler to flow-pace with effluent flow
- Install a new effluent flow meter and calibrate the existing effluent flow meter
- Modify the effluent flow meter piping to provide adequate straight pipe lengths
- Construct new RAS and scum pump stations
- Install new aerobic digester aeration
- Rehabilitate and pave the sludge drying beds
- Modify site electrical to utilize new 480V service
- Install new emergency generator

It is recommended that the City include a design for the secondary clarifier splitter box (and associated piping) and aerobic digester decanter in the Phase I design as Additive Bid (Optional with Owner) items. This plan will allow the City to construct more of the desired work if the bids are more competitive than estimated or if the City determines that the bid price for the additional work is favorable enough to warrant spending sewer reserves on the construction.

The estimated cost of the Phase I capital improvement project is presented in Table ES-2.

TABLE ES-2

Phase I Capital Improvement Cost Estimate [1]

Phase I	
Trench Safety Systems	$20,000
Excavation/Backfill	$35,000
Grinder Structure Modification	$30,000
Fine Screen Equipment	$210,000
Effluent Flow Meter and Piping Modifications	$29,000
RAS Station	$168,000
Scum Station	$196,000
Digester Surface Aerator	$150,000
Sludge Drying Bed Rehabilitation	$139,000
Electrical, Telemetry, and Controls	$652,000
Investment Grade Efficiency Audit	$10,000
Phase I Total	**$1,639,000**

(1) Project costs include mobilization, 25% contingency, sales tax, design, and construction administration.

Phase II Improvements

- Upsize Lift Station No. 2
- Construct new headworks and relocate mechanical fine screen
- Modify the influent sampler to flow-pace with influent flow
- Construct bioselectors
- Construct anoxic basin
- Install floating aerator in oxidation ditch
- Construct secondary clarifier splitter box
- Paint Secondary Clarifier No. 1
- Install additional effluent pump
- Install floating decanter in aerobic digester
- Construct additional sludge drying beds
- Construct nonpotable water pump station
- Modify plumbing to meet cross connection control requirements

If the City continues to experience growth at the design annual growth rate of 1.5%, it is recommended that the City begin design of the Phase II improvements in approximately 2015.

The estimated cost of the Phase II capital improvement project is presented in Table ES-3.

TABLE ES-3

Phase II Capital Improvement Cost Estimate (1)

Phase I	
Trench Safety Systems	$30,000
Excavation/Backfill	$50,000
Modify Lift Station No. 2	$37,000
Bioselectors	$251,000
Anoxic Basin	$335,000
Site Piping	$90,000
Sampler Modification	$12,000
Oxidation Ditch Modification	$59,000
Secondary Clarifier No. 1 Painting	$17,000
Aerobic Digester Decanter	$37,000
Cross Connection Control Upgrades	$75,000
Nonpotable Water Pump Station	$75,000
Sludge Drying Beds	$70,000
Effluent Pump	$55,000
Electrical, Telemetry, and Controls	$236,000
Phase II Total	**$1,429,000**

(1) Project costs include mobilization, 25% contingency, sales tax, design, and construction administration.

FINANCING

The City is currently on the award list for the PWTF program for funding of the design and construction of the Phase I improvements, and it is assumed that the funding will be available in the fall of 2012 to begin design. PWTF funding requires approximately $5,500 in annual debt service per $100,000 in loan, which results in an anticipated debt service of approximately $81,300 for the $1,478,200 loan. The remaining $160,800 will therefore be necessary for the City to finance through sewer funds.

As addressed in Chapter 8 of the Report, the City is projected to have an operating surplus of approximately $42,000 available for debt service of the Phase I improvements due to recent sewer rate increases. Therefore, the remaining annual $39,300 in debt service will require an additional rate increase of between $4 and $5 per month. It is recommended that the rate increase be established prior to beginning construction of the improvements to allow the City to establish sufficient reserves to fund the portion of the capital improvements not funded through the PWTF loan.

It is estimated that the Phase I work will be constructed in 2013-2014, and the City will not pursue funding for Phase II concurrently with the Phase I work. The work to be completed in Phase II is primarily required to address deficiencies in redundancy or a projected lack of capacity. However, the City should be capable of meeting its discharge permit limits in the interim if process equipment does not fail or otherwise become unavailable before the City constructs the Phase II improvements. As addressed in Chapter 6 of the Report, additional sludge drying bed volume and the anoxic basin are projected to become necessary in approximately five to six years if the City continues to grow at the projected rate. Therefore, it is recommended that the City plan to begin applying for funding for the Phase II improvements in 2015. This schedule should provide the City with enough time to apply for and receive funding, secure funding, design, and construct the improvements before they become necessary.

It is likely that the funding terms and eligibility requirements for the various funding programs will be different when the Phase II improvements are designed and constructed, but based upon current funding conditions, it is projected that the debt service for Phase II will be between approximately $70,000 and $90,000 per year. The rate increase for this debt service is projected to be between $8.00 and $10.00 per month, dependent upon population growth and availability of favorable funding. It is recommended that the City consider adopting General Facility Charges to assist in financing the Phase II improvements.

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CHAPTER 1

INTRODUCTION

CHAPTER 1

INTRODUCTION

PURPOSE

The purpose of this Engineering Report is to address the City of Soap Lake's planning needs for wastewater treatment and disposal for the next 20 years. This Report has been prepared in accordance with the provisions of the Revised Code of Washington (RCW), at Section 90.48, *Water Pollution Control*, WAC 173-240-060, *Engineering Report*, and the United States Code of Federal Regulations (CFR) at 40 CFR 35.917, *Facilities Planning*. Development of the Report has been coordinated with the City's 2011 *Water System Plan*.

The Report is intended to be feasible in terms of engineering, economic, regulatory, and political frameworks. Included in the Report are conceptual designs and cost estimates for recommended major improvements to facilities, as well as a proposed schedule for construction and a financing plan. The projects described in the Report are consistent with State regulations relating to the prevention and control of pollutants discharged into State waters, anti-degradation of existing and future beneficial uses of ground waters, and anti-degradation of surface waters. The Report will recommend sufficient flexibility to provide wastewater facilities for existing areas of need and to support future development within the planning area.

OVERVIEW

The City of Soap Lake was incorporated in July 1919. The City is located five miles north of Ephrata, Washington, at the southern end of the Grand Coulee. The City is 180 miles east of Seattle, 115 miles west of Spokane, 52 miles south of Grand Coulee, and 100 miles north of Pasco. A vicinity map for the surrounding area is shown in Figure 1-1.

The main topographic feature of the area, and the one that the City derives its economic livelihood from, is Soap Lake, a mineral lake containing chemicals which are therapeutic in nature. Tourists are drawn to Soap Lake to vacation and take advantage of the mineral baths available at the many hotels and motels. The economy of the City is oriented towards summer tourism, although many people have retired to Soap Lake due to the mild, dry climate.

The City of Soap Lake has a mayor and City Council form of government. The City owns and operates the municipal sewer collection system and the wastewater treatment facility (WWTF), which discharges to groundwater by infiltration of effluent into the soil. The collection system serves the residents, industries, and businesses within the city limits. The Mayor is Raymond Gravelle and the Public Works Director is Darrin Fronsman. The City's current mailing address and main telephone number are:

City of Soap Lake
239 Second Ave. SE
P.O. Box 1270
Soap Lake, WA 98851
(509) 246-1211

HISTORY AND DEVELOPMENT OF THE SEWER SYSTEM

The City of Soap Lake constructed a WWTF in 1978 to replace an existing facility which was originally built in 1946. The 1978 facility consisted of a comminutor, two 15 hp aeration basin rotors, one 28-ft diameter clarifier, one 10,500-gallon digester, three drying beds, a spray field, and a drainfield system. The spray field was abandoned during the first year of service because of fear of aerosol drift to the road and neighboring school. The drainfield did not provide the level of treatment and protection of the groundwater that is currently required. The drainfield was determined to be too small to adequately infiltrate the existing effluent flows in 2000, and has therefore not been used since the most recent upgrades in 2001.

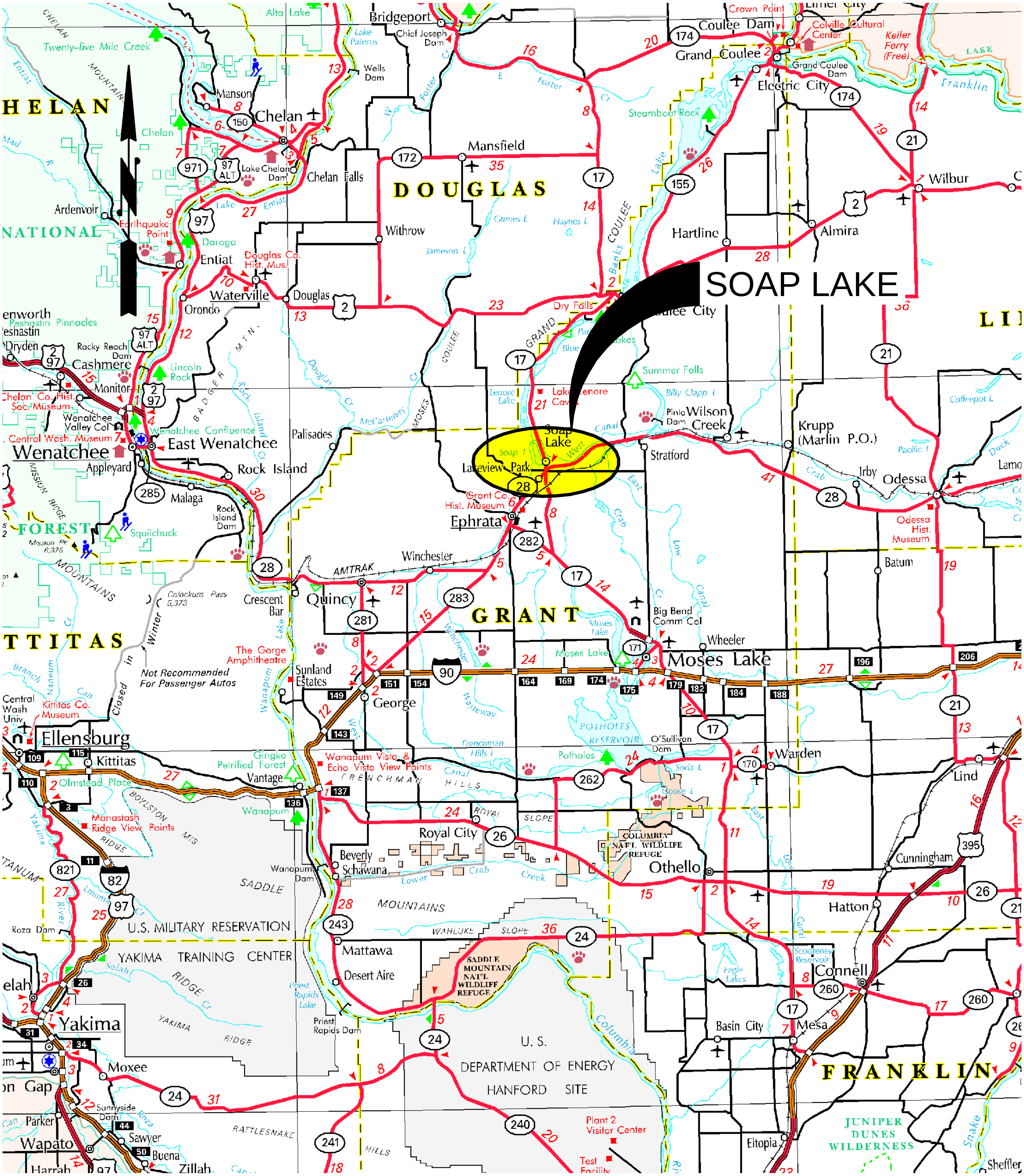
Plans for the most recent WWTF upgrade were submitted to Ecology during November 2000. Final approval was granted in January 2001. The upgraded facility became operational in the spring of 2004. Major components of the upgrade include an influent grinder, modified the existing oxidation ditch with nitrogen removal, a new clarifier, upgraded sludge handling facilities, and rapid infiltration basins that replaced the existing land application spray irrigation system.

The collection system includes approximately 11 miles of sewers from 6- to 12-inches in diameter and two lift stations. Concrete pipe dating to the original installation period from the late ‘40s and ‘50s is the predominant sewer pipe material. Some clay pipe is also present, but the quantity has not been determined. Recent extensions and replacements of approximately 5,700 feet of sewers have been constructed of PVC sewer pipe.

REVIEW OF EXISTING REPORTS

Existing documents and reports that were reviewed in preparing this Report include:

- *City of Soap Lake Water System Plan*, Gray & Osborne, Inc., 2011
- *City of Soap Lake Operation and Maintenance Manual for the Wastewater Treatment Plant*, Wilson Engineering, 2004
- *City of Soap Lake Predesign Report for Wastewater Treatment Plant Improvements*, Wilson Engineering, 2001



SOURCE: WSDOT

CITY OF SOAP LAKE

WASTEWATER FACILITY PLAN

FIGURE 1–1
VICINITY MAP

Gray & Osborne, Inc.
CONSULTING ENGINEERS

- *City of Soap Lake Comprehensive Sewer Plan*, Hammond, Collier & Wade-Livingstone Associates Inc., 1999.
- *City of Soap Lake Wastewater Treatment Facilities Engineering Report*, Hammond, Collier & Wade-Livingstone Associates Inc., 1998.
- *City of Soap Lake Hydrogeologic Report,* Hammond, Collier & Wade-Livingstone Associates Inc., 1997.
- *WWTF Construction Drawings,* Wilson Engineering Inc., 2001.

In addition to the above documents, City of Soap Lake staff members were consulted to help develop the planning numbers and assumptions used in this Report. Gray & Osborne and City staff held several meetings and conducted field inspections to evaluate the condition of the wastewater system.

SCOPE

This document is organized into the following chapters:

Chapter 1 – Introduction. This chapter contains a background of the project, purpose, and scope of the report.

Chapter 2 – Planning Data. This chapter includes a discussion of general planning data required to complete later chapters of the plan.

Chapter 3 – Regulatory Requirements. This chapter includes a discussion of the City's State Waste Discharge Permit, Biosolids Management (WAC 173-308) and its effect on the WWTF, and the required environmental permitting for WWTF improvement projects.

Chapter 4 – Wastewater Flows and Loadings. This chapter develops flows and loadings that will be used in subsequent chapters to evaluate the capacity of the WWTF and to plan improvements to the existing WWTF.

Chapter 5 – Wastewater Treatment Facility Evaluation. This chapter describes and provides a detailed capacity analysis of the existing WWTF.

Chapter 6 – Wastewater Treatment Facility Improvements. This chapter evaluates wastewater treatment alternatives and recommends capital improvements at the WWTF.

Chapter 7 – Water Reclamation and Reuse Evaluation. This chapter presents an evaluation of the opportunities available for the use of reclaimed water for the City of Soap Lake and its benefits.

Chapter 8 – Financing. This chapter presents a plan for the City to finance the capital improvements and operation and maintenance costs associated with the recommended wastewater treatment facility upgrades.

CHAPTER 2

PLANNING DATA

CHAPTER 2

PLANNING DATA

INTRODUCTION

The configuration of a wastewater collection and treatment system is influenced by community development trends and timing, regulatory requirements, growth considerations, and topography. This chapter addresses growth considerations by providing a projection of the population growth within the sewer service area for the 20-year planning period.

PLANNING PERIOD

The wastewater system is in need of periodic evaluation and improvement to continue to provide adequate wastewater services for existing customers and to serve future growth. The planning period for the wastewater utility evaluations should be long enough to be useful for an extended period, but not impractical. For this Report, the planning period is 2011 through 2031, a 20-year planning interval.

SERVICE AREA

The City of Soap Lake is subject to the State Growth Management Act, which requires cities to plan their growth, avoiding inefficient land use. Figure 2-1 delineates the corporate limits and Urban Growth Area (UGA) boundaries of the City. As allowed by the Growth Management Act, City utilities and services may be gradually expanded into the UGA area as needed. The City's corporate limits encompass an area of approximately 806 acres, while the UGA boundary encompasses an additional area of approximately 360 acres.

The current sewer service area is defined as the residential, business, commercial, industrial, and public areas served by the existing sewer collection system.

PROJECTED SERVICE AREA

Growth over the next 20 years is expected to continue to infill the area within the existing City limits and to expand into the UGA. It is not anticipated that there will be new connections associated with existing septic systems being connected to the sewer system since septic tanks are not allowable under current City code, and there are no known septic tanks in the City.

LAND USE AND ZONING

Figure 2-1 shows zoning for the City and the UGA. Table 2-1 summarizes the current zoning within the Soap Lake city limits.

TABLE 2-1

Existing Zoning within the City Limits

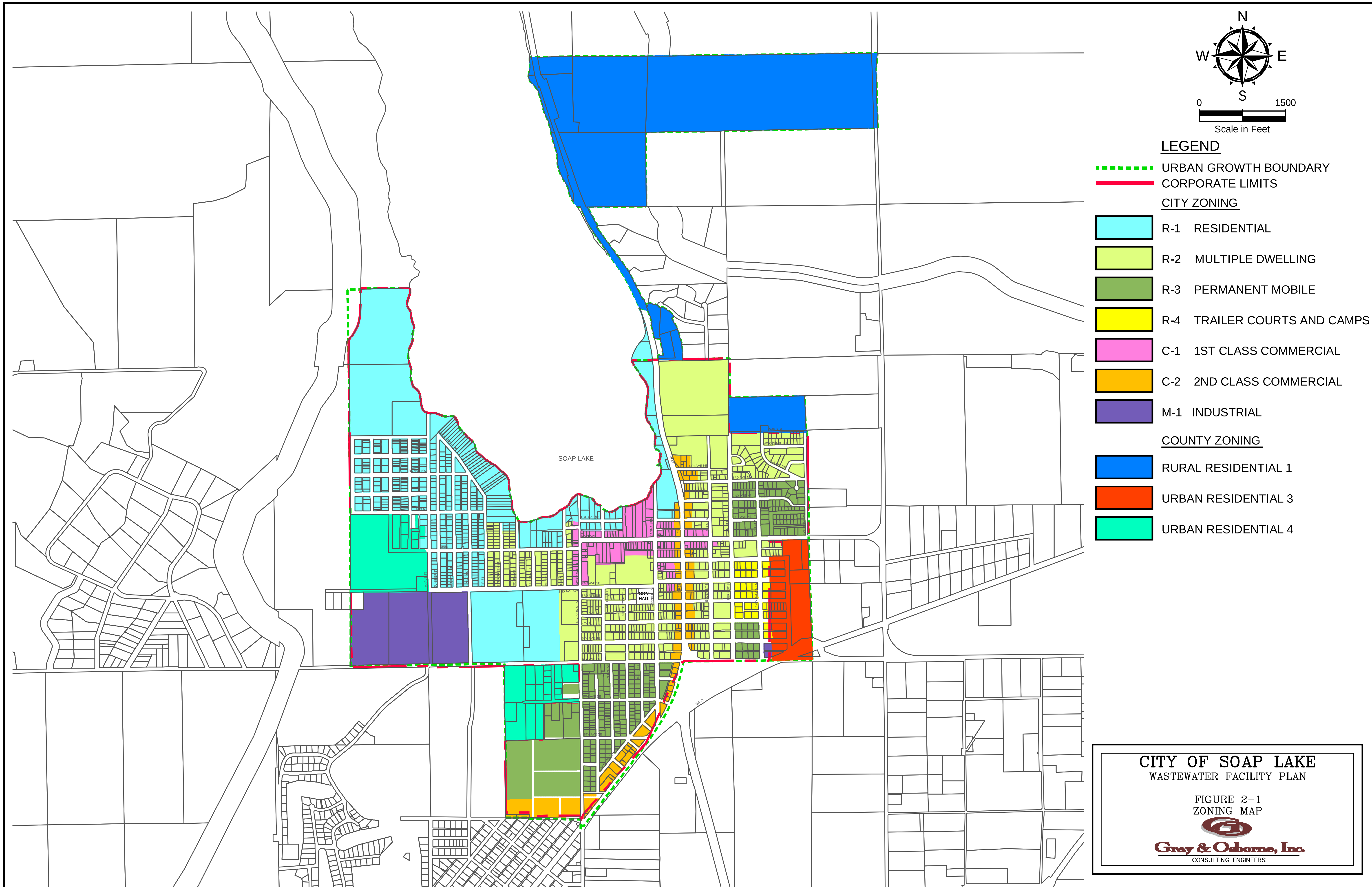
City Zoning Designation	Acres	Percent of Total Area
R-1 – Residential	216	26.8
R-2 – Multiple Dwelling	171	21.2
R-3 – Permanent Mobile	97	12.0
R-4 – Trailer Courts and Camps	10	1.2
C-1 – 1st Class Commercial	29	3.6
C-2 – 2nd Class Commercial	32	4.0
M-1 – Industrial	57	7.1
City ROW	194	24.1
Total City Limits	**806**	**100%**

The area between the current City limits and the UGA boundary is envisioned as a buffer zone between the urban land uses within the City limits and the rural land uses in the surrounding areas of Grant County. City services such as water and sewer could eventually be extended to this buffer zone as individual properties are annexed.

In general, existing land uses within the City limits correspond to the zoning districts presented in Figure 2-1. The majority of the City is zoned Residential (over 60 percent), and businesses are primarily located in central Soap Lake and extend to the southern City limits along SR 17. The southwest and southeast corners of the City are zoned Industrial.

SERVICE AREA POPULATION

As shown in Figure 2-2, the population within the City limits of Soap Lake has varied over the years, but has remained reasonably stable since 2000. Population data for Figure 2-2 was obtained from the Washington State Office of Financial Management (OFM).



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Scale in Feet
LEGEND
URBAN GROWTH BOUNDARY
CORPORATE LIMITS
CITY ZONING
R-1 RESIDENTIAL
R-2 MULTIPLE DWELLING
R-3 PERMANENT MOBILE
R-4 TRAILER COURTS AND CAMPS
C-1 1ST CLASS COMMERCIAL
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M-1 INDUSTRIAL
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RURAL RESIDENTIAL 1
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URBAN RESIDENTIAL 4
SOAP LAKE
CITY HALL
CITY OF SOAP LAKE
WASTEWATER FACILITY PLAN
FIGURE 2-1
ZONING MAP
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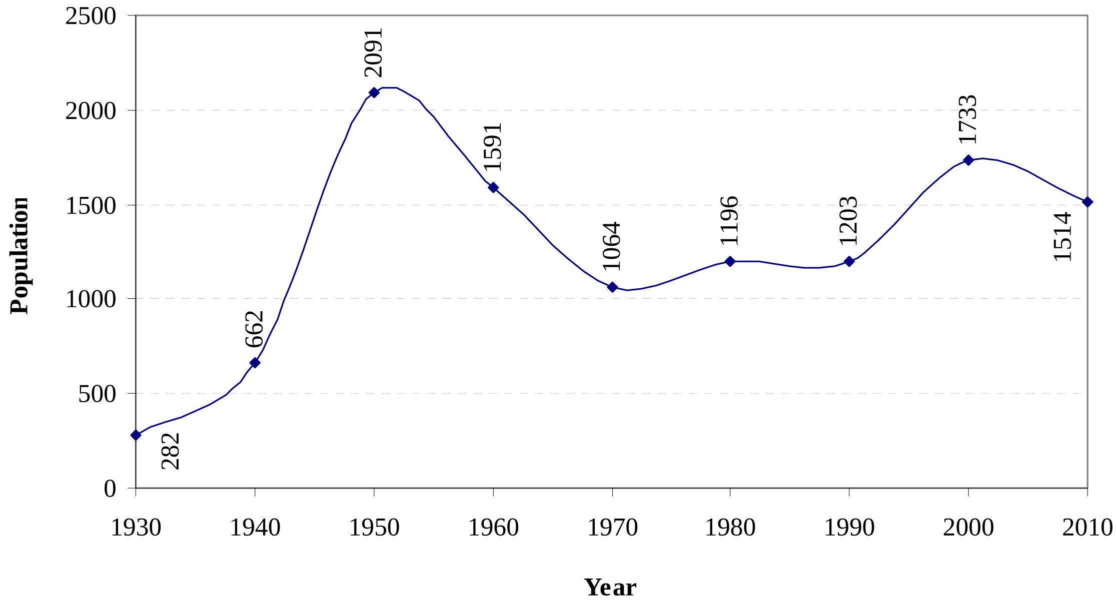
FIGURE 2-2

Historical Population



As shown in Figure 2-2, the City experienced a population decrease between 2000 and 2010. However, the City does not believe this trend will continue. For this Report, the City is projected to grow at an annual rate of 1.5 percent, which is the growth rate for Grant County. Use of this growth rate is consistent with all current City planning. The City's 2009 Comprehensive Plan Update cautions that while the County's growth rate represents the highest rate allowed under the Growth Management Act, that rate may not reflect true growth rates within Soap Lake. Consequently, the City plans to monitor actual growth during the planning period, and to make adjustments if necessary. Table 2-2 provides future population projections using a growth rate of 1.5 percent annually.

TABLE 2-2

City of Soap Lake Projected Population

Year	Projected Population
2011	1,537
2017	1,680
2031	2,069

The City has indicated that it is not aware of any large businesses with plans to begin operations in Soap Lake in the near future. However, as the population increases, new businesses are expected to open, and businesses serving the everyday needs of the community are expected to expand to meet these needs. As a result, it is projected that the size of businesses, including wastewater generation, will continue to grow at the same 1.5 percent annual rate as the population.

ENVIRONMENTAL FACTORS

Various natural features of the service area are discussed below, such as climate and precipitation, geography, topography, geology, soils, surface and ground water resources, and flood hazard areas.

CLIMATE AND PRECIPITATION

The climate in the Soap Lake area is influenced to a great extent by the Cascade Range and the Rocky Mountains. The Rocky Mountains shield the county from the more severe winter storms moving southward across Canada, while the Cascade Range forms a barrier to the early movement of moist air from over the ocean; however, some of the air from each of these sources reaches Soap Lake.

In the Soap Lake area, summers are warm or hot. Precipitation in summer falls mainly as showers, frequently as thunderstorms. In winter the ground is frequently covered with snow. Chinook winds, which blow downslope and are warm and dry, often melt and evaporate the snow.

Table 2-3 presents the temperature and precipitation data for the City.

TABLE 2-3

Climate Data City of Soap Lake [1]

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	33.3	41.9	53.1	62.8	72.5	81.1	88.3	87.4	77.5	63.0	45.0	33.8	61.7
Average Min. Temperature (F)	20.8	26.8	32.5	39.0	47.5	55.6	61.3	60.4	51.3	39.9	30.7	22.1	40.6
Average Temperature (F)	27.1	34.2	43.0	50.9	60.1	68.4	74.8	73.9	64.6	51.4	37.8	28.0	51.1
Average Total Precipitation (in.)	0.9	0.7	0.7	0.5	0.5	0.6	0.3	0.2	0.3	0.5	1.0	1.2	7.6

(1) Data from Global Historical Climatology Network Summary 1996 to 2010 (worldclimate.com).

GEOGRAPHY

The City of Soap Lake is located five miles north of Ephrata, WA at the southern end of the Grand Coulee. The City is 180 miles east of Seattle, 115 miles west of Spokane, 52 miles south of Grand Coulee, and 100 miles north of Pasco.

TOPOGRAPHY

Soap Lake is located within the broad flood plain of the prehistoric Columbia River Channel. At the northernmost point of this plain, the water flow excavated a deep pocket from the basalt which created the water body known as Soap Lake. The topography of the City is mostly flat land that is bordered by steep cliffs to the northeast and northwest. The topography ranges from 1,080 feet along the Lake to about 1,200 feet above sea level at the east and west ends of town.

GEOLOGY

The soils in the Soap Lake area were formed in glaciofluvial deposits, loess, lacustrine deposits, eolian sand colluvium from basalt and grandodiorite, glacial till, organic materials, and recent alluvium. Catastrophic floods of glacial melt water from Glacial Lake Missoula, 13,000 to 20,000 years ago, are the major source of glacial outwash deposits of sand and gravel in the area. Ice dams storing great volumes of water in Glacial Lake Missoula repeatedly were breached by overflow from the lake. The floods were diverted southward across the Columbia Plateau when glacial ice dammed the Columbia River. There probably were at least seven successive floods resulting from the failure of the ice dams, and five of these are believed to have crossed the Columbia Plateau.

It has been postulated that the loess that blankets the hills has a complex origin. The primary deposit was airborne. Local ponding, intermittent streamflow and sheetwash have played a secondary role in reworking and re-depositing the loess. The loess mantle on hills in the northern part of Grant County is dominantly 5-40 feet thick.

During Pliocene time, the rising of Horse Heaven Hills reduced the gradient of the Columbia River Tributary streams. This reduced gradient resulted in deposition of the Ringold Formation. The Ringold Formation is considered to represent a period of sedimentation continuing beyond the emission of the latest basalt flows. The sediment that accumulated prior to the emission of the latest basalt flows is known as the Ellensburg Formation.

During the Pliocene and early Pleistocene, the Cascade Range was uplifted, causing a gradual shift from semihumid to semiarid climate. The drier climate is recorded in the gradual increase in calcareousness and cementation of the Ringold surface. Post-glacial, or Holocene, modifications of the landscape include very localized deposition of alluvium. Saltese soils formed in remains of plants with a minor amount of alluvium. They formed in areas where the ground water level tends to fluctuate within the soil, allowing periodic aerobic decomposition of organic material.

SOILS

Soils in Soap Lake are grouped generally as Adkins very fine sandy loam, 5-10% slopes. This very deep, well drained soil is on hills and is formed in loess. The native vegetation is mainly grasses and shrubs.

Soils are further broken down into the following soil types. The most prevalent soil type in the City limits is Kennewick fine, sandy loam, with slopes of 5% or less. This soil is deep and well drained with a moderate infiltration rate. The second most prevalent is Kennewick silt-loam, with slopes of 5%-10%. This soil is also deep and well drained and has a moderately low infiltration rate. Other soil groups include Umapine silt-loam, a deep, well drained soil made up of glacial till and typically containing discontinuous lime and silica lenses less than 1/8" thick. Permeability through Umapine silt-loam is moderate through soil and moderately slow through the lenses. Also present is the Schawana complex on 0%-15% slopes. This soil type is made up of loamy fine sand, and cobbly loamy fine sand. Permeability is rapid, available water is low, and the hazard of soil blowing is high.

Quincy loamy fine sand, 0-15% slopes, can also be found here, and is a deep, somewhat excessively drained soil located on dunes and terraces. Permeability is rapid, available water capacity is low, and runoff is slow, and therefore the hazard of soil erosion is slight, however the hazard of soil blowing is high. Kennewick silt loam 0%-2% slopes and 2%-5% slopes can also be found within the limits of Soap Lake. These are well drained, very deep soils with moderately slow permeability with a high water capacity. The final large group of soil is Warden silt-loam, 0%-2% slopes. This is a very deep, well-drained soil with a moderate permeability and a high water capacity.

SURFACE WATER

The predominant geographic feature in the surrounding area, and the City's namesake, is Soap Lake. Soap Lake is used for its recreational opportunities and is also believed to have healing properties due to its unusual mineral content. Soap Lake is a meromectic lake that is extremely mineral-rich, and has been extensively studied due to its composition. Soap Lake is classified as a shoreline of State significance and falls under the Shoreline Management Act of 1971, Chapter 90.58 RCW. Thus, use of Soap Lake must comply with all state requirements and laws which manage shorelines of statewide significance.

GROUNDWATER

The City's water supply is provided by two groundwater wells, Well No. 1 and Well No. 3. The wells are rated for 800 gpm and 1,130 gpm, respectively. The City previously operated a third groundwater well, Well No. 2, that was removed from active status following construction of the City's wastewater treatment facility infiltration basins that are located within a few hundred feet of the well.

The City's infiltration basins return treated wastewater to the groundwater to recharge the aquifers. As a result, the City's State Waste Discharge Permit requires groundwater monitoring in three locations to assess any potential degradation of groundwater as a result of the City's wastewater treatment facility.

Groundwater in the vicinity of Soap Lake is managed by the Soap Lake Protective Works (Protective Works). The principal components of the Protective Works are the FMX wellfield and the INY wellfield. These wellfields each consist of three pumping wells in a manifold to a discharge header which discharges to the Bureau of Reclamation West Canal to supplement the irrigation water supply for the Columbia Basin Project. The purpose of the Protective Works is to maintain the level of Soap Lake and to prevent groundwater from diluting or otherwise modifying the unique water chemistry of Soap Lake.

FLOOD HAZARD AREAS

The FEMA maps for the Soap Lake vicinity do not suggest that there are any flood hazard areas in the City limits, aside from localized flooding potential due to low spots in site topography.

OTHER DOMESTIC/INDUSTRIAL WWTF

The City does not discharge treated wastewater to receiving water that is shared by other entities due to the nature of the discharge to groundwater. The closest domestic WWTF is the City of Ephrata Water Reclamation Facility six miles to the southwest, which also discharges effluent to groundwater, but as Class A reclaimed water.

CHAPTER 3

REGULATORY REQUIREMENTS

CHAPTER 3

REGULATORY REQUIREMENTS

INTRODUCTION

Regulatory requirements are used to develop design criteria as well as devise a long term strategy for discharge of treated liquid effluent and management of residual solids generated by the wastewater treatment process. This chapter identifies and summarizes the regulations that affect the planning, design, and approval of improvements to the City's collection system and wastewater treatment facilities (WWTF) at the federal, state and local regulatory levels.

WATER QUALITY STANDARDS FOR GROUND WATERS OF THE STATE OF WASHINGTON, CHAPTER 173-202 WAC

WAC 173-200 establishes ground water quality standards for the State of Washington. The goal of Ground Water Quality Standards is to minimize the impact to background water quality by promoting the most effective and reasonable treatment and reduction of wastewater discharges. Since ground water in the State has not been fully characterized, especially the interconnection between aquifers, the State protects all ground water equally. Therefore, the standards do not differentiate between the ground water receiving a wastewater discharge because all ground water is classified as a potential source of drinking water and/or potentially interconnected with a potential source of drinking water.

Water quality standards have been developed for ground water for parameters such as fecal coliform, pH, nitrate, metals, and toxic, radioactive, and deleterious substances.

The State of Washington has interpreted the Ground Water Quality Standards in Washington State Department of Ecology Publication 96-02, Implementation Guidance, which has been used in identifying requirements and the City's compliance with them.

ANTI-DEGRADATION POLICY

The anti-degradation policy is designed to ensure the protection of the State's ground waters and natural environment. Anti-degradation protects background water quality and prevents degradation of the State's waters beyond the criteria. The anti-degradation policy is based on RCW 90.48.010 (the Water Pollution Control Act) and RCW 90.54.020 (3) (the Water Resources Act).

The anti-degradation policy has a two-tiered approach. The first tier requires that existing and future beneficial uses be protected. As a result, all ground water is protected as a potential source of drinking water.

The second tier requires that whenever ground waters are of a higher quality than State ground water criteria, the existing water quality shall be protected, and contaminants that would reduce the existing water quality will only be allowed to enter the ground water when it is in the overriding public interest, and only when the contaminants are provided with all known, available, and reasonable methods of prevention, control, and treatment (AKART) prior to entry. Regardless of the quality of the receiving water, AKART must be applied to all wastes.

Based upon the limited groundwater monitoring data that the City has collected, it is assumed that the ground water in the vicinity of the WWTF is of higher quality than the numerical criteria in WAC 173-200-040. As a result, it is necessary to protect the quality of the ground water by reducing the discharge concentrations of various contaminants. Table 3-1 summarizes the ground water criteria for contaminants identified in the City's State Waste Discharge Permit and the corresponding ground water concentrations measured by the City quarterly in 2010 and 2011. The location of the monitoring wells is shown in Figure 3-1. Monitoring Well No. 1 is upgradient and Monitoring Wells No. 2 and 3 are downgradient.

TABLE 3-1

Ground Water Quality

Parameter	Ground Water Criteria (1)	Monitoring Well 1 (2)	Monitoring Well 2 (2)	Monitoring Well 3 (2)
Total Coliform Bacteria (# / 100 mL)	1	<1	<1	11.1
Total Dissolved Solids (mg/L)	500	268	252	290
Total Nitrogen (mg/L)	10	2.21	2.65	2.95
pH (Standard Units)	6.5 to 8.5 (3)	7.8 to 8.3 (3)	7.6 to 7.8 (3)	7.6 to 7.8 (3)

(1) Per WAC 173-200-040 Table 1.
(2) Maximum recorded value
(3) Range of minimum recorded value to maximum recorded value

Per the City's State Waste Discharge Permit:

> "Ecology has reviewed the existing records for the facility and is unable to determine background groundwater quality tolerance limits without additional data. The proposed permit includes a continued groundwater sampling schedule to establish the upgradient (background) quality of the groundwater. The available data indicates that the rapid infiltration land treatment process is providing adequate final treatment for the wastewater effluent and is maintaining groundwater standards at the point of compliance. It is Ecology's best professional judgment to continue permitting the rapid infiltration basin land

CITY OF SOAP LAKE
WASTEWATER FACILITY PLAN

FIGURE 3–1
MONITORING WELL LOCATIONS

Gray & Osborne, Inc.
CONSULTING ENGINEERS

> treatment process until sufficient data is collected to establish background water quality."

As a result of this statement, this Report does not recommend improvements to address the potential for more stringent permit conditions in the future. Until Ecology makes a determination regarding background water quality, future treatment that might be necessary is unknown. However, it is recognized that groundwater monitoring data appears to show an increase in total coliform bacteria and total nitrogen downstream of the WWTF, and therefore there is potential in the future for additional treatment requirements.

HYDROGEOLOGIC STUDY

For all activities which have a reasonable potential to contaminate ground water, a complete hydrogeologic study is required per WAC 173-200-080(2). The minimum required elements that should be addressed in the hydrogeologic study include ambient ground water quality, ground water depth and flow direction, location and construction of existing wells within one mile, waste characterization, AKART, and beneficial uses. Additional hydrogeologic characterization requirements may include characterization of geology, hydrogeology, area impacted, and nearby surface water.

A hydrogeologic report was completed in September 1997 by Hammond, Collier & Wade-Livingstone Associates, Inc. The study concluded that existing groundwater monitoring data was not significant, identified various nitrogen removal technologies available to the City, recommended a modified oxidation ditch intermittent aeration process, and identified the optimum geometry for subsurface effluent land application. The analysis and recommendations for this study were used as the foundation for the development of the project design that was subsequently constructed in 2000.

The hydrogeologic study requirements from WAC 173-200-080(2) have been met, and therefore no additional hydrogeologic analysis is required.

MONITORING PLAN

Some level of ground water monitoring is required for all wastewater treatment facilities which discharge effluent to ground water. However, per correspondence with Marcia Sands of the Department of Ecology (October 13, 2011), Soap Lake is not required to create a formal monitoring plan because the required ground water sampling and reporting is a component of the City's State Waste Discharge permit.

DISCHARGE PERMITS

The primary means for achieving the water quality standards of WAC 173-200 is the issuance of discharge permits, such as State Waste Discharge permits issued by the Department of Ecology. The City's most current State Waste Discharge permit was issued on February 3, 2012 and will expire on February 28, 2017 (refer to Appendix A).

Final effluent limits established for the WWTF in its current State Waste Discharge permit (permit no. ST 5282) and the basis for the limits are summarized in Table 3-2.

TABLE 3-2

City of Soap Lake Final Effluent Limitations (1)

Parameter	Basis of Limit	Average Monthly	Average Weekly	Maximum Daily
Flow	Technology (2)	0.30 MGD	N/A	0.42 MGD
Biochemical Oxygen Demand (5-day)	Technology (2)	30 mg/L or 85% removal of influent loading (lb/d)	45 mg/L	N/A
Total Suspended Solids	Technology (2)	30 mg/L or 85% removal of influent loading (lb/d)	45 mg/L	N/A
Total Nitrogen (3)	Water Quality	10 mg/L	N/A	N/A

(1) The average monthly effluent limitations are based on the arithmetic mean of the samples taken.
(2) Based on plant design.
(3) Total nitrogen is defined as the sum of Total Kjeldahl Nitrogen (TKN) plus nitrate and nitrite.

STATE OF WASHINGTON BIOSOLIDS REGULATIONS, WAC 173-308

WAC 173-308 is the basis for the statewide biosolids management program. Rather than applying for a permit, facilities that are subject to the permit program apply for coverage under the existing statewide general permit. The City of Soap Lake is covered under the general permit. Currently the City stores digested biosolids in its sludge drying beds and hauls dried solids to Boulder Park Inc., a facility approved for land application of biosolids near Mansfield, WA.

The current solids treatment process produces biosolids that meet the requirements for Class "B" pathogen reduction and vector attraction reduction requirements.

OTHER REGULATORY REQUIREMENTS

NATIONAL ENVIRONMENTAL POLICY ACT (NEPA)

The National Environmental Policy Act (NEPA) was established in 1969 and requires federal agencies to determine environmental impacts on all projects requiring federal funding or federal permits. If a project is determined to be environmentally insignificant, a Finding of No Significant Impact (FONSI) is issued; otherwise an Environmental Impact Statement (EIS) is required. NEPA is not applicable to projects that do not include a federal component. It is not anticipated at this time that the City will seek federal financing for the improvements in this Report; therefore a NEPA report will not be completed at this time.

STATE ENVIRONMENTAL POLICY ACT (SEPA)

The State Environmental Policy Act (SEPA), as presented in WAC 197-11-960, requires all governmental agencies to ensure that applicable environmental concerns are addressed in the process of project planning and documentation. Projects that have potential environmental impacts must complete a SEPA Checklist to satisfy planning and disclosure requirements. A SEPA Checklist was completed concurrently with this Report and is included as Appendix B.

STATE ENVIRONMENTAL REVIEW PROCESS (SERP)

Any funding administered through the Department of Ecology, whether it contains federal funding or not, requires the completion of the State Environmental Review Process (SERP). SERP is similar in scope to a NEPA, and consists of the SEPA process in conjunction with a biological assessment and a federal cross cutter report. The biological assessment consists of the identification of all endangered or threatened species in the project area and how the project in question would be projected to impact each species. The federal cross cutter report identifies the 13 federal environmental authorities, provides project documentation to each authority, and certifies that the project is in compliance with each authority.

Due to the length of time required to receive certification from each authority, the cross cutter process is typically started early in the project. Only the SEPA, biological assessment, and public meeting are required for approval of a Engineering Report. This information is included in Appendix B, and Ecology will complete the federal cross cutter report if necessary during project design.

ARCHEOLOGICAL AND CULTURAL RESOURCES SURVEY

In November 2005, the Governor of Washington signed Executive Order 05-05 which requires state agencies to review capital construction projects for potential impacts to cultural resources. This review is to be done in conjunction with the Department of Archeological and Historical Preservation (DAHP) and any affected Tribes. It is anticipated that an archaeological and cultural resources review will be completed during the design phase of the WWTF improvements project. During design, the City will contract with a state approved archeologist to perform the survey and to consult with the DAHP and affected Tribes. The archeologist's report will include survey findings as well as any recommended mitigations such as construction monitoring.

REGULATORY REQUIREMENTS FOR SHORELINE PERMITTING IN THE STATE OF WASHINGTON

The Shoreline Management Program manages shorelines through planning for and supporting all reasonable and appropriate uses of shoreline areas. The Washington State Shoreline Management Act of 1971 (SMA) defines shorelines as including the following:

- Lakes of 20 acres or greater, including reservoirs,
- Streams with a mean annual flow greater than 20 cubic feet per second,
- Marine waters,
- Areas within 200 feet landward of surface waters described above,
- Marshes, bogs, swamps, and river deltas associated with the surface waters described above.

Shoreline permits are required from the local jurisdiction for any sizable development or activity within the shoreline area. The City administers the local shoreline master program inside of the City limits. A Shoreline permit will not be required because the WWTF is greater than 200 feet from Soap Lake.

REGULATORY REQUIREMENTS FOR STORMWATER PERMITTING IN THE STATE OF WASHINGTON

As part of the Federal Clean Water Act, the Department of Ecology administers stormwater permitting for the State of Washington. Stormwater is considered a point source of water pollution and therefore an NPDES permit is required. The State of Washington has developed a General Permit for construction stormwater.

Stormwater permit coverage is required if the project disturbs more than one acre of land and if there is the possibility that stormwater runoff can enter waters of the state or conveyance systems that convey stormwater to waters of the state.

It is unknown if the construction of the WWTF improvements will disturb more than one-acre of land since the scope of the improvements does not include multiple large excavations. A determination of approximate ground disturbance will be made during project design. If it is determined that a construction stormwater permit is necessary, a permit will be obtained for the project. Due to the lengthy process for permit approval, it is anticipated that the City will initially apply for and obtain the permit prior to construction and transfer ownership to the Contractor.

SOAP LAKE CITY CODES

The WWTF and pump stations are within the City limits. The City will require the following permits for any improvements:

- Building Permit (applied for by the City prior to construction, paid for by the Contractor)
- Plumbing Permit (obtained/paid for by the Contractor during construction)

- Electrical Permit (through Labor & Industries) (obtained/paid for by the Contractor during construction)

REGULATORY SUMMARY

A summary of the regulatory requirements for improvements to the WWTF and collection system is presented in Table 3-3.

TABLE 3-3

Summary of Regulatory Requirements

Permit/Report	Agency	Comments
SWD Permit	Ecology	Expires 2/28/2017
Biosolids Permit	Ecology	Covered under General Permit.
NEPA	Federal Agency	Will be completed if federal funding is anticipated in the future.
SEPA	City of Soap Lake	Completed. See Appendix B.
SERP	Ecology	Partial Completion. See Appendix B. (1)
Cultural /Archeological Survey	DAHP	Will be completed by City during design.
Shoreline Permit	City of Soap Lake	Not required
Construction Stormwater Permit	Ecology	Applied for by the City during design if greater than 1 acre is disturbed, transferred to the Contractor prior to the start of construction.
Building Permit, Electrical Permit, Plumbing Permit	City of Soap Lake	Applied for by the City during design, obtained and paid for by the Contractor prior to construction activities.

(1) Includes SEPA, biological assessment, and federal cross cutters. The cross cutters will be completed during design if necessary.

CHAPTER 4

WASTEWATER FLOWS AND LOADINGS

CHAPTER 4

WASTEWATER FLOWS AND LOADINGS

INTRODUCTION

This chapter provides information on existing hydraulic, organic, and solids loadings to the City's existing WWTF, and presents projections of future flows and loadings through the 20-year planning period (2031). Quantifying the existing loading to the WWTF is necessary to determine the level at which the existing wastewater treatment processes are operating relative to their current capacities, and to project performance under future flows and loadings.

Future flows and loadings will be used to design upgrades to the WWTF that will be required to meet the demands of future growth and regulatory requirements.

HISTORICAL WASTEWATER FLOWS

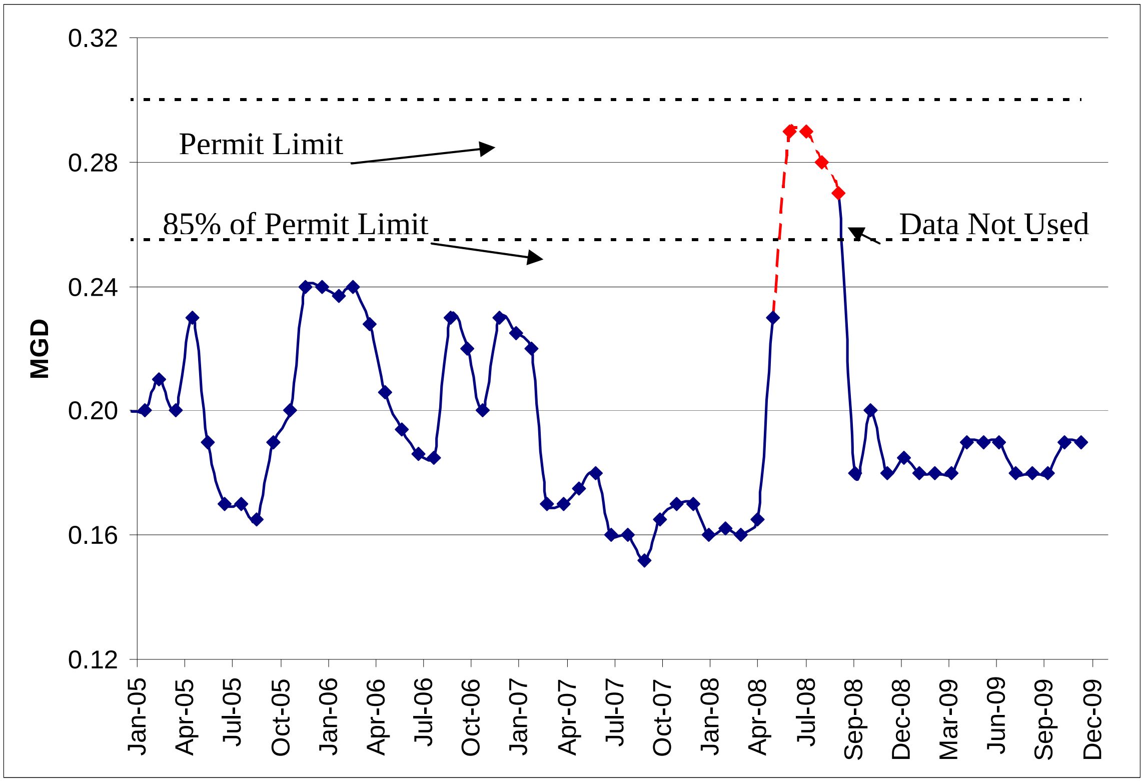
The City does not have an accurate means of determining instantaneous influent wastewater flows since the influent is pumped into the facility from Lift Station No. 2 at Canna Street. The lift station does not have a flow meter. The flows at the WWTF are measured with an 8-inch effluent magnetic flow meter located in a vault upstream of the chlorine contact tank.

Figure 4-1 shows the monthly average effluent flow for the years between 2005 and 2009. Data for 2010 and 2011 are not used in this analysis because the flow data was based on instantaneous flow readings, and therefore is not representative of average daily flows to the WWTF. Figure 4-1 shows that winter flows appear to be generally higher, although that is not always the case. Flow attenuation provided by the WWTF tanks may be a cause for the lack of a distinct seasonal pattern. A summary of discharge monitoring report data is included in Appendix C.

The City has indicated that during the period of June 2008 to September 2008, an unusual amount of groundwater infiltration into the sewer system occurred. The City believes this was due to irrigation wells owned by Columbia Basin Irrigation not being used during the period, raising the groundwater table in the City. Infiltration was therefore unusually high during the period. Therefore the data for this period of time should not be taken into account because of the extenuating circumstances that caused the increased flow. Therefore, the data is not used in this Report.

FIGURE 4-1

Historical WWTF Monthly Average Effluent Flows (1)
2005 – 2009



(1) Monthly effluent flows measured by the effluent flow meter at the WWTF.

Historical wastewater flows are presented in Table 4-1 and are based on data from the WWTF's discharge monitoring reports (DMRs) for the period 2005 to 2009. As indicated on Figure 4-1, data for the period from June 2008 to September 2008 has been excluded since it is not representative of the City's historical flow, as discussed above.

Daily records are not available for the time period 2005-2009, as the City's DMRs did not show daily flows. Instead, the DMRs only show average monthly and average weekly values prior to 2010. Starting in 2010, daily records have been kept and submitted in a more typical tabular daily format. However, the records for 2010 and 2011 are not representative of actual flows due to incorrect daily flow records, and are therefore not used.

Since historical maximum day flow values were not available, a peaking factor has been used to estimate the maximum day flow for the period 2005-2009. Maximum day flow is estimated as maximum month flow multiplied by 1.3. This factor is consistent with other eastern Washington communities with more complete flow data, and therefore the estimate is considered reasonable for this Report.

TABLE 4-1

Historical WWTF Effluent Flows 2005-2009

Year	AAF (1) (MGD)	MMF (2) (MGD)	Estimated MDF (3) (MGD)
2005	0.20	0.24	0.31
2006	0.22	0.24	0.31
2007	0.18	0.23	0.29
2008 (4)	0.18	0.23	0.30
2009	0.18	0.19	0.25
Average	**0.19**	**-**	**-**
Maximum	**-**	**0.24**	**0.31**

(1) AAF = Average Annual Flow, the average flow for the year.
(2) MMF = Maximum Month Flow, the flow for the month with the highest average flow in a calendar year.
(3) MDF = Maximum Day Flow, the flow for the day with the highest flow in a calendar year. MDF is estimated as MMF * 1.3. See discussion in text.
(4) Data from June 2008 to September 2008 is not included. See discussion in text.

HISTORICAL LOADINGS

The City's DMRs contain historical data for WWTF influent biochemical oxygen demand (BOD_5) concentration and total suspended solids (TSS) concentration, which will be utilized for projecting future loading to the WWTF. Annual summaries of the loading data are included in Table 4-2. Additional DMR data are included in Appendix C.

TABLE 4-2

Historical WWTF Influent Loading 2005-2009

Year	Avg. Ann. BOD_5 (lb/d) (1)	Max. Mo. BOD_5 (lb/d) (2)	Avg. Ann. TSS (lb/d) (1)	Max. Mo. TSS (lb/d) (2)
2005	291	340	252	319
2006	336	476	301	485
2007	252	385	233	297
2008 (3)	267	337	248	316
2009	282	459	214	257
Average	**286**	**-**	**250**	**-**
Maximum	**-**	**476**	**-**	**485**

(1) Average annual values were calculated from the average of twelve average month values. The average month value for a given month is equal to Average Flow (MGD) * Average Concentration (mg/L) * 8.34.

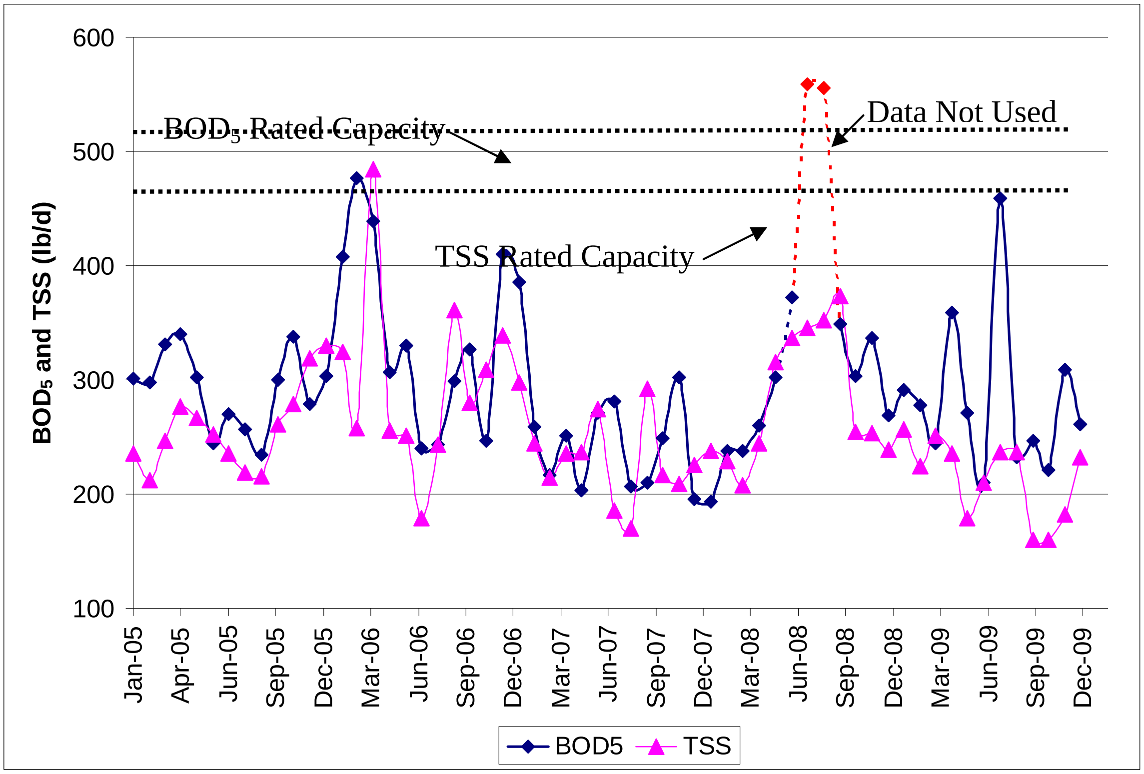
(2) Maximum month values are equal to the maximum average month value for the year, using a similar calculation as for (1).

(3) Data from June 2008 to September 2008 is not included.

Figure 4-2 presents the average monthly BOD_5 and TSS loadings for the period of January 2005 to December 2009. As would be expected of a municipal community with few seasonal water users, the City's loadings do not exhibit significant seasonal patterns. Although the City has summer tourism, it does not appear that loadings are consistently higher during the summer. Figure 4-2 also shows the elevated June 2008 to September 2008 data which is not used due to non-representative conditions.

FIGURE 4-2

Historical Influent WWTF Monthly Average BOD_5 and TSS Loading
2005 – 2009



INFILTRATION AND INFLOW (I/I)

I/I consists of relatively clean ground, surface, or storm water that does not require treatment to the same levels that domestic sewage does. The inclusion of this relatively clean water with the domestic wastewater flows can produce the following detrimental effects:

- WWTF impacts including hydraulic overloading, reduced treatment efficiency, reduced capacity, and violation of the State Waste Discharge Permit
- Additional costs for treating, transporting, and pumping the increased flow
- Increased flows within the collection system, creating the need to construct additional sewer facilities or upgrade existing facilities
- Surcharged manholes, sewage overflow, and bypasses to the environment in extreme cases

For these reasons it is advantageous for municipalities to minimize the amount of I/I within their systems. Figure 4-3 presents a diagram of typical I/I sources in a collection system.

DEFINITION OF INFILTRATION

Infiltration is defined as ground water entering a sewer system by means of defective or deteriorated pipes and side sewers, pipe joints, and manhole walls. The infiltration rate is relatively constant day to day, although it may vary seasonally if the local ground water elevation fluctuates. Infiltration can be a constant problem, increasing daily operations costs for the collection and conveyance systems.

DEFINITION OF INFLOW

Inflow is defined as surface water or runoff that enters the collection system through constructed openings such as manhole covers, cross-connections with storm sewers and combined sewers or direct connections such as yard, basement, or roof drains. Inflow is directly related to rainfall or flooding events and results in an immediate increase in sewage flows following the event. Inflow is an intermittent problem, causing an increase in sewage flows following the triggering event.

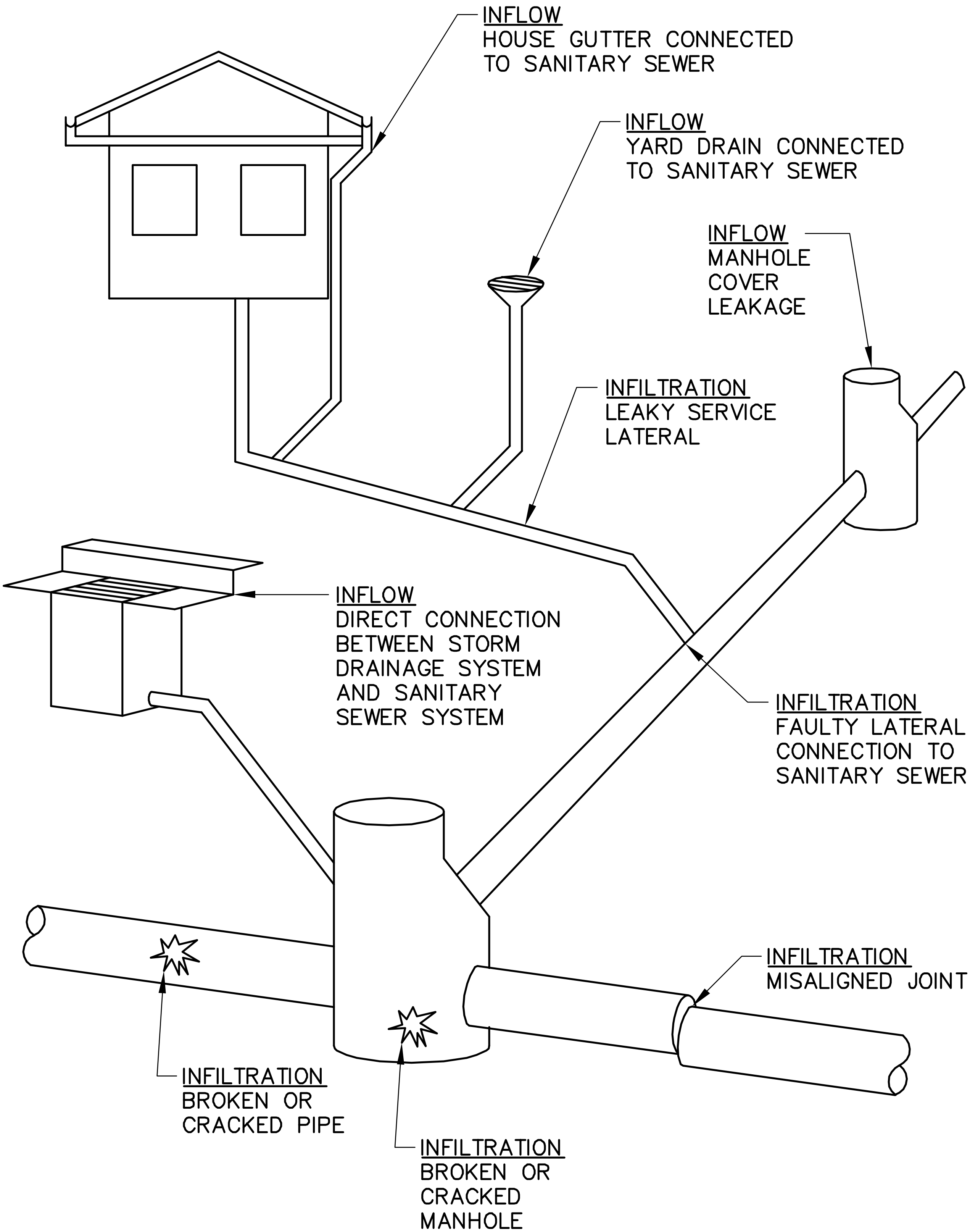
I/I FLOW CRITERIA

The United States Environmental Protection Agency (EPA) has determined specific quantitative guidelines for excessive I/I, as follows:

1. To determine if excessive *infiltration* is occurring, a threshold value of 120 gallons per capita per day (gpcd) is used. This threshold infiltration value is based on an average daily flow over a seven to fourteen day non-rainfall period during seasonal high groundwater conditions. In Soap Lake, high groundwater conditions occur in the spring (approximately March through May). At a population of 1,537, an average daily flow of 0.18 MGD would be required to exceed the EPA criteria.

   As indicated previously, the City does not have historical daily data to compare to rainfall data, however the City's average monthly flows during the summer months when rainfall is historically low have been less than 0.18 MGD. During the winter months, the City's historic flows have exceeded 0.18 MGD the majority of the time, and it is possible that flows exceeded 0.18 MGD during non-rainfall periods. However, due to the lack of historical daily flow measurement data, a determination cannot be definitively made as to whether the City exceeds this criterion or not.

2. To determine if excessive *inflow* is present in a collection system, the EPA uses a threshold value of 275 gpcd. If the average daily flow (excluding major commercial and industrial flows greater than 50,000 gpd each) during periods of significant rainfall exceeds 275 gpcd, the amount of inflow is considered excessive.



CITY OF SOAP LAKE
WASTEWATER FACILITY PLAN

FIGURE 4-3
TYPICAL I/I SOURCES

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M:\SOAP LAKE\11041 WASTEWATER FACILITY PLAN\FIGURES\FIG 4-3

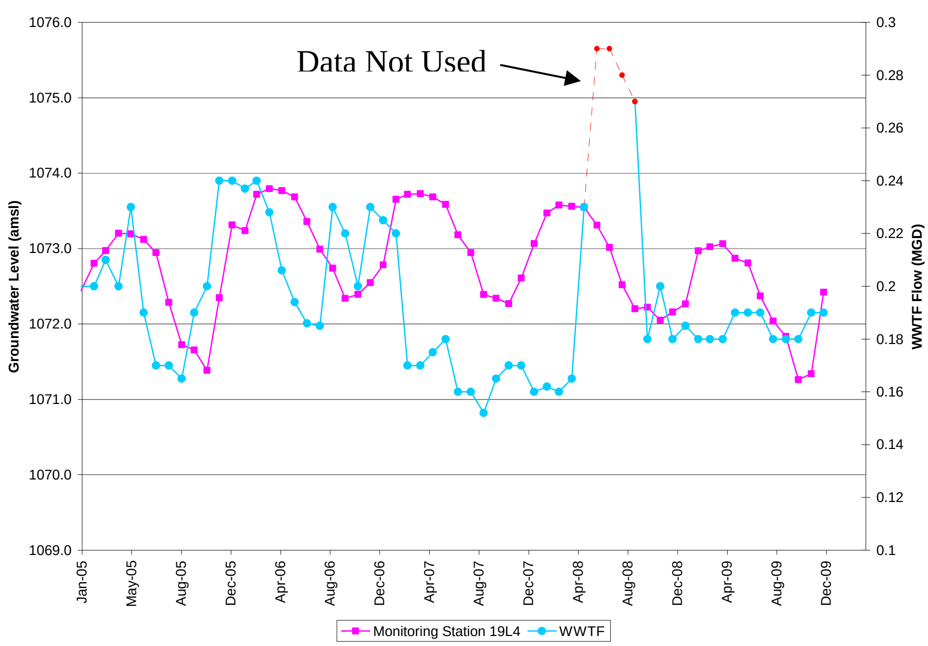
The maximum day flow for the period 2005-2009 was estimated to be 0.31 MGD using a peaking factor of 1.3 as determined above, which would be equal to 202 gpcd. At a population of 1,537, a maximum day flow of 0.42 MGD would be required to exceed the EPA criteria. This flow is equal to the rated capacity of the facility, and it is assumed that if the City had experienced storm events resulting in flows that met the rated capacity of the facility, the City would be aware of such events. However, City staff has no recollection of an event of that magnitude, and do not believe flows have been substantially greater during storm events in recent years. As a result, it is concluded that Soap Lake does not have excessive inflow.

GROUNDWATER IMPACT ON WWTF FLOW

Due to the proximity of the City's collection system and WWTF to Soap Lake, it is prudent to analyze groundwater levels and identify a relationship between groundwater levels and influent flow at the WWTF. Weekly groundwater measurements are collected by the USBR in 37 locations surrounding Soap Lake, and it was determined that based upon location of the monitoring points and a visual correlation between groundwater level and WWTF influent flow, Monitoring Station 19L4 appears to show a possible correlation to WWTF flow. Monitoring Station 19L4 is located near Lift Station No. 2. Figure 4-4 shows the average groundwater level in Monitoring Station 19L4 for the period 2005-2009 compared with WWTF flow.

FIGURE 4-4

Historical Groundwater Level at Monitoring Station 19L4 and WWTF Flow 2005 – 2009



Upon closer inspection, it appears that the groundwater level at Monitoring Station 19L4 followed approximately the same seasonal pattern for the period 2005-2009, while influent flow to the WWTF did not. Therefore, although the WWTF has been known to experience greater flows during periods of elevated groundwater level, a numerical correlation between groundwater level and flow to the WWTF cannot be identified at this time.

DETERMINATION OF I/I QUANTITIES

Although the City does not have excessive I/I, it is important to estimate the quantity of I/I in the system to more accurately project future flows and loadings. To determine the quantity of I/I in the Soap Lake collection system, the City's base sanitary flow is used. The base sanitary flow is anticipated to be relatively constant throughout the year, although it may be higher in the summer due to tourism.

The base sanitary flow for a community is typically determined through customer water records. Although Soap Lake is not convinced that its consumption water records are accurate, estimates can be made using production records. Water production data can often be used as a surrogate to base sanitary wastewater flow because the majority of winter water use in small communities without industry will enter the wastewater collection system. Since Soap Lake does not have a separate irrigation system and potable water is used for summer irrigation, only winter water use will be considered for determination of base sanitary flows. A conservative estimate will be made that 90 percent of the residential winter water production is assumed to end up as influent to the WWTF.

Residential winter water production data was analyzed for the period 2008 to 2010, as this was the data analyzed in the 2011 Water System Plan. Winter residential water production for the period was approximately 150,000 gpd or 98 gallons per capita per day (gpcd) (150,000 gpd / 1,537 water system customer population). An assumption of 10 percent leakage is made, which is consistent with the City's data and municipal water systems in the State. Therefore, actual water consumption is estimated to be 89.1 gpcd (98 gpcd / 1.1), and baseline sanitary flow is 80 gpcd (89.1 * 0.9). Multiplying the current Soap Lake population, which is all connected to the sewer, by 80 gpcd results in a baseline sanitary flow of 0.12 MGD.

To quantify I/I, DMR data was reviewed for the period 2005-2009. Using this DMR information and the base flow of 0.12 MGD enables the calculation of I/I quantity on an annual average, maximum monthly, maximum day, and peak hour basis. On an annual average basis the flow to the WWTF for the period was 0.19 MGD. Subtracting the base flow of 0.12 MGD results in an annual average I/I of 0.07 MGD. Similar calculations were performed for maximum monthly and maximum daily I/I, and the results are presented in Table 4-3. Peak hour I/I is calculated differently and is explained below.

The projected peak hour I/I cannot be based on just the base sanitary flow (0.12 MGD) because the short duration of the peak I/I flow (60 minutes) could theoretically occur during the same time as the diurnal peak base sanitary flow. Therefore, the base sanitary flow is multiplied by a diurnal peaking factor prior to subtracting from the peak hour flow to determine the peak hour I/I. As identified in Table 4-3, the peak hour flow is assumed to be equal to the output of one pump at Lift Station No. 2 (0.67 MGD). This is a conservative estimate, as in the City's experience, Lift Station No. 2 operates for longer periods during the highest flow periods, but does not operate continuously.

The Department of Ecology Criteria for Sewage Works Design provides a formula to estimate the diurnal peaking factor:

$$PF = \frac{18 + \sqrt{P}}{4 + \sqrt{P}}$$

Where PF is the diurnal peaking factor (the ratio of daily peak hour flow to average annual flow), and P is the population in thousands. The average population of 1,537 results in a diurnal peaking factor of 3.7. Therefore, the peak hour I/I is 0.23 MGD (0.67 MGD – (0.12 MGD)*3.7).

Table 4-3 is a summary of I/I quantities based on the above analysis.

TABLE 4-3

I/I Summary

Parameter	Average Flow	Maximum Month Flow	Max Day Flow	Peak Hour Flow
WWTF Flow, MGD (1)	0.19	0.24	0.31	0.67 (8)
Base Flow, MGD (2)	0.12	0.12	0.12	0.44 (9)
I/I, MGD (3)	0.07	0.12	0.19	0.23 (10)
I/I Ratio (4)	---	1.7	2.7	3.3
I/I per Acre, gpd (5)	87	149	237	286
I/I per Capita, gpd (6)	46	78	124	150
I/I % (7)	29%	50%	79%	96%

(1) Flow for the years 2005-2009.
(2) Base sanitary flow =80 gpcd * current population.
(3) I/I = WWTF Flow – Base Flow.
(4) I/I Ratio = MMF:AAF; MDF: AAF; PHF:AAF.
(5) I/I per Acre = I/I / total existing sewered acres 803.
(6) I/I per Capita = I/I / current population.
(7) I/I % =I/I / max month WWTF flow * 100%
(8) PHF = Output of one pump at Lift Station No. 2 (465 gpm)
(9) PHF Base = 0.12 MGD * 3.7.
(10) PHF I/I = WWTF Peak Flow-PHF Base Flow

PROJECTED WASTEWATER FLOWS AND LOADINGS

Projected wastewater flows and loadings for the design year 2031 are based on historical flows and loadings on a per capita basis and the population growth projections developed in Chapter 2.

AVERAGE ANNUAL FLOW (AAF)

Average annual flow (AAF) is the average flow over a one-year period. This flow rate is used to estimate annual operation and maintenance costs for collection system and treatment facilities and is the basis for developing flow ratios used in collection and treatment system designs.

The following is the basic formula that will be used to determine the future annual average design flow to the WWTF:

Projected Flow = (Population * Base Sanitary Flow) + Annual Average I/I.

As shown in Table 2-2, the projected 2031 population is 2,069. Using this future population and the base flow of 80 gpcd, a future annual average design base sanitary flow of 0.17 MGD is projected.

As shown in Table 4-3, the existing annual average I/I per acre is estimated at 87 gpad for a service area of 803 acres, based on the estimated existing annual average I/I of 0.07 MGD. It is assumed that this amount of I/I from the existing sewer service area will remain constant in the future. It is also assumed that future annual average I/I for areas with new sewers will be approximately 50 percent of the existing I/I, or 44 gpad, since the new sewer materials and methods of construction should significantly reduce I/I. Based on the City's urban growth area, the future area of development is approximately 360 acres. At 44 gpad and 360 acres, the future service area annual average I/I is projected to be 0.02 MGD. Therefore, projected future I/I is estimated as the existing and future service area annual average I/I and is 0.09 MGD (0.07 MGD + 0.02 MGD).

The total projected annual average flow for the year 2031 is therefore estimated to be 0.26 MGD (0.17 MGD + 0.09 MGD).

MAXIMUM MONTH FLOW (MMF)

The maximum month flow (MMF) is defined as the greatest single average monthly flow during the year. The individual average monthly flows and maximum daily flows for the previous five years are shown in Table 4-1. The maximum month flow is used to size most of the unit processes in a wastewater treatment facility, and is used as the critical flow in determining effluent limits for toxic substances (e.g. nitrates, chlorine, and heavy metals) on the basis of chronic toxicity for a groundwater discharge. The maximum month flow is used by Ecology to establish the "permitted capacity" for the wastewater treatment facility. The permitted capacity is used to determine when 85 percent of the facility's capacity has been reached, at which time Ecology requires the permittee to develop a formal plan to maintain adequate capacity.

The formula that will be used for projecting future maximum month flows is different than shown above for annual average flows. The future maximum month I/I component is calculated based on the ratio between the existing maximum month I/I flow and the existing average I/I flow as shown in Table 4-3. For the maximum month I/I flow, this ratio is 1.7. As calculated above, the projected annual average I/I is 0.09 MGD; therefore, using a ratio of 1.7 for maximum month results in a projected maximum month I/I of 0.15 MGD. The total projected maximum month flow for the year 2031 is calculated by adding the base sanitary annual average flow of 0.17 MGD to the projected maximum month I/I of 0.15 MGD, resulting in a total projected maximum month flow of 0.32 MGD.

MAXIMUM DAILY FLOW (MDF)

Maximum daily flow (MDF) is defined as the largest total flow over a 24-hour period occurring in a single year. The MDF is used to size processes that are affected by diurnal flow curves for proper performance (e.g. RAS pumps and equalization basins).

The formula that will be used for calculating maximum daily flow is similar to the formula used for the maximum month flow. The ratio of maximum daily I/I to annual average I/I is 2.7, resulting in a projected maximum daily I/I of 0.24 MGD (0.09 MGD * 2.7).

The total projected maximum daily flow for the year 2031 is estimated by adding the projected base sanitary annual average flow of 0.17 MGD to the projected maximum day I/I of 0.24 MGD, resulting in a total projected maximum daily flow of 0.41 MGD.

PEAK HOUR FLOW

Peak hour flow (PHF) is the peak sustained flow rate occurring during a one-hour period in a single year. The peak hour flow is used for design of collection and interceptor sewers, pumping stations, piping, flow meters, and certain unit treatment processes such as grit chambers, disinfection systems, and sedimentation tanks.

Because the entire flow to the WWTF is pumped from Lift Station No. 2, the peak flow to the facility will be equal to the discharge capacity of Lift Station No. 2, assuming it is less than the calculated PHF.

The formula for calculating peak hour flow is similar to the formula used for maximum month flow. The ratio of peak hour I/I to annual average I/I per Table 4-3 is 3.3, resulting in a projected peak hour I/I of 0.30 MGD (0.09 MGD * 3.3).

As previously explained, the diurnal peaking factor is used to calculate the base sanitary peak hour flow. Using the diurnal peaking factor of 3.7 and a base sanitary flow of 0.17 MGD results in a projected base sanitary peak hour flow of 0.63 MGD.

The total projected peak hour flow for the year 2031 is estimated by adding the projected base sanitary peak hour flow of 0.63 MGD to the projected peak hour I/I of 0.30 MGD, resulting in a total projected peak hour flow of 0.93 MGD.

The capacity of Lift Station No. 2 is 465 gpm with one pump running and the other in standby, or 0.67 MGD. Therefore, since the projected PHF is equal to 0.93 MGD, Lift Station No. 2 will require an upgrade or replacement in the future.

BOD_5 LOADING

The BOD_5 loading represents the number of pounds per day of oxygen-demanding material that enters the WWTF. BOD_5 loadings are used to design and size the WWTF biological treatment processes (i.e. oxidation ditch) and BOD_5 loadings are used by Ecology to establish the "permitted capacity" for the WWTF. The permitted capacity is used to determine when 85 percent of the WWTF capacity has been reached, at which time Ecology requires the permittee to develop a formal plan to maintain adequate capacity.

Because the permitted capacity applies to the maximum month, maximum month loadings are analyzed for design purposes. Annual average loading is also calculated and is important for determining biosolids production. WWTF loading for the five years from 2005 to 2009 is shown in Table 4-2. Since the OFM population estimates for the period were significantly different than the 2010 census population because they consisted of projections from the 2000 census data, the 2010 census population will be used for determining per capita loading.

Between 2005 and 2009, the annual average BOD_5 loading rate at the WWTF was 286 lb/d. Dividing by the 2010 census population (1,537) results in a BOD_5 loading of 0.19 pounds per capita day (ppcd). Multiplying 0.19 ppcd by the 2031 design population of 2,069 results in an annual average BOD_5 loading rate of 392 lb/d.

Between 2005 and 2009, the maximum month BOD_5 loading rate at the WWTF was 476 lb/d, which occurred in March 2006. Dividing by the 2010 census population (1,537) results in a BOD_5 loading of 0.31 pounds per capita day (ppcd), which is higher than many other communities in eastern Washington. Because tourism is a significant industry for the City, it is possible that the high maximum month BOD_5 loading rate is the result of BOD_5 loading that is independent of the actual population of the City.

For this Report, it is assumed that the per capita loading rate of 0.31 ppcd is a reasonable value, and it will be used for projecting future flows and loadings. Multiplying 0.31 ppcd by the 2031 design population of 2,069 results in a maximum month BOD_5 loading rate of 641 lb/d.

TSS LOADING

The TSS loading rate represents the number of pounds per day of suspended material that enters the WWTF. TSS loadings are used to design the size of biological treatment processes. In municipal wastewater, BOD_5 and TSS loadings are typically of similar magnitude. TSS loadings are used by Ecology to establish the "permitted capacity" for the WWTF. The permitted capacity is used to determine when 85 percent of the WWTF capacity has been reached, at which time Ecology requires the permittee to develop a formal plan to maintain adequate capacity. Because the permitted capacity applies to the maximum month, maximum month loadings are analyzed for design purposes. WWTF loading for the five years from 2005 to 2009 is shown in Table 4-2. Since the OFM population estimates for the period were significantly different than the 2010 census population, the census population will be used for determining per capita loading.

Between 2005 and 2009, the annual average TSS loading rate at the WWTF was 250 lb/d. Dividing by the 2010 census population (1,537) results in a TSS loading of 0.16 pounds per capita day (ppcd). Multiplying 0.16 ppcd by the 2031 design population of 2,067 results in an annual average TSS loading rate of 331 lb/d.

Between 2005 and 2009, the maximum month TSS loading rate at the WWTF was 485 lb/d, which occurred in April 2006. Dividing by the 2010 census population (1,537) results in a TSS loading of 0.32 pounds per capita day (ppcd), which is consistent with the BOD_5 projection. Multiplying 0.32 ppcd by the 2031 design population of 2,067 results in a maximum month TSS loading rate of 661 lb/d.

NITROGEN LOADING

Total nitrogen is comprised of organic nitrogen, ammonia, nitrite, and nitrate. Organic nitrogen is determined by the Kjeldahl method. Total Kjeldahl nitrogen (TKN) is the total of the organic and ammonia nitrogen. TKN loadings are used to design and size the nitrogen removal processes at the WWTF.

As discussed in the City's State Waste Discharge Permit, the City's effluent total nitrogen limit is the controlling factor in the facility design. Therefore, the City is required to report effluent TKN, nitrate, and ammonia concentrations. However, influent loadings are not regularly recorded. During the development of this Report, the City collected 24-hour composite samples for influent TKN eight times between November 2011 and February 2012. The sample TKN concentrations varied from 30.6 mg/L to 39.0 mg/L.

To determine an annual average TKN loading, it is assumed that the average TKN concentration of 35.0 mg/L is representative of typical influent TKN concentration. Because the City's daily flows during the sampling period are not known, TKN loadings associated with each sample cannot be determined. Because I/I is anticipated to be different at various times of the year, it is likely that TKN concentration is variable throughout the year due to dilution. The TKN samples were collected during the winter, therefore the AAF during winter months of 0.20 MGD is used to calculate an average month TKN loading of 58 lb/d (35.0 mg/L * 0.20 MGD * 8.345). Dividing this value by the 2010 census population (1,537) and multiplying by the 2031 design population (2,067) results in a projected annual average TKN loading rate of 78 lb/d.

Since the City's samples were all collected in a three month period of time that occurred entirely in the winter of 2011/2012, it is not likely that the maximum month TKN concentration during the sampling period (37.5 mg/L in January 2012) represents a maximum month TKN condition that is conservative enough for projecting future TKN loading. Instead, it is assumed that TKN loading is somewhat proportional to BOD_5 loading, and the ratio of maximum month BOD_5 loading (641 lb/d) to average annual BOD_5 (392 lb/d) can be used to estimate the existing maximum month TKN loading. Multiplying the projected annual average TKN loading by 1.64 (641 lb/d ÷ 392 lb/d) results in a projected maximum month TKN loading rate of 127 lb/d (78 lb/d * 1.64).

Typical domestic wastewaters have a 5:1 BOD_5:TKN ratio. The estimated BOD_5:TKN ratio for the Soap Lake wastewater using the method above is 5.0:1.

SUMMARY OF PROJECTED WASTEWATER FLOWS AND LOADINGS

A summary of the existing WWTF design criteria and the projected design criteria for the City of Soap Lake for the year 2031 is presented in Table 4-4. The existing design criteria were obtained from the City's State Waste Discharge permit.

TABLE 4-4

Existing, Projected, and Permitted Wastewater Flows and Loadings

Flow Criteria	Existing State Waste Discharge Permit Design Criteria (1)	Projected Design Criteria (2031)
Average Annual Flow (MGD)	NI(2)	0.26
Maximum Month Flow (MGD)	0.30	0.32
Maximum Day Flow (MGD)	0.42	0.41
Peak Hour Flow (MGD)	NI(2)	0.93
Loading Criteria	**Existing State Waste Discharge Design Criteria (1)**	**Projected Design Criteria (2031)**
Annual Average BOD_5 Loading (lb/d)	NI(2)	392
Maximum Month BOD_5 Loading (lb/d)	517	641
Annual Average TSS Loading (lb/d)	NI(2)	331
Maximum Month TSS Loading (lb/d)	465	661
Average Annual TKN Loading (lb/d)	NI(2)	78
Maximum Month TKN Loading (lb/d)	NI(2)	127
Design Population	2,586	2,067

(1) From the City's State Waste Discharge Permit Fact Sheet. Maximum month values shown in State Waste Discharge Permit area actually average annual design values. See discussion in text.

(2) NI = Not Indicated.

Table 4-4 appears to indicate that the projected loading for a population of 2,067 will be higher than the previously projected loading for a population of 2,586. However, the maximum month BOD_5 loading and maximum month TSS loading criteria contained in the State Waste Discharge Permit Fact Sheet are based upon the flow and loading projections summarized in Table 5 of the 1998 Engineering Report. Examination of the historical data used in the Engineering Report clearly indicates that the values used as maximum month loading criteria are average annual values, not maximum month values. Therefore, the maximum month criteria in the City's State Waste Discharge permit should be compared to the projected annual average values. This comparison shows that for the projected design population, the projected annual average design criteria represent a similar per capita loading as the criteria in the permit.

Further examination of the data used in the Engineering Report analysis indicates that the City has historically experienced TSS and BOD_5 loadings per capita of over 0.30 ppcd on a maximum month basis, and therefore the projected design criteria in Table 4-4 are reasonable and consistent with previous planning efforts.

CHAPTER 5

WWTF EVALUATION

CHAPTER 5

WWTF EVALUATION

GENERAL

The purpose of this chapter is to evaluate the existing WWTF with respect to capacity, reliability and redundancy, and to identify improvements to the WWTF to accommodate the design criteria as outlined in Chapter 4.

The City of Soap Lake owns and operates the wastewater treatment facilities that serve the sewer service area. The liquid treatment facilities include a grinder, oxidation ditch, secondary clarifiers, chlorine contact tank, and rapid infiltration basins. The solids treatment facilities include an aerobic digester, sludge drying beds, and a sludge storage slab.

PROJECTED WASTEWATER FLOWS AND LOADINGS

The wastewater treatment process units will be evaluated in this chapter based on the projected flows and loadings developed in Chapter 4. Table 5-1 provides a summary of the projected design flows and loadings for the year 2031.

TABLE 5-1

Projected Wastewater Flows and Loadings [(1)]

Flow Criteria	Projected Design Criteria
Average Annual Flow (MGD)	0.26
Maximum Month Flow (MGD)	0.32
Maximum Day Flow (MGD)	0.41
Peak Hour Flow (MGD)	0.93
Loading Criteria	**Projected Design Criteria**
Annual Average BOD_5 Loading (lb/d)	392
Maximum Month BOD_5 Loading (lb/d)	641
Annual Average TSS Loading (lb/d)	331
Maximum Month TSS Loading (lb/d)	661
Average Annual TKN Loading (lb/d)	78
Maximum Month TKN Loading (lb/d)	127
Design Population	2,067

(1) From Table 4-4

FUTURE PERMIT LIMITS

The City's current State Waste Discharge Permit (Permit) was issued in 2012 and will expire in 2017. At present, the Permit limits for BOD_5 and TSS are technology-based limits. The Permit contains a water quality-based limit for total nitrogen.

Because the Permit was issued during the development of this Report, it is assumed that the current Permit limits are representative of Ecology's limits for the facility in the foreseeable future. Specifically, the Permit does not include effluent Permit limits for pH, fecal coliform, or phosphorus.

Historically, the Permit has included technology-based effluent limits for pH, but the limits were removed in the current Permit due to a history of compliance and a consistent effluent pH.

The City has not had an effluent fecal coliform limit since the installation of the rapid infiltration basins and subsequent removal of the sprayfields from service. The City installed groundwater monitoring wells concurrently with the construction of the rapid infiltration basins, and the results of that monitoring have not resulted in the addition of fecal coliform limits in the recently issued Permit. As addressed in Chapter 3, Ecology is still in the process of determining the background ground water quality in the vicinity of the WWTF, and therefore has not made a determination regarding the need for disinfection. For purposes of this Report, it is assumed that effluent disinfection will not be required in the future.

The City was required to sample for phosphorus in the previous Permit, but is no longer required to do so because "the facility has collected sufficient data to characterize the effluent for that parameter". Though new permits for additional constituents are not expected, in October 2008, Ecology received funding from the EPA to conduct an evaluation of nutrient removal technologies at municipal WWTFs across the State of Washington. The EPA-funded study is being prepared to identify the technical and economic issues related to the removal of nitrogen and phosphorus. Ecology permit managers are encouraging all permit holders to consider nutrient removal as part of the planning process.

At this time, effluent phosphorus limits are not anticipated for many years. WAC 173-200-040 does not currently contain groundwater quality criteria for phosphorus, although that may change in the future. For purposes of this report, it is assumed that phosphorus removal will not be required during the 20-year period evaluated in this Report.

With respect to nutrient removal, the major nutrient of concern for the City is likely to be effluent nitrogen (ammonia, nitrate, and nitrite). Nitrogen levels in excess of the recommended ground water quality standards may degrade a potential future drinking water source. Ammonia is removed from wastewater by biological nitrification, which converts ammonia to nitrate in a two step process utilizing oxygen. Nitrate can then be converted to nitrogen gas through biological denitrification in the WWTF, which results in nitrogen removal. Due to the City's effluent nitrogen limit, denitrification is required.

Based on current Permit limits and the projected flow developed in Chapter 4, the future Permit effluent limits are predicted to be as shown in Table 5-2.

TABLE 5-2

Projected State Waste Discharge Permit Effluent Limits

Parameter	Average Monthly (1)	Average Weekly
Flow	0.32 MGD	N/A
Biochemical Oxygen Demand (5-day)	30 mg/L, 80 lb/d 85% Removal	45 mg/L, 120 lb/d 85% Removal
Total Suspended Solids	30 mg/L, 80 lb/d 85% Removal	45 mg/L, 120 lb/d 85% Removal
Total Nitrogen (2)	10 mg/L	N/A

(1) The average monthly effluent concentration for BOD_5 and TSS shall not exceed 30 mg/L or 15 percent of the respective monthly average influent concentrations, whichever is more stringent.

(2) Total nitrogen is defined as the sum of TKN plus nitrate and nitrite.

Table 5-2 shows that the average monthly flow rate limit is projected to increase to 0.32 MGD in the future. The projected average monthly limits for effluent BOD_5 and TSS are a concentration of 30 mg/L or 85% removal of influent load, whichever is more stringent. At the projected maximum month flow of 0.32 MGD and influent loadings of 641 lb/d BOD_5 and 661 lb/d TSS, 85% removal is less stringent for both BOD_5 and TSS. This is because 15% of the projected maximum month influent BOD_5 and TSS loadings (85% removal) equal 96 lb/d and 99 lb/d, respectively, but a flow of 0.32 MGD with a BOD_5 or TSS concentration of 30 mg/L results in a discharge of 80 lb/d of each constituent.

EXISTING OPERATION

Raw wastewater is pumped from Lift Station No. 2 to the WWTF. The wastewater enters the elevated headworks structure first, where a grinder conditions the influent to reduce the size of the solids in the sewage. At the headworks, a timed automated sampler collects composite wastewater samples for laboratory analysis of the influent. The flow then travels by gravity to the oxidation ditch.

The oxidation ditch biologically converts the organic material in the wastewater into biological cells and metabolic end products. Two cage rotors aerate the oxidation ditch.

Flows from the oxidation ditch are conveyed to the secondary clarifiers. The secondary clarifiers provide a quiescent environment where settleable secondary solids are removed from the treated wastewater. Flow enters along the circumference of the tank under a baffle and exits at the center of the tank by passing over a notched weir into a discharge launder.

Secondary effluent passes through a chlorine contact tank prior to being pumped to the rapid infiltration basins, although no chlorination chemicals are currently used because disinfection is not required by the State Waste Discharge permit.

The rapid infiltration basins consist of six earthen basins with soil conditions favorable to infiltration of treated wastewater. The operators rotate flows to one of the six basins sequentially to allow the wastewater to percolate to groundwater without overloading the soils.

The facility's waste solids treatment process includes the pumping of waste activated sludge from the bottom of the clarifiers to an aerobic digester. The digester consists of a lined earthen structure with floating aerators to provide oxygen for the aerobic destruction of biosolids. Due to the arid environment, evaporation continuously reduces the volume of water in the digester.

Twice per year, solids are removed from the digester and placed in sludge drying beds. The drying beds consist of shallow structures with a sand bottom for draining the digested sludge. Perforated drain pipe in the beds further dewater the sludge while evaporation occurs. Dried biosolids are stored on the solids storage slab and taken to the Boulder Park facility in Mansfield, WA for land application as Class B biosolids.

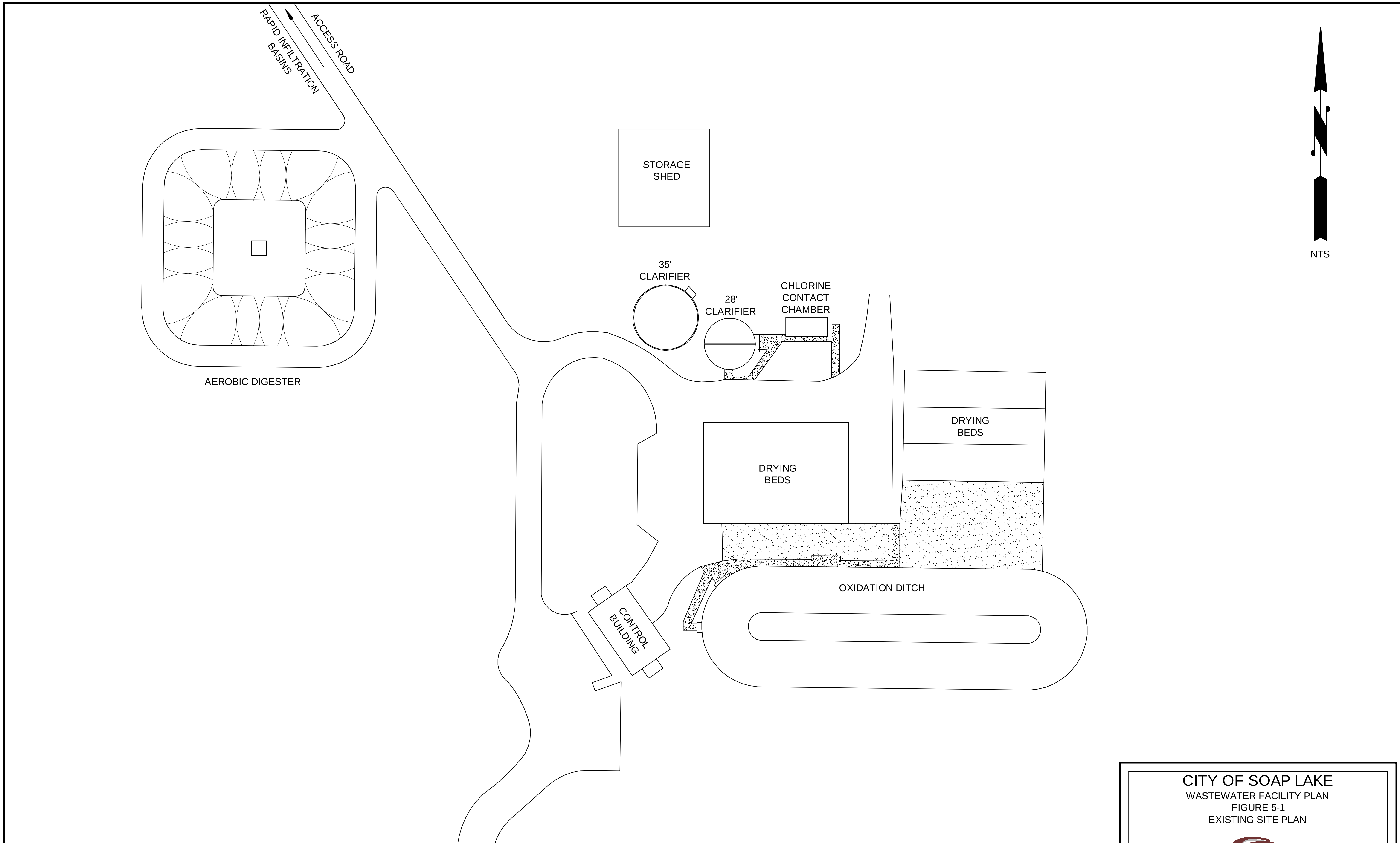
An existing site plan is provided in Figures 5-1 and 5-2. A hydraulic profile is provided in Figure 5-3.

LIFT STATION NO. 2

Lift Station No. 2 is a self-priming, above-ground Smith and Loveless style pump station which replaced a submersible pump station in 2009. In the event of an emergency, the generator is automatically supplied with power from a generator located at Lift Station No. 1. The lift station is equipped with a automatic dialer system that contacts City personnel with alarm notifications.

The submersible pump station is still available for use in an emergency, and is rated for the same flow as the new pump station. City staffs have indicated that there are no operational problems with Lift Station No. 2.

As noted in the Criteria for Sewer Works Design, it is recommended that lift stations be designed to pump peak hour flow with the largest pump out of service. The projected 20-year peak hour flow of 0.93 MGD is equal to 646 gpm, therefore the pump station is undersized to meet this recommendation for the 20-year planning period, as each pump is



CITY OF SOAP LAKE
WASTEWATER FACILITY PLAN
FIGURE 5-1
EXISTING SITE PLAN

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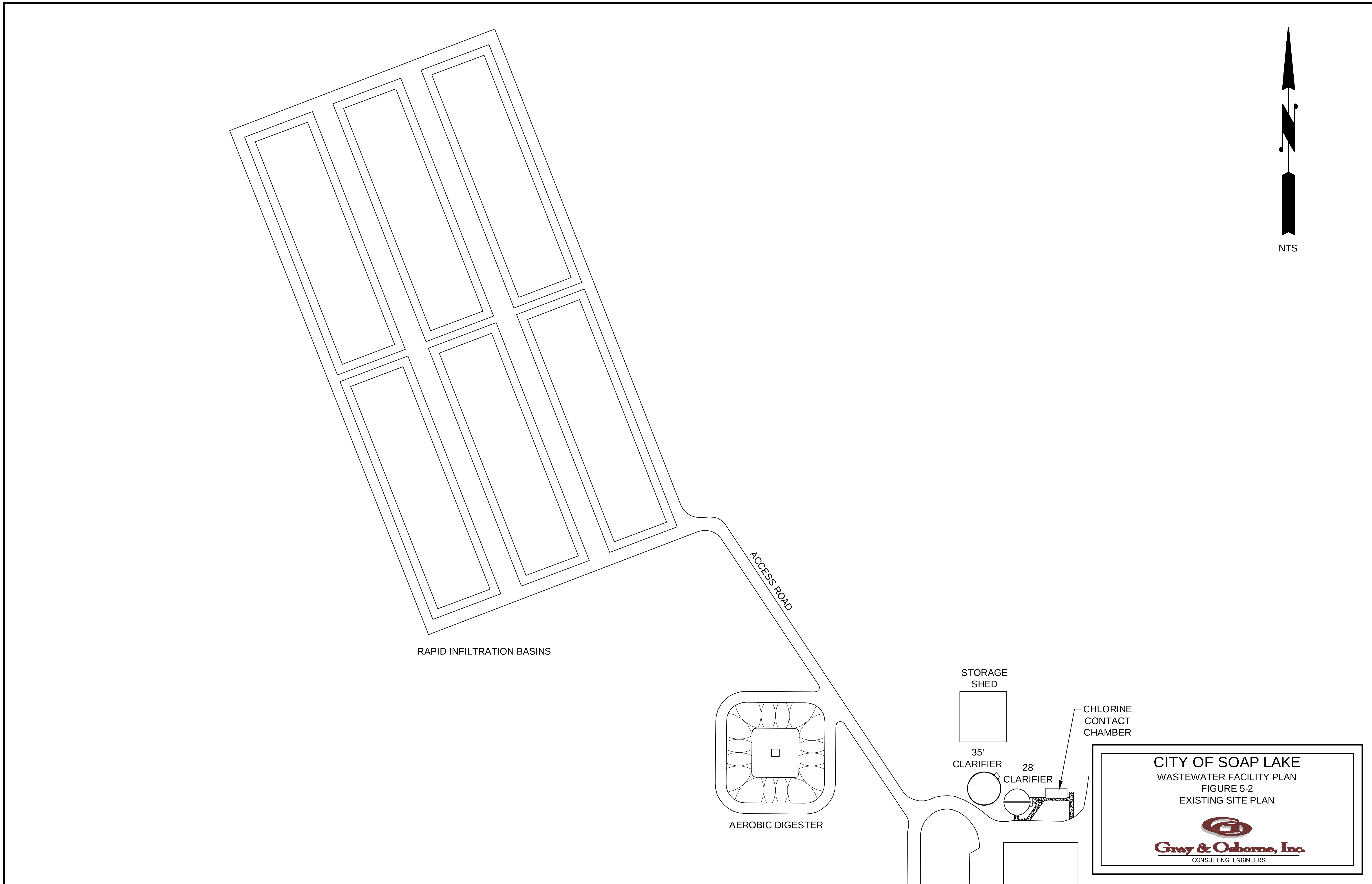

CITY OF SOAP LAKE
WASTEWATER FACILITY PLAN
FIGURE 5-2
EXISTING SITE PLAN

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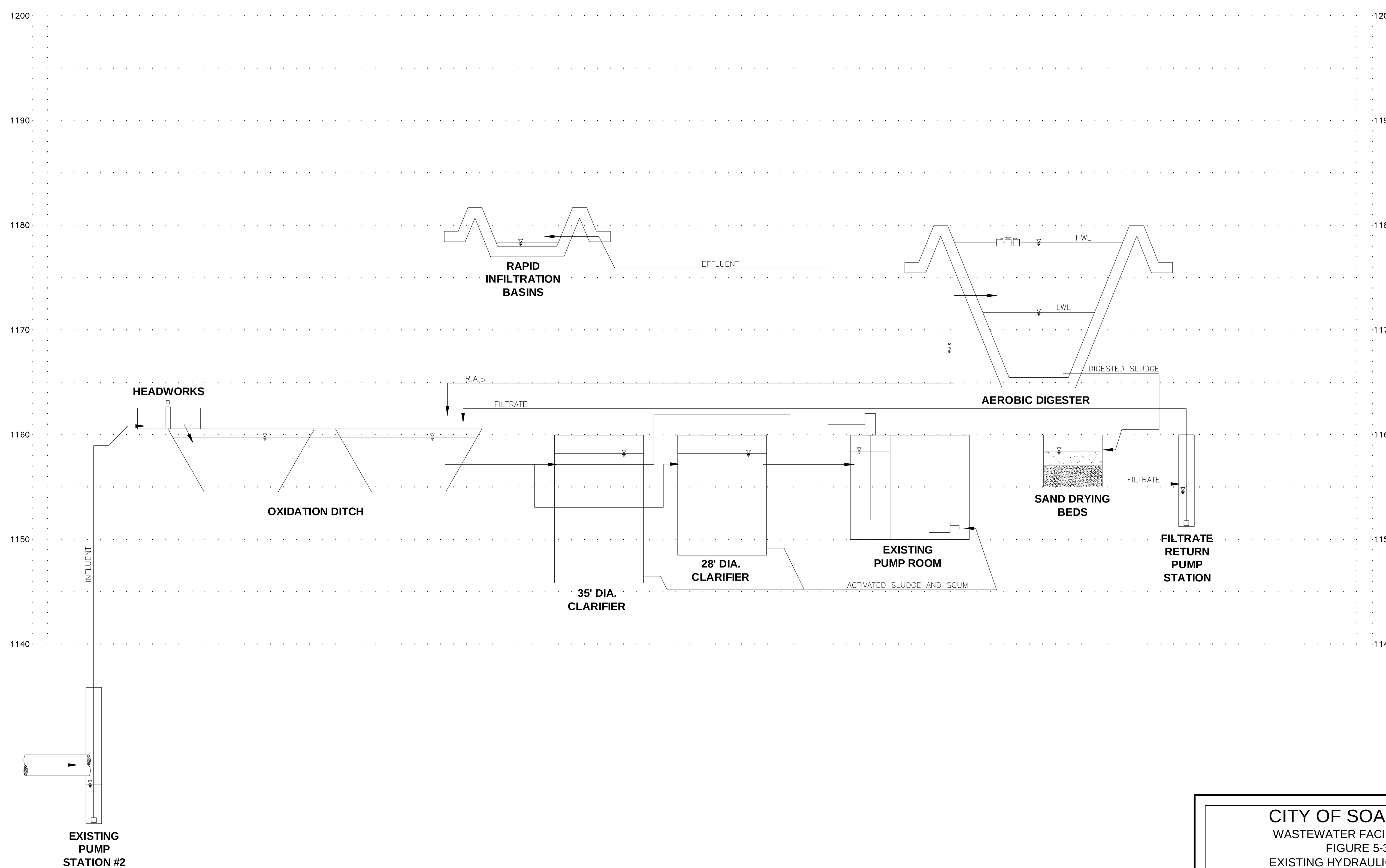


CITY OF SOAP LAKE

WASTEWATER FACILITY PLAN

FIGURE 5-3

EXISTING HYDRAULIC PROFILE

Gray & Osborne, Inc.

CONSULTING ENGINEERS

only rated for 465 gpm. However, the City has a backup lift station to provide additional pumping if a Lift Station No. 2 pump is out of service during high flow. Therefore, it is recommended that the City continue to exercise and maintain the backup lift station as an alternate approach to upsizing the Lift Station No. 2 to meet projected peak hour flows with a single pump.

Design criteria for the lift station are provided in Table 5-3.

TABLE 5-3

Existing Lift Station No. 2 Design Criteria

Parameter	Lift Station No. 2
Location	Canna St. N
Quantity of Pumps	2
Pump Type	Vacuum-primed centrifugal
Capacity @ TDH, each	465 gpm @ 120 ft
Motor	25 hp

WASTEWATER TREATMENT FACILITIES

GRINDER

Process Description

The grinder consists of a stationary, circular stainless steel screen and hardened stainless steel rotating cutter teeth driven by a small motor. The flow passes through the screen and rotating cutter teeth. The purpose of the grinder is to cut large solids into smaller solids to prevent accumulation of solids and plugging in downstream equipment. Raw wastewater from the City’s sewer collection system is pumped from Lift Station No. 2 into the concrete grinder structure. The operator has not had any significant problems with the grinder, although the quantity of grease and oils in the City’s influent make the equipment difficult to clean.

In 2007, WAC 173-308-205 was revised and states that all biosolids must be treated by a process such as physical screening or another method to significantly remove manufactured inerts prior to final disposition. By July 1, 2012 biosolids that are land applied, sold, or given away must contain less than one percent by volume recognizable manufactured inerts. Screening must employ openings of 3/8-inch or smaller in size.

It is recommended that an influent mechanical screen with ¼-inch openings be installed as soon as possible to reduce the amount of debris in the wastewater, thereby reducing operational problems, and to comply with WAC 173-308-205. The City was not able to meet the July 1, 2012 deadline, and the City’s oxidation ditch and aerobic digester contain shredded inerts at this time. As a result, the City will most likely be required to screen its biosolids prior to hauling them to Boulder Park until the quantity of inerts in the various structures at the WWTF has been adequately reduced. The piping layout from the aerobic digester to the sludge drying beds is conducive to temporary screening of biosolids, but it is not recommended as a permanent solution due to the significant benefit realized by removing debris upstream of the treatment process.

It is recommended that the grinder be removed from service once the screen is installed. The grinder structure is integral to the oxidation ditch structure, and therefore it is unlikely that the grinder structure will be demolished or otherwise removed. It is also recommended that grit removal facilities be constructed, as the current process does not remove grit from the influent wastewater, thereby filling the oxidation ditch and aerobic digester with grit over time, reducing their capacities.

Design criteria for the grinder are provided in Table 5-4.

TABLE 5-4

Existing Grinder Design Criteria

Grinder	
Quantity	1
Manufacturer	JWC
Model	Muffin Monster 30005-0018
Capacity	1.07 MGD
Motor Size	5 hp, 230V, 3-phase, 60 Hz

INFLUENT SAMPLER

Process Description

The influent sampler is located at the grinder structure. The sampler is an automatic composite sampler that takes samples once per hour over a 24-hour period. The sampler is not flow paced. Due to the generally good condition of the unit, it is recommended that the sampler be kept as part of the WWTF upgrades; however modifications will be necessary to ensure the sampler is flow paced and, therefore, the samples are more representative.

OXIDATION DITCH

Process Description

Effluent from the grinder flows by gravity to the oxidation ditch for biological treatment.

The oxidation ditch is a large, elliptical, reinforced concrete tank, which serves as the aeration basin for the activated sludge process. The liquid contents of the oxidation ditch are referred to as the “mixed liquor”. The mixed liquor is aerated, mixed, and propelled around the elliptical tank by two brush rotor aerators. The organic waste provides the food source for the bacteria in the mixed liquor. The aeration provides the oxygen required by the bacteria to assimilate and break down the organic waste. The bacteria use the biodegradable organic waste material as a source of energy (through oxidation) and as a source of carbon for cell synthesis (to produce new bacterial cells). The bacterial population is continually dying and being replaced by synthesis. Ideally, the biological activities in the treatment process will be balanced so as to maintain an adequate biological population to process the available food supply.

The rotational speed of the oxidation ditch rotors can be slowed with a VFD to reduce aeration while maintaining sufficient energy to provide mixing. This rotor speed control allows for creation of anoxic periods or cycles, which provide for assimilation of influent BOD_5 using nitrate (NO_3), produced under the preceding aeration cycle, as a source of oxygen. Since only non-filamentous bacteria are able to utilize nitrate in this manner, the anoxic cycle(s) also provide some degree of selection against filamentous bacterial growth. By maximizing the amount of influent BOD_5 consumed using nitrate, the periods of reduced rotor speed also provide improved total nitrogen removal and energy savings, since the rotor operation represents a significant portion of the facility’s energy use. This removal of nitrogen is necessary because the City’s State Waste Discharge Permit contains an effluent total nitrogen limit.

The oxidation ditch is equipped with an ORP control system capable of controlling the rotors to start and stop the anoxic cycle. However, the City does not use the control system and operates the rotors based upon 24-hour timers. The City has found that under existing conditions, this control method is adequate for meeting effluent total nitrogen limits.

The City replaced the rotor bearings in 2008 and has not had any significant problems with the rotors since that time.

Structural

The concrete tank appears to be in good condition and should be sufficient for the 20-year planning period. However, it is possible that there is a leak in the northeast corner of the structure. The operators have noticed the presence of green vegetation beyond the northeast corner of the ditch that only grows in that area. The operators have suspicions that there are periods when high flows and rotor operation raise the water level in the ditch rapidly, nearly overtopping the wall at this corner especially. Therefore, it is possible that the vegetation growth is a result of small, systematic wastewater spills at this location.

It is recommended that the operators watch for spills and the City consider evaluating the structural integrity of the oxidation ditch at this location in the future if wastewater spills are observed or considered likely. If there is evidence of spills, it is recommended that the structure’s wall be raised in this area.

Capacity

Oxidation ditch capacity requirements are dependent on three major design criteria. These criteria are solids retention time (SRT), net heterotrophic and autotrophic yields, and design mixed liquor suspended solids (MLSS) concentration. SRT is the criteria of greatest importance for nitrification. The City's State Waste Discharge Permit contains an effluent nitrogen limit, and therefore the WWTF is required to fully nitrify. Also, at the typical longer SRT used to provide stable operation and reduce waste sludge production, the system will provide nitrification.

The net specific growth rate of the nitrifying biomass is an order of magnitude lower than that of carbon oxidizing bacteria and is therefore used as the basis for determining the SRT of the aeration basin. Also, the SRT used to calculate the required value for nitrification must be the aerobic SRT since nitrification only occurs under aerobic conditions. Calculation of the required design SRT for the Soap Lake WWTF is provided below.

SRT Calculation

The first step in determining the required design SRT is to calculate the maximum specific nitrifier growth rate ($\mu_{n,m}$), decay rate (k_{dn}), and ammonia half saturation coefficient (K_N) using the following equations. The winter design temperature of 8°C is based on the historical low monthly temperature recommended by Dr. David Stensel (University of Washington Civil Engineering Department) in the system modeling performed in the Wastewater Treatment Facilities Engineering Report (November 1998, Hammond Collier & Wade-Livingstone).

$$\mu_{n,m,8} = (\mu_{n,m}) \times (\theta^{t-20}) = (0.75/d) \times (1.072^{8-20}) = 0.326/d$$

$$k_{dn,8} = (k_{dn}) \times (\theta^{t-20}) = (0.08 \text{ mg/L}) \times (1.029^{8-20}) = 0.057 \text{ mg/L}$$

$$K_{N,8} = (K_N) \times (\theta^{t-20}) = (0.74 \text{ mg/L}) \times (1.053^{8-20}) = 0.398 \text{ mg/L}$$

The numerical values for the various kinetic parameters above are typical for domestic wastewater.

Presently the City is required by the State Waste Discharge Permit to meet an average monthly effluent nitrogen concentration of 10 mg/L; to be conservative and provide a factor of safety the design total effluent nitrogen concentration is assumed to be 9 mg/L, with ammonia accounting for 1 mg/L of the total. Since anoxic operation of an oxidation ditch to remove nitrates by denitrification is not easily controlled, it is therefore assumed that effluent nitrate will comprise the majority of the effluent nitrogen. For the following calculations, a dissolved oxygen concentration (DO) of 2.0 mg/L, and an oxygen half saturation coefficient (K_O) of 0.5 mg/L are used. The design nitrifier growth rate is calculated as follows:

$$\mu_n = (\mu_{n,m,8})\left(\frac{N}{K_N + N}\right)\left(\frac{DO}{K_O + DO}\right) - k_{dn,8} = (0.326/d)\left(\frac{1.0}{0.398 + 1.0}\right)\left(\frac{2.0}{0.5 + 2.0}\right) - 0.057/d$$

This equation yields a net specific nitrifier growth rate of 0.130/d, which is then used to calculate the required SRT using the following equation:

SRT = $1/\mu_n$ = 7.7 days

Rounding up this value to provide a safety factor produces a required aeration basin SRT of 8 days. An additional safety factor is deemed unnecessary since there is no daily ammonia or nitrogen effluent limit.

The Soap Lake oxidation ditch is equipped to employ intermittent aeration to accomplish both nitrification and denitrification in a single tank. When the aeration is turned down, the tank essentially acts as an anoxic reactor as nitrate is used in lieu of oxygen for BOD_5 removal. During the anoxic period, the rotors slow down to provide limited mixing with minimal oxygen transfer, and nitrate is used as an electron acceptor.

The time for the anoxic and aerobic periods is important in determining the system's treatment performance. The following analysis determines the fraction of time the oxidation ditch must operate as an anoxic reactor and determines if the oxidation ditch has sufficient volume to maintain the required SRT.

The first step in determining anoxic time is the calculation of the specific denitrification rate (SDNR) with the following equations from Wastewater Engineering (Metcalf & Eddy, 2003):

$$SDNR = \frac{0.175 A_n}{Y_{net} SRT}$$

$$A_n = 1.0 - 1.42Y + \frac{1.42(k_d)(Y)(SRT)}{1 + (k_d)(SRT)}$$

$$Y_{net} = \frac{Y}{1 + (k_d)(SRT)}$$

Where:

SDNR	= specific denitrification rate, lb NO_3-N/lb biomass d
Y_{net}	= net yield for heterotrophic biomass, g VSS/g bCOD
A_n	= net oxygen utilization coefficient, lb O_2 / lb bCOD removed
SRT	= 8 days (from above)

$k_{d,t}$	= endogenous heterotrophic decay coefficient, d^{-1} = 0.075 / d (see below)
Y	= 0.40 lb/lb bCOD (typical for domestic wastewater)

The values for $k_{d,t}$ can be determined as follows.

$$k_{d,8^0} = (k_{n,\max})(\theta^{t-20}) = (0.12/d)(1.04^{8-20}) = 0.075/d \qquad \text{(typical for domestic wastewater)}$$

Therefore:

$$A_n = 1.0 - 1.42Y + \frac{1.42(k_d)(Y)(SRT)}{1+(k_d)(SRT)} = 1.0 - 1.42(0.4) + \frac{1.42(0.075)(0.4)(8)}{1+(0.075)(8)} = 0.64 \text{ lb/lb}$$

$$Y_{net} = \frac{Y}{1+(k_d)(SRT)} = \frac{0.4}{1+(0.075)(8)} = 0.250 \text{ lb/lb}$$

$$SDNR = \frac{0.175A_n}{Y_{net}SRT} = \frac{0.175(0.64)}{(0.250)(8)} = 0.056 \text{ lb } NO_3\text{-N/lb biomass/d}$$

To determine the amount of time the ditch must be operated in an anoxic cycle, the active biomass concentration must be calculated with the following equation:

$$X_b = \left(\frac{Q(SRT)}{V}\right)\left(\frac{Y(S-S_o)}{1+k_{dt}(SRT)}\right)$$

Where:

X_b	= active biomass concentration, mg/L
Q	= design flow, 0.32 MGD
V	= oxidation ditch volume, 0.300 MG
Y	= 0.40 lb/lb bCOD (from above)
SRT	= 8 days (from above)
$k_{d,t}$	= 0.075/d (from above)
S	= mass influent bCOD, taken as 1.6 x influent BOD_5 = 1,025 lb/d (641 lb/d x 1.6) = 384 mg/L
$S_{0.}$	= mass of effluent bsCOD, typical for 30 mg/L BOD_5 limit = 10 mg/L

Therefore:

$$X_b = \left(\frac{(0.32)(8)}{0.300}\right)\left(\frac{(0.4)(384-10)}{1+(0.075)(8)}\right) = 798 \text{ mg/L}$$

Using the specific denitrification rate (SDNR) of 0.056 lb NO_3-N per lb·d from above, the biomass is capable of denitrifying the following mass of nitrates:

$$Mass = (SDNR)(X_b)(V)\left(\frac{1lb}{453{,}592mg}\right)\left(\frac{1L}{0.264gal}\right) = \frac{(0.056)(798)(300{,}000)}{(119{,}748)} = 113 \text{ lb/d}$$

The actual mass of nitrates removed by nitrification depends on the duration of the daily anoxic period in the ditch. Estimating this removal can be determined by calculating that Soap Lake will discharge approximately 38 mg/L of nitrates without denitrification, or about 80% of the influent TKN. Assuming nitrates are reduced to 6 mg/L through the denitrification process and effluent organic nitrogen and ammonia are 2 mg/L and 1 mg/L, respectively (for a total nitrogen discharge of 9 mg/L), this effluent concentration results in a daily denitrification of:

$$(38-6)(0.32)(8.34) = 85 \text{ lb/d } NO_3\text{-N}$$

The amount of time that the oxidation ditch must be operated anoxically is therefore:

$$\frac{85}{113}\ \frac{lb/day}{lb/day} \times 24\frac{hr}{day} = 18.2\frac{hr}{day}$$

This anoxic period means that the oxidation ditch is therefore operated aerobically 5.8 hours per day. Since the SRT of 8 days required for nitrification is based upon 24 hours of aerobic performance, a total SRT based upon 5.8 hours of aeration per day is required.

$$\text{Total SRT } = \left(\frac{Aerobic\ \ SRT}{Aerobic\ \ hr/d/24}\right) = \frac{SRT_A}{\frac{5.8}{24}} = \frac{8}{\frac{5.8}{24}} = 33.1 \text{ days}$$

This new total SRT of 33.1 days affects the calculation of SDNR. Therefore, an iterative calculation process is performed to determine a new total SRT that is consistent with the design SRT_A of 8 days and the daily aerobic period duration. The iterative process results in a total required SRT of 21.4 days. The design daily anoxic period is 15.0 hours and the aerobic period is 9.0 hours.

In order to calculate the aerobic mass required for the design SRT, the net sludge production for the treatment system must first be estimated. Assuming a cell yield of 0.4

lb VSS/lb biodegradeable COD (bCOD), an influent wastewater and biomass VSS/TSS ratio of 0.85, and a design temperature of 8 ^{o}C, the total sludge production can be determined using the following equation:

$$P_X = \left[\frac{(Y)(S-S_0)}{(1+(k_{d,t})(SRT))0.85}\right] + \left[\frac{(f_d)(k_d)(Y)(S-S_0)(SRT)}{(1+(k_{d,t})(SRT))0.85}\right] + \left[\frac{(Y_n)(NO_x)}{(1+(k_{dn,t})(SRT_A))0.85}\right] + X_{iVSS} + X_{iTSS}$$

Where:

P_X = mass of waste activated sludge per day, lb/d (to be determined)
Y = heterotrophic cell yield = 0.40 lb/lb bCOD (from above)
Y_n = autotrophic cell yield = 0.12 lb/lb TKN (typical for domestic wastewater)
S = mass influent bCOD, taken as 1.6 x influent BOD_5 = 1,025 lb/d (from above)
S_0 = mass of effluent bsCOD, taken as 10 mg/L = 27 lb/d (from above)
f_d = fraction of cell mass remaining as cell debris = 0.15 lb/lb (typical for domestic wastewater)
$k_{d,t}$ = 0.075/d (from above)
$k_{dn,t}$ = 0.057 mg/L (from above)
SRT = solids retention time = 21.4 days (from above)
SRT_A = solids retention time = 8 days (from above)
X_{iVSS} = volatile nonbiodegradable solids, assumed volatile suspended solids (VSS) assumed to be 85 percent of influent TSS, volatile nonbiodegradable solids assumed to be 40 percent of VSS
= 0.4 x 0.85 x influent TSS = 225 lb/d
X_{iTSS} = influent nonvolatile suspended solids, assumed as 15 percent influent TSS = 99 lb/d
t = influent temperature = 8 ^{o}C
NO_x = amount of influent TKN oxidized to nitrate, assumed as 80% of influent TKN = 0.8 x 127 lb/d = 102 lb/d

The sludge production can then be calculated as follows:

$$P_X = \left[\frac{(0.4)(1{,}025-27)}{(1+(0.075)(21.4))0.85}\right] + \left[\frac{(0.15)(0.075)(0.4)(1{,}025-27)(21.4)}{(1+(0.075)(21.4))0.85}\right] + \left[\frac{(0.12)(102)}{(1+(0.057)(8))0.85}\right] + 225 + 99 = 558 \text{ lb/d}$$

This equation yields a total estimated waste sludge production of 558 lb/d. At the design SRT of 21.4 days, this waste sludge production results in a required total aerobic mass of 11,916 lbs. With a known aeration basin volume of 300,000 gallons, the required MLSS concentration is calculated to be 4,760 mg/L. It is therefore determined that if the aeration basin is operated at a mixed liquor suspended solids concentration of approximately 4,800 mg/L, the basin will operate at the desired aerobic mass and design

SRT. This concentration is high, but within the recommended range of MLSS concentrations for an oxidation ditch of between 3,000 and 5,000 mg/L. However, the secondary clarifiers are not large enough to receive an oxidation ditch effluent with a MLSS that concentrated. Therefore, additional aeration volume is required to provide the required aerobic mass at a lower MLSS concentration, or additional clarification area is required.

<u>Aeration Requirements</u>

To biologically oxidize the BOD_5 in the wastewater into bacteria and harmless end products, oxygen must be continuously added to the aeration basin. The required amount of oxygen consists of a carbonaceous oxygen demand and a nitrogenous oxygen demand.

The carbonaceous oxygen demand is calculated as follows:

$$Carbonaceous\, O_2 Demand = S - S_o - 1.42(P_{xbio})$$

Where:

- S = mass influent bCOD, 1,025 lb/d (from above)
- S_o = mass effluent bsCOD, 27 lb/d (from above)
- P_{xbio} = biodegradable biological mass, $0.85(P_X - X_{iVSS} - X_{iTSS})$
  = 0.85(558 lb/d – 225 lb/d - 99 lb/d) (P_X, X_{iVSS}, X_{iTSS} from above) = 199 lb/d

Therefore, the carbonaceous oxygen demand is 716 lb/d. The nitrogenous oxygen demand is calculated by first calculating the amount of nitrogen oxidized to nitrate:

$$Nitrogenous\, O_2 Demand = 4.33(TKN - NH_4 - 0.12(P_{xbio}))$$

Where:

- TKN = influent TKN, 127 lb/d (from above)
- NH_4 = effluent ammonia, 3 lb/d (assumed 1 mg/L concentration)
- P_{xbio} =199 lb/d (from above)

Therefore, the nitrogenous oxygen demand is 435 lb/d. As noted previously, one of the benefits of denitrification is the use of oxygen included in the nitrates. For each pound of nitrate nitrogen removed, 2.86 lbs of oxygen is produced, resulting in an oxygen credit of 244 lb/d (2.86 lb O_2 * 85 lb/d NO_3 removed). Therefore, the total oxygen demand is 907 lb/d, as determined below.

Total O_2 demand = Carbonaceous O_2 demand + Nitrogenous O_2 demand - Credit
= 716 lb/d + 435 lb/d – 244 lb/d = 907 lb/d

Applying a safety factor of 1.3 to account for fluctuations in diurnal loads results in a design oxygen demand of 1,179 lb/d.

Oxygenation equipment is specified based upon standard oxygen transfer rate (SOTR), the oxygen transfer rate in clean 20^{o}C water with no suspended solids, as opposed to actual oxygen transfer rate (AOTR). The SOTR is calculated as follows:

$$AOTR = SOTR\left(\frac{\beta C_{STH} - C_O}{C_{S20}}\right)\left(1.024^{T-20}\right)\alpha$$

Where:

α	= oxygen transfer correction factor, 0.9 (typical for this treatment process)
β	= salinity surface tension factor, 0.95
C_{STH}	= dissolved oxygen concentration at operating temperature and elevation = 9.8 mg/L
C_{S20}	= dissolved oxygen concentration at 20^{o}C and 1 atm, 9.08 mg/L
C_O	= operating dissolved oxygen concentration, 2 mg/L
T	= 15^{o}C (from Engineering Report (Wilson Engineering, 2000))

The resulting SOTR is therefore 1,832 lb/d delivered in 9.0 hours, or 204 lb/hr.

The existing rotors are each 14 feet long and operate at 11.4 inch immersion. Based upon manufacturer's information for these rotors, the oxygen transfer is 1,510 lb/d per rotor, or 63 lb/hr. With two rotors operating, the maximum SOTR from the existing rotors is 126 lb/hr, therefore the existing aeration system is undersized for the required aeration projection of 204 lb/hr. The Criteria for Sewage Works Design recommends that an oxidation ditch in a reliability class II facility, such as the Soap Lake WWTF, be provided with sufficient aeration with the largest capacity unit out of service. At existing conditions, the City does not meet these criteria, and it is projected that once the City population reaches approximately 1,691 people the City will not have sufficient aeration capacity with both rotors in service. At an annual growth rate of 1.5%, this is projected to occur in 2018.

Alkalinity Requirements

The stoichiometric reaction for the oxidation of ammonia nitrogen to nitrate shows that two moles of hydrogen are produced for every mole of ammonia nitrogen oxidized. In a wastewater treatment system, these hydrogen ions are neutralized by the wastewater's natural alkalinity (buffering capacity), preventing this acid condition from significantly reducing the pH within the treatment system. However, if the alkalinity present in the influent wastewater is not sufficient to neutralize the hydrogen ions released during nitrification, the pH within the system will begin to drop. This, in turn, can lead to low mixed liquor and effluent pH and a significant reduction in nitrification efficiency. An effluent pH value below 6 is a permit violation. Mixed liquor with pH readings outside the range from 7.2 to 8.0 can have an inhibitory effect on the nitrifying organisms.

To determine whether the alkalinity in the wastewater is sufficient, a nitrogen mass balance must be performed.

The first step is to determine how much nitrogen is in the waste cell tissue. The biodegradable biological mass of the waste activated sludge (WAS) was calculated to be 199 lb/d above, assuming that 0.12 lb N/lb of biomass is present results in 24 lb/d of nitrogen present in the waste cell tissue.

The mass of TKN oxidized (nitrification) and the mass of nitrates denitrified must be determined in order to calculate how much alkalinity is consumed and how much alkalinity is produced in the process. Following is the equation to determine the quantity of nitrates denitrified:

TKN Oxidized $= TKN - NH_4 - (0.12P_{x,bio})$
Nitrate Denitrified $= TKN - NH_4 - (0.12P_{x,bio}) - NO_3\text{-}N$

Where:

- TKN = influent TKN, 127 lb/d, (from above)
- NH_4 = effluent ammonia, 3 lb/d, (from above)
- $P_{x,bio}$ = biodegradable biomass wasted, 199 lb/d, (from above)
- NO_3-N = effluent nitrate mass 16 lb/d, (from above, based on 6 mg/L in the effluent)

These equations results in 100 lb/d of TKN oxidized to nitrates (nitrification) and 84 lb/d of nitrate denitrified. The amount of alkalinity consumed in the biological processes is calculated as follows:

$$\text{Consumption} = (\text{Nitrification})(7.14 \text{ mg } CaCO_3) - (\text{Denitrification})(3.57 \text{ mg } CaCO_3)$$

$$= (100 \text{ lbs/d TKN Oxidized})(7.14 \text{ mg } CaCO_3) - (84 \text{ lbs/d} \cdot NO_3\text{-N Denitrified})(3.57 \text{ mg } CaCO_3)$$

The total alkalinity consumed is calculated at 414 lb/d or 155 mg/L at a maximum monthly flow of 0.32 MGD. An alkalinity of 80 mg/L is required in the oxidation ditch to maintain a pH of 7.2. The total required alkalinity is 235 mg/L (155 mg/L + 80 mg/L).

The City's influent alkalinity is anticipated to be above 300 mg/L based on sampling performed for the Engineering Report (Hammond, Collier & Wade-Livingstone, 1998). This demonstrates that at the projected influent flows and loadings it is not anticipated that alkalinity consumption and low effluent pH will be a problem for the City.

Design criteria for the oxidation ditch are provided in Table 5-5.

TABLE 5-5

Existing Oxidation Ditch Design Criteria

Oxidation Ditch	
Volume	300,000 gal
Channel Width	25.5 ft
Side Water Depth	4 ft
Brush Rotors	
Quantity	2
Rotor Length	14 ft
Rotor Diameter	42 in
Motor	20 hp, 480 V, 3 phase

SECONDARY CLARIFIERS

Process Description

Following biological treatment, effluent from the oxidation ditch flows by gravity into one or more of the two circular secondary clarifiers. The secondary clarifiers provide a quiescent environment where settleable solids are separated from the flow by gravity sedimentation. Settled sludge is transported by mechanically operated rotating rake arms along the floor of the clarifier to a central hopper. Solids are removed from the hopper for return to the oxidation ditch by means of the return activated sludge (RAS) pump located in the Operations Building. Scum is pumped from the system by a scum pump located in the Operations Building. Effluent exits the clarifiers by passing over a weir launder located around the center column.

Structural

Both clarifiers appear to be in good structural condition, and should be sufficient for the 20-year planning period. However, it is recommended that the mechanism for Secondary Clarifier No. 1 be painted.

The operators have indicated that Secondary Clarifier No. 2 is constructed at a higher elevation than Secondary Clarifier No. 1. As addressed below, this negatively impacts the City's ability to operate the clarifiers in parallel.

Capacity

Wastewater Engineering (Metcalf & Eddy, 2003) recommends a maximum surface loading rate of 400-700 gpd/ft^2 at a maximum month flow and 1,000-1,600 gpd/ft^2 at peak hour flow for properly designed and operated clarifiers. Because the City's clarifiers are shallow (10 feet) and have an inefficient peripheral feed design, it is recommended that the design criteria for these clarifiers be reduced to 60% of the typical design criteria. Therefore, a maximum surface loading rate of 240-420 gpd/ft^2 at maximum month flow and 600-960 gpd/ft^2 at peak hour flow should be used to evaluate the clarifiers.

Also, as noted in the Criteria for Sewer Works Design, in order to meet Ecology's reliability standards for a reliability class II facility, one secondary clarifier must be capable of treating 50 percent of the design flow when the largest clarifier is out of service. For the City of Soap Lake, this criteria applies to Secondary Clarifier No. 1 because it is the smaller clarifier. Ecology's reliability standards also require at least two secondary clarifiers to be constructed to allow one tank to be removed from service for inspection, maintenance, and repairs.

As shown in the tables below, both clarifiers are capable of meeting the recommended overflow rates if the flow is split between the clarifiers. Due to the differing surface areas, it is recommended that the flow be split 39 percent to Secondary Clarifier No. 1 and 61% to Secondary Clarifier No. 2 to provide equal loading when both units are in operation. However, that is not currently possible due to the lack of a splitter box to divide the flows. As a result, the clarifiers meet the short term reliability standards in the Criteria for Sewer Works Design (each clarifier capable of treating 50 percent of the design flow), but for long term operation, flows cannot be split between the two clarifiers to treat 100% of the flow. Therefore, it is recommended that the clarifiers be modified to allow them to be operated in parallel. It is also recommended that a splitter box be installed to split the flows between the clarifiers proportionately to their surface areas so that the clarifiers are equally loaded when they are both in operation.

In addition to recommendations for surface loading rates, Wastewater Engineering recommends solids loading rates of 24-36 $lb/ft^2/d$ at a maximum month flow and 43 $lb/ft^2/d$ at peak hour flow. For the Soap Lake clarifiers, due to the shallow depth, these criteria should be decreased to 14.4 – 21.6 $lb/ft^2/d$ at maximum month flow and 25.8 $lb/ft^2/d$ at peak hour flow. As shown in the design criteria table below, Secondary Clarifier No. 1 is capable of meeting these criteria at the projected flows only if the MLSS concentration is 3,000 mg/L or lower. This condition further confirms that the biological process requires additional reactor volume, as it was previously determined that a MLSS concentration above 4,700 mg/L would be required to continue using only the existing oxidation ditch for biological treatment.

Design criteria for the secondary clarifiers are provided in Table 5-6.

TABLE 5-6

Existing Secondary Clarifiers Design Criteria

Secondary Clarifier No. 1	
Type	Circular; Peripheral Feed; Center Withdrawal
Diameter	28 ft
Side Water Depth	10 ft
Surface Area	616 ft^2
50% of Flow (Reliability Assessment)	
MMF Surface Overflow Rate @ 0.16 MGD	260 gpd/ft^2
PHF Surface Overflow Rate @ 0.47 MGD	755 gpd/ft^2
MMF Solids Loading Rate @ 0.32 MGD (1) MLSS 3,000 mg/L	13.0 $lb/ft^2/d$
PHF Solids Loading Rate @ 0.63 MGD (1) MLSS 3,000 mg/L	25.4 $lb/ft^2/d$
39% of Flow (Operational Assessment)	
MMF Surface Overflow Rate @ 0.12 MGD	203 gpd/ft^2
PHF Surface Overflow Rate @ 0.36 MGD	589 gpd/ft^2
MMF Solids Loading Rate @ 0.24 MGD (1) MLSS 3,000 mg/L	10.1 $lb/ft^2/d$
PHF Solids Loading Rate @ 0.48 MGD (1) MLSS 3,000 mg/L	19.8 $lb/ft^2/d$
Motor	0.5 hp

(1) RAS flow assumed as 50% of MMF.

Secondary Clarifier No. 2	
Type	Circular; Peripheral Feed; Center Withdrawal
Diameter	35 ft
Side Water Depth	10 ft
Surface Area	962 ft^2
50% of Flow (Reliability Assessment)	
MMF Surface Overflow Rate @ 0.16 MGD	166 gpd/ft^2
PHF Surface Overflow Rate @ 0.47 MGD	483 gpd/ft^2
MMF Solids Loading Rate @ 0.32 MGD (1) MLSS 3,000 mg/L	8.3 $lb/ft^2/d$
PHF Solids Loading Rate @ 0.63 MGD (1) MLSS 3,000 mg/L	16.3 $lb/ft^2/d$
61% of Flow (Operational Assessment)	
MMF Surface Overflow Rate @ 0.20 MGD	203 gpd/ft^2
PHF Surface Overflow Rate @ 0.57 MGD	590 gpd/ft^2
MMF Solids Loading Rate @ 0.40 MGD (1) MLSS 3,000 mg/L	10.2 $lb/ft^2/d$
PHF Solids Loading Rate @ 0.77 MGD (1) MLSS 3,000 mg/L	19.8 $lb/ft^2/d$
Motor	0.5 hp

(1) RAS flow assumed as 50% of MMF.

In addition to hydraulic issues associated with differing floor and overflow elevations in the clarifiers, the clarifiers have historically had poor settling sludge as a result of the bacterial population in the oxidation ditch. The Sludge Volume Index (SVI) should be maintained below 150 mL/g to enable operation at the loading rates shown above. In an oxidation ditch, there are many varieties of bacteria, including both floc-forming and filamentous types. Floc-forming bacteria typically produce dense flocs that have high settling velocities and compact well. Filamentous bacteria are generally long and thin with many branches.

At the high concentrations typical of activated sludge, filamentous bacteria form flocs that are not tightly compacted, partially due to the protruding filaments that increase the surface area and volume of the floc, but do not increase the mass. Therefore, the density of the resulting filamentous bacteria flocs are low compared to those of floc-forming bacteria. Since settling velocity is dependent upon density, the settling velocity of the filamentous bacteria is less than that of floc-forming bacteria. Consequently, the mixed liquor solids settle slowly and do not compact well. This condition is indicated by a high (>150 mL/g) SVI for the mixed liquor solids.

A common approach to control filamentous bacteria growth is the use of a bioselector upstream of the oxidation ditch. A bioselector is a series of small, mixed tanks in which the RAS and influent are combined in an environment favorable to the growth of floc-forming bacteria. Adding bioselectors to the WWTF upstream of the oxidation ditch will cause the sludge to settle more effectively, resulting in a low SVI (<150 mL/g) and higher quality effluent. For this reason, it is recommended that the City construct bioselectors as part of the WWTF improvements.

EFFLUENT FLOW METER

Process Description

A 6-inch magnetic flow meter is located in the piping into the chlorine contact chamber from the secondary clarifiers. The flow meter has a range of 0-4,300 gpm, which is sufficient for the 20-year planning period. The City has not calibrated this flow meter in recent years, so it is recommended that it be calibrated as soon as possible. To do this, it is recommended that a new magnetic flow meter be purchased and installed to enable the existing flow meter to be removed and sent to the manufacturer for calibration.

The flow meter installation also does not have the manufacturer-recommended length of straight 6-inch pipe upstream and downstream of the meter, so it is recommended that the piping be modified to provide the recommended run of straight pipe for the flow meter.

CHLORINE CONTACT TANK

Process Description

At present there is no disinfection of the wastewater effluent that is discharged from the WWTF. The City is not required to provide disinfection since the existing permit limits do not include a fecal coliform limit.

Prior to constructing the rapid infiltration basins and removing an effluent spray system from service, the City historically operated a chlorine contact tank for disinfection. Wastewater still flows through the tank prior to discharge, but no chemicals are added.

Design criteria for the chlorine contact tank are provided in Table 5-7

TABLE 5-7

Existing Chlorine Contact Tank Design Criteria

Chlorine Contact Tank	
Surface Area	170 ft^2
Side Water Depth	10 ft
Volume	12,500 gallons

EFFLUENT PUMPS

Process Description

The effluent pump station pumps effluent from the chlorine contact tank to the rapid infiltration basins for final disposal. The wet well is located in the Operations Building.

Capacity

Per the Criteria for Sewage Works Design, it is recommended that effluent pumps be designed to pump peak hour flow with the largest pump out of service. Based on a projected PHF of 0.93 MGD (646 gpm), the pumps have sufficient capacity for the 20-year planning period if both pumps are in operation. The existing peak hour flow conditions currently require the second pump to operate; therefore this improvement is currently required to meet redundancy requirements. To provide the required redundancy, it is recommended that a third pump be installed.

Design criteria for the effluent pumps are provided in Table 5-8.

TABLE 5-8

Existing Effluent Pumps Design Criteria

Effluent Pumps	
Quantity	2
Type	Vertical Turbine
Capacity @ TDH	340 gpm @ 44 ft
Motor	7.5 hp

EFFLUENT SAMPLER

Process Description

The effluent sampler is located in the Operations Building near the effluent pumps and samples effluent flowing to the effluent pump wet well. The sampler is an automatic composite sampler that takes samples once per hour over a 24-hour period. The sampler is not flow paced. Due to the generally good condition of the unit, it is recommended that the sampler be kept as part of the WWTF upgrades; however modifications will be necessary to ensure the sampler is flow paced and, therefore, the samples are more representative.

RAPID INFILTRATION BASINS

Process Description

The City's final effluent is pumped to one of six rapid infiltration basins that were constructed as part of the 2004 upgrades to replace the undersized City drainfield. The total area of the basins is 2.6 acres. During the summer, effluent is applied to a particular basin for 7-9 days, and then flow is switched to the next basin. During the winter, the application period is approximately 9-12 days. The operator has not reported any significant issues with the infiltration basins.

Capacity

Per the Predesign Report (Wilson Engineering, 2001) for the facility upgrade that constructed the rapid infiltration basins, the rapid infiltration basins are designed to accommodate an infiltration rate of 6.0 in/hr at a maximum nitrogen loading of 10 mg/L, an application period of 7-12 days dependent on the season, and a drying period of 10-16 days, dependent on the season. Assuming a single infiltration basin is online at a given time, the basins are large enough for a flow of 1,010 gpm, or 1.45 MGD. The basins are therefore large enough to adequately infiltrate the flow for the 20-year planning period. If the City continues rotating flows through the basins sequentially, there are a sufficient number of basins to allow a given basin to be dried for the required time period prior to being placed in to service again. The operators have indicated that the rapid infiltration basins operate as designed, and their experience confirms that the basins have significant capacity remaining.

Design criteria for the rapid infiltration basins are provided in Table 5-9.

TABLE 5-9

Existing Rapid Infiltration Basins Design Criteria

Rapid Infiltration Basins	
Quantity	6
Floor Dimensions, each	262’0” L x 62’0” W
Side Slope	2:1
Basin Depth	4.5 ft
Volume, each	648,600 gallons
Design Infiltration Rate	6.0 in/hr
Summer Application Period	7-9 days
Winter Application Period	9-12 days
Summer Drying Period	10-15 days
Winter Drying Period	12-16 days
Maximum Nitrogen Loading	10 mg/L

SOLIDS TREATMENT FACILITIES

The City’s solids treatment facilities consist of an aerobic digester, sludge drying beds, and a sludge storage pad. The City uses the digester for partial treatment and to reduce sludge volume, and the sludge drying bed process is used to achieve Class B biosolids criteria. Air drying in sand drying beds is designated by WAC 173-308 as a process to significantly reduce pathogens (PSRP) that is capable of meeting Class B pathogen reduction requirements if the biosolids are dried for a minimum of three months with at least two of the months having an ambient average daily temperature of at least 32 ^{o}F. Vector attraction reduction requirements are satisfied if the concentration of the volatiles solids in the biosolids is reduced by 38 percent during the digestion process.

Following is an analysis of the solids handling treatment facilities.

RETURN ACTIVATED SLUDGE SYSTEM

Process Description

Return activated sludge (RAS) is pumped from the secondary clarifiers to the oxidation ditch to maintain a concentrated biomass in the oxidation ditch. There are two RAS pumps located in the lower level of the Operations Building. The RAS from the secondary clarifiers is combined in a single withdrawal pipe and the clarifiers are not hydraulically independent, so the clarifiers cannot be operated independently. The existing pumps are non-clog, dry-pit centrifugal pumps rated at 200 gpm @ 25 feet TDH. The pumps are controlled by operator-adjustable VFDs. It is recommended that the RAS piping be modified to hydraulically isolate the RAS operation of each clarifier.

The pumps have packing to seal the shaft, and this packing requires a liquid media for lubrication. Typically, the source of water for seal water is either potable or non-potable water. However, currently the pumps' seal water is the RAS that is being handled by the pump. Utilizing sludge as the lubrication media results in poor cooling and eventually packing failures. To compensate for these problems, the operator has loosened the packing to allow sludge to leak more freely without the risk of plugging the packing. The sludge leaks to the floor where it is pumped by a sump pump back to the oxidation ditch.

The sludge leaking to the floor has created unsanitary conditions for the operator, and a very corrosive environment has been created as a result. The pumps were replaced in 2010, although the original motors are still in service. After approximately seven years of service, the electrical stanchions in the area have a significant amount of visible rust. The MCCs in the upper level of the building are currently exposed to a damp and corrosive environment that over time will contribute to accelerated deterioration of the electrical components.

The location of the pumps inside of an enclosed room also has implications for the installation of additional electrical gear in the future. Per NFPA 820 Standard for Fire Protection in Wastewater Treatment and Collection Facilities (2008 Edition), the RAS pumps create a classification for the entire room and any rooms connected to it without sufficient ventilation. This classification is based upon the likelihood of explosive gases such as methane forming in wastewater and the possibility that a buildup of gases within the classified area could lead to an explosive condition. Within these spaces, electrical equipment must be designed specifically for operation within a potentially explosive atmosphere. In many cases this is achieved through the installation of an explosion-proof motor or similar design modifications that protect the electrical components. However, these modifications add cost to equipment. An alternate means of addressing the NFPA standards is to ventilate the classified space to remove the need for expensive equipment replacement and upgrades. In the case of the Operations Building, ventilation of the RAS room would be expensive due to the size of the space and the heating requirements associated with maintaining non-freezing conditions in the room during the winter while simultaneously ventilating the space at all times.

For these reasons, it is recommended that the pumps be modified to utilize non-potable water in lieu of RAS for seal water or the RAS pumps be moved to a new location. For similar reasons, it is recommended that the scum pumps be moved to a new location with the RAS pumps when this work is undertaken.

Capacity
In addition to the problems created by utilizing RAS for seal water in the RAS pumps, the RAS system experiences low velocities in the sludge piping. Typical RAS flowrates are approximately equal to 50 percent of MMF, which is equal to 0.16 MGD for the 20-year planning period, or 111 gpm. Most of the RAS piping is 8-inch ductile iron, which at 111 gpm results in a velocity of 0.7 ft/s. This velocity is not sufficient to prevent solids from settling in the pipe. Scouring velocities are typically above 2 ft/s.

The operator has recognized this problem and uses the VFDs to speed up the pumps periodically during the week to keep the lines clear. This mode of operation appears to be a sufficient solution and has kept the pipes from plugging. It is recommended that the PLC be programmed to periodically speed the pumps up automatically. This solution will more reliably address the problem and ensure the solids are not settling in the pipes.

The City wastes sludge to the digester once per week, typically 8 hours on a Friday. This type of wasting schedule can result in a highly variable mixed liquor concentration at the oxidation ditch. Large swings in MLSS concentration are expected to compromise the ability of the treatment process to provide reliable nitrification.

To remedy this problem, it is recommended that the RAS system be modified to allow small volumes of sludge to be wasted more often.

Assuming that the RAS rate will be equal to 50 percent of MMF, the existing 200 gpm pumps will accommodate a MMF of 0.58 MGD with one pump out of service for reliability. This is greater than the projected MMF of 0.32 MGD, therefore the RAS pumps have adequate capacity for the planning period.

Design criteria for the RAS pumps are provided in Table 5-10.

TABLE 5-10

Existing RAS Pumps Design Criteria

RAS Pumps	
Quantity	2
Type	Non-Clog Dry-Pit Centrifugal
Capacity @ TDH	200 gpm @ 25 ft
Motor	5 hp

AEROBIC DIGESTER

Process Description

The solids that are not returned to the activated sludge process (oxidation ditch) from the clarifiers are called waste activated sludge (WAS) and are pumped to the aerobic digester. The ability to remove, stabilize, and dispose of WAS from the treatment process is one of the major factors which determines the capacity of the treatment plant. There are three fundamental elements in the State biosolids management regulations that establish the minimum criteria for biosolids disposal: pollutant concentration (primarily metals), pathogen reduction, and vector attraction. Currently, the Soap Lake WWTF meets the state requirements for pollutant concentration, pathogen reduction, and vector attraction for Class B biosolids. The solids are currently hauled off site to a permitted facility for final disposal.

Pathogens are destroyed during the aerobic digestion process since the digester's oxidizing environment is very hostile to most pathogenic microorganisms. The lack of soluble organic matter in the waste sludge creates an endogenous environment where the bacteria must feed off their own cell matter. Since the bacteria consume cell matter, the aerobic digestion process is capable of significantly reducing the mass of solids in the digester. Not all of the solids are capable of being destroyed through digestion since some of the solids are inert and non-biodegradable. The aerobic digestion process is capable of destroying approximately 38 percent of the total solids by weight pumped to the digester.

The Soap Lake digester is a lined, open-air basin. Depending on the water surface elevation, the basin water depth ranges from 7 to 12 feet, and the volume ranges from 240,000 to 570,000 gallons. Biosolids flow out of the basin by gravity to the sludge drying beds from a pit on the bottom of the basin. The digester is equipped with two floating aerators that are designed to mix the contents and transfer oxygen into the digester to promote biological degradation of the solids. The aerators operate by drawing (aspirating) atmospheric air into the water and diffusing the oxygen in fine bubbles into the water.

Design criteria for the aerobic digester are provided in Table 5-11.

TABLE 5-11

Existing Aerobic Digester Design Criteria

Aerobic Digester	
Floor Dimensions	52’0” L x 52’0” W
Basin Depth	7 - 12 ft
Volume	240,000 to 570,000 gallons
Aerators	
Quantity	2
Type	Floating Aspirator
Dimensions	5’7” L x 1’3” W
Motor	5 hp, 230/460 V, 3 phase, 60 Hz

Gray & Osborne, Inc. was hired in 2007 to evaluate the aeration system in the aerobic digesters and recommend alternatives. As noted in the letter (Appendix D), the City has experienced continual problems with the aeration system. Although the aerobic digester is equipped with aspirating aerators, they are not used because rags and tumbleweeds bind the aerators and cause the aerator bearings to fail. Several times per year, when the operator wastes biosolids to the drying beds, the inadequate aeration causes a major odor problem near the WWTF.

Another issue with the aspirating aerators is that they are intended to provide mixing of the digester in addition to providing the required oxygen. The City has observed that the aerators do not provide sufficient mixing and severe odors occur while running the aerators. These conditions indicate that the oxygen demand is not being met and the aspirating aerators are undersized for mixing the basin. Therefore, it is recommended that the City replace the aeration system with a new aeration system and install a mixing system if the new aeration system does not provide adequate mixing.

As addressed in the oxidation ditch analysis performed previously, the City will generate 558 lb/d of WAS, or approximately 6,690 gal/d at a concentration of about 10,000 mg/L. It is recommended that a floating decanter be installed to allow the digester to be decanted. Decanting of clear liquid from the surface of the digesters should allow the digesters to be operated at approximately 1.5 to 2 percent solids.

WAC 173-308-170 requires that biosolids must be agitated with air or oxygen to maintain aerobic conditions for a mean cell residence time (MCRT) between 40 days at 20^{o}C and 60 days at 15^{o}C. Due to the climate at Soap Lake, the aerobic digestion should be designed for a 60-day MCRT, as the average temperature reaches 20^{o}C only three months of the year. The projected MCRT is calculated as follows:

Solids Waste Rate	= 558 lb/d (from above)
Volatile Solids Content	= 70% (typical for domestic wastewater)

	= 391 lb/d (Solids Waste Rate * 70%)
Volatile Solids Destruction	= 38% (required by WAC 173-308) = 149 lb/d (Volatile Solids Content * 38%)
Solids Wasted from Digester	= 558 lb/d – 149 lb/d = 409 lb/d
Solids in Digester	= Solids Content * 8.345 * Digester Volume = 0.015 * 8.345 * 240,000 gal = 30,000 lb
MCRT	= Solids in Digester / Solids Wasted from Digester = 30,000 lb / 409 lb/d = 74 days

Therefore, the digester is projected to be large enough for the 20-year planning period if a floating decanter is installed to decant supernatant from the surface of the tank. Furthermore, the analysis was performed assuming a digester volume of 240,000 gallons, which is the lowest operating level. The digester has sufficient volume to reduce the need for the decanter, but it is recommended that the City thicken the digester contents regularly to reduce the water content of the digested solids that are placed in sludge drying beds. This will increase the capacity of the drying beds and reduce sludge hauling costs. Thickening of the digester contents from 1 percent solids to 1.5 to 2 percent solids will result in a recovery of 33 to 50 percent of the water that is currently dewatered via solar drying, which will increase the efficiency of the process and increase the capacity of the sludge drying beds.

SLUDGE DRYING BEDS

Process Description

Digested sludge from the aerobic digester is drained to the sludge drying beds. The drying beds consist of a shallow layer of sand over a layer of granular support material separated by low concrete walls. The sand allows water to percolate, leaving the drained biosolids on the surface for solar drying. There are a total of six drying beds. A drain system runs between the beds to remove the drained water from the sludge, although the drain piping has been crushed and no longer functions. It is recommended that the drain piping be repaired or replaced to allow the drying beds to be operated as designed.

Furthermore, the splitter box that diverts sludge to the beds contains only one functional valve, so when WAS is drained from the digester, it is not currently possible to prevent sludge flow in to the majority of the beds. It is recommended that the valves be replaced to allow the drying beds to be isolated, and therefore prevent WAS flow in to drying beds that contain dry biosolids, re-wetting the solids in the process.

The operator has also requested that the drying beds be paved to reduce the required maintenance. Partially because of the non-functional drains, the sand beds dry on the surface, but the majority of the sludge does not dry. The City cannot use a front loader or other mechanical equipment to agitate the sludge because the equipment sinks in the sand and may further damage the drain system; therefore the City relies upon labor-intensive manual operations to agitate the sludge. It is recommended that the sludge drying beds be paved to allow mechanical equipment to be used in the beds.

Design criteria for the sludge drying beds are provided in Table 5-12.

TABLE 5-12

Existing Sludge Drying Beds Design Criteria

Sludge Drying Beds	
Quantity	6
Floor Dimensions	80’0” L x 20’0” W
Depth Above Sand	3 ft
Total Area	9,600 ft^2

<u>Wastewater Engineering</u> recommends that paved drying beds be designed to dewater solids through drainage in addition to evaporative drying. The required drying bed area is calculated as follows:

$$Area = \frac{1.04(S)\left(\frac{1-s_d}{s_d} - \frac{1-s_e}{s_e}\right)}{10(k_e)(E_p) - 1000P}$$

Where

A	= sludge drying bed area, m^2
S	= digested sludge production, dry solids, kg/yr = 409 lb/d =67,700 kg/yr
s_d	= percent dry solids after gravity drainage = 0.10 (assumed)
s_e	= percent dry solids after evaporation = 0.85 (assumed)
k_e	= reduction factor for evaporation of sludge = 0.60 (typical)
E_p	= free water pan evaporation rate, cm/yr = 124.5 cm/yr in Soap Lake
P	= annual precipitation, m/yr = 0.19 m/yr in Soap Lake

The resulting required sludge drying bed area is therefore 1,120 m^2, or 12,000 ft^2. As shown above, the City has approximately 9,600 ft^2 of sludge drying beds, so the sludge drying beds have insufficient capacity for the 20-year planning period. It is therefore recommended that the City construct additional drying beds or add polymer to the digested sludge to increase the drainage efficiency of the sludge. It is estimated that the drying beds existing capacity will be sufficient until approximately 2017, assuming annual growth of 1.5%.

FILTRATE RETURN PUMP STATION

The liquid that drains from the sludge drying beds enters a manhole located on the north end of the walkway between the older drying beds and newer drying beds. When the manhole fills, a submersible pump in the manhole pumps down the manhole into the oxidation ditch. The City has indicated that the pump still works well, although it only operates during storm events because the sludge drying beds no longer drain into the pump station as designed. The City has confirmed that the pump can be replaced easily if necessary; therefore it is assumed that the pump station will serve the City's needs for the 20-year planning period.

NONPOTABLE WATER SYSTEM

The WWTF currently uses water throughout the facility for uses that do not require potable water. This primarily consists of yard hydrants for washdown water. The consumption of potable water is likely to increase as the WWTF is upgraded over time. It is recommended that the City install a nonpotable water system to use WWTF effluent instead of potable water wherever possible.

It is also recommended that the site piping be modified to provide proper cross connection control. Potable water enters the WWTF through a backwash prevention assembly, but there is not subsequent backflow prevention downstream of the assembly. Per the Department of Ecology Criteria for Sewage Works Design, it is recommended that there be an approved backflow prevention assembly to isolate various portions of the system including the lab, bathrooms, and site piping.

OPERATIONS BUILDING

The Operations Building appears to be in good condition, and City personnel have confirmed that the building is suitable for continued use. However, as indicated below, the location of the RAS pumps and motor control centers in the same room is a violation of the electrical code.

ELECTRICAL SERVICE

The existing plant electrical distribution system consists of a 240/120 volt, 3-phase 4-wire distribution system served from Grant County PUD through a pad-mounted transformer. The electrical service feeds a motor control center for the facility through a 600 amp circuit breaker. The circuit breaker and motor control center are located in the Operations Building. The motor control center feeds a power panel and lighting panel which subsequently provide power to ancillary systems and lighting throughout the facility.

The motor control center also provides an electrical service through a 200 amp harmonic conditioner to the variable frequency drive room located on the first floor. The variable frequency drive room contains a VFD cabinet for the two oxidation brush rotor VFDs and the two RAS pump VFDs. The VFD equipment was installed in the 2003 upgrade.

The existing service from Grant County PUD is an unusual voltage, and the PUD no longer supports the existing transformer. According to the Grant County PUD service department, the City will be required to upgrade the transformer either when it fails or when a future WWTF upgrade increases the electrical loading of the facility.

The motor control center and panelboards are over 35 years old. Based on the existing loads served from the 240/120 volt service, the existing distribution system appears to have the capacity to serve some limited new loads. However, the distribution equipment is located in a corrosive environment inside the same room as the RAS pumps. Because of the operating environment, the life expectancy of the motor control center and panels is reduced.

According to the City's SWD permit the City must ensure that adequate safeguards prevent the discharge of untreated wastes or wastes not treated in accordance with the requirements of the permit during electrical power failure at the treatment plant. Adequate safeguards include, but are not limited to alternate power sources, standby generator(s), or retention of inadequately treated wastes. Presently the City does not have an alternative source of power, a generator, nor does it have the ability to retain inadequately treated wastes. In the event of a power failure the wastewater bypasses the effluent pump station and is discharged to the drain field. The biota in the oxidation ditch cannot be maintained in an extended power outage.

The existing power distribution system does not meet with the EPA reliability criteria which require each of the plant critical loads to be connected to redundant busses in order to prevent a single point of failure on the distribution system.

Solutions to the electrical problems described above will be further explored in Chapter 6.

OPERATIONS

STAFFING

To assist the City in operating the WWTF in an efficient manner, an operation and maintenance manual for the WWTF has been developed. A copy of the manual is located in the operations building for operator reference. The manual was updated in 2004.

The U.S. Environmental Protection Agency (EPA) developed a methodology for estimating wastewater treatment plant staffing requirements in their 1973 publication, Estimated Staffing for Municipal Wastewater Treatment Facilities. The methodology is based upon the size of the treatment facility, its layout, the treatment components utilized, monitoring and testing requirements, and other factors. A spreadsheet utilizing this approach is included in Appendix F. The analysis is consistent with the Engineering Report (1998), which determined that the facility would only require a single operator once upgraded to its current state.

It is recommended that the City use the O&M manual for the facility in scheduling maintenance in accordance with the various equipment manufacturers' recommendations. The City currently has one full-time employee at the WWTF, but the total hours estimated to operate the facility may require that the operator be provided assistance periodically due to the nature of the work and the efficiency of some tasks when performed with multiple personnel. Furthermore, involving multiple City employees in the operation of the WWTF will have the benefit of cross-training employees and creating a more versatile staff.

The Department of Ecology requires that the City have a licensed back-up operator for periods when the operator is sick, on vacation, attending a training workshop, or otherwise unavailable for operating the WWTF. Therefore, it is recommended that the City locate and contract with a licensed operator in the vicinity or begin the process of certifying another City employee to address this requirement

LABORATORY

Per Section S2.D. of the City's State Waste Discharge Permit, the City must ensure that all monitoring data required by Ecology is prepared by a laboratory registered or accredited under the provisions of chapter 173-50 WAC, *Accreditation of Environmental Laboratories*. The City has a policy to have its laboratory accredited annually in June and is currently accredited. It is recommended that the City continue this practice.

ESTIMATED ANNUAL O&M

Based upon the existing O&M costs for the sewer utility, Table 5-13 summarizes the projected annual O&M costs presented in 2012 dollars.

TABLE 5-13

Estimated Annual O&M Cost for the Sewer Utility [1]

Item	Total
Salaries and Benefits	$130,000
Utilities	$40,000
Supplies	$20,000
Equipment Repair and Maintenance	$20,000
Professional Services [2]	$15,000
Miscellaneous	$15,000
Total Estimated O&M Costs	**$240,000**

(1) Based on historic expenditures.
(2) Includes biosolids land application costs

SUMMARY OF DEFICIENCIES

Based on the analysis above, a summary of the deficiencies at the Soap Lake WWTF are provided below.

1. **Grinder**
   a. The grinder does not remove manufactured inerts from the wastewater, and therefore biosolids from the WWTF do not meet WAC 173-308-205.
   b. The grinder structure does not remove grit from the wastewater.

2. **Influent Sampler**
   a. The influent sampler is not flow-paced.

3. **Oxidation Ditch**
   a. The oxidation ditch structure may be leaking or operation of the process results in periodic sewage spills.
   b. The oxidation ditch volume is not large enough to provide treatment to meet the nitrogen removal requirements of the State Waste Discharge Permit throughout the 20-year planning period.
   c. The aeration system does not have adequate capacity for the 20-year planning period.

4. **Secondary Clarifiers**
   a. The mixed liquor in the oxidation ditch is historically poor settling due to high SVI (high filament count).
   b. The mechanism for Secondary Clarifier No. 1 requires re-painting.
   c. Both clarifiers are shallow and have an inefficient design.

   d. The clarifiers cannot be operated in parallel due to hydraulics and site piping.
   e. The piping to the clarifiers is not set up to split flows equally based upon surface area.

5. **Effluent Flow Meter**
   a. The meter has not been calibrated in many years.
   b. The meter requires longer straight pipe runs on either side of the meter to achieve proper flow orientation, and therefore accurate measurements.

6. **Chlorine Contact Tank**
   a. The effluent is not currently chlorinated due to the lack of disinfection requirements in the State Waste Discharge Permit.

7. **Effluent Pumps**
   a. The existing pumps do not meet recommendations for redundancy and reliability.

8. **Effluent Sampler**
   a. The effluent sampler is not flow-paced with effluent flow.

9. **RAS System**
   a. The RAS pumps use the pumped fluid (sludge) for seal water.
   b. The RAS piping is large diameter, and the required RAS flows are not high enough to adequately prevent settling of solids in the piping.
   c. The RAS pumps cannot be operated as dedicated pumps for each secondary clarifier to enable parallel operation.

10. **Aerobic Digester**
   a. The floating aerators bind with tumbleweeds and fail often.
   b. The floating aerators are undersized for the WAS oxygen demand.
   c. The digester is not adequately mixed.
   d. The digester can only be decanted to set elevations, instead of allowing the operator to determine the operating level.

11. **Sludge Drying Beds**
   a. The drain piping is crushed and does not operate.
   b. Most of the valves associated with filling the beds do not close.
   c. The beds are not paved, increasing O&M costs associated with this process.
   d. The drying beds do not have adequate capacity for the 20-year planning period.

12. Water System

a. The City uses potable water for uses that could be served by nonpotable water.

b. There is not adequate backflow prevention within the site water system.

13. Operations Building

a. The installation of the RAS and scum pumps and motor control centers in one room result in a violation of the electrical code.

14. Electrical Service

a. The electrical service equipment is over 35-years old and approaching the end of its useful life.

b. The presence of RAS seal water in an enclosed room with the motor control center and panelboards has accelerated the aging of the equipment.

c. The service transformer is no longer supported and will be required to be replaced due to increasing loads or transformer failure.

d. There is no backup generator at the WWTF.

15. Operations

a. The City does not have a backup operator available.

CHAPTER 6

WWTF IMPROVEMENTS

CHAPTER 6

WASTEWATER TREATMENT FACILITY IMPROVEMENTS

INTRODUCTION

This chapter provides an evaluation of alternative options for treating the flows and loadings and describes recommended improvements to the existing facilities. A description of deficiencies requiring improvement is contained in Chapter 5. The goal of this evaluation is to select an alternative that is reliable, cost effective, produces an effluent that complies with the State Waste Discharge Permit, provides adequate treatment capacity for growth in the community, and generates biosolids that can be cost effectively managed in accordance with federal and state regulations. It is assumed that the treated effluent will continue to be discharged to groundwater, and the residual solids will continue to be land applied at the Boulder Park site.

In 2011, the City applied for design and construction funding from the Public Works Board for improvements to the WWTF, and the project was selected for funding. However, the scope of work for the project was based upon a letter report developed by Gray & Osborne, Inc. in 2008 (Appendix D); the City's priorities for WWTF needs have changed since the development of the letter report. As a result, this chapter identifies and recommends the improvements in two phases. The first phase consists of immediate improvements recommended for funding with the Public Works Trust Fund (PWTF) loan, and the second phase consists of improvements to be completed in the future as the growth of the City necessitates increased capacity. Each improvement recommended in this chapter is identified as either a Phase I improvement or a Phase II improvement.

WWTF IMPROVEMENTS

HEADWORKS

The new headworks will consist of two parallel concrete channels for gravity settling and manual removal of grit. The headworks will also be equipped with a mechanical fine screen that will remove debris larger than 1/4-inch in size. As the debris accumulates on the screen, the head loss through the screen will increase. When the head loss reaches a set level, the screen will automatically turn on and convey, compact, and dewater the screenings. The screen discharges the compacted and dewatered materials to a dumpster for disposal at a landfill.

A concrete channel parallel to the fine screen will be equipped with a manually cleaned bypass bar screen with 3/8-inch spacing between the bars. During normal operation this bypass channel will not be used, and will only be put into service when the mechanical fine screen is removed from service for maintenance. However, the wall between the two channels will be lower than the outside concrete walls so that flows will overflow into this channel in the case of a plugged mechanical screen. A Parshall flume will be installed in the headworks downstream of the gravity grit channels to measure influent flows and control water level in the grit channels.

The headworks and mechanical fine screen will be sized based upon the design peak hour flow to the facility. For the 20-year planning period, the peak hour flow is 0.93 MGD. Gravity grit channels are typically designed for a velocity of 1 ft/s at design peak hour flow. Assuming a 6-inch Parshall flume is installed in the channel, the flow depth through the channels will be approximately 0.8 feet at PHF conditions. To allow for an operating range of 13 inches upstream of the screen and a freeboard of 18 inches, the channels must therefore be at least 3.4 feet deep upstream of the screen. Based upon a flow depth of 0.8 feet, a 1.8 foot wide channel will produce 1 ft/s at PHF conditions.

To remove 65-mesh grit from the flow, the channels must be long enough to allow the grit to settle at a theoretical particle settling velocity of 3.8 ft/min. Since the depth of flow is assumed to be 0.8 feet based upon a flow of 0.93 MGD and 1.8 foot channel width, the required hydraulic detention time of the channel must be at least 0.8 ft / 3.8 ft/min, or 0.21 minutes. To account for removal inefficiency due to inlet and outlet turbulence, an additional 50 percent of theoretical detention time is required. These criteria result in a required detention time of 0.32 minutes at peak hourly flow, or 19 seconds. Assuming a velocity of 1 ft/s, the required channel length is 19 feet.

During the construction of the new headworks, it is recommended that the influent sampler be modified to receive a flow-paced signal from the new influent Parshall flume flow meter. This design will provide the City with a more representative influent sample.

Due to the immediate need for influent screening to meet regulatory requirements, it is recommended that the mechanical fine screen be installed in the Phase I improvements. However, the grit channels and flow measurement do not represent an immediate need; therefore that portion of the work can be delayed until the Phase II improvements. To address the need for influent screening, it is recommended that the grinder structure be modified to install a vertical mechanical screen in the Phase I improvements. During the Phase II improvements, the mechanical screen will be relocated from the grinder structure to a newly-constructed headworks structure. This approach will be more expensive than completing all of the headworks work in Phase I, but will allow the City to use all of its limited available funds on immediate needs.

Table 6-1 presents the design criteria for the headworks.

TABLE 6-1

Headworks Design Criteria

Mechanical Fine Screen	
Quantity	1
Type	Helical Auger
Orifice Opening	1/4 in
Screen Width	13 in
Capacity	1.05 MGD
Motor Size	3 hp
Maximum Head Loss	13 in
Bar Screen	
Quantity	1
Type	Manually Cleaned
Bar Spacing	3/8 in
Screen Width	1.8 ft
Gravity Grit Channels	
Quantity	2
Length	19 ft
Width	1.8 ft
Minimum Depth	3.4 ft
Parshall Flume	
Throat Width	6 in
Range	0.001 – 3.98 MGD
Water Depth at PHF	0.8 ft
Water Depth at AAF	0.4 ft

BIOSELECTOR BASINS

The bioselector basins will consist of a two-compartment baffled concrete tank with one vertical mixer per compartment. Since there is no primary clarification provided at the Soap Lake WWTF, the total BOD_5 loading to the oxidation ditch has a lower soluble fraction of BOD_5 than at a facility receiving primary effluent. Therefore, a relatively high design F/M (food to microorganism ratio) should be used for the selector design to provide a greater loading of readily available (soluble) BOD_5. The bioselector will be sized for an F/M of 6 g BOD/g MLSS·d in each compartment and an overall F/M ratio of 3 g BOD/g MLSS·d.

If the bioselector is sized for the 20-year planning period, the sizing for the compartments will be as follows:

Design Maximum Month BOD_5: 641 lb/d
Design MLSS: 3,000 mg/L

F:M = 6 = lb BOD_5 / lb MLSS
lb MLSS = 641 lb / 6 = 107 lb MLSS
Volume @ 3,000 mg/L = 107 lb / $(3000)(1 \times 10^{-6})(8.345)$ = 4,300 gallons

Based upon the anticipated process flow and economical construction, it is recommended that the bioselectors be constructed as a single structure with the new anoxic basins (addressed later in this Chapter). Therefore, the two structures will share a common structure depth to simplify construction. Based upon a sidewater depth of 11 feet, the bioselector compartments will each be approximately 7’9” L x 6’9” W x 13’0” D. To mix the contents of each bioselector and prevent settling, vertical shaft mixers are the most cost effective solution and will be used. Coarse bubble aeration is not cost effective since the installation of blowers in addition to air piping would be required.

Because the bioselectors are not essential for operating the treatment facility, it is recommended that they be included in the Phase II improvements.

Table 6-2 presents the design criteria for the bioselectors.

TABLE 6-2

Bioselector Design Criteria

Bioselectors	
Quantity	2
Dimensions, each	7’9” L x 6’9” W x 13’0” D
Sidewater Depth	11 ft
Volume, each	4,325 gal (578 ft^3)
F:M Ratio (2 basins)	6:3:1
Mixer Type	Top-mounted, vertical, gear driven
Motor Size	1 hp

BIOLOGICAL PROCESS

The existing oxidation ditch and rotors do not have sufficient capacity for the 20-year planning period. Denitrification will be included in the biological treatment because it is required to reduce the effluent nitrogen concentration below the State Waste Discharge permit limits.

There are many biological processes that the City could implement at the WWTF to meet the terms of its State Waste Discharge permit. However, since the City is able to reuse the majority of the existing infrastructure at the WWTF, it is not economical to implement the majority of the available biological treatment processes that would replace the existing infrastructure. Processes that are not considered in this Report include membrane bioreactors, sequencing batch reactors, post-anoxic denitrification, and proprietary processes such as the Biolac and Aero-Mod processes. Instead, only two alternatives that reuse much of the existing plant facilities will be evaluated, as discussed below.

Biological Treatment Process Alternatives

The Department of Ecology requires that alternatives be evaluated for a facility plan as described in WAC 173-240-050. This report will evaluate two alternatives for increasing the capacity of the biological treatment process. The two alternatives to increase the biological treatment capacity at the WWTF are described in the following sections:

Alternative No. 1 – Supplement Existing Oxidation Ditch with New Anoxic Basin

This alternative consists of the following components:

- New anoxic tank for denitrification, including vertical mixers to provide mixing without introducing oxygen
- Reuse of the oxidation ditch for aerobic biological treatment

The alternative is described below.

<u>Anoxic Basin</u>

The biological reduction of nitrates to nitrogen gas will take place in a new anoxic basin constructed separate from the existing oxidation ditch. In addition to removing nitrogen from the wastewater to meet effluent limits, the anoxic basin provides several other advantages to the treatment process. It improves overall process stability, recovers a portion of the alkalinity that is consumed during nitrification in the oxidation ditch, reduces aeration requirements (i.e. saves energy) by using nitrate in lieu of oxygen as an electron acceptor, and it provides some additional selection against filamentous bacteria.

The mixture of influent wastewater and return activated sludge (RAS) will enter the anoxic basin together with recycled mixed liquor from the oxidation ditch. This mixed liquor contains a high concentration of nitrates as a result of biological nitrification in the oxidation ditch.

The first step in sizing the anoxic basin is to calculate the active biomass in the anoxic basin, which will have the same MLSS concentration as in the oxidation ditch. The equation to determine the active biomass is as follows:

$$X_b = \left(\frac{(Q)(SRT)}{V}\right)\left(\frac{Y(S_o - S)}{1 + k_{d,8}(SRT)}\right)$$

Where:

X_b	= active biomass in aeration basin, mg/L
Q	= design flow = 0.32 MGD (from Chapter 4)
SRT	= solids retention time = 8 days (determined in aerobic section)
V	= volume of aerobic zone = 0.300 MG (existing oxidation ditch)
Y	= heterotrophic cell yield = 0.40 lb/lb bCOD (from Chapter 5)
S	= influent biodegradable COD (bCOD) = 384 mg/L (from Chapter 5)
S_o	= effluent bsCOD = 10 mg/L (from Chapter 5)
$k_{d,8}$	= endogenous heterotrophic decay coefficient = 0.075 / d (from Chapter 5)

Thus, the active biomass concentration in the mixed liquor would be as follows:

X_b = (0.32)(8)/(0.300) x [(0.4)(384-10)/(1+(0.075)(8))] = 800 mg/L

The next step is to determine the internal recycle (IR) ratio. The internal recycle returns nitrified effluent from the aerobic zone (oxidation ditch) to the anoxic basin such that the nitrates can be reduced to nitrogen gas and released to the atmosphere.

The amount of nitrates that will be returned from the oxidation ditch to the anoxic basin depends on the amount of nitrates that will be discharged in the effluent. The oxidation ditch will be designed for an effluent ammonia concentration of 1 mg/L. Also, the effluent suspended solids will contribute a small amount of organic nitrogen. The plant effluent will have a suspended solids concentration of less than 20 mg/L. Usually, 12 percent of the suspended solids consist of organic nitrogen. Thus, 2 mg/L of organic nitrogen would be present in the facility effluent.

The design total nitrogen limit is 10 mg/L (monthly average) in the treatment facility effluent. Since the WWTF effluent nitrogen will consist of ammonia, organic nitrogen, and nitrates, the allowable effluent nitrate concentration should be limited to 6 mg/L, resulting in a total nitrogen discharge of less than 9 mg/L. The IR ratio is defined as the IR flow divided by the influent flow and is determined by the following equation:

$$IR = (NO_x / N_e) - 1.0 - R$$

Where:

NO_x = oxidation ditch nitrate concentration resulting from nitrification of TKN = 38 mg/L (determined in aerobic section)

N_e = effluent nitrate concentration = 6 mg/L (discussed above)

R = RAS ratio = 0.5 (typical for domestic WWTFs)

Thus, the internal recycle ratio at design conditions would be as follows:

IR = (38/6) – 1.0 – 0.5 = 4.8

A maximum IR ratio of 4.8 will result in an IR flow of 4.8 x 0.32 MGD = 1.54 MGD = 1,067 gpm. The recycle pump will be located in a dry pit adjacent to the oxidation ditch.

The next step in sizing the anoxic basin is to determine the mass of nitrates that are fed to the anoxic basin. Nitrates are fed in both the IR flow and the RAS flow. Thus the total flow feeding nitrates to the anoxic basin is 0.32 x (4.8 + 0.5) = 1.70 MGD. The estimated concentration of nitrates in this flow is 6 mg/L, resulting in a total nitrate mass of 85 lb/d (1.70 x 6 x 8.345). This amount is the total mass of nitrates that will have to be converted to nitrogen gas in the anoxic basin.

The last step in sizing the anoxic basin is to determine the appropriate detention time required to remove the nitrates introduced to the anoxic basin and then calculate the volume. This is an iterative process (“trial-and-error”), and only the last iteration is presented herein. As such, the anoxic volume shown in the calculation below is not calculated or assumed, but is the volume necessary to obtain the required nitrogen removal as determined through the iterative process.

Removal of nitrates through denitrification is measured through the specific denitrification rate (SDNR). The estimation of SDNR in Chapter 5 is not valid for design of a new anoxic basin because the method used for determining SDNR in Chapter 5 is specific to processes employing intermittent aeration, such as the City’s existing oxidation ditch process. However, a dedicated anoxic basin will have a different bacterial population, SRT, hydraulic retention time, and other critical process parameters. Therefore the method used in Chapter 5 is not used.

In anoxic basins upstream of an aeration basin, it has been determined that the rate of denitrification at 20 ^oC ($SDNR_{20}$) is a function of the ratio of influent BOD_5 to the mass of the active biomass in the anoxic basin (F/M_b). The relationship is given on Figure 8-23 in <u>Wastewater Engineering, Treatment, and Reuse, Fourth Edition</u> (Metcalf and Eddy, 2003).

At an active biomass concentration of 800 mg/L and an influent BOD_5 of 641 lb/d:

$$F/M_b = \frac{(Q)(BOD)}{(V_{NOX})(X_b)}$$

Where:

Q = design flow = 320,000 gal/d (from Chapter 4)

BOD = influent BOD concentration = 240 mg/L (calculated from Q and loading)

V_{NOX} = Volume of anoxic zone = 81,500 gal (determined by iteration)

X_b = Anoxic zone biomass concentration = 800 mg/L (from above)

Thus, the F/M_b ratio would be as follows

F/M_b = (320,000)(240)/((81,500)(800)) = 1.2

Figure 8-23 in <u>Wastewater Engineering, Treatment, and Reuse</u> gives a $SDNR_{20}$ of 0.220 lb NO_3/lb active biomass per day. SDNR varies with temperature based on the following relationship, and the 8°C is assumed based upon the oxidation analysis performed in Chapter 5:

$SDNR_8 = SDNR_{20} \times 1.026^{(8-20)} = 0.162$ lb NO_3/ lb active biomass / d

The active biomass in the anoxic basin is 540 lb (X_b * V_{NOX} * 8.345 / 1,000,000). This biomass is capable of removing 87 lbs of nitrate per day (540 x 0.162), which is equal to the mass of nitrates that is required to be removed.

The detention time for the anoxic basin is calculated as 6.1 hours, based on treatment facility influent flow (0.081 MG x 24 hrs/day / 0.32 MGD). The use of nitrates in the anoxic basin as an electron acceptor will reduce the aeration requirements in the oxidation ditch. The aeration requirements will be reduced by 2.86 lbs of oxygen per lb of nitrates removed in the anoxic basin. Since 87 lbs of nitrate will be removed per day at design conditions, the required oxygen input to the oxidation ditch can be reduced by 2.86 x 87 = 248 lbs of oxygen per day. Oxygen requirements are discussed in detail in the next section.

<u>Aerobic Zone</u>

The analysis of the existing oxidation in Chapter 5 provides an in-depth calculation of kinetic parameters and coefficients, and provides a determination that the existing volume of the oxidation ditch is insufficient to adequately treat the wastewater at future design conditions. However, that analysis was performed under the assumption that denitrification was required in the same tank, which necessitated a significantly higher SRT and a higher MLSS concentration to provide the treatment required during the aerobic period. In this alternative, the anoxic basin is a separate tank, and the oxidation ditch will be used only for aerobic treatment.

An analysis of the biological system design is not repeated here in its entirety, but a summary is provided to show the differences associated with operating the oxidation ditch aerobically at all times. The significant design changes from the analysis in Chapter 5 are as follows:

- The total SRT of 8 days will not require modification to account for anoxic operation, therefore an SRT of 8 days in the aerobic zone (oxidation ditch) is used throughout the remainder of the analysis, and in the calculation of the active biomass for the anoxic basin (as shown above).
- Net sludge production increases from 558 lb/d to 654 lb/d, which will reduce the available capacity of the sludge drying beds.
- The standard oxygen transfer rate (SOTR) is increased from 1,832 lbs O_2/day to 2,006 lbs O_2/day.
- The required MLSS decreases below 3,000 mg/L, therefore additional aeration volume is not required.

Sludge Production

$$P_X = \left[\frac{(Y)(S-S_0)}{(1+(k_{d,t})(SRT))0.85}\right] + \left[\frac{(f_d)(k_d)(Y)(S-S_0)(SRT)}{(1+(k_{d,t})(SRT))0.85}\right] + \left[\frac{(Y_n)(NO_x)}{(1+(k_{dn,t})(SRT_A))0.85}\right] + X_{iVSS} + X_{iTSS}$$

$$P_X = \left[\frac{(0.4)(1{,}025-27)}{(1+(0.075)(8))0.85}\right] + \left[\frac{(0.15)(0.075)(0.4)(1{,}025-27)(8)}{(1+(0.075)(8))0.85}\right] + \left[\frac{(0.12)(102)}{(1+(0.057)(8))0.85}\right] + 225 + 99$$

$$P_X = 654 \text{ lb/d}$$

SOTR

P_{xbio} = biodegradable biological mass, $0.85(P_X - X_{iVSS} - X_{iTSS})$
P_{xbio} = 0.85(654- 225 - 99) = 281 lb/d

Carbonaceous O_2 Demand = S – S_o – 1.42(P_{xbio})
Carbonaceous O_2 Demand = 1,025 – 27 – 1.42(281) = 600 lb/d

Nitrogenous O_2 Demand = 4.33(TKN – NH_4 – 0.12(P_{xbio}))
Nitrogenous O_2 Demand = 4.33(127 – 3 – 0.12(281)) = 393 lb/d

Total O_2 Demand = Carbonaceous O_2 Demand + Nitrogenous O_2 Demand - O_2 Credit
Total O_2 Demand = 600 lb/d + 393 lb/d – 0 = 993 lb/d

Oxygen Demand Adjusted for Fluctuations in Diurnal Load = Total O_2 Demand * 1.3
Oxygen Demand Adjusted for Fluctuations in Diurnal Load = 993 * 1.3 = 1,290 lb/d

$$SOTR = \frac{AOTR}{\left(\frac{\beta C_{STH} - C_O}{C_{S20}}\right)\left(1.024^{T-20}\right)\alpha}$$

$$SOTR = \frac{1{,}290}{\left(\frac{(0.95)(9.8) - 2.0}{9.08}\right)\left(1.024^{15-20}\right)(0.9)}$$

SOTR = 2,006 lb/d

MLSS Concentration

Required Aerobic Mass = (P_x)(SRT)
Required Aerobic Mass = (654)(8) = 5,230 lbs

Required MLSS = Required Aerobic Mass / Volume in MG / 8.345
Required MLSS = 5,230 / 0.30 / 8.345 = 2,100 mg/L

Aeration Requirements

As indicated above, the SOTR for the revised biological process in the oxidation ditch is equal to 2,006 lbs O_2/day, or 84 lbs O_2/hr. As addressed in Chapter 5, based upon manufacturer's information for the existing rotors, the oxygen transfer is 1,510 lb/d per rotor, or 63 lb/hr. To provide the recommended redundancy, it is necessary to provide sufficient aeration with one rotor out of service. Therefore, the existing aeration system is undersized to provide the required aeration for the 20-year planning period. Because the rotors are still in good condition, it is recommended that a floating brush aerator be installed in the oxidation ditch to provide the additional 21 lbs O_2/hr. It is estimated that at the projected population growth rate, it will take approximately 5 years for the revised SOTR to surpass the capacity of a single rotor.

The City has not violated its State Waste Discharge Permit limits historically, therefore it is not necessary to construct the anoxic basin in the Phase I improvements project. However, if the anoxic basin is not constructed in Phase I, then the City's existing rotors will continue to be operated intermittently to remove nitrogen through anoxic denitrification, reducing their effective aeration capacity. Operating in this manner, it is estimated that the rotors will not have sufficient capacity to meet the required oxygen demand at maximum month conditions beginning in approximately 2018. Furthermore, both rotors will be required to operate in the interim, providing no redundancy.

It is not ideal to operate without the recommended equipment redundancy, but the existing system is capable of providing treatment to comply with the State Waste Discharge Permit, and the system is projected to be capable of remaining in compliance for approximately six more years, assuming projected population growth. Therefore, construction of an external anoxic basin can be delayed. If the City pursues this alterative, it is recommended that the anoxic basin be constructed in Phase II.

Table 6-3 presents the design criteria for the biological process improvements.

TABLE 6-3

Biological Process Improvements Design Criteria – Alternative 1

Anoxic Basin	
Quantity of zones per basin	2
Dimensions, each	30’0” L x 16’6” W x 13’0” D
Sidewater Depth	11 ft
Total Volume	81,500 gal
Detention Time	6.1 hours
Internal Recycle Ratio	4.8
Design MLSS	2,100 mg/L
Internal Recycle Pump	
Quantity	1
Type	Centrifugal
Capacity @ 5 ft TDH	1,067 gpm
Motor	3 hp
Anoxic Basin Mixers	
Quantity	2
Type	Top-mounted, vertical, gear-driven
Motor	5 hp
Oxidation Ditch Floating Brush Rotor	
Quantity	1
Oxygen Transfer	21 lb O_2/hr
Motor	10 hp

Alternative No. 2 – New Aeration Basin and Abandon Existing Oxidation Ditch

This alternative consists of the following components:

- New aeration basin including an anoxic zone for denitrification and an aerobic zone for biological treatment, including fine bubble diffusers and two aeration blowers for the addition of oxygen to the tank. This basin will provide all of the biological treatment because the oxidation ditch will be abandoned. The new aeration basin will be constructed with two trains, each capable of treating one-half of the flow.

- Abandonment of the oxidation ditch

Anoxic Zones

The anoxic basin design for this alternative is similar to the design from Alternative No. 1. The same anoxic volume is required, but the anoxic basin would be constructed as part of the new aeration basin structure. As a result, the anoxic zones will most likely be deeper due to the recommended depth of the aeration basin and ease of construction associated with a common foundation depth. Each anoxic zone is anticipated to be approximately 26’9” L x 13’6” W x 17’0” D.

Aeration Basin

It is recommended that the aeration basin be constructed with two parallel trains, allowing for a portion of the volume to be removed from service for maintenance of submerged air diffusers. The City could expand in the future by adding additional trains as needed.

As addressed previously, providing continuous aeration in the basin, as opposed to in the single oxidation ditch; reduces the required design SRT of the activated sludge system, resulting in a lower required MLSS concentration. The required MLSS concentration for a 300,000 gallon aeration basin is 2,100 mg/L, but increasing the maximum MLSS concentration in the new aeration basin to 3,000 mg/L will allow the City to reduce the required aeration basin volume to approximately 209,000 gallons. As addressed in Chapter 5, 3,000 mg/L is the highest MLSS concentration that the existing secondary clarifiers are capable of receiving while meeting the recommended redundancy requirements of a reliability class II facility.

It is recommended in Wastewater Engineering, Treatment, and Reuse that the depth of the aeration basin be at least 15 feet to maximize the energy efficiency of the air diffusion system. Additional recommendations include a width-to-depth ratio between 1.0:1 and 2.2:1 and a length-to-width-ratio of at least 5:1. There is sufficient space available at the Soap Lake WWTF site for the new aeration basin, but maintaining the operation of the existing oxidation ditch during construction will limit the amount of space that is available, and deep excavations near the ditch may be difficult without damaging the oxidation ditch structure. It is recommended that the new aeration basin be constructed close to the southern property line of the WWTF to minimize the difficulty in constructing the deep structure. The dimensions of each aeration basin will be approximately 69’0” L x 13’6” W x 17’0” D. This will result in a length-to-width ratio of approximately 5.1:1 and a width-to-depth ratio of approximately 0.9:1.

Aeration Requirements

The aeration basin treatment trains will be equipped with fine membrane bubble diffusers installed on the floor of the structure. Air will be supplied to the diffuser grids using positive displacement blowers installed with soundproof enclosures.

As indicated above, the SOTR for the revised biological process is 2,006 lbs O_2/day, or 84 lbs O_2/hr. The following calculation determines the required blower size to provide 84 lbs O_2/hr:

Fine Bubble Diffuser Efficiency	= 1.75%/foot submergence
Depth of Submergence	= 14.0 ft
Diffuser Efficiency	= 24.5%
Air Flow for Aeration	= (84 lbs O_2/hr)/(1 scf/0.0173 lbO_2)/(24.5%)
	= 19,820 scf/hr
	= 330 scfm

To provide adequate redundancy, two positive displacement blowers will be provided. As addressed in Alternative No. 1, installation can be delayed until Phase II, although this schedule will require the existing oxidation ditch to operate without aeration redundancy in the interim.

Table 6-4 presents the design criteria for the biological process improvements.

TABLE 6-4

Biological Process Improvements Design Criteria – Alternative 2

Anoxic Basin	
Quantity of zones	2
Dimensions, each	26'9" L x 13'6" W x 17'0" D
Sidewater Depth	15 ft
Total Volume	81,000 gal
Detention Time	6.1 hours
Internal Recycle Ratio	4.8
Design MLSS	3,000 mg/L
Internal Recycle Pump	
Quantity	1
Type	Centrifugal
Capacity @ 5 ft TDH	1,067 gpm
Motor	3 hp
Speed Control	VFD
Anoxic Basin Mixers	
Quantity	2
Type	Top-mounted, vertical, gear-driven
Motor	5 hp
Aeration Basin	
Quantity of trains	2
Dimensions, each	69'0" L x 13'6" W x 17'0" D
Sidewater Depth	15 ft
Total Volume	209,000 gal
Detention Time	15.7 hours
Design MLSS	3,000 mg/L
Aerobic SRT	8 days
Aeration Basin Blowers	
Quantity	2
Type	Positive Displacement
Capacity, each	330 scfm @ 7 psig
Motor	20 hp
Speed Control	VFD

Alternative Comparison

Preliminary operation and maintenance costs have been developed for each alternative utilizing the cost to operate the existing WWTF as a starting point. The operation and maintenance cost presented is the cost to operate the entire sewer utility. Currently the sewer utility operation and maintenance cost is approximately $260,000 per year. Table 6-5 presents a summary of the operation and maintenance costs for the alternatives.

TABLE 6-5

Capital and O&M Costs for Treatment Alternatives

Item	**Alternative 1 Supplement Existing Oxidation Ditch with New Anoxic Tank**	**Alternative 2 New Aeration Basin and Abandon Existing Oxidation Ditch**
Salaries and Benefits	$130,000	$130,000
Utilities	$43,000	$41,000
Supplies	$20,000	$20,000
Equipment Repair and Maintenance	$20,000	$20,000
Professional Services (2)	$15,000	$15,000
Miscellaneous	$16,000	$14,000
Total Estimated O&M Costs	**$244,000**	**$240,000**

(1) Based on historic expenditures.
(2) Includes biosolids land application costs.

Table 6-6 presents the capital cost and the 20-year present worth cost of both the alternatives. Detailed cost estimates are presented in Appendix E.

TABLE 6-6

Annual Operation and Maintenance Costs for Treatment Alternatives

	Alternative 1 Supplement Existing Oxidation Ditch with New Anoxic Tank	**Alternative 2 New Aeration Basin and Abandon Existing Oxidation Ditch**
Capital Cost (1)	$633,000	$1,386,000
O&M Cost (2)	$244,000	$240,000
Present Worth Cost (3)	$3,949,000	$4,648,000

(1) From Appendix E.
(2) From Table 6-5.
(3) Present Worth Cost = Capital Cost + 20-year present worth cost of O&M cost at 4.0% interest rate

It is apparent that Alternatives No. 1 and 2 have similar costs for operations and maintenance, but Alternative No. 1 has a significantly lower capital cost and present worth cost, due to the reuse of the existing oxidation ditch. The advantage of Alternative No. 1 is the lower cost and less difficulty associated with the construction of the improvements. Alternative No. 2 would require deep excavation near the oxidation ditch and nearby road, whereas Alternative No. 1 would retain the use of the existing oxidation ditch and require a more shallow excavation. Since the recommended location for the new aeration basin would be south of the existing oxidation ditch, the site layout would be crowded to fit the necessary structures in the available space if Alternative No. 2 were selected.

The primary benefit to selecting Alternative No. 2 is the opportunity to remove the oxidation ditch from service and construct a new structure with a smaller footprint and less likelihood of leakage compared to the existing oxidation ditch, which may potentially leak. The use of diffused air in Alternative No. 2 lieu of surface aeration would result in a slightly higher quality effluent since surface aeration is known to break up flocs, reducing the settleability of the sludge. Finally, the aeration basin in Alternative No. 2 could be expanded to address growth beyond the 20-year planning period more easily than using the existing oxidation ditch in Alternative No. 1.

Alternative No. 1 is recommended because of the significantly lower capital cost and the generally good condition of the existing oxidation ditch, which should be structurally and mechanically adequate for the 20-year planning period.

SECONDARY CLARIFIER SPLITTER BOX

The new secondary clarifier splitter box will be constructed to allow the operators to adjust the division of wastewater flow to each secondary clarifier. Flow will enter on one side of a concrete structure with a weir bisecting it. On the downstream side of the structure, a series of notches will allow the operator to place a stop gate, thereby dividing the structure into two hydraulically separated basins with different weir widths, based upon where the stop gate is placed.

To determine the required weir length, the following calculation is used:

$$L = \frac{Q}{2.152(H)^{1.5}}$$

Where:

Q = peak flow to clarifiers = 0.93 MGD + 0.32 MGD (RAS)
L = weir length, ft
H = head loss, ft

Based upon the existing hydraulic profile, it would appear that the maximum acceptable head loss for the splitter box is 0.25 feet at design flow. Therefore, the weir must be at least 4.6 feet long to accommodate the design flows. Using a factor of safety of 1.2, the splitter box will have a length of 5.5 feet. It is recommended that the splitter box be included in the Phase II improvements because the inability to split wastewater flows between the two clarifiers is not an immediate concern.

EFFLUENT PUMPS

The new effluent pump in the Operations Building will be identical in capacity to the two existing pumps to provide redundancy during periods of high flow. As addressed in Chapter 5, this need for a new pump is not immediate as the improvement is required to meet redundancy recommendations. Consequently, it is recommended that the pump be installed during the Phase II improvements.

Table 6-7 presents the design criteria for the new effluent pump.

TABLE 6-7

Effluent Pump Design Criteria

Effluent Pump	
Quantity	3 (1 new)
Type	Vertical Turbine
Capacity @ TDH	340 gpm @ 44 ft
Motor	7.5 hp

RAS AND SCUM PUMPS

As discussed in Chapter 5, the RAS pumping system causes an unsanitary working environment, a corrosive environment for electrical equipment, and violation of NFPA 820 standards, primarily due to the use of pumped sludge in lieu of nonpotable water for seal water. The scum pumps contribute to the NFPA 820 issues, although they do not contribute to the corrosive and unsanitary conditions. Although it is possible to address these issues with improvements to the building HVAC, it is recommended that the RAS and scum pumps be removed from service and new RAS and scum stations be constructed near the secondary clarifiers.

Typical RAS flowrates are approximately equal to 50 percent of MMF, which is equal to 0.16 MGD for the 20-year planning period, or 115 gpm. The new RAS piping will be 4-inch in diameter, which at 115 gpm results in a velocity of 2.8 ft/s. This velocity is sufficient to prevent solids from settling in the pipe. The RAS pumps will be equipped with VFDs to allow for better process control, and the pumps may operate at a lower flowrate for extended periods of time, resulting in solids settling. Therefore, when the

RAS pump station is constructed, control system improvements will be made to periodically speed the RAS pumps up to 100% speed to temporarily increase flow to clear the RAS pipes.

The RAS pump station will consist of two pad-mounted RAS pumps. Each pump will be equipped with a casing heater to provide cold weather protection, and all above-ground piping associated with the pump station will be heat traced and insulated. The RAS piping will be designed to allow the pumps to be operated in lead-lag fashion so that either RAS pump may pump RAS from either clarifier, and it will also allow the pumps to be isolated so that the clarifiers can be operated independently in parallel.

The scum pump station will consist of a circular concrete wetwell with a single submersible pump. The scum removed from the surface of both secondary clarifiers will be piped to the wet well, which will operate in a fill and draw manner. The pump will be sized to maintain 2 ft/s in the scum piping. Assuming 4-inch pipe, the required flowrate is 80 gpm, which should be adequate capacity.

It is recommended that this work be performed in the Phase I improvements because the removal of the RAS and scum pumps from the Operations Building is an immediate need. Table 6-8 presents the design criteria for the RAS and scum pump stations.

TABLE 6-8

RAS Pump Station Design Criteria

RAS Pumps	
Quantity	2
Type	Self-Priming Centrifugal
Capacity @ TDH	115 gpm @ 25 ft
Motor	3 hp
Speed Control	VFD
Scum Pump	
Quantity	1
Type	Submersible Centrifugal
Capacity @ TDH	80 gpm @ 25 ft
Motor	3 hp
Scum Wet Well	
Diameter	4 ft
Depth	12 ft

AEROBIC DIGESTER AERATION

The existing aerobic digester is equipped with floating aspirating aerators that do not provide adequate mixing and oxygen. Also, their design results in frequent equipment breakdowns due to tumbleweeds and rags binding the aerators and causing bearing failure.

It is recommended that the existing aspirating aerators be replaced with two floating brush rotors, similar to the permanent rotors installed in the oxidation ditch. This technology is recommended because, unlike the existing floating aerators, the floating brush rotors would be capable of providing adequate mixing for the tank in addition to providing the required oxygen to prevent the digester from becoming anoxic and producing odors.

It is anticipated that the new floating brush rotors will not experience the same problems as the existing aspirating aerators because of the City's experience with the brush rotors in the oxidation ditch and lack of problems associated with debris binding the aerators or bearing failure.

Because the brush rotor will be responsible for providing both oxygen transfer and tank mixing, it is necessary to determine which of the two functions requires a larger unit. Typical power requirements for mixing with high speed surface aerators vary from 0.1 to 0.2 hp/1,000 gallons, depending on the type of aerator and the geometry of the basin. Therefore, assuming that the digester is operated at a volume of approximately 240,000 gallons, the horsepower requirements for mixing the digester vary between 24 hp and 48 hp. Based upon available aerator sizing, it is assumed that 30 hp will be sufficient.

The oxygen demand of the digester sludge is approximated as 2.0 pounds of oxygen required per pound of volatile solids destruction. As determined in Chapter 5, the anticipated volatile solids destruction in the digester is 143 lb/d, resulting in an oxygen demand of 286 lb/d. The floating brush rotors are rated by the manufacturer to provide 2.3 lb O_2/hp/hr, therefore the required horsepower meeting the oxygen demand is 5 hp (286 lb/d $\div$ 2.3 O_2/hp/hr $\div$ 24 hr/d). The mixing horsepower is therefore used as the design basis for the improvements because it is a greater size.

It is also recommended that the digester be equipped with a floating decanter to allow the digester to be decanted periodically. Although the existing digester is equipped with a method for decanting, the decanting levels cannot be adjusted, reducing the operator's decanting ability.

It is anticipated that once all of the recommended improvements are made to the digester, the City will be able to discharge digested sludge to the sludge drying beds more frequently, as the lack of aeration and mixing currently prevents the City from discharging frequently without causing significant odor problems. As a result of the improvements, the City will not be required to store digested sludge for long periods of time, and the total sludge volume at any given time can be more easily maintained at the desired level. It is recommended that this improvement be constructed in the Phase I improvements because the City has identified this improvement as an immediate need.

Table 6-9 presents the design criteria for the aerators.

TABLE 6-9

Aerobic Digester Aerator Design Criteria

Aerators	
Quantity	2
Type	Floating Brush Rotor
Rotor Length	8 ft
Rotor Diameter	27 in
Motor Size	15 hp

SLUDGE DRYING BEDS

The existing sludge drying beds are projected to have sufficient capacity until approximately 2017, assuming that the City grows at the projected annual growth rate of 1.5%. To address the need for additional capacity, it is recommended that the City either construct additional drying beds or construct a polymer feed system to thicken waste sludge to accelerate the drying process.

Alternative 1 - Additional Drying Beds

As addressed in Chapter 5, the required sludge drying bed area for the projected sludge production at the end of the 20-year planning period is 12,000 ft^2, and the City currently has approximately 9,600 ft^2 of sludge drying beds. Therefore, if the City were to construct additional sludge drying beds, approximately 2,400 ft^2 would be required. The City owns sufficient land north of the existing drying beds to construct the necessary capacity, although the existing sludge drying bed piping will require modification to integrate new beds.

Table 6-10 presents the design criteria for the paved sludge drying beds.

TABLE 6-10

New Sludge Drying Beds Design Criteria

Sludge Drying Beds	
Quantity	2
Floor Dimensions	60’0” L x 20’0” W
Depth	3 ft
Total Area	2,400 ft^2

Alternative 2 – Polymer Feed System

A polymer feed system would address the limited sludge drying bed capacity by increasing the fraction of water in the digested sludge that drains from the drying beds. Based upon operator experience at other wastewater treatment facilities in Eastern Washington, it is assumed that the addition of polymer will increase the attainable drained sludge solids concentration from 10% to 20%. The required sludge drying bed area is therefore reduced to 483 m^2, or 5,200 ft^2, which is sufficient for the 20-year planning period:

$$Area = \frac{1.04(S)\left(\frac{1-s_d}{s_d} - \frac{1-s_e}{s_e}\right)}{10(k_e)(E_p) - 1000P}$$

Where

- A = sludge drying bed area, m^2
- S = digested sludge production, dry solids, kg/yr = 409 lb/d =67,700 kg/yr
- s_d = fraction dry solids after gravity drainage = 0.20 (assumed)
- s_e = fraction dry solids after evaporation = 0.85 (assumed)
- k_e = reduction factor for evaporation of sludge = 0.60 (typical)
- E_p = free water pan evaporation rate, cm/yr = 124.5 cm/yr in Soap Lake
- P = annual precipitation, m/yr = 0.19 m/yr in Soap Lake

The polymer feed system will be located at the aerobic digester, and the chemical injection will occur in the gravity line from the aerobic digester to the sludge drying beds. To protect the feed system from the weather, the system will be housed in a prefabricated, insulated enclosure.

Table 6-11 presents the design criteria for the polymer feed system.

TABLE 6-11

New Polymer Feed System Design Criteria

Polymer Feed System	
Quantity	1
Type of Chemical	Liquid Polymer
Capacity	0.1 – 1.0 gph
System Enclosure	
Dimensions	6’9” L x 5’4” W
Heating	500W, 120V Heater
Cooling	210 cfm Dual Exhaust Fans

Alternative Comparison

It is assumed that the man-hours necessary to operate additional sludge drying beds will be approximately equal to the time spent operating the polymer feed system. However, the polymer feed system also requires polymer to be purchased regularly. The estimated cost for polymer is $60 per dry ton of digested sludge, or approximately $4,500/yr.

Table 6-12 presents the capital cost and the 20-year present worth cost of both the alternatives. Detailed cost estimates are presented in Appendix E.

TABLE 6-12

Capital Costs and Present Worth Costs for Drying Alternatives

	Alternative 1 Construct Additional Drying Beds	**Alternative 2 Install Polymer Feed System**
Capital Cost (1)	$71,000	$151,000
Differential O&M Cost (2)	$0	$4,500
Present Worth Cost (3)	$71,000	$212,000

(1) From Appendix E.
(2) Actual O&M cost is higher. Number shown is difference between alternatives
(3) Present Worth Cost = Capital Cost + 20-year present worth cost of O&M cost at 4.0% interest rate

Alternative No. 1 is recommended because of the lower capital cost and lower O&M cost.

NONPOTABLE WATER SYSTEM

Currently the City uses potable water for all services at the WWTF including wash down water and landscape irrigation. To decrease use of potable water, it is recommended that a new nonpotable water pump station be installed at the chlorine contact tank. The nonpotable water equipment will include a chemical storage tank and sodium hypochlorite pump for disinfection. Two vertical turbine pumps for nonpotable water supply will be installed for redundancy. Because this improvement does not meet an immediate need, it is recommended that this improvement be constructed in the Phase II improvements.

The existing potable water piping configuration does not meet cross connection control requirements. It is recommended that the plumbing be modified to install the necessary backflow prevention equipment to bring the facility in to compliance. Because this improvement does not meet an immediate need, it is recommended that this modification be constructed in the Phase II improvements.

Table 6-13 presents the design criteria for the nonpotable water pump station.

TABLE 6-13

Nonpotable Water Pump Station Design Criteria

Storage Tank	
Side Water Depth	6 ft
Volume	10,500 gal
Nonpotable Water Pumps	
Quantity	2
Type	Vertical Turbine
Capacity	50 gpm @ 100 ft TDH
Motor Size	5 hp
Speed Control	VFD
Sodium Hypochlorite Pump	
Quantity	1
Type	Positive Displacement
Capacity	1 gph @ 230 ft TDH

PLANT ELECTRICAL SYSTEM

The motor control center and panelboards are over 35 years old and are showing signs of corrosion. Based on the existing loads served from the 240/120 volt service, the existing distribution system appears to have the capacity to serve some limited new loads. However, the distribution equipment is located in a corrosive environment. Because of the operating environment, the life expectancy of the motor control center and panels may be reduced.

The existing service from Grant County PUD is an unusual voltage, and the PUD no longer supports the existing transformer. Therefore, the City will be required to upgrade the transformer either when it fails or when a future WWTF upgrade increases the electrical loading at the facility. For example, the new aeration system at the digester will significantly increase the electrical loads at the facility.

Also, the existing power distribution system does not meet the EPA reliability criteria, which require each of the plant critical loads to be connected to redundant busses in order to prevent a single point of failure on the distribution system. Since the WWTF does not have a source of auxiliary power, the City does not meet the current requirements of their SWD permit that requires adequate safeguards that prevent untreated or inadequately treated wastes from being discharged.

Three options have been developed to address the electrical deficiencies.

<u>Option 1</u>

This option consists of performing the Phase I capital improvement project while keeping the existing 240/120 volt service in place to serve the existing loads. A new power service and distribution system will be installed to serve any new loads, primarily consisting of the new loads due to new aeration at the aerobic digester. This option will not include the installation of a new backup generator.

Option 1 is the least costly of the three options presented. However, there are some risks and disadvantages to this option. The main disadvantage is that this option does not meet the requirements of the City's SWD permit to safeguard against electrical power failures, including potential failure of the 35-year old transformer. It is estimated that the 35-year old equipment has approximately 10 years of life remaining. Although very rare, there is a risk that the transformer could fail. As stated earlier, the PUD no longer supports this transformer and, if replaced, the City would be required to upgrade the electrical system, including a new distribution system and new MCCs. If the transformer were to fail, the WWTF would be without power for several days and the City would have to perform a costly emergency electrical upgrade.

This option also keeps the existing 35-year old electrical equipment in place and adds a second power service from the PUD for the digester. If this equipment fails within the next 10 years, the power service will have to be changed at that time.

This option is estimated to cost $130,000 without sales tax, contingency, or engineering.

<u>Option 2</u>

This option is the same as Option 1, except that a new backup generator suitable for the existing service will be installed.

Option 2 will provide the City with a backup generator to meet the requirements of their SWD permit. The backup generator that would be installed as a part of this project would be expensive due to the unusual voltage rating of the electrical power service. This option still presents the risk of the need for an emergency electrical upgrade in the rare event that the transformer fails. This option also leaves the existing 35-year old electrical equipment in place with a second service to the digesters. As stated earlier, when this existing electrical equipment fails, a new power service will be required.

This option is estimated to cost $250,000 without sales tax, contingency, or engineering.

<u>Option 3</u>

This option consists of upgrading the entire electrical service and distribution system, which would include the installation of a new transformer, backup generator with an automatic transfer switch, new MCCs, and new VFDs. This option also includes the electrical costs associated with the construction of the Phase I improvement project. This option provides the City with the required power reliability and redundancy. Additionally this option has the benefit of providing the City with a single power service and new equipment that has a service life of 40 years.

If the City pursues Option 3, the distribution voltage must be selected. The two reasonable options are 208V service and 480V service. Both options will likely require re-wiring or replacing electrical equipment that is currently rated for either 208V or 480V, but not the other. Larger gauge wire is required for 208V service, and therefore new 208V circuits are more expensive than new 480V circuits. It is recommended that the City select 480V service because it is estimated to be less expensive.

This option is estimated to cost $315,000 without sales tax, contingency, or engineering.

It is recommended that the City proceed with Option 3 because it provides extended equipment service life and equipment reliability, and upgrades the electrical system to a more conventional voltage that is supplied by the PUD.

PHASE I IMPROVEMENTS

As stated previously, the City has applied for and received funding for a WWTF upgrade, and it is anticipated that the City will begin design for the project in the winter of 2012/2013. The recommended improvements described above are prioritized based on regulatory requirements, reliability and redundancy levels, operations and maintenance considerations, and City preference.

It is recommended that the City include the following improvements in the Phase I improvements project:

- Remove influent grinder from service, modify grinder structure, and install new mechanical fine screen
- Modify the effluent sampler to flow-pace with effluent flow
- Install a new effluent flow meter and calibrate the existing effluent flow meter
- Modify the effluent flow meter piping to provide adequate straight pipe lengths
- Construct new RAS and scum pump stations
- Install new aerobic digester aeration
- Rehabilitate and pave the sludge drying beds
- Modify site electrical to utilize new 480V service
- Install new emergency generator

It is recommended that the City include a design for the secondary clarifier splitter box (and associated piping) and aerobic digester decanter in the Phase I design as Additive Bid (Optional with Owner) items. This plan will allow the City to construct more of the desired work if the bids are more competitive than estimated or if the City determines that the bid price for the additional work is favorable enough to warrant spending sewer reserves on the construction.

PHASE II IMPROVEMENTS

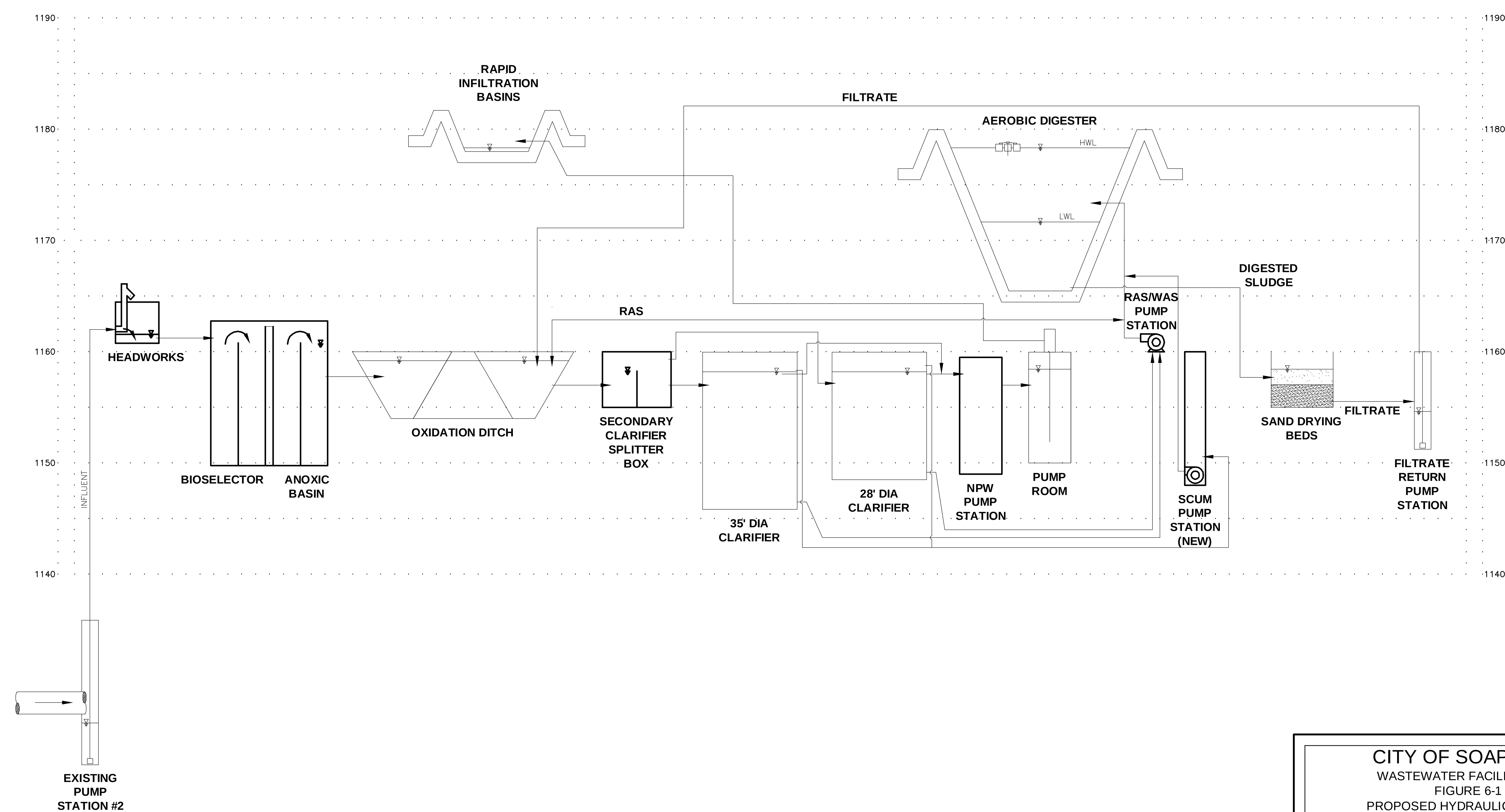
Based upon the remaining recommendations in this Chapter, the scope of work for the Phase II improvements consists of:

- Construct new headworks and relocate mechanical fine screen
- Modify the influent sampler to flow-pace with influent flow
- Construct bioselectors
- Construct anoxic basin
- Install floating aerator in oxidation ditch
- Construct secondary clarifier splitter box
- Install additional effluent pump
- Install floating decanter in aerobic digester
- Construct additional sludge drying beds
- Construct nonpotable water pump station
- Modify plumbing to meet cross connection control requirements

If the City continues to experience growth at the design annual growth rate of 1.5%, it is recommended that the City begin construction of the Phase II improvements in approximately 2017.

Detailed costs for the Phase I and Phase II improvements are included in Appendix E. The overall cost of the proposed Phase I project is $1,639,000 (2012 dollars) including engineering, tax, and a 25% contingency. The overall cost of the proposed Phase II project is $1,429,000 (2012 dollars) including engineering, tax, and a 25% contingency.

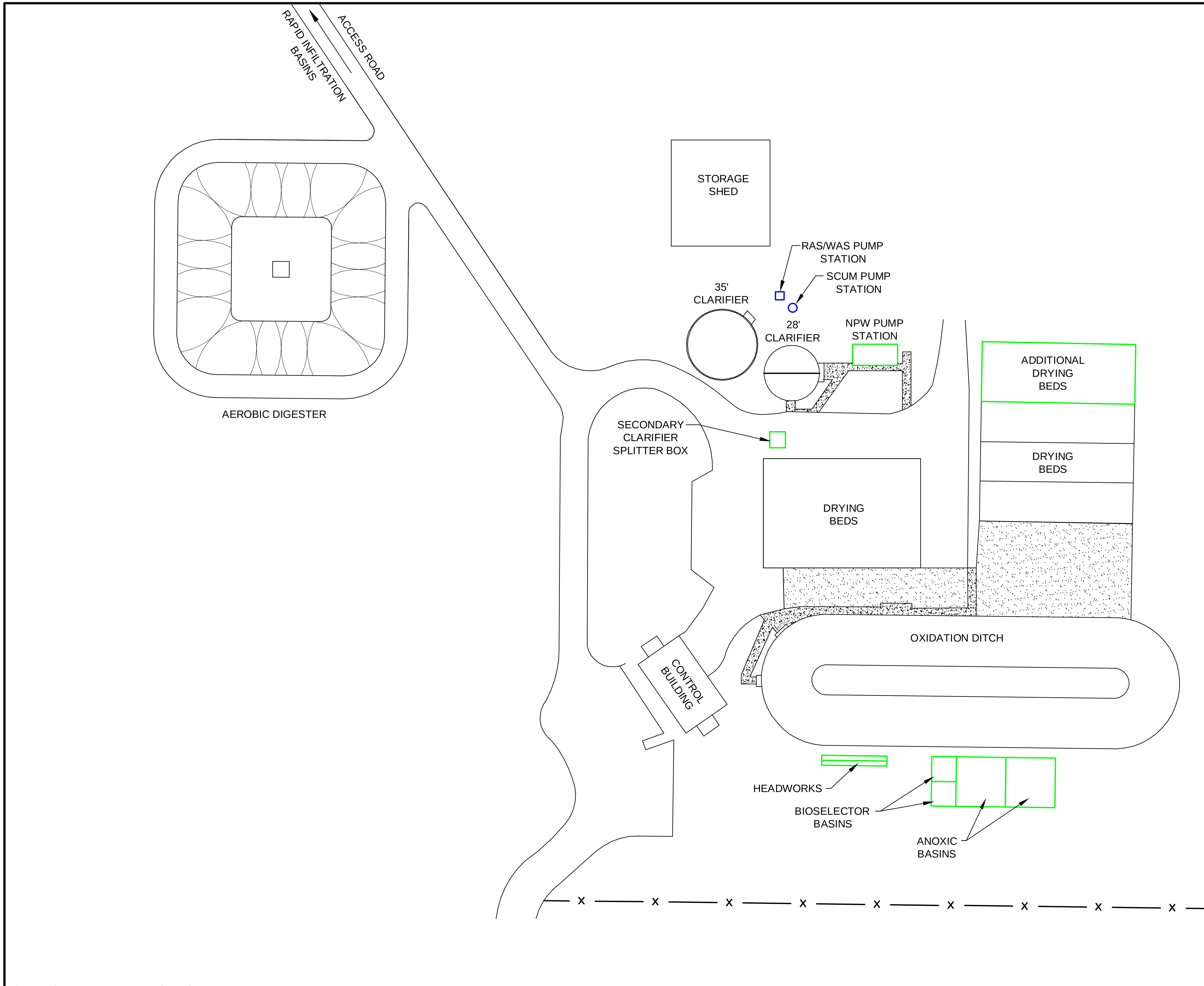
Figures 6-1 and 6-2 show the proposed hydraulic profile and site plan, respectively, once Phase II is complete.



CITY OF SOAP LAKE
WASTEWATER FACILITY PLAN
FIGURE 6-1
PROPOSED HYDRAULIC PROFILE

Gray & Osborne, Inc.
CONSULTING ENGINEERS

M:\SOAP LAKE\11041 WASTEWATER FACILITY PLAN\FIGURES\FIG 6-1



CITY OF SOAP LAKE
WASTEWATER FACILITY PLAN
FIGURE 6-2
PROPOSED SITE PLAN

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M:\SOAP LAKE\11041 WASTEWATER FACILITY PLAN\FIGURES\FIG 6-2

CHAPTER 7

WATER RECLAMATION AND REUSE EVALUATION

CHAPTER 7

WATER RECLAMATION AND REUSE EVALUATION

INTRODUCTION

As required by RCW 90.48.112, this Report must evaluate the "opportunities for the use of reclaimed water." Reclaimed water is defined in RCW 90.46.010 as "effluent derived in any part from sewage from a wastewater treatment system that has been adequately and reliably treated, so that as a result of that treatment, it is suitable for a beneficial use or a controlled use that would not otherwise occur, and is no longer considered wastewater."

Key differences between the requirements for water reuse and those for effluent disposal are the levels of reliability required within the treatment process, distribution, and use areas. The State of Washington's reuse treatment standards call for continuous compliance, meaning that the treatment standards must be met on a constant basis or the treated water cannot be used as reclaimed water.

ALLOWABLE USES FOR RECLAIMED WATER

The Washington State Water Reclamation and Reuse Standards describe several allowable uses of reclaimed water, including:

- Agricultural irrigation;
- Landscape irrigation;
- Impoundments and wetlands;
- Groundwater recharge;
- Streamflow augmentation;
- Industrial and commercial uses; and
- Municipal uses.

Depending upon its end use, there are four categories of reclaimed water: Class A, Class B, Class C, and Class D. Class A has the highest degree of effluent treatment. In general when unlimited public access to the reclaimed water is involved or when irrigation of crops for human consumption is the intended end use, the criteria will require Class A reclaimed water.

REUSE EVALUATION

Factors that could lead a wastewater treatment provider to pursue reclaimed water include the following:

- Regulatory Requirements. Regulatory conditions are such that making reclaimed water is a viable option compared to continuing to discharge secondary effluent, particularly when there is no viable secondary effluent discharge option.
- Water Rights. The ability to make and reuse reclaimed water could benefit the City's water rights situation, such as substitution of reclaimed water for previous potable water uses.
- Environmental Benefits. There can be environmental benefits in the right circumstances to making reclaimed water versus secondary effluent, such as diversion of pollutants from ground waters.
- Cost Effectiveness. The cost to make and reuse reclaimed water can be lower than the cost to develop new water rights and potable water supply when water sources are limited.

An evaluation of how each of these factors relates to the City's wastewater treatment utility is provided in the following sections.

REGULATORY REQUIREMENTS

At this time, the City is not having difficulty meeting its State Waste Discharge Permit requirements. The City has not had any consent orders or notices of violation in the past five years. The improvements listed in Chapter 6 will correct operational problems and projected equipment capacity deficiencies within the 20-year planning period.

Current regulatory requirements do not make production of reclaimed water a more viable option than continuing to produce secondary effluent.

WATER RIGHTS

RCW 90.46.120 states that the owner has exclusive right to any reclaimed water generated by the wastewater treatment facility. Consequently, reclaimed water has the potential to benefit water purveyors who are water-right deficient. However, the City determined in its 2011 Water System Plan Update that its water rights situation is secure and water rights are not an issue at this time.

RCW 90.46.130 states that the facilities that reclaim water shall not impair existing downstream water rights unless the impaired water right holder is compensated or mitigated. It is unknown at this time whether diverting some or all of the secondary effluent as reclaimed water in lieu of infiltrating it as groundwater will cause impairment to any water rights holder. Prior to implementing any plans to produce reclaimed water, it is recommended that the City study the water rights in the surrounding area to determine the impact of pursuing a water reclamation program.

ENVIRONMENTAL BENEFITS

The WWTF currently produces 213 acre-feet per year (ac-ft/yr) of effluent and is projected to produce 291 ac-ft/yr in 2031. The City does not have any large industrial users of water that would be capable of utilizing reclaimed water effectively. Of the 15 largest water users in the City, all 15 are residential connections, none of which consumes more than 1.0% of the City's total water use. The City does not have a separate irrigation system, therefore there is potential to utilize reclaimed water for irrigation, but irrigation is a seasonal use, and the City does not have another use for reclaimed water during the months of the year where irrigation is not utilized. There are little environmental benefits in utilizing reclaimed water to replace this irrigation demand. The additional electricity required to produce reclaimed water year-round to address this seasonal demand would actually create a negative environmental benefit.

COST EFFECTIVENESS

The following additional improvements will be required at the WWTF to produce Class A reclaimed water. These improvements are in addition to the improvements included in Chapter 6.

- Effluent filtration equipment
- Effluent pump station to pump the effluent from the filtration equipment to the beneficial use sites
- UV disinfection system
- Building to house the filtration equipment and UV disinfection system
- Lined storage ponds
- SCADA improvements for additional reliability considerations
- Bypass valves and piping. This analysis assumes that the reclaimed water facility will bypass to the infiltration basins during periods that the facility does not meet reclaimed water standards.

The estimated capital cost for producing reclaimed water is $7,160,000 (Appendix E) or approximately $33,615 per ac-ft ($7,160,000 / 213 ac-ft first year production). The City's existing operating cost for its water system to produce 213 ac-ft/yr is $205,000/yr, or approximately $962/acre-ft. Therefore, it is not cost effective to produce reclaimed water.

SUMMARY

Evaluation of the potential for water reclamation and reuse indicates that it is not cost effective, and there are no regulatory or environmental needs to pursue water reclamation or reuse. Furthermore, the City currently infiltrates its effluent to groundwater; therefore the City has already implemented water reclamation. As such, the production of reclaimed water is not recommended.

CHAPTER 8

FINANCING

CHAPTER 8

FINANCING

INTRODUCTION

This chapter presents a plan for financing the capital improvements recommended in Chapter 6. This chapter includes a review of the City's current financial status, available revenue sources, allocation of revenues, and the impact of the recommended capital improvement plan on sewer rates.

EXISTING SERVICE RATES AND CONNECTION CHARGES

The City collects revenue through connection charges and service rates that are established by Soap Lake Municipal Code. The City has two classifications of customers: residential and commercial. Apartment complexes are considered commercial units. Table 8-1 presents the sewer service rates for the City. The rates were raised by $8.50 per month in May 2011 to prepare for the Phase I capital improvements described in Chapter 6 and by $2.50 in May 2012 to address operating shortfalls.

TABLE 8-1

Sewer Service Rates

Classification	Base Rate	Volume Charge
Residential	$36.20	N/A
Commercial	$26.82	$1.53 per 100 cu. ft (1)
Standby	$7.14	N/A

(1) Volume charge is calculated based upon water use at the property

Connection charges are also defined by the Soap Lake Municipal Code. A connection to the City's collection system requires a payment of $250 plus the cost of materials and installation. At this time the City does not assess new customers a general facility charge (GFC) for contributing to the cost of existing and planned improvements.

HISTORICAL OPERATIONS

Revenues and expenditures in 2010 and 2011 for the City's sewer utility are summarized in Table 8-2. Like many Washington cities, Soap Lake has historically combined its water and sewer systems into a single combined utility, although revenues and expenses for water and sewer have been tracked separately to fund the combined fund appropriately for the separate services. Soap Lake also includes its mineral water system in its combined utility.

Since 2005, the City's combined utility fund has slowly declined as expenses have generally exceeded revenues. The City raised sewer rates in May 2011 and May 2012 to prepare for future projects and to address the operating shortfall, respectively. The sewer utility has an annual debt payment of $57,003 for the financing of the 2001 WWTF upgrade, and this loan is anticipated to be paid in full in 2021.

TABLE 8-2

Historical Revenues and Expenditures

Revenues	**2010**	**2011**
Sewer Service Charges	232,491	285,890
Sewer Connections Fees	329	329
Transfer to Reserves	-	(11,400)
Other Revenue	1,522	12,267
Total Revenue	**234,342**	**287,086**
Expenses		
Admin Salaries and Benefits	24,673	25,373
Admin Expenses	32,863	40,213
Operation Salaries and Benefits	107,905	99,297
Operation Expenses	88,784	57,283
Sewer Equipment	1,302	-
Total Expenses	**255,527**	**222,166**
Debt Service		
DOE Loan (WWTF)	57,003	57,003
Total Debt Service	**57,003**	**57,003**
Summary		
Income/Loss	(78,188)	7,917
Beginning Cash	244,425	166,237
Ending Cash (Reserves)	166,237	174,154

As illustrated above, the City's rate increase in May 2011 significantly increased revenues for the sewer system, and revenues are anticipated to be higher in the future as Table 8-2 does not reflect a complete year of increased rates, nor does it reflect the rate increase in May 2012. It is anticipated that based upon approximately 800 ERUs in the system, the City's annual revenue from sewer rates will be approximately $337,000 in the future ($286,000 + ($8.50 * 4 months * 800 ERU) + ($2.50 * 12 months * 800 ERU)). Assuming average annual expenses of $295,000 including DOE debt service, the City's existing sewer rates will provide an operating surplus of approximately $42,000 for future debt service.

CAPITAL IMPROVEMENT PROGRAM

Chapter 6 detailed the following projects:

- Phase I – This project will consist of a new mechanical fine screen, effluent flow meter, RAS and scum pump stations, new aeration in the aerobic digester, rehabilitation and paving of the sludge drying beds, installation of an emergency generator, and electrical upgrades to change the electrical service to the WWTF. The estimated cost is $1,639,000 including sales tax, contingency, and engineering.

- Phase II – This project consists of a new headworks including relocation of the mechanical fine screen, new anoxic basin, bioselectors, aeration in the oxidation ditch, secondary clarifier splitter box, additional sludge drying beds, nonpotable water pump station, effluent pump, modification of Lift Station No. 2, and modification to site plumbing. The estimated cost is $1,429,000 including sales tax, contingency, and engineering.

The City is currently on the award list for the PWTF program for funding of the design and construction of the Phase I improvements, and it is assumed that the funding will be available in the fall of 2012 to begin design. PWTF funding requires approximately $5,500 in annual debt service per $100,000 in loan, which results in an anticipated debt service of approximately $81,300 for the $1,478,200 loan. The remaining $160,800 ($1,639,000 - $1,478,200) will therefore be necessary for the City to finance through sewer reserve funds.

As addressed above, the City is projected to have an operating surplus of approximately $42,000 available for debt service of the Phase I improvements. Therefore, the remaining annual $39,300 in debt service will require an additional rate increase of between $4 and $5 per month. It is recommended that the rate increase be established prior to beginning construction of the improvements to allow the City to establish sufficient reserves to fund the portion of the capital improvements not funded through the PWTF loan.

It is estimated that the Phase I work will be constructed in 2013 - 2014, and the City will not pursue funding for Phase II concurrently with the Phase I work. The work to be completed in Phase II is primarily required to address deficiencies in redundancy or a projected lack of capacity. The City should be capable of meeting its discharge permit limits in the interim if process equipment does not fail or otherwise become unavailable before the City constructs the Phase II improvements. As addressed in Chapter 6, additional sludge drying bed volume and the anoxic basin are projected to become necessary in approximately five to six years if the City continues to grow at the projected rate. Therefore, it is recommended that the City plan to begin applying for funding for the Phase II improvements in 2015. This schedule should provide the City with enough

time to apply for and receive funding, secure funding, design, and construct the improvements before they become necessary.
It is likely that the funding terms and eligibility requirements for the various funding programs will be different when the Phase II improvements are designed and constructed, but based upon current funding conditions, it is projected that the debt service for Phase II will be between approximately $70,000 and $90,000 per year. The rate increase for this debt service is projected to be between $8.00 and $10.00 per month, dependent upon population growth and availability of favorable funding. The City may be able to defray much of this cost by adopting General Facility Charges that require new connections to pay a share of the cost of growth-driven improvements.

FINANCING OPTIONS

PUBLIC WORKS TRUST FUND

The Public Works Trust Fund is a revolving loan fund designed to help local governments finance needed public works projects through low-interest loans and technical assistance. The PWTF, established in 1985 by legislative action, offers loans up to $15,000,000 at interest rates substantially below market, payable over periods ranging up to 30 years. Interest rates vary between 0.50% and 2.00%, with lower rates associated with shorter repayment terms.

To be eligible, an applicant must be a local government such as a City, Town, County, or special purpose utility district, and have a long-term plan for financing its public works needs. If the applicant is a Town, City, or County, it must adopt the ¼ percent real estate excise tax dedicated to capital purposes. Eligible public works systems include streets and roads, bridges, storm sewers, sanitary sewers, and domestic water. Loans are offered for purposes of repair, replacement, rehabilitation, reconstruction, or improvement of existing service users. Since 1999, eligible projects may be designed to accommodate reasonable growth. This is generally the 20-year growth projection included in the local government’s comprehensive plan under the Growth Management Act (GMA).

USDA RURAL DEVELOPMENT

USDA Rural Development (RD) has a loan program that, under certain conditions, includes a limited grant program. Grant determination is based on a formula that incorporates existing utility debt service and existing utility service rates.

In addition, RD has a loan program for needy communities that cannot obtain funding by commercial means through the sale of revenue bonds. The loan program provides long-term 30- to 40-year loans at an interest rate that is based on federal rates and varies with the commercial market.

STATE REVOLVING FUND / CENTENNIAL CLEAN WATER FUND

In 1986, the Washington State Legislature established the Centennial Clean Water Fund (CCWF) and State Revolving Fund (SRF). The Department of Ecology is managing a portion of these funds and ensures that the funds are distributed fairly between the best projects and that those projects address the State's highest priority water pollution control problems. The Legislature directed that the CCWF and SRF be used to finance the planning, design, acquisition, construction, and improvement of water pollution control facilities and activities.

The primary program requirements are to have an approved facilities plan for treatment works and to demonstrate the ability to repay loans through a dedicated funding source. Ecology evaluates projects based on the severity of the existing water quality condition or the potential threat to the water quality of a specific body of water, the means of assuring that the project will achieve its intended purpose, and the water quality benefit that would result from the project. Ecology also considers public health emergencies. If the Washington State Department of Health declares a public health emergency, consideration is given to whether the proposed project will directly address and correct that emergency. Emergency funding may be applied for throughout the year.

Grant money is available only to those who can document hardship. Financial hardship is demonstrated if the proposed project will result in a user charge in excess of two percent of the median household income. Table 8-3 summarizes the qualifications for financial hardship per the most recent funding cycle.

TABLE 8-3

Ecology Grant/Loan Hardship Funding

Sewer User Fee Divided by MHI (2)	Below 2.0%	2.0% and above, but below 3.0%	3.0% and above, but below 5.0%.	5.0% and above
Hardship Designation	Non-Hardship	Moderate Hardship	Elevated Hardship	Severe Hardship
Grant Hardship Funding Continuum	0% Grant	50% Grant (up to $5 million)	75% Grant (up to $5 million)	100% Grant (up to $5 million)
Loan Hardship Funding Continuum (1)	Loan at 60% of market rate	Loan at 40% of market rate	Loan at 20% of market rate	Loan at 0% interest

(1) This is the percent of the average market rate for tax exempt municipal bonds.
(2) Median Household Income.

At a median household income of $29,583 (2010 Census), the City would have to have a rate of approximately $49.31 per month in order to qualify for any Ecology hardship funding.

STATE AND TRIBAL ASSISTANCE GRANTS

State and Tribal Assistance Grants (STAG) are available through the U.S. EPA. This funding is part of EPA's overall appropriations that include the state revolving fund program (which in Washington State is distributed through Ecology's State Revolving Fund), tribal funding programs, and other EPA funding programs. Money is appropriated on a case-by-case basis, and usually requires that the municipality request intercession from its federal congressional legislators on behalf of its project. At this time, there is no formal application process. Funding is approved as a separate appropriation in EPA's annual budget.

COMMUNITY ECONOMIC REVITALIZATION BOARD

This low interest loan and grant program is sponsored by the Department of Trade and Economic Development. Funding is available for infrastructure that supports projects that will result in specific private developments or expansions in manufacturing, and businesses that support the trading of goods and services outside the state border. Funding is not available to support retail shopping developments or acquisition of real property. The projects must create or retain jobs. The average is one job per $3,000 of Community Economic Revitalization Board (CERB) financing. The interest rate fluctuates with the state bond rate. It is unlikely that the capital projects outlined in this plan would qualify for CERB funding.

UTILITY LOCAL IMPROVEMENT DISTRICTS

Another potential source of funds for capital projects can be obtained through the formation of Utility Local Improvement Districts (ULIDs) involving a special assessment made against properties benefiting by the project. ULID bonds are further backed by a legal claim to the revenues generated by the utility.

Sewer system expansion is a frequent application of ULID financing. Typically, ULIDs are formed by the jurisdiction at the written request (by petition) of the property owners within a specific section of the service area. Upon receipt of a sufficient number of signatures or petitions, and acceptance by the council, the local improvement area is formed. Therefore, a sewer system is designed for that particular area in accordance with a sewer comprehensive plan. Each separate property in the ULID is assessed in accordance with the special benefits the property receives from the water or wastewater system improvements. An area-wide ULID could form part of a financing package for large-scale capital projects such as sewer line extensions or replacements that benefit all residents within the service area. The assessment places a lien on the property that must be paid in full upon sale of the property. ULID participants have the option of paying their assessment immediately upon receipt, thereby reducing the portion of the costs financed by the ULID bonds.

The advantages of ULID financing, as opposed to rate financing, to the property owner include:

- The ability to avoid interest costs by early payment of assessments
- If the ULID assessment is paid in installments, it may be eligible to be deducted from federal income taxes.
- Low-income senior citizens may be able to defer assessment payments until the property is sold.
- Some Community Block Grant funds are available to property owners with incomes near or below poverty level.

The major disadvantage to the ULID process is that it may be politically difficult to approve formation. The ULID process may be stopped if 40 percent of the property owners protest its formation. Also, there are significant legal and administrative costs associated with the ULID process, which increases total project costs by approximately 30 percent over other financing options.

GENERAL OBLIGATION BONDS

The City, by special election, may issue general obligation bonds to finance almost any project of general benefit to the City. Assessments levied against all privately owned properties within the City will pay for the bonds. This includes vacant property that otherwise would not contribute to the cost of such general improvements. This type of bond issue is usually reserved for municipal improvements that are of general benefit to the public, such as arterial streets, bridges, lighting, municipal buildings, firefighting equipment, parks, and water and wastewater facilities. Because the money is raised by assessment levied on property values, the business community also provides a fair share of funds to pay off such bonds.

General obligation bonds have the best market value and carry the lowest interest rate of all type of bonds available to the City.

Disadvantages of general obligation bonds include the following:

- Voter approval is required which may be time-consuming, with no guarantee of successful approval of the bond.
- The City would have a practical or legal limit for the total amount of general obligation debt. Financing large capital improvements through general obligation debt reduces the ability of the utility to issue future debt for projects such as parks and community facilities that cannot be directly funded through enterprise funds.

APPENDICES

APPENDIX A

STATE WASTE DISCHARGE PERMIT

FACT SHEET FOR STATE WASTE DISCHARGE PERMIT ST-5282
SOAP LAKE WASTEWATER TREATMENT PLANT

SUMMARY

PURPOSE of this Fact Sheet

This fact sheet explains and documents the decisions Ecology made in drafting the proposed State Waste Discharge Permit for the City of Soap Lake that will allow discharge of wastewater to the ground via rapid infiltration basins.

State law requires any domestic wastewater facility to obtain a permit before discharging waste or chemicals to waters of the state which includes groundwater.

A State Waste Discharge Permit limits the types and amounts of pollution the facility may discharge. Ecology bases those limits either on (1) the pollution control or wastewater treatment technology available to the facility, or on (2) the effects of the pollutants on the groundwater.

PUBLIC ROLE in the Permit

Ecology makes the draft permit and fact sheet available for public review and comment at least thirty (30) days before it issues the final permit to the facility operator. Copies of the fact sheet and draft permit for the Soap Lake Wastewater Treatment Plant, State Waste Discharge Permit ST-5282 are available for public review and comment from **December 9, 2011** until the close of business **January 9, 2012**. For more details on preparing and filing comments about these documents, please see **Appendix A - Public Involvement**.

The City of Soap Lake reviewed the draft Fact Sheet for factual accuracy. Ecology corrected any errors or omissions about the facility's location, discharges or receiving water, or its history.

After the public comment period closes, Ecology will summarize substantive comments and our responses to them. Ecology will include our summary and responses to comments to this Fact Sheet as **Appendix D - Response to Comments**, and publish it when we issue the final State Waste Discharge Permit. Ecology will not revise the rest of the fact sheet, but the full document including all appendices will become part of the legal history contained in the facility's permit file.

SUMMARY

The City of Soap Lake, located in Grant County, constructed a Wastewater Treatment Plant (WWTP) in 1978 to replace an existing facility which was originally built in 1946. The City upgraded the WWTP in 2004. The current WWTP incorporates both old system and upgraded components. The controlling factor for facility design is a Total Nitrogen effluent limit of 10 milligrams per liter (mg/L). Operator changes during the last permit cycle have resulted in more timely sampling and reporting of required permit conditions as well as improved facility maintenance. Permit requirements have been amended to reduce unnecessary analyses and add analyses currently required.

TABLE OF CONTENTS

I. Introduction

The legislature defined Ecology's authority and obligations for the wastewater discharge permit program in the Water Pollution Control law, Chapter 90.48 RCW (Revised Code of Washington).

Ecology adopted rules describing how it exercises its authority:

- State Waste Discharge Program (Chapter 173-216 WAC)
- Water Quality Standards For Ground Waters Of The State Of Washington (Chapter 173-200 WAC)
- Discharge Standards And Effluent Limits For Domestic Wastewater Facilities (Chapter 173–221 WAC)
- Submission of Plans and Reports for Construction of Wastewater Facilities (Chapter 173-240 WAC)

These rules require any domestic wastewater to obtain a State Waste Discharge Permit before discharging wastewater to state waters. They also help define the basis for limits on each discharge and for performance requirements imposed by the permit.

Under the State Waste Discharge Permit program and in response to a complete and accepted permit application, Ecology must prepare a draft permit and accompanying fact sheet, and make it available for public review before final issuance. Ecology must also publish an announcement (public notice) telling people where they can read the draft permit, and where to send their comments, during a period of thirty days. (See **Appendix A - Public Involvement** for more detail about the Public Notice and Comment procedures). After the Public Comment Period ends, Ecology may make changes to the draft State Waste Discharge Permit in response to comment. Ecology will summarize the responses to comments and any changes to the permit in **Appendix D.**

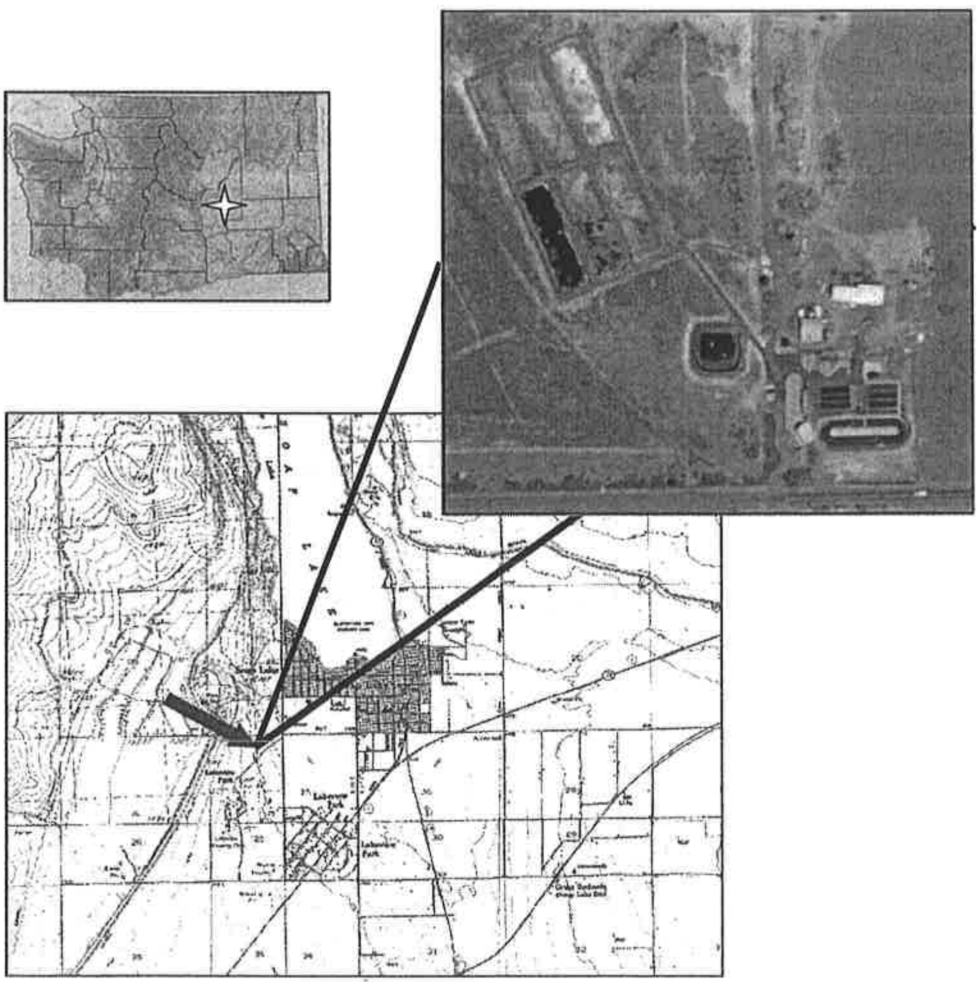
II. Background Information

Table 1: General Facility Information

Facility Information	
Applicant:	City of Soap Lake
Facility Name and Address:	Soap Lake Wastewater Treatment Plant (WWTP) 910 Road 20 NW Soap Lake, WA 98851
Type of Treatment:	Extended aeration activated sludge plant with discharge to rapid infiltration basins land treatment
Discharge Location:	Latitude: 47° 23' 04" N Longitude: 119° 29' 59" W
Legal Description:	SW¼ , SE¼ of Section 24, Township 22, Range 26 E.W.M.
Contact at Facility:	Robert Herron (509) 246-1823 (509)246-1213

Responsible Official:	Raymond Gravelle Mayor of Soap Lake 239 Second Ave SE, Soap Lake, WA 98851
Permit Status	
Renewal Date of Previous Permit:	March 8, 2006
Application for Permit Renewal Submittal Date:	December 10, 2010
Date of Ecology Acceptance of Application:	January 24, 2011
Inspection Status	
Date of Last Inspection Date:	April 7, 2011

Figure 1: Facility Location Maps



A. Facility Description

The Soap Lake Wastewater Treatment Plant (WWTP) is an extended aeration activated sludge plant with an oxidation ditch followed by a clarifier and aerobic digester for sludge treatment. Following primary treatment final discharge is to rapid infiltration basins for land treatment.

History

The City of Soap Lake incorporated in 1919. It is located five miles north of Ephrata and 115 miles west of Spokane, in Grant County, Washington **(Figure 1).** The U.S. Census Bureau reports the estimated population of Soap Lake as 1,790 in 2011, a 3% increase from the 2000 figures.

The City of Soap Lake is named after the major topographic and economic feature in the area also named Soap Lake; a mineral lake which is reputed to be therapeutic in nature. Summer tourism has driven the City's economy in the past but more recently, many retirees have made Soap Lake their permanent home because of the mild, dry climate.

The City constructed a Wastewater Treatment Plant (WWTP) in 1978 to replace an existing facility, originally built in 1946. The old system did not provide the level of treatment and protection of the groundwater currently required. The City upgraded the WWTP in 2004. The current WWTP incorporated several old system components including:

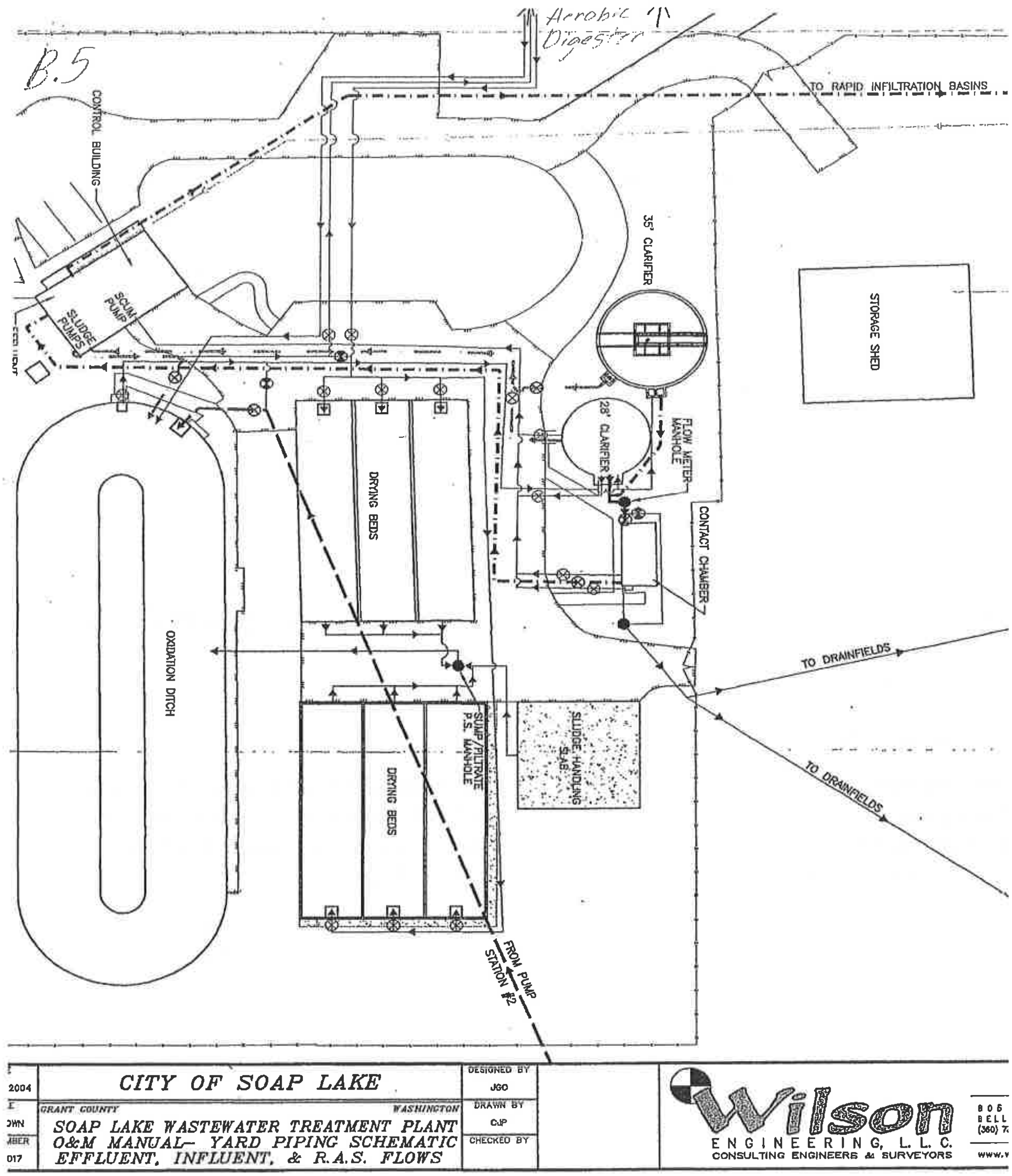
- A comminutor;
- Two 15-horsepower aeration basin rotors;
- One 10,500 gallon digester;
- Three drying beds;
- An abandoned spray field; and,
- A drainfield system.

The upgraded plant began operation in the spring of 2004. Major components of the upgrade include:

- An influent grinder;
- A modified oxidation ditch to add nitrogen removal capability;
- A clarifier;
- Upgraded sludge handling facilities; and,
- Rapid infiltration basins to replace the existing land application spray irrigation and drainfield.

The controlling factor for facility design is a Total Nitrogen effluent limit of 10 mg/L. The facility design is shown on **Figure 2**.

Figure 1: Wastewater Treatment Process (Prior to Land Treatment) Diagram



The Soap Lake WWTP is an extended aeration treatment type facility with a design flow of less than five (5) million gallons per day (MGD) and is therefore classified as a Type II facility (WAC 173-230-140). There is currently a single operator; the operator has obtained a Group II certification level. There are no reported pre-treatment industrial/commercial users discharging to the facility.

Lift Station #2 pumps wastewater into the headworks via a six-inch forcemain. The influent comminutor grinds and blocks large objects and discharges through an open channel towards the aeration-oxidation ditch. The aeration oxidation ditch provides biological oxidation and denitrification of the influent. Wastewater flows from the aeration-oxidation ditch to the clarifiers, which separates activated sludge from the clarified wastewater. Some sludge is recycled in the oxidation ditch as return activated sludge (RAS) and some is wasted waste activated sludge (WAS) and sent to the aerobic digester for additional aeration. Scum from the clarifiers is trapped in the outer raceway and routed into a 10-inch scum pipe, which is rotated once or twice a day on the downstream side of the pipe. The WAS is stored during winter months in the digester and discharged into the drying beds during summer months. The facility also can use a sludge handling slab to store dry sludge as well.

The City is not planning any upgrades or additions to the facility during this permit cycle. However, it will need to implement the new biosolids screening requirement prior to July 1, 2012. The biosolids screens will remove plastics, glass, ceramics, cans, and other garbage from biosolids prior to grinding. The City completed an Engineering Report in November 1998 (Hammond, 1998) which Ecology approved in May 1999. Ecology also approved an Engineering Report Supplement in May 1999. The City completed and submitted a Pre-design Report for WWTP improvements in 2001(Wilson, 2000). The City completed the facility upgrades outlined as Phase I in the Pre-design Report in 2004. The biosolids screening improvements were included in Phase II.

Collection System Status

The collection system consists of approximately 60,000 lineal feet of 6- to12-inch diameter pipe. The pipe is predominantly concrete and dates to the 1940's and 1950's. The system includes an undetermined amount of terracotta pipe with an unknown installation date. The City has recently added or replaced approximately 5,700 feet of piping with PVC.

Two pump stations serve the system. Pump Station No. 1 serves Basin A, which is the area east of Division Street and north of the city limits. Pump Station No. 2 serves Basin B, which is the area west of Division Street and extending across the city. Pump Station No. 1 discharges to Pump Station No. 2.

Distribution System (Infiltration Basins)

After secondary treatment and clarification, the facility pumps the effluent to one of six (6) rapid infiltration basins located northwest of the main facility. Total area of the basins is 2.6 acres. The operators rotate the discharge to the basins to avoid oversaturation.

Due to the arid nature of the region, discharge to each infiltration basin is continued until the surface of the basin has complete coverage (usually from one week to one month) to ensure the entire area of each infiltration basin is used for infiltration. Once coverage is complete, the operator rotates to the next infiltration basin.

Subsurface soils at the infiltration basins range from moderately permeable to highly permeable with vertical infiltration rates ranging from two to 20 inches per hour. Soap Lake completed maintenance of the basins in 2011. Maintenance consisted of removal of vegetative growth that could impede water infiltration or create pathways of preferential infiltration. A chain link fence restricts public access.

Solid Wastes

The solid waste from this facility is sent to Boulder Park for land application under permit by Ecology.

Geology and Hydrogeology

Ecology excerpted the following information regarding facility geology and hydrogeology from the Hydrogeologic Report completed in 1997 (Hammond, Collier & Wade-Livingstone, 1997).

The basic geologic unit underlying the Soap Lake area is the Columbia River Basalt group. The numerous lava flows of the Tertiary Age left a layered bed of basalt four to five thousand feet deep. Tilting and faulting during the Quaternary Age exposed the permeable sedimentary zones in mono and anticlines, which recharge and store groundwater.

Soap Lake lies in a basin at the south end of a chain of lakes in the old temporary bed of the Columbia River now known as the Lower Grand Coulee. The subsurface geology, near the WWTP, consists of sand, gravel and boulders to an approximately depth of 80 feet.

The only surface inflow to the lake comes from precipitation. Groundwater occurs in the shallow gravels and deeper basalts. Groundwater in some of the deeper basalt aquifers has been under artesian pressure in the past. The average saturated thickness of the gravel aquifer near the WWTP is approximately 45 feet. The regional groundwater of the shallow aquifer near the facility flows to the north towards the lake.

B. Summary of Compliance with Previous Permit

The Soap Lake WWTP violated permit conditions 31 times since issuance of the previous permit on March 9, 2006. However, the only significant violation is the late submittals of Discharge Monitoring Reports (DMR) which occurred at the end of 2010 and was likely due to an operator change. Since the City hired a new operator, it has submitted its DMRs on time and has met permit requirements. Currently the facility has no outstanding Notices of Violations or Orders to Comply.

C. Wastewater Characterization

The City of Soap Lake reported the concentration of pollutants in the State Waste Discharge application and in the submitted monthly DMRs.

The tabulated data represents the quality of the effluent discharged from April 1, 2006 through November 2010. The effluent prior to infiltration is characterized as follows:

Table 2: Wastewater Characterization

Parameter	Average Concentration	Maximum Concentration
Flow, maximum daily (gallons per day [gpd])	189,300	300,000
Biological Oxygen Demand five-day average (BOD_5, mg/L)	5.5	8.45
Total Suspended Solids (TSS, mg/L)	7	14
Total Dissolved Solids (TDS, mg/L)	426	640
Conductivity (µmhos/cm)	858	1022
Nitrate (NO_3, mg/L)	2.6	4.6
Ammonia as Nitrogen (N, mg/L)	0.83	25.1
pH in standard units (s.u.)	7.7	8.5
Total Phosphorus (as P)	4.2	17.5
Total Kjeldahl Nitrogen (TKN as N [mg/L])	1.9	13

D. Groundwater Characterization

Three groundwater monitoring wells were completed in September 2003 for the purpose of monitoring groundwater associated with the infiltration basins at the facility. **Table 3** provides monitoring well information.

Table 3: Monitoring Well Location Information

Well No.	Ecology Well Tag No.	Elevation (NAVD88)	Latitude Decimal	Longitude Decimal	Well Depth (feet from ground surface)
MW1	AHS516	1214.76	47.383665	119.506529	80.0
MW2	AHS517	1175.45	47.387138	119.503788	80.0
MW3	AHS518	1160.86	47.385235	119.501268	76.0

Soap Lake has conducted groundwater sampling sporadically since 2006. Available data indicates that groundwater is within the established groundwater quality criteria (173-200 WAC) for the requested analyses. Local groundwater flow direction is to the east. MW-1 is the apparent upgradient well.

E. SEPA Compliance

State law exempts reissuance or modification of any wastewater discharge permit from the SEPA process as long as the permit contains conditions that are no less stringent than federal and state rules and regulations (RCW 43.21C.0383). The exemption applies only to existing discharges, not to new discharges.

III. Proposed Permit Conditions

State regulations require that Ecology base limits in a State Waste Discharge Permit on the:

- Technology and treatment methods available to treat specific pollutants (technology-based). Dischargers must treat wastewater using all known, available, reasonable methods of prevention, control, and treatment (AKART). Ecology and the state Department of Health have adopted technology-based (AKART) criteria for municipal systems that discharge to ground; (WA. Dept. of Health, 1994).
- Operations and best management practices necessary to meet applicable water quality standards to preserve or protect beneficial uses for ground waters.
- Ground water quality standards (Ecology, 1996).
- Applicable requirements of other local, state and federal laws.

Ecology applies the most stringent of these limits to each parameter of concern and further describes the proposed limits below.

The limits in this permit reflect information received in the application and from supporting reports (engineering, hydrogeology, monitoring, and irrigation/crop management). Ecology evaluated the permit application and determined the limits needed to comply with the rules adopted by the State of Washington. Ecology does not develop effluent limits for all reported pollutants. Some pollutants are not treatable at the concentrations reported, are not controllable at the source, and are not listed in regulation.

Ecology does not usually develop permit limits for pollutants not reported in the permit application but may be present in the discharge. The permit does not authorize the discharge of the non-reported pollutants. During the five-year permit term, the facility's effluent discharge conditions may change from those conditions reported in the permit application. The facility must notify Ecology if significant changes occur in any constituent. Until Ecology modifies the permit to reflect additional discharges of pollutants, a permitted facility could be violating its permit.

A. Design Criteria

Under WAC 173-216-110 (4), flows and waste loadings must not exceed approved design criteria. Ecology approved design criteria for this facility's treatment plant and the sprayfields in the engineering report/facility plan/plans and specifications titled *Predesign Report for Wastewater Treatment Plant Improvements* (Wilson, 2000). The table below includes design criteria from the referenced report.

Table 3: Design Criteria for Plant Loading

Parameter	Design Quantity
Average Daily Flow	300,000 gpd
Maximum Daily Flow	420,000 gpd
Influent BOD5 Loading	517 lbs/day
Influent TSS Loading	465 lbs/day

B. Technology-Based Effluent Limits

Waste discharge permits issued by Ecology specify conditions requiring the facility to use AKART before discharging to waters of the state (RCW 90.48). Ecology defines AKART for domestic wastewater facilities in chapter 173-221 WAC, Discharge Standards and Effluent Limits for Domestic Wastewater Facilities and in the Department of Health's design criteria (1994).

Ecology approved the engineering report titled *City of Soap Lake Wastewater Treatment Facilities Engineering Report*, dated November 1998, and prepared by Hammond, Collier & Wade-Livingstone Associates, Inc.

Ecology evaluated the report using the:

- Discharge standards and effluent limits for domestic wastewater facilities
- Guidelines for the Preparation of Engineering Reports for Industrial Wastewater Land Application Systems, Ecology, May 1993.
- Guidance on Land Treatment of Nutrients in Wastewater, with Emphasis on Nitrogen, Ecology, November 1994 (http://www.ecy.wa.gov/biblio/0410081.html).
- Criteria for Sewage Works Design, Ecology, 2006).

Ecology determined that the facility meets the minimum requirements demonstrating compliance with the AKART standard if the City of Soap Lake operates the treatment and disposal system as described in the approved engineering report and any subsequent Ecology approved reports.

C. Groundwater Quality Based Effluent Limits

In order to protect existing water quality and preserve the designated beneficial uses of Washington's ground waters including the protection of human health, WAC 173-200-100 states that waste discharge permits shall be conditioned in such a manner as to authorize only activities that will not cause violations of the ground water quality standards. The goal of the ground water quality standards is to maintain the highest quality of the State's ground waters and to protect existing and future beneficial uses of the ground water through the reduction or elimination of the discharge of contaminants to ground water [WAC 173-200-010(4)]. Ecology achieves this goal by:

- Applying all known available and reasonable methods of prevention, control and treatment (AKART) to any discharge.
- Applying the antidegradation policy of the ground water standards.
- Establishing numeric and narrative criteria for the protection of human health and the environment in the ground water quality standards.

Antidegradation Policy

The state of Washington's ground water quality standards (GWQS) require preservation of existing and future beneficial uses of ground water through the antidegradation policy, which includes the two concepts of antidegradation and non-degradation.

Antidegradation

Antidegradation is not the same as non-degradation (see below). Antidegradation applies to calculation of permit limits in ground water when background (see below) contaminant concentrations are less than criteria in the GWQS. Ecology has discretion to allow the concentrations of contaminants at the point of compliance to exceed background concentrations but not exceed criteria in the GWQS. Ecology grants discretion through an approved AKART engineering analysis of treatment alternatives. If the preferred treatment alternative predicts that discharges to ground water will result in contaminant concentrations that fall between background concentrations and the criteria, then the preferred treatment alternative should protect beneficial uses and meet the antidegradation policy. In this case, the predicted concentrations become the permit limits. If the preferred alternative will meet background contaminant concentrations, background concentrations become the permit limits. Permit limits must protect ground water quality by preventing degradation beyond the GWQS criteria. If discharges will result in exceedance of the criteria, facilities must apply additional treatment before Ecology can permit the discharge.

Non-Degradation

Non-degradation applies to permit limits in ground water when background contaminant concentrations exceed criteria in the GWQS. Non-degradation means that discharges to ground water must not further degrade existing water quality. In this case, Ecology considers the background concentrations as the water quality criteria and imposes the criteria as permit limits. To meet the antidegradation policy, the facility must prepare an AKART engineering analysis that demonstrates that discharges to ground water will not result in increasing background concentrations. Ecology must review and approve the AKART engineering analysis.

You can obtain more information on antidegradation and non-degradation by referring to the *Implementation Guidance for the Ground Water Quality Standards (Implementation Guidance)*, Ecology Publication #96-02 (available at http://www.ecy.wa.gov/biblio/9602.html).

Background Water Quality

Background water quality is determined by a statistical calculation of contaminant concentrations without the impacts of the proposed activity. The calculation requires an adequate amount of ground water quality data and determining the mean and standard deviation of the data, as described in the *Implementation Guidance for Groundwater Quality Standards* (Implementation Guidance). Following the procedure in the *Implementation Guidance,* Ecology then defines background water quality for most contaminants as the 95 percent upper tolerance limit. This means that Ecology is 95 percent confident that 95 percent of future measurements will be less than the upper tolerance limit.

There are a few exceptions to the use of the upper tolerance limit. For pH, Ecology will calculate both an upper and a lower tolerance limit resulting in an upper and lower bound to the background water quality. If dissolved oxygen is of interest, Ecology will calculate a lower tolerance limit without an upper tolerance limit.

Applicable ground water criteria as defined in chapter 173-200 WAC and in RCW 90.48.520 for this discharge include those in the following table:

Table 5: Applicable Ground Water Quality Criteria

Parameter	Units
Total Coliform Bacteria	1 Colony/ 100 mL
Total Dissolved Solids	500 mg/L
Nitrate (as nitrogen)	10 mg/L
pH	6.5 to 8.5 s.u.

Ecology has reviewed existing records for the facility and is unable to determine background groundwater quality tolerance limits without additional data. The proposed permit includes a continued groundwater sampling schedule to establish the upgradient (background) quality of the ground water. The available data indicates that the rapid infiltration land treatment process is providing adequate final treatment for the wastewater effluent and is maintaining groundwater standards at the point of compliance. It is Ecology's best professional judgment to continue permitting the rapid infiltration basin land treatment process until sufficient data is collected to establish background water quality. The facility will operate within the approved design parameters and comply with all conditions in the permit.

D. Comparison of Effluent Limits with the Previous Permit

The average monthly effluent limitations for flow, BOD_5 and TSS will remain the same as the previous permit. Average weekly effluent limits (45 mg/L) have been added for BOD_5 and TSS. An average monthly removal rate of 85% has been added (in pounds per day [lbs/day]). Total Nitrogen has been defined as "…the sum of Total Kjeldahl Nitrogen (TKN) plus Nitrate and Nitrite". Limits for pH have been removed.

Table 6: Comparison of Previous and Proposed Limits

Parameter	Existing Effluent Limitations (average monthly)	Proposed Effluent Limitations (average monthly)
Flow	300,000 gpd	300,000 gpd
BOD5	30 mg/L	30 mg/L average monthly, 45 mg/L average weekly 85% Removal (lbs/day)
TSS	30 mg/L	30 mg/L average monthly, 45 mg/L average weekly 85% Removal (lbs/day)
pH	6.5-8.5 s.u.	Removed
Total Nitrogen (as N)	10 mg/L	10 mg/L

IV. Monitoring Requirements

Ecology requires monitoring, recording, and reporting (WAC 173-216-110) to verify that the treatment process functions correctly, the discharge meets ground water criteria and that the discharge complies with the permit's effluent limits.

A. Lab Accreditation

Ecology requires that facilities must use a laboratory registered or accredited under the provisions of chapter 173-50 WAC, Accreditation of Environmental Laboratories, to prepare all monitoring data (with the exception of certain parameters). Ecology accredited the laboratory at this facility for BOD, conductivity, TKN, Nitrate-Nitrite, Dissolved Oxygen, pH, Total Dissolved Solids, and Total Suspended Solids.

B. Wastewater Monitoring

Ecology details the proposed monitoring schedule under Permit Special Condition S2. Specified monitoring frequencies take into account the quantity and variability of the discharge, the treatment method, past compliance, significance of pollutants, and cost of monitoring. The required monitoring frequency is consistent with agency guidance given in the current version of Ecology's *Permit Writer's Manual* (Publication Number 92-09) for publicly owned treatment works discharging to land.

The following changes are proposed for the next permit cycle:

- The proposed permit expands the reporting requirements for *BOD_5* and *TSS* to include calculations for *pounds/day (lbs/day)* and *percent (%) removal* for effluent.
- A *total nitrogen* calculation was added to determine compliance with limit.
- *Total dissolved solids* analysis was changed to *total fixed dissolved solids* analysis to determine the inorganic salt loading potential. Bicarbonates are included in the TFDS analysis.

- The requirement for total phosphorus was removed from the effluent sampling because the facility has collected sufficient data to characterize the effluent for that parameter.
- The requirement for total metals (arsenic, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, and zinc) was removed from the effluent sampling because there are no know dischargers to the facility that would have sufficient waste stream to include.

C. Sludge Monitoring

Monitoring of sludge quantity and quality is necessary to determine the appropriate uses of the sludge. Biosolids monitoring is required by the current state and local solid waste management program and also by EPA under 40 CFR 503.

D. Groundwater Monitoring

Ecology requires ground water monitoring at the site in accordance with the Ground Water Quality Standards, Chapter 173-200 WAC. Ecology has determined that this discharge has a potential to pollute the ground water. Therefore the facility must evaluate the impacts on ground water quality. Ecology considers monitoring of the ground water within the site boundaries an integral component of such an evaluation.

Sufficient data have been collected to determine that infiltration of treated effluent are not significantly impacting groundwater for chloride and sulfate so these parameters will be removed from the groundwater monitoring schedule for this permit cycle. The requirement for temperature monitoring was also removed as it is meaningless unless completed in the field during sampling.

V. Other Permit Conditions

A. Reporting and Recordkeeping

Ecology based Special Condition S3. on its authority to specify any appropriate reporting and recordkeeping requirements to prevent and control waste discharges (WAC 173-216-110).

B. Prevention of Facility Overloading

Overloading of the treatment plant is a violation of the terms and conditions of the permit. To prevent this from occurring, RCW 90.48.110 and WAC 173-216-110 require the City of Soap Lake to:

- Take the actions detailed in proposed permit Special Condition S4.
- Plant expansions or modifications before the treatment plant reaches existing capacity.
- Report and correct conditions that could result in new or increased discharges of pollutants.

C. Operations and Maintenance

Ecology requires dischargers to take all reasonable steps to properly operate and maintain their wastewater treatment system in accordance with state regulations (WAC 173-240-080 and WAC 173-216-110). The facility has prepared and must submit an update of an Operation and Maintenance Manual for the wastewater facility.

Implementation of the procedures in the Operation and Maintenance Manual ensures the facility's compliance with the terms and limits in the permit and ensures the facility provides AKART to the waste stream.

D. Pretreatment

Duty to Enforce Discharge Prohibitions

This provision prohibits the Publicly Owned Treatment Works (POTW) from authorizing or permitting an industrial discharger to discharge certain types of waste into the sanitary sewer.

- The first section of the pretreatment requirements prohibits the POTW from accepting pollutants which causes "pass-through" or "interference". This general prohibition is from 40 CFR §403.5(a). Appendix C of this fact sheet defines these terms.
- The second section reinforces a number of specific state and federal pretreatment prohibitions found in WAC 173-216-060 and 40 CFR §403.5(b). These reinforce that the POTW may not accept certain wastes, which:
    a. Are prohibited due to dangerous waste rules.
    b. Are explosive or flammable.
    c. Have too high or low of a pH (too corrosive, acidic or basic).
    d. May cause a blockage such as grease, sand, rocks, or viscous materials.
    e. Are hot enough to cause a problem.
    f. Are of sufficient strength or volume to interfere with treatment.
    g. Contain too much petroleum-based oils, mineral oil, or cutting fluid.
    h. Create noxious or toxic gases at any point.

40 CFR Part 403 contains the regulatory basis for these prohibitions, with the exception of the pH provisions, which are based on WAC 173-216-060.

- The third section of pretreatment conditions reflects state prohibitions on the POTW accepting certain types of discharges unless the discharge has received prior written authorization from Ecology. These discharges include:
    a. Cooling water in significant volumes.
    b. Stormwater and other direct inflow sources.

Wastewaters significantly affecting system hydraulic loading, which do not require treatment.

Federal and State Pretreatment Program Requirements

Ecology administers the pretreatment program under the terms of the addendum to the "Memorandum of Understanding between Washington Department of Ecology and the United States Environmental Protection Agency, Region 10" (1986) and 40 CFR, Part 403. Under this delegation of authority, Ecology issues wastewater discharge permits for significant industrial users (SIUs) discharging to POTWs which have not been delegated authority to issue wastewater discharge permits.

Ecology must approve, condition, or deny new discharges or a significant increase in the discharge for existing significant industrial users (SIUs) [40 CFR 403.8 (f)(1)(i) and(iii)].

Industrial dischargers must obtain a permit from Ecology before discharging waste to the City of Soap Lake [WAC 173-216-110(5)]. Industries discharging wastewater that is similar in character to domestic wastewater do not require a permit.

Routine Identification and Reporting of Industrial Users

The permit requires non-delegated POTWs to take "continuous, routine measures to identify all existing, new, and proposed Significant Industrial Users (SIUs) and Potential Significant Industrial Users (PSIUs)" discharging to their sewer system. Examples of such routine measures include regular review of water and sewer billing records, business license and building permit applications, advertisements, and personal reconnaissance. System maintenance personnel should be trained on what to look for so they can identify and report new industrial dischargers in the course of performing their jobs. The POTW may not allow SIUs to discharge prior to receiving a permit, and must notify all industrial dischargers (significant or not) in writing of their responsibility to apply for a State Waste Discharge Permit. The POTW must send a copy of this notification to Ecology.

Industrial User Survey Update

This provision requires the POTW to complete an industrial user survey using the *Guidance Manual for Performing an Industrial User Survey* (Ecology, 2011, http://www.ecy.wa.gov/biblio/1110055.html), and submit an updated list of existing and proposed Significant Industrial Users (SIUs) and Potential Significant Industrial Users (PSIUs). This provides Ecology with notice of any new or proposed industrial users in the POTW's service area.

As sufficient data becomes available, the City must, in consultation with Ecology, reevaluate its local limits in order to prevent pass-through or interference. In addition, Ecology may require revision or establishment of local limits for any pollutant that causes a violation of water quality standards or established effluent limits.

Ecology may modify this permit to incorporate additional requirements relating to the establishment and enforcement of local limits for pollutants of concern.

E. Groundwater Quality Evaluation (Hydrogeologic Study)

The facility completed the hydrogeologic study in 1999, groundwater monitoring wells were installed per the recommendations of the study and groundwater monitoring began in 2006. Groundwater monitoring will continue on a quarterly basis throughout this permit cycle.

F. General Conditions

Ecology bases the standardized General Conditions on state and federal law and regulations. They are included in all State Waste Discharge Permits issued by Ecology.

VI. Permit Issuance Procedures

A. Permit Modifications

Ecology may modify this permit to impose more conservative numerical limits, if necessary to comply with water quality standards for ground waters, based on new information from sources such as inspections, effluent monitoring, outfall studies, and effluent mixing studies.

Ecology may modify this permit to comply with new or amended state regulations.

B. Proposed Permit Issuance

This proposed permit meets all statutory requirements for authorizing a wastewater discharge, including those limits and conditions believed necessary to control toxics, and to protect human health and the beneficial uses of waters of the State of Washington. Ecology proposes that the permit be issued for five (5) years.

VII. References for Text and Appendices

Gavlak, R., D. Horneck , R.O. Miller, and J. Kotuby-Amacher. Soil, Plant And Water Reference Methods For The Western Region, 2nd edition 2003.

Hammond, Collier & Wade-Livingstone Associates Incorporated, 1999. City of Soap Lake Hydrogeologic Report. 76pp.

Washington State Department of Ecology.

1993. *Guidelines for Preparation of Engineering Reports for Industrial Wastewater Land Application Systems*, Ecology Publication Number 93-36. 20 pp. (http://www.ecy.wa.gov/pubs/9336.pdf)

1997. *Water Reclamation and Reuse Standards*, Ecology Publication Number 97-23. 73 pp. (http://www.ecy.wa.gov/biblio/97023.html)

Laws and Regulations (http://www.ecy.wa.gov/laws-rules/index.html)

Permit and Wastewater Related Information (http://www.ecy.wa.gov/programs/wq/wastewater/index.html)

Revised October 2005. *Implementation Guidance for the Ground Water Quality Standards, Ecology Publication* Number 96-02. (http://www.ecy.wa.gov/biblio/9602.html)

Revised August 2008. *Criteria for Sewage Works Design.* Publication Number 98-37. (http://www.ecy.wa.gov/biblio/9837.html)

November 2010. *Permit Writer's Manual.* Publication Number 92-109 (http://www.ecy.wa.gov/biblio/92109.html)

November 2004. *Guidance on Land Treatment of Nutrients in Wastewater, with Emphasis on Nitrogen, Ecology Publication* Number 04-10-081; (http://www.ecy.wa.gov/biblio/0410081.html)

Washington State Department of Health.

February 1994. *Design Criteria for Municipal Wastewater Land Treatment Systems for Public Health Protection.* (http://www.ecy.wa.gov/programs/wq/wastewater/municipal_land_treatment_design_criteria.pdf)

Wilson Engineering, L.L.C., 2004. City of Soap Lake Operation and Maintenance Manual for the Wastewater Treatment Plant. March.

Wilson Engineering, L.L.C., 2001. City of Soap Lake, Predesign Report for Wastewater Treatment Plant Improvements. February.

Appendix A - Public Involvement Information

Ecology proposes to reissue a permit to The City of Soap Lake Wastewater Treatment Plant. The permit prescribes operating conditions and wastewater discharge limits. This fact sheet describes the facility and Ecology's reasons for requiring permit conditions.

Ecology placed a Public Notice of Application on January 28, 2011 and February 4, 2011 in the Columbia Basin Herald to inform the public about the submitted application and to invite comment on the reissuance of this permit.

Ecology will place a Public Notice of Draft Permit on December 9, 2011 in the Columbia Basin Herald to inform the public and to invite comment on the proposed reissuance of this State Waste Discharge Permit as drafted.

Ecology will place a Public Notice of Draft Amended Permit on January 16, 2012 in the Columbia Basin Herald to inform the public and to invite comment on the proposed reissuance of this State Waste Discharge Permit as drafted. Ecology is issuing a draft amended permit and fact sheet and is only accepting comments on the modified portions.

The notice:

- Tells where copies of the draft Permit and Fact Sheet are available for public evaluation (the closest Regional or Field Office, posted on our website).
- Offers to provide the documents in an alternate format to accommodate special needs.
- Urges people to submit their comments, in writing, before the end of the Comment Period
- Tells how to request a public hearing of comments about the proposed state waste discharge permit.
- Explains the next step(s) in the permitting process.

Ecology has published a document entitled *Frequently Asked Questions about Effective Public Commenting*, which is available on our website at http://www.ecy.wa.gov/biblio/0307023.html.

You may obtain further information from Ecology by telephone at (509) 329-3518 or by writing to the permit writer at the address listed below.

Water Quality Permit Coordinator
Department of Ecology
Eastern Regional Office
4601 North Monroe Street
Spokane, WA 99205-1295

The primary author of this permit and fact sheet is Marcia Sands.

Appendix B - Your Right to Appeal

You have a right to appeal this permit to the Pollution Control Hearing Board (PCHB) within 30 days of the date of receipt of the final permit. The appeal process is governed by chapter 43.21B RCW and chapter 371-08 WAC. "Date of receipt" is defined in RCW 43.21B.001(2) (see glossary).

To appeal you must do the following within 30 days of the date of receipt of this permit:

- File your appeal and a copy of this permit with the PCHB (see addresses below). Filing means actual receipt by the PCHB during regular business hours.
- Serve a copy of your appeal and this permit on Ecology in paper form - by mail or in person. (See addresses below.) E-mail is not accepted.

You must also comply with other applicable requirements in chapter 43.21B RCW and chapter 371-08 WAC.

ADDRESS AND LOCATION INFORMATION

Street Addresses	Mailing Addresses
Department of Ecology Attn: Appeals Processing Desk 300 Desmond Drive SE Lacey, WA 98503 **Pollution Control Hearings Board** 1111 Israel RD SW STE 301 Tumwater, WA 98501	**Department of Ecology** Attn: Appeals Processing Desk PO Box 47608 Olympia, WA 98504-7608 **Pollution Control Hearings Board** PO Box 40903 Olympia, WA 98504-0903

Appendix C - Glossary

1-DMax or 1-Day Maximum Temperature -- The highest water temperature reached on any given day. This measure can be obtained using calibrated maximum/minimum thermometers or continuous monitoring probes having sampling intervals of thirty minutes or less.

7-DADMax or 7-Day Average of the Daily Maximum Temperatures -- The arithmetic average of seven consecutive measures of daily maximum temperatures. The 7-DADMax for any individual day is calculated by averaging that day's daily maximum temperature with the daily maximum temperatures of the three days prior and the three days after that date.

Acute Toxicity -- The lethal effect of a compound on an organism that occurs in a short time period, usually 48 to 96 hours.

AKART -- The acronym for "all known, available, and reasonable methods of prevention, control and treatment." AKART is a technology-based approach to limiting pollutants from wastewater discharges, which requires an engineering judgment and an economic judgment. AKART must be applied to all wastes and contaminants prior to entry into waters of the state in accordance with RCW 90.48.010 and 520, WAC 173-200-030(2)(c)(ii), and WAC 173-216-110(1)(a).

Alternate Point of Compliance -- An alternative location in the ground water from the point of compliance where compliance with the ground water standards is measured. It may be established in the ground water at locations some distance from the discharge source, up to, but not exceeding the property boundary and is determined on a site specific basis following an AKART analysis. An "early warning value" must be used when an alternate point is established. An alternate point of compliance must be determined and approved in accordance with WAC 173-200-060(2).

Ambient Water Quality -- The existing environmental condition of the water in a receiving water body.

Ammonia -- Ammonia is produced by the breakdown of nitrogenous materials in wastewater. Ammonia is toxic to aquatic organisms, exerts an oxygen demand, and contributes to eutrophication. It also increases the amount of chlorine needed to disinfect wastewater.

Annual Average Design Flow (AADF) -- average of the daily flow volumes anticipated to occur over a calendar year.

Average Monthly Discharge Limit -- The average of the measured values obtained over a calendar month's time.

Background Water Quality -- The concentrations of chemical, physical, biological or radiological constituents or other characteristics in or of ground water at a particular point in time upgradient of an activity that has not been affected by that activity, [WAC 173-200-020(3)]. Background water quality for any parameter is statistically defined as the 95% upper tolerance interval with a 95% confidence based on at least eight hydraulically upgradient water quality samples. The eight samples are collected over a period of at least one year, with no more than one sample collected during any month in a single calendar year.

Best Management Practices (BMPs) -- Schedules of activities, prohibitions of practices, maintenance procedures, and other physical, structural and/or managerial practices to prevent or reduce the pollution of waters of the state.

BMPs include treatment systems, operating procedures, and practices to control: plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage. BMPs may be further categorized as operational, source control, erosion and sediment control, and treatment BMPs.

BOD_5 -- Determining the five-day Biochemical Oxygen Demand of an effluent is an indirect way of measuring the quantity of organic material present in an effluent that is utilized by bacteria. The BOD_5 is used in modeling to measure the reduction of dissolved oxygen in receiving waters after effluent is discharged. Stress caused by reduced dissolved oxygen levels makes organisms less competitive and less able to sustain their species in the aquatic environment. Although BOD_5 is not a specific compound, it is defined as a conventional pollutant under the federal Clean Water Act.

Bypass -- The intentional diversion of waste streams from any portion of a treatment facility.

Categorical Pretreatment Standards -- National pretreatment standards specifying quantities or concentrations of pollutants or pollutant properties, which may be discharged to a POTW by existing or new industrial users in specific industrial subcategories.

Chlorine -- A chemical used to disinfect wastewaters of pathogens harmful to human health. It is also extremely toxic to aquatic life.

Chronic Toxicity -- The effect of a compound on an organism over a relatively long time, often 1/10 of an organism's lifespan or more. Chronic toxicity can measure survival, reproduction or growth rates, or other parameters to measure the toxic effects of a compound or combination of compounds.

Clean Water Act (CWA) -- The federal Water Pollution Control Act enacted by Public Law 92-500, as amended by Public Laws 95-217, 95-576, 96-483, 97-117; USC 1251 et seq.

Compliance Inspection-Without Sampling -- A site visit for the purpose of determining the compliance of a facility with the terms and conditions of its permit or with applicable statutes and regulations.

Compliance Inspection-With Sampling -- A site visit for the purpose of determining the compliance of a facility with the terms and conditions of its permit or with applicable statutes and regulations. In addition it includes as a minimum, sampling and analysis for all parameters with limits in the permit to ascertain compliance with those limits; and, for municipal facilities, sampling of influent to ascertain compliance with the 85 percent removal requirement. Ecology may conduct additional sampling.

Composite Sample -- A mixture of grab samples collected at the same sampling point at different times, formed either by continuous sampling or by mixing discrete samples. May be "time-composite" (collected at constant time intervals) or "flow-proportional" (collected either as a constant sample volume at time intervals proportional to stream flow, or collected by increasing the volume of each aliquot as the flow increased while maintaining a constant time interval between the aliquots).

Construction Activity -- Clearing, grading, excavation, and any other activity, which disturbs the surface of the land. Such activities may include road building; construction of residential houses, office buildings, or industrial buildings; and demolition activity.

Continuous Monitoring -- Uninterrupted, unless otherwise noted in the permit.

Critical Condition -- The time during which the combination of receiving water and waste discharge conditions have the highest potential for causing toxicity in the receiving water environment. This situation usually occurs when the flow within a water body is low, thus, its ability to dilute effluent is reduced.

Date of Receipt – This is defined in RCW 43.21B.001(2) as five business days after the date of mailing; or the date of actual receipt, when the actual receipt date can be proven by a preponderance of the evidence. The recipient's sworn affidavit or declaration indicating the date of receipt, which is unchallenged by the agency, constitutes sufficient evidence of actual receipt. The date of actual receipt, however, may not exceed forty-five days from the date of mailing.

Detection Limit -- See Method Detection Level.

Dilution Factor (DF) -- A measure of the amount of mixing of effluent and receiving water that occurs at the boundary of the mixing zone. Expressed as the inverse of the percent effluent fraction, for example, a dilution factor of 10 means the effluent comprises 10% by volume and the receiving water 90%.

Distribution Uniformity -- The uniformity of infiltration (or application in the case of sprinkle or trickle irrigation) throughout the field expressed as a percent relating to the average depth infiltrated in the lowest one-quarter of the area to the average depth of water infiltrated.

Early Warning Value -- The concentration of a pollutant set in accordance with WAC 173-200-070 that is a percentage of an enforcement limit. It may be established in the effluent, ground water, surface water, the vadose zone or within the treatment process. This value acts as a trigger to detect and respond to increasing contaminant concentrations prior to the degradation of a beneficial use.

Enforcement Limit -- The concentration assigned to a contaminant in the ground water at the point of compliance for the purpose of regulation, [WAC 173-200-020(11)]. This limit assures that a ground water criterion will not be exceeded and that background water quality will be protected.

Engineering Report -- A document that thoroughly examines the engineering and administrative aspects of a particular domestic or industrial wastewater facility. The report must contain the appropriate information required in WAC 173-240-060 or 173-240-130.

Fecal Coliform Bacteria -- Fecal coliform bacteria are used as indicators of pathogenic bacteria in the effluent that are harmful to humans. Pathogenic bacteria in wastewater discharges are controlled by disinfecting the wastewater. The presence of high numbers of fecal coliform bacteria in a water body can indicate the recent release of untreated wastewater and/or the presence of animal feces.

Grab Sample -- A single sample or measurement taken at a specific time or over as short a period of time as is feasible.

Ground Water -- Water in a saturated zone or stratum beneath the surface of land or below a surface water body.

Industrial User -- A discharger of wastewater to the sanitary sewer that is not sanitary wastewater or is not equivalent to sanitary wastewater in character.

Industrial Wastewater -- Water or liquid-carried waste from industrial or commercial processes, as distinct from domestic wastewater.

These wastes may result from any process or activity of industry, manufacture, trade or business; from the development of any natural resource; or from animal operations such as feed lots, poultry houses, or dairies. The term includes contaminated storm water and, also, leachate from solid waste facilities.

Interference -- A discharge which, alone or in conjunction with a discharge or discharges from other sources, both:

- Inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal; and
- Therefore is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or of the prevention of sewage sludge use or disposal in compliance with the following statutory provisions and regulations or permits issued thereunder (or more stringent State or local regulations): Section 405 of the Clean Water Act, the Solid Waste Disposal Act (SWDA) (including title II, more commonly referred to as the Resource Conservation and Recovery Act (RCRA), and including State regulations contained in any State sludge management plan prepared pursuant to subtitle D of the SWDA), sludge regulations appearing in 40 CFR Part 507, the Clean Air Act, the Toxic Substances Control Act, and the Marine Protection, Research and Sanctuaries Act.

Local Limits -- Specific prohibitions or limits on pollutants or pollutant parameters developed by a POTW.

Major Facility -- A facility discharging to surface water with an EPA rating score of > 80 points based on such factors as flow volume, toxic pollutant potential, and public health impact.

Maximum Daily Discharge Limit -- The highest allowable daily discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for purposes of sampling. The daily discharge is calculated as the average measurement of the pollutant over the day.

Maximum Day Design Flow (MDDF) -- The largest volume of flow anticipated to occur during a one-day period, expressed as a daily average.

Maximum Month Design Flow (MMDF) -- The largest volume of flow anticipated to occur during a continuous 30-day period, expressed as a daily average.

Maximum Week Design Flow (MWDF) -- The largest volume of flow anticipated to occur during a continuous 7-day period, expressed as a daily average.

Method Detection Level (MDL) -- The minimum concentration of a substance that can be measured and reported with 99 percent confidence that the pollutant concentration is above zero and is determined from analysis of a sample in a given matrix containing the pollutant.

Minor Facility -- A facility discharging to surface water with an EPA rating score of < 80 points based on such factors as flow volume, toxic pollutant potential, and public health impact.

Mixing Zone -- An area that surrounds an effluent discharge within which water quality criteria may be exceeded. The permit specifies the area of the authorized mixing zone that Ecology defines following procedures outlined in state regulations (chapter 173-201A WAC).

National Pollutant Discharge Elimination System (NPDES) -- The NPDES (Section 402 of the Clean Water Act) is the federal wastewater permitting system for discharges to navigable waters of the United States. Many states, including the state of Washington, have been delegated the authority to issue these permits. NPDES permits issued by Washington State permit writers are joint NPDES/State permits issued under both state and federal laws.

pH -- The pH of a liquid measures its acidity or alkalinity. It is the negative logarithm of the hydrogen ion concentration. A pH of 7 is defined as neutral and large variations above or below this value are considered harmful to most aquatic life.

Pass-Through -- A discharge which exits the POTW into waters of the State in quantities or concentrations which, alone or in conjunction with a discharge or discharges from other sources, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation), or which is a cause of a violation of State water quality standards.

Peak Hour Design Flow (PHDF) -- The largest volume of flow anticipated to occur during a one-hour period, expressed as a daily or hourly average.

Peak Instantaneous Design Flow (PIDF) -- The maximum anticipated instantaneous flow.

Point of Compliance -- The location in the ground water where the enforcement limit must not be exceeded and a facility must comply with the Ground Water Quality Standards. Ecology determines this limit on a site-specific basis. Ecology locates the point of compliance in the ground water as near and directly downgradient from the pollutant source as technically, hydrogeologically, and geographically feasible, unless it approves an alternative point of compliance.

Potential Significant Industrial User (PSIU) -- A potential significant industrial user is defined as an Industrial User that does not meet the criteria for a Significant Industrial User, but which discharges wastewater meeting one or more of the following criteria:

a. Exceeds 0.5 % of treatment plant design capacity criteria and discharges <25,000 gallons per day or;

b. Is a member of a group of similar industrial users which, taken together, have the potential to cause pass through or interference at the POTW (e.g. facilities which develop photographic film or paper, and car washes).
Ecology may determine that a discharger initially classified as a potential significant industrial user should be managed as a significant industrial user.

Quantitation Level (QL) -- Also known as Minimum Level of Quantitation (ML) – The lowest level at which the entire analytical system must give a recognizable signal and acceptable calibration point for the analyte. It is equivalent to the concentration of the lowest calibration standard, assuming that the lab has used all method-specified sample weights, volumes, and cleanup procedures. The QL is calculated by multiplying the MDL by 3.18 and rounding the result to the number nearest to (1,2,or 5) x 10^n, where n is an integer. (64 FR 30417).
ALSO GIVEN AS:
The smallest detectable concentration of analyte greater than the Detection Limit (DL) where the accuracy (precision & bias) achieves the objectives of the intended purpose. (Report of the Federal Advisory Committee on Detection and Quantitation Approaches and Uses in Clean Water Act Programs Submitted to the US Environmental Protection Agency December 2007).

Reasonable Potential -- A reasonable potential to cause a water quality violation, or loss of sensitive and/or important habitat.

Responsible Corporate Officer -- A president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or the manager of one or more manufacturing, production, or operating facilities employing more than 250 persons or have gross annual sales or expenditures exceeding $25 million (in second quarter 1980 dollars), if authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures (40 CFR 122.22).

Significant Industrial User (SIU) --

1) All industrial users subject to Categorical Pretreatment Standards under 40 CFR 403.6 and 40 CFR Chapter I, Subchapter N and;

2) Any other industrial user that: discharges an average of 25,000 gallons per day or more of process wastewater to the POTW (excluding sanitary, noncontact cooling, and boiler blow-down wastewater); contributes a process wastestream that makes up 5 percent or more of the average dry weather hydraulic or organic capacity of the POTW treatment plant; or is designated as such by the Control Authority* on the basis that the industrial user has a reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement [in accordance with 40 CFR 403.8(f)(6)].

Upon finding that the industrial user meeting the criteria in paragraph 2, above, has no reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement, the Control Authority* may at any time, on its own initiative or in response to a petition received from an industrial user or POTW, and in accordance with 40 CFR 403.8(f)(6), determine that such industrial user is not a significant industrial user.

*The term "Control Authority" refers to the Washington State Department of Ecology in the case of non-delegated POTWs or to the POTW in the case of delegated POTWs.

Slug Discharge -- Any discharge of a non-routine, episodic nature, including but not limited to an accidental spill or a non-customary batch discharge to the POTW. This may include any pollutant released at a flow rate that may cause interference or pass through with the POTW or in any way violate the permit conditions or the POTW's regulations and local limits.

Soil Scientist -- An individual who is registered as a Certified or Registered Professional Soil Scientist or as a Certified Professional Soil Specialist by the American Registry of Certified Professionals in Agronomy, Crops, and Soils or by the National Society of Consulting Scientists or who has the credentials for membership.

Minimum requirements for eligibility are: possession of a baccalaureate, masters, or doctorate degree from a U.S. or Canadian institution with a minimum of 30 semester hours or 45 quarter hours professional core courses in agronomy, crops or soils, and have 5,3,or 1 years, respectively, of professional experience working in the area of agronomy, crops, or soils.

Solid Waste -- All putrescible and non-putrescible solid and semisolid wastes including, but not limited to, garbage, rubbish, ashes, industrial wastes, swill, sewage sludge, demolition and construction wastes, abandoned vehicles or parts thereof, contaminated soils and contaminated dredged material, and recyclable materials.

Soluble BOD_5 -- Determining the soluble fraction of Biochemical Oxygen Demand of an effluent is an indirect way of measuring the quantity of soluble organic material present in an effluent that is utilized by bacteria. Although the soluble BOD_5 test is not specifically described in Standard Methods, filtering the raw sample through at least a 1.2 um filter prior to running the standard BOD_5 test is sufficient to remove the particulate organic fraction.

State Waters -- Lakes, rivers, ponds, streams, inland waters, underground waters, salt waters, and all other surface waters and watercourses within the jurisdiction of the state of Washington.

Stormwater--That portion of precipitation that does not naturally percolate into the ground or evaporate, but flows via overland flow, interflow, pipes, and other features of a storm water drainage system into a defined surface water body, or a constructed infiltration facility.

Technology-Based Effluent Limit -- A permit limit based on the ability of a treatment method to reduce the pollutant.

Total Coliform Bacteria -- A microbiological test, which detects and enumerates the total coliform group of bacteria in water samples.

Total Dissolved Solids -- That portion of total solids in water or wastewater that passes through a specific filter.

Total Suspended Solids (TSS) -- Total suspended solids is the particulate material in an effluent. Large quantities of TSS discharged to a receiving water may result in solids accumulation. Apart from any toxic effects attributable to substances leached out by water, suspended solids may kill fish, shellfish, and other aquatic organisms by causing abrasive injuries and by clogging the gills and respiratory passages of various aquatic fauna. Indirectly, suspended solids can screen out light and can promote and maintain the development of noxious conditions through oxygen depletion.

Upset -- An exceptional incident in which there is unintentional and temporary noncompliance with technology-based permit effluent limits because of factors beyond the reasonable control of the Permittee. An upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, lack of preventative maintenance, or careless or improper operation.

Water Quality-Based Effluent Limit -- A limit imposed on the concentration of an effluent parameter to prevent the concentration of that parameter from exceeding its water quality criterion after discharge into receiving waters.

Appendix D - Response to Comments

The public notice that informed the public that a draft permit was available for review was published in the Columbia Basin Herald on December 9, 2011. Ecology received the following comments on the draft permit following the 30-day public comment period.

The public notice that informed the public that an amended draft permit was available for review was published in the Columbia Basin Herald on January 16, 2012. Ecology was only accepting comments on the amended portions of the permit and fact sheet. Ecology did not receive any comments following the 15-day public comment period.

City of Soap Lake Response to Comments on the Draft Waste Discharge Permit NO. ST-5282 and associated Fact Sheet

DRAFT PERMIT COMMENTS

Comment 1: Section S.1.A Effluent Limits

The existing effluent limit for Total Nitrogen is 10 mg/L on an *average monthly* basis. However, the draft Permit shows a Total Nitrogen limit of 10 mg/L on an *average weekly* basis. The draft Fact Sheet does not indicate this change in the Permit, and in Table 6 of the draft Fact Sheet the proposed Total Nitrogen effluent limit is shown as 10 mg/L on an *average monthly* basis. The reason for any change in the effluent Total Nitrogen limit is not provided in the draft Fact Sheet. If a change is intended, please provide the justification.

The Permit requires the City to sample two times per month for effluent Total Nitrogen. A change in the permit limit to an average weekly basis would essentially make this limit a maximum daily limit, which is overly restrictive for Soap Lake's facility. The compliance history of the Soap Lake facility provides record that an average monthly Total Nitrogen limit is adequate to protect groundwater quality. Therefore, we request that the existing average monthly limit be retained.

Response to Comment 1

The Total Nitrogen limit has been corrected to average monthly for consistency with the previous permit.

Comment 2: Section S.1.A Effluent Limits

Paragraph S.1.A states that the infiltration ponds are located on approximately 16 acres. The ponds actually occupy 2.6 acres, as correctly indicated on Page 8 of the draft Fact Sheet.

Response to Comment 2

This typo has been corrected.

Comment 3: Section S.1.A Effluent Limits

Footnote "b" in the Effluent Limits table is incorrect and should provide the correct definition of an average monthly effluent limit.

Response to Comment 3

Footnote "b" has been expanded to read "Average monthly effluent limit means the highest allowable average of daily discharges over a calendar month.
To calculate the discharge value to compare to the limit, you add the value of each daily discharge measured during a calendar month and divide this sum by the total number of daily discharges measured. "

Comment 4: Section S.2.A Wastewater Monitoring

The meanings of the abbreviations "avg", "max", "avm and "avw" for some of the parameters in the wastewater monitoring schedule are not clear.

All parameters will be monitored at the required frequencies and their measured values will be recorded on the DMRs. Please delete these abbreviations, or explain their meanings in the footnotes. Also, the formula for TKN in footnote "c" lacks "Nitrite" on the right side of the equation.

Response to Comment 4

The abbreviations mentioned have been defined within the text for clarity.

Comment 5: Section S.4.E Wasteload Assessment

We request that the submittal date for this report be changed to April 1, 2012, since the Permit issue date will not allow sufficient time to prepare this assessment by March 1, 2012.

Response to Comment 5

The requested change has been made.

Comment 6: Section S.5.A Certified Operator

The draft Permit indicates that the operator certification has been changed from a Level I to a Level III. The Fact Sheet does not discuss or provide a reason for this change, through Section II.A states that the facility is classified as Type II and has an operator with Level II certification. The City has not changed operations at the WWTF since the last upgrade in 2004, and according to the draft Permit there is no proposed increase in monitoring or sampling. In fact, there is a decrease in the monitoring required for process with secondary clarifiers and discharge to infiltration basins. Solids are treated in an aerobic digester and dried on sludge drying beds. The complexity of this plant does not justify the requirement for a Level II operator. We request that the operator certification be Level II. If Ecology's intention is to change the operator certifiecation to a Level III, the justification should be provided and the City should be allowed a compliance schedule for its operator to obtain that certification level.

Response to Comment 6

The requirement for Level III operator in the Permit was an error. The error was corrected in the Fact Sheet but was not caught in the Draft Permit. The Soap Lake WWTP is an extended aeration treatment type facility with a design flow of less than five (5) million gallons per day (MGD) and is therefore classified as a Type II facility (WAC 173-230-140). An operator of Group II certification level or higher is required.

DRAFT FACT SHEET (FS) COMMENTS

Comment FS-1: Section II Background Information

In Table 1, please change the "Contact at Facility" individual to Robert Herron (WWTF Operator), and the "responsible Official" to Raymond Gravelle (Mayor).

Response to FS-1

Noted and changed.

Comment FS-2: Section II.A Facility Description

The first paragraph in this section states that the facility provides disinfection of the final effluent. This statement needs correction since the facility does not have a disinfection process.

Response to FS-2

Noted and changed.

Comment FS-3: Section IV.B Wastewater Monitoring

The third bulleted item should be corrected to read: "Bicarbonates are included in the TFDS analysis".

Response to FS-3

Noted and changed.

CITY OF SOAP LAKE

Telephone (509)246-1211
Fax (509)246-1213

PO Box 1270
239 2nd Ave SE
Soap Lake WA 98851

January 5, 2012

Ms. Marcia Sands
Department of Ecology
4601 North Monroe Street
Spokane, WA 99205

Dear Ms. Sands:

The purpose of this letter is to submit review comments on the draft City of Soap Lake State Waste Discharge Permit (No. ST-5282) and associated Fact Sheet, as provided below.

STATE WASTE DISCHARGE PERMIT

1. SECTION S.1.A Effluent Limits

The existing effluent limit for Total Nitrogen is 10 mg/L on an *average monthly* basis. However, the draft Permit shows a Total Nitrogen limit of 10 mg/L on an *average weekly* basis. The draft Fact Sheet does not indicate this change in the Permit, and in Table 6 of the draft Fact Sheet the proposed Total Nitrogen effluent limit is shown as 10 mg/L on an *average monthly* basis. The reason for any change in the effluent Total Nitrogen limit is not provided in the draft Fact Sheet. If a change is intended, please provide the justification.

The Permit requires the City to sample two times per month for effluent Total Nitrogen. A change in the permit limit to an average weekly basis would essentially make this limit a maximum daily limit, which is overly restrictive for Soap Lake's facility. The compliance history of the Soap Lake facility provides record that an average monthly Total Nitrogen limit is adequate to protect groundwater quality. Therefore, we request that the existing average monthly limit be retained.

2. SECTION S.1.A Effluent Limits

Paragraph S.1.A states that the infiltration ponds are located on approximately 16 acres. The ponds actually occupy 2.6 acres, as correctly indicated on Page 8 of the draft Fact Sheet.

3. SECTION S.1.A Effluent Limits

Footnote "b" in the Effluent Limits table is incorrect and should provide the correct definition of an average monthly effluent limit.

4. SECTION S.2.A Wastewater Monitoring

The meanings of the abbreviations "avg", "max", "avm", and "avw" for some of the parameters in the wastewater monitoring schedule are not clear. All parameters will be monitored at the required frequencies and their measured values will be recorded on the DMRs. Please delete these abbreviations, or explain their meanings in the footnotes. Also, the formula for TKN in footnote "c" lacks "Nitrite" on the right side of the equation.

5. SECTION S.4.E Wasteload Assessment

We request that the submittal date for this report be changed to April 1, 2012, since the Permit issue date will not allow sufficient time to prepare this assessment by March 1, 2012.

6. SECTION S.5.A Certified Operator

The draft Permit indicates that the operator certification has been changed from a Level I to a Level III. The Fact Sheet does not discuss or provide reason for this change, though Section II.A states that the facility is classified as Type II and has an operator with Level II certification. The City has not changed operations at the WWTF since the last upgrade in 2004, and according to the draft Permit there is no proposed increase in monitoring or sampling. In fact, there is a decrease in the monitoring required for the ground water wells. The WWTF is rated for less than 1 MGD and consists of an extended aeration process with secondary clarifiers and discharge to infiltration basins. Solids are treated in an aerobic digester and dried on sludge drying beds. The complexity of this plant does not justify the requirement for a Level III operator. We request that the operator certification be Level II. If Ecology's intention is to change the operator certification to a Level III, the justification should be provided and the City should be allowed a compliance schedule for its operator to obtain that certification level.

<u>FACT SHEET</u>

1. SECTION II Background Information

In Table 1, please change the "Contact at Facility" individual to Robert Herron (WWTF Operator), and the "Responsible Official" to Raymond Gravelle (Mayor).

2. SECTION II.A Facility Description

The first paragraph in this section states that the facility provides disinfection of the final effluent. This statement needs correction since the facility does not have a disinfection process.

3. SECTION IV.B Wastewater Monitoring

The third bulleted item should be corrected to read: "Bicarbonates are included in the TFDS analysis".

We would be happy to meet with Ecology to further discuss the proposed changes in the City's permit. Please feel free to contact my office at any time should you have any questions about these comments.

Thank You,

R. Gravelle

Mayor Raymond Gravelle

Cc: Diana Washington, Water Quality Permit Unit Supervisor, Ecology – ERO

Nancy Morter, P.E., Gray & Osborne, Inc.

Issuance Date: February 3, 2012
Effective Date: March 1, 2012
Expiration Date: February 28, 2017

State Waste Discharge Permit Number ST-5282

State of Washington
DEPARTMENT OF ECOLOGY
Olympia, Washington 98504-7600
Eastern Regional Office
4601 North Monroe Street
Spokane, WA 99205-1295

In compliance with the provisions of the
State of Washington Water Pollution Control Law
Chapter 90.48 Revised Code of Washington, as amended,

City of Soap Lake
P.O. Box 1270
Soap Lake, WA 98851

is authorized to discharge wastewater in accordance with the special and general conditions which follow.

<u>Plant Location</u> 910 Road 20 NW Soap Lake, WA 98851	<u>Discharge Location</u> Legal Description :SW ¼, SE ¼, of Section 24, T.22N, R. 26E, Willamette Meridian
<u>Treatment Type</u> Extended aeration, activated sludge WWTP; Oxidation ditch followed by a clarifier and aerobic digester. Final discharge is to rapid infiltration basins.	Latitude: 47.385644 Longitude: -119.503116

James M. Bellatty
Water Quality Section Manager
Eastern Regional Office
Washington State Department of Ecology

Table of Contents

Summary of Permit Report Submittals

Refer to the Special and General Conditions of this permit for additional submittal requirements.

Permit Section	Submittal	Frequency	First Submittal Date
S3.A	Discharge Monitoring Report	Monthly	April 15, 2012
S3.E	Reporting Permit Violations	As necessary	***
S3.F	Other Reporting	As necessary	***
S4.B	Plans for Maintaining Adequate Capacity	As necessary	***
S4.D	Notification of New or Altered Sources	As necessary	***
S4.F	Waste Load Assessment	Annually	April 1, 2012
S5.F	Reporting Bypasses	As necessary	***
S5.G	Revise and Update the Facility Operations and Maintenance (O&M) Manual	Once	October 15, 2013
S5.G	O&M Manual Annual Review Letter	Annually	October 15, 2014
S6.C	Pretreatment Industrial User Survey	1/permit cycle	October 15, 2014
S8.	Application for Permit Renewal	1/permit cycle	February 29, 2016
G1.	Notice of Change in Authorization	As necessary	***
G4.	Permit Application for Substantive Changes to the Discharge	As necessary	***
G5.	Engineering Report for Construction or Modification Activities	As necessary	***
G7.	Notice of Permit Transfer	As necessary	***
G8.	Payment of Fees	As assessed	***
G10.	Duty to Provide Information	As necessary	***
G12.	Contract Submittal	As necessary	***

Special Conditions

S1. Discharge Limits

S1.A. Effluent Limits

All discharges and activities authorized by this permit must comply with the terms and conditions of this permit. The discharge of any of the following pollutants more frequently than, or at a concentration in excess of, that authorized by this permit violates the terms and conditions of this permit. Wastewater flows and loadings must not exceed the Design Criteria specified in Section S4.A.

Beginning on **March 1, 2012** and lasting through **February 28, 2017**, the Permittee is authorized to discharge domestic wastewater to infiltration basins at the permitted location. The infiltration ponds are located on approximately 2.6 acres north of the treatment plant at latitude 47.385644, longitude -119.503116. Discharges to the infiltration basins are subject to the following limits:

Effluent Limits: Outfall #001 Latitude 47.386944 Longitude -119.502222		
Parameter	**Average Monthly** [b]	**Maximum Daily** [a]
Flow (measured at influent)	300,000 gallons per day (gpd)	420,000 gpd
Parameter	**Average Monthly** [b]	**Average Weekly** [c]
Biochemical Oxygen Demand (BOD_5)	30 milligrams/liter (mg/L), 85% Removal (lbs/day)	45 mg/L
Total Suspended Solids (TSS)	30 mg/L, 85% Removal (lbs/day)	45mg/L
Total Nitrogen as N [d]	10 mg/L	***
a	Maximum Daily effluent limit means the highest allowable daily discharge.	
b	Average Monthly (avm) effluent limit means the highest allowable average of daily dischargers over a calendar month. To calculate the discharge value to compare to the limit, you add the value of each daily discharge measured during a calendar month and divide this sum by the total number of daily discharges measured.	
c	Average Weekly (avw) discharge limit means the highest allowable average of "daily discharges" over a calendar week, calculated as the sum of all "daily discharges" measured during a calendar week divided by the number of "daily discharges" measured during that week.	
d	Total Nitrogen is the sum of Total Kjeldahl Nitrogen (as N TKN) plus Nitrite (as N) and Nitrate (as N).	

S2. Monitoring Requirements

S2.A. Wastewater Monitoring

The Permittee must monitor the wastewater prior to discharging into the infiltration basins according to the following schedule. The Permittee must use the specified analytical methods (Appendix A) unless an alternate method used produces similar measurable results in the sample and EPA has listed it as an EPA-approved method in 40 CFR Part 136. If the Permittee uses an alternate method, not specified in the permit and as allowed above, it must report the test method, method detection limit (MDL), and quantitation limit (QL) on the discharge monitoring report.

Parameter	Units	Minimum Sampling Frequency	Sample Type
(1) Wastewater Influent			
Wastewater influent means the raw sewage flow from the collection system into the treatment facility. Sample the wastewater entering the headworks of the treatment plant excluding any side-stream returns from inside the plant.			
Flow (average & maximum)	GPD	Continuous	Meter
pH (minimum & daily maximum)	s.u.	2/week	Grab [a]
Biochemical Oxygen Demand (BOD_5) (avm & maximum)	mg/L, lbs/day	2/month	24-Hour Composite [b]
Total Suspended Solids (TSS) (avm & maximum)	mg/L, lbs/day		

[a] Grab means an individual sample collected over a fifteen (15) minute, or less, period.

[b] 24-hour composite means a series of individual samples collected over a 24-hour period into a single container, and analyzed as one sample.

Parameter	Units	Minimum Sampling Frequency	Sample Type
(2) Wastewater Effluent			
Final Wastewater Effluent means wastewater which is exiting, or has exited, the last treatment process or operation. The sampling point for the effluent will be at the end of pipe prior to discharging into the infiltration basins.			
pH (minimum & daily maximum)	s.u.	2/week	Grab [a]
BOD_5 (avm & avw)	mg/L, lbs/day, % removal	2/month	24-Hour Composite [b]
TSS (avm & avw)	mg/L, lbs/day, % removal		

Parameter	Units	Minimum Sampling Frequency	Sample Type
(2) Wastewater Effluent			
Total Kjeldahl Nitrogen (TKN) (average & maximum)	mg/L as N	2/month	24-Hour Composite [b]
Nitrate (NO_3)+Nitrite (NO_2) (average & maximum)	mg/L as N		
Ammonia (NH_3) (average & maximum)	mg/L as N		
Total Nitrogen [c] (avm & avw)	mg/L as N		
Total Fixed Dissolved Solids (TFDS), (average & maximum)	mg/L		
Conductivity (average & maximum)	Micromhos/cm (Mmho/cm)		

a	Grab means an individual sample collected over a fifteen (15) minute, or less, period.
b	24-hour composite means a series of individual samples collected over a 24-hour period into single container, and analyzed as one sample.
c	TN = TKN(as N) + Nitrate and Nitrite (as N)

S2.B. Groundwater Monitoring

The Permittee must use the specified analytical methods (Appendix A) unless an alternate method used produces similar measurable results in the sample and EPA has listed it as an EPA-approved method in 40 CFR Part 136. If the Permittee uses an alternate method, not specified in the permit and as allowed above, it must report the test method, method detection limit (MDL), and quantitation limit (QL) on the discharge monitoring report.

The Permittee must monitor the ground water at monitoring wells **MW-1 (AHS516), MW-2 (AHS517), and MW-3 (AHS518)** according to the following schedule:

Parameter	Units	Minimum Sampling Frequency	Sample Type
Measured Depth to Ground Water from top of casing	Feet (to nearest 0.01 ft)	4/year [a]	Field Measurement
pH	s.u.		Grab
Conductivity	Mmho/cm		
Total Coliform [b]	#organisms/100 mL		
Total Dissolved Solids (TDS)	mg/L		
Nitrate (NO_3)	mg/L as N		

Parameter	Units	Minimum Sampling Frequency	Sample Type
Total Kjeldahl Nitrogen (TKN)	mg/L as N		
a	4/Year means sample collection and analysis occurs in the months of **March, June, September and December.** Sample results to be submitted with following months DMR.		
b	Report a numerical value for total coliforms following the procedures in Ecology's Information Manual for Wastewater Treatment Plant Operators, Publication Number 04-10-020 available at http://www.ecy.wa.gov/programs/wq/permits/guidance.html. Do not report a result as too numerous to count (TNTC).		

S2.C. Sampling and Analytical Procedures

Samples and measurements taken to meet the requirements of this permit must represent the volume and nature of the monitored parameters, including representative sampling of any unusual discharge or discharge condition, including bypasses, upsets and maintenance-related conditions affecting effluent quality.

Ground water sampling must conform to the latest protocols in the *Implementation Guidance for the Ground Water Quality Standards*, (Ecology 1996).

Sampling and analytical methods used to meet the water and wastewater monitoring requirements specified in this permit must conform to the latest revision of the following rules and documents unless otherwise specified in this permit or approved in writing by the Department of Ecology (Ecology).

- Guidelines Establishing Test Procedures for the Analysis of Pollutants contained in 40 CFR Part 136
- Standard Methods for the Examination of Water and Wastewater (APHA)

S2.D. Flow Measurement, Field Measurement and Continuous Monitoring Devices

The Permittee must:

1. Use appropriate flow measurement, field measurement, and continuous monitoring devices and methods consistent with accepted scientific practices.
2. Calibrate, and maintain these devices to ensure the accuracy of the measurements is consistent with the accepted industry standard and the manufacturer's recommendation for that type of device.
3. Calibrate continuous monitoring instruments weekly unless it can demonstrate a longer period is sufficient based on monitoring records.
4. Calibrate continuous pH measurement instruments using a grab sample analyzed in the lab with a pH meter calibrated with standard buffers and analyzed within 15 minutes of sampling.
5. Use field measurement devices as directed by the manufacturer and do not use reagents beyond their expiration dates.

6. Calibrate these devices at the frequency recommended by the manufacturer.
7. Calibrate flow monitoring devices at a minimum frequency of at least one calibration per year.
8. Maintain calibration records for at least three years.

S2.E. Groundwater Monitoring Procedures

The Permittee must:

1. To avoid potential cross contamination of samples the presumed upgradient monitoring well shall be accessed first, cross-gradient wells next and downgradient wells last.

2. Prior to pumping well depth to water (dtw) shall be measured in feet and hundredths (0.01-feet) of feet from the top of monitoring well casing.

3. To ensure representative groundwater samples are obtained the monitoring wells shall be purged for until approximately three (3) well volumes of water have been removed with either a submersible or peristaltic pump prior to sample collection. Less purge volume may be used if there is inadequate water in the well. If the well runs dry during purging, let the well set while collecting samples from other wells then return and collect the sample.

4. To avoid cross contamination of samples, sampling devices (pumps or bailers) and tubing shall either be dedicated to the well or cleaned between wells by rinsing with distilled water at a minimum.

S2.F. Sample Handling Procedures

The Permittee must:

1. Sample bottles shall be marked with the unique well identification and collection date and be put into appropriate containers for analysis.

2. All samples collected for analysis shall be kept in a chilled cooler pending submittal to the analytical laboratory.

3. Upon completion of sampling, samples shall be delivered directly to the laboratory for analysis.

4. Laboratory holding times for specific analyses shall be met.

S2.G. Laboratory Accreditation

The Permittee must ensure that all monitoring data required by Ecology is prepared by a laboratory registered or accredited under the provisions of chapter 173-50 WAC, *Accreditation of Environmental Laboratories*. Flow, temperature, , conductivity, pH, and internal process control parameters are exempt from this requirement. The Permittee must obtain accreditation for conductivity and pH if it must receive accreditation or registration for other parameters.

S2.H. Request for Reduction in Monitoring

The Permittee may request a reduction of the sampling frequency after twenty four (24) months of consecutive monitoring. Ecology will review each request and at its discretion grant the request when it reissues the permit or by a permit modification.

The Permittee must:

1. Provide a written request.
2. Clearly state the parameters for which it is requesting reduced monitoring.
3. Clearly state the justification for the reduction.

S3. Reporting and Recordkeeping Requirements

The Permittee must monitor and report in accordance with the following conditions. The falsification of information submitted to Ecology constitutes a violation of the terms and conditions of this permit.

S3.A. Reporting

The first monitoring period begins on the effective date of the permit. The Permittee must:

1. Summarize, report, and submit monitoring data obtained during each monitoring period on a Discharge Monitoring Report (DMR) form provided, or otherwise approved, by Ecology.
2. If submitting DMRs electronically, report a value for each day sampling occurred and for the summary values (when applicable) included on the form.
3. Submit the DMR form as required with the words "*no discharge*" entered in place of the monitoring results, if the facility did not discharge during a given monitoring period.

   If submitting DMRs electronically, you must enter "**N*o Discharge***" for an entire DMR, for a specific monitoring point, or for a specific parameter as appropriate.
4. Ensure that DMR forms are postmarked or received by Ecology no later than the 15^{th} day of the month following the month sampling was completed.
5. Faxed or emailed DMR forms must be followed by the original hard copy mailed to Ecology.
6. Submit reports to Ecology online using Ecology's electronic DMR submittal forms or send reports to Ecology at:

   Water Quality Permit Coordinator
   Department of Ecology
   Eastern Regional Office
   4601 North Monroe Street
   Spokane, WA 99205-1295

S3.B. Records Retention

The Permittee must retain records of all monitoring information for a minimum of three (3) years. Such information must include all calibration and maintenance records and all original 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. The Permittee must extend this period of retention during the course of any unresolved litigation regarding the discharge of pollutants by the Permittee or when requested by Ecology.

The Permittee must retain all records pertaining to the monitoring of sludge for a minimum of five years.

S3.C. Recording of Results

For each measurement or sample taken, the Permittee must record the following information:

1. The date, exact place and time of sampling
2. The individual who performed the sampling or measurement
3. The dates the analyses were performed
4. The individual who performed the analyses
5. The analytical techniques or methods used
6. The results of all analyses

S3.D. Additional Monitoring by the Permittee

If the Permittee monitors any pollutant more frequently than required by Condition S2. of this permit, then the Permittee must include the results of such monitoring in the calculation and reporting of the data submitted in the Permittee's DMR.

S3.E. Reporting Permit Violations

The Permittee must take the following actions when it violates or is unable to comply with any permit condition:

1. Immediately take action to stop, contain, and cleanup unauthorized discharges or otherwise stop the non-compliance and correct the problem.
2. If applicable, immediately repeat sampling and analysis. Submit the results of any repeat sampling to Ecology within thirty (30) days of sampling.

   a. Immediate reporting

   The Permittee must immediately report to Ecology and the Local Health jurisdiction (at the numbers listed below), all:

   - Failures of the disinfection system.
   - Collection system overflows.
   - Plant bypasses resulting in a discharge.

- Any other failures of the sewage system (pipe breaks, etc)

Eastern Regional Office	509-329-3400
Grant County Health District	509-754-6060 or 509-762-1160 after hours

b. Twenty-four-hour reporting

The Permittee must report the following occurrences of non-compliance by telephone, to Ecology at the telephone numbers listed above, within 24 hours from the time the Permittee becomes aware of any of the following circumstances:

1. Any non-compliance that may endanger health or the environment, unless previously reported under immediate reporting requirements.
2. Any unanticipated bypass that causes an exceedance of an effluent limit in the permit (See Part S5.F., "Bypass Procedures").
3. Any upset that causes an exceedance of an effluent limit in the permit. Upset means an exceptional incident in which there is unintentional and temporary non-compliance with technology-based permit effluent limits because of factors beyond the reasonable control of the Permittee.

   An upset does not include non-compliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventive maintenance, or careless or improper operation.
4. Any overflow prior to the treatment works, whether or not such overflow endangers health or the environment or exceeds any effluent limit in the permit.

c. Report within five days

The Permittee must also provide a written submission within five days of the time that the Permittee becomes aware of any reportable event under subparts a or b, above. The written submission must contain:

1. A description of the non-compliance and its cause.
2. Maps, drawings, aerial photographs, or pictures to show the location and cause(s) of the non-compliance.
3. The period of non-compliance, including exact dates and times.
4. The estimated time the Permittee expects the non-compliance to continue if not yet corrected.
5. Steps taken or planned to reduce, eliminate, and prevent recurrence of the non-compliance.
6. If the non-compliance involves an overflow prior to the treatment works, an estimate of the quantity (in gallons) of untreated overflow.

d. Waiver of written reports

Ecology may waive the written report required in subpart c, above, on a case-by-case basis upon request if the Permittee has submitted a timely oral report.

e. All other permit violation reporting

The Permittee must report all permit violations, which do not require immediate or within 24 hours reporting, when it submits monitoring reports for S3.A ("Reporting"). The reports must contain the information listed in subpart c, above. Compliance with these requirements does not relieve the Permittee from responsibility to maintain continuous compliance with the terms and conditions of this permit or the resulting liability for failure to comply.

f. Report submittal

The Permittee must submit reports to the address listed in S3.A

S3.F. Other Reporting

The Permittee must report a spill of oil or hazardous materials in accordance with the requirements of RCW 90.56.280. You can obtain further instructions at the following website: http://www.ecy.wa.gov/programs/spills/other/reportaspill.htm.

Where 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 in any report to Ecology, it must submit such facts or information promptly.

S3.G. Maintaining a Copy of this Permit

The Permittee must keep a copy of this permit at the facility and make it available upon request to Ecology inspectors.

S4. Facility Loading

S4.A. Design Criteria

The flows or waste loads for the permitted facility must not exceed the following design criteria:

Monthly Average Flow	300,000 gpd
Maximum Daily Flow	420,000 gpd
BOD_5 Influent Loading for Maximum Month	517 lbs/day
TSS Influent Loading for Maximum Month	465 lbs/day

S4.B. Plans for maintaining adequate capacity

a. Conditions triggering plan submittal

The Permittee must submit a plan and a schedule for continuing to maintain capacity to Ecology when:

1. The actual flow or waste load reaches 85 percent of any one of the design criteria in S4.A for three consecutive months.
2. The projected plant flow or loading would reach design capacity within five years.

b. Plan and schedule content

The plan and schedule must identify the actions necessary to maintain adequate capacity for the expected population growth and to meet the limits and requirements of the permit. The Permittee must consider the following topics and actions in its plan.

1. Analysis of the present design and proposed process modifications
2. Reduction or elimination of excessive infiltration and inflow of uncontaminated ground and surface water into the sewer system
3. Limits on future sewer extensions or connections or additional waste loads
4. Modification or expansion of facilities

Engineering documents associated with the plan must meet the requirements of WAC 173-240-060, "Engineering Report," and be approved by Ecology prior to any construction.

If the Permittee intends to apply for state or federal funding for the design or construction of a facility project, the plan may also need to meet the environmental review requirements as described in 40 CFR 35.3040 and 40 CFR 35.3045, and it may also need to demonstrate cost effectiveness as required by WAC 173-95-730. The plan must specify any contracts, ordinances, methods for financing, or other arrangements necessary to achieve this objective.

S4.C. Duty to Mitigate

The Permittee must take all reasonable steps to minimize or prevent any discharge or sludge use or disposal in violation of this permit that has a reasonable likelihood of adversely affecting human health or the environment.

S4.D. Notification of New or Altered Sources

1. The Permittee must submit written notice to Ecology whenever any new discharge or a substantial change in volume or character of an existing discharge into the wastewater treatment plant is proposed which:
   a. Would interfere with the operation of, or exceed the design capacity of, any portion of the wastewater treatment plant.
   b. Is not part of an approved general sewer plan or approved plans and specifications.
   c. Is subject to pretreatment standards under 40 CFR Part 403 and Section 307(b) of the Clean Water Act.

2. This notice must include an evaluation of the wastewater treatment plant's ability to adequately transport and treat the added flow and/or waste load, the quality and volume of effluent to be discharged to the treatment plant, and the anticipated impact on the Permittee's effluent [40 CFR 122.42(b)].

S4.E. Wasteload Assessment

The Permittee must conduct an annual assessment of its influent flow and waste load and submit a report to Ecology **by April 1, 2012**, and annually thereafter. The Permittee must submit a paper copy and an electronic copy (preferably in a portable document format [PDF]).

The report must contain:

1. A description of compliance or non-compliance with the permit effluent limits.
2. A comparison between the existing and design:
   a. Monthly average dry weather and wet weather flows.
   b. Peak flows.
   c. BOD_5 loading.
   d. Total suspended solids loadings.
3. The percent change in the above parameters since the previous report.
4. The present and design population or population equivalent.
5. The projected population growth rate.
6. The estimated date upon which the Permittee expects the wastewater treatment plant to reach design capacity, according to the most restrictive of the parameters above.

Ecology may modify the interval for review and reporting if it determines that a different frequency is sufficient.

S5. Operation and Maintenance

The Permittee must, at all times, properly operate and maintain all facilities or systems of treatment and control (and related appurtenances), which are installed to achieve compliance with the terms and conditions of this permit. Proper operation and maintenance also includes keeping a daily operation logbook (paper or electronic), adequate laboratory controls, and appropriate quality assurance procedures. This provision of the permit requires the Permittee to operate backup or auxiliary facilities or similar systems only when the operation is necessary to achieve compliance with the conditions of this permit.

S5.A. Certified Operator

An operator certified for at least a Class II plant by the State of Washington must be in responsible charge of the day-to-day operation of the wastewater treatment plant.

S5.B. O & M Program

The Permittee must:

1. Institute an adequate operation and maintenance program for the entire sewage system.
2. Keep maintenance records on all major electrical and mechanical components of the treatment plant, as well as the sewage system and pumping stations. Such records must clearly specify the frequency and type of maintenance recommended by the manufacturer and must show the frequency and type of maintenance performed.
3. Make maintenance records available for inspection at all times.

S5.C. Short-Term Reduction

The Permittee must schedule any facility maintenance, which might require interruption of wastewater treatment and degrade effluent quality, during non-critical water quality periods and carry this maintenance out in a manner approved by Ecology.

If a Permittee contemplates a reduction in the level of treatment that would cause a violation of permit discharge limits on a short-term basis for any reason, and such reduction cannot be avoided, the Permittee must:

1. Give written notification to Ecology, if possible, thirty (30) days prior to such activities.
2. Detail the reasons for, length of time of, and the potential effects of the reduced level of treatment.

This notification does not relieve the Permittee of its obligations under this permit.

S5.D. Electrical Power Failure

The Permittee must ensure that adequate safeguards prevent the discharge of untreated wastes or wastes not treated in accordance with the requirements of this permit during electrical power failure at the treatment plant and/or sewage lift stations. Adequate safeguards include, but are not limited to alternate power sources, standby generator(s), or retention of inadequately treated wastes

S5.E. Prevent Connection of Inflow

The Permittee must strictly enforce its sewer ordinances and not allow the connection of inflow (roof drains, foundation drains, etc.) to the sanitary sewer system.

S5.F. Bypass Procedures

This permit prohibits a bypass, which is the intentional diversion of waste streams from any portion of a treatment facility. Ecology may take enforcement action against a Permittee for a bypass unless one of the following circumstances (1, 2, or 3) applies.

1. Bypass for essential maintenance without the potential to cause violation of permit limits or conditions.

This permit authorizes a bypass if it allows for essential maintenance and does not have the potential to cause violations of limits or other conditions of this permit, or adversely impact public health as determined by Ecology prior to the bypass. The Permittee must submit prior notice, if possible, at least ten (10) days before the date of the bypass.

2. Bypass which is unavoidable, unanticipated, and results in noncompliance of this permit.

   This permit authorizes such a bypass only if:

   a. Bypass is unavoidable to prevent loss of life, personal injury, or severe property damage. "Severe property damage" means substantial physical damage to property, damage to the treatment facilities which would cause 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.

   b. No feasible alternatives to the bypass exist, such as:

      - The use of auxiliary treatment facilities.
      - Retention of untreated wastes.
      - Maintenance during normal periods of equipment downtime, but not if the Permittee should have installed adequate backup equipment in the exercise of reasonable engineering judgment to prevent a bypass.
      - Transport of untreated wastes to another treatment facility or preventative maintenance), or transport of untreated wastes to another treatment facility.

   c. Ecology is properly notified of the bypass as required in Condition S3.E of this permit.

3. If bypass is anticipated and has the potential to result in noncompliance of this permit.

   a. The Permittee must notify Ecology at least thirty (30) days before the planned date of bypass. The notice must contain:

      - A description of the bypass and its cause.
      - An analysis of all known alternatives which would eliminate, reduce, or mitigate the need for bypassing.
      - A cost-effectiveness analysis of alternatives including comparative resource damage assessment.
      - The minimum and maximum duration of bypass under each alternative.
      - A recommendation as to the preferred alternative for conducting the bypass.
      - The projected date of bypass initiation.
      - A statement of compliance with SEPA.

- A request for modification of water quality standards as provided for in WAC 173-201A-410, if an exceedance of any water quality standard is anticipated.
- Details of the steps taken or planned to reduce, eliminate, and prevent reoccurrence of the bypass.

b. For probable construction bypasses, the Permittee must notify Ecology of the need to bypass as early in the planning process as possible. The Permittee must consider the analysis required above during preparation of the engineering report or facilities plan and plans and specifications and must include these to the extent practical. In cases where the Permittee determines the probable need to bypass early, the Permittee must continue to analyze conditions up to and including the construction period in an effort to minimize or eliminate the bypass.

c. Ecology will consider the following prior to issuing an administrative order for this type of bypass:

- If the bypass is necessary to perform construction or maintenance-related activities essential to meet the requirements of this permit.
- If feasible alternatives to bypass exist, such as the use of auxiliary treatment facilities, retention of untreated wastes, stopping production, maintenance during normal periods of equipment down time, or transport of untreated wastes to another treatment facility.
- If the Permittee planned and scheduled the bypass to minimize adverse effects on the public and the environment.

After consideration of the above and the adverse effects of the proposed bypass and any other relevant factors, Ecology will approve or deny the request.

Ecology will give the public an opportunity to comment on bypass incidents of significant duration, to the extent feasible. Ecology will approve a request to bypass by issuing an administrative order under RCW 90.48.120.

S5.G. Operations and Maintenance Manual

a. O&M manual submittal and requirements

The Permittee must:

1. Submit a revised O&M Manual for Ecology to review **by October 15, 2013**.
2. Keep the approved O&M Manual at the permitted facility.
3. Follow the instructions and procedures of the revised manual.
4. Review O&M Manual annually **starting October 15, 2014** and annually thereafter.
5. Submit a letter indicating that the O&M was reviewed along with a copy of the updates to Ecology annually.

b. **O&M manual components**

In addition to the requirements of WAC 173-240-150(1) and (2), the O&M manual must include:

1. Emergency procedures for plant shutdown and cleanup in event of wastewater system upset or failure.
2. Wastewater system maintenance procedures that contribute to the generation of wastewater.
3. Reporting protocols for submitting reports to Ecology to comply with the reporting requirements in the discharge permit.
4. Any directions to maintenance staff when cleaning, or maintaining other equipment or performing other tasks which are necessary to protect the operation of the wastewater system (for example, defining maximum allowable discharge rate for draining a tank, blocking all floor drains before beginning the overhaul of a stationary engine.)
5. Treatment plant process control monitoring schedule.
6. Wastewater sampling protocols and procedures for compliance with the sampling and reporting requirements in the wastewater discharge permit.
7. Minimum staffing adequate to operate and maintain the treatment processes and carry out compliance monitoring required by the permit.
8. Protocols and procedures for ground water monitoring sampling and testing.

S5.H. Best Management Practices/Pollution Prevention

The Permittee must comply with the following Best Management Practices to prevent pollution to waters of the State:

1. Do <u>not</u> discharge in excess of the hydraulic capacity of the infiltration ponds so that the pond overflows.
2. Do not discharge priority pollutants, dangerous wastes, or toxics in toxic amounts.

S6. Pretreatment

The Permittee must work with Ecology to ensure that all commercial and industrial users of the publicly owned treatment works (POTW) comply with the pretreatment regulations in 40 CFR Part 403 and any additional regulations that the Environmental Protection Agency (U.S. EPA) may promulgate under Section 307(b) (pretreatment) and 308 (reporting) of the Federal Clean Water Act.

S6.A. Discharge Authorization Required

The Permittee must:

1. Immediately notify Ecology of any proposed discharge of wastewater from a source, which may be a significant industrial user (SIU) [see fact sheet definitions or refer to 40 CFR 403.3(t)(i)(ii)].

2. Require all SIUs to obtain a SWDP from Ecology prior to accepting their non-domestic wastewater, or require proof that Ecology has determined they do not require a permit.
3. Require the documentation as described in S6.A.3 at the earliest practicable date as a condition of continuing to accept non-domestic wastewater discharges from a previously undiscovered, currently discharging and unpermitted SIU.
4. Require sources of non-domestic wastewater, which do not qualify as SIUs but merit a degree of oversight, to apply for a SWDP and provide it a copy of the application and any Ecology responses.
5. Keep all records documenting that its users have met the requirements of S6.A.

S6.B. Duty to Enforce Discharge Prohibitions

1. Under federal regulations (40 CFR 403.5(a) and (b)), the Permittee must not authorize or knowingly allow the discharge of any pollutants into its POTW which may be reasonably expected to cause pass through or interference, or which otherwise violate general or specific discharge prohibitions contained in 40 CFR Part 403.5 or WAC-173-216-060.
2. The Permittee must not authorize or knowingly allow the introduction of any of the following into their treatment works:
    a. Pollutants which create a fire or explosion hazard in the POTW (including, but not limited to waste streams with a closed cup flashpoint of less than 140 degrees Fahrenheit or 60 degrees Centigrade using the test methods specified in 40 CFR 261.21).
    b. Pollutants which will cause corrosive structural damage to the POTW, but in no case discharges with pH lower than 5.0, or greater than 11.0 standard units, unless the works are specifically designed to accommodate such discharges.
    c. Solid or viscous pollutants in amounts that could cause obstruction to the flow in sewers or otherwise interfere with the operation of the POTW.
    d. Any pollutant, including oxygen-demanding pollutants, (BOD_5, etc.) released in a discharge at a flow rate and/or pollutant concentration which will cause interference with the POTW.
    e. Petroleum oil, non-biodegradable cutting oil, or products of mineral origin in amounts that will cause interference or pass through.
    f. Pollutants which result in the presence of toxic gases, vapors, or fumes within the POTW in a quantity which may cause acute worker health and safety problems.
    g. Heat in amounts that will inhibit biological activity in the POTW resulting in interference but in no case heat in such quantities such that the temperature at the POTW headworks exceeds 40 degrees Centigrade (104 degrees Fahrenheit) unless Ecology, upon request of the Permittee, approves, in writing, alternate temperature limits.

h. Any trucked or hauled pollutants, except at discharge points designated by the Permittee.

i. Wastewaters prohibited to be discharged to the POTW by the Dangerous Waste Regulations (chapter 173-303 WAC), unless authorized under the Domestic Sewage Exclusion (WAC 173-303-071).

3. The Permittee must also not allow the following discharges to the POTW unless approved in writing by Ecology:
   a. Noncontact cooling water in significant volumes.
   b. Stormwater and other direct inflow sources.
   c. Wastewaters significantly affecting system hydraulic loading, which do not require treatment, or would not be afforded a significant degree of treatment by the system.
4. The Permittee must notify Ecology if any industrial user violates the prohibitions listed in this Section (S7.B), and initiate enforcement action to promptly curtail any such discharge.

S6.C. Industrial User Survey

The Permittee must enforce the established local sewer ordinance and complete an industrial user survey using the *Guidance Manual for Performing an Industrial User Survey* (Ecology, 2011, http://www.ecy.wa.gov/biblio/1110055.html), which is necessary for the proper administration of the state pretreatment program. The Permittee must submit the survey to Ecology **by October 15, 2014.**

S7. Solid wastes

S7.A. Solid Waste Handling

The Permittee must handle and dispose of all solid waste material in such a manner as to prevent its entry into state ground or surface water.

S8. Application for Permit Renewal or Modification for Facility Changes

The Permittee must submit an application for renewal of this permit **by February 29, 2016.** The Permittee must submit a paper copy and an electronic copy (preferably as a PDF).

The Permittee must also submit a new application or supplement at least one hundred eighty (180) days prior to commencement of discharges, resulting from the activities listed below, which may result in permit violations. These activities include any facility expansions, production increases, or other planned changes, such as process modifications, in the permitted facility.

GENERAL CONDITIONS

G1. Signatory Requirements

All applications, reports, or information submitted to Ecology must be signed as follows:

1. All permit applications must be signed by either a principal executive officer or ranking elected official.
2. All reports required by this permit and other information requested by Ecology must be signed by a person described above or by a duly authorized representative of that person. A person is a duly authorized representative only if:
    a. The authorization is made in writing by the person described above and is submitted to Ecology at the time of authorization, and
    b. The authorization specifies either a named individual or any individual occupying a named position.
3. Changes to authorization. If an authorization under paragraph B.2. above is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, a new authorization must be submitted to Ecology prior to or together with any reports, information, or applications to be signed by an authorized representative.
4. Certification. Any person signing a document under this section must make the following certification:

    "I certify under penalty of law, that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations."

G2. Right of Entry

Representatives of Ecology have the right to enter at all reasonable times in or upon any property, public or for the purpose of inspecting and investigating conditions relating to the pollution or the possible pollution of any waters of the state. Reasonable times include normal business hours; hours during which production, treatment, or discharge occurs; or times when Ecology suspects a violation requiring immediate inspection. Representatives of Ecology must be allowed to have access to, and copy at reasonable cost, any records required to be kept under terms and conditions of the permit; to inspect any monitoring equipment or method required in the permit; and to sample the discharge, waste treatment processes, or internal waste streams.

G3. Permit Actions

This permit is subject to modification, suspension, or termination, in whole or in part by Ecology for any of the following causes:

1. Violation of any permit term or condition;
2. Obtaining a permit by misrepresentation or failure to disclose all relevant facts;
3. A material change in quantity or type of waste disposal;
4. A material change in the condition of the waters of the state; or
5. Nonpayment of fees assessed pursuant to RCW 90.48.465.

Ecology may also modify this permit, including the schedule of compliance or other conditions, if it determines good and valid cause exists, including promulgation or revisions of regulations or new information.

G4. Reporting a Cause for Modification

The Permittee must submit a new application at least 60 days before it wants to discharge more of any pollutant, a new pollutant, or more flow than allowed under this permit. The Permittee should use the State Waste Discharge Permit application, and submit required plans at the same time. Required plans include an Engineering Report, Plans and Specifications, and an Operations and Maintenance manual, (see Chapter 173-240 WAC). Ecology may waive these plan requirements for small changes, so contact Ecology if they do not appear necessary. The Permittee must obtain the written concurrence of the receiving POTW on the application before submitting it to Ecology. The Permittee must continue to comply with the existing permit until it is modified or reissued. Submitting a notice of dangerous waste discharge (to comply with Pretreatment or Dangerous Waste rules) triggers this requirement as well.

G5. Plan Review Required

Prior to constructing or modifying any wastewater control facilities, an engineering report and detailed plans and specifications must be submitted to Ecology for approval in accordance with Chapter 173-240 WAC. Engineering reports, plans, and specifications should be submitted at least 180 days prior to the planned start of construction. Facilities must be constructed and operated in accordance with the approved plans.

G6. Compliance with Other Laws and Statutes

Nothing in this permit excuses the Permittee from compliance with any applicable federal, state, or local statutes, ordinances, or regulations.

G7. Transfer of This Permit

This permit is automatically transferred to a new owner or operator if:

1. A written agreement between the old and new owner or operator containing a specific date for transfer of permit responsibility, coverage, and liability is submitted to Ecology;
2. A copy of the permit is provided to the new owner and;

3. Ecology does not notify the Permittee of the need to modify the permit.

Unless this permit is automatically transferred according to Section A. above, this permit may be transferred only if it is modified to identify the new Permittee and to incorporate such other requirements as determined necessary by Ecology.

G8. Payment of Fees

The Permittee must submit payment of fees associated with this permit as assessed by Ecology. Ecology may revoke this permit if the permit fees established under Chapter 173-224 WAC are not paid.

G9. Penalties for Violating Permit Conditions

Any person who is found guilty of willfully violating the terms and conditions of this permit is guilty of a crime, and upon conviction thereof may be punished by a fine of up to ten thousand dollars and costs of prosecution, or by imprisonment in the discretion of the court. Each day upon which a willful violation occurs may be deemed a separate and additional violation.

Any person who violates the terms and conditions of a waste discharge permit incurs, in addition to any other penalty as provided by law, a civil penalty in the amount of up to ten thousand dollars for every such violation. Each and every such violation is a separate and distinct offense, and in case of a continuing violation, every day's continuance is considered a separate and distinct violation.

G10. Duty to Provide Information

The Permittee must submit to Ecology, within a reasonable time, all information which Ecology may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit. The Permittee must also submit to Ecology upon request, copies of records required to be kept by this permit.

G11. Duty to Comply

The Permittee must comply with all conditions of this permit. Any permit noncompliance constitutes a violation of chapter 90.48 RCW and is grounds for enforcement action; for permit termination, revocation and reissuance, or modification; or denial of a permit renewal application.

G12. Contract Review

The Permittee must submit to Ecology any proposed contract for the operation of any wastewater treatment facility covered by this permit.

The review is to ensure consistency with chapters 90.46 and 90.48 RCW. In the event that Ecology does not comment within a thirty (30)-day period, the Permittee may assume consistency and proceed with the contract.

Appendix A

LIST OF POLLUTANTS WITH ANALYTICAL METHODS, DETECTION LIMITS AND QUANTITATION LEVELS

The Permittee must use the specified analytical methods, detection limits (DLs) and quantitation levels (QLs) in the following table for permit and application required monitoring unless:

- Another permit condition specifies other methods, detection levels, or quantitation levels.
- The method used produces measurable results in the sample and EPA has listed it as an EPA-approved method in 40 CFR Part 136.

If the Permittee uses an alternative method, not specified in the permit and as allowed above, it must report the test method, DL, and QL on the discharge monitoring report or in the required report.

When the permit requires the Permittee to measure the base neutral compounds in the list of priority pollutants, it must measure all of the base neutral pollutants listed in the table below. The list includes EPA required base neutral priority pollutants and several additional polynuclear aromatic hydrocarbons (PAHs). The Water Quality Program added several PAHs to the list of base neutrals below from Ecology's Persistent Bioaccumulative Toxics (PBT) List. It only added those PBT parameters of interest to Appendix A that did not increase the overall cost of analysis unreasonably.

Ecology added this appendix to the permit in order to reduce the number of analytical "non-detects" in permit-required monitoring and to measure effluent concentrations near or below criteria values where possible at a reasonable cost.

CONVENTIONAL PARAMETERS

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
CONVENTIONAL PARAMETERS			
Biochemical Oxygen Demand (5 day)	SM5210-B		2 mg/L
Chemical Oxygen Demand	SM5220-D		10 mg/L
Total Organic Carbon	SM5310-B/C/D		1 mg/L
Total Suspended Solids	SM2540-D		5 mg/L
Total Ammonia (as N)	SM4500-NH3- GH		20
Flow	Calibrated device		

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
Dissolved oxygen	SM4500-OC/OG		0.2 mg/L
Temperature (max. 7-day avg.)	Analog recorder or Use micro-recording devices known as thermistors		0.2° C
pH	SM4500-H^+ B	N/A	N/A

NONCONVENTIONAL PARAMETERS

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
NONCONVENTIONAL PARAMETERS			
Total Alkalinity	SM2320-B		5 mg/L as CaCO3
Chlorine, Total Residual	SM4500 Cl G		50.0
Color	SM2120 B/C/E		10 color units
Fecal Coliform	SM 9221D/E,9222	N/A	N/A
Fluoride (16984-48-8)	SM4500-F E	25	100
Nitrate-Nitrite (as N)	SM4500-NO3-E/F/H		100
Nitrogen, Total Kjeldahl (as N)	SM4500-NH3-C/E/FG		300
Ortho-Phosphate (PO_4 as P)	SM4500- PE/PF	3	10
Phosphorus, Total (as P)	SM4500-PE/PF	3	10
Oil and Grease (HEM)	1664A	1,400	5,000
Salinity	SM2520-B		3 PSS

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
Settleable Solids	SM2540 -F		100
Sulfate (as mg/L SO_4)	SM4110-B		200
Sulfide (as mg/L S)	SM4500-S^2F/D/E/G		200
Sulfite (as mg/L SO_3)	SM4500-SO3B		2000
Total Coliform	SM 9221B, 9222B, 9223B	N/A	N/A
Total dissolved solids	SM2540 C		20 mg/L
Total Hardness	SM2340B		200 as CaCO3
Aluminum, Total (7429-90-5)	200.8	2.0	10
Barium Total (7440-39-3)	200.8	0.5	2.0
BTEX (benzene +toluene + ethylbenzene + m,o,p xylenes)	EPA SW 846 8021/8260	1	2
Boron Total (7440-42-8)	200.8	2.0	10.0
Cobalt, Total (7440-48-4)	200.8	0.05	0.25
Iron, Total (7439-89-6)	200.7	12.5	50
Magnesium, Total (7439-95-4)	200.7	10	50
Molybdenum, Total (7439-98-7)	200.8	0.1	0.5
Manganese, Total (7439-96-5)	200.8	0.1	0.5
NWTPH Dx	Ecology NWTPH Dx	250	250
NWTPH Gx	Ecology NWTPH Gx	250	250
Tin, Total (7440-31-5)	200.8	0.3	1.5
Titanium, Total (7440-32-6)	200.8	0.5	2.5

PRIORITY POLLUTANTS

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
METALS, CYANIDE & TOTAL PHENOLS			
Antimony, Total (7440-36-0)	200.8	0.3	1.0
Arsenic, Total (7440-38-2)	200.8	0.1	0.5
Beryllium, Total (7440-41-7)	200.8	0.1	0.5
Cadmium, Total (7440-43-9)	200.8	0.05	0.25
Chromium (hex) dissolved (18540-29-9)	SM3500-Cr EC	0.3	1.2
Chromium, Total (7440-47-3)	200.8	0.2	1.0
Copper, Total (7440-50-8)	200.8	0.4	2.0
Lead, Total (7439-92-1)	200.8	0.1	0.5
Mercury, Total (7439-97-6)	1631E	0.0002	0.0005
Nickel, Total (7440-02-0)	200.8	0.1	0.5
Selenium, Total (7782-49-2)	200.8	1.0	1.0
Silver, Total (7440-22-4)	200.8	0.04	0.2
Thallium, Total (7440-28-0)	200.8	0.09	0.36
Zinc, Total (7440-66-6)	200.8	0.5	2.5
Cyanide, Total (57-12-5)	335.4	5	10
Cyanide, Weak Acid Dissociable	SM4500-CN I	5	10
Cyanide, Free Amenable to Chlorination (Available Cyanide)	SM4500-CN G	5	10
Phenols, Total	EPA 420.1		50

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *μg/L unless specified*	Quantitation Level (QL)[2] *μg/L unless specified*
ACID COMPOUNDS			
2-Chlorophenol (95-57-8)	625	1.0	2.0
2,4-Dichlorophenol (120-83-2)	625	0.5	1.0
2,4-Dimethylphenol (105-67-9)	625	0.5	1.0
4,6-dinitro-o-cresol (534-52-1) (2-methyl-4,6,-dinitrophenol)	625/1625B	1.0	2.0
2,4 dinitrophenol (51-28-5)	625	1.0	2.0
2-Nitrophenol (88-75-5)	625	0.5	1.0
4-nitrophenol (100-02-7)	625	0.5	1.0
Parachlorometa cresol (59-50-7) (4-chloro-3-methylphenol)	625	1.0	2.0
Pentachlorophenol (87-86-5)	625	0.5	1.0
Phenol (108-95-2)	625	2.0	4.0
2,4,6-Trichlorophenol (88-06-2)	625	2.0	4.0

PRIORITY POLLUTANTS (continued)

Pollutant & CAS No.*(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *μg/L unless specified*	Quantitation Level (QL)[2] *μg/L unless specified*
VOLATILE COMPOUNDS			
Acrolein (107-02-8)	624	5	10
Acrylonitrile (107-13-1)	624	1.0	2.0
Benzene (71-43-2)	624	1.0	2.0
Bromoform (75-25-2)	624	1.0	2.0

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
VOLATILE COMPOUNDS			
Carbon tetrachloride (56-23-5)	624/601 or SM6230B	1.0	2.0
Chlorobenzene (108-90-7)	624	1.0	2.0
Chloroethane (75-00-3)	624/601	1.0	2.0
2-Chloroethylvinyl Ether (110-75-8)	624	1.0	2.0
Chloroform (67-66-3)	624 or SM6210B	1.0	2.0
Dibromochloromethane (124-48-1)	624	1.0	2.0
1,2-Dichlorobenzene (95-50-1)	624	1.9	7.6
1,3-Dichlorobenzene (541-73-1)	624	1.9	7.6
1,4-Dichlorobenzene (106-46-7)	624	4.4	17.6
Dichlorobromomethane (75-27-4)	624	1.0	2.0
1,1-Dichloroethane (75-34-3)	624	1.0	2.0
1,2-Dichloroethane (107-06-2)	624	1.0	2.0
1,1-Dichloroethylene (75-35-4)	624	1.0	2.0
1,2-Dichloropropane (78-87-5)	624	1.0	2.0
1,3-dichloropropene (mixed isomers) (1,2-dichloropropylene) (542-75-6) [3]	624	1.0	2.0
Ethylbenzene (100-41-4)	624	1.0	2.0
Methyl bromide (74-83-9) (Bromomethane)	624/601	5.0	10.0
Methyl chloride (74-87-3) (Chloromethane)	624	1.0	2.0

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
VOLATILE COMPOUNDS			
Methylene chloride (75-09-2)	624	5.0	10.0
1,1,2,2-Tetrachloroethane (79-34-5)	624	1.9	2.0
Tetrachloroethylene (127-18-4)	624	1.0	2.0
Toluene (108-88-3)	624	1.0	2.0
1,2-Trans-Dichloroethylene (156-60-5) (Ethylene dichloride)	624	1.0	2.0
1,1,1-Trichloroethane (71-55-6)	624	1.0	2.0
1,1,2-Trichloroethane (79-00-5)	624	1.0	2.0
Trichloroethylene (79-01-6)	624	1.0	2.0
Vinyl chloride (75-01-4)	624/SM6200B	1.0	2.0

PRIORITY POLLUTANTS (continued)

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
BASE/NEUTRAL COMPOUNDS (compounds in bold are Ecology PBTs)			
Acenaphthene (83-32-9)	625	0.2	0.4
Acenaphthylene (208-96-8)	625	0.3	0.6
Anthracene (120-12-7)	625	0.3	0.6
Benzidine (92-87-5)	625	12	24
Benzyl butyl phthalate (85-68-7)	625	0.3	0.6
Benzo(*a*)anthracene (56-55-3)	625	0.3	0.6

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
BASE/NEUTRAL COMPOUNDS (compounds in bold are Ecology PBTs)			
Benzo(b)fluoranthene (3,4-benzofluoranthene) (205-99-2) [4]	610/625	0.8	1.6
Benzo(j)fluoranthene (205-82-3) [4]	625	0.5	1.0
Benzo(k)fluoranthene (11,12-benzofluoranthene) (207-08-9) [4]	610/625	0.8	1.6
Benzo(r,s,t)pentaphene (189-55-9)	625	0.5	1.0
Benzo(*a*)pyrene (50-32-8)	610/625	0.5	1.0
Benzo(*ghi*)Perylene (191-24-2)	610/625	0.5	1.0
Bis(*2-chloroethoxy)*methane (111-91-1)	625	5.3	21.2
Bis(*2-chloroethyl*)ether (111-44-4)	611/625	0.3	1.0
Bis(*2-chloroisopropyl*)ether (39638-32-9)	625	0.3	0.6
Bis(*2-ethylhexyl*)phthalate (117-81-7)	625	0.1	0.5
4-Bromophenyl phenyl ether (101-55-3)	625	0.2	0.4
2-Chloronaphthalene (91-58-7)	625	0.3	0.6
4-Chlorophenyl phenyl ether (7005-72-3)	625	0.3	0.5
Chrysene (218-01-9)	610/625	0.3	0.6
Dibenzo (a,j)acridine (224-42-0)	610M/625M	2.5	10.0
Dibenzo (a,h)acridine (226-36-8)	610M/625M	2.5	10.0
Dibenzo(a-*h*)anthracene (53-70-3)(1,2,5,6-dibenzanthracene)	625	0.8	1.6

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
BASE/NEUTRAL COMPOUNDS (compounds in bold are Ecology PBTs)			
Dibenzo(a,e)pyrene (192-65-4)	610M/625M	2.5	10.0
Dibenzo(a,h)pyrene (189-64-0)	625M	2.5	10.0
3,3-Dichlorobenzidine (91-94-1)	605/625	0.5	1.0
Diethyl phthalate (84-66-2)	625	1.9	7.6
Dimethyl phthalate (131-11-3)	625	1.6	6.4
Di-n-butyl phthalate (84-74-2)	625	0.5	1.0
2,4-dinitrotoluene (121-14-2)	609/625	0.2	0.4
2,6-dinitrotoluene (606-20-2)	609/625	0.2	0.4

PRIORITY POLLUTANTS (continued)

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
BASE/NEUTRAL COMPOUNDS (compounds in bold are Ecology PBTs)			
Di-n-octyl phthalate (117-84-0)	625	0.3	0.6
1,2-Diphenylhydrazine (*as Azobenzene*) (122-66-7)	1625B	5.0	20
Fluoranthene (206-44-0)	625	0.3	0.6
Fluorene (86-73-7)	625	0.3	0.6
Hexachlorobenzene (118-74-1)	612/625	0.3	0.6
Hexachlorobutadiene (87-68-3)	625	0.5	1.0
Hexachlorocyclopentadiene (77-47-4)	1625B/625	0.5	1.0

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
BASE/NEUTRAL COMPOUNDS **(compounds in bold are Ecology PBTs)**			
Hexachloroethane (67-72-1)	625	0.5	1.0
Indeno(*1,2,3-cd*)Pyrene (193-39-5)	610/625	0.5	1.0
Isophorone (78-59-1)	625	0.5	1.0
3-Methyl cholanthrene (56-49-5)	625	2.0	8.0
Naphthalene (91-20-3)	625	0.3	0.6
Nitrobenzene (98-95-3)	625	0.5	1.0
N-Nitrosodimethylamine (62-75-9)	607/625	2.0	4.0
N-Nitrosodi-n-propylamine (621-64-7)	607/625	0.5	1.0
N-Nitrosodiphenylamine (86-30-6)	625	0.5	1.0
Perylene (198-55-0)	625	1.9	7.6
Phenanthrene (85-01-8)	625	0.3	0.6
Pyrene (129-00-0)	625	0.3	0.6
1,2,4-Trichlorobenzene (120-82-1)	625	0.3	0.6

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
DIOXIN			
2,3,7,8-Tetra-Chlorodibenzo-P-Dioxin (176-40-16)	1613B	1.3 pg/L	5 pg/L

PRIORITY POLLUTANTS (continued)

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
PESTICIDES/PCBs			
Aldrin (309-00-2)	608	0.025	0.05
alpha-BHC (319-84-6)	608	0.025	0.05
beta-BHC (319-85-7)	608	0.025	0.05
gamma-BHC (58-89-9)	608	0.025	0.05
delta-BHC (319-86-8)	608	0.025	0.05
Chlordane (57-74-9)[5]	608	0.025	0.05
4,4'-DDT (50-29-3)	608	0.025	0.05
4,4'-DDE (72-55-9)	608	0.025	0.05[10]
4,4' DDD (72-54-8)	608	0.025	0.05
Dieldrin (60-57-1)	608	0.025	0.05
alpha-Endosulfan (959-98-8)	608	0.025	0.05
beta-Endosulfan (33213-65-9)	608	0.025	0.05
Endosulfan Sulfate (1031-07-8)	608	0.025	0.05
Endrin (72-20-8)	608	0.025	0.05
Endrin Aldehyde (7421-93-4)	608	0.025	0.05
Heptachlor (76-44-8)	608	0.025	0.05
Heptachlor Epoxide (1024-57-3)	608	0.025	0.05
PCB-1242 (53469-21-9)[6]	608	0.25	0.5
PCB-1254 (11097-69-1)	608	0.25	0.5
PCB-1221 (11104-28-2)	608	0.25	0.5
PCB-1232 (11141-16-5)	608	0.25	0.5

Pollutant & CAS No. *(if available)*	Recommended Analytical Protocol	Detection (DL)[1] *µg/L unless specified*	Quantitation Level (QL)[2] *µg/L unless specified*
PESTICIDES/PCBs			
PCB-1248 (12672-29-6)	608	0.25	0.5
PCB-1260 (11096-82-5)	608	0.13	0.5
PCB-1016 (12674-11-2) [6]	608	0.13	0.5
Toxaphene (8001-35-2)	608	0.24	0.5

1. Detection level (DL) or detection limit means the minimum concentration of an analyte (substance) that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero as determined by the procedure given in 40 CFR part 136, Appendix B.

2. Quantitation Level (QL) also known as Minimum Level of Quantitation (ML) – The lowest level at which the entire analytical system must give a recognizable signal and acceptable calibration point for the analyte. It is equivalent to the concentration of the lowest calibration standard, assuming that the lab has used all method-specified sample weights, volumes, and cleanup procedures. The QL is calculated by multiplying the MDL by 3.18 and rounding the result to the number nearest to (1, 2, or 5) x 10^n, where n is an integer. (64 FR 30417).
   ALSO GIVEN AS:
   The smallest detectable concentration of analyte greater than the Detection Limit (DL) where the accuracy (precision & bias) achieves the objectives of the intended purpose. (Report of the Federal Advisory Committee on Detection and Quantitation Approaches and Uses in Clean Water Act Programs Submitted to the US Environmental Protection Agency December 2007).

3. 1, 3-dichloroproylene (mixed isomers) - You may report this parameter as two separate parameters: cis-1, 3-dichlorpropropene (10061-01-5) and trans-1, 3-dichloropropene (10061-02-6).

4. Total Benzofluoranthenes - Because Benzo(b)fluoranthene, Benzo(j)fluoranthene and Benzo(k)fluoranthene co-elute you may report these three isomers as total benzofluoranthenes.

5. Chlordane – You may report alpha-chlordane (5103-71-9) and gamma-chlordane (5103-74-2) in place of chlordane (57-74-9). If you report alpha and gamma-chlordane, the DL/PQLs that apply are 0.025/0.050.

6. PCB 1016 & PCB 1242 – You may report these two PCB compounds as one parameter called PCB 1016/1242.

APPENDIX B

SEPA

WAC 197-11-970 Determination of Nonsignificance (DNS).

Description of proposal:

Wastewater Facility Plan. The Wastewater Facility Plan is a planning tool to be used by the City of Soap Lake in conjunction with the City's current Comprehensive Plan under the Growth Management Act (GMA). The Wastewater Facility Plan describes the location and type of facilities needed to provide municipal wastewater service to the planning area to meet present and future needs. The proposal provides a method of implementing the various proposed projects based on need and the effect financing may have on wastewater rates.

Proponent:

City of Soap Lake
239 Second Ave. SE
P.O. Box 1270
Soap Lake, WA 98851

Location of proposal, including street address, if any:

The Wastewater Facility Plan encompasses the entire UGA boundary.

Lead agency: City of Soap Lake

The lead agency for this proposal has determined that it does not have a probable significant adverse impact on the environment. An environmental impact statement (EIS) is not required under RCW 43.21C.030 (2)(c). This decision was made after review of a completed environmental checklist and other information on file with the lead agency. This information is available to the public on request.

☐ There is no comment period for this DNS.

☐ This DNS is issued after using the optional DNS process in WAC 197-11-355. There is no further comment period on the DNS.

☑ This DNS is issued under WAC 197-11-340(2); the lead agency will not act on this proposal for 14 days from the date below. Comments must be submitted by September 20, 2012.

Responsible official: Raymond Gravelle

Position/title: Mayor Phone: (509) 246-1211

Address: 239 Second Ave. SE Soap Lake, WA 98851

Date: September 6, 2012

Signature: R. Gravelle

STATE OF WASHINGTON – GRANT COUNTY

No. 16466

Affidavit of Publication

NOTICE OF DETERMINATION OF NON-SIGNIFICANCE

The City of Soap Lake issued a determination of non-significance (DNS) under the State Environmental Policy Act Rules (Chapter 197-11 WAC) for the following project: Wastewater Facility Plan. The Wastewater Facility Plan is a planning tool to be used by the City of Soap Lake in conjunction with the City's current Comprehensive Plan under the Growth Management Act (GMA). The Wastewater Facility Plan describes the location and type of facilities needed to provide municipal wastewater service to the planning area to meet present and future needs. The proposal provides a method of implementing the various proposed projects based on need and the effect financing may have on wastewater rates. After review of a completed environmental checklist and other information on file with the agency, City of Soap Lake has determined this proposal will not have a probable significant adverse impact on the environment.

Copies of the DNS are available at no charge from the City of Soap Lake 239 Second Ave SE, Soap Lake, WA 98851. The public is invited to comment on this DNS by submitting written comments no later than September 20, 2012 to the City of Soap Lake at the above address.

9/6

The undersigned, on oath, states that he/she is an authorized representative of the Grant County Journal, a semi-weekly newspaper, which is a legal newspaper of general circulation and it is now and has been for more than six months prior to the date of publication hereinafter referred to, published in the English language continuously in Ephrata, Grant County, Washington, and it is now and during all of said time, was printed in an office maintained at the aforesaid place of publication of this newspaper.

The Grant County Journal was on the 2nd day of July 1941, approved as a legal newspaper by the Superior Court of Grant County.

The notice in the exact form annexed, was published in regular issues of the Grant County Journal, which was regularly distributed to its subscribers during the below stated period.

The annexed notice, a Notice of Determination

was published 9/6

The amount of the fee charged for the aforegoing publication is the sum of $ 40.75, which amount has been paid in full.

Subscribed and sworn to before me on September 7, 2012

Notary Public for the State of Washington, residing in Ephrata

HENNE NOTARY PUBLIC MAY 24, 2013 STATE OF WASHINGTON

WAC 197-11-970 Determination of Nonsignificance (DNS).

Description of proposal:

Wastewater Facility Plan. The Wastewater Facility Plan is a planning tool to be used by the City of Soap Lake in conjunction with the City's current Comprehensive Plan under the Growth Management Act (GMA). The Wastewater Facility Plan describes the location and type of facilities needed to provide municipal wastewater service to the planning area to meet present and future needs. The proposal provides a method of implementing the various proposed projects based on need and the effect financing may have on wastewater rates.

Proponent:

City of Soap Lake
239 Second Ave. SE
P.O. Box 1270
Soap Lake, WA 98851

Location of proposal, including street address, if any:

The Wastewater Facility Plan encompasses the entire UGA boundary.

Lead agency: City of Soap Lake

The lead agency for this proposal has determined that it does not have a probable significant adverse impact on the environment. An environmental impact statement (EIS) is not required under RCW 43.21C.030 (2)(c). This decision was made after review of a completed environmental checklist and other information on file with the lead agency. This information is available to the public on request.

☐ There is no comment period for this DNS.

☐ This DNS is issued after using the optional DNS process in WAC 197-11-355. There is no further comment period on the DNS.

☑ This DNS is issued under WAC 197-11-340(2); the lead agency will not act on this proposal for 14 days from the date below. Comments must be submitted by August 27, 2012.

Responsible official: Raymond Gravelle

Position/title: Mayor Phone: (509) 246-1211

Address: 239 Second Ave. SE Soap Lake, WA 98851

Date: August 13, 2012

Signature: ______________________________

STATE ENVIRONMENTAL POLICY ACT

ENVIRONMENTAL CHECKLIST

A. BACKGROUND

1. **Name of proposed project:** Wastewater Facility Plan

2. **Name of applicant:** City of Soap Lake

3. **Address and phone number of applicant and contact person:**

Applicant	Engineer
City of Soap Lake 239 Second Ave. SE P.O. Box 1270 Mr. Darrin Fronsman Public Works Supervisor (509) 246-1823	Gray & Osborne, Inc. 107 South 3rd Street Yakima, WA 98901 Robert Scott Staff Engineer (509) 453-4833

4. **Date checklist prepared:** August 6, 2012

5. **Agency requesting checklist:** City of Soap Lake

6. **Proposed timing or schedule (including phasing, if applicable):**

   Construction of Phase I improvements are projected to begin in the Spring of 2014 and be completed by Fall of 2014.

7. **Plans for future additions, expansion, or further activity related to or connected with this proposal:**

   Phase II improvements are currently projected to become necessary in approximately 2017.

8. **Environmental information you know about that has been prepared, or will be prepared, directly related to this proposal:**

   We have no knowledge of additional environmental information pertaining to this project.

9. **Applications that are pending for governmental approvals of other proposals directly affecting the property covered by your proposal:**

   N/A

10. **List any government approvals or permits that will be needed for the proposal:**

    Local building permits will be required.

11. **Brief complete description of the proposal, including the proposed uses and the size of the project and site:**

The Phase I improvements project includes modification of the existing headworks, construction of new RAS and scum pump stations, rehabilitation and paving of the sludge drying beds, installation of electrical equipment necessary to convert the facility to 480V service, and the installation of mechanical equipment typical of wastewater treatment.

The Phase II improvements project includes construction of a new headworks, construction of bioselector tanks, construction of an anoxic basin, construction of additional sludge drying beds, construction of a nonpotable water pump station, modification of site plumbing to meet cross connection control requirements, and the installation of mechanical equipment typical of wastewater treatment.

12. **Location of the proposal, including street address, if any, and section, township, and range: Provide a legal description, site plan, vicinity map, and topographic map, if reasonably available.**

The City of Soap Lake is located in Grant County. The proposed project will occur in Range26E in Township 22N.

The entirety of the work that will need performed as a result of this Wastewater Facility Plan will be conducted within the confines of the existing Wastewater Treatment Facility, aside from the potential replacement of a pump at the City's Lift Station No. 2, which will not impact the surrounding area.

A project vicinity map is attached that shows the location of the proposed construction activities.

B. ENVIRONMENTAL ELEMENTS

1. Earth

a. **General description of the site (underline one): <u>Flat</u>, rolling, hilly, steep slopes, mountainous, other:**

b. **What is the steepest slope on the site (approximate percent slope)?**

The steepest slope within the project area is associated with embankment rises at a slope of approximately 1H:1V.

c. **What general types of soils are found on the site (for example, clay, sand, gravel, peat, muck)? If you know the classification of agricultural soils, specify them and note any prime farmland.**

According to the Natural Resource Conservation Service Soils map for the project, soils are typically fine sandy loam, silty loam, and fine sand. No prime farmland classification exists within the WWTF site.

d. **Are there surface indications or history of unstable soils in the immediate vicinity? If so, describe.**

No.

e. **Describe the purpose, type, and approximate quantities of any filling or grading proposed. Indicate source of fill.**

Minor grading will be necessary to construct the proposed wastewater treatment facility upgrades. Soils removed for construction will be taken off site. Approximately 1,500 cubic yards of material will be moved as part of the Phase I and Phase II projects.

f. **Could erosion occur as a result of clearing, construction, or use?**

Erosion of cleared areas or of stockpiled materials may occur during periods of wet weather throughout construction, although these periods will be minimal due the arid climate in central Washington. However, temporary erosion control mitigation will be contractually mandated, installed and maintained throughout the construction process to mitigate soils erosion off-site.

g. **About what percent of the site will be covered with impervious surfaces after project construction (for example, asphalt or buildings)?**

Approximately 2-3 additional percent of the site will be covered with impervious surfaces after completion. The existing Wastewater Treatment Facility is covered by approximately 90% impervious surface.

h. **Proposed measures to reduce or control erosion, or other impacts to the earth, if any:**

The Contractor will employ Department of Ecology's best management practices to minimize the effects of erosion. The continual use of straw bails, silt fencing, etc. will be required during the construction process as a part of the contract. In addition, the project will be temporarily shut down during periods of inclement weather conditions.

2. **Air**

a. **What types of emissions to the air would result from the proposal (i.e. dust, automobile, odors, industrial wood smoke) during construction and when the project is completed? If any, generally describe and give approximate quantities, if known.**

Normal exhaust emissions from construction equipment is expected during construction. Dust may be emitted during the construction of the project. A water truck may be employed on-site as needed to control any severe dust problems.

A back-up diesel generator will be incorporated into the project actions occurring at the current Wastewater Treatment Facility. This generator will be utilized only during periods of power outages and for weekly testing of the generator. The existing WWTF produces a slight amount of odor that typically does not extend past the WWTF boundaries. The upgraded aeration equipment in the aerobic digester will reduce odor production at the facility.

b. **Are there any off-site sources of emissions or odor that may affect your proposal? If so, generally describe.**

None known.

c. **Proposed measures to reduce or control emissions or other impacts to air, if any:**

The construction contract will include provisions for dust control during construction.

3. **Water**

a. **Surface:**

1) **Is there any surface water body on or in the immediate vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names. If appropriate, state what stream or river it flows into.**

Yes. Soap Lake is located approximately half a mile to the northeast of the project site.

2) **Will the project require any work over, in, or adjacent to (within 200 feet) the described waters? If yes, please describe and attach available plans.**

No. See attached project site plan.

3) **Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.**

None.

4) **Will the proposal require surface water withdrawals or diversions? Give general description, purpose, and approximate quantities, if known.**

No.

5) **Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.**

No.

6) **Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.**

No.

b. **Ground:**

1) **Will ground water be withdrawn, or will water be discharged to ground water? Give general description, purpose, and approximate quantities, if known.**

Yes, surface disposal of wastewater via rapid infiltration basins is the means through which the treated wastewater is returned to waters of the State at the facility. The facility is permitted for a maximum daily discharge of 420,000 gallons per day. This will not change as a result of this project.

2) **Describe waste material that will be discharged into the ground from septic tanks or other sources, if any; describe the general size of the system, the number of such systems, the number of houses to be served (if applicable), or the number of animals or humans the system(s) are expected to serve.**

Yes, surface disposal of wastewater via rapid infiltration basins is the means through which the treated wastewater is returned to waters of the State at the facility. The facility is permitted for a maximum daily discharge of 420,000 gallons per day. This will not change as a result of this project.

c. **Water Runoff (including storm water):**

1) **Describe the source of runoff (including storm water) and method of collection and disposal, if any (include quantities, if known). Where will this water flow? Will this water flow into other waters? If so, describe.**

Stormwater runoff will occur from building roofs, gravel and paved surfaces. Stormwater is anticipated to infiltrate on site.

2) **Could waste materials enter ground or surface waters? If so, generally describe.**

No.

d. **Proposed measures to reduce or control surface, ground, and runoff water impacts, if any:**

Methods to minimize and mitigate construction related erosion will be provided for in the design process and further required within the contract documents. Methods will include the use of silt fencing, filter fabric and straw bales to contain the silt on-site and the placing of filter fabric over catch basins to restrict silt from entering the existing stormwater system. All final graded slopes will be properly stabilized to prevent post-construction erosion.

4. **Plants**

a. **Check or circle types of vegetation found on the site:**

______**deciduous tree: alder, maple, aspen, other**
______**evergreen tree: fir, cedar, pine, other (not within construction limits)**
__X__**shrubs**
__X__**grass**
______**pasture**
______**crop or grain**
______**wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other**
______**water plants: water lily, eelgrass, milfoil, other**
______**other types of vegetation**

b. **What kind and amount of vegetation will be removed or altered?**

Minor clearing and grubbing activities will be completed in the area. No large trees and/or shrubs are anticipated to be removed or destroyed during the construction process.

c. **List threatened or endangered species known to be on or near the site.**

According to the U.S. Fish and Wildlife Service Endangered and Threatened Species list for Grant County and the Washington Department of Fish and Wildlife Priority and Habitat Species maps, Showy stickseed (*Hackelia venusta)* and Ute ladies'-tresses (*Spiranthes diluvialis*) are potentially located in Soap Lake.

Per the U.S. Fish & Wildlife Service Recovery Plan for Showy stickseed, the only known population of Showy stickseed is in the lower slopes of Tumwater Canyon in Chelan County, and therefore is not expected to be present near the project site.

Ute ladies'-tresses have a very limited population in Washington state. They have been discovered in Grant County but require very specific conditions to grow in. The species is endemic to moist soils in mesic or wet meadows near springs, lakes, or perennial streams, and the WWTF site does not experience the elevated groundwater table typical of growth. Furthermore, the project site already consists of predominantly impervious surfaces, and disturbance of native species is not anticipated. Finally, the elevation range of known Ute ladies'-tresses occurrences is typically 4,300 to 7,000 feet. As such, it is assumed that Ute ladies'-tresses are not present in the project area.

d. **Proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site, if any:**

Disturbed areas will be re-seeded with a native seed mix at the end of construction.

5. **Animals**

a. **Underline any birds and animals which have been observed on or near the site or are known to be on or near the site:**

birds: hawk, heron, eagle, <u>songbirds</u>, <u>other</u>:
mammals: deer, bear, elk, beaver, <u>other</u>:
fish: bass, salmon, trout, herring, shellfish, other:

b. **List any threatened or endangered species known to be on or near the site.**

According to the U.S. Fish and Wildlife Service Endangered and Threatened Species list for Grant County and the Washington Department of Fish and Wildlife Priority and Habitat Species maps, the following endangered or threatened species are potentially located in Soap Lake:

- Pygmy rabbits (*Brachylagus idahoensis*)
- Gray wolf (*Canis lupus*) (not at site)
- Northern spotted owl (*Strix occidentalis caurina*) (not at site)
- Marbled murrelet (*Brachyramphus marmoratus*) (not at site)
- Bull trout (*Salvelinus confluentus*) (not at site)
- Grizzly bear (*Ursus arctos horribilis*) (not at site)

It is unknown if pygmy rabbits are located in the vicinity of the project site or not, as the vegetation in the surrounding area is conducive to pygmy rabbit habitats. However, the project site is not included in the recovery area for pygmy rabbits, as pygmy rabbits rely heavily upon sagebrush and tall grasses for cover and do not remain in the open.

The gray wolf is found in remote parts of Western Washington with a specific designation of being west of Highway 97 and 17. The gray wolf requires large tracts of wilderness and would not be located within the residential population of Soap Lake. It is assumed that gray wolves are not present in the project area.

The northern spotted owl inhabits old growth forests and landscapes. The project site does not include old growth forests, therefore it is assumed that the northern spotted owls are not present in the project area.

Marbled murrelets use forests that primarily include typical old growth forests and mature forests with an old growth component. Due to the lack of large forested areas in the vicinity of Soap Lake, it is assumed that marbled murrelets are not present in the project area.

The project site will have no impact on surface water, therefore there will be no impact to bull trout.

Grizzly bears require large, uninterrupted tracts of land and have a propensity to avoid human contact. There are only an estimated 20 grizzly bears in Washington State and their range is limited to extreme northeastern and northwestern corners of the state. For this reason, it is assumed that grizzly bears are not present in the project area.

c. Is the site part of a migration route? If so, explain.

No.

d. Proposed measures to preserve or enhance wildlife, if any:

None.

6. Energy and Natural Resources

a. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

The construction equipment during construction operations shall use oil, gas, and diesel fuel. The upgrades to the Wastewater Treatment Facility will use electric power and the project will install a diesel generator for backup power.

b. Would your project affect the potential use of solar energy by adjacent properties? If so, generally describe:

No.

c. **What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts, if any:**

The treatment plant will be designed to utilize gravity flow of water to the greatest extent possible to limit pumping requirements. Electrical components will run via variable frequency drives where feasible to reduce power requirements.

7. **Environmental Health**

a. **Are there any environmental health hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste, that could occur as a result of this proposal? If so, describe.**

No.

1) **Describe special emergency services that might be required.**

N/A.

2) **Proposed measures to reduce or control environmental health hazards, if any:**

N/A.

b. **Noise**

1) **What types of noise exist in the area which may affect your project (for example: traffic, equipment and operation, other)?**

Noise generation associated with the operation of a municipal wastewater treatment facility.

2) **What types and levels of noise would be created by or associated with the project on a short-term or a long-term basis (for example: traffic, construction, operation, other)? Indicate what hours noise would come from the site.**

Short-term noise from construction equipment during the allowable working hours are expected during the course of construction. A slight increase in noise generation will result as a consequence of increasing the handling capacity of the Wastewater Treatment Facility.

3) **Proposed measures to reduce or control noise impacts, if any:**

Working days and hours will be established by the contract, limiting working hours to non-holiday weekdays from 7:00 A.M. to 6:00 P.M., unless otherwise approved by the City. Additionally, reduced noise generating components will be utilized in construction whenever feasible.

8. **Land and Shoreline Use**

a. **What is the current use of the site and adjacent properties?**

The treatment facility project site is currently utilized as the City's Wastewater Treatment Facility. Adjacent properties are vacant, creating a buffer between the nearest residential area. A school is located approximately 500 feet east of the WWTF.

b. **Has the site been used for agriculture? Is so, describe.**

No.

c. **Describe any structures on the site.**

Buildings associated with the existing Wastewater Treatment Facility are on the site of the proposed upgrades.

d. **Will any structures be demolished? If so, what?**

No.

e. **What is the current zoning classification of the site?**

The project site is zoned industrial.

f. **What is the current comprehensive plan designation of the site?**

The proposed upgrades are on property owned by the City. There currently is no designation of the project site.

g. **If applicable, what is the current shoreline master program designation of the site?**

N/A

h. **Has any part of the site been classified as an "environmentally sensitive" area? If so, specify.**

No.

i. **Approximately how many people would reside or work in the completed project?**

The wastewater treatment facility requires one employee to operate and maintain the various processes and equipment..

j. **Approximately how many people would the completed project displace?**

None.

k. **Proposed measures to avoid or reduce displacement impacts, if any:**

N/A.

l. **Proposed measures to ensure the proposal is compatible with existing and projected land uses and plans, if any:**

N/A.

9. **Housing**

a. **Approximately how many units would be provided, if any? Indicate whether high, middle, or low-income housing.**

None.

b. **Approximately how many units, if any, would be eliminated? Indicate whether high, middle, or low-income housing.**

None.

c. **Proposed measures to reduce or control housing impacts, if any:**

N/A.

10. **Aesthetics**

a. **What is the tallest height of any proposed structure(s), not including antennas; what is the principal exterior building material(s) proposed?**

The tallest structure to be built will most likely be less than 10 feet above grade, with the majority of the structures to be primarily in-ground. Building materials consist primarily of cast-in-place concrete.

b. **What views in the immediate vicinity would be altered or obstructed?**

None.

c. **Proposed measures to reduce or control aesthetic impacts, if any:**

None.

11. **Light and Glare**

a. **What type of light or glare will the proposal produce? What time of day would it mainly occur?**

None.

b. **Could light or glare from the finished project be a safety hazard or interfere with views?**

No.

c. **What existing off-site sources of light or glare may affect your proposal?**

None.

d. **Proposed measures to reduce or control light and glare impacts, if any:**

N/A.

12. **Recreation**

a. **What designated and informal recreational opportunities are in the immediate vicinity?**

None.

b. **Would the proposed project displace any existing recreational uses? If so, describe.**

No.

c. **Proposed measures to reduce or control impacts on recreation, including recreation opportunities to be provided by the project or applicant, if any:**

N/A.

13. **Historic and Cultural Preservation**

a. **Are there any places or objects listed on, or proposed for, national, state, or local preservation registers known to be on or next to the site? If so, generally describe.**

No.

b. **Generally describe any landmarks or evidence of historic, archaeological, scientific, or cultural importance known to be on or next to the site.**

None.

c. **Proposed measures to reduce or control impacts, if any:**

None.

14. **Transportation**

a. **Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans, if any.**

The Wastewater Treatment Facility upgrades project site is located off of 6th Avenue SW and Maple St. in southwest Soap Lake.

b. **Is the site currently served by public transit? If not, what is the approximate distance to the nearest transit stop?**

No.

c. **How many parking spaces would the completed project have? How many would the project eliminate?**

The WWTF has approximately 10 designated parking spaces, and the project is not anticipated to eliminate any of these spaces.

d. **Will the proposal require any new roads or streets, or improvements to existing roads or streets, not including driveways? If so, generally describe (indicate whether public or private).**

No.

e. **Will the project use (or occur in the immediate vicinity of) water, rail, or air transportation? If so, generally describe.**

No.

f. **How many vehicular trips per day would be generated by the completed project? If known, indicate when peak volumes would occur.**

Only minor traffic will be generated; no more than a few trips per day.

g. **Proposed measures to reduce or control transportation impacts, if any:**

None.

15. Public Services

a. **Would the project result in an increased need for public services (for example, fire protection, police protection, health care, schools, other)? If so, generally describe.**

No

b. **Proposed measures to reduce or control direct impacts on public services, if any.**

N/A.

16. Utilities

a. **Underline utilities currently available at the site: <u>electricity</u>, natural gas, <u>water</u>, <u>refuse service</u>, <u>telephone</u>, <u>sanitary sewer</u>, television cable, septic system, other.**

b. **Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on the site or in the immediate vicinity which might be needed.**

Utilities proposed for the project include wastewater treatment owned and operated by the City of Soap Lake, and electrical and telephone service for the plant from the local utility.

C. SIGNATURE

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: Robt Scott

Date Submitted: 8/13/12

D. SUPPLEMENTAL SHEET FOR NONPROJECT ACTIONS

Evaluation for Agency Use Only

(do not use this sheet for project actions)

Because these questions are very general, it may be helpful to read them in conjunction with the list of the elements of the environment.

When answering these questions, be aware of the extent of the proposal, or the types of activities likely to result from the proposal, would affect the item at a greater intensity of at a faster rate than if the proposal were not implemented. Respond briefly and in general terms.

1. **How would the proposal be likely to increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise?**

The proposed modifications to the WWTF are expected to improve the quality of effluent discharged to groundwater from the project site and to improve the quality of biosolids being hauled from the project site for land application at the Boulder Park facility in Mansfield, WA. As the City grows, the quantity of effluent and biosolids is anticipated to increase.

Proposed measures to avoid or reduce such increases are:

None. The anticipated increases are due to growth of the City's population and corresponding per capita flows and loadings to the WWTF as a result of the growth.

2. **How would the proposal be likely to affect plants, animals, fish, or marine life?**

No impact on plants, animals, fish, or marine life is anticipated as a result of the proposal.

Proposed measures to protect or conserve plants, animals, fish, or marine life are:

None.

3. **How would the proposal be likely to deplete energy or natural resources?**

The proposed changes to the WWTF are anticipated to increase total energy use at the WWTF.

Proposed measures to protect or conserve energy and natural resources are:

The City is planning to undergo a design level energy audit to identify energy efficiency measures per the terms of the anticipated funding programs. Furthermore, energy efficiency pumps and motors will be selected.

4. **How would the proposal be likely to use or affect environmentally sensitive areas or areas designated (or eligible or under study) for governmental protection: such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands?**

No use of the identified areas is anticipated at this time.

Proposed measures to protect such resources or to avoid or reduce impacts are:

None.

5. **How would the proposal be likely to affect land and shoreline use, including whether it would allow or encourage land or shoreline uses incompatible with existing plans?**

The modifications to the WWTF are anticipated to occur entirely within the existing boundaries of the WWTF.

Proposed measures to avoid or reduce shoreline and land use impacts are:

None.

6. **How would the proposal be likely to increase demands on transportation or public services and utilities?**

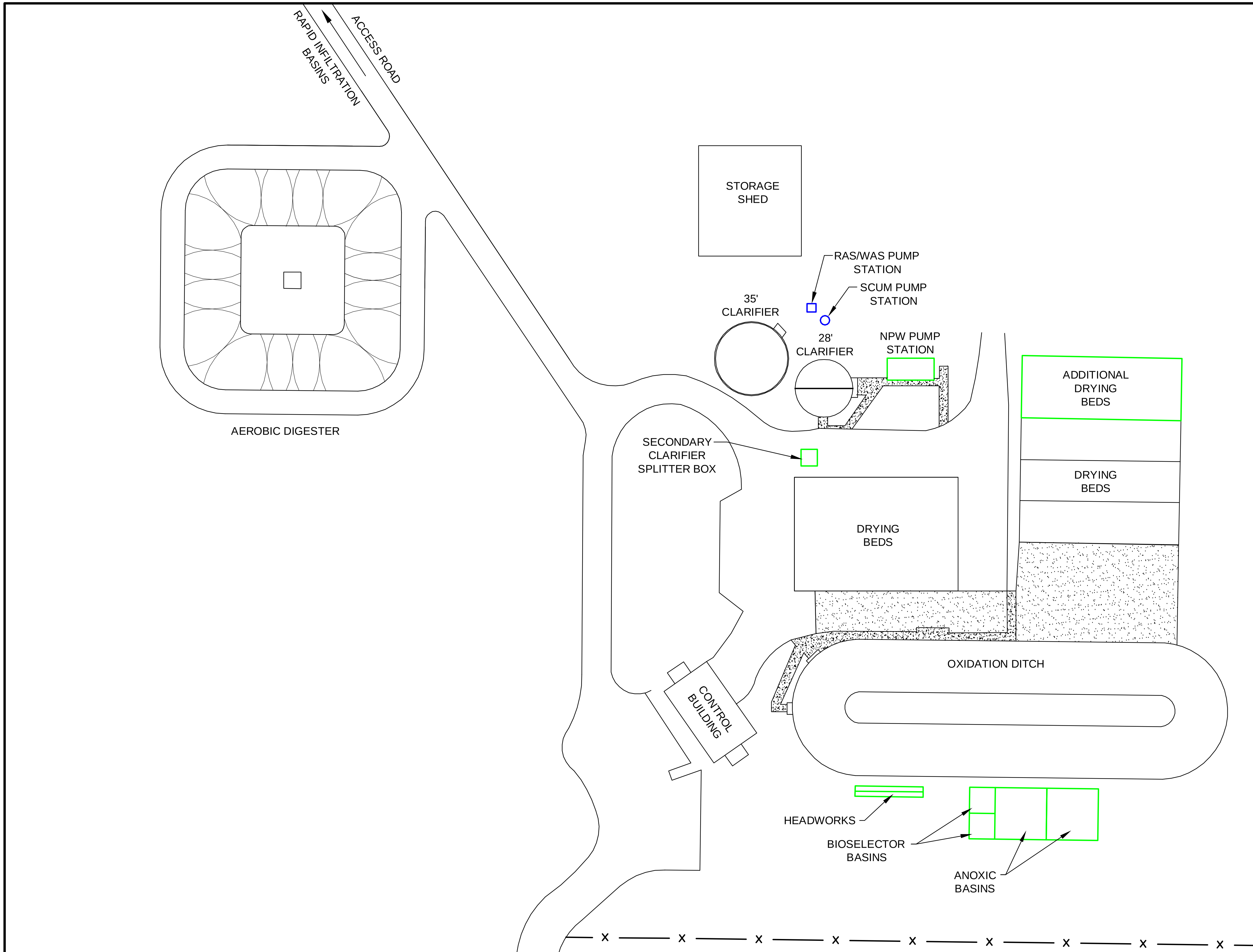
The proposed changes to the WWTF are anticipated to increase total energy use at the WWTF.

Proposed measures to reduce or respond to such demand(s) are:

The City is planning to undergo a design level energy audit to identify energy efficiency measures per the terms of the anticipated funding programs. Furthermore, energy efficiency pumps and motors will be selected.

7. **Identify, if possible, whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment.**

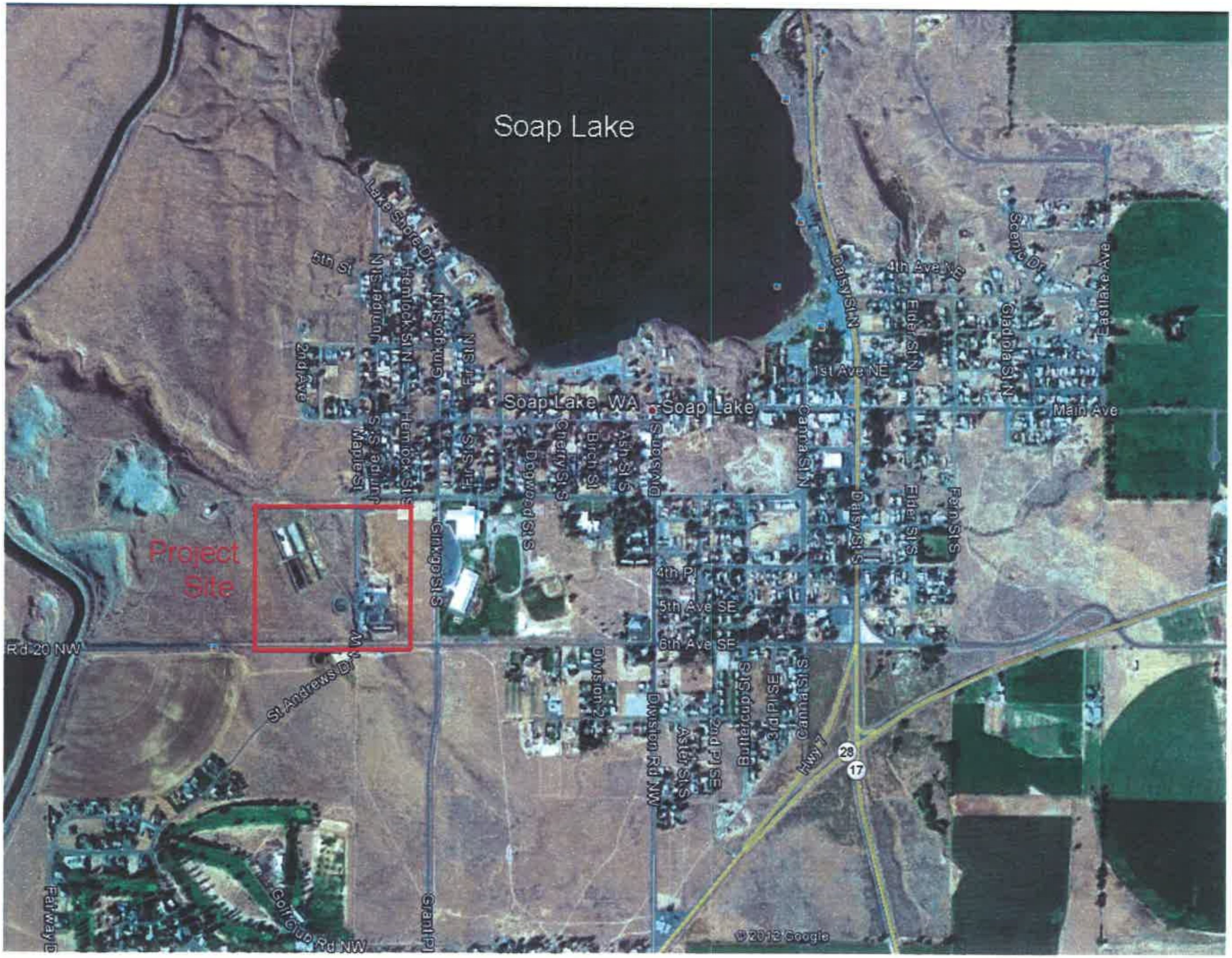
No such conflicts have been identified for this proposal.



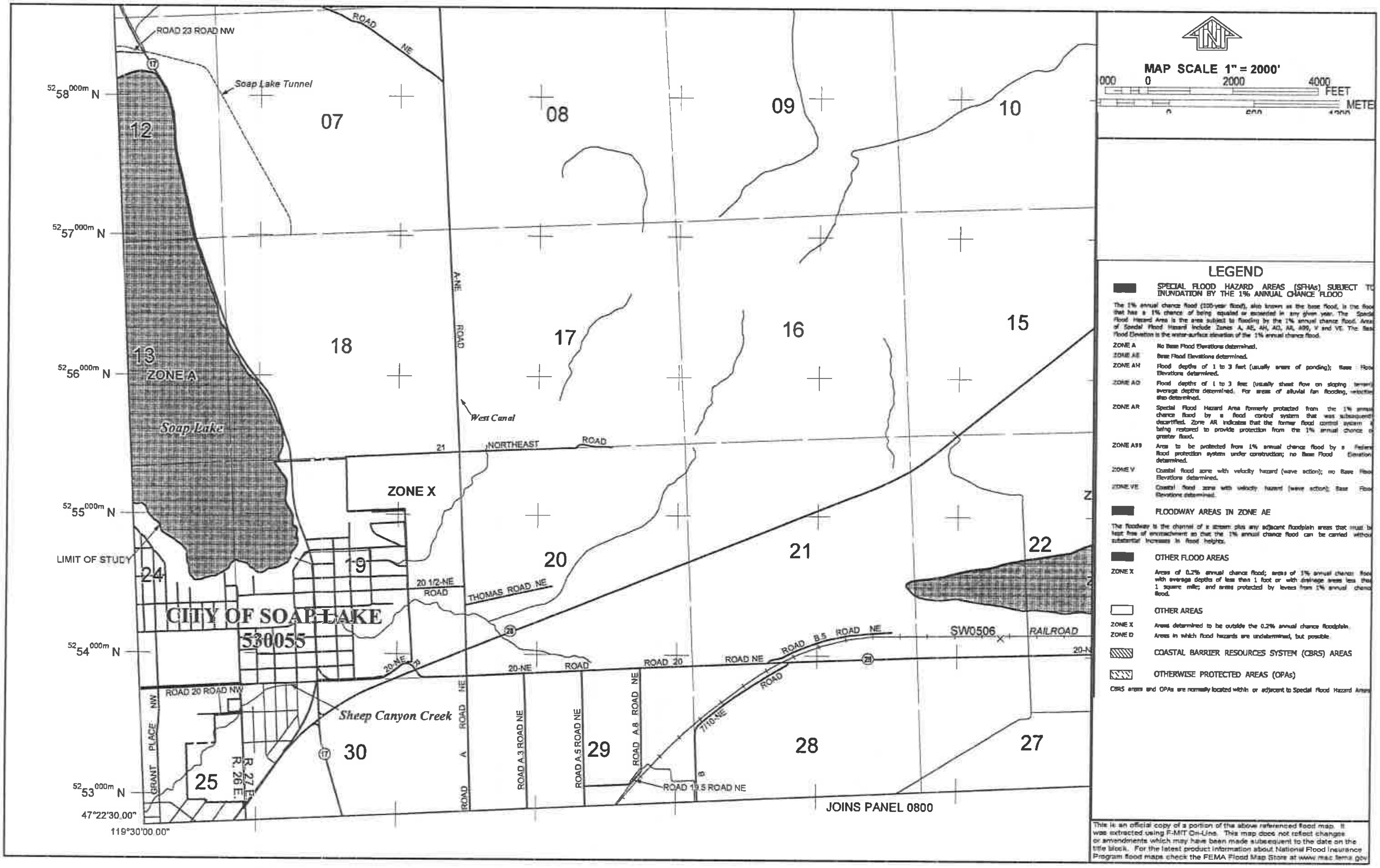
CITY OF SOAP LAKE
WASTEWATER FACILITY PLAN
FIGURE 6-2
PROPOSED SITE PLAN

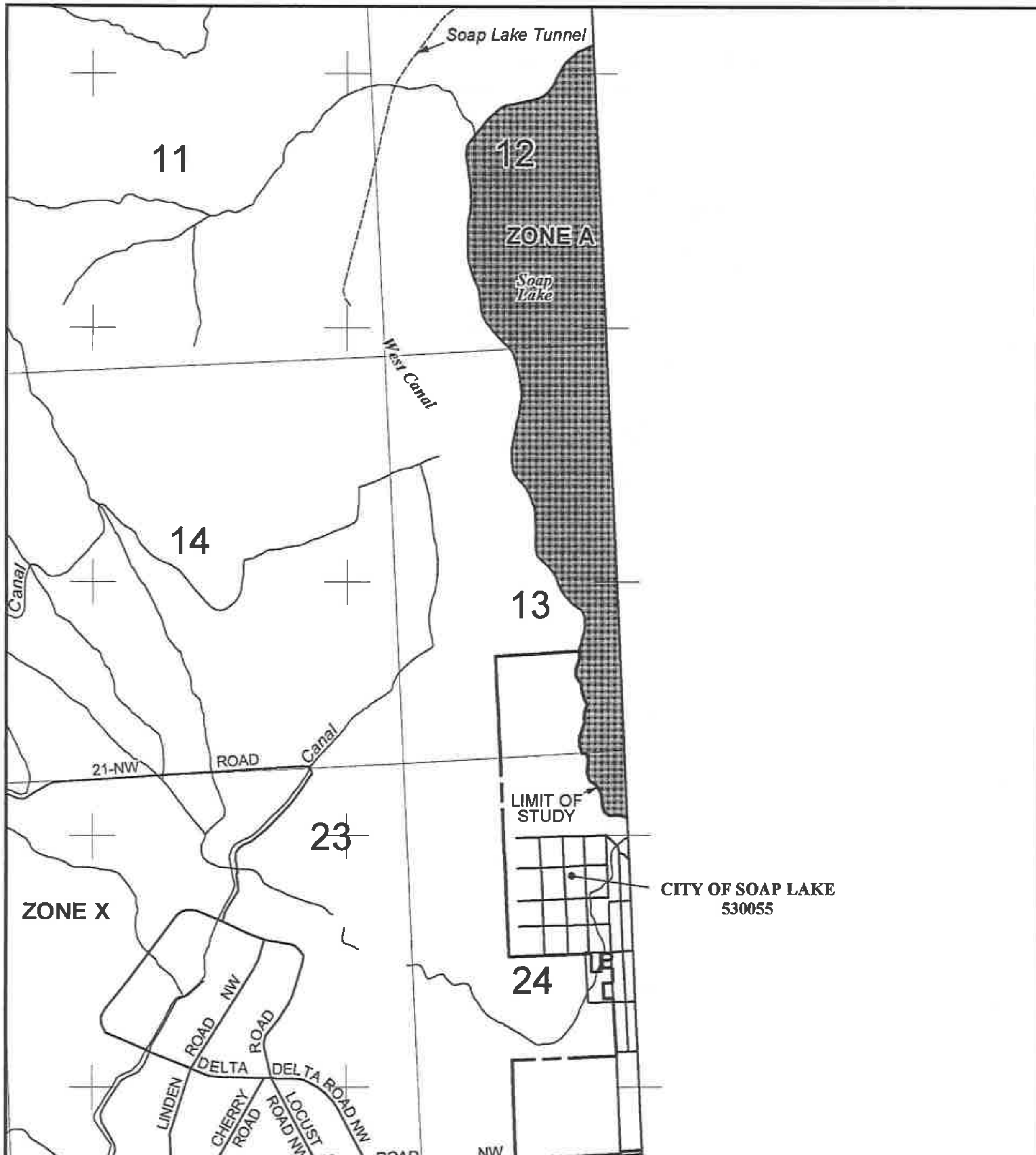
Gray & Osborne, Inc.
CONSULTING ENGINEERS

M:\SOAP LAKE\11041 WASTEWATER FACILITY PLAN\FIGURES\FIG 6-2



Soap Lake
Project Site
Soap Lake, WA
Soap Lake
Lake Shore Dr
5th St
Juniper St N
Hemlock St N
Ginkgo St N
Fir St N
2nd Ave
Maple St
Juniper St S
Hemlock St S
Fir St S
Ginkgo St S
Dogwood St S
Cherry St S
Birch St
Ash St S
Division St S
Canna St N
Daisy St N
1st Ave NE
4th Ave NE
Elder St N
Gladiola St N
Scenic Dr
Eastlake Ave
Main Ave
Daisy St S
Elder St S
Fern St S
4th Pl
5th Ave SE
6th Ave SE
Division 2
Division Rd NW
Aster St S
2nd Pl SE
Buttercup St S
3rd Pl SE
Canna St S
Hwy 7
28
17
Rd 20 NW
St Andrews Dr
Golf Club Rd NW
Grant Pl
© 2012 Google


MAP SCALE 1" = 2000'
0
2000
4000
FEET
ROAD 23 ROAD NW
Soap Lake Tunnel
07
08
09
10
12
13
ZONE A
Soap Lake
15
16
17
18
West Canal
21 NORTHEAST ROAD
ZONE X
19
20
21
22
CITY OF SOAP LAKE
530055
20 1/2-NE ROAD
THOMAS ROAD NE
SW0506
RAILROAD
ROAD B.5 ROAD NE
20-NE ROAD 20 ROAD NE
ROAD 20 ROAD NW
Sheep Canyon Creek
ROAD A ROAD NE
ROAD A.3 ROAD NE
ROAD A.5 ROAD NE
ROAD A.8 ROAD NE
7/10-NE ROAD
ROAD 19.5 ROAD NE
GRANT PLACE NW
24
25
27
28
29
30
R. 27 E.
R. 26 E.
LIMIT OF STUDY
52 58 000m N
52 57 000m N
52 56 000m N
52 55 000m N
52 54 000m N
52 53 000m N
47°22'30.00"
119°30'00.00"
JOINS PANEL 0800
LEGEND
SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD
ZONE A No Base Flood Elevations determined.
ZONE AE Base Flood Elevations determined.
ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.
FLOODWAY AREAS IN ZONE AE
OTHER FLOOD AREAS
ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.
OTHER AREAS
ZONE X Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D Areas in which flood hazards are undetermined, but possible.
COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS
OTHERWISE PROTECTED AREAS (OPAs)
CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



MAP SCALE 1" = 2000'

000 0 2000 4000 FEET

METE

LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the floo that has a 1% chance of being equaled or exceeded in any given year. The Specia Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Area of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Bas Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Floo Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain) average depths determined. For areas of alluvial fan flooding, velocitie also determined.
ZONE AR	Special Flood Hazard Area formerly protected from the 1% annua chance flood by a flood control system that was subsequentl decertified. Zone AR indicates that the former flood control system i being restored to provide protection from the 1% annual chance o greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federa flood protection system under construction; no Base Flood Elevation determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Floo Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Floo Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must b kept free of encroachment so that the 1% annual chance flood can be carried withou substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance floo with average depths of less than 1 foot or with drainage areas less tha 1 square mile; and areas protected by levees from 1% annual chanc flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

Soil Map—Grant County, Washington

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Units

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other

Special Line Features
- Gully
- Short Steep Slope
- Other

Political Features
- Cities

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

MAP INFORMATION

Map Scale: 1:3,740 if printed on A size (8.5" × 11") sheet.

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for accurate map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: http://websoilsurvey.nrcs.usda.gov
Coordinate System: UTM Zone 11N NAD83

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Grant County, Washington
Survey Area Data: Version 6, Jun 22, 2012

Date(s) aerial images were photographed: 7/1/2006

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Grant County, Washington (WA025)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
41	Ephrata fine sandy loam, 2 to 5 percent slopes	11.3	22.9%
52	Finley-Taunton complex, 0 to 5 percent slopes	8.7	17.7%
58	Kennewick fine sandy loam, 0 to 2 percent slopes	0.4	0.7%
63	Kennewick silt loam, 2 to 5 percent slopes	1.9	3.8%
64	Kennewick silt loam, 5 to 10 percent slopes	13.1	26.5%
98	Quincy loamy fine sand, 0 to 15 percent slopes	13.0	26.4%
121	Sagehill very fine sandy loam, 0 to 2 percent slopes	0.7	1.4%
177	Warden silt loam, 0 to 2 percent slopes	0.3	0.6%
Totals for Area of Interest		**49.2**	**100.0%**

LISTED AND PROPOSED ENDANGERED AND THREATENED SPECIES AND CRITICAL HABITAT; CANDIDATE SPECIES; AND SPECIES OF CONCERN IN GRANT COUNTY AS PREPARED BY THE U.S. FISH AND WILDLIFE SERVICE CENTRAL WASHINGTON FIELD OFFICE

(Revised March 15, 2012)

LISTED

Bull trout *(Salvelinus confluentus)*
Gray wolf *(Canis lupus)*
Pygmy rabbit *(Brachylagus idahoensis)* – Columbia Basin DPS

Major concerns that should be addressed in your Biological Assessment of project impacts to listed animal species include:

1. Level of use of the project area by listed species.

2. Effect of the project on listed species' primary food stocks, prey species, and foraging areas in all areas influenced by the project.

3. Impacts from project activities and implementation (e.g., increased noise levels, increased human activity and/or access, loss or degradation of habitat) that may result in disturbance to listed species and/or their avoidance of the project area.

Spiranthes diluvialis (Ute ladies'-tresses)

Major concerns that should be addressed in your Biological Assessment of project impacts to listed plant species include:

1. Distribution of taxon in the project vicinity.

2. Disturbance (trampling, uprooting, collecting, etc.) of individual plants and loss of habitat.

3. Changes in hydrology where taxon is found.

DESIGNATED

Critical habitat for the bull trout

PROPOSED

None

CANDIDATE

Greater sage grouse *(Centrocercus urophasianus)* – Columbia Basin DPS
Washington ground squirrel *(Spermophilus washingtoni)*
Yellow-billed cuckoo *(Coccyzus americanus)*
Artemisia campestris ssp. *borealis* var. *wormskioldii* (northern wormwood)

SPECIES OF CONCERN

Bald eagle *(Haliaeetus leucocephalus)*
Burrowing owl *(Athene cunicularia)*
California floater *(Anodonta californiensis)*
Columbian sharp-tailed grouse *(Tympanuchus phasianellus columbianus)*
Ferruginous hawk *(Buteo regalis)*
Giant Columbia spire snail *(Fluminicola columbiana)*
Kincaid meadow vole *(Microtus pennsylvanicus kincaidi)*
Loggerhead shrike *(Lanius ludovicianus)*
Long-eared myotis *(Myotis evotis)*
Northern goshawk *(Accipiter gentilis)*
Northern leopard frog *(Rana pipiens)*
Pacific lamprey *(Lampetra tridentata)*
Pallid Townsend's big-eared bat *(Corynorhinus townsendii pallescens)*
Redband trout *(Oncorhynchus mykiss)*
River lamprey *(Lampetra ayresi)*
Sagebrush lizard *(Sceloporus graciosus)*
Western brook lamprey *(Lampetra richardsoni)*
Cryptantha leucophaea (gray cryptantha)
Erigeron basalticus (basalt daisy)
Lomatium tuberosum (Hoover's desert-parsley)
Oxytropis campestris var. *wanapum* (Wanapum crazyweed)

Group	Name	Population	Status	Lead Office	Recovery Plan Name	Recovery Plan Stage
Birds	Yellow-billed Cuckoo (Coccyzus	Western U.S. DPS	Candidate	Sacramento Fish And Wildlife		
Birds	Greater sage-grouse	Columbia basin DPS	Candidate	Upper Columbia River Fish And		
Birds	Greater sage-grouse	entire	Candidate	Wyoming Ecological Services		
Flowering Plants	Northern Wormwood (Artemisia		Candidate	Washington Fish And Wildlife		
Mammals	Washington ground squirrel		Candidate	Oregon Fish And Wildlife Office		
Flowering Plants	Showy stickseed (Hackelia		Endangered	Washington Fish And Wildlife	Recovery Plan for Hackelia	Final
Mammals	Pygmy Rabbit (Brachylagus	Columbia Basin DPS	Endangered	Washington Fish And Wildlife	Draft Recovery Plan for the	Draft
Mammals	Gray wolf (Canis lupus)	Northern Rocky Mountain DPS	Recovery	Office Of The Regional Director		
Birds	Northern spotted owl (Strix		Threatened	Oregon Fish And Wildlife Office	Revised Recovery Plan for the	Final Revision 1
Birds	Marbled murrelet	CA, OR, WA	Threatened	Washington Fish And Wildlife	Recovery Plan for the	Final
Fishes	Bull Trout (Salvelinus	U.S.A., conterminous, lower 48	Threatened	Idaho Fish And Wildlife Office	Draft Recovery Plan for Three of	Draft
Fishes	Bull Trout (Salvelinus	U.S.A., conterminous, lower 48	Threatened	Idaho Fish And Wildlife Office	Draft Recovery Plan for the	Draft
Fishes	Bull Trout (Salvelinus	U.S.A., conterminous, lower 48	Threatened	Idaho Fish And Wildlife Office	Draft Recovery Plan for the	Draft
Flowering Plants	Ute ladies'-tresses (Spiranthes		Threatened	Utah Ecological Services Field	Ute Ladies'-Tresses Draft	Draft
Mammals	Grizzly bear (Ursus arctos	lower 48 States, except where	Threatened	Grizzly Bear Recovery	Revised Grizzly Bear Recovery	Final Revision 1

APPENDIX C

DMR’S

City of Soap Lake Wastewater Facility Plan
Summary of Discharge Monitoring Reports

	Influent					Effluent					
	Flow (MGD)	pH		BOD5 (mg/L)	TSS (mg/L)	pH		BOD5 (mg/L)	TSS (mg/L)	TKN (mg/L)	Nitrate (mg/L)
Month	Average Month	Minimum	Maximum	Average Month	Average Month	Minimum	Maximum	Average Month	Average Month	Average Month	Average Month
Jan-05	0.20	7.9	8.0	181	142	7.7	7.8	9	10	7	4
Feb-05	0.20	7.9	8.2	179	127	7.0	7.5	7	9	2	6
Mar-05	0.21	7.5	7.7	189	141	7.2	7.4	4	6	2	3
Apr-05	0.20	7.7	7.8	204	166	8.1	8.3	3	5	2	3
May-05	0.23	7.7	8.0	158	139	7.2	7.6	4	7	2	3
Jun-05	0.19	7.2	7.4	155	159	7.6	7.8	4	3	2	3
Jul-05	0.17	7.2	7.4	191	166	7.8	7.9	4	5	2	2
Aug-05	0.17	7.4	7.6	181	154	7.7	7.8	2	3	2	2
Sep-05	0.17	7.0	7.4	170	157	7.6	7.8	3	7	2	4
Oct-05	0.19	6.9	7.9	190	165	7.8	8.2	5	8	5	5
Nov-05	0.20	7.4	7.6	202	167	7.8	7.9	6	9	2	5
Dec-05	0.24	7.5	7.1	139	160	7.8	8.0	8	11	4	5
Jan-06	0.24	6.9	7.2	151	165	7.6	7.8	6	12	2	5
Feb-06	0.24	7.0	7.4	206	164	7.6	7.9	4	10	2	2
Mar-06	0.24	7.0	8.4	238	129	7.0	8.0	8	6	2	2
Apr-06	0.23	7.1	8.7	231	255	7.1	8.5	5	9	2	3
May-06	0.21	6.9	7.9	179	149	7.0	8.2	4	5	2	2
Jun-06	0.19	7.8	8.2	204	156	7.4	7.9	4	6	2	2
Jul-06	0.19	7.9	8.2	155	115	7.5	8.0	4	3	2	2
Aug-06	0.19	7.5	8.2	158	158	7.6	7.9	4	5	2	2
Sep-06	0.23	7.5	8.1	156	188	7.7	8.1	9	13	2	3
Oct-06	0.22	7.5	8.1	178	153	7.4	8.0	7	7	2	3
Nov-06	0.20	7.5	8.1	148	185	7.5	8.0	5	6	2	3
Dec-06	0.23	7.7	8.1	214	177	7.5	8.0	6	9	2	2
Jan-07	0.23	7.6	8.0	205	159	7.5	8.0	5	5	2	2
Feb-07	0.22	7.5	8.0	141	133	7.5	8.1	8	10	2	3
Mar-07	0.17	7.6	7.9	153	152	7.8	8.0	9	8	2	3
Apr-07	0.17	7.0	8.4	177	166	7.0	8.0	5	6	2	2
May-07	0.18	7.1	8.2	139	163	7.1	8.5	7	9	2	2
Jun-07	0.18	7.5	8.0	181	183	7.9	8.2	5	7	2	2
Jul-07	0.16	6.5	8.0	210	139	7.5	8.1	7	7	3	2
Aug-07	0.16	7.5	8.0	155	128	7.8	8.1	4	7	2	2
Sep-07	0.15	7.5	8.0	166	231	7.6	8.1	5	11	2	2
Oct-07	0.17	7.1	7.9	181	158	7.1	7.9	4	3	2	2
Nov-07	0.17	7.5	8.5	214	147	7.7	8.2	8	8	2	2
Dec-07	0.17	7.0	8.0	138	159	7.5	8.0	6	4	2	2
Jan-08	0.16	7.5	7.8	145	178	7.7	8.0	8	9	2	2
Feb-08	0.16	7.0	8.0	176	170	7.2	8.0	6	13	3	3
Mar-08	0.16	7.0	7.9	178	156	7.3	7.9	4	6	2	3
Apr-08	0.17	7.5	7.9	189	178	7.7	8.2	7	7	2	2
May-08	0.23	7.5	7.9	158	165	7.7	8.0	5	8	2	2
Jun-08	0.29	7.5	7.8	154	139	7.6	8.1	7	7	2	2
Jul-08	0.29	7.5	7.8	231	143	7.4	7.9	5	3	2	3
Aug-08	0.28	7.6	7.8	238	151	7.4	7.9	8	3	2	2
Sep-08	0.27	7.3	7.9	155	166	7.6	7.9	7	5	2	2
Oct-08	0.18	7.5	7.9	202	170	7.8	8.0	7	7	1	2
Nov-08	0.20	7.5	7.9	202	152	7.5	8.0	6	8	2	2
Dec-08	0.18	7.8	8.0	179	159	7.5	8.0	7	5	2	2
Jan-09	0.19	7.5	7.9	189	167	7.8	8.1	4	3	3	2
Feb-09	0.18	7.5	8.0	185	150	7.5	8.0	4	5	2	2
Mar-09	0.18	7.4	8.0	163	167	7.0	9.0	8	9	2	2
Apr-09	0.18	7.2	7.9	239	157	7.5	8.1	6	4	2	2
May-09	0.19	7.5	7.9	171	113	7.7	8.1	6	6	2	3
Jun-09	0.19	7.5	7.9	133	133	7.6	8.1	6	8	2	3
Jul-09	0.19	7.4	7.8	290	150	7.6	8.1	6	5	2	2
Aug-09	0.18	7.6	7.8	155	158	7.7	8.0	4	3	2	2
Sep-09	0.18	7.5	7.7	165	107	7.6	8.0	6	3	2	2
Oct-09	0.18	7.1	8.7	148	107	7.1	8.5	8	3	2	2
Nov-09	0.19	6.9	7.9	195	115	7.0	8.2	2	3	2	2
Dec-09	0.19	7.8	8.2	165	147	7.4	7.9	6	8	2	2
Jan-11	0.10	7.2	7.8	149	63	7.2	7.8	2	3	3	4
Feb-11	0.09	6.7	7.8	169	132	7.1	7.7	3	5	3	3
Mar-11	0.10	7.4	7.6	157	141	7.5	7.7	3	2	5	3
Apr-11	0.11	7.5	7.6	151	177	7.5	7.7	4	4	2	3
May-11	0.16	7.5	7.6	182	140	7.5	7.6	5	4	2	2
Jun-11	0.18	7.4	7.8	181	158	7.5	7.9	9	10	2	2
Jul-11	0.16	7.3	7.8	191	149	7.4	8.0	3	5	2	2
Aug-11	0.14	7.1	7.7	144	194	7.3	7.8	3	8	2	2
Sep-11	0.15	7.2	7.6	155	159	7.3	7.6	4	5	2	2
Oct-11	0.13	7.2	7.6	161	169	7.3	7.6	3	7	1	2

APPENDIX D

2007 AND 2008 WWTF REVIEW LETTERS

Gray & Osborne, Inc.

CONSULTING ENGINEERS

March 22, 2007

The Honorable Wayne Hovde, Mayor
City of Soap Lake
239 Second Ave., Ave.
P.O. Box 1270
Soap Lake, WA 98851

SUBJECT: REVIEW OF DIGESTER MIXER AT WWTP
CITY OF SOAP LAKE, GRANT COUNTY, WASHINGTON
G&O #07003.01

Dear Mayor Hovde:

As requested, we have evaluated alternatives to the existing aspirating aerators in the aerobic digester at the City's Wastewater Treatment Facility (WWTF). The existing digester has two 5 hp aspirating aerators in the aerobic digesters. The aspirating aerators are not being used because rags and tumbleweeds bind the aerators and cause the aerators bearings to fail. The WWTF has been operating for at least a year without the benefit of the aerators. The operator has been able to maintain Class B biosolids by testing the biosolids and allowing the biosolids to dry on the drying bed for several months. Three or four times a year when the operator wastes biosolids to the drying beds, the inadequate aeration causes a major odor problem near the WWTF.

The existing digester is a lined open-air basin. Depending on the water surface elevation, the basin depth ranges from 7 to 12 feet and the volume ranges from 240,000 to 570,000 gallons. The biosolids are pumped into the basin from the secondary clarifiers. Biosolids flow out of the basin by gravity from a pit on the bottom of the basin.

Aerobic Digesters must be supplied with adequate mixing to mix the basin and adequate oxygen to meet vector attraction requirements (VAR) of Class B Biosolids for land surface application. VAR requirement is that the Volatile Suspended Solids (VSS) are reduced by at least 38 percent. The design biological oxygen demand (BOD) loading for the WWTF is 517 lbs/day. Approximately 75 percent of the waste sludge from the oxidation ditch is VSS, and the total amount of solids wasted is estimated to be equal to the incoming BOD. Therefore, 38 percent VSS reduction of the waste solids is equal to 150 lb/day (517 lbs/day * 0.75 * 0.38), and the oxygen demand for the VSS reduction is 2 lb O_2/lb VSS destroyed or 300 lb O_2/day (150 lb/day VSS * 2 lb O_2/lb VSS) destroyed.

107 South 3rd Street Yakima, Washington 98901 (509) 453-4833 Fax (509) 453-5953

According to Wastewater Engineering and Treatment (Metcalf and Eddy Fourth Edition), between 0.75 to 1.5 hp per 7,500 gallons are required to adequately mix a basin. Therefore, 25 to 100 hp is required to mix this basin, depending on the water depth. At least 40 hp of mixing is recommended for this size of basin.

Three alternatives were evaluated to improve the operation of the aerobic digester: 1) replacement of the existing aspirating aerators with a jet aerator; 2) replacement of the existing aspirating aerators with a surface aerator, or 3) installation of a fine screen.

Jet Aeration – This option would consist of removing the existing aspirating mixers and installing a jet aerator in the aerobic digester. New equipment would also include a 40 hp submersible pump and blower. See attached cut sheet for description of a jet aerator. The pump would provide mixing of the basin and the blower would provide aeration for the basin. This option would provide adequate mixing of the basin and the blower would be sized to provide 300 lb/day of oxygen.

The estimated cost for this option is $207,000. The cost includes an outside blower in a protective cover. This option would minimize the ragging problem and blown-in debris, but it is still possible that rags could clog the submersible pump.

Surface Aerator – This option would consist of removing the existing aspirating mixers and installing a 40 hp surface aerator (or multiple aerators with a combined 40 hp. See attached cut sheet for description of a surface aerator. This option would provide adequate mixing and oxygen supply for the basin. A surface aerator typically provides about 2.3 lb O_2/hp/hr. A 40 hp aerator would provide 2,200 lb of oxygen per day if operated continuously.

The estimated cost of this option is $68,000 for a new surface aerator. This type of aerator is much more robust than the existing aspirating aerators. This option will minimize the ragging problem, but the operator will still need to clean the aerator several times a year. The other problem with the surface aerator is that it may cause some surface ice formation in the winter months due to the cooling effect of the aerator.

It is also possible that the City could purchase a used aerator to save costs. We are aware that the City of Aberdeen currently has some surplus, two speed 40 hp surface aerators.

Mechanical Fine Screen - This option would consist of installing a mechanical fine screen before the oxidation ditch in a new concrete structure. This option will remove the rags and other trash items from the wastewater before it enters the oxidation ditch. Therefore, this screen would eliminate this debris that enters the digester in the waste sludge, but airborne debris and tumbleweeds would continue to fall into the pond. The estimated cost for this screen is $235,000, including a new structure.

The existing aspiration aerators do not supply enough horsepower to adequately mix the basin. Aspirating aerators typically supply 1.0 lb O_2/hp/hr. The existing aerators will supply about 240 lb/day of O_2, which is inadequate for meeting the VAR requirements. Therefore the existing aerators need to be replaced with either of the first two options to provide adequate treatment of the biosolids.

The surface aerator is the recommended solution because it is the least cost and most reliable option for correcting the problem. Eventually the City might want to consider adding a fine screen to the WWTF to remove problems associated with rags.

The cost estimates provided in this letter are planning-level cost estimates and includes 25 percent for contingency and engineering fees. Please note that we expect that Ecology will require an engineering report before approving any changes to the WWTF.

If there are any questions about this evaluation, please call me.

Very truly yours,

GRAY & OSBORNE, INC.

David VanCleve, P.E.

DVC/pko

Encl.

cc: Mr. Rob Herron, WWTF Operator, City of Soap Lake, w/encl.

City of Soap Lake
Aerobic Digester
Engineer's Estimate
G&O #07003.01

Jet Aerator

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization and Demobilization	1	LS	$12,000	$12,000
2	Jet Aerator	1	LS	$25,000	$25,000
3	40 Hp submersible Motor	1	LS	$15,000	$15,000
4	Blower	1	LS	$40,000	$40,000
5	MCC Changes	1	LS	$20,000	$20,000
6	Conductors	1	LS	$8,000	$8,000
7	Motor Safety Disconnect Switch	2	EA	$1,500	$3,000
				Subtotal	$123,000
				Contingency (25%)	$30,750
				Subtotal	**$153,750**
				Washington State Sales Tax (7.9%):	$12,100
				TOTAL CONSTRUCTION COST:	**$165,850**
				Engineering Legal and Administration (25%)	$41,463
				TOTAL:	**$207,000**

City of Soap Lake
Aerobic Digester
Engineer's Estimate
G&O #07003.01

Fine Screen

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization and Demobilization	1	LS	$14,000	$14,000
2	Fine Screen	1	LS	$20,000	$65,000
3	Fine Screen Structure	1	LS	$15,000	$25,000
4	Piping Modifications	1	LS	$40,000	$15,000
5	MCC Changes	1	LS	$20,000	$11,000
6	Conduits & Conductors	1	LS	$8,000	$8,000
7	Motor Safety Disconnect Switch	1	EA	$1,500	$1,500
				Subtotal	$139,500
				Contingency (25%)	$34,875
				Subtotal	**$174,375**
				Washington State Sales Tax (7.9%):	$13,800
				TOTAL CONSTRUCTION COST:	**$188,175**
				Engineering Legal and Administration (25%)	$47,044
				TOTAL:	**$235,000**

City of Soap Lake
Aerobic Digester
Engineer's Estimate
G&O #07003.01

Surface Aerator

NO.	ITEM	Quantity	Unit	Unit Price	Amount
1	Mobilization and Demobilization	1	LS	$4,000	$4,000
2	Surface Aerator	1	LS	$15,000	$15,000
3	Installation Surface Aerator	1	LS	$5,000	$5,000
4	MCC Changes	1	LS	$11,000	$11,000
5	Conductors	1	LS	$4,000	$4,000
6	Motor Safety Disconnect Switch	1	EA	$1,500	$1,500

Subtotal	$40,500
Contingency (25%)	$10,125
Subtotal	**$50,625**
Washington State Sales Tax (7.9%):	$4,000
TOTAL CONSTRUCTION COST:	**$54,625**
Engineering Legal and Administration (25%)	$13,656
TOTAL:	**$68,000**

Aqua-Aerobic Systems, Inc.

Often imitated...never duplicated

The Aqua-Jet aerator may possibly be the most imitated aerator in the world. But, as with other manufactured products, copies never equal the original in terms of reliability and durability. Consistency is a key component of the Aqua-Jet's success.

As the wastewater treatment industry continues to change, so do the needs of its customers. Efficiency and economical operation have always been determining factors in the selection of equipment, but recently the issue of *maintenance* is playing a more significant role in the selection process.

Realizing this, Aqua-Aerobic Systems, Inc. has developed and documented in long-term field testing a new line of maintenance-free products called the Endura® Series. This new line of aerators, mixers and spray coolers offer a five-year no-maintenance warranty. Each Endura product is available in a wide variety of horsepower.

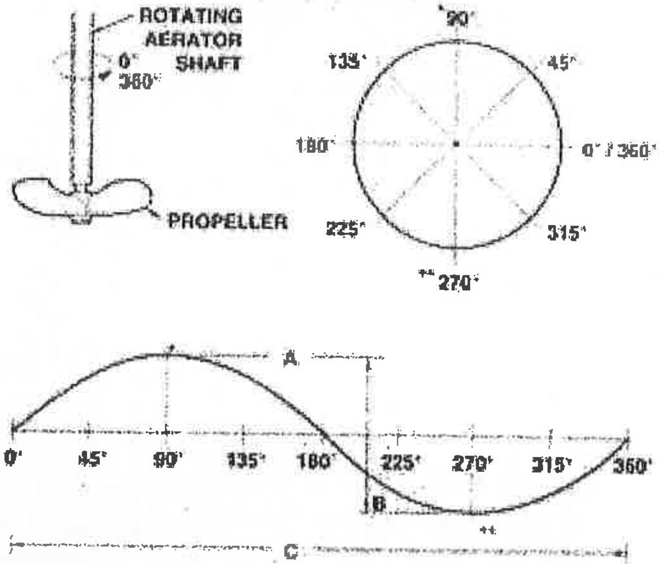
Vibration Controlled Design

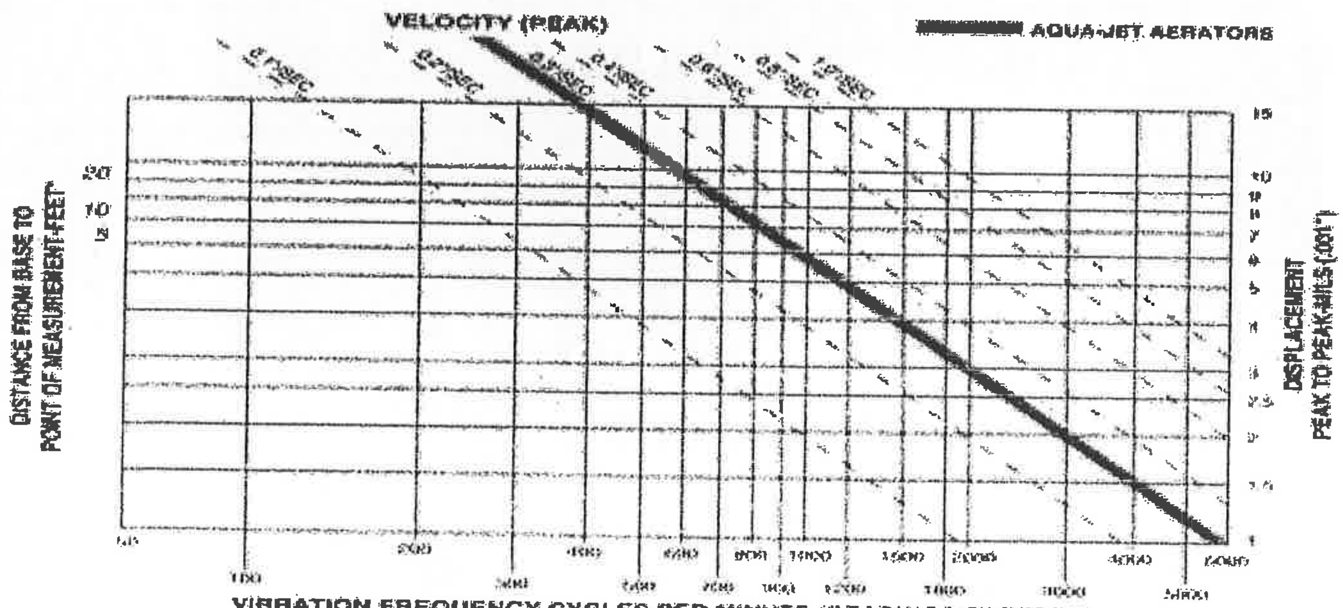
The continuous heavy-duty operating life of rotating equipment, such as an aerator, demands a vibration-limiting design that will assure smooth operation long after the unit has been installed. The velocity must be controlled to 0.3in/sec. or less. If this limitation is not met, early machine failure is inevitable.

The high maintenance cost of some aeration equipment is directly related to the manufacturer's inability to control vibration in the aerations. High maintenance and equipment failure is a fact of life with many aerator installations, but not with those which employ Aqua-Jets.

Proper design and the use of the highest quality materials have made the Aqua-Jets the most durable and reliable aerators in the industry. On properly maintained units, Aqua-Jets outlast other aerators 2 to 1. On poorly maintained aerators, Aqua-Jets outlast other aerators by more than a 3 to 1 margin. Scheduled maintenance on Aqua-Jets consists only of motor bearing lubrication 2-4 times per year, depending on motor size.

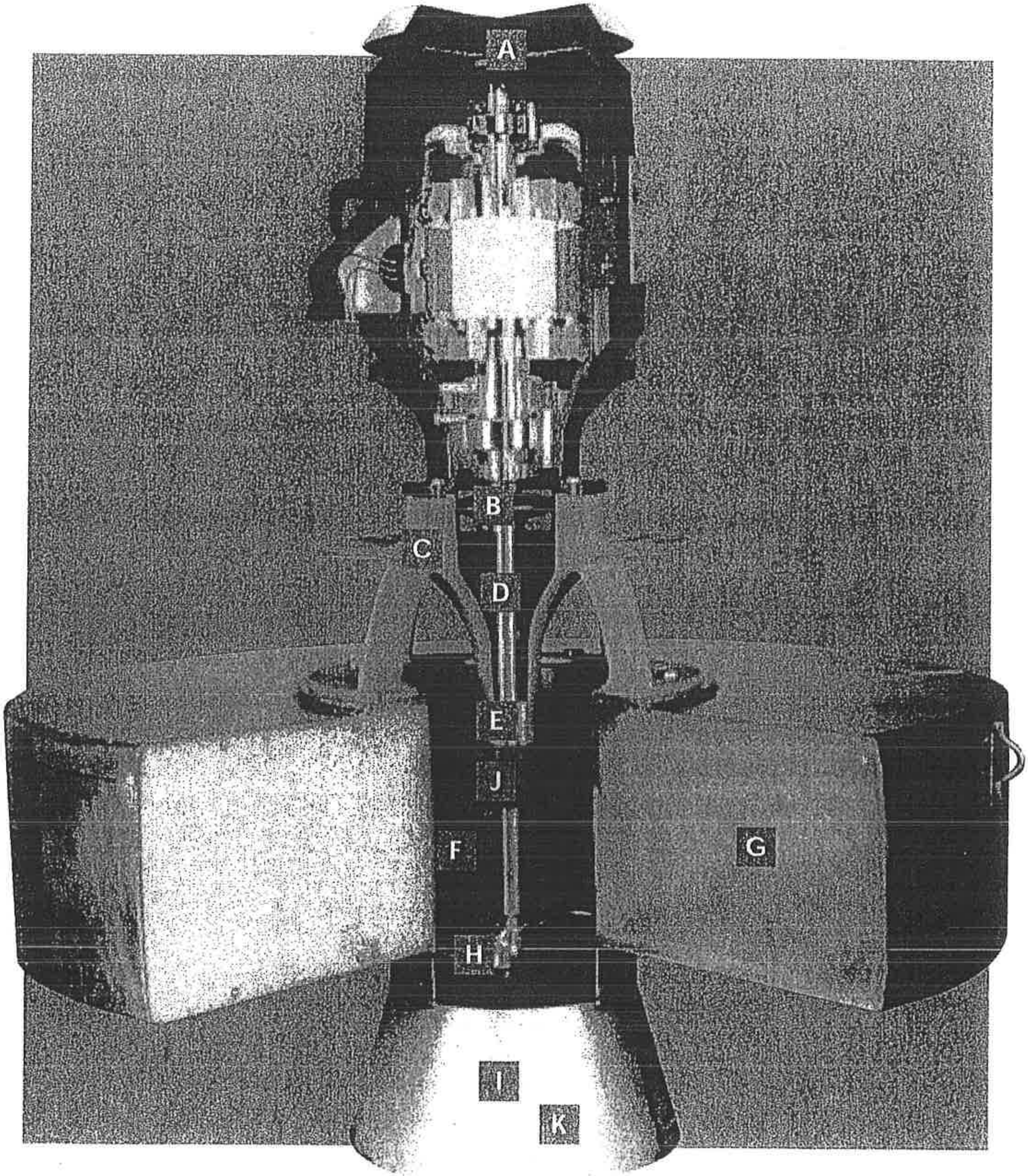
ILLUSTRATION OF ONE (1) VIBRATION CYCLE AND DISPLACEMENT





ACCEPTABLE FIELD VIBRATION LIMITS FOR VERTICLE PUMPS & HORIZONTAL PUMPS WITH PIGGYBACK MOUNTED MOTORS (NON RIGID STRUCTURES)

Quality Components



A **Motors** are totally enclosed, fan cooled, and rated for severe duty. Motors are available in standard or high efficiency and vibration tested for optimum performance in the most stringent applications. Standard features include heavy-duty bearings and seals, class F insulation or better and a minimum 1.15 service factor.

B **Labyrinth Seal Guard** prevents upward migration of water from contacting the lower end bell of the motor and working into motor bearing.

C The **diffusion head** of an aerator must be able to support the weight of the motor, evenly distribute static and dynamic loads, and change the direction of the high velocity discharge flow, optimizing discharge pressure and spray pattern.

The Aqua-Jet's cast diffusion head is designed to withstand the constant stress created by the upflow spray of the aerator. Its strong flanged connection to the volute ensures that minimum stress is placed on the connections and that no vibration or fatigue results.

D **One-piece shaft** of 17-4 PH (precipitation hardened) stainless steel eliminates the use of couplings which require constant lubrication with water or wastewater. The one-piece design eliminates the vibration and constant maintenance problems inherent in coupled-shaft designs, providing much greater strength than 304 or 316 stainless steel.

E **Anti-Deflection Insert** provides support for the shaft should debris be ingested into the unit. Under normal operating conditions, the shaft runs free of support by the insert. Located in an optimum location allowing some flexing, yet protecting loads on bearings.

F The **volute** of an aerator must be able to withstand constant duty in corrosive, abrasive and high velocity propeller-induced flow. The volute of the Aqua-Jet is constructed of heavy wall stainless steel to resist this assault. The heavy construction of the Aqua-Jet volute will provide a long, trouble-free life.

G **Float** is filled with a closed cell polyurethane foam that adds to the structural stability of the AquaJet and prevents sinking if excessive damage to the float exterior should occur. Float exteriors are of 14 gauge stainless steel; with fiberglass available as an option on most sizes.

H **Propeller** is a two blade design cast of 316 stainless steel. It features an 1800 sweepback design for non-clog operation and greater operating efficiency.

I **Intake Cone** provides a smooth transition of flow with minimum headloss. Anti-vortex crosses are included as standard on all sizes 20 HP and larger.

J **Fluid Deflector** contains the thrust washer and protects the anti-deflection insert from the upward liquid flow.

K **Draft Tube/Anti-erosion Assembly** (optional). Draft tubes are volute extensions used to extend the intake of the aerator to a greater depth. Anti-erosion assemblies consist of a stainless steel plate attached to the bottom of the intake cone, via the anti-vortex cross. The assembly causes water to be drawn from the sides of the cone rather than from directly below it. See page 11 for application and dimension information.

Case Histories

To date more than 50,000 Aqua-Jet aerators representing over 1,000,000 HP have been installed throughout the world. No matter what the application, municipal or industrial, Aqua-Jets provide unequalled oxygenation and mixing.

Aqua-Jets have been installed in a wide variety of treatment schemes including oxidation ditches, SBRs, flow-through activated sludge systems, MSBRs, lagoons and extended aeration systems. Some of the many industrial applications for Aqua-Jets include: beverage, dairy, meat processing, pulp & paper mills, refineries and chemical waste treatment plants. Many international corporations use Aqua-Jets exclusively. They know that when it comes to performance and reliability, Aqua-Jets can't be beat.

A few of the thousands of Aqua-Jet installations are discussed on the following pages.

Woodruff Municipal Wastewater Treatment Plant
Woodruff, South Carolina

The Woodruff Wastewater Treatment Plant utilizes a system designed by Linvil G. Rich, Ph.D., P.E. and Lockwood-Greene Engineers. The system is based on a multi-cell design characterized by :

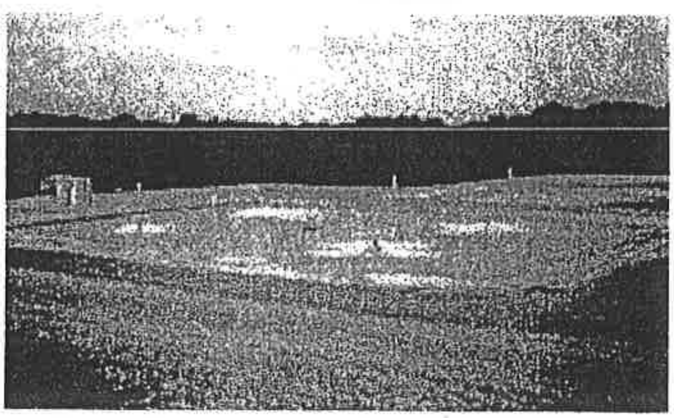
1. Sufficient power to maintain solids in suspension in the initial cell, which maximizes reduction of organic materials.
2. Effluent BOD5 and TSS less than 30mg/l
3. Shorter retention times which reduce algae growth
4. Less acreage for basins than lagoons of conventional aerated stabilization basin systems.

The Woodruff plant is designed for .700 MGD and currently treats .359 MGD. The plant utilizes four basins plus a post-aeration cell. A complete mix is attained in Cell No. 1 using four 7.5 HP Aqua-Jets and one 10 HP AquaDDM. A partial mix is attained in Cells 2-4 using six 1 HP Aqua-Jets per cell. By design, Cell No. 1 requires approximately 30 HP/MG in surface aeration to maintain solids in suspension. Cells 2-4 provide less aeration power (5-10 HP/MG) which allows the settleable fraction of the suspended solids from the effluent of Cell No. 1 to settle in Cells 2-4. The post-aeration basin (Cell No. 5) is equipped with a single 5 HP Aqua-Jet Aerator, and has a design hydraulic retention time of approximately 45 minutes.

The biodegradable materials from the settled solids decompose in a benthal environment. A low effluent concentration of TSS is achieved by limiting the retention time which reduces algae growth in Cells 2-4. Retention time in Cell No. 1 is 2.16 days; and 1.06 days/basin in Cells 2-4.

Annual Averages

	Inf.	Eff.
BOD_5	90.32 mg/l	24.75 mg/l
TSS	185 mg/l	27.25 mg/l



CPL Paperboard Ltd.
Burnaby, British Columbia

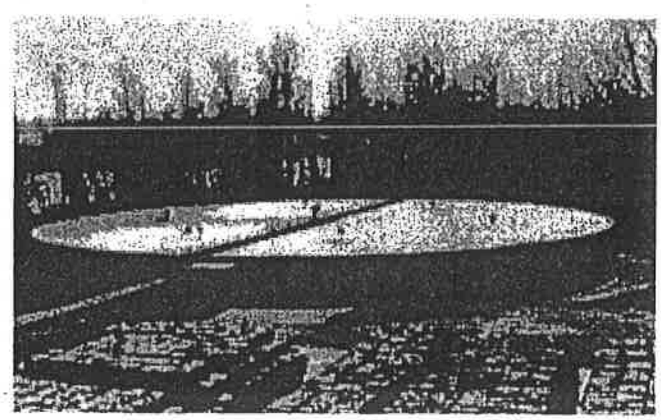
Secondary Treatment Systems
Six 60 HP Aqua-Jet Aerators

As a paper recycling plant, Paperboard Industries in Burnaby, British Columbia , makes an obvious impact in preserving our environment. This same impact is evident in the company's handling of the wastewater produced by the recycling process.

The company needed to implement a secondary treatment system to meet the toxicity requirements of its effluent discharge permit. At the time, no outside data was available regarding the treatment of waste water generated by the recycling process, so Paperboard Industries commissioned a detailed pilot study to determine the best method for treating this kind of waste. It was concluded that a complete mix aeration process without solids recycle would be an appropriate wastewater treatment system; however, the following criteria had to be met:

1. Because of the amount of land required, the company did not feel it was practical to install a large lagoon or system of lagoons. An alternate design was needed.
2. The process had to be a completely mixed system with no sludge accumulation.
3. Paperboard Industries wanted to meet its LC50 toxicity test without exception.

The first requirement was met by constructing a large concrete basin 265 feet in diameter and 18 feet deep. This basin was designed to handle up to 5 million gallons of wastewater per day. The second two criteria were easily met by installing six 60 HP Aqua-Jet aerators in the basin. Paperboard Industries' wastewater treatment system currently treats about 2 million gallons of recycling waste water daily. D.O. , BOD and toxicity levels fall well within the company's permit requirements for discharge in to the Fraser River.



Alberta Pacific Forest Products
Boyle, Alberta Canada

The Alberta Pacific Forest Product (Alpac) mill in Boyle, Alberta was commissioned in late summer of 1992 and started-up in September, 1993.

This 1500 metric tons/day greenfield kraft pulp mill produces hardwood and softwood pulp. The annual production is 75% hardwood and 25% softwood.

A description of the mill's waste water treatment system is as follows:

Design Flow 800 l/ s -1000 l/ s
(18.3-22.8mgd)

Secondary activated sludge treatment plant which includes:

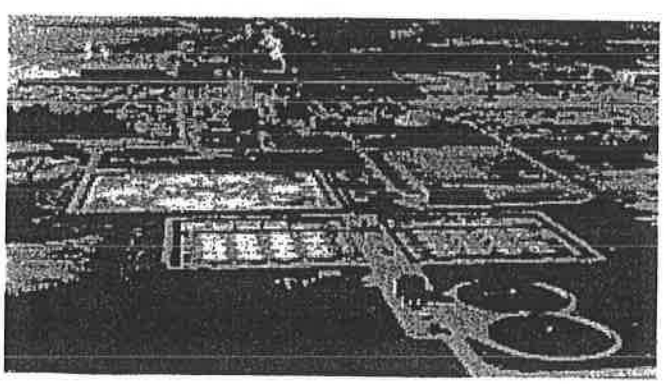
- **Primary treatment** - Mechanical screening and primary clarification, equalization/ cooling basin and spill basin.
- **Secondary treatment** - Primary effluent cooling using a two-cell crossflow cooling tower/pump station, a two-cell bioreactor with selector cells to provide an extended aeration - activated sludge process, phosphorus and nitrogen nutrient addition facilities, secondary clarification and return and waste activated sludge pumping.
- **Sludge Treatment** - Secondary waste activated sludge is thickened using a gravity belt thickener then blended with raw primary sludge. The blended mixture is dewatered using two screw presses. The dewatered waste sludge is burned in the mill power plant boiler.
- **Outfall Works** - A 5km, 1050mm (42") diameter discharge line delivers the treated effluent to a foam control facility prior to discharge through a submerged diffused outfall in the Athabasca River bed.
- **Bioreactors (2)**

  Total Volume 100,000 m³ (26.4MG)

  21-75 HP Aqua-Jet Aerators
  3-40 HP AquaDDM Mixers

- **Equalization/Cooling Pond**

  6-75 HP Aqua-Jet Aerators
  6-40 HP AquaDDM Mixers



Lakeside Foods
Reedsburg, Wisconsin

Aerated Lagoon Systems
11-40 HP Aqua-Jet Aerators

In 1975 Reedsburg Foods needed a new waste water treatment system. The canning company had been using a spray irrigation system but ponding was creating unacceptable runoff in to the Baraboo River. Reedsburg Foods contracted Mid-State Associates of Baraboo, Wisconsin to design and install an aerated lagoon system.

The new system included a primary aeration lagoon with a design capacity of 7.5 MG, a secondary lagoon with a 7.4 MG capacity, and a 15.4 MG holding pond. Eight 40 HP Aqua-Jet aerators were installed; six in the first lagoon and two in the second.

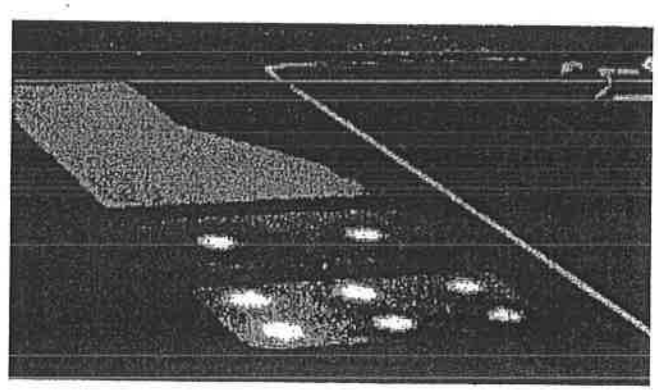
In 1985, after ten years of consistent production increase, Reedsburg Food's wastewater treatment system had once again reached capacity. Three 40 HP Aqua-Jets were added to the system.

Mid-State's Dave Murphy explains that Reedsburg Foods requires a system that can handle the variable loads generated by food processing waste. "Corn, for example, creates an especially high oxygen demand," he explains. "The starches and other organics from corn create an average BOD of 5200 mg/ l, while peas average a BOD of only 2400 mg/ l."

With 11 Aqua-Jets now in operation, Reedsburg Foods finds that its wastewater treatment system efficiently handles the fluctuating biological demands placed upon it, and that operators can easily maintain final effluent discharge limits throughout the entire canning season.

More than 15 years of operation in central Wisconsin's climate extremes attest to the durability of Aqua-Jet aerators. Eight of Reedsburg Foods' 11 Aqua-Jets have been in use since 1976, and all of the units remain in the lagoons year round. The lagoons are allowed to freeze completely in the winter when the system receives no waste water flow and, according to operator Mike Lennon, "The Aqua-Jets start right up in the spring."

Flow:	Average .25 mgd Peak .30 mgd
BOD_5:	Influent 5210 mg/l (avg. corn) Effluent 40mg/l (avg. corn)
REQ Effluent:	45 mg/l BOD_5 (weekly avg.)
Temperature:	Winter (avg) 20°F Summer (avg) 70°F



Original upgrade of Reedsburg Foods as it appeared until 1985.

Mooring Arrangements

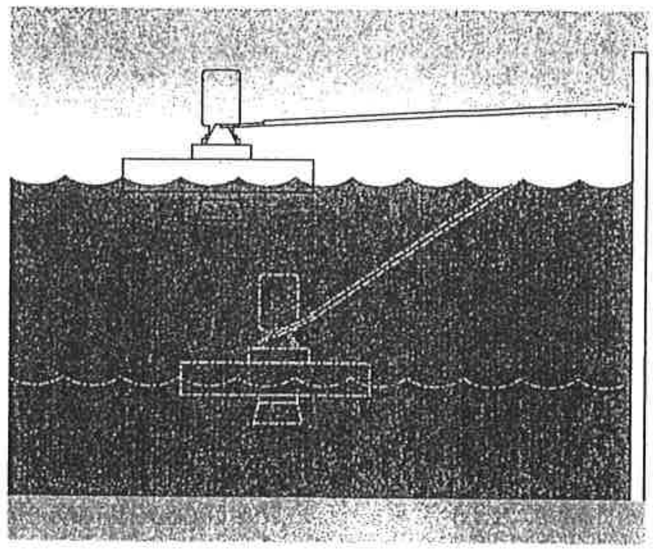
Dual Speed

Very few wastewater treatment systems are fully or evenly loaded at all times. Consequently, aeration systems sized to handle peak loads have excess capacity during periods of light loading. This results not only in an excessive dissolved oxygen residual, but also consumes more energy than is necessary.

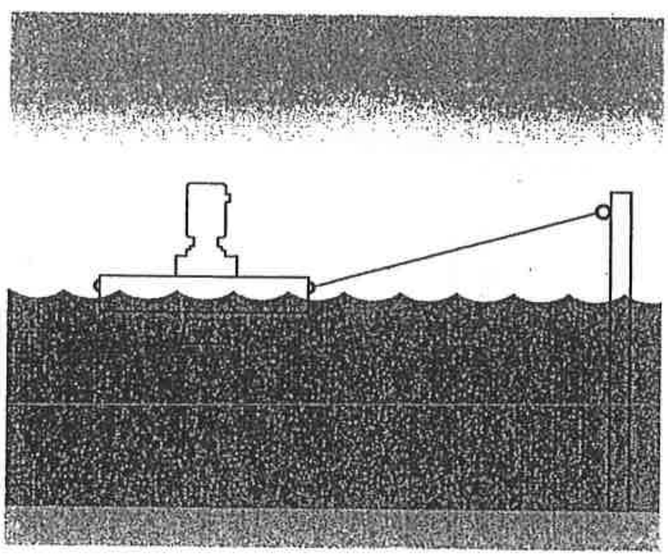
Aqua-Aerobic Systems' Dual Speed Aqua-Jet Aerators provide the option for speed reduction during periods of light loading, which results in reduced power consumption and operating costs. Control options are available to provide manual or automatic operation of your system.

Energy Efficient Motors

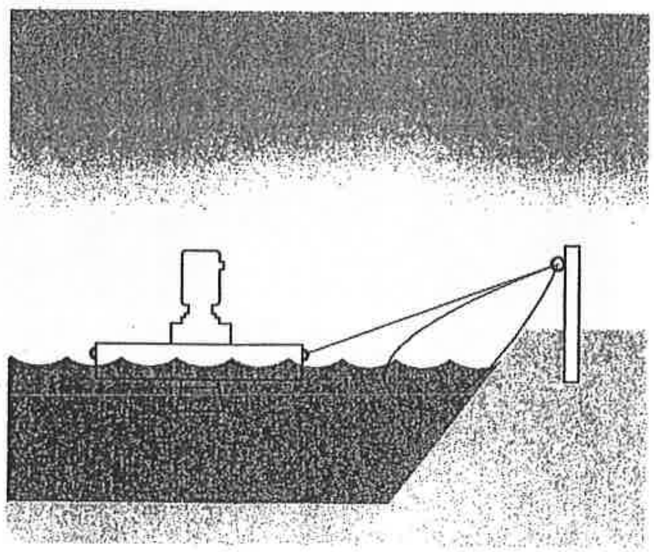
Optional energy efficient motors offer significant energy savings over standard industrial motors. The energy savings realized with the energy efficient design allow the initial price premium to be recovered in a relatively short period of time.



Pivotal Mooring arm is used in applications with varying water levels not exceeding arm length (lengths available up to 13 meters long). The Aqua-Jet pivotal mooring arm fits at the base of the motor allowing the aerator to adjust to varying water levels.

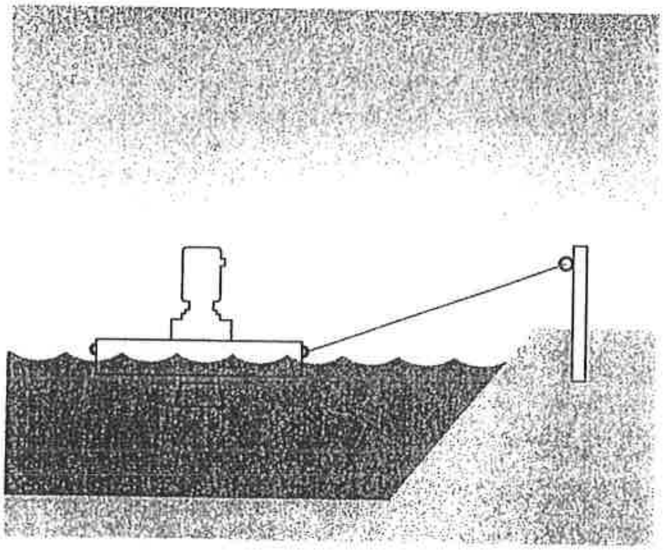


Post Mooring is used in larger lagoons where distances prohibit mooring the Aqua-Jet to the shore. A mooring post is installed into the lagoon floor and the mooring line is attached to an eyebolt in the post. For 3 or 4 point mooring.

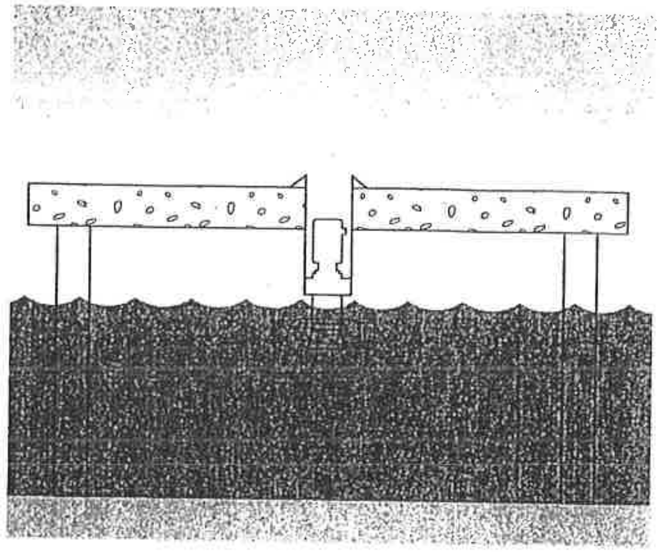


Maintenance Mooring enables the operator to easily move the aerator to the shore for maintenance. One or two mooring connection points are supplied with a disconnect device and a long length of cable. This allows the aerator to be moved to the opposite side of the basin without disconnecting the mooring line.

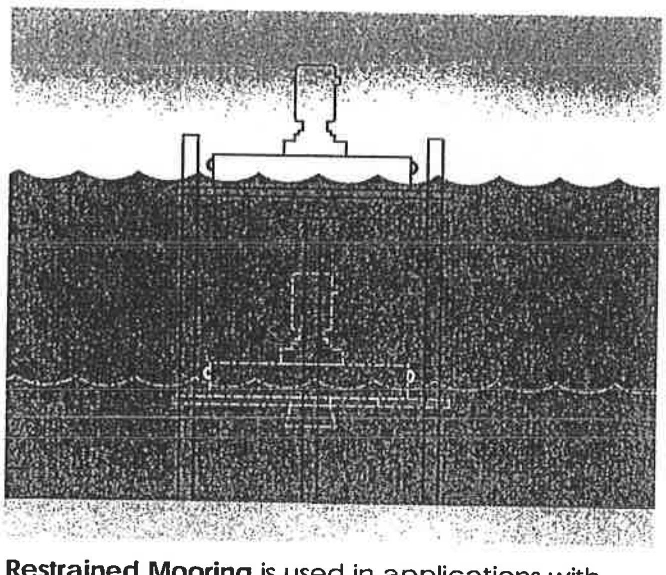
Mooring Arrangements (continued)



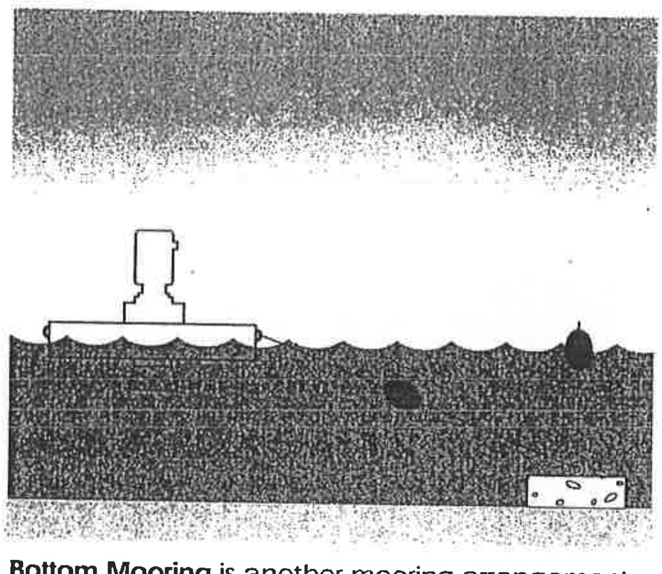
Shore Mooring, a three-point or four-point mooring to the shore, is the most common mooring configuration. Mooring cables are connected to the Aqua-Jet mooring eyes and to an eyebolt or embedded anchor on the shore.



Pier (Fixed) Mounting is used when the Aqua-Jet can be fixed-mounted to various platforms or structures. The hanging design shown here is one of the more common fixed-mounted arrangements. This mooring option is ideal for those installations where gear-reduced units are being replaced by the more efficient Aqua-Jet.



Restrained Mooring is used in applications with varying water levels. The Aqua-Jet restrained mooring frame fits around the mooring posts and allows the aerator to slide up and down the posts as the water level changes.

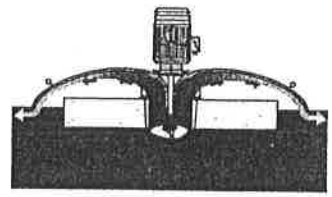


Bottom Mooring is another mooring arrangement for those installations where the distance from the Aqua-Jet to the shore would require longer lengths of cable than is practical and where the use of a mooring post is not feasible. The unit is moored from three or four points to concrete blocks on the lagoon floor.

Endura® Series

Endura® Series aerators offer a five-year no-maintenance warranty. This option is available on 3-150 HP Aqua-Jet® aerators. All Endura® Series are available in high efficiency, and each unit is vibration tested and hydraulically designed for optimum performance in the most stringent applications.

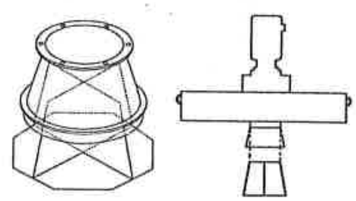
Aqua-Jet II® Contained Flow Aerator



The Aqua-Jet II® is designed for applications which require continued operation of aeration equipment during cold weather months, but are limited because of an inadequate heat sink due to process selection or environmental conditions. This aerator has proven to operate efficiently in a variety of applications, even in sub-zero temperatures.

The dome is essentially a spray control shield mounted to the diffusion head of the Aqua-Jet aerator.

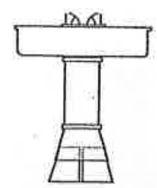
Anti-erosion Assemblies



Anti-erosion assemblies consist of a stainless steel plate attached to the bottom of the Aqua-Jet intake cone via an anti-vortex cross. The assembly causes water to be drawn from the sides of the intake cone, rather than from directly below it; and prevents the floor erosion that can sometimes occur in shallow basins.

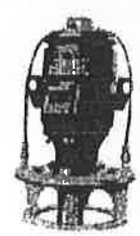
Anti-erosion assemblies are available for all HP Aqua-Jets. Consult your Aqua-Aerobic representative or the factory for dimensions.

Draft Tubes



The Draft Tube accessory provides an extension of the intake cone and permits a deeper intake of water. The draft tube extension is available in lengths of three and six feet.

Arctic Pak



The Arctic Pak ring contains thermal resistance heaters which minimize the chance of icing on the exposed surfaces of the Aqua-Jet, such as the cast diffusion head.

The Arctic Pak is complete with its own junction box (which mounts on the Aqua-Jet motor fan cover) and automatic controls and control panel. Operation of the Arctic Pak is controlled by an ambient temperature thermostat. The unit is available in either 230 or 460 volts, and can be used on either floating or fix-mounted Aqua-Jets.

Drawings and wiring diagrams are available on request. Contact your Aqua-Aerobic Systems representative.

Low Trajectory Diffuser (L.T.D.) Assembly

The low trajectory diffuser (L.T.D.) is a high density polyethylene ring that is attached to the top of the diffusion head, increasing the diameter of the diffuser. This arrangement lowers the spray of the Aqua-Jet reducing windblown spray and misting.

Low trajectory diffusers are used in colder climates, and where a smaller, lower spray pattern is desired.

Selection of Electrical Service Cable

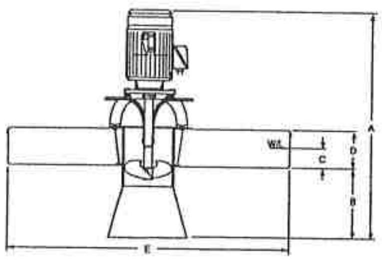
	HP	FULL-LOAD AMPS	AWG CABLE SIZE								
			12-4	10-4	8-4	6-4	4-4	2-4	0-4	00-4	000-4
230 VOLT	1	3.4	880	1240							
	2	6.6	540	930	1420						
	3	9	300	640	1000	1550					
	5	15	200	380	600	930	1420				
	7.5	22		260	410	635	970	1530			
	10	27			330	510	790	1250			
	15	40				350	530	840	1270		
	20	52					410	650	980	1200	
	25	64						525	790	975	
	30	78						440	650	800	975
	40	104							490	600	730
	50	125								500	600
460 VOLT	1	1.7	2550								
	2	3.3	2100								
	3	4.5	1620								
	5	7.5	970	1535							
	7.5	11	665	1047	1635						
	10	14	520	820	1280	2000					
	15	20		575	900	1400	2120				
	20	26			690	1070	1635				
	25	32			560	875	1325	2250			
	30	39				715	1090	1860	2610		
	40	52					815	1390	1955		
	50	63						1150	1615	1984	
	60	75						965	1355	1660	2000
	75	93							1090	1340	1600
	100	130							769	961	1230
	125	160								781	1000
	150	190									842
575 VOLT	1	1.4	3180								
	2	2.6	2770								
	3	4	2330								
	5	6	1540	2440							
	7.5	9	1030	1530	2550						
	10	11	840	1330	2080						
	15	16		970	1430	2230					
	20	21		700	1090	1700					
	25	26			880	1370	2200				
	30	31			740	1150	1740				
	40	41				870	1320	2090			
	50	50				710	1080	1720			
	60	60					900	1430	1665		
	75	74					800	1250	1850		
	100	104							1200	1500	
	125	128							975	1200	
	150	152								1030	

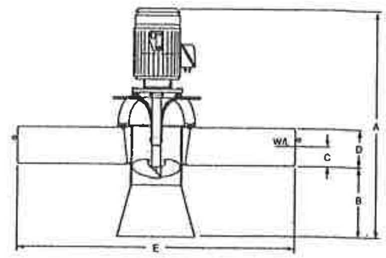
Maximum Allowable Cable Length in feet based on 5% voltage drop and 90% power factor.

Selection of Anchor Cable

DIAMETER	STRAND	MATERIAL	UNIT SIZE
3/16"	7 X 19	304 STAINLESS	1-30 HP
1/4"	7 X 19	304 STAINLESS	40-75 HP
3/8"	7 X 19	304 STAINLESS	100-150 HP

Single Speed and Dual Speed Units





Stainless Steel Series- SS and CSS

SS Model	CSS Model	HP	RPM	Apprx. Shpg. Wt. (lb)	DIMENSIONS A	B	C	D	E	Shaft Dia.	Mooring Cable Dia.
3900111	–	1	1800	325	34.69	8	4	7.5	46.75	.875	
3900211	–	2	1800	325	34.69	8	4	7.5	46.75	.875	
3900311	3900317	3	1800	525	44.13	8.5	5	11	59.5	1.250	
3900310	3900337	3/.9	1800/1200	525	46.63	8.5	5.5	11	59.5	1.250	
3900511	3900517	5	1800	525	44.13	8.5	5.25	11	59.5	1.250	
3900510	3900537	5/1.5	1800/1200	525	46.63	8.5	5.75	11	59.5	1.250	
3900711	3900717	7.5	1800	625	46.63	8.5	6.75	11	59.5	1.250	
3900710	3900737	7.5/2.2	1800/1200	625	49.13	8.5	7.25	11	59.5	1.250	3/16"
3901011	3901017	10	1800	945	51.69	10.38	6	12	70	1.750	
3901010	3901037	10/3.0	1800/1200	945	55.63	10.38	6.5	12	70	1.750	
3901511	3901517	15	1800	970	55.63	10.38	6.25	12	70	1.750	
3901510	3901537	15/4.4	1800/1200	970	59.55	10.38	6.75	12	70	1.750	
3902011	3902017	20	1200	1,300	67.94	16	6.5	13.5	82.88	2.125	
3902010	3902037	20/8.5	1200/900	1,300	68.81	16	7	13.5	82.88	2.125	
3902511	3902517	25	1200	1,350	68.81	16	6.75	13.5	82.88	2.125	
3902510	3902537	25/10.5	1200/900	1,350	69.69	16	7.25	13.5	82.88	2.125	
3903011	3903017	30	1200	1,845	86.94	*30.63	9.5	14.88	94.5	2.125	
3903010	3903037	30/12.7	1200/900	1,845	90.31	*30.63	10	14.88	94.5	2.125	
3904011	3904017	40	1200	1,870	90.31	*30.63	10	14.88	94.5	2.500	
3904010	3904037	40/17.0	1200/900	1,870	93.69	*30.63	10.5	14.88	94.5	2.500	
3905011	3905017	50	1200	2,850	101.06	*40.69	8.88	14.88	114.63	2.500	
3905010	3905037	50/21.0	1200/900	2,850	102.81	*40.69	9.38	14.88	114.63	2.600	
3905411	3905417	50	1200	1,900	90.31	30.63	10.5	14.88	94.5	2.500	1/4"
3905410	3905437	50/21.0	1200/900	1,950	93.69	30.63	10.75	14.88	94.5	2.500	
3906011	3906017	60	1200	3,000	102.81	*40.69	10	14.88	114.63	2.703	
3906010	3906037	60/25.0	1200/900	3,000	102.81	*40.69	10.5	14.88	114.63	2.703	
3907511	3907517	75	1200	3,000	102.81	*40.69	10	14.88	114.63	2.703	
3907510	3907537	75/31.5	1200/900	3,000	104.56	*38.69	10.5	16.88	114.63	2.703	
3910021	3910027	100	900	4,500	119.5	*48.5	9.5	17	131	3.930	
3910010	3910037	100/51	900/720	4,700	123.5	*46.5	10	19	131	3.930	
3910041	3910047	100	900	4,300	115.5	42.5	8.75	17	131	3.375	3/8"
3910040	3910049	100/51	900/720	4,475	119	42.5	9	19	131	3.375	
3912511	3912517	125	900	5,240	125.5	46.5	11.5	19	131	3.930	
3915011	3915017	150	900	5,390	128	46.5	11.63	19	131	3.930	

Dual Speed - Highlighted area indicates dual speed specifications.
All dimensions in inches.
* Includes allowance for anti-vortex cross.

FSS and CFSS Series

FSS Model	CFSS Model	HP	RPM	Apprx. Shpg. Wt. (lb)	DIMENSIONS A	B	C	D	E	Shaft Dia.	Mooring Cable Dia.
4200111	—	1	1800	325	34.69	8.5	4	7	46.75	.875	
4200211	—	2	1800	325	34.69	8.5	4	7	46.75	.875	
4200311	4200317	3	1800	550	44.13	8.5	4	11	64	1.250	
4200331	4200337	3/.9	1800/1200	550	46.63	8.5	4.5	11	64	1.250	
4200511	4200517	5	1800	550	44.13	8.5	5	11	64	1.250	
4200531	4200537	5/1.5	1800/1200	550	46.63	8.5	5.5	11	64	1.250	
4200711	4200717	7.5	1800	625	46.63	8.5	6	11	64	1.250	
4200731	4200737	7.5/2.2	1800/1200	625	48.25	8.5	6.5	11	64	1.250	
4201011	4201017	10	1800	900	51.69	10.38	5.5	12	71	1.750	3/16"
4201031	4201037	10/3.0	1800/1200	900	55.63	10.38	6	12	71	1.750	
4201511	4201517	15	1800	925	55.63	10.38	6	12	71	1.750	
4201531	4201537	15/4.4	1800/1200	925	58.25	10.38	6.5	12	71	1.750	
4202011	4202017	20	1200	1,100	67.94	15.5	7	14	84	2.125	
4202031	4202037	20/8.5	1200/900	1,100	68.81	15.5	7.5	14	84	2.125	
4202511	4202517	25	1200	1,150	68.81	15.5	8	14	84	2.125	
4202531	4202537	25/10.5	1200/900	1,150	70.13	15.5	8.5	14	84	2.125	
4203011	4203017	30	1200	1,845	86.94	*30	8	15.5	94.5	2.125	
4203031	4203037	30/12.7	1200/900	1,845	90.31	*30	8.5	15.5	94.5	2.125	
4204011	4204017	40	1200	1,845	90.31	*30	9	15.5	94.5	2.500	
4204031	4204037	40/17.0	1200/900	1,845	90.31	*30	9.5	15.5	94.5	2.500	
4205011	4205017	50	1200	1,900	90.31	*30	9	15.5	94.5	2.500	
4205031	4205037	50/21.0	1200/900	1,900	93.5	*30	9.5	15.5	94.5	2.500	1/4"
4205021	4205027	50	1200	2,350	101.06	40.69	5.5	15.25	114.75	2.500	
4205028	4205029	50/21.0	1200/900	2,450	102.81	40.69	6.12	15.25	114.75	2.500	
4206011	4206017	60	1200	2700	102.81	40.69	6.25	15.25	114.75	2.703	
4207517	4207517	75	1200	2700	102.81	40.69	6.25	15.25	114.75	2.703	

Dual Speed - Highlighted area indicates dual speed specifications.
All dimensions in inches.
* Includes allowance for anti-vortex cross.

Note: Endura® Series not available in some lower horsepower, single phase and special orders.

Materials of Construction

COMPONENT	MODEL SERIES STAINLESS STEEL	CSS	FSS	CFSS
MOTOR SHAFT	ONE-PIECE, 17-4 STAINLESS STEEL (1-2 HP units use 303 stainless shaft)			
PROPELLER	316 STAINLESS STEEL, DYNAMICALLY BALANCED			
MONOLITHIC CAST DIFFUSION HEAD	304 S.S.	GRAY IRON, EPOXY COATED	304 S.S.	GRAY IRON, EPOXY COATED
FLOAT SKIN	14 GAUGE, 304 S.S.		FIBER REINFORCED POLYESTER (FRP)	
FLOAT CONTENT	CLOSED CELL POLYURETHANE FOAM			
VOLUTE	304 STAINLESS STEEL			
INTAKE CONE	304 STAINLESS STEEL			

Typical Aqua-Jet Aerator Characteristics

UNIT SIZE (HP)	RPM	Zcm DIA. (FT)	D (FT)	ZOD DIA. (FT)	IMPINGEMENT DIA. (FT)
1	1800	20		65	6.5
2	1800	28		90	7.0
3	1800	40	6	145	14
.9	1200	27		87	
5	1800	45		150	15
1.5	1200	29		97	
7.5	1800	50	8	160	18
2.2	1200	32		104	
10	1800	51		172	18
3.0	1200	33		92	
15	1800	62	10	200	20
4.4	1200	39		129	
20	1200	72		230	20
8.4	900	46		149	

UNIT SIZE (HP)	RPM	Zcm DIA. (FT)	D (FT)	ZOD DIA. (FT)	IMPINGEMENT DIA. (FT)
25	1200	80		255	24
10.5	900	52		165	
30	1200	88	10	280	24
12.7	900	59		181	
40	1200	102		325	26
17.0	900	68		216	
50	1200	105		330	26
21.0	900	70		220	
60	1200	115	12	350	27
25.0	900	76		233	
75	1200	130		380	30
31.5	900	86		253	
100	900	135		395	36
51.0	720	96	15	280	
125	900	150		440	38
150	900	165		485	40

Note: These figures are typical performance rates as applied to operational systems, and they cannot be guaranteed on a random, non steady basis

D = normal operating depth in which the Zcm and Zod hold true

Zcm = Zone of complete mix(assumes conventional activated sludge mixed liquor solids)

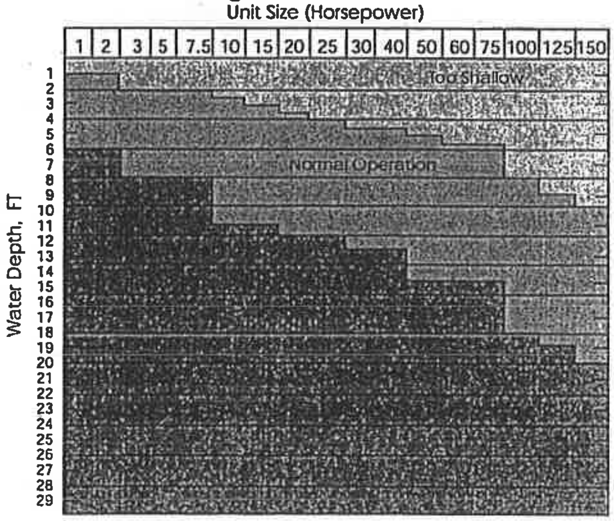
Zod = Zone of complete oxygen dispersion

Impingement = diameter of spray pattern

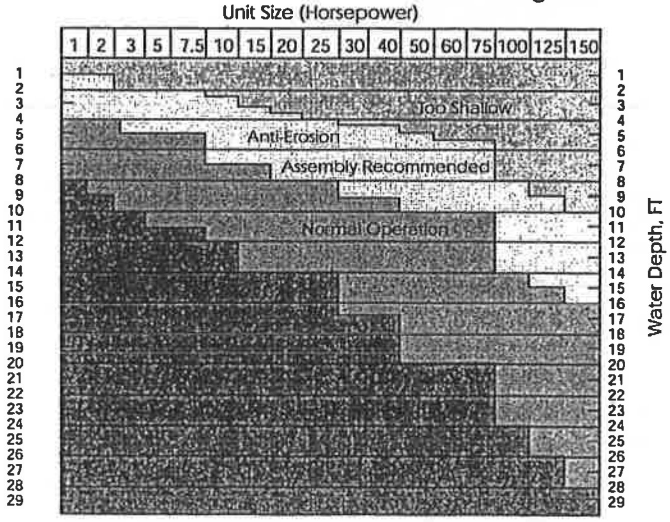
Horsepower of lower speed of dual speed Aqua-Jet

Typical Aqua-Jet Aerator Operating Depths*

Activated Sludge



Aerated Lagoons



Warning: The Aqua-Jet has a high velocity, upward directed hydraulic flow directly below the unit. In addition, horizontal surface velocities persist for some distances from the unit. These flow patterns may in some instances, cause damage to basin bottoms or walls creating leaking potential. In earthen or linen basins, Aqua -Aerobic Systems recommends the use of a concrete pad on the basin bottom directly below the aerator. If concrete is known to be non-resistant to the waste, other material should be investigated. Rip rapping or similar means of bank protection can protect basin walls. If basin contains toxic wastes, user is advised to obtain engineering advice as to basin design and construction necessary to prevent possible erosion and leakage. Aqua-Aerobic systems assume no liability or responsibility for any damage to basin bottoms or walls, or for any injuries or damages resulting therefrom.

* **Note:** These charts are intended for approximation purposes only. Requirements are dependent on basin geometry, etc., and Aqua-Aerobic System should be contacted for specific applications.
* **Note:** Consult Aqua-Aerobic Systems for information on larger horsepower units.

Utilizing Aqua-Jet® Mechanical Surface Aerators

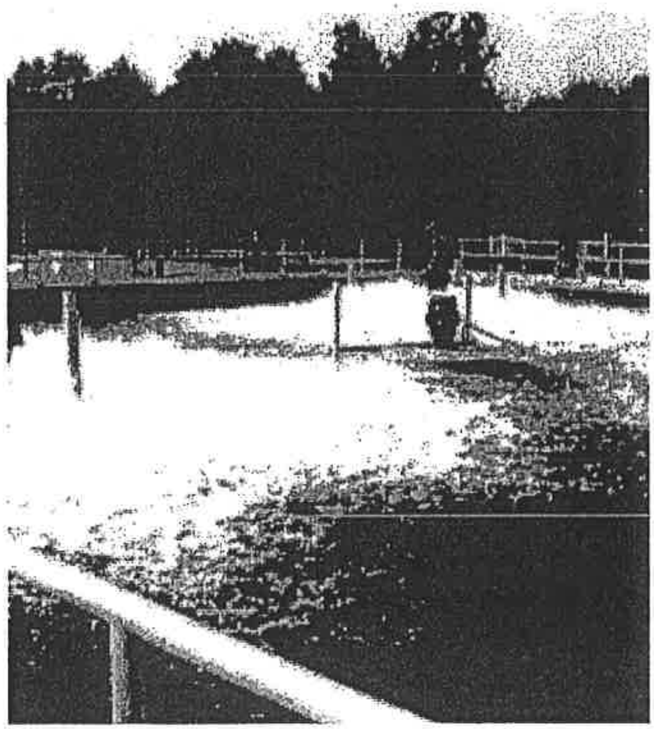
The MixAir System utilizes AquaDDM direct drive mixers in combination with any of several aeration sources, including Aqua-Jet aerators. As a brief description: the biomass is maintained in suspension, while the variable oxygen input keeps the system operating at the most efficient oxygen supply level.

Because mixing energy is separate from aeration energy, the MixAir System permits a greater choice of reactor sizes and shapes. The MixAir System simplifies the layout of the air distribution system by eliminating the need for tank baffles or full bottom coverage, as with typical diffused air systems. The system is well suited for new construction or for retrofit in existing aeration basins.

The combined use of a downflow AquaDDM mixer and an upflow aeration source, like the Aqua-Jet, creates complimentary flow patterns which result in optimum distribution of oxygen and substrate. Superior process efficiency can often be achieved with less overall horsepower which, in many applications, can result in significant energy savings. Short-circuiting and excess dissolved oxygen are eliminated.

Applications

- Retrofit in existing aeration systems including: extended aeration, aerobic digestion, equalization, aerated lagoons
- Oxidation ditches
- Variable load, activated sludge systems
- Diurnal flows, less than design conditions
- Batch reactor processes
- Municipal-industrial combinations
- long residence time processes in cold climates



Aqua-Jet
Surface Aerators

Aqua-Jet II
Contained Flow Aerators

AquaDDM
Direct Drive Mixer-Plenders

Aqua MixAir
Aeration Systems

Aqua EnduraDisc
Fine Bubble Diffusers

Aqua EnduraTube
Fine Bubble Diffusers

Aqua CB-12
Coarse Bubble Diffusers

Aqua CB-24
Coarse Bubble Diffusers

AquaSBR
Sequencing Batch Reactors

AquaMB Process
Multiple Barrier Membrane Systems

MSBR
Modified Sequencing Batch Reactor

AquaDisk
Cloth Media Filters

AquaDiamond
Cloth Media Filters

AquaDrum
Cloth Media Filters

AquaABF
Automatic Backwash Filters

ThermoFlo
Surface Spray Coolers

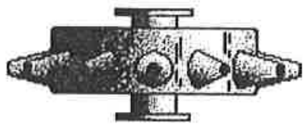
DynaBlend
Polymer Blending and Metering Systems

Contact Your Local Representative:

Aqua-Aerobic Systems, Inc.
6306 N. Alpine Rd. • P.O. Box 2026 • Rockford, IL 61130
(Phone) 815/654-2501 • (Fax) 815/654-2508 • Toll Free 877/214-9625
Email: solutions@aqua-aerobic.com • www.aqua-aerobic.com

The information contained herein relative to data, dimensions and recommendations as to size, power and assembly are for purpose of estimation only. These values should not be assumed to be universally applicable to specific design problems. Particular designs, installations and plants may call for specific requirements. Consult Aqua-Aerobic Systems, Inc. for exact recommendations or specific needs. Patents Apply. Patents Pending.

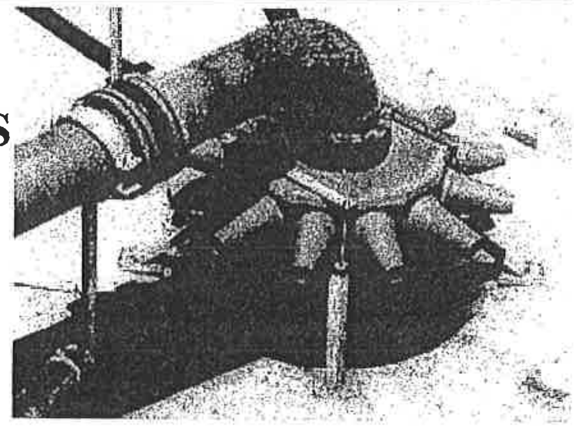
Bulletin #950H 05/04



MIXING SYSTEMS, INC.

7058 Corporate Way, Dayton, Ohio 45459, USA
Phone: 937-435-7227 ♦ Fax: 937-435-9200 ♦ E-mail: mixing@mixing.com

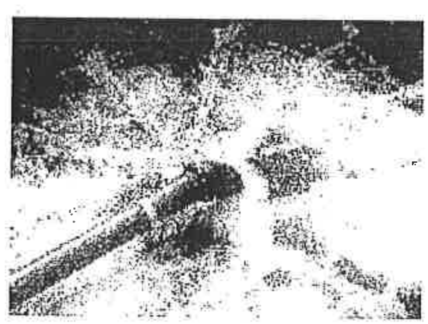
EDDY MIX JET AERATORS



Eddy Mix Jet Aerators (EMJA) place the nozzles in a radial arrangement around a common chamber which supplies both air and liquid to the nozzles. Typical EMJAs have twelve jet nozzles arranged thirty degrees apart to form a radial cluster. These nozzles create twelve individual plumes, as shown below, which thoroughly mix the tank. Air and liquid may both enter from the top, as shown to the right, or liquid may enter from the top and air from the bottom.

Click here to see the flow pattern of an eddy mix jet aerator in operation in a round tank.

Applications for Eddy Mix Jet Aerators



The EMJA is particularly suited for circular tanks. A single unit can accomodate tanks up to 65 feet (20 meters) in diameter or smaller.

The effective mixing pattern permits Eddy Mix Jet Aerators to be installed in square or circular tanks without affecting performance. Typically, these applications are medium to high reaction rate systems such as high-rate activated sludge and complete mix designs, aerobic digestion, recarbonation, and chemical oxidation.

For larger tanks, **Mixing Systems, Inc.** may use multiple EMJAs. It is common for a series of EMJAs to be used, served by common liquid and air headers. Mixing from one cell to

	another takes place through dynamic conditions existing at the boundaries.

7058 Corporate Way, Dayton, Ohio 45459, USA
Phone: 937-435-7227, Fax: 937-435-7227
E-mail: mixing@mixing.com

Gray & Osborne, Inc.
CONSULTING ENGINEERS

COPY

December 18, 2008

The Honorable Wayne Hovde, Mayor
City of Soap Lake
239 Second Ave SE
Soap Lake, WA 98851

SUBJECT: ENGINEERING LETTER
CITY OF SOAP LAKE, GRANT COUNTY, WASHINGTON
G&O #08041.00

Dear Mayor Hovde:

The purpose of this letter is to further describe operational and performance problems at the Soap Lake Wastewater Treatment Facility (WWTF) as presented in Gray & Osborne's State of the Infrastructure presentation to the City Council On April 16, 2008 and in our the letter to the City dated March 22, 2007.

Background
The Soap Lake WWTF was originally constructed in 1946 and received major upgrades in 1978 and 2004. The current WWTF consists of an influent grinder, oxidation ditch, secondary clarifiers and rapid infiltration basins for effluent disposal. The solids handling consists of an aerobic digester, and sludge drying beds. The City currently meets all requirements of its State Waste Discharge Permit.

The City has historically had problems with the operation of the aerobic digesters. The aeration system was continually breaking down and therefore causing severe odor issues. The City contracted with Gray & Osborne, Inc. to recommend a solution to the problems. Our recommendation included a new aeration system and influent fine screen as detailed in our letter dated March 22, 2007 (Appendix A).

Subsequent to the letter, Gray & Osborne toured the wastewater treatment facility and interviewed the operator. A number of other deficiencies were noted that if corrected, would aid in the operation and maintenance of the facilities and would improve the quality of the effluent discharged from the facility. These improvements were presented to City Council on April 16, 2008 and are further summarized and detailed below.

Current Design Criteria
The design criteria for the City's WWTF are presented in Table 1. The design criteria were developed as part of the <u>City of Soap Lake Wastewater Treatment Facilities</u>

Engineering Report, (Hammond, Collier & Wade-Livingston, 1998). Also included in Table 1 is a summary of the flows and loadings to the WWTF in 2007, as submitted on the WWTF's Discharge Monitoring Reports (DMRs).

Table 1
Design Criteria Per WWTF Engineering Report(1)

Parameter	Design Criteria	2007
Design Population (Year 2018)	2,585	1750(2)
Maximum Daily Flow	0.420 MGD	0.250 MGD
Monthly Average Flow	0.300 MGD	0.179 MGD
BOD_5 Influent Loading	517 lbs/day	385 lbs.day
TSS Influent Loading	465 lbs/day	297 lbs/day

(1) The design criteria are also consistent with the City's State Waste Discharge Permit No. ST-5282.
(2) Population obtained from the Office of Financial Management (OFM).

Effluent Limits
The Soap Lake WWTF is authorized to discharge wastewater to ground waters of the State of Washington by State Waste Discharge (SWD) Permit No. ST-5282, issued in March 2006; the permit expires in March 2011. The permit gives the City permission to discharge effluent meeting the discharge limits shown in Table 2.

Table 2
Effluent Limits per SWD Permit No. ST-5282

	Effluent Limitations	
Parameter	**Maximum Daily(1)**	**Average Monthly(2)**
Flow	0.42 MGD	0.30 MGD
BOD_5 Concentration	No Limit	30 mg/L
TSS Concentration	No Limit	30 mg/L
Total N Concentration	No Limit	10 mg/L
pH	Not outside the range of 6.5 to 8.5	

(1) The maximum daily effluent limitation is defined as the highest allowable daily discharge. The daily discharge means the discharge of a pollutant measured during a calendar day.
(2) The average monthly effluent limitation is defined as the highest allowable average of daily discharges over a calendar month, calculated as the sum of all daily discharges measured during a calendar month divided by the number of daily discharges measured during that month.

Influent Fine Screen
The headworks of the City's WWTF is equipped with an influent grinder. The open channel grinder shreds fibrous material (plastic, rags, handiwipes, etc.) present in the

influent wastewater. The grinder was installed as part of the 2004 WWTF upgrades. The grinder has a hydraulic capacity of 1.06 MGD, slot size of ¼ inch, and a 5 hp motor.

The grinder discharges the debris downstream into the oxidation ditch and other processes. This pass-through causes a variety of problems including binding of the digester aerators, which has caused the bearings to fail several times. Based on conversations with City personnel, it is apparent that the operator spends a considerable amount of time cleaning debris out of the oxidation ditch in an effort to avoid damaging downstream equipment and to avoid pump plugging.

In the Gray & Osborne letter dated March 22, 2007, it was suggested the City install a mechanical fine screen at the headworks. A mechanical fine screen will remove the rags and debris from the wastewater before they enter the oxidation ditch, rather than grinding the debris and sending it into the process stream where it can recombine and cause maintenance issues. A rotating fine screen consists of a perforated basket, through which the wastewater flows, and an internal screw conveyor. The accumulation of debris on the perforated basket restricts the flow and causes the water level in the upstream channel to rise. Once the water level reaches a set point, the screw type conveyor is activated and begins to rotate. The conveyor rotates inside the perforated basket to clean the basket and convey the debris upwards out of the wastewater and into a washing and dewatering compaction zone. A separate spray wash system, provided with heat tracing and insulation to prevent freezing, provides water for the washing system. Washed and compacted screenings are discharged from top of the screen into a trash container for transport to a local landfill.

The fine screen would be installed in a new concrete channel upstream of the existing influent grinder. Two channels would be constructed; one channel would contain the fine screen, and the other channel would have a manually cleaned bar screen for those instances when the mechanical fine screen is out of service. Although the screen would be specified to be weather-proof, these screens operate more reliably under a canopy to keep the wind, rain, and snow off the screen. We would propose a three-sided metal building over the fine screen structure.

Presently the City does not have a grit removal system at the WWTF. Grit consists of sand, gravel, and cinders that enter the treatment plant from the collection system. Grit causes wear on the process equipment, particularly the sludge pumps. Grit can also build up in the oxidation ditch and reduce the ditch capacity. We propose a simple and low cost grit removal system consisting of gravity grit channel that can be easily built as part of the screening structure. The WWTF operator will be required to periodically manually clean the channels, or if a vactor truck is available, the City may choose to mechanically clean the channels using this truck.

We estimate the cost for installation of the fine screen and grit channels to be approximately $343,000. A detailed cost estimate for the fine screen/grit channels is included in Appendix B (cost estimate includes contingency, tax and engineering).

Figure 1, located in Appendix C, shows a typical drawing of a fine screen/grit channel installation and pictures of typical fine screen installations.

An additional concern for the Soap Lake WWTF is the considerable amount of visible debris that can be seen in the dried solids. The visible debris consists of the inert solids that pass through the influent grinder and eventually end up in the sludge in the drying beds. WAC 173-308-205 states that by July 1, 2012, sludge must be treated by a process such as physical screening or another method to significantly remove manufactured inerts prior to final disposition. Essentially, the City would either need to screen the influent or screen the biosolids prior to final disposal to remove manufactured inerts. It would therefore be in the best interest of the City to install a fine screen, not only for the operation and maintenance benefits stated above, but to also meet the 2012 requirements in WAC 173-308-205.

Oxidation Ditch

Secondary biological wastewater treatment at the Soap Lake WWTF is provided by an activated sludge system, comprised of an oxidation ditch equipped with two brush rotors, two secondary clarifiers, and associated sludge pumps. The oxidation ditch is an elliptical, single tank with a center wall and brush rotors designed to aerate and rotate the contents in a circular fashion. Oxygen is introduced at the water surface using the partially submerged rotors.

The oxidation of organic and inorganic matter is carried out by microorganisms that are naturally present in wastewater and grow in favorable conditions in the oxidation ditch. The microorganisms use the organic and inorganic matter as a food source and reproduce accordingly. The oxidation ditch breaks down the BOD_5 and nitrifies the ammonia in a highly concentrated cell environment. The nitrification process oxidizes ammonia to nitrates and water, the former which must be removed (denitrification) to acceptable levels before discharge to ground water. Denitrification is the reduction of nitrate to nitrogen gas which is released to the atmosphere.

The oxidation ditch has a volume of approximately 290,000 gallons and in 2004 was converted to an intermittent aeration (IA) process to achieve nitrogen (nitrate) removal. The rotors are controlled by timers that the operator adjusts to operate the ditch in anoxic and oxic modes by automatically slowing down and speeding up the rotors. The ditch is equipped with two brush rotors that were installed as part of the 2004 upgrades. The rotors are 14 feet long, 28 inches in diameter and are equipped with 20 hp motors controlled by operator VFDs. The operator did not report any significant issues with the oxidation ditch other then the excessive debris that enters with the influent.

A review of the WWTF's Engineering Report reveals that the City's Engineer modeled the performance of the oxidation ditch based on the future flows and loadings for the years 2008 and 2018. The modeling was performed by Dr. David Stensel at the University of Washington. The modeling considered eight flows and loading scenarios. The first scenario modeled the flows and loadings as of 1998, and models No. 2 through No. 5 were based on the projected flows and loadings for the year 2008. Each model had a different set of conditions with regard to temperature, flow, and loading. The final three models were run based on the projected flows and loadings for the year 2018. These three models also included a variety of temperature, flows and loading conditions.

The modeling revealed the IA process would work, but improvements would have to be made to the ditch including the addition of more aeration capacity and a pre-anoxic tank. The Engineering Report proposed that the improvements be constructed over two phases, with the first phase being the replacement/upgrade of the rotors for additional aeration, and the second phase the construction of a pre-anoxic tank. The Phase I upgrades were those completed in 2004. Dr. Stensel's analysis showed that the City would need Phase II upgrades by the year 2008. The model suggested that the treatment plant would not be able to meet the effluent limit of less than 10 mg/L total nitrogen. Dr. Stensel recommended that a pre anoxic tank with internal recycle be built in the year 2008 to ensure that the City meet the nitrogen limit.

The flows and loadings utilized in the modeling were based on projections that were made in the year 1998. The projected 2008 average flow was 0.236 MGD with an average TKN (ammonia plus organic nitrogen) influent loading of 43.2 mg/L. A review of the City's 2007 DMRs reveals an average flow 0.179 MGD last year, TKN is not sampled in the influent stream.

The City has not grown at the rate predicted in the 1998 Engineering Report. The Engineering Report projected that the population would be 1,979 in the year 2007 based on a growth rate of 3% per year. However, according to the OFM the population of Soap Lake was about 1,720 in 2007, which indicates the growth rate has been about 1.6% per year.

In order to accurately predict when the City might need the Phase II improvements, an analysis of the oxidation ditch's current performance and the projection of future flows and loadings would have to be performed. This type of analysis was not included in this scope of work. Calculations show that at the current growth rate of 1.6%, the City will not reach the projected population of 1,979 until the year 2016. This projection indicates that it is possible that the Phase II improvements may not be necessary for several years. As previously stated, a more extensive study should be performed to more precisely determine the remaining capacity of the oxidation ditch.

The oxidation ditch produces poor settling sludge, which can cause problems with the quality of the effluent. The oxidation ditch creates an environment that promotes an abundance of filamentous bacteria, thereby producing sludge that does not settle well in the secondary clarifiers. If the liquid and solids do not separate well in the clarifiers, the WWTF may risk the discharge of excessive suspended solids, which could potentially result in a permit violation.

One proven method of increasing the settleabilty of solids in clarifiers is the use of biological selection. Biological selection in the aeration basin encourages the growth of floc-forming microorganisms in lieu of filamentous bacteria thereby producing an activated sludge with good settling characteristics.

Bioselectors consist of small zones in a concrete tank upstream of the oxidation ditch (between the fine screen and the ditch), where the influent and the return activated sludge form the clarifiers are mixed. For the Soap Lake WWTF, these small compartments would be approximately 7' x 7' x 8' deep, and would be mixed without aeration. The sludge that is returned from the clarifiers would enter the selector tanks mixing immediately with the influent from the City. This design creates an environment where there is a high food (influent BOD_5) to mass (solids returned from the clarifier) ratio, a condition that favors the growth of floc-forming bacteria.

The zones of the concrete selector tanks would be equipped with vertical shaft mixers to keep the solids from settling out in the tank. The tanks would also be equipped with interior baffles to create a plug flow environment. The flow would exit the bioselectors and enter the oxidation ditch, where aeration and nitrification/denitrification processes would occur for further waste breakdown.

We estimate the total cost for bioselectors to be $353,000. A detailed cost estimate for the bioselectors is included in Appendix B (cost estimate includes contingency, tax and engineering). This cost estimate assumes that there is electrical capacity at the WWTF for additional motor loads, assumes a spare MCC bucket is available, and assumes there is capacity in the telemetry and control systems to add new systems.

Secondary Clarifiers

Flow from the oxidation ditch continues to the secondary clarifiers. The secondary clarifiers are designed for solids separation and solids thickening. There are two secondary clarifiers; one 28-foot clarifier was installed in 1978 and one 35-foot clarifier was installed as part of the 2004 upgrades. The clarifiers both have peripheral feed, overflow launders with mechanical sludge scrapers.

Based on a maximum monthly flow (permitted flow) of 0.30 MGD, and with all flow entering one clarifier, the 35-foot clarifier has a surface loading rate of 312 gal/ft^2 per day and the 28-foot clarifier has a surface loading rate of 400 gal/ft^2 per day. The 28-foot clarifier is only 10-feet deep which is not optimal for activated sludge systems. This clarifier requires very good settling sludge to operate properly. Base on the values above the 35-foot clarifier is within acceptable design criteria for the maximum monthly flow; however, the 28-foot clarifier would only be able to capable of operating at 0.246 MGD which is below the maximum monthly design criteria. The level of reliability required for the Soap Lake WWTF is unclear in the existing permit; however, if the 35-foot clarifier were out of service, the 28-foot clarifier would be able to handle approximately 82% of the design flow; however the sludge must have good settling qualities.

The clarifier contents are kept quiescent to allow the biological solids to fall to the bottom of the clarifier by gravity sedimentation. The clarified wastewater exits the clarifiers over a weir. A portion of the settled solids at the bottom of the tank are pumped back to the oxidation ditch to keep the biomass concentration in the oxidation ditch high (return activated sludge, RAS). A portion of the solids are periodically pumped to the digester for treatment and eventual removal from the facility (waste activated sludge, or WAS). The operator did not report any significant issues with the secondary clarifiers other than the periodic settling issues as discussed above in the oxidation ditch section of this report.

RAS/WAS Pumping
Return activated sludge (RAS) is pumped from the secondary clarifier to the oxidation ditch to maintain a concentrated biomass in the oxidation ditch. There are two RAS pumps located in the lower level of the operations building. The existing pumps are a non-clog, dry-pit centrifugal pump rated at 200 gpm at 25 feet TDH. The pumps are controlled by operator adjustable VFDs.

The pumps have packing to seal the shaft; this packing requires a liquid media for lubrication. Typically, this liquid is termed "seal" water, and the source of the water is either potable or non-potable water.

At the Soap Lake WWTF, the pump's seal water is the sludge that is being handled by the pump. Utilizing sludge as the lubrication media results in poor cooling and eventually packing failures. To compensate for these problems, the operator has loosened the packing to allow sludge to leak more freely without the risk of plugging the packing.

The sludge leaks to the floor where it is pumped by a sump pump back to the oxidation ditch.

Sludge leaking to the floor creates extremely unsanitary conditions for the operator and a very corrosive environment inside the building. The corrosion is quite evident; after only four years the electrical stanchions in this area have a significant amount of visible rust. Also of concern are the MCCs that are mounted on the upper level of the building. These MCCs are exposed to this damp and corrosive environment that over time will contribute to the deterioration of the electrical components. Refer to Appendix C for photos of this area.

After contacting the manufacturer's representative for the RAS pumps, it was determined that the pump can be modified with either a different type of seal, or reworked to accept non-potable water as the seal lubricant in lieu of sludge.

An additional problem with the RAS system is the low velocities in the sludge pipe. According to the operator, the pumps are set to pump at 65 gpm; the rate is determined by the operator and is dependent upon a variety of factors. Most of the RAS piping is 8-inch ductile iron, which at 65 gpm results in a velocity of 0.5 ft/sec. This velocity is not enough velocity to prevent solids from settling out in the pipe. Scouring velocities are usually above 2 ft/sec. The operator has recognized this problem and uses the VFDs to speed up the pumps a couple times per week to keep the lines clear. This mode of operation appears to be a sufficient solution and has kept the pipes from plugging. Another way of handling this is to program the PLC to automatically speed up the pumps periodically to clean the lines.

The City wastes sludge to the digester once per week, typically 8 hours on a Friday. This type of wasting schedule can result in a highly variable mixed liquor concentration at the oxidation ditch. Large swings in MLSS concentration are expected to compromise the ability of the treatment process to provide reliable nitrification.

To remedy this problem, an automatic wasting system could be installed. This system would include the installation of an actuated valve and a meter. The operator would set the PLC to automatically open the valve and waste a certain volume of sludge several times per day, based on the desired wasting schedule for process control. This type of wasting would result in a more steady MLSS concentration.

We estimate the total cost for the sludge pump seal modifications and the automated wasting to be $64,000. A detailed cost estimate for the modifications is included in Appendix B (cost estimate includes contingency, tax and engineering).

Disinfection
At present there is no disinfection of the wastewater effluent that is discharged from the WWTF. The City is not required to provide disinfection since the existing permit limits do not include a fecal coliform limit. Disinfection requirements are further discussed in the permit section at the end of this report.

Effluent Pump Station
The effluent pump station pumps effluent from the secondary clarifiers to the rapid infiltration basins for final disposal. The wet well is located in the operations building. Effluent is pumped by two vertical turbine pumps with a duty point of 350 gpm at 44.0 feet total dynamic head. The pumps are equipped with 7.5 hp motors and were installed as part of the 2004 upgrades.

Based on discussion with the operator, only one pump is called when the level in the wet well rises to the ON level. Based on a average monthly flow of 0.3 MGD (208 gpm) and a maximum daily flow of 0.420 MGD (278 gpm) it appears that one 350 gpm pump can adequately handle these flows. There is no peak hour data available to determine if the pumps are adequate for the peak hour flow. The operator did not report any significant issues with the effluent pumps.

Rapid Infiltration Basins
The City's final effluent is pumped to one of six rapid infiltration basins that were constructed as part of the 2004 upgrades to replace the undersized City drainfield. The total area of the basins is 2.6 acres. The summer application period is 7-9 days per basin, and the winter application period is 9-12 days per basin. The operator did not report any significant issues with the infiltration basins, ground water quality is further discussed below.

Aerobic Digesters
The solids that are not returned to the activated sludge process (oxidation ditch) from the clarifiers are called waste activated sludge (WAS) and are pumped to the aerobic digester. The ability to remove, stabilize, and dispose of WAS from the treatment process is one of the major factors which determines the capacity of the treatment plant. There are three fundamental elements in the state biosolids management regulations that establish the minimum criteria for bioslids disposal: pollutant concentration (primarily metals), pathogen reduction, and vector attraction. Currently, the Soap Lake WWTF meets the state requirements for pollutant concentration, pathogen reduction and vector attraction for Class B biosolids. The solids are currently hauled off site to a permitted facility for final disposal.

Pathogens are destroyed during the aerobic digestion process since the digesters' oxidizing environment is very hostile to most pathogenic microorganisms. The lack of soluble organic matter in the waste sludge creates an endogenous environment where the bacteria must feed off their own cell matter. Since the bacteria consume cell matter, the aerobic digestion process is capable of significantly reducing the mass of solids in the digester. Not all of the solids are capable of being destroyed through digestion. The aerobic digestion process is capable of destroying about 40 percent of the total solids by weight pumped to the digester.

The Soap Lake digester is a lined, open-air basin measuring 52' x 52'. Depending on the water surface elevation, the basin water depth ranges from 7 to 12 feet and the volume ranges from 240,000 to 570,000 gallons. Biosolids flow out of the basin by gravity from a pit on the bottom of the basin to the sludge drying beds. The digester is equipped with two 5 hp floating aerators that are designed to mix the contents and transfer oxygen into the digester biological degradation of the solids. The aerators work by drawing atmospheric air into the water and diffusing the oxygen in fine bubbles into the water.

As noted in the 2007 letter from Gray & Osborne, the City has had continual problems with the aeration system of the aerobic digesters. At the time the letter was written Gray & Osborne evaluated alternatives to the existing 5 hp aspirating aerators in the aerobic digester. The aspirating aerators are not being used because rags and tumbleweeds bind the aerators and cause the aerator bearings to fail. The operator is able to maintain Class B biosolids by testing the biosolids and allowing the biosolids to dry on the drying bed for several months. Three or four times per year, when the operator wastes biosolids to the drying beds, the inadequate aeration causes a major odor problem near the WWTF.

Our calculations indicate that based on a design BOD_5 loading of 517 lbs per day, as shown in Table 1, the oxygen requirement in the digester is approximately 663 lbs per day. The existing aspirating aerators are likely claimed by the manufacturer as capable of supplying 2.5 lbs of oxygen/hp/hr, which results in a total oxygen supplied to the digester of 600 lbs/day (300 lbs/day each aerator). However, in our experience, we have found that most floating aspirating aerators, like those supplied at Soap Lake, do not supply their publicized oxygen transfer rate. We suspect the oxygen transfer is actually about 1.0 lbs oxygen/hp/hr which results in a total oxygen transfer of 240 lbs per day (120 lbs/day each aerator). This actual transfer capacity would explain why the current aeration system is insufficient for aerobic digestion.

Another issue with the aspirating aerators is that they must not only supply the required oxygen, but they must have enough power to completely mix the digester. The City has observed that the tanks are not mixed and that severe odors occur while running the aerators. These conditions indicate that the oxygen demand is not being met and that the aspirating aerators are undersized for mixing the basin.

Two alternatives for improving digester performance were evaluated as part of the 2007 letter. To improve the operation of the aerobic digester the following modifications could be considered: 1) replace the existing aerators with a jet aerator; 2) replace the existing aerators with a surface aerator. These two options are discussed in more detail below. As previously stated, the debris that enters the plant and eventually is wasted to the digester causes the aerators to bind and burn up the bearings. A fine screen at the front of the plant would prevent the majority of the debris from entering the digester. Therefore, regardless of the option chosen, a fine screen should be installed at the headworks as part of the overall solution.

Jet Aeration – This option would consist of removing the existing aerators and installing a jet aerator in the aerobic digester. New equipment would include a 40 hp submersible pump and blower. The pump would provide mixing of the basin and the blower would provide aeration for the basin. The estimated cost for this option is $227,000. The cost includes an exterior blower equipped with a weatherproof enclosure. This option would provide sufficient air and mixing; however, unless an influent fine screen is installed, it is still possible that rags could clog the submersible pump.

Surface Aerator – This option would consist of removing the existing aerators and installing a 40 hp surface aerator. The estimated cost of this option is $68,000. This type of aerator is much more robust than the existing aspirating aerators. This option would provide sufficient air and mixing; however, unless an influent fine screen is installed it is still possible that rags could clog the aerators. An additional problem with the surface aerator is possible ice build up in the winter.

Based on the cost estimates presented above we recommend the replacing the existing aerators with a new surface aerator and adding a fine screen at the headworks. The cost assumes that there is adequate electrical capacity for the 40 hp aerator. Additional information on the proposed surface aerator can be found in Appendix C.

Sludge Drying Beds

After aerobic digestion, stabilized sludge flows by gravity to the sludge drying beds. The City has approximately 9,500 SF of drying bed area. For sludge stabilized from a waste activated sludge process, Ecology's design criteria recommends 1.75 to 2.5 sq ft per capita. As stated in Table 1, the design population for the City of Soap Lake's WWTF is 2,585 which results in approximately 6,500 SF of necessary sludge drying bed area. Based on this criteria it appears that the beds are sufficient at this time. The Operator did not state that there were any problems with the sludge drying beds.

Electrical and Plant Control Systems
The City's supervisory control and data acquisition (SCADA) system was installed as part of the 2004 upgrades. The SCADA application software is Rockwell RSView, Wonderware Intouch, and Intellution iFix.

The system monitors all PLC I/O points and alerts the operator of several alarms including the following:

- Utility Power Failure
- PLC Failure
- Equipment Fail Alarms
- Building Basement Sump High/Low
- Effluent Pump Station Wet Well High/Low
- High/Low Flow Alarms
- Oxidation Ditch High/Low DO Levels

The PLC is located in the plant control panel and is an Allen-Bradley SLC5/05. The operator did not indicate that there were any major problems with the plant PLC or SCADA system. However, the PLC and SCADA programming will have to be modified to accommodate new process units. Experience has shown that the life of a WWTF computer is approximately 5-7 years. The main operator interface computer and software should be replaced at the time of the next upgrade.

The costs to upgrade the PLC and SCADA programming are dependent upon the extent to which improvements are made. Assuming the addition of a fine screen, bioselectors, automatic wasting, surface aerators and replacement of the computer interface and the software, we estimate the total cost for this level of an upgrade to be $37,000 (cost estimate includes contingency, tax and engineering).

Emergency Power
The City's WWTF is not equipped with an emergency generator. In the event that the WWTF were to lose power, the partially-treated effluent would be diverted by gravity to the old effluent drainfield. As stated previously, the reliability requirement at the Soap Lake WWTF in not clearly defined in the permit; however, the Criteria for Sewage Works Design (Ecology, 2006), sometimes referred to as the Orange Book, states that criteria for Class III reliability (the least restrictive class), the facility must be able to operate screening or comminution equipment, primary settling tanks, main wastewater pumps, disinfection systems, critical lighting, and ventilation systems if primary power is unavailable. The Soap Lake WWTF does not have a generator and therefore does not

meet the Orange Book standards for a backup power source. We recommend auxiliary power be provided to ensure reliable treatment.

We estimate the total cost for a generator and automatic transfer switch to be $157,000. A detailed cost estimate for the modifications is included in Appendix B (cost estimate includes contingency, tax and engineering).

Safety Hazards
Wastewater treatment facilities are required to be designed to comply with National Fire Protection Association (NFPA) Standard 820. This standard establishes the minimum requirements for protection against fire and explosion hazards in wastewater treatment plants and associated collection systems, including the hazard classification of specific areas and processes. The standard dictates the ventilation and electrical requirements necessary to avoid explosive conditions within the different processes of the WWTF.

The City's existing sludge pumps are installed in the lower level of the operations building. Per NFPA 820, if this area is not ventilated, or ventilated at less than 12 air changes per hour, the area would be classified as a hazardous/classified area where all motors and associated electrical gear would have to be designed to be explosion proof. Explosions can occur at WWTFs if methane gas builds to a high enough concentration. Based on preliminary observations and conversations with the operator, the area is ventilated with two large mechanical ventilation fans in the roof that are thought to provide sufficient ventilation; however, the Operator only runs these in the summer. In the winter, the heating system cannot adequately heat the room if the vent fans are operated. This lack of ventilation creates a hazardous/classified area in the winter, and presents a safety condition if the operator enters the area without proper ventilation.

A preliminary review reveals that a heat recovery unit could be installed in this area that would provide adequate ventilation to avoid hazards while keeping the room warm enough to prevent condensation and freezing in the room. A heat recovery ventilator uses separate blowers to move incoming fresh and outgoing stale air. The heat exchange core transfers heat to fresh air without mixing the two airstreams.

We estimate the total cost for the installation of a heat recovery unit to be approximately $67,000 (cost estimate includes contingency, tax and engineering). This cost estimate assumes that the existing ventilation fans are of sufficient size to meet the required air changes per hour, and that there is electrical capacity at the WWTF for additional motor loads, and a spare MCC bucket is available. Additional information on a heat recovery unit is provided in Appendix C.

Cost Summary

Table 3 is a summary of the estimated costs for the recommended improvements. The cost estimate for each item includes contingency, tax and engineering. Details on the cost estimate for each item can be found in Appendix B.

Table 3
Total Cost Estimate Summary for
Recommended WWTF Improvements

Item	Total Cost	Priority
Fine Screen/Grit Channels	$343,000	1
Bioselectors	$353,000	5
Sludge Pumping Improvements	$64,000	3
Digester Aeration	$68,000	2
PLC/SCADA Upgrades	$37,000	6(1)
Heat Recovery Unit	$67,000	4
Generator	$157,000	7
Total	**$1,089,000**	

(1) PLC/HMI upgrades may be required for items that are higher on the priority list.

The projects were prioritized based on what projects, in our opinion, provide the greatest cost benefit for the City. The installation of the fine screen would protect downstream equipment, enable the City to comply with future biosolids rules, enable the operator to have more time throughout the day to maintain the treatment plant rather than cleaning debris out of the ditch and repairing broken equipment. As we stated earlier, a project that includes both the fine screen/grit channels and the digester improvements would be most beneficial.

Although the sludge pumping appears to work for the City, it is not a sanitary environment for the operator to work in. In addition, the continual presence of corrosive gasses in this area will eventually cause damage to the plant's main electrical system. We recommend this project along with the addition of a heat recovery unit would best be performed together.

The remaining items on the priority list could be arranged differently depending on the City's own priorities and funding resources.

Future State Waste Discharge Permit
The City's existing permit expires on March 7, 2011. Six months prior to the permit expiration, the City is required to apply for a new discharge permit. State regulations require that the effluent limits in the discharge permit must be the more stringent of either technology based limits or water quality based limits. Water quality based limits for Soap Lake would be based upon compliance with the state Ground Water Quality Standards (WAC 173-200) since the effluent is discharged to the ground. The Washington State Ground Water Quality Standards are presented below in Table 3.

Table 3
Ground Water Quality Standards

Parameter	**Limit**
Total Coliform Bacteria	1 colony/100 ml
Total Dissolved Solids	500 mg/L
Chloride	250 mg/L
Sulfate	250 mg/L
Nitrate	10 mg/L
pH	6.5 to 8.5 Standard Units
Maganese	0.05 mg/L
Total Iron	0.3 mg/L
Toxics	No toxics in toxic amounts.

Washington State also has an Antidegradation Policy, WAC 173-200-030. The goal of this policy is to ensure the purity of the state's ground waters and to protect the natural environment. The antidegradation policy states the following:

(a) Existing and future beneficial uses shall be maintained and protected and degradation of ground water quality that would interfere with or become injurious to beneficial uses shall not be allowed.

(b) Degradation shall not be allowed of high quality ground waters constituting an outstanding national or state resource, such as waters of national and state parks and wildlife refuges, and waters of exceptional recreational or ecological significance.

(c) Whenever ground waters are of a higher quality than the criteria assigned for said waters, the existing water quality shall be protected, and contaminants that will reduce the existing quality thereof shall not be allowed to enter such waters, except in those instances where it can be demonstrated to the department's satisfaction that:

(i) An overriding consideration of the public interest will be served; and

(ii) All contaminants proposed for entry into said ground waters shall be provided with all known, available, and reasonable methods of prevention, control, and treatment prior to entry.

A review of the state waste discharge permit fact sheet reveals that Ecology was unable to determine the existing quality of the Soap Lake ground water because existing background data did not exist. Ecology could not determine if the background ground water quality was higher or lower than the criteria stated above. The fact sheet does state that Ecology did not expect this discharge to interfere with beneficial uses.

The City's current permit requires them to collect ground water data. As part of the 2004 upgrade, three monitoring wells were installed. One of the wells is upgradient of the infiltration basins, and two of the wells are down gradient of the infiltration basins. Location of the monitoring wells was based on the hydrogeological investigation that was completed as part of the Engineering Report. As stated in the permit fact sheet, the collection and evaluation of this data and the effluent data as reported by the City's DMRs may result in a permit modification. Table 4 presents a summary of the data collected in 2007 and 2008.

Table 4
Ground Water Monitoring Data

Parameter	MW #1(1)	MW #2(1)	MW #3(1)
Total Coliform MPN Water(2)	<2	<2	<2
Chloride(2) mg/L	6.35	7.9	6.45
Sulfate(2) mg/L	26.7	31.35	31.6
Total Dissolved Solids(2) mg/L	217	255	221
TKN(2) mg/L	0.4	0.4	0.35
Nitrate(2) mg/L	2.43	3.12	3.31

(1) Monitoring Well No. 1 is the upgradient well; Monitoring Well No. 2 and No. 3 are down gradient from the infiltration basins.
(2) The concentrations reported for the parameters are the average of four sampling events in 2007 and 2008

A review of the data above shows that the City is not violating the state ground water standards (Table 3); however, there is a slight degradation of groundwater as the background well, Well No. 1, has lower levels of most of the contaminants then were sampled in Wells No. 2 and 3, including nitrates. However, as noted above, the data analyzed for this report includes only a few sampling events.

According to the permit fact sheet, the current limits in the permit were taken from the City's Engineering Report, and were based on the design criteria of the system, or technology based limits. If Ecology finds that the City's effluent is degrading the quality of the groundwater, or exceeding the limits of the state ground water quality standards, Ecology may impose new limits and/or lower the existing limits. New and lower limits may result in the requirements for upgrades to the treatment plant, including additional aeration capacity and disinfection. New requirements could be very costly for the City as they may include a variety of new process units. The City will not know if there are any new requirements until the permit is issued in 2011. It is assumed that the permit will provide the City with adequate time (compliance schedule) to construct any required new facilities.

Summary & Conclusions

It is recommended that a number of improvements at the Soap Lake WWTF be implemented to improve the effluent quality and the operations and maintenance of the facilities. Those improvements include the following:

- New Mechanical Fine Screen/Grit Channels
- New Selector Basins
- New Aerobic Digester Aeration System
- New RAS/WAS Pumping
- Modified SCADA and Electrical Systems
- New Heat Recovery Unit in the Operations Building
- Generator/Transfer Switch

These individual projects could be completed in one large project, or could be separated into smaller individual projects. The only projects identified as best performed together are the addition of a fine screen and the aeration improvements to the digester. The total estimated cost for all of the proposed improvements is $1,089,000, including sales tax, contingency, and engineering.

Phase II improvements, the addition of a pre-anoxic tank, is not included the improvements listed above. In order to accurately predict when the City might need the Phase II improvements, an analysis of the oxidation ditch's current performance and the projection of future flows and loadings would have to be performed. Calculations show that at the current growth rate of 1.6%, the City may not need the Phase II improvements until the year 2016. A more extensive study should be performed to more precisely determine the remaining capacity of the oxidation ditch.

The City has several options for funding the projects, including grants and low interest loans. We appreciate the opportunity to discuss funding strategies and a project schedule with the City Council. We look forward to presenting our findings at the Council meeting on January 21, 2009.

Very truly yours,

GRAY & OSBORNE, INC.

Nancy J. Morter

Nancy J. Morter, P.E.

NJM/dlw

APPENDIX E

COST ESTIMATES

CITY OF SOAP LAKE
WWTF FACILITY PLAN
PHASE I
G&O #11041

No.	Item	Qty	Unit	Unit Price	Amount
1	Mobilization and Demobilization	1	LS	$96,000	$96,000
2	Trench Safety Systems	1	LS	$10,000	$10,000
3	Excavation/Backfill	1	LS	$20,000	$20,000
4	Grinder Structure Modification	1	LS	$15,000	$15,000
5	Fine Screen Equipment and Install	1	LS	$112,000	$112,000
6	Effluent Flow Meter and Piping Modifications	1	LS	$15,000	$15,000
7	RAS Pumps	2	EA	$20,000	$40,000
8	RAS Station	1	LS	$30,000	$30,000
9	Scum Pump	1	EA	$10,000	$10,000
10	Scum Station	1	LS	$75,000	$75,000
11	Pump Station Piping	1	LS	$40,000	$40,000
12	Digester Surface Aerator w/install	2	EA	$40,000	$80,000
13	Sludge Drying Bed Drain Repair	1	LS	$20,000	$20,000
14	Sludge Drying Bed Valve Replacement	1	LS	$20,000	$20,000
15	Sludge Drying Bed Paving	1100	SY	$30	$33,000
16	Miscellaneous Electrical/SCADA	1	LS	$35,000	$35,000
17	Electrical (Option 3)	1	LS	$315,000	$315,000
				Construction Subtotal	$ 966,000
				Contingency (25%)	$ 241,500
				Sales Tax (7.9 %)	$ 95,000
				Subtotal	$ 1,302,500
				Investment Grade Efficiency Audit	$ 10,000
				Design & Construction Engineering (25%)	$ 325,600
				Total Construction Cost (Rounded)	$ 1,639,000

CITY OF SOAP LAKE
WWTF FACILITY PLAN
PHASE II
G&O #11041

No.	Item	Qty	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 77,000	$ 77,000
2	Trench Safety Systems	1	LS	$ 10,000	$ 10,000
3	SPCC Plan	1	LS	$ 5,000	$ 5,000
4	Excavation/Backfill	530	CY	$ 50	$ 26,500
5	Modify Lift Station No. 2	1	LS	$ 20,000	$ 20,000
6	Bioselector Mixer	1	LS	$ 55,000	$ 55,000
7	Bioselector Structure	1	LS	$ 80,000	$ 80,000
8	Anoxic Basin	60	CY	$ 1,250	$ 75,000
9	Recycle Pump	1	LS	$ 30,000	$ 30,000
10	Vertical Mixers	2	EA	$ 37,500	$ 75,000
11	Site Piping	1	LS	$ 50,000	$ 50,000
12	Sampler Modification	2	EA	$ 3,000	$ 6,000
13	Oxidation Ditch Surface Aerator	1	LS	$ 25,000	$ 25,000
14	Oxidation Ditch Structural Modification	1	LS	$ 6,000	$ 6,000
15	Secondary Clarifier No. 1 Painting	1	LS	$ 10,000	$ 10,000
16	Floating Decanter w/install	1	EA	$ 20,000	$20,000
17	Cross Connection Control	1	LS	$ 40,000	$ 40,000
18	Nonpotable Water Pump Station	1	LS	$ 40,000	$ 40,000
19	Sludge Drying Beds	1	LS	$ 38,000	$ 38,000
20	Effluent Pump	1	LS	$ 30,000	$ 30,000
21	Electrical, Telemetry, and Control	1	LS	$ 128,300	$ 128,300
				Construction Subtotal	$ 846,800
				Contingency (25%)	$ 211,700
				Sales Tax (7.9 %)	$ 84,000
				Subtotal	$ 1,142,500
				Design & Construction Engineering (25%)	$ 285,600
				Total Construction Cost (Rounded)	$ 1,429,000

CITY OF SOAP LAKE
WWTF FACILITY PLAN
ALTERNATIVE NO. 1
G&O #11041

No.	Item	Qty	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 34,000	$ 34,000
2	Trench Safety Systems	1	LS	$ 10,000	$ 10,000
3	SPCC Plan	1	LS	$ 5,000	$ 5,000
4	Excavation	530	CY	$ 50	$ 26,500
5	Anoxic Basin	60	CY	$ 1,250	$ 75,000
6	Recycle Pump	1	EA	$ 30,000	$ 30,000
7	Vertical Mixers	2	EA	$ 37,500	$ 75,000
8	Oxidation Ditch Aerator	1	EA	$ 30,000	$ 30,000
9	Site Piping	1	LS	$ 20,000	$ 20,000
10	Electrical, Telemetry, and Control	1	LS	$ 70,000	$ 70,000
				Construction Subtotal	$ 375,500
				Contingency (25%)	$ 93,900
				Sales Tax (7.9 %)	$ 37,000
				Subtotal	$ 506,400
				Design & Construction Engineering (25%)	$ 126,600
				Total Construction Cost (Rounded)	$ 633,000

CITY OF SOAP LAKE
WWTF FACILITY PLAN
ALTERNATIVE NO. 2
G&O #11041

No.	Item	Qty	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 75,000	$ 75,000
2	Trench Safety Systems	1	LS	$ 10,000	$ 10,000
3	SPCC Plan	1	LS	$ 5,000	$ 5,000
4	Excavation	2190	CY	$ 50	$ 109,500
5	Anoxic Basin	60	CY	$ 1,250	$ 75,000
6	Aeration Basin	110	CY	$ 1,250	$ 137,500
7	Positive Displacement Blowers	2	EA	$ 30,000	$ 60,000
8	Fine Bubble Diffusers	1	LS	$ 40,000	$ 40,000
9	Recycle Pump	1	LS	$ 30,000	$ 30,000
10	Vertical Mixers	2	EA	$ 37,500	$ 75,000
11	Oxidation Ditch Solids Removal	100	TN	$ 150	$ 15,000
12	Oxidation Ditch Abandonment	1	LS	$ 10,000	$ 10,000
13	Site Piping	1	LS	$ 80,000	$ 80,000
14	Electrical, Telemetry, and Control	1	LS	$ 100,000	$ 100,000
				Construction Subtotal	$ 822,000
				Contingency (25%)	$ 205,500
				Sales Tax (7.9 %)	$ 81,000
				Subtotal	$ 1,108,500
				Design & Construction Engineering (25%)	$ 277,100
				Total Construction Cost (Rounded)	$ 1,386,000

CITY OF SOAP LAKE
WWTF FACILITY PLAN
SLUDGE DRYING ALTERNATIVE NO. 1
G&O #11041

No.	Item	Qty	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 4,000	$ 4,000
2	Trench Safety Systems	1	LS	$ 500	$ 500
3	SPCC Plan	1	LS	$ 500	$ 500
4	Excavation	50	CY	$ 50	$ 2,500
5	Paved Sludge Drying Beds	270	SY	$ 50	$ 13,500
6	Sludge Drying Bed Valving	1	LS	$ 6,000	$6,000
7	Site Piping	1	LS	$ 15,000	$15,000
				Construction Subtotal	$ 42,000
				Contingency (25%)	$ 10,500
				Sales Tax (7.9 %)	$ 4,000
				Subtotal	$ 56,500
				Design & Construction Engineering (25%)	$ 14,100
				Total Construction Cost (Rounded)	$ 71,000

CITY OF SOAP LAKE
WWTF FACILITY PLAN
SLUDGE DRYING ALTERNATIVE NO. 2
G&O #11041

No.	Item	Qty	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 8,000	$ 8,000
2	Trench Safety Systems	1	LS	$ 500	$ 500
3	SPCC Plan	1	LS	$ 500	$ 500
4	Polymer Feed System	1	LS	$ 55,000	$ 55,000
5	Insulated Enclosure	1	LS	$ 5,000	$ 5,000
6	Site Piping	1	LS	$ 10,000	$10,000
7	Electrical	1	LS	$ 10,000	$10,000
				Construction Subtotal	$ 89,000
				Contingency (25%)	$ 22,300
				Sales Tax (7.9 %)	$ 9,000
				Subtotal	$ 120,300
				Design & Construction Engineering (25%)	$ 30,100
				Total Construction Cost (Rounded)	$ 151,000

CITY OF SOAP LAKE
WWTF FACILITY PLAN
WATER RECLAMATION UPGRADE
G&O #11041

No.	Item	Qty	Unit	Unit Price	Amount
1	Mobilization	1	LS	$ 386,000	$ 386,000
2	Trench Safety Systems	1	LS	$ 20,000	$ 20,000
3	SPCC Plan	1	LS	$ 10,000	$ 10,000
4	Filtration Equipment	1	LS	$ 335,000	$ 335,000
5	Tanks	1	LS	$ 35,000	$ 35,000
6	Building	1	LS	$ 380,000	$ 380,000
7	Pump Station	1	LS	$ 152,000	$ 152,000
8	UV System	1	LS	$ 300,000	$ 300,000
9	Storage Ponds	1	LS	$ 2,000,000	$ 2,000,000
10	SCADA Upgrades	1	LS	$ 300,000	$ 300,000
11	Bypass Valves and Piping	1	LS	$ 76,000	$ 76,000
12	Reclaimed Water Pipeline	1	LS	$ 53,000	$ 53,000
13	Electrical, Telemetry, and Control	1	LS	$ 200,000	$ 200,000
				Construction Subtotal	$ 4,247,000
				Contingency (25%)	$ 1,061,800
				Sales Tax (7.9 %)	$ 419,000
				Subtotal	$ 5,727,800
				Design & Construction Engineering (25%)	$ 1,432,000
				Total Construction Cost (Rounded)	$ 7,160,000

APPENDIX F

WWTF STAFFING REQUIREMENTS SPREADSHEET

Project Name: Soap Lake WWTF **Date:** 7-Aug-12
Design Flow (mgd): 0.32
Hours/Day of Sludge Dewatering Operation 1.00
Productive Hours/Worker/Year 2,000

Table of Adjustment for Local Conditions

CATEGORY	LOCAL CONDITION	ADJUSTMENT					
		Operation	Maintenance	Supervisory	Clerical	Laboratory	Yardwork
PLANT LAYOUT	Average	0%	0%				0%
UNIT PROCESSES	Std. Equipt/Different Mfr	0%	0%				
LEVEL OF TREATMENT	Secondary	0%	0%	0%	0%	0%	0%
TYPE OF WASTE REMOVAL REQUIREMENT	Effluent Concentration	5%				10%	
INDUSTRIAL WASTE	None or Constant	0%				0%	
PRODUCTIVITY OF LABOR	Average	0%	0%				
CLIMATE	Moderate Winters		0%				
TRAINING	Certification & Continuing Ed.	-5%		-10%			
AUTOMATIC MONITORING	Monitoring With Feedback	-5%	5%				
AUTOMATIC SAMPLING	Influent & Effluent	-5%				-5%	
OFF-PLANT LABORATORY WORK	None					0%	
OFF-PLANT MAINTENANCE	None		0%				
AGE AND CONDITION OF EQUIPMENT	Relatively new & well cared for		0%				
TOTAL		-10%	5%	-10%	0%	5%	0%

Annual Manhours

Unit Process/Category	Exists at Plant?	Operation	Maintenance	Supervisory	Clerical	Laboratory	Yardwork
Supervisory & Administrative				240			
Clerical					10		
Laboratory						310	
Yardwork							210
Raw Sewage Pumping at Plant	No		0				
Screening & Grinding	Yes	10	10				
Grit Removal	Yes	110	10				
Primary Clarification	No	0	0				
Aeration	Yes	320	220				
Secondary Clarification for Activated Sludge	Yes	50	170				
Chlorination	No	0	0				
Mixed Media Filtration	No	0	0				
Anaerobic Digestion	No	0	0				
Aerobic Digestion	Yes	40	10				
Gravity Thickening	No	0	0				
Flotation Thickening	No	0	0				
Sludge Drying Beds	Yes	150					
Sludge Dewatering	Yes	110	70				
Sludge Lagoons	No	0					
SUBTOTAL		790	490	240	10	310	210
SUBTOTAL ADJUSTED FOR LOCAL CONDITIONS		710	510	220	10	330	210
Number of Workers		0.4	0.3	0.1	0.0	0.2	0.1

Total Labor Hours/Year 1,990
Total Number of Workers 1