Preparing Hauled-Waste Acceptance Plans

October 2015

oregon association of CLEAN WATER agencies

DEQ
State of Oregon
Department of Environmental Quality

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Alternative formats (Braille, large type) of this document can be made available. Contact DEQ, Portland, at 503-229-5696, or toll-free in Oregon at 1-800-452-4011, ext. 5696.

Table of Contents

Introduction

This report is intended to provide technical assistance to communities who accept or are considering accepting hauled-waste at their Publically Owned Treatment Works. It is intended to be a supplement to EPA's guidance document: *Guidance Manual for the Control of Wastes Hauled to Publicly Owned Treatment Works*, EPA, EPA-833-B-98-003, September 1999.

Templates for developing hauled-waste plans were developed jointly by DEQ and the Oregon Association of Clean Water Agencies. Water quality permit holders accepting hauled-waste or wanting to accept hauled-waste should coordinate with their DEQ permit writer in developing a complete and approvable hauled-waste plan.

DEQ-approved hauled-waste plans are specific to the types and quantities of hauled-waste outlined in the approved plan. Adding wastes or increasing the amount of wastes accepted will require a plan modification and additional approval from DEQ.

Contact your DEQ permit writer with questions. Locations and contact information for the DEQ Regional Offices are available at http://www.deq.state.or.us/about/locations.htm.

Communities that operate under a DEQ approved Industrial Pretreatment Program do not require a separate hauled-waste plan, since all hauled-wastes accepted at the POTW should be included as part of the pretreatment program. An inventory of the communities with DEQ approved Industrial Pretreatment program is available at http://oracwa.org/c-pretreatment.html.

Background

Hauled-Waste can cause adverse impacts to POTWs because it is usually more concentrated than typical domestic wastewater and may contain chemicals that require changes to operations for proper treatment. Adverse impacts may include:

- Pass through of pollutants to the effluent and/or biosolids. Some hauled-wastes include toxic substances that could impact the ability of the treatment plant to meet DEQ limits, including passing the Whole Effluent Toxicity test.
- Interference with biological treatment
- Sludge inhibition and contamination
- Slug loading to the treatment system
- Nuisances such as bad odors and pump clogging
- Hazards to POTW employee health and or other safety hazards

Communities should only accept wastes that can be effectively treated by their systems, thereby reducing pollution while increasing revenue. Communities should not accept hauled-wastes that their treatment works cannot process, that could upset the biological treatment systems at the plant, which would reduce biosolids quality, jeopardize permit compliance, or threaten employees' health and safety.

This report outlines the basics for preparing a hauled-waste plan to receive DEQ approval to accept hauled-waste at an Oregon wastewater treatment plant. Every plan will vary by the types and amount of wastes received at the treatment plant – there is no 'one-size-fits-all'.

Facilities That Need a DEQ Approved Hauled-Waste Plan

Oregon wastewater treatment plants that operate under National Pollutant Discharge Elimination System permits need to get DEQ-approval prior to accepting hauled-waste. Most NPDES permits contain a specific requirement in Schedule D (Special Conditions) of the permit regarding hauled-waste control. All NPDES permit contain a requirement in Schedule F (General Conditions) to notify DEQ of any new pollutants introduced into the treatment system. This includes hauled-waste.

Examples of Hauled-Waste

Examples of hauled-waste common in Oregon are many and include:

- FOG from restaurant grease-removal devices
- Septage
- Portable or chemical toilets
- Landfill leachate
- Compost operation leachate
- Food-processing waste
- Winery waste
- Pet waste from rural kennels
- Dairy waste
- Brewery waste
- Groundwater remediation site wastewater
- Industrial or commercial wastes

For industrial or commercial wastes, the Federal pretreatment categorical standards apply and must be met prior to accepting the waste. For some types of industrial or commercial wastes, the utility would need a DEQ-approved Industrial Pretreatment Program prior to accepting the waste.

Utility Considerations

Utilities should consider the issues listed below to balance the risks and benefits of accepting hauled-waste or expanding the types of hauled-waste accepted. Only include the appropriate information in the hauled-waste plan filed with DEQ.

Insurance requirements

Some utilities require a specific type of insurance for waste haulers and that the utility be named on the insurance policy.

Training Program

A training program and appropriate review will be needed for the wastewater treatment plant operators on the hauled-waste plan and its procedures

Communication

Communication strategies with a variety of audiences should be considered, including DEQ, neighboring wastewater treatment plants, haulers, the Council or Commission, and customers.

For DEQ, the wastewater utility will want a procedure to notify the local DEQ regional office when a hauled-waste load is rejected by the treatment plant.

For neighboring wastewater treatment plants, consider sharing information locally to watch for haulers that may be misrepresenting their wastes or to watch for loads that have been rejected by a neighboring facility.

Consider what communication strategies will be used for these additional target audiences:

- Waste haulers that serve your community
- Council or Commission members
- Customers

Sewer Use Ordinance

All utilities that accept hauled-waste will need a Sewer Use Ordinance outlining the types of hauled-wastes that can be accepted at the treatment plant. The sewer use ordinance establishes the legal authority to allow the municipality to accept hauled-waste and prevent impacts to the treatment works and collection system from industry and business discharges and to protect worker health and safety. A variety of sewer use ordinances are posted on the *ACWA Community, Voluntary Pretreatment Program* web site at http://www.oracwa.org/cbpt-ordinance.html.

Prohibited Discharges

The adopted sewer use ordinance should prohibit the following materials from being discharged into the collection system or at the treatment plant:

- Pollutants that create a fire or explosion hazard
- Pollutants with a pH below 6.0 or above 9.0
- Solid or viscous pollutants in amounts which will cause obstruction or the flow in the Publically Owned Treatment Works or results in interference
- Any pollutant, including oxygen demanding pollutants released in a discharge at a flow rate and/or pollutant concentration which will cause interference with the POTW
- Heat in amounts which will inhibit biological activity in the POTW resulting in interference
- Petroleum oil, non-biodegradable cutting oil, or products of mineral oil origin, in amounts that cause interference or pass through
- Pollutants that result in the presence of toxic gases vapors, or fumes within the POTW in a quantity that may cause acute worker health and safety problems

Sewer Use Ordinance for Hauled-Waste

The ordinance related to hauled-waste should also include the following:

- Prohibition of the discharge of hauled-waste, except at points designated by the POTW.
- Statement that all hauled-waste must meet all applicable federal, State, and local pretreatment standards and requirements including categorical standards developed for the waste generator’s industrial category. If the POTW’s legal authority allows it to do so, the ordinance should also be expanded to allow the POTW to permit and regulate the generator of non-domestic hauled-wastes.
- The POTW may require commercial, industrial, and/or residential waste haulers to obtain a permit.
- A record keeping system.
- Specifics of a manifest system, if used.

- The POTW may collect samples of each hauled load to ensure compliance with applicable standards.
- No load may be discharged without prior consent of the POTW.
- The POTW may require the hauler to provide a waste analysis of any load prior to discharge.
- Details regarding penalties for violating the ordinance or permit.

Hauled-Waste Plan Content

This report outlines three different types of hauled-waste plans:

- Wastes at Digester only
- Septage Only
- Variety of Wastes

Examples of hauled-waste plans for each scenario are included in the appendices.

Requirements for all Hauled-Waste Plans

At a minimum, all hauled-waste plans must include the following:

- Description of the wastewater treatment system
- Type(s) and amounts of hauled-waste received.
- Prohibitions against hazardous wastes (federal requirements)
- The exact discharge location(s) at the treatment plant.
- Hauled-Waste receipt procedures.
- Hauled-Waste rejection procedures.
- Recordkeeping

The following sections provide information on the level of detail needed for some of the most common hauled-wastes.

Wastes at Digester Only

Some wastewater utilities accept wastes only at the digester. Generally, these are FOG or other high-energy food wastes that increase the biogas generated at the digester in order to fuel co-generation units generating power at the wastewater treatment plant. DEQ discourages the receipt of FOG at the headworks. Other examples of wastes accepted at the digester might include waste-activated sludge from a neighboring wastewater treatment plant and chemical toilet wastes.

For a utility that accepts wastes at the digester only, a simple hauled-waste plan is appropriate.
The plan should include these items:

1. Facility Description

   Include a brief description of the wastewater treatment plant system, including unit processes, designed capacity, peak capacity, and average capacity.

2. Sources of FOG or Other Wastes and the Hauler Authorization System

   The plan should detail the types of wastes allowed, such as FOG, and include how the utility controls the wastes being accepted into the digester, likely through a permitting system, a manifest system, or other control mechanism.

3. Waste-testing Procedures

The utility should detail the waste-testing procedures. Some wastewater utilities use portable testing such as pH test strips or PCB colorimetric strip tests for any oily wastes when loads arrive at the treatment plant.

The utility should also consider visual screening for loads. A good initial question to ask is: does the load look and smell like what the hauler says it is?

For new sources of industrial food manufacturing waste or FOG from other haulers, consider requesting these analyses to evaluate the waste:

- Volatile solids
- Water content
- Ash content
- Biological Oxygen Demand
- Chemical Oxygen Demand
- Total Kjeldahl Nitrogen
- Ammonia
- Total phosphorous
- Soluble phosphorous
- Oils and grease
- Volatile fatty acids
- pH
- Alkalinity
- Trace metals

4. Digester Capacity and Compatibility

The hauled-waste plan should address digester capacity and compatibility of the hauled-waste. This information will be included in the digester feasibility studies.

5. Record Keeping

The hauled-waste plan should detail how to maintain records of hauled-waste accepted on a routine basis, including adequate information to generate an annual report.

A sample hauled-waste plan for digester-only waste is included as Appendix B. The example plan is from the City of Gresham.

Septage Only Hauled-Waste Plans

The second tier hauled-waste plan is for a utility that only accepts residential septage. For a septage-only hauled-waste plan, the utility should include these items:

1. Facility Description

Include a brief description of the wastewater treatment plant system including unit processes, designed capacity, peak capacity, and average capacity.

2. Sources of Septage and Hauler Authorization System

Detail how the wastewater utility will authorize haulers to discharge septage waste at the treatment plant, such as a permit or manifest system or other control mechanism.

The hauled-waste plan should detail types of wastes allowed. For a septage-only hauled-waste plan, only residential septage and chemical toilet waste can be accepted.

3. Waste Testing and Screening Procedures

The utility should detail what the testing procedures are for hauled-wastes. Some utilities use portable testing such as pH test strips or PCB colorimetric strip tests for oily wastes when loads arrive. Some utilities take a sample of the waste and observe the microbial activity. If there is no microbial activity, the wasteload may contain toxics that could upset the treatment plant. The utility should visually screen loads. Does the load look and smell like what the hauler says it is?

Some utilities require additional testing for priority pollutants including pesticides, PCBs, volatile organic compounds, semi-volatiles, and metals including arsenic, antimony, beryllium, cadmium, chromium, copper, lead, mercury, molybdenum, nickel, selenium, silver, thallium, and zinc.

Some utilities use a random testing program to ensure accuracy in reporting the sources of hauled-waste, including a monthly random sample tested for Specific Oxygen Uptake Rate, BOD, Total Suspended Solids, and nutrients. Additionally, at least once per quarter, random samples could be tested for volatile organic compounds and metals.

4. Capacity To Accept Waste Within Permit Limits

The hauled-waste Plan will need to demonstrate that the wastewater treatment plant has the hydraulic and organic capacity to handle the additional hauled-waste.

The unused treatment plant capacity available to handle and treat hauled-waste loadings will be the difference between the design or actual capacity (organic and hydraulic) of the treatment plant and the current and projected sewer collection system loadings.

This capacity analysis will need to be conducted on each individual unit process basis, including:

- Primary process,
- Secondary process, and
- Disinfection process.

The utility will need to calculation the pollutant concentrations and loadings that can be received without exhibiting interference for each unit process. For example, at what loading of TSS, BOD, or other pollutant does impairment of sludge settling or dewatering occur.

Next, determine the pollutant loading increases to the effluent and biosolids due to the hauled-waste, and compare these increased loadings/concentrations to the appropriate environmental standards, such as the NPDES permit limits, applicable receiving water quality standards, and biosolids quality standards. Use a table to compare the calculated impacts from receiving hauled-waste to the applicable standards.

With this information, evaluate the POTWs ability to control feed rates of hauled-waste into the treatment plant to ensure permit limits and biosolids quality standards can be met.

Using the information from the evaluation, set reasonable limits on acceptable hauled-waste, including:

- Limits for type, volume, and strength of waste

    - Daily and monthly limits for total amount accepted

- Waste Receipt Procedures

  To ensure smooth operations, the hauled-waste plan should detail the discharge location at the treatment plant and the connection method. Spills can occur, so spill clean up procedures and necessary ‘on-hand’ equipment should be detailed in the plan.

- Load Rejection Procedures

  Utilities should have a procedure in place to notify the local DEQ regional office when a hauled-waste load is rejected by the treatment plant.
  For neighboring wastewater treatment plants, consider sharing information locally to watch for haulers that may be misrepresenting their wastes or to watch for loads that have been rejected by a neighboring facility

- Record-Keeping Procedures

  The hauled-waste Plan should detail how records will be kept of hauled-waste accepted on a routine basis, including adequate information to generate an annual report.

An example septage-only waste plan is included as Appendix C. The example plan is from Rogue Valley Sewer Services for the treatment plant it operates at Shady Cove.

Accepting Other Hauled-Wastes

The most robust hauled Waste Plan will be for a utility that is considering accepting a variety of hauled wastes such as:

- Fats, Oil & Grease from restaurant grease removal devices
- Portable toilet and septage
- Landfill leachate
- Compost operation leachate
- Food processing waste
- Winery waste
- Pet waste from rural kennels
- Dairy waste
- Brewery waste
- Groundwater remediation site wastewater
- Industrial or commercial wastes

For industrial or commercial wastes the Federal Pretreatment Categorical standards apply and must be met prior to accepting the waste. For some types of industrial or commercial wastes, the utility would need a DEQ approved Industrial Pretreatment Program prior to accepting the waste.

The first step is to complete a waste treatability study to determine if the waste is compatible with the treatment process. This study must address the six areas of potential adverse impacts (Pass through of pollutants, Interference with biological treatment, Sludge inhibition and contamination, Slug loading, Nuisances such as bad odors and pump clogging, and Hazards to POTW employee health and or other cause safety hazards). The study should also quantify the amount of waste that can be received without any adverse impacts. The utility should follow EPA’s guidance manual and contact DEQ for assistance.

The contents of a hauled-waste plan for a variety of wastes is similar to the contents of a septage only hauled-waste plan (see above). The utility must submit both the treatability study and the hauled-waste plan to DEQ for approval.

An example of a municipal landfill leachate hauled-waste plan is included as Appendix D. The example plan is from the City of Reedsport.

Resources

There are a variety of resources for utilities preparing hauled Waste Plans including:

- *Guidance Manual for the Control of Wastes hauled to Publicly Owned Treatment Works*, EPA, EPA-833-B-98-003, September, 1999
- POTW Pretreatment Considerations and Permitting Programs for hauled Waste (10/12) see - *http://water.epa.gov/polwaste/npdes/pretreatment/The-Pretreatment-101-Series-POTW-Pretreatment-Considerations-and-Permitting-Programs-for-hauled-waste.cfm*
- *Guidance Manual for the Identification of Hazardous Wastes Delivered to Publicly Owned Treatment Works by Truck, Rail, or Dedicated Pipe*, USEPA, June 1987.

Appendix A

Hauled-Waste plan example table of contents

Appendix B

Example digester-only hauled-waste plan for the City of Gresham

Appendix C

Example septage waste plan for the Shady Cove Treatment Plant (Rogue Valley Sewer Services)

Appendix D

Example municipal landfill leachate plan prepared for the City of Reedsport.

Revision	Date	Changes	Editor
Original	October 16, 2015	N/A	Jon Gasik

Appendix A

Hauled-Waste plan example table of contents - To be Submitted to DEQ with Acceptability Evaluation Report

Draft Table of Contents

1. Facility Information
    a. Brief process description
    b. Summary of capacity (hydraulic and organic) from evaluation report
    c. Plan author and contact information
2. Hauler authorization
    a. Authorized haulers only.
    b. Hauler authorization process (form)
    c. Permitting process
    d. Termination procedures
3. Prohibited Materials
    a. Federal Prohibitions
    b. Additional Owner Prohibitions
4. Source and Types of Waste
5. Limits on Waste Received: Type, Volume, Strength (Daily and monthly limits)
6. Waste Testing
    a. Every Load: visual, pH, microbial activity, etc.
    b. Random Periodic: Frequency and tests (SOUR, BOD, TSS, metals, VOCs)
    c. Plant Upset Testing: (Ex. Maintain sample in plant refrigerator for 1 week to test in the event of a plant upset).
7. Load Rejection Procedures: Notify DEQ. Hauler termination?
8. Receipt (Discharge) Procedures
    a. Manifest system
    b. Discharge location and connection method
    c. Clean up procedures
9. Record Keeping
    a. Tracking amount and types of hauled waste accepted

Appendices: Acceptability Evaluation Report

Appendix B

Example digester-only hauled-waste plan for the City of Gresham

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Oregon

John A. Kitzhaber, MD, Governor

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

January 28, 2014

Alan Johnston
City of Gresham
1333 NW Eastman Pkwy
Gresham, OR 97030-3825

RE: Hauled Waste Plan for the Gresham Wastewater Treatment Plant
WQ - Multnomah County, File 35173; Permit No.102523
APPROVAL: Hauled Waste Plan

Dear Mr. Johnston PE:

We have reviewed the City of Gresham WWTP Hauled Waste Plan. It was received January 28th of 2015 in the Northwest Region Parkside office.

Following is a description of the plan:

- Only Fats, Oils and Greases (FOG) are accepted at the plant.
- There are only three pre-approved haulers who can discharge FOG at the Gresham WWTP.
- The FOG is for digester gas production enhancement ONLY.
- FOG is not to be placed in the liquid stream process.
- FOG acceptance is limited to the amount the plant can hold and use to produce digester gas.
- FOG shall be tested as required in the plan.
- All loads will have manifests, and all records will be maintained by the plant supervisor.

While DEQ is approving the proposed program, the Gresham WWTP is remains responsible for meeting permit limits at all times. Accordingly, we caution you to be aware of the impact the FOG digestion may have on the production and treatment of ammonia in the plant. The Oregon Environmental Quality Commission adopted revisions to Oregon’s water quality criteria for ammonia on January 9, 2015. Generally, they are more stringent than the current criteria.

If you have any questions regarding this letter, please call me at (503) 229-5310.

Sincerely,

Michael Pinney PE
Senior Water Quality Engineer

Cc: Jeff Maag, City of Gresham

Ecc: Tiffany Yelton-Bram, NWR WQ

CITY OF GRESHAM

Department of Environmental Services
1333 N.W. Eastman Parkway
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January 28, 2015

Michael Pinney
Northwest Region
Oregon Department of Environmental Quality
2020 SW 4th Avenue, Suite 400
Portland, OR 97201

RE: City of Gresham WWTP Hauled Waste Plan
Permit Number: 102523 File Number: 35173

Dear Mr. Pinney,

Attached is our hauled waste plan as required by our NPDES permit for your review.

If you have any questions or comments regarding this please contact me at 503.618.3454.

Sincerely,

Alan Johnston

Alan Johnston, P.E.
Senior Engineer

CITY OF GRESHAM, OREGON
HAULED WASTE PLAN
FOR THE
GRESHAM WASTEWATER TREATMENT PLANT

Submitted for ODEQ review and approval, January 28, 2015

NPDES Permit No. 102523

File No. 35173

Prepared for:

State of Oregon

Department of Environmental Quality

Water Quality Division

Prepared by:

CITY OF GRESHAM

Department of Environmental Services

Wastewater Services Division

(503) 661-3000

Contact:	**Alan Johnston**	**Site Address:**	**20015 N.E. Sandy Blvd.**
	(503) 618-2431		**Portland, OR 97230**
	alan.johnston@greshamoregon.gov		**Multnomah County**

Introduction

The City of Gresham currently accepts only one hauled waste at the City of Gresham Wastewater Treatment Plant (WWTP) – Fats, Oil and Grease (FOG). This plan outlines how the City receives and controls the delivery of FOG and safeguards the operation of the plant. The FOG is injected directly into the anaerobic digesters – this is a well-established technology which is becoming more common at WWTPs across the country.

Facility Information

The City owns one wastewater treatment plant (WWTP) located at 20015 NE Sandy Blvd, Gresham, Oregon in Multnomah County. The WWTP receives domestic, commercial and industrial waste from incorporated areas of Gresham, Wood Village and Fairview as well as a few small sections of the City of Portland.

The WWTP is currently operated under contract by Veolia Water North America Operating Services, LLC. The contract commenced on July 1, 2005 and now extends through June 30, 2017. In general, the Contract Operator is responsible for all operations, maintenance and management duties required to ensure efficient and effective operation of the facility and eight related pump stations. The City is responsible for operating and maintaining the collection system and outfall, rates and rate setting, as well as meter reading and managing and enforcing the industrial pretreatment program. The City is also responsible for new sewer connections, long term system and area-wide planning and reviewing and authorizing expenditures from the City's Repair and Replacement Fund as well as capital replacements and upgrades for the WWTP. NPDES and air permitting is also the City's responsibility, as is the associated reporting such as the Biosolids, Industrial Pretreatment Program and Stormwater Annual Reports.

The designed average dry weather flow of the WWTP is 20 million gallons per day (MGD). Actual flows during the 2014 dry season averaged 11.1 MGD and during the 2014 wet season averaged 13.7 MGD. The peak flow design capacity is 75 MGD. The wastewater processed is 80 percent domestic, 10 percent commercial, and 10 percent industrial.

The WWTP utilizes a secondary wastewater treatment system with activated sludge and anaerobic digestion. The City has two anaerobic digesters, a primary digester and a secondary digester. Dewatering is achieved by use of two belt filter presses. Disinfection is accomplished with sodium hypochlorite and sodium bisulfite. Treated effluent is discharged into the Columbia River through an outfall diffuser. The City applies dewatered biosolids to agricultural sites in Oregon.

The WWTP is fairly unique in Oregon because it has a FOG Receiving Station. The FOG Receiving Station is designed to receive FOG from tanker trucks, then mix it and heat it to 90 degrees F before injecting it directly into the anaerobic digesters. There is a wash down area where the trucks connect to the station with their 4” camlock hose, which is designed to direct any spills or washdown water to the plant process.

Injection of the FOG into the digesters basically doubles biogas production. The biogas is directed to two cogen engines, which generate enough electrical power to make the plant energy net zero. Currently, the plant feeds a maximum of approximately 15,000 gallons of FOG per day to the digesters to avoid overloading the digesters. The operators avoid overloading the digesters by tracking gallons of FOG received and injected, and also by watching operational parameters such as the volatile acids / alkalinity ratio of the sludge in the digesters. Attached is the Feasibility Study for the FOG Receiving Station which contains further technical background information.

Sources and Types of Waste and Hauler Authorization

The FOG that the WWTP receives comes from two sources: restaurant and deli greasetraps, and industrial food manufacturing plants. All FOG received at the plant is delivered by one of the three haulers that are contracted by the City to deliver FOG to the WWTP.

The three haulers were selected through a public request for proposals (RFP) process. The long term contracts outline the requirement that the City has for the haulers regarding quantity of FOG received (approximately 10,000 to 15,000 gallons per day total for all haulers combined), quality of FOG (total solids between 3% and 10%) and accountability (must be in the regional FOG Preferred Pumper program and must provide manifests).

Testing the Waste

Plant operators take a combined sample out of the FOG tank daily to check the homogeneous characteristics of the FOG at that time. The samples are tested for pH, volatile solids and total solids. As outlined in the contracts with FOG haulers, plant operators also have the right to randomly sample FOG trucks as they arrive at the plant.

Any new source of industrial food manufacturing FOG undergoes rigorous testing prior to testing it in the actual digesters. The parameters tested are: volatile solids concentration, water content, ash content, biological oxygen demand, chemical oxygen demand, total kjeldahl nitrogen, ammonia, total phosphorous, soluable phosphorous, oils and grease, volatile fatty acids, pH, alkalinity, and trace metals.

Following successful review of the analytical test results, industrial food manufacturing FOG is then tested in the digesters – typically the load is increased from 1,000 gallons / day up to the maximum daily volume in 1,000 gallon increments over the course of several days. If no negative side effects to the digester are detected, then the material is accepted and can be brought to the facility at any time by the hauler.

Manifesting and Billing

The FOG Receiving Station is operated by the haulers using a card key system which identifies which hauler and truck has dropped a load. The system is highly automated, so plant operators are not normally involved in the process. Drivers for all FOG haulers receive training on proper operation of the system and are aware that they are to deliver only FOG in trucks used exclusively for handling FOG.

The control system automatically produces a daily report which is emailed to haulers and plant staff which documents the number and size of loads delivered by each hauler the previous day.

Haulers email the City their manifests on a regular basis. The manifests document the source and volumes of FOG delivered, as well as the date and time the FOG was removed from the grease trap and when it was delivered to the WWTP.

Attachment 1: Photos of FOG Receiving Station

FOG RECEIVING STATION

HOOKING UP HOSE TO UNLOAD A 5,000 GALLON LOAD OF FOG

Attachment 2: Feasibility Study of Digester Grease/Food Waste Injection System

Final Report

Feasibility Study of Digester Grease/Food Waste Injection System

Wastewater Treatment Plant Process Improvements Pre-Design

Contract No. 3009

Prepared for

City of Gresham, Oregon

December 2009

Prepared by
CH2MHILL
2020 SW 4th Ave, Suite 300
Portland, OR 97201

Project No.: 390239.01.06

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Acronyms and Abbreviations

BETC	Business Energy Tax Credit
BOD	biochemical oxygen demand
Btu	British thermal unit
COD	chemical oxygen demand
cp	centipoise
ELA	engineering, legal, and administrative
FOG	fat, oil, and grease
hp	horsepower
HRT	hydraulic retention time
kW	kilowatt
kWh	kilowatt-hour
lb	pound
mgd	million gallons per day
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
NREL	National Renewable Energy Laboratory
SCF	standard cubic feet
SWD	side water depth
TSS	total suspended solids
VS	volatile solids
VSS	Volatile suspended solids
VS/TS	volatile solids per total solids
WWTP	Wastewater Treatment Plant

Executive Summary

Purpose

The feasibility of developing an electrical cogeneration system at the Gresham Wastewater Treatment Plant (WWTP) using fat, oil, and grease (FOG) and food waste from restaurants and food processors in the Portland metropolitan area was evaluated to determine if the project would be economically viable.

FOG discharges can be categorized as brown or yellow FOG. This study addresses the codigestion of brown FOG with primary sludge and thickened waste activated sludge in existing anaerobic digesters at the Gresham WWTP. Brown FOG is collected in grease traps after food waste enters the wastewater stream. Brown FOG typically contains 90 to 97 percent water. Yellow FOG is waste material collected before it enters the wastewater stream and is a high value waste because it can be readily recycled into biodiesel. Yellow FOG is generally not available for codigestion with WWTP biosolids.

The City of Gresham completed this evaluation in partnership with the Oregon Business Development Department, who provided a grant for this study.

Findings

A new cogeneration system fueled by digester gas produced from the codigestion of FOG and food waste would be economically viable based on a combination of avoided power costs, tipping fees, Business Energy Tax Credit (BETC), and Energy Trust incentive payments, if at least 7,000 to 11,000 gallons of FOG were codigested each day at the Gresham WWTP, BETC tax credits were available from a pass-through partner, and a tipping fee of at least $0.03 per gallon was collected. The project is estimated to have a simple payback period of 7 years or less.

A FOG receiving station with a 395 kW cogeneration facility receiving and processing a total volume of 17,000 gallons of FOG and food/dairy waste per day is estimated to cost $3.7 million to construct and $60,000 to operate annually (2009 dollars), with maintenance expenditures of $200,000 at years 10, 20, and 30. The $ 3.7 million includes the FOG receiving station, additional cogeneration capacity (assumed use of internal combustion engines) inside a new building, and electrical improvements that would enable use of the additional generated electricity in the upper plant.

The existing digesters have sufficient hydraulic and volatile solids capacity to accept 17,000 gallons of additional waste per day. The existing digesters are currently loaded at approximately 50 percent of their capacity (without redundancy—both digester tanks in operation). The FOG additions would increase solids loading by 40 percent, resulting in the load increasing to 70 percent of total digester capacity. Effective mixing will be essential to assure dispersal of FOG throughout the digester. The digester mixing system improvements being undertaken by the City under a separate project are essential for the successful codigestion of FOG in the existing digesters.

Codigestion of 17,000 gallons of FOG and food waste daily is estimated to produce between 77,400 standard cubic feet (SCF)/day and 140,000 SCF/day of additional digester gas, depending on volatile solids content. The lower estimate is based on a volatile solids concentration of 2.7 percent and the higher estimate is based on a volatile solids content of 6.7 percent. Combined with the estimated 29,100 SCF/day excess digester gas currently being flared, total estimated digester gas production available to power a new cogeneration unit is between 106,500 SCF/day and 169,100 SCF/day. The fuel value of the digester gas measured by Gresham is 575 Btu/SCF. At the lower volatile solids content, methane produced by codigestion of FOG would probably fuel a 250 kW cogeneration unit. At the higher concentration, the codigestion of FOG would probably fuel a 395 kW cogeneration unit.

Codigestion of FOG and high fat food waste may have little impact on biosolids production at the Gresham WWTP. Some research shows that codigesting high fat wastes with primary and secondary sludge results in more efficient digestion and slight reductions in biosolids production.

The impact on greenhouse gas emissions from the WWTP resulting from receiving and digesting FOG is anticipated to be negligible assuming that the majority of the methane produced is contained and utilized to produce electricity and/or heat. Net overall greenhouse gas emissions (including outside of the WWTP fence line) are expected to decrease because the emissions that would have resulted from the FOG and food waste processing and disposal (typically to a landfill) would not occur.

Market Survey

A market survey was conducted to determine the volume of FOG available to Gresham for codigestion. The market survey included interviews with six FOG haulers and analysis of ten samples collected by Gresham staff for this study. The two largest of the six haulers declined to provide estimates of the quantities of FOG those haulers process to prevent the release of competitive data. The remaining four haulers estimate that they collect 330,000 gallons of FOG monthly, which is approximately 11,000 gallons per day. In addition for FOG, substantial quantities of high fat content liquid wastes are produced by dairies and similar food processing facilities in the Portland Metropolitan area. These food wastes could supplement the FOG that is available. Most FOG and dairy waste is dewatered and then landfilled. The haulers reported paying tipping fees of $0.06 to $0.15 per gallon. It is assumed that 6,000 gallons per day of food waste would supplement the 11,000 gallons of FOG for a total of 17,000 gallons per day.

Sampling conducted by Gresham for this study showed that the availability and strength of FOG are highly variable. For example, the average volatile solids concentration of the ten samples collected for this study was strongly affected by one sample, which raised the average from 2.7 to 6.7 percent. CH2M HILL measured similar FOG strengths in studies conducted for the Hampton Roads Sanitation District in Virginia and Johnson County Wastewater in Kansas. In those studies, the total solids content of FOG averaged 4 to 5 percent and the solids were almost all volatile solids. In both studies, the volume of FOG available each day and solids content of the FOG varied substantially from day-to-day.

Gresham has been contacted by a FOG hauler interested in constructing a FOG receiving station at no cost to the City of Gresham in exchange for exclusive use of the facility. The hauler indicated that its market study indicated that quantities similar to those estimated for this study would be available to Gresham for codigestion.

The quantity of FOG and similar food wastes available for codigestion is likely to increase as regulations prohibiting the discharge of FOG are more stringently enforced. Nationally, most successful FOG codigestion programs are coupled with strong enforcement of regulations prohibiting the discharge of FOG to sanitary sewers.

Financial Analysis

Financial analyses of 26 cogeneration alternatives were completed to determine the sensitivity of the project to FOG availability and strength, avoided power costs, Oregon Business Energy Tax Credits, tipping fees, and Energy Trust Biomass-to-Energy incentive payments. In addition, the impact of having a private entity construct and contribute a FOG receiving station was evaluated. From this evaluation it was determined it is likely to be economically feasible to produce up to 395 kW of additional electrical power and hot water containing 60 million British thermal units (MMBtu)/day of additional heat at the Gresham WWTP by codigesting FOG and food waste in the existing anaerobic digesters. The largest positive impacts on financial viability were produced by tipping fees and ability to use tax credits.

The effect of FOG availability on financial viability of the project was evaluated by calculating the net present value for two FOG concentrations bracketing the range of solids concentrations measured in the samples collected by Gresham; FOG volumes of 6,000 gallons per day (gpd), 11,000 gpd, and 17,000 gpd; pass-through BETC; sale of renewable energy certificates; and a tipping fee of $0.03 per gallon. Figure ES-1 shows the results of that evaluation. For this combination of revenue sources, the threshold volume of FOG making the project economically viable was 7,000 to 11,000 gallons per day.

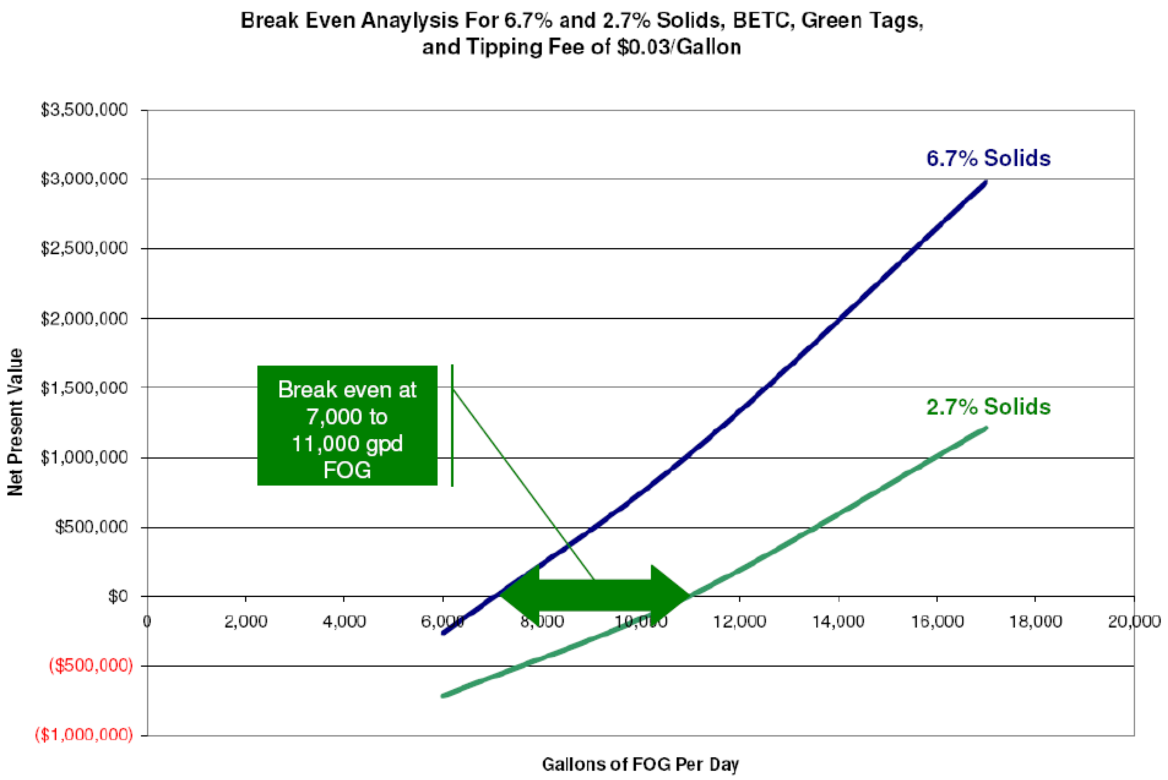


FIGURE ES-1
Impact of FOG Availability on Financial Viability

The FOG receiving station and cogeneration unit could be financed from a combination of sources including avoided power costs, tipping fees paid by FOG haulers, Oregon BETC, sale of renewable energy certificates, and Energy Trust biomass-to-energy incentive payments covering above-market costs. The avoided electrical power cost is estimated to be approximately $190,000 per year in 2009 dollars. A 250 kWh cogeneration unit would generate slightly less power, producing an avoided power cost of $130,000 per year.

FOG haulers in the Portland Metropolitan area currently pay tipping fees of $0.06 to $0.15 per gallon for the disposal of FOG. FOG haulers have indicated that the choice of disposal sites is driven by price and logistics. The financial analyses indicate that a tipping fee of $0.03 per gallon or more, coupled with tax credits and sale of renewable energy certificates, would make the project financially viable.

The Oregon BETC allows organizations who pay taxes to take a tax credit of up to 50 percent of allowable costs for biomass-to-energy project. A municipality can pass the tax credit through to a business partner in exchange for a lump sum payment. The lump sum payment is 42.5 percent of eligible project costs as of January 1, 2010. The financial analyses conducted for this study show that the BETC pass-through is an important part of financing the new cogeneration unit.

The new cogeneration unit produces renewable energy. The above-market cost of renewable energy is traded using renewable energy certificates. The market for renewable energy certificates is currently quite volatile and varies with the sources of renewable energy. Kip Pheil of the Oregon Department of Energy estimates that biomass-to-energy renewable energy certificates currently can be sold for $6 to $7 per megawatt-hour, for estimated total annual revenue of $20,800 per year for the 395 kW cogeneration unit.

Energy Trust may contribute an incentive payment covering above market costs for biomass-to-energy projects. The amount of the incentive payment is determined on a case-by-case basis based on analysis of project revenues, tax credits, and costs. In initial discussions, Energy Trust representatives indicated that additional discussions would be needed to determine the amount and timing of a possible incentive payment and therefore no Energy Trust incentive payment has been included in the financial scenarios.

Table ES-1 summarizes the financial analysis of the project based on a tipping fee of $0.03 per gallon, BETC, avoided power costs, and sale of renewable energy tax credits. Based on these factors, the project is estimated to have a payback period of 7 years or less.

TABLE ES-1
Project Financial Summary—FOG Receiving Station and Cogeneration Unit
395 kW Cogeneration Unit and FOG Receiving Station, 17,000 gallons FOG and Food Waste/day, 6.7% Solids

Item	Value
Estimated capital cost (2009 dollars, accuracy of +50% to -30%)	($3,700,000)
Possible Business Energy Tax Credit	$1,573,000
Net capital cost after BETC	($2,127,000)
Estimated power cost savings (based on avoiding purchase of 3,014,000 kWh annually at $0.063/kWh)	$190,000
Estimated annual tipping fees at $0.03/gallon	$133,000
Estimated annual sale of renewable energy credits	$20,800
Net annual income	$343,800
Estimated annual operating cost	($60,000)
Periodic maintenance at years 10, 20, and 30	($200,000)
Simple payback period	7 years

Recommendations

Based on the favorable preliminary findings of this evaluation, the City of Gresham should continue to investigate the possibility of codigesting FOG and food waste in its existing digesters. Because the availability and strength of FOG and food waste are highly variable, Gresham should consider proceeding in phases. The first phase would construct the FOG receiving facility to verify the availability, strength, and handling characteristics of the waste before committing to the electrical/cogeneration system improvements that would be necessary to take advantage of the additional digester gas production. Subsequent phases would design and construct a cogeneration system using gas production data obtained by operating the receiving station.

Initially, to encourage FOG haulers to bring their waste to the WWTP, it may be advisable for the city to charge a reduced, below-market tipping fee. Gresham should also investigate the possibility of forging agreements with FOG haulers to establish regular and reliable sources of FOG. In the future, after the program has gained some footing and its acceptance among food waste producers is better known, the City may wish to increase tipping fees that can be adjusted based on how it affects the supply of FOG to the WWTP.

If Gresham implements a FOG and food waste cogeneration program, it will be important to prevent unwanted material from being discharged to the FOG receiving system. Gresham should limit FOG deliveries to grease trap pumpage collected by haulers participating in the Preferred Pumper Program. In addition, the hauler should be required to maintain written records indicating the source of the waste for each load.

SECTION 1

Purpose

The City of Gresham is committed to economically viable, sustainable, “green” asset management as well as an overall goal of attaining energy independence from grid power within the WWTP fence line. Based on these commitments, the WWTP is making significant strides in reducing its reliance on outside energy by improving energy efficiency and implementing renewable energy opportunities. The City’s goal for the WWTP is to go beyond reducing the need for purchased power to achieve energy independence. To realize this ambitious goal, the City of Gresham is considering creative and innovative approaches, such as cogeneration powered by FOG and food waste.

This report documents an evaluation of the feasibility of expanding the existing cogeneration system at the Gresham WWTP by receiving and anaerobically digesting FOG and food wastes produced by restaurants, cafeterias, fast-food outlets, dairies, bakeries, and other food processors. The Gresham WWTP currently anaerobically digests biosolids to produce methane, which is used to generate electrical energy for use inside the plant, and hot water, which is used to heat the digesters and other facilities at the plant. Existing digester capacity at the Gresham WWTP would be used to produce additional methane gas supplying a new cogeneration unit, producing additional electrical energy and hot water.

The City of Gresham is working in partnership with the Oregon Business Development Department, who provided a grant for this study, to complete the evaluation.

SECTION 2

FOG and Food Waste Available to the Gresham WWTP

This section summarizes the quantities and characteristics of FOG and food waste available in the Portland metropolitan area for cogeneration at the Gresham WWTP.

2.1 FOG from Grease Traps and Grease Interceptors

FOG discharges from restaurants, fast food outlets, and food processors are controlled by installing grease traps. Trap contents are pumped into tank trucks for disposal. According to a survey conducted by the National Renewable Energy Laboratory (NREL) in 1998, in communities requiring grease traps, the average amount of FOG collected is 13.4 pounds per person. The second type of FOG consists of petroleum-based oil and grease discharges to wastewater collection systems; these discharges are controlled by pretreatment programs and are not part of this evaluation.

FOG discharges from restaurants, fast food outlets, and food processors can be categorized as yellow or brown FOG. Yellow FOG is waste material collected before entering the wastewater stream. Yellow FOG is collected and utilized by biodiesel producers. Brown FOG is material that has been discharged to sanitary sewers. Brown FOG contains water and other contaminants.

Historically, when brown FOG was discharged to wastewater collection systems it caused blockages, sewage spills, and back-ups. FOG entering wastewater treatment plants potentially caused foaming, coating of equipment, and degradation of process performance. All of this drained budgets, manpower, and other resources. However, with current approaches, what was once a problem for wastewater treatment plants is being turned into a viable and sustainable energy resource. FOG collected from grease traps can be fed directly into anaerobic digesters at a wastewater treatment plant to produce methane, which can be used to power a cogeneration system.

Using the per capita FOG generation estimated by NREL in 1996, restaurants within the City of Gresham could generate 1.34 million pounds of FOG annually, based on its population of 100,000. Depending on its strength, FOG from Gresham could produce 5 to 16 million cubic feet of digester gas annually, with fuel value of up to 9.7 billion Btu. This is enough fuel for a 100 kW or larger cogeneration unit at the WWTP. Gresham could potentially draw on FOG produced in the eastern part of the metro area to increase the energy produced from FOG. However, CH2M HILL has found that the NREL estimates overstate the quantities of FOG actually generated by a community. Since FOG availability and concentration vary, local information about the strength and availability of FOG is essential to evaluate the viability of a FOG cogeneration project.

How FOG is managed varies from municipality to municipality. Some cities have rigorous FOG programs, others none at all. On the east coast, FOG is often collected and disposed of at the local wastewater treatment facility. The FOG is either routed directly to the headworks, incinerated, or used as part of a composting program. In California, several municipalities have successfully installed FOG and food waste receiving facilities and are feeding FOG and food waste to digesters to increase biogas production. Riverside, Millbrae, Oxnard, and East Bay Municipal Utility District (MUD) are among the municipalities that successfully codigest FOG with wastewater treatment plant sludge.

2.2 Plumbing Code Requirements and the Preferred Pumper Program

Food establishments are required by code to have grease traps and/or interceptors installed downstream of all kitchen sinks to collect FOG and also to regularly clean and maintain these traps. But, these codes have not always been enforced. Recently, sanitary districts and municipalities are beginning to understand and, more importantly, quantify the costs and disadvantages associated with the lack of enforcement. Five wastewater providers in the metro area, Wilsonville, Troutdale, Gresham, Clean Water Services, and Clackamas Water Environment Services, have formed the Preferred Pumper Program (PPP) to establish criteria for companies that clean and maintain grease traps/interceptors. These companies are occasionally referred to as haulers or pumpers. The goal of this program is to minimize FOG discharged to wastewater collection systems. Although the City of Portland is currently not part of the PPP, they actively monitor the program and may join in the future.

In addition to establishing requirements for the FOG pumpers, FOG program coordinators and inspectors from the districts and municipalities have been tasked to educate food establishments regarding the importance of best management practices to minimize FOG in the sanitary collection system as well as enforce the existing plumbing codes. In Gresham, there are currently 314 food establishments within the city limits. Approximately 130 of these food establishments (40 percent) do not have grease traps and or grease interceptors and discharge FOG to the wastewater collection system. As these restaurants change owners, expand, or renovate, the City of Gresham requires installation of grease traps and grease interceptors. However, this process takes time and it will take several years of monitoring, educating, and enforcement to establish a more inclusive FOG program. Nationally, most successful FOG programs depend on strong enforcement of ordinances prohibiting the discharge of FOG to sanitary sewer systems.

The six major grease trap/interceptor pumpers in the Portland metro area are part of the PPP and have agreed to follow the requirements outlined in the program. The companies in the PPP include Pro-Pump Sanitary Solutions, Metro Rooter Plumbing, Darling International, Baker Commodities, Oregon Oils, and River City Environmental. These FOG haulers have clean-out contracts across the region and are not limited to just the Portland metro area. As a member of the PPP, the companies are promoted and recommended in the metro area to new and existing food establishments by the FOG program coordinator and inspectors.

2.3 FOG Quantities

Currently in the Portland Metro area, each grease trap/interceptor pump-out company is responsible for disposing the FOG it collects. In the Metro area, local wastewater treatment plants do not typically accept FOG for treatment and the disposal methods are not regulated. Consequently, each business attempts to minimize the costs associated with FOG disposal and each has a slightly different approach.

As part of this study, six clean-out contractors in the PPP were contacted to discuss current disposal methods, estimated quantities, and to gauge its interest in a local FOG receiving station. Several of the contractors were willing to discuss their business operations, while others chose not to discuss their business models for proprietary reasons.

Four of the six major FOG pumpers have their own treatment facilities, while two of the pumpers truck their waste to Pacific Powervac for disposal. Pacific Powervac operates wastewater treatment facilities in Portland, Oregon, and in Tacoma, Washington. Waste materials from wastewater treatment operations, industrial operations, and commercial operations are treated, processed, and discharged directly to the City of Portland sanitary sewer system.

Table 2-1 presents information obtained from the FOG haulers, including the contractor name, quantities (if provided), current treatment approach, and costs (if provided). The four pumpers who were willing to provide quantities pump an estimated total of 330,000 gallons of FOG from grease traps each month in the Metro area. Less than 5 percent of the FOG collected in the Metro area is estimated to come from Gresham.

2.4 Competition for FOG

Until recently, trap grease has been a waste to be disposed of, but municipalities and the private sector are becoming interested in developing beneficial uses for FOG. In the Portland area, Gresham, Clean Water Services, and Water Environment Services are evaluating construction of FOG receiving stations. Wastewater providers with available digester capacity or plans to build digesters see the collection of FOG waste as an easy way to increase biogas production. Because there may be competition for FOG, it is critical to maintain contact with FOG pumpers to develop strategies and methods that will entice them to bring their FOG waste to the City of Gresham. The key driver for FOG pumpers is cost of disposal as measured by the tipping fee.

TABLE 2-1
FOG Hauler Details

Criteria	Pro-Pump	MRP	Darling	Baker	River City	Oregon Oils
Dewatered?	Yes, with lime and polymer	Yes, with lime and polymer	Yes, with lime and polymer	Yes, with lime and polymer	No	No
Current Disposal Method	Landfill (sent to Metro South Transfer Station in Oregon City)	Landfill ((sent to Metro South Transfer Station in Oregon City)	Portion used for biofuel, portion landfilled	Trucked to Seattle for internal uses	Trucked to Pacific Powervac for treatment	Trucked to Pacific Powervac for treatment
Treatment Costs	$0.06/gallon	$0.08/gallon	NA	$0.09/gallon	~ $0.15/gallon	~ $0.12/gallon
FOG Collection: % of Business	> 95%	~ 35%	NA	10 to 15%	~ 35%	NA
Mixed Loads?	No	Yes	No	No	No	No
Monthly Quantity	80,000 gallons	80,000 gallons	NA	120,000 gallons	50,000 gallons	NA
Open to a FOG Receiving Station?	Yes	Yes	Yes	No	Yes	No
% of Business in Gresham	< 5%	< 5%	NA	< 5%	< 5%	NA

2.5 FOG Characteristics

The physical and chemical characteristics of FOG are highly variable. FOG waste characteristics were evaluated by collecting five samples from each of two grease trap pumpers in June 2009. In total, ten samples were collected by Paul Kramer of the City of Gresham. The difficult nature of FOG is illustrated by the Figure 2-1 photographs of samples being collected at Pro-Pump and Darling. Columbia Analytical Services analyzed the samples for total solids, volatile solids, chemical oxygen demand, pH, total oil and grease, nonpolar oil and grease, and viscosity. In addition, three samples were obtained of dewatered FOG produced at each of the two pumpers. The samples were collected at the pumpers' facilities as the trucks were being unloaded.

At Pro-Pump

At Darling

FIGURE 2-1
Collecting FOG Samples
Photographs courtesy of Paul Kramer, City of Gresham Wastewater Division

Table 2-2 summarizes sampling results for FOG before it was dewatered and also provides values for comparison from a literature survey and from sampling for a project being designed for Johnson County (Kansas) Wastewater by CH2M HILL. The composition of FOG samples collected by Gresham varied substantially from truckload to truckload and even within a single truckload. For example, in 10 truckloads of FOG, total solids concentrations ranged from 0.1 percent to 41.8 percent. (Where multiple samples were taken from a single load, the analytical results were averaged per truckload.) The variation between truckloads was assessed by averaging the data with and without the high values for total solids. One sample with a total solids concentration of 41.8 percent increased the average total solids concentration by a factor of 2.4 from 2.74 to 6.65 percent. The variation in concentration in a single truckload was assessed by collecting samples at the beginning, midway, and end of discharge at the receiving facility. Total solids concentrations varied by a factor of three in one truckload, from 27,600 to 89,200 milligrams per kilogram (mg/kg) during the course of discharging 3,000 gallons of FOG. Total solids concentrations varied by a factor of four in a second truckload, from 20,500 to 93,200 mg/kg during the course of discharging 3,000 gallons. A FOG receiving station should include facilities to receive, store, blend or fractionate, and transfer FOG to the digesters, equalizing the peaks and valleys in volume and concentration from load-to-load. After fractionating into FOG-rich and FOG-lean fractions, the FOG-rich fraction can be fed to the digesters and the FOG-lean portion can be combined with wastewater entering the plant.

TABLE 2-2
Gresham FOG Sample Results June 2009—Before Dewatering

Constituent	Values Reported in Literature	Johnson County Wastewater (Average, Minimum, Maximum)	Gresham FOG Samples Before Dewatering[a, b, c, d, e] (Average, Minimum, Maximum)
Total solids	5.4%	4% average 0.9 to 7.8%	6.65% average 0.1 to 41%[f]
Volatile solids percent of total solids	90%	84.5% average 68.2 to 97%	91% average 84 to 99%
pH	-	4.5 average 3.6 to 4.8	5.1 median 4.2 to 6.5
COD	242,000 mg/L	112,500 mg/L average 14,600 to 203,400 mg/L	1,089,000 mg/kg average 2,070 to 2,220,000 mg/kg
Total oil and grease	-	> 22,500 mg/L average 4,390 to 61,000 mg/L	10,000 mg/L average 490 to 17,000 mg/kg
Nonpolar oil and grease	-		6,992 mg/kg average 10 to 45,967 mg/kg
Viscosity	-	1.7 cp median	1.59 cp median 1.4 to 249,000 cp

[a] Gresham collected five samples from Pro-Pump and five samples from Darling.

[b] FOG came from grease traps and grease interceptors at restaurants, grocery stores, and assisted living facility

[c] Multiple values for same truckload were averaged together.

[d] Samples were collected as trucks discharged at receiving facility.

[e] Considerable variation was noted as trucks discharged. For example, total solids concentrations varied from 92,400 to 20,500 mg/kg in three samples collected from the same load as one truck discharged.

[f] One sample with total solids concentration of 418,000 mg/kg raised the total solids average from 2.74% to 6.65%.

cp = centipoise
mg/kg = milligrams per kilogram
mg/L = milligrams per liter

Table 2-3 summarizes sampling results for FOG after it was dewatered by the FOG pumper. When compared to FOG that has not been dewatered, dewatered FOG generally has a much higher solids concentration and a slightly lower percentage of volatile solids. The pH of lime-treated FOG is much higher, chemical oxygen demand (COD) concentration are higher, oil and grease concentrations are much higher, and the material is more viscous. These characteristics indicate that dewatered material may be difficult to handle using pumps and piped conveyance. Lime-treated FOG may have a high proportion of inert material that may interfere with operation of the digesters.

TABLE 2-3
Gresham FOG Sample Results June 2009—Dewatered Samples Compared to Samples Before Dewatering

Constituent	**Gresham Dewatered FOG Samples (Average, Minimum, Maximum)**	**Gresham FOG Samples Before Dewatering[a, b, c, d] (Average, Minimum, Maximum)**
Total solids	31.1% average 14.7 to 61.0%	6.65% average 0.1 to 41%
Volatile solids per cent of total solids	81.0% average 75.3 to 89.6%	91% average 84 to 99%
pH	12.1 median 5.04 to 12.3	5.1 median 4.2 to 6.5
COD	2,265,833 mg/kg average 1,220,000 to 3,170,000 mg/kg	1,089,000 mg/kg average 2,070 to 2,220,000 mg/kg
Total oil and grease	274,600 mg/kg average 93,000 to 860,000 mg/kg	10,000 mg/L average 490 to 17,000 mg/kg
Nonpolar oil and grease	203,000 mg/kg average 79,000 to 620,000 mg/kg	6,992 mg/kg average 10 to 45,967 mg/kg
Viscosity	249,000 cp at 24.9˚C median 249,000 cp to not readable	1.59 cp median 1.4 to 249,000 cp

[a] Gresham collected 3 dewatered samples from Pro-Pump and 3 dewatered samples from Darling
[b] FOG was dewatered using pumper
[c] High pH reflects lime treatment at Darling; Pro-Pump samples had pH of 5.04.
[d] Dewatered samples came from different loads than samples before dewatering.

cp = centipoise
mg/kg = milligrams per kilogram
mg/L = milligrams per liter

2.6 Food Waste

Restaurants, cafeterias, grocery stores, bakeries, and dairies produce large quantities of food waste, which are disposed of in landfills or composted. An alternative to land filling is source separating and anaerobically digesting the waste using existing digester capacity at a wastewater treatment plant. The methane produced by the digesters can fuel a cogeneration facility. The U.S. Environmental Protection Agency (EPA) supports codigestion of food wastes using available digester capacity, and maximizing the energy recovery from waste food streams. The benefits of codigestion include increased biogas production, energy production, collection of tipping fees from waste haulers, and reduction in greenhouse gas emissions from landfills.

Food wastes vary greatly in their potential to produce methane when codigested with municipal wastewater sludge. Food wastes high in fats and oils, such as wastes from vegetable oil manufacturing and processing of foods with high oil concentrations such as salad dressings or mayonnaise, produce large volumes of methane when codigested with municipal wastewater sludge. Other food wastes, such as vegetable wastes, fruit wastes, and dairy whey are likely to produce smaller volumes of methane.

Food wastes vary in consistency and suitability for feeding to municipal WWTP anaerobic digesters. Depending on its physical characteristics, food waste may need to be processed by screening, grinding, emulsifying, blending with more liquid wastes, or dewatering, to prevent clogging of digester piping, pumps, and mixing equipment. Some wastewater treatment plants have had good success with source separation to remove metal, paper, and plastic items from food wastes before they are transported to the WWTP. If the food waste must be processed at the wastewater treatment plant, the processing adds a great deal of complexity. It would be better to limit food waste to pretreated liquids having near neutral pH. Liquid food wastes could be received, stored, and metered to the digesters similar to the methods used to feed FOG.

The quantity of residual biosolids produced after anaerobic digestion of food wastes also varies. For example, vegetable and fruit wastes tend to have more nondigestible inert solids, and wastes from vegetable oil producers and salad dressing manufacturers tend to have lower concentrations of inert material.

CH2M HILL has investigated the availability of sources of food waste in the Portland Metro area. The potential sources of food wastes other than FOG include:

- Food processing waste, such as that from Boyd Coffee and Townsend Farms
- Dairy waste
- Waste food from food distribution centers
- Institutional food waste

2.6.1 Food Processing Waste

CH2M HILL contacted Boyd Coffee and Townsend Farms to obtain information about the quantities of waste generated by the two firms.

Boyd Coffee operates a food processing facility immediately south of the Gresham WWTP. The wastes from the facility include citric acid, cocoa, sugars, milk solids, beef fat, and chicken fat. These wastes combine to form two waste streams, one from the citric acid, and another from the food production and cleaning wastes. Boyd Coffee staff indicated that the majority of the food production and cleaning waste is sugar. The waste stream containing citric acid is neutralized. Wastewater from the facility is stored in two 1,500 gallon tanks, one for each waste stream after passing through a coarse screen. The screened wastewater is tested for biochemical oxygen demand (BOD), total suspended solids (TSS), pH, metals, organics, and toxic chemicals before being discharged to a City of Gresham sanitary sewer. In 2008, daily wastewater discharge averaged 2,100 to 2,200 gallons containing approximately 47 pounds of suspended solids (2,600 to 2,700 mg/L) after screening. Boyd Coffee was unable to provide an estimate of the quantity of screenings discharged each day. Additional testing would be needed to assess methane production from the screenings.

Townsend Farms is a seasonal producer of food products. The wastewater discharge from the facility varied from a low of approximately 134 gallons per day to a high of 1.8 million gallons per day (mgd) in 2008. During the peak month, Townsend Farms discharged 13,500 pounds (lb) of BOD and 2,447 lb of suspended solids to the Gresham WWTP. The wastewater passes through a rotary screen with 0.02 inch openings. During the peak season, the facility produces approximately 3,000 lb/day of screenings that are removed and disposed offsite by River City. The screenings are primarily fruit wastes. Additional testing would be needed to assess methane production from the screenings.

Methane production from codigesting food processing wastes depends on the waste being digested. Wastes from vegetable oil manufacturing plants and salad dressing manufacturing plants could generate as much methane per pound of solids as FOG. Food processing wastes containing mostly fruit peelings and pulp could be expected to generate about 25 percent to 50 percent of the methane generated by the same weight of FOG solids, and would also increase biosolids production. The impact on digested biosolids would need to be verified from actual operations.

2.6.2 Dairy Waste

Several dairies in the Portland area produce 2,500 to 3,000 gallons of waste sludge each day from the production of milk, cheese, and other dairy products. The waste is currently trucked for disposal in lagoons or landfills. Staff members at the dairies report that the sludge is high in milk fat, but the solids concentrations and fat content are unknown. The dairies have indicated that they would haul their wastes to a wastewater treatment plant for disposal if the disposal costs were lower than existing disposal options. There are several large dairies in the Portland area, including the Safeway Supply Operations Milk Facility in Clackamas, the Kroger Swan Island Dairy in Portland, the Alpenrose Dairy in Portland, Sunshine Dairy Products in Portland, and Yo Cream in Portland.

Dairy wastes vary in their fat content. For example, dairy waste might consist of whey from cheese manufacturing or wastes higher in fat produced by ice cream production or disposal of off-specification product. Whey contains proteins and lactose, but very little fat. The solids content of whey is about 6.5 percent. About 70 percent of the solids consist of lactose, 10 percent proteins, 11 percent minerals, 4 percent non-proteinaceous nitrogen compounds, 3 percent lactic acid, and 2 percent fats. In addition, whey is acidic with a pH of 4.5 to 6.6, and alkalinity may need to be added to raise pH and increase gas production. Dewatering whey may improve gas production. Dairy waste with higher fat concentrations is likely to produce more methane per pound of solids.

Since the fat and solids content of dairy waste is likely to vary substantially from dairy to dairy, sampling would be needed to determine the solids concentration and fat content of waste from a particular plant.

2.6.3 Waste Foods from Distribution Centers

Several grocery store distribution centers consolidate produce waste from their stores. Produce waste can be expected to produce about one-quarter to one-third of the methane per pound of solids that codigestion of FOG would produce. Produce waste is 100 percent solids, however. Produce waste would need to be processed to remove metal, plastic, and wood and would need to be ground and screened to reduce the material to a size that could be fed to Gresham's digesters. It would also need to be blended with other liquid wastes or water to facilitate feeding into the digesters. The codigestion of produce in Gresham's digesters is likely to increase biosolids production.

2.6.4 Institutional Food Waste

Several utilities successfully codigest food waste from institutional food service operations such as college cafeterias. The waste may be contain plastic, paper, wood, and metal, which need to be removed from the waste stream before grinding the food waste and feeding it to the digesters. Food waste may also contain paper and cardboard. These materials can be removed by source separation or by screening and other separation processes installed as part of a food waste receiving station. The amount of methane produced by codigestion of institutional food waste and reported in literature waste varies from 50 percent to 100 percent of that produced by digesting a similar weight of FOG solids.

SECTION 3

Existing Gresham WWTP Facilities

FOG and food waste could be codigested using existing available capacity in anaerobic digesters and biosolids processing equipment at the Gresham WWTP. Addition of FOG and food wastes to the digesters may require the installation of mixing equipment in the secondary digester. Additional biosolids processing equipment is not likely to be needed, although existing equipment may need to be operated for longer periods each day, depending on the type and quantity of waste added to the digesters.

The codigestion of FOG is not likely to increase the production of residual solids from the digesters. The codigestion of food wastes may increase the production of residual solids from the digesters.

The WWTP employs a suspended media activated sludge process treating domestic, commercial, and industrial wastewater from incorporated areas of Gresham, Wood Village, and Fairview. Figure 3-1 is a diagram illustrating the process arrangement at the Gresham WWTP. Figure 3-2 shows the location of major unit processes at the WWTP.

Programs eliminating FOG discharges to the wastewater system often reduce the volume of scum collected in primary and secondary clarifiers. By separating FOG from wastewater at its source and injecting it directly into the digesters, wastewater treatment plant operations may be streamlined.

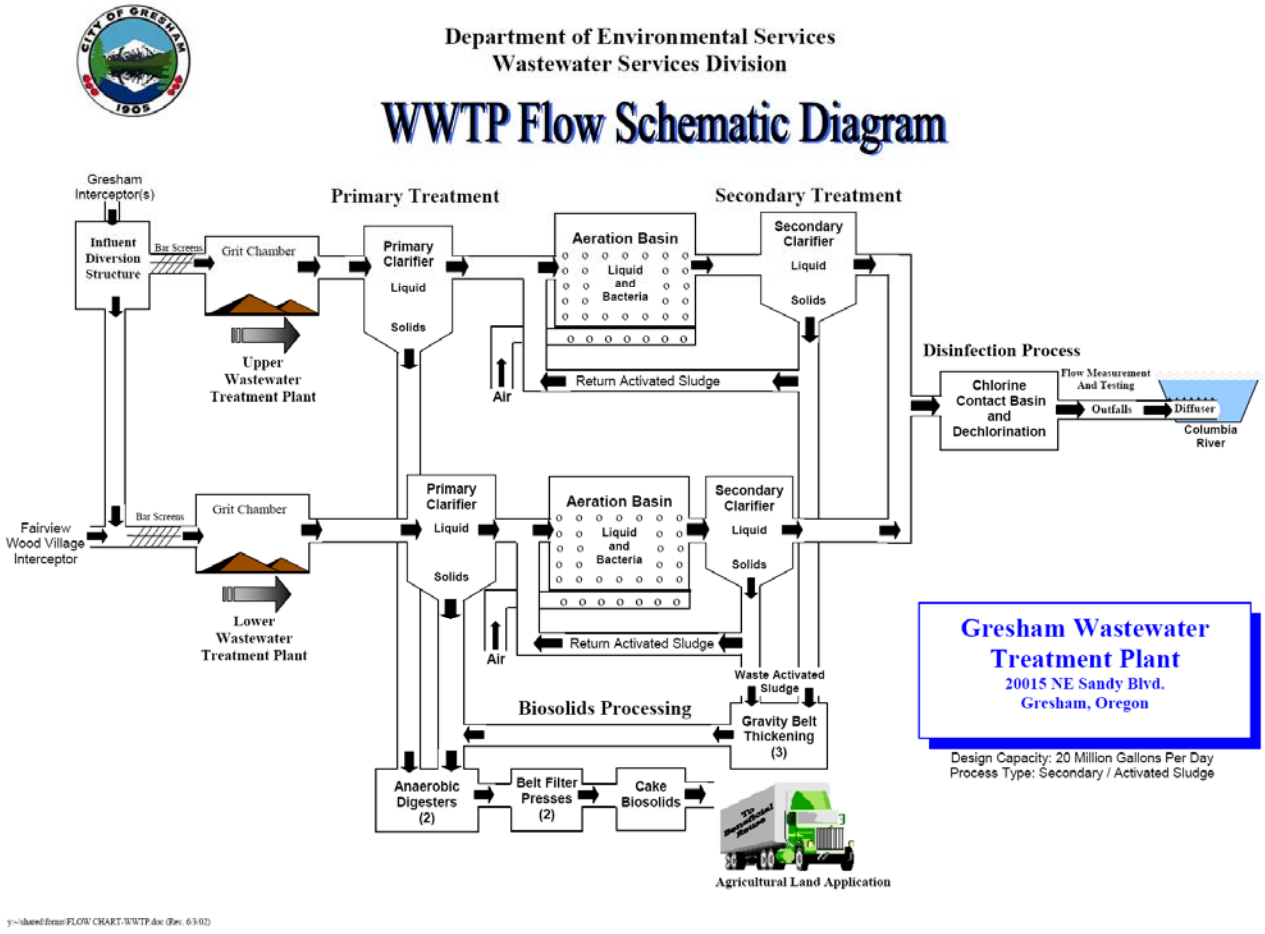
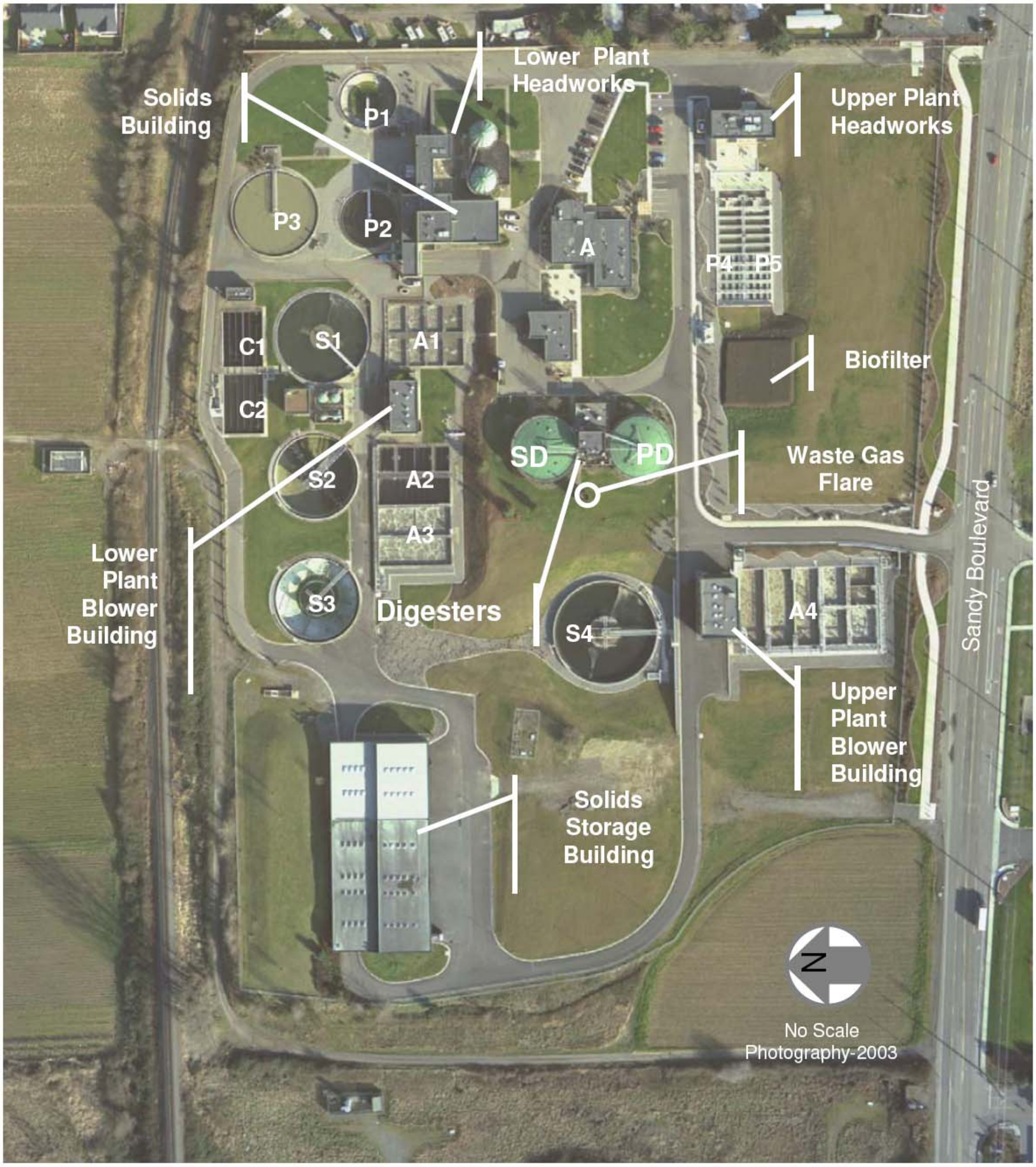


FIGURE 3-1
Gresham WWTP Flow Schematic Diagram



Key

P1 - Primary Clarifier 1-5
A1 - Aeration Basin 1-4
S1 - Secondary Clarifier 1-4
C1 - Chlorine Contact Basin 1-2
PD - Primary Digester
SD - Secondary Digester
A - Administration Building

FIGURE 3-2
Gresham WWTP Site Layout

The WWTP is divided into upper and lower liquids process streams. Solids from the upper and lower plants are processed together. The major components of the existing treatment facilities include screening, grit removal, primary clarification, secondary aeration tanks, secondary clarification, disinfection using sodium hypochlorite, dechlorination, sludge thickening using gravity belt thickeners, anaerobic digestion, dewatering of digested sludge using belt filter presses, biosolids storage, and biosolids reuse by local land application.

Based on an analysis of unit processes at the plant performed by CH2M HILL for the 2004 Master Plan Update, the capacity of existing facilities at the Gresham WWTP is 23.7 mgd (maximum wet weather month), with the limiting unit processes at the plant being aeration basins and secondary clarification. The plant is permitted as a 20 mgd facility. The plant currently operates at approximately two-thirds of its capacity. For example, for the period from 2004 through 2008, the annual average influent flow rate ranged from 11.6 mgd in 2008 to 12.9 mgd in 2005, the average dry weather flow varied from 10.1 mgd to 12.9 mgd in 2005, and the wet weather average month varied from 13.0 mgd in 2004 to 15.4 mgd in 2006.

Solids from the treatment system are digested in primary and secondary anaerobic digesters. Table 3-1 summarizes operational data for the digesters. Primary sludge is pumped from the bottom of the primary clarifiers to the primary digester at solids concentration of approximately 5 percent to 7 percent and a volatile solids concentration of 80 percent to 87 percent. Activated sludge from the aeration basins, is routed to the secondary clarifiers for settling of the sludge. Waste activated sludge from the secondary clarifiers is pumped to gravity belt thickeners for dewatering and then pumped to the primary digester at 5 percent to 7 percent solids. Approximately 80 percent to 85 percent of the solids are volatile solids. The remainder of the activated sludge is returned directly to the aeration basins as return activated sludge. Primary sludge and thickened waste activated sludge are mixed in the primary digester where stabilization, volatile solids reduction, and methane production occurs. Hydraulic detention is currently 35 to 55 days, depending on the WWTP influent flow rate and waste activated sludge production. Temperatures in the primary digester range from 93 to 96 degrees Fahrenheit (°F). Current volatile solids reduction is 55 percent to 65 percent. The digesters are currently operated in series with the primary digester overflowing to the secondary digester. The primary digester operates at a constant level.

The secondary digester is normally used as a sludge holding tank to store sludge until it is sent to belt filter presses for dewatering and beneficial reuse. As a result, the operating level in the secondary digester varies. Only the primary digester is currently heated and mixed.

The digesters were designed to operate at a hydraulic retention time of 20 days and a volatile solids loading of 0.15 pound of volatile solids per cubic foot per day. Plant records show that the existing digesters processed approximately 42,000 gallons of biosolids each day with a solids concentration of 5 to 7 percent from April 2008 through May 2009. Based on the capacity of primary digester, hydraulic loading averaged 84 percent of design capacity and volatile solids loading averaged 98 percent of capacity. During this 12 month period, the volatile solids loading varied from a low of 71 percent to a maximum of 119 percent of the design capacity of the primary digester.

TABLE 3-1
Gresham WWTP Anaerobic Digester Information

Item	Value
Primary Digester—Mesophilic, fixed cover, fixed depth, overflow to secondary digester, completely mixed (gas mixing)	
Dimensions	80 ft diameter, 27 ft SWD operating depth
Primary digester operating volume	1,000,000 gallons
Operating temperature (monthly average May 2008 to April 2009)	90.7˚F to 98.0˚F
Capacity of primary digester at 0.15 lb VSS/ft^3/day	20,053 lb VSS/day
Capacity of primary digester at detention times of 20 and 15 days	50,000 to 66,667 gallons/day
Secondary Digester—Floating cover; generally unheated but insulated roof; generally not mixed but mixing equipment is in place; used for storage, settling, and decanting supernatant	
Secondary digester operating SWD	14 to 26 ft, average 20 to 25 ft
Secondary digester operating volume	977,600 gallons
Operating temperature (monthly averages May 2008 to April 2009)	87.8˚F to 94.4˚F
Capacity of secondary digester at 0.15 lb VSS/ft^3/day	19,600 lb VSS/day
Capacity of secondary digester at detention time of 20 to 15 days	48,880 to 65,173 gallons/day
Performance at Existing Loads	
Volatile solids removal (annual average)	60% average; 57.3% minimum; 64.7% maximum
Gas production per lb VSS removed	12 to 15 SCF/lb VSS removed
Solids concentration leaving digesters	2% average; 1.8% minimum; 2.6% maximum
Sum of capacities of digesters at 0.15 lb VSS/ft^3/day	39,658 lb VSS/day
Sum of capacities of digesters at detention time of 20 to 15 days	98,800 to 131,840 gallons/day
Current Loadings (May 2008 through April 2009)	
Average primary digester HRT (from pant records)	24 days
Hydraulic load (calculated from reported HRT)	42,000 gallons/day
% of available capacity utilized based on hydraulic load and 20-day HRT if only primary is used	84%
% of available capacity utilized based on hydraulic load and 20-day HRT if primary and secondary are used	43%
Actual VSS load	19,637 lb/day average; 14,269 lb/day minimum; 23,762 lb/day maximum
% of available capacity based on VSS/day if only primary digester is used	98% average; 71% minimum; 119% maximum
% of available capacity based on VSS/day if sum of primary and secondary digester capacity is used	50% average; 36% minimum; 60% maximum

HRT = hydraulic retention time
SCF = standard cubic feet
SWD = side water depth
VSS = volatile suspended solids

If the total capacity of the two digesters is considered, the digesters were loaded at approximately 43 percent of their hydraulic design capacity and approximately 60 percent of their volatile solids design capacity. The secondary digester would need to be heated and mixed to fully utilize its capacity. The City is considering installing new mixing systems in the digesters. These improvements will aid in more complete digestion of the existing biosolids feed and future FOG/food waste streams.

The digested solids are dewatered using belt filter presses, and then stored and land applied. The belt filter presses are currently operated 8 hours each day. Additional biosolids processing equipment is not likely to be needed. The codigestion of FOG with primary sludge and thickened activated sludge often improves digestion and reduces the volume of biosolids produced by the digesters. The impact of codigesting FOG can best be assessed by operating a pilot program to verify the impact of FOG on biosolids production.

Codigestion of FOG and food wastes with primary sludge and thickened waste activated sludge in the existing digesters at Gresham will increase the volume being fed to the digesters from 42,000 gallons per day to 59,000 gallons per day, an increase of 40 percent. With the proposed project, the digesters will continue to operate within their design hydraulic and volatile solids loading. Good mixing will be essential in both digesters to prevent the FOG from forming a scum layer on top of the liquid in the digesters. The quantity of biosolids produced by the digesters may increase, depending on the nature of the material being processed. Some studies have indicated that the codigestion of FOG may increase the production of digester gas with minimal increases in residual solids volumes.

SECTION 4

Current Energy Use at the Gresham WWTP

Energy use and production at the Gresham WWTP from May 2008 through April 2009 is summarized in Table 4-1. The plant used a total of 5,790,000 kilowatt-hours (kWh) of electrical power during that period and 2,030 therms of natural gas. The existing cogeneration system produced 2,776,000 kWh of power during that period, using 53,200,000 cubic feet of digester gas. Plant staff estimates that approximately 9,000,000 cubic feet of the digester gas was flared during that same period. The cogeneration system produced 48 percent of the electrical power used at the WWTP during the period. The heat recovered from the cogeneration system was used to heat the digesters. The WWTP purchased the remainder of the electrical power from Portland General Electric Company (PGE) at an average cost of $0.093 per kWh, which includes a voluntary wind power source fee of $0.01 per kWh and demand charge. The energy cost component of electrical power purchases from PGE without wind power and demand charges is estimated to be approximately $0.063 per kWh.

As part of its cogeneration operations, Gresham has measured the fuel value and CO_2 content of its digester gas. The fuel content of the gas is 575 Btu per cubic foot, which is consistent with values reported in other studies. The gas is approximately 36.6 percent CO_2.

TABLE 4-1
Energy Use and Production at Gresham WWTP—May 2008 to April 2009

Item	Value	
Total electrical power used at Gresham WWTP during 12-month period	5,790,000	kWh/12 months
Power produced by 395 kW cogeneration unit during 12-month period	2,776,000	kWh/12 months
Power purchased from PGE during 12-month period	3,014,000	kWh/12 months
Cost of power purchased from PGE during 12-month period	$280,768	
Cost of natural gas purchased from NWN during 12-month period	$2,482	
Natural gas purchased from NWN	2,030	therms
Digester gas used to power cogeneration unit during 12-month period	53,200,000	SCF/12 months
Digester gas flared	Unknown	
Gas use for cogeneration at full duty	174,500	SCF/day
Gas use per kWh (average)	20	SCF/kWh
Existing cogeneration unit running % of time (average)	88%	
Energy content of digester gas (measured)	575	Btu/SCF
CO_2 content digester gas (measured average)	36.6%	

SECTION 5

Proposed FOG and Food Waste Receiving Station

With the proposed project, the FOG and food waste will be collected by commercial haulers and discharged to a receiving station at the Gresham WWTP. FOG waste can be difficult to handle due to potentially high viscosity, variations in solids content, presence of debris, and potential for odors. Liquid food wastes, such as dairy waste, have handling characteristics similar to FOG, but other food wastes might arrive in a solid form and need to pass through a grinder before being fed to the digesters. In addition, the quantity of FOG and food waste available to Gresham could vary depending on the tipping fee and convenience to FOG haulers.

Because of these uncertainties Gresham may want to construct a pilot-scale facility to verify the availability of FOG before committing to additional cogeneration and electrical facilities. The pilot-scale facility will be designed to be expandable as the supply of FOG develops and to accept FOG and liquid food wastes such as dairy wastes, but not solids, such as institutional food waste or vegetable and fruit processors.

During the design of a FOG receiving station for Johnson County Wastewater, CH2M HILL visited WWTPs with existing FOG receiving stations to identify the components needed for a successful installation. In addition, CH2M HILL reviewed the design of other facilities. Based on these investigations, it was determined that a FOG receiving station should be designed to temporarily mix and store FOG in heated tanks before being fed into the digesters at a steady, equalized rate. The station should provide grinding. Sufficient storage needs to be provided to accommodate variations in the frequency of delivery and to store FOG over weekends to even out loading on the digesters. Load tracking should be provided to make collection companies responsible for the quality of material delivered to the unloading station. The system should be designed to contain odors and route the collected air through an air treatment control system.

CH2M HILL has also reviewed design requirements for the FOG receiving station with Liquid Environmental Systems (LES), a FOG hauler interested in entering the Portland grease pumping market. LES favors a FOG receiving station with a large, unheated tank with a single chopper pump recirculating FOG. LES believes that using an unheated tank with a chopper recirculation pump results in FOG particles being dispersed throughout the storage volume.

Figure 5-1 is a process flow diagram showing the major components of the FOG receiving station. Figure 5-2 is an aerial photograph showing the proposed location of the FOG facility. The proposed design criteria and features of the pilot-scale FOG receiving station with expansion provisions include:

- **Design capacity**—The FOG facility will be designed to accept three 3,000-gallon truckloads each day, with provision for expansion to six 3,000-gallon truckloads each day. While the total supply is estimated to be approximately 11,000 gallons per day, the delivery of FOG proved to be somewhat erratic during the sampling effort for this study. Some grease traps are pumped on a regular schedule and others are pumped only when needed. It will be necessary to accommodate the unloading schedule of the grease haulers to build and sustain a source of supply. A truck will be able to unload only when there is sufficient storage space available for the entire truckload. Initially, one 10,000-gallon tank and pumping system will be installed. A second 10,000-gallon tank and pumping system will be installed as the supply increases.

- **Materials that will be accepted**—The receiving station will be designed to accept FOG and other liquid wastes, such as dairy wastes.
- **Truck unloading pad**—The truck unloading pad will be a concrete pad big enough to contain a vacuum truck. It will be sloped to drain to the plant drain system. The loading area will allow unloading of one vehicle at a time, and will be open during the day shift, 5 days a week, with possible after hours discharge available on an emergency basis.
- **Quick-connect**—Trucks will unload by connecting to a quick-connect hose connection at the unloading station. The coupling will be protected by bollards.
- **Power washer**—The unloading station will be equipped with a dedicated power washer to wash down the truck and truck unloading area. The wash water will be collected by the sloped concrete pad and will drain to the plant drains system and will be conveyed to the headworks.
- **Grinding**—An in-line grinder will be provided to prevent debris, rags, and large grease balls from clogging the pumps and piping.
- **Transfer pumping and grinding**—300 gallons per minute (gpm) at 20 feet total dynamic head (TDH) rotary lobe pumps will be provided to transfer the waste to storage tanks. The pump will also be used to circulate FOG through heat exchangers.
- **Storage**—One 15,000 gallon vertical insulated polyethylene or fiberglass storage tank will be provided with odor control on the tank vents. A second tank would be installed at a later time.
- **Mixing**—The tanks will be mixed by dual-purpose rotary lobe pumps. The pump will also be used for truck unloading. FOG will be circulated through heat exchangers and grinders using this pump. Flushing connections will be provided throughout the piping.
- **Heating**—Two heat exchangers using hot water from the cogeneration system will be provided to maintain the FOG at 80˚F in the storage tanks.
- **Odor control**—A 55-gallon carbon canister will be used to control odors from the tank.
- **Digester feed pumps**—Variable speed progressive cavity pumps will be used to pump the wastes to the digesters. The capacity of each pump will be 2.5 to 40 gpm at 40 feet TDH.

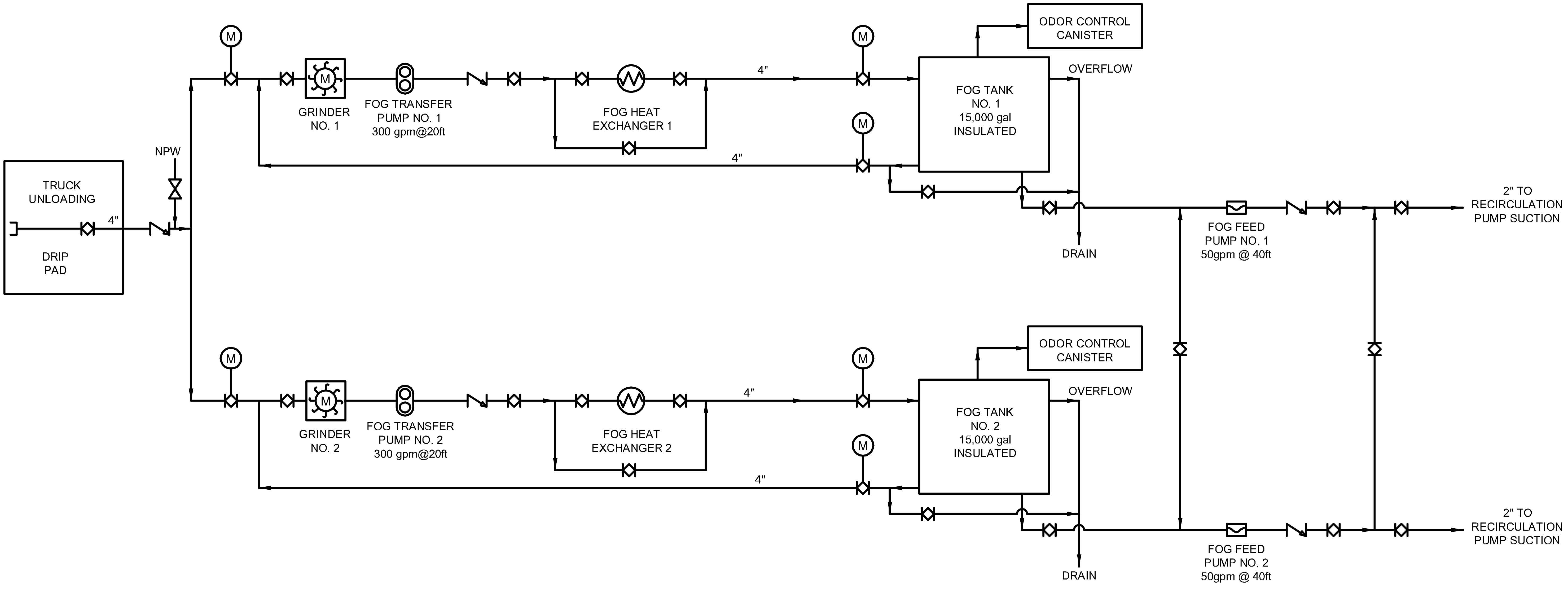


FIGURE 5-1

PROCESS FLOW DIAGRAM
FOR RECEIVING STATION

CH2MHILL

FOG System Improvements Include:
- 50 ft X 26 ft Covered Truck Unloading Pad
- Catch basin and drain
- Quick-connects for unloading
- Power washer
- In-line grinders
- 2 300-gpm Transfer pumps
- 2 15,000-Gallon Storage Tanks
- 395 kW Engine-Generator
- Gas Conditioning Equipment
- Switchegear
- Instrumentation

Figure 5-2
Proposed FOG Codigestion System

- **Electrical and instrumentation**—Associated electrical, instrumentation, and controls will include a magnetic-strip card reader at the off-loading station for the drivers to activate the unloading station and provide load tracking information.
- **Building**—The unloading area, pumps, electrical and instrumentation equipment, heat exchangers, and storage tank will be housed under cover to provide weather protection for the equipment and to limit discharges to the plant drain system. The building will be a steel-framed canopy with a concrete floor slab with clearance of 15 feet for FOG trucks and the storage tanks. The floor slab will be approximately 50 feet by 26 feet. Heated enclosures will be provided for pumps. Piping will be insulated and heat traced.

A single, 6-inch quick connect hose fitting will be provided on the outside of the building for unloading FOG waste from the hauling trucks. A truck-size area around the fill station will be sloped to a catch basin underneath the hose connection, and a high pressure hose will be available for haulers to wash out the truck and surrounding area. Each potential FOG waste pumping company will be pre-approved by Gresham before being allowed onsite. Each driver will be issued a swipe card that will be used for each delivery. Swiping the card through a reader will be required before allowing an unloading cycle to begin. The card reader will record the delivery company, the particular driver, the date and time, and the amount of FOG waste unloaded. Once the card has been swiped and the truck discharge hose connected, the driver will push a button to begin an automated unloading cycle. A programmable logic controller (PLC) will check the beginning fluid level in the tank and determine if there is adequate volume in the tank for an assumed 3,000-gallon delivery. Once the system has verified that sufficient volume is available to unload the truck, the level will be recorded, the pump suction motorized valve will open, the tank recirculation motorized valve will close, and the influent pump will energize. A sensor, either low flow or low pressure, will signal the tank recirculation valve to open and the influent valve to close. The PLC will then record the final tank volume and calculate the volume delivered. An automatic flushing system using plant non-potable water will activate to clean the influent pipe.

Inside the building, an in-line grinder with an integral sediment trap and washout system coupled with a rotary lobe pump will draw FOG from the trucks to fill the storage tanks. A rotary lobe pump will not be subject to losing prime if air is sucked into the pipe from the delivery truck and can run dry. Both of these technical obstacles are problematic for centrifugal chopper type pumps, which were ruled out as an option for the feed pumps. The discharge from the pumps will go through a heat exchanger before entering a storage tank. Initially, there will be one system, consisting of a grinder and pump system, heat exchanger, and high density polyethylene (HDPE) storage tank. The 300 gpm pump will unload a delivery truck in approximately 10 minutes. The tank will provide enough capacity to hold three truckloads. The rotary lobe pumps will also be used for mixing the stored FOG waste. The tank will be fitted with a 2 ½-inch fill nozzle angled tangentially to the inside wall and turned slightly up. This will accelerate the fluid to 20 feet per second and should provide good mixing regardless of water depth. The vent from each tank will be routed to a 55 gallon canister type odor control unit.

The heat exchangers will bring the FOG waste up to a temperature of 80˚F over an 8 hour period. As the supply of FOG increases, additional tank systems can be added. The future capacity will help ensure adequate storage volumes for peak delivery days and allow

Gresham to pump FOG waste to the digesters during non-delivery days. Feed to the digesters will be provided by variable speed progressing cavity pumps with a range from 50 to 2.5 gpm. A suitable alternative to progressing cavity pumps would be rotary lobe type pumps. There will be two FOG waste effluent pipes to the digester, which will provide redundancy should one of the pipes become clogged. The pipes will be insulated, but since the distance from the FOG building to the digester building is short, heat tracing will not be required. Flushing connections will be placed throughout the FOG waste storage and feed system for cleaning.

Gresham may wish to consider alternatives for heating the tanks. Some plants heat FOG to a higher temperature to fractionate FOG into FOG-rich and FOG-lean components. The FOG-rich portion is fed to the anaerobic digesters. The FOG-lean solution is sent to the headworks and combined with wastewater entering the plant. Other plants do not heat the FOG and depend on the recirculation pump to break the FOG into small particles dispersed throughout the storage tank volume.

The unloading area, pumps, electrical and instrumentation equipment, heat exchangers, and storage tank will be housed under a canopy providing weather protection for the equipment and to limit discharges to the plant drain system.

SECTION 6

Potential Digester Gas Production

The gas supply to a new cogeneration system at the Gresham WWTP will draw on existing digester gas that is not currently utilized, gas produced from the codigestion of FOG, and gas that is produced by the codigestion of food wastes, such as dairy wastes. Four potential gas production scenarios are summarized in Table 6. The first scenario is based on using the excess gas that is currently flared plus gas produced by codigesting 6,000 gallons of FOG with a solids concentration of 6.7 percent each day. The second scenario is based on using the excess gas that is currently flared plus the gas produced by codigesting 6,000 gallons of FOG with a solids concentration of 6.7 percent and 3,000 gallons of dairy waste each day. The third scenario is based on codigesting 11,000 gallons of FOG with a solids concentration of 6.7 percent and 6,000 gallons of dairy waste each day. The fourth scenario is based on codigesting 11,000 gallons of FOG with a solids concentration of 2.74 percent and 6,000 gallons of dairy waste each day.

The gas production rates shown in Table 6-1 (provided on next page) are based on volatile solids removal and literature values for gas production for each pound of volatile solids removed. The combination of primary sludge and thickened waste activated sludge digested at the Gresham WWTP produces approximately 15 standard cubic feet (SCF) of digester gas per pound of volatile solids removed. FOG produces approximately 24 SCF of digester gas per pound of volatile solids removed. Dairy waste can be expected to produce approximately 15 SCF of digester gas per pound of volatile solids removed. The Gresham WWTP removes approximately 60 percent of the VSS entering the digesters in sludge from the WWTP. The removal rate for dairy solids is assumed to be similar. It should be noted that these volatile solids loading rates are based on anaerobic digestion of primary and thickened secondary sludge produced by a conventional activated sludge plant. Some studies have shown that the codigestion of FOG with municipal sludge can increase volatile solids loading rates by up to 30 percent if all of the additional volatile solids are derived from FOG.

Codigestion of 11,000 gallons of FOG and 6,000 gallons of dairy waste daily (Scenario 3) would probably produce enough digester gas to power a second 395 kW cogeneration unit at the Gresham WWTP if the average solids concentration of the waste were 6.7 percent. The calculation is sensitive to volume and solids concentration of FOG received at the WWTP. FOG production and concentrations are highly variable, as the sampling conducted by Gresham for this study demonstrated. An average of approximately 11,000 gallons of FOG is available daily for codigestion, but there may be days where no FOG is available, due to the haulers' pumping schedules.

TABLE 6-1
Digester Gas Production Estimates for Four Potential Scenarios with FOG at 6.7 Percent Solids

Scenario	Gas Production	
Scenario 1		
Existing excess digester gas production (approximately 83% of existing gas production is used to power existing cogeneration unit)	29,100	SCF/day
Gas production from codigestion of 6,000 gallons of FOG (6.7% solids, 90% VS/TS, 80% removal, 24 SCF/lb VS removed)	58,000	SCF/day
Total estimated gas production for new cogeneration unit	87,100	SCF/day
Scenario 2		
Existing excess digester gas production (approximately 80% of existing gas production is used to power existing cogeneration unit)	29,100	SCF/day
Gas production from codigestion of 6,000 gallons of FOG (6.7% solids, 90% VS/TS, 80% removal, 24 SCF/lb VS removed)	58,000	SCF/day
Gas production from codigestion of 3,000 gallons of dairy waste (6,5% solids, 80% VS/TS, 90% removal, 15 SCF/lb VS removed)	17,000	SCF/day
Total estimated gas production for new cogeneration unit	104,100	SCF/day
Scenario 3		
Existing excess digester gas production (approximately 80% of existing gas production is used to power existing cogeneration unit)	29,100	SCF/day
Gas production from codigestion of 11,000 gallons of FOG (6.7% solids, 90% VS/TS, 80% removal, 24 SCF/lb VS removed)	106,000	SCF/day
Gas production from codigestion of 6,000 gallons of dairy waste (6,5% solids, 80% VS/TS, 90% removal, 15 SCF/lb VS removed)	34,000	SCF/day
Total estimated gas production for new cogeneration unit	169,100	SCF/day
Scenario 4		
Existing excess digester gas production (approximately 80% of existing gas production is used to power existing cogeneration unit)	29,100	SCF/day
Gas production from codigestion of 11,000 gallons of FOG (2.74% solids, 90% VS/TS, 80% removal, 24 SCF/lb VS removed)	43,400	SCF/day
Gas production from codigestion of 6,000 gallons of dairy waste (6,5% solids, 80% VS/TS, 90% removal, 15 SCF/lb VS removed)	34,000	SCF/day
Total estimated gas production for new cogeneration unit	106,500	SCF/day
Digester Gas Required to Power Cogeneration Units		
Digester gas required to power existing 395 kW cogeneration unit at 575 Btu/SCF	162,000	SCF/day
Digester gas required to power 250 kW cogeneration unit at 575 Btu/SCF	102,000	SCF/day

VS = volatile solids
VS/TS = volatile solids per total solids

Codigestion of 6,000 gallons of FOG and 3,000 gallons of dairy waste daily (Scenario 2) would probably produce enough digester gas to power a new 250 kW cogeneration unit at the Gresham WWTP if the average solids concentration of the waste were 6.7 percent.

Codigestion of 11,000 gallons of FOG and 6,000 gallons of dairy waste daily (Scenario 4) would probably produce enough digester gas to power a new 250 kW cogeneration unit at the Gresham WWTP if the average solids concentration of the waste were 2.74 percent.

Codigestion of 6,000 gallons of FOG and 6,000 gallons of dairy waste daily (Scenario 1) would probably produce enough digester gas to power a new 200 kW cogeneration unit at the Gresham WWTP if the average solids concentration of the waste were 6.7 percent.

SECTION 7

Proposed Cogeneration Unit and Electrical Improvements

The additional methane produced by codigesting FOG will be used to supply a new cogeneration unit. Gresham currently operates a 395 kW cogeneration unit powered by digester gas. The engine-generator is a Caterpillar G3508 with heat recovery. The digester gas passes through a gas conditioning system that removes hydrogen sulfide, siloxanes, and water, and boosts gas pressure. The system includes paralleling switchgear to start the cogeneration unit and switchgear allowing the generator to supply the lower plant without backfeeding the upper plant. The configuration of the existing system and the proposed modifications described below are shown on Figure 7-1.

The existing electrical power distribution system is configured so that the 395 kW Caterpillar biogas engine generator can be started, brought up to speed, synchronized with power from PGE at motor control center MCC-D, and the generator paralleling switchgear circuit breaker closed for operation of the generator in parallel with PGE on the WWTP power distribution system. If the generator power output exceeds the electrical load at MCC-D, the generated power is backfed through the blower building motor control center to the power distribution center (lower plant).

As the total electrical demand at the power distribution center drops below a preset minimum utility import (MUI) value of 20 kW, the output of the biogas engine generator is reduced to maintain the preset MUI level. If the electrical load at the power distribution center drops below the preset MUI, the biogas engine generator is shut down.

Power from PGE is always to flow into the power distribution center via the 2,000 amp main circuit breaker, and biogas engine generator power is never to flow out of the power distribution center into the WWTP 12.47 kV power distribution system.

The addition of a second engine-generator will allow the cogeneration system to serve the upper plant as well. The existing switchgear will be modified to allow power to be transferred back through the existing power circuit from the power distribution center through the existing 1,500 kVA (480-volt to 12.47 kV) transformer and 12.47 kV power distribution system to existing upper plant electrical loads using their existing 12.47 kV to 480-volt transformers.

It is assumed existing motor control center MCC-D has a 600 amp bus (consistent with the MCC-D main circuit breaker rating), which is the rated output of the existing 395 kW biogas engine generator. A new biogas engine generator could be connected at the power distribution center bus, which is assumed to be rated 2,000 amps (consistent with the power distribution center main circuit breaker rating) via a new free-standing “Biogas Engine Generator 2” paralleling switchgear circuit breaker and a power distribution center “Biogas Engine Generator 2” circuit breaker. The MUI setting at the existing power distribution center main circuit breaker intertie protection relay can be disabled to allow power to flow to the upper plant with provisions to trip the power distribution center main circuit breaker if the PGE power source to the WWTP main fused switch is lost.

Though the combined maximum demand at the upper and lower plants will be slightly more than the combined ratings of the existing and new biogas engine generators, it is recommended that a shunt trip or motor operator and intertie protection relay be provided at the WWTP main fused disconnect switch. The intertie protection relay will:

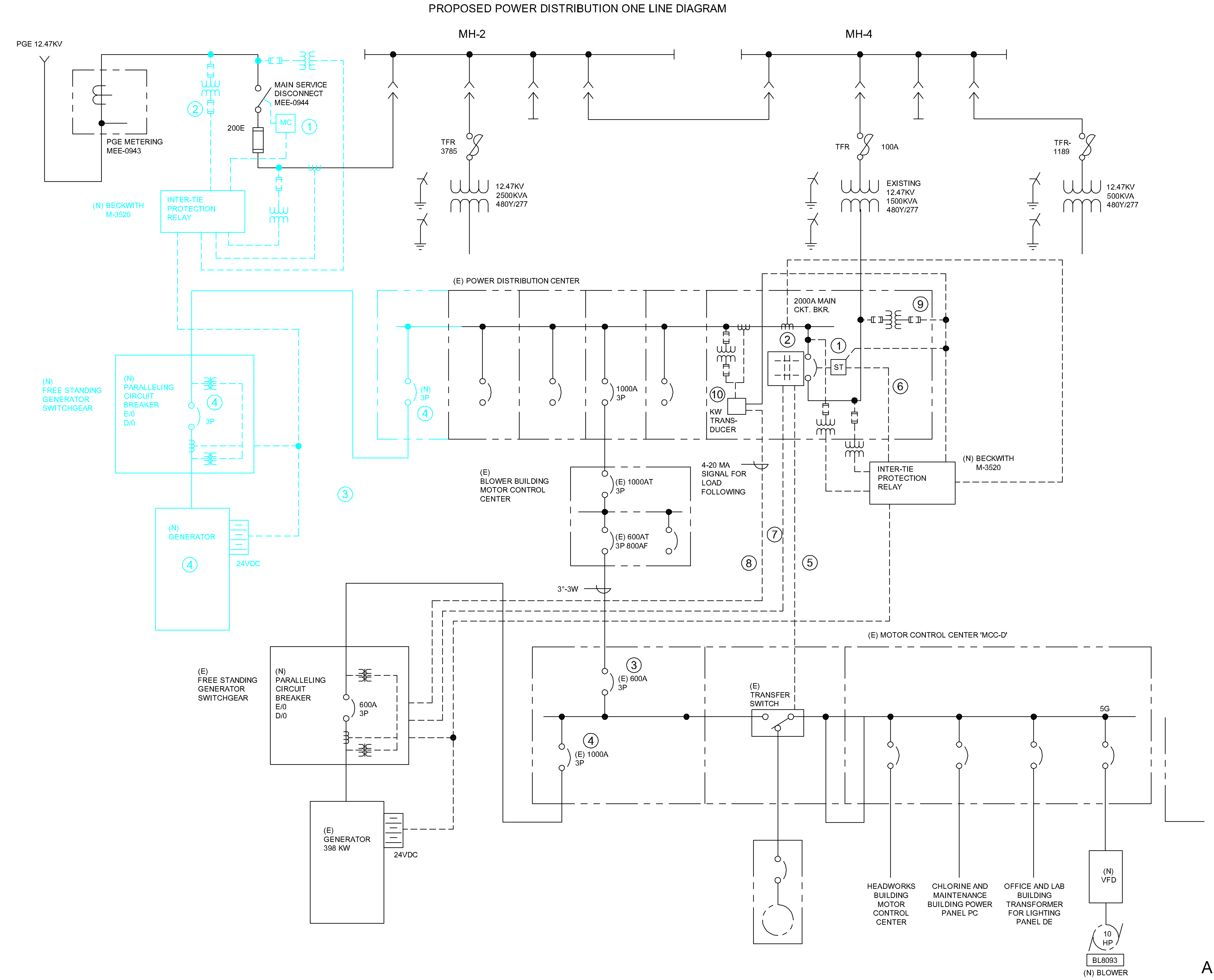
- Detect a loss of PGE power to the WWTP.
- Open the WWTP main fused disconnect switch via the shunt trip/motor operator.
- Open the power distribution center main circuit breaker.

This scenario will allow the lower plant to keep operating, provided there is enough biogas to fuel the engine generator(s) for the current lower plant electrical load. If there is not enough biogas, the headworks, chlorine and maintenance building, and office and lab will be powered by the existing 230 kW standby engine generator. If there is enough biogas, the current lower plant electrical loads can be powered by the biogas engine generator(s). If there is more than enough biogas, upper plant electrical loads can be turned off, the power distribution center main circuit breaker closed, and upper plant electrical loads can be selectively started to the extent the biogas engine generator output rating(s) and the capacity of the available biogas are not exceeded. For the biogas engine generators to operate independent of electric utility power, a “compensation” control and interface needs to be provided between the two biogas engine generator switchgear lineups.

When PGE power to the WWTP is again available, the main fused switch intertie protection relay:

- After a short time delay, can open the power distribution center main circuit breaker, which will interrupt power to the upper plant.
- After a short time delay, close the WWTP main fused switch, which will provide PGE power to the upper plant.
- Ramp down biogas engine generator power output and open the biogas engine generator paralleling switchgear circuit breakers, which will interrupt power to the lower plant.
- After a short time delay, close the power distribution center main circuit breaker, which will provide PGE power to the lower plant.
- Initiate synchronizing the biogas engine generator outputs with the PGE power and closing the biogas engine generator paralleling switchgear circuit breakers for parallel operation of the biogas engine generators with PGE power at both the upper and lower plants.

Final design of the protective relays will need to consider the conversion to net metering that is being installed as part of the solar power installation at the WWTP.



NOTES:

1. PROGRAM BECKWITH OUTPUT CONTACT TO OPEN MAIN SERVICE DISCONNECT SWITCH ON LOSS OF UTILITY.

2. 480V TO 120V AC 200VA CONTROL POWER TRANSFORMER WITH PRIMARY AND SECONDARY FUSING, FOR POWER TO BECKWITH M-3520 AND MOTOR OPERATOR.

3. ITEMS IN BLUE ARE NEW AND PART OF THE REVISIONS PROPOSED IN THE FOG FEASIBILITY STUDY.

4. THE NEW BIOGAS ENGINE GENERATOR, PARALLELING SWITCHGEAR CIRCUIT BREAKER, AND FEEDER CIRCUIT BREAKER ARE CONNECTED TO THE EXISTING POWER DISTRIBUTION CENTER TO AVOID EXCEEDING THE CURRENT RATING OF THE EXISTING MOTOR CONTROL CENTER MCC-D BUS. ENGINE GENERATORS WITH THESE POWER AND CURRENT RATINGS AT 480V, 3-PHASE ARE BEING CONSIDERED:

RATED POWER	RATED KVA AT 0.8 PF	RATED CURRENT
200 KW	250 KVA	300 AMPS
400 KW	500 KVA	600 AMPS
600 KW	750 KVA	900 AMPS

FIGURE 7-1

PROPOSED GENERATION UNIT AND ELECTRICAL IMPROVEMENTS

CH2MHILL

SECTION 8

Estimated Costs of Proposed Project

The capital cost of a new FOG receiving station with a capacity of 17,000 gallons of liquid waste and 395 kW cogeneration facility is estimated to be approximately $3,700,000 (2009 dollars). This is an order-of-magnitude (Class 4) cost estimate as defined by the Association for the Advancement of Cost Engineering (AACE) and adopted by the American National Standards Institute. An estimate of this type is normally expected to be within +50 percent or -30 percent of the actual construction cost. The estimate is summarized in Table 8-1. The capital cost estimate includes 20 percent for contingencies, 25 percent for engineering, legal, and administrative costs (ELA); and 14 percent for management costs. Approximately 40 percent ($1,400,000) of the total cost is for construction of the FOG receiving facility. If Gresham desired to construct just the FOG receiving facility to test the availability of FOG, the capital cost of a 9,000 gallon per day FOG receiving facility including canopy roof, automated card reader, and provisions for expansion is estimated to be $1,000,000 (2009 dollars. A temporary FOG receiving facility suitable for testing the availability of FOG could probably be constructed for $400,000.

TABLE 8-1
Estimated Project Costs—FOG Receiving Station and 395 kW Cogeneration Unit
(2009 Dollars, Budget-Grade Estimates with Expected Accuracies of +50%, -30%)

Item	Estimated Costs
FOG Receiving Station	
Building	
50-ft by 26-ft by 14-ft high steel canopy	$130,000
50-ft by 26-ft by 8-inch concrete slab with grated catch basin and drain piping	$20,000
Lighting panel, lights, and convenience outlets	$8,000
Power washer	$3,000
Pumps and piping	
Two 300 gpm @ 20 ft TDH rotary lobe pumps	$40,000
Two Inline grinders	$40,000
Two Heat exchangers	$30,000
Progressing cavity pumps 2.5 to 50 gpm at 40 ft and variable frequency drive	$50,000
Pump enclosures	$10,000
Bollards	$2,400
Tank fill and heat loop piping insulated and traced, 6 motor operated valves, valves and fittings (100 linear feet 4-inch steel)	$40,000
Hot water piping to and from cogeneration unit (300 linear feet 3-inch insulated and traced)	$18,000

TABLE 8-1 [CONTINUED]
Estimated Project Costs—FOG Receiving Station and 395 kW Cogeneration Unit
(2009 Dollars, Budget-Grade Estimates with Expected Accuracies of +50%, -30%)

Item	Estimated Costs
Digester feed piping insulated and traced (150 ft 3-in pipe insulated and traced)	$9,000
Pump panel and electrical 480 V 3-phase (2@ 5-hp)	$20,000
Two 15,000 gallon HDPE tanks insulated	$30,000
Site electrical (200 ft branch in conduit, 200 ft instrumentation cable in conduit)	$10,000
Instrumentation (Card reader, level sensing, pump controls, valve controls)	$50,000
395 kW Cogeneration System (Assume Installation in 1,000 SF Expansion of Cogeneration Building)	
395 kW engine generator	$350,000
Ancillary equipment	$60,000
Heat recovery equipment	$60,000
Paralleling circuit breaker	$60,000
Intertie switchgear	$200,000
Gas conditioning system (blower, 10-ton chiller, hydrogen sulfide removal vessel, siloxane SAG tanks, stainless steel gas piping, stainless steel heat exchangers, insulated and traced water piping, control panel, wiring and conduit to digester MCC breaker room)	$120,000
Civil/site work	$40,000
Project Subtotal	$1,400,400
Contingencies at 45%	$630,000
Subtotal	$2,030,400
Contractor general condition, mobilization, demobilization, overhead, bonds, and profit at 27%	$548,000
Estimated capital cost	$2,578,400
Engineering, legal, and administration at 25%	$645,000
Subtotal	$3,223,400
Management at 14%	$451,000
Total Estimated Project Costs (2009 dollars, +50% -30%)	$3,674,000
Rounded	**$3,700,000**

The capital costs for a FOG receiving station and 250 kW cogeneration facility are expected to be slightly lower, at $3,200,000. The cost difference would primarily result from the lower price of a 250 kW cogeneration unit and paralleling switchgear. The cost of other electrical improvements and the FOG receiving station for a 250 kW unit are expected to be similar to the costs for a 395 kW unit.

SECTION 9

Financial Analysis

The net present values of 26 alternatives for codigesting FOG with sludge in Gresham's digesters were evaluated. The scenarios vary in FOG and food waste availability, tipping fee, and tax credits and incentive payments. In addition to the savings in energy purchases made possible by the cogeneration system, Gresham may be eligible for an Oregon Business Energy Tax Credit (BETC), incentive payments from an Energy Trust program for biomass-to-energy installations, and payments from the sales of carbon credits. A FOG hauler, Liquid Environmental Systems, has expressed an interest in constructing a FOG receiving station at no cost to Gresham in exchange for the exclusive right to use the FOG receiving station. Spreadsheets summarizing the present value analyses are included in Appendix A to this report.

Figure 9-1 and Table 9-1 summarize the estimated net present values of 26 alternatives for financing 250 kilowatt (kW) and 395 kW cogeneration facilities based on avoided power costs with and without Oregon Business Energy Tax Credits, tipping fees, and possible Energy Trust Biomass-to-Energy incentive payment. Operations and maintenance costs were estimated at $60,000 per year, which is assumed to cover the costs of a 0.5 full-time-equivalent of an operator. In addition, the impact of having a private entity construct and contribute a FOG receiving station was evaluated. From this evaluation it was determined it is likely to be economically feasible to produce up to 395 kW of additional electrical power and hot water containing 60 million British thermal units (Btu)/day of additional heat at the Gresham WWTP by codigesting FOG and food waste in existing anaerobic digesters at the Gresham WWTP.

The analysis summarized in Figure 9-1 and Table 9-1 is based on codigesting a total of 17,000 gallons per day of FOG and high solids food processing waste similar to dairy waste. The analysis included two concentrations of FOG, 2.7 percent and 6.7 percent, bracketing the range of total solids concentrations measured in ten samples of FOG collected by Gresham staff for this study. The analysis period is 30 years and the interest rate was 5 percent. A net present value greater than zero indicates that revenue from the project exceeds project costs, including interest on borrowed money. Sixteen of the 26 alternatives had net present values greater than zero. Tipping fees and ability to utilize the BETC had the largest positive impacts on financial viability.

The BETC program provides a tax credit of 50 percent of eligible project costs for renewable energy resource generation projects constructed in Oregon. The tax credit is taken 10 percent each year over 5 years. Trade, business and rental property owners who pay taxes are eligible for the tax credit. A non-profit project owner can use the tax credit by partnering with an Oregon business or resident who has an Oregon tax liability. A non-profit project owner can transfer the tax liability to its partner for a lump sum payment. Eligible costs include all costs related directly to the project, including design, equipment, materials, supplies, and installation. The Oregon Department of Energy may assist a municipality to identify a business partner who can take advantage of the BETC tax credit. The availability of business partners depends on the visibility of the project, the size of the project and business conditions at the time the project is constructed. The lump sum payment is based on the present value of the tax credit stream to the partner. As of January 1, 2010, Gresham would receive a lump sum payment equal to 42.5 percent of eligible costs.

Energy Trust may offer an incentive payment for biomass-to-energy projects for the above market cost of power produced by the project. Above market costs are the difference between what the power is worth at standard rates and what power from the project actually costs to generate. In its analysis, Energy Trust considers capital costs, yearly operations and maintenance costs, interest on debt, permitting, other upfront costs, and other yearly expenses. Revenues may include power sales, avoided power purchases, tax credits, sales of secondary contracts, and grants.

A biomass-to-energy project will produce carbon credits, which may be sold. The market for carbon credits is uncertain in the short run, with prices varying from $6 to $7 per mega-Watt-hour, (MWh) according to Kip Pheil of the Oregon Department of Energy. A 395 kW generator operating at 95 percent duty will produce approximately 3,200 MWh of energy annually.

The annual savings in electrical power usage were calculated for a 395 kW cogeneration unit and for a 250 kW cogeneration unit. A 250 kW cogeneration unit appears to be the smallest unit available that is powered by an internal combustion engine. Smaller cogeneration systems could use gas microturbines, Stirling engines, or fuel cells. The cogeneration units are assumed to be available 95 percent of the time and to operate at 100 percent load. The avoided cost of electrical power that would be produced by the cogeneration unit was assumed to be $0.063 per kWh, which is the average cost paid by the WWTP for electrical energy purchased from PGE. The wind power and demand components of electrical power purchases from PGE were not included in the avoided costs. The wind energy charge is an elective payment representing an above-market charge. The impact of a biomass-to-energy project on demand charges at the Gresham WWTP is unpredictable. With 95 percent availability for the generators, the WWTP will continue to pay a demand charge based on the 5 percent of the time that the plant is purchasing power from PGE.

A 395 kW cogeneration unit could produce slightly more power than the 3,014,000 kWh the plant currently purchases from PGE, but for this analysis the production was capped at the current electrical power usage at the facility. A 395 kW cogeneration unit could reduce electrical energy purchases from PGE by 3,014,000 per year at an avoided rate of $0.063 per kWh, saving up to $190,000 per year (2009 dollars). A 250 kW unit could reduce power purchases from PGE by up to $138,000 per year (2009 dollars).

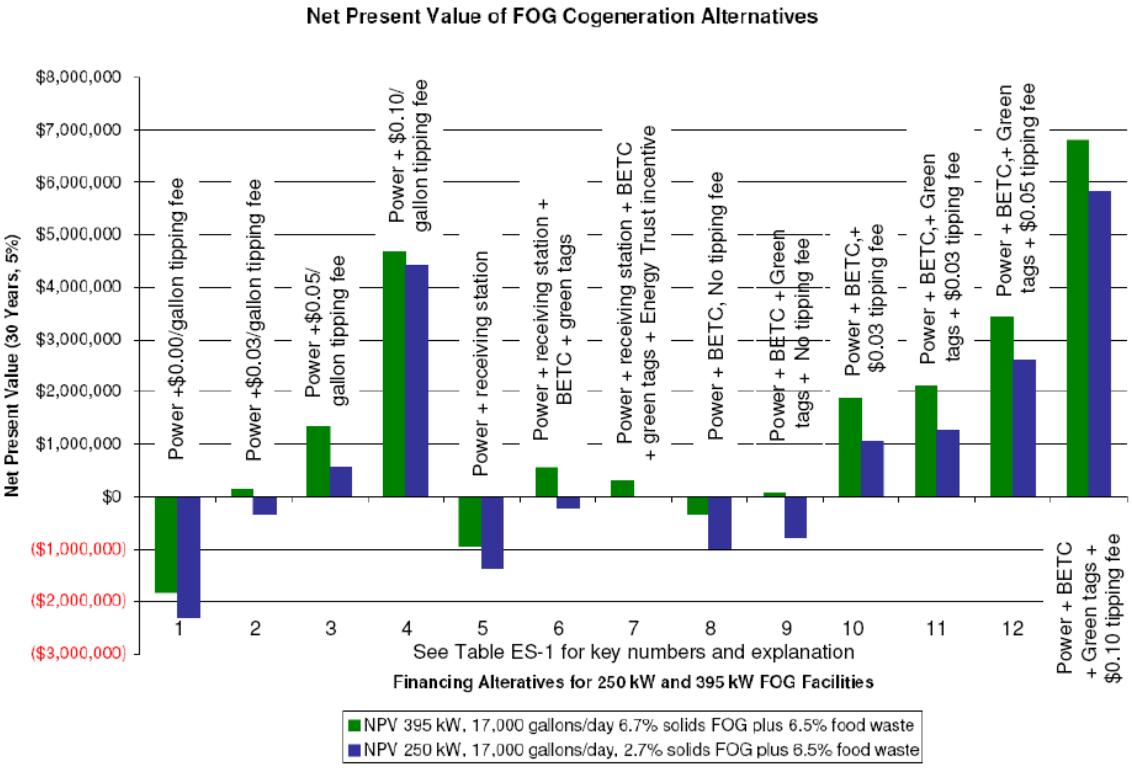


FIGURE 9-1
Comparison of Cost and Revenue Alternatives

TABLE 9-1

Estimated Net Present Values for Combinations of Avoided Power, Tipping Fees, BETC, Green Tag Sales, and Energy Trust Biomass-to-Energy Incentives

Key Number	**Avoided Power Cost**	**Tipping Fee per Gallon**	**Contributed Fog Receiving Station**	**BETC**	**Green Tags**	**Energy Trust Incentive Payment**	**Net Present Value, 30 years @ 5%**	
							17,000 Gallons/day 6.7% FOG Plus 6.5% Food Waste	**17,000 Gallons/day 2.7% FOG Plus 6.5% Food Waste**
Avoided Power Plus Tipping Fee Alternatives								
1	✓	$0.00					$1,824,000	($2,293,000)
2	✓	$0.03					$139,370	($330,000)
3	✓	$0.05					$1,498,294	$576,000
4	✓	$0.10					$4,895,606	$4,426,000
Avoided Power Plus Contributed Receiving Station Alternatives								
5	✓	$0.00	✓				($946,000)	($1,368)
6	✓	$0.00	✓	✓	✓		$542,089	($216,000)
7	✓	$0.00	✓	✓	✓	$216,000	$542,089	$0
Avoided Power Plus BETC and Green Tag Alternatives								
8	✓	$0.00		✓			($317,000)	($983,000)
9	✓	$0.00		✓	✓		$1,700	($783,000)
10	✓	$0.03		✓			$1,977,802	$1,055,000
11	✓	$0.03		✓	✓		$2,297,000	$1,255,000
12	✓	$0.05		✓	✓		$3,656,000	$2,614,000
13	✓	$0.10		✓	✓		$6,796,000	$5,812,000

Table 9-2 summarizes the financial analyses for a 395 kW cogeneration unit and FOG receiving station based on receiving 17,000 gallons of FOG and food waste per day at an average total solids concentration of 6.7 percent. Annual operating costs were estimated at $60,000, with additional periodic maintenance costs of $200,000 at 10 year intervals. Table 9-3 presents a year-by-year cash flow analysis for the project.

TABLE 9-2
Net Present Value—FOG Receiving Station and Cogeneration Unit
395 kW Cogeneration Unit and FOG Receiving Station, 17,000 gallons FOG and Food Waste/day, 6.7% solids

Item	Value
Estimated capital cost (2009 dollars, +50%, -30%)	($3,700,000)
Possible Business Energy Tax Credit	$1,573,000
Net capital cost after BETC	($2,127,000)
Estimated power cost savings (based on avoiding purchase of 3,014,000 kWh annually at $0.063/kWh)	$190,000
Estimated annual tipping fees at $0.03/gallon	$133,000
Estimated annual sale of renewable energy credits	$20,800
Net annual income	$343,800
Estimated annual operating cost	($60,000)
Periodic maintenance at years 10, 20, and 30	($200,000)
Estimated annual principal and interest payment at 5% for 30 years	($120,400)
Estimated annual operating costs and principal and interest payments except years 10, 20, and 30	$180,400
Simple payback period	7 years

TABLE 9-3

Gresham WWTP FOG Codigestion Cash Flow Analysis: BETC

	Expenditures					Avoided Costs, Income, and Tax Credits								
Year	Capital Expenditure	Loan Receipt	Principal and Interest Payment	Annual operations and Maintenance Cost	Sum of Yearly Expenditures	Electrical Power Cost Avoided	BETC Tax Credit	Green Tags	Energy Trust Incentive Payment	Tipping Fee	Sum of Avoided Costs and Income	Net Income (Loss)	Present Value Factor	Present Value
0	($3,700,000)	$2,127,500		0	($1,572,500)	0	$1,572,500.00		TBD	$0.00	$0.00	$0	1	($2,127,500)
1	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.00		$132,600.00	$343,361.00	$144,964	1	$144,964
2	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	$144,964	1	$144,964
3	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	$144,964	1	$144,964
4	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	$144,964	1	$144,964
5	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	$144,964	1	$144,964
6	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	$144,964	1	$144,964
7	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	$144,964	1	$144,964
8	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	$144,964	1	$144,964
9	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	$144,964	1	$144,964
10	($200,000)		($138,396.93)	($60,000)	($398,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	($55,036)	1	($55,036)
11	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	$144,964	1	$144,964
12	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	$144,964	1	$144,964
13	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	$144,964	1	$144,964
14	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	$144,964	1	$144,964
15	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	$144,964	1	$144,964
16	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	$144,964	1	$144,964
17	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	$144,964	1	$144,964
18	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	$144,964	1	$144,964
19	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	$144,964	1	$144,964
20	($200,000)		($138,396.93)	($60,000)	($398,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	($55,036)	1	($55,036)
21	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	$144,964	1	$144,964
22	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	$144,964	1	$144,964
23	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	$144,964	1	$144,964
24	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	$144,964	1	$144,964
25	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	$144,964	1	$144,964
26	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	$144,964	1	$144,964
27	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	$144,964	1	$144,964
28	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	$144,964	1	$144,964
29	0		($138,396.93)	($60,000)	($198,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	$144,964	1	$144,964
30	($200,000)		($138,396.93)	($60,000)	($398,397)	$190,000		$20,761.20		$132,600.00	$343,361.20	($55,036)	1	($55,036)
Total														$1,621,428

Assumptions:

Interest rate = 5%; tipping fee = $0.03/gallon.

FOG/food waste quantity = 17,000 gpd; average total solids = 6.70%.

Cogeneration unit = 395 kW; power purchase avoided = 3,000,000 kWh/year.

SECTION 10

Findings and Recommendations

10.1 Findings

From this evaluation it was determined that the Gresham WWTP could produce up to 395 kilowatts (kW) of additional electrical power and hot water containing 60 million British thermal units (Btu)/day of additional heat by constructing a FOG receiving and processing facility that feeds existing anaerobic digesters at the WWTP.

The financial viability of a FOG receiving station is affected by the portion of FOG in the Portland Metro area that can be captured, the volatile solids concentration of that FOG, unit sizes of electrical generation equipment, the amount of excess anaerobic digester capacity currently available to process FOG, the availability of tax credits to partially offset capital costs, and the tipping fee that FOG haulers are charged.

The existing digesters have sufficient hydraulic and volatile solids capacity to accept 17,000 gallons of additional waste per day. The existing digesters are currently loaded at approximately 50 percent of their capacity. The additions would be approximately 40 percent of the existing digester loading. Effective mixing is essential to assure dispersal of FOC throughout the digester.

The amount of methane generated by FOG will depend on its volatile solids content. The availability and strength of FOG are highly variable. During the sampling for this study, for example, 10 samples of FOG were collected and analyzed. The average volatile solids concentration of the ten samples was strongly affected by one sample, which raised the average from 2.7 percent to 6.7 percent.

10.2 Recommendations

Based on the favorable preliminary findings of this evaluation, it is recommended that City of Gresham continue to investigate the possibility of codigesting FOG and food waste in its existing digesters. Because the availability and strength of FOG and food waste are highly variable, Gresham should consider constructing a temporary FOG and food waste receiving facility to verify the availability, strength, and handling characteristics of the waste before committing to the construction of a permanent FOG receiving facility and cogeneration system.

Initially, to encourage FOG haulers to bring their waste to the WWTP, it may be advisable for the city to accept the waste without charging a tipping fee. Gresham should also investigate the possibility of forging agreements with FOG haulers to establish regular and reliable sources of FOG. In the future, after the program has gained some footing and its acceptance among food waste producers is better known, the city may wish to add a tipping fee that can be adjusted based on how it affects the supply of FOG to the WWTP.

If Gresham implements a FOG and food waste cogeneration program, it will be important to prevent unwanted material from being discharged to the FOG receiving system. Gresham should limit FOG deliveries to grease trap pumpage collected by haulers participating in the Preferred Pumper Program. In addition, a manifest indicating the source of the waste should be required for each load. The associated load tracking process could be automated using card keys and readers and data entry by the driver at the time a load is delivered.

10.3 Implementation

Implementation of the new cogeneration system should proceed in phases. The first phase should include additional market research, construction of a pilot FOG receiving station, monitoring of digester gas production, and continued discussions with the Oregon Department of Energy and Energy Trust. It would be desirable to have 6 months of operating data to verify FOG availability and characteristics.

The next phase would include finalizing the size of the FOG receiving station and cogeneration unit based on data obtained from operating the pilot facility, securing a business partner, and working with Energy Trust to determine the incentive payment based on above market costs.

The third phase would include design and construction of the permanent FOG receiving station and cogeneration unit.

APPENDIX A

Financial Analysis Spreadsheets

Gresham WWTP
FOG Codigestion Financial Feasibility Analysis
Low Strength FOG, Avoided Power Cost, BETC, Green tags, No Tipping Fee

Interest rate 5%
FOG/Food waste quantity 17,000 gpd
Average total solids 2.70%

Tipping fee $0.00 per gallon
Cogen unit 395 kW
Power purchase avoided 2,000,000 kWh/year

	Expenditures			Income							
Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor
0	($2,200,000)	0	($2,200,000)	0	$0.00		$0.00	$0.00	$0.00	($2,200,000)	1
1	0	($60,000)	($60,000)	$130,000	$220,000.00	$13,000.00	$0.00	$0.00	$363,000.00	$303,000	0.952380952
2	0	($60,000)	($60,000)	$130,000	$220,000.00	$13,000.00	$0.00	$0.00	$363,000.00	$303,000	0.907029478
3	0	($60,000)	($60,000)	$130,000	$220,000.00	$13,000.00	$0.00	$0.00	$363,000.00	$303,000	0.863837599
4	0	($60,000)	($60,000)	$130,000	$220,000.00	$13,000.00	$0.00	$0.00	$363,000.00	$303,000	0.822702475
5	0	($60,000)	($60,000)	$130,000	$220,000.00	$13,000.00	$0.00	$0.00	$363,000.00	$303,000	0.783526166
6	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000.00	$83,000	0.746215397
7	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000.00	$83,000	0.71068133
8	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000.00	$83,000	0.676839362
9	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000.00	$83,000	0.644608916
10	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000.00	($117,000)	0.613913254
11	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000.00	$83,000	0.584679289
12	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000.00	$83,000	0.556837418
13	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000.00	$83,000	0.530321351
14	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000.00	$83,000	0.505067953
15	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000.00	$83,000	0.481017098
16	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000.00	$83,000	0.458111522
17	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000.00	$83,000	0.436296688
18	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000.00	$83,000	0.415520655
19	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000.00	$83,000	0.395733957
20	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000.00	($117,000)	0.376889483
21	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000.00	$83,000	0.358942365
22	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000.00	$83,000	0.341849871
23	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000.00	$83,000	0.325571306
24	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000.00	$83,000	0.31006791
25	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000.00	$83,000	0.295302772
26	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000.00	$83,000	0.281240735
27	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000.00	$83,000	0.267848319
28	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000.00	$83,000	0.255093637
29	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000.00	$83,000	0.242946321
30	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000.00	($117,000)	0.231377449

Net present value

Interest rate	Years
5%	30

Gresham WWTP
FOG Codigestion Financial Feasibility Analysis
Low Strength FOG, Avoided Power Cost, BETC, No Tipping Fee

Interest rate 5%
FOG/Food waste quantity 17,000 gpd
Average total solids 2.70%

Tipping fee $0.00 per gallon
Cogen unit 395 kW
Power purchase avoided 2,000,000 kWh/year

		Expenditures			Income						
Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Grren tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor
0	($3,200,000)	0	($3,200,000)	0	$0.00	$0.00	$0.00	$0.00	$0.00	($3,200,000)	1
1	0	($60,000)	($60,000)	$130,000	$320,000.00	$0.00	$0.00	$0.00	$450,000.00	$390,000	0.952380952
2	0	($60,000)	($60,000)	$130,000	$320,000.00	$0.00	$0.00	$0.00	$450,000.00	$390,000	0.907029478
3	0	($60,000)	($60,000)	$130,000	$320,000.00	$0.00	$0.00	$0.00	$450,000.00	$390,000	0.863837599
4	0	($60,000)	($60,000)	$130,000	$320,000.00	$0.00	$0.00	$0.00	$450,000.00	$390,000	0.822702475
5	0	($60,000)	($60,000)	$130,000	$320,000.00	$0.00	$0.00	$0.00	$450,000.00	$390,000	0.783526166
6	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.746215397
7	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.71068133
8	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.676839362
9	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.644608916
10	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	($130,000)	0.613913254
11	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.584679289
12	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.556837418
13	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.530321351
14	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.505067953
15	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.481017098
16	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.458111522
17	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.436296688
18	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.415520655
19	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.395733957
20	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	($130,000)	0.376889483
21	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.358942365
22	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.341849871
23	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.325571306
24	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.31006791
25	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.295302772
26	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.281240735
27	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.267848319
28	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.255093637
29	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.242946321
30	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	($130,000)	0.231377449

Net present value

Interest rate	Years
5%	30

Gresham WWTP
FOG Codigestion Financial Feasibility Analysis
Low Strength FOG, Avoided Power Cost, BETC, $0.10 Tipping Fee

Interest rate 5%
FOG/Food waste quantity 17,000 gpd
Average total solids 2.70%

Tipping fee $0.10 per gallon
Cogen unit 395 kW
Power purchase avoided 2,000,000 kWh/year

	Expenditures			Income							
Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green Tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor
0	($3,200,000)	0	($3,200,000)	0	$0.00		$0.00	$0.00	$0.00	($3,200,000)	1
1	0	($60,000)	($60,000)	$130,000	$320,000.00		$0.00	$442,000.00	$892,000.00	$832,000	0.952380952
2	0	($60,000)	($60,000)	$130,000	$320,000.00		$0.00	$442,000.00	$892,000.00	$832,000	0.907029478
3	0	($60,000)	($60,000)	$130,000	$320,000.00		$0.00	$442,000.00	$892,000.00	$832,000	0.863837599
4	0	($60,000)	($60,000)	$130,000	$320,000.00		$0.00	$442,000.00	$892,000.00	$832,000	0.822702475
5	0	($60,000)	($60,000)	$130,000	$320,000.00		$0.00	$442,000.00	$892,000.00	$832,000	0.783526166
6	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$442,000.00	$572,000.00	$512,000	0.746215397
7	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$442,000.00	$572,000.00	$512,000	0.71068133
8	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$442,000.00	$572,000.00	$512,000	0.676839362
9	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$442,000.00	$572,000.00	$512,000	0.644608916
10	($200,000)	($60,000)	($260,000)	$130,000	$0.00		$0.00	$442,000.00	$572,000.00	$312,000	0.613913254
11	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$442,000.00	$572,000.00	$512,000	0.584679289
12	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$442,000.00	$572,000.00	$512,000	0.556837418
13	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$442,000.00	$572,000.00	$512,000	0.530321351
14	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$442,000.00	$572,000.00	$512,000	0.505067953
15	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$442,000.00	$572,000.00	$512,000	0.481017098
16	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$442,000.00	$572,000.00	$512,000	0.458111522
17	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$442,000.00	$572,000.00	$512,000	0.436296688
18	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$442,000.00	$572,000.00	$512,000	0.415520655
19	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$442,000.00	$572,000.00	$512,000	0.395733957
20	($200,000)	($60,000)	($260,000)	$130,000	$0.00		$0.00	$442,000.00	$572,000.00	$312,000	0.376889483
21	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$442,000.00	$572,000.00	$512,000	0.358942365
22	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$442,000.00	$572,000.00	$512,000	0.341849871
23	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$442,000.00	$572,000.00	$512,000	0.325571306
24	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$442,000.00	$572,000.00	$512,000	0.31006791
25	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$442,000.00	$572,000.00	$512,000	0.295302772
26	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$442,000.00	$572,000.00	$512,000	0.281240735
27	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$442,000.00	$572,000.00	$512,000	0.267848319
28	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$442,000.00	$572,000.00	$512,000	0.255093637
29	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$442,000.00	$572,000.00	$512,000	0.242946321
30	($200,000)	($60,000)	($260,000)	$130,000	$0.00		$0.00	$442,000.00	$572,000.00	$312,000	0.231377449

Net present value
Interest rate Years
5% 30

Gresham WWTP
FOG Codigestion Financial Feasibility Analysis
Low Strength FOG, Avoided Power Cost, 0.10 Tipping Fee

Interest rate 5%
FOG/Food waste quantity 17,000 gpd
Average total solids 2.70%

Tipping fee $0.10 per gallon
Cogen unit 395 kW
Power purchase avoided 2,000,000 kWh/year

	Expenditures			Income							
Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor	Yearly net income X Present value factor
0	($3,200,000)	0	($3,200,000)	0	$0.00	$0.00	$0.00	$0.00	($3,200,000)	1	($3,200,000)
1	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.952381	$487,619
2	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.907029	$464,399
3	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.863838	$442,285
4	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.822702	$421,224
5	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.783526	$401,165
6	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.746215	$382,062
7	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.710681	$363,869
8	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.676839	$346,542
9	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.644609	$330,040
10	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$312,000	0.613913	$191,541
11	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.584679	$299,356
12	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.556837	$285,101
13	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.530321	$271,525
14	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.505068	$258,595
15	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.481017	$246,281
16	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.458112	$234,553
17	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.436297	$223,384
18	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.415521	$212,747
19	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.395734	$202,616
20	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$312,000	0.376889	$117,590
21	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.358942	$183,778
22	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.34185	$175,027
23	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.325571	$166,693
24	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.310068	$158,755
25	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.295303	$151,195
26	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.281241	$143,995
27	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.267848	$137,138
28	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.255094	$130,608
29	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$512,000	0.242946	$124,389
30	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$0.00	$442,000.00	$572,000.00	$312,000	0.231377	$72,190

Net present value		$4,426,259
Interest rate	Years	
5%	30	

Gresham WWTP
FOG Codigestion Financial Feasibility Analysis
Low Strength FOG, Avoided Power Cost, BETC, Green tags, 0.05 Tipping Fee

Interest rate	5%		Tipping fee	$0.05 per gallon
FOG/Food waste quantity	17,000 gpd		Cogen unit	395 kW
Average total solids	2.70%		Power purchase avoided	2,000,000 kWh/year

	Expenditures			Income								
Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor	Yearly net income X Present value factor
0	($3,200,000)	0	($3,200,000)	0	$0.00		$0.00	$0.00	$0.00	($3,200,000)	1	($3,200,000)
1	0	($60,000)	($60,000)	$130,000	$320,000.00	$13,000.00	$0.00	$221,000.00	$684,000.00	$624,000	0.952380952	$594,286
2	0	($60,000)	($60,000)	$130,000	$320,000.00	$13,000.00	$0.00	$221,000.00	$684,000.00	$624,000	0.907029478	$565,986
3	0	($60,000)	($60,000)	$130,000	$320,000.00	$13,000.00	$0.00	$221,000.00	$684,000.00	$624,000	0.863837599	$539,035
4	0	($60,000)	($60,000)	$130,000	$320,000.00	$13,000.00	$0.00	$221,000.00	$684,000.00	$624,000	0.822702475	$513,366
5	0	($60,000)	($60,000)	$130,000	$320,000.00	$13,000.00	$0.00	$221,000.00	$684,000.00	$624,000	0.783526166	$488,920
6	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$221,000.00	$364,000.00	$304,000	0.746215397	$226,849
7	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$221,000.00	$364,000.00	$304,000	0.71068133	$216,047
8	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$221,000.00	$364,000.00	$304,000	0.676839362	$205,759
9	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$221,000.00	$364,000.00	$304,000	0.644608916	$195,961
10	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$13,000.00	$0.00	$221,000.00	$364,000.00	$104,000	0.613913254	$63,847
11	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$221,000.00	$364,000.00	$304,000	0.584679289	$177,743
12	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$221,000.00	$364,000.00	$304,000	0.556837418	$169,279
13	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$221,000.00	$364,000.00	$304,000	0.530321351	$161,218
14	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$221,000.00	$364,000.00	$304,000	0.505067953	$153,541
15	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$221,000.00	$364,000.00	$304,000	0.481017098	$146,229
16	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$221,000.00	$364,000.00	$304,000	0.458111522	$139,266
17	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$221,000.00	$364,000.00	$304,000	0.436296688	$132,634
18	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$221,000.00	$364,000.00	$304,000	0.415520655	$126,318
19	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$221,000.00	$364,000.00	$304,000	0.395733957	$120,303
20	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$13,000.00	$0.00	$221,000.00	$364,000.00	$104,000	0.376889483	$39,197
21	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$221,000.00	$364,000.00	$304,000	0.358942365	$109,118
22	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$221,000.00	$364,000.00	$304,000	0.341849871	$103,922
23	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$221,000.00	$364,000.00	$304,000	0.325571306	$98,974
24	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$221,000.00	$364,000.00	$304,000	0.31006791	$94,261
25	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$221,000.00	$364,000.00	$304,000	0.295302772	$89,772
26	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$221,000.00	$364,000.00	$304,000	0.281240735	$85,497
27	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$221,000.00	$364,000.00	$304,000	0.267848319	$81,426
28	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$221,000.00	$364,000.00	$304,000	0.255093637	$77,548
29	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$221,000.00	$364,000.00	$304,000	0.242946321	$73,856
30	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$13,000.00	$0.00	$221,000.00	$364,000.00	$104,000	0.231377449	$24,063

Net present value		$2,614,222
Interest rate	Years	
5%	30	

Gresham WWTP
FOG Codigestion Financial Feasibility Analysis
Low Strength FOG, Avoided Power Cost, BETC, Green tags, 0.03 Tipping Fee

Interest rate 5%
FOG/Food waste quantity 17,000 gpd
Average total solids 2.70%

Tipping fee $0.03 per gallon
Cogen unit 395 kW
Power purchase avoided 2,000,000 kWh/year

	Expenditures			Income								
Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor	Yearly net income X Present value factor
0	($3,200,000)	0	($3,200,000)	0	$0.00		$0.00	$0.00	$0.00	($3,200,000)	1	($3,200,000)
1	0	($60,000)	($60,000)	$130,000	$320,000.00	$13,000.00	$0.00	$132,600.00	$595,600.00	$535,600	0.952380952	$510,095
2	0	($60,000)	($60,000)	$130,000	$320,000.00	$13,000.00	$0.00	$132,600.00	$595,600.00	$535,600	0.907029478	$485,805
3	0	($60,000)	($60,000)	$130,000	$320,000.00	$13,000.00	$0.00	$132,600.00	$595,600.00	$535,600	0.863837599	$462,671
4	0	($60,000)	($60,000)	$130,000	$320,000.00	$13,000.00	$0.00	$132,600.00	$595,600.00	$535,600	0.822702475	$440,639
5	0	($60,000)	($60,000)	$130,000	$320,000.00	$13,000.00	$0.00	$132,600.00	$595,600.00	$535,600	0.783526166	$419,657
6	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$132,600.00	$275,600.00	$215,600	0.746215397	$160,884
7	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$132,600.00	$275,600.00	$215,600	0.71068133	$153,223
8	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$132,600.00	$275,600.00	$215,600	0.676839362	$145,927
9	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$132,600.00	$275,600.00	$215,600	0.644608916	$138,978
10	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$13,000.00	$0.00	$132,600.00	$275,600.00	$15,600	0.613913254	$9,577
11	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$132,600.00	$275,600.00	$215,600	0.584679289	$126,057
12	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$132,600.00	$275,600.00	$215,600	0.556837418	$120,054
13	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$132,600.00	$275,600.00	$215,600	0.530321351	$114,337
14	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$132,600.00	$275,600.00	$215,600	0.505067953	$108,893
15	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$132,600.00	$275,600.00	$215,600	0.481017098	$103,707
16	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$132,600.00	$275,600.00	$215,600	0.458111522	$98,769
17	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$132,600.00	$275,600.00	$215,600	0.436296688	$94,066
18	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$132,600.00	$275,600.00	$215,600	0.415520655	$89,586
19	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$132,600.00	$275,600.00	$215,600	0.395733957	$85,320
20	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$13,000.00	$0.00	$132,600.00	$275,600.00	$15,600	0.376889483	$5,879
21	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$132,600.00	$275,600.00	$215,600	0.358942365	$77,388
22	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$132,600.00	$275,600.00	$215,600	0.341849871	$73,703
23	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$132,600.00	$275,600.00	$215,600	0.325571306	$70,193
24	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$132,600.00	$275,600.00	$215,600	0.31006791	$66,851
25	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$132,600.00	$275,600.00	$215,600	0.295302772	$63,667
26	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$132,600.00	$275,600.00	$215,600	0.281240735	$60,636
27	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$132,600.00	$275,600.00	$215,600	0.267848319	$57,748
28	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$132,600.00	$275,600.00	$215,600	0.255093637	$54,998
29	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$132,600.00	$275,600.00	$215,600	0.242946321	$52,379
30	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$13,000.00	$0.00	$132,600.00	$275,600.00	$15,600	0.231377449	$3,609

Net present value		$1,255,297
Interest rate	Years	
5%	30	

Gresham WWTP
FOG Codigestion Financial Feasibility Analysis
High Strength FOG, Avoided Power Cost, BETC, Green tags, 0.05 Tipping Fee

Interest rate	5%	Tipping fee	$0.05 per gallon
FOG/Food waste quantity	17,000 gpd	Cogen unit	395 kW
Average total solids	6.70%	Power purchase avoided	2,000,000 kWh/year

		Expenditures				Income						
Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor	Yearly net income X Present value factor
0	($3,200,000)	0	($3,200,000)	0	$0.00		$0.00	$0.00	$0.00	($3,200,000)	1	($3,200,000)
1	0	($60,000)	($60,000)	$190,000	$320,000.00	$20,761.00	$0.00	$221,000.00	$751,761.00	$691,761	0.952380952	$658,820
2	0	($60,000)	($60,000)	$190,000	$320,000.00	$20,761.20	$0.00	$221,000.00	$751,761.20	$691,761	0.907029478	$627,448
3	0	($60,000)	($60,000)	$190,000	$320,000.00	$20,761.20	$0.00	$221,000.00	$751,761.20	$691,761	0.863837599	$597,569
4	0	($60,000)	($60,000)	$190,000	$320,000.00	$20,761.20	$0.00	$221,000.00	$751,761.20	$691,761	0.822702475	$569,114
5	0	($60,000)	($60,000)	$190,000	$320,000.00	$20,761.20	$0.00	$221,000.00	$751,761.20	$691,761	0.783526166	$542,013
6	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$221,000.00	$431,761.20	$371,761	0.746215397	$277,414
7	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$221,000.00	$431,761.20	$371,761	0.71068133	$264,204
8	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$221,000.00	$431,761.20	$371,761	0.676839362	$251,623
9	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$221,000.00	$431,761.20	$371,761	0.644608916	$239,641
10	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$20,761.20	$0.00	$221,000.00	$431,761.20	$171,761	0.613913254	$105,446
11	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$221,000.00	$431,761.20	$371,761	0.584679289	$217,361
12	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$221,000.00	$431,761.20	$371,761	0.556837418	$207,011
13	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$221,000.00	$431,761.20	$371,761	0.530321351	$197,153
14	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$221,000.00	$431,761.20	$371,761	0.505067953	$187,765
15	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$221,000.00	$431,761.20	$371,761	0.481017098	$178,823
16	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$221,000.00	$431,761.20	$371,761	0.458111522	$170,308
17	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$221,000.00	$431,761.20	$371,761	0.436296688	$162,198
18	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$221,000.00	$431,761.20	$371,761	0.415520655	$154,474
19	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$221,000.00	$431,761.20	$371,761	0.395733957	$147,119
20	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$20,761.20	$0.00	$221,000.00	$431,761.20	$171,761	0.376889483	$64,735
21	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$221,000.00	$431,761.20	$371,761	0.358942365	$133,441
22	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$221,000.00	$431,761.20	$371,761	0.341849871	$127,087
23	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$221,000.00	$431,761.20	$371,761	0.325571306	$121,035
24	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$221,000.00	$431,761.20	$371,761	0.31006791	$115,271
25	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$221,000.00	$431,761.20	$371,761	0.295302772	$109,782
26	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$221,000.00	$431,761.20	$371,761	0.281240735	$104,554
27	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$221,000.00	$431,761.20	$371,761	0.267848319	$99,576
28	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$221,000.00	$431,761.20	$371,761	0.255093637	$94,834
29	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$221,000.00	$431,761.20	$371,761	0.242946321	$90,318
30	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$20,761.20	$0.00	$221,000.00	$431,761.20	$171,761	0.231377449	$39,742

Net present value		$3,655,877
Interest rate	Years	
5%	30	

Gresham WWTP
FOG Codigestion Financial Feasibility Analysis
High Strength FOG, Avoided Power Cost, BETC, Green tags, 0.03 Tipping Fee

Interest rate	5%	Tipping fee	$0.03 per gallon
FOG/Food waste quantity	17,000 gpd	Cogen unit	395 kW
Average total solids	6.70%	Power purchase avoided	2,000,000 kWh/year

		Expenditures			Income							
Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor	Yearly net income X Present value factor
0	($3,200,000)	0	($3,200,000)	0	$0.00		$0.00	$0.00	$0.00	($3,200,000)	1	($3,200,000)
1	0	($60,000)	($60,000)	$190,000	$320,000.00	$20,761.00	$0.00	$132,600.00	$663,361.00	$603,361	0.952380952	$574,630
2	0	($60,000)	($60,000)	$190,000	$320,000.00	$20,761.20	$0.00	$132,600.00	$663,361.20	$603,361	0.907029478	$547,266
3	0	($60,000)	($60,000)	$190,000	$320,000.00	$20,761.20	$0.00	$132,600.00	$663,361.20	$603,361	0.863837599	$521,206
4	0	($60,000)	($60,000)	$190,000	$320,000.00	$20,761.20	$0.00	$132,600.00	$663,361.20	$603,361	0.822702475	$496,387
5	0	($60,000)	($60,000)	$190,000	$320,000.00	$20,761.20	$0.00	$132,600.00	$663,361.20	$603,361	0.783526166	$472,749
6	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$132,600.00	$343,361.20	$283,361	0.746215397	$211,448
7	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$132,600.00	$343,361.20	$283,361	0.71068133	$201,380
8	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$132,600.00	$343,361.20	$283,361	0.676839362	$191,790
9	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$132,600.00	$343,361.20	$283,361	0.644608916	$182,657
10	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$20,761.20	$0.00	$132,600.00	$343,361.20	$83,361	0.613913254	$51,177
11	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$132,600.00	$343,361.20	$283,361	0.584679289	$165,675
12	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$132,600.00	$343,361.20	$283,361	0.556837418	$157,786
13	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$132,600.00	$343,361.20	$283,361	0.530321351	$150,272
14	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$132,600.00	$343,361.20	$283,361	0.505067953	$143,117
15	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$132,600.00	$343,361.20	$283,361	0.481017098	$136,302
16	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$132,600.00	$343,361.20	$283,361	0.458111522	$129,811
17	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$132,600.00	$343,361.20	$283,361	0.436296688	$123,630
18	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$132,600.00	$343,361.20	$283,361	0.415520655	$117,742
19	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$132,600.00	$343,361.20	$283,361	0.395733957	$112,136
20	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$20,761.20	$0.00	$132,600.00	$343,361.20	$83,361	0.376889483	$31,418
21	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$132,600.00	$343,361.20	$283,361	0.358942365	$101,710
22	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$132,600.00	$343,361.20	$283,361	0.341849871	$96,867
23	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$132,600.00	$343,361.20	$283,361	0.325571306	$92,254
24	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$132,600.00	$343,361.20	$283,361	0.31006791	$87,861
25	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$132,600.00	$343,361.20	$283,361	0.295302772	$83,677
26	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$132,600.00	$343,361.20	$283,361	0.281240735	$79,693
27	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$132,600.00	$343,361.20	$283,361	0.267848319	$75,898
28	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$132,600.00	$343,361.20	$283,361	0.255093637	$72,284
29	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$132,600.00	$343,361.20	$283,361	0.242946321	$68,842
30	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$20,761.20	$0.00	$132,600.00	$343,361.20	$83,361	0.231377449	$19,288

Net present value		$2,296,952
Interest rate	Years	
5%	30	

Gresham WWTP
FOG Codigestion Financial Feasibility Analysis
High Strength FOG, Avoided Power Cost, BETC, 0.03 Tipping Fee

Interest rate	5%	Tipping fee	$0.03 per gallon
FOG/Food waste quantity	17,000 gpd	Cogen unit	395 kW
Average total solids	6.70%	Power purchase avoided	2,000,000 kWh/year

		Expenditures			Income							
Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor	Yearly net income X Present value factor
0	($3,200,000)	0	($3,200,000)	0	$0.00		$0.00	$0.00	$0.00	($3,200,000)	1	($3,200,000)
1	0	($60,000)	($60,000)	$190,000	$320,000.00	$0.00	$0.00	$132,600.00	$642,600.00	$582,600	0.95238095	$554,857
2	0	($60,000)	($60,000)	$190,000	$320,000.00	$0.00	$0.00	$132,600.00	$642,600.00	$582,600	0.90702948	$528,435
3	0	($60,000)	($60,000)	$190,000	$320,000.00	$0.00	$0.00	$132,600.00	$642,600.00	$582,600	0.8638376	$503,272
4	0	($60,000)	($60,000)	$190,000	$320,000.00	$0.00	$0.00	$132,600.00	$642,600.00	$582,600	0.82270247	$479,306
5	0	($60,000)	($60,000)	$190,000	$320,000.00	$0.00	$0.00	$132,600.00	$642,600.00	$582,600	0.78352617	$456,482
6	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.7462154	$195,956
7	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.71068133	$186,625
8	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.67683936	$177,738
9	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.64460892	$169,274
10	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$62,600	0.61391325	$38,431
11	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.58467929	$153,537
12	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.55683742	$146,226
13	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.53032135	$139,262
14	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.50506795	$132,631
15	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.4810171	$126,315
16	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.45811152	$120,300
17	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.43629669	$114,572
18	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.41552065	$109,116
19	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.39573396	$103,920
20	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$62,600	0.37688948	$23,593
21	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.35894236	$94,258
22	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.34184987	$89,770
23	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.32557131	$85,495
24	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.31006791	$81,424
25	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.29530277	$77,547
26	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.28124073	$73,854
27	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.26784832	$70,337
28	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.25509364	$66,988
29	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.24294632	$63,798
30	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$62,600	0.23137745	$14,484

Net present value			$1,977,802
Interest rate	Years		
5%	30		

395	kW
3460200	kWh/year
3460.2	mWh/year
$6	per mWh
$20,761.20	

Gresham WWTP
FOG Codigestion Financial Feasibility Analysis
Low Strength FOG, Avoided Power Cost, BETC, 0.03 Tipping Fee

Interest rate	5%		Tipping fee	$0.03 per gallon
FOG/Food waste quantity	17,000 gpd		Cogen unit	395 kW
Average total solids	2.70%		Power purchase avoided	2,000,000 kWh/year

		Expenditures			Income							
Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor	Yearly net income X Present value factor
0	($3,200,000)	0	($3,200,000)	0	$0.00		$0.00	$0.00	$0.00	($3,200,000)	1	($3,200,000)
1	0	($60,000)	($60,000)	$130,000	$320,000.00	$0.00	$0.00	$132,600.00	$582,600.00	$522,600	0.952380952	$497,714
2	0	($60,000)	($60,000)	$130,000	$320,000.00	$0.00	$0.00	$132,600.00	$582,600.00	$522,600	0.907029478	$474,014
3	0	($60,000)	($60,000)	$130,000	$320,000.00	$0.00	$0.00	$132,600.00	$582,600.00	$522,600	0.863837599	$451,442
4	0	($60,000)	($60,000)	$130,000	$320,000.00	$0.00	$0.00	$132,600.00	$582,600.00	$522,600	0.822702475	$429,944
5	0	($60,000)	($60,000)	$130,000	$320,000.00	$0.00	$0.00	$132,600.00	$582,600.00	$522,600	0.783526166	$409,471
6	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.746215397	$151,183
7	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.71068133	$143,984
8	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.676839362	$137,128
9	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.644608916	$130,598
10	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$2,600	0.613913254	$1,596
11	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.584679289	$118,456
12	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.556837418	$112,815
13	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.530321351	$107,443
14	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.505067953	$102,327
15	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.481017098	$97,454
16	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.458111522	$92,813
17	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.436296688	$88,394
18	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.415520655	$84,184
19	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.395733957	$80,176
20	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$2,600	0.376889483	$980
21	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.358942365	$72,722
22	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.341849871	$69,259
23	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.325571306	$65,961
24	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.31006791	$62,820
25	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.295302772	$59,828
26	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.281240735	$56,979
27	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.267848319	$54,266
28	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.255093637	$51,682
29	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.242946321	$49,221
30	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$2,600	0.231377449	$602

Net present value		$1,055,455
Interest rate	Years	
5%	30	

250	kw
2190000	kwh/year
2190	mWh/year
$6	per mWh
$13,140	per year

Gresham WWTP
FOG Codigestion Financial Feasibility Analysis
Low Strength FOG, Avoided Power Cost, 0.03 Tipping Fee

Interest rate	5%	Tipping fee	$0.03 per gallon
FOG/Food waste	17,000 gpd	Cogen unit	395 kW
Average total solids	2.70%	Power purchase avoided	2,000,000 kWh/year

	Expenditures			Income							
Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor
0	($3,200,000)	0	($3,200,000)	0	$0.00	$0.00	$0.00	$0.00	$0.00	($3,200,000)	1
1	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.95238095
2	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.90702948
3	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.8638376
4	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.82270247
5	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.78352617
6	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.7462154
7	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.71068133
8	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.67683936
9	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.64460892
10	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$2,600	0.61391325
11	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.58467929
12	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.55683742
13	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.53032135
14	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.50506795
15	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.4810171
16	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.45811152
17	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.43629669
18	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.41552065
19	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.39573396
20	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$2,600	0.37688948
21	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.35894236
22	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.34184987
23	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.32557131
24	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.31006791
25	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.29530277
26	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.28124073
27	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.26784832
28	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.25509364
29	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$202,600	0.24294632
30	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$0.00	$0.00	$132,600.00	$262,600.00	$2,600	0.23137745

Net present value

Interest rate	Years
5%	30

Gresham WWTP
FOG Codigestion Financial Feasibility Analysis
Low Strength FOG, Avoided Power Cost, No Tipping Fee, Contributed FOG Receiving Station

Interest rate	5%	Tipping fee	$0.00 per gallon
FOG/Food waste quantity	17,000 gpd	Cogen unit	395 kW
Average total solids	2.70%	Power purchase avoided	2,000,000 kWh/year

	Expenditures			Income							
Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor
0	($2,200,000)	0	($2,200,000)	0	$0.00	$0.00	$0.00	$0.00	$0.00	($2,200,000)	1
1	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.952380952
2	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.907029478
3	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.863837599
4	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.822702475
5	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.783526166
6	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.746215397
7	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.71068133
8	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.676839362
9	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.644608916
10	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	($130,000)	0.613913254
11	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.584679289
12	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.556837418
13	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.530321351
14	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.505067953
15	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.481017098
16	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.458111522
17	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.436296688
18	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.415520655
19	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.395733957
20	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	($130,000)	0.376889483
21	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.358942365
22	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.341849871
23	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.325571306
24	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.31006791
25	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.295302772
26	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.281240735
27	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.267848319
28	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.255093637
29	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	$70,000	0.242946321
30	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$0.00	$0.00	$0.00	$130,000.00	($130,000)	0.231377449

Net present value

Interest rate	Years
5%	30

Gresham WWTP
FOG Codigestion Financial Feasibility Analysis
Low Strength FOG, Avoided Power Cost, No Tipping Fee

Interest rate	5%	Tipping fee	$0.00 per gallon		
FOG/Food waste	17,000 gpd	Cogen unit	395 kW		
Average total solids	2.70%	Power purchase avoided	3,014,000 kWh/year	$0.06	Avoided cost per kWh

	Expenditures			Income					Sum of avoided costs and income	Yearly income less expenditures	Present value factor
Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee			
0	($3,200,000)	0	($3,200,000)	0	$0.00		$0.00	$0.00	$0.00	($3,200,000)	1
1	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.952380952
2	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.907029478
3	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.863837599
4	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.822702475
5	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.783526166
6	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.746215397
7	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.71068133
8	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.676839362
9	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.644608916
10	($200,000)	($60,000)	($260,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	($130,000)	0.613913254
11	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.584679289
12	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.556837418
13	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.530321351
14	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.505067953
15	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.481017098
16	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.458111522
17	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.436296688
18	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.415520655
19	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.395733957
20		($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.376889483
21	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.358942365
22	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.341849871
23	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.325571306
24	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.31006791
25	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.295302772
26	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.281240735
27	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.267848319
28	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.255093637
29	0	($60,000)	($60,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	$70,000	0.242946321
30	($200,000)	($60,000)	($260,000)	$130,000	$0.00		$0.00	$0.00	$130,000.00	($130,000)	0.231377449

Net present value	
Interest rate	Years
5%	30

Gresham WWTP
FOG Codigestion Financial Feasibility Analysis
High Strength FOG, Avoided Power Cost, No Tipping Fee

Interest rate 5% Tipping fee $0.00 per gallon
FOG/Food waste quantity 17,000 gpd Cogen unit 395 kW
Average total solids 6.70% Power purchase avoided 3,014,000 kWh/year $0.06 Avoided cost per kWh

	Expenditures			Income				Sum of	Yearly income	Present value	Yearly net
Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee			
0	($3,653,000)	0	($3,653,000)	0	$0.00	$0.00	$0.00	$0.00	$0.00	($3,653,000)	1
1	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.952380952
2	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.907029478
3	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.863837599
4	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.822702475
5	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.783526166
6	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.746215397
7	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.71068133
8	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.676839362
9	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.644608916
10	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	($70,000)	0.613913254
11	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.584679289
12	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.556837418
13	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.530321351
14	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.505067953
15	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.481017098
16	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.458111522
17	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.436296688
18	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.415520655
19	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.395733957
20		($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.376889483
21	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.358942365
22	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.341849871
23	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.325571306
24	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.31006791
25	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.295302772
26	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.281240735
27	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.267848319
28	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.255093637
29	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.242946321
30	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000.00	($70,000)	0.231377449

Net present value

Interest rate	Years
5%	30

Gresham WWTP
FOG Codigestion Financial Feasibility Analysis
Low Strength FOG, Avoided Power Cost, BETC, Green Tags, No Tipping Fee

Interest rate	5%		Tipping fee	$0.00 per gallon
FOG/Food waste quantity	17,000 gpd		Cogen unit	395 kW
Average total solids	2.70%		Power purchase avoided	3,014,000 kWh/year

		Expenditures				Income						
Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Grren tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor	Yearly net income X Present value factor
0	($3,200,000)	0	($3,200,000)	0	$0.00		$0.00	$0.00	$0	($3,200,000)	1	($3,200,000)
1	0	($60,000)	($60,000)	$130,000	$320,000.00	$13,000.00	$0.00	$0.00	$463,000	$403,000	0.952381	$383,810
2	0	($60,000)	($60,000)	$130,000	$320,000.00	$13,000.00	$0.00	$0.00	$463,000	$403,000	0.907029	$365,533
3	0	($60,000)	($60,000)	$130,000	$320,000.00	$13,000.00	$0.00	$0.00	$463,000	$403,000	0.863838	$348,127
4	0	($60,000)	($60,000)	$130,000	$320,000.00	$13,000.00	$0.00	$0.00	$463,000	$403,000	0.822702	$331,549
5	0	($60,000)	($60,000)	$130,000	$320,000.00	$13,000.00	$0.00	$0.00	$463,000	$403,000	0.783526	$315,761
6	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000	$83,000	0.746215	$61,936
7	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000	$83,000	0.710681	$58,987
8	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000	$83,000	0.676839	$56,178
9	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000	$83,000	0.644609	$53,503
10	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000	($117,000)	0.613913	($71,828)
11	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000	$83,000	0.584679	$48,528
12	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000	$83,000	0.556837	$46,218
13	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000	$83,000	0.530321	$44,017
14	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000	$83,000	0.505068	$41,921
15	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000	$83,000	0.481017	$39,924
16	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000	$83,000	0.458112	$38,023
17	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000	$83,000	0.436297	$36,213
18	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000	$83,000	0.415521	$34,488
19	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000	$83,000	0.395734	$32,846
20	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000	($117,000)	0.376889	($44,096)
21	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000	$83,000	0.358942	$29,792
22	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000	$83,000	0.34185	$28,374
23	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000	$83,000	0.325571	$27,022
24	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000	$83,000	0.310068	$25,736
25	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000	$83,000	0.295303	$24,510
26	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000	$83,000	0.281241	$23,343
27	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000	$83,000	0.267848	$22,231
28	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000	$83,000	0.255094	$21,173
29	0	($60,000)	($60,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000	$83,000	0.242946	$20,165
30	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$13,000.00	$0.00	$0.00	$143,000	($117,000)	0.231377	($27,071)

Net present value		($783,090)
Interest rate	Years	
5%	30	

Gresham WWTP
FOG Codigestion Financial Feasibility Analysis
High Strength FOG, Avoided Power Cost, BETC, Green Tags, No Tipping Fee

Interest rate	5%	Tipping fee	$0.00 per gallon
FOG/Food waste quantity	17,000 gpd	Cogen unit	395 kW
Average total solids	6.70%	Power purchase avoided	3,014,000 kWh/year

		Expenditures				Income							
Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Grren tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor	Yearly net income X Present value factor	
0	($3,653,000)	0	($3,653,000)	0	$0.00		$0.00	$0.00	$0	($3,653,000)	1	($3,653,000)	
1	0	($60,000)	($60,000)	$190,000	$365,300.00	$20,761.20	$0.00	$0.00	$576,061	$516,061	0.952381	$491,487	395
2	0	($60,000)	($60,000)	$190,000	$365,300.00	$20,761.20	$0.00	$0.00	$576,061	$516,061	0.907029	$468,083	
3	0	($60,000)	($60,000)	$190,000	$365,300.00	$20,761.20	$0.00	$0.00	$576,061	$516,061	0.863838	$445,793	
4	0	($60,000)	($60,000)	$190,000	$365,300.00	$20,761.20	$0.00	$0.00	$576,061	$516,061	0.822702	$424,565	
5	0	($60,000)	($60,000)	$190,000	$365,300.00	$20,761.20	$0.00	$0.00	$576,061	$516,061	0.783526	$404,347	
6	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$0.00	$210,761	$150,761	0.746215	$112,500	
7	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$0.00	$210,761	$150,761	0.710681	$107,143	
8	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$0.00	$210,761	$150,761	0.676839	$102,041	
9	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$0.00	$210,761	$150,761	0.644609	$97,182	
10	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$20,761.20	$0.00	$0.00	$210,761	($49,239)	0.613913	($30,228)	
11	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$0.00	$210,761	$150,761	0.584679	$88,147	
12	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$0.00	$210,761	$150,761	0.556837	$83,949	
13	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$0.00	$210,761	$150,761	0.530321	$79,952	
14	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$0.00	$210,761	$150,761	0.505068	$76,145	
15	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$0.00	$210,761	$150,761	0.481017	$72,519	
16	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$0.00	$210,761	$150,761	0.458112	$69,065	
17	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$0.00	$210,761	$150,761	0.436297	$65,777	
18	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$0.00	$210,761	$150,761	0.415521	$62,644	
19	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$0.00	$210,761	$150,761	0.395734	$59,661	
20	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$20,761.20	$0.00	$0.00	$210,761	($49,239)	0.376889	($18,558)	
21	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$0.00	$210,761	$150,761	0.358942	$54,115	
22	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$0.00	$210,761	$150,761	0.34185	$51,538	
23	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$0.00	$210,761	$150,761	0.325571	$49,084	
24	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$0.00	$210,761	$150,761	0.310068	$46,746	
25	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$0.00	$210,761	$150,761	0.295303	$44,520	
26	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$0.00	$210,761	$150,761	0.281241	$42,400	
27	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$0.00	$210,761	$150,761	0.267848	$40,381	
28	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$0.00	$210,761	$150,761	0.255094	$38,458	
29	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.20	$0.00	$0.00	$210,761	$150,761	0.242946	$36,627	
30	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$20,761.20	$0.00	$0.00	$210,761	($49,239)	0.231377	($11,393)	

Net present value		$1,691
Interest rate	Years	
5%	30	

Gresham WWTP
FOG Codigestion Financial Feasibility Analysis
High Strength FOG, Avoided Power Cost, BETC, No Tipping Fee

Interest rate	5%	Tipping fee	$0.00 per gallon
FOG/Food waste quantity	17,000 gpd	Cogen unit	395 kW
Average total solids	6.70%	Power purchase avoided	3,014,000 kWh/year

	Expenditures			Income							
Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor
0	($3,653,000)	0	($3,653,000)	0	$0.00		$0.00	$0.00	$0	($3,653,000)	1
1	0	($60,000)	($60,000)	$190,000	$365,300.00	$0.00	$0.00	$0.00	$555,300	$495,300	0.952380952
2	0	($60,000)	($60,000)	$190,000	$365,300.00	$0.00	$0.00	$0.00	$555,300	$495,300	0.907029478
3	0	($60,000)	($60,000)	$190,000	$365,300.00	$0.00	$0.00	$0.00	$555,300	$495,300	0.863837599
4	0	($60,000)	($60,000)	$190,000	$365,300.00	$0.00	$0.00	$0.00	$555,300	$495,300	0.822702475
5	0	($60,000)	($60,000)	$190,000	$365,300.00	$0.00	$0.00	$0.00	$555,300	$495,300	0.783526166
6	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000	$130,000	0.746215397
7	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000	$130,000	0.71068133
8	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000	$130,000	0.676839362
9	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000	$130,000	0.644608916
10	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000	($70,000)	0.613913254
11	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000	$130,000	0.584679289
12	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000	$130,000	0.556837418
13	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000	$130,000	0.530321351
14	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000	$130,000	0.505067953
15	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000	$130,000	0.481017098
16	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000	$130,000	0.458111522
17	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000	$130,000	0.436296688
18	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000	$130,000	0.415520655
19	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000	$130,000	0.395733957
20	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000	($70,000)	0.376889483
21	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000	$130,000	0.358942365
22	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000	$130,000	0.341849871
23	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000	$130,000	0.325571306
24	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000	$130,000	0.31006791
25	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000	$130,000	0.295302772
26	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000	$130,000	0.281240735
27	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000	$130,000	0.267848319
28	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000	$130,000	0.255093637
29	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000	$130,000	0.242946321
30	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$0.00	$0.00	$0.00	$190,000	($70,000)	0.231377449

Net present value

Interest rate	Years
5%	30

Gresham WWTP
FOG Codigestion Financial Feasibility Analysis
High Strength FOG, Avoided Power Cost,BETC, Green Tags, No Tipping Fee

Interes
t rate 5%
FOG/Food waste 17,000 gpd
Average total solids 6.70%

Tipping fee $0.00 per gallon
Cogen unit 395 kW
Power purchase avoided 3,014,000 kWh/year

		Expenditures				Income					
Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor
0	($2,700,000)	0	($2,700,000)	0	$0.00		$0.00	$0.00	$0	($2,700,000)	1
1	0	($60,000)	($60,000)	$190,000	$270,000.00	$20,761.00	$0.00	$0.00	$480,761	$420,761	0.952380952
2	0	($60,000)	($60,000)	$190,000	$270,000.00	$20,761.00	$0.00	$0.00	$480,761	$420,761	0.907029478
3	0	($60,000)	($60,000)	$190,000	$270,000.00	$20,761.00	$0.00	$0.00	$480,761	$420,761	0.863837599
4	0	($60,000)	($60,000)	$190,000	$270,000.00	$20,761.00	$0.00	$0.00	$480,761	$420,761	0.822702475
5	0	($60,000)	($60,000)	$190,000	$270,000.00	$20,761.00	$0.00	$0.00	$480,761	$420,761	0.783526166
6	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$0.00	$210,761	$150,761	0.746215397
7	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$0.00	$210,761	$150,761	0.71068133
8	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$0.00	$210,761	$150,761	0.676839362
9	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$0.00	$210,761	$150,761	0.644608916
10	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$20,761.00	$0.00	$0.00	$210,761	($49,239)	0.613913254
11	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$0.00	$210,761	$150,761	0.584679289
12	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$0.00	$210,761	$150,761	0.556837418
13	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$0.00	$210,761	$150,761	0.530321351
14	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$0.00	$210,761	$150,761	0.505067953
15	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$0.00	$210,761	$150,761	0.481017098
16	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$0.00	$210,761	$150,761	0.458111522
17	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$0.00	$210,761	$150,761	0.436296688
18	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$0.00	$210,761	$150,761	0.415520655
19	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$0.00	$210,761	$150,761	0.395733957
20	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$20,761.00	$0.00	$0.00	$210,761	($49,239)	0.376889483
21	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$0.00	$210,761	$150,761	0.358942365
22	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$0.00	$210,761	$150,761	0.341849871
23	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$0.00	$210,761	$150,761	0.325571306
24	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$0.00	$210,761	$150,761	0.31006791
25	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$0.00	$210,761	$150,761	0.295302772
26	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$0.00	$210,761	$150,761	0.281240735
27	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$0.00	$210,761	$150,761	0.267848319
28	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$0.00	$210,761	$150,761	0.255093637
29	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$0.00	$210,761	$150,761	0.242946321
30	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$20,761.00	$0.00	$0.00	$210,761	($49,239)	0.231377449

Net present value

Interest rate	Years
5%	30

Gresham WWTP
FOG Codigestion Financial Feasibility Analysis

Interest rate 5%
FOG/Food waste quantity 17,000 gpd
Average total solids 6.70%

Tipping fee $0.00 per gallon
Cogen unit 395 kW
Power purchase avoided 3,014,000 kWh/year

	Expenditures			Income							
Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor	Yearly net income X Present value factor
0	($2,700,000)	0	($2,700,000)	0	$0.00	$0.00	$0.00	$0.00	($2,700,000)	1	($2,700,000)
1	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.952381	$123,810
2	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.907029	$117,914
3	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.863838	$112,299
4	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.822702	$106,951
5	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.783526	$101,858
6	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.746215	$97,008
7	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.710681	$92,389
8	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.676839	$87,989
9	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.644609	$83,799
10	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	($70,000)	0.613913	($42,974)
11	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.584679	$76,008
12	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.556837	$72,389
13	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.530321	$68,942
14	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.505068	$65,659
15	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.481017	$62,532
16	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.458112	$59,554
17	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.436297	$56,719
18	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.415521	$54,018
19	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.395734	$51,445
20	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	($70,000)	0.376889	($26,382)
21	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.358942	$46,663
22	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.34185	$44,440
23	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.325571	$42,324
24	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.310068	$40,309
25	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.295303	$38,389
26	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.281241	$36,561
27	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.267848	$34,820
28	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.255094	$33,162
29	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	$130,000	0.242946	$31,583
30	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$0.00	$0.00	$190,000.00	($70,000)	0.231377	($16,196)

Net present value ($946,017)

Interest rate	Years
5%	30

Gresham WWTP
FOG Codigestion Financial Feasibility Analysis
Low Strength FOG, Avoided Power Cost, $0.05 Tipping Fee

Interest rate 5% Tipping fee $0.0500 per gallon
FOG/Food waste quantity 17,000 gpd (5-day week) Cogen unit 395 kW
Average total solids 2.70% Power purchase avoided 3,014,000 kWh/year

		Expenditures			Income							
Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Sale of green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor	Yearly net income X Present value factor
0	($3,653,000)	0	($3,653,000)	0	$0.00	$0.00	$0.00	$0.00	$0.00	($3,653,000)	1	($3,653,000)
1	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.952380952	$277,143
2	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.907029478	$263,946
3	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.863837599	$251,377
4	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.822702475	$239,406
5	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.783526166	$228,006
6	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.746215397	$217,149
7	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.71068133	$206,808
8	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.676839362	$196,960
9	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.644608916	$187,581
10	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$91,000	0.613913254	$55,866
11	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.584679289	$170,142
12	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.556837418	$162,040
13	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.530321351	$154,324
14	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.505067953	$146,975
15	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.481017098	$139,976
16	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.458111522	$133,310
17	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.436296688	$126,962
18	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.415520655	$120,917
19	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.395733957	$115,159
20	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$91,000	0.376889483	$34,297
21	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.358942365	$104,452
22	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.341849871	$99,478
23	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.325571306	$94,741
24	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.31006791	$90,230
25	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.295302772	$85,933
26	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.281240735	$81,841
27	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.267848319	$77,944
28	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.255093637	$74,232
29	0	($60,000)	($60,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$291,000	0.242946321	$70,697
30	($200,000)	($60,000)	($260,000)	$130,000	$0.00	$0.00	$0.00	$221,000.00	$351,000.00	$91,000	0.231377449	$21,055

Net present value $575,947
Interest rate Years
5% 30

Gresham WWTP
FOG Codigestion Financial Feasibility Analysis
High Strength FOG, Avoided Power Cost, $0.05 Tipping Fee

Interest rate	5%		Tipping fee	$0.0500 per gallon
FOG/Food waste quantity	17,000 gpd (5-day week)		Cogen unit	395 kW
Average total solids	6.70%		Power purchase avoided	3,014,000 kWh/year

	Expenditures			Income								
Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Sale of green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor	Yearly net income X Present value factor
0	($3,653,000)	0	($3,653,000)	0	$0.00	$0.00	$0.00	$0.00	$0.00	($3,653,000)	1	($3,653,000)
1	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.952380952	$334,286
2	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.907029478	$318,367
3	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.863837599	$303,207
4	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.822702475	$288,769
5	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.783526166	$275,018
6	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.746215397	$261,922
7	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.71068133	$249,449
8	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.676839362	$237,571
9	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.644608916	$226,258
10	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$151,000	0.613913254	$92,701
11	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.584679289	$205,222
12	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.556837418	$195,450
13	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.530321351	$186,143
14	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.505067953	$177,279
15	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.481017098	$168,837
16	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.458111522	$160,797
17	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.436296688	$153,140
18	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.415520655	$145,848
19	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.395733957	$138,903
20	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$151,000	0.376889483	$56,910
21	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.358942365	$125,989
22	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.341849871	$119,989
23	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.325571306	$114,276
24	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.31006791	$108,834
25	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.295302772	$103,651
26	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.281240735	$98,715
27	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.267848319	$94,015
28	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.255093637	$89,538
29	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$351,000	0.242946321	$85,274
30	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$0.00	$0.00	$221,000.00	$411,000.00	$151,000	0.231377449	$34,938

Net present value		$1,498,294
Interest rate	Years	
5%	30	

Gresham WWTP
FOG Codigestion Financial Feasibility Analysis
High Strength FOG, Avoided Power Cost, $0.03 Tipping Fee

Interest rate	5%		Tipping fee	$0.0300	per gallon
FOG/Food waste quantity	17,000	gpd (5-day week)	Cogen unit	395	kW
Average total solids	6.70%		Power purchase avoided	3,014,000	kWh/year

Expenditures

Income

Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor
0	($3,653,000)	0	($3,653,000)	0	$0.00	$0.00	$0.00	$0.00	$0.00	($3,653,000)	1
1	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.952380952
2	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.907029478
3	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.863837599
4	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.822702475
5	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.783526166
6	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.746215397
7	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.71068133
8	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.676839362
9	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.644608916
10	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$62,600	0.613913254
11	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.584679289
12	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.556837418
13	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.530321351
14	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.505067953
15	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.481017098
16	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.458111522
17	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.436296688
18	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.415520655
19	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.395733957
20	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$62,600	0.376889483
21	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.358942365
22	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.341849871
23	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.325571306
24	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.31006791
25	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.295302772
26	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.281240735
27	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.267848319
28	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.255093637
29	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$262,600	0.242946321
30	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$0.00	$0.00	$132,600.00	$322,600.00	$62,600	0.231377449

Net present value

Interest rate	Years
5%	30

Gresham WWTP
FOG Codigestion Financial Feasibility Analysis
High Strength FOG, Avoided Power Cost, BETC, Green Tags, $0.10 Tipping Fee

Interest rate	5%	Tipping fee	$0.10 per gallon
FOG/Food waste quantity	17,000 gpd (5-day week)	Cogen unit	395 kW
Average total solids	6.70%	Power purchase avoided	3,014,000 kWh/year

		Expenditures				Income						
Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor	Yearly net income X Present value factor
0	($3,653,000)	0	($3,653,000)	0	$0.00		$0.00	$0.00	$0.00	($3,653,000)	1	($3,653,000)
1	0	($60,000)	($60,000)	$190,000	$365,300.00	$20,761.00	$0.00	$442,000.00	$1,018,061.00	$958,061	0.95238095	$912,439
2	0	($60,000)	($60,000)	$190,000	$365,300.00	$20,761.00	$0.00	$442,000.00	$1,018,061.00	$958,061	0.90702948	$868,990
3	0	($60,000)	($60,000)	$190,000	$365,300.00	$20,761.00	$0.00	$442,000.00	$1,018,061.00	$958,061	0.8638376	$827,609
4	0	($60,000)	($60,000)	$190,000	$365,300.00	$20,761.00	$0.00	$442,000.00	$1,018,061.00	$958,061	0.82270247	$788,199
5	0	($60,000)	($60,000)	$190,000	$365,300.00	$20,761.00	$0.00	$442,000.00	$1,018,061.00	$958,061	0.78352617	$750,666
6	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$442,000.00	$652,761.00	$592,761	0.7462154	$442,327
7	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$442,000.00	$652,761.00	$592,761	0.71068133	$421,264
8	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$442,000.00	$652,761.00	$592,761	0.67683936	$401,204
9	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$442,000.00	$652,761.00	$592,761	0.64460892	$382,099
10	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$20,761.00	$0.00	$442,000.00	$652,761.00	$392,761	0.61391325	$241,121
11	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$442,000.00	$652,761.00	$592,761	0.58467929	$346,575
12	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$442,000.00	$652,761.00	$592,761	0.55683742	$330,072
13	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$442,000.00	$652,761.00	$592,761	0.53032135	$314,354
14	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$442,000.00	$652,761.00	$592,761	0.50506795	$299,385
15	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$442,000.00	$652,761.00	$592,761	0.4810171	$285,128
16	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$442,000.00	$652,761.00	$592,761	0.45811152	$271,551
17	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$442,000.00	$652,761.00	$592,761	0.43629669	$258,620
18	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$442,000.00	$652,761.00	$592,761	0.41552065	$246,304
19	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$442,000.00	$652,761.00	$592,761	0.39573396	$234,576
20	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$20,761.00	$0.00	$442,000.00	$652,761.00	$392,761	0.37688948	$148,027
21	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$442,000.00	$652,761.00	$592,761	0.35894236	$212,767
22	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$442,000.00	$652,761.00	$592,761	0.34184987	$202,635
23	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$442,000.00	$652,761.00	$592,761	0.32557131	$192,986
24	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$442,000.00	$652,761.00	$592,761	0.31006791	$183,796
25	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$442,000.00	$652,761.00	$592,761	0.29530277	$175,044
26	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$442,000.00	$652,761.00	$592,761	0.28124073	$166,709
27	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$442,000.00	$652,761.00	$592,761	0.26784832	$158,770
28	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$442,000.00	$652,761.00	$592,761	0.25509364	$151,210
29	0	($60,000)	($60,000)	$190,000	$0.00	$20,761.00	$0.00	$442,000.00	$652,761.00	$592,761	0.24294632	$144,009
30	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$20,761.00	$0.00	$442,000.00	$652,761.00	$392,761	0.23137745	$90,876

	Net present value	$6,796,311
	Interest rate	Years
5%	30	

Gresham WWTP
FOG Codigestion Financial Feasibility Analysis
High Strength FOG, Avoided Power Cost, $0.10 Tipping Fee

Interest rate	5%		Tipping fee	$0.10	per gallon
FOG/Food waste quantity	17,000	gpd (5-day week)	Cogen unit	395	kW
Average total solids	6.70%		Power purchase avoided	3,014,000	kWh/year

		Expenditures			Income								
Year	Capital expenditure	Annual operations and maintenance cost	Sum of yearly expenditures	Electrical power cost avoided	BETC tax credit	Green tags	Energy Trust incentive payment	Tipping fee	Sum of avoided costs and income	Yearly income less expenditures	Present value factor	Yearly net income X Present value factor
0	($3,653,000)	0	($3,653,000)	0	$0.00	$0.00	$0.00	$0.00	$0.00	($3,653,000)	1	($3,653,000)
1	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.952380952	$544,762
2	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.907029478	$518,821
3	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.863837599	$494,115
4	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.822702475	$470,586
5	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.783526166	$448,177
6	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.746215397	$426,835
7	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.71068133	$406,510
8	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.676839362	$387,152
9	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.644608916	$368,716
10	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$372,000	0.613913254	$228,376
11	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.584679289	$334,437
12	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.556837418	$318,511
13	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.530321351	$303,344
14	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.505067953	$288,899
15	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.481017098	$275,142
16	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.458111522	$262,040
17	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.436296688	$249,562
18	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.415520655	$237,678
19	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.395733957	$226,360
20	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$372,000	0.376889483	$140,203
21	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.358942365	$205,315
22	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.341849871	$195,538
23	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.325571306	$186,227
24	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.31006791	$177,359
25	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.295302772	$168,913
26	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.281240735	$160,870
27	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.267848319	$153,209
28	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.255093637	$145,914
29	0	($60,000)	($60,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$572,000	0.242946321	$138,965
30	($200,000)	($60,000)	($260,000)	$190,000	$0.00	$0.00	$0.00	$442,000.00	$632,000.00	$372,000	0.231377449	$86,072
										Net present value		$4,895,606
										Interest rate	Years	
										5%	30	

Appendix C

Example septage waste plan for the Shady Cove Treatment Plant (Rogue Valley Sewer Services)

1. DEQ Request Letter

2. Standard Operating Procedures for the receipt of hauled waste.

3. Waste Hauler application form.

4. Waste delivery manifest.

5. Waste Hauler authorization letter.

6. Loading calculations.

ROGUE VALLEY SEWER SERVICES

Location: 138 West Vilas Road, Central Point, OR - Mailing Address: P.O. Box 3130, Central Point, OR 97502-0005
Tel. (541) 664-6300, Fax (541) 664-7171 www.RVSS.us

October 2, 2012

Jon Gasik, PE
Oregon Department of Environmental Quality
221 Stewart Ave, Suite 201
Medford, OR 97501

RE: Proposal to Receive Hauled Waste at the Shady Cove Wastewater Treatment Plant, NPDES Permit No. 100998

Dear Jon,

Rogue Valley Sewer Services operates the Shady Cove Wastewater Treatment Plant under contract with the City. We are requesting approval of a plan to receive and treat hauled waste at this plant. Under this plan we would only receive domestic septic tank waste. The volume of waste received would be limited to 3,000 gallons per day when one aeration basin is in operation and 15,000 gallons per day when two basins are in operation. Our calculations indicate that this additional loading will have no adverse impact on the plant's performance.

Please find enclosed the following:

1. Standard Operating Procedures for the receipt of hauled waste.
2. Waste Hauler application form.
3. Waste delivery manifest.
4. Waste Hauler authorization letter.
5. Loading calculations.

Please call me if you have any questions regarding this proposal.

Thank you,

Carl Tappert, PE

Cc: Danise Brakeman, City of Shady Cove.

Standard Operating Procedures

Department: **Shady Cove WWTP**

Subject: **Hauled Waste Disposal**

Approved by: **Carl Tappert, Manager**

Responsible Person: **Treatment Plant Supervisor**

Participants: **Treatment Plant Staff**

General: Hauled waste from domestic septic tanks may be disposed of at the Shady Cove Wastewater Treatment Plant provided that the disposal does not adversely impact the operations of the plant. The Treatment Plant Supervisor has the authority to accept or reject any truck load of hauled waste.

Hauler Authorization: All waste haulers wanting to discharge at the plant must complete a Waste Hauler Authorization form [attached]. Haulers approved by RVSS will be given authorization to discharge. This authorization acknowledges that the hauler has the appropriate equipment, state licensing, insurance, etc. to haul waste. The hauler must agree to abide by the requirements of the hauler authorization. It does not guarantee that the plant will be able to accept any or all of the waste the hauler generates. RVSS may rescind a hauler's authorization to discharge hauled waste if the hauler is found to be in violation with the provisions of the hauler authorization.

Source of Waste: Waste will only be accepted from domestic septic tanks from within Jackson County. Waste from commercial or industrial tanks, or from chemical toilets, porta-potties, etc. will not be accepted.

Prohibited Materials: The plant not accept any pollutant(s) which cause Pass Through or Interference with wastewater treatment processes. In addition, the following pollutants shall not be introduced into a POTW:

(1) Pollutants which create a fire or explosion hazard;

(2) Pollutants with pH If the pH is below 6.0 or above 9.0;

(3) Solid or viscous pollutants in amounts which will cause obstruction to the flow in the POTW resulting in Interference;

(4) Any pollutant, including oxygen demanding pollutants (BOD, etc.) released in a Discharge at a flow rate and/or pollutant concentration which will cause Interference with the POTW.

(5) Heat in amounts which will inhibit biological activity in the POTW resulting in Interference

(6) Petroleum oil, nonbiodegradable cutting oil, or products of mineral oil origin in amounts that will cause interference or pass through;

(7) Pollutants which result in the presence of toxic gases, vapors, or fumes within the POTW in a quantity that may cause acute worker health and safety problems;

Volume of Waste: The plant will only accept waste at times and days designated by the plant supervisor. A maximum of 3,000 gallons of septic waste per day will be accepted when one aeration basin is in operation and 15,000 gallons when both aeration basins are in operation.

Waste Testing: Every load received will be tested for pH and Toxicity prior to discharge. The supervisor will reject any load that does not meet the pH or toxicity requirements. In addition, if the supervisor believes that the load has constituents that could adversely affect the operation of the plant the load will be rejected pending the results of further testing. A sample from each load will be collected and held for a period of 1 week.

1. The pH test will be made using test strips. If the pH is below 6.0 or above 9.0 the load will be rejected.

2. Toxicity will be tested by observing a sample of the waste under a microscope to view microbial activity. The plant operator will determine if the sample has a normal level of microbial activity. If, in the opinion of the operator, the activity is absent or diminished, the load will be rejected. The operator will notify the following agencies that the load has been rejected and the reasons for rejection:

   Oregon DEQ (541-776-6010)
   Clearwater Technology (541-471-6226)
   Heard Farms (541-459-7529)

   2.1. If a load is rejected because of low microbial activity, the hauler may submit a sample of the waste to an approved testing lab Laboratory for a Priority Pollutants (OR-DEQ Reasonable Potential Analysis) test. If the results of this test indicate no harmful constituents the load will be accepted. The hauler is responsible for the cost of this test. The test must, at minimum, test for the following constituents:

2.1.1. Specific Oxygen Uptake Rate (SOUR)	SM 2710 B.
2.1.2. Pesticides and PCBs	EPA 608
2.1.3. VOCs	EPA 624
2.1.4. Semi-Volatiles	EPA 625
2.1.5. Metals	EPA 200.8
2.1.5.1. Arsenic	
2.1.5.2. Antimony	
2.1.5.3. Berylium	
2.1.5.4. Cadmium	
2.1.5.5. Chromium	

2.1.5.6. Copper
2.1.5.7. Lead
2.1.5.8. Mercury
2.1.5.9. Molybdenum
2.1.5.10. Nickel
2.1.5.11. Selenium
2.1.5.12. Silver
2.1.5.13. Thalium
2.1.5.14. Zinc

3. Plant upset: If there is a significant increase in BOD, TSS, and/or ammonia effluent concentrations, or an obvious upset at the plant the samples from the previous week's deliveries will be tested for toxicity as noted above to determine if any of the deliveries contributed to the plant upset.

4. Random Testing: At least once per month, a random sample will be tested for Specific Oxygen Uptake Rate (SOUR), BOD, TSS, and nutrients (TKN, NH3-Nm NO2+NO3-N, Total phosphorus). At least once per quarter, a random sample will be tested for VOCs and Metals as noted above.

Discharge Procedures:

1. Haulers must schedule the delivery at least 24 hours in advance. The treatment plant supervisor will give the hauler a time frame when deliveries will be accepted.

2. Upon arrival at the plant the hauler will provide the Supervisor with a manifest identifying the sources and volume of the waste.

3. The Supervisor will inspect the delivery and take a sample of the waste. The waste will be tested as noted above.

4. All waste accepted will be discharged into the manhole immediately upstream from the headworks through a cam-lock connection port, if available. If the connection port is not available the discharge will be made by extending the discharge hose to the invert of the manhole.

5. The Waste Hauler will be responsible for hosing down the dump site and leaving it in clean condition.

6. The hauler and Supervisor will sign the manifest upon completion of disposal.

Billing:

1. Haulers will be billed on a monthly basis for all deliveries in the previous month.

2. Haulers that are 30 days past due on payment will be prohibited from discharging.

3. The billing rate will be per gallon and will assume that all deliveries are at full capacity.

Record Keeping:

1. The plant Supervisor will maintain a database to track all of the septic waste delivered to the plant.

2. The Plant Supervisor will maintain a database of all test results from septic waste delivered to the plant.

3. The plant Supervisor will provide the General Manager with a monthly report documenting the amount of hauled waste received by the plant.

Discharge Procedures:

1. Haulers must schedule the delivery a minimum of 24 hours in advance.

Approved by:

District Engineer, Wade Denny ________ Date: 10/2/12

Maintenance Supervisor, Terry Sackett Terry Sackett Date: 10-2-12

ROGUE VALLEY SEWER SERVICES
WASTE TRANSPORTER AUTHORIZATION APPLICATION

Section A - Company Informatio

Company Name: Brownsboro Excavation, Inc.

Mailing Address: 125 S. Obenchain Rd.

City: Eagle Point State: OR Zip: 97524

Contact Name: Phone: (541)826-1438

DEQ License No: 36599 Expiration Date: 6/30/2013

Section B - Waste Transport Vehicles

Make	Model	Tank Volume	Plate No.	State	Expiration Date	RVSS Vehicle Numbe

Section C - Insuranc

Attach a certificate documenting that your company has adequate comprehensive general liability and auto liability insurance that includes RVSS and the City of Sady Cove as additional insureds and includes provisions for informing RVSS 10 days prior to the time of policy cancellations or renewals.

I have personally examined and am familiar with the information submitted in this document and attachments and certify the information to be true, accurate, and complete. I further agree to operate under provisions of all pertinent RVSS Code and realize failure to do so may result in my discharge privileges being revoked and enforcement action being taken against me.

Name and Title of Signing Official: ______________________

Signature: ______________________ Date: __________

Approved By: ______________________

Carl Tappert, Manager
Rogue Valley Sewer Services

NON-HAZARDOUS WASTE MANIFEST

RVSS Delivery #: 6 Company Name: "A Fresh Way" Septic Tank Cleaning Service

DEQ License #: 35219 Phone: (541)772-6954 VehicleID #: 6

SOURCE INFORMATION:

Name	Address	Phone	Volume

Total Waste:

Gallons

TEST RESULTS:

pH: ____________________________

Toxicity: ____________________________

Date Waste Received: ________________

Receiving Operator: ________________________

ROGUE VALLEY SEWER SERVICES
Location: 138 West Vilas Road, Central Point, OR - Mailing Address: P.O. Box 3130, Central Point, OR 97502-0005
Tel. (541) 664-6300, Fax (541) 664-7171 www.RVSS.us

[date]

[Company Name and Address]

RE: Waste Hauler Authorization

Rogue Valley Sewer Services has approved your request to haul septic waste to the Shady Cove Wastewater Treatment Plant. This approval is subject to the following conditions:

1. All waste hauled to the plant must come from domestic sources only. No commercial, industrial, agricultural, or other sources of waste are permitted.
2. All waste hauled to the plant must originate within Jackson County, Oregon.
3. All waste deliveries must be scheduled a minimum of 24 hours in advance. The scheduling is done through our main office at 541-779-4184.
4. Deliveries to the plant must approach from the South on Rogue River Drive. We do not want full trucks travelling on Rogue River Drive through the City.
5. Waste containing prohibited materials, unacceptable pH levels, or evidence of toxicity will not be accepted. (See Standard Operating Procedures)
6. Haulers must follow all testing and discharge procedures outlined in the Standard Operating Procedures.

This authorization is valid for a period of two years. Authorization expires on [date]. Rogue Valley Sewer Services may terminate this service at any time.

Failure to comply with these conditions will result in your discharge privilege being suspended or revoked.

Carl Tappert, PE
Manager

Oct 1, 2012

1/6

Shady Cove Wastewater Treatment Plant

<u>Purpose:</u> Assess the impact of adding domestic septic tanks waste to the treatment plant.

<u>Step 1 - Determine Plant Capacity</u>: Plant is an activated sludge plant using extended aeration process. There are two aeration basins each with a volume of 35,000 ft^3. Basins can be operated singly or in parallel.

<u>Capacity Based on Volumetric Loading</u>: Loading is expressed in terms of pounds of BOD/day divided by the volume of the aeration basin. For extended aeration acceptable operating range is 10 - 30 lb BOD/day/1,000 ft^3 [Water Supply and Pollution Control, Viessman and Hammer, Table 12.3]

Plant capacity range $= 10 \frac{\text{lb BOD}}{\text{day}}/1000\,\text{ft}^3 \times 35{,}000\,\text{ft}^3 = 350 \frac{\text{lb BOD}}{\text{Day}}$

to $30 \frac{\text{lb BOD}}{\text{day}}/1000\,\text{ft}^3 \times 35{,}000\,\text{ft}^3 = 1{,}050 \frac{\text{lb BOD}}{\text{day}}$

$350 - 1{,}050 \frac{\text{lb BOD}}{\text{day}}$ per Basin

2/6

Oct. 1, 2012

Capacity Based on Food/Microorganism (F/M) Ratio: Loading is expressed in terms of pounds of BOD applied per day divided by the pounds of MLSS in the aeration basin. Acceptable operating range for extended aeration is 0.05 to 0.2 $\frac{\text{lb BOD}}{\text{lb MLSS}}$ [ibid] Operating range of MLSS is 2,000-5,000 mg/l [Metcalf and Eddy, Table 8-1c]

Plant Capacity Range

$$\frac{0.05\text{ lb BOD}}{\text{lb MLSS}}\;\Big|\;\frac{2{,}000\text{ mg MLSS}}{l}\;\Big|\;\frac{28.3\,l}{1\text{ ft}^3}\;\Big|\;\frac{1\text{ lb}}{453{,}592\text{ mg}}\;\Big|\;35{,}000\text{ ft}^3$$

$= 218$ lb BOD/day Lower Bound

$$\frac{0.20\text{ lb BOD}}{\text{lb MLSS}}\;\Big|\;\frac{5{,}000\text{ mg MLSS}}{l}\;\Big|\;\frac{28.3\,l}{1\text{ ft}^3}\;\Big|\;\frac{1\text{ lb}}{453{,}592\text{ mg}}\;\Big|\;35{,}000\text{ ft}^3$$

$= 2{,}184$ lb BOD/day Upper Bound

Oct. 1, 2012

STEP 2 - Determine Current Loading

Plant records from January 2008 through August 2012 show the following (See attached data sheet)

Sample mean = 495 lbs BOD/day
Precision = ± 39 lbs BOD/day
Confidence Interval = 456 - 534 lbs BOD/day

For MLSS
Sample Mean : 2,955 mg/l
Precision : 238 mg/l
Confidence Interval : 2,716 - 3193 mg/l

Volumetric loading using upper bound of confidence interval :

$$534 \frac{\text{lbs BOD}}{\text{day}} \div 35,000 \text{ ft}^3 = 15.2 \frac{\text{lbs BOD}}{1,000 \text{ ft}^3}$$ ✓

F/M loading using upper bound of BOD and Lower Bound of MLSS

534 lbs BOD	l	1 ft^3	453,592 mg	
day	2,716 mg MLSS	28.3 l	1 lbs	35,000 ft^3

$$= 0.09 \frac{\text{lbs BOD}}{\text{lbs MLSS}}$$ ✓

∴ Both parameters are within acceptable range.

Oct 1, 2012

STEP 3 - Evaluate Proposed Additional Loading.

OPTION 1 - Add 3,000 gallons/day of septic waste to plant

Septic Waste strength = 6,500 mg/l BOD

Additional load:

$$\frac{3000\ \text{gal}}{\text{day}} \left| \frac{6{,}500\ \text{mg BOD}}{l} \right| \frac{3.78\ l}{1\ \text{gal}} \left| \frac{1\ \text{lb}}{453{,}592\ \text{mg}} \right.$$

$= 162$ lb BOD/day

Add to existing load $= 534 + 162 = 696$ lb BOD/day

Check loading:

Volumetric

$$696\ \frac{\text{lb BOD}}{\text{day}} \div 35{,}000\ \text{ft}^3 = 19.9\ \frac{\text{lb BOD}}{1{,}000\ \text{ft}^3}$$ ✓

F/M Ratio

$$\frac{696\ \text{lb BOD}}{\text{day}} \left| \frac{l}{2{,}716\ \text{mg MLSS}} \right| \frac{1\ \text{ft}^3}{28.3\ l} \left| \frac{453592\ \text{mg}}{1\ \text{lb}} \right| \frac{}{35{,}000\ \text{ft}^3}$$

$= 0.12\ \frac{\text{lb BOD}}{\text{lb MLSS}}$ ✓

∴ Both parameters are within acceptable range.

Oct. 1, 2012

OPTION 2 - Add 15,000 gallons/day of Septic Waste with both aeration basins in operation.

Additional Load

$$\frac{15{,}000\ \text{gal}}{\text{day}} \Bigg| \frac{6{,}500\ \text{mg BOD}}{\ell} \Bigg| \frac{3.78\ \ell}{1\ \text{gal}} \Bigg| \frac{1\ \text{lb}}{453{,}592\ \text{mg}} =$$

812 lb BOD / Day

Add to existing load = 534 + 812 = 1,346 $\frac{\text{lb BOD}}{\text{day}}$

Check Loading

Volumetric:

$$1{,}346\ \frac{\text{lb BOD}}{\text{day}} \div 70{,}000\ \text{ft}^3 = 19.2\ \frac{\text{lb BOD}}{1{,}000\ \text{ft}^3}$$ ✓

F/M Ratio

$$\frac{1346\ \text{lb BOD}}{\text{day}} \Bigg| \frac{1\ \ell}{2{,}716\ \text{mg MLSS}} \Bigg| \frac{1\ \text{ft}^3}{28.3\ \ell} \Bigg| \frac{453{,}592\ \text{mg}}{1\ \text{lb}} \Bigg| \frac{}{70{,}000\ \text{ft}^3} =$$

$$= 0.11\ \frac{\text{lb BOD}}{\text{lb MLSS}}$$ ✓

∴ Both parameters are within acceptable operating range

Oct. 1, 2012

Conclusion:

The additional loading resulting from the addition of 3,000 gallons of septic waste to the plant with one aeration basin in operation; or of 15,000 gallons of septic waste with two basins in operation, will not adversely impact the plant's performance.

REGISTERED PROFESSIONAL ENGINEER
17,768PE
OREGON
MAY 16, 1995
CARL WALTER TAPPERT

Expires 6/30/2014

Shady Cove Wastewater Treatment Plant			
Month	Average BOD (lb)	Average MLSS (mg/l)	F/M Ratio
January-08	556.1	1,691	0.151
February-08	588.2	2,086	0.130
March-08	568.8	3,274	0.080
April-08	384.1	3,027	0.058
May-08	576.7	2,743	0.097
June-08	449.4	2,547	0.081
July-08	661.0	2,395	0.127
August-08	493.5	1,903	0.119
September-08	401.5	3,125	0.059
October-08	221.0	3,161	0.032
November-08	345.5	3,331	0.048
December-08	361.4	4,235	0.039
January-09	327.8	5,390	0.028
February-09	255.4	5,535	0.021
March-09	344.5	5,622	0.028
April-09	393.4	5,704	0.032
May-09	266.2	4,335	0.028
June-09	384.6	3,242	0.054
July-09	313.9	3,010	0.048
August-09	267.1	3,158	0.039
September-09	341.6	3,236	0.048
October-09	355.4	3,060	0.053
November-09	479.6	2,761	0.080
December-09	782.2	2,993	0.120
January-10	584.1	3,017	0.089
February-10	576.9	3,126	0.085
March-10	646.7	3,156	0.094
April-10	642.5	2,873	0.103
May-10	559.1	2,352	0.109
June-10	733.0	2,255	0.149
July-10	452.4	2,064	0.101
August-10	670.7	1,893	0.163
September-10	337.5	1,973	0.079
October-10	565.8	2,064	0.126
November-10	490.6	2,211	0.102
December-10	435.3	2,176	0.092
January-11	693.9	2,450	0.130
February-11	483.9	2,437	0.091
March-11	521.4	2,547	0.094
April-11	576.6	2,430	0.109
May-11	537.3	2,601	0.095
June-11	580.4	2,482	0.107
July-11	573.5	2,468	0.107
August-11	467.1	2,589	0.083
September-11	398.3	2,640	0.069
October-11	174.7	2,940	0.027
November-11	385.7	2,952	0.060
December-11	537.7	3,104	0.080
January-12	575.8	3,177	0.083
February-12	423.5	2,905	0.067
March-12	850.7	2,773	0.141
April-12	567.0	2,603	0.100
May-12	657.4	2,487	0.121
June-12	648.5	2,871	0.104
July-12	652.8	3,046	0.098
August-12	595.6	3,230	0.085
September-12			
October-12			
November-12			
Mean	494.9	2,954.6	0.085
Standard Dev	146.9	888.9	0.035
Count	56.0	56.0	56.0
Standard Error	19.6	118.8	0.005
Confidence Level	0.95	0.95	0.95
t cutoff value	2.004	2.004	2.004
Precision	39.3	238.1	0.009
Lower Bound	455.6	2,716.5	0.075
Upper Bound	534.3	3,192.6	0.094

Appendix D

Example municipal landfill leachate plan prepared for the City of Reedsport.

City of Reedsport

Leachate Acceptance Plan

City of Reedsport

451 Winchester Avenue
Reedsport, OR 97467

January 2015

Pickets
Engineering
LLC
ACEC Member Firm

6617 NE 132nd Street, Kirkland, WA 98034, Phone (425) 417-2048
pickets@att.net

January 26, 2015

Jon Gasik, PE
Water Quality
Oregon Department of Environmental Quality
750 Front Street NE, Suite 120
Salem, OR 97301

**RE:	City of Reedsport Leachate Acceptance Plan**

Dear Mr. Gasik:

At the request of Jonathan Wright, City Manager, City of Reedsport, Pickets Engineering, LLC, (Pickets) is submitting two copies of the City of Reedsport Leachate Acceptance Plan. Pickets prepared the plan, which includes a Leachate Treatment Evaluation for accepting leachate at the City of Reedsport Wastewater Treatment Plant prepared by BHC Consultants, LLC.

If you have any questions, please contact Jonathan Wright at (541 271-3603 or me at (425) 417-2048.

Sincerely,
PICKETS ENGINEERING, LLC

Kathleen Robertson, P.E., C.E.G.
Principal

cc: Jonathan Wright, City Manager, City of Reedsport
John Stokes, Public Works Director, City of Reedsport
Tom Manton, Manager, Natural Resources Division, Douglas County
Bard Horton, PE, BHC Consultants, LLC

Enclosure:	City of Reedsport Leachate Acceptance Plan

City of Reedsport

Leachate Acceptance Plan

TABLE OF CONTENTS

Appendices

1.0 INTRODUCTION

This plan documents the standard operating procedures (SOPs) for accepting landfill leachate at the City of Reedsport's (the City) Wastewater Treatment Plan (WWTP). The WWTP is in Reedsport, Oregon at 183 West Railroad Avenue on the east side of U.S. Highway 101 near the Umpqua River. The WWTP operates under National Pollutant Discharge Elimination System Wastewater Discharge Permit (NPDES permit) No. 100941, File No. 74319, which is administered by the Oregon Department of Environmental Quality (the DEQ).

1.1 Background

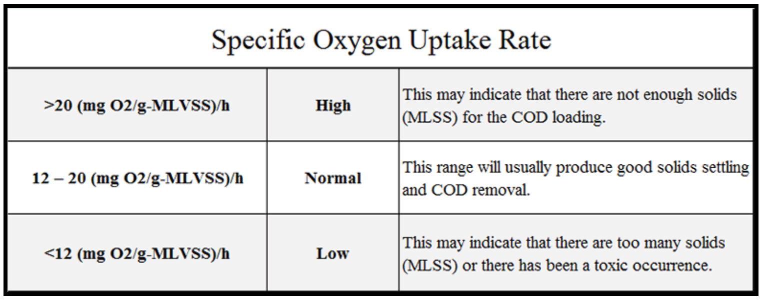
Douglas County (the County) is the permitee for the closed Reedsport Landfill (the Landfill) on Scholfield Creek Road. The DEQ approved the County's conceptual design, with the City or Reedsport's concurrence, to discontinue an on-site treatment system and convey leachate via pipeline to the City's sewer collection system that discharges to the WWTP for treatment. The DEQ requires that the City has a leachate acceptance plan (LAP) in place and has conducted a leachate treatment evaluation (LTE) that demonstrates accepting leachate will not allow pollutants to pass through the system and/or interfere with the treatment process at the WWTP before leachate can be conveyed to the WWTP. The SOPs for leachate acceptance are described in this plan.

1.2 Leachate Treatment Evaluation (LTE)

The LTE was prepared by BHC Consultants and is included in Appendix A. As part of the LTE, the City conducted a Specific Oxygen Uptake Rate (SOUR) test using leachate from the Landfill. The SOUR test results are presented in Appendix B, and summarized below. Iron is also specifically addressed below to address DEQ concerns about the potential for iron to precipitate and become a maintenance issue.

1.2.1 SOUR Test Results

BHC reviewed the City's SOUR test results to evaluate if the applied organic loading from the added leachate was too high or inhibitory. The SOUR test determines the rate that bacteria consume oxygen in the wastewater. The SOUR will fall into one of three ranges (high, normal, or low), as defined below (see http://waterfacts.net/OUR/SOUR/sour.html).



Specific Oxygen Uptake Rate

>20 (mg O2/g-MLVSS)/h	**High**	This may indicate that there are not enough solids (MLSS) for the COD loading.
12 – 20 (mg O2/g-MLVSS)/h	**Normal**	This range will usually produce good solids settling and COD removal.
<12 (mg O2/g-MLVSS)/h	**Low**	This may indicate that there are too many solids (MLSS) or there has been a toxic occurrence.

Notes:

mg = milligram
g = gram
h = hour
MLSS = Mixed Liquor Suspended Solids

The City conducted four SOUR tests on samples of Mixed Liquor (samples Control A and B) from the treatment plant and Mixed Liquor with the Landfill leachate added at a 20:1 ratio by volume (samples Leachate A and B). The results are summarized below:

- Control A, SOUR = 16.9 mg O2/g MLVSS/h
- Leachate A, SOUR = 17.5 mg O2/g MLVSS/h
- Control B, SOUR = 16.9 mg O2/g MLVSS/h
- Leachate B, SOUR = 17.2 mg O2/g MLVSS/h

The results fall within the normal range from the table above. Both leachate samples had slightly higher SOUR values than the control samples which might result from the relatively high Biological Oxygen Demand (BOD) and COD concentration of the leachate. These results indicate that leachate flows at 5 percent or less of the WWTP flows are not likely to inhibit the biological treatment processes of the WWTP.

1.2.2 Iron

BHC's technical memo in Appendix A includes discusses iron as an impact on the WWTP. Based on an average iron concentration of 6.34 milligrams per liter (mg/L) measured in 20 samples of the Landfill leachate and an average annual leachate flow of 4.86 million gallons from 2004 to 2012 results in an average annual iron load of approximately 257 pounds to the WWTP. If 100% of the iron is removed by the treatment process, iron in the biosolids generated at the WWTP would increase by 257 pounds on average. Biosolids disposal does not have a regulatory limit for iron.

BHC's recent experience includes landfill leachate that had average iron concentrations approximately ten times higher (68 mg/L) received at the City of Unalaska's (in Alaska) wastewater treatment plant. At the plant, iron staining or precipitate was observed on equipment. While the leachate partially attributed to fouling of the ultraviolet disinfection system, the City's WWTP uses a chlorine disinfection system, which is not susceptible to fouling. In summary, at the concentrations measured in the Landfill leachate, iron is not expected to cause maintenance issues at the WWTP.

2.0 STANDARD OPERATING PROCEDURES (SOPS)

2.1 Leachate Waste

The Landfill is the source of leachate, which is classified as non-hazardous waste. The WWTP Superintendent has the authority to refuse to accept leachate if conditions develop related to the delivered leachate that would cause the WWTP to violate conditions of its NPDES permit.

2.2 Authorization to Discharge to the WWTP Collection System

Terms and conditions for accepting the leachate will be documented in an Intergovernmental Agreement (IGA) executed between the City and the County. This LAP will be made part of the IGA by reference.

2.3 Leachate Conveyance and Connection Point

The County will convey leachate to the WWTP via a pipeline that connects to the City's sewer system. The City has designated the connection point to be at the end of a new sewer extension on Elm Avenue, east of Crestview Access Road and near an existing stream gauging station. This location is approximately 0.7 miles from the WWTP. The City plans to build the sewer extension in 2015.

2.4 Prohibited Waste

The City will not accept leachate that contains pollutants that would allow pollutants to pass through the system and/or interfere with the treatment process with the WWTP processes, including:

1. Leachate that has a pH below 6.0 or above 9.0.
2. Solid or viscous pollutants in amounts that could obstruct flow resulting in interference.
3. Any pollutant, including oxygen demanding pollutants (e.g., BOD, etc.), released at a flow rate or concentration that will cause interference.
4. Leachate having a temperature that will inhibit biological activity in the WWTP resulting in interference.
5. Fats, oils or grease, including petroleum oil, non-biodegradable oil or products of mineral origin that could cause interference.
6. Pollutants that result in the presence of toxic gases, vapors or fumes within the WWTP that could cause worker health or safety issues.
7. Domestic septage shall not be commingle with leachate.
8. Waters or wastes containing sludges or screenings from tank bottom contents, industrial sump bottom contents, grease or oil trap wastes, plating or metal finishing wastes.
9. Noxious or malodorous liquids, gases, solids, or other wastewaters, which either singly or by interaction with other wastes, create a public nuisance or hazard to life, or are sufficient to prevent entry into the sewers for maintenance and repair.
10. Substances that may cause the WWTP effluent or any other residues, sludges, or scum to be unsuitable for reclamation and reuse or to interfere with the reclamation process.
11. Leachate containing any radioactive waste or isotopes except as specifically approved by the WWTP Superintendent in compliance with applicable State or Federal regulations.
12. Materials which exert or cause:
    a. Unusual concentrations of inert suspended solids or dissolved solids.
    b. Unusual chlorine demand or concentrations in such quantities as to constitute a significant load on the WWTP, or that violate worker health and safety limits
    c. Medical wastes.
    d. Excessive foaming in the WWTP system.
13. Hazardous waste according to 40 CFR Part 261 except as specifically authorized by the WWTP Superintendent.
14. Leachate causing two readings on an explosion hazard meter at the connection point of more than 5 percent (5%) or any single reading over 10 percent (10%) of the Lower Explosive Limit of the meter.

The County shall notify the City within 24 hours of discovery of discharges that could cause problems to the sewer or WWTP systems. The County shall take the steps outlined in Section 2.6.6.

2.5 Quantity of Leachate and Potential Pass-through and/or Interference

Based the Landfill leachate and WWTP flow analyses in the LTE (Appendix A), leachate flows are expected to be less than 5 percent of the WWTP's daily maximum, average day and maximum month flows. The hydraulic and loading analyses presented in the LTE demonstrate that the WWTP can accept leachate flow at 5 percent of the WWTP flows without allowing pollutants to pass through the system and/or interfere with the treatment process.

2.6 Monitoring

2.6.1 Analytical Testing Standards

All collection, preservation, handling and laboratory analyses of samples for compliance monitoring shall be performed in accordance with 40 CFR Part 136 and related amendments, unless otherwise agreed to by the City and County.

2.6.2 Initial Characterization of Leachate

After the County connects to the City's sewer system and within 10 days of the date leachate begins flowing to the WWTP, the County shall sample the leachate for the purposes of initial characterization. The sample shall be analyzed for:

- Biological Oxygen Demand (BOD)
- Total Suspended Solids (TSS)
- Oil & grease
- Total Kjedahl Nitrogen (TKN)
- Ammonia
- Iron
- Manganese
- pH
- Phenols
- Phosphorus
- Chlorides
- Total Dissolved Solids (TDS)
- All priority pollutants except 2,3,7,8 tetrachlorodibenzo-p-dioxin and asbestos (http://water.epa.gov/scitech/methods/cwa/pollutants.cfm)

Results shall be reported in milligrams per liter (mg/L) where applicable.

The County shall provide the City a copy of the analytical results within 10 days of receipt from the laboratory.

2.6.3 Semi-annual Testing

The County shall test leachate semi-annually for metals and other parameters that may tend to cause a violation of the WWTP's permits, operations guidelines or as specified by the DEQ. Testing will include, but is not limited to, the following parameters:

Parameter	Units	Sample Type
Arsenic	mg/L	24-hour Composite
Cadmium	mg/L	24-hour Composite
Copper	mg/L	24-hour Composite
Cyanide	mg/L	Grab
Lead	mg/L	24-hour Composite
Mercury	mg/L	24-hour Composite
Nickel	mg/L	24-hour Composite
Silver	mg/L	24-hour Composite
Zinc	mg/L	24-hour Composite

Sampling and testing will take place in the first and third quarters of the year and the results will be reported to the City within 30 days of the end of the quarter, i.e., April 30th and October 30th of each year, unless otherwise agreed to by the City and County. Reporting requirements are further described in Section 2.7.

The County shall bear the cost of analytical laboratory testing of the County's delivered leachate.

2.6.4 Random Testing

Up to six times each calendar year that leachate is conveyed to the WWTP, the City will conduct random spot analytical laboratory testing of the County's leachate by collecting samples from the County's pump station and/or the point of connection to the City's sewer system. Leachate may be tested for metals, BOD or other parameters. The City will provide the testing results to the County within 10 days of receipt. The County shall bear the cost of the random testing.

2.6.5 Daily Flow and pH Monitoring

The County shall install an automated flow and pH meter at the connection point that records daily leachate flow and pH into the City's sewer system. The flow and pH meters shall be capable of remote data retrieval by City and County staffs. Daily grab samples of pH can be substituted for continuous metering.

2.6.6 Corrective Action

If the City determines that the leachate conveyed to the WWTP has adversely affected treatment processes, impacted the sewer system, caused a system upset or would potentially cause a violation of the NPDES permit, the City will notify the County within 24 hours of such discovery. The County shall immediately implement appropriate corrective action to mitigate the issue and resample as necessary until compliance is achieved.

If the City discovers a violation during its random sampling events, the County may also be required to resample until compliance is achieved.

The County shall bear the full cost of correction action and resampling.

2.7 Recordkeeping and Reporting

The City and County shall keep independent databases to track daily flow and analytical results of leachate conveyed to the WWTP.

The County shall include the following information in its compliance reports for each reporting period:

- The date, location, time, and methods of sampling or measurements, and sampling preservation techniques
- Who performed the sampling or measurements
- The date(s) the analyses were performed
- Who performed the analyses
- The analytical techniques or methods used
- The results of the analyses

The reports shall also include:

- The measured highest single daily value (Daily Maximum)
- The 30 day average of total monthly flows (Monthly Average).

All reports shall be submitted to the City as described elsewhere in this LAP.

The County shall place, in its Landfill Operating Record, all records, memoranda, reports, correspondence and other documents relating to monitoring, sampling and chemical analyses associated with leachate conveyance to the WWTP. These records shall be kept for a minimum of three years. The County shall make these records available to the City upon request.

The City will be responsible for its own recordkeeping and reporting requirements under the NPDES permit.

APPENDIX A

Evaluation of Treating Reedsport Landfill Leachate at the City of Reedsport Wastewater Treatment Plant

BHC
CONSULTANTS

TECHNICAL MEMORANDUM

Date: **December 31, 2014**

To: **Kathy Robertson, PE, Pickets Engineering**

From: **Bard Horton, PE**

Subject: **Evaluation of Treating Reedsport Landfill Leachate at the City of Reedsport Wastewater Treatment Plant**

This document was prepared under the direct supervision of the following Professional Engineer:

85342PE
Bard Horton
OREGON
MARCH 8, 2011
BARD B. HORTON
12/31/2014
EXPIRES: 6/30/2015

Introduction

The purpose of this analysis is to evaluate potential impacts that may be caused by the treatment of Reedsport Landfill leachate at the City of Reedsport Wastewater Treatment Plant (WWTP). This evaluation was requested by the Oregon Department of Environmental Quality (DEQ) as part of a process to review the proposed treatment of leachate at the Reedsport WWTP. Based on a conference call with DEQ, Douglas County and consultant staff, DEQ stated that the analysis should include a pass-through and interference to treatment process evaluation and potential impacts to biosolids disposal operations generally following the guidance provided in "Guidance Manual for the Control of Wastes Hauled to Publicly Owned Treatment Works" (EPA-833-B-98-033). DEQ also asked that a specific oxygen uptake rate (SOUR) test be undertaken by Reedsport WWTP staff using a blend of leachate and WWTP influent that will be submitted separately.

Approach

The general approach used in this analysis was to estimate changes in Reedsport WWTP influent loadings, effluent quality and biosolids quality for selected constituents if the Reedsport Landfill leachate was treated at the Reedsport WWTP. Three years of operating data for the Reedsport WWTP (2011-2013) were used to establish baseline conditions. The corresponding three years of Reedsport Landfill leachate flow data were used to determine critical leachate-WWTP flow ratios used for the SOUR tests and for the analyses related to potential changes in influent loadings, pass-through of metals and metals impacts to biosolids disposal operations. Available chemical data collected by Douglas County was used to characterize Reedsport Landfill leachate water quality.

The approach undertaken for the analysis follows standard practice to determine the “reasonable potential” to cause or contribute to the exceedance of water quality criteria or to adversely impact biosolids disposal practices. The “reasonable potential” analysis was developed by EPA and has been adopted by Oregon DEQ. Extreme, high (95% level of occurrence) concentrations were used to characterize leachate quality to estimate blended leachate-WWTP effluent for evaluation of potential acute and chronic water quality conditions. The 95% level of occurrence or higher (maximum) concentration has been used by others in their reasonable potential analysis of impacts. Moreover, to be conservative in our analysis, we assumed that all of the leachate metals would “pass through” the Reedsport WWTP treatment processes for the water quality analysis. On the other hand, for the analysis of potential impacts to biosolids quality and disposal operations, we assumed that the treatment processes would remove all of the leachate metals.

Results of Analysis

The results of the analysis are presented in the following sections:

1. Summary of Reedsport WWTP influent data
2. Reedsport Landfill leachate characteristics,
3. Leachate-WWTP flow analysis
4. Potential impacts relative to conventional pollutant loadings

5. Potential impacts relative to metals water quality criteria
6. Potential impacts to biosolids.

The calculations supporting each section are included in the appendices.

Summary of Reedsport WWTP Influent Data

For the purposes of this analysis, we assumed that effluent flow measurements at the Reedsport WWTP equal influent flows as effluent flows are reported on the Discharge Monitoring Reports (DMRs) prepared by the WWTP operators. Daily effluent flows ranged from about 0.4 million gallons per day (mgd) to nearly 3.9 mgd during 2011-2013. Average day, monthly effluent flows for the Reedsport WWTP ranged from about 0.35 mgd to nearly 1.70 mgd during the same period.

Influent biochemical oxygen demand (BOD) and total suspended solids (TSS) loadings ranged from about 555 pounds per day (ppd) to 1,477 ppd and 610 ppd to 2,164 ppd, respectively. Wastewater treatment facilities are designed for maximum month flows and loadings (among other conditions) and the maximum month flows, BOD loadings and TSS loadings reported during 2011-2013 are listed in Table 1. Design criteria for the facility are 2.90 mgd for maximum-month, wet-weather flow, 2,000 ppd for maximum month BOD loading and 2,900 ppd for maximum month TSS loading. When the highest of the maximum month influent conditions are compared to the design criteria, the maximum month flow was about 59% of design, BOD loading about 74% of design and TSS loading about 75% of design.

Table 1: Summary of Maximum Month Influent Flows and Loads 2011-2013

	Flow		BOD Loading		TSS Loading	
Year	(mgd)	(month)	(ppd)	(month)	(ppd)	(month)
2011	1.51	March	1,477	March	1,694	April
2012	1.70	Dec	1,428	Dec	2,164	Dec
2013	0.90	Jan	1,059	Sept	1,245	Jan

Reedsport Landfill Leachate Characteristics

Landfill leachate flows monitored at the Reedsport Landfill during 2011-2013 ranged from no flow during dry weather conditions to nearly 70,000 gallons per day (gpd) or 0.07 mgd during wet weather conditions (Appendix A). The maximum-month, average-day leachate flow was 0.034 mgd (March 2012). The average annual leachate flow used for this analysis was 0.01 mgd based on historical flow monitoring data and development plans for Reedsport Landfill (*Reedsport Landfill Leachate Conveyance System Predesign Report*, BHC Consultants, July 2013).

Reedsport Landfill leachate has been analyzed for several chemical constituents since 1999. The monitoring data used in this analysis is included in Appendix A and summarized in Table 2.

Table 2: Summary of Leachate Characteristics

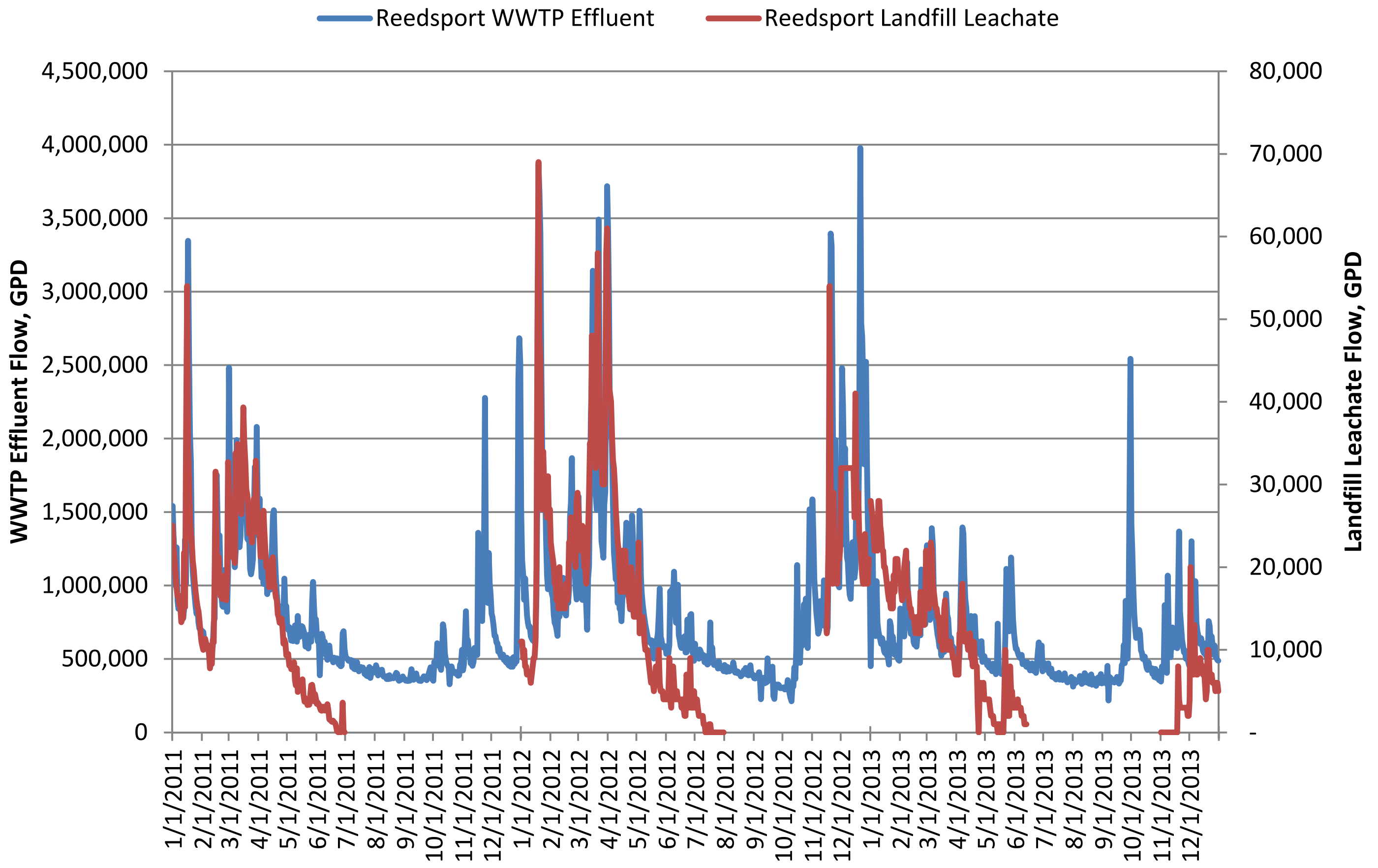
Constituent	Period of Records	# of Samples[1]	Concentration (mg/L)[2]		
			Average	Maximum	Std. Dev
BOD	5/99-10/03	15	15.7	51.0	12.4
Chemical Oxygen Demand (COD)	5/99-10/07	24	55.7	134.0	29.1
TSS	5/99-10/07	22	73.3	115	36.9
Total Kjehldahl Nitrogen (TKN)	5/99-10/03	14	17.0	34.2	5.9
Ammonia-Nitrogen (NH_3-N)	5/99-10/13	35	12.39	18.7	
Arsenic (As)	5/99-10/13	22/1	0.001	0.001	
Cadmium (Cd)	5/99-10/13	22/2	0.00015	0.0002	
Chromium (Cr)	5/99-10/13	22/3	0.0017	0.0022	
Copper (Cu)	5/99-10/13	22/5	0.0030	0.0101	
Lead (Pb)	5/99-10/13	22/0			
Nickel (Ni)	5/99-10/13	17/7	0.0033	0.0049	
Selenium (Se)	5/99-10/13	22/0			
Silver (Ag)	5/99-10/13	17/0			
Zinc (Zn)	5/99-10/13	23/15	0.044	0.184	

Notes:
1) Number of samples collected/number with reported concentration greater than “Non-detect”
2) mg/L = milligrams per liter

Leachate-WWTP Flow Analysis

Landfill leachate daily flows were compared to Reedsport WWTP daily flows to calculate the dilution of leachate at the WWTP if the flows were blended (Appendix B). Both WWTP and leachate flows are related to weather conditions as the highest flows occurred during wet weather periods and lowest flows during summer and fall (Figure 1). Daily flows were compared to calculate the flow ratios for the 2011-2013 period and the ratios were ranked according from highest to lowest in terms of percent leachate in the blended flow. The highest percentage calculated during the period was 6.19% for January 1, 2013 conditions. The WWTP flow was 0.452 mgd with leachate flow at 0.028 mgd. This daily event in the three year record is the equivalent to 0.09% probability of occurrence and is therefore considered a very rare event.

Figure 1: Reedsport Landfill Leachate and WWTP Effluent Flows



The next highest set of leachate: WWTP flows consisted of four daily events, also in January 2013, with percentages ranging from 4.01% to 4.24%. Ten daily events had flow percentages between 3.5% and 4.0% and occurred in December 2012 and January 2013. During conditions when WWTP daily flows are higher, generally greater than 2 mgd, leachate flows were less than 2.2% of WWTP flows during 2011-2013. Based on these observations, and to be conservative, 5.0% leachate was recommended for the SOUR tests.

Potential Impacts Relative to Conventional Pollutant Loadings

Conventional pollutants considered in this analysis were BOD, TSS and ammonia (NH_3-N) because of influent design criteria and effluent limits authorized by DEQ for the WWTP. BOD and TSS design criteria were discussed in a previous section. NH_3-N was included because it has been monitored in Reedsport Landfill leachate and it may be of concern at the WWTP for potential future regulatory effluent limits.

The potential increase of these pollutants if Reedsport Landfill leachate were treated at the Reedsport WWTP is presented in Appendix C for monthly conditions and summarized in Table 3. The calculated increase in maximum month loadings was less than 2% for all three pollutants, with the increased influent loadings for BOD and TSS well below design criteria. These increases are considered to be very conservative as the BOD increase was calculated using the COD concentration rather than BOD concentration to correct for any potential leachate toxicity that may have occurred in the leachate BOD tests. COD would better represent “actual” BOD that would be exerted in the treatment process if leachate toxicity were eliminated by the high dilution of the leachate in the blended leachate-influent wastewater flows. In addition, as discussed previously, the 95 percentile concentrations for COD (116 mg/L) and TSS (150 mg/L) and maximum NH_3-N (18.7 mg/L) were used to calculate the leachate loadings. Influent NH_3-N data is unavailable for the WWTP, so an influent concentration of 30 mg/L, which is typical of raw municipal wastewater, was assumed to be representative of existing Reedsport conditions.

It should be noted, however, that there will likely be higher increases than 2% in monthly loadings for other than maximum monthly conditions. Calculated leachate BOD and TSS loadings were added to the monthly loadings reported in the 2011-2013 WWTP Discharge Monitoring Reports to estimate potential increases throughout the year. The largest calculated increases were 3.1% (33 ppd) for BOD, 3.2% (43 ppd) for TSS and 1.5% (1.5 ppd) for NH_3-N; however, these increases occur when total loadings are less than during peak month conditions. Nonetheless, the total higher calculated loadings were still well below influent design criteria for BOD and TSS. As stated before, these calculated increases are considered to be conservatively high due to the high concentrations used for the leachate pollutants in the monthly loading calculations.

Table 3: Potential Increase in BOD, TSS and NH_3 Loads (ppd) to Reedsport WWTP

Month Constituent	Existing WWTP Max. Infl. Loading	Leachate Max Loading	Combined Loading	Increase in Max Load from Leachate
BOD	1,477	27	1,504	1.8%
TSS	2,164	35	2,199	1.6%
NH_3-N	423	5	428	1.2%

Potential Impacts Relative to Metals Water Quality Criteria

The potential impact of metals in leachate on receiving water quality was evaluated assuming the following conservative assumptions for the analysis:

- The January 1, 2013 event with the maximum percentage of leachate observed during 2011-2013.
- All metals in the leachate would remain in solution or in suspension through the WWTP process and would be discharged to the Umpqua River as blended effluent. This assumption is very conservative as at least 50% metals removal could be expected during treatment.
- The maximum reported metals concentrations in both leachate and existing WWTP effluent were used in the calculations. The WWTP effluent was analyzed four times for all metals from 2006 through 2009 except mercury. Mercury was measured only once in

three samples; cadmium was not detected in any of the four samples collected. The data can be found in Appendix D.

The results of the calculations are summarized in Table 4 and compared to regulatory metals water quality criteria. The metals criteria shown in Table 4 are the most restrictive from DEQ Tables 33A, 33B, 33C and 40 with Table 33B criteria calculated using a hardness of 25 mg/L and alkalinity of 25 mg/L (Appendix E). The metals concentrations in existing WWTP effluent are below all criteria except for the mercury chronic criterion. The metals concentrations in landfill leachate are also below all criteria except for the zinc acute and chronic criteria. The calculated metals concentrations for the blended flows are below all criteria except for the chronic mercury criterion.

Note that the blended zinc concentration is just below both zinc criteria. If 75% of the leachate zinc were removed in the Reedsport WWTP, a typical removal rate for a secondary treatment plant, the corresponding blended effluent zinc concentration would decrease to 26.4 micrograms per liter (µg/L), well below the 36.2 µg/L criteria. Thus, given the conservativeness of the analysis, we conclude that the potential for exceeding metals criteria is very low if landfill leachate were treated at the Reedsport WWTP.

Table 4: Comparison of Metals Concentrations in Existing Reedsport WWTP Effluent, Landfill Leachate and Leachate Blended with Existing Effluent with Water Quality Criteria

	Concentration (µg/L)			Water Quality
Metal	WWTP Effl. Max	Leachate Max	Blended Flow Max	Criteria (DEQ Table Source)
Arsenic	0.55	1	0.58	2.1 (T.40)
Cadmium	ND	0.2	0.012	0.094^{1} (T.33B)
Chromium	0.92	2.2	0.99	183.3/14^{2} (T.33B)
Copper	8.33	10.1	8.34	1300(T.40)
Lead	0.44	ND	0.44	13.88/0.54^{2} (T.33B)
Nickel	2.88	4.9	3	145/16.1^{2} (T.33B)
Selenium	2.1	ND	2.1	140 (T.40)
Silver	0.23	ND	0.23	0.296^{3} (T.33B)
Zinc	25.2	184	34.5	36.2/36.2^{2} (T.33B)
Mercury	0.5	NA	0.5	2.4/0.012^{2} (T.33A)

Notes:

1) Ch Chronic Criterion
2) Acute/chronic criteria
3) Acute criterion

Potential Impacts to Biosolids

Biosolids impacts were evaluated in terms of potential changes to biosolids quality and disposal site life. The pollutants of concern were BOD and TSS for increases in biosolids quantity and metals for biosolids quality and disposal site life. Existing biosolids quantities and quality and disposal site life calculations prepared by Reedsport WWTP staff for 2011-2013 were used as baseline conditions for the evaluation of potential impacts from treating the landfill leachate. All calculations for potential biosolids impacts are in Appendix F.

Biosolids generated from treatment of leachate were calculated to be 1.6 dry tons per year (DT/Y) for an average annual leachate flow of 0.01 mgd, average TSS concentration of 73 mg/L, average BOD concentration of 56 mg/L, a BOD:TSS yield of 0.6 and complete removal of all solids associated with leachate in the WWTP processes. Actual annual leachate flows for each year were used to adjust the 1.6 DT/Y increase and added to the actual reported biosolids production reported by Reedsport staff for 2011-2013 as shown in Table 5. Increases in biosolids from leachate treatment averaged about 1.5 DT/Y which represents an average of about 3.4%.

Table 5: Potential Increase in Biosolids Production from Reedsport Landfill Leachate Treatment

	WWTP Biosolids Prod.	Reedsport Landfill Leachate		Calculated Total Biosolids Prod.	
Year	(DT/Y)	Annual Flow (mgd)	Biosolids Prod. (DT/Y)	(DT/Y)	% Increase
2011	40.61	0.0074	1.14	41.75	2.8
2012	55.42	0.0138	2.25	57.67	4.1
2013	32.27	0.0063	1.03	33.30	3.2

The estimated concentrations of metals in biosolids generated from treatment of an annual average leachate flow of 0.01 mgd are shown in Table 6. These concentrations were calculated assuming that all metals were removed during treatment. This assumption is conservative, as metals removal typically ranges from 70% to 80% in a secondary treatment process; thus, the actual metals concentrations would likely be lower in the biosolids than the calculated concentrations. Note that concentrations for lead, mercury, molybdenum and selenium were not estimated due to “Non-detect” reported in leachate sampling results or lack of analytical results.

Table 6: Estimated Metals Concentrations of Reedsport Landfill Leachate Biosolids[1]

Metal	Leachate Concentration (mg/L)	Loading (lbs/Y)	Biosolids Production (lbs/DT)	Biosolids Concentration (mg/kg)
Arsenic	0.001	0.0304	0.0187	9.33
Cadmium	0.00015	0.0045	0.0028	1.4
Chromium	0.0017	0.0518	0.0318	15.9
Copper	0.003	0.091	0.056	28.0
Nickel	0.0033	0.100	0.062	30.8
Zinc	0.0444	1.352	0.829	415

Notes:
1) Biosolids production based on 1.63 DT/Y of solids and average annual flow of 0.01 mgd

The estimated leachate biosolids metals concentrations are compared with existing average WWTP biosolids metals concentrations and EPA Ceiling Limits in Table 7. The comparison with the Ceiling Limits is consistent with calculations performed by the Reedsport WWTP staff for their annual biosolids report to DEQ. Nickel in leachate biosolids are the only metal higher than the 2011-2013 average WWTP biosolids metals. All leachate biosolids metals concentrations are well below the EPA Ceiling Limits.

Table 7: Estimated Leachate Biosolids Metals Compared to WWTP Biosolids Metals and EPA Limits

Metal	Leachate Biosolids (mg/kg)	Ave. WWTP Biosolids (mg/kg)	EPA Ceiling Limits (mg/kg)
Arsenic	9.33	10.1	75
Cadmium	1.4	5.1	85
Chromium	15.9	21.7	1200
Copper	28.0	569	4300
Nickel	30.8	16.7	420
Zinc	415	514	7500

Notes:
1) 40 CFR 503.13 Table 1 Concentration Limits

The potential impact to treating leachate at the WWTP is to shorten the biosolids disposal site life due to potential increases in biosolids loadings. The higher nickel concentration in leachate biosolids is not a critical factor as the existing site life is currently controlled by copper as shown in the calculations by Reedsport WWTP staff. The copper concentration in leachate biosolids is much lower than the existing WWTP biosolids copper; however, the increased copper loading from leachate treatment would still slightly reduce disposal site life. For example, the lowest copper-based site life was 602 years calculated for 2012 and it would be reduced by 0.2% to 600 years if leachate were treated and would actually be less because not all copper would be removed during treatment.

Nitrogen is also available in landfill leachate and would have a potential impact on the biosolids disposal site due to nitrogen loading limits. Additional area would potentially be required for biosolids disposal if nitrogen loading is the critical factor determining the size of the current disposal site. Reedsport Landfill leachate would add about 36 lbs/Y of available nitrogen to the disposal site for an average annual flow of 0.01 mgd, with TKN of 17 mg/L, NH_3-N of 12.4 mg/L, NO_3-N of 3.9 mg/L and assuming that 10% of the nitrogen in the leachate is removed at the WWTP. The actual calculated nitrogen loading to the disposal site was highest in 2012 at 1,943 lbs/Y, which would have required a disposal site area of 19.4 acres determined by Reedsport WWTP staff. The increase of 36 lbs/Y from leachate treatment would have increased the required area to 19.8 acres. However, the actual biosolids disposal site area is 25 acres, so nitrogen loading is not currently a site constraint and would not be a constraint if the leachate nitrogen load were added.

Iron concentrations in leachate can be relatively high and may have an impact on the WWTP biosolids. Based on an average iron concentration of 6.34 milligrams per liter (mg/L) measured in 20 samples of the landfill leachate and an average annual leachate flow of 4.86 million gallons from 2004 to 2012, an average annual iron load of approximately 257 pounds would be discharged to the WWTP. If 100% of the iron is removed by the treatment process, iron in the biosolids generated at the WWTP would increase by 257 pounds on average. There is no biosolids disposal regulatory limit for iron.

BHC's recent experience includes landfill leachate that had average iron concentrations approximately ten times higher (68 mg/L) received at the City of Unalaska's (in Alaska) wastewater treatment plant. At this plant, iron staining or precipitate was observed on process treatment equipment, the leachate partially attributed to fouling of the ultraviolet disinfection system. The Reedsport WWTP uses a chlorine disinfection system, which should not be susceptible to fouling. In summary, at the concentrations measured in the Reedsport Landfill leachate, iron is not expected to cause maintenance issues at the WWTP.

Conclusions

Treatment of Reedsport Landfill leachate would have insignificant potential impacts for pass-through and interference at the Reedsport WWTP and for biosolids impacts for the following reasons as discussed above:

- Leachate flows are expected to be less than 5% of the Reedsport WWTP flows in terms of both daily maximum and average-day, maximum month flows.
- Minor increases in maximum month influent BOD and TSS loadings are expected to increase less than 2% at the Reedsport WWTP and would still be well below WWTP influent design criteria. The potential increase in NH_3-N monthly influent loading is expected to be less than 1.5% and should not create an NH_3-N effluent discharge issue for current operating conditions at the WWTP.
- Metals concentrations in existing WWTP effluent are less than metals criteria. Metals concentrations in Reedsport Landfill leachate are also less than acute and chronic water quality criteria except for zinc. The blended WWTP and leachate effluent zinc concentration was calculated to be just below the zinc criteria if no zinc were removed during treatment at the WWTP. However, significant zinc removal would be expected during treatment and the resulting blended effluent zinc concentrations would be well below water quality criteria.
- The calculated metals concentrations in biosolids generated by treatment of leachate are well below EPA Ceiling Limits and lower than current Reedsport WWTP biosolids metals concentrations, except for nickel. However, copper, rather than nickel, is the metal that limits the life of the Reedsport biosolids disposal site. Based on a calculated increase in

biosolids production due to leachate treatment, the copper loadings would increase by 0.02% which would reduce the calculated site life by 2 years, from 602 years to 600 years, which would actually be less due to the conservative assumptions made for the analysis.

In summary, the calculated increases of influent loadings, blended effluent metal concentrations and increases biosolids metals loadings discussed above are all considered to be high estimates due to the conservative assumptions made in the analysis of potential impacts. It is highly likely that all potential impacts identified in this report would be less than quantified. Based on these considerations, we conclude that the treatment of Reedsport Landfill leachate at the Reedsport WWTP would have insignificant potential impacts on pass-through and interference at the WWTP and on biosolids disposal for the conditions assumed in this report.

Reedsport Landfill Leachate Acceptance Plan

Preliminary Calculations

BHC CONSULTANTS

Prepared By: Martin Harper, PhD

June 2014

Appendix A

Reedsport Landfill Leachate Flows and Water Quality Data

Martin Harper

From: Erika Schuyler
Sent: Wednesday, March 05, 2014 10:37 AM
To: Martin Harper
Cc: Bard Horton
Subject: RE: Reedsport Average Monthly Flows

No. There is a comment embedded in the spreadsheet which reads: "D. Gabriel: No flow per letter T. Manton's letter, November 14, 2011" and applies from October through December of 2011.

From: Martin Harper
Sent: Wednesday, March 05, 2014 10:35 AM
To: Erika Schuyler
Cc: Bard Horton
Subject: Re: Reedsport Average Monthly Flows

No flow inNov. & Dec. 2011?

Sent from my iPhone

On Mar 5, 2014, at 10:24 AM, "Erika Schuyler" <Erika.Schuyler@bhcconsultants.com> wrote:

> Marty:
>
> Following is the average monthly leachate flow breakdown for Reedsport for the past 3 years. Please let me know if you'd like this in spreadsheet form, or as a chart, or have any questions/comments.
>
> We've requested the most recent flows for Roseburg from Kathy; I'll send you the breakdown for Roseburg once I receive that.
>
> Erika

REEDSPORT

Year	Month	Average Monthly Flow, GPD
2011	January	20,389
	February	15,433
	March	27,827
	April	18,040
	May	5,811
	June	1,806
	July	0
	August	0
	September	0
	October	0
	November	0
	December	0
2012	January	21,258
	February	19,862
	March	33,516

Annual $\bar{x}$ = 7,442

Year	Annual $\bar{x}$ (gpd)
2011	7,442
2012	13,754
2013	6,312

3-Yr $\bar{x}$ = 9,169

Use 10,000 gpd

	April	24,000	
	May	8,935	
	June	4,467	
	July	2,077	
	August	0	Annual $\bar{x}$ = 13,754
	September	0	
	October	0	
	November	23,400	
	December	27,533	
2013	January	21,161	
	February	15,750	
	March	13,355	
	April	9,172	
	May	3,071	
	June	2,385	Annual $\bar{x}$ = 6,312
	July	0	
	August	0	
	September	0	
	October	0	
	November	3,333	
	December	7,516	

Martin Harper

From: Erika Schuyler
Sent: Wednesday, March 05, 2014 10:25 AM
To: Martin Harper
Cc: Bard Horton
Subject: Reedsport Average Monthly Flows

Marty:

Following is the average monthly leachate flow breakdown for Reedsport for the past 3 years. Please let me know if you'd like this in spreadsheet form, or as a chart, or have any questions/comments.

We've requested the most recent flows for Roseburg from Kathy; I'll send you the breakdown for Roseburg once I receive that.

Erika

REEDSPORT

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2011	January	20,389
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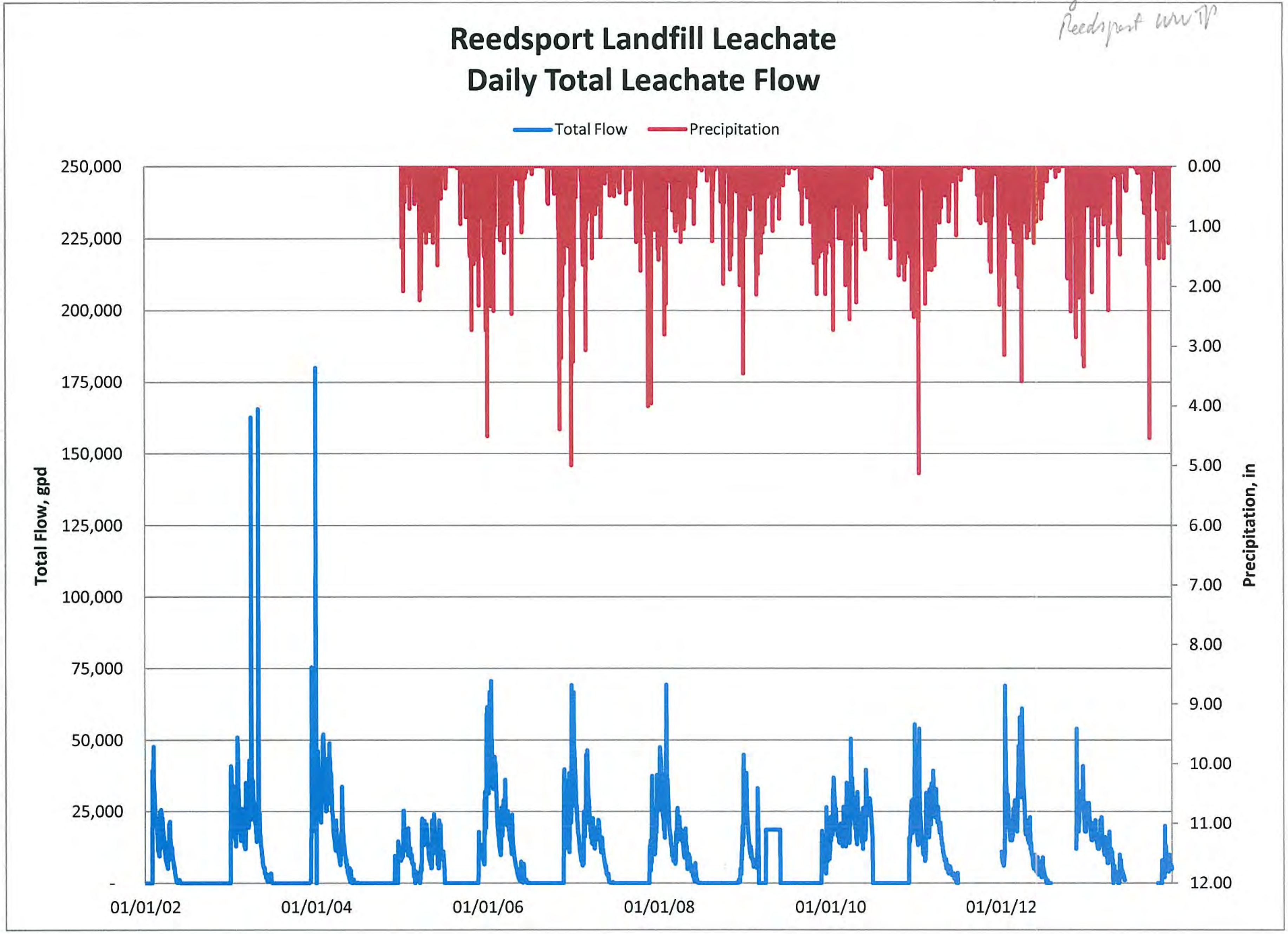
	February	19,862
	March	33,516
	April	24,000
	May	8,935
	June	4,467
	July	2,077
	August	0
	September	0
	October	0
	November	23,400
	December	27,533
2013	January	21,161
	February	15,750
	March	13,355
	April	9,172
	May	3,071
	June	2,385

July	0
August	0
September	0
October	0
November	3,333
December	7,516

Discharges to
Reedsport WWTP



Reedsport Landfill Leachate
Daily Total Leachate Flow

Reedsport Landfill
Metals and Ammonia

3-Apr-13

Parameter	Period of Record	No. of Samples Total	>ND	(excluded "ND" values) Mean Concentration	Max Concentration
Arsenic	5/19/99 through 10/23/13	22	1	0.0010	0.0010
Cadmium	5/19/99 through 10/23/13	22	2	0.00015	0.0002
Chromium III	5/19/99 through 10/23/13	22	3	0.00170	0.0022
Copper	5/19/99 through 10/23/13	22	5	0.0030	0.0101
Lead	5/19/99 through 10/23/13	22	0	-	-
Mercury		NOT FOUND IN DATA			
Nickel	5/19/99 through 10/23/13	17	5	0.0033	0.0049
Selenium	5/19/99 through 10/23/13	22	0	-	-
Silver	5/19/99 through 10/23/13	17	0	-	-
Zinc	5/19/99 through 10/23/13	23	15	0.0444	0.1840
Ammonia (as N)	5/19/99 through 10/23/13	35	35	12.3863	18.7000
Nitrate-N (NO3)	5/19/99 through 10/23/13	34	34	3.90	20.30
TKN (as N)	5/19/99 10/28/03	14	14	17.0	34.2

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Reedsport Landfill
Metals and Ammonia

13-Mar-13

Parameter	**Period of Record**	**No. of Samples**		(excluded "ND" values) **Mean Concentration**	**Max Concentration**
		Total	**>ND**		
Arsenic	5/19/99 through 10/23/13	22	1	0.0010	0.0010
Cadmium	5/19/99 through 10/23/13	22	2	0.00015	0.0002
Copper	5/19/99 through 10/23/13	22	5	0.0030	0.0101
Lead	5/19/99 through 10/23/13	22			
Selenium	5/19/99 through 10/23/13	22			
Zinc	5/19/99 through 10/23/13	23	15	0.0444	0.1840
Ammonia	5/19/99 through 10/23/13	35	35	12.3863	18.7000

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Table 4 - Group 1b Results For Leachate

Reedsport LF

Site	Date	Laboratory pH	Laboratory Conductivity (umho/cm)	Total Dissolved Solids (mg/L)	Hardness (mg/L as CaCO3)	Chemical Oxygen Demand (mg/L)	Total Suspended Solids (mg/L)	Total Alkalinity (mg/L as CaCO3)	Total Organic Carbon (mg/L)
SP-3	05/19/99	7.00	1011	615	300.0	71.7	85.20	311.0	34.50
SP-12a(SP-3 duplicate)	05/19/99	7.10	1013	619	292.0	62.8	90.80	319.0	28.10
SP-3(DEQ)	05/19/99			640	258.0	64.0	86.00	370.0	21.00
SP-3(DEQ duplicate)	05/19/99			630	282.0	60.0	81.00	370.0	21.00
SP-3	10/27/99	7.60	1234	699	272.0	81.8	107.00	388.0	27.90
SP-12a(SP-3 duplicate)	10/27/99	7.70	1241	717	362.0	81.8	115.00	391.0	35.10
SP-3	05/10/00	7.30	911	536	325.0	134.0	109.00	353.0	20.40
SP-12(SP-3 duplicate)	05/10/00	7.30	925	529	314.0	124.0	173.00	335.0	19.80
SP-3	10/10/00	7.40	1140	748	322.0	75.9	33.30	458.0	27.30
SP-3	04/10/01	7.10	828	430	215.0	45.0	41.10	325.0	1.30
SP-3	10/17/01	7.80	844	566	256.0	35.9	19.10	338.0	15.94
SP-3	04/29/02	6.90	748	416	198.0	16.4	50.50	324.0	16.50
SP-3	10/08/02			468	221.0	29.0	49.00	319.0	15.30
SP-3	04/22/03			476	212.0	16.0	62.00	332.0	15.50
SP-3	10/28/03			376	230.0	41.0	37	307.0	15.00
SP-3 (DEQ)	10/28/03			420	227.0	32.0	43	301.0	14.00
SP-3	10/28/04			412	219.0	38.0	~~ND@5~~	333.0	
SP-12(SP-3 duplicate)	10/28/04			428	215.0	45.0	~~ND@5~~	331.0	
SP-3	10/25/05			428	243.0	60.0	107	304.0	
SP-12(SP-3 duplicate)	10/25/05			428	238.0	53.0	93	298.0	
SP-3	10/11/06			371	225	38	60	277.0	
SP-12(SP-3 duplicate)	10/11/06			338	214	34	59	278.0	
SP-3	10/30/07			412	233	47	85	338.0	
SP-12(SP-3 duplicate)	10/30/07			388	235	51	77	344.0	
SP-3	10/07/08							253.0	
SP-12(SP-3 duplicate)	10/07/08							262.0	

Notes: ND = Non-detect

n=24
$\bar{x}$ = 55.7
σ = 29.1

n=22
73.3
36.9

3/14/14

Reedsport Leachate:

① Ave. annual Q = 10,000 gpd

② Ave TSS conc. = 73 mg/L Ave TSS load = (0.010 mgd)(73)(8.34) = 6.1 ppd
If 95% confidence limit for TSS is used (t-value = 2.07 for n = 22),
TSS conc. = 73.3 + (2.07)(36.9) = 149.7. and TSS loading = 12.5 ppd

③ Ave BOD conc. = 16 mg/L Ave BOD loading = (0.01)(16)(8.34) = 1.3 ppd
If 95% confidence limit for BOD is used (t-value = 2.13 for n=15)
BOD conc = 15.7 + (2.13)(12.4) = 42 mg/L and BOD loading = 3.4 ppd

④. If COD is better indicator of oxygen demand due to toxicity with BOD test,
Ave COD conc. = 56 mg/L → COD loading = 4.7 ppd
Using 95% confidence limits (t-value = 2.06), COD conc = 116 mg/L → COD loading = 9.6 ppd

⑤ Solids Generated from Leachate = TSS loading + (0.6)(BOD loading) = 6.1 ppd + (0.6)(1.3 ppd) = 6.9 ppd = 1.3

Using 95% Conf. Limit for COD loading & 95% Conf. Limit for TSS
Say 20 ppd = 13.7 tons/y

Table 24 - Group 5 Results For Leachate and Surface Water

Reedsport LF

Site	Date	Total Coliform Bacteria (MPN)	E. Coli (CFU/.1L)	Total Kjeldahl Nitrogen (mg/L)	ortho-Phosphate (mg/L)	Fecal Coliform Bacteria (CFU/.1L)	Biological Oxygen Demand (mg/L)	Total Phosphorus (mg/L)	Total Halogenated Organics (mg/L)
Leachate									
SP-3	05/19/99	Absent	ND@1.0	16.30	ND@.01		10.00	0.347	0.090
SP-12a(SP-3 duplicate)	05/19/99	Absent	ND@1.0	18.30	ND@.01		8.20	0.304	0.080
SP-3(DEQ)	05/19/99	48 Est	ND@4		NA	ND@4	28.00		0.166
SP-3(DEQ duplicate)	05/19/99	100	ND@4		NA	ND@4	26.00		0.190
SP-3	10/27/99	>2419	Absent	20.80	ND@.01		8.10	0.360	0.170
SP-12a(SP-3 duplicate)	10/27/99	>2419	Absent	20.50	ND@.01		11.60	0.197	0.020
SP-3	05/10/00	>2419	Positive	13.20	ND@.04	32.3	18.60	0.037	0.020
SP-12(SP-3 duplicate)	05/10/00	>2419	Positive	12.70	ND@0.01	36.4	19.30	ND@0.01	0.070
SP-3	10/10/00	>2419	Positive	34.20	0.019	2.0	8.01	0.126	0.170
SP-3	04/10/01	87	Absent	18.60	ND@0.01	<2	2.40	0.400	0.070
SP-3	10/17/01	291	Absent	13.60	ND@0.01	0.0	9.11	0.030	0.170
SP-3	04/29/02	199	1	17.72	0.138	1.0	2.40	0.136	0.080
SP-3	10/09/02	>1600	ND@1	12.10	ND@0.01	2	14.00	0.04	0.080
SP-3	04/22/03	2	ND@1	16.80	ND@0.01	ND@2	~~ND@4.0~~	0.17	0.070
SP-3	10/28/03	1410	ND@1	11.50	ND@0.01	ND@2	19.00	0.03	0.083
SP-3 (DEQ)	10/28/03	*130*	ND@1	12.00	ND@0.005	ND@2	51.00	0.04	*0.094*

Notes: ND = Non-detect

UJ – The material was analyzed for, but was not detected. The associated value is an estimate and may be inaccurate or imprecise.

J – The associated value is an estimated quantity.

$n = 15$
$\bar{x} = 15.7$
$\sigma = 12.4$

$n = 14$
$\bar{x} = 17.0$ mg/L
$\sigma = 5.9$ mg/L
MAX = 34.2 mg/L

Group 2a Results for Leachate

Site	Date	Calcium (Ca)*	Manganese (Mn)*	Ammonia (as N)	Bicabonate (HCO3)	Magnesium (Mg)*	Sodium (Na)*	Nitrate-N (NO3)	Sulfate (SO4)	Iron (Fe)*	Potassium (K)*	Carbonate (CO3)	Chloride (Cl)
SP-3	05/19/99	37.40	2.68	15.50	382.00	31.80	72.60	6.32	71.00	7.16	33.90		56.70
SP-12a(SP-3 duplicate)	05/19/99	31.10	2.54	14.70	386.00	34.50	73.30	6.49	72.00	7.81	34.80		57.00
SP-3 (DEQ)	05/19/99	62.20	2.02	14.70		24.90	77.70	5.66	70.10	6.96	30.30		62.00
SP-3(DEQ duplicate)	05/19/99	64.20	2.21	14.20		27.40	86.20	5.92	69.50	7.46	33.40		61.00
SP-3	10/27/99	79.50	3.07	18.60	516.00	40.80	126.00	6.81	29.10	0.29	40.40	ND@3.0	126.00
SP-12a(SP-3 duplicate)	10/27/99	89.40	4.56	18.70	519.00	43.10	138.00	6.62	28.70	0.78	42.30	ND@3.0	107.00
SP-3	05/10/00	82.60	0.04	11.40	379.00	28.20	92.30	2.96	10.10	4.06	30.20	ND@3.0	14.70
SP-12a(SP-3 duplicate)	05/10/00	80.00	0.05	11.00	381.00	26.90	97.80	20.30	70.00	3.65	30.40	ND@3.0	118.00
SP-3	10/10/00	76.00	3.61	15.00	451.00	41.20	135.00	8.83	55.50	0.18	49.20	ND@3.0	112.00
SP-3	04/10/01	48.70	1.17	18.30	329.00	21.10	65.30	1.38	11.00	1.17	17.30	ND@3.0	53.80
SP-3	10/17/01	69.80	3.05	13.50	416.00	25.90	196.00	1.67	11.70	0.14	22.10	ND@3.0	69.80
SP-3	04/29/02	56.80	3.21	15.20	394.00	19.60	53.50	1.11	4.83	9.76	14.40	ND@3.0	69.90
SP-3	10/08/02	56.40	3.66	13.40	319.00	17.50	55.80	2.30	16.00	0.64	16.90	ND@2.0	53.00
SP-3	04/22/03	56.70	2.61	18.10	332.00	15.50	47.80	2.90	2.50	17.40	18.90	ND@2.0	38.00
SP-3	10/28/03	61.90	3.97	11.80	307.00	18.30	49.90	1.20	13.10	56.30	16.20	ND@2.0	53.00
SP-3 (DEQ)	10/28/03	61.80	3.76	10.70		19.20	49.30	1.36	12.10	0.09	16.10		58.00
SP-3	10/28/04			12.90	333.00			5.00			20.20		
SP-12a(SP-3 duplicate)	10/28/04			12.80	331.00			5.00			19.70		
SP-3	10/25/05			10.90	304.00			2.70			18.20		
SP-12a(SP-3 duplicate)	10/25/05			11.10	298.00			2.70			17.60		
SP-3	10/11/06			12.40	277.00			1.20			14.40		
SP-12a(SP-3 duplicate)	10/11/06			12.10	278.00			1.20			14.30		
SP-3	10/30/07			13.20	338.00			3.70			19.90		
SP-12a(SP-3 duplicate)	10/30/07			12.80	344.00			3.80			20.20		
SP-3	10/07/08	51.20	2.42	10.10	253.00	15.40	43.40	2.10	8.00	1.17	14.10	ND@2.0	43.60
SP-12(SP-3 duplicate)	10/07/08	53.30	2.54	10.50	262.00	15.80	44.70	2.10	7.90	0.34	14.20	ND@2.0	43.40
SP-3 (DEQ)	10/07/08	51.90	2.49	11.00		15.20	41.60		7.94	0.10	13.20		45.10
SP-3	10/21/09			9.46	262.00			3.24			14.70		
SP-3	10/13/10			9.95	258.00			1.84			12.20		
SP-12(SP-3 duplicate)	10/13/10			10.10	256.00			1.85			12.30		
SP-3	10/27/11			9.80	254.00			2.37			13.30		
SP-12(SP-3 duplicate)	10/27/11			9.85	265.00			2.35			13.30		
SP-3	10/17/12			9.21	248.00			3.29			12.50		
SP-12(SP-3 duplicate)	10/17/12			9.33	245.00			3.28			12.60		
SP-3	10/23/13	59.90	2.10	1.22	305.00	17.80	50.90	3.16	4.93	1.36	17.40	22.00	39.60
SP-3 (DEQ)	10/23/13												
SP-3 (resampling)	02/20/14												
SP-3 (resampling) (DEQ)	02/20/14												

NOTES:

Units in milligrams per liter (mg/L) or parts per million (ppm) unless noted.

ND = Non-detect

*Dissolved

as NO_3 → as N

$14+3(16)$ 14

$= 62$

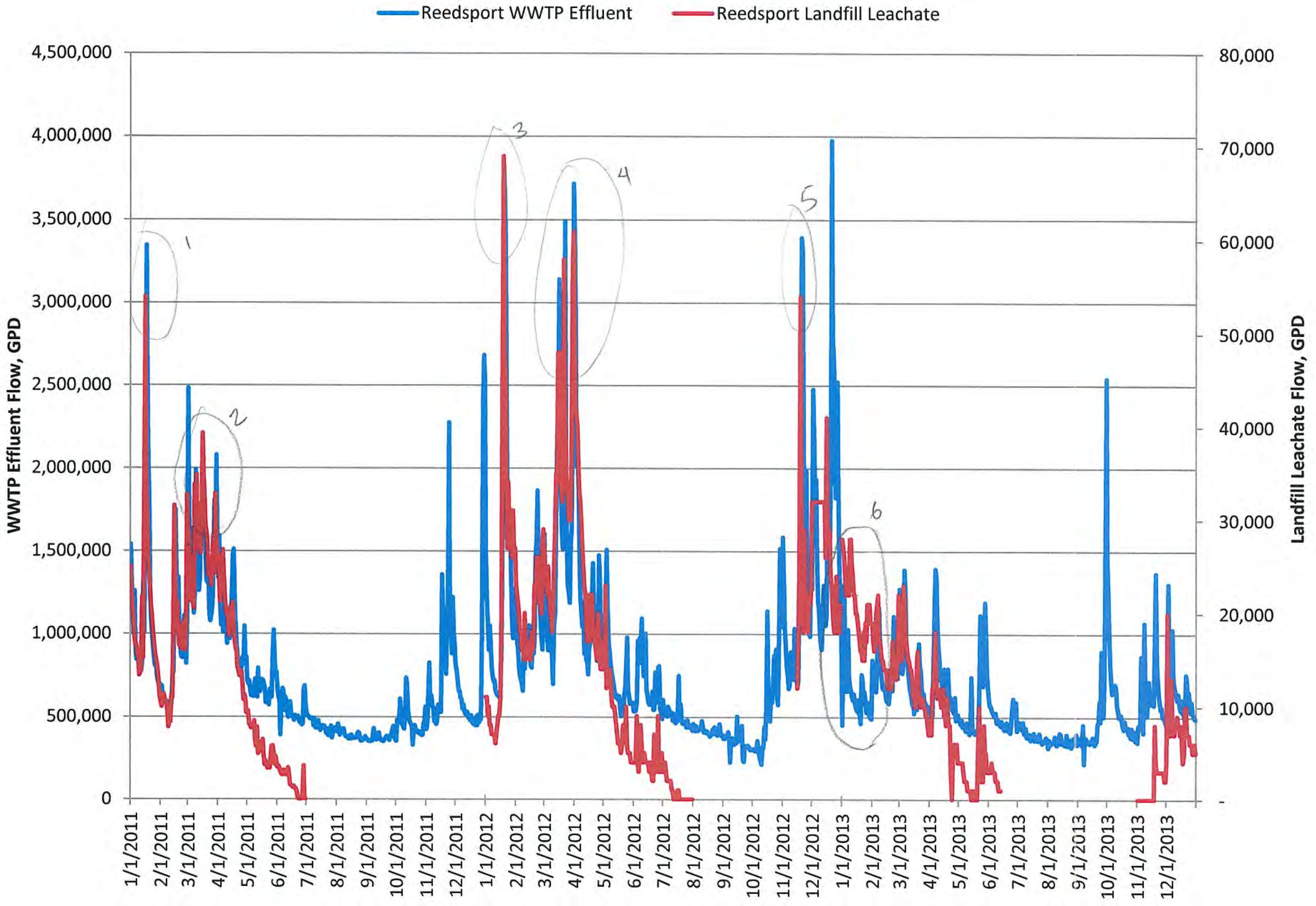
Convert as NO_3 → as N

$14/62$

Appendix B

Reedsport Landfill Leachate Flow: Reedsport WWTP Flows

Reedsport Landfill Leachate and WWTP Effluent Flows



	Reedsport WWTP Effluent Flow		Landfill Leachate Flow	Ratio of Leachate to WWTP Flow	
Date	MGD	GPD	GPD		
10/1/2011	0.352363	352,363		#VALUE!	
1/1/2013	0.452165	452,165	28,000	6.19%	
1/10/2013	0.660299	660,299	28,000	4.24%	
1/29/2013	0.507718	507,718	21,000	4.14%	4
1/9/2013	0.688265	688,265	28,000	4.07%	
1/28/2013	0.523492	523,492	21,000	4.01%	
1/12/2013	0.603285	603,285	24,000	3.98%	
1/11/2013	0.633917	633,917	25,000	3.94%	
1/31/2013	0.487803	487,803	19,000	3.90%	
1/30/2013	0.492945	492,945	19,000	3.85%	
1/16/2013	0.54055	540,550	20,000	3.70%	
12/16/2012	1.113008	1,113,008	41,000	3.68%	10
1/14/2013	0.598318	598,318	22,000	3.68%	
1/15/2013	0.556191	556,191	20,000	3.60%	
1/27/2013	0.592641	592,641	21,000	3.54%	
12/11/2012	0.909267	909,267	32,000	3.52%	
1/15/2011	1.01287	1,012,870	35,210	3.48%	
1/20/2013	0.462202	462,202	16,000	3.46%	
1/13/2013	0.641869	641,869	22,000	3.43%	
1/18/2013	0.525409	525,409	18,000	3.43%	
12/10/2012	0.935227	935,227	32,000	3.42%	
1/6/2013	0.656247	656,247	22,000	3.35%	
1/5/2013	0.658831	658,831	22,000	3.34%	
1/19/2013	0.519248	519,248	17,000	3.27%	
1/25/2013	0.588214	588,214	19,000	3.23%	19
1/2/2013	0.836111	836,111	27,000	3.23%	
1/26/2013	0.530318	530,318	17,000	3.21%	
1/29/2012	0.974448	974,448	31,000	3.18%	
12/9/2012	1.012134	1,012,134	32,000	3.16%	
1/17/2013	0.606057	606,057	19,000	3.14%	
2/28/2012	0.905439	905,439	28,000	3.09%	
11/19/2012	1.761827	1,761,827	54,000	3.07%	
2/5/2013	0.653743	653,743	20,000	3.06%	
1/4/2013	0.786171	786,171	24,000	3.05%	
12/14/2012	1.061079	1,061,079	32,000	3.02%	
2/28/2011	1.092722	1,092,722	32,720	2.99%	

①

Date	Reedsport WWTP Effluent Flow		Landfill Leachate Flow	Ratio of Leachate to WWTP Flow
	MGD	GPD	GPD	
1/1/2011	1.540303	1,540,303	25,010	1.62%
1/2/2011	1.31915	1,319,150	22,230	1.69%
1/3/2011	1.14293	1,142,930	20,700	1.81%
1/4/2011	0.998063	998,063	18,970	1.90%
1/5/2011	1.259292	1,259,292	17,470	1.39%
1/6/2011	0.896593	896,593	16,520	1.84%
1/7/2011	0.841843	841,843	16,560	1.97%
1/8/2011	0.855014	855,014	15,380	1.80%
1/9/2011	0.851497	851,497	15,140	1.78%
1/10/2011	0.875908	875,908	13,340	1.52%
1/11/2011	0.795546	795,546	13,700	1.72%
1/12/2011	0.776362	776,362	13,920	1.79%
1/13/2011	0.842943	842,943	21,750	2.58%
1/14/2011	1.314033	1,314,033	15,170	1.15%
1/15/2011	1.01287	1,012,870	35,210	3.48%
1/16/2011	2.483027	2,483,027	54,010	2.18%
1/17/2011	3.346034	3,346,034	34,960	1.04%
1/18/2011	2.574916	2,574,916	30,790	1.20%
1/19/2011	2.040666	2,040,666	25,860	1.27%
1/20/2011	1.842615	1,842,615	24,080	1.31%
1/21/2011	1.259405	1,259,405	22,840	1.81%
1/22/2011	1.08867	1,088,670	20,730	1.90%
1/23/2011	0.999204	999,204	19,730	1.97%
1/24/2011	0.925493	925,493	18,220	1.97%
1/25/2011	0.856385	856,385	16,970	1.98%
1/26/2011	0.807139	807,139	15,990	1.98%
1/27/2011	0.853999	853,999	15,180	1.78%
1/28/2011	0.749963	749,963	14,720	1.96%
1/29/2011	0.708113	708,113	13,620	1.92%
1/30/2011	0.703099	703,099	12,320	1.75%
1/31/2011	0.694621	694,621	10,970	1.58%

2

	Reedsport WWTP Effluent Flow		Landfill Leachate Flow	Ratio of Leachate to WWTP Flow
Date	MGD	GPD	GPD	
2/27/2011	0.821324	821,324	18,550	2.26%
2/28/2011	1.092722	1,092,722	32,720	2.99%
3/1/2011	2.48261	2,482,610	29,540	1.19%
3/2/2011	1.739549	1,739,549	27,160	1.56%
3/3/2011	1.424188	1,424,188	21,280	1.49%
3/4/2011	1.241079	1,241,079	26,050	2.10%
3/5/2011	1.633696	1,633,696	23,290	1.43%
3/6/2011	1.360446	1,360,446	21,170	1.56%
3/7/2011	1.124676	1,124,676	20,520	1.82%
3/8/2011	1.24114	1,241,140	33,840	2.73%
3/9/2011	1.98991	1,989,910	27,370	1.38%
3/10/2011	1.650362	1,650,362	34,880	2.11%
3/11/2011	1.729434	1,729,434	26,920	1.56%
3/12/2011	1.26115	1,261,150	27,580	2.19%
3/13/2011	1.334685	1,334,685	31,010	2.32%
3/14/2011	1.742523	1,742,523	26,430	1.52%
3/15/2011	1.584182	1,584,182	30,820	1.95%
3/16/2011	1.656256	1,656,256	39,330	2.37%
3/17/2011	1.642337	1,642,337	35,220	2.14%
3/18/2011	1.706902	1,706,902	32,630	1.91%
3/19/2011	1.466649	1,466,649	29,440	2.01%
3/20/2011	1.319493	1,319,493	28,760	2.18%
3/21/2011	1.307913	1,307,913	27,600	2.11%
3/22/2011	1.341354	1,341,354	24,070	1.79%
3/23/2011	1.112416	1,112,416	24,630	2.21%
3/24/2011	1.076939	1,076,939	24,650	2.29%
3/25/2011	1.117611	1,117,611	22,990	2.06%
3/26/2011	1.179381	1,179,381	25,620	2.17%
3/27/2011	1.470543	1,470,543	28,270	1.92%
3/28/2011	1.806758	1,806,758	24,250	1.34%
3/29/2011	1.439022	1,439,022	32,890	2.29%
3/30/2011	2.079396	2,079,396	28,300	1.36%
3/31/2011	1.582742	1,582,742	26,120	1.65%
4/1/2011	1.339188	1,339,188	26,330	1.97%
4/2/2011	1.591823	1,591,823	23,830	1.50%
4/3/2011	1.203647	1,203,647	21,240	1.76%
4/4/2011	1.053482	1,053,482	26,070	2.47%
4/5/2011	1.452284	1,452,284	22,190	1.53%

	Reedsport WWTP Effluent Flow		Landfill Leachate Flow	Ratio of Leachate to WWTP Flow
Date	MGD	GPD	GPD	
4/6/2011	1.011734	1,011,734	26,820	2.65%

③

	Reedsport WWTP Effluent Flow		Landfill Leachate Flow	Ratio of Leachate to WWTP Flow
Date	MGD	GPD	GPD	
1/17/2012	0.936362	936,362	20,000	2.14%
1/18/2012	1.663743	1,663,743	49,000	2.95%
1/19/2012	3.865708	3,865,708	69,000	1.78%
1/20/2012	3.674989	3,674,989	48,000	1.31%
1/21/2012	3.394625	3,394,625	45,000	1.33%
1/22/2012	2.483734	2,483,734	34,000	1.37%
1/23/2012	1.863743	1,863,743	27,000	1.45%
1/24/2012	1.670658	1,670,658	34,000	2.04%
1/25/2012	1.661887	1,661,887	30,000	1.81%
1/26/2012	1.704363	1,704,363	31,000	1.82%
1/27/2012	1.313211	1,313,211	27,000	2.06%
1/28/2012	1.070191	1,070,191	26,000	2.43%
1/29/2012	0.974448	974,448	31,000	3.18%

④

Date	Reedsport WWTP Effluent Flow MGD	Reedsport WWTP Effluent Flow GPD	Landfill Leachate Flow GPD	Ratio of Leachate to WWTP Flow
3/13/2012	1.676981	1,676,981	35,000	2.09%
3/14/2012	2.171322	2,171,322	34,000	1.57%
3/15/2012	2.442274	2,442,274	48,000	1.97%
3/16/2012	3.141468	3,141,468	48,000	1.53%
3/17/2012	2.601969	2,601,969	40,000	1.54%
3/18/2012	1.861586	1,861,586	35,000	1.88%
3/19/2012	1.621964	1,621,964	32,000	1.97%
3/20/2012	1.51528	1,515,280	34,000	2.24%
3/21/2012	1.956769	1,956,769	58,000	2.96%
3/22/2012	3.490381	3,490,381	45,000	1.29%
3/23/2012	2.343168	2,343,168	38,000	1.62%
3/24/2012	1.650871	1,650,871	33,000	2.00%
3/25/2012	1.300565	1,300,565	33,000	2.54%
3/26/2012	1.254897	1,254,897	30,000	2.39%
3/27/2012	1.188855	1,188,855	34,000	2.86%
3/28/2012	1.551016	1,551,016	30,000	1.93%
3/29/2012	1.636112	1,636,112	40,000	2.44%
3/30/2012	2.508965	2,508,965	58,000	2.31%
3/31/2012	3.717885	3,717,885	61,000	1.64%
4/1/2012	3.411338	3,411,338	50,000	1.47%
4/2/2012	2.905312	2,905,312	42,000	1.45%
4/3/2012	2.017739	2,017,739	41,000	2.03%
4/4/2012	2.133919	2,133,919	40,000	1.87%
4/5/2012	1.930813	1,930,813	36,000	1.86%
4/6/2012	1.552068	1,552,068	33,000	2.13%
4/7/2012	1.22537	1,225,370	32,000	2.61%
4/8/2012	1.140512	1,140,512	30,000	2.63%
4/9/2012	1.041889	1,041,889	27,000	2.59%

⑤

Date	Reedsport WWTP Effluent Flow MGD	 GPD	Landfill Leachate Flow GPD	Ratio of Leachate to WWTP Flow
11/18/2012	1.3053	1,305,300	24,000	1.84%
11/19/2012	1.761827	1,761,827	54,000	3.07%
11/20/2012	3.394917	3,394,917	31,000	0.91%
11/21/2012	3.311456	3,311,456	20,000	0.60%
11/22/2012	2.345462	2,345,462	18,000	0.77%
11/23/2012	1.513217	1,513,217	29,000	1.92%
11/24/2012	1.953215	1,953,215	23,000	1.18%
11/25/2012	1.990735	1,990,735	21,000	1.05%
11/26/2012	1.412683	1,412,683	19,000	1.34%
11/27/2012	1.224209	1,224,209	18,000	1.47%

⑥

	Reedsport WWTP Effluent Flow		Landfill Leachate Flow	Ratio of Leachate to WWTP Flow
Date	MGD	GPD	GPD	
12/24/2012	2.425825	2,425,825	18,000	0.74%
12/25/2012	1.826606	1,826,606	18,000	0.99%
12/26/2012	2.22046	2,220,460	24,000	1.08%
12/27/2012	2.522604	2,522,604	18,000	0.71%
12/28/2012	1.863276	1,863,276	20,000	1.07%
12/29/2012	1.438278	1,438,278	18,000	1.25%
12/30/2012	1.211345	1,211,345	21,000	1.73%
12/31/2012	1.076722	1,076,722	0	0.00%
1/1/2013	0.452165	452,165	28,000	6.19%
1/2/2013	0.836111	836,111	27,000	3.23%
1/3/2013	1.300649	1,300,649	26,000	2.00%
1/4/2013	0.786171	786,171	24,000	3.05%
1/5/2013	0.658831	658,831	22,000	3.34%
1/6/2013	0.656247	656,247	22,000	3.35%
1/7/2013	1.029168	1,029,168	25,000	2.43%
1/8/2013	0.747555	747,555	22,000	2.94%
1/9/2013	0.688265	688,265	28,000	4.07%
1/10/2013	0.660299	660,299	28,000	4.24%
1/11/2013	0.633917	633,917	25,000	3.94%
1/12/2013	0.603285	603,285	24,000	3.98%
1/13/2013	0.641869	641,869	22,000	3.43%
1/14/2013	0.598318	598,318	22,000	3.68%
1/15/2013	0.556191	556,191	20,000	3.60%
1/16/2013	0.54055	540,550	20,000	3.70%
1/17/2013	0.606057	606,057	19,000	3.14%
1/18/2013	0.525409	525,409	18,000	3.43%
1/19/2013	0.519248	519,248	17,000	3.27%
1/20/2013	0.462202	462,202	16,000	3.46%
1/21/2013	0.757595	757,595	16,000	2.11%
1/22/2013	0.724084	724,084	15,000	2.07%
1/23/2013	0.604683	604,683	18,000	2.98%
1/24/2013	0.652803	652,803	15,000	2.30%
1/25/2013	0.588214	588,214	19,000	3.23%
1/26/2013	0.530318	530,318	17,000	3.21%
1/27/2013	0.592641	592,641	21,000	3.54%
1/28/2013	0.523492	523,492	21,000	4.01%
1/29/2013	0.507718	507,718	21,000	4.14%
1/30/2013	0.492945	492,945	19,000	3.85%

	Reedsport WWTP Effluent Flow		Landfill Leachate Flow	Ratio of Leachate to WWTP Flow
Date	MGD	GPD	GPD	
1/31/2013	0.487803	487,803	19,000	3.90%
2/1/2013	0.843419	843,419	19,000	2.25%
2/2/2013	0.777704	777,704	17,000	2.19%
2/3/2013	0.704596	704,596	16,000	2.27%
2/4/2013	0.67265	672,650	17,000	2.53%
2/5/2013	0.653743	653,743	20,000	3.06%
2/6/2013	0.833255	833,255	21,000	2.52%
2/7/2013	1.082546	1,082,546	22,000	2.03%
2/8/2013	1.158839	1,158,839	17,000	1.47%
2/9/2013	0.943359	943,359	17,000	1.80%
2/10/2013	0.774971	774,971	16,000	2.06%
2/11/2013	0.722115	722,115	15,000	2.08%
2/12/2013	0.671227	671,227	15,000	2.23%
2/13/2013	0.697885	697,885	14,000	2.01%
2/14/2013	0.682842	682,842	14,000	2.05%
2/15/2013	0.614418	614,418	14,000	2.28%
2/16/2013	0.596735	596,735	13,000	2.18%
2/17/2013	0.594371	594,371	12,000	2.02%
2/18/2013	0.583635	583,635	13,000	2.23%
2/19/2013	0.656645	656,645	14,000	2.13%
2/20/2013	0.679144	679,144	12,000	1.77%
2/21/2013	0.685507	685,507	12,000	1.75%
2/22/2013	0.661669	661,669	17,000	2.57%
2/23/2013	1.109108	1,109,108	15,000	1.35%
2/24/2013	0.929834	929,834	13,000	1.40%
2/25/2013	0.834637	834,637	15,000	1.80%

Appendix C

Impact on Monthly BOD, TSS, and NH_3 Influent Loadings

Project Impact of Reedsport LF Leachate on Reedsport WWTP Date 3/20/14
Subject Potential Ammonia Impacts. Sheet ____ of ____
Computed By MEH Job Number ____
Checked By ____ Task Number ____

BHC CONSULTANTS

NOTE: No ammonia testing data available for Reedsport WWTP

\+ Use Max Conc. for Leachate = 18.7 mg/L
* Assume influent NH_3 conc = 30 mg/L (W-G WWTP $\bar{x}$ < 30 mg/L)

	Reedsport WWTP			Reedsport LF Leachate			Combined Influent	
		NH_3			NH_3		NH_3	
Month	Q (mgd)	(mg/L)	(ppd)	Q (mgd)	(mg/L)	(ppd)	(ppd)	(% Increase)
Jan 2011	1.20	30	300	0.020	18.7	3	303	1.0
Feb	0.88		220	0.015		2	222	1.0
Mar	1.51		378	0.028		4	382	1.1
Apr	1.08		270	0.018		3	273	1.1
May	0.69		173	0.006		1	173	0.6
June 2011	0.55		138	0.002		1	139	0.7
Jan 2012	1.36		340	0.021		3	343	0.9
Feb	1.02		255	0.020		3	258	1.2
Mar	1.69		423	0.034		5	428	1.2
Apr	1.29		323	0.024		4	327	1.2
May	0.75		188	0.009		2	190	1.1
June	0.70		175	0.005		1	171	0.6
July	0.50		125	0.002		1	126	0.8
Nov	1.29		323	0.023		4	327	1.2
Dec 2012	1.70		425	0.028		4	429	0.9
Jan 2013	0.90		225	0.021		3	228	1.3
Feb	0.78		195	0.016		3	198	1.5
Mar	0.75		188	0.013		2	190	1.1
Apr	0.72		180	0.009		2	182	1.1
May	0.58		145	0.003		1	146	0.7
June	0.49		123	0.002		1	124	0.8
Nov	0.63		158	0.003		1	159	0.6
Dec 2013	0.64	30	160	0.008	18.7	1	161	0.6

Project Reedsport LF Leachate
Subject BOD/TSS Loadings Impacts @ Reedsport WWTP
Computed By MSH
Checked By
Date 5/6/14
Sheet 1 of 1
Job Number
Task Number

BHC CONSULTANTS

		Reedsport WWTP Influent Loading (ppd)		Reedsport Landfill Leachate					Combined Infl. Load			
				Flow	BOD(1)		TSS		BOD		TSS	
Year	Month	BOD	TSS	(mgd)	(mg/L)	(ppd)	(mg/L)	(ppd)	(ppd)	(% Inc.)	(ppd)	% Inc.
2011	Jan	1,009	1,109	0.020	116	19	150	25	1,028	1.7	1,134	2.3
	Feb	798	851	0.015	↑	15	↑	19	813	1.9	870	2.2
	Mar	1,477	1,466	0.028		27		35	1,504	1.8	1,501	2.4
	Apr	1,322	1,694	0.018		17		23	1,339	1.3	1,717	1.4
	May	803	815	0.006		6		8	809	0.7	823	1.0
	June	750	666	0.002		2		3	752	0.3	669	0.5
2012	Jan	1,053	1,236	0.021		20		26	1,073	1.9	1,262	2.1
	Feb	800	903	0.020		19		25	819	2.4	928	2.8
	Mar	1,062	1,326	0.034		33		43	1,095	3.1	1,369	3.2
	Apr	1,378	1,164	0.024		23		30	1,408	1.7	1,194	2.6
	May	943	837	0.009		9		11	952	1.0	848	1.3
	June	753	882	0.004		4		5	757	0.5	887	0.6
	July	627	715	0.002		2		3	629	0.3	718	0.4
	Nov	912	1,188	0.023		22		29	934	2.4	1,217	2.4
	Dec	1,428	2,164	0.028		27		35	1,455	1.9	2,199	1.6
2013	Jan	922	1,245	0.021		20		26	942	2.2	1,271	2.1
	Feb	711	925	0.016		15		20	726	2.1	945	2.2
	Mar	700	1,028	0.013		13		16	713	1.9	1,044	1.4
	Apr	983	1,143	0.009		9		11	992	1.1	1,154	1.0
	May	808	932	0.003		3		4	811	0.4	936	0.4
	June	788	823	0.002		2		3	790	0.3	826	0.4
	Nov	931	1,146	0.003	↓	3	↓	4	934	0.3	1,150	0.3
	Dec	864	984	0.008	116	8	150	10	872	0.9	994	1.0

(1). Used COD rather than BOD and 95% confidence limit concentration = 116 mg/L; max COD = 134 mg/L
Note that 95% confidence limit concentration for BOD = 42 mg/L; max BOD reported = 51 mg/L
(2). Used 95% confidence limit concentration for TSS = 150 mg/L; max TSS reported = 173 mg/L

Summary:	$\bar{X}$ =	13.8 ppd	18.0 ppd		1.4 %	1.5 %
	σ =	9.3 ppd	12.1 ppd		0.8 %	0.9 %
	Max =	27 ppd	43 ppd	1508 ppd	3.1 %	2,199, 3.2%
	% of Design Criteria =			75.4%		75.8% ppd

Reedsport Landfill

Year	Month	Average Monthly Leachate Flow, GPD	Reedsport WWTP Average Monthly Flow, GPD	Leachate Flow/WWTP Flow	Average Monthly WWTP Influent BOD, mg/L	BOD Loading (ppd)	Average Monthly WWTP Influent TSS, mg/L	TSS Loading (ppd)
2011	January	20,389	1,201,797	1.70%	101	1,009	111	1,109
	February	15,433	881,409	1.75%	109	798	116	851
	March	27,827	1,511,140	1.84%	117	1,477	116	1,466
	April	18,040	1,075,494	1.68%	147	1,322	189	1,694
	May	5,811	694,256	0.84%	139	803	141	815
	June	1,806	545,076	0.33%	165	750	147	666
	July	0	442,460		188	694	162	599
	August	0	386,443		216	695	178	575
	September	0	373,794		221	688	198	619
	October	0	466,870		178	691	157	610
	November	0	827,687		142	979	133	920
	December	0	756,049		137	862	152	957
2012	January	21,258	1,357,022	1.57%	93	1,053	109	1,236
	February	19,862	1,022,971	1.94%	94	800	106	903
	March	33,516	1,693,450	1.98%	75	1,062	94	1,326
	April	24,000	1,290,786	1.86%	128	1,378	108	1,164
	May	8,935	748,840	1.19%	151	943	134	837
	June	4,467	697,802	0.64%	129	753	152	882
	July	2,077	500,057	0.42%	150	627	171	715
	August	0	416,855		160	555	176	613
	September	0	346,852		210	608	224	648
	October	0	592,716		157	778	208	1,028
	November	23,400	1,292,804	1.81%	85	912	110	1,188
	December	27,533	1,697,568	1.62%	101	1,428	153	2,164
2013	January	21,161	899,912	2.35%	123	922	166	1,245
	February	15,750	776,750	2.03%	110	711	143	925
	March	13,355	753,581	1.77%	111	700	164	1,028
	April	9,172	718,990	1.28%	164	983	191	1,143
	May	3,071	581,449	0.53%	167	808	192	932
	June	2,385	491,814	0.48%	192	788	201	823
	July	0	390,809		256	834	260	849
	August	0	350,769		265	774	268	784
	September	0	534,507		238	1,059	258	1,148
	October	0	573,784		158	754	172	821
	November	3,333	634,520	0.53%	176	931	217	1,146
	December	7,516	644,026	1.17%	161	864	183	984
			(from DMRs)		(from DMRs)		(from DMRs)	

Reedsport Landfill
BOD/COD/TSS

19-Mar-13

Parameter	Period of Record	No. of Samples		(excluded "ND" values) Mean Concentration	Max Concentration	Standard Deviation
		Total	>ND			
BOD				NOT FOUND IN DATA		
COD	5/19/99 through 10/23/13	35	35	47.954	134.000	26.626
TSS	5/19/99 through 10/23/13	35	31	66.339	173.000	35.116

Reedsport Landfill

Year	Month	Average Monthly Leachate Flow, GPD	Reedsport WWTP Average Monthly Flow, GPD	Leachate Flow/WWTP Flow	Average Monthly WWTP Influent BOD, mg/L	Average Monthly WWTP Influent TSS, mg/L
2011	January	20,389	1,201,797	1.70%	101	111
	February	15,433	881,409	1.75%	109	116
	March	27,827	1,511,140	1.84%	117	116
	April	18,040	1,075,494	1.68%	147	189
	May	5,811	694,256	0.84%	139	141
	June	1,806	545,076	0.33%	165	147
	July	0	442,460		188	162
	August	0	386,443		216	178
	September	0	373,794		221	198
	October	0	466,870		178	157
	November	0	827,687		142	133
	December	0	756,049		137	152
2012	January	21,258	1,357,022	1.57%	93	109
	February	19,862	1,022,971	1.94%	94	106
	March	33,516	1,693,450	1.98%	75	94
	April	24,000	1,290,786	1.86%	128	108
	May	8,935	748,840	1.19%	151	134
	June	4,467	697,802	0.64%	129	152
	July	2,077	500,057	0.42%	150	171
	August	0	416,855		160	176
	September	0	346,852		210	224
	October	0	592,716		157	208
	November	23,400	1,292,804	1.81%	85	110
	December	27,533	1,697,568	1.62%	101	153
2013	January	21,161	899,912	2.35%	123	166
	February	15,750	776,750	2.03%	110	143
	March	13,355	753,581	1.77%	111	164
	April	9,172	718,990	1.28%	164	191
	May	3,071	581,449	0.53%	167	192
	June	2,385	491,814	0.48%	192	201
	July	0	390,809		256	260
	August	0	350,769		265	268
	September	0	534,507		238	258
	October	0	573,784		158	172
	November	3,333	634,520	0.53%	176	217
	December	7,516	644,026	1.17%	161	183
			(from DMRs)		(from DMRs)	(from DMRs)

Wastewater Flow and Loading Projections

Item	Current value	Year 2025
Population	5,300	7,500
Flows		
ADWF, mgd	0.77	1.02
Average annual flow, mgd	1.15	1.46
AWWF, mgd	1.53	1.90
MMDWF, mgd	0.96	1.28
MMWWF, mgd	1.82	2.90
Peak week flow, mgd	2.35	3.40
Peak day flow, mgd	2.96	5.00
PWWF, mgd	4.80	7.00
Loads		
Average BOD load, ppd	1,100	1,600
Maximum month BOD load, ppd	1,400	2,000
Peak week BOD load, ppd	1,900	2,700
Peak day BOD load, ppd	2,500	3,700
Average TSS load, ppd	1,250	1,800
Maximum month TSS load, ppd	2,000	2,900
Peak week TSS load, ppd	2,500	3,600
Peak day TSS load, ppd	3,600	5,200

Notes:

1. Projected flows assuming that the collection system had sufficient capacity to deliver all peak flows to the treatment plant.
2. Flows are based on plant flow data from 2003 to 2005.

Design Data Treatment Plant Expansion

Item description	Value
Railroad Pumping Station	
Type: Submersible	
No. of Pumps	4
Drive type	Adjustable Frequency Drive
Capacity	5,000 gpm @ 50 ft. total dynamic head
Pump HP	(2) @ 30 HP
Pump HP	(2) @ 40 HP
Level Control	Ultrasonic Level Sensor
Overflow Point	6.00', NW Wall
Overflow Discharge	Umpqua River
Auxillary Power Type	WWTP Stand-by Generator
Location	WWTP Blower/Electrical Building
Forcemains	
No. of Forcemains	2
Length, Type	1350 LF 16" HDPE 800 LF 12" AC 550 LF 12" HDPE 16"
Profile	Varies w/ grade, min. 3' cover
Discharge point	WWTP Headworks
Air Release Valve	At Station
Vacuum Release Valve	At Station
Avg. Detention time	7.5 minutes @ start-up, 6 minutes @ ult.
Sulfide Control System	none
Stand-by Generator	
Type: Diesel Engine	
Output	400 KW
Fuel Tank Capacity	
Gallons	1,000
Run Time	24 hours
Transfer Switch	Automatic
Alarm Telemetry	SCADA, PLC screen display
EPA Reliability Class	I
Septage receiving station	
Max. septage per week:	(2) 2,000 gal. trucks
Volume, gallons	2,000
Septage pump	
Type: Submersible Chopper	
Capacity, gpm	155
Horsepower	5
Headworks	
Mechanical screen	
Type: Perforated plate	
Opening, inches	0.25
Screen capacity, mgd	6.0
Bypass channel with manual screen capacity, mgd	7.0
Grit removal chamber	
Type: Vortex	
Diameter, feet	10
Capacity, mgd	7.0
Grit pump	
Type: Recessed impeller	
Capacity, gpm	250
Horsepower	15
Grit classification	
Grit cyclone, number	1
Grit classifier, number	1
Secondary treatment	
Aeration basins	
Number	2
Length, feet	147
Width, feet	20
Water depth, feet	18
Volume each, 1,000 cubic feet	53
Volume each, gallons	396,440
Sludge age, days, at max month load and MLSS of 2,500 mg/l	6.5
Blowers	
Type: Variable speed, positive displacement	
Number	3
Capacity, each, scfm	450 to 1,220
Discharge pressure, max, psig	11
Horsepower, each	100
Mixer	
Type: Submersible	
Number	3
Horsepower, each	3

Design Data Treatment Plant Expansion, Cont'd

Item description	Value
ML recycle pumps	
Type: Submersible propeller	
Number	2
Capacity, each, gpm	1,300/2,000
Horsepower, each	5
Sodium hydroxide	2
Storage tanks, number	2
Volume, each, gallons	2,500
Concentration, percent	25
Use, gal/day at max. week	760
Feed pumps, number	2
Type: Paristaltic	
Capacity each at max speed, gallons/hour	50
Secondary clarifiers	
Number	2
Diameter, feet	60
Water depth, feet	16
Volume, each, 1,000 cubic feet	45.2
Volume, each, gallons	338,400
Peak flow, total, mgd	7.0
Overflow rate at pwwf, gpd/sqft	1,240
RAS pumps	
Type: Variable speed, nonclog horizontal	
Number, each clarifier	2
Capacity, each, gpm	200 to 300
Horsepower, each	7.5
WAS pumps	
Type: Variable speed, Rotary lobe	
Number	2
Capacity, each pump, gpm	75 to 150
Horsepower, each	10
Scum pump	
Type: Submersible	
Capacity, gpm	150
Horsepower	5
Chlorine contact basins	
Number	2
Length to width ratio per basin:	47:1
Water depth, feet	8.4 to 9.9
Volume, total, 1,000 cubic feet	9.7 to 11.4
Volume, total, gallons	72,500 to 85,500
Detention time, minutes	
Average dry weather flow, 1.02 mgd	102
Maximum month wet weather flow, 2.90 mgd	36
Peak week flow, 3.40 mgd	31
Peak day flow, 5.00 mgd	23
Peak hour flow, 7.00 mgd	17.5
Rapid mix chlorine gas	
Type: Submerged chemical induction	
Number	1
Chlorine gas	
Storage tanks, number	10
Volume, each, lbs	150
Chlorine dose, mg/L	5
lbs/day at max month flow, 2.90 mgd	121
Max month use, lbs	3,628
Peak use, lbs/hour	12
Chlorinators, number	2
Type: Gaseous	
Capacity, each, lbs/hour	12
Bisulfite	
Storage tanks, number	2
Volume, each, gallons	500
Concentration, percent	25
Use, gal/day at max month, 2.90 mgd	8.3
Max month use, gallons	254
Peak use, lbs/hour	1.2
Bisulfite feed pumps, number	2
Type: Peristaltic	
Capacity, each, at max speed, gallons/hour	1.2
Effluent Parshall Flume Throat	
Width, inches	12
Outfall	
Existing pipeline	
Material: concrete	
Diameter, inches	24
Length, feet	490

Design Data Treatment Plant Expansion, Cont'd

Item description	Value
New pipeline	
Material: HDPE	
Diameter, inches	30
Length, feet	100
Diffuser	
Type: Multiport	
Number of ports	4
Port diameter, inches	14
Aerobic digestion and digested solids storage	
Average WAS production, ppd	1,030
Assumed volatile solids content, percent	80
Volatile solids destruction, percent	37
Average DS production, ppd	720
Assumed average solids concentration in digestion/storage, percent	2
Aerobic digesters, number	2
Diameter, feet	42
Depth, feet	10.5
Volume, each, 1,000 cubic feet	14.5
Volume, each, gallons	108,813
Detention time @ avg. DS prod. & 2% concentration, each, days	25.4
Aeration type: course bubble diffusers	
Digested solids storge basins, number	2
Length, feet	118
Width, feet	62
Depth, feet	9.3
Volume, each, 1,000 cubic feet	57.7
Volume, each, gallons	431,600
Detention time @ avg. DS prod. & 2% concentration, each, days	100.7
Aeration type: course bubble diffusers	
Total volume all basins, gallons	1,080,000
Total volume all basins, 1,000 cubic feet	144.4
Maximum solids in digestion/storage, lbs	180,000
Total storage available, days	252
Solids handling blowers	
Type: Variable speed, positive displacement	
Number	2
Capacity, each, scfm	370 to 1,635
Discharge pressure, max, psig	6.5
Horsepower, each	100
Digested sludge pumps	
Type: Rotary lobe	
Number	2
Rated capacity, each, gpm	200
Horsepower, each	10
Supernatant pumps	
Type: Variable speed, submersible	
Number	2
Rated capacity, each, gpm	160 to 320
Horsepower, each	5
Sludge truck loading pumps	
Type: Self-priming centrifugal	
Number	2
Capacity, each, gpm	500
Horsepower, each	7.5
Solids beneficial use	
Annual solids production, tons per year	128
Annual available nitrogen, lbs N per year	4,000
Land requirement at 75 lbs N/acre/year	53
City-owned forest site, acres	10
Private agricultural land, acres	45
Tank drain pumps	
Type: Non-clog submersible	
Number	2
Rated capacity, each, gpm	200
Horsepower, each	3
Utility water pumps	
Type: Submersible turbine	
Number	2
Rated capacity, each, gpm	150
Horsepower, each	10

USE OF DOCUMENTS

THIS DOCUMENT, INCLUDING THE INCORPORATED DESIGNS, IS AN INSTRUMENT OF SERVICE FOR THIS PROJECT AND SHALL NOT BE USED FOR ANY OTHER PROJECT WITHOUT THE WRITTEN AUTHORIZATION OF KENNEDY/JENKS CONSULTANTS.

NO.	REVISION	DATE	BY

SCALES
0 — 1"
0 — 25mm
IF THIS BAR IS NOT DIMENSION SHOWN, ADJUST SCALES ACCORDINGLY.

16627
William M. Hazlehurst
JULY 20, 1993
WILLIAM M. HAZLEHURST
EXPIRES: 6/30/07

DESIGNED WMH
DRAWN GAS
CHECKED PJL/BIB

CITY OF REEDSPORT
REEDSPORT, OREGON

WASTEWATER TREATMENT PLANT IMPROVEMENTS

Kennedy/Jenks Consultants
EUGENE, OREGON

BASIS OF DESIGN

FILE NAME 0676005-G006
JOB NO. 0676005
DATE JUNE 2007
SHEET G006 OF

P:\CAD\2006\0676005 Reedsport WWTP Improvements\0676005-G006.dwg BECKY WILTSE 6/29/2007 8:16 AM

Appendix D

Impacts on WWTP Effluent Metals

Potential Impact of Reedsport Landfill Leachate on Reedsport WWTP Effluent Metals Concentration

		Concentration (ug/L)		
Metal	WWTP Max	Leachate Max	Blended Flow Max	Water Quality Criteria
Arsenic	0.55	1	0.58	2.1
Cadmium	ND	0.2	0.012	0.094
Chromium	0.92	2.2	0.99	183/3.14
Copper	8.33	10.1	8.34	1300
Lead	0.44	ND	0.44	13.88/0.54
Nickel	2.88	4.9	3	145/16.1
Selenium	2.1	ND	2.1	140
Silver	0.23	ND	0.23	0.296
Zinc	25.2	184	34.5	36.2/36.2
Mercury	0.05	ND	0.05	2.4/0.012

1. Blended flow maximum concentration calculated for highest observed daily leachate:WWTP flows (6.2% on 1/1/13). WWTP flow was 0.452 mgd and leachate flow was 0.028 mgd.
2. Leachate metals are assumed to remain in dissolved or in suspension during treatment.

Reedsport Landfill
Metals and Ammonia

18-Mar-13

				Concentration (mg/L)	
				(excluded "ND" values)	
Parameter	**Period of Record**	**No. of Samples**		**Mean Concentration**	**Max Concentration**
		Total	**>ND**		
Arsenic	5/19/99 through 10/23/13	22	1	0.0010	0.0010
Cadmium	5/19/99 through 10/23/13	22	2	0.00015	0.0002
Chromium III	5/19/99 through 10/23/13	22	3	0.00170	0.0022
Copper	5/19/99 through 10/23/13	22	5	0.0030	0.0101
Lead	5/19/99 through 10/23/13	22	0	-	-
Mercury		**NOT FOUND IN DATA**			
Nickel	5/19/99 through 10/23/13	17	5	0.0033	0.0049
Selenium	5/19/99 through 10/23/13	22	0	-	-
Silver	5/19/99 through 10/23/13	17	0	-	-
Zinc	5/19/99 through 10/23/13	23	15	0.0444	0.1840
Ammonia	5/19/99 through 10/23/13	35	35	12.3863	18.7000

1999 ND
2003 ND } Hg

S:\Projects\Pickets Engineering\Reedsport Landfill\Leachate Acceptance Plan\Reedsport LF leachate chemistry and flow data 2013-12-31Summary March 2014

Reedsport Landfill

Year	Month	Average Monthly Leachate Flow, GPD		Reedsport WWTP Average Monthly Flow, GPD		Leachate Flow/WWTP Flow
2011	January	20,389		1,201,797		1.70%
	February	15,433		881,409		1.75%
	March	27,827		1,511,140		1.84%
	April	18,040	$\bar{x}$=7,442	1,075,494		1.68%
	May	5,811		694,256		0.84%
	June	1,806		545,076	$\bar{x}$=763,540	0.33%
	July	0		442,460		
	August	0		386,443		
	September	0		373,794		
	October	0		466,870		
	November	0		827,687		
	December	0		756,049		
2012	January	21,258		1,357,022		1.57%
	February	19,862		1,022,971		1.94%
	March	33,516		1,693,450		1.98%
	April	24,000		1,290,786		1.86%
	May	8,935		748,840		1.19%
	June	4,467	$\bar{x}$= 13,754	697,802	$\bar{x}$=915,314	0.64%
	July	2,077		500,057		0.42%
	August	0		416,855		
	September	0		346,852		
	October	0		592,716		
	November	23,400		1,292,804		1.81%
	December	27,533		1,697,568		1.62%
2013	January	21,161		899,912		2.35%
	February	15,750		776,750		2.03%
	March	13,355		753,581		1.77%
	April	9,172		718,990		1.28%
	May	3,071	$\bar{x}$= 6,312	581,449		0.53%
	June	2,385		491,814	$\bar{x}$=565,456	0.48%
	July	0		390,809		
	August	0		350,769		
	September	0		534,507		
	October	0		573,784		
	November	3,333		634,520		0.53%
	December	7,516		644,026		1.17%

(from DMRs)

3-Yr $\bar{x}$ = 9,169 gpd

3-Yr $\bar{x}$ = 748,103 gpd

Use Reedsport Landfill
leachate Q = 10,000 gpd
= 0.01 mgd

Use Reedsport WWTP
Average Annual Q = 748,100 gpd
= 0.75 mgd

Average
Annual

$$\frac{\text{Leachate}}{\text{Leachate+WWTP}} = \frac{0.01}{0.75+0.01} = 1.3\%$$

Reedsport WWTP Effluent Metals Concentrations (ug/L)

Metal	8/29/2006	11/27/2007	4/22/2008	3/26/2009	Average
Arsenic	NA	0.45	0.55	0.39	0.46
Cadmium	NA	ND	ND	ND	
Chromium	0.56	0.92	0.6	0.65	0.68
Copper	4.46	8.05	8.33	6.4	6.81
Lead	0.42	0.44	0.27	0.17	0.32
Nickel	1.27	2.88	1.54	1.39	1.77
Selenium	2.1	0.91	0.64	0.17	0.95
Silver	0.23	0.06	0.08	0.07	0.11
Zinc	25.2	25.1	22.4	14.3	21.8
Mercury	NA	0.05	ND	ND	0.02

NA = Not analyzed
ND = Not detected in analysis

3/12/14

Impact of Receiving Reedsport Leachate – Average Annual Conditions

① Assume all metals in leachate remain in suspension and pass thru the WWTP

②. Reedsport LF leachate Q = 0.01 mgd (Ave. Annual Q)

③. Reedsport WWTP Q = 0.75 mgd

Arsenic :

W Q Criteria

$$\text{Blended As} = \frac{(\text{WWTP Q})(\text{WWTP c}) + (\text{Leach. Q})(\text{Leach. c})}{\text{WWTP Q} + \text{Leachate Q}}$$

$$= \frac{(0.75)(0.46\ \text{ug/L}) + (0.01)(1.0)}{0.75 + 0.01} = 0.47\ \text{ug/L}$$ 2.1

Cadmium:

Blended Cd = [(0.75)(0) + (0.01)(0.2)]/ 0.76 = 0.003 ug/L 0.094

Chromium, Cr = [(0.75)(0.68)+(0.01)(2.2)]/0.76 = 0.7 ug/L 183/3.4

Copper, Cu = [(0.75) (6.81) + (0.01)(10.1)]/ 0.76 = 6.85 ug/L 1300

Lead, Pb = NO CHANGE = 0.32 ug/L 13.88/0.541

Nickel, Ni = [(0.75)(1.77)+(0.01)(4.9)]/ 0.76 = 1.81 ug/L 145/16.1

Selenium, Si = NO CHANGE = 0.95 ug/L 140

Silver, Ag = NO CHANGE = 0.11 ug/L 0.296

Zinc, Zn = [(0.75)(21.8) + (0.01)(184)]/0.76 = 23.9 ug/L 36.2/36.2

Mercury, Hg = NO DATA FOUND = 0.02 ug/L 2.4/0.012

Project

Subject Receiving Water Quality vs METALS CRITERIA

Computed By MH

Checked By

Date 3/18/14

Sheet 2 of 2

Job Number

Task Number

BHC CONSULTANTS

Impact of Receiving Reedsport Leachate

1) For a worst-case Analysis

Assume: ① Leachate flow @ highest % - Based on rankings 2011-2013:

1/1/13: WWTP Q = 0.452 mgd

Leachate Q = 0.028 mgd

Total Q = 0.480 mgd

②. Use maximum conc. reported for both WWTP & leachate to compare w/ W.Q. criteria. This calculation also assumes that all metals in leachate remain in suspension & don't settle-out during treatment.

	MAX CONC.	W.Q. Criteria
Cadmium, Cd : [(0.452)(0.0)+(0.028)(0.2)]/0.48 =	0.012 ug/L	0.094
Chromium, Cr : [(0.452)(0.92)+(0.028)(2.2)]/0.48 =	0.99 ug/L	183/3.14
Copper, Cu : [(0.452)(8.33)+(0.028)(10.1)]/0.48 =	8.43 ug/L	1300
Lead, Pb : NO CHANGE	0.44 ug/L	13.88/0.541
Nickel, Ni : [(0.452)(2.88)+(0.028)(4.9)]/0.48 =	3.0 ug/L	145/16.1
Selenium, Si : NO CHANGE	2.15 ug/L	140
Silver, Ag : NO CHANGE	0.23 ug/L	0.296
Zinc, Zn : [(0.452)(25.2)+(0.028)(184)]/0.48 =	34.5 ug/L	36.2/36.2

5/15/14 — Note: If leachate Zn were removed @ 50%,

then Zn = [(0.452)(25.2)+(0.028)(92)]/0.48 = 29.1 ug/L

If Zn were removed @ 75%,

then Zn = [(0.452)(25.2)+(0.028)(46)]/0.48 = 26.4 ug/L

Arsenic, As : [(0.452)(0.55)+(0.028)(1.0)]/0.48 = 0.58 ug/L 2.1

Project ______ Date 4/17/12
Subject Reedsport WWTP Effluent Metals Sheet ____ of ____
Computed By MH Job Number ______
Checked By ______ Task Number ______

BHC CONSULTANTS

City of Reedsport WWTP Effluent Metals Concentrations (mg/L)

Metal	8/29/06	11/27/07	4/22/08	3/26/09	$\bar{x}$	WQ Std
Arsenic	–	0.00045	0.00055	0.00039	0.00046	0.0021
Cadmium	–	ND	ND	ND	–	0.000094
Chromium	0.00056	0.00092	0.00060	0.00065	0.000.68	0.00314
Copper	0.00446	0.00805	0.00833	0.00640	0.00681	1.30
Lead	0.00042	0.00044	0.000268	0.000168	0.000324	0.000541
Nickel	0.00127	0.00288	0.00154	0.00139	0.00177	0.0161
Selenium	0.00210	0.000906	0.00642	0.00017	0.00095	0.140
Silver	0.00023	0.000055	0.000084	0.000071	0.00011	0.000296
Zinc	0.0252	0.0251	0.0224	0.0143	0.0218	0.0362
Mercury	–	0.000005	ND	ND	~~0.000005~~	0.0024/0.000012

Dilution Ratios

		ZID	RMZ
Summer	WWTP Q = 1.9 mgd	3.5:1	35:1

Source: NPDES Permit Evaluation and Fact Sheet for Reedsport WWTP, June 18, 2004.

Analysis Report

ORELAP 100016
EPA OR00028

City of Reedsport
451 Winchester Ave
Reedsport, OR 97467
Client Sample ID: **Effluent**
Sample Location: **Effluent 24 hr Comp**
Project: **Toxic Pollutants Effluent**

Lab Order: **0608818**
NRC Sample ID **0608818-01**
Collection Date: **08/29/06 8:00:00 AM**
Received Date: **08/31/06 11:23:00 AM**
Reported Date: **09/12/06 8:19:37 AM**
Matrix: **Aqueous**

ANALYTICAL RESULTS

Analyses	NELAC Accredited	Result	Qual	MRL	Units	Dilution Factor	Date Analyzed
Trace Metals by ICP-MS by EPA 200.8							*Analyst: BAR*
Chromium		0.000558		0.0005	mg/L	1	09/10/06
Copper		0.00446		0.0005	mg/L	1	09/10/06
Lead		0.000422		0.0001	mg/L	1	09/10/06
Nickel		0.00127		0.0005	mg/L	1	09/10/06
Selenium		0.00210		0.0005	mg/L	1	09/10/06
Silver		0.000230		0.0001	mg/L	1	09/10/06
Thallium		ND		0.0005	mg/L	1	09/10/06
Zinc		0.0252		0.003	mg/L	1	09/10/06
Trace Metals by EPA 245.1							*Analyst: BAR*
Mercury	A	ND		0.0002	mg/L	1	09/01/06
Trace Metals by EPA 200.7							*Analyst: BAR*
Calcium	A	8.42		1	mg/L	1	09/07/06
Hardness		40.2		3.8	mg/L	1	09/07/06
Magnesium	A	4.66		1	mg/L	1	09/07/06
Semivolatile Organics by EPA 625							*Analyst: BAY*
Acenaphthene	A	ND		10	µg/L	1	08/31/06
Acenaphthylene	A	ND		10	µg/L	1	08/31/06
Anthracene	A	ND		10	µg/L	1	08/31/06
Azobenzene	A	ND		10	µg/L	1	08/31/06
Benzidine	A	ND		10	µg/L	1	08/31/06
Benz(a)anthracene	A	ND		10	µg/L	1	08/31/06
Benzo(a)pyrene	A	ND		10	µg/L	1	08/31/06
Benzo(b)fluoranthene	A	ND		10	µg/L	1	08/31/06
Benzo(k)fluoranthene	A	ND		20	µg/L	1	08/31/06
Benzo(g,h,i)perylene	A	ND		10	µg/L	1	08/31/06
Bis(2-chloroethoxy)methane	A	ND		10	µg/L	1	08/31/06
Bis(2-chloroethyl)ether	A	ND		10	µg/L	1	08/31/06
Bis(2-chloroisopropyl)ether	A	ND		10	µg/L	1	08/31/06
Bis(2-ethylhexyl)phthalate	A	ND		10	µg/L	1	08/31/06
4-Bromophenyl phenyl ether	A	ND		10	µg/L	1	08/31/06
Butyl benzyl phthalate	A	ND		10	µg/L	1	08/31/06
2-Chloronaphthalene	A	ND		10	µg/L	1	08/31/06
4-Chlorophenyl phenyl ether	A	ND		10	µg/L	1	08/31/06

Qualifiers:

ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
B - Analyte detected in the associated Method Blank
* - Value exceeds Maximum Contaminant Level
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
E - Value above quantitation range
MRL - Minimum Reporting Limit

Neilson Research Corporation

245 South Grape Street, Medford, Oregon 97501 541-770-5678 Fax 541-770-2901

Analysis Report

ORELAP 100016
EPA OR00028

City of Reedsport
451 Winchester Ave
Reedsport, OR 97467
Client Sample ID: **Reedsport WWTP**
Sample Location: **Effluent/24hr Comp**
Project: **Effluent - Toxic Pollutants**

Lab Order: **0711588**
NRC Sample ID **0711588-02D**
Collection Date: **11/27/07 9:00:00 AM**
Received Date: **11/29/07 9:51:00 AM**
Reported Date: **12/13/07 4:09:25 PM**
Matrix: **Aqueous**

ANALYTICAL RESULTS

Analyses	Result	Qual	MDL	MRL	Units	DF	Date Analyzed
TRACE METALS			**EPA 245.1**			Analyst: **BAR**	
Mercury	0.000010	J	0.00000500	0.0001	mg/L	1	12/03/07 6:04:19 PM
TRACE METALS			**EPA 200.7**			Analyst: **BAR**	
Calcium	10.2		0.0239	1	mg/L	1	11/30/07
Hardness	46.8		1.25	3.8	mg/L	1	11/30/07
Magnesium	5.21		0.00201	1	mg/L	1	11/30/07
TRACE METALS BY ICP-MS			**EPA 200.8**			Analyst: **BAR**	
Antimony	0.00014	J	0.0000103	0.0002	mg/L	1	12/05/07 12:32:00 PM
Arsenic	0.00045	J	0.000354	0.0005	mg/L	1	12/05/07 12:32:00 PM
Beryllium	0.0000070	J	0.00000560	0.0001	mg/L	1	12/05/07 12:32:00 PM
Cadmium	ND		0.00000760	0.0001	mg/L	1	12/05/07 12:32:00 PM
Chromium	0.00092	J	0.0000633	0.001	mg/L	1	12/05/07 12:32:00 PM
Copper	0.00805		0.0000201	0.0005	mg/L	1	12/05/07 12:32:00 PM
Lead	0.000440		0.00000550	0.0001	mg/L	1	12/05/07 12:32:00 PM
Nickel	0.00288		0.0000126	0.0005	mg/L	1	12/05/07 12:32:00 PM
Selenium	0.000906		0.000140	0.0005	mg/L	1	12/05/07 12:32:00 PM
Silver	0.000055	J	0.00000240	0.0001	mg/L	1	12/05/07 12:32:00 PM
Thallium	ND		0.00000950	0.0005	mg/L	1	12/05/07 12:32:00 PM
Zinc	0.0251		0.0000720	0.001	mg/L	1	12/05/07 12:32:00 PM

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Minimum Reporting Limit
S	Spike Recovery outside accepted recovery limits		

City of Reedsport	Lab Order: **0804483**
451 Winchester Ave	NRC Sample ID **0804483-02D**
Reedsport, OR 97467	Collection Date: **04/22/08 8:00:00 AM**
Client Sample ID: **Reedsport WWTP**	Received Date: **04/23/08 10:33:00 AM**
Sample Location: **Effluent/Mid Flow**	Reported Date: **05/08/08 10:52:06 AM**
Project: **Effluent - Toxic Pollutants**	Matrix: **Aqueous**

ANALYTICAL RESULTS

Report lim

Analyses	Result	Qual	MDL	MRL	Units	DF	Date Analyzed
TRACE METALS			**EPA 245.1**			Analyst: **BAR**	
Mercury	ND		0.00000500	0.0001	mg/L	1	04/24/08 7:01:18 PM
HARDNESS			**SM 2340B**			Analyst: **BAR**	
Hardness	36.8		1.25	3.8	mg/L	1	04/28/08
TRACE METALS BY ICP-MS			**EPA 200.8**			Analyst: **BAR**	
Antimony	0.00013	J	0.0000103	0.0002	mg/L	1	05/01/08 3:28:00 PM
Arsenic	0.000551		0.000354	0.0005	mg/L	1	05/01/08 3:28:00 PM
Beryllium	0.000014	J	0.00000560	0.0001	mg/L	1	05/01/08 3:28:00 PM
Cadmium	ND		0.00000760	0.0001	mg/L	1	05/01/08 3:28:00 PM
Chromium	0.00060	J	0.0000633	0.001	mg/L	1	05/01/08 3:28:00 PM
Copper	0.00833		0.0000201	0.0005	mg/L	1	05/01/08 3:28:00 PM
Lead	0.000268		0.00000550	0.0001	mg/L	1	05/01/08 3:28:00 PM
Nickel	0.00154		0.0000126	0.0005	mg/L	1	05/01/08 3:28:00 PM
Selenium	0.000642		0.000140	0.0005	mg/L	1	05/01/08 3:28:00 PM
Silver	0.000084	J	0.00000240	0.0001	mg/L	1	05/01/08 3:28:00 PM
Thallium	0.000050	J	0.00000950	0.0005	mg/L	1	05/01/08 3:28:00 PM
Zinc	0.0224		0.0000720	0.001	mg/L	1	05/01/08 3:28:00 PM

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Minimum Reporting Limit
S	Spike Recovery outside accepted recovery limits		

Neilson Research Corporation

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Analysis Report

ORELAP 100016
EPA OR00028

City of Reedsport	Lab Order: **0903531**
451 Winchester Ave	NRC Sample ID **0903531-01A**
Reedsport, OR 97467	Collection Date: **3/26/09 1:00:00 PM**
Client Sample ID: **Secondary Effluent**	Received Date: **3/27/09 9:15:00 AM**
Sample Location: **Sec Eff/5 hr Comp**	Reported Date: **4/6/09 11:08:02 AM**
Project: **Priority Pollutants-Metals, CN, Phenolics**	Matrix: **Aqueous**

ANALYTICAL RESULTS

Analyses	Result	Qual	MDL	MRL	Units	DF	Date Analyzed
TRACE METALS			**EPA 245.1**			Analyst: **BAR**	
Mercury	ND		0.00000850	0.0002	mg/L	1	3/31/09
HARDNESS			**SM 2340B**			Analyst: **BAR**	
Hardness	37.0		1.25	3.8	mg/L	1	3/30/09
TRACE METALS BY ICP-MS			**EPA 200.8**			Analyst: **BAR**	
Antimony	0.00015	J	0.0000103	0.0002	mg/L	1	3/31/09
Arsenic	0.00039	J	0.000354	0.0005	mg/L	1	3/31/09
Beryllium	0.000027	J	0.00000560	0.0001	mg/L	1	3/31/09
Cadmium	ND		0.00000760	0.0001	mg/L	1	3/31/09
Chromium	0.000650		0.0000633	0.0005	mg/L	1	3/31/09
Copper	0.00640		0.0000201	0.0005	mg/L	1	3/31/09
Lead	0.000168		0.00000550	0.0001	mg/L	1	3/31/09
Molybdenum	0.00142		0.0000297	0.0005	mg/L	1	3/31/09
Nickel	0.00139		0.0000126	0.0005	mg/L	1	3/31/09
Selenium	0.00017	J	0.000140	0.0005	mg/L	1	3/31/09
Silver	0.000071	J	0.00000240	0.0001	mg/L	1	3/31/09
Thallium	0.00028	J	0.00000950	0.0005	mg/L	1	3/31/09
Zinc	0.0143		0.0000720	0.001	mg/L	1	3/31/09

Qualifiers:

*	Value exceeds Maximum Contaminant Level	B	Analyte detected in the associated Method Blank
E	Value above quantitation range	H	Holding times for preparation or analysis exceeded
J	Analyte detected below quantitation limits	ND	Not Detected at the Minimum Reporting Limit
S	Spike Recovery outside accepted recovery limits		

Appendix E

Water Quality Criteria

Summary of Freshwater Water Quality Criteria for Metals (ug/L)

	Table 33A		Table 33B		Table 33C		Table 40
Metal	Acute	Chronic	Acute	Chronic	Acute	Chronic	
Arsenic					850	48	2.1
Cadmium				0.094			
Chromium III			183	3.14			
Copper							1300
Lead			13.88	0.541			
Mercury	2.4	0.012					
Nickel			145	16.1			140
Selenium							140
Silver			0.296				
Zinc			36.2	36.2			

3/14/14

Summary of Freshwater Water Quality Criteria for Metals (µg/L)

Parameter	Table 33A Acute	Table 33A Chronic	Table 33B (1) Acute	Table 33B (1) Chronic	Table 33C Acute	Table 33C Chronic	Table 40 (2)
Arsenic							2.1
Cadmium				0.094			
Chromium III			183	3.14			
Copper							1300
Lead			13.88	0.541			
Mercury	2.4	0.012					
Nickel			145	16.1			140
Selenium							140
Silver			0.296				
Zinc			36.2	36.2			

(1). Water quality criteria were calculated using hardness of 25 mg/L. Alkalinity of 25 mg/L was used in DEQ fact sheets for the Reedsport and Winston-Green WWTP NPDES discharge permits.

(2). Water quality criteria based on human health criteria for the consumption of water and organism.

MEH 3/13/14

Roseburg Landfill
Metals and Ammonia

13-Mar-13

report as ug/L

Freshwater Criteria ↓

	Parameter	Period of Record	No. of Samples Total	No. of Samples >ND	Mean Concentration (excluded "U" values)	Max Concentration	T-33A	T-33B
Table 40	Arsenic	9/6/95 through 11/3/2009	18	3	0.0077	0.0093	–	2.1/2.1
(*)	Cadmium	9/6/95 through 11/3/2009	18	2	0.0070	0.0140	–	0.094
Table 40	Copper	6/8/95 through 11/3/2009	28	6	0.0134	0.0170	–	1300
	Lead	9/6/95 through 11/3/2009	18	1	0.0020	0.0020	–	13.8/0.541
Table 40	Selenium	9/6/95 through 11/3/2009	18	1	0.0250	0.0250	–	120
(*)	Zinc	6/8/95 through 11/3/2009	28	19	0.0385	0.1200	–	36.2/36.2
	Ammonia	6/8/95 through 11/3/2009	27	27	36.2963	78.8000	○	
(*)	Chromium			4	0.0120	0.017		560/3.51
	Cyanide							
	Mercury						2.4/0.012	
	Silver			1	0.0002	0.00002		0.296/–
	Nickel	(PLCS data available				Table 40		145/16.1 140?

(*) Acute/chronic criteria

Alkalinity = 25 mg/L as $CaCO_3$ (W-G Fact Sht) * (Reedsport Fact Sht)

Cd: $CCC = \left[e^{(0.7409)(\ln 25)+(-4.719)}\right]\left[1.101672-[(\ln 25)(0.041838)]\right]$

$= (0.09689)(0.967) = 0.094$ ug/L

Pb: $CMC = \left(e^{(1.273\ln 25)-1.46}\right)\left(1.462-(\ln(25)(0.1457))\right)$

$= (13.98)(0.993) = 13.88$ ug/L

$CCC = \left(e^{(1.273\ln 25)-4.705}\right)(0.993) = (0.545)(0.993) = 0.541$ ug/L

Zn: $CMC = \left(e^{(0.8473)(\ln 25)+0.884}\right)(0.978) = (37.0)(.978) = 36.2$ ug/L

$CCC = CMC$

Cr
Cr III

$CMC = \left(e^{(0.8190\ln 25)+3.7256}\right)\left(\overset{0.316}{\cancel{0.982}}\right) =$ ~~560~~ ug/L or ~~187~~ 183

$CCC = \left(e^{(0.1890\ln 25)+0.6848}\right)\left(\overset{0.860}{\cancel{0.962}}\right) =$ ~~3.51~~ ug/L or ? 3.14

~~Chromium III or IV~~?

(Ag) Silver $CMC = \left(e^{(1.72\ln 25)+(-6.59)}\right)(0.85) = 0.296$ ug/L

Ni $CMC = \left(e^{(0.846\ln 25)+2.255}\right)(0.998) = 145$

$CCC = \left(e^{(0.846\ln 25)+0.0584}\right)(0.997) = 16.1$

S:\Projects\Pickets Engineering\Roseburg Landfill\Leachate Acceptance Plan\updated PV-1 and PLCS data 2014-01-30Summary March 2014

Table 33A

AQUATIC LIFE WATER QUALITY CRITERIA SUMMARY

The concentration for each compound listed in Table 33A is a criterion not to be exceeded in waters of the state in order to protect aquatic life. All values are expressed as micrograms per liter (µg/L) except where noted. Compounds are listed in alphabetical order with the corresponding EPA number (from National Recommended Water Quality Criteria: 2002, EPA 8220R-02-047), the Chemical Abstract Service (CAS) number, aquatic life freshwater acute and chronic criteria, aquatic life saltwater acute and chronic criteria. The acute criteria refer to the average concentration for one (1) hour and the chronic criteria refer to the average concentration for 96 hours (4-days), and that these criteria should not be exceeded more than once every three (3) years.

			Freshwater		**Saltwater**	
EPA No.	**Pollutant**	**CAS No.**	**Acute (CMC)**	**Chronic (CCC)**	**Acute (CMC)**	**Chronic (CCC)**
56	Acenaphthene	83329				
57	Acenaphthylene	208968				
17	Acrolein	107028				
18	Acrylonitrile	107131				
102	Aldrin	309002				
1 N	Alkalinity			20,000 P		
2 N	Aluminum (pH 6.5 - 9.0)	7429905				
3 N	Ammonia	7664417			D	D
58	Anthracene	120127				
1	Antimony	7440360				
2	Arsenic	7440382				
15	Asbestos	1332214				
6 N	Barium	7440393				
19	Benzene	71432				
59	Benzidine	92875				
60	Benzo(a)Anthracene	56553				

			Freshwater		Saltwater	
EPA No.	Pollutant	CAS No.	Acute (CMC)	Chronic (CCC)	Acute (CMC)	Chronic (CCC)
61	Benzo(a)Pyrene	50328				
62	Benzo(b)Fluoranthene	205992				
63	Benzo(g,h,i)Perylene	191242				
64	Benzo(k)Fluoranthene	207089				
3	Beryllium	7440417				
103	BHC alpha-	319846				
104	BHC beta-	319857				
106		319868				
105	BHC gamma- (Lindane)	58899	0.95			
7 N	Boron	7440428				
20	Bromoform	75252				
	Bromophenyl Phenyl Ether 4-					
70	Butylbenzyl Phthalate	85687				
4	Cadmium	7440439				
21	Carbon Tetrachloride	56235				
107	Chlordane	57749				
8 N	Chloride	16887006	860000	230000		
9 N	Chlorine	7782505	19	11	13	7.5
22	Chlorobenzene	108907				
23	Chlorodibromomethane	124481				
24	Chloroethane	75003				
65	ChloroethoxyMethane Bis2-	111911				
66	ChloroethylEther Bis2-	111444				
25	Chloroethylvinyl Ether 2-	110758				
26	Chloroform	67663				
67	ChloroisopropylEther Bis2-	108601				
15 N	ChloromethylEther, Bis	542881				
71	Chloronaphthalene 2-	91587				
45	Chlorophenol 2-	95578				
10 N	Chlorophenoxy Herbicide (2,4,5,-TP)	93721				

EPA No.	Pollutant	CAS No.	Freshwater		Saltwater	
			Acute (CMC)	Chronic (CCC)	Acute (CMC)	Chronic (CCC)
11 N	Chlorophenoxy Herbicide (2,4-D)	94757				
72	Chlorophenyl Phenyl Ether 4-	7005723				
12 N	Chloropyrifos	2921882	0.083	0.041	0.011	0.0056
5a	Chromium (III)					
5b	Chromium (VI)	18540299				
73	Chrysene	218019				
6	Copper	7440508				
14	Cyanide	57125	22 S	5.2 S	1 S	1 S
108	DDT 4,4'-	50293				
109	DDE 4,4'-	72559				
110	DDD 4,4'-	72548				
14 N	Demeton	8065483		0.1		0.1
74	Dibenzo(a,h)Anthracene	53703				
75	Dichlorobenzene 1,2-	95501				
76	Dichlorobenzene 1,3-	541731				
77	Dichlorobenzene 1,4-	106467				
78	Dichlorobenzidine 3,3'-	91941				
27	Dichlorobromomethane	75274				
28	Dichloroethane 1,1-	75343				
29	Dichloroethane 1,2-	107062				
30	Dichloroethylene 1,1-	75354				
46	Dichlorophenol 2,4-	120832				
31	Dichloropropane 1,2-	78875				
32	Dichloropropene 1,3-	542756				
111	Dieldrin	60571	0.24			
79	DiethylPhthalate	84662				
47	Dimethylphenol 2,4-	105679				
80	DimethylPhthalate	131113				
81	Di-n-Butyl Phthalate	84742				
49	Dinitrophenol 2,4-	51285				

			Freshwater		Saltwater	
EPA No.	**Pollutant**	**CAS No.**	**Acute (CMC)**	**Chronic (CCC)**	**Acute (CMC)**	**Chronic (CCC)**
27 N	Dinitrophenols	25550587				
82	Dinitrotoluene 2,4-	121142				
83	Dinitrotoluene 2,6-	606202				
84	Di-n-Octyl Phthalate	117840				
16	Dioxin (2,3,7,8-TCDD)	1746016				
85	Diphenylhydrazine 1,2-	122667				
68	EthylhexylPhthalate Bis2-	117817				
	Endosulfan					
112	Endosulfan alpha-	959988				
113	Endosulfan beta-	33213659				
114	Endosulfan Sulfate	1031078				
115	Endrin	72208	0.086			
116	Endrin Aldehyde	7421934				
33	Ethylbenzene	100414				
86	Fluoranthene	206440				
87	Fluorene	86737				
17 N	Guthion	86500		0.01		0.01
117	Heptachlor	76448				
118	Heptachlor Epoxide	1024573				
88	Hexachlorobenzene	118741				
89	Hexachlorobutadiene	87683				
91	Hexachloroethane	67721				
19 N	Hexachlorocyclo-hexane-Technical	319868				
90	Hexachlorocyclopentadiene	77474				
92	Ideno1,2,3-(cd)Pyrene	193395				
20 N	Iron	7439896		1,000		
93	Isophorone	78591				
7	Lead	7439921				
21 N	Malathion	121755		0.1		0.1
22 N	Manganese	7439965				

EPA No.	Pollutant	CAS No.	Freshwater		Saltwater	
			Acute (CMC)	Chronic (CCC)	Acute (CMC)	Chronic (CCC)
8a	Mercury	7439976	2.4	0.012	2.1	0.025
23 N	Methoxychlor	72435		0.03		0.03
34	Methyl Bromide	74839				
35	Methyl Chloride	74873				
48	Methyl-4,6-Dinitrophenol 2-	534521				
52	Methyl-4-Chlorophenol 3-	59507				
36	Methylene Chloride	75092				
8b	Methylmercury	22967926				
24 N	Mirex	2385855		0.001		0.001
94	Naphthalene	91203				
9	Nickel	7440020				
25 N	Nitrates	14797558				
95	Nitrobenzene	98953				
50	Nitrophenol 2-	88755				
51	Nitrophenol 4-	100027				
26 N	Nitrosamines	35576911				
28 N	Nitrosodibutylamine,N	924163				
29 N	Nitrosodiethylamine,N	55185				
96	N-Nitrosodimethylamine	62759				
98	N-Nitrosodiphenylamine	86306				
30 N	Nitrosopyrrolidine,N	930552				
97	N-Nitrosodi-n-Propylamine	621647				
32 N	Oxygen, Dissolved	7782447				
33 N	Parathion	56382	0.065	0.013		
119	Polychlorinated Biphenyls PCBs:	1336363	2 U	0.014 U	10 U	0.03 U
34 N	Pentachlorobenzene	608935				
53	Pentachlorophenol	87865	M		13	7.9
99	Phenanthrene	85018				
54	Phenol	108952				
36 N	Phosphorus Elemental	7723140				0.1

			Freshwater		Saltwater	
EPA No.	**Pollutant**	**CAS No.**	**Acute (CMC)**	**Chronic (CCC)**	**Acute (CMC)**	**Chronic (CCC)**
100	Pyrene	129000				
10	Selenium	7782492				
11	Silver	7440224				
40 N	Sulfide-Hydrogen Sulfide	7783064		2		2
43 N	Tetrachlorobenzene,1,2,4,5	95943				
37	Tetrachloroethane 1,1,2,2-	79345				
38	Tetrachloroethylene	127184				
12	Thallium	7440280				
39	Toluene	108883				
120	Toxaphene	8001352	0.73	0.0002	0.21	0.0002
40	Trans-Dichloroethylene 1,2-	156605				
44 N	Tributyltin (TBT)	688733				
101	Trichlorobenzene 1,2,4-	120821				
41	Trichloroethane 1,1,1-	71556				
42	Trichloroethane 1,1,2-	79005				
43	Trichloroethylene	79016				
45 N	Trichlorophenol 2,4,5	95954				
55	Trichlorophenol 2,4,6-	88062				
44	Vinyl Chloride	75014				
13	Zinc	7440666				

Footnotes for Table 33A

D Ammonia criteria for saltwater may depend on pH and temperature. Values for saltwater criteria (total ammonia) can be calculated from the tables specified in *Ambient Water Quality Criteria for Ammonia (Saltwater)--1989* (EPA 440/5-88-004;

M Freshwater aquatic life values for pentachlorophenol are expressed as a function of pH, and are calculated as follows: CMC=(exp(1.005(pH)-4.869); CCC=exp(1.005(pH)-5.134).

N This number was assigned to the list of non-priority pollutants in National Recommended Water Quality Criteria: 2002 (EPA-822-R-02-047).

P Criterion shown is the minimum (i.e. CCC in water should not be below this value in order to protect aquatic life).

S This criterion is expressed as µg free cyanide (CN)/L.

U This criterion applies to total PCBs (e.g. the sum of all congener or all isomer or homolog or Arochlor analyses).

Table 33B

AQUATIC LIFE WATER QUALITY CRITERIA SUMMARY

The concentration for each compound listed in Table 33B is a criterion not to be exceeded in waters of the state in order to protect aquatic life. All values are expressed as micrograms per liter (µg/L) except where noted. Compounds are listed in alphabetical order with the corresponding EPA number (from National Recommended Water Quality Criteria: 2002, EPA 8220R-02-047), the Chemical Abstract Service (CAS) number, aquatic life freshwater acute and chronic criteria, aquatic life saltwater acute and chronic criteria. The acute criteria refer to the average concentration for one (1) hour and the chronic criteria refer to the average concentration for 96 hours (4-days), and that these criteria should not be exceeded more than once every three (3) years.

			Freshwater		**Saltwater**	
EPA No.	**Pollutant**	**CAS No.**	**Acute (CMC)**	**Chronic (CCC)**	**Acute (CMC)**	**Chronic (CCC)**
2 N	Aluminum (pH 6.5 - 9.0)	7429905				
3 N	Ammonia	7664417				
2	Arsenic	7440382				
15	Asbestos	1332214				
19	Benzene	71432				
3	Beryllium	7440417				
105	BHC gamma- (Lindane)	58899				
4	Cadmium	7440439		E, F	40 E	8.8 E
107	Chlordane	57749				
	CHLORINATED BENZENES					
26	Chloroform	67663				
67	ChloroisopropylEther Bis2-	108601				
15 N	ChloromethylEther, Bis	542881				
5a	Chromium (III)		E,F	E,F		
5b	Chromium (VI)	18540299	16 E	11 E		

			Freshwater		Saltwater	
EPA No.	**Pollutant**	**CAS No.**	**Acute (CMC)**	**Chronic (CCC)**	**Acute (CMC)**	**Chronic (CCC)**
6	Copper	7440508			4.8 E	3.1 E
108	DDT 4,4'-	50293				
	DIBUTYLPHTHALATE					
	DICHLOROBENZENES					
	DICHLOROBENZIDINE					
	DICHLOROETHYLENES					
	DICHLOROPROPENE					
111	Dieldrin	60571		0.056		
	DINITROTOLUENE					
	DIPHENYLHYDRAZINE					
115	Endrin	72208		0.036		
86	Fluoranthene	206440				
	HALOMETHANES					
20 N	Iron	7439896				
7	Lead	7439921	E,F	E,F	210 E	8.1 E
22 N	Manganese	7439965				
8a	Mercury	7439976				
	MONOCHLOROBENZENE					
9	Nickel	7440020	E,F	E,F	74 E	8.2 E
53	Pentachlorophenol	87865		M		
54	Phenol	108952				
	POLYNUCLEAR AROMATIC HYRDOCARBONS					
10	Selenium	7782492			290 E	71 E
11	Silver	7440224	E,F	0.10 E	1.9 E	
44 N	Tributyltin (TBT)	688733	0.46	0.063	0.37	0.01
41	Trichloroethane 1,1,1-	71556				
55	Trichlorophenol 2,4,6-	88062				
13	Zinc	7440666	E,F	E,F	90 E	81 E

Footnotes for Table 33B

E Freshwater and saltwater criteria for metals are expressed in terms of "dissolved" concentrations in the water column, except where otherwise noted (e.g. aluminum).

F The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. Criteria values for hardness may be calculated from the following formulae (CMC refers to Acute Criteria; CCC refers to Chronic Criteria):

$$CMC = (\exp(m_A*[\ln(\text{hardness})] + b_A))*CF \quad \leftarrow \text{Acute}$$
$$CCC = (\exp(m_C*[\ln(\text{hardness})] + b_C))*CF \quad \leftarrow \text{Chronic}$$

where CF is the conversion factor used for converting a metal criterion expressed as the total recoverable fraction in the water column to a criterion expressed as the dissolved fraction in the water column.

Chemical	m_A	b_A	m_C	b_C
Cadmium	---	---	0.7409	-4.719
Chromium III	0.8190	3.7256	0.8190	0.6848
Copper	---	---	---	---
Lead	1.273	-1.460	1.273	-4.705
Nickel	0.8460	2.255	0.8460	0.0584
Silver	1.72	-6.59		
Zinc	0.8473	0.884	0.8473	0.884

Conversion factors (CF) for dissolved metals (the values for total recoverable metals criteria were multiplied by the appropriate conversion factors shown below to calculate the dissolved metals criteria):

Chemical	Freshwater		Saltwater	
	Acute	Chronic	Acute	Chronic
Arsenic	---	---	---	---
Cadmium	---	1.101672-[(ln hardness)(0.041838)]	0.994	0.994
Chromium III	0.316	0.860	--	--
Chromium VI	0.982	0.962	---	---
Copper	---	---	0.83	0.83
Lead	1.46203-[(ln hardness)(0.145712)]	1.46203-[(ln hardness)(0.145712)]	0.951	0.951
Nickel	0.998	0.997	0.990	0.990
Selenium	---	---	0.998	0.998
Silver	0.85	0.85	0.85	---
Zinc	0.978	0.986	0.946	0.946

M Freshwater aquatic life values for pentachlorophenol are expressed as a function of pH, and are calculated as follows: CMC=(exp(1.005(pH)-4.869); CCC=exp(1.005(pH)-5.134).

N This number was assigned to the list of non-priority pollutants in National Recommended Water Quality Criteria: 2002 (EPA-822-R-02-047).

Table 33C

WATER QUALITY GUIDANCE VALUES SUMMARY^{A}

The concentration for each compound listed in Table 33c is a guidance value that can be used in application of Oregon's Narrative Toxics Criteria (340-041-0033(1)) to waters of the state in order to protect aquatic life. All values are expressed as micrograms per liter (µg/L) except where noted. Compounds are listed in alphabetical order with the corresponding EPA number (from National Recommended Water Quality Criteria: 2002, EPA-822-R-02-047), corresponding Chemical Abstract Service (CAS) number, aquatic life freshwater acute and chronic guidance values, and aquatic life saltwater acute and chronic guidance values.

EPA No.	Compound	CAS Number	Freshwater		Saltwater	
			Acute	Chronic	Acute	Chronic
56	Acenaphthene	83329	1,700	520	970	710
17	Acrolein	107028	68	21	55	-
18	Acrylonitrile	107131	7,550	2,600	-	-
1	Antimony	7440360	9,000	1,600	-	-
2	Arsenic	7440382	850	48	2,319	13
19	Benzene	71432	5,300	-	5,100	700
59	Benzidine	92875	2,500	-	-	-
3	Beryllium	7440417	130	5.3	-	-
19 B	BHC (Hexachlorocyclohexane-Technical)	319868	100	-	0.34	-
21	Carbon Tetrachloride	56235	35,200	-	50,000	-
	Chlorinated Benzenes		250	50	160	129
	Chlorinated naphthalenes		1,600	-	7.5	-
	Chloroalkyl Ethers		238,000	-	-	-
26	Chloroform	67663	28,900	1,240	-	-
45	Chlorophenol 2-	95578	4,380	2,000	-	-
	Chlorophenol 4-	106489	-	-	29,700	-
52	Methyl-4-chlorophenol 3-	59507	30	-	-	-
5a	Chromium (III)	16065831	-	-	10,300	-
109	DDE 4,4'-	72559	1,050	-	14	-
110	DDD 4,4'-	72548	0.06	-	3.6	-
	Diazinon	333415	0.08	0.05	-	-
	Dichlorobenzenes		1,120	763	1,970	-
29	Dichloroethane 1,2-	107062	118,000	20,000	113,000	-
	Dichloroethylenes		11,600	-	224,000	-
46	Dichlorophenol 2,4-	120832	2,020	365	-	-
31	Dichloropropane 1,2-	78875	23,000	5,700	10,300	3,040
32	Dichloropropene 1,3-	542756	6,060	244	790	-
47	Dimethylphenol 2,4-	105679	2,120	-	-	-
	Dinitrotoluene		330	230	590	370
16	Dioxin (2,3,7,8-TCDD)	1746016	0.01	38pg/L	-	-
85	Diphenylhydrazine 1,2-	122667	270	-	-	-
33	Ethylbenzene	100414	32,000	-	430	-
86	Fluoranthene	206440	3,980	-	40	16
	Haloethers		360	122	-	-
	Halomethanes		11,000	-	12,000	6,400
89	Hexachlorobutadiene	87683	90	9.3	32	-
90	Hexachlorocyclopentadiene	77474	7	5.2	7	-
91	Hexachloroethane	67721	980	540	940	-
93	Isophorone	78591	117,000	-	12,900	-
94	Naphthalene	91203	2,300	620	2,350	-
95	Nitrobenzene	98953	27,000	-	6,680	-
	Nitrophenols		230	150	4,850	-
26 B	Nitrosamines	35576911	5,850	-	3,300,000	-
	Pentachlorinated ethanes		7,240	1,100	390	281
54	Phenol	108952	10,200	2,560	5,800	-
	Phthalate esters		940	3	2,944	3.4
	Polynuclear Aromatic Hydrocarbons		-	-	300	-
	Tetrachlorinated Ethanes		9,320	-	-	-

TABLE 33C

WATER QUALITY GUIDANCE VALUES SUMMARY (Continued)

EPA No.	Compound	CAS Number	Freshwater		Saltwater	
			Acute	Chronic	Acute	Chronic
37	Tetrachloroethane 1,1,2,2-	79345	-	2,400	9,020	-
	Tetrachloroethanes		9,320	-	-	-
38	Tetrachloroethylene	127184	5,280	840	10,200	450
	Tetrachlorophenol 2,3,5,6		-	-	-	440
12	Thallium	7440280	1,400	40	2,130	-
39	Toluene	108883	17,500	-	6,300	5,000
	Trichlorinated ethanes		18,000	-	-	-
41	Trichloroethane 1,1,1-	71556	-	-	31,200	-
42	Trichloroethane 1,1,2-	79005	-	9,400	-	-
43	Trichloroethylene	79016	45,000	21,900	2,000	-
55	Trichlorophenol 2,4,6-	88062	-	970	-	-

The following chemicals/compounds/classes are of concern due to the potential for toxic effects to aquatic organisms; however, no guidance values are designated. If these compounds are identified in the waste stream, then a review of the scientific literature may be appropriate for deriving guidance values.

Polybrominated diphenyl ethers (PBDE)
Polybrominated biphenyls (PBB)
Pharmaceuticals
Personal care products
Alkyl Phenols
Other chemicals with Toxic effects

Footnotes:

A Values in Table 33c are applicable to all basins.

B This number was assigned to the list of non-priority pollutants in National Recommended Water Quality Criteria: 2002 (EPA-822-R-02-047).

TABLE 40: Human Health Water Quality Criteria for Toxic Pollutants

Effective October 17, 2011

Human Health Criteria Summary

The concentration for each pollutant listed in Table 40 was derived to protect Oregonians from potential adverse health impacts associated with long-term exposure to toxic substances associated with consumption of fish, shellfish, and water. The "organism only" criteria are established to protect fish and shellfish consumption and apply to waters of the state designated for fishing. The "water + organism" criteria are established to protect the consumption of drinking water, fish, and shellfish, and apply where both fishing and domestic water supply (public and private) are designated uses. All criteria are expressed as micrograms per liter (µg/L), unless otherwise noted. Pollutants are listed in alphabetical order. Additional information includes the Chemical Abstract Service (CAS) number, whether the criterion is based on carcinogenic effects (can cause cancer in humans), and whether there is an aquatic life criterion for the pollutant (i.e. "y"= yes, "n" = no). All the human health criteria were calculated using a fish consumption rate of 175 grams per day unless otherwise noted. A fish consumption rate of 175 grams per day is approximately equal to 23 8-ounce fish meals per month. For pollutants categorized as carcinogens, values represent a cancer risk of one additional case of cancer in one million people (i.e. 10^{-6}), unless otherwise noted. All metals criteria are for total metal concentration, unless otherwise noted. Italicized pollutants represent non-priority pollutants. The human health criteria revisions established by OAR 340-041-0033 and shown in Table 40 do not become applicable for purposes of ORS chapter 468B or the federal Clean Water Act until approved by EPA pursuant to 40 CFR 131.21 (4/27/2000).

					Human Health Criteria for the Consumption of:	
No.	**Pollutant**	**CAS No.**	**Carcinogen**	**Aquatic Life Criterion**	**Water + Organism (µg/L)**	**Organism Only (µg/L)**
1	Acenaphthene	83329	n	n	95	99
2	Acrolein	107028	n	n	0.88	0.93
3	Acrylonitrile	107131	y	n	0.018	0.025
4	Aldrin	309002	y	y	0.0000050	0.0000050
5	Anthracene	120127	n	n	2900	4000
6	Antimony	7440360	n	n	5.1	64
7	Arsenic (inorganic)[A]	7440382	y	n	2.1	2.1 (freshwater) 1.0 (saltwater)
	[A] The arsenic criteria are expressed as total inorganic arsenic. The "organism only" criteria are based on a risk level of approximately of 1.1 x 10^{-5}, and the "water + organism" criterion is based on a risk level of 1 x 10^{-4}					
8	Asbestos[B]	1332214	y	n	7,000,000 fibers/L	--
	[B] The human health risks from asbestos are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.					
9	*Barium* [C]	7440393	n	n	1000	--

No.	Pollutant	CAS No.	Carcinogen	Aquatic Life Criterion	*Human Health Criteria for the Consumption of:* Water + Organism (µg/L)	*Human Health Criteria for the Consumption of:* Organism Only (µg/L)
	[C] The human health criterion for barium is the same as originally published in the 1976 EPA Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value was also published in the 1986 EPA Gold Book. Human health risks are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.					
10	Benzene	71432	y	n	0.44	1.4
11	Benzidine	92875	y	n	0.000018	0.000020
12	Benz(a)anthracene	56553	y	n	0.0013	0.0018
13	Benzo(a)pyrene	50328	y	n	0.0013	0.0018
14	Benzo(b)fluoranthene 3,4	205992	y	n	0.0013	0.0018
15	Benzo(k)fluoranthene	207089	y	n	0.0013	0.0018
16	BHC Alpha	319846	y	n	0.00045	0.00049
17	BHC Beta	319857	y	n	0.0016	0.0017
18	BHC Gamma (Lindane)	58899	n	y	0.17	0.18
19	Bromoform	75252	y	n	3.3	14
20	Butylbenzyl Phthalate	85687	n	n	190	190
21	Carbon Tetrachloride	56235	y	n	0.10	0.16
22	Chlordane	57749	y	y	0.000081	0.000081
23	Chlorobenzene	108907	n	n	74	160
24	Chlorodibromomethane	124481	y	n	0.31	1.3
25	Chloroethyl Ether bis 2	111444	y	n	0.020	0.05
26	Chloroform	67663	n	n	260	1100
27	Chloroisopropyl Ether bis 2	108601	n	n	1200	6500
28	*Chloromethyl ether, bis*	542881	y	n	0.000024	0.000029
29	Chloronaphthalene 2	91587	n	n	150	160
30	Chlorophenol 2	95578	n	n	14	15
31	*Chlorophenoxy Herbicide (2,4,5,-TP)*[D]	93721	n	n	10	--
	[D] The Chlorophenoxy Herbicide (2,4,5,-TP) criterion is the same as originally published in the 1976 EPA Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value was also published in the 1986 EPA Gold Book. Human health risks are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.					
32	*Chlorophenoxy Herbicide (2,4-D)*[E]	94757	n	n	100	--
	[E] The Chlorophenoxy Herbicide (2,4-D) criterion is the same as originally published in the 1976 EPA Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value was also published in the 1986 EPA Gold Book. Human health risks are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.					
33	Chrysene	218019	y	n	0.0013	0.0018
34	Copper[F]	7440508	n	y	1300	--
	[F] Human health risks from copper are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.					
35	Cyanide[G]	57125	n	y	130	130
	[G] The cyanide criterion is expressed as total cyanide (CN)/L.					
36	DDD 4,4'	72548	y	n	0.000031	0.000031
37	DDE 4,4'	72559	y	n	0.000022	0.000022

No.	Pollutant	CAS No.	Carcinogen	Aquatic Life Criterion	*Human Health Criteria for the Consumption of:*	
					Water + Organism (µg/L)	Organism Only (µg/L)
38	DDT 4,4'	50293	y	y	0.000022	0.000022
39	Dibenz(a,h)anthracene	53703	y	n	0.0013	0.0018
40	Dichlorobenzene(m) 1,3	541731	n	n	80	96
41	Dichlorobenzene(o) 1,2	95501	n	n	110	130
42	Dichlorobenzene(p) 1,4	106467	n	n	16	19
43	Dichlorobenzidine 3,3'	91941	y	n	0.0027	0.0028
44	Dichlorobromomethane	75274	y	n	0.42	1.7
45	Dichloroethane 1,2	107062	y	n	0.35	3.7
46	Dichloroethylene 1,1	75354	n	n	230	710
47	Dichloroethylene trans 1,2	156605	n	n	120	1000
48	Dichlorophenol 2,4	120832	n	n	23	29
49	Dichloropropane 1,2	78875	y	n	0.38	1.5
50	Dichloropropene 1,3	542756	y	n	0.30	2.1
51	Dieldrin	60571	y	y	0.0000053	0.0000054
52	Diethyl Phthalate	84662	n	n	3800	4400
53	Dimethyl Phthalate	131113	n	n	84000	110000
54	Dimethylphenol 2,4	105679	n	n	76	85
55	Di-n-butyl Phthalate	84742	n	n	400	450
56	Dinitrophenol 2,4	51285	n	n	62	530
57	*Dinitrophenols*	25550587	n	n	62	530
58	Dinitrotoluene 2,4	121142	y	n	0.084	0.34
59	Dioxin (2,3,7,8-TCDD)	1746016	y	n	0.0000000051	0.0000000051
60	Diphenylhydrazine 1,2	122667	y	n	0.014	0.020
61	Endosulfan Alpha	959988	n	y	8.5	8.9
62	Endosulfan Beta	33213659	n	y	8.5	8.9
63	Endosulfan Sulfate	1031078	n	n	8.5	8.9
64	Endrin	72208	n	y	0.024	0.024
65	Endrin Aldehyde	7421934	n	n	0.030	0.030
66	Ethylbenzene	100414	n	n	160	210
67	Ethylhexyl Phthalate bis 2	117817	y	n	0.20	0.22
68	Fluoranthene	206440	n	n	14	14
69	Fluorene	86737	n	n	390	530
70	Heptachlor	76448	y	y	0.0000079	0.0000079
71	Heptachlor Epoxide	1024573	y	y	0.0000039	0.0000039
72	Hexachlorobenzene	118741	y	n	0.000029	0.000029
73	Hexachlorobutadiene	87683	y	n	0.36	1.8
74	*Hexachlorocyclo-hexane-Technical*	608731	y	n	0.0014	0.0015
75	Hexachlorocyclopentadiene	77474	n	n	30	110
76	Hexachloroethane	67721	y	n	0.29	0.33
77	Indeno(1,2,3-cd)pyrene	193395	y	n	0.0013	0.0018
78	Isophorone	78591	y	n	27	96
79	*Manganese*[H]	7439965	n	n	--	100
	[H] The "fish consumption only" criterion for manganese applies only to salt water and is for total manganese. This EPA recommended criterion predates the 1980 human health methodology and does not utilize the fish ingestion BCF calculation					

No.	Pollutant	CAS No.	Carcinogen	Aquatic Life Criterion	***Human Health Criteria for the Consumption of:***	
					Water + Organism (µg/L)	**Organism Only (µg/L)**
	method or a fish consumption rate.					
80	*Methoxychlor*[I]	72435	n	y	100	--
	[I] The human health criterion for methoxychlor is the same as originally published in the 1976 EPA Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value was also published in the1986 EPA Gold Book. Human health risks are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.					
81	Methyl Bromide	74839	n	n	37	150
82	Methyl-4,6-dinitrophenol 2	534521	n	n	9.2	28
83	Methylene Chloride	75092	y	n	4.3	59
84	Methylmercury (mg/kg)[J]	22967926	n	n	--	0.040 mg/kg
	[J] This value is expressed as the fish tissue concentration of methylmercury. Contaminated fish and shellfish is the primary human route of exposure to methylmercury					
85	Nickel	7440020	n	n	140	170
86	*Nitrates*[K]	14797558	n	n	10000	--
	[K] The human health criterion for nitrates is the same as originally published in the 1976 EPA Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value was also published in the 1986 EPA Gold Book. Human health risks are primarily from drinking water, therefore no "organism only" criterion was developed. The "water + organism" criterion is based on the Maximum Contaminant Level (MCL) established under the Safe Drinking Water Act.					
87	Nitrobenzene	98953	n	n	14	69
88	*Nitrosamines*	35576911	y	n	0.00079	0.046
89	*Nitrosodibutylamine, N*	924163	y	n	0.0050	0.022
90	*Nitrosodiethylamine, N*	55185	y	n	0.00079	0.046
91	Nitrosodimethylamine, N	62759	y	n	0.00068	0.30
92	Nitrosodi-n-propylamine, N	621647	y	n	0.0046	0.051
93	Nitrosodiphenylamine, N	86306	y	n	0.55	0.60
94	*Nitrosopyrrolidine, N*	930552	y	n	0.016	3.4
95	*Pentachlorobenzene*	608935	n	n	0.15	0.15
96	Pentachlorophenol	87865	y	y	0.15	0.30
97	Phenol	108952	n	n	9400	86000
98	Polychlorinated Biphenyls (PCBs)[L]	NA	y	y	0.0000064	0.0000064
	[L] This criterion applies to total PCBs (e.g. determined as Aroclors or congeners).					
99	Pyrene	129000	n	n	290	400
100	Selenium	7782492	n	n	120	420
101	*Tetrachlorobenzene, 1,2,4,5-*	95943	n	n	0.11	0.11
102	Tetrachloroethane 1,1,2,2	79345	y	n	0.12	0.40
103	Tetrachloroethylene	127184	y	n	0.24	0.33
104	Thallium	7440280	n	n	0.043	0.047
105	Toluene	108883	n	n	720	1500
106	Toxaphene	8001352	y	y	0.000028	0.000028
107	Trichlorobenzene 1,2,4	120821	n	n	6.4	7.0
108	Trichloroethane 1,1,2	79005	y	y	0.44	1.6
109	Trichloroethylene	79016	y	n	1.4	3.0
110	Trichlorophenol 2,4,6	88062	y	n	0.23	0.24

No.	Pollutant	CAS No.	Carcinogen	Aquatic Life Criterion	*Human Health Criteria for the Consumption of:*	
					Water + Organism (µg/L)	**Organism Only (µg/L)**
111	*Trichlorophenol, 2, 4, 5-*	95954	n	n	330	360
112	Vinyl Chloride	75014	y	n	0.023	0.24
113	Zinc	7440666	n	n	2100	2600

Appendix F

Impacts on Reedsport WWTP Biosolids

3/14/14
MEH

Reedsport WWTP Sludge Production Analysis

Year	Reedsport Sludge Prod. (DT/Y)	Reedsport Landfill Leachate (Ave Q, mgd)	Sludge (DT/Y)(1)	Estimated Total Sludge Production (DT/Y)	% Increase
2011	40.61	0.0074	0.96	41.57	2.4
2012	55.42	0.0138	1.79	57.21	3.2
2013	32.27	0.0063	0.87	33.14	2.7

(1) Based on annual leachate flow generated and 1.3 DT/Y @ 0.01 mgd

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MEH
4/3/2014

If COD is used to calculate solids generation from leachate rather than BOD due to potential inhibition with BOD tests,

Ave. Annual Solids Generation @ 0.01 mgd of leachate =

Ave TSS load + (0.6)(Ave COD load)

= 6.1 ppd + (0.6)(4.7 ppd) = 8.9 ppd = 1.63 DT/Y

Revised % Increase Using COD data:

Year	Reedsport Sludge Prod. (DT/Y)	Reedsport Landfill Leachate (Ave Q, mgd)	Sludge Prod (DT/Y)(1)	Estimated Total Sludge Prod. (DT/Y)	% Increase
2011	40.61	0.0074	1.14	41.75	2.8
2012	55.42	0.0138	2.25	57.67	4.1
2013	32.27	0.0063	1.63	33.30	3.2

(1) Based on 1.63 DT/Y Sludge Production from Leachate

$\bar{x} = 3.4$

Table 4 - Group 1b Results For Leachate

Reedsport LF

Site	Date	Laboratory pH	Laboratory Conductivity (umho/cm)	Total Dissolved Solids (mg/L)	Hardness (mg/L as CaCO3)	Chemical Oxygen Demand (mg/L)	Total Suspended Solids (mg/L)	Total Alkalinity (mg/L as CaCO3)	Total Organic Carbon (mg/L)
SP-3	05/19/99	7.00	1011	615	300.0	71.7	85.20	311.0	34.50
SP-12a(SP-3 duplicate)	05/19/99	7.10	1013	619	292.0	62.8	90.80	319.0	28.10
SP-3(DEQ)	05/19/99			640	258.0	64.0	86.00	370.0	21.00
SP-3(DEQ duplicate)	05/19/99			630	282.0	60.0	81.00	370.0	21.00
SP-3	10/27/99	7.60	1234	699	272.0	81.8	107.00	388.0	27.90
SP-12a(SP-3 duplicate)	10/27/99	7.70	1241	717	362.0	81.8	115.00	391.0	35.10
SP-3	05/10/00	7.30	911	536	325.0	134.0	109.00	353.0	20.40
SP-12(SP-3 duplicate)	05/10/00	7.30	925	529	314.0	124.0	173.00	335.0	19.80
SP-3	10/10/00	7.40	1140	748	322.0	75.9	33.30	458.0	27.30
SP-3	04/10/01	7.10	828	430	215.0	45.0	41.10	325.0	1.30
SP-3	10/17/01	7.80	844	566	256.0	35.9	19.10	338.0	15.94
SP-3	04/29/02	6.90	748	416	198.0	16.4	50.50	324.0	16.50
SP-3	10/08/02			468	221.0	29.0	49.00	319.0	15.30
SP-3	04/22/03			476	212.0	16.0	62.00	332.0	15.50
SP-3	10/28/03			376	230.0	41.0	37	307.0	15.00
SP-3 (DEQ)	10/28/03			420	227.0	32.0	43	301.0	14.00
SP-3	10/28/04			412	219.0	38.0	~~ND@5~~	333.0	
SP-12(SP-3 duplicate)	10/28/04			428	215.0	45.0	~~ND@5~~	331.0	
SP-3	10/25/05			428	243.0	60.0	107	304.0	
SP-12(SP-3 duplicate)	10/25/05			428	238.0	53.0	93	298.0	
SP-3	10/11/06			371	225	38	60	277.0	
SP-12(SP-3 duplicate)	10/11/06			338	214	34	59	278.0	
SP-3	10/30/07			412	233	47	85	338.0	
SP-12(SP-3 duplicate)	10/30/07			388	235	51	77	344.0	
SP-3	10/07/08							253.0	
SP-12(SP-3 duplicate)	10/07/08							262.0	

Notes: ND = Non-detect

$n=24$
$\bar{x} = 55.7$
$\sigma = 29.1$

$n=22$
73.3
36.9

3/14/14

Reedsport Leachate:

① Ave. annual Q = 10,000 gpd

② Ave TSS conc. = 73 mg/L   Ave TSS load = (0.010 mgd)(73)(8.34) = 6.1 ppd

If 95% confidence limit for TSS is used (t-value = 2.07 for n = 22),

TSS conc. = 73.3 + (2.07)(36.9) = 149.7. and TSS loading = 12.5 ppd

③ Ave BOD conc. = 16 mg/L   Ave BOD loading = (0.01)(16)(8.34) = 1.3 ppd

If 95% confidence limit for BOD is used (t-value = 2.13 for n=15)

BOD conc = 15.7 + (2.13)(12.4) = 42 mg/L and BOD loading = 3.4 ppd

④. If COD is better indicator of oxygen demand due to toxicity with BOD test,

Ave COD conc. = 56 mg/L → COD loading = 4.7 ppd

Using 95% confidence limits (t-value = 2.06), COD conc = 116 mg/L → COD loading = 9.6 ppd

⑤ Solids Generated from Leachate = TSS loading + (0.6)(BOD loading) = 6.1 ppd + (0.6)(1.3 ppd) = 6.9 ppd = 1.3T/Y

Using 95% Conf. Limit for COD loading & 95% Conf. Limit for TSS

95% Solids Loading = 12.5 ppd + (0.6)(9.6) = 18.3 ppd ; Say 20 ppd = 3.7 tons/yr

Table 24 - Group 5 Results For Leachate and Surface Water

Reedsport LF

Site	Date	Total Coliform Bacteria (MPN)	E. Coli (CFU/.1L)	Total Kjeldahl Nitrogen (mg/L)	ortho-Phosphate (mg/L)	Fecal Coliform Bacteria (CFU/.1L)	Biological Oxygen Demand (mg/L)	Total Phosphorus (mg/L)	Total Halogenated Organics (mg/L)
Leachate									
SP-3	05/19/99	Absent	ND@1.0	16.30	ND@.01		10.00	0.347	0.090
SP-12a(SP-3 duplicate)	05/19/99	Absent	ND@1.0	18.30	ND@.01		8.20	0.304	0.080
SP-3(DEQ)	05/19/99	48 Est	ND@4		NA	ND@4	28.00		0.166
SP-3(DEQ duplicate)	05/19/99	100	ND@4		NA	ND@4	26.00		0.190
SP-3	10/27/99	>2419	Absent	20.80	ND@.01		8.10	0.360	0.170
SP-12a(SP-3 duplicate)	10/27/99	>2419	Absent	20.50	ND@.01		11.60	0.197	0.020
SP-3	05/10/00	>2419	Positive	13.20	ND@.04	32.3	18.60	0.037	0.020
SP-12(SP-3 duplicate)	05/10/00	>2419	Positive	12.70	ND@0.01	36.4	19.30	ND@0.01	0.070
SP-3	10/10/00	>2419	Positive	34.20	0.019	2.0	8.01	0.126	0.170
SP-3	04/10/01	87	Absent	18.60	ND@0.01	<2	2.40	0.400	0.070
SP-3	10/17/01	291	Absent	13.60	ND@0.01	0.0	9.11	0.030	0.170
SP-3	04/29/02	199	1	17.72	0.138	1.0	2.40	0.136	0.080
SP-3	10/09/02	>1600	ND@1	12.10	ND@0.01	2	14.00	0.04	0.080
SP-3	04/22/03	2	ND@1	16.80	ND@0.01	ND@2	~~ND@4.0~~	0.17	0.070
SP-3	10/28/03	1410	ND@1	11.50	ND@0.01	ND@2	19.00	0.03	0.083
SP-3 (DEQ)	10/28/03	*130*	ND@1	12.00	ND@0.005	ND@2	51.00	0.04	*0.094*

Notes: ND = Non-detect

UJ – The material was analyzed for, but was not detected. The associated value is an estimate and may be inaccurate or imprecise.

J – The associated value is an estimated quantity.

$n=15$
$\bar{x}=15.7$
$\sigma=12.4$

Project Reedsport LF Leachate Impacts
Subject Leachate Metals Loading in Biosolids
Computed By MEH
Checked By
Date 4/3/2014
Sheet 1 of 2
Job Number
Task Number

BHC CONSULTANTS

Potential Metals Loading in WWTP Biosolids

Average Annual Sludge Production from Leachate = 1.63 DT/Y @ 0.01 mgd

Metal	Biosolids Production (DT/Y)	Ave Q (mgd)	Ave Metal Conc. (mg/L)	Ave Metal Loading (1) (ppd)	(lbs/Y)	Metal Production (lbs/DT)	(mg/kg) (2)
Arsenic	1.63	0.01	0.001	8.34×10^{5}	0.0304	0.0187	9.33
Cadmium	↑	↑	0.00015	1.25×10^{-5}	0.0045	0.0028	1.4
Chromium			0.0017	1.42×10^{-4}	0.0518	0.0318	15.9
Copper			0.003	2.5×10^{-4}	0.091	0.056	28.0
Lead			—	—	—	—	—
Mercury			—	—	—	—	—
Molybdenum			—	—	—	—	—
Nickel			0.0033	2.75×10^{-4}	0.100	0.062	30.8
Selenium	↓	↓	—				—
Zinc	1.63	0.01	0.0444	0.0037	1.352	0.829	415

(1) Assumes 100% of leachate metals is removed in treatment plant

(2). $mg/kg = \frac{lbs}{ton} * \frac{ton}{2000\ lbs} * 10^6 \frac{mg}{kg} = 500 * \left(\frac{lbs}{DT}\right)\ mg/kg$

Potential Change to Reedsport WWTP Biosolids Metals Conc

	Reedsport Biosolids(1)		Reedsport L.F. Leachate		Blended Biosolids		
Metal	Ave Prod. (DT/Y)	Ave Conc (mg/kg)	Ave Solid Prod. (DT/Y)	Ave Conc. (mg/kg)	Ave. Prod. (DT/Y)	Ave Concentration (mg/kg)	(% Change)
Arsenic	42.8	10.1	1.6	9.33	44.4	10.07	-0.3
Cadmium		5.10		1.4		4.97	-2.6
Chromium		21.7		15.9		21.5	-1.0
Copper		569		28		550	-3.3
Nickel		16.7		30.8		17.2	+3.0
Zinc	42.8	514	1.6	415	44.4	510	-0.8

(1) Averages for 2011 – 2013

Potential Impact in Biosolids Metals Loadings

	Reedsport WWTP Biosolids			Leachate	Total	
Metal	Ave Prod (DT/Y)	Ave Conc. (mg/kg)	Metal Load(1) (lbs/Y)	Load. (lbs/Y)	Loading (lbs/Y)	(% Increase)
Arsenic	42.8	10.1	0.865	0.030	0.895	3.5
Cadmium		5.10	0.437	0.005	0.442	1.1
Chromium		21.7	1.88	0.05	1.91	2.7
Copper		569	48.7	0.1	48.8	0.2
Nickel		16.7	1.43	0.10	1.53	7.0
Zinc	42.8	514	44.0	1.4	45.4	3.2

(1). Average metals loading = $\left(\text{Ave Solids Prod } \frac{DT}{yr}\right)\left(\frac{2000\,lbs}{DT}\right)\left(\text{Ave. Conc } \frac{mg}{kg}\right)\left(\frac{kg}{10^6\,mg}\right) = \frac{lbs}{yr}$

$= (0.002)(\text{Ave. Solids Prod})(\text{Ave Conc})$

⑤

↓

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Source File No.	2011 Reedsport 74319					
Metals	Biosolid concentration mg/kg	Ceiling Limits 503.13 Table 1 Conc. mg/kg	Ceiling Limits 503.13 Table 1 metal lb./ton biosolid	Yearly lb. Metal per ton biosolids	Yearly Loading lb./ac-yr.	Yearly Loading kg/yr.
Arsenic	10.5	75	0.150	0.85283	0.03411	0.038
Cadmium	4.42	85	0.170	0.35900	0.01436	0.016
Chromium	25.7	1200	2.400	2.08739	0.08350	0.094
Copper	570	4300	8.600	46.29631	1.85185	2.074
Lead	80.6	840	1.680	6.54646	0.26186	0.293
Mercury	0.734	57	0.114	0.05962	0.00238	0.003
Molybdenum	6.78	75	0.150	0.55068	0.02203	0.025
Nickel	21.8	420	0.840	1.77063	0.07083	0.079
Selenium	5.16	100	0.200	0.41910	0.01676	0.019
Zinc	597	7500	15.000	48.48929	1.93957	2.172

There is no Ceiling limit for Chromium, table value is a past limit that is no longer valid, used here for loading calculations only.

Metals	Analysis Biosolid conc. mg/kg	Cumulative Pollutant Limits CFR 503.13 Table 2 mg/ha	40 CFR 503.13 Table 2 metal lb./ac biosolid	Yearly lb. Metal per ton biosolids	Biosolid Loading lb./ac-yr.	Biosolid Loading kg/ha-yr.
Arsenic	10.5	41	45.920	1.470	0.0588	0.066
Cadmium	4.42	39	43.680	0.619	0.0248	0.028
Chromium	25.7	1200	1344.000	3.598	0.1439	0.161
Copper	570	1500	1680.000	79.800	3.1920	3.575
Lead	80.6	300	336.000	11.284	0.4514	0.506
Mercury	0.734	17	19.040	0.103	0.0041	0.005
Molybdenum	6.78	75	84.000	0.949	0.0380	0.043
Nickel	21.8	420	470.400	3.052	0.1221	0.137
Selenium	5.16	100	112.000	0.722	0.0289	0.032

Reedsport Landfill
Metals and Ammonia

3-Apr-13

Parameter	Period of Record	No. of Samples		(excluded "ND" values) Mean Concentration	Max Concentration
		Total	>ND		
Arsenic	5/19/99 through 10/23/13	22	1	0.0010	0.0010
Cadmium	5/19/99 through 10/23/13	22	2	0.00015	0.0002
Chromium III	5/19/99 through 10/23/13	22	3	0.00170	0.0022
Copper	5/19/99 through 10/23/13	22	5	0.0030	0.0101
Lead	5/19/99 through 10/23/13	22	0	-	-
Mercury			NOT FOUND IN DATA		
Nickel	5/19/99 through 10/23/13	17	5	0.0033	0.0049
Selenium	5/19/99 through 10/23/13	22	0	-	-
Silver	5/19/99 through 10/23/13	17	0	-	-
Zinc	5/19/99 through 10/23/13	23	15	0.0444	0.1840
Ammonia (as N)	5/19/99 through 10/23/13	35	35	12.3863	18.7000
Nitrate-N (NO3)	5/19/99 through 10/23/13	34	34	3.90	20.30

S:\Projects\Pickets Engineering\Reedsport Landfill\Leachate Acceptance Plan\Reedsport LF leachate chemistry and flow data 2013-12-31Summary March 2014

Reedsport WWTP Biosolids Metals Analysis (mg/kg dry weight)

Erika - Add Nitrogen

Metal	2013	2012	2011	Average
Arsenic	10.7	9.04	10.5	10.1
Cadmium	6.51	4.38	4.42	5.10
Chromium	22.4	17	25.7	21.7
Copper	635	501	570	569
Lead	59.4	64.8	80.6	68.3
Mercury	0.769	1.1	0.734	0.868
Molybdenum	5.25	4.12	6.78	5.35
Nickel	15	13.3	21.8	16.7
Selenium	7.12	4.31	5.16	5.52
Zinc	544	400	597	514
Biosolids Production DT/Y	32.27	55.42	40.61	42.8

Existing Arsenic in Reedsport Biosolids

fact = 0.002

$$\left(10.1\ \frac{mg}{kg}\right)\left(42.8\ \frac{tons}{yr}\right)\left(\frac{2000\ lb}{ton}\right)\left(\frac{kg}{2.2\ lb}\right) = 392{,}982\ \frac{mg}{yr} \times \frac{kg}{1{,}000{,}000\ mg} \cdot \frac{2.2\ lbs}{kg}$$

$$= 0.865\ lbs/yr$$

Reedsport Leachate Contribution

① Assuming all metals are removed during treatment.

②. Sludge production from leachate:

$Q = 0.01\ mgd$

$TSS = 66.3\ mg/L$

$BOD = COD = 48\ mg/L$

Sludge production $= (8.34)(0.01\ mgd)\left[66.3 + (0.6)(48)\right] = 8\ ppd \times 365\ \frac{d}{yr} = 2895\ \frac{lbs}{yr} = 1.5\ T/y$

③. Metals loading from leachate:

Max. As conc $= 0.001\ mg/L$

As loading $= (0.01\ mgd)(0.001\ mg/L)(8.34) = 0.0000834\ ppd \times 365 = 0.030\ lbs/yr$

④. Total existing biosolids + leachate $= 0.865 + 0.030 = 0.895\ lbs/yr$ (3.5% increase)

⑤. ∴ Arsenic conc. in biosolids increases 3.5% (max) $= (10.1)(1.035) = 10.5\ mg/kg$

Project: Reedsport LF Leachate Impacts at WWTP
Date: 5/7/14
Subject: Impact of Leachate Metals Loading on Biosolid Disposal Site Life
Sheet: 1 of 1
Computed By: MEH
Job Number:
Checked By:
Task Number:

BHC CONSULTANTS

Impact on Biosolids Disposal Site Life

①. Review site life calcs for 2011, 2012 & 2013 & select lowest calculated life for each leachate metal evaluated.

②. Use calculated increases in site metals loadings to determine the reduced site life.

Metal	Site Life(1) (years)	Calculated for(1) Year	Loading Increase from Leachate	Reduced Site Life (years)
Arsenic	913	2012	3.5 %	882
Cadmium	1,793	2012	1.1 %	1,773
Chromium	12,832	2011	2.7%	12,494
Copper	602	2012	0.2%	600
Nickel	5294	2011	7.0%	4,747
Zinc	1288	2011	3.2%	1,248

---

(1). See Calculations by Reedsport WWTP staff for annual biosolids reports

(2). See BHC Calcs - Reedsport WWTP Biosolids Impacts dated 4/3/14, sht 2/2

Summary: Copper is the metal for all three years having the lowest calculated site life. Copper loadings from leachate would increase 0.2%, which would reduce the 602 year life (min. calculated for 2011-2013) to 600 years.

The Second most critical metal was Arsenic, which would increase 3.5% due to leachate treatment. Site life would be reduced from 913 yrs to 882 yrs (for 2012 calculations)

Zinc	597	2800	3136.000	83.580	3.3432	3.744

There are no limits for Chromium or Molybdenum under Table 2, Mo concentration comes from Table 1. Ceiling Limit.

2011
Source Reedsport
File No. 74319

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Metals	Biosolid Analysis mg/kg	Pollutant Conc. Limits Table 3 mg/ha	Table 3 lb. Metal per /ac biosolid	Loading lb./ac-yr.	Loading kg/ha-yr.	Site Life in years
✓ *Arsenic*	10.5	41	45.920	0.034	0.038	1073.111987 ← Next Critical
✓ *Cadmium*	4.42	39	43.680	0.014	0.016	2424.894374
✓ *Chromium*	25.7	1200	1344.000	0.083	0.094	12832.12587 ←
✓ *Copper*	570	1500	1680.000	1.852	2.074	$\boxed{723.2141116}$ Critical Parameter
Lead	80.6	300	336.000	0.262	0.293	1022.908297
Mercury	0.734	17	19.040	0.002	0.003	6365.072427
Molybdenum	6.78	75	84.000	0.022	0.025	3040.059319
✓ *Nickel*	21.8	420	470.400	0.071	0.079	5294.723496 ←
Selenium	5.16	100	112.000	0.017	0.019	5325.995396
✓ *Zinc*	597	2800	3136.000	1.940	2.172	1288.944413 ←

There are no limits for Chromium or Molybdenum under Table 3, Mo concentration comes from Table 1. Ceiling Limit.

40 CFR 503.13 Tables 1-4.

T1, Ceiling loading, bulk biosolids sold or given away, bag or container, can not exceed pollutant concentration Table 1.

T2, Cumulative Loading, has to meet Table 1 and 2 limits, no lawn/garden Class A no ability to tract.

T3, Pollutant Concentration , bulk biosolid land applied on agriculture land, forest, public contact site or reclamation site has to meet Tables 1 &3.

T4, Annual Pollutant loading Rate, for land application of Class A biosolid given away in bag or container, has to meet Table 1 & 4.

	2013
Source	Reedsport
File No.	74319

Metals	Biosolid Analysis mg/kg	Pollutant Conc. Limits Table 3 mg/ha	Table 3 lb. Metal per /ac biosolid	Loading lb./ac-yr.	Loading kg/ha-yr.	Site Life in years
Arsenic	10.7	41	45.920	0.028	0.031	1325.182394 — Next Critical
Cadmium	6.51	39	43.680	0.017	0.019	2071.854231
Chromium	22.4	1200	1344.000	0.058	0.065	18527.15803
Copper	635	1500	1680.000	1.639	1.836	816.9455508 — Critical Parameter
Lead	59.4	300	336.000	0.153	0.172	1746.668097
Mercury	0.769	17	19.040	0.002	0.002	7645.363868
Molybdenum	5.25	75	84.000	0.014	0.015	4940.575474
Nickel	15	420	470.400	0.039	0.043	9683.527929
Selenium	7.12	100	112.000	0.018	0.021	4857.307348
Zinc	544	2800	3136.000	1.404	1.573	1780.060281

There are no limits for Chromium or Molybdenum under Table 3, Mo concentration comes from Table 1. Ceiling Limit.

40 CFR 503.13 Tables 1-4.

T1, Ceiling loading, bulk biosolids sold or given away, bag or container, can not exceed pollutant concentration Table 1.

T2, Cumulative Loading, has to meet Table 1 and 2 limits, no lawn/garden Class A no ability to tract.

T3, Pollutant Concentration , bulk biosolid land applied on agriculture land, forest, public contact site or reclamation site has to meet Tables 1 &3.

T4, Annual Pollutant loading Rate, for land application of Class A biosolid given away in bag or container, has to meet Table 1 & 4.

SITE LAND APPLICATION

	2012
Source	Reedsport
File No.	74319

Metals	Biosolid Analysis mg/kg	Pollutant Conc. Limits Table 3 mg/ha	Table 3 lb. Metal per /ac biosolid	Loading lb./ac-yr.	Loading kg/ha-yr.	Site Life in years	
Arsenic	9.04	41	45.920	0.040	0.045	913.308076 ←	Next Critical
Cadmium	4.38	39	43.680	0.019	0.022	1793.049868 ←	
Chromium	17	1200	1344.000	0.075	0.084	14214.58538	
Copper	501	1500	1680.000	2.221	2.488	602.9140505 ←	Critical Parameter
Lead	64.8	300	336.000	0.287	0.322	932.2837632	
Mercury	1.1	17	19.040	0.005	0.005	3112.132708	
Molybdenum	4.12	75	84.000	0.018	0.020	3665.775962	
Nickel	13.3	420	470.400	0.059	0.066	6359.156617	
Selenium	4.31	100	112.000	0.019	0.021	4672.234173	
Zinc	400	2800	3136.000	1.774	1.986	1409.61305	

There are no limits for Chromium or Molybdenum under Table 3, Mo concentration comes from Table 1. Ceiling Limit.

40 CFR 503.13 Tables 1-4.

T1, Ceiling loading, bulk biosolids sold or given away, bag or container, can not exceed pollutant concentration Table 1.

T2, Cumulative Loading, has to meet Table 1 and 2 limits, no lawn/garden Class A no ability to tract.

T3, Pollutant Concentration , bulk biosolid land applied on agriculture land, forest, public contact site or reclamation site has to meet Tables 1 &3.

T4, Annual Pollutant loading Rate, for land application of Class A biosolid given away in bag or container, has to meet Table 1 & 4.

SITE LAND APPLICATION
Cake

Site Name	Location	Acres	Approved lb. N/ac required for Crop	Max. lb. N/site	Max. yd3/ site	Max. yd3 /ac
D	County	0	100	0	#DIV/0!	#DIV/0!

lb. N/ Truck 1	Truck 3 loads/site	Truck 3 loads/ac	Truck 4 lb. N/	Truck 4 loads/site	Truck 4 loads/ac
#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Project Reedsport LF Leachate Impacts @ WWTP
Date 4/9/2014
Subject Impact of Leachate N on Disposal Site Load.
Sheet 1 of 2
Computed By MEH
Job Number
Checked By
Task Number

BHC CONSULTANTS

Nitrogen Loading from Reedsport LF leachate

- Reedsport LF Leachate Quality:

Parameter	$\bar{x}$	Max
TKN (as N)	17.0	34.2
NH_3 (as N)	12.4	18.7
NO_3 (as N?)	3.9	20.3

- Average Annual Leachate Q = 10,000 gpd = 0.01 mgd

- Average Annual Loading to WWTP

TKN = (17.0)(0.01)(8.34) = 1.42 ppd = 517 lbs/y
NH_3 = (12.4)(0.01)(8.34) = 1.03 ppd = 377 lbs/y
NO_3 = (3.9)(0.01)(8.34) = 0.33 ppd = 119 lbs/y

- Assuming all leachate nitrogen is removed at WWTP and is ADDED to biosolids, calculate amount available at biosolids disposal site using the same availability factors used by WWTP in Annual Biosolid reports:

Org-N Available = 30% Org-N Load = 30% (TKN - NH_3)
= (0.3)(517 - 337) = 54 lbs/y
NH_3 Available = 50% NH_3 Load = (0.5)(377) = 189 lbs/y
NO_3 Available = 100% NO_3 Load = 119 lbs/y
Total N Available from Leachate = 362 lbs/y

- No N-Removal Processes at Designed at Reedsport WWTP, but maximum N-Removal for an activated sludge facility might be 5-10% of total N loading (particulate organic N).

Using 10% as a conservative upper limit, Total-N available = 36 lbs/y

Project Reedsport LF Leachate Impacts
Subject Leachate N on Disposal Site Loading
Computed By
Checked By

Date 4/9/2014
Sheet ______ of ______
Job Number
Task Number

BHC CONSULTANTS

- Historical Available N Loading Impacts:

Year	Calculated N Loading (lbs/Y)	L.F. Leachate Increase (lbs/Y)	Potential Total (lbs/Y)	% Increase
2011	1136	36	1172	3.2
2012	1943	36	1979	1.9
2013	1037	36	1073	3.5
				$\bar{x} = 2.9\%$

- Impacts on Disposal Area Requirements
  → Calculated using 100 lb N/A/Yr - same as in Annual Biosolids Report calcs.

Year	Calculated Area Req'd (A)	Potential Total Area Req'd (A)		% Increase
2011	11.4	11.7	, Δ = 0.36	3.2
2012	19.4	19.8	"	1.9
2013	10.4	10.7	"	3.5
				$\bar{X} = 2.9\%$

- Conclusions:
  → Total-N availability would increase 3%.
  → ∴ 3% more land area req'd. Currently calculated area req'd = 19.4 A in 2012 that would increase to 19.8 A. However, application site is 25 A, ∴ OK.

Biosolid Analysis Year 2013

Source	Reedsport	**Lab analysis #**	1136051	**Date**	06/04/13
File No.	74319				
Phone No.	541-271-4313				
Contact	Charles Hurlocker				

Nutrient and metals analysis are an average of representative sampling events taken over the year biosolids are land applied.
Nutrient and metal concentrations are determined from the current year's representative solids analysis.
Site loading rates for nutrients and metal must be adjusted based on current analysis to meet authorized site loading rates.

COLOR KEY

▨	**requires entered value**
▨	**calculated value**
▨	**replace 1 with coefficient from selection**

SOLIDS ANALYSIS

Cake Biosolid	1	0.85	**Replace the 1 with the appropriate decimal**
Liquid Biosolid	0.5	0.5	**Dewater (10-50%) and Liquid**
% Total Solids	2.49		
% Volatile Solids	64.5		

PATHOGEN REDUCTION

Class A Biosolid			**Put X next to Class A if true**
Class B Biosolid		X	**Put X next to Class B if true**
	503.32 Class B Alternative #1		**Cite 503.32 Alternative**

Fecal Coliform	1,673	**<2,000,000 /dry gr. Total Solids**
org.-100ml/1 dry gr.	Geo Mean	

VECTOR ATTRACTION REDUCTION (DIGESTION METHOD)

Volatile Solids Reduction Method	503.33 (b)(1)	**Cite 503.33 Option**

	2013
Source	Reedsport
File No.	74319

VOLATILE SOLIDS REDUCTION (DIGESTION METHOD)

Volatile Solids Reduction Method 503.33 (b) (#1) Cite 503.33 option

Anaerobic D.	1	0.2	Replace the 1 with the appropriate decimal
Aerobic D.	0.3	0.3	Replace the 1 with the appropriate decimal
Drying Bed	1	0.15	Replace the 1 with the appropriate decimal
Gal/yr.	310,800		

* **Note If cake biosolids are generated then is total cubic yards instead of total gallons**

Note biosolid cake conversion is 0.65 ton/ yd^3

Dry TS US ton/yr.	32.2712964 ✓	
lb. TS/yr.	64543 ✓	
Total US tons	32.27	✓

Pounds Equation

lb. TS/yr. = %TS x 8.34 x gal/yr.

0	**Cubic yards hauled**
0	**Total US tons**
0	
0	

Conversion

US-> Metric tons multiply by 1.11

Metric -> US tons multiply by 0.9

Total Metric tons 29.04416676

$32.27 \frac{tons}{yr} \times \frac{2000 lbs}{ton} * \frac{kg}{2.2 lbs} = 29,336 kg/yr$

NUTRIENT ANALYSIS

	%	mg/kg dry-wt.
Total Organic	2.76	27600
TKN	2.99	29900
NH4	0.23	2300
NO3	0.663	6630
Phosphorus	2.43	24300
Potassium	0.0186	186

Organic N = (%TKN-%NH4)

Inorganic N = (%NH4 + %NO3)

	mg/kg dry-wt.	lb. / yr.	lb./ac-yr.	kg/ha
Phosphorus	24300	1568.3850	62.73540	70.26365
Potassium	186	12.0049	0.48020	0.53782

pH	4.48

Calc's based on 25 A site

30% of Total Organic N is available : (1,781)(0.3) = 534 lbs/yr
30% of TKN is available : (1930)(0.3) = 579
50% of NH_4 is available : (143 lbs/y)(0.5) = 74 lbs/yr ✓

pg. 3/7

25 A site

Total Org = (2.76%)(64,543 lbs/yr) = 1,781 lbs/yr
= 71 lbs/A/Y

TKN = (2.99%)(64,543) = 1930 lbs/y

NH_3 = (0.23%)(64,543) = 143 lbs/yr

NO_3 = (0.663%)(64,543) = 427.9 lbs/yr

Source	2013 Reedsport					
File No.	74319					
NITROGEN	% ? ~~mg/kg-dry-wt.~~	lb. / yr.	lb./ac-yr.	kg/ha		
Total Organic	2.76	534.4127	21.3765	23.9417		
TKN	2.99	578.9471	77.1929	86.4561		
NH4	0.23	74.2240	2.9690	3.3252		
NO3	0.663	427.9174 ✓	17.11670	19.17070		
lb. mineralized organic N/dry ton			16.5600			
lb. inorganic N/dry ton			0.6224			
Total lb. available N/dry ton			17.182			
NUTRIENT LOADING						
Crop nitrogen loading rate N lb./acre			100.000	112	kg/ha	
Total acres land applied for year.			25			
Number dry tons land applied per acre			1.29 ✓	2.89	metric ton/ha	
lb. Available Nitrogen per dry ton			32.12			
Total lb. Org-N produced per year			534.41			
Total lb. NH4 produced per year			74.22			
Total lb. NO3 produced per year			427.92		#DIV/0!	lb. N / yd^3
Total lb. Available N per year			1036.55		0.00	lb. N / gallon
Min. number of acres required per year (Nitrogen)			10.37			

1036

TKN + NO_3 = 1930 + 428
= 2358 lbs/Y

lbs Inorganic N = (lbs NH_3 + lbs NO_3) / Y = (74 + 428) = $\frac{502 \text{ lbs/Y}}{32.27 \text{ T/Y}}$ ← =

Calculate Impacts based on : 30% of Org N is available = 30% (TKN − NH_3) is available
50% of NH_3 is available
100% of NO_3 is available

Equals Total Available N/yr
& use loading rate of 100 lbs/A/Y.

	2013
Source	Reedsport
File No.	74319

LAND APPLICATION EQUIPMENT

Liquid

Truck #	Tank Capacity
Truck 1	5000
Truck 2	6000
Truck #3	*4360*

Cake

Truck #	Truck yd3
Truck 3	0
Truck 4	0

SITE LAND APPLICATION

Liquid

Site Name	Location	Acres	Approved lb. N/ac required for Crop	Max. lb. N/site	Max. gal./ site	Max. gallons /ac
Weatherly #1	Douglas County	25	100	2500	749599	29984

lb. N/ Truck 1	Truck 1 loads/site	Truck 1 loads/ac	Truck 2 lb. N/	Truck 2 loads/site	Truck 2 loads/ac
16.7	149.9	6.0	20.0107	124.9	5.0

Site Name	Location	Acres	Approved lb. N/ac required for Crop	Max. lb. N/site	Max. gal./ site	Max. gallons /ac
Weatherly#2	Douglas County	86	100	8600	2578621	29984

lb. N/ Truck 1	Truck 1 loads/site	Truck 1 loads/ac	Truck 2 lb. N/	Truck 2 loads/site	Truck 2 loads/ac
16.7	515.7	6.0	20.0107	429.8	5.0

Site Name	Location	Acres	Approved lb. N/ac required for Crop	Max. lb. N/site	Max. gal./ site	Max. gallons /ac
Weatherly#3	Douglas County	39	100	3900	1169375	29984

lb. N/ Truck 1	Truck 1 loads/site	Truck 1 loads/ac	Truck 2 lb. N/	Truck 2 loads/site	Truck 2 loads/ac
16.7	233.9	6.0	20.0107	194.9	5.0

	2013
Source	Reedsport
File No.	74319

Site Name	Average Truck Cap. Gal.	Trucks loads	Total lb. N applied	Total gal. applied	Total gallons hauled yr.	Total lb. Nitrogen in biosolids/yr
Weatherly #1	5405	57.5	958.8458385	310787.5		
Weatherly #2	5000	0	0	0		
Weatherly #3	5000	0	0	0		
TOTALS			958.8458385	310787.5	310800	1036.55

BIOSOLID METALS ANALYSIS AND CALCULATIONS

Sample calculation:

[([(10.7 mg As/1000000 mg TS X 64542 lb. Total Solids) = 0.69 lb. As/yr.
(((10.7 mg As/ 1000000 mg TS) x 64542 lb. TS) / 25ac = 0.02762 lb. As/ac-yr.
(EPA cumulative loading 41 total lb. As/ac / 0.02762 lb. As/ac/yr.) =1325.18 yr. site life for As
(0.02762 lb. As/ac-yr.) x 1.12 conversion factor = 0.0309 kg/ha-yr.
(3.1 tons biosolid is equivalent to a loading rate of 100 lb. total available N/ac) .

Metal Analysis	mg/kg dry-wt.
Arsenic	10.7
Cadmium	6.51
Chromium	22.4
Copper	635
Lead	59.4
Mercury	0.769
Molybdenum	5.25
Nickel	15
Selenium	7.12
Zinc	544

	2013
Source	Reedsport
File No.	74319

Metals	Biosolid concentration mg/kg	Ceiling Limits 503.13 Table 1 Conc. mg/kg	Ceiling Limits 503.13 Table 1 metal lb./ton biosolid	Yearly lb. Metal per ton biosolids	Yearly Loading lb./ac-yr.	Yearly Loading kg/yr.
Arsenic	10.7	75	0.150	0.69061	0.02762	0.031
Cadmium	6.51	85	0.170	0.42017	0.01681	0.019
Chromium	22.4	1200	2.400	1.44575	0.05783	0.065
Copper	635	4300	8.600	40.98455	1.63938	1.836
Lead	59.4	840	1.680	3.83383	0.15335	0.172
Mercury	0.769	57	0.114	0.04963	0.00199	0.002
Molybdenum	5.25	75	0.150	0.33885	0.01355	0.015
Nickel	15	420	0.840	0.96814	0.03873	0.043
Selenium	7.12	100	0.200	0.45954	0.01838	0.021
Zinc	544	7500	15.000	35.11117	1.40445	1.573

There is no Ceiling limit for Chromium, table value is a past limit that is no longer valid, used here for loading calculations only.

Metals	Analysis Biosolid conc. mg/kg	Cumulative Pollutant Limits CFR 503.13 Table 2 mg/ha	40 CFR 503.13 Table 2 metal lb./ac biosolid	Yearly lb. Metal per ton biosolids	Biosolid Loading lb./ac-yr.	Biosolid Loading kg/ha-yr.
Arsenic	10.7	41	45.920	1.498	0.0599	0.067
Cadmium	6.51	39	43.680	0.911	0.0365	0.041
Chromium	22.4	1200	1344.000	3.136	0.1254	0.140
Copper	635	1500	1680.000	88.900	3.5560	3.983
Lead	59.4	300	336.000	8.316	0.3326	0.373
Mercury	0.769	17	19.040	0.108	0.0043	0.005
Molybdenum	5.25	75	84.000	0.735	0.0294	0.033
Nickel	15	420	470.400	2.100	0.0840	0.094
Selenium	7.12	100	112.000	0.997	0.0399	0.045
Zinc	544	2800	3136.000	76.160	3.0464	3.412

There are no limits for Chromium or Molybdenum under Table 2, Mo concentration comes from Table 1. Ceiling Limit.

	2013
Source	Reedsport
File No.	74319

Metals	**Biosolid Analysis mg/kg**	**Pollutant Conc. Limits Table 3 mg/ha**	**Table 3 lb. Metal per /ac biosolid**	**Loading lb./ac-yr.**	**Loading kg/ha-yr.**	**Site Life in years**
Arsenic	10.7	41	45.920	0.028	0.031	1325.182394
Cadmium	6.51	39	43.680	0.017	0.019	2071.854231
Chromium	22.4	1200	1344.000	0.058	0.065	18527.15803
Copper	635	1500	1680.000	1.639	1.836	816.9455508
Lead	59.4	300	336.000	0.153	0.172	1746.668097
Mercury	0.769	17	19.040	0.002	0.002	7645.363868
Molybdenum	5.25	75	84.000	0.014	0.015	4940.575474
Nickel	15	420	470.400	0.039	0.043	9683.527929
Selenium	7.12	100	112.000	0.018	0.021	4857.307348
Zinc	544	2800	3136.000	1.404	1.573	1780.060281

There are no limits for Chromium or Molybdenum under Table 3, Mo concentration comes from Table 1. Ceiling Limit.

40 CFR 503.13 Tables 1-4.

T1, Ceiling loading, bulk biosolids sold or given away, bag or container, can not exceed pollutant concentration Table 1.

T2, Cumulative Loading, has to meet Table 1 and 2 limits, no lawn/garden Class A no ability to tract.

T3, Pollutant Concentration , bulk biosolid land applied on agriculture land, forest, public contact site or reclamation site has to meet Tables 1 &3.

T4, Annual Pollutant loading Rate, for land application of Class A biosolid given away in bag or container, has to meet Table 1 & 4.

SITE LAND APPLICATION

Cake Site Name	Location	Acres	Approved lb. N/ac required for Crop	Max. lb. N/site	Max. yd3/ site	Max. yd3 /ac
D	County	0	100	0	#DIV/0!	#DIV/0!

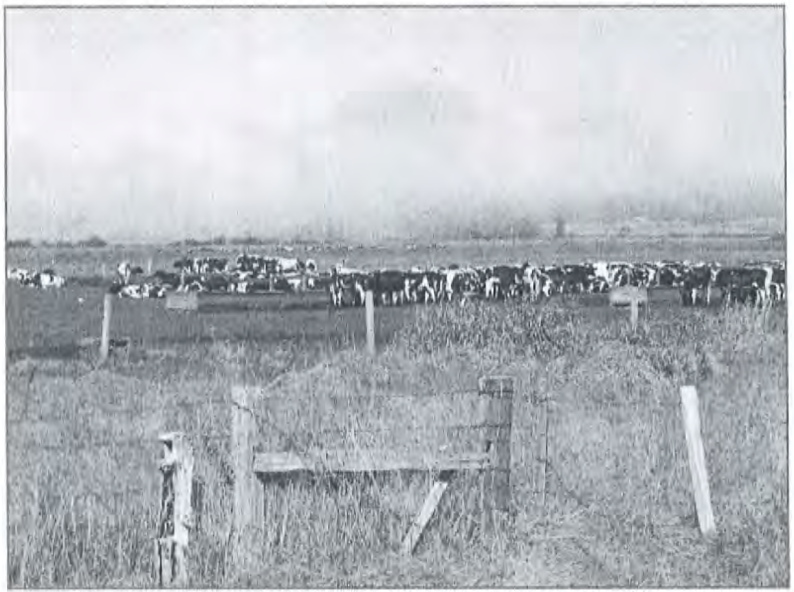
	lb. N/ Truck 1	Truck 3 loads/site	Truck 3 loads/ac	Truck 4 lb. N/	Truck 4 loads/site	Truck 4 loads/ac
	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Cake Site Name	Location	Acres	Approved lb. N/ac required for Crop	Max. lb. N/site	Max. yd3/ site	Max. yd3 /ac
E	County	0	200	0	#DIV/0!	#DIV/0!

	lb. N/ Truck 1	Truck 3 loads/site	Truck 3 loads/ac	Truck 4 lb. N/	Truck 4 loads/site	Truck 4 loads/ac
	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!

Revised 6/4/2013

Total Nitrogen


Storm runoff from a cattle operation can increase Total Nitrogen levels in a water body.

Total Nitrogen is an essential nutrient for plants and animals. However, an excess amount of nitrogen in a waterway may lead to low levels of dissolved oxygen and negatively alter various plant life and organisms. Sources of nitrogen include: wastewater treatment plants, runoff from fertilized lawns and croplands, failing septic systems, runoff from animal manure and storage areas, and industrial discharges that contain corrosion inhibitors.

Understanding Total Nitrogen: There are three forms of nitrogen that are commonly measured in water bodies: ammonia, nitrates and nitrites. Total nitrogen is the sum of total kjeldahl nitrogen (ammonia, organic and reduced nitrogen) and nitrate-nitrite. It can be derived by monitoring for organic nitrogen compounds, free-ammonia, and nitrate-nitrite individually and adding the components together. An acceptable range of total nitrogen is 2 mg/L to 6 mg/L, though it is recommended to check tribal, state, or federal standards for an adequate comparison of your data.


Trash areas like this may leach chemicals that can increase Total Nitrogen during a storm event into a water body.

Monitoring Equipment: Depending upon monitoring objectives set forth in an environmental program, the following equipment options are commonly used to collect total nitrogen data from the field.

Readily available and economically priced:

- Total Nitrogen Kits

For each component of total nitrogen, the following can be used and are of greater precision and higher cost:

- Meters
- Multiparameter Probes
- Contract Laboratories (if necessary)

For additional information:
www.epa.gov/owow/monitoring/volunteer/stream

For more information, please contact your CWA Project Officer or Kristin Gullatt, Manager of the Water Division, Tribal Office at (415) 972-3432.

APPENDIX B

SOUR Test Results

revised 1.12.15

Appendix B

Specific Oxygen Uptake Rate (SOUR)

Specific oxygen uptake Rate (SOUR) procedure performed on Douglas County Leachate for a Toxicity Evaluation (provided by: Charles Hurlocker at the City of Reedsport Wastewater Treatment Plant)

Procedure

- Grab samples were collected 3/21/14 of leachate at the Douglas County Landfill and Transfer Facility(see daily lab bench sheet). The wet well discharge grab sample was chosen as the most represenitive of proposed flow to the WWTP. Therefore, chosen for SOUR testing purposes.
- A grab sample of mixed liquor was collected at the aeration basin and warmed to 20 deg. C under aeration. A mixed liquor volatile suspended solids procedure(see work sheet) was run from this sample to provide a mixed liquor volatile suspended solids value needed to calculate the SOUR value.
- Four SOUR tests were performed; two control tests and two tests for the purpose of toxicity evaluations respectively. On the tests that included Douglas County leachate, a leachate strength of 5% (based on flow comparisons) was determined by BHC Consultants. Dilutions, record of oxygen depletions and SOUR calculations are provided on the OUR/SOUR Worksheets.

Conclusion

- All SOUR tests performed scored values considered neither toxic nor show low activity by the activated sludge process standards employed at the Reedsport Wastewater treatment facility.

- SOUR tests containing Douglas County leachate values compare favorably with the values of the control tests, indicating no short term toxicity.

CITY OF REEDSPORT
WASTEWATER TREATMENT PLANT

OUR/SOUR Work Sheet

NAME___Hurlocker **DATE 3.21.14**

SAMPLE ID Doug. Co. leachate B

TIME: 1449 **Initial D.O., mg/L 8.8**

1. 8.8

2. 8.3

3. 7.9

4. 6.9

5. 6.4

6. 5.8

7. 5.3

8. 4.8

9. 4.3

10. 3.8 **Final D.O., mg/L**

$$\frac{(\text{Initial} - \text{Final})\ 60}{10} = \text{OUR} \qquad \frac{(8.8 - 3.8)60}{10} = 30$$

$$\frac{\text{OUR}}{(\text{VSS} / 1000)} = \text{SOUR} \qquad \frac{30}{(1740 / 1000)} = 17.2$$

REMARKS: Mixed liquor@anoxic Zone #3/ Fed 5% or 15 mls. Leachate-wet well discharge.

CITY OF REEDSPORT
WASTEWATER TREATMENT PLANT

OUR/SOUR Work Sheet

NAME__Hurlocker **DATE__3.21.14___**

SAMPLE ID: Douglas Co. leachate A

TIME: 1400 **Initial D.O., mg/L 8.3**

1. 7.9
2. 7.5
3. 6.9
4. 6.4
5. 5.9
6. 5.3
7. 4.8
8. 4.3
9. 3.8
10. 3.2 **Final D.O., mg/L**

$$\frac{(\text{Initial} - \text{Final})\ 60}{10} = \text{OUR} \qquad \frac{(\ 8.3 - 3.2\ )\ 60}{10} = 30.6$$

$$\frac{\text{OUR}}{(\text{VSS} / 1000)} = \text{SOUR} \qquad \frac{30.6}{(\ 1740\ /\ 1000)} = 17.5$$

REMARKS: Mixed liquor @ anoxic zone#3// fed 20% influent containing 5% (3 mls) Doug. Co leachate- wet well discharge

CITY OF REEDSPORT
WASTEWATER TREATMENT PLANT

OUR/SOUR Work Sheet

NAME____Hurlocker **DATE__3.21.14____**

SAMPLE ID Control A

TIME: 1418 **Initial D.O., mg/L 7.3**

1. 6.8

2. 6.3

3. 5.6

4. 5.3

$$\frac{(\text{Initial} - \text{Final})\ 60}{10} = \text{OUR} \qquad \frac{(\ 7.3\ \ -2.4\ \ )\ 60}{10} = 29.4$$

5. 4.9

6. 4.3

7. 3.8

$$\frac{\text{OUR}}{(\text{VSS} / 1000)} = \text{SOUR} \qquad \frac{29.4}{(\ \ 1740 / 1000)} = 16.9$$

8. 3.4

9. 3.0

10. 2.4 **Final D.O., mg/L**

REMARKS__Mixed liquor @ anoxic zone #3// Fed 20% raw influent

CITY OF REEDSPORT
WASTEWATER TREATMENT PLANT

OUR/SOUR Work Sheet

NAME_Hurolcker____ **DATE___3.21.14_____**

SAMPLE ID__Control B________________

TIME: 1935 **Initial D.O., mg/L 9.2**

1. 8.8 initial
2. 8.4
3. 7.9
4. 7.4
5. 6.9
6. 6.4
7. 5.9
8. 5.4
9. 4.9
10. 4.4
11. 3.9 **Final D.O., mg/L**

$$\frac{(\text{Initial} - \text{Final})\ 60}{10} = \text{OUR} \qquad \frac{(\ 8.8\ -\ 3.9)\ 60}{10} = 29.4$$

$$\frac{\text{OUR}}{(\text{VSS} / 1000)} = \text{SOUR} \qquad \frac{29.4}{(\quad 1740 / 1000)} = 16.9$$

REMARKS__mixed liquor @ anoxic zone #3 / UNFED___

CITY OF REEDSPORT WASTEWATER PLANT
SUSPENDED SOLIDS WORKSHEET

DATE: 3.21.14

LAB TECH Hurlocker

INFLUENT
Final #1 ______ g
Final #2 ______ g
Initial ______ g = 150
______ mg = ______
Ash
Final ______ g Flo = ______
vss ______ mg
vss ______ mg/l = ______
vss%

WAS
Final #1 ______ g
Final #2 ______ g
Initial ______ g = 4
______ mg
S.S. = ______
Ash
Final ______ g
vss ______ mg
vss ______ mg/l
vss%

EFFLUENT
Final #1 ______ g
Final #2 ______ g
Initial g ______ mls = ______
______ mg = ______
Ash
Final ______ g = ______
vss ______ mg % = ______
vss ______ mg/l = ______
vss%

#1 Digester
Final #1 ______ g
Final #2 ______ g
Initial ______ g = 4
______ mg
S.S. = ______
Ash
Final ______ g
vss ______ mg
vss ______ mg/l
vss%

Lab Control Standard 85%
Final #1 ______
Final #2 0.2682 g
Initial 0.2331 g = 200
35.1 mg
S.S. = 176
Ash
Final ______ g
vss ______ mg
SS=170±11%
vss ______ mg/l
vss%

#2 digester
Final #1 ______ g
Final #2 ______ g
Initial ______ g = 4
______ mg
S.S. = ______
Ash
Final ______ g
vss ______ mg
vss ______ mg/l
vss%

#1 MLSS ____ MG/L
#1 MLVS: ____ MG/L X .396 X 8.3 MLVSS Lb ______
#2 MLSS ____ MG/L
#2 MLVS: ____ MG/L X .396 X 8.3 MLVSS Lb ______
total mlvs ____ MG/L X .792x8.34 TOTAL LB ______

TSS & MLSS = Final - Initial x 1000 / mls
MLVSS= Final - Ash Final x 1000 / mls
% RED. = IN - OUT / IN
SVI = 30 min. Set. X 1000 / MLSS
INF&EFF Lb. = SS x 8.34 x Q
VSS % = VSS / SS

AERATION BASIN ONE
Final#1 ______
Final #2 0.2856 g
Initial 0.2282 g = 25
57.4 mg
Ash 30 MIN. SETT. = 300
Final 0.2421 g
vss 43.5 mg = 2296
mlvss 1740 mg/l SVI 131
vss% mL/gm

AERATION BASIN TWO
Final#1 ______
Final #2 ______ g
Initial ______ g = 25
______ mg
Ash 30 MIN. SETT. = ______
Final ______ g
vss ______ mg = ______
mlvss ______ mg/l = ______
vss% mL/gm

RAS #1
Final#1 ______
Final #2 ______ g
Initial ______ g = 4
______ mg
S.S. = ______
Ash
Final ______ g
vss ______ mg
vss ______ mg/l
vss%

POND #1
Final #1 ______
Final #2 ______ g
Initial ______ g = 4
______ mg
Ash
Final ______ g
vss ______ mg = ______
vss ______ mg/l
vss% vss%

POND #2
Final #1 ______
Final #2 ______ g
Initial ______ g = 4
______ mg
Ash
Final ______ g
vss ______ mg = ______
vss ______ mg/l
vss%

RAS #2
Final #1 ______
Final #2 ______ g
Initial ______ g = 4
______ mg
S.S. = ______
Ash
Final ______ g
vss ______ mg
vss ______ mg/l
vss%

CITY OF REEDSPORT
Wastewater Treatment Plant

Daily Lboratory Bench Sheet

Effluent Flow: ~~0.732478~~ 0.687958 MGD
D.O.B.#1 3 Ft.
Date: 3-21-14

Gardiner Flow: ~~0.068720~~ 0.066261 MGD
D.O.B.#2 3 Ft.
Name: Hurlocker

Rainfall: 0 In.
Temp: H: L:

	Aeration Basin #1		Aeration Basin #2	
	SSV	SSC	SSV	SSC
	1000		1000	
5	800		846	
10	600		640	
15	500		510	
20	425		490	
25	390		400	
30	360		360	
60			260	
Rise Time:				

Time	C12 Res.	Lb. Used
0840	0.18	9.2
dechlor	0.01	

Microbial

Rotifers <>
Stalks <>
Fre. Swim <>

	Temp.	pH	D. O.	Time	T. Alk.MG/L
Influent	12.7	7.09	2.9	~~09~~0750	
Effluent	13.7	6.50	6.5	0840	
Aeration Basin #1	14.5	6.47	2.5	1340	
Aeration Basin #2	13.3	6.94	3.2	0745	
Digester #1					
Digester #2					
RAS					
WAS					

Process Changes Why?
1
2
3
4
5
6

Calibration of Instruments

DO Meter

20.0	Temp.
7.8	Initial DO
9.0	Final DO

pH Meter

4	4 pH
7	7 pH
-57.7	Slope -58.0 ± 3.0

BOD Meter

20.0	Temp.
9.3	Initial DO
9.1	Final DO

REMARKS: 4.22 B/S

time
1230 DC WET Well #1 9.0 do 14.2 TEMP 7.60 PH
1230 DC wetwell discharge 10.0 do 14.5 temp 7.68 PH
1230 DC Pond discharge 8 do 12.8 temp 7.77 PH