Kennedy/Jenks Consultants

Town of Yacolt, Washington
Wastewater Facility Plan
Regulatory Review Copy

May 2012

Prepared for

Town of Yacolt
202 W. Cushman Street
Yacolt, WA 98675

K/J Project No. 0991020.00

Town of Yacolt, Washington

Yacolt Wastewater Facility Plan

Regulatory Review Submittal

May 2012

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Executive Summary

ES.1 Background

Wastewater from the Town of Yacolt (Yacolt) is handled by septic tanks. Yacolt sought to define the requirements and costs associated with construction of a centralized sewer system and decommission of existing septic tanks. Yacolt developed a General Sewer Plan[1] (GSP), which was approved by the Washington Department of Ecology (Ecology) in February 2011. (Appendix A contains the approval letter). The GSP provided alternatives analysis for wastewater collection, treatment and discharge, as well as preliminary estimates of cost for construction and operation of a sewer system. This Facility Plan offers additional assessments of recommended alternatives for these components.

The Town of Yacolt (incorporated area) is 315 acres. Within the current Town Urban Growth Area (UGA) there are 362 acres. There is currently an estimated 85 acres of undeveloped residential land within the current UGA. It is estimated that this will yield 77 developable acres. Yacolt, as an urban area, has both urban zoning as well as rural zoning in the unincorporated area (see Figure 1.2). In the Clark County Growth Management Act update process (2007), an additional 325 acres of land adjacent to the current UGA/Town limits was added to the new Yacolt UGA. This land was placed within an Urban Reserve designation. Urban Reserve allows for annexation provided certain criteria are achieved. A criterion established by the County and supported by Yacolt is that a plan must be developed for sanitary sewer service before annexation of the lands within the Urban Reserve is allowed.

ES.2 Planning Projections

In order to maintain consistency with the Clark County Growth Management Plan[2] (2007), a two percent annual growth value is used as the basis of planning. This applies to the residential category, which dominates wastewater production in Yacolt.

Flow values and loading were estimated based on Ecology's Orange Book[3], which recommends using a per capita flowrate of 100 gpd when designing sewerage facilities. The Orange Book also recommends per capita loads of 0.2 lb/day for total suspended solids (TSS) and biochemical oxygen demand (BOD). Table ES.1 presents projected flowrates and loading during the planning period. The 2029 maximum month flowrate is estimated at 0.30 MGD; 2029 BOD/TSS loads are estimated at 600 ppd, and ammonia-nitrogen is estimated at 75 ppd.

[1] Yacolt General Sewer Plan. *Kennedy/Jenks Consultants* (14 January 2011)
[2] Yacolt Comprehensive Growth Management Plan, February 2004
[3] Criteria for Sewage Works Design, Washington Department of Ecology (August 2008)

Table ES.1: Projected Population, Flowrates and Loads

Year	Population	ERUs						Population Equivalent	Max Month Flows @ 100 gpcd (MGD)	Dry Average Flows @ 80 gpcd (MGD)	Wet Average Flows @ 90 gpcd (MGD)	TSS/BOD Average Annual @ 0.2 (lb/day)
		New Res ERUs	Res ERU Total	Comm ERU Total	Light Industrial ERU	Public ERU	Total ERUs					
	A	B	C	D	E	F	G	H	I	J	K	L
2000	1,055	-	344	12	3	35	394	1,304	0.130	0.104	0.117	260.7
2001	1,065	3	347	12	3	36	398	1,316	0.132	0.105	0.118	263.2
2002	1,105	12	359	12	3	37	410	1,358	0.136	0.109	0.122	271.7
2003	1,115	3	362	12	3	37	414	1,371	0.137	0.110	0.123	274.2
2004	1,135	6	368	12	3	38	421	1,393	0.139	0.111	0.125	278.7
2005	1,160	8	376	12	3	39	429	1,421	0.142	0.114	0.128	284.2
2006	1,220	18	394	12	3	40	448	1,483	0.148	0.119	0.134	296.7
2007	1,370	45	439	12	3	41	494	1,636	0.164	0.131	0.147	327.2
2008	1,470	30	527	12	3	41	583	1,929	0.193	0.154	0.174	385.9
2009	1,499	9	536	15	3	42	596	1,974	0.197	0.158	0.178	394.7
2010	**1,529**	**9**	**545**	**19**	**3**	**43**	**610**	**2,019**	**0.202**	**0.161**	**0.182**	**403.7**
2011	**1,560**	**9**	**554**	**22**	**3**	**44**	**624**	**2,064**	**0.206**	**0.165**	**0.186**	**412.8**
2012	**1,591**	**9**	**564**	**26**	**4**	**45**	**638**	**2,110**	**0.211**	**0.169**	**0.190**	**422.1**
2013	**1,623**	**10**	**573**	**29**	**4**	**46**	**652**	**2,157**	**0.216**	**0.173**	**0.194**	**431.5**
2014	**1,655**	**10**	**583**	**32**	**4**	**47**	**666**	**2,205**	**0.220**	**0.176**	**0.198**	**441.0**
2015	**1,689**	**10**	**593**	**36**	**4**	**48**	**681**	**2,253**	**0.225**	**0.180**	**0.203**	**450.6**
2016	**1,722**	**10**	**603**	**39**	**5**	**49**	**696**	**2,302**	**0.230**	**0.184**	**0.207**	**460.4**
2017	**1,757**	**10**	**614**	**42**	**5**	**49**	**711**	**2,352**	**0.235**	**0.188**	**0.212**	**470.4**
2018	**1,792**	**11**	**624**	**46**	**5**	**50**	**726**	**2,403**	**0.240**	**0.192**	**0.216**	**480.5**
2019	**1,828**	**11**	**635**	**49**	**6**	**51**	**741**	**2,454**	**0.245**	**0.196**	**0.221**	**490.8**
2020	**1,864**	**11**	**646**	**53**	**6**	**53**	**757**	**2,506**	**0.251**	**0.200**	**0.226**	**501.2**
2021	**1,902**	**11**	**657**	**56**	**6**	**54**	**773**	**2,559**	**0.256**	**0.205**	**0.230**	**511.8**
2022	**1,940**	**11**	**669**	**59**	**6**	**55**	**789**	**2,612**	**0.261**	**0.209**	**0.235**	**522.5**
2023	**1,978**	**12**	**681**	**63**	**7**	**56**	**806**	**2,667**	**0.267**	**0.213**	**0.240**	**533.4**
2024	**2,018**	**12**	**693**	**66**	**7**	**57**	**822**	**2,722**	**0.272**	**0.218**	**0.245**	**544.5**
2025	**2,058**	**12**	**705**	**70**	**7**	**58**	**839**	**2,779**	**0.278**	**0.222**	**0.250**	**555.7**
2026	**2,100**	**12**	**717**	**73**	**7**	**59**	**857**	**2,836**	**0.284**	**0.227**	**0.255**	**567.2**
2027	**2,142**	**13**	**730**	**76**	**8**	**60**	**874**	**2,894**	**0.289**	**0.232**	**0.260**	**578.8**
2028	**2,184**	**13**	**743**	**80**	**8**	**62**	**892**	**2,953**	**0.295**	**0.236**	**0.266**	**590.5**
2029	**2,228**	**13**	**756**	**83**	**8**	**63**	**910**	**3,013**	**0.301**	**0.241**	**0.271**	**602.5**

ES.3 Collection

A vacuum collection system is recommended based on total present worth value and on the recommended solids handling system, a facultative lagoon. The major components of the proposed vacuum collection system are:

- Gravity Sewer Lines from Residences to Sump
- Sump with Vacuum Valve
- Laterals and Collection Mains
- Vacuum Station with Collection Tank, Sewage Pumps, Vacuum Pumps

Sewage pumps will transfer collected sewage from the vacuum station to the treatment plant via a 6-inch pipe. Clark County has indicated that it would be acceptable to route this force main within their easement along the railroad and Railroad Ave.

The estimated capital cost for the vacuum collection system is $9.61 M. The annual O&M cost is estimated at approximately $70,000.

ES.4 Treatment

A Biolac lagoon system is recommended for sewage treatment. The Biolac lagoon system was selected among alternatives considered due to lower present worth cost, simplicity of operation, and efficiency. Biolac is a proprietary process, however it is fundamentally an extended-aeration activated sludge process. Biolac utilizes an earthen basin lagoon with an integral clarifier for secondary clarification. Primary clarification is unnecessary and would not be utilized at Yacolt. The Biolac system which is proposed for Yacolt will achieve denitrification and phosphorus removal by biological means; the treatment scheme features an anaerobic zone upstream of the aeration basin to promote denitrification.

Design criteria for the Yacolt treatment facility are summarized in Table ES.2, which presents both anticipated values of Biolac effluent quality and proposed discharge permit limits. The plant will consist of two hydraulically-isolated trains, and will meet all reliability and redundancy requirements for a Class II WWTP as defined by Ecology. It would be feasible to operate both trains as soon as the facility is constructed. In addition, the facility could be expanded initially by installation of additional blowers and air diffusers; larger expansions could be accomplished with construction of additional trains. A maintenance building will be constructed also.

Table ES.2: Yacolt Treatment Plant Design Criteria

Design Flow Conditions (2029)	MGD	Remarks	
AAF	0.26	85 gpcd (=avg of ADF@80 & AWF@90)	
MMF	0.30	100 gpcd	
MWF	0.39		
PDF	0.7	PF = 2.3	
PHF	0.77	assume PF = 3 (low I&I)	
Design Loadings (2029)	**ppd @ MMF**	**Remarks**	
BOD5	600	0.2 ppcd (= 240 mg/l @ 100 gpcd ← MMF)	
TSS	600	0.2 ppcd (= 240 mg/l @ 100 gpcd ← MMF)	
Ammonia-nitrogen	75	90 @ MWF	
Effluent Water Quality	**Biolac Effluent**	**Proposed Permit Limits** [1]	
BOD5 (mg/l)	10	20 / 30	
TSS (mg/l)	15 [2]	20 / 30	
Ammonia-nitrogen (mg/l)	1	- -	
Total Nitrogen (mg/l)	8 [3]	10 / 15	
Phosphorus (mg/l)	2 [4]	- -	
pH	6 - 9	6 - 9	
Fecal Coliforms	- -	200/100 ml MGM / 400/100 ml WGM	
Process Design Criteria	**Design Values**	**Design Flow Condition**	**% Capacity, 1 Unit Out of Service**
Screen (6 mm), Capacity (MGD)	0.77	PHF	100% (via bypass)
Anaerobic Selector Zones(2) HRT, total (hr)[5]	4	MMF	50%
BIOLAC Lagoons (2)		MMF	50%
BIOLAC: F/M Ratio (1/day)	0.038		
BIOLAC: HRT, MMF (days)	2.1		
BIOLAC: MLSS (mg/L)	3,000		
BIOLAC: SRT, total (days)	58		
BIOLAC: Temperature (^{0}C)	20; 10 minimum		
Basin Dimensions[6] @grade/@floor(ft), each	114x55 / 90x31		
Side Water Depth (ft)	10		
Basin Volume, total, 2 basins (MG)	0.62		

Process Design Criteria	Design Values	Design Flow Condition	% Capacity, 1 Unit Out of Service
Clarifiers (2)			50%
Clarifier Surface Area, total, 2 basins (SF)	1,170		
Overflow Rate at AAF, (gpd/sf)		222	444
Overflow Rate at MMF, (gpd/sf)		256	513
Overflow Rate at PHF, (gpd/sf)		658	1316
Aeration		MMF	100%
Blowers (3 units; 1 standby) (Hp, ea.)	15		
Estimated SCFM @MMF, total, 2 basins (for Nitrification & Denitrification)	438		
Est. Std Oxygen Rqmt. @MMF, total (lb/hr)	72		
Estimated Brake Hp @MMF, total	16		
UV disinfection capacity, 2 banks [7] (mgd)	1.12	PHF	100%
UV disinfection capacity, 1 bank O.O.S.	0.56	PHF	73%

1 95% confidence limits, approximate.
2 Increase from GSP value of 10 mg/l due to switch to biological treatment for P (via selector zone & wave oxidation) from chemical feed and filtration.
3 Decrease from GSP value due to switch to biological treatment for P, which incorporates both nitrification and denitrification.
4 Land application expected to reduce [P] to 1 mg/l. Estimated influent [P] = 7.5 – 10.
5 Concrete, with mixers (not part of Parkson Biolac scope)
6 Construct as one basin with interior concrete dividing wall
7 Assume 65% transmittance

The estimated capital cost for the wastewater treatment plant is $2.85 M.

The annual O&M cost is estimated at approximately $90,000 and in addition a cost of approximately $270,000 will be realized every 7 years for dredging solids. This O&M cost includes hire of one employee for operation and maintenance of the new sewage system.

ES.5 Effluent Disposal

The recommended means of handling treatment plant effluent is a rapid infiltration system which will discharge effluent into land en route to the Yacolt Aquifer below. This recommendation is based on field infiltration testing, which confirmed the feasibility of this approach and also served as the basis for development of a rate of application of effluent to the infiltration trenches. Based on the application rate of 21gpd/sf an area of 14,300 sf would be required to handle the projected 2029 maximum month flowrate (MMF) of 0.3 MGD. The Town of Yacolt intends to purchase an 8-acre parcel of land for infiltration trenches.

Initially five trenches would be constructed, each with a capacity of 100,000 gpd. This would allow for operation via a cycle whereby the rest period is at least as long as the dose period under MMF conditions. Future expansion would require construction of an additional trench of

100,000-gpd capacity, and one or two additional trenches of equal size for rest periods. This would provide a total system discharge capacity of approximately 300,000 gpd. A trench depth of approximately 7 feet is anticipated, with the bottom 3 feet comprised of drain rock and the upper 4 feet of excavated or imported soil. Distribution piping of perforated D3034 PVC will be embedded in the drain rock. The capital cost of the discharge system is estimated at $0.65 M.

Three groundwater monitoring wells were installed on 14/15 November 2012 at the discharge site in order to monitor groundwater quality in the vicinity of the proposed infiltration trenches and to evaluate the groundwater gradient flow direction. Water level elevations will be measured in the new monitoring wells beginning in 2012 (tentatively). This will provide multiple years of data on water table elevations prior to operation of the new sewer system. Water from these wells will be sampled and tested for water quality beginning at least one year prior to operation of the system, in accordance with Ecology standard permit requirements for groundwater monitoring in association with treated municipal wastewater discharge to land.

ES.6 Regulatory Requirements

The Town of Yacolt will require a State Waste Discharge Permit (SWDP) rather than an NPDES permit because WWTP effluent will be discharged to land rather than to a surface water. Anticipated limits for BOD5 and TSS are 20 mg/l monthly average and 30 mg/l weekly average. Also, total nitrogen will most likely be limited to 10 mg/l monthly average and 15 mg/l weekly average.

Ecology administers regulations on solids in accordance with Chapter 173-308 WAC, which establishes requirements regarding biosolids management, treatment, storage, recycling, and permitting requirements. Ecology enforces regulatory requirements through a wastewater facility's statewide General Permit for Biosolids Management; facilities apply for coverage under the existing General Permit. Washington biosolids regulations define three measures for biosolids quality: pathogen reduction, vector attraction reduction, and pollutants.

On 22 February 2012 the Town issued a Determination of Non-Significance for this Facility Plan. The comment period ended on 8 March 2012; no comments were received. A SEPA checklist with the DNS was distributed, and a corresponding advertisement was published in the Battle Ground Reflector newspaper on 22 February 2012. Two outreach meetings dedicated to educating the public and soliciting their questions and concerns were held. The meetings occurred on 27 February 2012 and 26 March 22, 2012. These meetings partially fulfill Ecology's SERP requirements associated with this Facility Plan; a cost effectiveness analysis is also required, and are being submitted with this Facility Plan, along with a SERP cover sheet.

The following construction permits and approvals are anticipated for the Yacolt sewer system: Building and Grading Permits; Construction Stormwater Permit; Railroad Right-of-Way; and Fire District Approval.

ES.7 Financial Analysis

The total capital cost is shown for each component in Table ES.3.

Table ES.3: Capital Cost Estimate for Major Sewer System Components

	Raw Cost ($ Million)	APCF	Total Cost ($Million)
Collection System	4.89	1.965	9.61
Treatment	1.45	1.965	2.85
Land	0.30	---	0.30
Discharge	0.33	1.965	0.65
Electrical Service	0.03	1.965	0.06
Permits	0.15	---	0.15
TOTAL	**7.15**		**13.62**

Estimates of O&M cost are summarized in Table ES.4.

Table ES.4: Summary of O&M Cost Estimates

Component	Annual O&M	Additional O&M	Remarks
Collection System	70,000		<== assumes ~1/2 FTE@ $40/hr
Treatment, Liquid	90,000		<== includes 3/4 FTE @ $40/hr
Treatment, Solids	2,000	270,000	<== every 7 years (dredge)
Discharge	3,000		
Electrical Service (2)	1,000		
TOTALS	**166,000**	**270,000**	<== every 7 years (dredge)

There are three main categories of funding programs: (i) loans, (ii) grants, and (iii) federal appropriations. Appendix H provides a summary of the major programs along with their purposes, terms, and requirements. Bonds do not appear to be feasible for Yacolt. Many programs carry the specific purpose of aiding small and/or economically disadvantaged communities. With a population of less than 2,000 people, Yacolt is well-suited to compete for small-community programs.

At the time of writing, the Town of Yacolt is uncertain as to when a sewer system will be constructed. Overall, two years should be allocated for the design phase and an additional two years for the construction phase although an accelerated schedule could be implemented if desired.

Funding for estimated capital and O&M costs for the sewer system was evaluated in order to develop a range of probable monthly service rates. Case (1) was the most conservative case (i.e. highest monthly rates) and Case (2) was the least conservative case (i.e. lowest rates) from

the multiple scenarios considered. Case (1) assumes no grant funding and a 20-year loan @ 1% from the Public Works Trust Fund. The maximum estimated monthly rate over the repayment period is approximately $127. Case (2) assumes a $5.5 million grant, loans from Ecology (20-yr, 2.7%) and from USDA-RD (40-yr, 3.0%), and sewer development charges of $7,500 for new development. The maximum estimated monthly rate over the repayment period is approximately $93 for Case (2).

Section 1: Background

Wastewater from the Town of Yacolt (Yacolt) is handled by septic tanks. Yacolt sought to define the requirements and costs associated with construction of a centralized sewer system and decommission of existing septic tanks. Yacolt petitioned for a grant (from state funding for a north Clark County study) in 2009; these funds were sought in order to finance development of this Facility Plan. The requested grant was provided, and has funded this effort. Yacolt previously developed a General Sewer Plan[4] (GSP), which was approved by the Washington Department of Ecology (Ecology) in February 2011. (Appendix A contains the approval letter). The GSP provided alternatives analysis for wastewater collection, treatment and discharge, as well as preliminary estimates of cost for construction and operation of a sewer system. This Facility Plan offers additional assessments of recommended alternatives for these components.

Section 1 provides information on the existing environment at the Town of Yacolt, and also describes current demographics and land use. Additional information on environmental elements can be found within the SEPA Checklist in Appendix B. This section also provides a cross-reference to the Washington Department of Ecology's requirements for a Facility Plan.

1.1 References to Ecology Criteria for Facility Plans

Ecology's "Criteria for Sewage Works Design"[5] (i.e. "Orange Book") explains requirements for engineering reports and facility plans; Table G1-2 provides the basis of these requirements, namely WAC 173-240-060 requirements. Table 1.1 indicates where WAC requirements listed in the Orange Book's Table G1-2 can be found within this Facility Plan.

Table 1.1: Cross-References to Orange Book / WAC 173-240-060 Requirements

Text from WAC 173-240-060	Location in Facility Plan
The engineering report shall include the following information, together with any other relevant data as requested by Ecology:	
(a) The name, address, and telephone number of the owner of the proposed facilities, and their authorized representative.	• Title Page
(b) A project description including a location map and a map of the present and proposed service area.	• Section 1 • Figure 1.2 • Figure 3.2
(c) A statement of the present and expected future quantity and quality of wastewater, including any industrial wastes which may be present or expected in the sewer system.	• Section 2.2 • Table 2.1
(d) The degree of treatment required based upon applicable permits and regulations, the receiving water, the amount and strength of wastewater to be treated, and other influencing factors.	• Section 4.3.2 • Table 4.1

[4] Yacolt General Sewer Plan. *Kennedy/Jenks Consultants* (14 January 2011)
[5] Criteria for Sewage Works Design, Washington Department of Ecology (August 2008)

Text from WAC 173-240-060	Location in Facility Plan
(e) A description of the receiving water, applicable water quality standards, and how water quality standards will be met at the boundary of any applicable dilution zone. (173-201A-10Q WAC).	• Section 5
(f) The type of treatment process proposed, based upon the character of the wastewater to be handled, the method of disposal, the degree of treatment required, and a discussion of the alternatives evaluated and the reasons they are unacceptable.	• Section 4
(g) The basic design data and sizing calculations of each unit of the treatment works. Expected efficiencies of each unit, the entire plant, and character of effluent anticipated.	• Section 4.3.3 • Table 4.1 • Table 4.2 • Appendix D
(h) Discussion of the various sites available and the advantages and disadvantages of the site(s) recommended. The proximity of residences or developed areas to any treatment works. The relationship of a 25-year and 100-year flood to the treatment plant site and the various plant units.	• Section 4.4
(i) A flow diagram showing general layout of the various units, the location of the effluent discharge, and a hydraulic profile of the system that is the subject of the engineering report and any hydraulically related portions.	• Figure 4.2 • Figure 5.2 • Figure 5.3
(j) A discussion of infiltration and inflow problems, overflows and bypasses, and proposed corrections and controls.	• N/A
(k) A discussion of any special provisions for treating industrial wastes, including any pretreatment requirements for significant industrial sources.	• N/A
(l) Detailed outfall analysis or other disposal method selected.	• (GSP)
(m) A discussion of the method of final sludge disposal and any alternatives considered.	• Section 4.8
(n) Provision for future needs.	• Various sections
(o) Staffing and testing requirements for the facilities.	• Appendix F • Section 4.12
(p) An estimate of the costs and expenses of the proposed facilities and the method of assessing costs and expenses. The total amount shall include both capital costs and also operation and maintenance costs for the life of the project, and shall be presented in terms of total annual cost and present worth.	• Section 3.3 • Section 4.14 • Section 5.5 • Section 7.1 (includes rate evaluations)
(q) A statement regarding compliance with any applicable state or local water quality management plan or any such plan adopted pursuant to the federal Water Pollution Control Act as amended.	• N/A
(r) A statement regarding compliance with SEPA and NEPA, if applicable.	• New SERP (separate submittal) • Note: Permit requirements in Sections 6.3 and 6.4

Text from WAC 173-240-060	Location in Facility Plan
060(4) Land Application Discharges	
The engineering report for projects utilizing land application, including seepage lagoons, irrigation, and subsurface disposal, shall include information on the following together with appropriate parts of subsection C(3) of this table, as determined by Ecology: (a) Soils and their permeability. (b) Geohydrologic evaluation of such factors as: (i.) Depth to ground and ground water movement during different times of the year. (ii.) Water balance analysis of the proposed discharge area. (iii.) Overall effects of the proposed facility upon the ground water in conjunction with any other land application facilities that may be present. (c) Availability of public sewers. (d) Reserve areas for additional subsurface disposal.	• Section 5

1.2 Existing Environment

1.2.1 Water, Air, and Sensitive Areas

1.2.1.1 Drinking Water

The Town of Yacolt is served with potable water by the Clark Public Utility District (CPU). A schematic of the water system is shown on Figure 1.1. Water comes from a shallow unconfined aquifer known as the Yacolt Aquifer. Yacolt has a well field at the north end of town adjacent to the baseball fields, north of the area zoned commercial along W. Christy Street east of N. Amboy Road. There are four wells on this site, with service for the Town provided extensively from a single well (#7, new well identification is 407) at 300 gallons per minute (gpm). (Note that although this Facility Plan refers to these municipal supply wells with single-digit designations, CPU now refers to the active municipal supply wells as well numbers 403 through 407.) The remaining wells include monitoring wells and two low-producing municipal wells (#1 (401) and #2 (402)) that are no longer used.

There is also a single public well (as well as two abandoned wells) located at the Yacolt Town Park on W. Humphrey Street, west of N. Amboy Avenue. This well is used periodically with flow alternated from this site and well #3 (403). This well is approximately 128 feet deep, producing 100 gpm.

Two concrete storage reservoirs, with 500,000-gallons (1975) and 300,000-gallon (1991) capacity are located west of the urban growth boundary (UGA) to balance water pressure needs for the Town. Service to the Town is provided by two-inch to eight-inch waterlines virtually all located within public right-of-way. All homes and businesses are on CPU-provided potable water. There is an intertie with other CPU sources, providing emergency flows if necessary.

There are seven recorded public water wells and five recorded private water wells within the existing Town limits/UGA, with four additional public wells and four additional private wells located within the Urban Reserve area.

1.2.1.2 Groundwater

Depth to groundwater in the area ranges from a few feet to more than 100 feet below ground surface (bgs) depending on location and season. The shallow groundwater occurs in the southern portion of the valley and the deeper groundwater is in the north. There is no low permeable barrier within the valley so the ground water is influenced by all activity (rainfall, septic systems etc) within the valley. Recharge of the groundwater level generally occurs within the first three-months of the beginning of the winter rain season (November-January).

1.2.1.3 Surface Water

Yacolt has four major streams flowing through with several unnamed tributaries. The area streams (year round) include Yacolt Creek on the west and south side, Cedar Creek on the north, Weaver Creek along the southeast and Big (Tree) Creek on the east side. Cedar Creek flows into the North Fork of the Lewis River. The remaining three creeks flow into the East Fork of the Lewis River. The entire valley drains to the south. The Yacolt Hydrogeologic Study does not anticipate that the upper reaches of Yacolt and Weaver Creek are ever in direct connection with the aquifer; however, the lower reaches are in connectivity and as the water table rises additional upstream lengths of the Creeks are in contact with the water table.

1.2.1.4 Climate

The Yacolt area lies within a valley and experiences mild weather influences. The Town averages 80 inches of rain per year and receives up to 20 inches of snow per year. Temperatures vary from 0 to 100 degrees Fahrenheit with normal average temperatures of 65 in the summer and 45 in the winter.

1.2.1.5 Topography

The Town is located in a valley at elevation 690 to 710 feet surrounded by hills reaching 1,000 feet in elevation. The hills are forested with conifers, while the valley is primarily grassland.

1.2.1.6 Soils

The U. S. Geological Survey map for the Yacolt area shows that the valley floor sediments are glacial outwash deposits which consist of poorly consolidated pebbly to cobbly gravel to sand, with clay layers and discontinuous deposits throughout the valley. Based on well logs on file with Ecology, the subsurface is dominated by clay and clay mixtures to depths generally ranging between five and thirty feet. Deeper material in the area tends to be rocky or sandy. Patterns for the depth and thickness of this clay layer are not evident from well log descriptions. The soil survey for the Yacolt area shows that silt loam soils overlying the glacial outwash textures predominate in the top five feet of soil for much of the valley. Some areas along Yacolt, Weaver, and Cedar Creeks, and along the railroad tracks, have loam to stony loam soil textures.

1.2.2 Floodplains

The proposed project does not lie within a 100-year floodplain. There are designated floodplains associated with Yacolt Creek and an unknown tributary to Weaver Creek that are within the UGA, but the proposal does not lie within them.

1.2.3 Shorelands

The Town does not have any land affected by shorelines.

1.2.4 Wetlands and Endangered Species / Habitats

The proposed project does not lie within area classified as “environmentally sensitive”. There have been riparian and wetland habitat areas mapped by Clark County during the 2007 Growth Management Act (GMA) update that appear outside of the proposed sites.

1.2.5 Prime or Unique Farmland

No properties are currently zoned for agricultural uses. Some areas are used for pasture.

1.2.6 Archaeological and Historical Sites

There are no places or objects on or near the proposed facilities which are listed or proposed for national, state, or local preservation registers. Also there is no evidence of historic, archaeological, scientific, or cultural importance known to be on or near the proposed facilities.

1.2.7 Wild and Scenic Rivers

There are no rivers which are designated as wild and scenic near the proposed facilities.

1.2.8 Threatened Species

There are no threatened or endangered species known to be on or near the proposed facilities.

1.3 Demographics and Land Use

1.3.1 Planning Area

The Town of Yacolt (incorporated area) is 315 acres. Within the current Town Urban Growth Area (UGA) there are 362 acres. There is currently an estimated 85 acres of undeveloped residential land within the current UGA. It is estimated that this will yield 77 developable acres. Yacolt, as an urban area, has both urban zoning as well as rural zoning in the unincorporated area (see Figure 1.2). (The Comprehensive Plan designations include urban uses only.) In the Clark County GMA update process (2007), an additional 325 acres of land adjacent to the current UGA/Town limits was added to the new Yacolt UGA. This land was placed within an Urban Reserve designation. Urban Reserve allows for annexation provided certain criteria are achieved. Within Yacolt, a criterion established by the County and supported by Yacolt is that a plan must be developed for sanitary sewer service before annexation of the lands within the Urban Reserve designation is allowed.

1.3.2 Current Population

According to the 2010 federal census, the population in Yacolt was 1,556.

1.3.3 Present Wastewater Treatment

Yacolt is currently served by individual septic tanks and drainfields for wastewater handling. Yacolt plans to own, operate and maintain their proposed sanitary sewer system and plant upon completion of construction.

1.3.4 Advanced WasteTreatment Need Evaluated

The proposed wastewater treatment plant (WWTP) would provide biological nutrient removal. This treatment system, originally recommended in the Yacolt General Sewer Plan is described in Section 4.

1.3.5 I/I Studies and CSOs

I/I and CSOs are not applicable to the existing wastewater handling system, however the proposed sewage collection system would feature low I/I. This is described in Section 3.

1.3.6 Industrial and Commercial Uses

Currently there are no industrial discharges in Yacolt. Currently there is a three-acre satellite telecommunications relay facility located on a twenty-acre site immediately east of the town limits within the UGA, which is zoned light industrial. Also there is a storage building for well-drilling equipment and an associated shop.

1.3.7 Public Health

Construction of a centralized sewer system may protect the drinking water supply (Yacolt Aquifer) by reducing the amount of nitrogen which enters the aquifer in association with wastewater handling.

Section 2: Planning Projections

The Town of Yacolt General Sewer Plan (GSP) examined available population data and projected future population growth and future wastewater flowrates and loads. Since the completion of the GSP, no significant changes have taken place which would indicate a need to alter the projections, in spite of issuance of the national 2010 census. (Yacolt population is listed in the 2010 census as 1,566 whereas the GSP shows 1,529.) Therefore this section maintains projections from the GSP, which are presented in Table 2.1.

Note that the GSP considered a planning period to year 2029. For consistency with the GSP, the same planning period is used in this Facility Plan.

2.1 Population

In order to maintain consistency with the Clark County Growth Management Plan[6] (2007), a two percent annual growth value is used as the basis of planning. (The Washington State Office of Financial Management (OFM) projects an average rate for Clark County grow of 1.8% to 2.2%.) This applies to the residential category, which dominates wastewater production in Yacolt.

Population per household is assumed at 3.31 persons. The 2008 residential equivalents were taken from a physical count of 527 residences which include the 16 multiple dwelling units.

According to the Yacolt 2004 Comprehensive Plan update, there were 10 acres of commercial use in 2000; the 10 acres resulted in 12 businesses in 2000. It is assumed that full 'build out' of the commercial parcels will occur by 2029 with flow generated at a rate of 750 gal/acre/day resulting in 83 equivalent residential units (ERUs). Light Industrial occupied only one acre in 2000 with three uses. As with commercial uses, light industrial uses are assumed to generate 750 gal/acre/day of flow.

Public uses include the school, city hall, and church. 24 students are assumed per ERU. The school population is assumed to increase at the same rate of two percent per year as that of the residential population. The church and town hall were each assigned 1 ERU, with no increases over time.

Estimated population equivalents and ERUs for 2029 are 3,013 and 910, respectively. Table 2.1 presents projected population and population equivalents during the planning period.

2.2 Projected Flowrates and Loading

Flow values and loading were estimated based on Ecology's Orange Book. The Orange Book recommends using a per capita flowrate of 100 gpd when designing sewerage facilities. Within this Facility Plan the per capita design flow is also considered to be the maximum month flowrate, and corresponding average dry and wet weather flows are 80 gpd and 90 gpd, respectively; this assumption is carried forth from the GSP, which referenced the 2007 Orange Book.

[6] Yacolt Comprehensive Growth Management Plan, February 2004

Regarding loading, the Orange Book recommends per capita loads for use in designing sewage facilities for total suspended solids (TSS) and biochemical oxygen demand (BOD) of 0.2 lb/day per capita. (Note that BOD values refer to 5-day carbonaceous BOD.) Within this Facility Plan the per capita design loads are also considered to correspond to maximum month values, that is, a TSS/BOD of 600 ppd corresponds to a flowrate of 0.30 MGD and thus a concentration of 240 mg/l, which is typical for a medium-strength wastewater. Ammonia-nitrogen concentration of the raw wastewater is estimated at 30 mg/l, which is also typical for a medium-strength wastewater.

Table 2.1 presents projected flowrates and loading during the planning period. Values at the end of the planning period are listed below. Design values for the Yacolt sewer system are bold.

- **Maximum Month Flowrate: 0.30 MGD**
- **Maximum Week Flowrate: 0.39 MGD**
- Average Dry Flowrate: 0.24 MGD
- Average Wet Flowrate: 0.27 MGD
- Average Annual Flowrate: 0.26 MGD
- **Maximum Month TSS: 600 PPD**
- **Maximum Month BOD: 600 PPD**
- **Maximum Month NH3-N: 75 PPD**

The peaking factor for peak hour flowrate (PHF) is estimated at 3.0 times greater than the average flowrate. The Orange Book[7] indicates that the appropriate peaking factor would be approximately 3.5 (based on the population equivalent of 3,000), as shown on Figure 2.1. However it is anticipated that I&I will be considerably lower due to construction of a new vacuum collection system, as discussed in the following section. This gives rise to a value for PHF of 0.77 MGD. The peak day flowrate (PDF) is estimated at approximately 0.7 MGD, which equates to a peaking factor of 2.3.

Table 2.1: Projected Population, Flowrates and Loads

Year	Population	ERUs						Population Equivalent	Max Month Flows @ 100 gpcd (MGD)	Dry Average Flows @ 80 gpcd (MGD)	Wet Average Flows @ 90 gpcd (MGD)	TSS/BOD Average Annual @ 0.2 (lb/day)
		New Res ERUs	Res ERU Total	Comm ERU Total	Light Industrial ERU	Public ERU	Total ERUs					
	A	B	C	D	E	F	G	H	I	J	K	L
2000	1,055	-	344	12	3	35	394	1,304	0.130	0.104	0.117	260.7
2001	1,065	3	347	12	3	36	398	1,316	0.132	0.105	0.118	263.2
2002	1,105	12	359	12	3	37	410	1,358	0.136	0.109	0.122	271.7
2003	1,115	3	362	12	3	37	414	1,371	0.137	0.110	0.123	274.2
2004	1,135	6	368	12	3	38	421	1,393	0.139	0.111	0.125	278.7
2005	1,160	8	376	12	3	39	429	1,421	0.142	0.114	0.128	284.2
2006	1,220	18	394	12	3	40	448	1,483	0.148	0.119	0.134	296.7
2007	1,370	45	439	12	3	41	494	1,636	0.164	0.131	0.147	327.2
2008	1,470	30	527	12	3	41	583	1,929	0.193	0.154	0.174	385.9
2009	1,499	9	536	15	3	42	596	1,974	0.197	0.158	0.178	394.7
2010	**1,529**	**9**	**545**	**19**	**3**	**43**	**610**	**2,019**	**0.202**	**0.161**	**0.182**	**403.7**
2011	**1,560**	**9**	**554**	**22**	**3**	**44**	**624**	**2,064**	**0.206**	**0.165**	**0.186**	**412.8**
2012	**1,591**	**9**	**564**	**26**	**4**	**45**	**638**	**2,110**	**0.211**	**0.169**	**0.190**	**422.1**
2013	**1,623**	**10**	**573**	**29**	**4**	**46**	**652**	**2,157**	**0.216**	**0.173**	**0.194**	**431.5**
2014	**1,655**	**10**	**583**	**32**	**4**	**47**	**666**	**2,205**	**0.220**	**0.176**	**0.198**	**441.0**
2015	**1,689**	**10**	**593**	**36**	**4**	**48**	**681**	**2,253**	**0.225**	**0.180**	**0.203**	**450.6**
2016	**1,722**	**10**	**603**	**39**	**5**	**49**	**696**	**2,302**	**0.230**	**0.184**	**0.207**	**460.4**
2017	**1,757**	**10**	**614**	**42**	**5**	**49**	**711**	**2,352**	**0.235**	**0.188**	**0.212**	**470.4**
2018	**1,792**	**11**	**624**	**46**	**5**	**50**	**726**	**2,403**	**0.240**	**0.192**	**0.216**	**480.5**
2019	**1,828**	**11**	**635**	**49**	**6**	**51**	**741**	**2,454**	**0.245**	**0.196**	**0.221**	**490.8**
2020	**1,864**	**11**	**646**	**53**	**6**	**53**	**757**	**2,506**	**0.251**	**0.200**	**0.226**	**501.2**
2021	**1,902**	**11**	**657**	**56**	**6**	**54**	**773**	**2,559**	**0.256**	**0.205**	**0.230**	**511.8**
2022	**1,940**	**11**	**669**	**59**	**6**	**55**	**789**	**2,612**	**0.261**	**0.209**	**0.235**	**522.5**
2023	**1,978**	**12**	**681**	**63**	**7**	**56**	**806**	**2,667**	**0.267**	**0.213**	**0.240**	**533.4**
2024	**2,018**	**12**	**693**	**66**	**7**	**57**	**822**	**2,722**	**0.272**	**0.218**	**0.245**	**544.5**
2025	**2,058**	**12**	**705**	**70**	**7**	**58**	**839**	**2,779**	**0.278**	**0.222**	**0.250**	**555.7**
2026	**2,100**	**12**	**717**	**73**	**7**	**59**	**857**	**2,836**	**0.284**	**0.227**	**0.255**	**567.2**
2027	**2,142**	**13**	**730**	**76**	**8**	**60**	**874**	**2,894**	**0.289**	**0.232**	**0.260**	**578.8**
2028	**2,184**	**13**	**743**	**80**	**8**	**62**	**892**	**2,953**	**0.295**	**0.236**	**0.266**	**590.5**
2029	**2,228**	**13**	**756**	**83**	**8**	**63**	**910**	**3,013**	**0.301**	**0.241**	**0.271**	**602.5**

Section 3: Collection

3.1 Alternatives Analysis

The General Sewer Plan (GSP) evaluated five types of collection systems, for implementation at Yacolt:

- Gravity system
- Septic Tank Effluent Pumping (STEP) system
- Septic Tank Effluent Gravity (STEG) system
- Grinder Pump system
- Vacuum system

Alternatives were evaluated with respect to capital costs, operational costs, and suitability for the Yacolt geography. It was noted that the STEP and STEG systems utilize septic tanks for solids treatment, whereas the other alternatives would utilize the future treatment facilities for solids handling.

The GSP concluded that a vacuum system has the lowest total present worth value (cost), followed closely by STEP/STEG systems. The Town prefers a vacuum system, based on cost and non-cost considerations. Ecology's letter of approval of the GSP (Appendix B) considered a vacuum system to be the recommended system.

Based on these considerations and also on the intended solids handling system (i.e. facultative lagoons, as discussed in the following section) Kennedy/Jenks recommends use of a vacuum collection system. The proposed vacuum system for Yacolt is described within this section.

3.2 Description of Proposed Vacuum Sewer Collection System

A vacuum sewer system uses the differential pressure between atmospheric pressure and a partial vacuum maintained in the piping network and vacuum station collection vessel. This differential pressure allows a central vacuum station to collect the wastewater of several thousand individual homes, depending on terrain. The general downward slope from north to south in Yacolt is favorable for a vacuum system; although the vacuum station can be located centrally, a southeasterly location near Railroad Ave. would require a lower vacuum pump head and so this location is proposed. A single station will meet requirements.

The system requires a normally closed valve at each sewage input point to seal the vacuum lines so that a vacuum can be maintained throughout the system. This valve opens automatically when a given quantity of sewage has accumulated in the collecting sump, admitting the sewage and the correct volume of air, then closing and sealing the system.

The major components of the proposed vacuum collection system are described below:

3.2.1 Gravity Sewer Lines from Residences to Sump

Service laterals will be installed at a 2-percent slope from each residence to a valve sump. Existing gravity side sewers will be intercepted and redirected to the valve sump. A supplemental vent will also be provided. This is required because when the interface valve opens it evacuates the sewage and a significant volume of air from the sump. As that volume of sewage and air is removed from the sump, an equal volume of air needs to be drawn in to replace the evacuated volume. By providing a supplemental vent the makeup air can be supplied without any impacts on the fixtures in the residence. A single vent could be supplied on each valve pit, rather than on individual gravity service lines.

3.2.2 Sump with Vacuum Valve

The valve sump, or pit, is the point of interface between the gravity system and the vacuum collection system. The valve pit is a two-compartment vault, as shown in Figure 3.1. The lower chamber provides storage for influent sewage. The upper chamber houses the interface valve. These two chambers are sealed from each other. The valve pit is typically located in the right-of-way between property lines. Valve pits will be H20 traffic rated, constructed of polyethylene with cast-iron covers and frames. Pits will be counterweighted as required to prevent flotation. Up to four separate building sewers can connect to a valve pit, each at 90 degrees of one another. However, for Yacolt only 2 connections per pit are proposed due to property line considerations, lot depths, and elevation differences. The construction cost estimate assumes 455 valve pits for 910 connections (at total buildout at the end of the planning period).

Each pit will contain a normally closed 3-inch vacuum/gravity valve to seal the collection system lines in order to maintain vacuum. The vacuum valve operates without electricity. The vacuum valve opens when a predetermined amount of sewage accumulates in the collecting sump. The resulting differential pressure between atmosphere and vacuum becomes the driving force that propels the sewage towards the vacuum station.

As the liquid level rises in the sump, it pressurizes the air in the sensor pipe. This air pressure is transmitted through a tube to the controller/sensor unit mounted on top of the valve housing. The air pressure operates the controller/sensor unit that applies vacuum from the sewer to the valve operator. This opens the valve and activates a field-adjustable timer in the controller. After a set time period has expired, the valve closes. (The needle valve on top of the controller is adjustable via a small screwdriver. One can adjust how long the valve stays open. The controller may be removed by removing the slip key that holds the controller on. No tools are required. The valve itself remains in place, although some tubing must be removed and reinstalled on the new controller.)

Once the sewage has been evacuated, a set amount of atmospheric air is admitted through the vacuum valve to provide the propulsion for the sewage. The source of the makeup air is through the air vent discussed above. A detail of a vent from the sump is provided in Appendix C. This vent would rise above the ground near the valve pit. Note that the controller that sits on top of the valve is vented as well (through the sump).

Note that the complete removal of the vacuum valve is generally not necessary. If a small object is caught, generally a few turns of the threaded upper housing will retract the plunger enough to allow the obstacle to pass. Or the entire upper housing may be removed if necessary, leaving the body in place.

3.2.3 Service Laterals and Collection Mains

Each valve pit will be connected to the vacuum collection system by a 3-inch vacuum service lateral of SDR 21 PVC. The 3-inch service lateral connects to a branch or main line (also SDR 21 PVC), which delivers sewage to the vacuum station. Figure 3.2 provides a preliminary layout of the vacuum collection system, showing main pipes and their diameter (of 4-inch, 6-inch, 8-inch and 10-inch). Flexible elastic joints with "Reiber Style" gasket will be used. Cleanouts will be provided at the end of each branch and main line.

Unlike gravity sewers that must be laid with enough slope to create a scouring velocity, the collection mains are only slightly sloped (0.2%) toward the vacuum station since vacuum provides adequate velocity. The vacuum mains are installed with a saw tooth profile to minimize burial depth. When the vacuum line exceeds the minimum cover requirement of 3 feet by a foot or more, insertion of two 45-degree fittings and a short section of pipe will create a lift back to minimum cover. Note that the pipeline will be installed below the local frost depth (of approximately 12 inches or less) in order to avoid pipeline misalignment due to freezing soil. Differential air pressure (7-10 psi) propels the sewage into the vacuum collection system, as discussed above. (Turbulence disintegrates the solids and mixes them with the air and liquid to form aerobic foam, which scours the pipeline, preventing blockage.) Also, the system shall be designed for a head loss not to exceed 18 feet, assuming 5 feet of loss through valves.

Isolation valves will be provided at the beginning of each branch line and on the vacuum main near these branch connections, and at intervals not to exceed 1,500 ft. The purpose of these valves is to isolate sections of the vacuum system for troubleshooting purposes. While both plug and resilient-wedge gate valves have been used, the latter is recommended. Note that a concrete buffer (i.e. holding) tank with valves will be provided at the Yacolt school because it carries the potential for delivering high peak flows to the system.

3.2.4 Vacuum Station

The vacuum station will be a two-level structure with the vacuum pumps and control panel located on the top floor. The collection tank and sewage pumps will be located on the lower floor in order to reduce the pumps' net positive suction head requirement as shown in the section illustration in Appendix C. The vacuum pumps maintain a negative pressure in the top portion of the collection tank and transfer that pressure throughout the collection system.

The station will be located (tentatively) to the southeast of the town along Railroad Ave., as shown on Figure 3.2. This location is ideal because its lower elevation relative to town reduces vacuum requirements associated with collecting sewage from the town.

A backup generator will be provided to ensure continued operation of vacuum and sewage pumps during power failures. Also, an odor control system will be provided for treating exhaust from the vacuum pumps because the station will be located in a residential area. The following

components will be provided on a skid which can be lifted into the building and connected to the incoming vacuum main and the outgoing force main:

- Collection Tank – Mild steel, internally / externally epoxy-coated tank, anodically-protected, and with a design working pressure of 20 in. Hg vacuum, tested to 28 in. HG vacuum. The tank will have a capacity of 4,500 gallons, to meet the volumetric design criterion of 3 times operating volume; this also provides more than 20 minutes of storage at average design flowrate.

- Sewage Pumps – Three dry-pit, horizontal, non-clog centrifugal pumps to transfer thecollection system design peak flow (7.5 Hp each). Pumps shall be controlled automatically via liquid-level sensors. Isolation and check valves shall also be provided. One pump shall serve as a standby unit.

- Vacuum Pumps – Three 25-Hp sliding-vane type vacuum pumps capable of an ultimate vacuum range of 29" Hg. One pump shall serve as a standby unit.

- Control Panel - Typical electrical controls include PLC, vacuum switches with stainless bellows, liquid level controls, motor starters with overload protection, automatic alternators for pump cycling, hour run meters, a solid state telephone alarm system, and a seven-day circular vacuum chart recorder.

Sewage pumps will transfer collected sewage from the vacuum station to the treatment plant via a 6-inch pipe. Clark County has indicated that it would be acceptable to route this force main within their easement along the railroad and Railroad Ave.

Note that existing septic tanks will be abandoned in place following pumpout of solids and filling with sand.

3.3 Cost Estimates

3.3.1 Capital Cost Estimate

The estimated capital cost for the vacuum collection system is $9.61 M. This estimate is based on cost information from the vacuum system supplier "AirVac". Itemized components and corresponding cost estimates were adjusted to reflect specific requirements of the Yacolt collection system. Cost estimating markups are then applied in order to account for taxes, engineering / legal / administration (ELA), mobilization, contractor overhead and profit, and contingency. As discussed in Section 7, a contingency of 25% is included in the cost estimate. These costs are itemized on Table 3.1.

Table 3.1: Collection System Capital Cost Estimate

Item		Cost
Valve Pits (455 units)		1,820,000
Standard Vacuum Station		
Standard Skid		260,000
Building (N/I land)		250,000
Wiring/Piping		60,000
Equipment Installation		15,000
Odor Control		25,000
Emergency Generator		35,000
Vacuum Mains and Valves		
Mains (10", 8", 6", 4")		1,200,000
3" service laterals		180,000
Isolation Valves		40,000
Upgrades to Airvac Proposal		170,000
Field Services by Airvac		100,000
Surface Restoration / Tank Decommission and 2" Service Laterals		600,000
Railroad Crossings		100,000
Tools, Parts, Temp Vac Pump		35,000
Subtotal		**4,890,000**
Taxes	8.40%	410,760
Subtotal		5,300,760
Engineering, Legal, Ad.	23%	1,219,175
Mobilization, Bonding, etc.	7%	371,053
Contractor O/H & P	15%	775,114
Subtotal		**7,686,102**
Contingency	25%	**1,921,526**
TOTAL		**9,607,628**

3.3.2 O&M Cost Estimate

The annual O&M cost is estimated at approximately $70,000, as shown on Table 3.2. Labor is estimated at $40/hr (for approximately 0.5 FTE). Power costs for vacuum pumps (to collect

sewage from the collection system) and centrifugal pumps (to deliver collected sewage to the WWTP) are based on the average annual flowrate (0.26 MGD) and $0.09/kWhr. Maintenance is estimated at $10,000/yr, including equipment replacement.

Table 3.2: Collection System Annual Operation and Maintenance Cost Estimate

Labor	40,000
Power	20,000
Maintenance	10,000
Total	**70,000**

Section 4: Treatment

4.1 Introduction

As discussed in the companion document GSP, Yacolt wastewater is composed exclusively of domestic sewage. Thus it will be amenable to standard treatment schemes, as it should not contain recalcitrant constituents.

A variety of treatment process alternatives were evaluated in the GSP. A Biolac system was selected. The proposed Biolac system is described in detail below, following a summary of the alternatives analysis presented in the GSP.

4.2 Process Choice - Background

Initially, each of these technologies was considered:

Suspended-Growth Systems

- conventional activated sludge
- sequencing batch reactor
- oxidation ditch
- membrane bioreactor (package system)
- biological nutrient removal (package system)

Fixed-Film Systems

- recirculating media filters – sand/gravel
- recirculating media filters – Orenco Advantex

Lagoon System – Parkson Biolac

These alternatives were evaluated and the following were considered to be most promising:

- conventional activated sludge
- membrane bioreactor (package system)
- biological nutrient removal (package system)
- lagoon System – Parkson Biolac

A fifth alternative was also considered. For this alternative, no treatment system would be constructed at Yacolt; rather, wastewater would be pumped to the Clark County's regional plant (Salmon Creek Treatment Plant, SCTP). This alternative requires construction of a force main and a pump station.

Each of these screened alternatives is capable of producing an acceptable effluent quality, as measured against these preliminary criteria:

- reduction of BOD5 to < 10 mg/l
- reduction of TSS to < 10 mg/l
- reduction of ammonia-N to 1 mg/l
- reduction of phosphorus to 2 mg/l

The Biolac lagoon system was selected among these alternatives due to lower present worth cost, simplicity of operation, and efficient treatment capability for meeting Yacolt's needs.

4.3 Process Description of Biolac and Auxiliary Facilities

4.3.1 General Description

Biolac is a proprietary process, however it is fundamentally an extended-aeration activated sludge process and thus is effective with widely-varying flow and waste loads. Biolac contains typical characteristics of extended-aeration systems, including long hydraulic and solids retention times, high microorganism concentration, and low food:microorganism ratio (F/M). Primary clarification is unnecessary and would not be utilized at Yacolt. The Biolac system which is proposed for Yacolt will achieve denitrification and phosphorus removal by biological means; the treatment scheme is similar to the modified MLE-type of activated sludge process and thus features an anaerobic zone upstream of the aeration basins, as discussed below.

Biolac utilizes an earthen basin lagoon with an integral clarifier for secondary clarification and an anaerobic zone to promote denitrification. A double liner of 100-mil HDPE or similar material, and a leak detention system, will be provided above the earthen basin in order to meet Ecology requirements for groundwater protection without constructing an adjacent monitoring well system. Figure 4.1 is a photograph of a Biolac system with an interior dividing wall. Figure 4.2 is a flow diagram of the proposed treatment process.

Raw wastewater first passes through a stainless-steel perforated fine screen (6 mm) for removal of particulate matter. The screen will be sized to handle the PHF of 0.77 mgd. The screening system uses a spiral rather than a basket. The spiral dewaters solid matter and conveys it to a receiving container. The screening system will be placed into a concrete channel; a parallel concrete bypass channel will be constructed also, and it will contain a manually-cleaned bar rack.

The screened wastewater then enters a concrete flow splitter box and anaerobic zone. The anaerobic zone will work in conjunction with the Biolac process by providing a zone without aeration; this anaerobic zone will thus favor the growth of denitrifying bacteria and will also reduce the growth of filamentous bacteria. This zone will receive return activated sludge (RAS) from the clarifiers, and it will contain mixers to prevent deposition of solids.

Influent then enters the Biolac basins where fine bubble diffuser assemblies are suspended above the basin floor by floating aeration chains. Fine bubble membrane diffusers are attached to the aeration chains; they are moved across the basin by air released from the diffusers. The moving diffuser assemblies provide efficient mixing of lagoon contents as well as high oxygen

transfer. The action of air delivery and moving diffuser assemblies creates alternating multiple aerobic and anoxic “zones” known as “Wave Oxidation”. Air delivery will be controlled by PLC programming and flow-paced with blowers powered by variable-frequency drives. Mixed-liquor dissolved oxygen concentration (DO) will be monitored and compared to a threshold value. If DO falls below this value, an additional blower will be started.

Solids in effluent from the Biolac basin are settled in an integral clarifier which shares a common wall with the Biolac aeration zone. Figure 4.3 provides a cross-section of a typical Biolac clarifier. Biomass is separated from the mixed liquor in the clarifier. A floating flocculating rake mechanism travels back and forth across the length of the clarifier to aid in solids settling and distribution. Settled sludge is collected in the bottom of the clarifier by a stationary suction pipe and pumpd by an airlift pump which discharges to a channel and then the RAS piping. Sludge from the clarifier (RAS) will be recycled to the anaerobic zone, by gravity. Biomass wasting is controlled by an automated valve. The clarifiers will be constructed of concrete, as will the anaerobic zone. A facultative sludge lagoon will be constructed for treatment and storage of sludge that is collected from the clarifier, as discussed below. Effluent flows over a fixed V-notch overflow weir. Floating materials and debris are removed using a rotating scum removal system.

Clarified wastewater then enters the UV system for disinfection. The UV system will be comprehensive featuring two independent UV banks, each with four modules of four UV lamps. The lamp assemblies will be contained within an outdoor stainless-steel channel. Transition boxes at both ends of the channel will connect to influent and effluent piping. A weir will be contained within the channel in order to maintain submergence of lamps at all times. The UV system will have a firm capacity of 0.56 mgd and a total capacity of 1.12 mgd. Automated features will include shutoff of one bank when flowrate is less than 0.56 mgd, and real-time measurement of UV intensity with corresponding alarm.

4.3.2 Flow, Loading, and Effluent Water Quality

Design criteria for the Yacolt treatment facility are summarized in Table 4.1. Design flow and loadings were discussed in Section 2.

Effluent water quality parameters are carried forth from the GSP, however subsequent to approval of the GSP by Ecology (February 2011) modifications were made to the planned Biolac treatment scheme. The fundamental revision of the treatment scheme is a change to biological phosphorus removal, with nitrification and denitrification. (The previous scheme utilized filtration and alum feed for phosphorus removal, and did not denitrify.) This revision led to adjustments in the TSS and total nitrogen concentrations.

Table 4.1 presents both anticipated values of Biolac effluent quality (based on correspondence with Parkson), and proposed discharge permit limits. Permit limits will be higher than expected plant effluent values because they provide a safety factor corresponding to 95% confidence limits.

Table 4.1: Yacolt Treatment Plant Design Criteria

Design Flow Conditions (2029)	MGD	Remarks	
AAF	0.26	85 gpcd (=avg of ADF@80 & AWF@90)	
MMF	0.30	100 gpcd	
MWF	0.39		
PDF	0.7	PF = 2.3	
PHF	0.77	assume PF = 3 (low I&I)	
Design Loadings (2029)	**ppd @ MMF**	**Remarks**	
BOD5	600	0.2 ppcd (= 240 mg/l @ 100 gpcd ← MMF)	
TSS	600	0.2 ppcd (= 240 mg/l @ 100 gpcd ← MMF)	
Ammonia-nitrogen	75	90 @ MWF	
Effluent Water Quality	**Biolac Effluent**	**Proposed Permit Limits** [1]	
BOD5 (mg/l)	10	20 / 30	
TSS (mg/l)	15 [2]	20 / 30	
Ammonia-nitrogen (mg/l)	1	- -	
Total Nitrogen (mg/l)	8 [3]	10 / 15	
Phosphorus (mg/l)	2 [4]	- -	
pH	6 - 9	6 - 9	
Fecal Coliforms	- -	200/100 ml MGM / 400/100 ml WGM	
Process Design Criteria	**Design Values**	**Design Flow Condition**	**% Capacity, 1 Unit Out of Service**
Screen (6 mm), Capacity (MGD)	0.77	PHF	100% (via bypass)
Anaerobic Selector Zones(2) HRT, total (hr)[5]	4	MMF	50%
BIOLAC Lagoons (2)		MMF	50%
BIOLAC: F/M Ratio (1/day)	0.038		
BIOLAC: HRT, MMF (days)	2.1		
BIOLAC: MLSS (mg/L)	3,000		
BIOLAC: SRT, total (days)	58		
BIOLAC: Temperature (^{0}C)	20; 10 minimum		
Basin Dimensions[6]@grade/@floor(ft), each	114x55 / 90x31		
Side Water Depth (ft)	10		
Basin Volume, total, 2 basins (MG)	0.62		

Process Design Criteria	Design Values	Design Flow Condition	% Capacity, 1 Unit Out of Service
Clarifiers (2)			50%
Clarifier Surface Area, total, 2 basins (SF)	1,170		
Overflow Rate at AAF, (gpd/sf)		222	(444)
Overflow Rate at MMF, (gpd/sf)		256	(513)
Overflow Rate at PHF, (gpd/sf)		658	(1,316)
Aeration		MMF	100%
Blowers (3 units; 1 standby) (Hp, ea.)	15		
Estimated SCFM @MMF, total, 2 basins (for Nitrification & Denitrification)	438		
Est. Std Oxygen Rqmt. @MMF, total (lb/hr)	72		
Estimated Brake Hp @MMF, total	16		
UV disinfection capacity, 2 banks [7] (mgd)	1.12	PHF	100%
UV disinfection capacity, 1 bank O.O.S.	0.56	PHF	73%

Notes:

1 95% confidence limits, approximate.
2 Increase from GSP value of 10 mg/l due to switch to biological treatment for P (via selector zone & wave oxidation) from chemical feed and filtration.
3 Decrease from GSP value due to switch to biological treatment for P, which incorporates both nitrification and denitrification.
4 Land application expected to reduce [P] to 1 mg/l. Estimated influent [P] = 7.5 – 10.
5 Concrete, with mixers (not part of Parkson Biolac scope)
6 Construct as one basin with interior concrete dividing wall
7 Assume 65% transmittance

Proposed permit limits also take into consideration discussions with Ecology, and NPDES permit limits for similar plants in Washington. Limits would apply to both the MMF and the MWF conditions. BOD5 and TSS limits would be 20 mg/l and 30 mg/l for MMF and MWF, respectively. Total nitrogen would be limited to 10 mg/l and 15 mg/l. Fecal coliforms would be limited to 200 / 100 ml and 400 / 100 ml.

Nitrogen concentration will be limited by the permit. It is anticipated that total nitrogen will be listed, with a MMF limit of 10 mg/l and a MWF limit of 15 mg/l.

Although phosphorus is not anticipated to be listed in the permit, it is targeted for removal as discussed herein. The Biolac process will be designed to remove phosphorus to 2 mg/l or less. Furthermore, it is anticipated that a further reduction will occur via land application as the treated effluent percolates through the soil, based on an EPA reference[7]. (The reduction is difficult to predict, but a reduction of 50% is likely.) Nitrogen concentration will be reduced

[7] USEPA "Process Design Manual for Land Treatment of Municipal Wastewater", EPA 625/1-81-013, Section 5.2.3, October 1981.

similarly. An alum feed system will also be provided as a backup system for phosphorus removal.

Fecal coliform concentrations will be reduced by the Biolac and UV disinfection processes, as discussed below.

4.3.3 Sizing, Process Design Criteria, and Equipment

4.3.3.1 Sizing

The required sizing of the Biolac basins for meeting effluent quality parameters was determined by Parkson. Plant sizing is straightforward and follows standard, commonly-accepted formulas. (Calculations are provided in Appendix D.) This subsection describes the criteria presented in Table 4.1.

The plant will be designed and operated with a solids retention time (SRT) of 55 to 60 days. This represents a long sludge age, with most microorganisms operating in the endogenous respiration zone. It is expected that the sludge will be relatively stable with low VOC content, as a result; this makes feasible the use of a facultative sludge lagoon (discussed below).

4.3.3.2 Process Design Criteria

- **MLSS.** The estimated mixed liquor suspended solids concentration is 3,000 mg/l. This is a common value for an extended-aeration activated sludge plant, although perhaps low for a SRT of 55 – 60 days. The expected MLVSS:MLSS ratio is 0.7 - 0.8.
- **Yield**. Heterotrophic yield is estimated at 0.5 based upon VSS; this is typical for extended-aeration long SRT processes.
- **F/M**. The estimated food:microorganism ratio is 0.038/day. This value is low, even for an extended-aeration activated sludge plant, although it reflects a high SRT of 55 – 60 days.
- **HRT**. The plant will have a hydraulic retention time of 2.1 days at the design MMF of 0.3 MGD. Because the basin will be divided into two by a full-length interior concrete wall, it will be possible to operate only one basin during the early years of the plant and still maintain a similar HRT.
- **SVI**. Parkson has indicated that the value of this process monitoring / operational parameter will be between 80 and 120.
- **Temperature**. The design temperature of the raw wastewater entering the Biolac basins is 20 degrees C; the assumed minimum temperature is 10 degrees C.
- **Anaerobic Selector Zone.** The selector zone will be sized for a total hydraulic detention time of 4 hours at the design MMF of 0.3 MGD. Both Biolac basins will have a hydraulically-isolated (upstream) selector zone.
- **Biolac Basin Dimensions.** Assuming that a single basin with a concrete dividing wall is constructed, rather than two separate basins, the dimension of each basin at its high point will be 114 ft by 55 ft, and 90 ft by 31 ft at the floor. The side water depth is 10 ft. The total basin volume is 0.62 MG. Note that during the preliminary design phase it will be necessary to assess freeboard requirements in order to accommodate peak rainfall and snowfall accumulations within the basin.

- **Clarifiers.** The clarifier overflow rates are 256 gpd/sf and 658 gpd/sf for MMF and PHF, respectively, with both units in service.
- **UV Disinfection System.** As noted above and shown on Table 4.1, it is expected that Yacolt's discharge permit limit for fecal coliforms will be 200 coliforms per 100 ml on a MMF basis (i.e., Geometric Mean (GM) of 30 consecutive daily grab samples), and 400 coliforms per 100 ml on a MWF basis (i.e. GM of 7 consecutive daily grab samples). The UV system will be designed to deliver a minimum UV dose of 30,000] µWs/cm2 mJ/cm2, in effluent with a UV Transmission of 65]% after reductions for quartz sleeve absorption, sleeve fouling, and lamp aging. Appendix E contains figures of the proposed configuration.

4.3.3.3 Equipment

Table 4.2 presents a summary of unit processes and corresponding major equipment for the Yacolt WWTP. Major equipment at the Yacolt WWTP will consist of:

- Aeration assemblies
- Blowers
- PLC (WaveOx) control including DO feedback loop
- Pumps
- Mixer(s)
- Mag Meter
- UV
- Basket Screen

4.4 WWTP Location and Layout

Figure 4.4 presents the tentative location of the Yacolt WWTP and also the proposed location of the discharge site. The Town tentatively plans to purchase a minimum of 5 acres on a 21.6-acre lot for siting the plant; this is more area than the plant and solids lagoon require, therefore the layout for these facilities need not be compressed and ample area would be available for future expansions. A detailed layout of unit processes within the WWTP will be developed during the preliminary design phase. Figure 4.4 provides conceptual locations for the WWTP, the facultative lagoon, and piping.

The proposed location is approximately one half mile away from Town limits, yet would be relatively close to the vacuum station and the discharge site. This is desirable in order to minimize the amount of piping and pumping between these facilities.

The proposed location of the plant provides a buffer from the Town, which would mitigate citizens' concerns over adverse aesthetic impacts of siting the plant near their residential area.

4.5 Redundancy

The plant will meet all reliability and redundancy requirements for a Class II WWTP as defined by Ecology and discussed in Section 6.1.10. Table 4.2 summarizes redundancy features associated with each unit process. A description of the major plant redundancies follows. The proposed treatment system will essentially provide multiple parallel trains of unit processes, as required by Ecology for systems for which peak hourly flowrate will be three times the average annual flowrate.

Table 4.2: Unit Processes and Major Equipment

Unit Process	Typical Design Flow Condition	Projected 2030 Flow @ Design Condition (Mgd)	Proposed Type Of Equipment	Number Of Units	Redundancy	Design Capacity Of Units, Firm (Mgd)
Influent Pumps (@ vacuum station)	Peak Hourly Flow (PHF)	0.77	Centrifugal Nonclog	3 @ 315 gpm ea. (7.5 Hp ea.)	1 standby	0.79
Screen	PHF	0.77	Parkson Helisieve[a]	1	Bypass channel	0.77
Biolac Basin	Maximum Month Flow (MMF)	0.3		2	1 basin operational when 1 basin O.O.S.	0.3 (@600 ppd BOD/TSS)[b]
Blowers		0.3	PD units with VFDs	3 @ 15 Hp ea.	1 standby	0.3
Anaerobic Zone		0.3	2 hr HRT @MMF	2 @ 2 hr ea.	1 can standby	0.3
Anaer. Zone Mixer		0.3	3-Hp mechanical mixer	2	1 can standby	0.3
Final clarifiers	75% of MMWF w/1 unit O.O.S.	0.3	(proprietary)	2	1 can standby	0.3[c]
RAS Airlift Pumps				2	1 uninstalled (stored on site)	
UV Disinfection	PHF	0.77	Low-Pressure	2	2 banks	0.56
Effluent Pump Station	PHF	0.77	Centrifugal	3 @ 275 gpm ea. (7.5 Hp ea.)	1 standby	0.79

Notes:

(a) or equal
(b) Can also handle MWF = 0.39 MGD / 780 ppd BOD/TSS
(c) Refer to Table 4.1 for overflow rates

The screen system will feature a bypass channel with bar rack. Thus it will continue to provide removal of larger solids if the screen is disabled.

The Biolac treatment system will be constructed from a single lagoon however it will be divided by a concrete wall into two hydraulically-isolated basins, as noted above. Therefore if one basin were to be taken out of service then the other could handle the full influent flow for a temporary period. The Biolac system can handle at least 10 lb BOD5 / 1,000 cubic feet; the proposed basin volume is 0.62 MG (total for 2 basins) therefore the system can handle at least 830 ppd BOD5, or 38% more than the projected 2029 MMF BOD loading. Thus the maximum week condition could be handled. A standby blower will be installed, and could be used if necessary to handle higher loads. Also, Yacolt will have a spare airlift pump and a spare mixer in storage if required, in case one is needed.

A standby pump will be provided for delivering raw wastewater to the plant from the collection system vacuum station. Treated and disinfected effluent will be pumped from the plant to drainfields, as discussed above. A standby pump will be provided for effluent pumping also.

The UV disinfection system will contain two separate banks. The capacity of each bank will be 0.56 MGD. Thus if one bank is out of service, then the active bank will fully disinfect MMF and MWF, and would partially-disinfect PHF.

Electrical service will be provided by Clark Public Utilities via a drop from an existing service line along Railroad Ave. A new 150-kVA transformer and electrical conduit will be provided to the plant as part of this project. An emergency generator will be provided. The generator will be sized to handle all loads at the treatment plant.

4.6 Operation During Initial Period of Low Loadings

During the first few years of the facility's life, flowrate and loadings will be significantly lower than in at the end of the facility's planning period; in addition, flowrate and loadings may be lower than projected due to current depressed economic and population growth.

As noted above, each basin can handle at least 415 ppd BOD5 / TSS. This is a conservative value; most likely each can handle at least 450 ppd, which corresponds to a loading of 11 lb BOD5 (or TSS) / 1,000 cubic feet. Therefore it is probable that only one treatment train would be operated during the first year(s) following construction. However Biolac can handle BOD5 loads as low as 4 lb BOD5 (or TSS) / 1,000 cubic feet, which corresponds to 330 ppd. Therefore it would be feasible to operate both trains as soon as the facility is constructed.

4.7 Expansion

The capacity of the facility could be expanded by providing additional air delivery; the initial construction will feature diffuser assemblies which could accommodate 67% more diffusers. Additional or larger blowers could be provided as needed.

Clarification efficacy would limit this approach to expansion. Larger expansions would necessitate construction of additional treatment trains. The site is relatively large and could accommodate such expansions, as discussed above.

4.8 Solids Handling

The Biolac plant will produce solids (which are in the waste activated sludge, WAS) which are relatively stable due to their long residence time which provides a measure of aerobic digestion. The GSP evaluated the following methods for solids handling:

- Drying (Class A)
- Lime Stabilization (Class A)
- Land Application (Class B)
- Facultative Lagoon
- Haul to Regional Facilities

The GSP recommended a facultative lagoon, and noted that hauling solids to regional treatment facilities should also be considered further. A brief comparison of these two alternatives for treating and disposing of WAS from the future plant is presented. The first alternative considered is to haul the WAS to the regional Salmon Creek Wastewater Treatment Plant (SCTP), and the second is to treat it in a facultative lagoon and then land-apply the solids as Class B biosolids.

4.8.1 Basis of Evaluation; Solids Production

The annual WAS and biosolids production during the 20-year period from 2010 to 2029 is used as the basis of solids production estimating, and is shown in Table 4.3. Although the earliest years of this period have passed, this approach provides a feasible evaluation of solids production and handling costs, and affords a realistic comparison of the two handling alternatives. The listed WAS production of 269 ppd for 2029 was provided by Biolac (Appendix D, "Yacolt Sludge Production"). WAS production in preceding years is reduced in proportion to anticipated organic loadings as described in Section 2.

4.8.2 Alternative 1 - Haul Solids to Salmon Creek Treatment Plant

This option contains three cost components: (i) treatment, (ii) hauling, and (iii) storage. Each is discussed below.

4.8.2.1 Treatment

Costs for Yacolt solids disposal at the SCTP would consist of:

<u>County Charges</u>

- treatment costs: $0.31/dry#
- testing costs: $45/load
- overhead charges: 14.97% of treatment & testing costs

<u>Clark Regional Wastewater District (CRWWD) Charges</u>

- capital recovery fee: $100.40/load
- pretreatment: $1,500 – $2,000 per year

Table 4.3: Estimated Costs of Hauling WAS to the Salmon Creek Treatment Plant

A. ANNUAL TREATMENT AND HAULING COSTS													
			2010	2029									
BIOLAC WAS (TSS)		lb/d	184	269									
						County Costs (based on Ridgefield)				**CRWW District Costs**		***Hauling Costs***	
	WAS Produced		assume WAS concentration =		3%							*assume*	**TOTAL**
Year	Pounds/Day	Gal/Day	Gallons/Year	loads / year	dry lb/ year	cost to treat	cost to test	overhead cost	**Total Annual**	Capital Recovery	Pretreatment	*load cost =*	**ANNUAL**
						(@ 0.31/dry#)	(@ 45/load)	(@ 14.97%)	**County Costs**	(@100.40/load)	(estimated)	*500*	**COSTS**
2010	184	735	268,425	54	**67160**	**$20,820**	**$2,416**	**$3,478**	**$26,714**	**$5,390**	**$1,500**	***$26,843***	**$60,446**
2011	188	751	274,261	55	**68620**	**$21,272**	**$2,468**	**$3,554**	**$27,295**	**$5,507**	**$1,500**	***$27,426***	**$61,728**
2012	193	771	281,555	56	**70445**	**$21,838**	**$2,534**	**$3,648**	**$28,020**	**$5,654**	**$1,500**	***$28,155***	**$63,330**
2013	197	787	287,390	57	**71905**	**$22,291**	**$2,587**	**$3,724**	**$28,601**	**$5,771**	**$1,500**	***$28,739***	**$64,611**
2014	202	807	294,684	59	**73730**	**$22,856**	**$2,652**	**$3,819**	**$29,327**	**$5,917**	**$1,500**	***$29,468***	**$66,213**
2015	206	823	300,520	60	**75190**	**$23,309**	**$2,705**	**$3,894**	**$29,908**	**$6,034**	**$1,500**	***$30,052***	**$67,494**
2016	211	843	307,814	62	**77015**	**$23,875**	**$2,770**	**$3,989**	**$30,634**	**$6,181**	**$1,500**	***$30,781***	**$69,096**
2017	215	859	313,649	63	**78475**	**$24,327**	**$2,823**	**$4,064**	**$31,214**	**$6,298**	**$1,500**	***$31,365***	**$70,377**
2018	220	879	320,943	64	**80300**	**$24,893**	**$2,888**	**$4,159**	**$31,940**	**$6,445**	**$1,500**	***$32,094***	**$71,979**
2019	224	895	326,779	65	**81760**	**$25,346**	**$2,941**	**$4,235**	**$32,521**	**$6,562**	**$1,500**	***$32,678***	**$73,261**
2020	229	915	334,073	67	**83585**	**$25,911**	**$3,007**	**$4,329**	**$33,247**	**$6,708**	**$2,000**	***$33,407***	**$75,362**
2021	233	931	339,908	68	**85045**	**$26,364**	**$3,059**	**$4,405**	**$33,828**	**$6,825**	**$2,000**	***$33,991***	**$76,644**
2022	238	951	347,202	69	**86870**	**$26,930**	**$3,125**	**$4,499**	**$34,554**	**$6,972**	**$2,000**	***$34,720***	**$78,246**
2023	242	967	353,038	71	**88330**	**$27,382**	**$3,177**	**$4,575**	**$35,134**	**$7,089**	**$2,000**	***$35,304***	**$79,527**
2024	247	987	360,332	72	**90155**	**$27,948**	**$3,243**	**$4,669**	**$35,860**	**$7,235**	**$2,000**	***$36,033***	**$81,129**
2025	251	1,003	366,167	73	**91615**	**$28,401**	**$3,296**	**$4,745**	**$36,441**	**$7,353**	**$2,000**	***$36,617***	**$82,410**
2026	256	1,023	373,461	75	**93440**	**$28,966**	**$3,361**	**$4,839**	**$37,167**	**$7,499**	**$2,000**	***$37,346***	**$84,012**
2027	260	1,039	379,297	76	**94900**	**$29,419**	**$3,414**	**$4,915**	**$37,748**	**$7,616**	**$2,000**	***$37,930***	**$85,294**
2028	265	1,059	386,591	77	**96725**	**$29,985**	**$3,479**	**$5,010**	**$38,474**	**$7,763**	**$2,000**	***$38,659***	**$86,895**
2029	269	1,075	392,426	78	**98185**	**$30,437**	**$3,532**	**$5,085**	**$39,054**	**$7,880**	**$2,000**	***$39,243***	**$88,177**
												Total	**$1,486,232**
B. CAPITAL COST -- PLASTIC STORAGE TANK w/CONCRETE PAD:					**150,00**	(installed)							

4.8.2.2 Hauling

The cost of a 5,000-gallon truck to deliver solids approximately 30 miles to the SCTP is estimated at $500/load. The number of loads per year is listed on Table 4.3 (e.g. 78 loads in 2029).

4.8.2.3 Storage

In addition to operational expenses, this option carries a capital cost for a sludge storage tank. Kennedy/Jenks estimates a cost of $150,000 for a 10,000-gallon storage tank. The tank would be plastic, mounted on a concrete pad. Secondary containment and insulation for freeze protection are assumed.

Estimated costs are summarized on the Table 4.3. Total estimated annual costs vary from approximately $60,000 at the beginning of the period considered to approximately $90,000 20 years later, with a total of approximately $1.5 million. (Note: costs are not adjusted to a present worth value.)

4.9 Alternative 2 - Facultative Sludge Lagoon

4.9.1 Facility Sizing

A facultative sludge lagoon would be sized to store deposited solids for a period of 7 years between dredgings. (This would require approval from Ecology's Solid Waste Division; however preliminary discussions with Ecology indicate that this approach is approvable.) Lagoon decant would be recycled back to the head of the Biolac treatment train.

In order to develop a preliminary size for the lagoon, the annual WAS production over the planning period was estimated. Sludge production over the final 7 years was used to size the solids-carrying capacity of the lagoon: sludge production was estimated at approximately 650,000 dry pounds, or approximately 325 dry tons.

The anticipated rate of treatment within a facultative lagoon in terms of reduction of volatile organic content would be minimal; this is because the Biolac sludge age will be greater than 50 days. (Fecal coliform counts would be reduced greatly by residence time in the lagoon, however.) A net reduction of 10% of solids mass between dredgings (i.e. a 7-year period) was also assumed. Following this, an assumption was made of 6% solids concentration in the biosolids. This assumption is based on anticipated characteristics of the extended-aeration Biolac plant and also on recent results from dredging the sewage lagoon in Battle Ground, WA (2011). This results in a required solids holding capacity of approximately 155,000 cuft, assuming a specific gravity of 1.01 for solids.

The facultative lagoon would have a depth of 6 ft for solids containment, and another 2 ft of depth for water cap and another 2 ft of depth for freeboard. Lagoon area is estimated at 26,000 sf.

The estimated a construction cost is $200,000, which includes earthwork and installation of a double liner (of 100 mil HDPE each layer) with a leak detection system.

4.9.2 Land Application

Based on bid results for dredging of the Battle Ground lagoon (2011), a cost of dredging the future Yacolt facultative lagoon is estimated at between $800 and $850 per dry ton (in 2012 dollars). Using the estimated sludge mass of 325 dry tons from the final 7 years of the planning period, a cost of $270,000 was derived. In order to provide a conservative estimate of operation and maintenance cost, this $270,000 cost for dredging and land application also was applied to the first two 7-year intervals within the period considered for a total cost of $810,000 (not adjusted to a present worth value). Note that another option for sludge disposal would be to landfill, however land application is environmentally preferable because the solids are essentially recycled into (growing) crops.

4.10 Recommended Approach for Solids Handling

The facultative lagoon option appears to be less costly, as the estimated capital cost is similar to but approximately $50,000 greater than that of the haul option, but the estimated annual costs are lower. It may be possible to reduce the capital costs associated with hauling solids to the SCTP. If Yacolt were to purchase their own tank truck and collect WAS directly into the truck, they could avoid the cost of a storage tank and also reduce hauling charges. However they would have less storage capacity which would be a detriment during poor weather.

Also, the lagoon option leaves a lower “carbon footprint” as compared to hauling solids to the SCTP, by eliminating hauling (except when dredging).

The facultative lagoon option is recommended, primarily because this approach is less costly. However either option is viable as long as solids processing capacity is available at the SCTP. Also, it would be possible to initially use a facultative lagoon and then transition to hauling solids to the SCTP in future years.

Note that consideration was given to using the 2nd Biolac train as a sludge lagoon during the early years of the facility life; however it was decided to not plan for this approach because it would eliminate Biolac treatment redundancy, and it may not provide adequate storage capacity. As indicated above, 2 Biolac trains would not be underloaded during the initial years.

4.11 Maintenance Building

A maintenance building will be constructed at the site of the wastewater treatment plant. The building will be a slab on grade with steel roof and partial or fully-open sides, i.e. a pole barn. The building will be used to store maintenance equipment, blowers, and a small alum feed unit (and drums of alum). The building is sized at approximately 1,000 SF.

Note that a laboratory/administration building is not planned as part of this project. Samples would be analyzed by a contracted laboratory. Monitoring of WWTP process, vacuum collection station, and pumps would be done local to the facilities and also at Town Hall via a web- or radio-based system.

4.12 Operation and Maintenance Staffing

Kennedy/Jenks recommends that the Town of Yacolt hire an employee for operation and maintenance (O&M) of the new sewage system. Based on the "Northeast Guide for Estimating Staffing at Publicly and Privately Owned Wastewater Treatment Plants", 1.5 FTE is required. (Reference Appendix F.) However the Public Works Director and his assistant at the Town will carry out some O&M responsibilities, thus 1.0 FTE should be adequate. Once the system is online and actual O&M requirements are better-defined, the Town can make staffing adjustments as required.

For purposes of estimating O&M costs (below), 0.75 FTE is assumed for the WWTP and approximately 0.5 FTE is assumed for the collection system (noted in Section 3).

4.13 Transmission of Raw and Treated Wastewater

Based on discussions with Clark County[8] (owner of the railroad right of way), it will be feasible to install transmission piping in the railroad easement along Railroad Ave. Two pipelines will be installed in this easement: (i) the 6-inch line which will pump raw sewage from the vacuum collection station to the wastewater treatment plant, and (ii) the 6-inch line which will pump plant effluent to the discharge trenches, as shown on Figure 4.4. (Note that the capital cost for these two force mains is included in the following section.)

4.14 Cost Estimates

4.14.1 Capital Cost Estimate

The estimated capital cost for the wastewater treatment plant is $2.85 M. This estimate is composed of the following major categories and associated unburdened, installed costs:

- Biolac equipment and fine screen (1): $680,000 (N/I earthwork or concrete)
- UV disinfection system: $80,000
- Auxiliary equipment: $100,000
- Earthwork and liner / leak detection: $60,000
- Concrete: $430,000 (Incl. slab and roof for "maintenance building", i.e. pole barn)
- Facultative lagoon, liner/leak detection: $100,000

These costs are listed on Table 4.4. Cost estimating markups are then applied in order to account for taxes, ELA, mobilization, contractor overhead and profit, and contingency.

[8] Jon Holladay, Chelatchie Prairie Railroad (360.397.2323x4113), February 14, 2012

Table 4.4: Treatment Plant Capital Cost Estimate

Main Treatment Equipment (Installed)		
Item		**Cost**
Screen (Hycor)		
Biolac		
UV		
		$760,000
Auxiliary Equipment (Installed)		
Item		**Cost**
Electrical service		$50,000
Emergency generator		$25,000
Backup alum feed		$8,000
Mixer		$8,000
Gates		$9,000
		$100,000
Biolac Earthen Basin (Installed)		
		Cost
Earthwork		$10,000
Double liner & leak detection		$50,000
		60,000
Facultative Lagoon Costs (Installed)		
		Cost
Earthwork		$20,000
Double liner & leak detection		$80,000
		100,000
Concrete Costs (Installed)		
		Cost
Clarifiers (2)		$100,000
Anaerobic zone		$85,000
Screen, misc. pads		$15,000
Center wall		$30,000
Pole barn, slab		$200,000
		$430,000
Subtotal		**$1,450,000**
Cost Estimating Markups		
Taxes	8.40%	$121,800
Subtotal		$**1,571,800**
Engineering, Legal, Admin.	23%	$361,514
Mobilization, Bonding, etc.	7%	$110,026
Contractor O/H & Profit	15%	$235,770
Subtotal		**$2,279,110**
Contingency	**25%**	**$569,778**
TOTAL		**$2,848,888**

4.14.2 Operation and Maintenance Cost Estimate

The annual O&M cost is estimated at approximately $90,000 and in addition the dredging cost of approximately $270,000 will be realized every 7 years, as noted above. Labor is estimated at $40/hr (for 0.75 FTE). Power costs are based on the average annual flowrate (0.26 MGD) and $0.09/kWhr. Repair is estimated at $10,000/yr, including equipment replacement. A very small cost is included for the facultative sludge lagoons because they do not require scheduled O&M. Table 4.5 presents O&M costs.

Table 4.5: Treatment System Annual Operations and Maintenance Estimate

Item	Unit	Unit Cost / Hr	Quantity / Yr	Cost	Notes
Labor	FTE	40.00	1560	62,400	
Power	kWhr	0.09	200,000	18,000	
Blowers					(14 Hp)
Mixer					(6.5 Hp)
Pumps					(7 Hp)
UV					(2.5 kW)
					(average annual Q)
Maintenance	LS	10,000	1	10,000	
Total				**90,400**	

Section 5: Effluent Disposal

5.1 Introduction

This Section summarizes the work performed in sampling, analyzing, and determining a proposed location and system for discharging treated wastewater and for monitoring groundwater quality in the proximity of the proposed infiltration site for the Town of Yacolt. The basis for this Section 5 is the Technical Memorandum "Yacolt Hoag Street Discharge Memo"[9]. Information contained within that document is updated to reflect construction of new monitoring wells in the proposed infiltration site and further definition of proposed trench design and layout.

5.2 Field Investigation and Infiltration Tests

Kennedy/Jenks conducted a pilot infiltration test on 9 May 2011 and 10 May 2011 at two locations on the proposed Hoag Street site. The test locations were selected after a preliminary survey of soil conditions was performed. The locations of the test pits are within the Yacolt Loam which consists of cobbly loam at the base of the soil profile (23 to 60 inches). This lithology is consistent with field observations made during the excavation of the test pits.

The infiltration test sites were spaced so that measurements would be representative of the entire site area that will be occupied by the infiltration discharge system. The proposed infiltration discharge facility will be constructed approximately in an east-west configuration in anticipation of a southwesterly groundwater flow pattern that occurs throughout much of the central and southern Yacolt Valley. Note that although a southwesterly flow direction is common in the area, recent groundwater data from new groundwater monitoring wells within the proposed discharge site (discussed below) indicate that groundwater periodically flows in a northwesterly direction.

Constant-head infiltration tests were conducted at the two locations for a minimum of 18 hours. Data from the test pits are plotted on Figures 5.1a and 5.1b, and Table 5.1 summarizes the results. The tests involved the provision of constant flow to the infiltration area by use of a float-valve-controlled delivery system. Depth of water was maintained at approximately 16 inches above the bottom of the hole. The infiltration area consisted of a wooden plywood box constructed approximately 4 feet wide by 4 feet long with 4 feet of available depth. The test pits were excavated to approximately 7 feet below ground surface. Following the initial startup, consistent flow and infiltration were witnessed over the two test basin areas. Figure 5.2 displays the two test pit locations (TP-1 and TP-2).

[9] "Yacolt Hoag Street Discharge Memo", Kennedy/Jenks Consultants (7 September 2011).

Table 5.1: Summary of Infiltration Test Results at the Hoag Site, Yacolt

Location	Test Basin Area	Test Results	
	sf	gpm	gpd/sf[1]
TP-1	16	1.4	126.0
TP-2	15	3.2	307.2

1) 2029 Maximum Month Design Flow, gpd: 301,000

5.3 Correction Factor for Rapid Infiltration Area

Infiltration test results were 126 gpd/sf for TP-1 and 307 gpd/sf for TP-2. As the infiltration test is considered a short term rate, a correction factor is applied in order to approximate the long-term, sustainable infiltration rate.

Two references were used to determine the correction factor as recommended and provided by Ecology:

1. Stormwater Management in Western Washington Volume III, Hydrologic Analysis and Flow Control Design/BMPs (Washington State Department of Ecology Water Quality Program, February 2005, Publication No. 05-10-31) (Ecology Stormwater)

2. USEPA: Process Design Manual for Land Treatment of Municipal Wastewater (EPA)

Both of the references cited above were considered in determination of the design correction factor.

The Ecology Stormwater reference is considered first. This document specifies a correction factor which is composed of three parameters in order to establish a design infiltration rate: site variability, the degree of long term maintenance, and degree of influent control (i.e. quality of treatment plant effluent discharged). The value of each of these partial correction factors can range from 1.5 to 6. An analysis of these characteristics was conducted based on guidance provided. Table 5.2 summarizes this correction factor (CF) analysis.

Table 5.2: Ecology Stormwater Correction Factor Analysis

Characteristic	Partial Correction Factor	Rationale
Site Variability	2	The lower of two infiltration rates was used to calculate the short term infiltration rate, although some of the site will have infiltration capacity similar to that of the higher infiltration rate.
Degree of Long Term Maintenance	2	Yacolt will provide routine maintenance for the infiltration trench system as part of the overall WWTP maintenance program.
Degree of Influent Control	2	Wastewater treatment technology will consist of a Biolac Lagoon system to provide advanced treatment, including nitrogen and phosphorus removal.
Total Correction Factor	**6**	

The U.S. Environmental Protection Agency (EPA) reference is considered next. This document recommends that when rapid infiltration (RI) basin field testing is done, the design annual hydraulic loading rate should be not greater than 10-15 percent of the measured basin infiltration rate.

If a CF of 6 is applied to the measured rate, then the design infiltration rate will be 16.7 percent of the measured rate. This is slightly higher than the EPA guidance. Kennedy/Jenks believes this marginally-higher rate is justified considering the conservative design criteria associated with wastewater effluent from the proposed treatment system. As described in Table 4.1, effluent characteristics are anticipated as listed below (based upon monthly averages). Note that proposed permit limits contain higher values of these parameters, as shown on Table 4.1.

- BOD5: 10 mg/l
- TSS: 15 mg/l
- Total Nitrogen: 8 mg/l
- Ammonia-N: 1 mg/l
- Total Phosphorus: 2 mg/l

The quality of this effluent is significantly higher than that assumed by the EPA reference. Accordingly, the resultant fouling of the trenches will be far lower and take a much longer period. Requirements for degradation of N, P, and BOD5 after discharge are lower than generally assumed in the EPA reference.

Application of a CF of 6 to the measured infiltration rate of 126 gpd/sf results in a design loading of 21 gpd/sf (this equates to 2.8 ft/d or 85 cm/d). It is recommended that the facility be sized for

the maximum month wet weather flowrate (MMF) of 0.301 MGD, as discussed below. An RI area of 14,300 sf would be required to handle the MMF at a dose rate of 21 gpd/sf. Rest cycles and area requirements are discussed below.

The location of the proposed infiltration trench gallery is shown on Figure 5.2. (General location is provided on Figure 4.4.) The Town of Yacolt intends to purchase an 8-acre parcel (which is approximately one half of the available parcel).

5.4 Trench Phasing and Design Considerations

5.4.1 Phasing

Phasing considerations include the influences of population (and corresponding flow increases), trench application cycles (dose and rest cycles), and seasonality.

5.4.1.1 Population

As described in Section 2, the population and corresponding flowrate is expected to experience a steady increase during the planning period. For purposes of infiltration trench planning and (also for rate studies, as discussed in Section 8) it is assumed that the sewer system will be brought online in 2019. The projected 2019 MMF = 0.245 MGD and the projected 2029 MMF = 0.301 MGD.). Initial construction should meet initial discharge flowrate requirements and with additional trenches as needed to provide adequate rest cycles. As trench construction is relatively simple, additional trenches can be added when needed.

5.4.1.2 Required Dose / Rest Cycles

The EPA reference provides numerous examples of dose/rest cycles for operating systems whereby secondary effluent is fed to RI systems. Optimum dose/rest cycles are strongly affected by soil permeability, effluent quality, RI objectives, and other factors. A cycle with equal periods of dose and rest under MMF is suggested as a reasonable starting point for initial operation; however, to be conservative, provisions should be made for longer rest periods if needed.

5.4.1.3 Seasonal Variations in Flowrate

Projections of sewage flowrates are based on planning criteria which range from 100 gallons per capita per day (gpcd) to 80 gpcd, depending on the flow condition. This provides an indication of seasonal variation; however, while seasonal variation may occasionally exceed these planning values, it is unlikely with the construction of an entirely new vacuum collection system.

5.4.2 Design Concepts

5.4.2.1 Trenches: Number and Size

It is recommended that the RI system be sized for MMF rather than peak hourly flow (PHF) because the trenches will have a depth of approximately seven feet and thus will contain a significant holding capacity which will prevent overflow during PHF. Also, it is assumed that equalization facilities will not be provided.

Trench area should be designed with a high degree of flexibility, allowing future adjustment of dose / rest cycles, accommodation of deviation from projected population increases, and seasonal variation. This can be accomplished by initially constructing five trenches, each with a capacity of 100,000 gpd (and an effective area of approximately 4,800 sf). Assuming a MMF of 0.245 MGD at the time of plant startup, this would allow for operation via a cycle whereby the rest period is at least as long as the dose period under MMF conditions. (Rest periods would exceed dose periods when flow is less than MMF).

From a planning perspective, the expansion phase would require construction of an additional trench of 100,000-gpd capacity, and one or two additional trenches of equal size for rest periods. This would provide a total system discharge capacity of approximately 300,000 gpd. Operational practice and actual capacity of the initial trench construction should be considered prior to confirming the need for and the required number of additional trenches.

5.4.2.2 Trench Materials of Construction and Dimensions

The conceptual design of trench construction is a trench depth of approximately 7 feet with the bottom 3 feet comprised of drain rock (1 ½ " – 1 ¼ ") and the upper 4 feet of excavated or imported soil. Distribution piping of perforated D3034 PVC will be embedded in the drain rock.

Each trench will be approximately 8 ft wide with a length of approximately 600 ft. Two drain pipes will be laid in parallel within the length of each trench.

Infiltration trenches will be hydroseeded.

During the preliminary design phase a final layout for the RI system will be developed. Consideration should be given to required area between trenches, access roads, and any other buffer or set-aside area needs. Because a 10-acre site will be available for discharge trenches, land availability will not be a limitation.

5.5 Cost Estimate

The capital cost of the discharge system is estimated at $0.65 M. This cost is based on the rapid infiltration trenches as described immediately above (for the planning period to 2029); a cost of $370,000 is anticipated. It also contains the cost for two 6-inch PVC force mains to deliver sewage to the WWTP and also to the trenches for discharge, and for the corresponding pump station at the WWTP; this cost is estimated at $280,000 including an allowance for boring below railroad crossings. As discussed above for capital cost estimates for collection and treatment systems, the estimate contains markups for taxes, engineering/legal/administration, contractor overhead/profit and mobilization, and contingency @ 25%.

5.6 Monitoring Well Plan

Three groundwater monitoring wells were installed on November 14/15, 2012 in order to monitor groundwater quality in the vicinity of the proposed infiltration trenches and to evaluate the groundwater gradient flow direction. These wells were named MW-5, MW-6, and MW-7. Construction details and groundwater elevations are presented in Table 5.3. Well locations are shown on Figure 5.2. Figure 5.3 shows the topography of the property to be acquired for infiltration trenches.

Table 5.3: Monitoring Well Construction Details and Groundwater Elevations

Monitoring Well	Total Depth (below ground surface)	Screen Interval (below ground surface)	Top of Casing Elevation	Depth to Groundwater (11/14/2011)	Groundwater Elevation (11/14/2011)
MW-5	75	35 - 75	708.30	66.4	641.6
MW-6	70	30 - 70	699.57	58.2	643.7
MW-7	75	35 - 75	696.54	54.7	642.3

The lithology in the Yacolt area, described in the Yacolt Hydrogeologic Study[10], consists of variable assemblages of gravel, sand, and silt and there does not appear to be extensive low permeability units present in the valley. The Yacolt Aquifer exists within these sediments, which act as a single stratigraphic unit. Hart Crowser derived hydraulic conductivity measurements that are consistent with moderately-permeable silty sands to highly-permeable sandy gravels.

Based on this study and also the Town of Yacolt Wellhead Protection Plan Update[11], groundwater in the vicinity of the proposed infiltration trench typically flows to the southwest. However as shown on Table 5.3, groundwater elevations at the three wells during the time of well construction indicated a northwesterly flow direction, and so it is probable that flow direction varies from northwest to southwest depending on season and other factors. This does not introduce a problem for monitoring the effect of WWTP discharge on groundwater quality because in either case there will be one upgradient well and two downgradient wells.

(Originally MW-5 was positioned in the presumed upgradient direction (north) of the northernmost infiltration trench and MW-6 and MW-7 were positioned in the presumed downgradient direction (south) from the infiltration trenches. The wells are located a distance from the nearest future trenches in order to avoid the influence of water table “mounding” from the infiltration trenches. Yacolt has gained a legal access agreement from the individual who owns the property on which the wells are located.)

The hydraulic gradient is lowest when the water level elevation is lowest (during dry months) and highest when the water level elevation is highest (during wet months). Multiple water level measurements collected from monitoring well MW-4, located approximately 1,200 feet southwest of the proposed infiltration trench area, indicated the depth to groundwater ranges from 14 to 48 feet. However depth to groundwater at MW-5, MW-6, and MW-7 on the date of their construction ranged from 55 ft to 68 ft as shown on Table 5.3.

Water level elevations will be measured in the new monitoring wells beginning in Spring 2012 (tentatively). This will provide multiple years of data on water table elevations prior to operation of the new sewer system. Water from these wells will be sampled and tested for water quality beginning at least one year prior to operation of the system, in accordance with Ecology standard permit requirements for groundwater monitoring in association with treated municipal wastewater discharge to land.

[10] Hart Crowser, 4 January 1996
[11] Pacific Groundwater Group, 12 May 2003

New groundwater monitoring wells MW-5 and MW-6 have a total depth of 75 ft; MW-6 has a total depth of 70 ft. The three wells were constructed according to requirements of WAC173-160 and feature 2-inch PVC casing and 40 feet of PVC screen. Wells were constructed with a greater depth than originally intended because groundwater depth at time of drilling exceeded expectations; final well depths will accommodate the range of groundwater levels without the top of the screened interval being submerged.

Appendix G includes historic groundwater elevations for monitoring well MW-4 and other monitoring wells in the Yacolt area, and the well logs for MW-4, MW-5, MW-6, and MW-7.

Section 6: Regulatory Requirements

Numerous regulatory requirements govern the operation, planning, design, and construction of a wastewater system. These requirements directly affect facility sizing, treatment levels, effluent disposal, biosolids management, etc. This chapter provides a summary of the primary regulatory requirements which will potentially apply to the Yacolt wastewater system. Both liquid stream (wastewater) and solids are considered.

6.1 Wastewater

6.1.1 NPDES Permit Program

The Federal Water Pollution Control Act (i.e., Clean Water Act) was developed in 1972 to establish water quality standards for surface waters of the United States for the protection of public health, continuation of public enjoyment, and protection of fish, shellfish, and wildlife. One mechanism for achieving the goals of the Clean Water Act is the National Pollutant Discharge Elimination System (NPDES) permit program, which regulates discharges to surface water. The U.S. Environmental Protection Agency (EPA) has delegated responsibility to administer the NPDES permit program to the State of Washington. The Revised Code of Washington (RCW) Chapter 90.48 and Chapter 173-220 of the Washington Administrative Code (WAC) define Ecology's authority and obligations in administering the program.

In order to obtain an NPDES permit, Ecology must first prepare a draft permit and accompanying fact sheet. At least 30 days before the proposed permit is issued, public notice must be given that the fact sheet and draft permit are available for public review.

The permit itself contains a number of general conditions, which are common to all surface water discharges, as well as special conditions, which are specific to each individual discharge. The general conditions govern permit actions, permit modification, plan review, fees, and permit violations, among other things. The special conditions generally cover the following topics:

- Discharge limitations
- Monitoring requirements
- Reporting and recordkeeping requirements
- Facility loading
- Operation and maintenance
- Pretreatment
- Residual solids.

The list above is common to NPDES permits for other local treatment plants such as at the City of Washougal.

6.1.2 State Waste Discharge Permit

The Town of Yacolt will require a State Waste Discharge Permit (SWDP) rather than an NPDES permit because WWTP effluent will be discharged to land rather than to a surface water, as described in Section 5. Most of the requirements associated with an NPDES permit also apply to a SWDP. However, requirements specific to surface water discharge (e.g. mixing zone definition and dilution of acute and chronic toxic compounds) are not applicable. A summary of the anticipated requirements for Yacolt's SWDP are described below.

6.1.3 Discharge Limitations

Discharge limitations are derived, in part, from the domestic wastewater criteria for discharge to surface waters regulated under Chapter 173-221 WAC pursuant to the NPDES permit program. Effluent discharge limits for standard secondary treatment facilities are 30 mg/L monthly average BOD5 and TSS (or no more than 15 percent of the respective influent concentration, whichever is more stringent) and 45 mg/L weekly average BOD5 and TSS. However the Yacolt WWTP will need to meet stricter standards, as discussed in Section 3. Anticipated limits for BOD5 and TSS are 20 mg/l monthly average and 30 mg/l weekly average. Also, total nitrogen will most likely be limited to 10 mg/l monthly average and 15 mg/l weekly average. Limits for fecal coliform bacteria are 200 geometric mean per 100 milliliters (mL) of sample (#200/100 mL) monthly and #400/100 mL weekly. Effluent must maintain a pH between 6.0 and 9.0.

Ecology has indicated that a phosphorus effluent limit probably would not apply to the Yacolt treatment plant at this time, but limits may be applied in the future. The plant will provide phosphorus removal, as discussed in Section 4.

Although discharge limitations on metals for the Yacolt treatment plant are highly unlikely, the Yacolt plant could be subject to future metals limitations if industries discharging metals were to locate within the area.

6.1.4 Monitoring Requirements

Monitoring requirements generally include a monitoring schedule, sampling and analytical procedures, flow measurements, and laboratory accreditation. The monitoring schedule states the type, location and frequency of samples and the tests to be performed on each sample. Samples and measurements shall be representative of the volume and nature of monitored parameters, including any unusual conditions. An accredited laboratory shall prepare all monitoring data. Appropriate flow measurement devices shall be used to ensure reliable and accurate readings, and these devices shall be calibrated at least once a year.

6.1.5 Reporting and Recordkeeping Requirements

Reporting and recordkeeping requirements include reporting monitoring data, recording results, retaining records, additional monitoring, and reporting any instances of noncompliance. Monitoring data report forms are submitted monthly to Ecology. Generally, the permittee must retain records of all monitoring information for 3 years. Records pertaining to sludge monitoring must be kept for at least 5 years. Additional monitoring data must be included in the report. If a permit violation occurs, the permittee must notify Ecology immediately, take corrective action, and submit a detailed written report.

6.1.6 Facility Loading

This section of the SWDP permit designates maximum flow and loading to the treatment plant based upon the design criteria; requires notification of a new or altered discharge to the treatment plant; and may stipulate completing an evaluation of I/I, a waste load assessment, or a similar report.

The permittee must provide written notification to Ecology whenever any new discharge, increase in volume, or change in character of the existing discharge is proposed that would meet one of the following conditions:

Interferes with the operation of, or exceeds the design capacity of, any portion of the collection or treatment system.

- Qualifies the discharger as a Significant Industrial User (SIU, i.e. >25,000 gallons per day) or increases total system flow or influent waste load by more than 10 percent.
- Is not part of the approved General Sewer Plan or approved plans and specifications.
- Is subject to pretreatment standards under Code of Federal Regulations (CFR) 40 Part 403 and Section 307(b) of the Clean Water Act.

This written notice must include an evaluation of the system's ability to adequately transport and treat additional flow and/or waste load.

6.1.7 Operation and Maintenance

This section of the permit covers all aspects of plant O&M, from operator certification to the O&M program and bypass procedures. The permittee must maintain an adequate operating staff which is qualified to carry on the operation, maintenance and testing activities required to ensure compliance with permit conditions. The Yacolt treatment plant will be a Class II facility, requiring an operator with appropriate certification from the State of Washington to oversee day-to-day treatment plant operation.

An O&M manual must be kept at the treatment plant. This manual shall be used as a dynamic tool and updated regularly by the operators themselves, complete with notes on operation (e.g., what works, what does not work, what to do in certain conditions) and updates on equipment and process changes.

An O&M program is required for the entire system. Maintenance records must be kept for all electrical and mechanical systems, as well as wastewater treatment and pump stations. These records must be available for Ecology inspections.

If the facility plans a short-term reduction in treatment level that would cause an exceedance of permit effluent limitations, the permittee must provide a 30-day written notice to Ecology detailing the reasons for, length of time of, and potential effects of the reduced treatment level.

The permittee is responsible for maintaining adequate safeguards to prevent discharge of untreated or inadequately treated wastewater during an electrical power failure. This may be

accomplished by means of alternative power sources, a standby generator, or retention of the wastewater.

Bypasses of untreated or partially treated wastewater are to be avoided unless it is anticipated to accommodate maintenance or construction, essential for maintenance, or unavoidable. A detailed written application must be submitted to Ecology at least 30 days before undertaking any anticipated maintenance or construction work that will result in an overflow or bypass of wastewater. If a bypass is essential for maintenance and does not have the potential to cause permit violations, an application is not necessary for authorization. A bypass is considered unavoidable if it prevents loss of life, personal injury, or severe property damage.

6.1.8 Pretreatment

The permittee shall work cooperatively with Ecology to ensure that all commercial and industrial discharges to the treatment plant comply with pretreatment regulations. The permittee must submit a notice to Ecology at least 30 days before a SIU connects to the wastewater system. A commercial or industrial user cannot discharge any pollutants, which would pass through or interfere with the wastewater system. If any commercial or industrial user violates the permit, the permittee must notify Ecology as soon as possible. The permit contains a list of specific discharges prohibited from being released into the wastewater system.

6.1.9 Residual Solids

Residual solids include screenings, grit, scum, biosolids, and other solid waste. The permittee shall store and handle all residual solids in a manner that will prevent their entry into state ground or surface waters. The permittee shall comply with all applicable regulations of the local health district, Ecology, and EPA regarding beneficial use or disposal of biosolids.

6.1.10 Ecology Criteria for Sewage Works Design Reliability Requirements

Ecology's Orange Bookserves as a guide for the design of sewage collection, treatment, and reclamation systems. The reliability criteria within this publicationare particularly important to the development of a wastewater system. Ecology has established reliability standards for three classes (I, II, III) of sewerage works. Reliability classifications are based on the water quality and public health consequences of a component or system failure.

- Class I - "These are works whose discharge, or potential discharge, 1) is into public water supply, shellfish, or primary contact recreation waters, or 2) as a result of its volume and/or character, could permanently or unacceptably damage or affect the receiving waters or public health if normal operations were interrupted."

- Class II - "These are works whose discharge, or potential discharge, as a result of its volume and/or character, would not permanently or unacceptably damage or affect the receiving waters or public health during periods of short-term operations interruptions, but could be damaging if continued interruption of normal operations were to occur (on the order of several days)."

- Class III – "These are works not otherwise classified as Reliability Class I or Class II."

Ecology has indicated that the proposed Yacolt WWTP would be a Class II facility, and thus the facility will be designed and constructed to meet Class II requirements. In general, the sewage system must be capable of satisfactory operation during power failures, flooding, peak loads, equipment failure, and maintenance shutdown.

Except as modified below, unit operations in the main wastewater treatment system should be designed so that, with the largest-flow-capacity unit out of service, the hydraulic capacity (not necessarily the design-rated capacity) of the remaining units will be sufficient to handle the peak wastewater flow. System flexibility should be sufficient to reroute wastewater flow to the remaining units in service when any unit is out of service. Equalization basins or tanks are not considered a substitute for component backup requirements.

6.1.10.1 Class I

General requirements for Reliability Class I facilities are summarized below; specific requirements are described in EPA 430-99-74-001. For components included in the design of Reliability Class I works, the following backup requirements apply:

- Mechanically Cleaned Bar Screens: "A backup bar screen, designed for mechanical or manual cleaning, shall be provided. Facilities with only two bar screens shall have at least one bar screen designed to permit manual cleaning."

- Pumps: "A backup pump shall be provided for each set of pumps performing the same function. The capacity of the pumps shall be such that, with any one pump out of service, the remaining pumps will have the capacity to handle the peak flow."

- Primary Sedimentation Basins: "The units shall be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units should have a design flow capacity of at least 50 percent of the total design flow."

- Final Sedimentation Basins and Trickling Filters: "The units shall be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units should have a design flow capacity of at least 75 percent of the total design flow."

- Activated Sludge Process Components:

    - Aeration Basin: "A backup basin will not be required; however, at least two equal-volume basins shall be provided."

    - Aeration Blowers or Mechanical Aerators: "There shall be a sufficient number of blowers or mechanical aerators to enable the design oxygen transfer to be maintained with the largest-capacity-unit out of service. It is permissible for the backup unit to be an uninstalled unit, provided that the installed units can be easily removed and replaced. However, at least two units shall be installed."

    - Air Diffusers: "The air diffusion system for each aeration basin shall be designed so that the largest section of diffusers can be isolated without measurably impairing the oxygen transfer capability of the system."

- Disinfectant Contact Basins: "The units shall be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units shall have a design flow capacity of at least 50 percent of the total design flow."

- Electrical Power Sources: "Two separate and independent sources of electric power shall be provided to the plant either from two separate utility substations or from a single substation and a works-based generator located at the plant. If available from the electric utility, at least one of the power sources shall be a preferred source (e.g., a utility source that is one of the last to lose power from the utility grid because of loss of power-generating capacity). In geographical areas where it is projected that sometime during the design period, the electric utility might reduce the rated line voltage (i.e., brown-out) during peak utility system load demands, a generator shall be provided as an alternate power source, where practical." The minimum capacity of the backup power source shall be "sufficient to operate all vital components, critical lighting, and ventilation during peak wastewater flow conditions."

6.1.10.2 Class II

The Reliability Class I requirements shall apply except as modified below.

- Final Sedimentation Basins and Trickling Filters: "The units shall be sufficient in number and size so that, with the largest-flow-capacity unit out of service, the remaining units shall have a design flow capacity of at least 50 percent of the design basin flow."

- Electrical Power Sources: The same as Reliability Class I except the "vital components used to support the secondary processes (i.e., mechanical aerators or aeration basin air compressors) need not be operable to full levels of treatment, but shall be sufficient to maintain the biota."

6.1.11 Reclaimed Water

The State recognizes four classes of reclaimed water, which are distinguished by the level of post-secondary treatment provided. A new Draft Reclaimed Water Rule is available, however at the time of writing rule-making has remained suspended (since December 2010). The draft rule outlines administrative procedures and technical requirements for use of reclaimed water in Washington. Because reuse is not proposed for the Town of Yacolt, the new rule is not anticipated to impact the Town's planning for wastewater services.

6.2 Solids

6.2.1 Biosolids

Biosolids are the solids derived from primary, secondary, or advanced treatment of domestic wastewater that have been treated to significantly reduce pathogens and reduce volatile solids to the extent that they do not attract vectors. This term refers to domestic wastewater treatment facility solids that have undergone adequate treatment to permit their land application.

Because recycling biosolids through beneficial use provides a more environmentally sound solution than disposal, the EPA and Ecology are trying to shift the focus of biosolids from disposal to recycling. Most WWTPs in Washington beneficially use their biosolids through

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

Biosolids may be disposed via land application, surface disposal, or incineration. Because this Facility Plan recommends disposal via land application (per Section 4), standards and regulations associated with surface discharge and incineration are not discussed herein.

6.2.2 Biosolids Regulations

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

Ecology implements their regulatory authority in accordance with Chapter 173-308 WAC, which establishes requirements regarding biosolids management, treatment, storage, recycling, and permitting requirements. Ecology implements regulatory requirements through a wastewater facility's statewide General Permit for Biosolids Management. The permitting process to obtain coverage under the General Permit also addresses requirements under the State Environmental Policy Act and federal biosolids public notification requirements. The permit contains a complete description of a facilities biosolids beneficial use process including: flows, treatment processes, quantity and quality, hauling procedures, spill response plans, land application site information, and sale or give-away program for Class A Exceptional Quality (EQ) biosolids. A Biosolids General Land Application Plan and a Site Specific Land Application Plan are not required for facilities that generate Class A EQ biosolids.

The state biosolids regulations define three measures for biosolids quality:

- Pathogen Reduction
- Vector Attraction Reduction
- Pollutants.

6.2.3 Pathogen Reduction Requirements

Pathogens are disease-causing organisms such as viruses, parasites, and certain types of bacteria. These organisms are significantly reduced during the biosolids treatment process so that they can be beneficially used. Pathogen reduction requirements define two classifications of biosolids – Class A and Class B. These classifications indicate the density (number per unit mass) of pathogens in biosolids. Class A requirements necessitate almost the complete destruction of pathogens. Class B requirements call for significantly reducing the density of pathogens and land applying biosolids by implementing specific site management practices

such as buffers from rivers and streams. A third classification of biosolids is Class A EQ. This refers to biosolids that have met the Class A pathogen reduction requirements and have met the lower concentrations standards for pollutants or “metals.”

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

Class B biosolids must be treated using one of EPAs pathogen reduction alternatives, which include several treatment methods known as PSRPs, or an equivalent process. These processes include aerobic digestion, air drying, anaerobic digestion, and lime stabilization.

6.2.4 Vector Attraction Requirements

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

- Volatile solids in the biosolids must be reduced by a minimum of 38 percent.
- The specific oxygen uptake rate for biosolids treated by aerobic digestion must be less than or equal to 1.5 million gallons (mg) oxygen per hour per gram of total solids at a temperature of 20 °C.
- Aerobic processes shall treat the biosolids for a minimum of 14 days with an average temperature of at least 45 °C and a minimum temperature of 40 °C.
- Material containing no unstabilized biosolids must be dried to at least 75 percent solids.
- Material containing unstabilized biosolids must be dried to at least 90 percent solids.
- Lime or other alkali addition must raise the power of hydrogen (pH) of the biosolids to a minimum of 12 for two hours and maintain the pH at a minimum of 11.5 for an additional 22 hours without additional lime.

6.2.5 Site Management Practices

In addition to meeting pathogen reduction and vector attraction reduction requirements, Class B biosolids land application activities must implement certain site management practices. These practices include maintaining setback distances to drinking water wells and streams, controlling public access to the land application site, grazing or harvest restrictions based on the type of crop and biosolids application method, agronomic application rate calculations, and providing for public notification of the land application activity.

The use of Class A EQ biosolids does not require any of the site management practices described above and are essentially free of regulatory restrictions once the pathogen reduction and vector attraction reduction standards have been met in the WWTP.

6.2.6 Pollutants

Wastewater facilities that generate and beneficially use biosolids (e.g., agricultural land application) must monitor for and meet concentration limits for nine pollutants. These pollutants, commonly referred to as "metals," include: arsenic, cadmium, copper, lead, mercury, molybdenum, nickel, selenium, and zinc. In addition to the nine pollutants, several other parameters must be monitored. The parameters include nitrogen, phosphorus, potassium, pH, total solids, and volatile solids.

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

3. Ceiling Concentrations – All biosolids applied to the land must meet the ceiling concentrations for pollutants listed in Code of Federal Regulations (CFR) 40 CFR §503.13, Table 1. The ceiling concentrations are the maximum concentration limits for the nine regulated pollutants in biosolids. If a limit for any one of the pollutants is exceeded, the biosolids cannot be applied to the land until such a time that the ceiling concentration limits are no longer exceeded.

4. Pollutant Concentrations – Biosolids that are to be sold or given away; or applied to the land and are not to be required to calculate cumulative pollutant loading (see below) must meet the concentrations listed in 40 CFR §503.13, Table 3. If the pollutant concentrations for the nine regulated metals in biosolids are exceeded, then the facility must track the cumulative loading of the metals until such a time that the pollutant concentration limits fall below Table 3 levels.

5. Cumulative Pollutant Loading Rates – Biosolids that exceed the pollutant concentrations listed in 40 CFR §503.13, Table 3 but are below 40 CFR §503.13, Table 1, must be tracked and must not exceed the cumulative pollutant loading rates per hectare in accordance with 40 CFR §503.13, Table 2.

6. Annual Pollutant Loading Rates – Biosolids that meet Class A requirements with respect to pathogen and vector attraction reduction requirements, that are bagged, but do not meet the pollutant concentrations in Table 3 must not exceed the annual pollutant loading rates prescribed in 40 CFR §503.13, Table 4.

6.2.7 Coverage under Ecology's General Permit for Biosolids Management and Residual Solids Management Plan

Wastewater facilities that are subject to Ecology's General Permit apply for coverage under the existing general permit. This is done in two stages. The first stage is accomplished by submitting a Notice of Intent. This form notifies Ecology that a facility recognizes its obligations under the general permit. The second stage of the permit process is the submittal of a full permit application. This submittal addresses all aspects of biosolids management proposed by a facility. This includes review under the State Environmental Policy Act, public notice, and potentially public hearings or meetings.

Submittal of all permit application documents, meeting public notice requirements, and operating in compliance with the state biosolids rule (Chapter 173-308 WAC) and the General Permit for Biosolids Management results in a facility having "provisional approval". Provisional approval refers to the fact that there is an additional review process specific to each facility. As a condition of final approval of coverage, Ecology may impose additional or more stringent requirements beyond those of the basic general permit if they are necessary to protect public health or the environment. Permit applications must be submitted at least 180 days prior to beginning biosolids management activities.

6.3 Environmental Review

6.3.1 SEPA and SERP

On 22 February 2012 the Town issued a Determination of Non-Significance for this Facility Plan. The comment period ended on 8 March 2012; no comments were received. A SEPA checklist with the DNS was distributed, and a corresponding advertisement was published in the Battle Ground Reflector newspaper on 22 February 2012.

At the time of writing, Ecology is finalizing a revised State Environmental Review Process (SERP). In accordance with Ecology's draft SERP guidance document[12], the following activities have been executed:

1. Public Outreach: two meetings dedicated to educating the public and soliciting their questions and concerns were held. The meetings occurred on 27 February 2012 and 26 March, 2012.

2. Cost Effectiveness Analysis

These documents are being submitted to Ecology as a single separate document in association with this Facility Plan.

6.3.2 NEPA

The National Environmental Policy Act (NEPA) requires assessing the environmental impacts of actions affecting federal lands, considering those impacts while making decisions, and disclosing those impacts to the public. Because the proposed sewer system is not on federally-owned land, an environmental review is not required by NEPA.

6.3.3 CARA

A critical aquifer recharge area (CARA) permit may be required from the County.

[12] Washington Dept. of Ecology, "Draft Revolving Fund State Environmental Review Process and Federal Cross Cutter Guidelines" (August 2011).

6.4 Construction Permits and Approvals

6.4.1 Building and Grading Permits

A building permit and a grading permit will have to be obtained from the County for construction of the Yacolt sewer system.

6.4.2 Construction Stormwater Permit

A Construction Stormwater Permit is required for clearing, grading, excavating, or other construction activities which will disturb 5 or more acres of land and which will discharge stormwater from the site into surface water or storm drainage systems which discharge to a surface water. Ecology's Stormwater Unit administers this permit. The permit application, or Notice of Intent, generally requires information about the project location, receiving water, construction activities, pollution prevention plan, and public notice. Before submitting the notice of intent, the applicant must develop a Stormwater Pollution Prevention Plan, comply with SEPA, and issue a public notice.

6.4.3 Right-of-Way

The existing railroad which runs parallel to and beyond Railroad Avenue is administered by Clark County. Discussions with the county[13] indicate permission would be granted to use existing railroad right-of-way for installation of the two 6-inch force mains between town and the WWTP. (Refer to Figure 4.4.) The pipes should be installed within two feet of the edge of Railroad Avenue (within the west side of the railroad easement). Any railroad crossings must be cased the full length of the railroad right-of-way; this applies both to the force mains and also to the collection system.

6.4.4 Uniform Fire Code

New construction will require approval of plans by the local fire district.

6.4.5 EPA Risk Management Program (RMP) Rule

Chlorine gas is particularly dangerous because a leak creates a serious, potentially fatal health hazard. Consequently, the EPA requires any facility with more than 2,000 pounds of chlorine gas onsite to submit an RMP. However, UV disinfection will be utilized at the Yacolt WWTP rather than chlorine gas and so an RMP will not have to be prepared and submitted to the EPA.

[13] Jon Holladay, Clark County (February 2012)

Section 7: Financial Analysis

7.1 Cost Estimates

Cost estimates are presented in Sections 3, 4, and 5 for collection, treatment, and discharge facilities, respectively. Both capital costs and O&M costs presented in those sections are summarized below.

Each of the major system components carries a capital cost for materials, equipment and labor. Additional costs must be applied as appropriate. Associated project costs are comprised of both construction-related and non-construction-related costs. Construction-related costs are contractor mobilization and bonding, and contractor overhead and profit. Non-construction costs are engineering / legal and administrative services, taxes, and contingency. (Contingency is applied to the capital cost subtotal including associated project costs.) The individual values of these components are shown in Table 7.1. The total associated project cost factor (APCF) is 1.965, shown in Table 7.1.

Table 7.1: Associated Project Costs

Item		Cost as Percent of Construction Cost
Taxes		8.4%
Contractor O/H & Profit		15.0%
Mobilization & Bonding		7%
Engineering/Legal/Administrative		23%
Pre-Design	3%	
Design Engineering	10%	
Administrative and Legal Expenses	2%	
Bid, Construction Management, and Start-Up	8%	
Contingency		25%

Total Associated Project Cost Factor = 1.965 ((=(1.00+0.084) x 1.45) x 1.25)

The capital cost is shown for each major component in Table 7.2. The total capital cost for the Yacolt sewer system is $13.6 M. This estimate carries an expected accuracy of (+)50 percent to (-)30 percent of the actual project cost.

Table 7.2: Capital Cost Estimate for Major Sewer System Components

	Raw Cost ($ Million)	APCF	Total Cost ($Million)
Collection System	4.89	1.965	9.61
Treatment	1.45	1.965	2.85
Land	0.30	---	0.30
Discharge	0.33	1.965	0.65
Electrical Service	0.03	1.965	0.06
Permits	0.15	---	0.15
TOTAL	**7.15**		**13.62**

Note that capital cost estimates correspond to the full buildout of the sewer system. In reality the initial construction of the collection system should include all collection mains and the vacuum collection station, but vacuum pits and connections to residences will only be installed at existing residences. The treatment plant will be constructed in full with the initial construction. The initial construction of the discharge infiltration trenches will include approximately two-thirds of the total construction.

The final project cost will be influenced greatly by inflation, economic conditions, and how many years into the future the facilities are constructed. (Rate studies assume the system will start up in 2019, as discussed below.)

Estimates of O&M cost are summarized in Table 7.3

Table 7.3: Summary of O&M Cost Estimates

Component	Annual O&M	Additional O&M	Remarks
Collection System	70,000		<== assumes ~1/2 FTE@ $40/hr
Treatment, Liquid	90,000		<== includes 3/4 FTE @ $40/hr
Treatment, Solids	2,000	270,000	<== every 7 years (dredge)
Discharge	3,000		
Electrical Service (2)	1,000		
TOTALS	**166,000**	**270,000**	<== every 7 years (dredge)

As discussed above for capital costs, O&M costs assume operation of the fully-built-out WWTP and collection system. This conservative assumption should be offset partially by the use of $0.09 per kW*hr for power cost calculations. This is slightly higher than the current rate, however the rate will rise above $0.09 per kW*hr well prior to the end of the planning period.

7.2 Overview of Funding Sources

7.2.1 Introduction

This section provides a general overview of potential sources of capital funding for the future Yacolt sewer system.

The source of many loans and grants is the Federal government. However, for many programs the federal government utilizes States for administration. There are three main categories of funding programs: (i) loans, (ii) grants, and (iii) federal appropriations. Appendix H provides a summary of the major programs along with their purposes, terms, and requirements.

Many programs carry the specific purpose of aiding small and/or economically disadvantaged communities. With a population of less than 2,000 people, Yacolt is well-suited to compete for small-community programs.

In addition to the loan, grant, and direct appropriations funding alternatives described in this document, general obligation or revenue bonds are often utilized as a source of funds for capital improvements. However bonds do not appear to be feasible for Yacolt because the Town most likely does not have the financial resources and extensive credit history to meet requirements developed to ensure bond repayment.

7.2.2 Loans

Two major loan programs exist – the Public Works Trust Fund (PWTF) and the Washington State Revolving Fund (SRF). The PWTF is administered by the Washington Public Works Board (PWB), which is staffed by the State of Washington Department of Commerce. The SRF is administered by the Department of Ecology. Typically the interest rates for PWTF loans are lower than those for SRF loans, but where hardship can be proven, SRF loan rates may be lowered. Specific information regarding both programs is provided below.

7.2.2.1 Public Works Trust Fund

The PWTF funds projects involving the planning, design, construction, repair, or rehabilitation of water, sanitary sewer, storm sewer, and solid waste disposal systems. Loans of up to $15 million per biennium are available for terms of 20 years at interest rates between 0.25% and 2.0% for FY 2014. Loan terms other than 20-years are available. No match is required. Additional information is presented in Appendix G.

7.2.2.2 State Revolving Fund

The SRF program provides low-interest loans to local governments for projects that improve and protect the State's water quality. FY 2013 loans with terms of 5 years or less are available at an interest rate of 1.4%. Loans with terms of 20 years are available at an interest rate of 2.7%. (Ecology bases interest rates for non-hardship projects on the average market interest rate for tax exempt municipal bonds as published in the Bond Buyer's Index.) Where hardship is proven, longer loan terms and lower interest rates can be obtained. SRF loans may cover up to 100% of project costs (requiring no match) with certain restrictions.

SRF loans do not require a match, but carry a reserve requirement. For revenue-secured loans with terms greater than 5 years, the recipient is required to commit to accumulating a reserve equivalent to at least the average annual debt service on the loan during the first 5 years of the repayment period of the loan.

Applications for the SRF are accepted during September and October. As with PWTF loans, funds can be obtained to purchase land to meet project requirements, or to fund pre-construction activities. An approved Facility Plan is required prior to pre-construction loan application; approved construction documents are required prior to construction loan application.

Note that Ecology administers the SRF loan program and two grant programs (discussed below) in an integrated fashion whereby only one application is required. Ecology assesses the applicability of the proposed project to each of these three funding programs; thus a specific program (among the three) need not be specified.

7.2.2.3 Rural Community Assistance Corporation (RCAC)

Rural Community Assistance Corporation (RCAC) is a loan fund targeted for rural communities. In 1996, the RCAC was designated as a Community Development Financial Institution by the U.S. Treasury. Projects must primarily serve low-income communities. Maximum loan amount for construction is $2 million. The interest rate is generally 2% - 3% higher than short-term rates, and a loan fee of approximately 1% is added.

7.2.2.4 U.S. Department of Agriculture Rural Development (USDA-RD)

The United States Department of Agriculture (USDA) provides loans and grants to communities of populations below 10,000 via its Rural Development division, for municipal water, wastewater, stormwater, and solids management projects. Loan terms allow a loan repayment period of up to 40 years and current interest rates are between 2.0% and 3.375%. In addition, the USDA also has a Rural Utilities Service grant and loan program with preference is given to communities with populations below 5,500.

7.2.2.5 Community Economic Revitalization Board (CERB) Programs

The State's Department of Commerce administers CERB programs. These programs represent the State's only economic development infrastructure program, and terms are described in Appendix H. They are:

- Traditional Construction Program: serves as a catalyst for private capital investment with new job creation and existing job retention; requires eligible private sector commitment ("bird in hand").

- Rural Construction Program: provides economic opportunities to rural counties and rural natural resource areas; assists disadvantaged rural communities to fund high-priority economic development infrastructure for CERB-eligible prospective economic development projects.

7.2.3 Grants

7.2.3.1 Ecology Centennial Clean Water Fund (CCWF)

The Ecology Centennial Clean Water Fund (CCWF) provides grants for construction of wastewater treatment facilities and activities intended to reduce non-point source pollution. In order to obtain grant funding for facilities, financial hardship must be proven. Additional information is provided in Appendix H.

7.2.3.2 Ecology Clean Water Act Section 319 Grant

Ecology also provides grants to address nonpoint source pollution and to improve and protect water quality. The project must directly or indirectly provide water quality benefits via preventing or controlling nonpoint sources of pollution. This program does not fund water pollution facilities projects.

7.2.3.3 Community Development Block Grants

Community Development Block Grant (CDBG) General Purpose Grants are made available annually through a competitive application process to assist small cities, towns and counties in carrying out community and economic development projects that principally benefit low- and moderate-income persons. The County CDBG program is funded by the U.S. Dept. of Housing and Urban Development (HUD). Eligible General Purpose Grant activities include public facilities such as water, wastewater, storm sewer and street projects.

Clark County is one of five counties in Washington which administer CDBGs directly to municipalities within its borders. The maximum size of a County CDBG is $300,000. Generally at least 51% of the project beneficiaries must have an income at or below 80% of the County Median Household Income (MHI); at the time of writing, HUD had not yet calculated MHI for Clark County communities based on the 2010 census.

7.3 Timeline

At the time of writing, the Town of Yacolt is uncertain as to when a sewer system will be constructed.

Table 7.4 provides an overview of duration of design and construction phases for each of the major system components. Overall, two years should be allocated for the design phase and and an additional two years for the construction phase although an accelerated schedule could be implemented if desired.

Applications for grant and loan funding for the design and construction phases should be submitted approximately one to two years in advance. Refer to Appendix H for deadlines.

Table 7.4: General Timeline for Yacolt Sewer System

	Design Phase		Construction Phase	
Project Component	**Year 1**	**Year 2**	**Year 3**	**Year 4**
(Timeline Assumed in Rate Study ==>)	(2015)	(2016)	(2017)	(2018)
Collection System				
Treatment Plant				
Discharge Basins				
Miscellaneous Items				
- Pipelines				

As discussed below, the rate study assumes that the sewer system would begin operation in 2019; the corresponding years for design are 2015/2016 and for construction are 2017/2018. Note that a relatively small portion of construction funding for discharge trenches would be deferred to future construction, as described in Section 5, and land for the WWTP may be purchased prior to the design phase. Table 7.5 assigns assumed capital expenses to these years; this information is the basis for capital cost requirements which are assumed in the rate study.

Table 7.5: Assumed Capital Expense Timeline for Rate Study

		Design		Construct				
Project Component	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	***2027***	**totals**
Property purchase	$300,000							300,000
								-
Collection system development		$270,240	$270,240	$4,534,760	$4,534,760			9,610,000
								-
Treatment system development		$206,855	$0	$1,321,573	$1,321,573			2,850,000
								-
Discharge system development			$37,864	$334,466			$277,670	650,000
								-
Miscellaneous								-
-Electrical Service (2)			$6,000	$54,000				60,000
-Permits				$150,000				150,000
								-
						TOTAL:		$13,620,000

7.4 Rate Evaluation

Funding for estimated capital and O&M costs for the sewer system was evaluated in order to develop a range of probable monthly service rates.

The main difference among scenarios considered is the assumed proportion of loan to grant money. Other differences are sewer development charges, loan terms, and loan interest rates. Each evaluation assumed 3% inflation and an interest earnings rate of 0.8%. Projected ERUs are per Table 2.1. Note that capital and O&M costs presented in Tables 7.2/7.5 and 7.3, respectively, are in 2012 dollars; the total future CIP costs are approximately $16.0 M due to inflation.

Two scenarios are described herein; these were chosen because they represent the most conservative (i.e. highest monthly rates) and least conservative (i.e. lowest rates) cases from the multiple scenarios considered.

Case (1): No grant funding, single loan. This scenario contains the following assumptions:

- all costs are funded through a 1% loan via Public Works Trust Fund
- loan terms: 20 years, no match
- O&M expenses are funded directly via rates
- no sewer development charges (SDCs)

The maximum estimated monthly rate over the repayment period is approximately $127. Rates are projected to reduce with time due to steady increases in participating ERUs (of approximately 2%). This scenario is depicted graphically on Figure 7.1. (Note that monthly rate payments are required prior to construction.) Additional information is provided in Appendix I.

Case (2): Grant funding, two loans. This scenario contains the following assumptions:

- $5.5 million grant: applied to initial years (beginning 2014)
- $5.5 million Ecology SRF loan: 20 year term, 2.7% interest rate
- $2.6 million USDA-RD loan to satisfy remaining funding needs: 40 year term, 3.0% interest rate
- O&M expenses are funded directly via rates
- $7,500 SDC for new development

The maximum estimated monthly rate over the repayment period is approximately $93. Note that USDA loan repayment would occur for an additional 20 years (along with O&M expenses) following repayment of the SRF loan. This scenario is depicted graphically on Figure 7.2.

Figures

Q:\Projects\09proj\0991020.00 City of Yacolt WW Plant\SEPA Checklist\0991020_Figure-1.1.dwg AARON LAWLER 4/23/2012 6:25 PM

NE W H GARNER RD
NE AMBOY RD
N AMBOY RD
Cedar Creek
Yacolt
Yacolt Creek
NE RAILROAD AVE
Big Tree Creek

Legend

- Reservoir
- Public Drinking Well
- Roads
- Streams and Rivers
- Water Line
- 2007 Urban Growth Area
- 2008 Town Limits
- Urban Reserve

N

0 660 1320
APPROXIMATE SCALE IN FEET

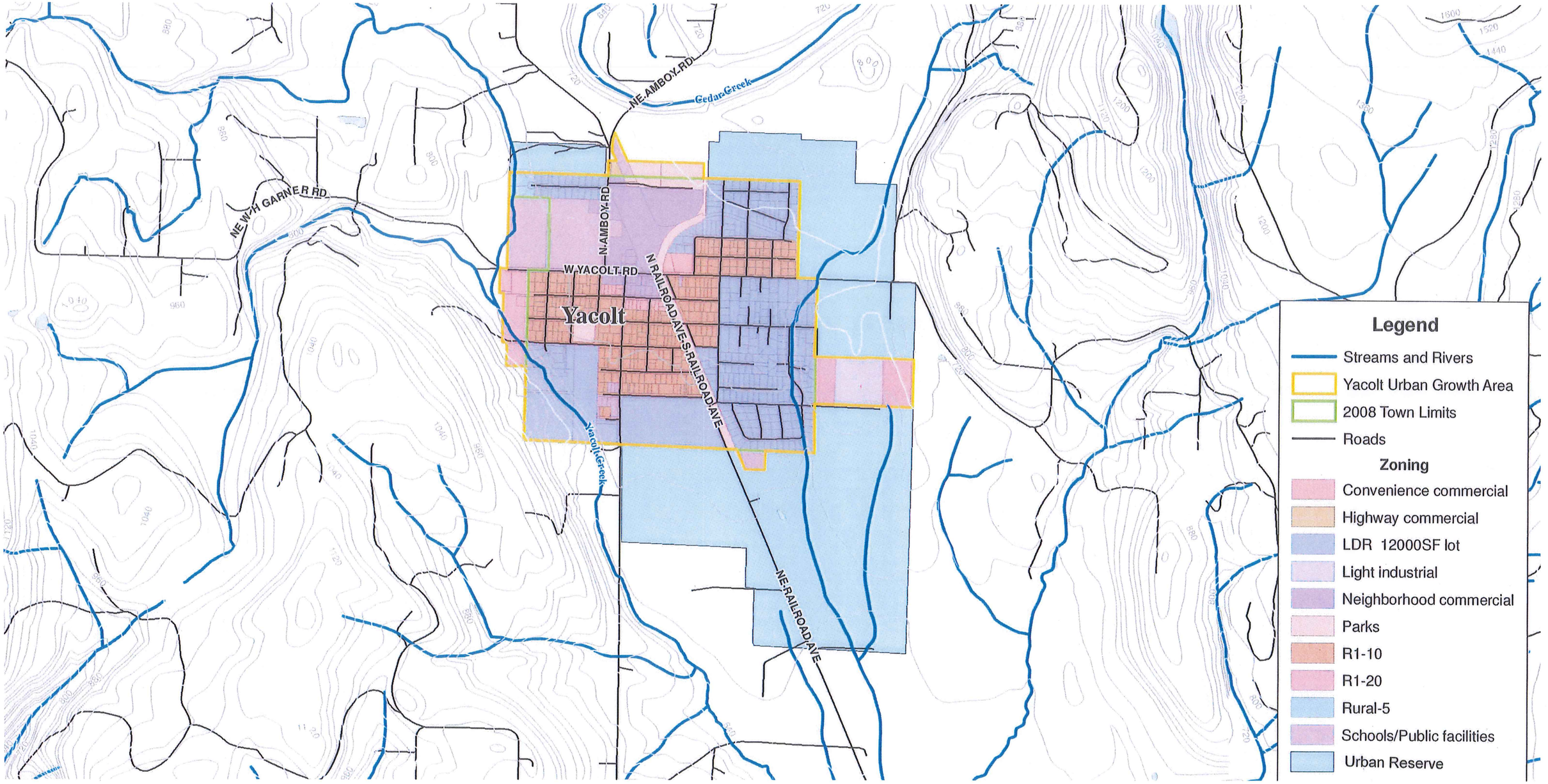
Kennedy/Jenks Consultants

YACOLT FACILITY PLAN

EXISTING WATER SYSTEM

K/J 0991020.00

FIGURE 1.1



N

0 660 1320

APPROXIMATE SCALE IN FEET

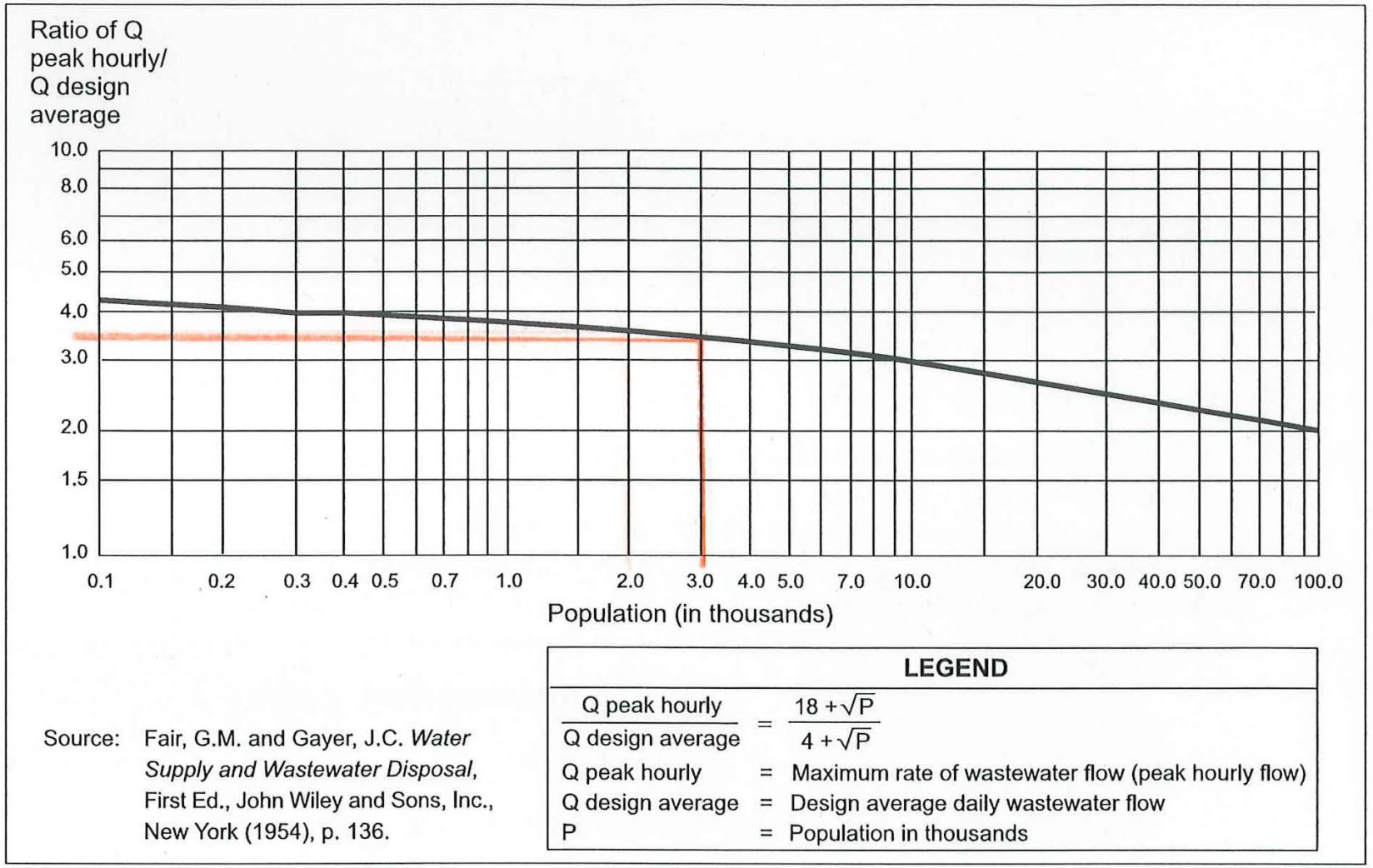
Kennedy/Jenks Consultants

YACOLT FACILITY PLAN

ZONING

K/J 0991020.00

FIGURE 1.2



LEGEND

$$\frac{\text{Q peak hourly}}{\text{Q design average}} = \frac{18 + \sqrt{P}}{4 + \sqrt{P}}$$

Q peak hourly = Maximum rate of wastewater flow (peak hourly flow)

Q design average = Design average daily wastewater flow

P = Population in thousands

Source: Fair, G.M. and Gayer, J.C. *Water Supply and Wastewater Disposal*, First Ed., John Wiley and Sons, Inc., New York (1954), p. 136.

Kennedy/Jenks Consultants

YACOLT FACILITY PLAN

RATIO OF PEAK HOURLY FLOW TO DESIGN AVERAGE FLOW[1]

0991020.00

FIGURE 2.1

[1] *Criteria for Sewage Works Design, Ecology (August 2008)*

Kennedy/Jenks Consultants

YACOLT FACILITY PLAN

VACUUM VALVE PIT

0991020.00

FIGURE 3.1

Kennedy/Jenks Consultants

YACOLT FACILITY PLAN

PROPOSED COLLECTION SYSTEM LAYOUT

0991020.00

FIGURE 3.2

P:\cad\09\0991020.00_Yacolt\0991020_FIG3-2.dwg

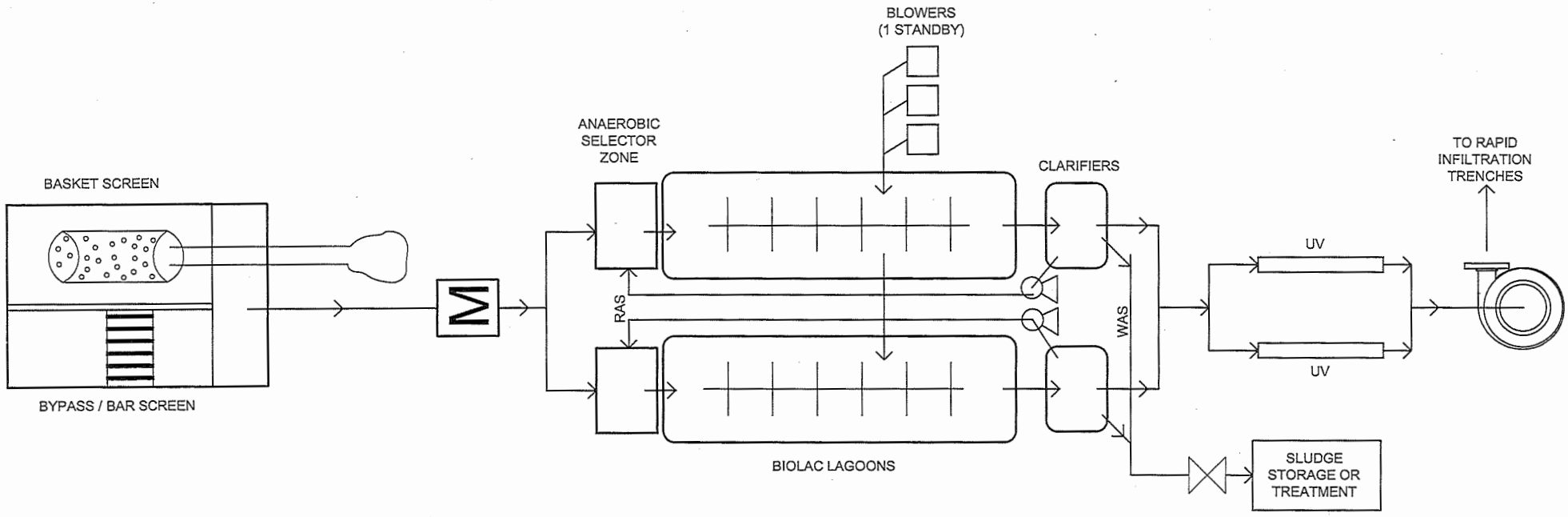
Kennedy/Jenks Consultants

YACOLT FACILITY PLAN

TYPICAL BIOLAC SYSTEM WITH INTERIOR DIVIDING WALL
(Calistoga,CA)

0991020.00

FIGURE 4.1



P:\cad\09\0991020.00_Yacolt\Process_Flow_Diagram.dwg 4/11/2012 4:39 PM AARON LAWLER

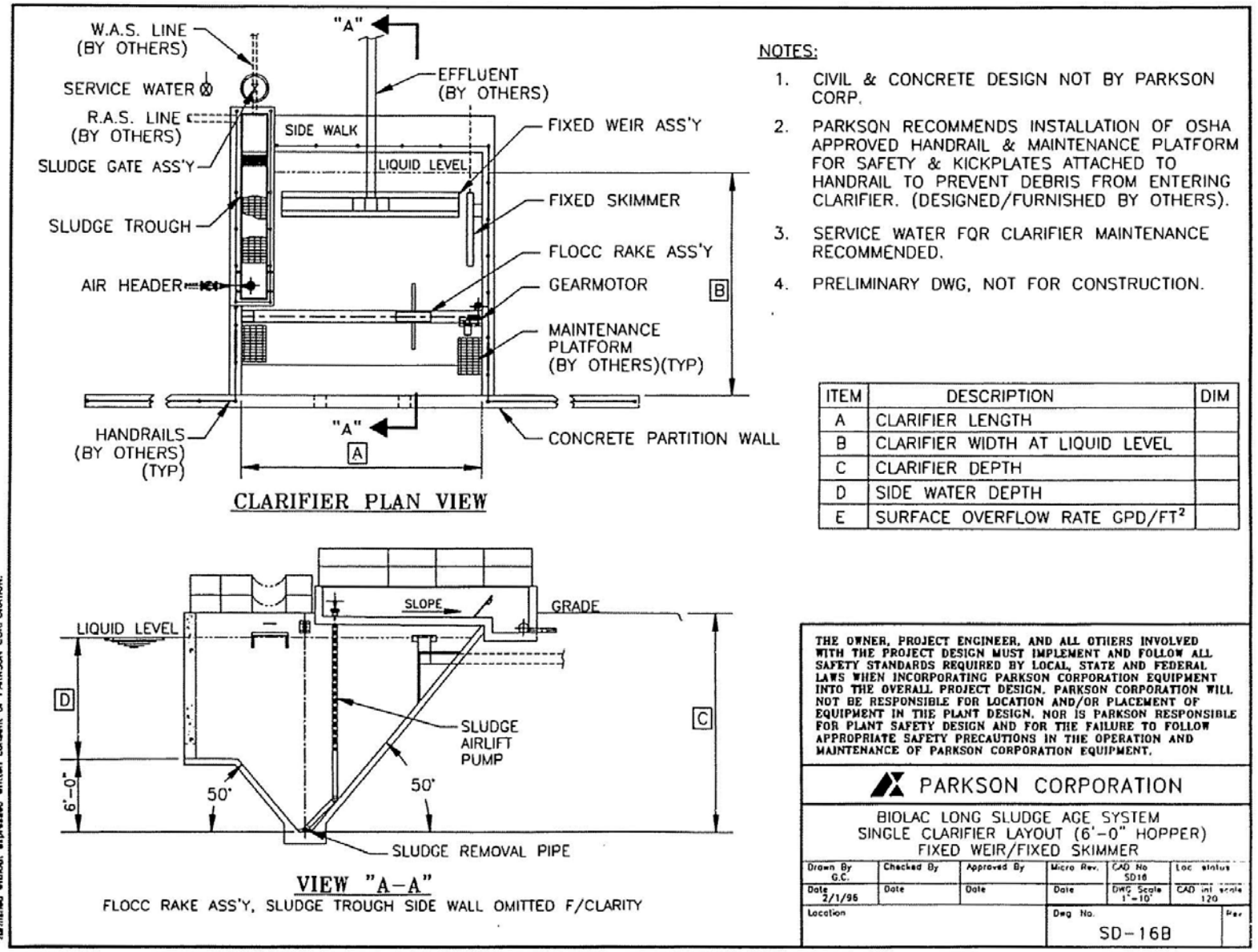
Kennedy/Jenks Consultants

YACOLT FACILITY PLAN

BIOLAC WWTP PROCESS
FLOW DIAGRAM

0991020.00

FIGURE 4.2



NOTES:

1. CIVIL & CONCRETE DESIGN NOT BY PARKSON CORP.
2. PARKSON RECOMMENDS INSTALLATION OF OSHA APPROVED HANDRAIL & MAINTENANCE PLATFORM FOR SAFETY & KICKPLATES ATTACHED TO HANDRAIL TO PREVENT DEBRIS FROM ENTERING CLARIFIER. (DESIGNED/FURNISHED BY OTHERS).
3. SERVICE WATER FOR CLARIFIER MAINTENANCE RECOMMENDED.
4. PRELIMINARY DWG, NOT FOR CONSTRUCTION.

ITEM	DESCRIPTION	DIM
A	CLARIFIER LENGTH	
B	CLARIFIER WIDTH AT LIQUID LEVEL	
C	CLARIFIER DEPTH	
D	SIDE WATER DEPTH	
E	SURFACE OVERFLOW RATE GPD/FT^2	

THE OWNER, PROJECT ENGINEER, AND ALL OTHERS INVOLVED WITH THE PROJECT DESIGN MUST IMPLEMENT AND FOLLOW ALL SAFETY STANDARDS REQUIRED BY LOCAL, STATE AND FEDERAL LAWS WHEN INCORPORATING PARKSON CORPORATION EQUIPMENT INTO THE OVERALL PROJECT DESIGN. PARKSON CORPORATION WILL NOT BE RESPONSIBLE FOR LOCATION AND/OR PLACEMENT OF EQUIPMENT IN THE PLANT DESIGN, NOR IS PARKSON RESPONSIBLE FOR PLANT SAFETY DESIGN AND FOR THE FAILURE TO FOLLOW APPROPRIATE SAFETY PRECAUTIONS IN THE OPERATION AND MAINTENANCE OF PARKSON CORPORATION EQUIPMENT.

PARKSON CORPORATION

BIOLAC LONG SLUDGE AGE SYSTEM
SINGLE CLARIFIER LAYOUT (6'-0" HOPPER)
FIXED WEIR/FIXED SKIMMER

Drawn By G.C.	Checked By	Approved By	Micro Rev.	CAD No SD16	Loc status
Date 2/1/96	Date	Date	Date	DWG Scale 1"=10"	CAD init scale 120
Location			Dwg No. SD-16B		Rev

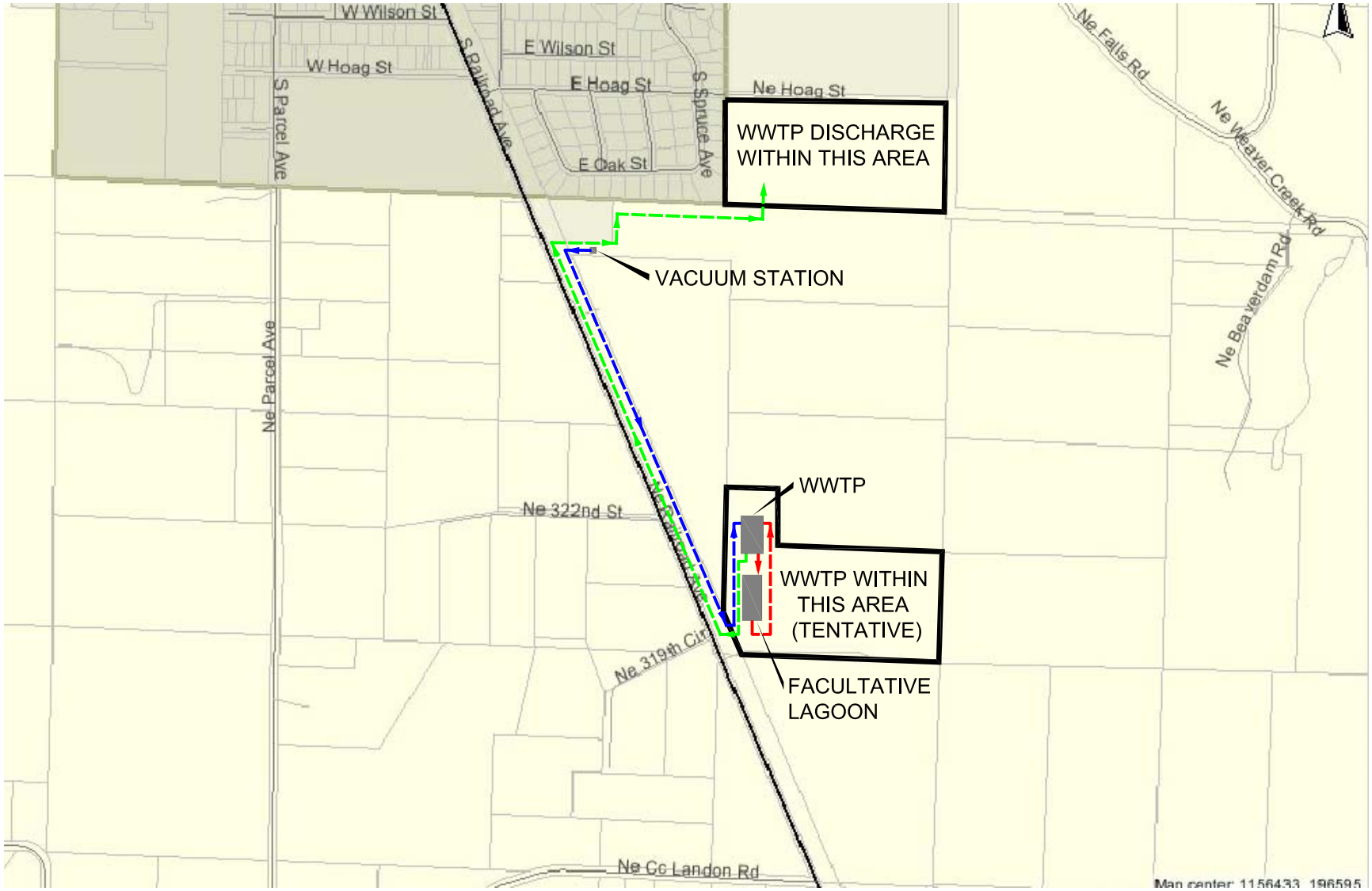
Kennedy/Jenks Consultants

YACOLT FACILITY PLAN

CLARIFIER

0991020.00

FIGURE 4.3



P:\cad\09\0991020.00_Yacolt\0991020_FIG4-4.dwg

LEGEND

- 6" FM (VACUUM STATION TO WWTP)
- 6" FM (WWTP TO INFILTRATION TRENCH DISCHARGE)
- SOLIDS PROCESS PIPING

N

Kennedy/Jenks Consultants

YACOLT FACILITY PLAN

PROPOSED LOCATION OF WWTP, DISCHARGE BASINS, VACUUM STATION AND FORCE MAINS

0991020.00

FIGURE 4.4

Figure 5.1 (a) Infiltration Data for Test Site 1

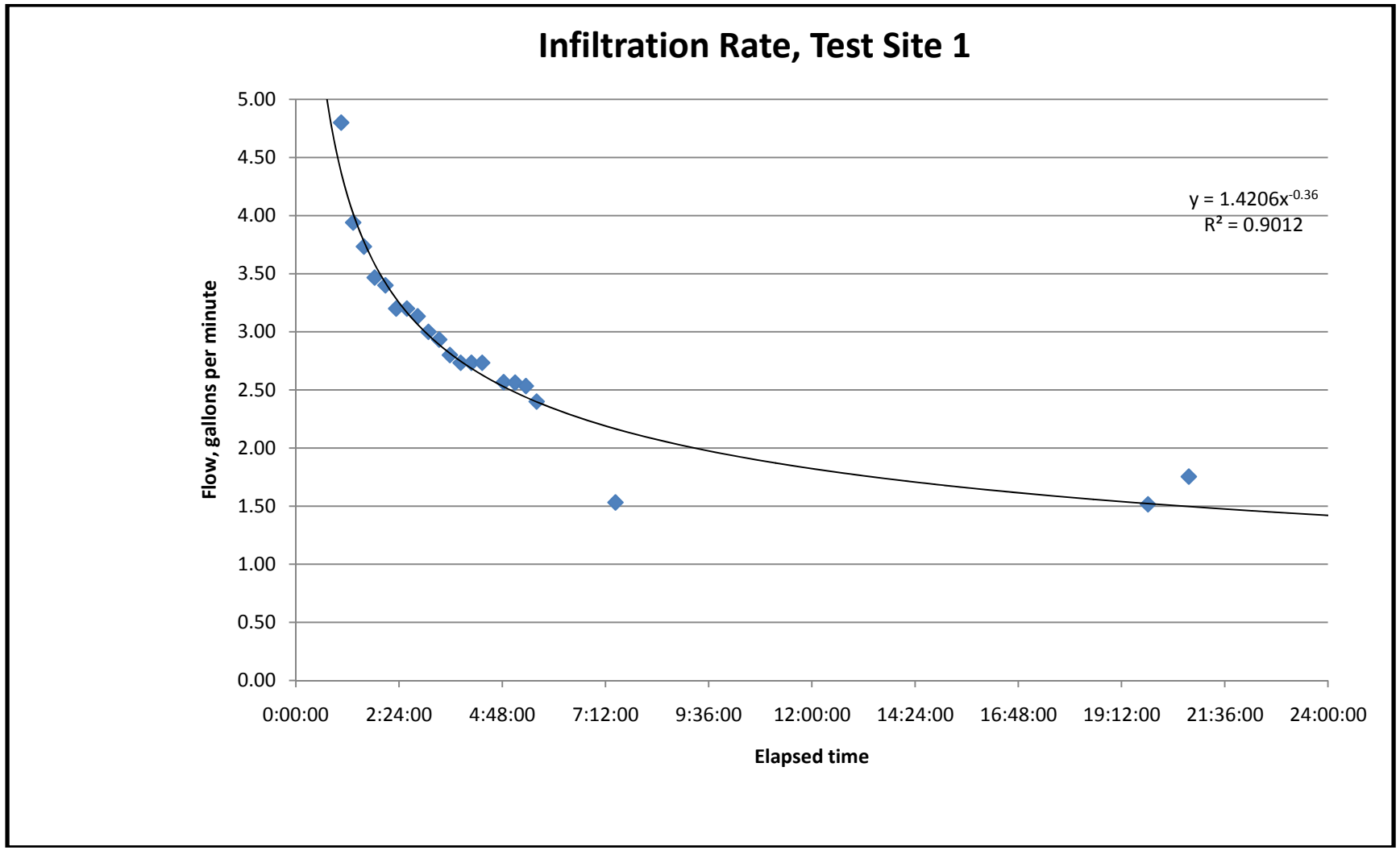
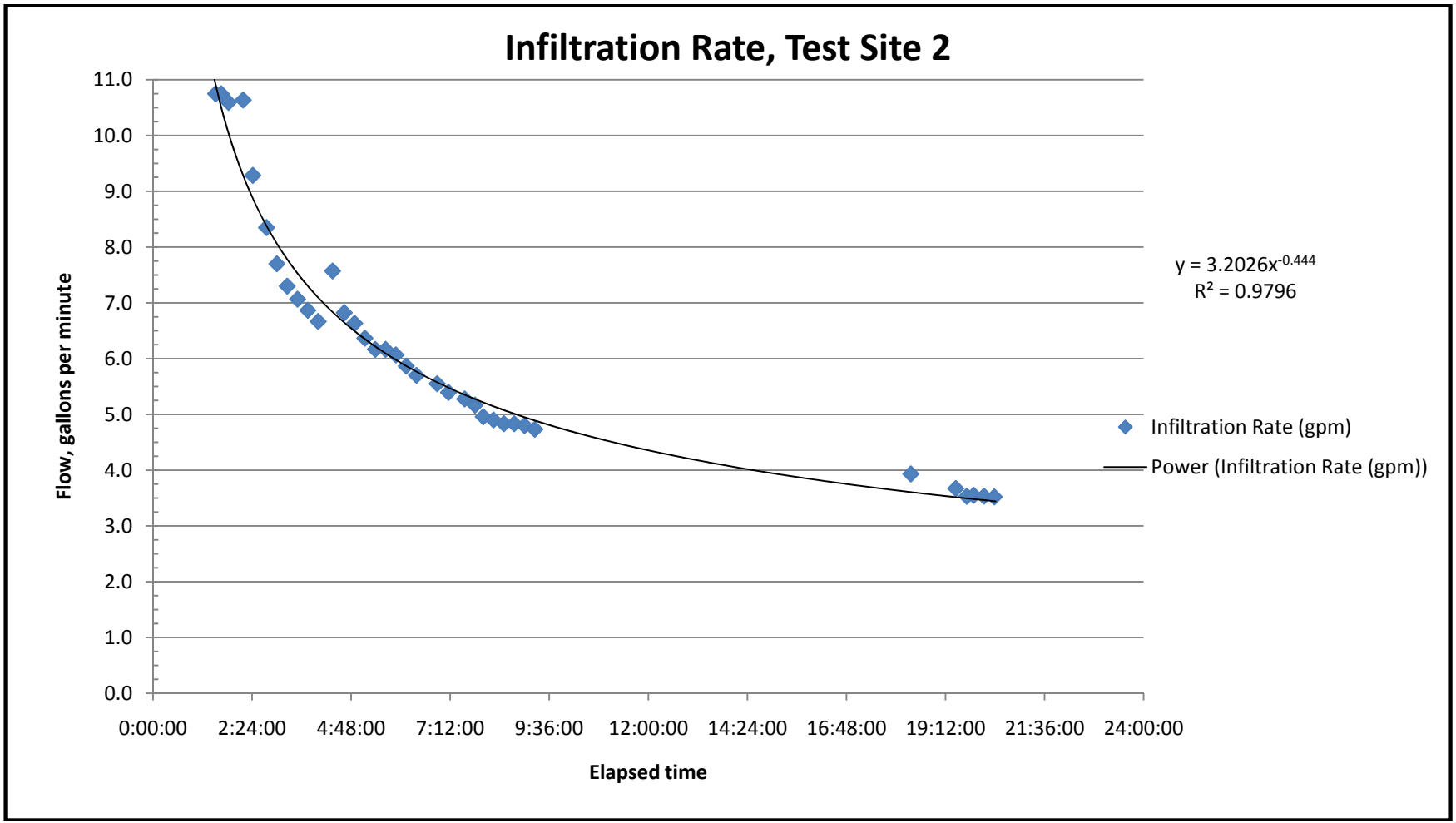
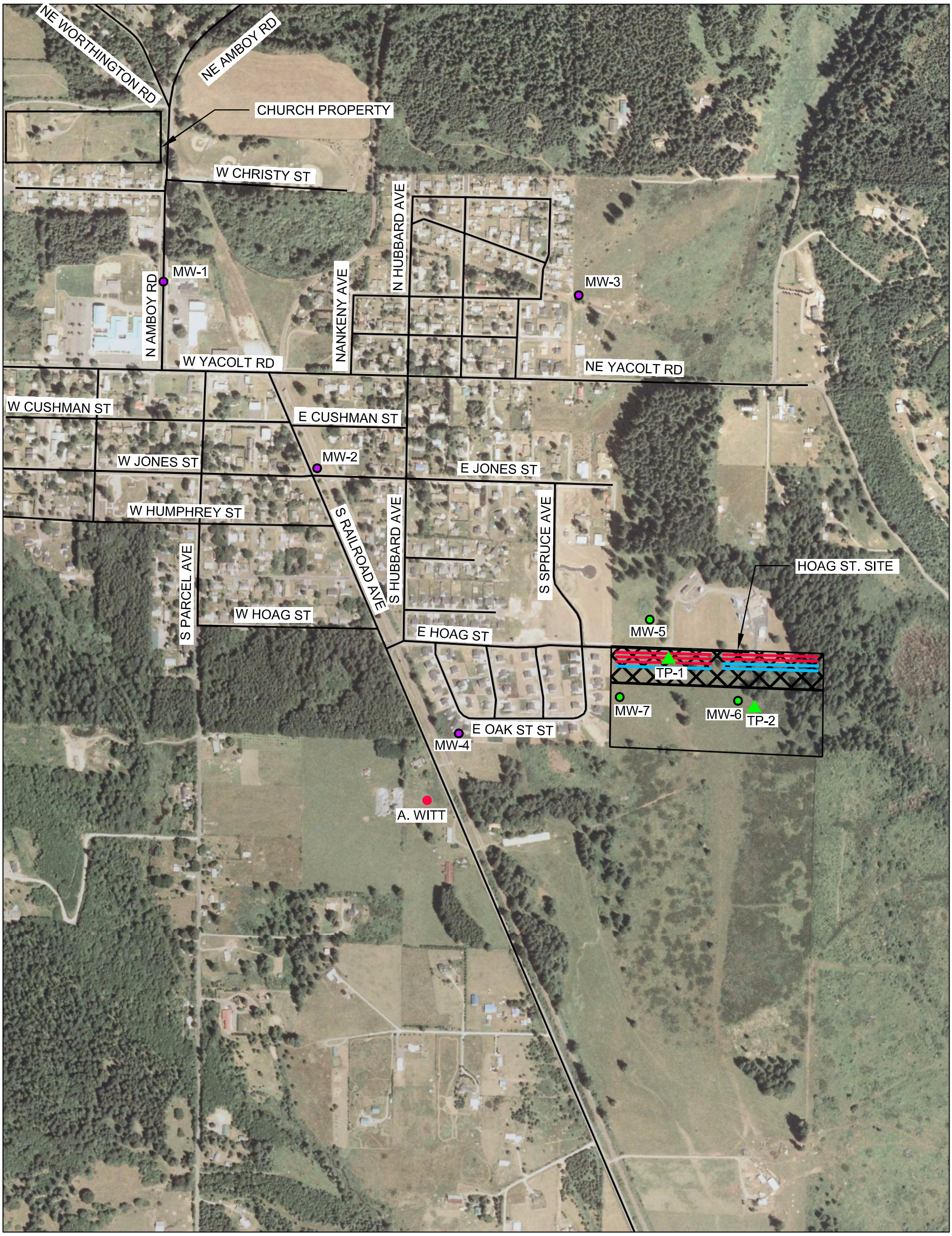


Figure 5.1 (b) Infiltration Data for Test Site 2





P:\cad\09\0991020.00_Yacolt\0991020_FIG5-2.dwg 4/11/2012 5:00 PM AARON LAWLER

LEGEND

- PROPOSED 8 ACRES OF PROPERTY TO BE PURCHASED BY THE TOWN OF YACOLT
- EXISTING WELL
- NEW MONITORING WELL
- EXISTING MONITORING WELL (MW)
- INFILTRATION TEST LOCATIONS (TP)
- PROPOSED INFILTRATION TRENCH (NTS)
- RESERVED AREA (FUTURE INFILTRATION TRENCH) (NTS)

N

0 300 600

APPROXIMATE SCALE IN FEET

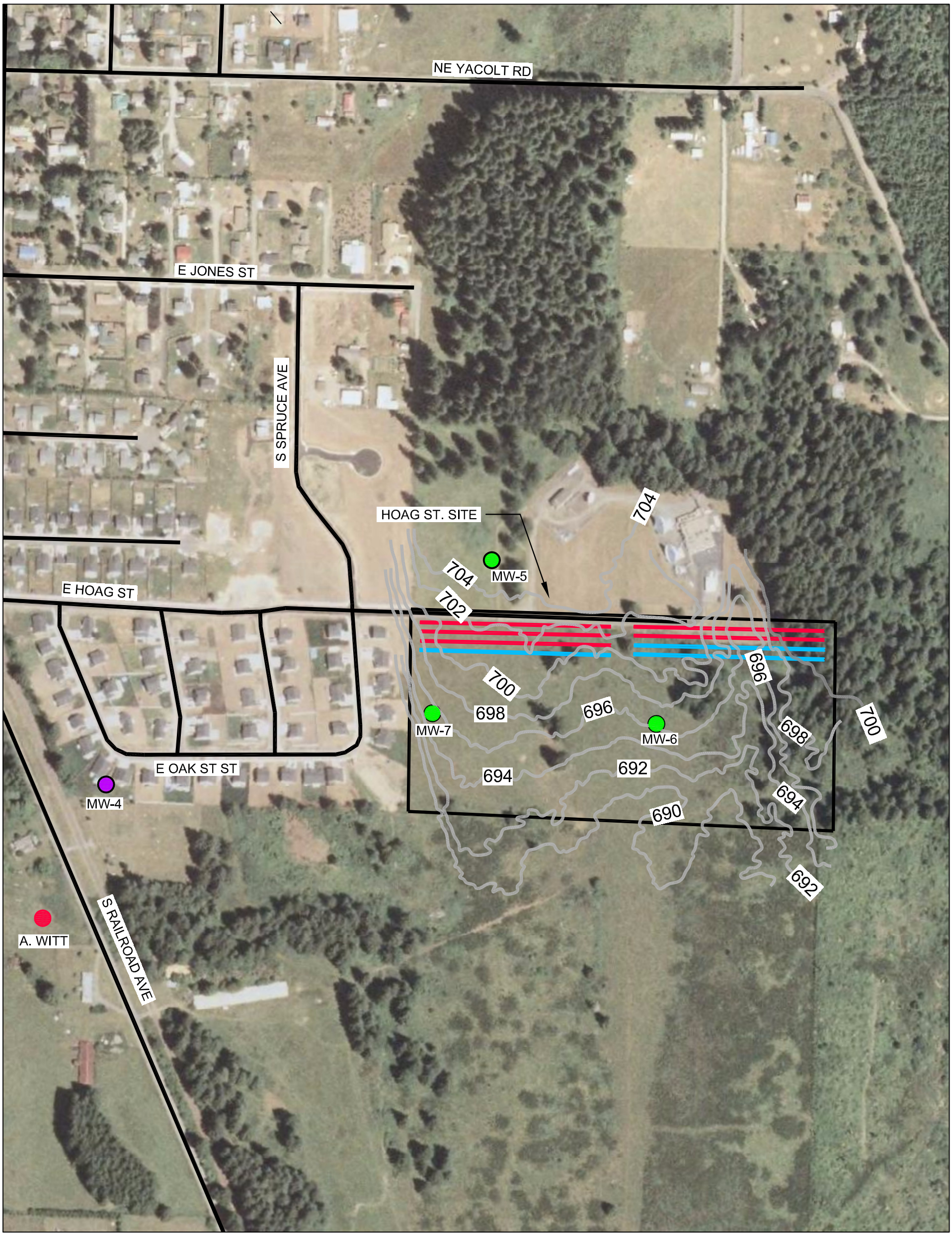
Kennedy/Jenks Consultants

YACOLT FACILITY PLAN

PROPOSED SUBSURFACE DISCHARGE LOCATION AND NEW MONITORING WELL LOCATIONS

0991020.00

FIGURE 5.2



P:\cad\0910991020.00_Yacolt\0991020_FIG5-3.dwg 4/11/2012 4:48 PM AARON LAWLER

LEGEND

- NEW MONITORING WELL
- EXISTING MONITORING WELL (MW)
- EXISTING WELL
- PROPOSED INFILTRATION TRENCH (NTS)
- RESERVED AREA (FUTURE INFILTRATION TRENCH) (NTS)

N

0 150 300

APPROXIMATE SCALE IN FEET

Kennedy/Jenks Consultants

YACOLT FACILITY PLAN

PROPOSED SUBSURFACE DISCHARGE LOCATION TOPOGRAPHY

0991020.00

FIGURE 5.3

Figure 7.1: Estimated Yacolt Sewer Rates – Case (1)

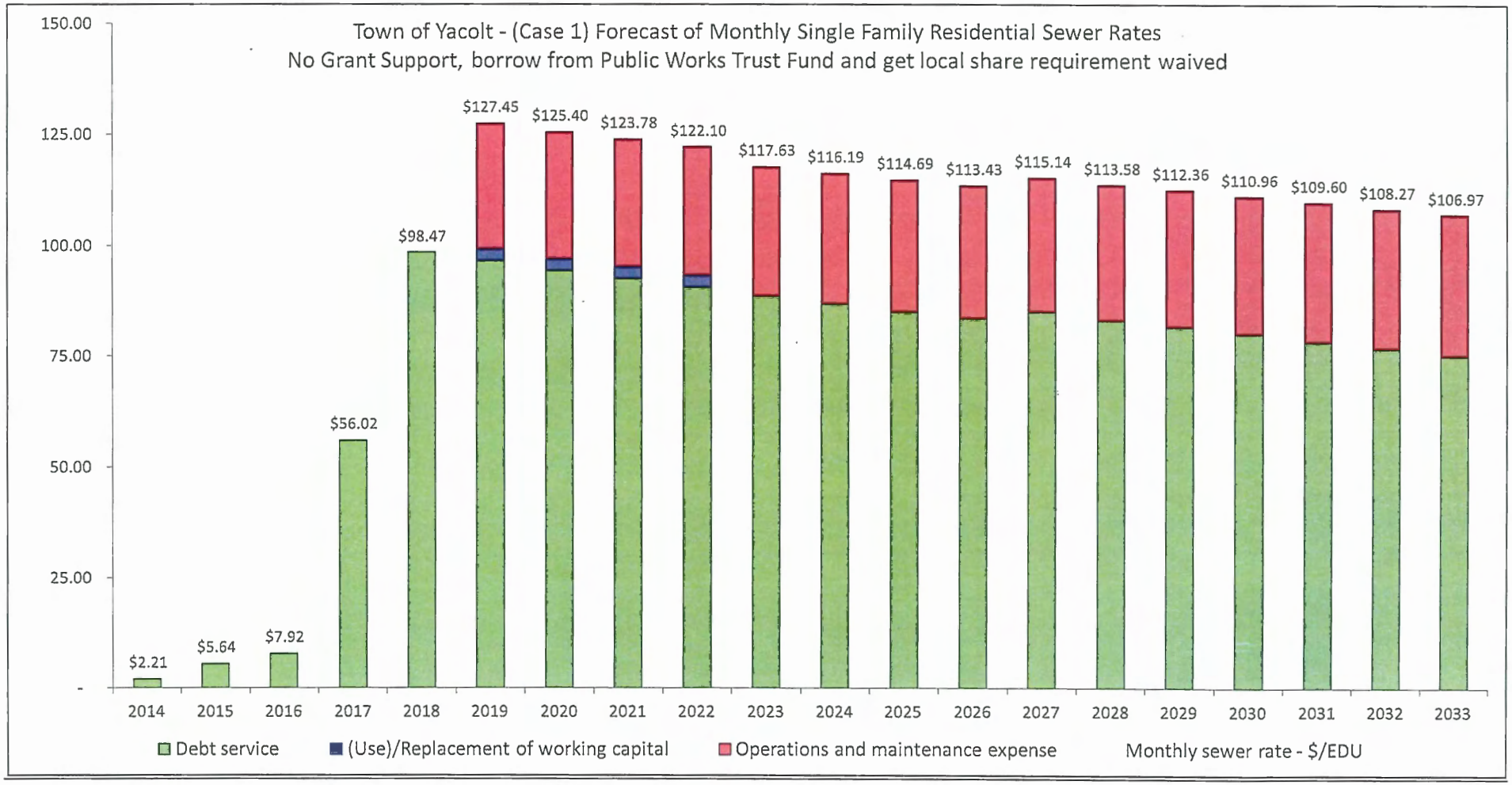


Figure 7.2: Estimated Yacolt Sewer Rates – Case (2)

Appendix A

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY
PO Box 47775 • Olympia, Washington 98504-7775 • (360) 407-6300

February 24, 2011

The Honorable Joe Warren, Mayor
Town of Yacolt
P.O. Box 160
Yacolt, WA 98675

Re: Town of Yacolt, Washington, General Sewer Plan, 14 January, 2011 (Charles T. McDonald P.E., Kennedy/Jenks Consultants)

Dear Mayor Warren:

The above-referenced plan is **Approved** as a General Sewer Plan. The plan describes the preferred alternative as a vacuum sewer system, a Biolac treatment system, and discharge to ground in the vicinity of Hoag Street. The plan estimates an effluent nitrate level of 4.5 mg/l will preclude groundwater degradation. Ecology concurs.

In addition to a preferred alternative, the General Sewer Plan suggests that the City should continue investigating alternative collection and disposal systems. While we always appreciate contingency planning, we recommend that the City focus its efforts on the preferred alternative. We suggest the following course of action:

1. First, characterize the Hoag Street site hydrogeology so that you can estimate the drain field area requirements, confirm its viability, and acquire the properties needed for the project.
2. If the Hoag Street site is viable, complete the facility plan and hydrogeologic study, and then proceed to design and construction.
3. If the Hoag Street site is not viable, the City can amend its GSP to identify a different preferred alternative. Similar to the approach for the existing preferred alternative, the City might need to develop the water quality data that confirms that alternative. Once confirmed, the City can proceed to property acquisition, facility planning, and then design and construction.

We also suggest that the City limit the amount of money it spends on a secondary alternative until you know that you need to spend it. Taking the above steps out of sequence, e.g. engaging an engineer to develop plans and specifications for a treatment works prior to obtaining approval of a facility plan, or before you know that the site is viable, could be a costly and non-productive effort.

We appreciate the City's efforts in this matter. If you have any questions, please contact David J. Knight P.E., Facility Manager, at 360-407-6277, or me at 360-407-6293.

Sincerely,

Steven G. Eberl, P.E.
Acting Southwest Region Manager
Water Quality Program

SG:DK:sb

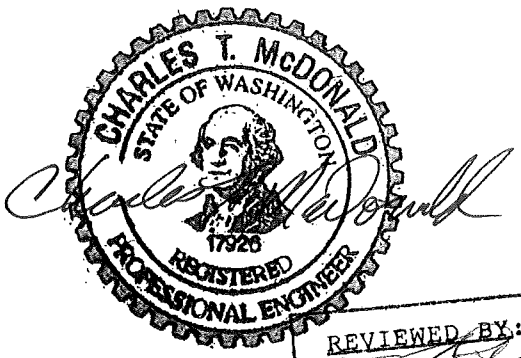
cc: Mr. Chuck McDonald, P.E.
Mr. Steve Carley, Ecology/HQ/FMS
Mr. Dave Dougherty, Ecology/SWRO/WQ
File: Clark County, Town of Yacolt STP, Engineering

Town of Yacolt, Washington

Yacolt General Sewer Plan

Final Submittal

14 January 2011



REVIEWED BY: David T. Knight P.E. 2/17/2011 DATE

APPROVED BY: Steven G. Eberl 2-17-2011 DATE

DEPARTMENT OF ECOLOGY
WATER QUALITY PROGRAM
SOUTHWEST REGIONAL OFFICE

Submitted by:

Chuck McDonald, P.E.
Travis Tormanen, P.E.

KENNEDY/JENKS CONSULTANTS
200 S.W. Market Street, Suite 500
Portland, Oregon 97201-5715
503-295-4911
503-295-4901 (Fax)

JOB NO. 0891009.00

Appendix B

File: 12 - 0991020.00
DNS 12 - 01

Date Published: February 15, 2012

Please find enclosed an environmental Determination of Non-Significance issued pursuant to the State Environmental Policy Act (SEPA) Rules (Chapter 197-11), Washington Administrative Code.

You may comment on this DNS by submitting written comments within Fifteen (15) days of this notice as provided for by WAC 197-11-408.

Please address all correspondence to: Kennedy/Jenks Consultants
200 SW Market Street, Suite 500
Portland, OR 97201

Attn: Tim Caire

DISTRIBUTION LIST

Federal Agencies

- US Army Corps of Engineers, Portland District
- Northwest Power Planning Council
- Bonneville Power Administration

Native American Interests

- Chinook Indian Tribe
- Cowlitz Indian Tribe
- Yakima Indian Nation

State Agencies

- Office of Archaeology and Historic Preservation
- Department of Community Development
- Department of Ecology
- Department of Health

- Department of Natural Resources – SEPA Center
- Department of Fish and Wildlife

Regional Agencies

- Fort Vancouver Regional Library
- Battle Ground Branch-FV Library
- Southwest Clean Air Agency

Local Agencies

- City of Battle Ground
- City of La Center
- Clark County Department of Community Development:
    - Administration
    - Central Files
    - Water Quality Division
- Department of Public Works
    - Administration
- Clark County Public Health

Special Purpose Agencies

- C-Tran
- CRESA
- Clark Public Utilities
- Battle Ground School District
- Clark Regional Wastewater District
- Fire Protection District 13

Interest Groups

- Building Industry Association
- Neighborhood Associations Council of Clark County
- Clark County Natural Resources Council
- Vancouver Housing Authority
- Columbia River Economic Development Council
- Fish First

DETERMINATION OF NONSIGNIFICANCE

Description of proposal: Adoption of the Yacolt Wastewater Facility Plan (WFP). This plan provides for the planning, design and construction of capital facilities within the Town of Yacolt for the next 20 year planning period. The applicable costs estimated will be used to establish sanitary sewer connection fees and monthly service fees.

Proponent: **Town of Yacolt**

Location of proposal, including street address, if any.

Town of Yacolt, Urban Growth Area

Lead Agency: **Town of Yacolt**

The lead agency for this proposal has determined that it does not have a probable significant adverse impact on the environment. The environmental impact statement (EIS) is not required under RCW 43.21C.030(2)(c). This decision was made after review of a completed environmental checklist and other information on file with the lead agency. This information is available to the public on request.

___ There is no comment period for this DNS.

_X_ This DNS is issued under WAC 197-11-3420(2); the lead agency will not act on this proposal for 15 days from the date below. Comments must be submitted by March 8, 2012

Responsible Official: **Jeff Carothers**
Position/Title: **Mayor**
Telephone: **360-686-3922**
Fax: **360-686-3853**
Address: **P.O. Box 160**
202 W. Cushman Street
Yacolt, WA 98675

Date: February 22, 2012 Signature

ENVIRONMENTAL CHECKLIST

Purpose of Checklist:

The State Environmental Policy Act (SEPA), Chapter 43.21C RCW, requires all governmental agencies to consider the environmental impacts of a proposal before making decisions. An environmental impact statement (EIS) must be prepared for all proposals with probably significant adverse impacts on the quality of the environment. The purpose of this checklist is to provide information to help you and the agency identify impacts from your proposal (and to reduce or avoid impacts from the proposal, if it can be done) and to help the agency decide whether an EIS is required.

Instructions for Applicants:

This environmental checklist asks you to describe some basic information about your proposal. Governmental agencies use this checklist to determine whether the environmental impacts of your proposal are significant, requiring preparation of an EIS. Answer the questions briefly, with the most precise information known, or given the best description you can.

You must answer each question accurately and carefully, to the best of your knowledge. In most cases, you should be able to answer the questions from your own observations or project plans without the need to hire experts. If you really do not know the answer, or if a question does not apply to your proposal, write "do not know" or "does not apply". Complete answers to the questions may avoid unnecessary delays later.

Some questions ask about governmental regulations, such as zoning, shoreline, and landmark designations. Answer these questions if you can. If you have problems, the governmental agencies can assist you.

The checklist questions apply to all parts of your proposal, even if you plan to do them over a period of time or on different parcels of land. Attach any additional information that will help describe your proposal or its environmental effects. The agency to which you submit this checklist may ask you to explain your answers or provide additional information reasonably related to determining if there may be significant adverse impact.

Use of Checklist of Non-Project Proposals:

Complete this checklist for non-project proposals, even though questions may be answered "does not apply". IN ADDITION, complete the SUPPLEMENTAL SHEET FOR Non-project ACTIONS (part D).

For non-project actions, the references in the checklist to the words "project," "applicant," and "property or site" should be read as "proposal," "proposer," and "affected geographic area," respectively.

A. BACKGROUND

1. Name of Proposed Project, if applicable:

   Wastewater Facility Plan (WFP) for the Town of Yacolt

2. Name of Applicant: ***Town of Yacolt***

3. Address and Phone Number of Applicant and Contact Person:

   P.O. Box 160
   202 W. Cushman Street
   Yacolt, WA 98675

   360-686-3922

   Attn: **Pete Roberts, Public Works Director**

4. Date Checklist Prepared:

   February 7, 2012

5. Agency Requesting Checklist:

   Town of Yacolt

6. Proposed Timing or Schedule (including phasing, if applicable):

   Adoption of the WFP is scheduled for 2012 following approval by the Washington State Department of Ecology. If the Town of Yacolt chooses to proceed with construction of this wastewater system and if the financial means are available, the wastewater system could be completed and online as early as 2017.

7. Do you have any plans for future additions, expansions, or further activity related to or connected with this proposal? If yes, please explain.

   Yes, future updates or amendments will occur in conjunction with Clark County Growth Management updates and changes to the current Urban Growth Boundary (UGB). Other potential impacts could include changes to current development policies or requests for changes to zoning.

8. List any environmental information you know about that has been or will be prepared related to this proposal:

   No documents have been prepared at this time. Additional environmental reports will be prepared during the development of the wastewater collection system, treatment facility, and rapid infiltration (RI) discharge design and required state and/or federal funding documents.

9. Are other applications pending for governmental approvals affecting the property covered by your proposal? If yes, please explain.

   No other applications are pending at this time.

10. List any government approvals or permits that will be needed for your proposal.

Approval by the Yacolt Town Council
Approval by the Washington State Department of Ecology

11. Give a brief, complete description of your proposal, including the proposed uses and size of the project and site. There are several questions addressed later in this checklist that ask you to describe certain aspects of your proposal. You do not need to repeat those answers on this page (Lead agencies may modify this form to include additional specific information on project description).

    The Town limits of Yacolt include 315 acres. There are 46 acres outside of the incorporated area but within the pre-2007 UGA, with an additional 325 acres located within an urban holding designation that cannot be annexed into the Town until sanitary sewer service is available. There is no public sanitary sewer within Yacolt; all properties are served with individual septic systems. The WFP addresses the need for sanitary sewer within Yacolt and the preliminary design considerations, cost estimates, and funding approaches to provide sewer. Using existing population and projections from Clark County (Clark County Growth Management Plan update – 2007) sanitary sewer service has been planned for the community including preliminary planning for treatment and discharge. Infrastructure needs as required by the Washington Administrative Code have been incorporated into the document.

12. Location of the proposal. Give sufficient information for a person to understand the precise location of your proposed project, including street address, section, township, and range. If this proposal occurs over a wide area, please provide the range or boundaries of the site. Also, a legal description, site plan, vicinity map, and topographic map. You are required to submit any plans required by the agency, but not required to submit duplicate maps or plans submitted with permit applications related to this checklist.

The UGB of the Town of Yacolt is roughly bounded by West Christy Street on the North, NE Thompson Road on the East, NE 319th Street on the South and Johnson Avenue on the West. Figure 1 shows these boundaries, and also zoning classifications within and adjacent to the Town. The proposed collection system service area only includes those areas located within the Urban Growth Area (UGA) of Yacolt. The central vacuum collection station is proposed to be constructed within the southern part of the Town, along Railroad Ave., in order to take advantage of the downward slope towards the south. From the collection station, sewage will be pumped south along the railroad easement to the wastewater treatment plant (WWTP). The WWTP site is located just east of S. Railroad Avenue and the rail grade, south of the Town. Following treatment, effluent will be pumped north along the rail easement to the RI discharge basins. The RI discharge basin is located south of E. Hoag Street in the southeast corner of the Town. The proposed locations of the WWTP and the discharge basins are shown on Figure 2.

B. ENVIRONMENTAL ELEMENTS

1. **EARTH**

   A. General description of the site (circle one): (flat,) rolling, hilly, steep slopes, mountainous, other.

   B. What is the steepest slope on the site and the approximate percentage of the slope?

      The Town limits slope to the southwest with a 1% slope over most of the area.

   C. What general types of soils are found on the site (e.g., clay, sand, gravel, peat, muck)? Please specify the classification of agricultural soils and note any prime farmland.

Soils in the Yacolt valley are primarily unconsolidated sediments deposited by streams and glacial activity. These sediments include a mixture of gravel and sand with variable amounts of silt. There are cobbley gravels overlying bedrock at the north end of Town in the vicinity of the existing wells. The unconsolidated sediments range from 60 to 120' in depth, thinning in the south valley area. Soils underlying the collection system, WWTP site, and RI discharge site are primarily Yacolt loam, Yacolt stony loam, Gumboot silt loam, and Cinebar silt loam. All areas of Yacolt loam are considered prime farmland. However, the areas of Yacolt loam are also within the already developed Town boundaries.

D. Are there surface indications or history of unstable soils in the immediate vicinity? If so, please describe.

None known.

E. Describe the purpose, type and approximate quantities of any filling or proposed grading. Also, Indicate the source of fill.

NA – will be addressed with specific construction projects.

F. Could erosion occur as a result of clearing, construction or use? If so, please describe.

NA – erosion should be marginal due to the flat slopes within the Yacolt valley.

G. What percentage of the site will be covered with impervious surfaces after the project construction (e.g., asphalt or buildings)?

NA – no construction is in this project. Impervious coverage will be discussed with specific construction projects.

H. Proposed measures to reduce or control erosion, or other impacts to the earth include:

NA – will be addressed with specific construction projects.

2. **AIR**

A. What types of emissions to the air would result from the proposal (e.g., dust, automobile, odors, industrial wood smoke) during construction and after completion? If yes, describe and give approximate quantities.

NA – will be addressed with specific construction projects.

B. Are there any off-site sources of emissions or odor that may affect your proposal? If so, please describe:

NA – none anticipated.

C. Proposed measures to reduce or control emissions or other impacts to air:

NA – will be addressed with specific construction projects.

3. **WATER**

A. Surface

1. Is there any surface water body on or in the vicinity of the site (including year-round and seasonal streams, saltwater, lakes, ponds, wetlands)? If yes, describe type and provide names and into which stream or river it flows into.

Yacolt has four major streams flowing through with several unnamed tributaries. The area streams (year round) include Yacolt Creek on the west and south side, Cedar Creek on the north, Weaver Creek along the southeast and Big (Tree) Creek on the east side. Cedar Creek flows into the North Fork of the Lewis River. The remaining three creeks flow into the East Fork of the Lewis River.

2. Will the project require any work within 200 feet the described waters? If yes, please describe and attach available plans.

No. The collection system, WWTP and RI discharge facilities will not be within 200 feet of a creek.

3. Estimate the amount of fill and dredge material that would be placed in or removed from surface water or wetlands and indicate the area of the site that would be affected. Indicate the source of fill material.

None within this proposal.

4. Will the proposal require surface water withdrawals or diversions? Please provide description, purpose and approximate quantities:

None within this proposal.

5. Does the proposal lie within a 100-year floodplain? If so, note location on the site plan.

No, the proposal does not lie within a 100-year floodplain. There are designated floodplains associated with Yacolt Creek and an unknown tributary to Weaver Creek that are within the UGA, but the proposal does not lie within them.

6. Does the proposal involve any discharges of waste materials to surface waters? If so, describe the type of waste and anticipated volume of discharge.

No, the proposal will not discharge treated effluent into surface waters.

B. Ground

1. Will ground water be withdrawn, or will water be discharged to ground water? Please give description, purpose, and approximate quantities.

Treated effluent will be ultimately discharged to shallow groundwater via RI discharge basins. The anticipated initial discharge will be approximately 200,000 gallons/day.

2. Describe waste material that will be discharged into the ground from septic tanks or other sources, if any (e.g., domestic sewage; industrial, containing the following chemicals…; agricultural; etc.). Describe the size and number of the systems, houses to be served; or, the number of animals or humans the system are expected to serve.

It is anticipated that the implementation of this plan will result in the removal of between 600 and 650 septic systems from groundwater discharge.

C. Water Runoff (including storm water):

1. Describe the source of runoff (including storm water) and the method of collection and disposal. Include quantities, if known. Describe where water will flow, and if it will flow into other water.

None within this proposal.

2. Could waste materials enter ground or surface waters? If so, please describe.

NA

D. Proposed measures to reduce or control surface, ground, and runoff water impacts, if any:

NA

4. **PLANTS**

A. Check or circle types of vegetation found on the site:
_X_ Deciduous tree: alder, maple, aspen, other
_X_ Evergreen tree: fir, cedar, pine, other
_X_ Shrubs
_X_ Grass
_X_ Pasture
___ Crop or grain
___ Wet soil plants: cattail, buttercup, bullrush, skunk cabbage, other
___ Water plants: water lily, eelgrass, milfoil, other
_X_ Other types of vegetation

B. What kind and amount of vegetation will be removed or altered?

None within this proposal.

C. List any threatened or endangered species known to be on or near the site.

None known.

D. List proposed landscaping, use of native plants, or other measures to preserve or enhance vegetation on the site:

None within this proposal.

5. **ANIMALS**

A. Circle any birds and animals which have been observed on or near the site:

Birds: (hawk), heron, (eagle), (songbirds), other: *monk parrot*
Mammals: (deer), (bear), elk, (beaver), other: *raccoons, opossums*
Fish: bass, salmon, trout, herring, shellfish, other:

B. List any threatened or endangered species known to be on or near the site.

None known.

C. Is the site part of a migration route? If so, please explain.

The Yacolt area is within the Pacific Flyway, a major north-south route of travel for migratory birds in the Americas, extending from Alaska to Patagonia.

D. List proposed measures to preserve or enhance wildlife:

None within this proposal.

6. **ENERGY AND NATURAL RESOURCES**

A. What kinds of energy (electric, natural gas, oil, wood stove, solar) will be used to meet the completed project's energy needs? Describe whether it will be used for heating, manufacturing, etc.

None within this proposal. Gas and electricity will be used to operate the WWTP when constructed.

B. Would your project affect the potential use of solar energy by adjacent properties? If so, please describe.

No.

C. What kinds of energy conservation features are included in the plans of this proposal? List other proposed measures to reduce or control energy impacts:

None within this proposal. Energy conservation will be reviewed and included during the wastewater project design where applicable.

7. **ENVIRONMENTAL HEALTH**

A. Are there any environmental hazards, including exposure to toxic chemicals, risk of fire and explosion, spill, or hazardous waste that could occur as a result of this proposal? If so, please describe.

None anticipated.

1. Describe special emergency services that might be required.

   None anticipated.

2. Proposed measures to reduce or control environmental health hazards, if any?

   None anticipated. The removal of septic systems will improve groundwater quality.

B. Noise

1. What types of noise exist in the area which may affect your project (e.g., traffic, equipment operation, other)?

   None within this proposal.

2. What types and levels of noise are associated with the project on a short-term or a long-term basis (e.g., traffic, construction, operation, other)? Indicate what hours the noise would come from the site.

   None within this proposal.

3. Proposed measures to reduce or control noise impacts:

NA

8. **LAND AND SHORELINE USE**

A. What is the current use of the site and adjacent properties?

Land use is currently suburban single family residences with properties located outside of the annexed area primarily used as single family residences.

B. Has the site been used for agriculture? If so, describe.

Some areas are used for pasture. No properties are currently zoned for agricultural uses.

C. Describe any structures on the site.

NA

D. Will any structures be demolished? If so, please describe?

NA

E. What is the current zoning classification of the site?

Properties within the UGA include zonings of Rural R-5 and R-10, urban zonings of R1-10, R 1-12.5 and R1-20, Neighborhood Commercial and Convenience Commercial, Light Industrial, Parks and Public Facilities. The proposed WWTP site is in Urban Reserve.

F. What is the current comprehensive plan designation of the site?

Properties within the UGA include designations of Urban Low, Rural (R-5 and R-10), General Commercial, Light Industrial, Parks and Open space and Public Facilities.

G. What is the current shoreline master program designation of the site?

Per Clark County's Master Shoreline Management Plan, the Town of Yacolt does not have any land affected by shorelines.

H. Has any part of the site been classified as an "environmentally sensitive" area? If so, please specify.

No. There have been riparian and wetland habitat areas mapped by Clark County during the 2007 GMA update that appear outside of the proposed sites.

I. How many people would reside or work in the completed project?

Does not apply.

J. How many people would the completed project displace?

No displacement with this project.

K. Please list proposed measures to avoid or reduce displacement impacts:

NA

L. List proposed measures to ensure the proposal is compatible with existing and projected land uses and plans:

This project will fully support existing and projected land uses by providing sanitary sewer facilities.

9. **HOUSING**

A. Approximately how many units would be provided? Indicate whether it's high, middle, or low income housing.

None. Provision of sanitary sewer will relate in the potential for additional development and construction of new housing units.

B. Approximately how many units, if any, would be eliminated? Indicate whether it's high, middle, or low-income housing.

None.

C. List proposed measures to reduce or control housing impacts:

NA

10. **AESTHETICS**

A. What is the tallest height of any proposed structure(s), not including antennas? What is proposed as the principal exterior building materials?

NA

B. What views in the immediate vicinity would be altered or obstructed?

NA

C. Proposed measures to reduce or control aesthetic impacts:

NA

11. **LIGHT AND GLARE**

A. What type of light or glare will be proposal produce? What time of day would it mainly occur?

None.

B. Could light or glare from the finished project be a safety hazard or interfere with views?

NA

C. What existing off-site sources of light or glare may affect your proposal?

None.

D. Proposed measures to reduce or control light and glare impacts:

NA

12. **RECREATION**

A. What designated and informal recreational opportunities are in the immediate vicinity?

There are Town parks, ball fields and school yards within the Town limits. There are also potential rail uses for sightseeing excursions that commence from Yacolt, however this is a contracted use and is not always in operation.

B. Would the project displace any existing recreational uses? If so, please describe.

No.

C. Proposed measures to reduce or control impacts on recreation, including recreational opportunities to be provided by the project or applicant:

NA

13. **HISTORIC AND CULTURAL PRESERVATION**

A. Are there any places or objects listed on or near the site which are listed or proposed for national, state, or local preservation registers? If so, please describe.

None.

B. Please describe any landmarks or evidence of historic, archaeological, scientific, or cultural importance known to be on or next to the site.

None.

C. Proposed measures to reduce or control impacts:

No impacts anticipated.

14. **TRANSPORTATION**

A. Identify public streets and highways serving the site, and describe proposed access to the existing street system. Show on site plans, if any.

See attached maps for local streets.

B. Is the site currently served by public transit? If not, what is the approximate distance to the nearest transit stop?

Yes, the C-TRAN transit stop is on West Yacolt Road with two visits per day (am/pm).

C. How many parking spaces would the completed project have? How many would the project eliminate?

No parking spaces would be provided with this project.

D. Will the proposal require any new roads or streets, or improvements to existing roads or streets, not including driveways? If so, please describe and indicate whether it's public or private.

None with the proposal, but ultimately new roads will be constructed based on new construction.

E. Will the project use water, rail, or air transportation? If so, please describe.

No.

F. How many vehicular trips per day would be generated by the completed project? Indicate when peak traffic volumes would occur.

None.

G. Proposed measures to reduce or control transportation impacts:

NA

15. **PUBLIC SERVICES**

A. Would the project result in an increased need for public services (e.g., fire protection, police protection, health care, schools, other)? If so, please describe.

No

B. Proposed measures to reduce or control direct impacts on public services.

NA

16. **UTILITIES**

A. Circle the utilities currently available at the site: (Electricity), natural gas, (water), (refuse service), (telephone), sanitary sewer, (septic system), other.

B. Describe the utilities that are proposed for the project, the utility providing the service, and the general construction activities on or near the site.

As a result of future construction as described in the WFP, sanitary sewer service will be provided by the Town.

C. SIGNATURE

The above answers are true and complete to the best of my knowledge. I understand that the lead agency is relying on them to make its decision.

Signature: _____

Date Submitted: February 7, 2012

D. SEPA SUPPLEMENTAL SHEET FOR NON-PROJECT ACTIONS

INSTRUCTIONS:

Because these questions are very general, it may be helpful to read them in conjunction with the list of the elements of the environment. When answering these questions, be aware of the extent of the proposal and the types of activities likely to result from this proposal. Please respond briefly and in general terms.

1. How would the proposal increase discharge to water; emissions to air; production, storage, or release of toxic or hazardous substances; or production of noise? ***There would be no initial impact based on this project. Eventually construction will impact water and air by improving the treatment of effluent (vs. septic systems) and potentially creating minor air impacts.***

   Proposed measures to avoid or reduce such increases are: ***Water impacts would be improvements to the existing environment; air impacts would meet applicable permit requirements.***

2. How would the proposal be likely to affect plants, animals, fish, or marine life? ***There would be no impacts to plants, animals, fish or marine life within this project. Ultimately minor impacts will occur based on construction activity.***

   Proposed measures to protect or conserve plants, animals, fish, or marine life are: ***Appropriate guidelines will be followed and permits will be acquired for any construction and impacts that may be encountered.***

3. How would the proposal be likely to deplete energy or natural resources? ***There will be no impact to energy or natural resources by this project. Construction will marginally impact land, but will improve ground and stream water in the area.***

   Proposed measures to protect or conserve energy and natural resources are: ***The project will be designed with review of opportunities to reduce impacts and conserve energy.***

4. How would the proposal use or affect environmentally sensitive areas or those designated (or eligible or under study) for governmental protection; such as parks, wilderness, wild and scenic rivers, threatened or endangered species habitat, historic or cultural sites, wetlands, floodplains, or prime farmlands? ***No impacts will occur with this project. Resultant construction will review criteria for affected areas and should improve wetlands and floodplains by removing septic systems and reducing potential groundwater and surface water impacts.***

   Proposed measures to protect such resources or to avoid or reduce impacts are: ***The resultant construction projects will be constructed in accordance with governmental requirements.***

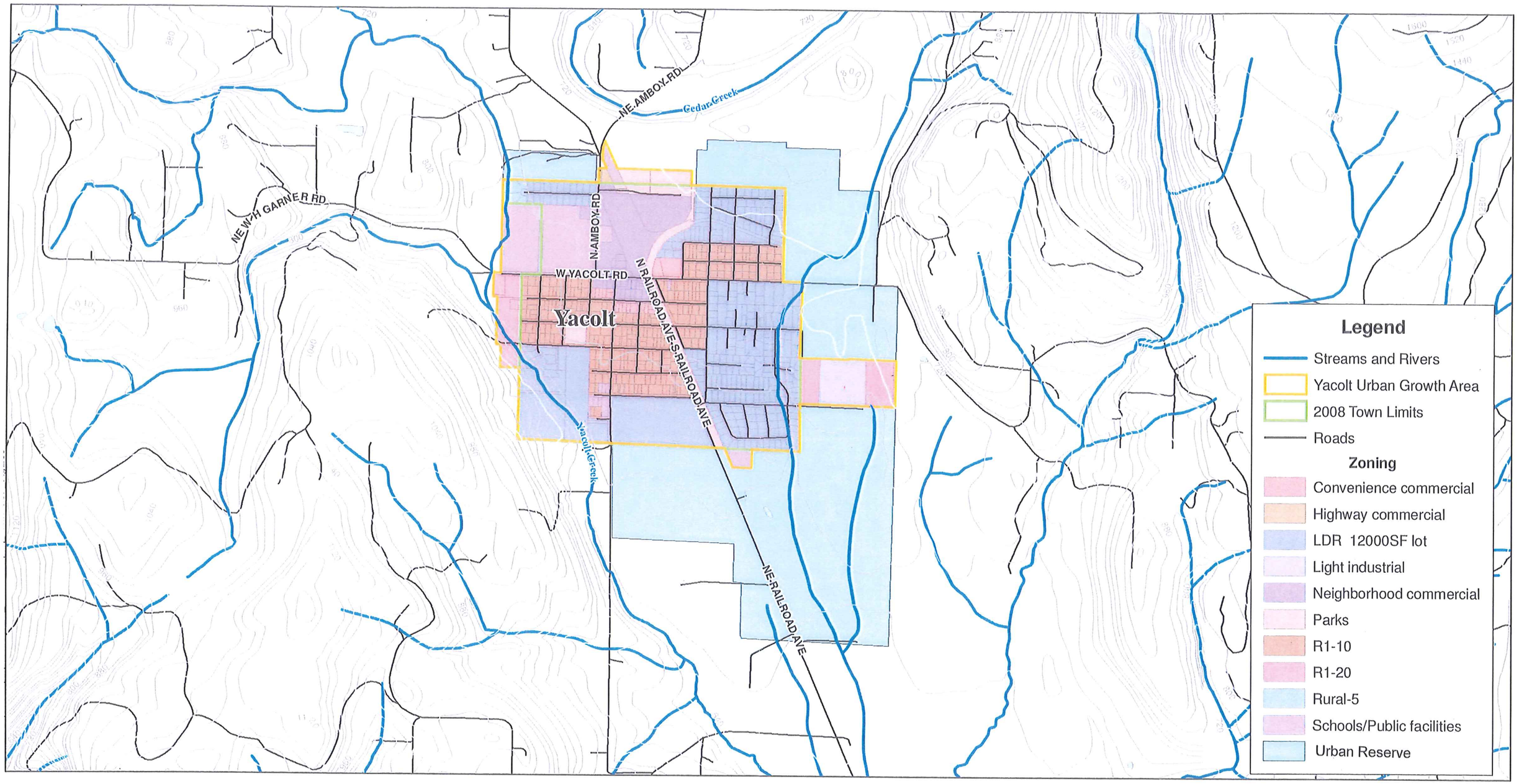
5. How would the proposal be likely to affect land and shoreline use? Will it allow or encourage land or shoreline uses incompatible with existing plans? ***No impacts will occur with this project. Resultant construction will not encourage uses incompatibly with existing plans.***

   Proposed measures to avoid or reduce shoreline and land use impacts are: ***The resultant construction projects will be constructed in accordance with governmental requirements.***

6. How would the proposal be likely to increase demands on transportation or public services and utilities? ***No impacts will occur with this project. While resultant construction may increase demands on transportation and utilities, the demand will be consistent with approved levels for the community.***

   Proposed measures to reduce or respond to such demand(s) are: ***Impacts from the resulting construction will be within the design parameters of the current improvements.***

7. Identify whether the proposal may conflict with local, state, or federal laws or requirements for the protection of the environment. ***The proposal is in compliance with requirements for federal state and local laws to protect the environment.***



Q:\Projects\09proj\0991020.00 City of Yacolt WW Plant\SEPA Checklist\0991020_Figure-1.dwg AARON LAWLER 1/31/2012 8:55 AM

N

0 660 1320

APPROXIMATE SCALE IN FEET

Kennedy/Jenks Consultants

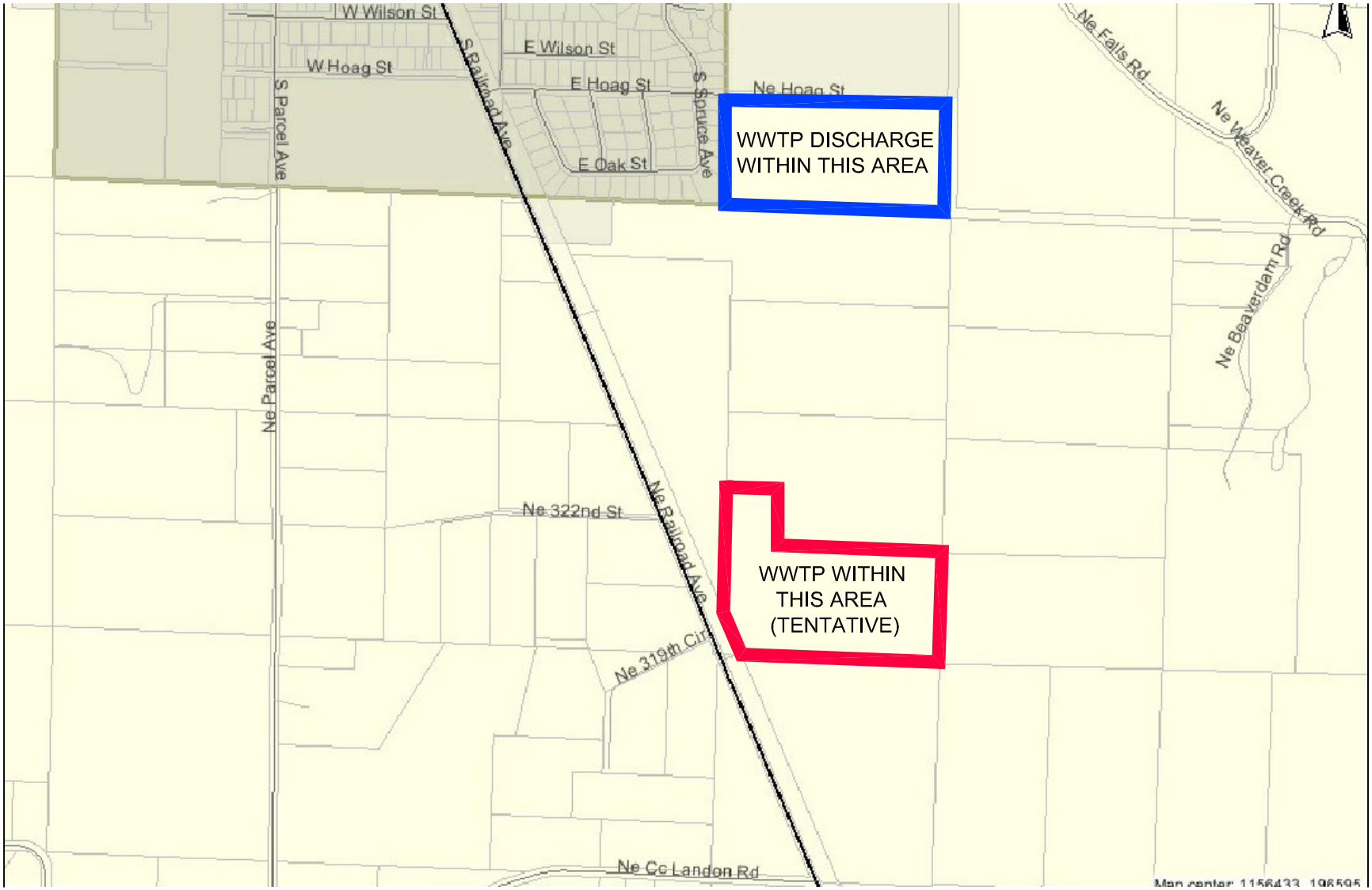
TOWN OF YACOLT
YACOLT, WASHINGTON

GENERAL TOPOGRAPHY AND ZONING

K/J 0991020.00

FIGURE 1

Q:\Projects\09proj\0991020.00 City of Yacolt WW Plant\Figures\Parcel_Map\0991020.00_Figure-2.dwg



Kennedy/Jenks Consultants

TOWN OF YACOLT
YACOLT, WASHINGTON

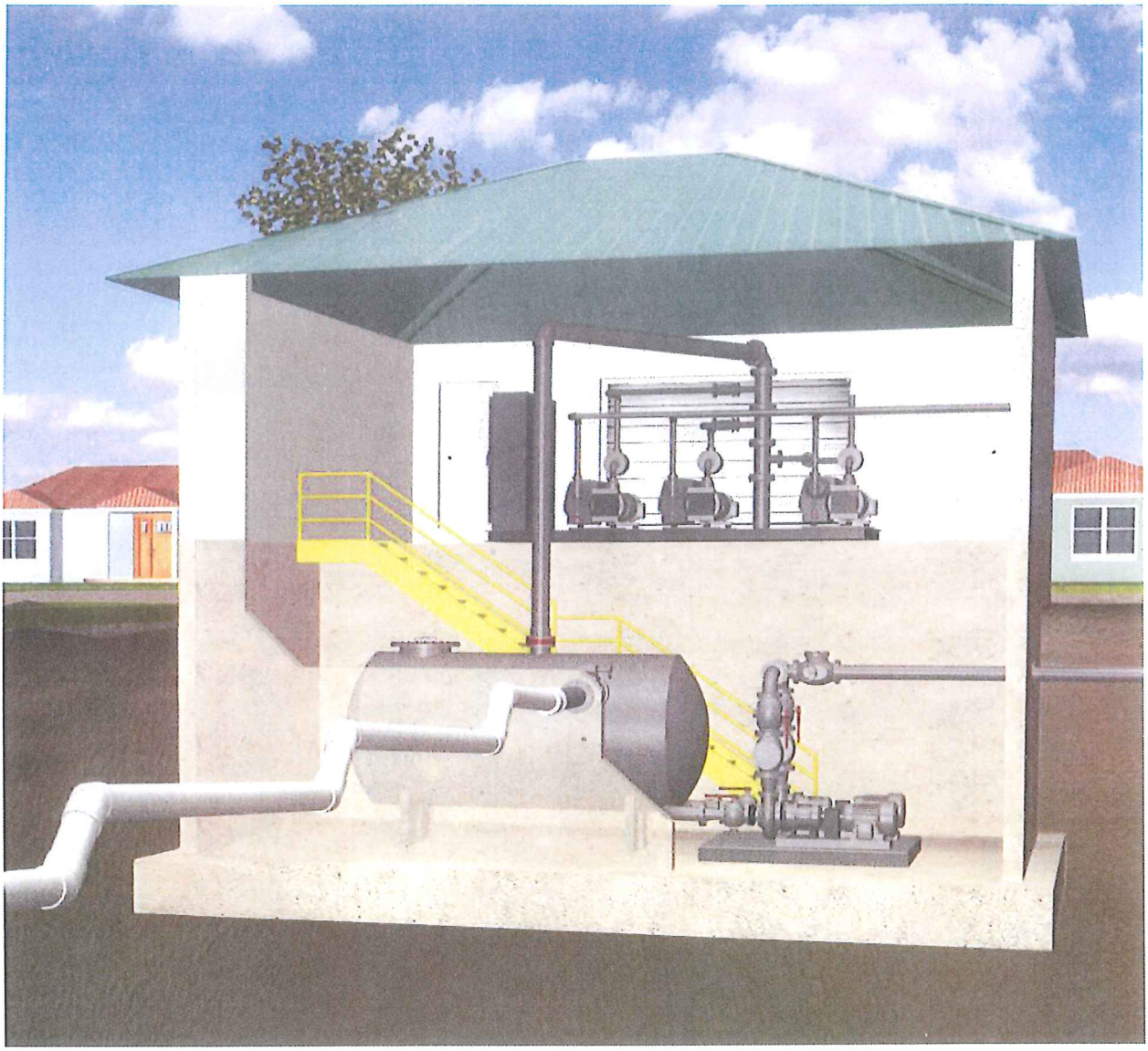
PROPOSED LOCATIONS OF WWTP AND DISCHARGE BASINS

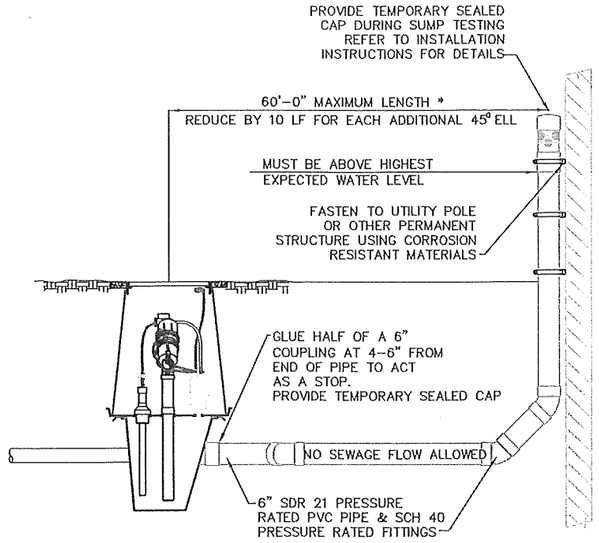
0991020.00

FIGURE 2

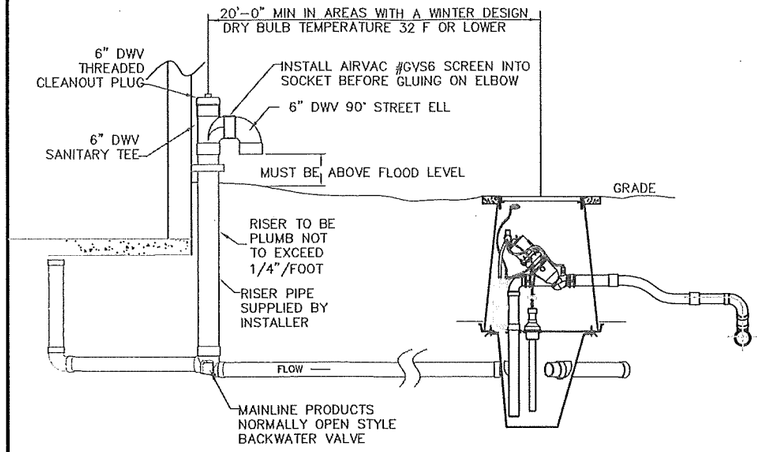
Appendix C

Vacuum Collection Station

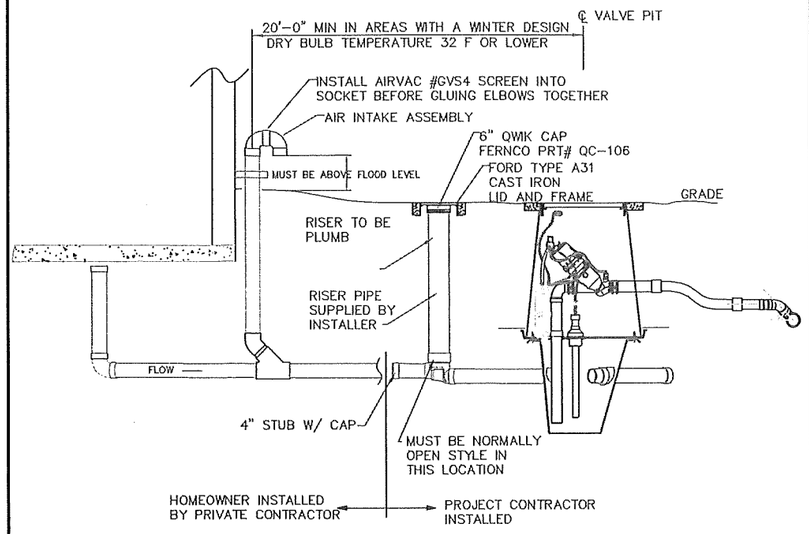




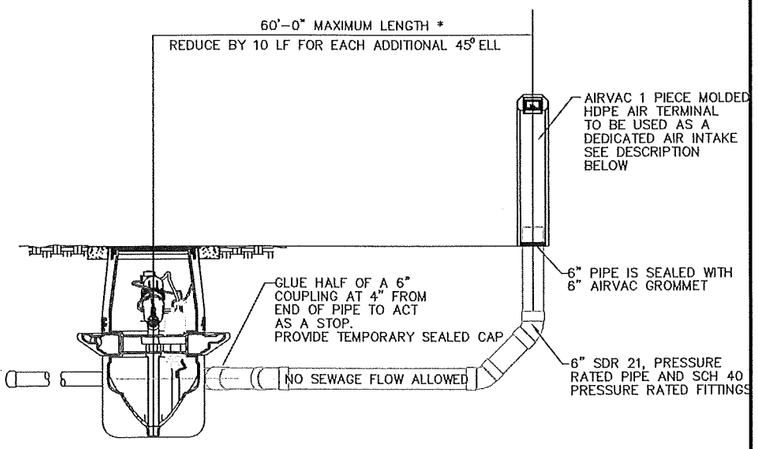
6" DEDICATED AIR TERMINAL DETAIL
CONTACT AIRVAC FOR ADDITIONAL DRAWINGS
THIS 6" PVC PIPE TO BE A DEDICATED AIR PIPE FROM THE SEWAGE HOLDING SUMP WITH NO SEWAGE FLOW.



6" AIR-INTAKE WITH BACKWATER VALVE DETAIL
SEE AIRVAC DRAWING "BACKWATER 1" FOR DETAILS



4" AIR-INTAKE WITH BACKWATER VALVE DETAIL
SEE AIRVAC DRAWING "BACKWATER 2" FOR DETAILS



6" DEDICATED HDPE AIR TERMINAL DETAIL
CONTACT AIRVAC FOR ADDITIONAL DRAWINGS

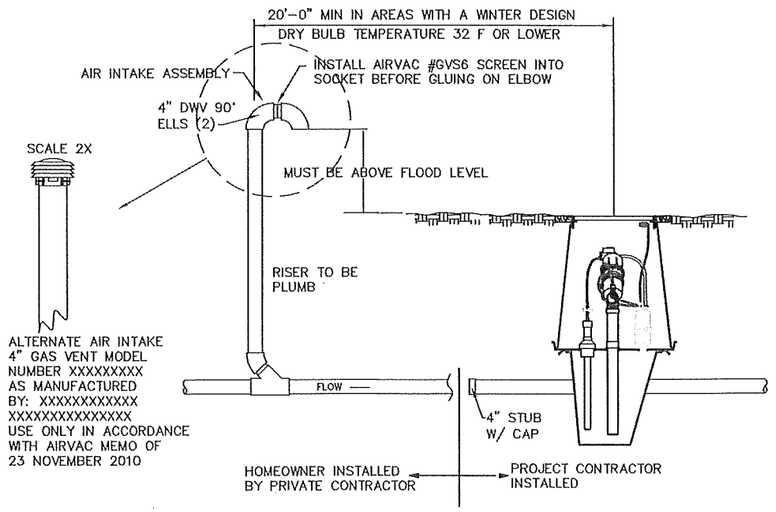
* 20'-0" MIN IN AREAS WITH A WINTER DESIGN DRY BULB TEMPERATURE 32° F OR LOWER

MATERIAL: POLYETHYLENE, MOLDED CONSTRUCTION WITH APPROXIMATELY 3/16" WALL THICKNESS.

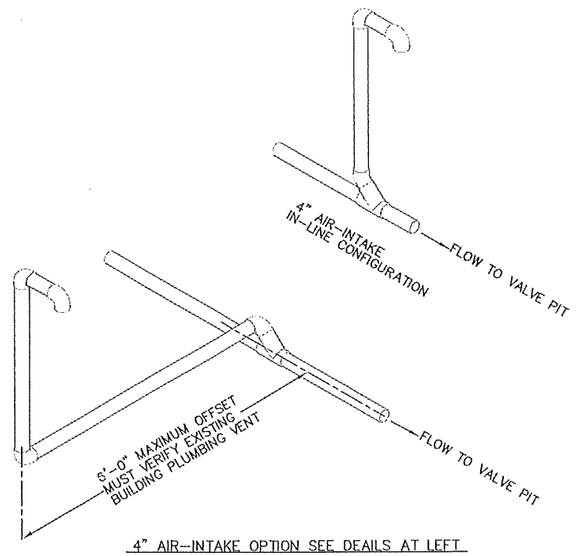
COLOR: SIMULATED BROWN STONE.

INSTALLATION: PUSH DOWN ONTO 6" SDR 21 PVC PIPE INSTALLED AT 6" ABOVE FINISHED GRADE.

THIS 6" PVC PIPE TO BE A DEDICATED AIR PIPE FROM THE SEWAGE HOLDING SUMP WITH NO SEWAGE FLOW.



4" AIR-INTAKE DETAIL (SEE ARIVAC DRAWING S-1)
EXISTING BUILDING PLUMBING VENT MUST BE VERIFIED



4" AIR-INTAKE OPTION SEE DEAILS AT LEFT

AIRVAC®

AIRVAC HAS EXPENDED EFFORT IN THE PREPARATION OF THESE DOCUMENTS ON THE UNDERSTANDING THAT THEY WILL BE USED ONLY IF AIRVAC IS CHOSEN AS THE VACUUM SYSTEM SUPPLIER. THESE DOCUMENTS CONTAIN PROPRIETARY INFORMATION OF AIRVAC AND ANY USE OF THAT INFORMATION WITHOUT AIRVAC'S PRIOR WRITTEN CONSENT IS PROHIBITED.

VACUUM SEWER SYSTEMS

AIRVAC, INC.
P.O. BOX 528, 4217 N. OLD U.S. 31, ROCHESTER, INDIANA 46975 U.S.A.
TELEPHONE (574) 223-3980
FAX (574) 223-5566

The Viable Alternative®

NO.	REVISIONS	DATE
–	–	–
1	ADDED 4" GAS VENT DETAIL	12/16/10

TITLE: AIRVAC STANDARDS
AIR TERMINAL OPTIONS

CLIENT:

DRAWN BY: NDM
DESIGN BY: MAT
DATE: 2/22/06
COPYRIGHT © AIRVAC ®
SCALE:
DRAWING NO.: AIR TERM OPS

Appendix D

CALCULATIONS OF SLUDGE PRODUCTION

Project: *Yacolt, WA*
Date *10-03-11*

Basic Design Data

Flow (Q)	0.3	*TSS $_{in}$*	237.327		
BOD $_{in}$	237.327	*TSS $_{out}$*	15	T (water)	20
BOD $_{out}$	10	*TKN $_{in}$*	40	Y_H	0.5
K_{dH}	0.09	*Y_A*	0.1	K_{dA}	0.06
SRT	58	*TKN $_{out}$*	1		

Non-Biodegradable ***(X_I)***

$$X_I = TSS\,(1-f_v+f_v f_{nv})Q$$

Where

f_v = Volatile content of influent TSS (85%)

f_{nv} = Non-biodegrable fraction of VSS (20%)

$$X_I = 86.2354 \text{ kg/d}$$

Active Hetrotrophic Biomass ***(X_{BH})***

$$X_{BH} = \frac{Y_H\,(BOD_{in} - BOD_{out})Q}{(1+SRT x K_{dH})}$$

$$K_{dH} = K_{dH}\,(20\ ^{\circ}C) \times 1.04^{T-15}$$

$$K_{dH} = 0.109499$$

$$X_{BH} = 17.65903 \text{ kg/d}$$

Active Autotrophic Biomass ***(X_{BA})***

$$X_{BA} = \frac{Y_A\,(TKN_{in} - TKN_{out})Q}{(1+SRT x K_{dA})}$$

$$K_{dA} = K_{dA}\,(20\ ^{\circ}C) \times 1.04^{T-15}$$

$$K_{dA} = 0.072999$$

BIOLAC SYSTEM
AERATION SIZING PROCEDURE
WAVE OXIDATION MODIFICATION

DATE: 8/23/2011
PROJECT LOCATION Yacolt, WA
CONSULTING ENGR: Kennedy Jenks

Basin Data (at mid-depth) FOR BASIN ONE

BASIN CAPACITY	*	NUMBER OF BASINS	=	TOTAL BASIN CAPACITY
42000	*	1	=	42000

TOTAL BASIN CAPACITY	*	7.48	=	MILLION GALLON BASIN CAPACITY (MGBC
42000	*	7.48/1000000	=	0.31

Oxygen Requirements for the Biolac Aeration Syster

M G D	*	BOD (mg./l.)	*	8.34 LBS./(mg./l.)	=	TOTAL LBS. BOD/DAY
0.15		240.8	*	8.34	=	301

1.5 LBS. O2/LB. OF BOD REMOVED

50 HOURS RETENTION TIME

96 % REMOVAL OF BOD

LBS. BOD REMOVED/DAY	*	LBS.O2/LB. BOD REMOVED	=	AOR FOR BOD REMOVAL
289	*	1.5	=	434

M G D	*	TKN(mg./l.)	*	8.34	=	TOTAL LBS. TKN / DAY
0.15		40	*	8.34	=	50

4.6 LBS.O2/LB. OF TKN REMOVED (STANDARD)

98 % REMOVAL OF TKN

LBS. TKN REMOVED/DAY	*	LBS. O2/LB. TKN REMOVED	=	AOR FOR TKN REMOVA
49	*	4.6	=	226

COMBINED AOR = 659 /24 HRS. = 27 LBS. O2/HR. AOR

ADJUSTED AOR FOR CONDITIONS AS LISTED

PERCENT TKN NITRIFIED	98	TOTAL LBS/DAY	49
PERCENT NITRATE REMOVED	88	TOTAL LBS/DAY	43
LBS OXYGEN/LB NITRATE	2.9	TOTAL LBS/DAY	125

ADJUSTED COMBINED AOR = TOTAL LBS O2 - LBS O2 RECOVERED FROM NITRAT

ADJUSTED AOR = 534 LBS/DAY = 22 LBS O2/HR AOR

THE ACTUAL OXYGEN REQUIREMENT MUST BE CONVERTED TO A STANDARD OXYGE REQUIREMENT. THIS CONVERSION TAKES INTO CONSIDERATION SUCH FACTORS TEMPERATURE, ELEVATION, DIFFUSER DEPTH, ALPHA FACTOR, BETA FACTOR, DISSOLVED OXYGEN LEVEL DESIRED.

TEMPERATURE=(T)	20
SATURATION=(CSM)	9.092
SITE BAROMETRIC PRESSURE=(BP)	14.337
DIFFUSER WATER DEPTH=(DWD)	9
EQUIVILENT DEPTH FACTOR=(F)	0.25
ALPHA=(A)	0.7
BETA=(B)	0.95
THETA=(O)	1.024
DISSOLVED OXYGEN LEVEL=(C-L)	0.5

C-ST = CSM * (BP+(.433*DWD* F)) / 14.7 = 9.4704

C-S20= 9.092 *((14.7+(.433*DWD* F)) / 1.= 9.6946

C-SW = BETA * C-ST = 8.9969

$$SOR = \frac{\text{LBS.O2/HR. AOR}}{\text{ALPHA*(C-SW - C-L / C-S20) * (THETA\^T - 20)}} = \frac{22}{} = 36$$

SOR = 36

AERATION SYSTEM DESIGN

AIR RATE PER FT OF DIFFUSER AS DETERMINED 1.52 SCFM

SOR = 36

DEFINE 02 TRANSFER RATE/FT OF DIFFUSER :

DIFFUSER 02 TRANSFER RATE 0.249

SCFM REQ =(SOR/FT OF DIFF 02 TRANS RATE*AIR FLOW RATE/FT D

SCFM = 219

DELTA P = (swd - 1 /34)14.7+1.5 = 5.39

BHP.= (SCFM*0.3775)((ATM.P+DEL.P/ATM.P)^.283-1)

BHP. = 8

MIN SCFM FOR MIXING BASED ON SIDE SLOPE = 4 /1000 FT3
MIN SCFM = BASIN VOLUME 1000 FT3 4 168 SCFM
MIN BHP FOR MIXING = 6

TOTAL FT OF DIFFUSERS SUGGESTED AT TARGET FLOW RAT 288
TUBES PER BIOFUSER ASSEM 3 TOTAL BIOFUSERS 24

NUMBER OF BIOFLEX CHAINS INSTALLED ON PROJECT = 6
NUMBER OF BIOFUSER ASSEMBLIES PER BIOFLEX CHAIN = 4
AIR FLOW PER OPERATING CHAIN (SCFM) = 73
FEED DIAMETER = 4 R VELOCITY DURING WOX OPERATION = 12

SOR = 36 LBS O2/HR

SCFM/FT OF DIFFUSER LENG	0.5	1	1.5	2	2.5
LBS O2/FT OF DIFFUSER/HR	0.09065	0.1763	0.2463	0.3075	0.355
TOTAL FT OF DIFFUSER REQ'	396	203	146	117	101
TOTAL SCFM REQ.	198	203	218	233	253

FINAL REQUIREMENT:

144 TOTAL FT OF DIFFUSER TUBES @ 1.52 SCFM/ FT OF DIFF

TOTAL SCFM REQUIRED FOR SYSTEM AS PER ABOVE CONDITIONS = 219

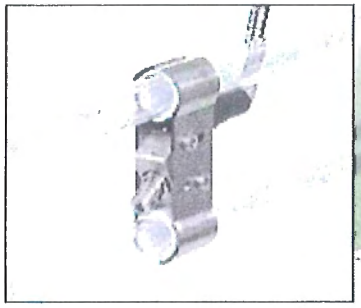
PERCENT OXYGEN TRANSFER FOR CONDITIONS AS SHOWN = 15.80

Appendix E

TROJAN UV3000™ PTP | TROJAN UV3000™ B

Robust, operator-friendly solutions designed for economical disinfection

System Monitor/Control Center



TrojanUV3000™PTP – Optional

The optional System Monitor includes a submersible UV sensor, and provides digital output of UV intensity at each bank. Elapsed time display provides continuous readout of actual hours of operation (lamp hours). A dry contact enables a remote low UV intensity alarm.

TrojanUV3000™B

The System Control Center (SCC) provides control of all UV functions, tracks lamp hours, and uses a submersible UV sensor (one per bank) to monitor UV intensity. The SCC is capable of "flow pacing" – automatically turning banks of UV lamps off or on in response to changes in the flow rate in order to conserve power and prolong lamp life.

Water Level Control

TrojanUV3000™PTP

A fixed weir maintains the correct channel effluent depth over different flow rates, with maximum headloss of 1.5 inches (3.8 cm) at peak flow. Equipped with a drain for easy channel cleaning, and available for both concrete channels and stainless steel channel option.

Highly Flexible Installation Configurations

TrojanUV3000™PTP is pre-engineered for cost-effective integration with piping or channels

Benefits:

- Systems are pre-designed to meet disinfection requirements with minimal engineering costs
- Systems can be installed in series to treat higher flows or provide additional redundancy
- Pre-engineered stainless steel channels with built-in weirs are installed as a freestanding structure
- Stainless steel channels are easily integrated with existing flanged piping using Trojan's highly flexible transition boxes (Figure 1)
- Optional turn boxes minimize system footprint by connecting stainless steel channels and allowing two banks in series to be installed side-by-side (Figure 2)
- Transition boxes allow flanged pipe connection on any of three sides for flexible integration (Figure 3)

Figure 1: Banks in Series – Side View

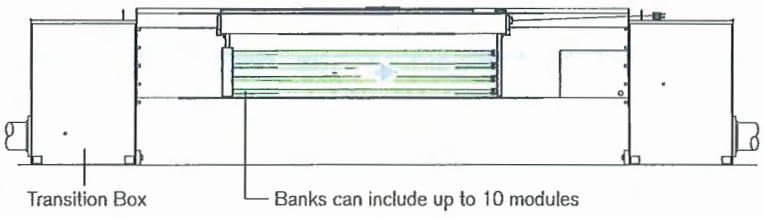


Figure 2: Banks in Series With Turn Box – Overhead View

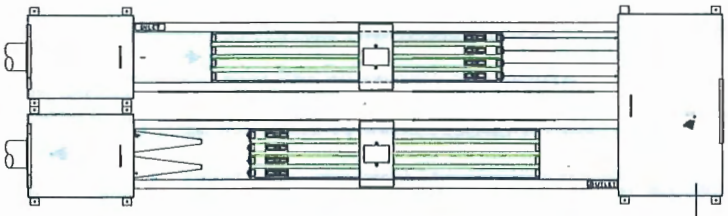
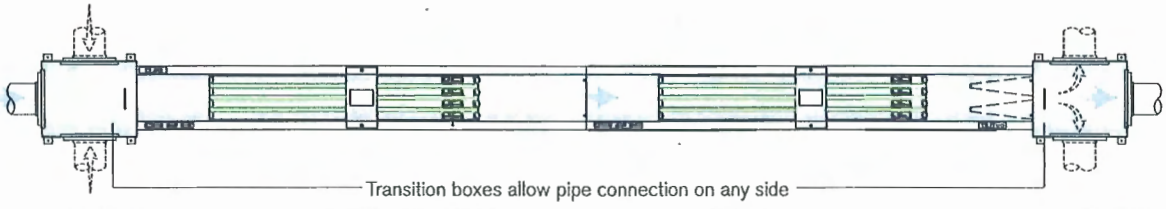


Figure 3: Banks in Series – Overhead View



The TrojanUV3000™PTP is pre-engineered for simple, effective, low cost wastewater disinfection. The optional 304 stainless steel channels feature a UV module support rack, and can be set in a poured concrete channel or installed as a freestanding unit. Trojan turn boxes and transition boxes allow systems to be incorporated with maximum flexibility and minimal footprint.

Flow Pacing Reduces O&M Costs

TrojanUV3000™B system controller offers flow-pacing for increased operating efficiency

Benefits:

- The System Control Center (SCC) provides monitoring and control of all UV functions
- The SCC provides digital display of bank status, lamp hours, and UV intensity (mW/cm^2)
- The SCC allows the TrojanUV3000™B to be flow paced – meaning the UV lamps of individual banks are turned on and off automatically in response to variations in flow rate (based on a flow meter signal)
- Flow pacing maximizes operating efficiency by matching UV output to disinfection requirements, and reducing electrical consumption during periods of low flow by turning lamps off (Figures 1 & 2)
- Flow pacing also increases the operating life of UV lamps, thereby reducing the frequency, expense and labor required for lamp replacement

The System Control Center of the TrojanUV3000™B monitors lamp hours and uses a submerged UV sensor to feed accurate data on UV intensity for at-a-glance system status. The SCC also allows flow pacing to minimize operating and maintenance costs by turning banks on and off based on flow requirements

Flow Pacing Optimizes System Efficiency

Figure 1: Operation During Periods of High Flow

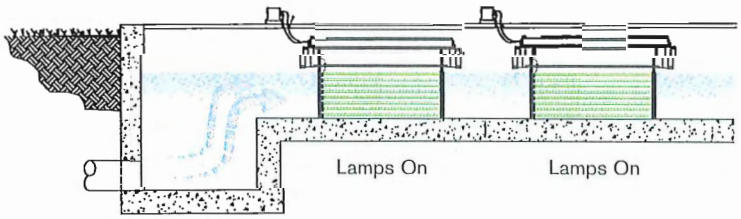
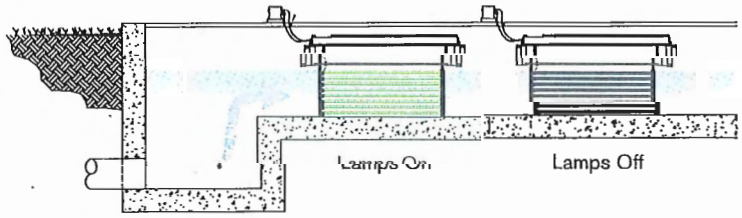
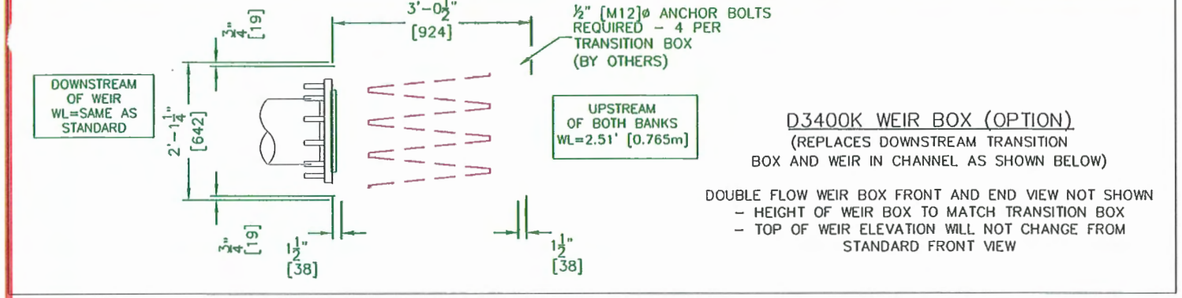


Figure 2: Operation During Periods of Low Flow





D3400K WEIR BOX (OPTION)

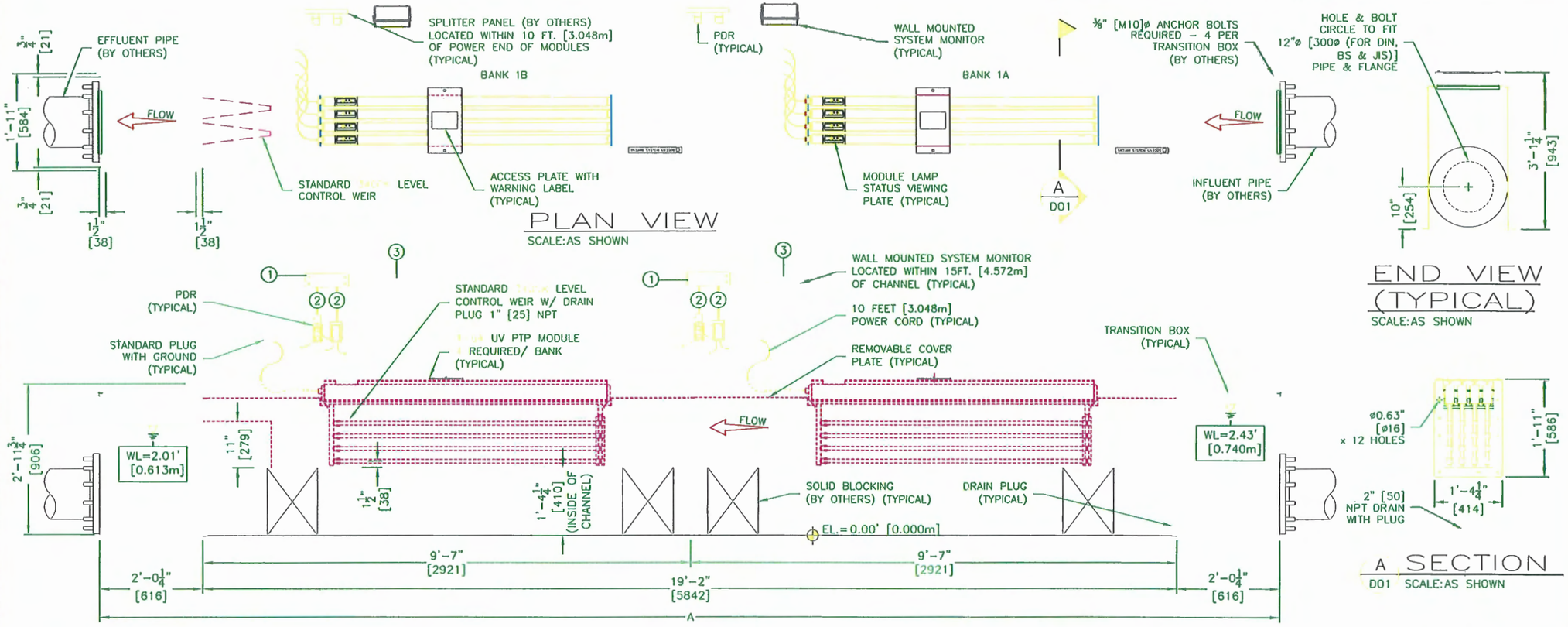
(REPLACES DOWNSTREAM TRANSITION BOX AND WEIR IN CHANNEL AS SHOWN BELOW)

DOUBLE FLOW WEIR BOX FRONT AND END VIEW NOT SHOWN
- HEIGHT OF WEIR BOX TO MATCH TRANSITION BOX
- TOP OF WEIR ELEVATION WILL NOT CHANGE FROM STANDARD FRONT VIEW

TROJAN UV3000™ PTP

EQUIPMENT INTERCONNECTIONS

No.	DESCRIPTION	FROM	TO
1	SPLITTER PANEL POWER SUPPLY 120V, 1 PHASE, 2 WIRE, ACTUAL DRAW 12.7 AMPS / SPLITTER PANEL	DISTRIBUTION PANEL (DP) (NOT SHOWN) (BY OTHERS)	SPLITTER PANEL (BY OTHERS)
2	POWER DISTRIBUTION RECEPTACLE (PDR) POWER SUPPLY 120V, 1 PHASE, 2 WIRE, ACTUAL DRAW 6.3 AMPS / PDR	SPLITTER PANEL (BY OTHERS)	PDR
3	SYSTEM MONITOR POWER SUPPLY 120V, 1 PHASE, 2 WIRE, 5 AMPS	DP (NOT SHOWN) (BY OTHERS)	SYSTEM MONITOR



PLAN VIEW
SCALE:AS SHOWN

END VIEW (TYPICAL)
SCALE:AS SHOWN

A SECTION
D01 SCALE:AS SHOWN

FRONT VIEW
SCALE:AS SHOWN

NOTES:
: DO NOT SLOPE CHANNEL FLOOR.
: CHANNEL WIDTH & DEPTH MUST BE KEPT WITHIN A TOLERANCE OF + OR – ¼" [6].
: ANCHOR BOLTS ARE NOT SUPPLIED BY TROJAN TECHNOLOGIES.
: BOLTS, WASHERS AND NUTS FOR CONNECTION OF CHANNELS AND TRANSITION BOXES TO CHANNELS ARE PROVIDED BY TROJAN TECHNOLOGIES.
: SYSTEM CONDUIT, WIRING, DISTRIBUTION PANELS & INTERCONNECTIONS BY OTHERS.
: ELECTRICAL REQUIREMENTS SHOWN ARE TO SUPPLY TROJAN UV EQUIPMENT ONLY. ELECTRICAL INRUSH FACTOR TO BE ADDED AS PER LOCAL CODE.
ANY EXTRA OUTLETS NOT BEING USED BY TROJAN EQUIPMENT HAVE NOT BEEN CLUDED IN THE INTERCONNECT AMPERAGE.
CONTRACTOR TO REVIEW ALL TROJAN TECHNOLOGIES INSTALLATION INSTRUCTIONS PRIOR TO EQUIPMENT INSTALLATION.
: ACCESS IS REQUIRED FOR MODULE REMOVAL – NOTE THE CHANNEL WIDTH AND ENSURE ADEQUATE ACCESS IS PROVIDED TO ALL MODULES.
: DO NOT ENCASE THE STEEL CHANNEL IN CONCRETE.
: [ ] INDICATES MILLIMETERS UNLESS OTHERWISE SPECIFIED

MULTIPLE CHANNELS IN PARALLEL (OPTION):
: ADDITIONAL UNITS CAN BE INSTALLED PARALLEL TO THE UNIT SHOWN.
: ACCESS BETWEEN EVERY 2 PARALLEL CHANNELS IS REQUIRED FOR MODULE REMOVAL – NOTE THE CHANNEL WIDTH AND ENSURE ADEQUATE ACCESS IS PROVIDED BETWEEN TRANSITION BOXES AND CHANNELS.
: ACCESS BETWEEN A MAXIMUM OF 2 CHANNELS IS NOT REQUIRED FOR MODULE REMOVAL. TRANSITION BOXES CAN BE INSTALLED ADJACENT TO EACH OTHER.

	DIM "A"
W/ WEIR IN TRANSITION BOX	24'-1¾" [7360]
W/ WEIR IN CHANNEL	23'-2½" [7074]

TROJAN UV

DESCRIPTION:
LAYOUT, UV3000PTP (UV3400K) 1 CHANNEL
2 BANK 4 LAMPS WEIR

DRAWN BY :	DATE :
CHECKED BY :	DATE :
APPROVED BY :	DATE :
SCALE (8½x11) :	LOG NUMBER :

STANDARD DRAWING NO. 3M0276
REFERENCE NO. N/A
DWG NO. D01
REV. F

Appendix F

CHART 1 (One-Plus Shift)
BASIC AND ADVANCED OPERATIONS AND PROCESSES

Process	Flow						Total Hours for Plant
	0.25-0.5 mgd	0.5-1.0 mgd	1.0-5.0 mgd	5.0-10.0 mgd	10.0-20.0 mgd	>20 mgd	
Preliminary Treatment	160	160	320	640	960	1280	
Primary Clarification (mult. by # of units)	160	160	160	320	320	320	
Activated Sludge	640	1280	1920	1920-2560	2560-3200	7680	
Activated Sludge w/BNR	960	1920	2560	2880-3840	3840-7680	8960	
Rotating Biological Contactor	320	480-960	960-1920	1920	X	X	
Sequencing Batch Reactor (per tank)	320	320	320	320	320	320	
Extended Aeration (w/o primary)	800	1600	2560	X	X	X	800
Extended Aeration w/BNR	1120	2240	3200	X	X	X	
Pure Oxygen Facility	X	X	X	2560-3200	3200	5760	
Pure Oxygen Facility w/BNR	X	X	X	3200-4800	4800	7680	
Trickling Filter	320	320	640	960	1280	2560	
Oxidation Ditch (w/o primary)	800	1600	2560	X	X	X	
Oxidation Ditch w/BNR	1120	2240	3200	X	X	X	
Aeration Lagoon	480	480	480	X	X	X	
Stabilization Pond	320	320	320	X	X	X	
Innovative Alternative Technologies	640	960	X	X	X	X	
Nitrification	80	80	160	160	320	640	80
Denitrification	80	80	160	160	320	640	80
Phosphorus Removal (Biological)	80	80	160	160	320	640	80

Continued on page 36

CHART 1 (One-Plus Shift) *continued*
BASIC AND ADVANCED OPERATIONS AND PROCESSES

Process	Flow						Total Hours for Plant
	0.25-0.5 mgd	0.5-1.0 mgd	1.0-5.0 mgd	5.0-10.0 mgd	10.0-20.0 mgd	>20 mgd	
Phosphorus Removal (Chemical/Physical)	80	160	320	640	960	1280	
Membrane Processes	80	80	160	160	320	320	
Cloth Filtration	80	80	160	160	160	160	
Granular Media Filters (Carbon, sand, anthracite, garnet)	160	320	320	480	480	960	
Water Reuse	80	80	160	160	160	160	
Plant Reuse Water	32	32	32	48	80	80	
Chlorination	160	160	320	320	320	320	
Dechlorination	160	160	320	320	320	320	
Ultraviolet Disinfection	160	160	320	320	320	320	160
Wet Odor Control (mult. by # of systems)	160	160	320	320	320	320	
Dry Odor Control (mult. by # of systems)	80	80	160	160	160	160	
Septage Handling	160	160	320	320	320	320	
TOTAL							1,200

- Activated Sludge process includes RAS and WAS pumping.
- Secondary Clarification has been built into basic operations processes.

CHART 2 (One-Plus Shift)
MAINTENANCE

Activity	Flow						Multiply by	Total Hours for Plant
	0.25-0.5 mgd	0.5-1.0 mgd	1.0-5.0 mgd	5.0-10.0 mgd	10.0-20.0 mgd	>20 mgd		
Manually Cleaned Screens	80	80	80	80	160	320	# of screens	
Mechanically Cleaned Screens	80	80	80	320	960	1280	# of screens	
Mechanically Cleaned Screens with grinders/ washer/compactors	80	160	320	640	1280	1600	# of screens	80
Comminutors/ Macerators	80	80	80	160	240	320	# of units	
Aerated Grit Chambers	32	32	80	160	240	320	# of chambers	
Vortex Grit Removal	32	32	80	160	240	320	# of units	
Gravity Grit Removal	32	32	48	64	80	160	# of units	
Additional Process Tanks	32	32	32	32	32	32	# of tanks	
Chemical Addition (varying dependent upon degree of treatment)	32	32	32	32-96	96-192	256	# of chemicals added for processes	
Circular Clarifiers	80	80	160	160	240	320	# of clarifiers	
Chain and Flight Clarifiers	80	80	160	160	240	320	# of clarifiers	
Traveling Bridge Clarifiers	X	X	X	X	240	320	# of clarifiers	
Squircle Clarifiers	80	80	160	160	240	320	# of clarifiers	
Pumps	100	100	250	500	750	1500	X2	200 effluent pumps
Rotating Biological Contactor	48	48	80	80	X	X	# of trains	
Trickling Filters	48	48	48	80	128	160	# of TFs	
Sequencing Batch Reactor	48	48	48	80	128	160	# of tanks	
Mechanical Mixers	32	32	32	32	48	64	# of mixers	
Aeration Blowers	64	64	64	64	96	128	# of blowers	128
Membrane Bioreactor	32	32	32	64	96	128	# of cartridges	

note: labor costs for collection system is included in collection system O&M estimate

Continued on page 38

CHART 2 (One-Plus Shift) *continued*
MAINTENANCE

Activity	Flow							
	0.25-0.5 mgd	0.5-1.0 mgd	1.0-5.0 mgd	5.0-10.0 mgd	10.0-20.0 mgd	>20 mgd	Multiply by	Total Hours for Plant
Subsurface Disposal System	32	32	32	32	96	128	# of systems	32
Groundwater Discharge	32	32	32	32	48	64	X	
Aerobic Digestion	32	32	32	32	48	64	# of digesters	
Anaerobic Digestion	X	64	64	96	192	320	# of digesters	
Gravity Thickening	32	32	32	32	96	128	# of basins	
Gravity Belt Thickening	48	48	48	80	128	160	# of belts	
Belt Press	48	48	48	80	128	160	# of presses	
Mechanical Dewatering (Plate Frame and Centrifuges)	48	48	48	80	128	160	# of units	
Dissolved Air Floatation	X	32	32	32	96	128	# of units	
Chlorination (gas)	32	32	32	64	96	128	X	
Chlorination (liq.)	64	64	64	96	144	192	X	
Dechlorination (gas)	32	32	32	64	96	128	X	
Dechlorination (liq.)	64	64	64	96	144	192	X	
Ultraviolet	32	32	32	48	80	96	# of racks	64
Biofilter	160	160	160	160	160	160	# of units	
Activated Carbon	160	160	160	240	240	320	# of units	
Wet Scrubbers	X	X	X	48	80	96	# of units	
Microscreens	32	32	32	48	80	96	# of screens	
Pure Oxygen	X	X	X	64	96	128	# of units	
Final Sand Filters	64	64	64	64	96	192	# of units	
Probes/ Instrumentation/ Calibration	32	32	32	32	32	32	# of probes in-line	
TOTAL								504

CHART 3 (One-Plus Shift)
LABORATORY OPERATIONS

	How often are tests run?				
Test Required by Permit	Testing Time (hrs.)	Tested Weekly X 52	Tested Monthly X 12	Tested Quarterly X 4	Annual Hours
Acidity	0.75				
Alkalinity, total	0.75				
Biochemical Oxygen Demand (BOD)	2.5				
Chemical Oxygen Demand (COD)	2.5				
Chloride	0.5				
Chlorine, Total Residual	0.25				
Coliform, Total, Fecal, E.Coli	1.0				
Dissolved Oxygen (DO)	0.25				
Hydrogen Ion (pH)	0.25				
Metals	3.0				
Toxicity	2.0				
Ammonia	2.0				
Total Nitrogen	2.0				
Oil and Grease	3.0				
Total and Dissolved Phosphorus	2.0				
Solids, Total, Dissolved, and Suspended	3.0				
Specific Conductance	0.25				
Sulfate	1.0				
Surfactants	1.0				
Temperature	0.25				
Total Organic Carbon (TOC)	0.25				
Turbidity	0.25				
Bacteriological Enterococci	1.0				
Lab QA/QC Program	1.0				
Process Control Testing	3.0				
Sampling for Contracted Lab Services	0.25	5			65
Sampling for Monitoring Groundwater Wells	0.5				
TOTAL					65

- Sampling time is built into testing time estimates.

CHART 4 (One-Plus Shift)
BIOSOLIDS/SLUDGE HANDLING

Process	Flow					
	0.25-0.5 mgd	0.5-1.0 mgd	1.0-5.0 mgd	5.0-10.0 mgd	10.0-20.0 mgd	>20 mgd
Belt Press	320	960	1920	2560	2560	2560/shift
Plate & Frame Press	320	480	960	2560	2560	2560
Gravity Thickening	80	80	160	160	320	320
Gravity Belt Thickening	80	80	160	160	320	640
Rotary Press	80	80	160	160	320	640
Dissolved Air Floatation	X	160	160	320	320	320
Alkaline Stabilization	80	80	80	80	80	80
Aerobic Digestion	160	160	160	320	480	640
Anaerobic Digestion	80	80	160	480	800	1280
Centrifuges	320	320	960	2560	2560	2560
Composting	320	640-960	1280	2560	2560	2560/shift
Incineration	X	X	X	X	7680	7680
Air Drying – Sand Beds	160	160	X	X	X	X
Land Application	80	160	160	X	X	X
Transported Off-Site for Disposal	80	320	1280	2560	2560	2560
Static Dewatering	320	320	X	X	X	X
Facultative Lagoon	(80)					
TOTAL	80					

CHART 5 (One-Plus Shift)
YARDWORK

	Size of Plant			
Work Done	Small	Average	Large	Total Hours for Plant
Janitorial/Custodial Staff	100	200	400	
Snow Removal	60	120	400	
Mowing	100	120	400	100
Vehicle Maintenance (per vehicle)	25	25	25	25
Facility Painting	60	80	160	
Rust Removal	60	80	160	
TOTAL				125

CHART 6 (One-Plus Shift)
AUTOMATION/SCADA

Type of Automation	Yes	No
Automated attendant or interactive voice recognition (IVR) equipment		
Automated Meter Reading (AMR), Touchpad meters or other automated metering technology		
Automatic call director (ACD)		
Billing system		
Computerized facilities management (FM) system		
Computerized preventative maintenance		
Computerized recordkeeping		
E-mail		
Geographical information system (GIS)		
Integrated purchasing and inventory		
Internet website		
Laboratory information management system (LIMS)		
Local area network (LAN)		
Supervisory control and data acquisition (SCADA)		
Telemetry		
Utility customer information system (CIS) package		

CHART 7 (One-Plus Shift)
CONSIDERATIONS FOR ADDITIONAL PLANT STAFFING

• Management responsibilities (i.e., human resources, budgeting, outreach, training, town/city meetings, scheduling, etc.) and responsibility for clerical duties (i.e., billing, reports, correspondence, phones, time sheets, mailings, etc.)	✓
• Plant staff responsible for collection system operation and maintenance, pump station inspections, and/or combined sewer overflows	✓
• Plant operators responsible for snow plowing, road/sidewalk repair, or other municipal project	
• Plant staff involved in generating additional energy	
• Plant receives an extra high septage and/or grease load (higher than designed organic and grease loadings) or plant takes in sludge from other treatment plants	
• Plant is producing a Class A Biosolid product	
• Plant operators responsible for operating generators and emergency power	✓
• Plant responsible for industrial pre-treatment program	
• Plant staff responsible for plant upgrades and large projects done both on-site and off-site (i.e., collection systems, manholes, etc.)	
• Plant operators responsible for machining parts on-site	
• Age of plant and equipment (over 15 years of age)	

NEIWPCC

THE NORTHEAST GUIDE FOR ESTIMATING STAFFING AT PUBLICLY AND PRIVATELY OWNED WASTEWATER TREATMENT PLANTS (One-Plus Shift)

Plant Name: Yacolt WWTP

Design Flow: 0.3 MGD (MM) Actual Flow: _____

FINAL ESTIMATES	
Chart #	**Annual Hours**
1 – Basic and Advanced Operations and Processes	1,200
2 – Maintenance	504
3 – Laboratory Operations	69
4 – Biosolids/Sludge Handling	80
5 – Yardwork	125
Estimated Operation and Maintenance Hours	1,974
Estimated Operation and Maintenance Staff	1.32
Estimated Additional Staff from Chart 7	0.25
Total Staffing Estimate	1.5

• Divide the total of Annual Hours by 1500 hours per year to get the Estimated Operation and Maintenance Staff needed to operate the plant. This assumes 5-day work week; 29 days of vacation, sick leave, holidays; and 6.5 hours per day of productive work.

Note: The estimate from Charts 1-5 will not be the final amount of staff necessary to run the facility. Please review Chart 7 for additional staffing needs.

Chart 6 – Automation/SCADA (List all "yes" answers from Chart 6.)

Chart 7 – Considerations for Additional Plant Staffing (List all "yes" answers from Chart 7.)
Attach supporting information to justify additional staffing needs from Chart 7.

(· collection system)
· gensets
· management

Conclude: need total of approx. 1.5 FTE; assume use existing PW staff (2), and hire additional 0.75 FTE

Appendix G

MW-1
Yacolt, Wa

Amended

Please print, sign and return by mail to Department of Ecology

RESOURCE PROTECTION WELL REPORT

CURRENT Notice of Intent No. RE06528

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission *(select one)*
- [x] Construction
- [ ] Decommission *ORIGINAL INSTALLATION Notice of Intent Number* _____

Consulting Firm Kennedy Jenks

Unique Ecology Well ID Tag No. BCR 331

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

[x] Driller [ ] Engineer [ ] Trainee Name (Print) Brian Adams

Driller/Engineer/Trainee Signature _____

Driller or Trainee License No. 2997

If trainee, licensed driller's Signature and License No. _____

Type of Well *(select one)*
- [x] Resource Protection
- [ ] Geotech Soil Boring

Property Owner Jack Witt

Site Address NE Hoag St

City Yacolt County Clark

Location NE 1/4-1/4 NE 1/4 Sec 2 Twn 4 R 3 (Select One) [x] EWM [ ] WWM

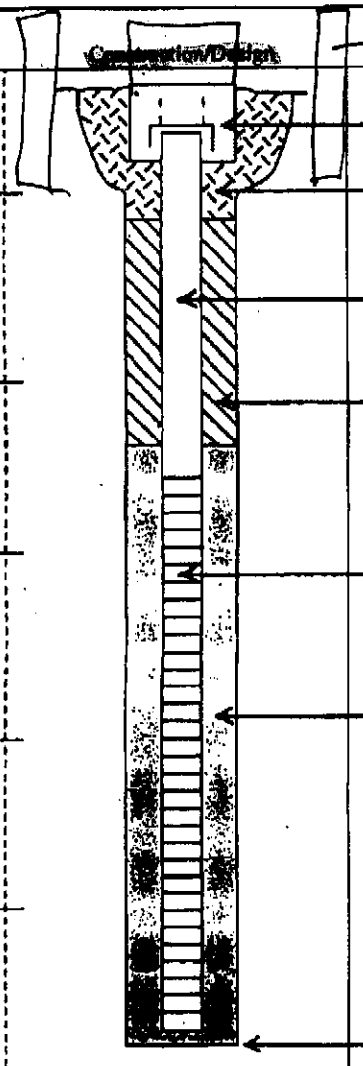
Lat/Long (s, t, r still REQUIRED) Lat Deg _____ Lat Min/Sec _____ Long Deg _____ Long Min/Sec _____

Tax Parcel No. _____

Cased or Uncased Diameter 6" Static Level 65

Work/Decommission Start Date 11/14/11

Work/Decommission Completed Date 11/15/11



Well Data		Formation Description
MONUMENT TYPE: above grade		0 - 15 ft. Soil/Sand/Rock
CONCRETE SURFACE SEAL	0 - 3 ft.	
PVC BLANK	2 "x 35-0	15 - 30 ft. Rock/Sand
BACKFILL	33-3 ft.	
TYPE:	Benchip	30 - 60 ft. light grey silt like material with boulders
PVC SCREEN	2 "x 75-35	
SLOT SIZE:	.10	
TYPE:	PVC.	60 - 75 ft. Pump Gravels
GRAVEL PACK	75-33 ft.	
MATERIAL:	10/20	
		ft.
WELL DEPTH	75. "	

REMARKS _____

RECEIVED
JAN 09 2012
WA State Department of Ecology (SWRO)

MW-2
Yacolt, Wa

Amended

Please print, sign and return by mail to Department of Ecology

RESOURCE PROTECTION WELL REPORT

CURRENT Notice of Intent No. RE 06528

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission *(select one)*

☒ Construction

☐ Decommission *ORIGINAL INSTALLATION Notice of Intent Number* _____

Consulting Firm Kennedy Jenks

Unique Ecology Well ID Tag No. BCR-332

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

☒ Driller ☐ Engineer ☐ Trainee Name (Print) Brian Owens

Driller/Engineer/Trainee Signature _____

Driller or Trainee License No. 2997

If trainee, licensed driller's Signature and License No. _____

Type of Well *(select one)*

☒ Resource Protection

☐ Geotech Soil Boring

Property Owner Jack Witt

Site Address NE Hoag St.

City Yacolt County Clark

Location NE 1/4-1/4 NE 1/4 Sec 2 Twn 4 R 3 (Select One) ☒ EWM ☐ WWM

Lat/Long (s, t, r still REQUIRED) Lat Deg _____ Lat Min/Sec _____ Long Deg _____ Long Min/Sec _____

Tax Parcel No. _____

Cased or Uncased Diameter 6" Static Level 65

Work/Decommission Start Date 11/15/11

Work/Decommission Completed Date 11/16/11

Bollard

Construction/Design	Well Data	Formation Description
	MONUMENT TYPE: above ~3'	0 - 6 ft. Soil/Small Rocks
	CONCRETE SURFACE SEAL 0-3 ft.	
	PVC BLANK 2 "x 30-0	6 - 20 ft. Boulders after Boulders
	BACKFILL 28-3 ft. TYPE: Bentchip	
		20 - 50 ft. Mixed Boulders/Soils
	PVC SCREEN 2 "x 70-30 SLOT SIZE: .10 TYPE: PVC.	
		50 - 70 ft. Gravels
	GRAVEL PACK 70-28 ft. MATERIAL: 10/20	
		- ft.
	WELL DEPTH 70 ' "	REMARKS

RECEIVED

JAN 09 2012

WA State Department of Ecology (SWRO)

MW-3
Yacolt, Wa

Amended

Please print, sign and return by mail to Department of Ecology

RESOURCE PROTECTION WELL REPORT

CURRENT Notice of Intent No. RE06528

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission *(select one)*
- [x] Construction
- [ ] Decommission *ORIGINAL INSTALLATION Notice of Intent Number* _____

Consulting Firm Kennedy Jenks

Unique Ecology Well ID Tag No. BCR-330

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

[x] Driller [ ] Engineer [ ] Trainee Name (Print) Brian Owens

Driller/Engineer /Trainee Signature _____

Driller or Trainee License No. 2997

If trainee, licensed driller's Signature and License No. _____

Type of Well *(select one)*
- [x] Resource Protection
- [ ] Geotech Soil Boring

Property Owner Jack Witt

Site Address NE Hoag St

City Yacolt County Clark

Location NE 1/4-1/4 NE 1/4 Sec 2 Twn 4 R 3 Select One [x] EWM [ ] WWM

Lat/Long (s, t, r still REQUIRED) Lat Deg _____ Lat Min/Sec _____ Long Deg _____ Long Min/Sec _____

Parcel No. _____

Cased or Uncased Diameter 6" Static Level 70

Work/Decommission Start Date 11/16/11

Work/Decommission Completed Date 11/17/11

Construction Design — Bollard

Well Data

MONUMENT TYPE: above 3'

CONCRETE SURFACE SEAL 0-3 ft.

PVC BLANK 2" x 35-0

BACKFILL 33-3 ft.

TYPE: Ben Chip

PVC SCREEN 2" x 75-35

SLOT SIZE: 20

TYPE: PVC

GRAVEL PACK 75-33 ft.

MATERIAL: 10-20

WELL DEPTH 75 ft.

Formation Description

0 - 5 ft. Soil/Roots/Rocks

5 - 20 ft. Rocks, boulders

20 - 50 ft. Fill/boulders

50 - 75 ft. Gravels, Boulders

- ft.

REMARKS

RECEIVED
JAN 09 2012
WA State Department of Ecology (SWRO)

Table A-1: Annual Minimum and Maximum Groundwater Elevation, Feet Above Mean Sea Level

Year	*MW-1*		*MW-2*		*MW-3*		*MW-4*	
	Minimum	**Maximum**	**Minimum**	**Maximum**	**Minimum**	**Maximum**	**Minimum**	**Maximum**
2003	645.7	664.1	Not Available	Not Available	646.4	669.0		
2004	651.5	668.0	647.4	667.7	652.0	671.2		
2005	648.6	667.0	652.0	667.5	649.1	671.2		
2006	646.0	673.8	656.4	673.7	646.8	678.0	641	674
2007	645.5	665.0	654.9	664.4	646.3	667.8	641	668
2008	646.7	672.7	652.0	673.0	647.5	677.6	650	674
2009	650.3	665.2	655.5	664.6	656.1	668.2	648	667
2010	665.9	667.8	665.9	667.5	669.1	671.2		670

JAN-17-2006 11:58 YACOLT MW4 ET MON-GW 2063296968 P.02

Please print, sign and return by mail to Department of Ecology

RESOURCE PROTECTION WELL REPORT

CURRENT Notice of Intent No. R 20385

(SUBMIT ONE WELL REPORT PER WELL INSTALLED)

Construction/Decommission *(select one)*
- [x] Construction
- [ ] Decommission *ORIGINAL INSTALLATION Notice of Intent Number* _____

Type of Well *(select one)*
- [x] Resource Protection
- [ ] Geotech Soil Boring

Consulting Firm _____

Unique Ecology Well ID
Tag No. AIG 652

Property Owner Silver Star Homes

Site Address P.O. Box 109

City Amboy County Clark

Location SW 1/4-1/4 NE 1/4 Sec 2 Twn 4N R 3E Select One [ ] EWM [ ] WWM

WELL CONSTRUCTION CERTIFICATION: I constructed and/or accept responsibility for construction of this well, and its compliance with all Washington well construction standards. Materials used and the information reported above are true to my best knowledge and belief.

[x] Driller [ ] Engineer [ ] Trainee Name (Print) Tim Jones

Driller/Engineer /Trainee Signature _____

Driller or Trainee License No. 1342

If trainee, licensed driller's Signature and License No. _____

Lat/Long (s, t, r still REQUIRED) Lat Deg _____ Lat Min/Sec _____ Long Deg _____ Long Min/Sec _____

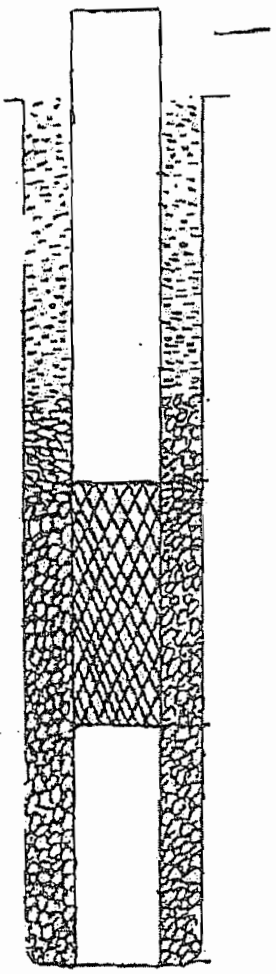
Tax Parcel No. _____

Cased or Uncased Diameter 2" Static Level 18

Work/Decommission Start Date 1-3-06

Work/Decommission Completed Date 1-5-06

Construction/Design



Well Data

Well Cover flush mount

Bentonite surface seal
depth 37 ft.

Blank casing 2" 39 ft
Material PVC
flush joints
0 to 39 ft

Screen 2" by 10 ft
Slot size .020
Material PVC
39 ft to 49 ft.

Tail pipe flush joint
2" PVC
49 ft to 59 ft.

Sand packed with 10 x 12 sand
37 ft. to 59
well depth 59 ft

Formation Description

Top soil	0 - 1
Brown clay, gravel & cobbles	1 - 13
Brown sand & gravel	13 - 25
Brown sand & gravel semi-cemented with hard layers & boulders	25 - 52
Grey rock w/quartz	52 - 59

Appendix H

Appendix H Summary of Wastewater Grant and Loan Programs

PRE-CONSTRUCTION

Program	Eligible Projects	Eligible Applicants	Funding Available	How To Apply
PWTF PRE-CON Public Works Trust Fund – Pre-Construction Program	Pre-construction activities such as preliminary engineering, design, bid-document preparation, right-of-way acquisition, environmental studies, and cultural/historic project review	Counties, cities, special purpose districts, and quasi-municipal organizations that meet certain requirements (contact a Client Service Representative for more information). No school or port districts. (*) NEW: • Affordability Index: Affordability Index (AI) is a measure of the consumers' financial ability to pay for utility services. Applicants that qualify for AI terms can receive lower cost loan terms • Performance based incentives: Projects that meet contract incentives may qualify for slightly lower interest rate or longer repayment term (Policy would be considered by Public Works Board upon re-establishment of PWTF Pre-Construction loan)	Loan $1 million per jurisdiction each biennium. • Must complete work within 24 months. • Rates and terms vary based on an affordability index (which assesses a utility's ability to sustain the utility) • Interest rates: 0.25% - 2% Standard interest rate is 1%, but can vary • Terms may change at Public Works Board discretion.	Visit the Public Works Board website at http://www.pwb.wa.gov to obtain the latest information on pre-construction funding availability. A small amount of pre-construction funding may be available July 2012. **Contact:** Bruce Lund, Client Service Manager, 360-725-3163, Bruce.lund@commerce.wa.gov Client Service Representative contact information: https://fortress.wa.gov/com/pwbrfa/NewAppPages/StaffListingPage1.aspx

PRE-CONSTRUCTION - continued

Program	Eligible Projects	Eligible Applicants	Funding Available	How To Apply
ECOLOGY: INTEGRATED WATER QUALITY FUNDING PROGRAM State Water Pollution Control Revolving Fund Centennial Clean Water Fund	Design projects associated with publicly-owned wastewater and stormwater facilities. The integrated program also funds planning and implementation of nonpoint source pollution control activities.	Counties, cities, towns, conservation districts, or other political subdivision, municipal or quasi-municipal corporations, and tribes <u>Preconstruction Set-aside</u> Jurisdictions listed above with a population of 25,000 or less and a MHI (median household income) below the statewide average receive priority for loan funds. <u>Preconstruction Set-aside (Distressed Communities)</u> Jurisdictions listed above with a population of 25,000 or less and a MHI below 80% of the statewide average.	Loan, at either: (SFY 2013 interest rates) • 2.7% interest for 6-20 year term, or • 1.4% interest for 5 year term <u>Pre-Construction Set-aside (Distressed Communities)</u> 50% forgivable principal loan and 50% loan, at either: (SFY 2013 interest rates) • 2.7% interest for 6-20 year term, or • 1.4% interest for 5 year term Note: SFY 2014 interest rates not yet determined.	State Fiscal Year 2014 application cycle closes on November 2, 2012. Applications typically accepted September 1 through first Friday in November. **Contact:** David Dunn 360-407-6503 david.dunn@ecy.wa.gov http:/www.ecy.wa.gov/programs/wq/funding/funding.html
RCAC RURAL COMMUNITY ASSISTANCE CORPORATION Feasibility and Pre-Development Loans	Water and/or wastewater planning; environmental work; and other work to assist in developing an application for infrastructure improvements	Non-profit organizations, public agencies, tribes, and low-income rural communities with a 50,000 population or less, or 10,000 or less if guaranteed by USDA Rural Development financing	• Maximum $50,000 for feasibility loan • Maximum $350,000 for pre-development loan • 1 year term • 5.5% interest rate	Applications accepted anytime Contact: Josh Griff 720-898-9463 jgriff@rcac.org Applications available on-line at www.rcac.org

CONSTRUCTION and DESIGN/CONSTRUCTION

Program	Eligible Projects	Eligible Applicants	Funding Available	How To Apply
CDBG-GP Community Development Block Grant – General Purpose Grant Program (Clark County)	Final design and construction of domestic wastewater, drinking water, side connections, stormwater, streets, bridge, community facility, economic development, and housing rehabilitation projects.	Projects must principally benefit low- to moderate-income people.	Grant • Up to $300,000 in 1 year • No match required, but local contribution and gap financing preferred (i.e. factored into score)	RFP: October 1 Due: December 1 **Contact:** Pete Munroe 360-397-2075
PWTF Public Works Trust Fund – Construction Program	New construction, replacement, and repair of existing infrastructure for domestic water, sanitary sewer, stormwater, solid waste, road or bridge projects, and reasonable growth	Counties, cities, special purpose districts, and quasi-municipal organizations that meet certain requirements (contact a Client Service Representative for more information). No school or port districts. (*) NEW: • Affordability Index: Affordability Index (AI) is a measure of the consumers' financial ability to pay for utility services. Applicants that qualify for AI terms can receive lower cost loan terms • Performance based incentives: Projects that meet contract incentives can qualify for slightly lower interest rate or longer repayment term	Loan • $15 million per jurisdiction for the 2014 funding year • Must complete work within 60 months • Rates and terms vary based on an affordability index (which assesses a utility's ability to sustain the utility) • Interest rates: 0.25-2%; Standard interest rate is 1%, but can vary • Repayment Term: Up to 30 years. Standard repayment term is 20 years. The repayment term cannot exceed the life of the improvement.	Applications accepted through May 11, 2012. Please visit http://www.pwb.wa.gov to apply online. **Contact:** Bruce Lund, Client Service Manager, 360-725-3163, Bruce.lund@commerce.wa.gov Client Service Representative contact information: https://fortress.wa.gov/com/pwbrfa/NewAppPages/StaffListingPage1.aspx
RD U.S. Dept. of Agriculture Rural Development - Rural Utilities Service - Water and Waste Disposal Direct Loans and Grants	Pre-construction and construction associated with building, repairing, or improving drinking water, solid waste facilities and wastewater facilities	• Cities or towns with fewer than 10,000 population • Counties, special purpose districts, non-profit corporations or tribes unable to get funds from other sources at reasonable rates and terms	Loans; Grants in some cases • Interest rates vary (currently 2.00 – 3.375% • Up to 40-year loan term • No pre-payment penalty	Applications accepted year-round on a fund-available basis **Contact:** Gene Dobry 360-704-7733 eugene.dobry@wa.usda.gov http://www.rurdev.usda.gov/wa

CONSTRUCTION AND DESIGN/CONSTRUCTION – continued

ECOLOGY: INTEGRATED WATER QUALITY FUNDING PROGRAM State Water Pollution Control Revolving Fund Centennial Clean Water Fund	Construction projects associated with publicly-owned wastewater and stormwater facilities. The integrated program also funds planning and implementation of nonpoint source pollution control activities.	Counties, cities, towns, conservation districts, or other political subdivision, municipal or quasi-municipal corporations, and tribes Hardship Assistance Jurisdictions listed above with a population of 25,000 or less	Loan, at either: (SFY 2013 interest rate) • 2.7% interest for 6-20 year term, or • 1.4% interest for 5-year term Note: SFY 2014 interest rates not yet determined. Hardship assistance for the construction of wastewater treatment facilities may be available in the form of a reduced interest rate, grant subsidy, or loan forgiveness. Hardship assistance is based on impact to residential ratepayers and the community MHI. Hardship funding is only available for portion of a facility serving existing residential need.	State Fiscal Year 2014 application cycle closes on November 2, 2012. Applications typically accepted September 1 through first Friday in November. **Contact:** David Dunn 360-407-6503 david.dunn@ecy.wa.gov http:/www.ecy.wa.gov/programs/wq/funding/funding.html

CONSTRUCTION and DESIGN/CONSTRUCTION – continued

Program	Eligible Projects	Eligible Applicants	Funding Available	How To Apply
CERB Community Economic Revitalization Board - Construction Program	Projects must support significant job creation or significant private investment in the state. • Bridges, roads and railroad spurs, domestic and industrial water, sanitary and storm sewers • Electricity, natural gas and telecommunications • General purpose industrial buildings, port facilities • Acquisition, construction, repair, reconstruction, replacement, rehabilitation	• Counties, cities, towns, port districts, special districts • Federally-recognized tribes • Municipal and quasi-municipal corporations with economic development purposes.	Loans; grants in unique cases • Public facility projects required by private sector expansion and job creation • Projects without a committed business allowed for rural areas • $1 million maximum per project, per policy • Interest rates: 3% for non-distressed and 2.5% for distressed counties • 20-year term maximum • Requires 10% minimum match • Applicants must demonstrate gap in public project funding and need for CERB assistance • CERB is authority for funding approvals	Applications accepted year-round. The Board meets six times a year. **Contact:** Jacki Skaught 360-725-3161 jacki.skaught@commerce.wa.gov
RCAC **RURAL COMMUNITY ASSISTANCE CORPORATION** Construction Loans	Water, wastewater, solid waste and stormwater facilities that primarily serve low-income rural communities. Can include pre-development costs.	Non-profit organizations, public agencies, tribes, and low-income rural communities with a 50,000 population or less, or 10,000 populations or less if using Rural Development financing as the takeout	• Maximum $2 million with commitment letter for permanent financing • Security in permanent loan letter of conditions • 1-3 year term: 5.5% interest rate • 1% loan fee	Applications accepted anytime **Contact:** Josh Griff 720-898-9463 jgriff@rcac.org Applications available on-line at www.rcac.org
RCAC **RURAL COMMUNITY ASSISTANCE CORPORATION** Intermediate Term Loan	Water, wastewater, solid waste and stormwater facilities that primarily serve low-income rural communities.	Non-profit organizations, public agencies, tribes, and low-income rural communities with a 50,000 population or less.	• For smaller capital needs, normally not to exceed $100,000 • Maximum 20 year term • 5% interest rate • 1% loan fee	Applications accepted anytime **Contact:** Josh Griff 720-898-9463 jgriff@rcac.org Applications available on-line at www.rcac.org

Appendix I

Town of Yacolt
Forecast of Monthly Sewer Rates

	Forecast																				
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Gross revenue requirements:																				
Operations and maintenance expense	$ -	$ -	$ -	$ -	$ -	$ 251,597	$ 259,145	$ 266,919	$ 274,927	$ 283,175	$ 291,670	$ 300,420	$ 309,433	$ 318,716	$ 328,277	$ 338,125	$ 348,269	$ 358,717	$ 369,479	$ 380,563
Capital outlays	318,270	513,345	361,689	7,420,224	6,846,271	-	-	-	-	-	-	-	-	598,986	-	-	-	-	-	-
Transfers to other funds	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Debt service	17,637	46,084	66,127	477,321	856,710	856,710	856,710	856,710	856,710	856,710	856,710	856,710	856,710	889,903	889,903	889,903	889,903	889,903	889,903	889,903
(Use)/Replacement of working capital	-	-	-	-	-	25,000	25,000	25,000	25,000	-	-	-	-	-	-	-	-	-	-	-
Total gross revenue requirements	335,907	559,429	427,816	7,897,546	7,702,980	1,133,307	1,140,855	1,148,629	1,156,637	1,139,884	1,148,380	1,157,130	1,166,142	1,807,604	1,218,180	1,228,028	1,238,172	1,248,620	1,259,381	1,270,466
Non-rate revenue offsets:																				
Connection Fees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Investment Earnings	-	0	-	-	-	-	200	400	600	800	936	1,004	1,004	1,004	1,004	1,004	1,004	1,004	1,004	1,004
Miscellaneous Fees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Special Revenues	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Developer contributions	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rate stabilization contributions	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grant Proceeds:																				
Community Development Block Grant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Washington Department of Ecology	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
USDA -RDA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Future PWTF loan borrowed reserve	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Future PWTF loan proceeds	318,270	513,345	361,689	7,420,224	6,846,271	-	-	-	-	-	-	-	-	598,986	-	-	-	-	-	-
Total non-rate revenue offsets	318,270	513,345	361,689	7,420,224	6,846,271	-	200	400	600	800	936	1,004	1,004	599,990	1,004	1,004	1,004	1,004	1,004	1,004
Net revenues required from rates	$ 17,637	$ 46,084	$ 66,127	$ 477,321	$ 856,710	$ 1,133,307	$ 1,140,655	$ 1,148,229	$ 1,156,037	$ 1,139,084	$ 1,147,444	$ 1,156,125	$ 1,165,138	$ 1,207,614	$ 1,217,175	$ 1,227,024	$ 1,237,167	$ 1,247,615	$ 1,258,377	$ 1,269,461
Billable Equivalent Dwelling Units (EDUs)	666	681	696	710	725	741	758	773	789	807	823	840	856	874	893	910	929	949	969	989
Monthly sewer rate - $/EDU	$ 2.21	$ 5.64	$ 7.92	$ 56.02	$ 98.47	$ 127.45	$ 125.40	$ 123.78	$ 122.10	$ 117.63	$ 116.19	$ 114.69	$ 113.43	$ 115.14	$ 113.58	$ 112.36	$ 110.96	$ 109.60	$ 108.27	$ 106.97

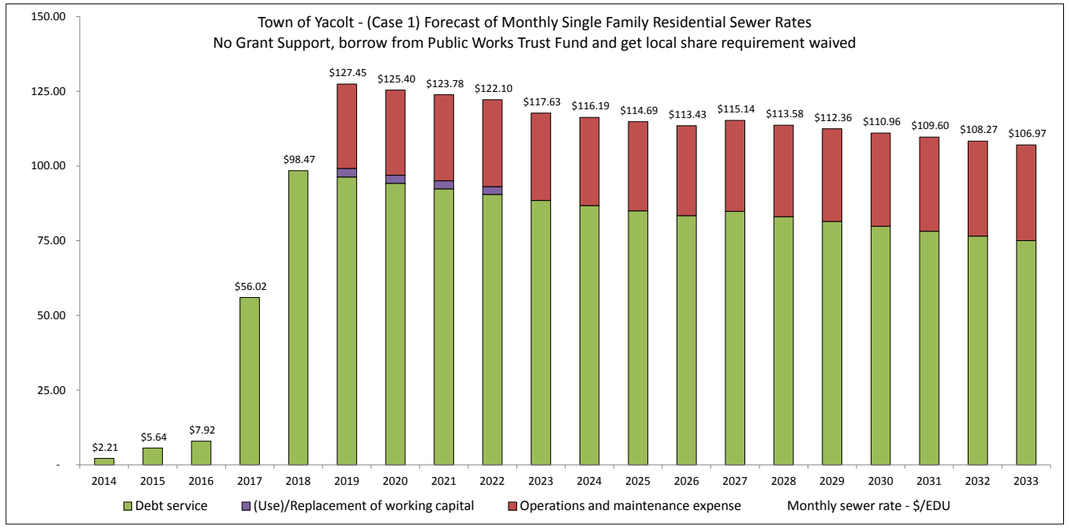
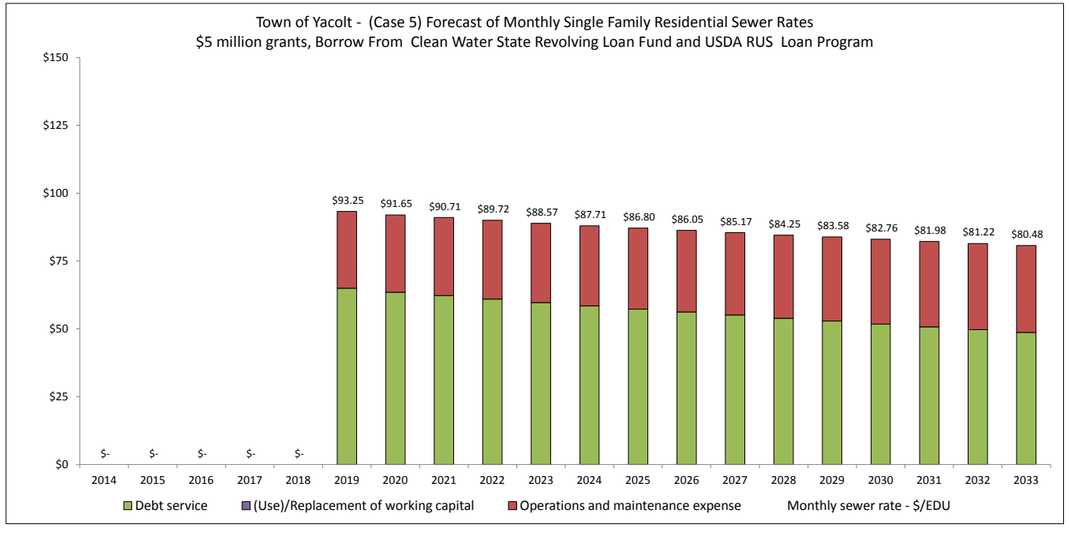


Chart Data:	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Operations and maintenance expense	-	-	-	-	-	28.29	28.49	28.78	29.04	29.24	29.53	29.80	30.12	30.39	30.63	30.96	31.24	31.51	31.79	32.07
Debt service	2.21	5.64	7.92	56.02	98.47	96.35	94.19	92.36	90.48	88.47	86.75	84.99	83.40	84.85	83.04	81.49	79.82	78.17	76.56	74.99
(Use)/Replacement of working capital	-	-	-	-	-	2.81	2.75	2.70	2.64	-	-	-	-	-	-	-	-	-	-	-
Total	2.21	5.64	7.92	56.02	98.47	127.45	125.40	123.78	122.10	117.63	116.19	114.69	113.43	115.14	113.58	112.36	110.96	109.60	108.27	106.97

Town of Yacolt
Forecast of Monthly Sewer Rates

	Forecast																				
	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Gross revenue requirements:																				
Operations and maintenance expense	$ -	$ -	$ -	$ -	$ -	$ 251,597	$ 259,145	$ 266,919	$ 274,927	$ 283,175	$ 291,670	$ 300,420	$ 309,433	$ 318,716	$ 328,277	$ 338,125	$ 348,269	$ 358,717	$ 369,479	$ 380,563
Capital outlays	318,270	513,345	361,689	7,420,224	6,846,271	-	-	-	-	-	-	-	-	598,986	-	-	-	-	-	-
Transfers to other funds	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Debt service	-	-	-	-	-	577,593	577,593	577,593	577,593	577,593	577,593	577,593	577,593	577,593	577,593	577,593	577,593	577,593	577,593	577,593
Future SRF loan reserve requirement	-	-	-	-	-	384,652	-	-	-	-	-	-	-	-	-	-	-	-	-	-
(Use)/Replacement of working capital	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total gross revenue requirements	318,270	513,345	361,689	7,420,224	6,846,271	1,213,842	836,738	844,513	852,520	860,768	869,263	878,013	887,026	1,495,294	905,870	915,719	925,862	936,311	947,072	958,156
Non-rate revenue offsets:																				
Transfers from other funds - Sewer Development Impact Fee Fund	-	-	-	-	-	-	-	-	-	-	-	-	-	598,986	-	-	-	-	-	-
Investment Earnings	-	-	-	-	-	-	3,077	3,077	3,077	3,077	3,077	3,077	3,077	3,077	3,077	3,077	3,077	3,077	3,077	3,077
Miscellaneous Fees	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Special Revenues	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Developer contributions	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Rate stabilization contributions	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Grant Proceeds:																				
Community Development Block Grant	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Washington Department of Ecology	318,270	513,345	361,689	4,306,696	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
USDA -RDA	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Future USDA RUS loan proceeds	-	-	-	-	4,459,799	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Future SRF loan borrowed reserve	-	-	-	-	-	384,652	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Future SRF loan proceeds	-	-	-	3,113,528	2,386,472	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total non-rate revenue offsets	318,270	513,345	361,689	7,420,224	6,846,271	384,652	3,077	3,077	3,077	3,077	3,077	3,077	3,077	602,063	3,077	3,077	3,077	3,077	3,077	3,077
Net revenues required from rates	$ -	$ -	$ -	$ -	$ -	$ 829,190	$ 833,661	$ 841,435	$ 849,443	$ 857,691	$ 866,186	$ 874,936	$ 883,949	$ 893,232	$ 902,793	$ 912,641	$ 922,785	$ 933,233	$ 943,995	$ 955,079
Billable Equivalent Dwelling Units (EDUs)	666	681	696	710	725	741	758	773	789	807	823	840	856	874	893	910	929	949	969	989
Monthly sewer rate - $/EDU	$ -	$ -	$ -	$ -	$ -	$ 93.25	$ 91.65	$ 90.71	$ 89.72	$ 88.57	$ 87.71	$ 86.80	$ 86.05	$ 85.17	$ 84.25	$ 83.58	$ 82.76	$ 81.98	$ 81.22	$ 80.48



	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Chart Data:																				
Operations and maintenance expense	-	-	-	-	-	28.29	28.49	28.78	29.04	29.24	29.53	29.80	30.12	30.39	30.63	30.96	31.24	31.51	31.79	32.07
Debt service	-	-	-	-	-	64.96	63.50	62.27	61.00	59.64	58.48	57.30	56.23	55.07	53.90	52.89	51.80	50.74	49.69	48.67
(Use)/Replacement of working capital	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Non-rate revenue offsets	-	-	-	-	-	-	(0.34)	(0.33)	(0.33)	(0.32)	(0.31)	(0.31)	(0.30)	(57.40)	(0.29)	(0.28)	(0.28)	(0.27)	(0.26)	(0.26)
Total	-	-	-	-	-	93.25	91.65	90.71	89.72	88.57	87.71	86.80	86.05	85.17	84.25	83.58	82.76	81.98	81.22	80.48