HOODSPORT RURAL ACTIVITY CENTER

MASON COUNTY **WASHINGTON**

HOODSPORT RAC
WASTEWATER FACILITY PLAN

G & O No. 07570

AUGUST 2007

Gray & Osborne, Inc.
CONSULTING ENGINEERS
701 DEXTER AVENUE NORTH SUITE 200
SEATTLE, WASHINGTON 98109 • (206) 284-0860

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MASON COUNTY **WASHINGTON**

HOODSPORT RAC
WASTEWATER FACILITY PLAN

HARRY E. SELLERS
STATE OF WASHINGTON
27906
REGISTERED
PROFESSIONAL ENGINEER
7-31-07

EXPIRES: 4-7-2008

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LIST OF ABBREVIATIONS

AAF	average annual flow
ADA	Americans with Disabilities Act
ADWF	average dry weather flow
AKART	All known, available, and reasonable technologies
BOD_5	5-day biochemical oxygen demand
$CBOD_5$	5-day carboneous biochemical oxygen demand
CFR	Code of Federal Regulations
CFS	cubic feet per second
cfu	colony forming units
County	Mason County
CWA	Clean Water Act
DMR	discharge monitoring reports
DNR	Washington State Department of Natural Resources
DNS	determination of non-significance
DOH	Washington State Department of Health
Ecology	Washington State Department of Ecology
EIS	Environmental Impact Statement
EOS	enhanced on-site systems
EPA	Environmental Protection Agency
ERU	Equivalent Residential Unit
ESA	Endangered Species Act
FC	fecal coliform
FCC	Fully Contained Community
FEMA	Federal Emergency Management Agency
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
FTE	full time equivalent
GIS	Geographic Information System
GMA	Growth Management Act
gpcd	gallons per capita per day
gpd	gallons per day
gpd/acre	gallons per day – per acre
gpd/ft^2 or gal/sf/day	gallons per day per square foot
gpm	gallons per minute
HCCC	Hood Canal Coordinating Council
hp	horsepower
HPA	Hydraulic Project Approval
HRT	hydraulic residence time
I/I	infiltration and inflow
ITP	Incidental Take Permit
kW	kilowatt
kWhr	kilowatt hour
LAMIRD	Limited Areas of More Intensive Rural Development
lb.	pounds

LIST OF ABBREVIATIONS - continued

lb./day	pounds per day
LEED	Leadership in Energy and Environmental Design
lf	linear foot
LOSS	Large On-Site Sewer Systems
LS	lump sum
MBR	membrane bioreactor
MCC	Mason County Code
MCRI	municipal, residential, commercial and industrial development
MCRT	mean cell residence time
MDF	maximum daily flow
MG	million gallons
mgd	million gallons per day
mg/L	milligrams per liter
MH	manhole
mL	milliliters
MLSS	mixed liquor suspended solids
MMF	maximum monthly flow
MOU	Memorandum of Understanding
MPR	Master Planned Resort
MTCA	Model Toxics Control Act
NA	not applicable
NEPA	National Environmental Policy Act
NH_4^+-N	ammonium ion
NMFS	National Marine Fisheries Service
NO_3-N	nitrate – nitrogen
NPDES	National Pollutant Discharge Elimination System
NSSP	National Shellfish Sanitary Program
NTU	nephelometric turbidity units
OFM	Office of Financial Management
ORCAA	Olympic Region Clean Air Agency
O&M	operations and maintenance
ONF	Olympic National Forest
OSS	on-site sewage system
PACA	Preliminary Assessment and Corrective Action Plan
pH	negative log hydronium ion concentration
Plan	Wastewater Facility Plan
PHF	peak hour flow
PIE	Public Involvement and Education
POTW	publicly owned treatment works
PPC	persons per capita
psi	pounds per square inch
PUD	Public Utility District
PWTF	Public Works Trust Fund
RA	Rural Area
RAC	Rural Activity Center
RAS	return activated sludge
RCW	Revised Code of Washington

LIST OF ABBREVIATIONS - continued

RDI/I	rain dependent I/I
RGF	recirculating gravel filter
SBR	sequencing batch reactor
scfm	standard cubic feet per minute
SEPA	State Environmental Policy Act
SLAM	State Local Air Monitoring Station
SMP	Shoreline Management Plan
SRF	State Revolving Fund
SRT	sludge retention time
STAG	State and Tribal Assistance Grant
STEG	Septic Tank Effluent Gravity
STEP	Septic Tank Effluent Pump/Small Town Environment Program
SWD	State Waste Discharge Permit
TDS	total dissolved solids
TCLP	toxic characteristics leachate procedure
THD	total dynamic head
TN	total nitrogen
TKN	total Kjehldahl nitrogen
TMDL	total maximum daily load
Town	Town of Hoodsport
TOG	total oil and grease
TSS	total suspended solids
UAA	use attainability analysis
UGA	Urban Growth Area
ULID	Utility Local Improvement District
UV	ultraviolet radiation
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
WAC	Washington Administrative Code
WAS	waste activated sludge
WQS	Water Quality Standards
WRIA	Water Resource Inventory Area
WRR	Water Reclamation and Reuse Standards
WSDFW	Washington State Department of Fish and Wildlife
WSDOT	Washington State Department of Transportation
WWFP	wastewater facility plan
WWTF	wastewater treatment facility

EXECUTIVE SUMMARY

INTRODUCTION

This Wastewater Facility Plan (Plan) has been prepared for the Hoodsport Rural Activity Center (RAC) in Mason County to meet regulatory planning requirements and to provide recommendations for a centralized system for wastewater collection, treatment, and disposal or reuse. Funds to develop this Plan were obtained through a grant from the Washington State Department of Ecology.

Mason County, Mason County PUD No. 1, and others have been seeking a solution for the replacement of failing and substandard on-site systems since the 1990s. This Plan was preceded by the Finch Creek Wastewater Feasibility Study (August 2000) which addressed the Finch Creek corridor and part of the commercial area along Highway 101. Other reports, prepared by the Puget Sound Acting Team, and testing conducted by the Washington State Department of Health have identified excess nutrient loading and high fecal coliform counts in Hood Canal.

Hoodsport is a rural community lying on the western shoreline of Hood Canal, along US Highway 101. It is primarily residential with a limited number of small businesses. Hoodsport also contains a fish hatchery operated by the Washington Department of Fish and Wildlife (WDFW) and a Visitors Center maintained by the USDA Forest Service.

SERVICE AREA AND POPULATION

The Hoodsport RAC covers approximately 584 acres and contains a current population of 642.

The Mason County Comprehensive Plan (updated 2005) contains the planning policies applicable to an RAC. The most important general planning policy is that development density in an RAC should be no more than one dwelling unit for every 2.5 acres and should not expect, or require, urban levels of service. For wastewater planning, this development density is too low to support a centralized sewer system.

The existing development within the Hoodsport RAC has occurred on smaller lots than currently allowed under RAC guidelines. Approximately 26 percent of the existing lots are less than one-third acre, and another 32 percent are one-third to 1 acre. Most of these smaller lots are located along the shoreline, the Finch Creek corridor, or the central commercial area of Hoodsport. In addition, these lots are most likely to be served with older on-site systems which do not meet current DOH or Mason County Standards.

Environmental conditions (e.g., type of soils) within the Hoodsport RAC indicate the highest risk of contaminant transport is found along Finch Creek and the Highway 101 corridor. This area also corresponds to the area with most of the commercial

development and substandard lot sizes. Figure E-1 presents the proposed service area based on the highest risk of contaminant transport and existing development density. This service area includes the Finch Creek corridor, Highway 101, Cedardale Lane, parts of Old Mill Hill Road and North Schoolhouse Road, and North Hill Road. The estimated population within the service area is currently 346. Table E-1 presents population projections through 2027. It is assumed that the annual population growth rate will be 1.5 percent.

TABLE E-1

Population Projections

	2007	2017	2027
Sewer Service Area	346	401	466

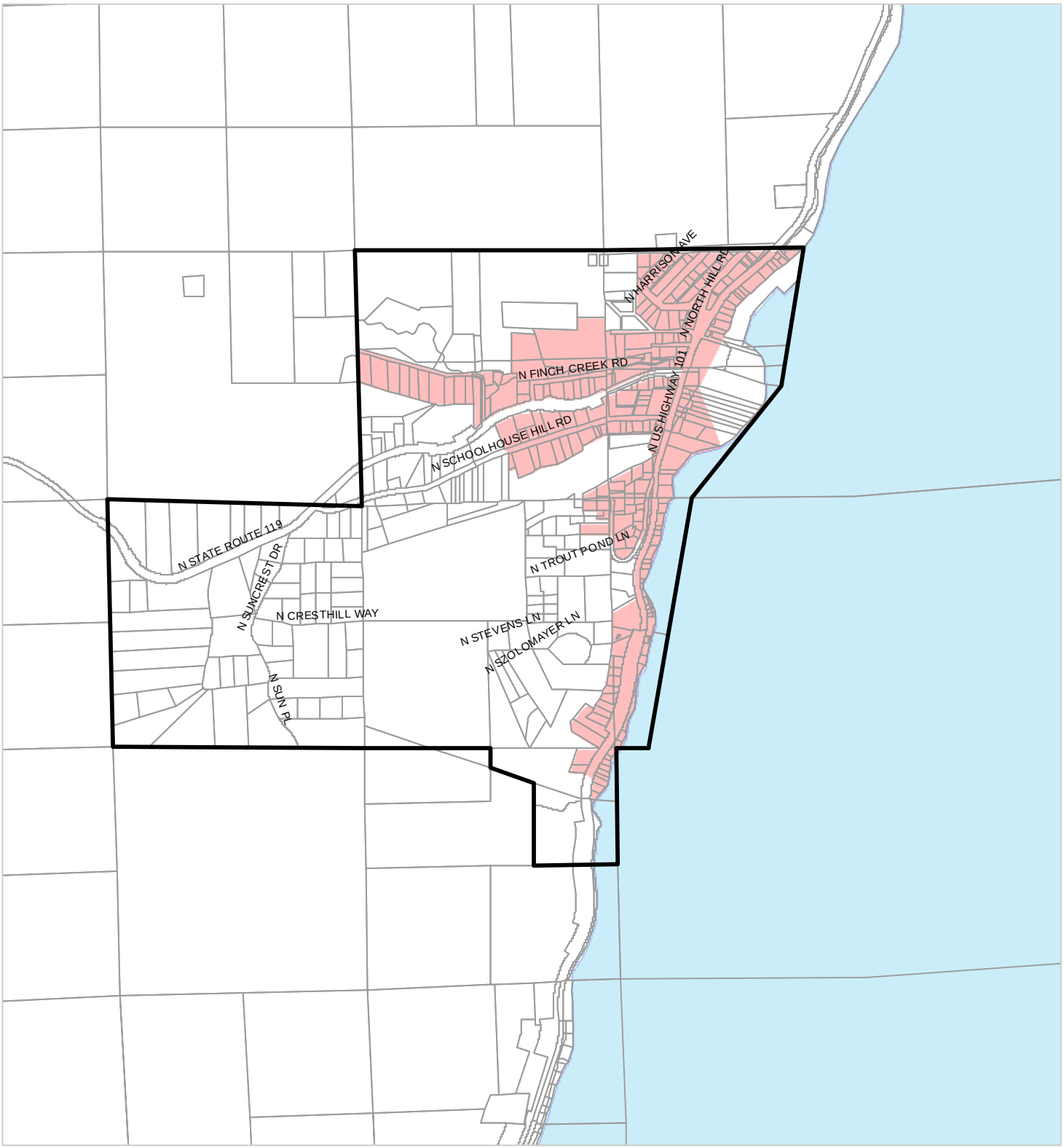
WASTEWATER FLOWS AND LOADINGS

Wastewater flows and loadings are developed based on unit values and growth estimates. An average unit wastewater flow of 65 gallons per day per capita (gpcd) is used along with 0.18 lbs/capita per day for BOD_5. It is assumed that the growth rate for commercial flows will be 3.5 percent, but only 1.5 percent for residential population. Table E-2 presents future flow and loading estimates for the sewer service area.

TABLE E-2

Future Flows and Loadings

	Sewer Service Area		
	Existing	**2017**	**2027**
Wastewater Flows:			
Average Flow, gpd	29,652	35,892	44,153
Maximum Month Flow, gpd	36,495	44,175	54,609
Maximum Daily Flow, gpd	59,304	71,784	88,306
Peak Hour Flow, gpd	103,782	125,622	154,535
Wastewater Loadings:			
BOD_5:			
Average, lbs/day	92	109	136
Maximum Month, lbs/day	115	136	170
TSS:			
Average, lbs/day	97	119	147
Maximum Month, lbs/day	121	149	184
TKN:			
Average, lbs/day	14	18	22
Maximum Month, lbs/day	18	22	27



LEGEND:

- HOODSPORT RAC
- PARCELS
- PROPOSED SERVICE AREA

N

0 750 1,500 Feet

MASON COUNTY

HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE E-1

PROPOSED SERVICE AREA

Gray & Osborne, Inc.
CONSULTING ENGINEERS

O:\CLIENTS\MasonCo\HOODSPORT RAC WW PLAN\FIGE-1.mxd

Equivalent Residential Units (ERUs) are a means to express residential and commercial flows in terms of single-family households. One single-family residence is an ERU. For large commercial connections, the unit value of 200 gallons per day is the basis for an ERU. Table E-3 provides estimates for the number of ERUs for 2007, 2017, and 2027.

TABLE E-3

Equivalent Residential Units

Area	Population	Commercial Flow (gpd)	Residential ERUs	Commercial ERUs	Total ERUs
2007					
Sewer Service Area	346	8,575	146	43	189
2017					
Sewer Service Area	401	12,095	161	60	221
2027					
Sewer Service Area	466	17,062	187	85	272

SITE ASSESSMENT

Because there is not a wastewater facility within the Hoodsport RAC, several locations were considered to assess both the availability and suitability of property in the vicinity. The general criteria were parcels approximately 1 acre in size, relatively flat, and accessible. Five locations were considered as shown on Figure E-2.

The recommended site for a wastewater treatment facility is property east of the Fire Hall. These two parcels, identified as #422114400220 and #422114400270, are owned by one owner and cover approximately 1.0 acre. As reported by a local real estate agent, this owner may request a change in zoning from residential to commercial. Currently, the Fire Hall and a storage facility, four parcels to the east, are categorized as commercial and a conversion would be consistent with existing use in the vicinity. A primary advantage of this site is that it is located at an elevation of about 35 feet and does not require an additional lift station to reach the site. A grinder pump collection system can discharge to the site while maintaining low pressure in the pipelines.

WASTEWATER TREATMENT TECHNOLOGY

This Plan evaluated two treatment systems: a membrane bioreactor (MBR) and a sequencing batch reactor (SBR). As shown in the cost summary in Table E-4, there is little difference in costs between the two alternatives. However, there are several reasons to recommend the MBR system over the SBR. The MBR will provide a higher quality effluent with BOD_5 less than 5 mg/L, TSS less than 2 mg/L, total nitrogen less than 10 mg/L and effluent turbidity less than 0.1 NTU. The SBR system cannot achieve the effluent turbidity of the MBR. In addition, the SBR tanks are larger, and there is

additional process equipment required. The MBR system has a smaller site "footprint" than the SBR. For treatment, the recommended alternative is the MBR system.

TABLE E-4

Treatment System Alternative Cost Comparison

Alternative	Construction	Annual O&M	20-Year Life Cycle
MBR	$2,758,672	$123,800	$4,758,515
SBR	$2,782,335	$119,400	$4,711,623

WATER RECLAMATION AND REUSE

The largest challenge for wastewater planning in the Hoodsport RAC is locating a suitable site for reuse or disposal. Treated secondary effluent with a surface water discharge to Hood Canal is not a feasible alternative. Therefore, to provide the maximum potential for reuse with fewest restrictions, Class A reclaimed water was the selected level of treatment.

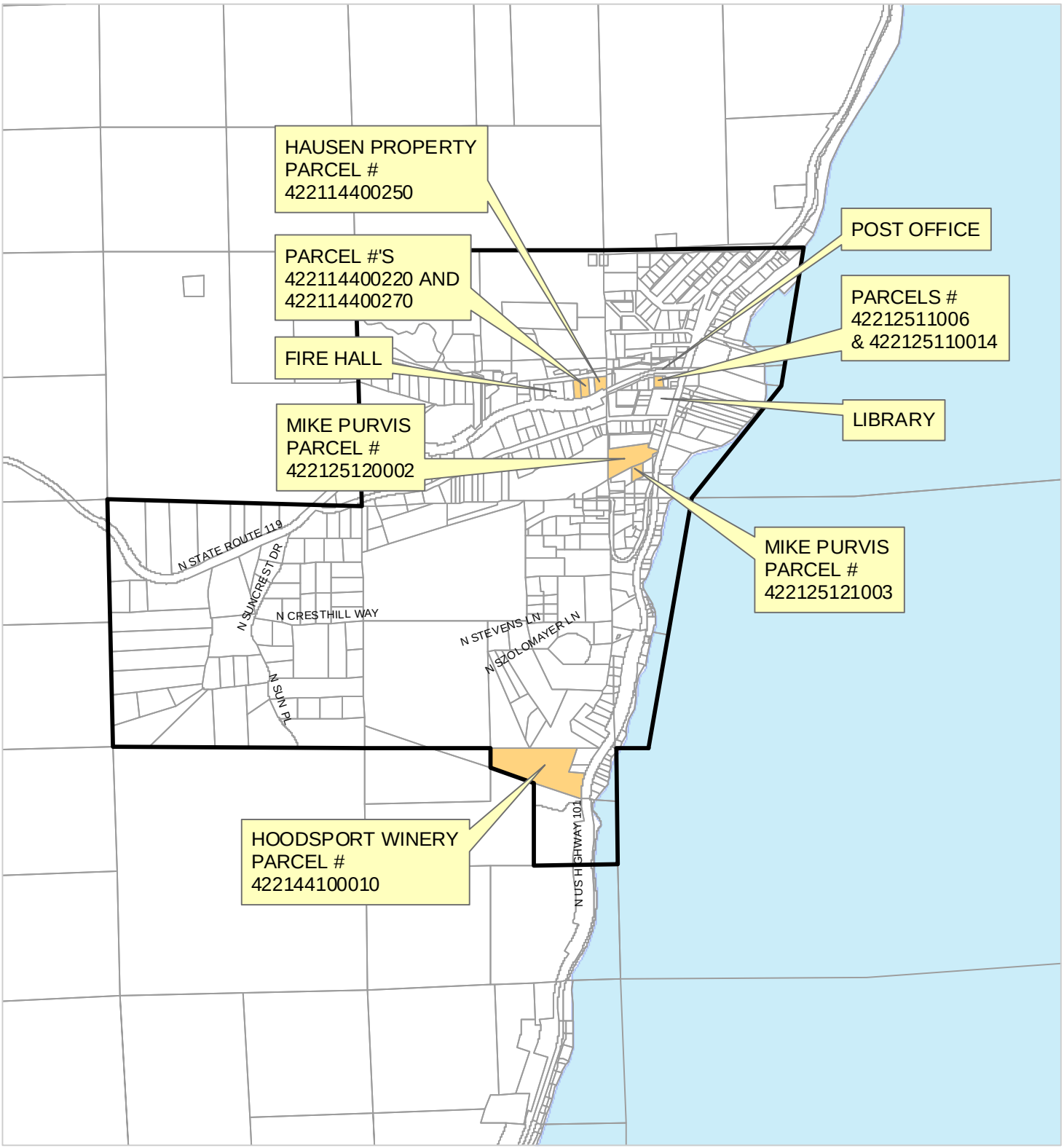
The MBR treatment system is capable of meeting the standards for Class A reclaimed water except for disinfection. Filtered effluent will be further treated by UV disinfection to achieve a 7-day median value of 2.2 total coliform per 100 ml.

Potential uses of Class A reclaimed water identified for the Hoodsport RAC include stream flow augmentation, groundwater recharge, and irrigation/landscaping. All three uses were evaluated in the Plan but the one considered most feasible was groundwater recharge. Stream flow augmentation was not likely to be permitted and there are not sufficient local landscaping uses to utilize the full volume of Class A reclaimed water.

For groundwater recharge, the proposed method is infiltration ponds. Two sites were evaluated. One is a County-owned park, Foothills Park, approximately 2 miles west of Hoodsport, and another is property owned by Lewallen, approximately 1/2 mile from Hoodsport. Both locations are shown in Figure E-3.

At $1,254,965, the Foothills Park alternative was found to be both the highest cost and highest risk alternative. Because of the elevation of about 600 feet, this alternative would require high horsepower pumps and special class force main material for high pressure conditions. The only advantage of Foothills Park is that it is County-owned and would require less cost for property acquisition.

Use of Class A reclaimed water for infiltration on the Lewallen property provides several cost, design, and implementation advantages. The estimate construction cost is $899,838 compared to $1,254,965 for the Foothills Park alternative. The pumping requirements doe not require the exceptional pressure rating as the Foothills Park alternative or the



LEGEND:

- HOODSPORT RAC
- PARCELS

N

0 750 1,500 Feet

MASON COUNTY

HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE E-2
TREATMENT PLANT SITE ALTERNATIVES

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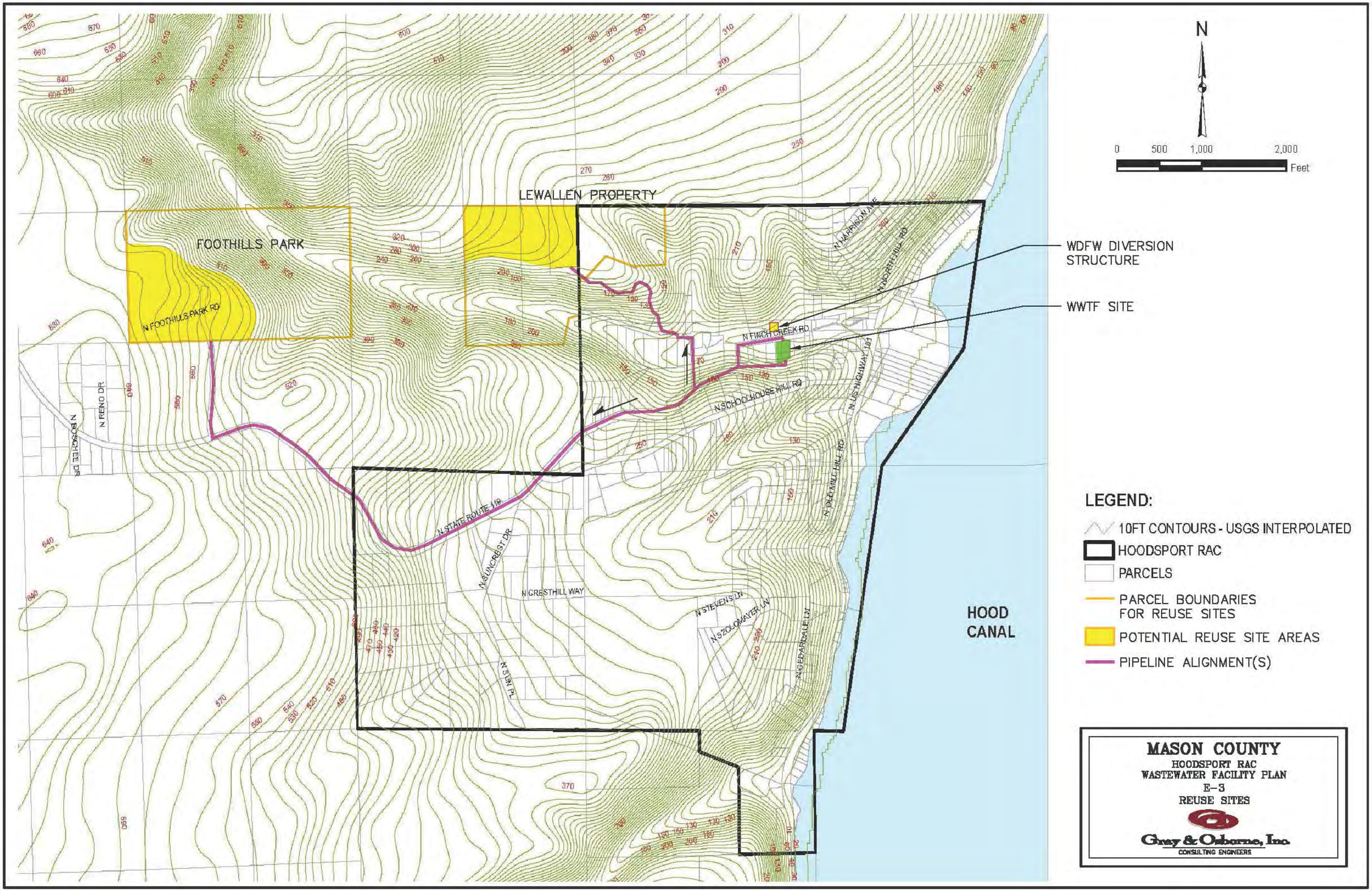
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500
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Feet
LEWALLEN PROPERTY
FOOTHILLS PARK
N FOOTHILLS PARK RD
N RENO DR
N BOSCHEE DR
N HARRISON AVE
N CRESTHILL RD
N FINCH CREEK RD
N SCHOOLHOUSE HILL RD
N US HIGHWAY 101
N OLD MILL HILL RD
N STATE ROUTE 119
N SUNCREST DR
N CRESTHILL WAY
N STEVENS LN
N SZOLOMAYER LN
N SUN PL
N GREENDALE LN
HOOD CANAL
WDFW DIVERSION STRUCTURE
WWTF SITE
LEGEND:
10FT CONTOURS - USGS INTERPOLATED
HOODSPORT RAC
PARCELS
PARCEL BOUNDARIES FOR REUSE SITES
POTENTIAL REUSE SITE AREAS
PIPELINE ALIGNMENT(S)
MASON COUNTY
HOODSPORT RAC
WASTEWATER FACILITY PLAN
E-3
REUSE SITES
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high-horsepower pumps. The location of the reuse facilities is near the treatment facility, thus providing convenience for monitoring and operation and maintenance. In addition, while preliminary, the soil conditions appear more favorable for infiltration than Foothills Park. The primary challenge with this alternative is completing the property acquisition needed to implement this alternative. However, this difficulty appears to present a lower risk and significantly lower costs than the Foothills Park alternative. Therefore, the recommended alternative for reuse is infiltration on property owned by Lewallen.

COLLECTION SYSTEM

The Plan evaluated three collection system alternatives: grinder pump, septic tank effluent pump (STEP), and septic tank effluent gravity (STEG). The construction, and operation and maintenance costs for each are summarized in Table E-5.

TABLE E-5

Collection System Alternative Cost Comparison

Alternative	Construction	Annual O&M	20-Year Life Cycle
Grinder Pump	$3,791,648	$35,584	$4,366,465
Septic Tank Effluent Pump (STEP)	$3,661,125	$46,380	$4,410,339
Septic Tank Effluent Gravity (STEP/STEG)	$3,746,065	$51,250	$4,573,948

The primary difference between the grinder pump and the STEP/STEG alternatives is the requirement to pump septic tanks for each individual connection. This requirement is reflected in higher O&M costs shown in Table E-5.

Among non-cost factors one advantage of the STEP/STEG units is the larger storage volume provided by the septic tanks in the event of an extended power outage. However, the grinder pump units would be expected to have fewer problems with odors because less detention time within the pump tank. Currently, Mason County operates a grinder system at its North Bay-Case Inlet facility. Neither the cost information presented in Table E-5 nor the non-cost factors provided enough justification to recommend a collection system other than the grinder pump system.

RECOMMENDED PLAN

The recommended plan for treatment, reuse, and collection are presented in Figure E-4. The recommendation for treatment is the membrane bioreactor with the enhanced site plan shown in Figure E-4. For reuse, Figure E-4 shows two Class A reclaimed water infiltration ponds with a 4-inch force main. Each residential and commercial connection

will be equipped with a grinder pump. The piping schematic, with pipe diameters ranging from 1.25 to 4 inch, discharges at the proposed site on Finch Creek Road.

The summary of costs for the recommended plan is shown in Table E-6. These costs include construction with a 15 percent contingency and an allowance of 8.3 percent for state sales tax. The construction cost, together with engineering, legal and land acquisition, provide the total project cost estimate.

TABLE E-6

Cost Summary

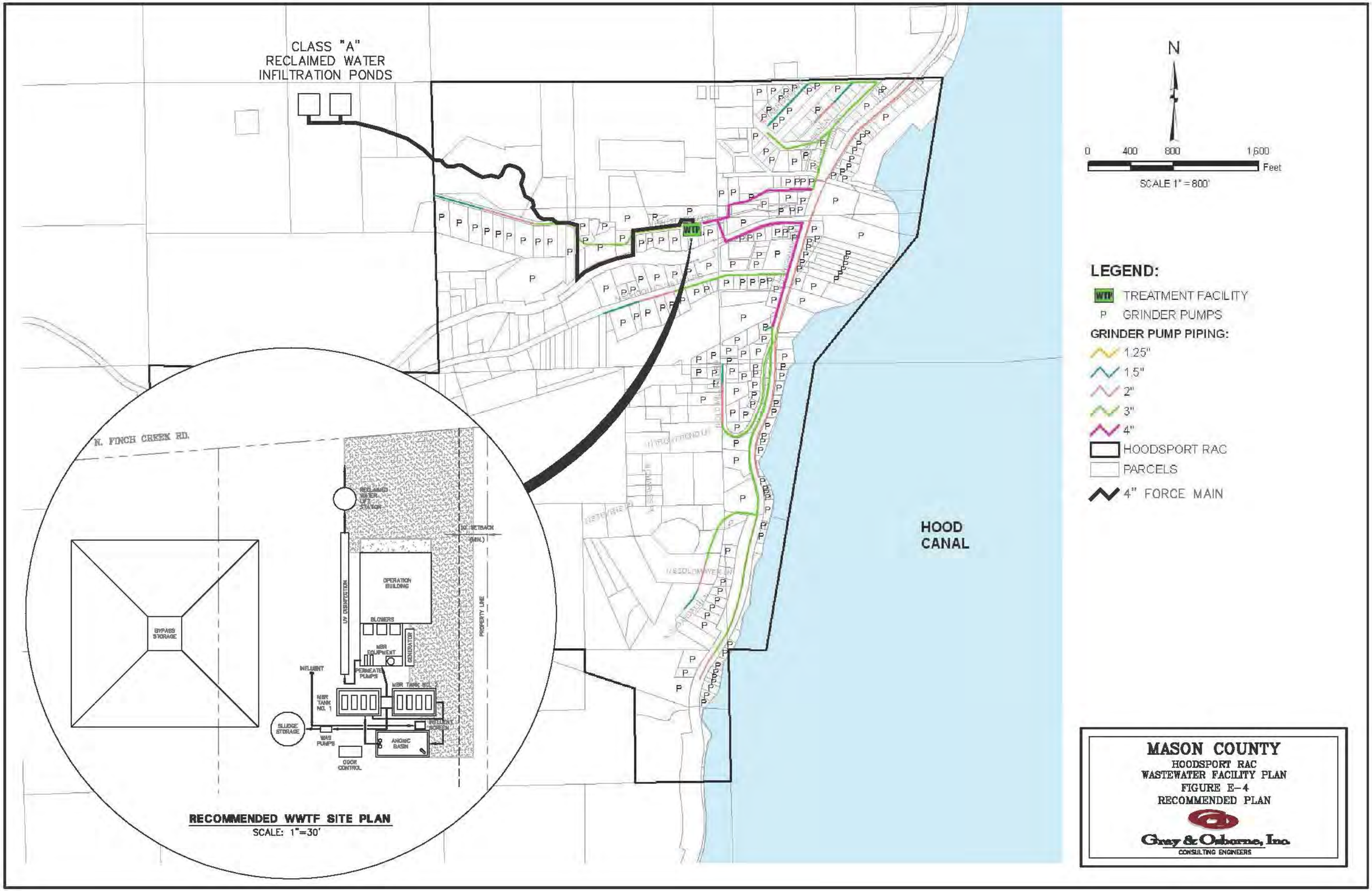
Construction Cost	**Amount**
Treatment	$2,758,672
Reuse	$ 899,838
Collection	$3,791,648
Total Construction Cost	**$7,450,158**
Engineering Services (including Legal)	
Design	$ 500,000
Easements/ROEs	$ 60,000
Recording Fees	$ 10,000
Construction Support	$ 510,000
Record Drawings/Operation and Maintenance Manuals	$ 70,000
Land Acquisition	$ 350,000
Total Engineering Cost	**$1,500,000**
TOTAL PROJECT COST	**$8,950,158**
Annual Operation and Maintenance Cost	
Administration	$ 25,000
Treatment	$ 113,800
Reuse	$ 12,980
Collection	$ 25,584
Total Annual Operation and Maintenance Costs	**$ 177,364**

PLAN IMPLEMENTATION

For complete project implementation, a number of steps will be required to ensure the long-term success of the sewer system. These are highlighted below:

- Property Acquisition: It is expected that property for the treatment plant site will be purchased. The reuse site may be purchased or leased.

- Predesign/Design: A critical step for the predesign step is a formal reliability analysis for the MBR/reuse system to ensure there are adequate redundancy and alarm features in place in the event of failure. During the


CLASS "A"
RECLAIMED WATER
INFILTRATION PONDS
N
0 400 800 1,600
Feet
SCALE 1" = 800'
LEGEND:
WTP TREATMENT FACILITY
P GRINDER PUMPS
GRINDER PUMP PIPING:
1.25"
1.5"
2"
3"
4"
HOODSPORT RAC
PARCELS
4" FORCE MAIN
HOOD CANAL
N. FINCH CREEK RD.
RECLAIMED WATER LIFT STATION
10' SETBACK (MIN.)
OPERATION BUILDING
UV DISINFECTION
BLOWERS
MBR EQUIPMENT
GENERATOR
PERMEATE PUMPS
INFLUENT
MBR TANK NO. 1
MBR TANK NO. 2
SLUDGE STORAGE
WAS PUMPS
ANOXIC BASIN
INFLUENT SCREEN
DOOR CONTROL
PROPERTY LINE
BYPASS STORAGE
RECOMMENDED WWTF SITE PLAN
SCALE: 1"=30'
MASON COUNTY
HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE E-4
RECOMMENDED PLAN
Gray & Osborne, Inc.
CONSULTING ENGINEERS

design phase, contract documents for construction will be completed along with permit acquisition.

- Ordinance establishing the sewer utility: This ordinance would establish the service area, roles and responsibilities, and provisions for operating and funding the sewer system.

- Easements/right-of-entries: For the grinder pump system, each connection will require a right-of-entry for operation and maintenance.

- State Waste Discharge (SWD) Permit: The SWD is a permit issued by Ecology for operation of the treatment facility and reuse area.

- Operation and Maintenance Manuals/Record Drawings.

- Rules and Regulations: These govern the use of the community sewer system.

CHAPTER 1

INTRODUCTION

PREFACE

This Wastewater Facility Plan (Plan) has been developed for the community of Hoodsport, Mason County Washington. The Plan is intended to address the on-site treatment system problems identified in the Hood Canal Low Dissolved Oxygen Preliminary Assessment and Corrective Action (PACA) Plan. This PACA plan was developed through a collaborative and cooperative arrangement between the Puget Sound Action Team, the state's partnership for Puget Sound, Mason County, and the council of governments within the Hood Canal watershed.

The PACA plan identified and quantified human-related sources of nitrogen that enter Hood Canal from land, surface, and groundwater and recommends the need for actions that will help to reduce the overall nitrogen inputs into Hood Canal. Specifically, the plan cites "reducing the nitrogen loading from stormwater runoff and onsite sewage systems is particularly important in densely-developed areas such as the Hoodsport area and the north and south shores of lower Hood Canal."

Hood Canal and its shorelines are prime areas utilized for permanent and seasonal housing and recreational facilities. Activities such as swimming, fishing, and boating form the basis of Hood Canal's tourism industry. Residential development and recreation are drawn to the scenic beauty and natural resources of this area. Both development and recreation add to the human waste impacts that threaten Hood Canal.

GENERAL

This Plan will evaluate short- and long-term alternatives for wastewater treatment and disposal in the Hoodsport area of the lower Hood Canal and will develop cost estimates for various wastewater alternatives. The Plan will present alternatives to meet the needs of the environment which are financially acceptable to Mason County and the citizens of the Hoodsport Rural Activity Center (RAC). The area of focus for this Plan encompasses the boundaries of the Hoodsport RAC, as presented in Figure 1-1.

This Plan is prepared and presented in accordance with Washington Administrative Code (WAC) 173-240-060, Engineering Report and serves to meet the planning goals of the Washington State Growth Management Act (Ch. 36.70A.020 RCW). The planning period of this General Sewer and Facility Plan extends to the year 2027. The Plan was funded by Mason County.

BACKGROUND

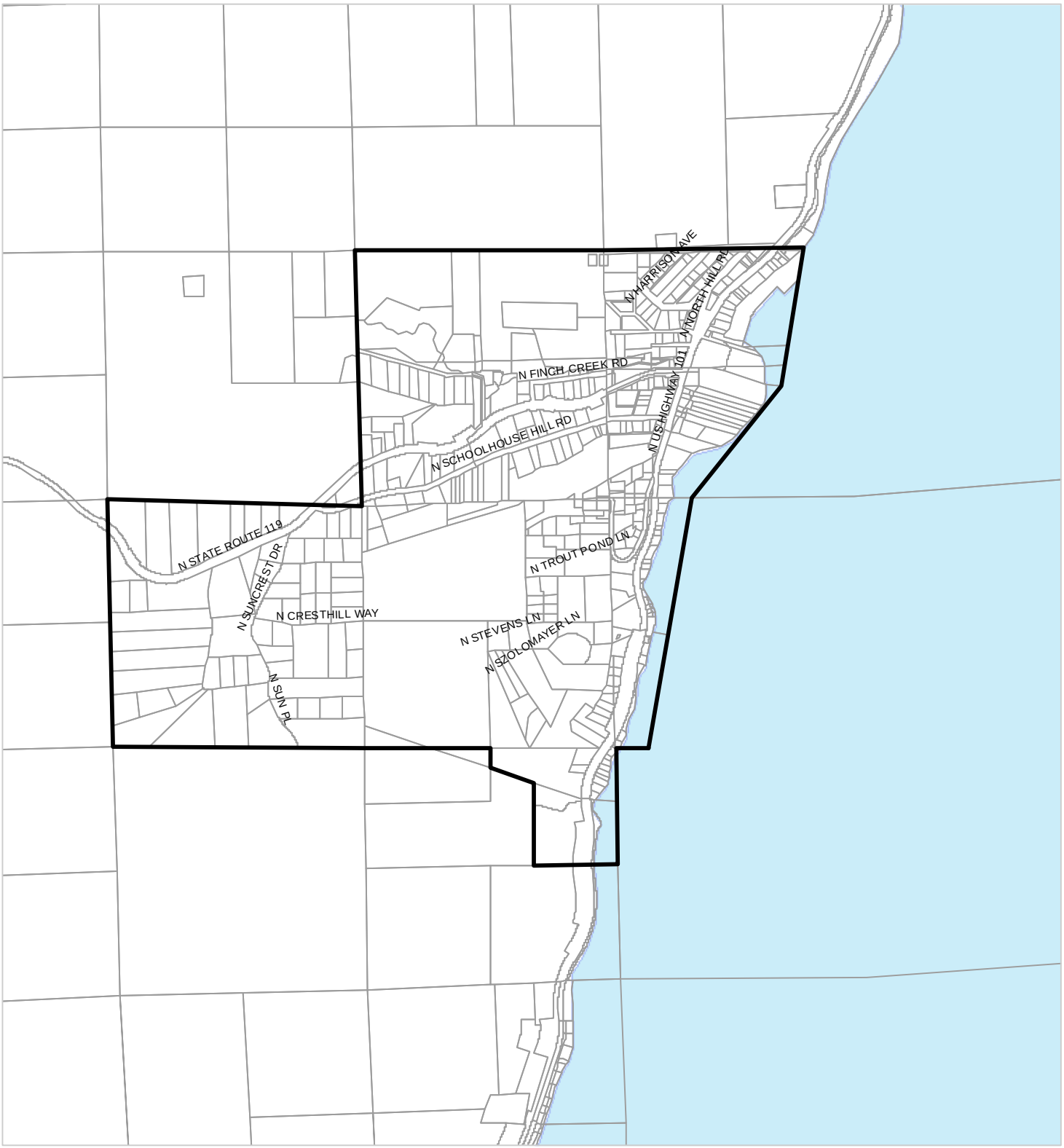
The marine shorelines in Mason County are some of the richest shellfish tidelands in the country and produce 34 percent of the commercial shellfish in the State of Washington. The *Lower Hood Canal Watershed Study Report* (1991) identifies Hood Canal as one of the best areas for natural reproduction of the Pacific oyster on the West Coast. The Lower Hood Canal has many public and private shellfish harvest areas and supports a wide variety of fish, shellfish, and waterfowl.

The community of Hoodsport lies on the western shoreline of Hood Canal, approximately five miles north of the canal's Great Bend. The community predominantly resides along Finch Creek and the slopes to the north and south that comprise the Finch Creek drainage. The drainage including the Finch Creek corridor extends approximately three and one half miles from the Olympic Range foothills of Dow Mountain to Hood Canal. Finch Creek discharges directly into Hood Canal at the Washington Department of Fish and Wildlife (WDFW) Hoodsport fish hatchery. Additional commercial and residential development exists along the State Route 101 corridor along the Hood Canal within the Hoodsport RAC.

The Finch Creek area has documented water quality problems that have resulted in restrictions on swimming and shellfish harvesting. For the most part, these problems have been attributed to failing commercial and residential onsite sewage systems along the Finch Creek corridor. The area has seasonally high ground water and soils underlain by a restrictive layer that limits infiltration of the on site treatment system effluent. It is suspected that these failing systems drain to Finch Creek, which, in turn, discharges contaminants directly into Hood Canal.

Since 1976, local volunteers and Mason County Health officials recorded elevated fecal coliform levels in Finch Creek. In 1987, the Washington Departments of Health (DOH) and Fish and Wildlife (WDFW) closed the public access tidelands at the mouth of Finch Creek to shellfish harvesting. Private tideland owners were also warned against harvesting shellfish on local beaches. These restrictions and closures remain in place today. In 1993, Mason County conducted an educational project under a grant from the Puget Sound Water Quality Authority's Public Involvement and Education (PIE) Fund. During that project, 30 failing onsite sewage systems were identified along Finch Creek. According to County records, only a few of these systems have been repaired. Some systems were deemed not repairable due to small lot sizes and the high water table along the creek.

In 1996, Mason County approached the Department of Ecology (Ecology) about implementing Ecology's Small Town Environment Program (STEP) as a means of trying to solve the water quality problems on Finch Creek. The STEP program is a self-help approach that assists local residents to reduce the cost of solving their problems through the use of voluntary labor. In 1997, a group made up primarily of Finch Creek residents,



LEGEND:

- HOODSPORT RAC
- PARCELS

N

0 750 1,500 Feet

MASON COUNTY

HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE 1-1
LOCATION MAP

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known locally as the "Fecal Ferrets," began to work with Ecology staff to further document the occurrence of fecal coliform contamination within the community. For several months, the local group collected water samples from Finch Creek and several drainage ditches in the community. The samples showed varying levels of contamination. They also collected data from private wells along Finch Creek. The group held several public meetings that included presentations from Ecology, Mason County Health Services, and Taylor United Shellfish Company.

In 1996, a ballot measure was passed that gave PUD No. 1 the authority to provide wastewater service in Mason County. The PUD No. 1 conducted a study of the feasibility of a community wastewater collection and treatment system for the area of Finch Creek. The plan completed in August 2000 concluded that the least expensive solution to these problems would be a Septic Tank Effluent Pump (STEP) wastewater-collection system, a settling tank, and a pressurized system to convey effluent to a centrally located drainfield with better infiltration characteristics than those associated with the private on site treatment systems being replaced. However, the scope of the August 2000 plan differs significantly from the scope of this current plan. The August 2000 plan covered a limited area of Hoodsport, while this Plan considers the entire RAC.

The Finch Creek Wastewater Feasibility Study, August 2000 analyzed alternatives that were technologically feasible to eliminate failing residential and commercial on site treatment systems along the Finch Creek corridor (Service Area 1) and additionally along the U.S. Highway 101 corridor as well as the Finch Creek corridor (Service Area 2). The Feasibility Study analyzed the system technologies, regulatory considerations, and costs for the respective service areas. These respective areas are shown on Figure 1-2.

Hoodsport is not unique in having to deal with fecal coliform contamination issues impacting Hood Canal. The Department of Health (Health), Office of Shellfish Programs, conducted water quality studies in Lynch Cove in the lower Hood Canal in April and November of 1987. These marine studies found fecal coliform bacteria levels well beyond the standards for approved commercial shellfish growing areas. Based on these results, Lynch Cove was downgraded to a prohibited commercial growing area and an advisory closure was issued at the Belfair State Park.[1]

The following description from the 1990 *Port of Allyn Comprehensive Plan and Engineering Report* characterizes the oceanographic processes that result from the Hood Canal's unique bathymetry:

> *A number of hydrographic characteristics make Hood Canal more vulnerable to pollutants than the other water bodies of Puget Sound. As an arm of Puget Sound, it is separated from the Sound by a 180-foot sill. This natural underwater barrier reduces the flushing action of the tidal flows so that the water of the Canal is infrequently flushed with waters from the Sound. In addition, the waters of Hood Canal become stratified for extended periods of the year with very little vertical mixing occurring.*

> *Mixing which does occur is situated in the upper region of the waters of the Canal and just below the water surface. Occasionally, the deeper waters, with low dissolved oxygen levels, mixes vertically. With these hydrographic conditions, limiting the production of algae in the Canal is of particular concern. Although algal growth is dependent on both the nutrients, nitrate and phosphate, nitrates appear to be the limiting nutrient in Hood Canal.*[2]

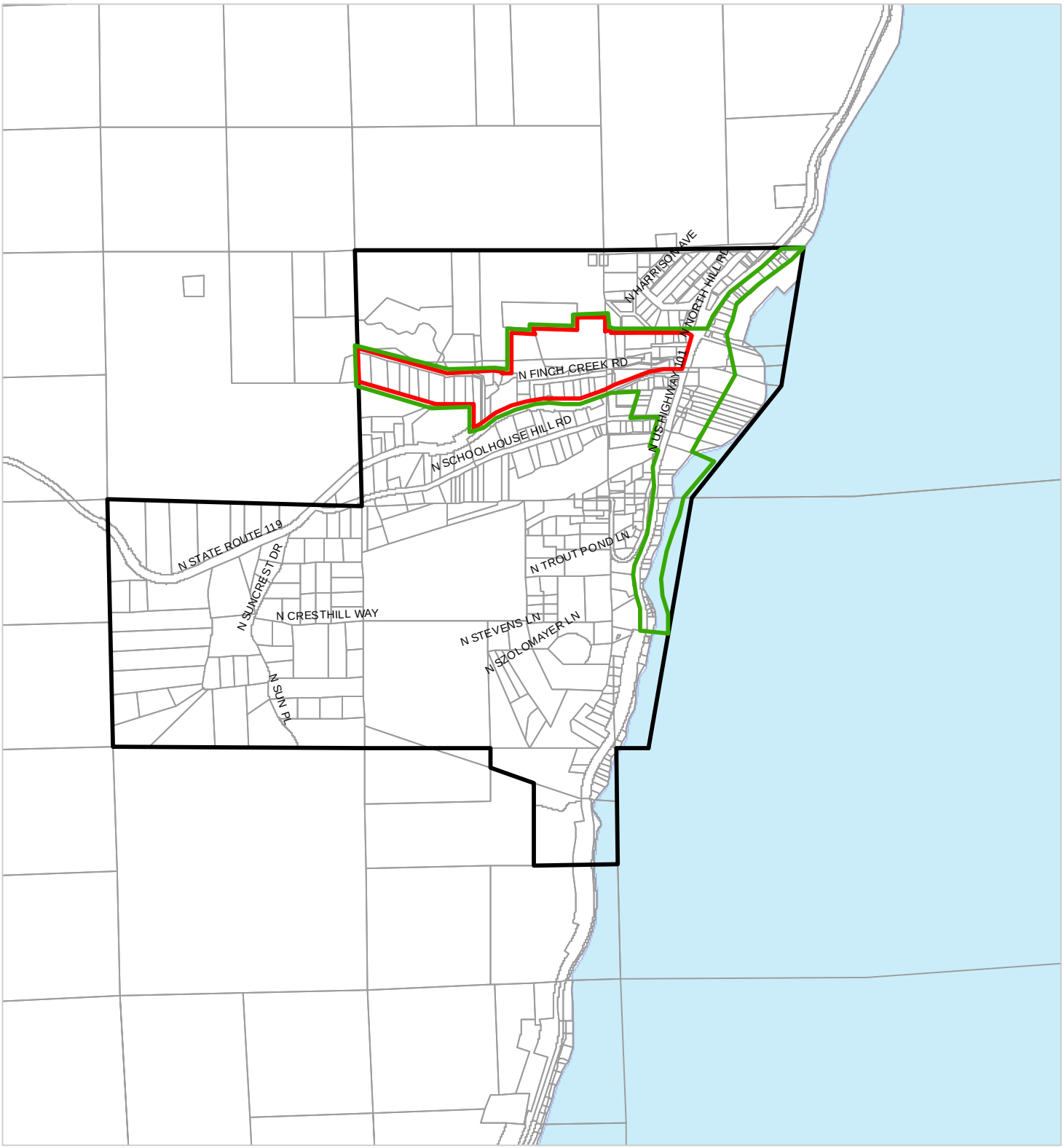
The Department of Ecology's 1990 *Water Quality Assessment* identified the Lower Hood Canal as *non-supportive of beneficial uses*. The beneficial uses of the Lower Hood Canal, as reported in the Watershed Study Report, "are recreation, shellfish, anadromous fish, domestic water supply, stock watering, and the general quality of life."

Reoccurring dissolved oxygen problems in Hood Canal was the major focus of the *Hood Canal Low Dissolved Oxygen Preliminary Assessment and Corrective Action Plan dated May 6, 2004*. This plan by the Puget Sound Action Team and the Hood Canal Coordinating Council, identified human sources of nitrogen as a primary cause of dissolved oxygen deficiencies in lower Hood Canal.

RECOMMENDATIONS FROM PREVIOUS REPORTS

Several alternatives for collection systems and wastewater treatment have been developed in both the Finch Creek Study and the Hoodsport-Skokomish Wastewater Management Alternatives Analysis (Gray & Osborne, Inc., October 2006) to address nutrient and fecal coliform loading in Hood Canal. The Finch Creek Study considered two service areas and developed design criteria, schematics, and costs for alternatives for both areas. The Alternatives Analysis prepared similar information for all of the Hoodsport RAC. The Alternatives Analysis also considered decentralized wastewater systems and management options to reduce the nutrient and fecal coliform loadings.

Table 1-1 summarizes the cost-effective wastewater collection and treatment alternatives considered in both reports. Table 1-1 lists the approximate number of equivalent residential units (ERUs), a brief description of the alternative, and the estimated capital and annual operation and maintenance (O&M) costs. The Finch Creek Study was prepared in 2000, and for any use for 2007, these costs would need to be updated.



LEGEND:

SERVICE_AREAS

- AREA 1
- AREA 2
- HOODSPORT RAC
- PARCELS

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0 750 1,500 Feet

MASON COUNTY

HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE 1-2
SERVICE AREAS 1 AND 2
FROM FINCH CREEK STUDY

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TABLE 1-1

Alternative and Cost Summary from Previous Reports

Service Area	Estimated No. of ERUs	Alternative	Capital Cost	Annual O&M
Service Area 1: Finch Creek Corridor (1)	40	STEP Collection System, Settling Tank, and Pressurized Drain Field	$1.3 million	$18,560
Service Area 2: Finch Creek Corridor and Commercial Area (2)	128	Grinder or STEP Collection System and Water Reclamation Facility	$3.3 million	$86,440-$90,360
Hoodsport RAC (3)	301 (2005) 424 (2015)	Grinder Pump Collection System, MBR or SBR Treatment Facility, and Effluent Reuse	$11.6-$11.8 million	$255,000-$267,000

(1) Table 9-1, *Finch Creek Wastewater Feasibility Study* (August 2000).
(2) Table 9-2, *Finch Creek Wastewater Feasibility Study* (August 2000).
(3) Table 8-10, *Hoodsport-Skokomish Wastewater Management Alternatives Analysis* (October 2006).

For each of the service area alternatives, the capital costs per ERU are very high and are not likely affordable without a significant amount of funding assistance. The least cost per ERU in Table 1-1 is $26,000 per ERU and the highest cost is $32,500 per ERU. For the Hoodsport RAC, the capital cost per ERU is $27,400 based on an assumption that the target year would be 2015. Most conventional funding of wastewater treatment facilities is through loan programs. However, the debt service for the loans combined with annual O&M costs likely would result in unaffordable sewer rates.

The Alternatives Analysis considered decentralized on-site systems, such as recirculating sand filters and proprietary products for nitrogen removal. The cost of these individual on-site systems ranges from $15,000 (low) to $30,000 (high) with additional O&M costs. The expected installation costs for a recirculating sand filter is $15,000 to $20,000 with $400 to $600 for annual O&M. These costs are less than the capital and O&M costs per ERU for a centralized wastewater collection and treatment facility. However, due to small lot sizes, high groundwater table, and unsuitable soils, the on-site alternatives may not be suitable for all areas of the Hoodsport RAC. As a result, the Alternatives Analysis recommended a combination approach utilizing centralized and decentralized alternatives. The centralized treatment alternatives would focus on the core commercial area, Finch Creek, and possibly a few other selected areas. This area closely follows Service Area 2 as outlined in the Finch Creek Study. The decentralized alternatives

would focus on the larger lots which are generally located in the upland areas of the RAC.

PURPOSE

The primary purpose of this Plan is to evaluate wastewater treatment and disposal alternatives for the Hoodsport RAC for the protection of water quality within the Lower Hood Canal.

This analysis of the Hoodsport RAC will consider environmental and financial factors to determine appropriate wastewater alternatives. This Plan will review and incorporate comments from state regulatory agencies, Mason County, and public input from the citizens of the Hoodsport RAC in the lower Hood Canal.

SCOPE OF WORK

The following is a list of the tasks to be accomplished through the Hoodsport RAC Wastewater Facility Plan according to the contract between Gray & Osborne (Engineer), and Mason County.

- Introduction – Provide general information including project background, purpose, funding sources, and pertinent reports.

- Study Area Environment – Describe area geographic boundaries, area description including climate, geology, soils, vegetation, critical areas, surface water resources, air quality, outdoor recreation, and public utilities. Conduct hydrogeological evaluations to characterize potential sites for reuse or effluent disposal.

- Land Use and Population – Identify Mason County and Hoodsport RAC land use designations, shoreline master program, and population.

- Regulations and Design Guidelines – Discuss onsite individual and large sewage systems, ground and surface water discharge and state regulatory design guidelines. Water reuse and biosolids treatment are also discussed.

- Existing System Evaluation – Review the history of onsite sewage systems, which including alternative methods of sewage treatment as well as treatment performance. Present the history of shellfish bed closures and dissolved oxygen episodes.

- Wastewater Flows and Loadings – Perform an analysis of contributors including residential, commercial, institutional, and infiltration and

inflow. Wastewater characteristics and organic loading design criteria. Establish projected wastewater flows and loadings through year 2027.

- Wastewater Treatment Alternatives – Evaluate wastewater treatment alternatives to meet future capacity needs, discharge standards, and other stipulations of the regulatory agencies.

- Reuse and Conservation – Evaluate alternatives to reduce, reuse, and/or reclaim municipal wastewater.

- Solids Treatment Alternatives/Biosolids Management – Coordinate with Mason County and the Washington State Department of Ecology to determine regulatory requirements and potential site locations for biosolids use.

- Cost Estimates – Provide capital and operation and maintenance costs for each component of the system (e.g., collection, treatment, and disposal/reuse).

PREVIOUS REPORTS

Local and State References

Hoodsport-Skokomish Wastewater Management Alternatives Analysis, Gray & Osborne, Inc., October 2006

Nitrogen Reducing Technologies, Washington State Department of Health, Office of Environmental Health and Safety, June 2005

This report was prepared for the Puget Sound Action Team and presents information about the chemical and biological processes for nitrogen removal and available technologies for use as on-site systems. The Washington State Department of Health is proposing a standard of 20 mg/L for total nitrogen for effluent from these types of systems effective July 2007. This report is available on the Puget Sound Action Team website at http://www.psat.wa.gov/Programs/hood_canal.htm.

Hood Canal Low Dissolved Oxygen Preliminary Assessment and Corrective Action Plan, Puget Sound Action Team, May 2004

The Preliminary Assessment and Corrective Action (PACA) Plan developed through a collaborative and cooperative arrangement between the Puget Sound Action Team, the state's partnership for Puget Sound, and the Hood Canal Coordinating Council (HCCC), and the council of governments within the Hood Canal watershed. It identified and estimated major categories of nitrogen sources in to Hood Canal and suggested corrective

actions to reduce these sources. Onsite treatment systems were identified as the leading human-influenced source of nitrogen loadings to Hood Canal.

This and other reports prepared for or by the Puget Sound Action Team can be found on its website at www.psat.wa.gov.

Port of Hoodsport Property Suitability Analysis, Port of Hoodsport, December 2003

The purpose of this report was to prepare a detailed analysis of property in the Port of Hoodsport district that will meet the intent of both the "Primary Goals" as indicated by the Port's Economic Development Study, November 2002 and the Community Vision Statement. The "Primary Goals" included, "acquiring property for a parking lot and future site for public restrooms and Business Incubator building (this site could also serve as the future location of an interpretive center and possibly a new salt water marina, breakwater, fuel dock, and artificial reef". The Community Vision Statement was determined as follows, "Foster economic development that supports the preservation and public enjoyment of local, cultural, and natural resources, provides family wage jobs, local services, and promotes the development of cottage industries, tourism, and family related activities."

Office of Food Safety and Shellfish Programs 2004 Annual Inventory: Commercial and Recreational Shellfish areas of Puget Sound

The Washington State Department of Health prepares an annual inventory for commercial and recreational areas in Puget Sound, including Lower Hood Canal. This publication provides important health information about shellfish resources in Puget Sound and contributes to the fulfillment of the Puget Sound Water Quality Management Plan.

This reference is available at http://www.doh.wa.gov/ehp/sf/Pubs/2004Annualinventory.pdf.

Environmental Report for the Finch Creek Wastewater System, Mason County PUD No. 1, June 2003

This environmental report evaluated wastewater treatment and collection alternatives and the environmental consequences for the community located within the Hoodsport RAC along the Finch Creek corridor. The report concluded that there would be no significant impact to proceed with construction of the least cost alternative as defined in the Finch Creek Wastewater Feasibility Study, August 2000.

Hoodsport/Cushman Economic Development Study, Port of Hoodsport, August 2002

The purpose of this study was to prepare an economic development and project feasibility study for the Hoodsport/Cushman area developed through a public process that defined planning strategy goals for the service area that are supported by the local citizens. The

plan analyzed economic development strategies for self-directed efforts toward long-term economic sustainability.

Washington State Marine Water Quality, 1998 through 2000, Washington State Department of Ecology, December 2002.

This is a report of Ecology's long-term Marine Waters Monitoring Program for October 1997 through December 2000 summarizing data for stations in the Puget Sound, Grays Harbor, and Willapa Bay.

Finch Creek Wastewater Feasibility Study, Mason County PUD No. 1, August 2000

This report evaluated wastewater treatment and collection needs and alternatives for a small portion of the Hoodsport RAC along the Finch Creek corridor.

Mason County Department of Health On-Site Standards, January 1999

These design standards follow and add to the State's requirements under Chapter 246-272 WAC, now 246-272A, for on-site sewage systems. The County's on-site regulations also establish certification requirements for pumpers, installers, designers, and maintenance specialists.

1998 Puget Sound Update, Puget Sound Water Quality Action Team, February 1998

This report is the sixth Puget Sound Update and covers the overall health of Puget Sound, including Lower Hood Canal. In part this report states that degradation of water quality caused by excess loading of nutrients in Puget Sound appears to be limited to semi-enclosed inlets, bays, and passages. The combination of poorly mixed marine waters and excess nutrient contributions from watersheds creates problems in some areas of Lower Hood Canal.

Mason County Comprehensive Plan, Department of Community Development, August 1998 (Amendments May 2000)

The Comprehensive Plan addressed how best to respond to the needs and demands of anticipated growth. It looked ahead to the year 2014 and set policies for County investments in roads, water, sewer, parks, and other public facilities. It guided development and land use regulations, which were created to manage private growth and ensure that resource lands, and the environment were protected. The elements of the Comprehensive Plan include land use and rural lands, housing, capital facilities, utilities, and transportation.

A more recent version of the Mason County Comprehensive Plan was completed in November 2005, and is available at http://www.co.mason.wa.us/code/comp_plan/index.php.

This Comprehensive Plan serves to guide public decision making in Mason County. The Plan stated the goals for the future that were identified by the citizens of the County, as well as county-wide planning policies specified under the Growth Management Act.

The County chose to organize its land use and planning on seven watershed basins. This approach provided the County with a meaningful process for analyzing growth impacts, preparation of effective development regulations, and establishment of mitigation measures. The County's watershed approach was established from the premise that action within one portion of a watershed impacts environmental and biological functions in other areas of the watershed. Alleviating negative impacts of specific actions within a watershed protects environmental resources throughout the entire watershed. For example, the filling of a wetland not only impacts the area surrounding the wetland, but also affects the watershed's overall ability to control flooding and filter out pollutants before they enter the groundwater system. Mason County's comprehensive watershed planning process seeks to protect water quality, wildlife habitat, other environmental resources and beneficial uses, and ensure adequate flood control.

Criteria for Sewage Works Design, Washington State Department of Ecology, Water Quality Program, December 1998

This manual is often referred to as the "Orange Book" and covers design criteria for collection systems, lift stations, and wastewater treatment facilities. Ecology has jurisdiction for design flows exceeding 14,500 gallons per day for any wastewater treatment system and for all mechanical systems exceeding 3,500 gallons per day.

Lower Hood Canal Watershed Action Plan, Lower Hood Canal Watershed Management Committee, October 1994

This Watershed Action Plan was the product of the Lower Hood Canal Watershed Management Committee. The Committee was charged with the responsibility of developing an action plan to address sources of non-point source water pollution in the Lower Hood Canal watershed. This Action Plan described the causes of non-point source pollution and recommended community-supported action steps and implementation strategies. The goal of this Watershed Action Plan was to protect and improve water quality and sustain beneficial uses of the waters within the Lower Hood Canal watershed.

Design Standards for Large On-Site Sewage Systems, Washington State Department of Health, Office of Environmental Health and Safety, December 1993

This report covers design standards for on-site sewage systems with design flows greater than 3,500 gallons per day. The Department of Health (DOH) is responsible for reviewing and approving on-site systems utilizing subsurface soil disposal with ultimate design flows between 3,500 and 14,500 gallons per day.

Lower Hood Canal Watershed Study Report, Mason & Kitsap Counties, Washington, Puget Sound Cooperative River Basin Team, April 1991

In December 1988, the Lower Hood Canal watershed was ranked number one in priority by the Mason County Watershed Ranking Committee. The Ranking Committee identified the non-point source pollution problems in the watershed. This Report served as one form of technical assistance provided by the Puget Sound Cooperative River Basin Team to the Lower Hood Canal Watershed Management Committee. As the lead of the Watershed Management Committee, Mason County requested that the River Basin Team study and evaluate the potential sources of non-point pollution within the watershed. The Watershed Management Committee ultimately produced an action plan based, in part, on the findings, conclusions, and recommendations of this Watershed Study Report.

National References

13th NW Onsite Wastewater Short Course and Equipment Exhibition Proceedings, September 2005

This short course was held at the University of Washington and presented current research and technologies on onsite wastewater treatment by recognized national experts. The course covered performance capabilities of onsite technologies, particularly regarding nutrient reduction.

Valuing Decentralized Wastewater Technologies, Prepared by Rocky Mountain Institute for the US Environmental Protection Agency, November 2004

The purpose of this report is to present a "catalog" of the economic advantages and disadvantages of decentralized wastewater systems relative to larger scale solutions, or centralized systems. There is a considerable amount of information in the report which address "decentralization benefit," consideration. However, only a small part of the report addresses the impacts of high effluent standards and nitrogen removal. The report contains a valuable section and management considerations for decentralized systems.

On-Site Wastewater Treatment Systems Manual, U.S. Environmental Protection Agency, Office of Research and Development, (EPA/625/R-00/08) February 2002

This manual provides up-to-date information for on-site wastewater treatment system siting, design, installation, maintenance, and replacement.

Wastewater Engineering Treatment, Disposal and Reuse (3rd Edition), Metcalf and Eddy, 1991

This text and reference book covers the range of wastewater engineering and contains a valuable section on small wastewater treatment systems.

PROJECT CONTACTS

For comments or questions regarding the development of this Plan or the implementation of its recommendations, the following staff of Mason County and the engineering firm of Gray & Osborne, Inc., can be contacted:

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Gray & Osborne, Inc.
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[1] Lower Hood Canal Watershed Study Report, prepared by Puget Sound Cooperative River Basin Team and provided to Lower Hood Canal Watershed Management Committee by request of Mason County Commissioners, April 1991, p. 27.
[2] Port of Allyn Wastewater Comprehensive Plan and Engineering Report, August 1990, p. 11.

CHAPTER 2

STUDY AREA ENVIRONMENT

INTRODUCTION

The purpose of this Chapter is to provide a general description of the study area environment. This description includes discussion of climate and precipitation, geology and topography, soils, vegetation, critical areas, floodplains, wetlands, surface water resources, air quality, outdoor recreation, public utilities, and water systems.

AREA LOCATION

Mason County, Washington, is the location of the study area for this Plan. Mason County's basic planning unit is based on watershed drainage basins; therefore, this Plan will emphasize the Hood Canal watershed. However, it is important to note that watershed boundaries are drawn based on topography above sea level. Hood Canal (at sea level) derives freshwater inputs from the Lower Hood Canal and Skokomish watersheds in addition to the Hood Canal watershed. Therefore, Hood Canal is impacted by a blending of the fresh water inputs of each of these watersheds as well as circulation between them. Communities within Mason County and the Hood Canal watershed include Hoodsport, Lake Cushman, Lilliwaup, and Eldon.

MASON COUNTY

Mason County is situated in the southwestern portion of Puget Sound and is approximately 968 square miles in size. Mason County shares borders with Jefferson County to the north, Grays Harbor County to the west and southwest, Thurston County to the southeast, Pierce County to the East, and Kitsap County to the northeast (see Figure 2-1).

Mason County remains a predominately rural area despite the urban migration from both Thurston and Kitsap Counties. The City of Shelton is the only incorporated community in Mason County and serves as County Seat. Shelton consists of approximately 4.77 square miles, or less than one percent of the County's total land area. Two American Indian Tribes, the Skokomish and the Squaxin Island, have reservations within the boundaries of the County.

The County is divided by seven watershed drainage basins that include Case Inlet, Chehalis, Lower Hood Canal, Oakland Bay, Skokomish, Totten-Little Skookum, and West Hood Canal. Mason County also includes over 90 miles of marine shoreline; over 100 freshwater lakes; and three major river systems, the Skokomish, Hamma Hamma, and Satsop; and numerous smaller tributaries and creeks.

WEST HOOD CANAL WATERSHED

The west Hood Canal watershed covers 43,571 acres outside of Olympic National Park and Olympic National Forest. It extends along the West Shore of Hood Canal from Potlatch north to the Jefferson/Mason County line.

Long-term commercial forests represent the primary land use within the west Hood Canal watershed, which cover approximately 34,120 acres and accounts for 78 percent of the watershed's land. Residential land use consists of 2 percent of the watershed and is mostly located in the communities of Lilliwaup, Hoodsport, Eldon, and along the shorelines of Hood Canal. The Hoodsport RAC is located entirely within the west Hood Canal watershed.

LOWER HOOD CANAL WATERSHED

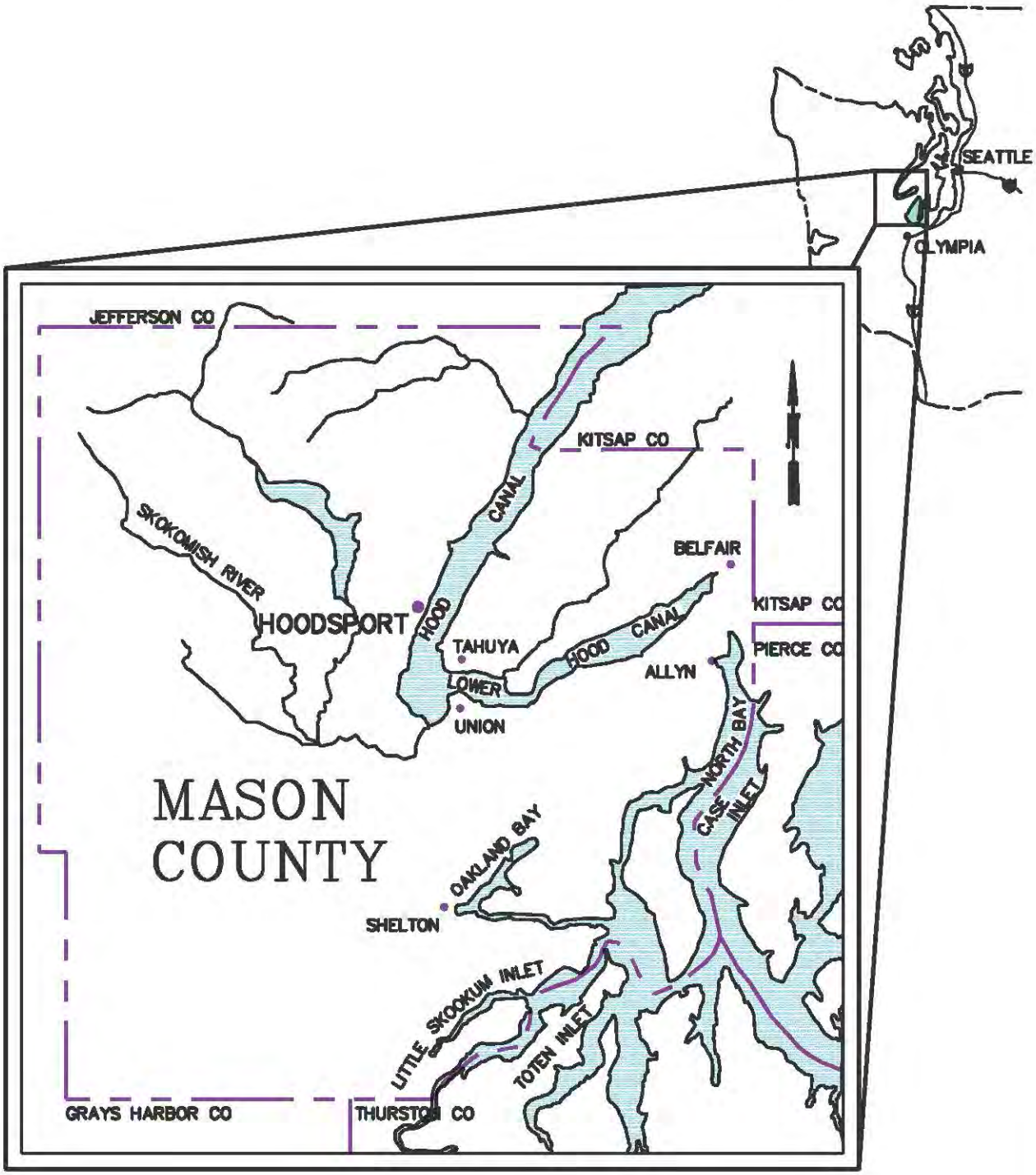
The lower Hood Canal watershed is located almost entirely in northeastern Mason County with a portion in western Kitsap County. The watershed drains an area of about 99,125 acres, directly into Hood Canal (see Figure 2-2). It contains three river systems, the Union, Tahuya, and Dewatto Rivers; numerous smaller creek drainages; and 111 lakes of varying size.

Forested lands compose over 86 percent (88,000 acres) of the watershed, covering most of the upland areas. Residential land use consists of only 6.2 percent (6,100 acres) of the watershed and is mostly located in Belfair, Union, Tahuya, and along the saltwater and lake shorelines. Agricultural and grazing land uses occur in less than 1/2 percent (just over 300 acres) of the watershed area, mainly adjacent to streams and rivers.

SKOKOMISH WATERSHED

The Skokomish watershed is located in the northwest corner of the County and is largely occupied by Olympic National Park and Olympic National Forest. Although it is the largest watershed in the County, only 61,468 acres lie outside the National Park and National Forest boundaries. This watershed also includes Lake Cushman. Lake Cushman is Mason County's only lake designated as a Shoreline of Statewide Significance under the Washington State Shoreline Management Act. Long-term commercial forests represent the primary land use within the Skokomish watershed. This classification covers 28,704 acres and accounts for 46.7 percent of the watershed's land that lies outside of the National Park and National Forest lands.

The Skokomish Indian Reservation is located at the mouth of the Skokomish River, and the river valley includes commercial agriculture and some other commercial activity.



MASON COUNTY
HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE 2-1
MASON COUNTY LOCATION MAP

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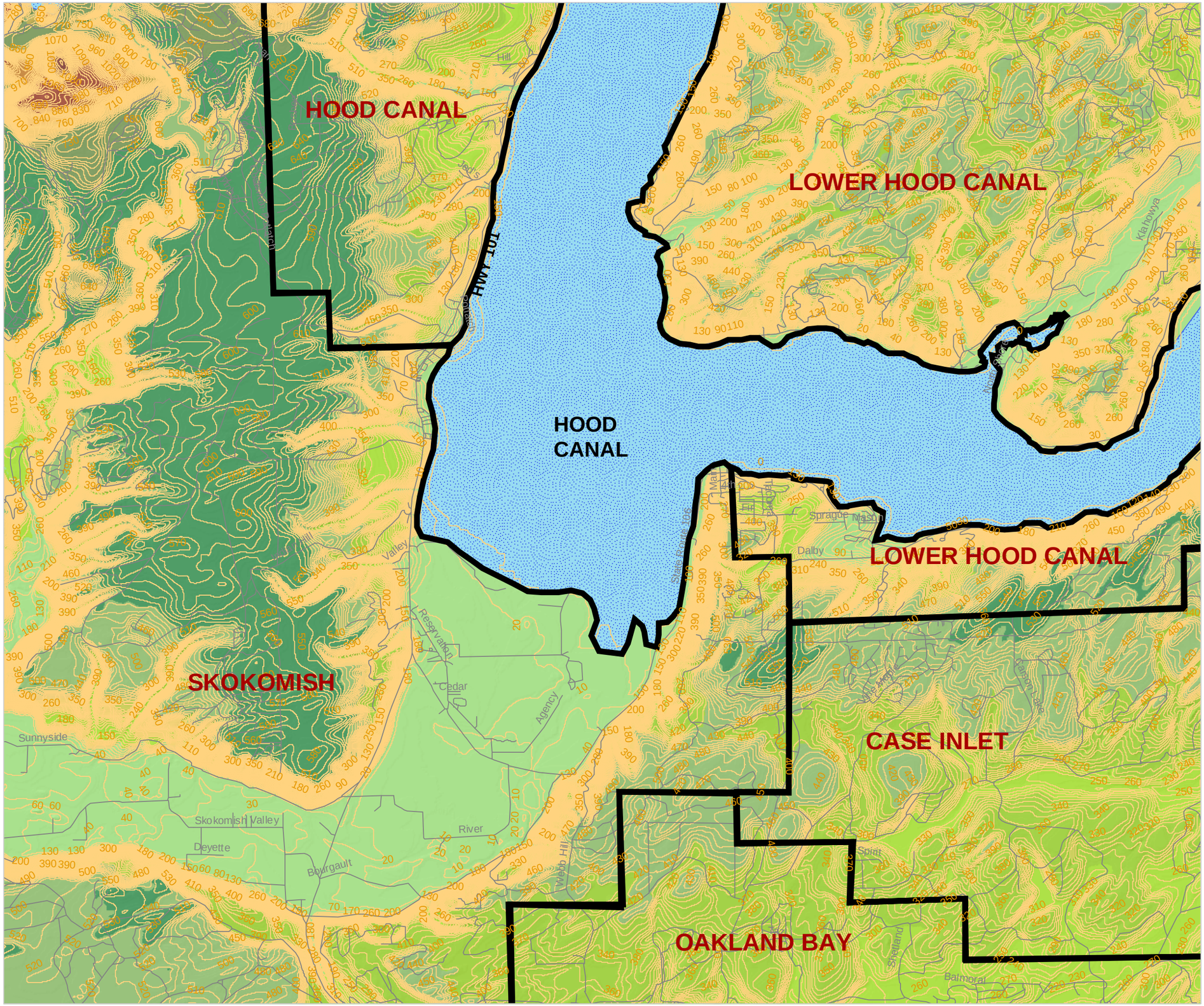

N

0 2,250 4,500 9,000 Feet

SCALE 1" = 4500'

LEGEND:

- WATERSHED BOUNDARIES
- USGS 10FT CONTOURS (INTERPOLATED)
- ROADS
- WATER

MASON COUNTY

HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE 2-2
WATERSHED BOUNDARIES

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CONSULTING ENGINEERS

O:\CLIENTS\MasonCo\HOODSPORT RAC WW PLAN\FIG2-2.mxd

STUDY AREA

The study area of this Plan is the Hoodsport RAC, which is located along the Highway 101 corridor north of Potlatch and the Skokomish Indian Reservation.

HOODSPORT

Hoodsport is a rural community lying on the western shoreline of Hood Canal, along US Highway 101 (Olympic Highway). The community is approximately ten miles north of the City of Shelton and about 5 miles north of the canal's Great Bend. The small community of Lilliwaup lies 3 miles to the north and the Potlatch community is about 3 miles to the south. The Olympic National Forest and Lake Cushman, including their recreational resources, lie directly west of Hoodsport.

Hoodsport is primarily residential, with a limited number of small businesses, including one motel. Most of the businesses provide essential services, while several are oriented to the many tourists that pass through the area. The USDA Forest Service maintains a Visitor Center and office compound in Hoodsport. There is also a fish hatchery at the mouth of Finch Creek that is owned and operated by the Washington Department of Fish and Wildlife (WDFW).

In the Mason County Comprehensive Plan, the Hoodsport area was designated as a "Rural Activity Center" (RAC). The County's Comprehensive Plan was updated in November 2005. The RAC includes approximately 584 acres. The Comprehensive Plan defines the RAC as follows:

> *"Concentrated settlements within rural lands that may include a variety of residential, small scale commercial, resource-based and rural light industrial, recreation, and public uses. They may also include a compact, pedestrian-oriented core. They may be served by community water systems and have community sewage treatment facilities but have only rural governmental services. They reflect an existing development pattern, but they are not intended to expand."*

The Mason County Shoreline Management Program (SMP) has designated Highway 101 from Lilliwaup Falls to Potlatch as "Urban Commercial." The Urban Commercial designation is defined in the SMP as follows:

> *"The Urban Commercial Environment is an area of high intensity commercial land use. The environment does not necessarily include all shorelines within an incorporated city, but is particularly suitable to those areas presently subjected to extremely intensive use pressure, as well as areas planned to accommodate commercial expansion. Shorelines planned for future commercial expansion should not have a high priority for designation as an alternative environment.*

> *Because shorelines suitable for urban commercial uses are a limited resource, emphasis should be given to development within already developed areas and particularly to water-dependent commercial uses requiring frontage on navigable waters."*

AREA DESCRIPTION

The study area is entirely within the west Hood Canal watershed, which is located in the southwest portion of the Puget Sound basin. The Hood Canal contributes significantly to the aesthetic and environmental quality of the Puget Sound region. The Puget Sound Water Quality Action Team reports that the Puget Sound is recognized worldwide as an extraordinary natural resource. National recognition of the beneficial values of the Puget Sound has lead to its formal designation as an "Estuary of National Significance."[1] The region's residents enjoy fishing, boating, beach combing, and other activities of the Canal's waters and beaches. A detailed description of the study area including environmental conditions of the watershed follows in this Chapter.

CLIMATE AND PRECIPITATION

The Olympic Mountains lying to the west are a major influence on the climate of Mason County. Consequently, the area receives a relatively high rate of the precipitation that moves east over the mountains from the Pacific Ocean. Precipitation levels measured at the Cushman Powerhouse Station are presented in Table 2-1. During the recording period ranging from 1990 to 2000, annual rainfall averaged about 97.1 inches. The lowest annual average rainfall was 71.9 inches (1993), and the highest average annual rainfall was 119.5 inches (1999). December had the highest monthly average rainfall during this period followed by January then November, while July had the lowest monthly rainfall.

TABLE 2-1

Total Monthly Precipitation (Inches)
Cushman Powerhouse Station, 1990 to 2000

Month	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	Avg.
January	23.5	10.6	24.7	9.78	10.1	17.2	14.1	18.7	22.2	19.43	15.33	**16.9**
February	12.8	12.5	10.0	0.49	12.7	12.8	15.6	6.75	14.7	30.97	6.88	**12.4**
March	6.79	7.69	1.64	10.4	9.16	12.6	2.38	22.6	6.91	9.99	7.2	**8.9**
April	2.74	11.1	8.86	11.3	5.50	5.38	13.4	7.06	2.63	2.39	3.25	**6.7**
May	2.61	3.11	0.04	5.10	3.78	1.40	4.52	5.10	1.32	2.72	5.25	**3.2**
June	4.09	1.32	2.08	3.61	2.36	1.37	1.20	2.73	0.63	1.67	5.18	**2.4**
July	0.27	0.83	0.81	2.93	0.75	1.66	1.03	1.76	0.44	0.89	0.77	**1.1**
August	1.53	4.94	0.74	0.49	0.34	3.18	1.10	2.88	0.14	0.79	0.49	**1.5**
September	0.01	T	2.83	0.00	1.91	3.46	3.10	10.6	1.42	0.06	2.04	**2.3**
October	9.26	2.14	6.47	3.03	10.0	9.53	12.4	16.8	5.57	7.25	6.31	**8.1**
November	25.8	16.4	10.0	5.75	17.4	22.9	13.0	11.0	32.0	22.92	7.26	**16.8**
December	12.3	10.9	9.22	19.0	26.8	18.0	24.2	9.66	25.3	20.44	11.32	**17.0**
Ann. Total	**101.7**	**97.9**	**77.4**	**71.9**	**100.8**	**109.2**	**106.0**	**115.5**	**113.3**	**119.5**	**71.3**	**97.1**

Temperature readings recorded at the Cushman Powerhouse for the period ranging from 1988 to 1998 are shown in Table 2-2. The average temperature over the 10-year period was 52 °F. July was the warmest month with an average monthly temperature of 65.0 °F, while December has the coolest average monthly temperature at 39.3 °F.

TABLE 2-2

Average Temperature (°F)
Cushman Powerhouse Station, 1988 to 1998

Month	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	Avg.
January	39.1	40.0	41.3	39.2	42.8	36.7	43.3	42.6	39.1	39.9	41.4	**40.5**
February	43.8	36.3	38.4	46.4	45.6	40.3	38.6	43.1	41.0	41.9	43.7	**41.7**
March	44.9	42.6	45.9	43.5	50.1	46.4	46.9	45.3	46.4	43.8	46.1	**45.6**
April	50.6	52.4	52.4	48.2	52.4	50.1	51.1	49.1	50.2	48.4	49.8	**50.4**
May	54.7	55.7	54.3	54.1	59.2	59.1	56.2	57.4	52.0	58.1	55.6	**56.0**
June	59.0	61.9	59.6	57.1	63.6	59.1	58.5	61.0	59.0	58.9	60.1	**59.8**
July	64.5	62.4	67.2	65.0	65.7	61.3	65.8	65.1	66.1	64.5	67.1	**65.0**
August	60.2	63.0	66.8	65.4	65.6	63.9	65.1	61.4	65.6	66.6	62.9	**64.2**
September	59.6	61.3	62.9	61.2	58.6	60.0	61.7	63.2	57.0	61.0	62.9	**60.9**
October	54.9	52.2	50.1	51.7	53.4	54.2	50.3	51.1	50.5	51.3	51.7	**51.9**
November	44.8	45.6	45.6	46.8	44.3	41.6	39.5	48.0	42.7	47.6	45.7	**44.7**
December	40.5	42.1	34.6	42.6	38.1	39.3	38.9	40.2	37.2	40.7	38.4	**39.3**
Ann. Avg.	**51.4**	**51.3**	**51.6**	**51.8**	**53.3**	**51.0**	**51.3**	**52.3**	**50.6**	**51.9**	**52.1**	

The prevailing winds are from the south or southwest in winter and west or northwest in summer. The strongest winds are from the south or southwest and usually occur as the more intense Pacific winter storms move inland. Extreme winds at 30 feet above the ground can be expected to exceed 55 mph once in 2 years, 80 mph once in 50 years, and 90 mph once in 100 years. Occasionally in winter, the combined influence of low pressure systems off the coast and high pressure continental air masses spilling over the Cascade Mountains can result in cold northerly or easterly winds over the area. In summer, winds are light and on most afternoons a northerly breeze develops over the water and lowlands.

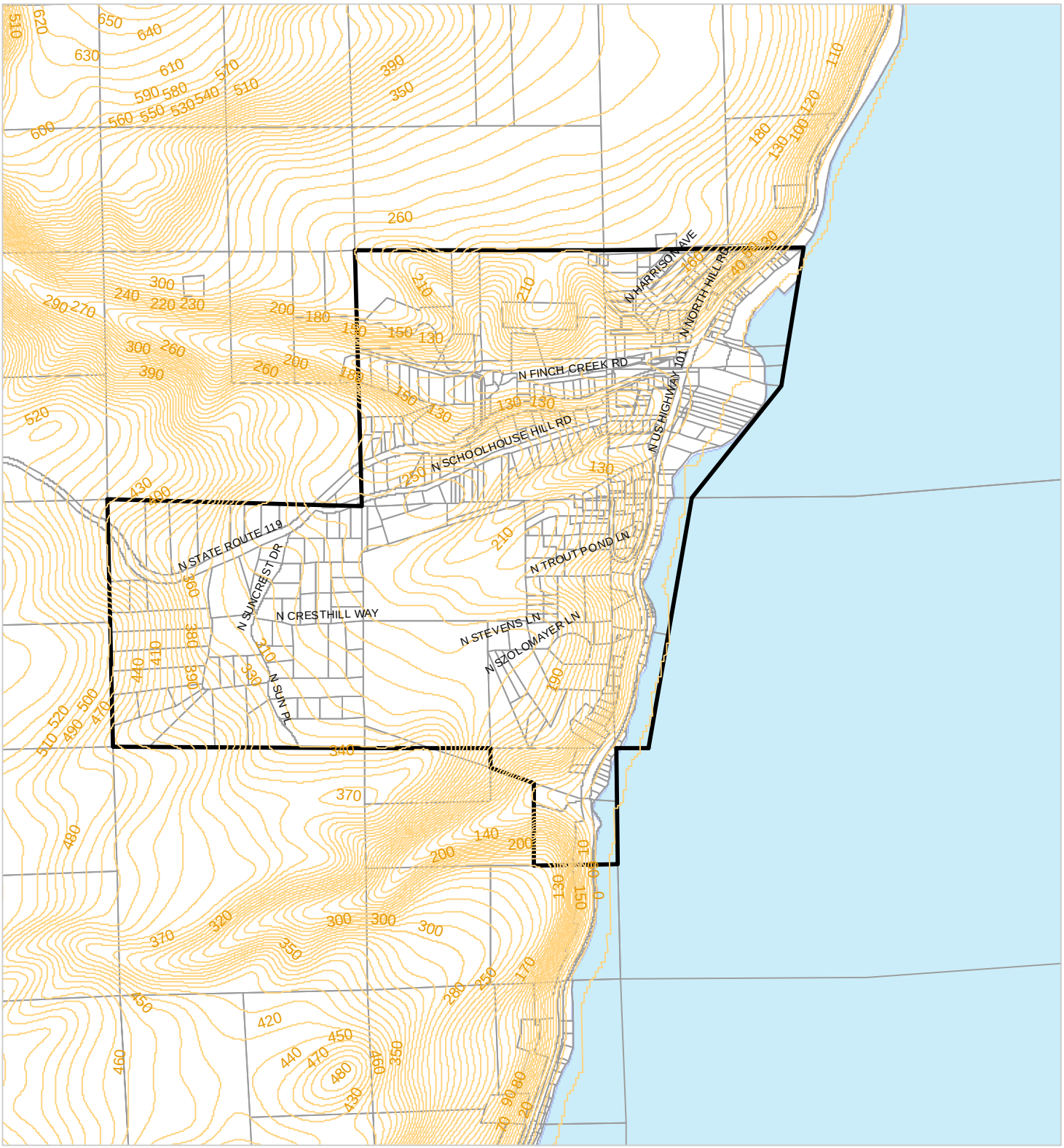
GEOLOGY AND TOPOGRAPHY

Three geological provinces combine to form Mason County, the Puget Sound Lowlands, the Olympic Mountains, and the Black Hills. Hoodsport is located within the Olympic Mountains geological province.

The region is similar in geology and topography to other coastal regions in the Puget Sound basin, reflecting the influence of mountain building and glacial activity. Uplifting of the Cascade and Olympic Mountains caused the lowland areas of the Puget Sound trough to become sites of deposition for sedimentary materials washed down from the surrounding mountain ranges. The underlying volcanic bedrock is overlain with several thousand feet of marine sedimentary rock. Periods of glaciation, followed by erosion and deposition, resulted in the rolling topography found in the Hood Canal watersheds. The topography within the study area is relatively steep, rising from sea level along the shoreline to elevations in excess of 600 feet within a mile west of Hood Canal. The contours indicate slopes in excess of 15 to 45 percent in the area immediately west of Highway 101. Drainages of local creeks cut narrow ravines on the eastern edge of the hillsides. The larger topographic picture is of a large ridge, descending to the west to the Skokomish River, ending to the south by the channel of the same river and descending to the east to Hood Canal. All drainages from this ridge flow either to the Skokomish and then to Hood Canal, or directly to Hood Canal. Figure 2-3 presents the topography of Hoodsport and the surrounding area.

SOILS

HWA GeoSciences prepared a report dated February 7, 2007, which characterized soils and geologic conditions for the Hoodsport RAC. The complete report is included in Appendix A. The dominant soil types are presented in Figure 2-4. Table 2-3 describes the important characteristics of the dominant soils, including natural drainage, occurrence of high water table, moisture-supplying capacity, root penetration limits, depth to layer that limits root penetration, natural fertility, and special management problems. Closest to the shorelines is Hoodsport gravelly sandy loam with 30 to 45 percent slopes in the northern area. Farther to the south are Hoodsport gravelly sandy loam with 15 to 30 percent slopes and Grove gravelly sandy loam with slopes of 5 to15 percent. The upper headlands in this area are predominantly Hoodsport gravelly sandy loam with



LEGEND:

- USGS 10FT CONTOURS (INTERPOLATED)
- HOODSPORT RAC
- PARCELS

N

0 750 1,500 Feet

MASON COUNTY

HOODSPORT RAC WASTEWATER FACILITY PLAN

FIGURE 2-3

TOPOGRAPHY MAP

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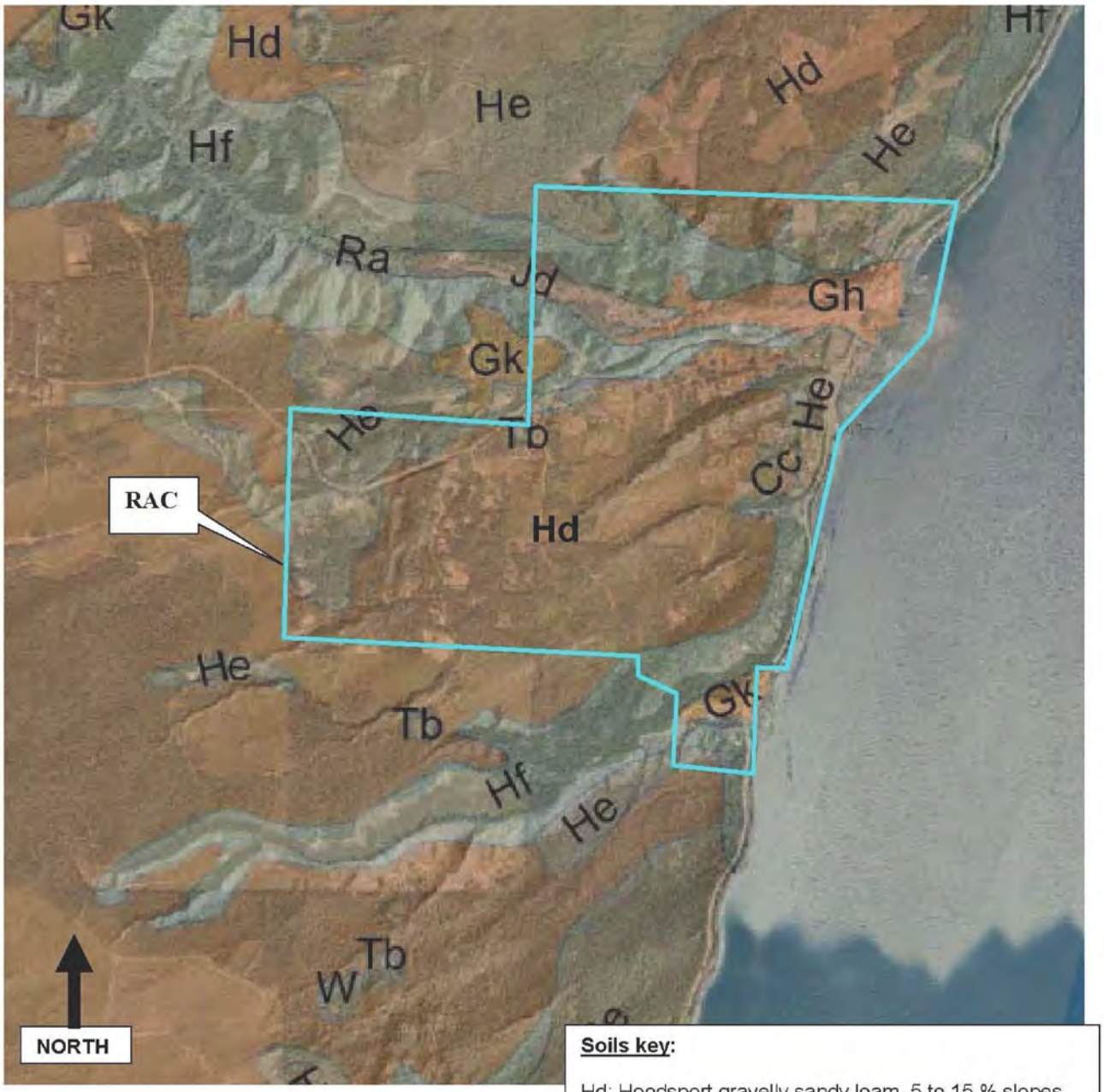
O:\CLIENTS\MasonCo\HOODSPORT RAC WW PLAN\FIG1-1.mxd



Soils key:

Hd: Hoodsport gravelly sandy loam, 5 to 15 % slopes
He: Hoodsport gravelly sandy loam, 15 to 30 % slopes
Hf: Hoodsport gravelly sandy loam, 30 to 45 % slopes
Gh: Grove gravelly sandy loam, 0 to 5 % slopes
Gk: Grove gravelly sandy loam, 5 to 15 % slopes
Cc: Cloquallum silt loam, 5 to 15 % slopes
Tb: Tanwax peat, 0 to 2 % slopes
Jd: Juno sandy loam, 0 to 3 % slopes

From: Ness, A. 0., and Fowler, R. H., 1960. *Soil Survey Of Mason County, Washington,* Soil Conservation Service, United States Department of Agriculture, Washington Agricultural Experiment Stations.
http://www.or.nrcs.usda.gov/pnw_soil/wa_reports.html

MASON COUNTY
HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE 2-4
SOILS MAP

Gray & Osborne, Inc.
CONSULTING ENGINEERS

slopes of 5 to 15 percent. The Hoodsport series consists of well-drained, reddish soils on the uplands. They have developed from granitic till that is highly stained by iron and that contains considerable metamorphosed and basic igneous gravel and stone. This parent material originated from local glacial till and from glacial till of the Vashon glacier.

The Grove series exists primarily at the interface of Hood Canal and various creeks along the western shore of Hood Canal. The Grove series consists of somewhat excessively drained, reddish-brown gravelly soils. It occupies the large glacial outwash plains. The Grove soils have developed from Vashon glacial drift, modified considerably by inclusions of local basaltic rock and mixed material from the Olympic Mountain glaciers.

TABLE 2-3

Dominant Soils Characterization
Hoodsport/Cushman Study Area

Soil	Natural Drainage	Occurrence of High Water Table	Moisture-Supplying Capacity(1)	Root Penetration Limits	Depth to Layer that Limits Root Penetration(2)	Natural Fertility	Special Management Problems
Hoodsport gravelly sandy loam (Hf, 30 to 45 percent slopes)	Good	None	Low	Compact Till	Moderately Deep	Very Low	Low Fertility Droughtiness Slopes
Hoodsport gravelly sandy loam (He, 15 to 30 percent slopes)	Good	None	Low	Compact Till	Moderately Deep	Very Low	Low Fertility Droughtiness Slopes
Hoodsport gravelly sandy loam (He, 5 to 15 percent slopes)	Good	Seasonal	Fair to Low	Compact Till	Moderately Deep	Very Low	Low Fertility Droughtiness
Grove gravelly sandy loam (Gh, 0 to 5 percent slopes)	Somewhat Excessive	Seasonal	Low	Gravel	Moderately Deep	Low	Low Fertility Droughtiness
Grove gravelly sandy loam (Gk, 5 to 15 percent slopes)	Somewhat Excessive	Seasonal	Low	Gravel	Moderately Deep	Low	Low Fertility Droughtiness Steep Slopes

(1) Refers to capacity to supply moisture that plants can use.
(2) Refers to the depths to which roots can readily penetrate: Moderately Shallow (20 to 36 inches) and Moderately Deep (36 to 60 inches)
SOURCE: Soil Survey, Mason County Washington, Soil Conservation Service, September 1960.

VEGETATION

Vegetation has been classified by soil types described previously. The Hoodsport series supports dense forests of Douglas fir and hemlock. Nearly all the area has been logged and is slowly restocking with the original varieties of forest trees. The forests are dense, but they are growing slowly and are of poor quality. The understory is rhododendron, kinnikinnick, an occasional madrona, and scattered vine maple and stinky laurel – all of which characteristically grow on droughty soil. Huckleberry is common but not luxuriant. The soil is not suitable for farming; its best use is forestry. In the areas of creek drainage and along the Hood Canal, the trees and other vegetation have difficulty surviving due to the steep slopes.

Grove series soil vegetation consists of coniferous forest, with an understory dominated by the lower growing mosses, kinnikinnick, and snowberry, and these mixed with huckleberry, salal, and Oregon grape. The drought-resistant manzanita is especially common on the Grove soils. Logged areas restock slowly to Douglas fir and some pure stands of lodgepole pine.

CRITICAL AREAS

The Mason County Comprehensive Plan identifies areas and ecosystems as "critical areas." These are site sensitive areas that the County has identified for protection through its development regulations.

The Mason County Interim Resource Ordinance (Chapter 17.01 of the Mason County Code) identifies geologic hazard areas, flood hazard areas, wetlands, surface water resources, critical aquifer recharge areas, and fish and wildlife habitat areas. Under the code geologic hazard areas include landslide, seismic, and erosion-prone locations. Under surface water resources, both marine and freshwater habitats are addressed. Each critical area for this Plan is described in general terms in the order listed below:

- Geologic Hazard Areas
  - Landslide Hazard Areas
  - Seismic Hazard Areas
  - Erosion Hazard Areas
- Flood Hazard Areas
- Wetlands
- Surface Water Resources
- Groundwater and Aquifer Recharge Areas
- Fish and Wildlife Habitat

GEOLOGIC HAZARD AREAS

Landslide Hazard Areas

A landslide is defined as a rapid down slope movement of a mass of material such as rocks, soil, or other debris. The risk of landslide occurrence depends on the soils vulnerability, slope, and the degree of water saturation. Development activities can increase the risk of landslide by exposing soils through clearing, altering natural drainage patterns, excavating the "toe" of slopes, or increasing soil moisture content. Marine bluffs and unconsolidated glacial deposits on steep hillsides (greater than 40 percent) are especially susceptible to landslide hazards. According to the Mason County Comprehensive Plan, Potential Landslide Hazard Areas are areas that meet the following criteria:

1. Areas with indication of earth movement such as debris slides, earth flows, slumps and rock falls; or

2. Areas with artificially steepened or unengineered slopes, i.e., cuts or fills;

3. Areas containing soft or potentially liquefiable soils;

4. Areas unstable as a result of stream incision, stream bank erosion, and undercutting by wave action;

5. Slopes greater than 15 percent (8.5 degrees), except areas composed of consolidated rock, and having either of the following:

    a. Steep hillsides intersecting geologic contacts with a relatively permeable sediment overlying a relatively impermeable sediment or bedrock; or
    b. Springs or groundwater seepage.

Unconsolidated glacial deposits on hillsides greater than 40 percent are particularly susceptible to land slide hazard. To maintain the stability of steeper slopes, forest practices, activities, and residential development would be limited or prohibited under Mason County Critical Areas Ordinances.

Seismic Hazard Areas

Conditions that precipitate earthquake damage include settlement and soil liquefaction due to seismic activity. Soils within these areas contain high organic matter (e.g., wetland soils), loose sand and gravel, artificial fills, landslide deposits, and fine-grained soils with high water tables. The critical areas regulations do not allow public buildings in a seismic hazard area. The Mason County Comprehensive Plan defines Seismic Hazard Areas as areas susceptible to ground failure, including the following:

1. Mapped geologic faults;
2. Areas of poorly compacted artificial fill;
3. Areas with artificially steepened slopes;
4. Post-glacial stream, lake or beach sediments;
5. River deltas;
6. Areas designated as potential Landslide Hazard Areas;
7. Bluff areas;
8. Deep road fills and unsupported fills.

The Coastal Zone Atlas of Washington identifies the Seismic Hazard Areas in the study area as the interface of Hood Canal and the shoreline from approximately Potlatch north to Lilliwaup along Highway 101. However, the Mason County Comprehensive Plan does not identify seismic hazard areas specifically within the study area.

Erosion Hazard Areas

Erosion is a natural process in which the land surface is worn away by the action of water, wind, ice, or other geologic process. The most common cause of erosion is water falling or flowing across the land. Factors contributing to erosion hazard include soil type and slope. Erosion hazards generally occur on soils subject to erosion where slopes exceed 15 percent.

The erosion process can be accelerated by development activity that exposes and disturbs soils so they are more vulnerable to weather and erosion processes. Increased areas of impervious surfaces reduce the infiltration of rainfall, increase stormwater runoff, and can result in even greater erosion potential. Increased runoff, erosion, and sedimentation may adversely affect the physical and biological characteristics of streams and other water resources.

Erosion hazard is similar to landslide hazards in that both can be created by, or aggravated by, development activities such as clearing and grading.

The steeply sloped, relatively unconsolidated deposits along Finch Creek are susceptible to erosion during heavy rainfall. Aerial photos show a sizable buildup of sediment at the mouth of the creek, indicating transport of sediment down the creek.

FLOOD HAZARD AREAS

Flood hazard areas are lands subject to one percent or greater chance of flooding in any given year. In Mason County they include areas identified as potential or historic flood areas based on three sources: (1) the Department of Ecology's *Coastal Zone Atlas*, (2) areas identified as "Zone A" flood areas on the National Flood Insurance Program, Flood Insurance Rate Maps for Mason County, and (3) Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map.

Flooding in Mason County generally occurs from November through April. The greatest cause of flooding is heavy rainfall combined with snowmelt. The FEMA floodplain map for the Hoodsport area indicates that the populated portion of Finch Creek lies within the 100-year floodplain (Figure 2-5).

Flooding of marine shorelines is caused by a number of factors that can occur individually or in combination. These conditions include extreme high tides, waves generated by winds, and locally generated seismic waves or boils. Wind-driven waves, superimposed on extreme high tides, represent the most common form of coastal flooding in Mason County.

WETLANDS

The identified wetland areas in the Plan area are shown in Figure 2-6.

The coastal beach that parallels Highway 101 to the south of Hoodsport is designated as "estuarine intertidal unconsolidated shore" (E2US). The beach to the south has an added designation as "regularly flooded" (N).

SURFACE WATER RESOURCES

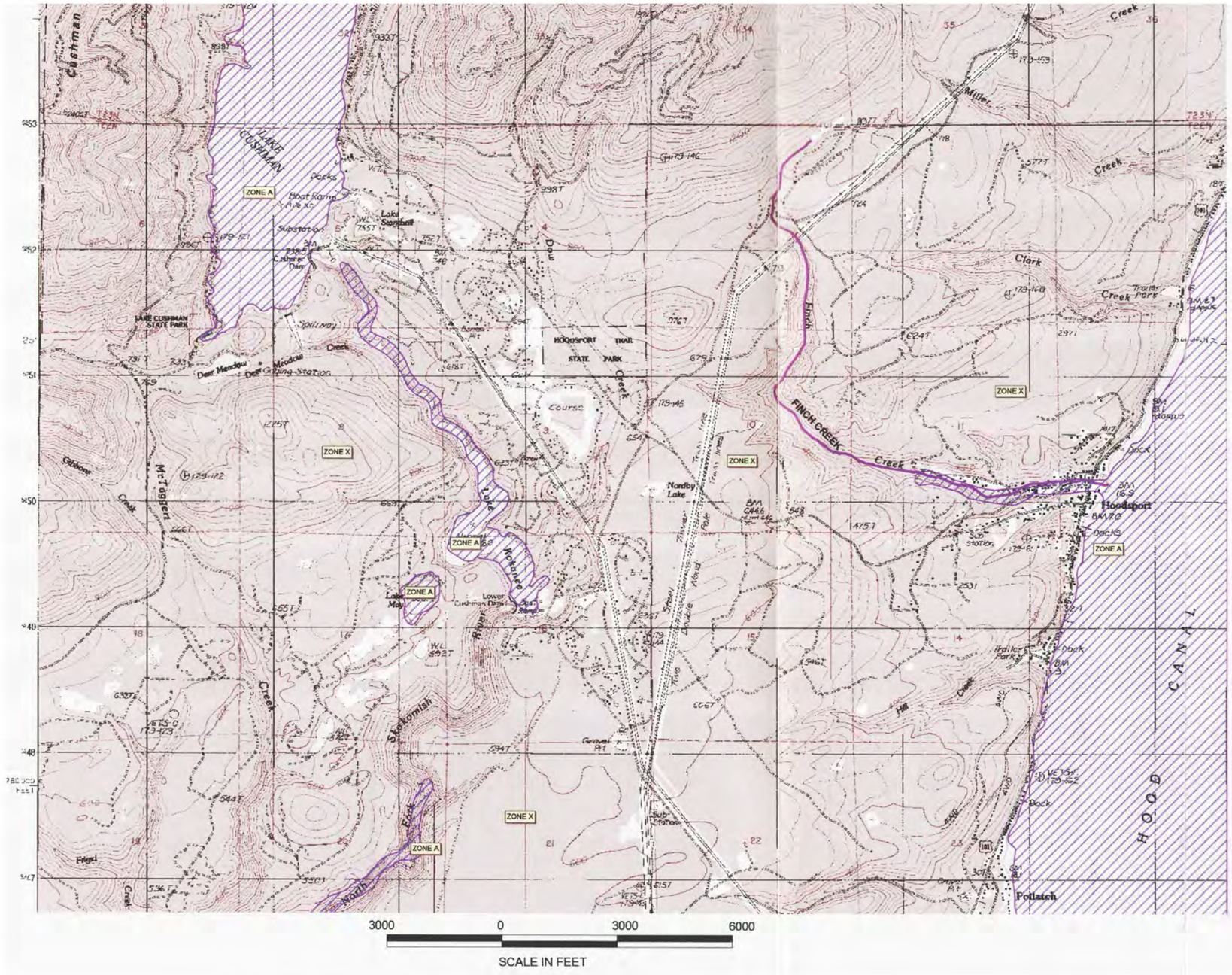
There are a number of surface water resources within the study area, which include marine, estuarine, and fresh water sources. These are shown on Figure 2-7.

Both Ecology and the Puget Sound Action Team provide information about the conditions of Hood Canal and other surface waters on their websites. The Ecology website is www.ecy.wa.gov/program/wq/303d/2002/2002-index.html. The latest findings of the Puget Sound Ambient Monitoring Program can be found at www.psat.wa.gov/publications/update_02/update_02.htm.

A brief description of Hood Canal and Finch Creek is included below.

Surface Water Classifications and Standards

The State of Washington designates the waters of the State into different water quality classes under Ch. 173-201A WAC, Water Quality Standards for Surface Waters of the State. The State adopted revised water quality standards on July 1, 2003. The standards are based on two objectives: protection of public health and enjoyment, and protection of fish, shellfish, and wildlife. For each surface water body in the state, the revised standards assign specific uses, such as aquatic life, recreation or water supply uses. Water quality standards have been developed for each use, for parameters such as fecal coliform, dissolved oxygen, temperature, pH, and turbidity. The water quality standards also have narrative criteria regarding toxic, radioactive, otherwise deleterious materials,



LEGEND

FINCH CREEK

FLOODPLAIN CLASSIFICATION

ZONE A:
100 YEAR FLOODPLAIN

ZONE X:
AREAS OUTSIDE THE 100 -YEAR FLOOD PLAIN, AREAS OF 100 -YEAR SHEET FLOW FLOODING WHERE AVERAGE DEPTHS AVERAGE LESS THAN 1 FOOT, AREAS OF 100-YEAR STREAM FLOODING WHERE THE CONTRIBUTING DRAINAGEAREA IS LESS THAN 1 SQ MILE, OR AREAS PROTECTED FROM THE 100-YEAR FLOOD BY LEVEES.

MASON COUNTY

HOODSPORT RAC WASTEWATER FACILITY PLAN

FIGURE 2-5

FEMA FLOODPLAIN MAP

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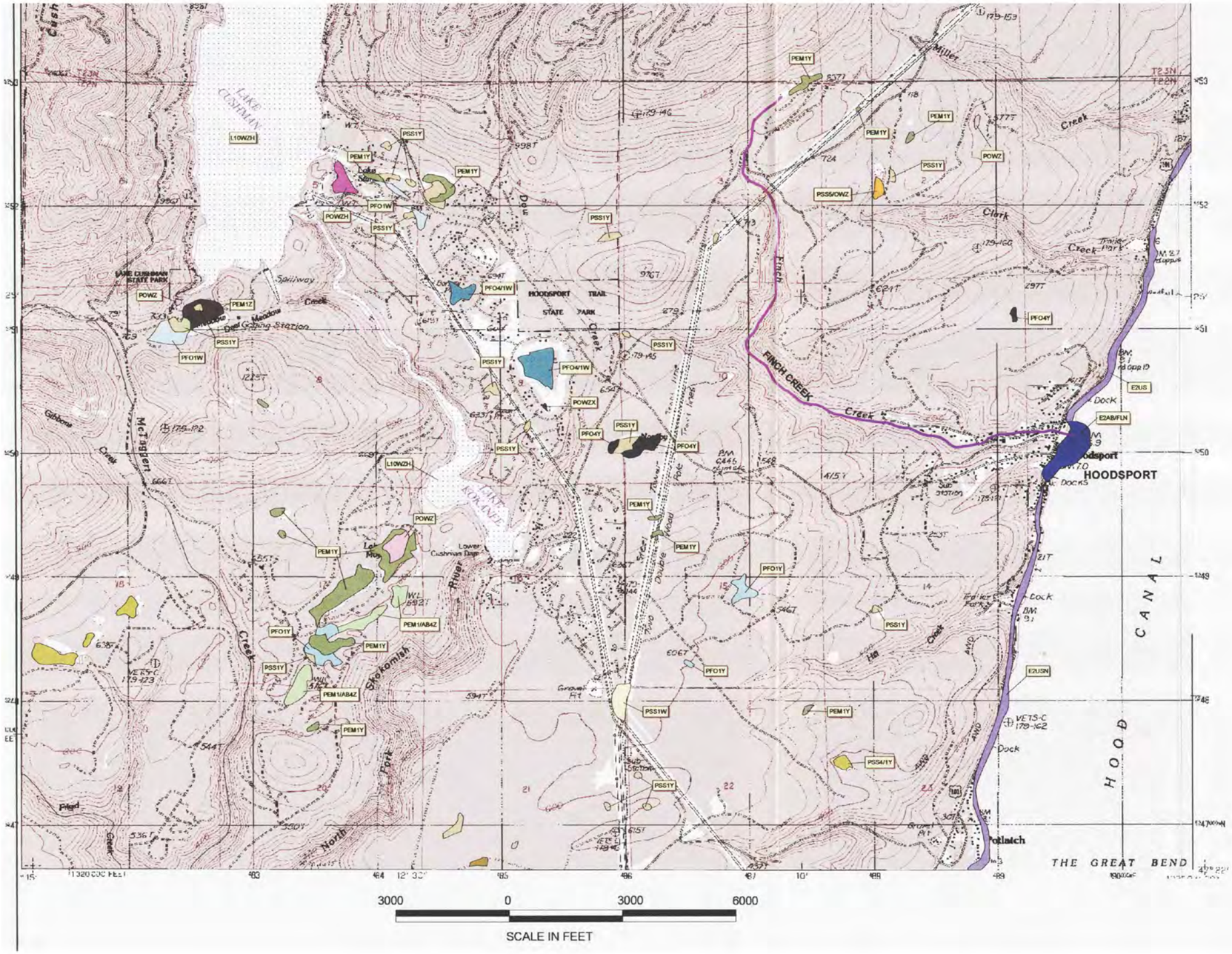

MASON COUNTY

HOODSPORT RAC WASTEWATER FACILITY PLAN

FIGURE 2-6

NATIONAL WETLAND INVENTORY MAP

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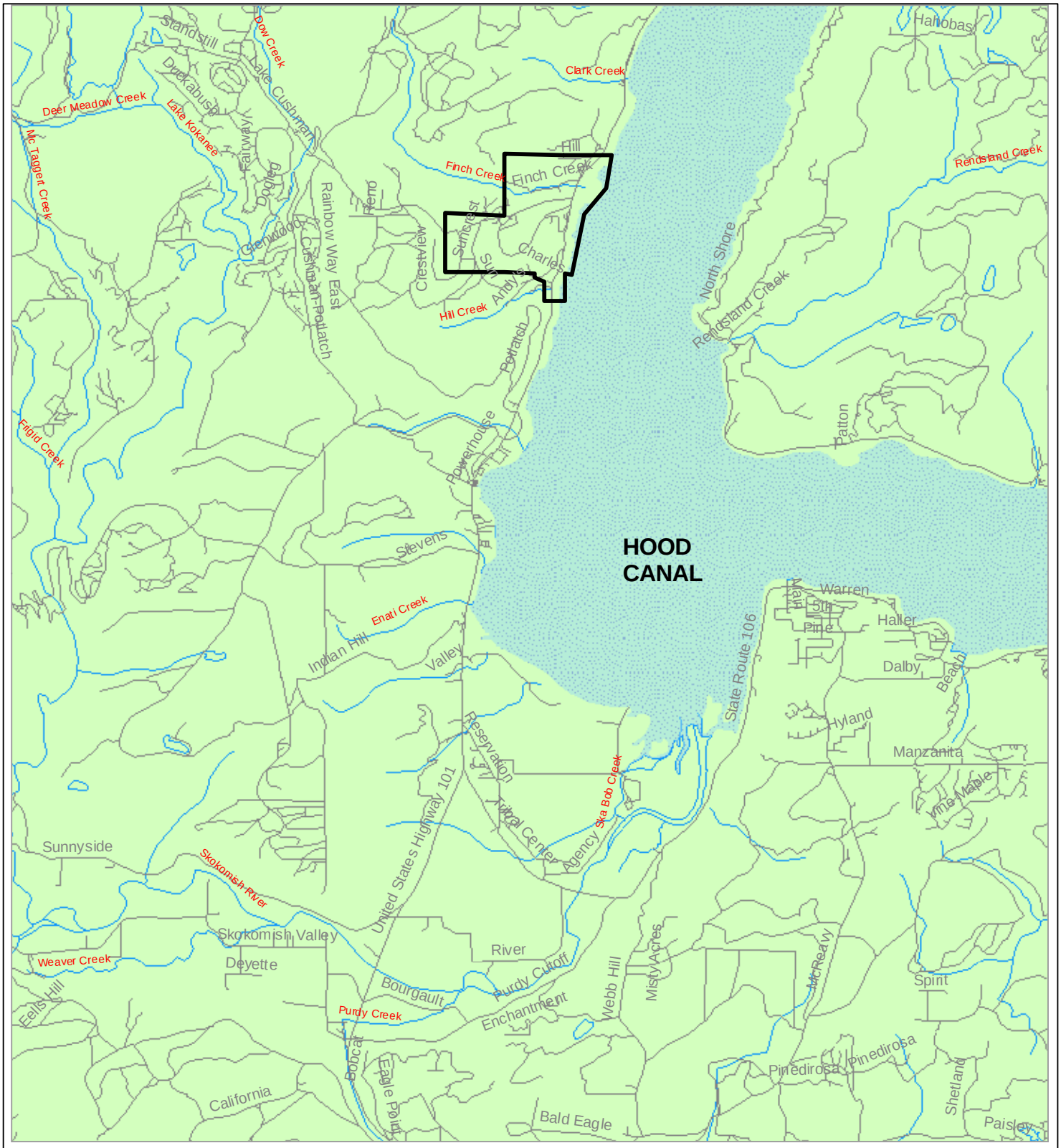
M:\MASONCO\07570\FIGURES\FIG.2-6.DWG, 2-6, 7/6/2007 10:16:42 AM, 1:1, BY: M NAGEL



N

0 3,500 7,000 Feet

MASON COUNTY

HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE 2-7
SURFACE DRAINAGES

Gray & Osborne, Inc.
CONSULTING ENGINEERS

O:\CLIENTS\MasonCo\HOODSPORT RAC WW PLAN\FIG2-7.mxd

or materials that impair aesthetics. These materials are prohibited in concentrations that affect aquatic life, human health or impair aesthetics.

Numeric criteria for 29 toxic substances are listed in WAC 173-201A-040. Criteria are listed on both an acute and chronic basis and for certain substances (e.g., metals, chlorine, and ammonia), the criteria must be calculated as a function of receiving water pH, hardness, and whether salmonids are present.

The water quality standards allow for variances and site-specific criteria to be developed in individual cases.

Lower Hood Canal and all tributaries draining into it are given the highest level of classification of quality and must meet the requirements to support substantially all uses including: water supply (domestic, agricultural, and industrial), fish and shellfish, wildlife, and recreation (contact recreation, boating, fishing, and aesthetic enjoyment).

Hood Canal

Chapter 173-201A Washington Administrative Code (WAC), the Water Quality Standards for Surface Waters, classifies Hood Canal as Class AA, Extraordinary.

Designated uses for Class AA waters are: water supply and stock watering (freshwater), fish and shellfish migration, rearing, spawning and harvesting, wildlife habitat, primary contact recreation, sport fishing, boating and aesthetic enjoyment, and commerce and navigation. The water quality standards for Class AA marine waters are presented in Table 2-4.

TABLE 2-4

Class AA Marine Water Quality Standards

Parameter	Standard
Dissolved Oxygen (1)	>7.0 mg/L
Temperature (1)	≤13.0 °C
pH (1)	within range of 7.0 to 8.5
Fecal Coliform	≤14 colonies/100 ml
Turbidity (1)	≤5 NTU
Total Dissolved Gas	≤110 percent of saturation
Toxic, radioactive, or deleterious material concentrations shall be below those, which have the potential, either singularly or cumulatively, to adversely affect characteristic water uses, cause acute or chronic conditions to the most sensitive biota dependent upon those waters, or adversely affect public health.	
Aesthetic values shall not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch, or taste.	

(1) When natural conditions cause noncompliance with the water quality standard, limited impacts due to human-caused activities are allowable based on Chapter 173-201A-030.

Finch Creek

Finch Creek is not specifically classified in the Water Quality Standards. However, the regulation states that all unclassified surface waters that are tributaries to Class AA waters are classified as Class AA. Therefore, Finch Creek would also be designated as a Class AA water body. The Class AA water quality standards for freshwater are presented in Table 2-5.

TABLE 2-5

Class AA Freshwater Water Quality Standards

Parameter	Standard
Dissolved Oxygen (1)	>9.5 mg/L (lowest 1-day minimum)
Temperature (1)	≤13.0 °C
pH (1)	within range of 6.5 to 8.5
Fecal coliform	≤50 colonies/100 ml
Turbidity (1)	≤5 NTU over background
Total dissolved gas	≤110 percent of saturation
Toxic, radioactive, or deleterious material concentrations shall be below those which have the potential, either singularly or cumulatively, to adversely affect characteristic water uses, cause acute or chronic conditions to the most sensitive biota dependent upon those waters, or adversely affect public health.	
Aesthetic values shall not be impaired by the presence of materials or their effects, excluding those of natural origin, which offend the senses of sight, smell, touch, or taste.	

(1) When natural conditions cause noncompliance with the water quality standard, limited impacts due to human-caused activities are allowable based on Chapter 173-201A-030.

As part of its ambient monitoring program, the Department of Ecology has collected periodic data near the Highway 101 bridge on Finch Creek to assess its overall water quality based on Class AA standards. These data, which also include nutrients such as nitrogen and phosphorous, are presented in Table 2-6. The Ecology data indicate that, with the exception of fecal coliform, Finch Creek meets Class AA water quality standards. Ecology considers the creek impaired due to the exceedances of the standard for fecal coliform.

TABLE 2-6

Finch Creek Water Quality Data

Date	Temp (°C)	Flow (cfs)	Conduct. (µmho/cm)	Dissolv. Oxygen (mg/L)	Oxygen Saturation (%)	pH	TSS (mg/L)	Total N (mg/L)	Ammonia (mg/L)	Dissolv. Phosph. (mg/L).	Ortho Phosph. (mg/L)	Turbid (NTU)	Fecal Coliform (#/100 ml)	Nitrate/ Nitrite (mg/L)
10/93	8.2		82	12	98.9	7.5	2	0.249	0.013	0.028	0.024	1	19	0.166
11/93	8		84	11.2	94.8	7.7	3	0.243	0.013	0.032	0.022	2.1	240	0.179
12/93	6.7		56	12	95.9	7.4	3	0.335	0.027	0.021	0.016	0.9	13	0.298
01/94	7.7		67	11.8	98.6	7.7	1	0.242	0.011	0.017	0.015	0.5	2	0.2
02/94	6.4		62	12	97	7.3	2	0.263	0.010	0.015	0.013	0.9	9	0.213
03/94	6.8		71	12.1	98.2	7.8	1	0.131	0.010	0.010	0.015	0.5	2	0.114
04/94	7.8		67	11.7	98.4	7.9	1	0.088	0.01	0.024	0.014	0.5	10	0.093
05/94	9.6		79	11.7	101.2	7.8	1	0.107	0.010	0.010	0.017	0.5	11	0.079
06/94	9.3		84	11.4	97.7	7.7	1	0.128	0.010	0.018	0.018	0.5	5	0.103
07/94	10.4		74	11.2	98.7	7.6	1	0.136	0.010	0.024	0.020	0.5	18	0.096
08/94	10.6		85	11.7	104	7.3	1	0.165	0.020	0.030	0.027	0.6	15	0.090
09/94	11.4		88	11.7	105.4	7.9	1				0.015	0.5	035	0.053
10/98	8	1.5	83	10.9	92.1	7.5	1	0.093	0.010	0.026	0.010	0.5	44	0.078
11/98	7.4	35	62	8.7	72	7.6	13	0.642	0.131	0.033	0.016	2.9	5	0.424
12/98	4.2	15	72	12.4	92.5	8	1	0.18	0.023	0.018	0.013	1	85	0.155
01/99	5.9	14	66	12	95	7.7	1	0.166	0.010	0.018	0.016	0.8	130	0.146
02/99	5.6	37	40	11.7	92.5	7.6	3	0.122	0.025	0.019	0.009	2	3	0.11
03/99	6.7	39	67	11.6	94.6	8	1	0.127	0.010	0.038	0.022	0.8	10	0.09
04/99	8.1	22	81	11.5	96.7	8.1	1	0.064	0.010	0.035	0.019	0.5	6	0.063
05/99	8.3	13	78	11.7	99.2	7.8	1	0.104	0.03	0.044	0.020	0.5	27	0.071
06/99	7.9	21	88	11.5	96	7.7	2	0.111	0.010	0.040	0.021	0.5	24	0.067
07/99	8.7	9	74	11.7	99.9	7.9	2	0.107	0.026	0.046	0.020	1.2	48	0.073
08/99	9.6	1.4	75	11.3	98.6	7.9	1	0.09	0.010	0.043	0.022	0.5	86	0.05
09/99	8.7	1.5	77	11.5	97.1	7.5	1	0.098	0.031	0.043	0.021	0.5	6	0.074

Table 2-7 summarizes data about Finch Creek collected by the WDFW at the Hoodsport hatchery; it shows the average of the water data by month for 3 years. The table reflects the amount of water (million gallons per day, mgd) and the temperature (degrees F) of Finch Creek water used by the hatchery.

TABLE 2-7

Finch Creek Temperature and Water Usage

	Temperature (°F)									Water Usage (mgd)		
	2004			2005			2006					
	Avg.	Min.	Max.	Avg.	Min.	Max.	Avg.	Min.	Max.	2004	2005	2006
Jan	46	40	49	47	43	52	46	44	49	5.9	8.4	7.2
Feb	46	43	51	46	43	50	45	42	47	12.0	10.1	9.8
Mar	48	44	53	47	44	50	46	44	48	14.4	12.1	13.0
Apr	49	45	54	48	44	53	47	45	50	10.1	13.0	13.0
May	50	47	55	50	46	54	48	46	52	8.6	10.4	10.1
Jun	51	46	57	51	47	54	49	47	51	5.2	3.6	5.2
Jul	52	48	57	51	48	55	49	48	51	5.2	3.3	4.3
Aug	52	49	60	50	48	57	49	48	51	3.6	3.3	3.6
Sep	50	48	54	50	45	54	49	47	52	4.3	4.7	4.0
Oct	49	46	53	49	45	51	48	45	50	6.1	4.3	4.8
Nov	48	45	51	47	42	51	47	43	51	6.1	5.8	6.1
Dec	47	44	52	46	41	50	45	43	46	6.1	6.5	6.1

GROUNDWATER AND AQUIFER RECHARGE AREAS

Groundwater exists in underground layers of porous rock or soil that are referred to as aquifers. Water stored in aquifers reaches the surface through springs, wells, or by seepage from surface waters such as lakes, rivers, streams, and wetlands. At the same time, aquifers are replenished (recharged) through seepage from these same water systems and from precipitation. Precipitation provides the primary source of recharge for Mason County's groundwater. Mason County's Comprehensive Plan shows an aquifer recharge area due west of Hoodsport in the vicinity of the outlet of Lake Cushman along the North Fork of the Skokomish River and Lake Kokanee (see Figure 2-8). Mason County's Resource Ordinance has designated this recharge area as "extremely critical." There are no areas along the Hood Canal shoreline that are considered critical or extremely critical.

Water levels in wells are typically within 125 feet of the land surface. Aquifers exist throughout Mason County and groundwater provides virtually all of the County's potable water. The quality of groundwater in an aquifer is linked to its recharge area. Therefore, protecting aquifers and aquifer recharge areas is critical to maintaining Mason County's water supply. Many well systems are developed in shallow sands and gravels and are,

therefore, susceptible to surface non-point source pollution. Within the Hoodsport RAC, a total of 18 well records were reviewed and showed an average depth to groundwater of 56 feet.

FISH AND WILDLIFE HABITAT

Lower Hood Canal, and its tributary watersheds, provide habitat for a rich variety of terrestrial wildlife, and both marine and freshwater fish species. The salmonid species, hardshell clams, and oysters are the major commercial and sport fishing resources.

Wildlife Species

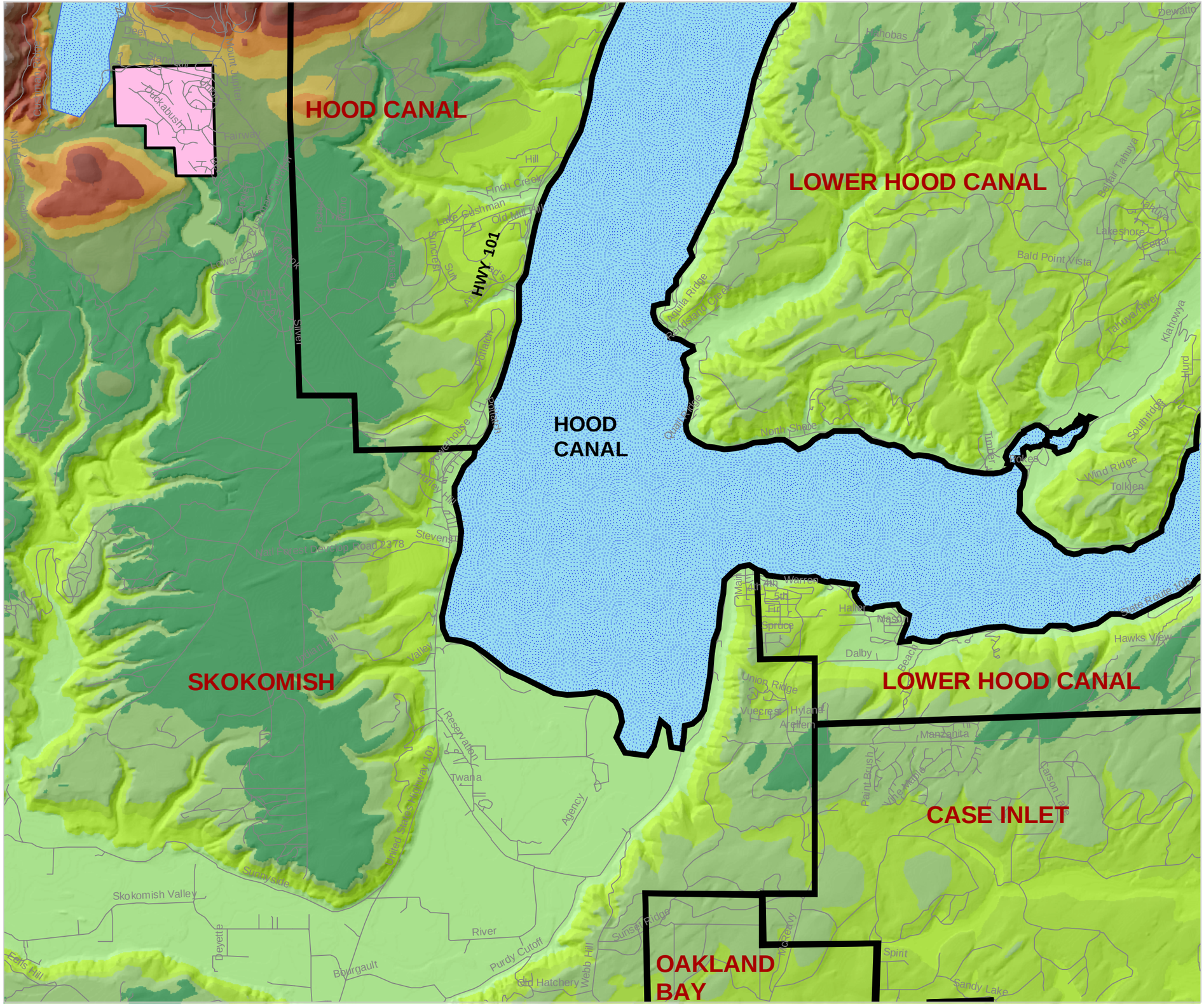
Lower Hood Canal provides wildlife habitat for a variety of game and non-game animals. Wildlife known to exist in the vicinity include elk, blacktail deer, black bear, cougar, coyote, bobcat, raccoon, beaver, river otter, red fox, and various species of small mammals. According to the Washington Department of Fish and Wildlife Habitats and Species Map of May 6, 2003, two bald eagle nesting sites are located approximately one mile south of the Hoodsport in the Hill Creek drainage. To the north, a bald eagle territory polygon has been drawn based on observed aerial survey observations, local knowledge and literature information on basic eagle behavior. Additionally, the priority species, purple martin has been noted nesting just north of the docks in Hoodsport. The Hoodsport RAC has been logged extensively, so the presence of northern spotted owls and marbled murrelets in the immediate vicinity is unlikely. The Washington Natural Heritage Program, which is responsible for information on the state's rare plants as well as high quality ecosystems indicated that scurvygrass (*Cochlearia officinalis*) is located within the Hoodsport RAC. Scurvygrass is listed as state status sensitive and it should be noted that the state Endangered Species Act (ESA) does not include provisions to list or protect rare plant species – the state rare plant list is advisory only.

Salmonid and Other Fish Species

Streams flowing into Lower Hood Canal provide spawning and rearing habitat for chinook, coho, and chum salmon and for steelhead, cutthroat trout, and rainbow trout.

The Hoodsport salmon hatchery is located at the mouth of Finch Creek. This hatchery is unique since it can be operated using either fresh or salt water for the rearing of juvenile salmon. The hatchery has been very successful in production of chinook, coho, pink, and chum salmon. Over the years many streams within all of Hood Canal have been outplanted from this station; however, this practice has been modified in recent years and present releases are predominantly into Finch Creek or the Skokomish River.

The quantity of good spawning area in Finch Creek above the hatchery rack is limited and can only support a small number of spawners. Finch Creek fall chinooks were artificially developed from transplanted stocks from the Elwha River in 1953 and the Green River in 1954. Coho returns to Hoodsport are used primarily to bolster streams in


HOOD CANAL
LOWER HOOD CANAL
HOOD CANAL
SKOKOMISH
LOWER HOOD CANAL
CASE INLET
OAKLAND BAY
HWY 101
Deckabush
Finch Creek
Lake Cushman
Old Mill Hill
Suncrest
Sun
Portlatch
Dewatto
Hamhobas
Belfair Tahuya
Tahuya
Lakeshore
Cedar
Bald Point Vista
Tahuya River
Klahowya
Hurd
Southridge
Wind Ridge
Tolken
Tolten
Timber
North Shore
Quamtrudge
Squilla Ridge
Pickerel Island Creek
Stevens
Nat Forest Develop Road 2378
Valley
Indian Hill
Reservation
Twana
Agency
United States Highway 101
Sunnyside
Skokomish Valley
River
Deyette
Bourgault
Purdy Cutoff
Old Hatchery
Webb Hill
Sunset Ridge
McReavy
Spirit
Sandy Lake
Paint Brush
Manzanita
Jaison Lake
Union Ridge
Vuecrest
Hyland
Arellen
Dalby
Spruce
Fir
Hallstrom
Mason
Worres
Beach
Hawks View
Lewis Rd
Ells Hill
Nat Forest Develop Road 2378
Mount Jupiter
Fairway
Hill
Silver
Oak
Lower Lake
Gymnasium
Cedar Creek
Nat Forest Develop Road 2378
Dewatto River
Mason Lake
Dewatto
N
0
2,250
4,500
9,000
Feet
SCALE 1" = 4500'
LEGEND:
WATERSHED BOUNDARIES
ROADS
AQUIFER RECHARGE AREA
WATER
MASON COUNTY
HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE 2-8
AQUIFER RECHARGE AREA
Gray & Osborne, Inc.
CONSULTING ENGINEERS
O:\CLIENTS\MasonCo\HOODSPORT RAC WW PLAN\FIG2-8.mxd

the area where runs are depleted and to provide surplus eggs to fulfill demands for coho stock by other states and foreign countries. The pink salmon run to Finch Creek at the Hood Canal Hatchery was artificially induced through transfer of Skeena River eggs in 1954 and the run has maintained itself on a relatively low level. The chum runs returning to this system are handled at the hatchery with the majority of these progeny surplus to this station.

The Washington Department of Fish and Wildlife prepared a list on May 6, 2003, which included the presence of priority anadromous fish, priority resident fish, and other fish in the Finch Creek corridor. The anadromous fish noted in Finch Creek are Chum Salmon, Coho Salmon, Searun Cutthroat, and Winter Steelhead. The priority resident fish include Resident Cutthroat. As noted previously, Finch Creek has been dammed approximately 1/4 mile from the mouth of the creek but includes a fish passage facility, which currently only Summer Chum are allowed to navigate by WDFW personnel.

Baitfish are another important fish resource within the Lower Hood Canal. Both Pacific herring and surf smelt depend on the Hood Canal for habitat. Spawning habitat has been heavily impacted by shoreline development primarily due to construction of bulkheads and loss of beaches by filling or other actions. Other species of marine fish, often caught for sport, include Pacific tomcod, brown rockfish, rock sole, English sole, starry flounder, and sand sole.

Shellfish Species

The Lower Hood Watershed Study Report (1991) states that the intertidal area of the shoreline of Lower Hood Canal supports a wide variety of marine invertebrates including the Olympia oyster, the Pacific oyster, mussels, clams, and geoducks. In addition, the tidal flats of lower Hood Canal provide important salt marsh habitat for shellfish. Recreational and commercial harvest of shrimp and Dungeness crab occurs north and south of Hoodsport adjacent to the shore. Hardshell intertidal clam habitat extends south along the coast from approximately the south end of the Hoodsport RAC.

The Department of Health, Office of Shellfish Management, classifies all actual and potential commercial shellfish growing areas in Washington as *Approved, Conditionally Approved, Restricted, or Prohibited*. The commercial growing area classification is based on a comprehensive sanitary survey that includes water quality and shoreline investigations designed to identify sources of contamination and evaluation of fecal coliform levels in the area. Each of these categories is defined in the National Shellfish Sanitary Program (NSSP) manual as follows:

> ***Approved Areas:*** *Growing areas may be designated as approved when the sanitary survey and marine biotoxin surveillance data indicate that fecal material, pathogenic microorganisms, poisonous, and deleterious substances are not present in the area in dangerous concentrations.*

The standard for approved shellfish growing waters is fecal coliform geometric mean not greater than 14 organisms/100 ml with not more than 10 percent greater than 43 organisms/100 ml.

Conditionally Approved Areas: *Growing areas that are subject to intermittent microbiological pollution may be classified as conditionally approved. This option is voluntary and may be used when the suitability of an area for harvesting shellfish for direct marketing is affected by a predictable pollution event.*

Restricted Areas: *An area may be classified as restricted when a sanitary survey indicates a limited degree of pollution or poisonous or deleterious substances are low enough that relaying or purifying, as provided for in Part l, Section D, and Part II, NSSP Manual of Operations, will make the shellfish safe to market.*

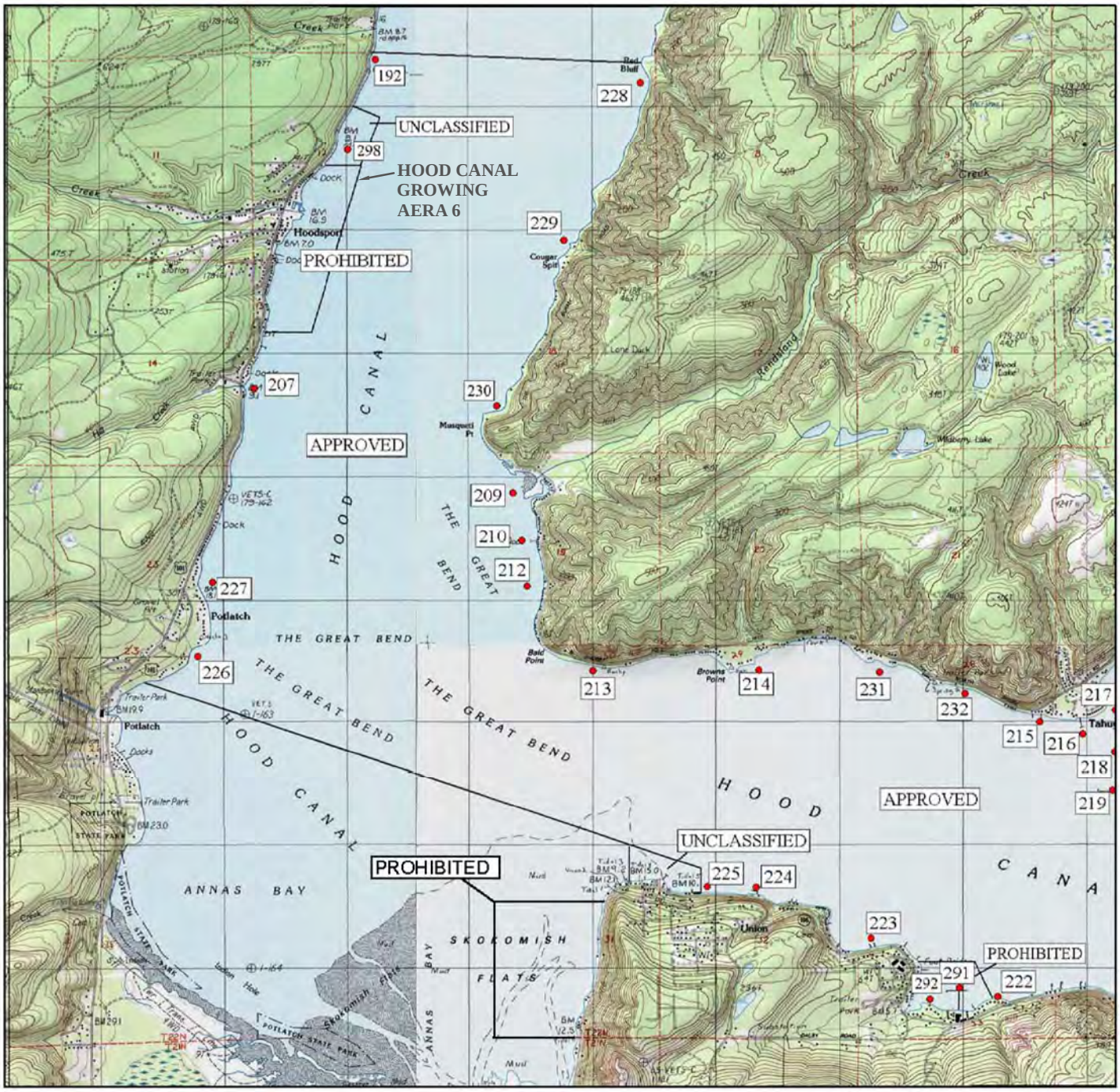
Prohibited Areas: *A growing area shall be classified prohibited if there is no current sanitary survey or if the sanitary survey or other monitoring program data indicate that fecal material, pathogenic microorganisms, poisonous or deleterious substances, marine biotoxins, or radionuclides may reach the area in excessive concentrations. The taking of shellfish for any human food purposes from such areas is prohibited.*

Figure 2-9 shows the location and the status of shellfish harvest areas in the vicinity of lower Hood Canal.

According to the DOH Shellfish Program website, http://ww4.doh.wa.gov/gis/growingareas.htm, all shellfish areas within the study area (Hood Canal 6 Growing Area) are approved for harvest with the exception of the area surrounding the Hoodsport RAC, which is prohibited; the area immediately north of the RAC, which is unclassified; and part of Annas Bay, which is prohibited.

AIR QUALITY

Air quality in the vicinity is generally good due to the influence of storms off the Pacific Ocean and limited automobile traffic, commercial and industrial development. In a 2003 letter of response to the Finch Creek Sewer Project, the Olympic Region Clean Air Agency (ORCAA) "considers the Mason County Air Quality to be better than Washington State and National Ambient Air Quality Standards for all listed standards including PM10, PM2.5, Carbon Monoxide, Ozone and Nitrogen Dioxide". There are no air quality monitoring stations located within the Hoodsport area; determination of air quality is based on a State Local Air Monitoring Station (SLAM) in Shelton, a special purpose ozone monitoring site in Belfair, and a continuous visibility monitoring site at South Mountain (discontinued in 2003).



MASON COUNTY

HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE 2-9
DOH SHELLFISH AREA CLASSIFICATION

Gray & Osborne, Inc.
CONSULTING ENGINEERS

M:\MASONCO\07570\FIGURES\FIG.2-9.DWG, 2-9, 7/6/2007 9:48:08 AM, 1:1, BY: M NAGEL

OUTDOOR RECREATION

The study area enjoys outdoor recreational opportunities from Hood Canal, Lake Cushman, Olympic National Forest (ONF), Olympic National Park, and Foothills County Park. Hood Canal offers marine water recreational activities such as beach combing, shellfish harvesting, fishing, diving, boating and sailing. Lake Cushman provides fresh water activities such as fishing, swimming, boating, hiking, and camping. Recreational facilities on and around the lake include the former Lake Cushman State Park and the ONF Staircase Ranger Station. Foothills County Park located along SR 119 incorporates approximately 20 acres for day use, which includes ball fields, picnic areas, and a children's play area. In addition, the Potlatch State Park is located approximately three miles south of Hoodsport. Currently there are seven public boat ramps located in the immediate area. From north to south these are: Sund Creek, Hoodsport, two on Lake Cushman, Potlatch, and two in the community of Union.

PUBLIC UTILITIES

Public utilities in the Hoodsport area include water, power, and telephone. Currently, there is no community wastewater collection in the area. Telephone service to the Hoodsport area is provided by Qwest. Mason County PUD No. 1 supplies both electrical power and water service to the community. The electrical service area for PUD No. 1 extends from the Potlatch area north along the Canal for approximately 50 miles and east along the south shore of Hood Canal near Twanoh State Park. Mason County PUD No. 1 provides power to approximately 4,200 customers.

The PUD No. 1 manages a large number of water systems in the county, including the Hoodsport/Suncrest water system that provides water supply too much of Hoodsport as well as the Suncrest development. A number of homes around Hoodsport, including those along the upper portion of Finch Creek Road, are served by private drinking water wells.

The PUD No. 1 has operated the Hoodsport Water System since 1995. Prior to that time it was known under a different name and owned and operated by a private owner. The Washington Department of Health (DOH) had put the system into receivership and requested the PUD No. 1 to take over management due to serious operational and water quality problems. The PUD No. 1 eventually purchased the system and since 1996 has been implementing a series of improvements to bring the system into compliance with state requirements. Phases 1 and 2 of the planned improvements have been completed; a third phase of work is yet to be completed. The Hoodsport Water System serves 190 customers, 170 from the original Hoodsport system and 20 from the Suncrest system, and covers an area of approximately 650 acres. A layout of the Hoodsport Water System is presented in Figure 2-10.

Wastewater is handled in the area by individual onsite septic systems. If a community wastewater collection and treatment system is developed for the Finch Creek/Hoodsport

area, the PUD No. 1 would assume ownership and responsibility for the system. In 1996, the PUD No. 1 was authorized by a public vote to provide wastewater services in the area. The PUD No. 1 operates a recently constructed community onsite facility for the residents of the Madrona community on Hood Canal.

There are only a few wastewater facilities in Mason County, and only a couple proximate to the Hoodsport area. The City of Shelton owns and operates a wastewater system for its service area. The Washington Department of Corrections also owns and operates a facility for the Washington Corrections Center, located just north of Shelton. The Alderbrook Resort near Union operates a small privately owned wastewater facility that serves only the resort facilities. Mason County operates a water reclamation facility near Allyn. The Skokomish Tribe has proposed a wastewater collection and treatment system for the reservation area, but has not yet been successful in moving the project forward.

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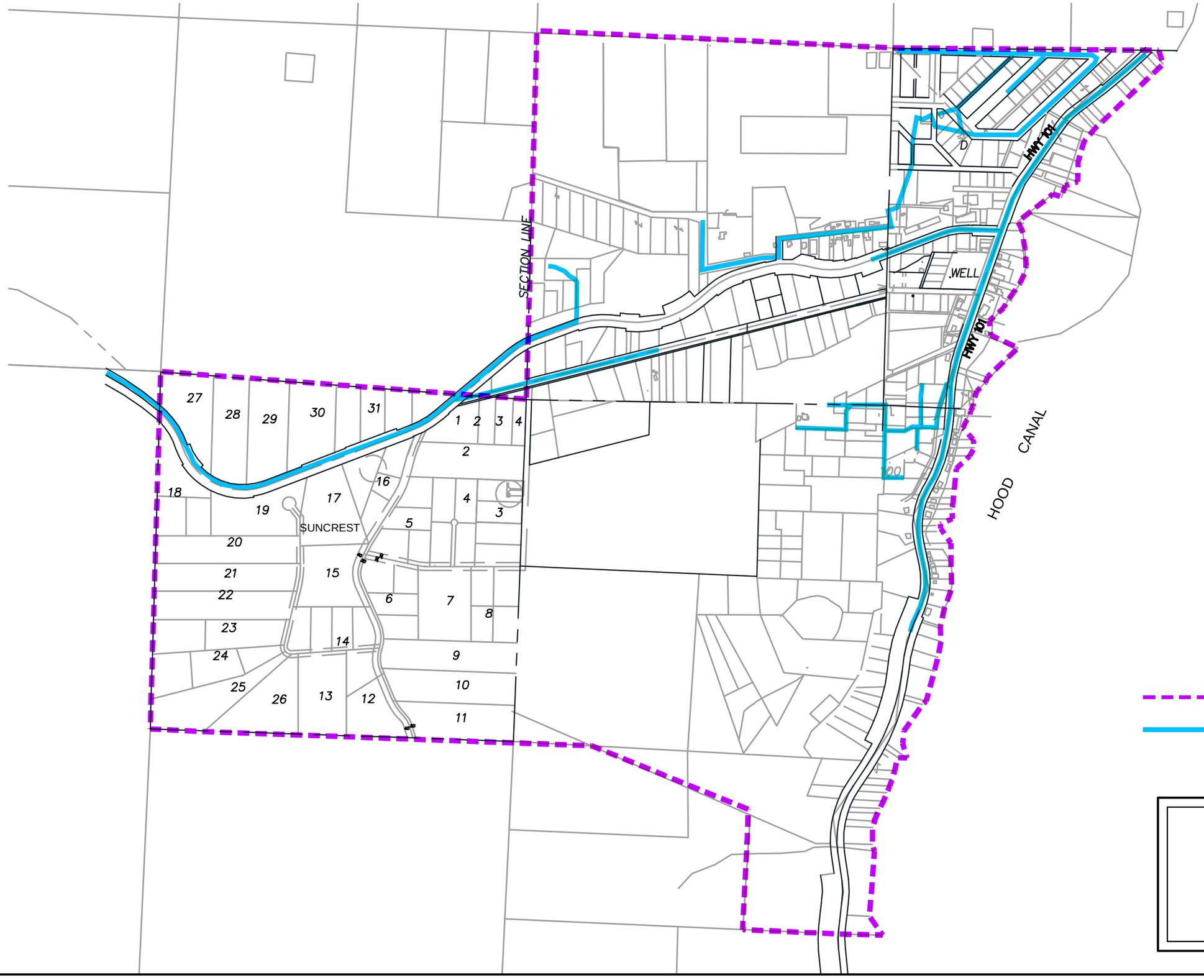
[1] Personal conversation, Sandy Davies, Puget Sound Water Quality Action Team, April 15, 1997.



SCALE: 1"=700'

LEGEND:

HOODSPORT RURAL ACTIVITY CENTER (RAC) BOUNDARY

WATER MAIN

MASON COUNTY
HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE 2-10
HOODSPORT WATER SYSTEM MAP

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CONSULTING ENGINEERS

M:\MASONCO\07570\FIGURES\FIG.2-10.DWG, 2-10, 7/6/2007 9:42:29 AM, 1:1, By: M NAGEL

CHAPTER 3

LAND USE AND POPULATION

GENERAL

An accurate analysis of land use and population projections is essential in the development of alternatives for wastewater treatment and disposal/reuse systems. Land use and population are used to establish sewage flow rates, the size of facilities needed to transport and treat the wastewater generated, and the ultimate cost of wastewater facilities.

LAND USE

The study area for this Plan includes land within the jurisdiction of Mason County and the community of Hoodsport. In the Mason County Comprehensive Plan and development regulations (Ordinance No. 82-96), the County has adopted Growth Management Act (GMA) land use designations. These land use designations are in lieu of typical residential and non-residential zones. The County's Comprehensive Plan and development regulations were last amended in November 2005. Land use planning within Mason County is organized by watershed drainage basin. The watershed of interest for this Plan is the Hood Canal watershed. The shorelines within the study area are additionally regulated by the Mason County Shoreline Master Program. The following sections describe land use designations, general policies for wastewater treatment, and shoreline policy applicable to Hoodsport.

The most recent version of the Mason County Comprehensive Plan is available at http://www.co.mason.wa.us/code/comp_plan/index.php.

MASON COUNTY LAND USE DESIGNATIONS

For the purposes of regulating development activity within Mason County, the County has designated three general types of development areas. These areas include urban growth areas (UGA), resource lands, and several categories of rural lands. These land use designations contain characteristics which have been identified in the County's Comprehensive Plan as worthy of preservation and/or enhancement. The purpose of these designations is to promote orderly development consistent with the County's Comprehensive Plan. Each land use designation has been assigned a specific development density. A description of the three land use designations, and their subtypes, follow. Figure 3-1 shows the land use categories in the vicinity of Hood Canal.

Urban Growth Areas

Urban growth areas are to accommodate the majority of the growth that is expected to occur within the County in the foreseeable future. These areas have urban characteristics and services where the widest variety of uses, and the highest densities will be allowed. Within Mason County, only the City of Shelton and the communities of Belfair and Allyn have been designated as urban growth areas.

Resource Lands

Resource lands, defined in the County's development regulations, cover a variety of land use types within the County that have value due to their soil types, ground cover, or capacity for mineral extraction. Lands with intrinsic aesthetic value are also included in this category. Examples of resource lands in Mason County include national parks, national forests, long-term commercial forests, agricultural lands, and mineral resource lands.

There is an abundance of forested lands with long-term commercial significance in the study area. Long-term commercial forest lands and forestry play a considerable role in the County's land use due to the acreage maintained by the U.S. Forest Service, the Washington Department of Natural Resources (DNR), and the private timber resource industry.

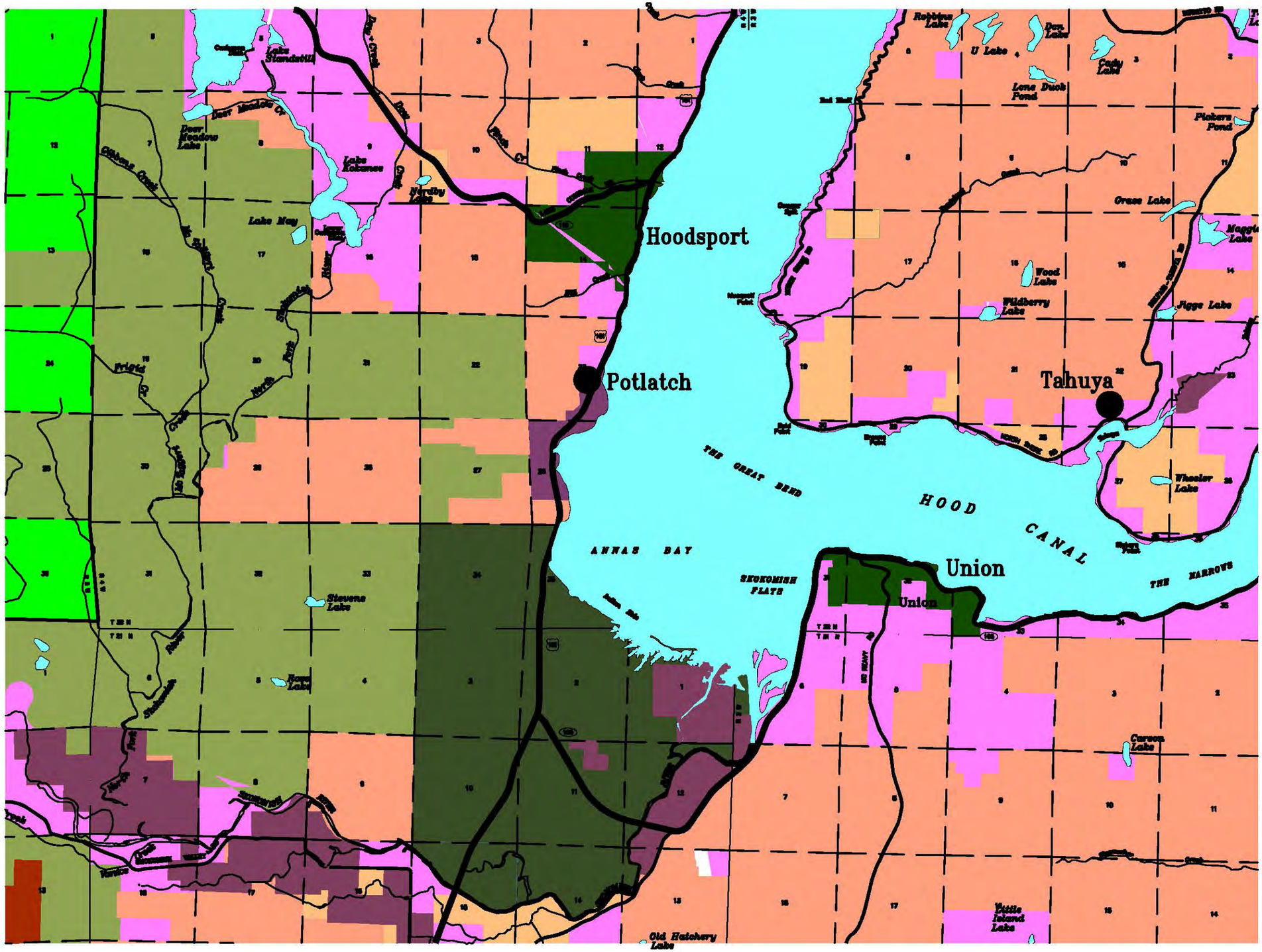
Rural Lands

Mason County is predominately rural. Rural lands in Mason County are those areas not designated as urban areas or resource lands. Typical land uses in the rural areas of the County include rural residential, farming, forestry, recreation, single-purpose commercial, retail, and industrial uses. In Mason County, rural lands are divided into several performance districts. Rural land performance districts include Limited Areas of More Intensive Rural Development (LAMIRD), Fully Contained Community (FCC), Master Planned Resort (MPR), and Rural Area (RA). The LAMIRD performance district, formerly known as "General Rural Lands", includes land use designations such as Rural Activity Centers (RAC), Hamlets, Rural Commercial/Industrial Areas, and Rural Tourist/Recreational Areas.

Policies applicable to Hoodsport, a Rural Activity Center, are described below.

<u>Rural Activity Centers (RAC)</u>

The community of Hoodsport is designated by Mason County as a RAC. The County's general land use policies for RACs states that new development should be served by "*adequate facilities for water supply, wastewater disposal, electricity, and storm drainage. However, these facilities are not intended to be urban levels of service.*"


Hoodsport
Potlatch
Tahuya
Union
Union
THE GREAT BEND
HOOD CANAL
ANNAS BAY
SKOKOMISH FLATS
THE NARROWS
Lake Standerwick
Lake Kokanee
Lake May
Deer Meadow Lake
Robbins Lake
U Lake
Dan Lake
Cady Lake
Lone Duck Pond
Plobers Pond
Grass Lake
Maggie Lake
Wood Lake
Wildberry Lake
Figgy Lake
Wheeler Lake
Stevens Lake
Carson Lake
Little Island Lake
Old Hatchery Lake
Frigid Cr
Gibbons Creek
Dry Creek
Dewatto River
Tahuya River
Mission Creek
Skokomish River
North Fork
South Fork
Vance Creek
Hamma Hamma River
Lilliwaup Creek
Finch Creek
Cranberry Creek
Dry Creek
Black Cr
Dry Creek
Cranberry Creek
Tahuya River
Dewatto

New development within RACs should only be encouraged in areas where public services can be provided. Redevelopment to higher densities in undeveloped residential or commercial areas must also provide adequate public facilities. RACs should promote a standard residential density of one dwelling unit/2.5 acres.

The Mason County Comprehensive Plan (updated 2005) contains the planning policies applicable to an RAC. There are 40 general, residential, and nonresidential policy statements found in the Comprehensive Plan. Those pertaining to wastewater service within an RAC are shown below:

RU-104 New residential platting (development) densities for new development in RACs should be no more than one dwelling unit for every 2.5 acres, and existing residential development may rebuild and/or expand as long as it remains consistent with existing RAC development, meets density requirements, and does not require or expect urban services.

RU-107 New development should be served by adequate facilities for water supply, wastewater disposal, electricity, and storm drainage.

RU-120 Mason County should encourage and promote rural lot sizes in RACs at a density of one dwelling unit per 2.5 acres for new platting and development, allow continued development for historically legally platted lots for single-family uses, and small-scale multifamily uses such as accessory units, duplexes, and triplexes when meeting all applicable regulations. This approach will help provide affordable housing choices for all income levels.

RU-122 Mason County should encourage new residential development to occur in RACs where adequate facilities and services can be provided.

RU-123 New residential development in RACs should achieve an average density of one dwelling unit per acre. This average density may be achieved by a combination of single-family, small-scale multifamily, and mixed-use developments on new plats of one dwelling unit per 2.5 acres and historical existing lots.

RU-124 New multifamily uses in RACs should be developed as mother-in-law units as an accessory to a primary residences, accessory dwelling units, and small-scale multifamily such as duplexes and triplexes.

RU-126 A range of living environments should be provided for within RACs. This includes housing for special populations, independent living, assisted living, and care facilities as single uses or within mixed-use developments for no more than eight clients per use.

RU-130 Allow mixed use of residential and commercial uses within the same structure or adjacent to each other in RACs.

RU-141 Retail uses within RACs should provide for tourist services and attractions to support Mason County's tourist industry.

RU-142 Allow commercial development in RACs such as business and professional services, light fabrication and assembly, tourism, institutional uses, and wholesale trade.

RU-144 Mixed-use residential and business uses should be encouraged within RACs.

RU-150 Mason County should allow the development of high-profile commercial recreation uses within RACs and evaluate them based on the proposed use, density/intensity of proposed development, design and materials, vehicle access, water supply, wastewater disposal, and stormwater runoff/drainage.

RU-152 Resource-based industrial and commercial uses should be allowed to locate or expand in RACs, provided that: they meet the criteria for rural uses, they do not require urban levels of service, they do not conflict with natural resource-based uses, they are compatible with surrounding rural uses, and their expansion does not occur outside the boundary of the RAC, consistent with RCW 36.70A.0070(5) limited areas of more intensive rural development.

The Mason County Comprehensive Plan suggests a limited amount of growth will occur within RACs over the next 20 years. It is anticipated that growth within the RACs will result from an increase in "retail, commercial, tourism and industrial uses necessary to support the residential growth in the Rural Area." The Comprehensive Plan recommends concentration of growth within RACs in order to "protect the surrounding rural area resource lands from sprawling patterns of development." Development within isolated or remote rural locations is discouraged due to the difficulty of providing emergency services, such as fire and police protection or medical attention.

The Comprehensive Plan supports the potential need for wastewater system improvements by the following acknowledgement:

> *Because of their past development and location next to water bodies, some RACs may require some means of collective wastewater treatment to protect water quality.*

Minimum Building Lot Size

As outlined in Mason County Plats and Subdivisions Ordinance (Title 16), basic minimum requirements for lot sizes shall be as follows:

1. A lot shall have a minimum average width of not less that one-third of the median length and a minimum width at any point of 25 feet.

2. The minimum area of lots served by municipal sewage works shall be 6,000 square feet.

3. The minimum gross land areas of lots served by individual sewage system on each lot shall be two acres, provided that when the lots are proposed as part of a subdivision or cluster subdivision, then the minimum lot size for a residential lot shall be 20,000 square feet. These minimum sizes shall be for lots proposed for single-family units outside of urban growth areas.

Prior to submission of a preliminary plat, approval must be obtained from the Mason County Environmental Health Division as to the ability of the soils to accept septic tank effluents. In addition, all development in Mason County that relies on individual on-site sewage systems shall comply with Washington State Department of Health regulations, Chapter 246-272A WAC. This Chapter regulates the location, design, installation, operation, and maintenance, and monitoring of on-site systems to specifically limit discharge of sewage effluent to waters of the state.

SHORELINE MASTER PROGRAM LAND USE ENVIRONMENTS

The Shoreline Management Program is contained in Chapter 9 of the County's 2005 Comprehensive Plan. The Shorelines Management Act of 1971 has designated the shoreline areas of Hood Canal as Shorelines of Statewide Significance.

The County's Shoreline Master Program designates five environments. These shoreline environments include urban residential, urban commercial, rural, conservancy, and natural. Multi-family developments are permitted within urban residential and rural environments depending on an average sewage flow for each acre of the development. Residential development is not allowed within the conservancy environment.

Urban Residential Environment

Most all shorelines of the study area have been designated as "urban residential." The objective of the urban residential environment is to ensure optimum utilization of the shoreline for residential development. This designation is appropriate for areas presently under intensive development pressure, as well as areas planned to accommodate future urban growth. Clustering of dwelling units is encouraged in order to preserve natural features, minimize physical and visual impacts, and reduce utility and road costs. The

minimum lot size for shoreline urban residential areas is 12,500 square feet (approximately 0.29 acre). One accessory unit per residential lot is allowed if the lot size is at a minimum, 18,750 square feet. Multifamily residences are permitted, subject to a maximum projected output of 1,570 gallons of sewage per acre per day.

Urban Commercial Environment

Shoreline uses designated as urban commercial, typically involve wholesale or retail trade, restaurants, hotel/motel facilities, or other business activities. Commercial developments are encouraged to locate buildings, parking, or accessory structures inland from shorelines. Commercial development may be allowed along the shoreline only if the business is water dependent, water related, or water oriented. All other non-water dependent or oriented business activities will not be allowed to develop within or on shorelines.

The Mason County Shoreline Master Program has designated State Highway 101 in Hoodsport from the former ITT Rayonier building to the Sunrise Motel, both ends inclusive as "urban commercial."

Rural Environment

The "rural" environment is one in which the objective is to protect agricultural land from urban expansion, restrict intensive development along undeveloped shorelines, function as a buffer between recreational uses compatible with agricultural activities. Development is restricted to one residence per 20,000 square feet (approximately 0.46 acre). Multifamily residences are permitted, subject to a maximum projected output of 785 gallons of sewage per acre per day. New development in the rural environment must reflect the character of the surrounding area by limiting residential density, providing permanent open space, and by maintaining adequate building setbacks from the water to prevent shoreline resources from being destroyed.

Conservancy Environment

In the "conservancy" environment, the objective is to protect, conserve, and manage existing natural resources and valuable historic and cultural areas in order to ensure recreational benefits to the public and to achieve sustained resource utilization. It is intended that these areas will maintain their existing character through non-consumptive uses such as outdoor recreation, timber harvests on a sustained-yield basis, and pasture and range lands. Residential development within shoreline areas of the conservancy environment allow only one residential unit for every 5 acres and 200 lineal feet of shoreline.

There are no lands in Hoodsport designated as "conservancy" environment.

Natural

The "natural" environment is intended to preserve and restore those natural resource systems existing relatively free of human influence. Any activity which would bring about a change in the existing situation would be desirable only if such a change would contribute to the preservation of the existing character.

Table 3-1 summarizes lot sizes for the shorelines of the study area:

TABLE 3-1

Shoreline Master Program Minimum Building Lot Size

Environments	Residential Unit	Residence and Accessory Unit
Urban	12,500 sf	18,750 sf
Rural	20,000 sf	20,000 sf
Conservancy	5 acres(1)	5 acres(1)
Natural	Prohibited	Prohibited

Source: Mason County Shoreline Master Program, 2002.
(1) One residential unit is allowed per 200 lineal feet in the shoreline jurisdiction area.

LAND USE IN THE HOODSPORT AREA

As shown in Figure 3-2, the current land use in Hoodsport is primarily residential with homes along the shoreline, Finch Creek, and upland areas above Highway 101. The urban environment has a commercial district located primarily along Highway 101 that includes several restaurants, small retail businesses, a motel, and a gas station. The urban environment also has a Timberland Library, a WDFW fish hatchery, and several facilities for the USDA Forest Service. A listing of business/nonresidential types is presented in Table 3-2.

TABLE 3-2

Business Types within Hoodsport RAC

Business Type	Number within the RAC
Restaurant/Eatery	6
Vacant/Closed	6
Boutique/Hair Salon	4
Post Office/Library/Bank	3
Churches	2
Clinics	2
Hardware Store	2
National Forest/Park Office	2
Other	2
Real Estate	2
RV Storage/Auto Repair	2
Fire Station	1
Fish Hatchery	1
Gas Station	1
Motel (15 rooms)	1
Nursery	1
Total	**38**

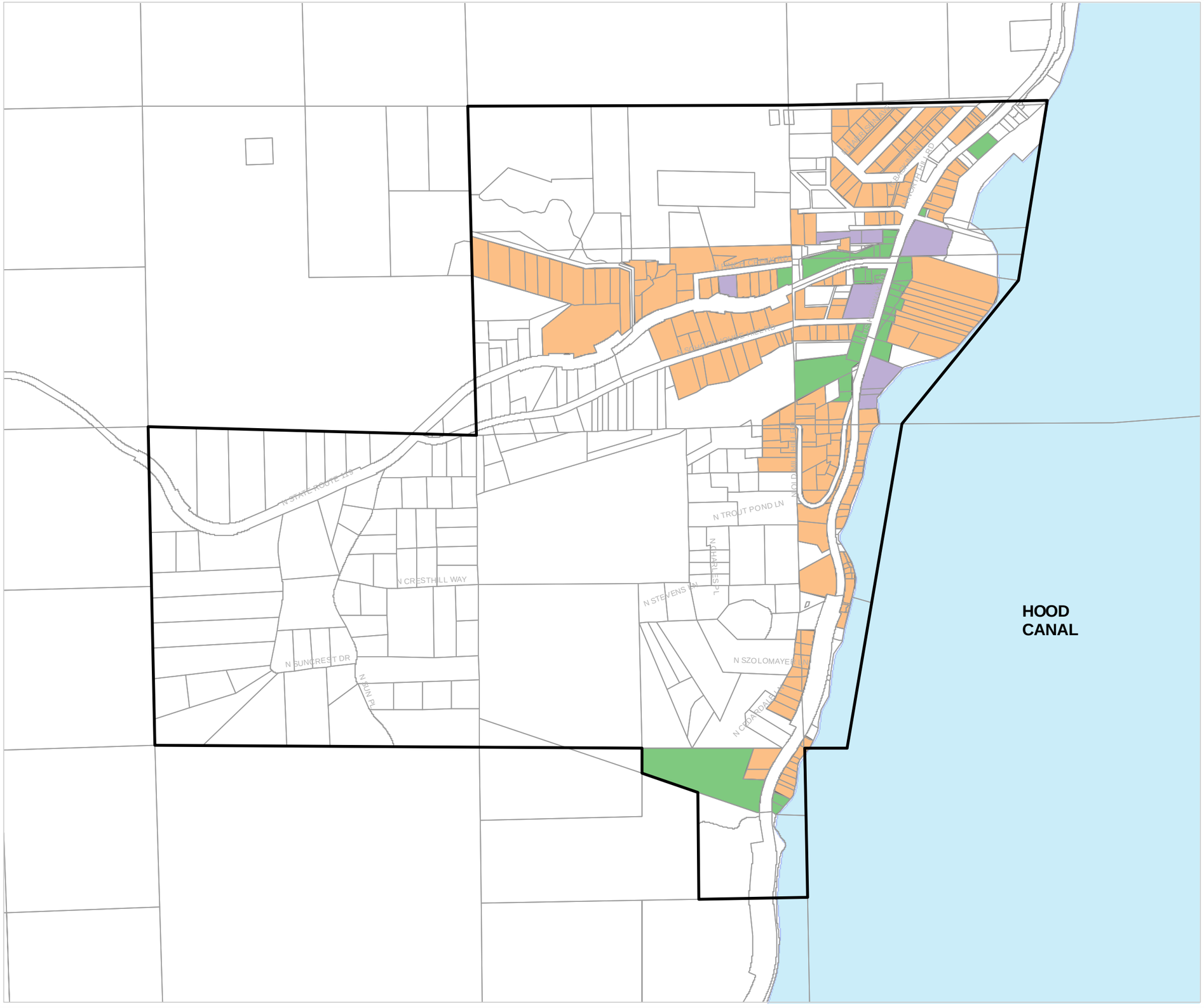
Table 3-3 summarizes the existing lot size based on a survey of County records covering 200 lots within the Hoodsport RAC. The average lot size was calculated to be 55,666 square feet, or 1.25 acres. In general, smaller lot sizes are located near shoreline areas or the commercial area. Larger parcels are located in upland areas west of Highway 101 and along Cushman Road and Old Millhouse Road. As discussed earlier in this Chapter, these larger parcels can be developed at one unit per 2.5 acres. Lots platted prior to 1996 are not subject to this density requirement and may be able to develop at an average density of one dwelling unit per acre.

TABLE 3-3

Hoodsport RAC Existing Lot Sizes (1)

	<1/3 acre (2)	1/3 to 1 acre	1 to 2.5 acres	>2.5 acres	Total (3)
Number of Lots	51	65	66	18	200
Percent	26	32	33	9	100

(1) Mason County Assessor records.
(2) Mason County minimum building lot size for siting individual on-site systems: 12,500 square feet or 1/3 acre.
(3) Number of lots available in County's Assessor records.



N

0 400 800 1,600 Feet

SCALE 1" = 800'

LEGEND:

- HOODSPORT RAC
- PARCELS

LAND USE:

- RESIDENTIAL
- COMMERCIAL
- INSTITUTIONAL/STATE/FEDERAL

MASON COUNTY

HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE 3-2
CURRENT LAND USE WITHIN
THE SERVICE AREA

Gray & Osborne, Inc.
CONSULTING ENGINEERS

O:\CLIENTS\MasonCo\HOODSPORT RAC WW PLAN\FIG3-2.mxd

POPULATION

To develop wastewater flows and loadings for Hoodsport, it is necessary to determine existing population and estimate future growth. Population estimates are used in determining design flows for wastewater treatment and collection system alternatives. Due to the rural nature of Hoodsport, population was estimated by counting the number of housing units during drive-by "windshield" surveys. The number of housing units along with Mason County sources for the per capita population provides the basis for the population estimates.

MASON COUNTY

The County's population in 1990 was reported by the U.S. Census as 38,341 and in 2000 as 49,405. The average annual growth rate for this 10-year period was, therefore, approximately 2.57 percent. More recently, the Washington State Office of Financial Management estimated the County's population as 50,800, indicating an annual growth rate of less than 1 percent for the past 4 years. For its long-term forecast, the Office of Financial Management projects a County-wide population of 57,088 by 2025, based on the medium series population assumption. Using 2000 Census population of 49,405, the medium series population assumes an annual growth rate of 1.7 percent for the next 25 years, or significantly less than the County experienced from 1990 to 2000. Based on information contained in its 2005 Comprehensive Plan, the County uses 2.5 persons per household for a typical residence. The number of persons per household in the 2000 Census was 2.49.

Table 3-4 summarizes Mason County area growth projections through 2025.

TABLE 3-4

Area Growth Projections for Mason County 2005 to 2025

Area	Share of Growth	Additional Population
Shelton Urban Growth Area	33%	10,500
Belfair Urban Growth Area	18%	5,600
Allyn Urban Growth Area	7%	2,250
Fully Contained Community Reserve	3%	1,000
RAC-LAMIRDS	1.5%	469
Rural Lands	37%	11,480
Total County	**100%**	**31,299**

SEASONAL POPULATION

Mason County experiences seasonal fluctuations in population. Although seasonal residents are not included in the County's population statistics, they must be considered

since there is definite increase in demand for certain types of capital facilities during the summer months when seasonal population is high and tourism is at its peak.

In order to approximate the seasonal population variation, the County has used billing addresses from both PUD No. 1 and PUD No. 3 customers. In this case, a seasonal resident is one who receives utility billings at an out-of-County address. Hoodsport is served by Mason County PUD No. 1.

According to PUD No. 1 and PUD No. 3 billing records, roughly 30 to 35 percent of County utilities customers are seasonal. Using this as an indication of seasonal population, the County's population increases accordingly during the summer months. This seasonal population tends to be concentrated along the County's waterfront. Thus, in 2004, the population increased from 50,800 people in the off season to approximately 66,040 during the height of the season.

HOODSPORT RURAL ACTIVITY CENTER

Population data was estimated from a "windshield" survey (conducted in February 2005) of the number of housing units within the RAC multiplied by 2.49. The total number of residential housing units was 258 and the total number of commercial businesses was 38 within the RAC. Therefore, the estimated population within the RAC in 2005 is 642 individuals. It is unlikely that population has changed significantly since the "windshield" survey was completed.

Seasonal housing information was not available from the "windshield" survey. However, all available housing units were tabulated including those that may be seasonal. The 2005 Mason county Comprehensive Plan estimated from PUD billing records that roughly 30 percent of County utility customers are seasonal. Since all currently available housing units within the RAC were counted, it is assumed that approximately 30 percent are vacant during the "off season" with an equal reduction in population during this time.

Future, or projected, population is dependent upon the growth rate within the RAC and changes in land use. For the Hoodsport-Skokomish Wastewater Management Alternatives Analysis (October 2006), Mason County recommended an annual growth rate of 3.5 percent. This rate was utilized to project population from 2005 through the year 2025 for both permanent and seasonal population as shown in Table 3-5. With an area of approximately 584 acres and a large number of undeveloped parcels, the RAC can accommodate a significant increase in population. However, it is anticipated that the majority of the growth would occur in the uplands area of the RAC rather than the existing commercial corridor.

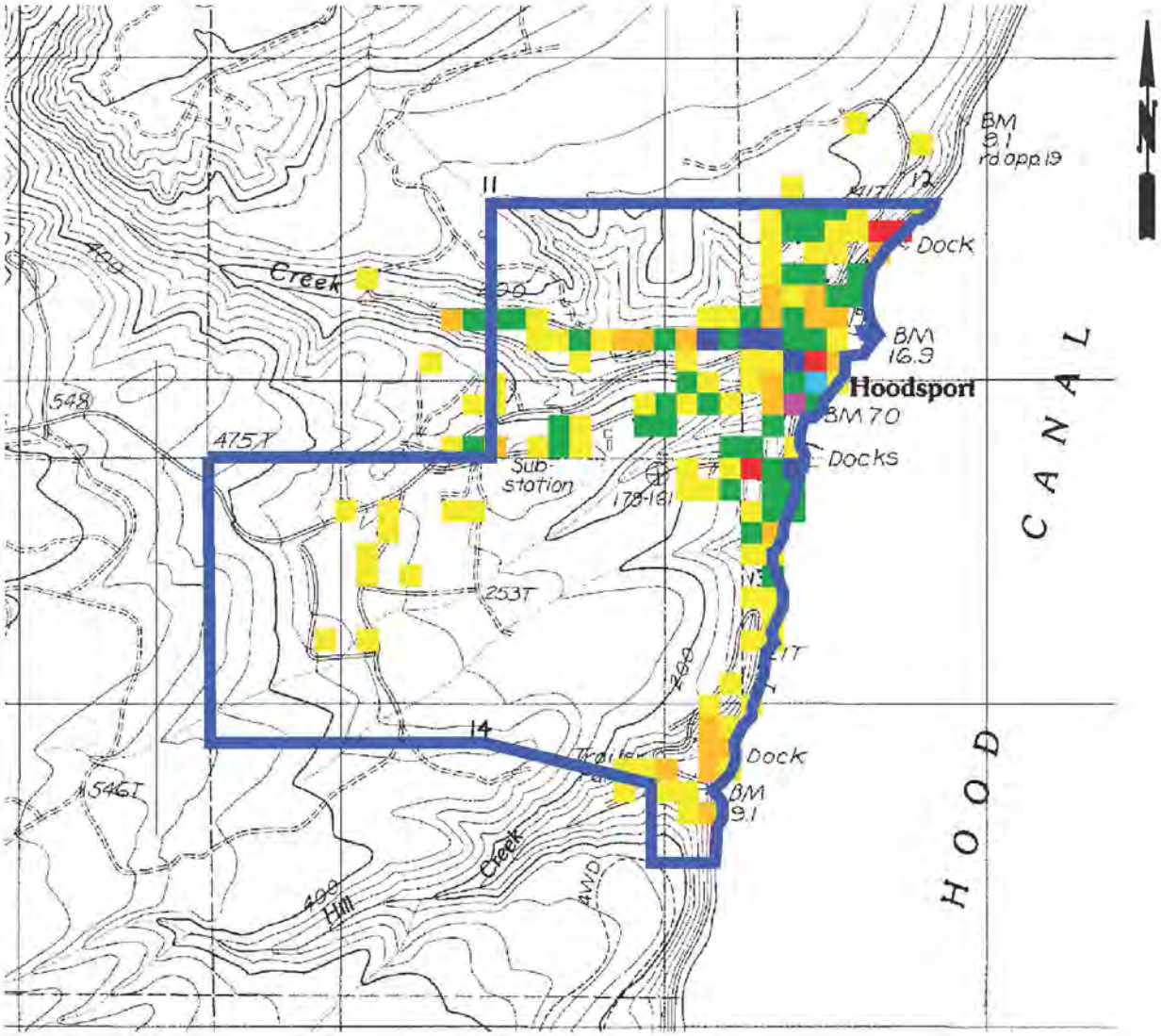
TABLE 3-5

Hoodsport RAC Population Projections

Category	2005	2007	2010	2012	2015	2020	2025
Permanent Population Projections	449	481	534	572	634	753	894
Seasonal Population Projections	193	206	229	245	272	323	383
Total Population Projections	**642**	**688**	**762**	**817**	**906**	**1,076**	**1,277**
Total Housing Units	258	276	306	328	363	432	512

Persons/Housing Units – Source: 2000 U.S. Census at 2.49, 3.5 percent growth rate.

Figure 3-3 presents a population density schematic for the Hoodsport RAC. Currently, the population density is highest along the Highway 101 corridor.



LEGEND:

- 1 HOME PER ACRE
- 2 HOMES PER ACRE
- 3 HOMES PER ACRE
- 4 HOMES PER ACRE
- 5 HOMES PER ACRE
- 6 HOMES PER ACRE
- 7 HOMES PER ACRE
- HOODSPORT RURAL ACTIVITY CENTER (RAC) BOUNDARY

MASON COUNTY
HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE 3-3
POPULATION DENSITY

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CONSULTING ENGINEERS

M:\MASONCO\07570\FIGURES\FIG.3-3.DWG, 3-3, 7/6/2007 11:18:31 AM, 1:1, BY: M NAGEL

CHAPTER 4

REGULATORY REQUIREMENTS

INTRODUCTION

The purpose of this Chapter is to provide a general overview of authorities and regulations pertaining both to on-site and centralized wastewater treatment and disposal. Pertinent authorities include Mason County; the Washington State Departments of Health, Ecology, and Fish and Wildlife; and the Skokomish Tribe. In recent years, there have been significant changes in regulations both for on-site systems (e.g., WAC 246-272A) and in water quality standards (e.g., WAC 173-201A). In addition, this Chapter contains a discussion of the water reclamation and reuse standards and various permitting requirements for wastewater facilities.

Within the State of Washington, wastewater treatment systems are regulated at three different levels based on their peak day design flow and the complexity of the treatment process. Treatment systems with a design flow less than 3,500 gallons per day (gpd), regardless of the means of treatment, are the responsibility of the owner and are regulated by the county or local health department. Individual and larger on-site systems designed for peak day flows between 3,500 gpd and 14,500 gpd are regulated by the Washington State Department of Health (DOH).

Mechanical treatment facilities with a design flow greater than 3,500 gpd and any type of treatment system with a design flow greater than 14,500 gpd are under the regulation of the Washington State Department of Ecology (Ecology). For each of these levels, specific standards and regulations apply. These standards and regulations are discussed in the following sections.

WASTEWATER MANAGEMENT ALTERNATIVES

CENTRALIZED SYSTEMS

One alternative for providing enhanced wastewater treatment is to construct a collection system and central wastewater treatment plant. This approach typically produces dependable results because the requirements and treatment technologies are well established and maintained. These systems are also historically funded and regulated by state and federal agencies. In order to offset the installation expense of centralized systems, it has been a common practice to allow these systems to grow through the addition of new customers.

Centralized systems can be equipped and operated to reliably remove tertiary level pollutants, such as nitrogen and phosphorous.

A major cost with a centralized system is the collection system which may represent 70 to 80 percent of the total project cost. In addition, depending upon the components of a collection system, operation and maintenance may be costly. Lift stations are a significant operation and maintenance component. Also, while infrequent, failures in collection system components may result in large volumes of raw sewage released to the environment in a short time. Typically, the source of failures with a centralized system lies with the collection system rather than the treatment component.

CLUSTER SYSTEMS

Another alternative is the use of cluster systems. These are smaller treatment systems that reduce the collection system costs by using a series of smaller treatment plants that operate with less direct attention than required by a centralized facility. The Environmental Protection Agency defines a cluster system as a decentralized wastewater collection and treatment system where two or more dwellings, but less than an entire community is served. In Washington State, regulatory agencies share jurisdiction of wastewater management with systems up to 3,500 gallons per day regulated by local health departments and systems between 3,500 gpd to 14,500 gpd by the Washington State Department of Health. The capacity of 3,500 gpd corresponds to about the amount of wastewater expected from 10 homes. Major concerns with cluster systems include the operational challenge of managing multiple facilities as well the need to construct and maintain a collection system. Cluster systems can be equipped and operated to remove tertiary level pollutants, but less reliably than centralized systems.

ENHANCED ON-SITE SYSTEMS

Another alternative under consideration is the use of enhanced on-site systems (EOS). There is a growing availability of single-property treatment systems that operate like miniature wastewater treatment plants with the capability of some nutrient removal. Although not as capable as central systems in nutrient removal, they avoid the requirement for a collection system and may be more compatible with rural environments and growth management regulations. As with cluster systems, the funding, regulation, operation, and maintenance of these systems need to be addressed. Enhanced on-site systems are subject to wide variations in wastewater characteristics and flows and are costly. With nutrient removal, a typical enhanced on-site system will cost in excess of $20,000.

CONVENTIONAL ON-SITE SYSTEMS

The last alternative that must be considered is the status quo of continuing to use conventional on-site (otherwise referred to as individual septic) systems. When properly designed, installed, and maintained, these systems are capable of removing conventional pollutants, but nitrogen removal is limited. Particularly for shoreline environments, conventional on-site systems are not likely to be permitted.

ON-SITE SEWAGE SYSTEMS

Chapter 246-272 WAC (Washington Annotated Code) is the primary regulation governing on-site sewage treatment systems in the state of Washington. Chapter 246-272 WAC has been revised as 276-272A as of September 15, 2005; the new rules are in effect as of July 1, 2007, and can be found in Appendix C. The purpose of the regulation is to protect public health by minimizing effects to the following circumstances:

- The potential for public exposure to sewage from on-site systems;
- The adverse effects that on-site sewage discharge may have on surface water and groundwater resources.

Under the revised WAC 246-272A, "on-site sewage system (OSS)" is defined as an integrated system of components, located on or nearby the property it serves, that conveys, stores, treats, and/or provides subsurface soil treatment and dispersal of sewage. It consists of a collection system, a treatment component, and a soil dispersal component. An on-site sewage system also refers to a holding tank sewage system or other system that does not have a soil dispersal component.

While many of the basic standards are unchanged with WAC 246-272A, there are several significant differences. Previously, under WAC 264-272, Treatment Standard 1 required an end-of-pipe effluent less than 10 mg/L BOD_5 and TSS, and less than 200 fecal coliform per 100 ml. Under the new rules, the standard is Level A with 10 mg/L $CBOD_5$, 10 mg/L TSS, and 200 fecal coliform per 100 ml. Similarly, where Treatment Level 2 required an effluent less than 10 mg/L BOD_5 and TSS and less than 800 fecal coliform per 100 ml, the new standard is Level B with 15 mg/L $CBOD_5$, 15 mg/L TSS, and 1,000 fecal coliform per 100 ml. There are also treatment classifications C, D, E, and N with the new rules. For nitrogen-reducing technologies, the performance standard is Level N, which is an average of 20 mg/L total effluent nitrogen.

Also, under WAC 264-272A-0015, Local Management and Regulation, this section has broadened the scope of activities of some local health offices. Puget Sound local health jurisdictions must now address nine different functions in the management plans, ranging from developing an inventory of all on-site systems to ensuring coordination with comprehensive land use plans. One of the nine functions is to identify any areas where on-site systems could pose an increased public health risk. The rule lists nine specific areas (plus one for "other areas") that should "be given priority in this activity," including shellfish growing areas and areas where nitrogen has been identified as a contaminant of concern. For much of Hood Canal, nitrogen is a contaminant of concern, including Hoodsport and the Finch Creek drainage.

The Mason County Department of Health Services implements the regulation at the local level, overseeing systems with a design flow up to 3,500 gpd. Large on-site systems (LOSS) are regulated at the state level by DOH under Chapter 246-272B WAC. Large

on-site systems are defined in the regulation as on-site systems that have a design flow, at any common point, greater than 3,500 gpd. As stated above, any system with a design flow greater than 14,500 gpd is regulated by Ecology.

INDIVIDUAL ON-SITE SEWAGE SYSTEMS

CHAPTER 246-272A WAC

Chapter 246-272A WAC, effective July 1, 2007, presents the minimum design requirements for on-site systems with regard to design flow, horizontal and vertical separation, soil and site evaluation, loading rate, and minimum lot sizes. The regulation also addresses the responsibilities of state and local authorities with regard to system installation, inspection, operation, and maintenance, and repairs of existing systems.

Design Flow. The design flow for a residential on-site system must be based on 120 gallons per day (gpd) per bedroom. However, the minimum design flow for any system must be at least 240 gpd, unless technical justification is provided to support approval of a lower design flow. This design flow is considered to be a peak day flow for the system, and all components must be sized to transport and treat this amount of flow. It is critical that extraneous water from surface runoff, footing drains, roof drains, and other non-sewage flows be kept from the on-site system components and the areas where the system is located. Excessive flows into the system will limit treatment effectiveness and greatly increase the potential for system failure.

To determine design flows for nonresidential facilities, the reader is referred to the "*On-site Wastewater Treatment and Disposal Systems Manual*," (USEPA, EPA-625/R-00/008, February 2002); the *"Design Standards for Large On-site Sewage Systems,"* (DOH, December 1993); or *"Criteria for Sewage Works Design,"* (Ecology, December 1998), as appropriate.

Horizontal Separation. To reduce the potential for impacts to public health and surface and groundwaters, various on-site system components are required to be located minimum distances from drinking water sources such as wells and springs, surface waters, drainage courses, building foundations, and easement and property lines.

Table 4-1 presents the minimum horizontal separation distances required under Chapter 246-272A WAC. These requirements may be increased if a condition exists that creates a greater potential for contamination or pollution. Such conditions include excessively permeable soils, unconfined aquifers, shallow or saturated soils, dug wells, and improperly abandoned wells. The horizontal setback requirements may be decreased if certain specified protective physical conditions exist and enhanced treatment beyond a conventional system is provided.

TABLE 4-1

Minimum Horizontal Separations

Items Requiring Setback	From Edge of Soil Dispersal Component and Reserve Area	From Sewage Tank and Distribution Box	From Building Sewer and Nonperforated Distribution Pipe
Well or Suction Line	100 feet	50 feet	50 feet
Public Drinking Water Well	100 feet	100 feet	100 feet
Public Drinking Water Spring(2)	200 feet	200 feet	100 feet
Spring or Surface Water Used As Drinking Water Source(1, 2)	100 feet	50 feet	50 feet
Pressurized Water Supply Line	10 feet	10 feet	10 feet
Properly Decommissioned Well (decommissioned in accordance with Chapter 173-160 WAC)	10 feet	NA	NA
Surface Water(2)	100 feet	50 feet	10 feet
Building Foundation/In-Ground Swimming Pool	10 feet	5 feet	2 feet
Property or Easement Line	5 feet	5 feet	NA
Interceptor/Curtain Drains/Drainage Ditches/Foundation Drains			
Downgradient(3)	30 feet	5 feet	NA
Upgradient(3)	10 feet	NA	NA
Other Site Features that May Allow Effluent to Surface			
Downgradient(3)	30 feet	5 feet	NA
Upgradient(3)	10 feet	NA	NA
Downgradient Cuts or Banks with At Least 5 feet of original, undisturbed soil above a restrictive layer due to a structural or textural change	25 feet	NA	NA
Downgradient Cuts or Banks with Less Than 5 feet of original, undisturbed soil above a restrictive layer due to a structural or textural change	50 feet	NA	NA
Other Adjacent Soil Dispersal Components/Subsurface Stormwater Infiltration Systems	10 feet	NA	NA

(1) If surface water is used as a public drinking water supply, the designer shall locate the OSS outside of the required source water protection area.

(2) Measured from the ordinary high water mark.

(3) The item is downgradient when liquid will flow toward it upon encountering a water table or a restrictive layer. The item is upgradient when liquid will flow away from it upon encountering a water table or restrictive layer.

Soil and Site Evaluation. Evaluation of the proposed treatment site and the soils on the site is very critical to the design of the on-site system. The regulation requires that this evaluation be completed by professional engineers, qualified on-site system designers, or local health officers. Soil scientists may only perform soil evaluations. The evaluation

must include a sufficient number of soil logs to determine the classification of soils in the primary or initial soil dispersal component and reserve disposal areas and whether a restrictive layer exists within five feet of the surface. Table 4-2 presents the soil classification information used to evaluate soils for on-site sewage systems.

TABLE 4-2

Soil Textural Classification

Soil Type	Classification Description
1	Gravelly and very gravelly coarse sands, all extremely gravelly soils excluding Soil Types 5 and 6, all soil types with greater than or equal to 90 percent rock fragments.
2	Coarse sands.
3	Medium sands, loamy coarse sands, loamy medium sands.
4	Fine sands, loamy fine sands, sandy loams, loams.
5	Very fine sands, loamy very fine sands; or silt loams, sandy clay loams, clay loams and silty clay loams with a moderate or strong structure (excluding platy structure).
6	Other silt loams, sandy clay loams, clay loams, silty clay loams.
7/Unsuitable for Treatment or Dispersal	Sandy clay, clay, silty clay, and strongly cemented or firm soils.

The site evaluation must determine the groundwater conditions and the expected maximum groundwater table level. The proposed site also must be reviewed for drainage, slide and erosion potential, flood potential, cuts, banks, fill areas, and existing appurtenances such as wells, surface water, and existing utilities.

Vertical Separation. Vertical separation is defined by Chapter 246-272A WAC as follows:

> "…means the depth of unsaturated, original, undisturbed soil of soil types 1–6 between the bottom infiltrative surface of a soil dispersal component and the highest seasonal water table, a restrictive layer, or soil type 7..."

The vertical separation that exists between the bottom of the disposal component and the high groundwater table, restrictive layer, or a Type 7 soil, along with soil classification and horizontal separation requirements, have a significant bearing on the level of treatment and type of disposal required. The effects of vertical separation and soil classification on treatment and effluent distribution requirements are presented in Table 4-3.

TABLE 4-3

Treatment Component Performance Levels and Method of Distribution(1)

Vertical Separation (inches)	Soil Type		
	1	2	3 to 6
12 to <18	A – Pressure with timed dosing	B – Pressure with timed dosing	B – Pressure with timed dosing
≥18 to <24	B – Pressure with timed dosing	B – Pressure with timed dosing	B – Pressure with timed dosing
≥24 to <36	B – Pressure with timed dosing	C – Pressure	E – Pressure
≥36 to <60	B – Pressure with timed dosing	E – Pressure	E – Gravity
≥60	C – Pressure	E – Gravity	E – Gravity

(1) The treatment component performance levels correspond with those established for treatment components under the product testing requirements in WAC 246-272A-0110.

As indicated in Table 4-3, on-site systems are not allowed where less than 12 inches of vertical separation exist or where soil Type 7 is found. Where 18 to 24 inches of vertical separation exist, treatment performance Level B and pressure with timed dosing of effluent is required with all soil types. The coarsest textured soil within the vertical separation selected determines the minimum treatment level and method of distribution.

TABLE 4-4

Treatment System Performance Testing Levels

Level	Parameters		
	$CBOD_5$	TSS	Fecal Coliform
A	10 mg/L	10 mg/L	200/100 ml
B	15 mg/L	15 mg/L	1,000/100 ml
C	25 mg/L	30 mg/L	50,000/100 ml
E	125 mg/L	80 mg/L	—

Treatment system performance Levels A, B, C, and E, as defined in Chapter 246-272A WAC indicate that carbonaceous biochemical oxygen demand ($CBOD_5$), total suspended solids (TSS), and fecal coliform per 100 milliliters (FC/100 ml) are defined as listed in Table 4-4. The $CBOD_5$, TSS, and fecal coliform values for Levels A through D are based on 30-day values with averages used for $CBOD_5$ and TSS and the geometric mean for fecal coliform. The values for Level E are derived from full test values. If mound systems are used to provide treatment and additional separation where the vertical separation is only 12 to 18 inches, an intermittent sand filter must be used for pretreatment in order to meet the treatment requirements.

Loading Rate. The volume of effluent that can be applied to a disposal area is determined by the soil classification. Table 4-5 indicates the maximum loading rates per soil type. This table can be used to calculate the total soil absorption area required to be provided for the given design flows. The available soil absorption area is based on the total area of the bottom of the disposal trench.

TABLE 4-5

Maximum Hydraulic Loading Rate

Soil Type	Loading Rate for Residential Effluent Using Gravity or Pressure Distribution (gal/sf/day)
1	1.0
2	1.0
3	0.8
4	0.6
5	0.4
6	0.2
7	Not Suitable

Soil Type 1 is extremely coarse and gravelly, resulting in a very high permeability. Because soil Type 1 is so permeable, it provides minimal soil treatment and; therefore, requires that enhanced treatment be provided. The soil classification ascension from Type 1 to Type 6 indicates soils that are increasingly less permeable. Table 4-5 demonstrates that as the soil type becomes less permeable, the allowable loading rate decreases. This results in an increasing area requirement for absorption. Some soil types, such as clay and glacial till, may be considered unsuitable because they lack hydraulic capacity.

Repair and Replacement of Existing Systems. When existing on-site systems fail and the proposed repair or replacement system cannot conform to the previously discussed vertical and horizontal requirements, Chapter 246-272A WAC provides for a means of repair or replacement through enhanced treatment requirements. The enhanced requirements are found in Table IX of the regulation and are; therefore, commonly referred to as "Table 9 repairs." These requirements are presented in Table 4-6.

TABLE 4-6

Treatment Component Performance Levels for Repair of OSS Not Meeting Vertical and Horizontal Separations[(1)]

Vertical Separation (inches)	Horizontal Separation[(2)]											
	<25 feet			25 < 50 feet			50 < 100 feet[(3)]			≥100 feet		
	Soil Type			Soil Type			Soil Type			Soil Type		
	1	2	3–6	1	2	3–6	1	2	3–6	1	2	3–6
<12	A	A	A	A	A	A	A	A	B	B	B	B
≥12 < 18	A	A	A	A	B	B	A	B	B	Conforming Systems		
≥18 < 24	A	A	A	A	B	B	A	B	C			
≥24 < 36	A	B	B	B	C	C	B	C	C			
≥36	A	B	B	B	C	C	B	C	E			

(1) The treatment component performance levels correspond with those established for treatment components under the product performance testing requirements in Table III of WAC 246-272A-0110.

(2) The horizontal separation indicated in Table 4-6 is the distance between the soil dispersal component and the surface water, well, or spring. If the soil dispersal component is upgradient of a surface water, well, or spring to be used as a potable water source or beach where shellfish are harvested, the next higher treatment level shall apply unless treatment Level A is already required.

(3) On a site where there is a horizontal setback of 75 to 100 feet between an OSS dispersal component and an individual water well, individual spring, nonmarine surface water, or surface water that is not a public water source and a vertical separation of greater than 12 inches, a conforming system that complies with WAC 246-272A-0210(4) shall be installed if feasible.

The horizontal separation requirements presented in Table 4-6 refer to the distance to surface water, a well, or a spring. Treatment Standard A was previously defined as a system that produces an effluent with less than 10 mg/L of BOD_5 and TSS and less than 200 FC/100 ml, based on a monthly average. Treatment Standard B has the same requirement for BOD_5 and TSS, but a less stringent fecal coliform requirement of less than 1,000 FC/100 ml. Effective July 1, 2007, the previous Treatment Standards 1 and 2 have been replaced, respectively, by Levels A and B.

Minimum Land Area. Chapter 246-272A WAC also contains minimum land requirements for new developments and subdivisions to be served by on-site systems. These minimum land area requirements are based on soil type and the proposed source of drinking water supply. Table 4-7 presents the minimum land area requirements for new on-site systems being served by a public water supply and by private wells.

TABLE 4-7

Minimum Land Area Requirement Single-Family Residence or Unit Volume of Sewage

Type of Water Supply	Soil Type					
	1	2	3	4	5	6
Public (Hoodsport)	0.5 acre 2.5 acres(1)	12,500 sf	15,000 sf	18,000 sf	20,000 sf	22,000 sf
Individual Wells on Each Lot	1 acre 2.5 acres(1)	1 acre	1 acre	1 acre	2 acres	2 acres

(1) See WAC 246-272A-0234(6).

MASON COUNTY REGULATIONS

Mason County Department of Health Services (County) is the local authority that implements Chapter 246-272A WAC for on-site systems with design flows up to 3,500 gpd. At a minimum, the County must implement the requirements of the state regulation. The County may elect to make certain provisions more stringent or implement additional requirements to address local conditions. The County implements the state regulation by means of the Mason County Board of Health On-site Sewage Regulation (revised April 1998).

Mason County Board of Health On-site Sewage Regulation. The stated purpose of the County regulation is to:

- Minimize the public health effects of on-site sewage systems on surface water and groundwater;
- Minimize the potential for public exposure to sewage;
- Establish design, installation, and management requirements for on-site sewage systems to accommodate effective treatment and disposal of sewage on a long-term basis;
- Require a known level for sewage disposal in Mason County; and
- Enhance protection of environmentally sensitive areas within Mason County.

The County's on-site system regulation adopts and incorporates by reference, Chapter 246-272A WAC as the minimum standards. The County regulation also adopts and incorporates by reference the *Mason County Standards for the Design, Construction, Operation, and Maintenance of Sewage Systems*. This document is also known as the

Mason County Department of Health Services On-site Standards (revised January 1999). These design standards expand and add to the requirements of Chapter 246-272A WAC. The County's on-site regulation also establishes requirements for certification of pumpers, installers, designers, and maintenance specialists and outlines rules for enforcement and appeals.

Mason County Standards for the Design, Construction, Operation, and Maintenance of Sewage Systems (Mason County Department of Health Services On-site Standards). The design standards outline procedures for obtaining approval of an on-site sewage system, as well as design, installation and operation and maintenance requirements. The system must be designed by a septic designer or professional engineer certified by the County.

Design Criteria. For the most part, the County design criteria are consistent with WAC Chapter 246-272A, with the same requirements for design flow and vertical and horizontal separation. One difference is in the sizing of the septic tank, which is slightly more conservative under the County design criteria. The minimum tank volume is based on the number of bedrooms in the home, as shown in Table 4-8.

TABLE 4-8

Minimum Septic Tank Volume

Number of Bedrooms	Volume of Tank (Gallons)
1-2	1,000
3-4	1,200
5+	Add 250 Gallons per Bedroom

The design standards incorporate guidelines from the Washington State Technical Review Committee (TRC) for the design of alternative systems and pressure distribution.

Operation and Maintenance. In June 1993, the County entered into an Agreed Order with Ecology to address deteriorating water quality in four Mason County watersheds. Failing on-site systems along marine shorelines were believed to be a major cause of the water quality problems. One outcome of the Agreed Order was the County's commitment to implement an operation and maintenance (O&M) program for on-site sewage systems. Table 4-9 summarizes the minimum frequency of operation and maintenance required for each type of on-site system, and the owner's options for completing the necessary operation and maintenance work. As the table indicates, with increasing technical complexity of the on-site system, more frequent O&M oversight is required. There is also a greater need to have the work completed by appropriately trained technical personnel.

TABLE 4-9

On-site System Operation and Maintenance Requirements

Inspection Interval	Conventional Gravity or Graveless Chambers w/ or w/o Reduction	Pressure Distribution or Siphon	Mound or Sandfilter	Aerobic Units	Disinfection Units
First 6 weeks					PRO, CMS
First 6 months		CMS		PRO, CMS	
As required by the manufacturer or NSF, but no less than every 6 months				PRO, CMS	PRO, CMS
Year 1 of cycle		HO, CMS			
Year 2 of cycle		HO, CMS			
Year 3 of cycle	HO, PUM, INS, DES, CMS	CMS			

HO = Home Owner
PRO = Proprietary Device Licensee
PUM = Certified Pumper
INS = Certified Installer
DES = Certified Designer
CMS = Certified Maintenance Specialist

The design standards outline the County's implementation plan for a phased O&M program that was initiated in 1997. In Phase 1 (1997), participation in the O&M program was mandatory for all new permits where the design required an aerobic treatment device or was a "Table 9" repair requiring Treatment Standard A or B due to site limitations. Participation was also required for existing systems located within critical aquifer recharge areas, along lakes designated as the primary source of drinking water, and along marine shorelines within the Oakland Bay, Skokomish, and West Hood Canal watersheds, and for existing systems serving food service establishments.

In Phase 2 (1998), participation was to be mandatory for new permits requiring a sandfilter or mound design and all existing systems located along designated freshwater shorelines. In Phase 3 (1999), participation was to be mandatory for new permits requiring pressurized distribution and all existing systems located along marine shorelines. In Phase 4 (2000), participation was to be mandatory for all new permitted systems, regardless of the type of system design. The program is voluntary for existing systems that are not located over critical aquifer recharge areas or along designated shorelines.

The County has instituted a voluntary program for private residences. At this time, over 50 percent of the residences have met the reporting requirements.

LARGE ON-SITE SEWAGE SYSTEMS

On-site systems with design flows, at any common point, greater than 3,500 gpd are considered "large" or "community" on-site sewage systems. The Washington Department of Health (DOH) approves and regulates Large On-site Sewage Systems (LOSS) up to a peak day flow of 14,500 gpd.

CHAPTER 246-272B WAC

While the overall general requirements of Chapter 246-272B WAC apply to LOSS, the large systems are specifically addressed in Section 246-272B-08001 of the regulation. This section identifies information that must be submitted to DOH in order to obtain approval of a LOSS, as well as management, operation and maintenance, and permitting requirements.

Due to the potential for greater impacts from a LOSS, the proponent must submit an engineering report that includes the proposed design information, as well as a thorough analysis of the proposed site. The site analysis must discuss site topography, geology, surface and groundwater, drainage, zoning, surrounding land use, etc. The proponent must also present how the system will be managed, operated, and maintained. The engineering report, as well as the design plans and specifications, are required to be prepared by a professional engineer. A certified installer is required to construct the system, and the design engineer must inspect the construction of the system.

Once the engineer documents that construction is complete and the DOH engineer performs the final inspection, the LOSS is issued an operating permit from DOH. As-built drawings and an operation and maintenance (O&M) manual, prepared by the design engineer, are also required. The operating permit is renewed annually, if the management, treatment adequacy, and O&M are acceptable to DOH.

WASHINGTON DEPARTMENT OF HEALTH DESIGN STANDARDS

Chapter 246-272B-08001 WAC states that a proposal to construct a LOSS must meet the requirements of the *Design Standards for Large On-site Sewage Systems*. These standards are based on the regulation and outline in more detail the planning and design requirements for large on-site systems.

***Design Flows and Loadings*.** Design flows for multiple single homes or multifamily dwellings that discharge to a LOSS are based on 120 gallons per day per bedroom. Table 4-10 indicates the allowable flows per dwelling unit based on number of bedrooms and estimated individuals per dwelling unit. These design flows are assumed to be peak flows. Therefore, if actual peak flows are expected to be greater than these estimates, the actual, higher flow estimates should be used.

TABLE 4-10

Residential Design Flows for Large On-site Sewage Systems

Bedrooms/Unit	Individuals/Unit	Design Flows (gpd)
1	2	200*
2	3	240
3	3.5	360
4	4.5	480

*Minimum design flow per unit.
Note: Minimum design flow for subdivisions and new mobile home parks is 360 gpd per lot or space.

Design flows for facilities other than residential, including commercial, recreational, and institutional facilities, should be based on Table 4-11 or other appropriate design flow information. Also, if water use data is available, this information can be used to justify design flows.

Septic Tanks. Septic tank volume must be sized to provide 1.5 times the peak day design flow. This volume can be provided with a single tank or with multiple tanks. If multiple tanks are used, the first tank should have a minimum of 24 hours detention time at peak flow. Enhanced treatment beyond a septic tank may be required based on factors such as soil type, strength of the wastewater, and location in an area of special concern. Typical domestic wastewater strength is assumed to be 230 mg/L BOD_5, 150 mg/L TSS, and <50 mg/L of Total Oil and Grease (TOG). If wastewater strengths were expected to be significantly greater than these levels, then enhanced treatment beyond that provided by a septic tank would likely be required.

TABLE 4-11

Design Flows for Nonresidential Development

Discharge Facility	Design Units	Flow** (gpd)	Flow Duration (hr)
School w/ showers and cafeteria	Per person	16	8
School w/o showers and w/ cafeteria	Per person	12.6	8
School w/o showers and w/o cafeteria	Per person	10	8
Boarding schools	Per person	75	16
Motels @ 65 gal/person (rooms only)	Per room	130	24
Restaurants*	Per seat	50	16
Interstate or through highway restaurants*	Per seat	180	16
Interstate rest areas	Per person	5	24
Service stations	Per vehicle served	10	16

TABLE 4-11 – (continued)

Design Flows for Nonresidential Development

Discharge Facility	Design Units	Flow** (gpd)	Flow Duration (hr)
Factories w/ showers	Per person/8-hr shift	25	Operating period
Factories w/o showers	Per person/8-hr shift	15	Operating period
Shopping centers*	Per 1,000 sf of floor space	200-300	12
Hospitals*	Per bed	300	24
Nursing homes*	Per bed	200	24
Homes for the aged*	Per bed	100	24
Doctor's office in medical center*	Per 1,000 sf	500	12
Laundromats	Per machine	500	16
Community colleges	Per student and faculty	15	12
Swimming pools	Per swimmer	10	12
Theaters, drive-in type	Per car	5	4
Theaters, auditorium type	Per seat	5	12
Churches w/o kitchen	Per seat	3	4
Churches w/ kitchen	Per seat	5	4
Day care centers	Per person	20	12
Picnic areas	Per person	5	12
Campgrounds w/ limited comfort stations, no laundry, no sewer hookup	Per camp site	50	24
Campgrounds/RV parks w/ flush toilets, showers, laundry, no sewer hookup	Per camp site	75	24
Campgrounds/RV parks w/ flush toilets, showers, w/ or w/o laundry, and sewer hookup	Per camp site	100	24
Campgrounds/RV parks w/ sewer hookup only, no comfort station	Per camp site	50	24
Trailer dump stations*	Per dump	20	24

* Indicates potential high waste strengths facilities requiring pretreatment.
** Includes normal infiltration.
Source: Criteria for Sewage Works Design (Ecology, revised December 1998).

Disposal Field Design. Vertical separation at the proposed LOSS disposal site must be a minimum of 3 feet to any restrictive layer, high groundwater table, or Type 1 soil. Mounds or sand fill cannot be used to achieve the required minimum separation.

Pressure distribution is required for all LOSS disposal fields, regardless of soil type or treatment design. Design must be according to the TRC "*Guidelines for the Use of Pressure Distribution Systems.*"

The disposal field is required to be constructed in two drain fields, each at 50 percent of the required area. A third disposal field equal to 50 percent of the required area must also be constructed to provide for alternating disposal. The alteration of discharges should be designed according to the TRC "*Guidelines for Alternating and Dosing Systems.*" An additional area equal to 50 percent of the required disposal area must be reserved for construction of a future replacement disposal field.

Disposal field loading rates are as shown in Table 4-5; however, a LOSS would not be allowed in Type 6 soils. A LOSS would only be allowed in Type 1 soils if enhanced treatment is provided.

GROUNDWATER DISCHARGE

Within the State of Washington, a discharge of wastewater effluent to groundwater greater than 14,500 gallons per day (gpd) is regulated by the Department of Ecology (Ecology). The discharges to groundwater are required to comply with Chapter 173-200 WAC, the Groundwater Quality Standards. Ecology implements the Groundwater Standards through issuance of a State Waste Discharge Permit, which details permit limits, special conditions, and monitoring requirements. Procedures for issuance of a State Waste Discharge Permit are presented in Chapter 173-216 WAC.

GROUNDWATER QUALITY STANDARDS

Chapter 173-200 applies to all groundwaters of the state that occur in the saturated zone beneath the land surface. According to the regulation, discharges must be applied in a manner that will not cause pollution of any groundwaters in the saturated zone. Compared to surface water, groundwater is relatively immobile. Groundwater residence times can vary from a few weeks to thousands of years. This fact alone makes the assimilative capacity of groundwater limited. Once reaching an underground aquifer, the physical and chemical characteristics of water change slowly. While groundwater may support a number of beneficial uses, the overriding basis for the regulations is to protect all groundwater as a potential drinking water source.

GROUNDWATER QUALITY CRITERIA

The Groundwater Standards contain numerical criteria that cannot be exceeded in groundwater, with exception of natural causes. The groundwater quality criteria in WAC 173-200 are human health based standards that, for many parameters, are equivalent to the Washington State Department of Health Drinking Water Standards. The Drinking Water Standards do not directly apply to the discharge, but are mentioned for comparison and explanation of the Groundwater Quality Standards.

ANTI-DEGRADATION POLICY

The State of Washington has very high quality groundwater, such that the groundwater often does not require treatment to be used directly for drinking water. The goal of the Groundwater Standards is to maintain that high quality, and to protect it to the level of a drinking water source. The intent of the regulation is to prevent degradation of groundwater quality beyond existing background conditions. Degradation above background levels can only be allowed when "an overriding consideration of the public interest will be served," and "all contaminants have been provided with all known, available, and reasonable methods of prevention, control and treatment (AKART) prior to entry." This policy is known as "anti-degradation." The policy of anti-degradation often becomes the prime determinant of what can be discharged to groundwater.

As stated above, the Groundwater Standards contain numerical criteria that cannot be exceeded in groundwater (with the exception of natural causes) and that are comparable to the numerical criteria established for drinking water. The most significant standard for wastewater disposal is for nitrate, which is 10 mg/L. The Groundwater Standards do not allow a discharge to cause an increase in nitrate, or any other parameter, in the groundwater up to the value cited in the groundwater quality criteria. Quite to the contrary, as previously mentioned, the intent is to maintain the water quality that is present prior to the onset of the discharge (i.e., the background water quality).

The background water quality would be the quality of a sample taken upgradient of the discharge area. In essence, the intent of the Groundwater Standards is to maintain the quality of the groundwater downgradient of the discharge area at the same quality as the upgradient groundwater. This policy is known as the "Antidegradation Policy," which is found in WAC 173-200-030. Section (2)(a) and (c) of this policy is reiterated as follows:

> (a) Existing and future beneficial uses shall be maintained and protected and degradation of groundwater quality, that would interfere with or become injurious to beneficial uses, shall not be allowed.
>
> (c) Whenever groundwaters are of a higher quality than the criteria assigned for said waters, the existing water quality shall be protected, and contaminants that will reduce the existing quality thereof shall not be allowed to enter such waters. Exceptions to this standard can be issued in those instances where it can be demonstrated to the department's satisfaction that: (i) An overriding consideration of the public interest will be served; and (ii) All contaminants proposed for entry into said groundwater shall be provided with all known, available, and reasonable methods of prevention, control, and treatment prior to entry.

In actuality, most waste discharges to the groundwater will result in an increase in contaminants above the level of the background water quality in the area downgradient of the discharge. When this occurs, Ecology must make a determination of what constitutes degradation and impact to beneficial use, what constitutes an overriding consideration of the public interest, and what constitutes all known, available, and reasonable methods of prevention, control, and treatment (AKART) for the effluent discharge.

DESIGN REQUIREMENTS

Nitrogen is the major parameter of concern with the discharge of treated wastewater into groundwater. Nitrate nitrogen (NO_3-N) is the form of nitrogen of highest concern because of its potential impact on human health. The groundwater standard for nitrate is 10 mg/L, the same as the current drinking water standard. Nitrate is a highly soluble and mobile species. If it is not taken up in the root zone, it will readily migrate to groundwater. Reduced forms of nitrogen, such as organic nitrogen and ammonia, are readily oxidized to nitrate. Therefore, reduction of total nitrogen to less than 10 mg/L prior to groundwater discharge is generally recommended. To be accepted as AKART, treatment technologies for wastewater effluent discharges to groundwater must be capable of reducing total nitrogen in the discharge to less than 10 mg/L.

In situations where the background nitrate level is low (i.e., less than 0.5 mg/L), Ecology will generally seek to limit the downgradient increase in nitrate to no more than 2 to 3 mg/L. This higher nitrate limitation is viewed as not resulting in degradation of beneficial uses. Increases significantly above this level would be required to demonstrate that there is a significant "overriding consideration of the public interest" that will be served by the project. As a result, when designing a disposal system with such as a drain field or spray field, nitrogen loading must be evaluated along with hydraulic loading to determine area requirements.

HYDROGEOLOGICAL SITE INVESTIGATION

The proponent of a discharge to groundwater would be required to perform a hydrogeological evaluation of the proposed discharge area. The evaluation must include the following elements:

- Soil investigation (test pits)
- Monitoring well installation
- Aquifer testing and characterization
- Groundwater sampling
- Hydrogeologic analysis
- Site characterization and monitoring report

Soil samples should be analyzed for parameters such as grain size, pH, salinity, organic content, and cation exchange capacity. The groundwater would need to be evaluated to establish background water quality. The groundwater should be tested for parameters

such as nitrogen compounds (i.e., nitrate, TKN, ammonia), BOD_5, total dissolved solids (TDS), total suspended solids (TSS), coliform, alkalinity, chloride, sulfate, iron, manganese, pH, conductivity and temperature.

GROUNDWATER MODELING

Modeling of the proposed discharge would be required to evaluate the necessary discharge area and to estimate potential impacts to groundwater, primarily with respect to nitrate loading. The model would estimate annual nitrogen loads infiltrating from the discharge area, and then estimate the resulting nitrate-nitrogen concentration in groundwater when nitrate from the infiltrating source is added to background concentrations.

STATE WASTE DISCHARGE PERMIT

As stated previously, Ecology implements the Groundwater Standards through issuance of a State Waste Discharge Permit. The permit details the effluent limits, monitoring requirements, and special conditions. Procedures for issuance of a State Waste Discharge Permit are presented in Chapter 173-216 WAC.

It is anticipated that monitoring would be required for a groundwater recharge project in order to ascertain impacts and to ensure there is no significant degradation. Ongoing monitoring requirements would be established by Ecology in the State Waste Discharge Permit. Parameters that would generally be monitored under a State Waste Discharge Permit include the following:

- Nitrate
- Total Kjeldahl Nitrogen (TKN)
- Ammonia
- Biological Oxygen Demand (BOD)
- Total Dissolved Solids (TDS)
- Total Suspended Solids (TSS)
- Total Coliform Bacteria
- Calcium
- Potassium
- Sodium
- Bicarbonate
- Carbonate
- Chloride
- Sulfate
- Iron
- Manganese

The following field parameters would also be measured in the groundwater and reported to the Department:

- pH
- Conductivity
- Dissolved Oxygen
- Temperature

SURFACE WATER DISCHARGE

A discharge to surface water is regulated by the Washington Department of Ecology (Ecology), which implements the Clean Water Act under delegation from the Environmental Protection Agency. Permitting of a surface water discharge would also involve the Washington Department of Fish and Wildlife (WDFW). For marine water discharge, permitting and regulatory oversight would involve the Washington Departments of Natural Resources (DNR) and Health (DOH), as well. In the Hood Canal area, only the Skokomish River and Hood Canal have sufficient volume of riverine or tidal mixing flow to serve as receiving water bodies for treated effluent. However, extensive receiving water studies would be required for a discharge to either of these water bodies. In addition, increasing concerns about protection of shellfish resources and oxygen depletion would indicate that use of these water bodies for effluent of any quality from any point source is unlikely.

WASHINGTON DEPARTMENT OF ECOLOGY

Ecology regulates surface water discharges of wastewater effluent under the Clean Water Act through the issuance of National Pollutant Discharge Elimination System (NPDES) permits. Procedures for the issuance of an NPDES permit are presented in Chapter 173-220 WAC. The state regulation that implements the Clean Water Act, Chapter 173-201A WAC, the Surface Water Quality Standards, is administered through the issuance of NPDES permits.

WATER QUALITY STANDARDS FOR SURFACE WATERS OF THE STATE OF WASHINGTON, CHAPTER 173-201A WAC

Description of Regulations

WAC 173-201A establishes water quality standards for the State of Washington. The State adopted revised water quality standards on July 1, 2003. The standards are based on two objectives: protection of public health and enjoyment, and protection of fish, shellfish, and wildlife. For each surface water body in the state, the revised standards assign specific uses, such as aquatic life, recreation or water supply uses. Water quality standards have been developed for each use, for parameters such as fecal coliform, dissolved oxygen, temperature, pH, turbidity, and toxic, radioactive, deleterious substances.

The water uses that are defined in the standards for marine waters are:

Aquatic Life Uses
- Extraordinary quality
- Excellent quality
- Good quality
- Fair quality

Shellfish Harvesting

Recreational Uses
- Primary contact recreation
- Secondary contact recreation

Miscellaneous Uses
- Wildlife habitat
- Harvesting
- Commerce and navigation
- Boating
- Aesthetics

Water Quality Classification

Hood Canal is classified in **WAC 173-201A-612** as having the following uses in the segment of concern:

- Aquatic Life Use: Extraordinary Quality-salmonid and other fish migration, rearing
- Recreation Use: Primary contact recreation
- Miscellaneous Uses: All (wildlife habitat, commerce and navigation)

The water quality standards also have narrative criteria regarding toxic, radioactive, otherwise deleterious materials, or materials that impair aesthetics. These materials are prohibited in concentrations that affect aquatic life, human health or impair aesthetics.

Numeric criteria for 29 toxic substances are listed in WAC 173-201A-040. Criteria are listed on both an acute and chronic basis and for certain substances (e.g., metals, chlorine, and ammonia), the criteria must be calculated as a function of receiving water pH, hardness, and whether salmonids are present.

The water quality standards allow for variances and site-specific criteria to be developed in individual cases.

To remove a use from the list of uses for which a water body is protected, a use attainability analysis (UAA) must be performed. The UAA must demonstrate that the use does not exist in the water body or would not be attainable. The proposed change to the

assigned uses must be consistent with Federal laws and subject to a public involvement process including consultations with tribes.

The goal of the surface water quality standards is to maintain existing beneficial uses of surface water by preventing degradation of existing water quality. However, some allowances are made for discharges into surface water that enable a temporary or mitigated degradation to occur. These allowances are made by determining the *assimilative capacity* of the receiving water and establishing *mixing zones*.

Mixing Zones. Mixing zones may be granted when water quality criteria cannot be achieved by the wastewater treatment process. Before a mixing zone is granted, the discharger is required to apply AKART ("all known, available, and reasonable methods of prevention, control, and treatment") prior to discharge. AKART represents the most current methodology that can be reasonably required for preventing, controlling, or treating the pollutants in the discharge.

The mixing zone is that portion of the water body where the discharge mixes with the receiving water, thereby resulting in dilution. If a mixing zone is granted, water quality standards may be exceeded within the mixing zone. However, at the outer limit of the mixing zone, water quality standards must be met. For toxic substances, the standards include acute and chronic toxicity criteria that may result in both acute and chronic mixing zones.

Assimilative Capacity. Assimilative capacity describes the surface water's ability to accept pollutant loadings without a permanent degradation of water quality and impairment of beneficial uses. Ecology conducts waste load capacity studies for watersheds across the state. The studies are used to determine the assimilative capacity of the water body for various pollutants such as BOD_5, chlorine, ammonia, metals, etc. For example, the assimilative capacity of a surface water with respect to BOD_5 will be based on the mass of an oxygen-depleting substance (e.g., organic matter and ammonia) that can be discharged into a surface water without depleting dissolved oxygen to levels that would be detrimental to aquatic life.

Technology-Based Versus Water Quality-Based Standards. Treatment of discharges to surface water from wastewater treatment facilities are required to meet minimum "technology-based" standards for secondary treatment as presented in Chapter 173-221-040 WAC. The secondary treatment standards are presented in Table 4-12.

TABLE 4-12

Secondary Standards for Wastewater Treatment

Parameter	Monthly Average	Weekly Average
BOD_5	30 mg/L(2)	45 mg/L
TSS	30 mg/L(2)	45 mg/L
Fecal Coliform(1)	200/100 ml	400/100 ml
pH	Between 6.0 and 9.0	

(1) Geometric average.
(2) Monthly average removal cannot be less than 85 percent.

If these minimum limits are not sufficient for the discharge to meet the "water quality-based" standards established in WAC 173-201A, more stringent limits and/or additional limits must be set by Ecology. Limits for toxic compounds, such as ammonia and chlorine, are always determined using water quality-based standards, since they are not addressed in the secondary standards.

Parameters of Concern. The primary parameters of concern in a wastewater surface water discharge are dissolved oxygen, temperature, nitrogen, phosphorous, and chlorine. Dissolved oxygen is critical for the viability of aquatic life in the receiving water. Dissolved oxygen can be depleted through the process of breaking down of organic matter and the conversion of ammonia-nitrogen to nitrate-nitrogen. Ammonia and chlorine are toxic to fish and other aquatic life at levels above the water quality criteria. Elevated temperature is detrimental and even fatal to aquatic life and results in lower dissolved oxygen levels.

NPDES PERMIT

A project to discharge to surface water would require an NPDES Permit from Ecology. As stated previously, the procedures for issuance and administration of NPDES permits are presented in Chapter 173-220 WAC. The NPDES permit would include discharge limits for the effluent discharge, as well as operation, monitoring, and reporting requirements. The discharge limits would be developed based on the water quality classification of the water body receiving the discharge. Hood Canal is the water body of concern for this report.

Hood Canal is classified as Class AA, extraordinary, according to Chapter 173-201A. The water quality standards for Class AA marine water were presented in Chapter 2. Currently, there is only one point source wastewater effluent discharge to Hood Canal, that being Alderbrook Inn Resort, which was permitted in 1991. Ecology staff have stated that no new point source discharges to Hood Canal would be allowed due to historical water quality problems and potential shellfish impacts, particularly in Lower Hood Canal. However, there is no known official written policy to that effect.

WASHINGTON DEPARTMENT OF FISH AND WILDLIFE

In-stream work such as construction of a wastewater effluent outfall into freshwater or marine water requires a Hydraulic Project Approval (HPA) permit from the Washington Department of Fish and Wildlife (WDFW). Over the past ten years or more, WDFW has closely scrutinized the issuance of HPA permits in order to limit potential impacts to fisheries, shellfish, and other aquatic life. Application for an HPA permit for a marine water discharge would require documentation to show that an upland discharge was not feasible. It is believed that WDFW would take a very strong stance against issuance of an HPA permit for any proposed discharge to Hood Canal.

WASHINGTON DEPARTMENT OF HEALTH

The Washington Department of Health (DOH) is responsible for protecting the public safety and health with regard to potential impacts to surface waters or shellfish resources. If a surface water discharge has the potential to impact shellfish resources, DOH must establish a closure area where commercial harvest would be prohibited and recreational harvest would be discouraged. If there is a discharge to a freshwater body that flows into a marine water, the potential for public health impacts must also be assessed.

WASHINGTON DEPARTMENT OF NATURAL RESOURCES

The Washington Department of Natural Resources (DNR) is responsible for the administration and sale of state shellfish and other aquatic resources for the state of Washington. If these resources are impacted due to a freshwater or marine effluent outfall (i.e., a closure zone is established by DOH), DNR will seek monetary compensation from the discharger.

WATER REUSE

The legislation authorizing water reuse in the state of Washington, Chapter 90.46 RCW (Revised Code of Washington), the Reclaimed Water Use Act, was passed in 1992. The intent of this initial legislation was to encourage the use of reclaimed water while assuring the health and safety of the public and the protection of the environment. The underlying belief was that implementing water reuse would enable the state to use its water resources in the best interest of present and future generations. The basic premise for reclamation is that the water must be used for direct, beneficial purposes.

The legislation was amended in 1995 to provide for non-consumptive uses of reclaimed water such as groundwater recharge, streamflow augmentation, and wetland augmentation. The 1995 amendment also clearly established that reclaimed water is no longer to be considered wastewater. Reclaimed wastewater would be classified as a water resource.

Chapter 90.46 RCW required the Washington Departments of Health (DOH) and Ecology (Ecology) to jointly develop interim standards for the implementation of water reclamation and reuse. The interim standards were issued in 1994, and the Water Reclamation and Reuse Standards (Reuse Standards) became final in 1997. The Reuse Standards are the primary guidance provided for the development of water reclamation projects.

The use of reclaimed water must also meet the applicable water quality standards. An application to a surface water body is required to comply with the Surface Water Quality Standards (WAC 173-201A). Likewise, an application of reclaimed water to groundwater is required to comply with the Groundwater Quality Standards (WAC 173-200). Ecology and DOH have a memorandum of understanding (MOU) that outlines responsibility for review and permitting of reclaimed water projects. Both agencies will review and approve a reclaimed water project.

The *Water Reclamation and Reuse Standards* define the water quality standards for reclaimed water. An evaluation of the feasibility of water reclamation and reuse for Hoodsport is provided in Chapter 8. The generation of Class "A" reclaimed water has four minimum requirements that are described below:

- **Continuously Oxidized –** Wastewater that at all times has been stabilized such that the monthly average BOD_5 and TSS are less than 30 mg/L, is non-putrescable, and contains dissolved oxygen.

- **Continuously Coagulated –** Oxidized wastewater that at all times has been treated by a chemical or equally effective method to destabilize and agglomerate colloidal and finely suspended matter prior to filtration.

- **Continuously Filtered –** Oxidized and coagulated wastewater that at all times has been passed through a filtering media so that the turbidity of the filtered effluent does not exceed an average of 2 nephelometric turbidity units (NTU), determined monthly, and does not exceed 5 NTU at any time.

- **Continuously Disinfected –** Oxidized, coagulated, and filtered wastewater that at all times has been disinfected to destroy or inactivate pathogenic organisms. A group of indicator microorganisms, coliform bacteria, is used to measure the effectiveness of the disinfection process. The Class "A" reclaimed water standard is a total coliform density of 2.2 per 100 milliliters (ml) for the median of the last 7 days of samples, with no sample having a density greater than 23 per 100 ml.

Chapter 8 provides additional information on reclaimed water for the Hoodsport RAC.

FEDERAL AND STATE STATUTES, REGULATIONS AND PERMITS

In this section, some of the various state and federal laws that may affect wastewater management are discussed, as well as other relevant permits, programs, and regulations.

FEDERAL CLEAN WATER ACT

The Federal Water Pollution Control Act is the principal law regulating the water quality of the nation's waterways. Originally enacted in 1948, it was significantly revised in 1972 and 1977, when it was given the common title of the "Clean Water Act" (CWA). The CWA has been amended several times since 1977. The 1987 amendments replaced the Construction Grants program with the State Revolving Fund (SRF), which provides low-cost financing for a range of water quality infrastructure projects.

The National Pollutant Discharge Elimination System (NPDES) is established by Section 402 of the CWA and subsequent amendments. The Department of Ecology (Ecology) administers NPDES permits for the United States Environmental Protection Agency (EPA) with the exception of Tribal lands. Most NPDES permits have a 5-year life span and place limits on the quantity and quality of pollutants that may be discharged. NPDES permits granted under Phase I of the CWA are required for point source discharges, including wastewater discharges to surface waters from municipal wastewater treatment facilities.

Section 303 of the CWA established the Total Maximum Daily Load (TMDL) program. Under this program, states must establish a list of water bodies that will not achieve water quality standards even with "all known available and reasonable technology (AKART)" in place. In such situations, Ecology conducts a TMDL analysis to determine the capacity of the water body to absorb pollutants and allocates pollutant loads among point and nonpoint discharges.

Section 307 of the CWA established the National Pretreatment Program. This program is designed to protect publicly owned treatment works (POTWs) and limits the amount of industrial or other nonresidential pollutant discharged to municipal sewer systems.

A 401 Water Quality Certification is required under the CWA for any activity that may result in discharge to surface waters including excavation activities that occur in streams, wetlands, or other waters of the nation. The USEPA has delegated 401 Certification to the Department of Ecology.

Section 404 of the CWA regulates discharges of fill or dredged materials in wetlands, including any related draining, flooding, and excavation. Pipeline and pump station projects in wetlands will require a Section 404 permit, in addition to any related local permits. In most cases, activities impacting greater than 1/3 of an acre will also require a Section 401 Certification.

FEDERAL ENDANGERED SPECIES ACT

On March 16, 1999, the National Marine Fisheries Service (NMFS) listed the Puget Sound Chinook as "threatened" under the Endangered Species Act (ESA). In 1999, the United States Fish and Wildlife Service (USFWS) listed the Bull Trout as "threatened." ESA listings are expected to significantly impact activities that affect salmon and trout habitat, such as water use, land use, construction activities, and wastewater disposal. Impacts to the County may include revised wasteload allocations developed under the Section 303 of the Clean Water Act, longer timelines for permit applications, and more stringent regulation of construction impacts and activities in riparian corridors.

The purpose of the 1972 ESA is to "provide a means whereby the ecosystems upon which endangered species and threatened species depend may be conserved..." In pursuit of this goal, the ESA authorizes NMFS and USFWS to list species as endangered or threatened, and to identify and protect the critical habitat of listed species. USFWS has jurisdiction over terrestrial and freshwater plants and animals such as Bull Trout, while NMFS is responsible for protection of marine species including anadromous salmon. Under the ESA, endangered status is conferred upon "any species which is in danger of extinction throughout all or a significant portion of its range," while threatened status is conferred upon "any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range." The ESA defines critical habitat as the "geographical area containing physical and biological features essential to the conservation of the species."

Once a species is listed as endangered or threatened, the ESA makes it illegal for the government or individuals to "take" a listed species. "Take" has been interpreted by the federal courts to include "significant modification or degradation of critical habitat" that impairs essential behavior patterns. For species listed as endangered, the blanket prohibitions against "take" are immediate.

The ESA Section 9 "take" prohibition applies to all "persons" including local public entities. State and local governments may face double exposures through both their direct conduct and through the exercise of the regulatory authorities over activities, which can be construed as a "take."

Federal rules also allow threatened species to be protected through a more flexible Section 4(d) rule describing specific activities that are likely to result in a "take." The draft of the Section 4(d) rule prepared by NMFS was published in the Federal Register on January 3, 2000 (Federal Register, Vol. 65, No. 1). The final 4(d) rule was published in June 2000 and became effective January 8, 2001.

The 4(d) rules may exempt certain activities from "take" liabilities and thereby offer an alternative mechanism by which to secure relief from potential "take" liability. The 4(d) rule approves some specific existing state and local programs, and creates a means for NMFS to approve additional programs if they meet certain standards set out in the rule.

NMFS published "A Citizen's Guide to the 4(d) Rule for Threatened Salmon and Steelhead on the West Coast" in June 2000. The guide introduces and explains the rule. The following discussion summarizes this guide.

Section 4(d) requires NMFS to issue regulations deemed "necessary and admissible to provide for the conservation to the species." NMFS must establish protective rules for all species now listed as threatened under the ESA. The rules need not prohibit all "take." There may be an "exception" from the prohibitions on take so long as the take occurs as the result of a program that adequately protects the listed species and its habitat. The 4(d) rule can "limit" the situations to which the take prohibitions apply. By providing limitation from take liability, NMFS encourages governments and private citizens to adjust their programs and activities to be "salmon safe."

In order to minimize liability under the ESA, local governments must demonstrate that their land use regulations will not result in a prohibited "take" of a listed species, including adverse modification of critical habitat.

It should be noted that the ESA includes a third-party citizen suit provision. Compliance with the Section 4(d) rule does not, therefore, rule out legal challenges, although it is likely to provide greater protection from successful litigation.

NATIONAL ENVIRONMENTAL POLICY ACT

The National Environmental Policy Act (NEPA) was established in 1969 and requires federal agencies to determine environmental impacts on all projects requiring federal permits or funding. Federally delegated activities such as NPDES permits or Section 401 Certification are considered state actions and do not require NEPA compliance. If a project involves federal action (through, for example, an Army Corps of Engineers Section 404 permit), and is determined to be environmentally insignificant, a Finding of No Significant Impact (FONSI) is issued, otherwise an Environmental Impact Statement (EIS) is required. NEPA is not applicable to projects that do not include a federal component that would trigger the NEPA process.

FEDERAL CLEAN AIR ACT

The Federal Clean Air Act requires all wastewater facilities to plan to meet the air quality limitations of the region.

STATE STATUTES, REGULATIONS AND PERMITS

STATE WATER POLLUTION CONTROL ACT

The intent of the state Water Pollution Control Act is to "maintain the highest possible control standards to ensure the purity of all waters of the state consistent with public health and the enjoyment…the propagation and protection of wildlife, birds, game, fish

and other aquatic life, and the industrial development of the state." Under the Revised Code of Washington (RCW) 90.48 and the Washington Administrative Code (WAC) 173-240, Ecology issues permits for wastewater treatment facilities and also land application of wastewater under WAC 246-271.

Submission of Plans and Reports for Construction of Wastewater Facilities, WAC 173-240

Prior to construction or modification of domestic wastewater facilities, engineering reports and plans, and specifications must be submitted to and approved by Ecology. This regulation outlines procedures and requirements for the development of an engineering report, which thoroughly examines the engineering and administrative aspects of a domestic wastewater facility project. This regulation defines a facility plan as described in federal regulations, 40 CFR Part 35, as an engineering report.

Key provisions of WAC 173-240 are provided below:

- An engineering report for a wastewater facility project must contain everything required for a general sewer plan unless an up-to-date general sewer plan is on file with Ecology.

- An engineering report shall be sufficiently complete so that plans and specifications can be developed from it without substantial changes.

- A wastewater facility engineering report must be prepared under the supervision of a professional engineer.

- The engineering report shall include the following information (letter designations are taken from WAC 173-240-060; requirements that include those found in 40 CFR 35.917 for federal facility plan requirements are noted with an asterisk, "*").

  (a) Name, address, phone number of owner.
  (b) Project description.
  (c) Current and projected wastewater flows and loadings.
  (d) Treatment standards.
  (e) Receiving water characteristics, including dilution zone.
  (f) Proposed treatment and disposal process, including an evaluation of alternatives.*
  (g) Basic design data and calculations for each unit process.
  (h) Site availability and relationship to 25/100 flood cycles and residential or developed areas.
  (i) Flow diagram with hydraulic profile.
  (j) Discussion of inflow and infiltration.*

(k) Provisions for treating industrial waste, including pre-treatment programs.*
(l) Outfall analysis.
(m) Method of final sludge disposal and alternatives considered.
(n) Provisions for future needs.
(o) Staffing and testing requirements.
(p) Estimated capital and O&M costs, evaluated in terms of annual costs and present worth.*
(q) A statement regarding compliance with any applicable state or local water quality plan.
(r) A statement regarding compliance with the State (or National) Environmental Policy Act, SEPA (or NEPA) as applicable.

Criteria for Sewage Works Design, Washington State Department of Ecology

Ecology has published design criteria for collection systems and wastewater treatment plants. While these criteria are not legally binding, their use is strongly encouraged by Ecology since the criteria are used by the agency to review engineering reports for upgrading wastewater treatment systems. These design criteria, commonly referred to as the "Orange Book," primarily emphasize unit processes through secondary treatment. Any expansion or modification of the Hood Canal Shoreline collection system and/or treatment plant will require continued conformance with Ecology criteria.

Certification of Operators of Wastewater Treatment Plants, WAC 173-230

Wastewater treatment plant operators are certified by the State water and wastewater operators' certification board. The operator assigned overall responsibility for operation of a wastewater treatment plant is defined by WAC 173-230 as the "operator in responsible charge." This individual must have State certification at or above the classification rating of the plant.

WATER QUALITY STANDARDS FOR SURFACE WATERS OF THE STATE OF WASHINGTON, CHAPTER 173-201A WAC

Basis of Regulations

The State of Washington has authority under the Federal Water Pollution Control Act, also known as the Clean Water Act, (CWA) to establish and administer programs to meet the requirements of the CWA. Under RCW 98.40.35, the Washington Department of Ecology has the authority to establish "rules and regulations relating to standards of quality for waters of the State and for substances discharged therein..." The State of Washington also implements the National Pollutant Discharge Elimination System (NPDES) program, created under the CWA with the exception of Tribal lands.

The water quality standards also have narrative criteria regarding toxic, radioactive, otherwise deleterious materials, or materials that impair aesthetics. These materials are prohibited in concentrations that affect aquatic life, human health or impair aesthetics.

Numeric criteria for 29 toxic substances are listed in WAC 173-201A-040. Criteria are listed on both an acute and chronic basis and for certain substances (e.g., metals, chlorine, and ammonia), the criteria must be calculated as a function of receiving water pH, hardness, and whether salmonids are present.

The water quality standards allow for variances and site-specific criteria to be developed in individual cases.

To remove a use from the list of uses for which a water body is protected, a use attainability analysis (UAA) must be performed. The UAA must demonstrate that the use does not exist in the water body or would not be attainable. The proposed change to the assigned uses must be consistent with Federal laws and subject to a public involvement process including consultations with tribes.

Antidegradation Policy

The antidegradation policy aims to maintain the highest possible quality of water in the State, by preventing the deterioration of water bodies that currently have higher quality than the water quality standards require. The revised water quality standards define three tiers of waters in the anti-degradation policy.

Tier I water bodies are those with violations of water quality standards, from natural or human-caused conditions. The focus of water quality management is on maintaining or improving current uses, and preventing any further human-caused degradation.

Tier II water bodies are those of higher quality than required by the water quality standards. The focus of the policy is on preventing degradation of the water quality, to preserve the excellent natural qualities of the water body. New or expanded actions are not allowed to cause a “measurable change” in the water quality, unless they are demonstrated to be “necessary and in the overriding public interest.”

New or expanded actions that may cause a measurable change in water quality must have a Tier II review conducted. For increased wastewater treatment plant discharges, this review will take place as part of the NPDES permit modification process. Measurable change, for the purpose of the anti-degradation policy, is defined as follows:

- Temperature increase greater than 0.3 degrees C.
- Dissolved oxygen concentration decrease greater than 0.2 mg/L.
- Bacteria level increase greater than 2 CFU/100 ml.
- pH change greater than 0.1 standard units.
- Turbidity increase greater than 0.5 NTU.

- Any detectable change in concentration of toxic or radioactive substances, which include ammonia and chloride.

A new or expanded action may be determined by the Department of Ecology to be necessary and in the overriding public interest based on a review of the following factors:

- Economic benefits, such as job creation
- Providing or contributing to necessary social services
- Status as a demonstration project using innovative technical or management approaches that produce a significant improvement over AKART
- Prevention or remediation of environmental or public health threats
- Societal or economic benefits of better health protection
- The loss of assimilative capacity for future industry or development
- The loss of benefits associated with the current high water quality, i.e., uses such as fishing or tourism.

The new or expanded action would be allowed to measurably reduce the water quality only if it is demonstrated that the action has selected the combination of site, technical and managerial approaches that will minimize the effect on water quality. Alternative approaches that must be evaluated include:

- Pollution prevention or source control to reduce toxic compound discharges.
- Reuse or recycling of wastewater.
- Water conservation to minimize production of wastewater.
- Land application or infiltration to reduce surface water discharges.
- Alternative or enhanced treatment technologies.
- Improved operation and maintenance of existing facilities.
- Seasonal or controlled discharge to avoid critical water quality conditions.
- Water quality offsets with another water quality action (point or non-point source), providing no net decrease of water quality.

STATE ENVIRONMENTAL POLICY ACT

The WAC 173-240-050 requires a statement in all wastewater comprehensive plans that proposed projects are evaluated using the State Environmental Policy Act (SEPA), if applicable. The capital improvements proposed in this plan will fall under SEPA regulations.

ACCREDITATION OF ENVIRONMENTAL LABORATORIES (WAC 173-050)

The State of Washington requires that all laboratories reporting data to comply with NPDES and Solid Waste Disposal (SWD) permits must be generated by an accredited

laboratory. This accreditation program establishes specific tasks for quality control and quality assurance (QA/QC) that are intended to ensure the integrity of laboratory procedures. Accreditation requirements must be met for any on-site laboratory or outside laboratory used to analyze samples. Only accredited commercial laboratories may be used for analyses reported for compliance with NPDES or SWD permits.

MINIMUM STANDARDS FOR SOLID WASTE HANDLING (WAC 173-304)

Grit and screenings are not subject to the sludge regulations in WAC 173-308, but their disposal is regulated under the State solid waste regulations, WAC 173-304. Waste placed in a municipal solid waste landfill must not contain free liquids, nor exhibit any of the criteria of a hazardous waste as defined by WAC 173-303. To be placed in a municipal solid waste landfill, grit and screenings must pass the paint filter test, which determines the amount of free liquids associated with the solids, and the toxic characteristics leachate procedure (TCLP) test, which determines if the waste has hazardous characteristics.

WETLANDS

Dredging and Filling Activities in Natural Wetlands (Section 404 of the Federal Water Pollution Control Act)

An Army Corps permit is required when locating a structure, excavating, or discharging dredged or fill material in waters of the United States or transporting dredged material for the purpose of dumping it into ocean waters. Typical projects requiring these permits include the construction and maintenance of piers, wharves, dolphins, breakwaters, bulkheads, jetties, mooring buoys, and boat ramps.

If wetland fill activities cannot be avoided, negative impacts can be mitigated by creating new wetland habitat in upland areas, and if other federal agencies agree, the Corps will generally issue a permit.

Wetlands Executive Order 11990

This order directs federal agencies to minimize degradation of wetlands and enhance and protect the natural and beneficial values of wetlands. The order also mandates avoidance and mitigation of impacts to wetlands, and must be considered before an NPDES permit is issued. Assurances must be provided that the natural and beneficial values of wetlands will be protected and enhanced by the discharge.

SHORELINE MANAGEMENT ACT

The Shoreline Management Act of 1971 (RCW 90.58) establishes a broad policy giving preference to shoreline uses that protect water quality and the natural environment, depend on proximity to the water, and preserve or enhance public access to the water.

Shoreline Management Act jurisdiction extends to lakes or reservoirs of 20 acres or greater, streams with a mean annual flow of 20 cubic feet per second (CFS) or greater, marine waters, and an area inland 200 feet from the ordinary high water mark. Projects are reviewed by local governments according to state guidelines and a local Shoreline Master Program.

Local Shoreline Master programs are developed in accordance with guidelines from the Department of Ecology (Ecology). Although this rule does impose a varying level of scrutiny within the shoreline area, the purpose is to use "Best Available Science" as required by the Growth Management Act to ensure that regulations are substantively linked to the protection of shoreline functions and values.

FLOODPLAIN DEVELOPMENT PERMIT

Local governments that are participating in the National Flood Insurance Program are required to review projects (including wastewater collection facilities) in a mapped flood plain and impose conditions to reduce potential flood damage from floodwater. A Floodplain Development Permit is required prior to construction.

HYDRAULIC PROJECT APPROVAL

Under the Washington State Hydraulic Code (WAC 220-110), the Washington State Department of Fish and Wildlife (WDFW) requires a hydraulic project approval (HPA) for activities that will "use, divert, obstruct, or change the natural flow or bed" of any waters of the state. For District activities such as pipeline crossings of streams, an HPA will be required, and will include provisions necessary to minimize project specific and cumulative impacts to fish.

Because of ESA listings throughout Washington, WDFW and NMFS are revising the Hydraulic Code to protect species listed as threatened or endangered. If NMFS determines that the revisions are sufficient to protect listed species, the State hopes the revised Code will constitute an acceptable Habitat Conservation Plan (HCP) under Section 10 of the ESA. If the HCP is approved, NMFS issues an Incidental Take Permit (ITP) allowing incidental take of a listed species if the permittee has complied with the Habitat Conservation Plan. This ITP expires after an agreed upon period of time, and may then be revised by NMFS.

CHAPTER 5

EXISTING SYSTEM EVALUATION

GENERAL

The purposes of this Chapter are to provide an evaluation of the existing on-site wastewater systems within the Hoodsport RAC and determine the most likely area of the RAC which may impact water quality in Hood Canal. The on-site evaluation covers the types of systems in use in Mason County, their age, and the associated lot size. In addition, current on-site system requirements under WAC 246-272A are reviewed. The area of the RAC most likely to impact water quality is based on current development and a report by HWA GeoSciences dated February 7, 2007.

HISTORY OF CONVENTIONAL ON-SITE SEWAGE SYSTEMS

In the early days of on-site sewage systems the main intent was to keep wastewater effluents underground to prevent or reduce human contact with pathogens normally associated with wastewater. These on-site systems were relatively inexpensive to install and consisted mainly of pipes going to a cesspool with no outlet. However, it was found that health problems were attributed to drinking water wells in the area of cesspools and effluent surfacing from underground cesspools.

A solution to these cesspool problems included installing underground tanks to collect and separate solids from liquids. These underground tanks became known as septic tanks and were constructed from a variety of materials and in various sizes. Most tanks were constructed of cast-in-place or precast concrete although others were constructed with steel or even 55-gallon barrels. Currently, septic tanks of fiberglass construction are available. Regardless of the material of construction, a septic tank must be water-tight and structurally sound if it is to function properly.

Figure 5-1 illustrates typical installations for single and double compartment septic tanks. The older style, single compartment tank is often found in systems installed prior to 1970. In addition, the single compartment units are sized for 500 or 750 gallons. As indicated in Table 4-7, Mason County's standard for a two bedroom home is a 1,000-gallon tank volume with two compartments. The two-compartment system has been used to limit the discharge of solids in the effluent from the septic tank. Many of the older on-site systems with unbaffled tanks would not meet current local or state standards. In addition, many of these older concrete tanks are not watertight.

Final treatment and disposal from conventional on-site sewage systems is accomplished by a gravity, soil absorption system. The system consists of a series of narrow, relatively shallow trenches installed with a perforated pipe and filled with gravel or other porous

material. Where soil and groundwater conditions are satisfactory, as discussed in Chapter 4, the gravity, soil absorption system will treat and dispose of septic tank effluent. However, particularly where groundwater conditions are high, the septic tank effluent is not always retained within the disposal field for a sufficient period of time for adequate treatment. The result of this reduced detention time is elevated levels of fecal coliform and high concentrations of other wastewater constituents. Failure of these conventional systems also occurs because of poor design and/or construction, poor soil conditions, development in flood-prone areas, density of development and small lot sizes.

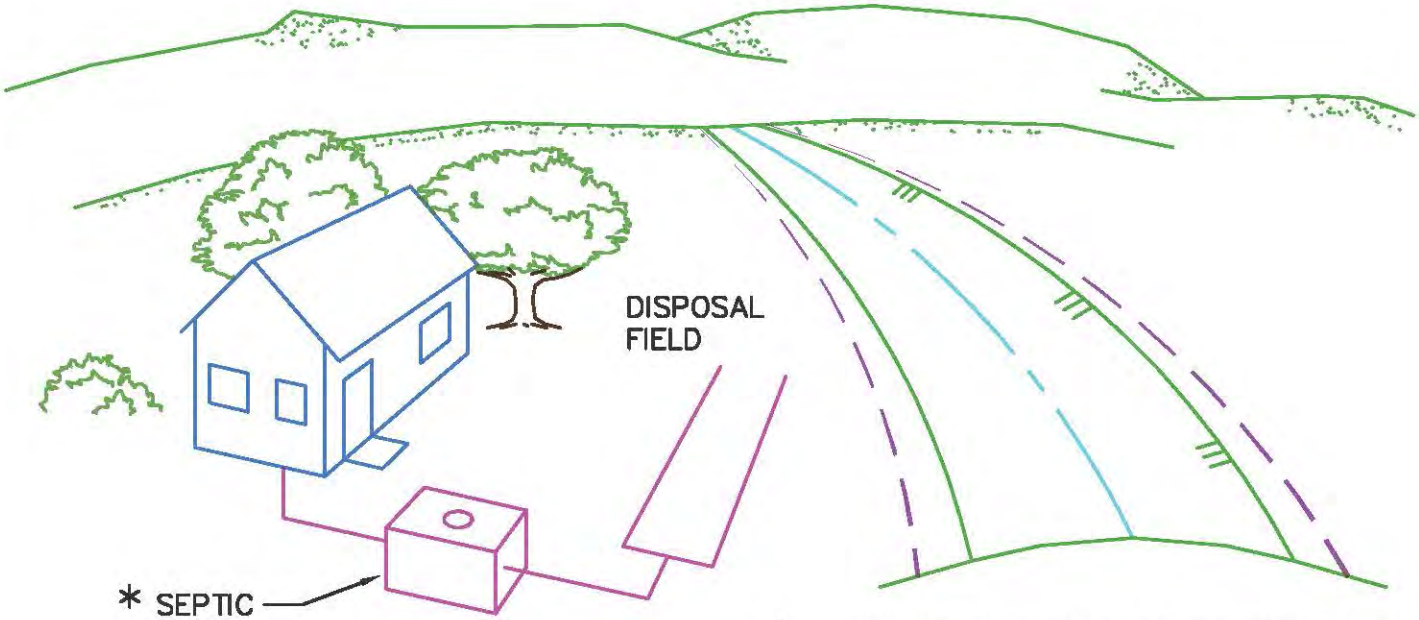
The next development in on-site disposal systems was the use of periodic dosing or pumping of septic tank effluent instead of gravity-flow application. Figure 5-2 illustrates this type of pressure distribution system. In 1984, the Washington State Department of Health states in its "Guidelines for the use of Pressure Distribution Systems" that pressure distribution was desirable in certain locations to:

1. Maintain a uniform application rate throughout the drain field area;
2. Treat and dispose of effluent in the uppermost levels of the soil profile;
3. Aid in mitigating the potential contamination of groundwater in areas of excessively permeable soils;
4. Improve the performance and increase the life span of a drain field; and
5. Reduce the chance of breakout or seepage on slopes.

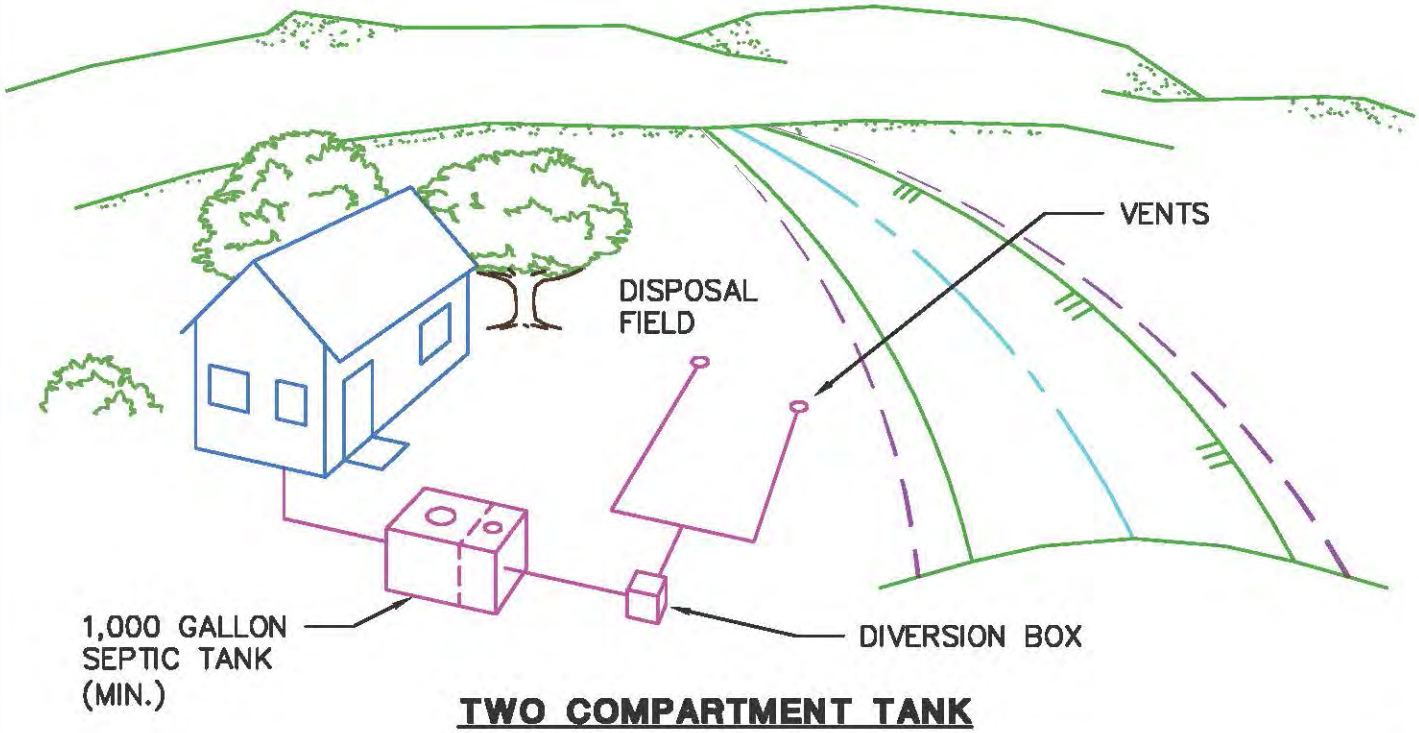
Currently, under WAC 246-272A, pressure distribution is required under most soil types and vertical separation conditions. Refer to Table IV in Appendix C of WAC 246-272A or Table 4-3 earlier in the previous chapter. The use of pressure distribution systems increases both the design and operation complexities for on-site systems. The design application rate needs to be low enough to avoid saturated flow conditions. In addition, in soils with high permeability, effluent should be applied in small doses distributed over the entire disposal area to achieve effective treatment. One potential problem with pressure systems is uneven pressure distribution. The effluent will then be discharged in excessive amounts in localized areas with the lowest pressure, resulting in ponding within the drain field area. This problem is less likely with low pumping rates, intermittent pumping cycles, and proper design and installation.

ALTERNATIVE SEWAGE SYSTEMS

A conventional on-site sewage disposal system consists of a septic tank and gravity flow or pressure distribution to a gravel-filled drain field. Other on-site sewage disposal sewage treatment and/or disposal system is an "alternative" system. Alternative systems are reviewed and approved by the Washington State Department of Health (DOH). Upon DOH approval, standards for performance, application, design, and operation and maintenance are developed for implementing the specific technology. When such standards exist the local health officer may issue permits for the alternate technology or system.



SINGLE COMPARTMENT TANK



TWO COMPARTMENT TANK

MASON COUNTY
HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE 5-1
CONVENTIONAL ON-SITE SEWAGE
DISPOSAL SYSTEMS

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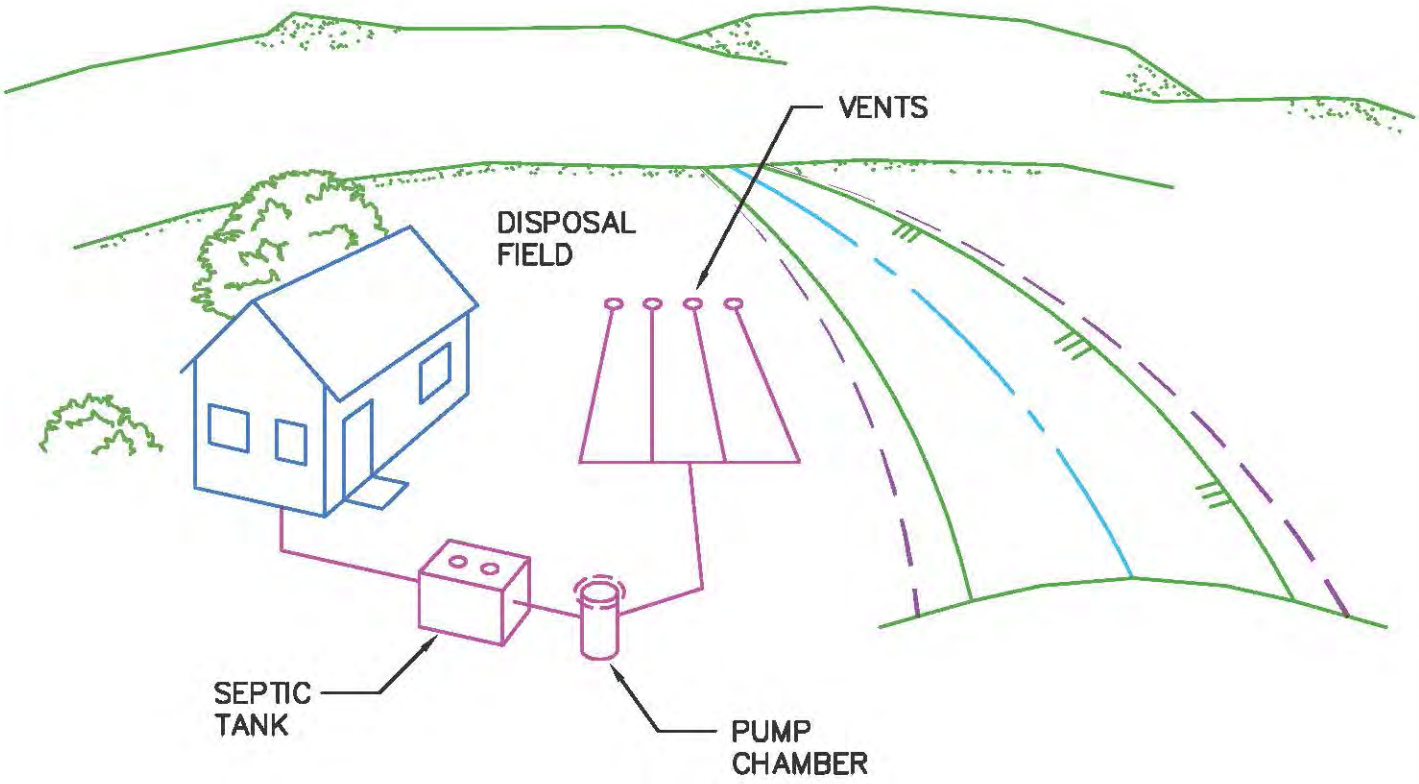
M:\MASONCO\07570\FIGURES\FIG.5-1.DWG, 5-1, 7/6/2007 11:17:35 AM, 1:1, BY: M NAGEL



MASON COUNTY
HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE 5-2
PRESSURE DISTRIBUTION SYSTEM

Gray & Osborne, Inc.
CONSULTING ENGINEERS

M:\MASONCO\07570\FIGURES\FIG.5-2.DWG, 5-2, 7/6/2007 11:17:18 AM, 1:1, BY: M NAGEL

A subcategory of the alternate systems is the proprietary device or method. Typically, proprietary devices are held under other alternative systems; therefore, DOH must approve the proprietary product before it may be authorized by local authorities. DOH maintains a list of approved systems and products.

For marginal site conditions, such as shoreline locations, "Level A" or "Level B" may be necessary to meet the requirements under WAC 246-272A. These standards are applicable for repair and replacement. The specific requirements are shown in Table 4-3 in the previous chapter, or Appendix C, Table VI, of WAC 246-272A. The most common method to achieve these standards is an intermittent sand filter. Intermittent sand filters are shallow beds of sand provided with a surface distribution and an underdrain collection system. The treated effluent is collected at the bottom of the filter and discharged to a disposal field, either by a pump or a gravity flow. The filter may be located either above or below grade. In addition, if "Level A" is required, a disinfection unit may be included following the sand filter. This type of system is illustrated in Figure 5-3.

Unlike the biological activity that occurs with a septic tank, where facultative conditions exist, the sand filter provides for BOD_5 removal and ammonia removal under aerobic conditions. In addition, the conversion of nitrate to nitrogen gas can occur if anaerobic bacteria coexist within the filter bed.

In addition to the treatment units, such as the sand filter, the list of items approved by DOH also includes septic tanks, composting or incineration toilets, gravelless drain field systems, mound systems, and vaults and pit privies.

Both the composting and incineration toilets are designed to reduce the total wastewater volume up to 50 percent and also provide a significant reduction in nitrogen loading. The remaining wastewater from household fixtures excluding water and solids from toilets may then be treated through conventional or alternative means. There are several difficulties with the installation of composting or incineration toilets for existing residences. The plumbing would need to be separated and additional venting and electrical installed. Use with new construction is more feasible than modifying existing residences.

The alternative sewage systems address many of the problems with conventional on-site systems by providing a higher level of treatment, more even distribution of septic tank effluent, and greater vertical separation from groundwater. However, the alternative systems are much more expensive to construct, operate, and maintain. The installation of the latest systems can cost over $20,000 to construct and, if the system is to function effectively, requires significant operation and maintenance. Table 5-1 provides cost comparisons of typical conventional on-site and alternative residential system in use within the state of Washington. Cost will vary significantly based on individual site conditions. In addition, costs for commercial units or cluster system units may be significantly greater than residential uses.

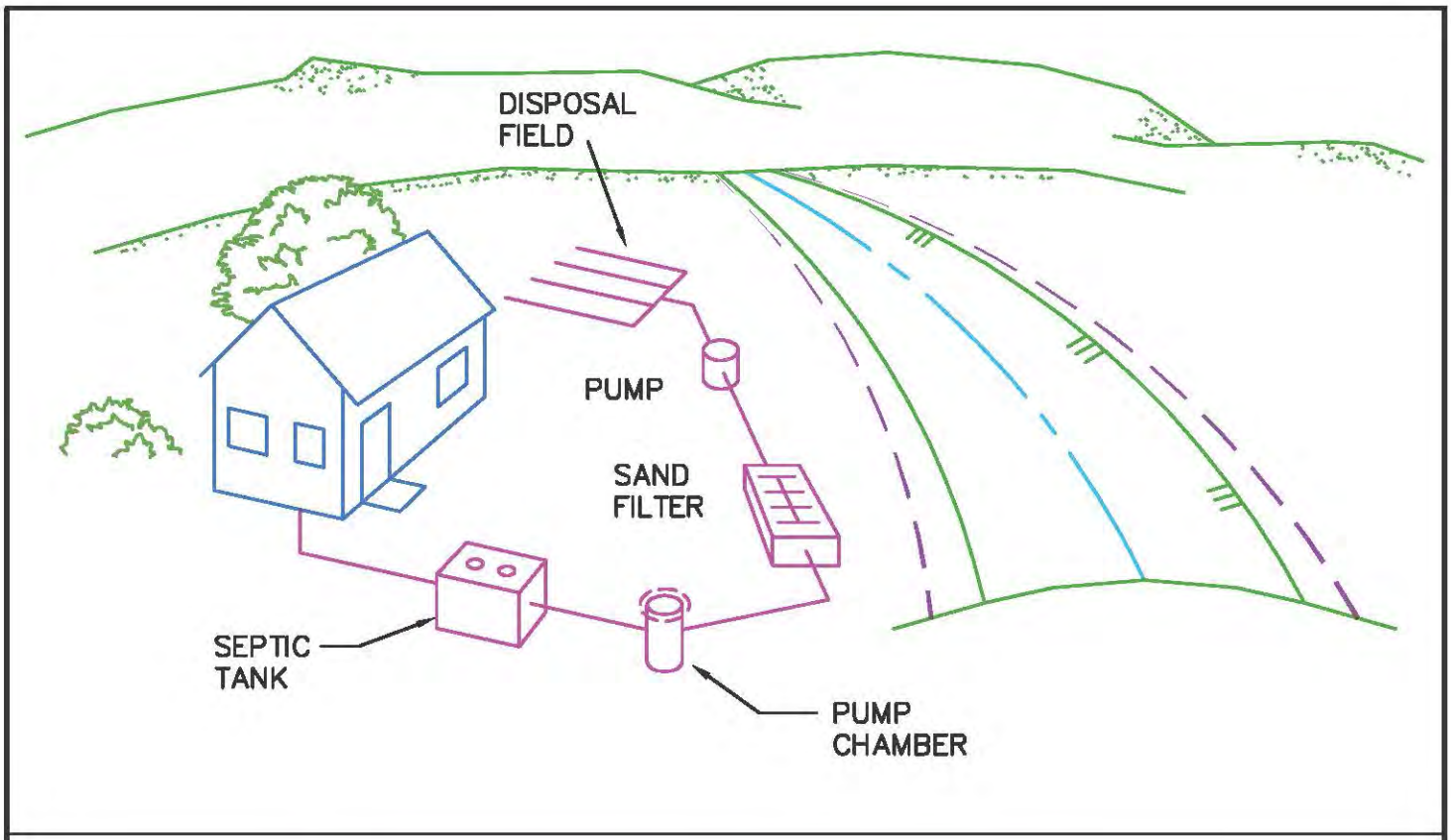
Under WAC 246-272A, there is a new standard for nitrogen reduction called Level N. The Level N standard is a total effluent nitrogen concentration of 20 mg/L. Currently, the DOH List of Approved Systems and Products does not include any product to meet the Level N standard. However, other states have approved systems in place to achieve this standard or better. The New Jersey Pinelands Commission has approximately 85 on-site systems installed for nitrogen reduction. The overall cost with the drain field is included in Table 5-1. With equipment, installation, engineering, service package, and permits, the total cost covers a range of $30,000 to $35,000.

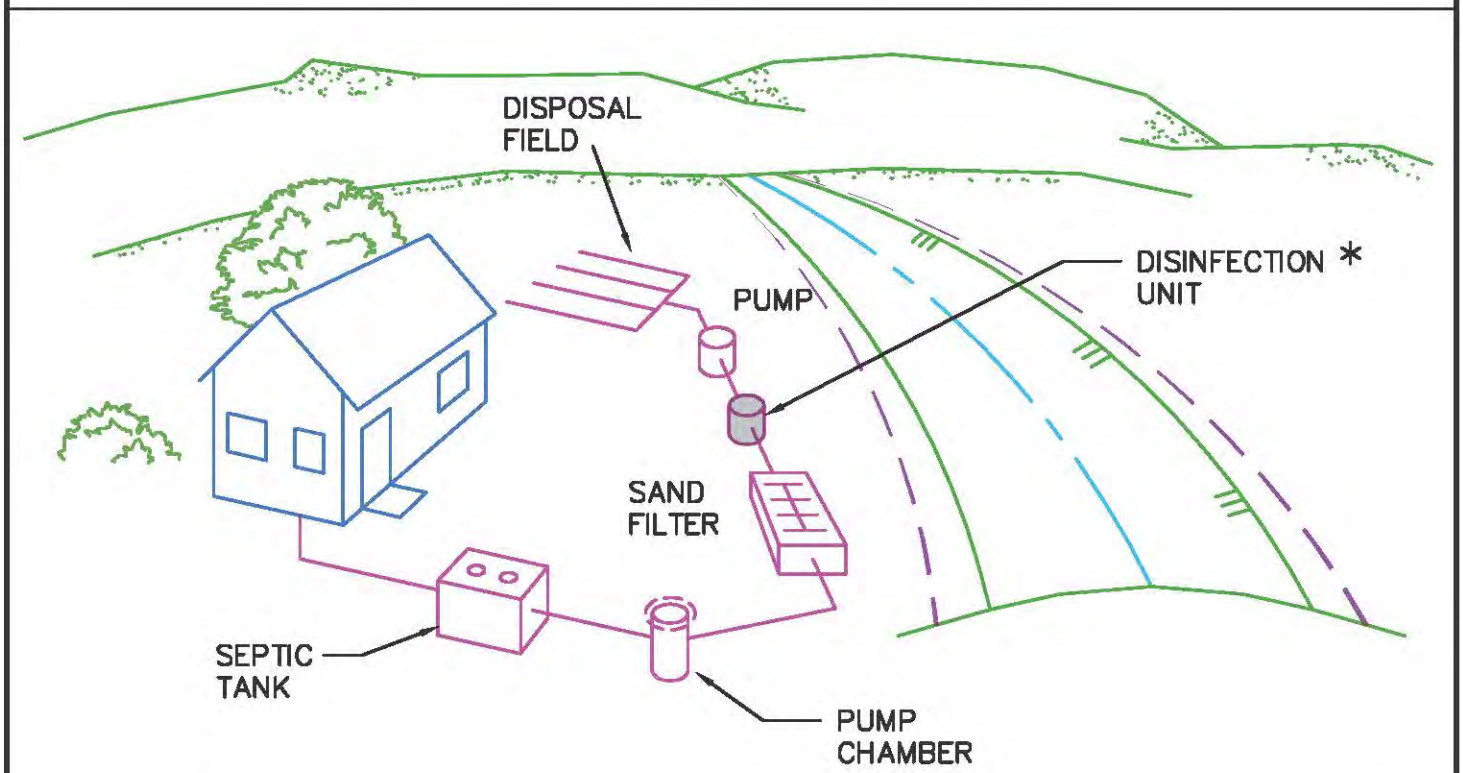
TABLE 5-1

Conventional and Alternative On-Site Sewage System Costs(1)

Type of System	Total Cost
Conventional	
• 1,000 Gallon Septic Tank with Gravity Flow Discharge	$ 6,000
• 1,000 Gallon Septic Tank with Pressure Distribution	$ 8,000
Alternative	
• 1,000 Gallon Septic Tank, Pressure Distribution, and Mound System	$12,000
• 1,200 Gallon Septic Tank, Pump, Sand Filter and Pressure Distribution	$20,000
• 1,200 Gallon Septic Tank, Pump, Sand Filter with Disinfection and Pressure Distribution	$24,000
• 1,200 Gallon Septic Tank, Complete System Package for Nitrogen Reduction, and Drain Field	$30,000 to $35,000
Other	
• Composting Toilet	$10,000

(1) Costs presented in this table are a result of discussions with local installers, designers, and equipment vendors and are intended to cover design, permitting, and installation. Costs for nitrogen reduction are from the New Jersey Pinelands Commission.





* DISINFECTION MAY BE REQUIRED TO ACHIEVE TREATMENT STANDARD 1 UNDER WAC 246-272 OR LEVEL A UNDER WAC 246-272A.

MASON COUNTY
HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE 5-3
TYPICAL ALTERNATIVE SEWAGE DISPOSAL SYSTEMS

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M:\MASONCO\07570\FIGURES\FIG.5-3.DWG, 5-3, 7/6/2007 11:16:55 AM, 1:1, By: M NAGEL

At the same time on-site systems were being improved and their costs were escalating, means of providing centralized wastewater treatment to rural areas were developing. Over the past 20 years, low pressure sewer collection systems have come into common use to deliver wastewater to a centralized treatment facility. These centralized systems not only meet the new more stringent regulatory and environmental requirements, they can also remove nutrients in the wastewater and reclaim the water for reuse.

TREATMENT PERFORMANCE OF ON-SITE SYSTEMS

As with other wastewater treatment systems, the objective of a properly designed and constructed on-site sewage disposal system is effective treatment of the wastewater from individual residences so that it protects public health, does not cause any nuisance conditions, and does not impact any of the beneficial uses of local surface water or groundwater. The principal constituents of concern are BOD_5, TSS, nitrogen, phosphorous, bacteria and viruses. Treated septic tank effluent travels either to groundwater, nearby water courses, or both.

Performance data for various on-site components are presented in Table 5-2. The table presents the contaminant levels found in raw wastewater and shows reduction occurring with septic and drain fields to sand filters and disinfection. See Table 4-4 for discussion of Levels A and B treatment standards, and Appendix C for new DOH rules. The performance characteristics of on-site systems will vary significantly depending on local site conditions. Low temperatures in the soil, for example, will limit the rate of biological treatment and low alkalinity will limit the system's capability to convert ammonia to nitrate. The type of soil, as shown in Table 4-5, will control the maximum hydraulic loading rate, as gallons per day per square foot.

TABLE 5-2

Treatment Performance of On-Site Components
(Contaminant Reduction)

Parameter[(1)]	Raw Wastewater[(1)]	Septic Tank Effluent[(1)]	Drain Field[(1)]		Sand Filter[(1)] Effluent	Sand Filter w/Disinfection
			1.0 Ft. Below Trench	3.0 Ft. Below Trench		
BOD_5, mg/L	210 – 530	140 – 200	0	0	<10	<10
TSS, mg/L	210 – 600	50 – 90	0	0	<10	<10
Nitrogen, mg/L						
Total	35 – 80	25 – 60	--	--		
Ammonia	7 – 40	20 – 60	25	--	<0.5	<0.5
Nitrate	<1	<1	40	40	25	25
Total Phosphorous, mg/L	10 – 27	10 – 30	10	1		
Fecal Coliform, MPN/100 ml	$10^6 – 10^{10}$	10^3 - 10^6	$0 – 10^2$	0	$10^2 – 10^4$	$<2 \times 10^2$
Viruses, PFU/ml	Unknown	$10^5 – 10^7$	$0 – 10^3$	0		Unknown

(1) Table 14-7, Wastewater Engineering Treatment, Disposal and Reuse, Metcalf & Eddy, Inc., 3rd Edition.

Table 5-2 indicates both the capabilities and limitations of on-site sewage disposal systems. For conventional on-site systems, there is good removal of BOD_5 and TSS. If vertical separation of 3 feet exists, most of the constituent values are at or below detection limits. The exceptions are nitrate and phosphorous. Even with a sand filter, nitrate concentrations often remain above 20 mg/L. The disinfection step ensures compliance with Level A for fecal coliform under WAC 246-272A.

As discussed in Chapter 4, the nitrate standard for groundwater is 10 mg/L. As shown in Table 5-2, on-site sewage disposal systems cannot treat to this level. However, a single, isolated residential unit will not likely have a significant impact on groundwater quality. The effect of septic tank density increases the likelihood of negative impacts to groundwater. Minimum land area requirements, as shown in Table 4-7, regulate the density of on-site systems for new developments but do not adequately address the potential impacts from existing development density, which may have been in place prior to any new requirements.

EXISTING WASTEWATER SYSTEMS WITHIN THE STUDY AREA

The Hoodsport RAC is currently served by on-site sewage systems. On-site systems serve as the principal means of sewage treatment and disposal for rural and small community residents in Mason County.[1] There are approximately 18,000 to 20,000 on-site sewage systems in unincorporated Mason County. Within the Hoodsport RAC, 258 homes and 38 businesses were counted in the 'windshield' survey conducted in February 2005. Septic system records that were reviewed from the Mason County Health Department included 223 residences and 34 businesses in the study area. The County does not have records for every septic system within the study area, but compiles records for septic systems under the following conditions:

- New construction
- Remodel that requires a construction permit
- Change in zoning
- Repair to septic system
- Citizen complaint
- In some cases, change of ownership

Within the study area County records yielded the following generalizations with regard to on-site septic systems:

1. Of the 684 residences and businesses counted, 257 septic records were available or approximately 38 percent.

2. Of the 257 septic records, only 202 had a date of installation or repair associated with them.

Table 5-3 shows the compilation of data from Mason County records for the 202 septic records, which included date of installation or repair.

Not all on-site systems within the study area have records on file with the County. In the *2000 Finch Creek Study*, only 19 out of 40 properties along Finch Creek Road has records on file. For the expanded area in Hoodsport, including the shoreline, only 40 out of 90 properties had records on file with the County. It is expected that the on-site systems without records would fall into the pre-1980 categories.

TABLE 5-3

Study Area Septic Systems Statistics

Date of Installation or Repair	Number of Septic Systems	Percentage of Gravity or Pressure	Average Lot Size (square feet)	Average Septic Tank Size (gallons)
Pre 1970	29	100% Gravity	22,326	728
1971-1980	30	100% Gravity	43,745	988
1981-1990	37	89% Gravity 11% Pressure	87,348	1,139
1991-2000	86	59% Gravity 41% Pressure	71,054	1,215
2001 to Present	20	13% Gravity 87% Pressure	53,857	1,218
Total	**202**	**72% Gravity 28% Pressure**	**55,666**	**1,058**

Many on-site systems installed over 20 years ago would not meet current state and county design and siting criteria.[2] Few of these systems would have pressure distribution systems or septic tanks greater than 1,000 gallons.

In 1993, Mason County conducted an educational project under a grant from the Puget Sound Water Quality Authority's Public Involvement and Education (PIE) Fund. During that project, 30 failing on-site sewage systems were identified along Finch Creek. According to County records, only a few of these systems have been repaired. Some systems were deemed not repairable due to small lot sizes and the high water table along the creek.

The Mason County Public Health Services rates on-site sewage disposal systems according to one of three categories:

- Functional
- Suspect
- Failure

Criteria for each category are discussed below:

1. Functional: Systems, which showed no signs of failure either by visual inspection or dye testing. The records for these systems will also indicate that they were constructed and located to provide adequate treatment of effluent.

2. Suspect: Systems which showed no visible signs of failure but were suspected of not adequately providing treatment for the following reasons:

   A. Water samples were collected near the drain field with high fecal coliform count (i.e., greater than 200 per 100 ml) but lack confirming dye test results.

   B. Positive dye samples in charcoal packets but either lack of confirming water sample data or dye concentrations too low to conclude system failure.

   C. Systems influenced by high groundwater or tidal conditions.

3. Failure: Systems with surfacing sewage or effluent, being discharged through pipe or tile, observed grey water discharge or the combination of the following:

   A. Dye concentrations ten times, or greater than background levels; and

   B. Water sample with fecal coliform count greater than 200 per 100 ml.

A combination of visual inspection, dye testing, and water sampling is the preferred method for a complete on-site sewage system survey. It is also the most costly. For example, in 1993, Mason County surveyed 17 on-site systems for the commercial area of Allyn. The cost of this work was about $14,000. In addition, where a storm drainage system does not exist, it may be very difficult to properly locate the charcoal packets for effective dye testing.

RELATED STUDIES WITH ON-SITE SYSTEMS WITH THE LOWER HOOD CANAL WATERSHED

The River Basin Team provided an analysis of the Lower Hood Canal watershed in the *Lower Hood Canal Watershed Study Report (April 1991)* and the follow up *Watershed Action Plan (October 1994)*. The Puget Sound River Basin Team was comprised of representatives from the USDA Soil Conservation Service, USDA Forest Service, and

Washington Departments of Ecology and Fisheries. Findings of their analysis included the following elements:

- *3,900 of the 5,300 residential units in the watershed were along Hood Canal or area lakes.*

- *Ninety percent of the residential parcels along Hood Canal have homes located on them, leaving around 300 parcels yet undeveloped.*

- *Small parcel size (from 0.1 to 0.2 acres), inadequate area for on-site sewage disposal, and soils with severe limitations for on-site sewage systems use (99 percent of the soil in the watershed are evaluated as such) combine to substantiate the concerns about residential development and degrading water quality in area lakes, rivers, streams and Lower Hood Canal.*[3]

Figure 5-4 illustrates how the combination of poor on-site systems and limited soils may be hydraulically connected to Hood Canal.

The Puget Sound River Basin Team outlined a number of issues associated with residential and commercial development in the Lower Hood Canal as stated in the following "Problem Statement:"

Problem Statements: Residential & Commercial

1. *Many on-site sewage systems are located in soils with severe limitations for standard on-site system application.*

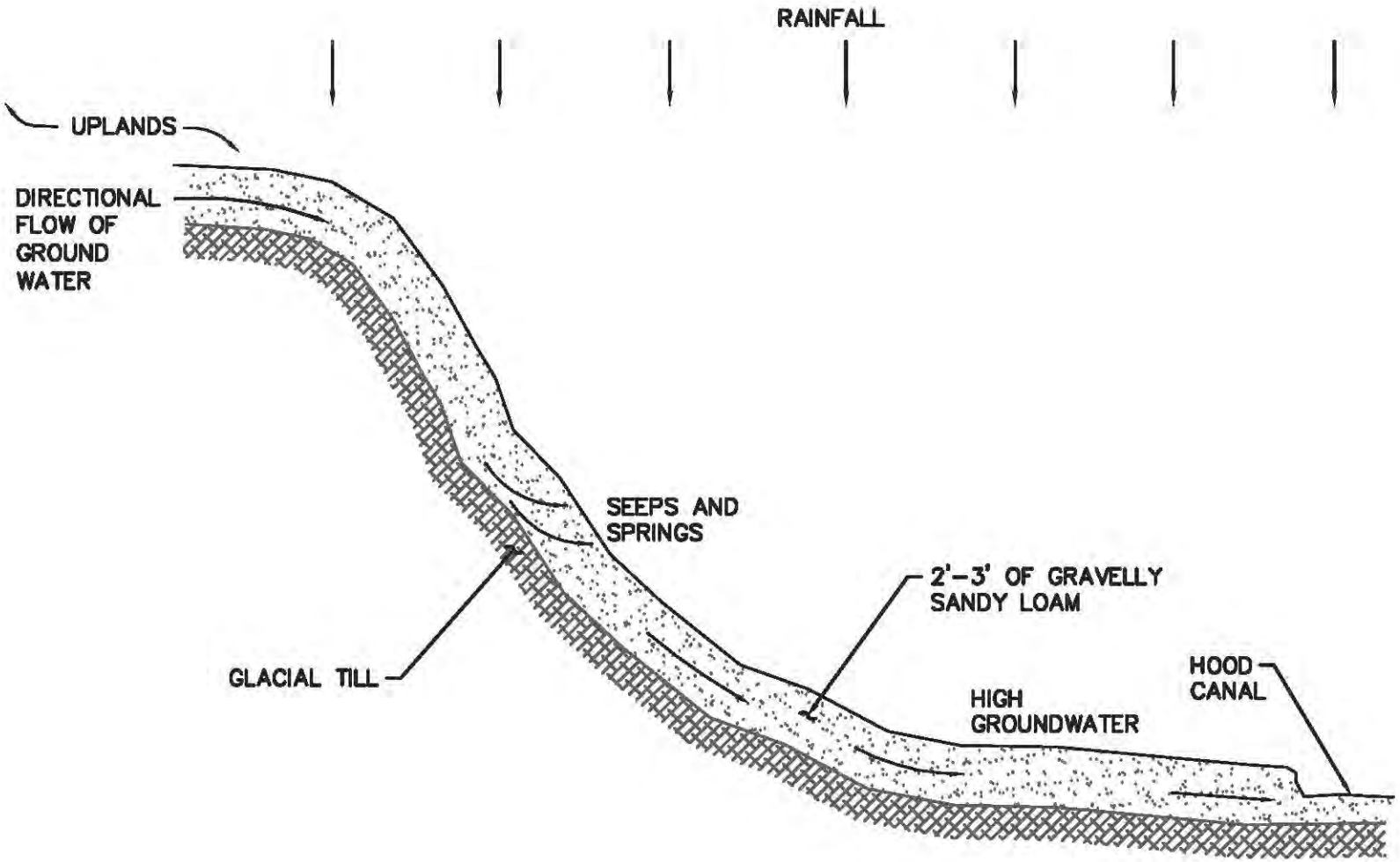
2. *Many on-site sewage systems within the watershed are older, standard gravity-flow systems.*

3. *Many on-site sewage systems are located in fill material contained behind bulkheads situated within the marine intertidal zone.*

4. *Small lot sizes have resulted in sections of densely developed marine shoreline.*

5. *In the past, horizontal setback and vertical separation standards for installation and repair of marine shoreline on-site sewage systems have not been strictly followed.*

6. *Mason and Kitsap Counties lack staff. Additional funding is needed to investigate on-site sewage system problems and follow-up on repair activity in a comprehensive manner.*



MASON COUNTY

HOODSPORT RAC
WASTEWATER FACILITY PLAN

FIGURE 5-4
LATERAL MOVEMENT OF GROUND WATER FROM UPLAND AREAS

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CONSULTING ENGINEERS

7. *Grandfathered on-site sewage systems are being subjected to use beyond original design specifications.*

8. *There is a lack of native vegetation buffers along developed portions of streams, rivers, and the marine shoreline in the watershed.*

9. *High-volume commercial establishments (e.g., restaurants, laundromats, and mobile home parks) are using standard gravity flow systems that may not be fully effective.*

10. *Large commercial on-site sewage systems do not have maintenance and operation contracts.*

11. *Commercial development within the Belfair area is continuing to add to the existing problems.*

12. *Zoning and land use planning has not been in place to address sensitive area concerns within the watershed.*

13. *Mason and Kitsap County's enforcement procedures for failing on-site sewage systems are not adequate because of insufficient resources.*

14. *There are seasonal failures of on-site sewage systems in the watershed.*

15. *There is a need for regulatory agencies to investigate and approve workable, alternative on-site sewage systems for use when standard septic systems are ineffective.*[4]

EFFECTS OF ON-SITE SYSTEMS TO GROUNDWATER AND SURFACE WATER RESOURCES

The HWA report included in Appendix A considered the risk of contaminant transport within the Hoodsport RAC based on soil types, geological conditions, slopes, and distances to surface and ground water. The report established three risk categories as described below:

- Low Risk – Upland areas underlain by glacial till and Hoodsport soils, not near surface water drainages.

- Moderate Risk – Areas mapped as having outwash soils, but not in or near surface water drainages.

- High Risk – Areas within or adjacent to surface water drainages including the Hood Canal coastline. Most of the areas in and near drainages also

contain permeable soils which are more likely to transmit water and contaminants with minimum treatment.

Figure 5-5 presents the three risk areas delineated in the Hoodsport RAC. The low risk area is the uplands area located in the southwest corner of the RAC. The moderate risk area, as shown in Figure 5-5, is a small area of the RAC outside of surface water drainages. The high risk area is the Finch Creek corridor, the shoreline area, and other areas defined by steep slopes. Approximately all areas within 600 feet of the shoreline or Finch Creek would be included within the high risk area.

PUBLIC HEALTH AND SAFETY

As a result of fecal coliform contamination of shellfish beds, the Washington State Department of Health closed the tidelands to shellfish harvesting at the Hoodsport fish hatchery at the mouth of Finch Creek. Based upon similar studies and surveys in the Belfair/Lower Hood Canal area, on-site system failures were determined to be a major contributor to fecal coliform problems within the Canal.

WATER QUALITY STUDIES IN HOOD CANAL

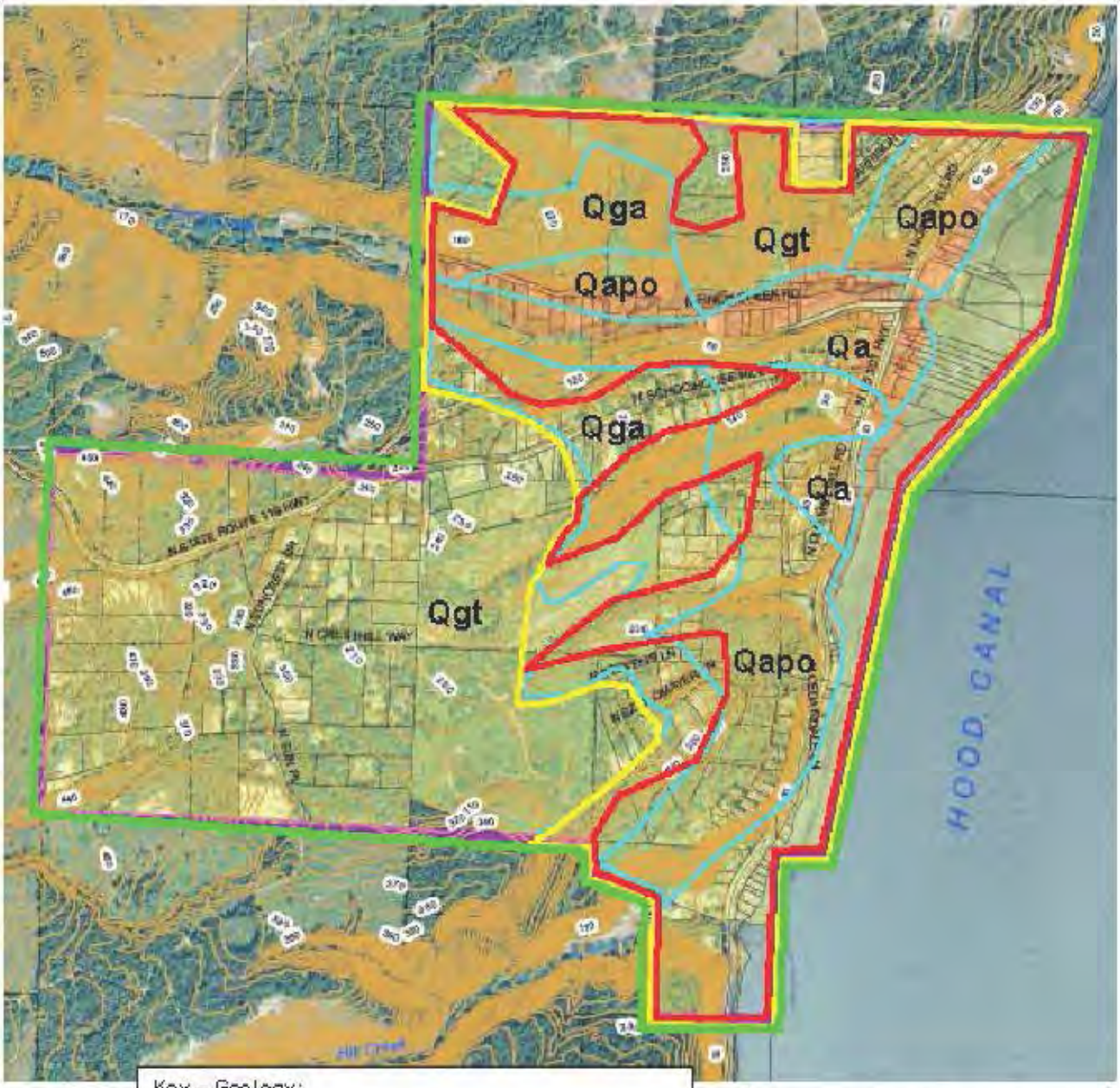
Health has established approximately 67 marine monitoring stations in Lower Hood Canal, some of which are shown in Figure 2-10. These stations are along the shorelines of the Canal and are distributed among four monitoring areas: Hood Canal #6, #7, #8, and #9. Hoodsport is located within Hood Canal #6. Due to high fecal coliform in Finch Creek, the shellfish bed located at the mouth is classified as "prohibited." The area is presented in Figure 2-10.

The Department of Health primarily monitors for fecal coliform organisms in terms of number of organisms per 100 ml. The standard for approved shellfish growing waters is a fecal coliform geometric mean not greater than 14 organisms/100 ml, with not more than 10 percent of the samples greater than 43 organisms/100 ml.

For the marine waters in the vicinity of the study area, the 2004 Washington Water Quality Assessment Draft Section 303(d) list included Finch Creek for exceeding standards for fecal coliform, and Hood Canal, both to the north and south of Hoodsport, for exceedences for dissolved oxygen. The complete 2004 303d/305b report can be viewed through Ecology's web page at www.ecy.wa.gov/programs/wq/303d/2002/2002-indext.html.

BUILDING LOT SIZE

In addition to the site evaluation requirements of the Department of Health, consisting of a soil analysis with adequate vertical and horizontal separation, there are several building standards that require a minimum lot size to provide adequate land area to site on-site



Key – Geology:

Qgt - Till, late Wisconsinan (Pleistocene)
Qga - Advance outwash, late Wisconsinan (Pleistocene)
Qgo - Proglacial and recessional outwash, late Wisconsinan (Pleistocene)
Qapo - Alpine outwash, pre–late Wisconsinan (Pleistocene)
Qa - Alluvium (Holocene)

NORTH

Key - Relative contaminant transport risk:

Low
Medium
High

Base mapping by: Mason County (aerial, topo & parcels), Geology by Logan, 2003

MASON COUNTY
HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE 5–5
RELATIVE CONTAMINANT TRANSPORTATION RISK

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M:\MASONCO\07570\FIGURES\FIG.5-5.DWG, 5-5, 7/6/2007 11:19:59 AM, 1:1, By: M NAGEL

systems and drain fields. However, there are ongoing changes in minimum lot size requirements because of the County's new 2005 Comprehensive Plan and recent changes in DOH regulations.

Mason County's development regulations base minimum lot size requirements for on-site systems on the Department of Health's On-Site Sewage regulations, Chapter 246-272A WAC. This WAC regulates the location, design, installation, operation and maintenance, and monitoring of on-site systems to specifically limit discharge of sewage effluent to waters of the state. Development along the shorelines of the County now must meet the building lot requirements of the County's 2005 Comprehensive Plan.

As outlined in Mason County Plats & Subdivisions ordinance (Title 16), basic minimum requirements for lot sizes shall be as follows:

> *(1) All lots shall have a minimum average width of not less than one-third of the median length and a minimum width at any point of twenty-five (25) feet.*
>
> *(2) The minimum area of lots served by municipal sewage works shall be six thousand (6000) square feet.*
>
> *(3) The minimum gross land areas of lots served by individual sewage systems on each lot shall be twelve thousand five hundred (12,500) square feet. These minimum sizes shall be for lots proposed for single family units outside of urban growth areas. Lots for single family units inside of urban growth areas and for multiple family units shall be as approved by the Mason County Planning Commission.*

The latest amendments to Title 16 contain provisions for density bonuses. Under these provisions if a developer seeks to gain either a reduction in the minimum lot size or additional residential density, a portion of the developable land can be devoted to open space or other forms of preservation including recreation.

Prior to submission of a preliminary plat, approval must be obtained from the Mason County Environmental Health Division as to the ability of the soils to accept septic tank effluents. In addition, all development in Mason County that relies on individual on-site sewage systems shall comply with Washington State Department of Health regulations, Chapter 246-272A WAC, On-Site Sewage Systems.

Mason County has designated Hoodsport as a Rural Activity Center. As defined, undeveloped areas within an RAC boundary can be developed; however, the recommended density is one unit per 2.5 acres. Lots platted prior to 1996 are not subject to this density requirement and may be able to develop at an average density of one dwelling unit per acre with individual wells.

Table 5-4 summarizes building requirements for residential development along the shorelines based on the 1988 Shoreline Master Program. Residential and accessory units requirements are based on minimum building lot size and multifamily development is based on maximum sewerage. However, the requirements of the 1988 Shoreline Master Program have been superceded by the County's 2005 Comprehensive Plan. Lot sizes and density limits shall instead be governed by this Plan.

Another consideration that may affect property owners in marine shoreline areas are DOH rules under WAC 246-272A-0015, Local Management and Regulation. Under these rules, Mason County shall develop a plan by July 1, 2007, for managing on-site systems and protect priority areas where on-site systems may pose a public health risk. Among these priority areas are shellfish growing areas and areas where nitrogen has been identified as a contaminant of concern.

TABLE 5-4

Shoreline Master Program Minimum Building Requirements

Environments	Residential Unit	Residence and Accessory Unit	Duplex	Multifamily
	Minimum Lot Size		Maximum Sewerage	
Urban Residential	12,500 sf	18,750 sf	1,570 gal/ac/day	1,570 gal/ac/day
Rural	20,000 sf	20,000 sf	785 gal/ac/day	785 gal/ac/day
Conservancy	5 acres	5 acres	5 acres	5 acres
Natural	N/A	N/A	N/A	N/A

Source: Mason County Shoreline Master Program, 1988.

EXISTING LOT SIZE IN THE HOODSPORT RAC

Mason County Assessor maps and tax rolls were used to provide an analysis of existing lots sizes within the study area. The purpose for this analysis was to ascertain the proportion of existing lots that meet Washington State criteria for on-site systems (WAC 246-272A). The State's on-site criteria require adequate land area for the installation, expansion, or repair of individual on-site systems. Creek frontage and shoreline areas were significant to this Analysis due to the existing density of housing, their close proximity to Hood Canal, and the potential threat to water quality from any failing on-site systems. The minimum building lot size, under ideal conditions, that the County has determined for adequate land area for on-site wastewater treatment and that meets the state criteria for on-site systems is 12,500 ft^2, or approximately one-third acre. However, within the Hoodsport RAC 1 dwelling for each 2.5 acres is specified for new

development. Existing lot sizes less than this standard likely would be required to meet Level A or B treatment standards, or new DOH rules under WAC 246-272A.

The County's assessor records provided the lot size for approximately 38 percent of the known residences within the RAC. The average lot size was calculated to be approximately 55,666 square feet or 1.25 acres. This would indicate that existing lot sizes meet the lot size requirements and contain adequate land area, on average, for installation or repair of on-site systems under current State and County criteria. Table 5-5 summarizes the results of the lot-size analysis. In general, smaller lot sizes are located near shoreline areas and larger parcels in the upland areas. The shoreline area of the Hoodsport RAC is an example where development has occurred on small lot sizes.

The lot size analysis does not account for steep slopes. While the overall lot size may indicate sufficient area for an on-site system, steep slopes may result in unbuildable conditions.

TABLE 5-5

Study Area Existing Lot Sizes(1)

	<1/3 acre(2)	**1/3 to 1 acre**	**1 to 2.5 acres**	**>2.5 acres**	**Total(3)**
Number of Lots	51	65	66	18	200
Percent	26%	32%	33%	9%	100%

(1) Mason County Assessor Records.

(2) Mason County minimum building lot size for siting individual on-site systems: 12,500 ft^2 or 1/3 acre.

(3) Number of lots available in County's assessor records.

FUTURE DEVELOPMENT

Future development in the study area is dependent on the density standards established by Mason County. Table 5-6 is a summary of development densities for the land use categories within the study area.

TABLE 5-6

Hood Canal Study Area Development Densities

Land Use Designation	Residential Density[(1)]	Maximum Building Size
Rural Activity Center	1 du/2.5 acres	10,000 sf
Shoreline Rural	20,000 sf	Varies
Shoreline Urban	12,500 sf	Varies
General Rural Area	Varies (1 du/2.5, 5, 10, 20 acres)	3,000 sf

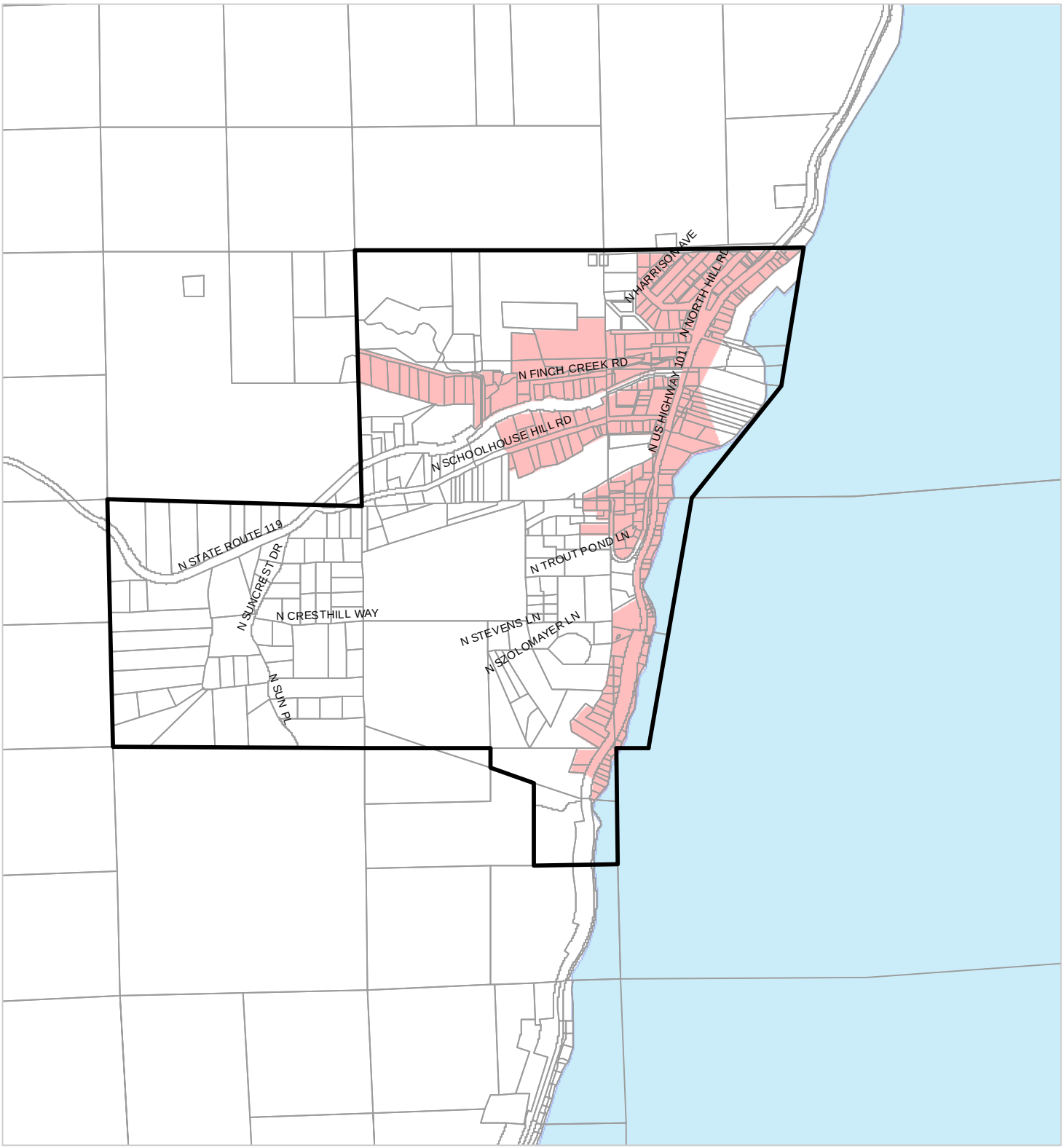
Mason County has established lot size standards for RACs and other areas by its Comprehensive Plan. As shown in Table 5-6, the standard for the RAC is one dwelling unit per 2.5 acres. This standard, however, addresses new lot creation. In Hoodsport and other areas, there are a large number of existing legal lots which are less than the 2.5-acre standard. For existing legal lots, the regulations which are most pertinent are the on-site regulations under WAC 246-272A, effective July 2007. These WAC requirements are found in Table X, WAC 276-272A-0320, in Appendix C. For existing legal lots the most important considerations are the availability of a public water supply and the type of soil. With the Hoodsport RAC, there are approximately 460 existing legal lots, and some of these can be developed even though they do not meet the current lot size requirements.

PROPOSED SERVICE AREA

Environmental conditions within the Hoodsport RAC indicate that the highest risk of contaminant transport is found in the Finch Creek and Highway 101 corridor. This area is shown in Figure 5-5. This area also contains most of the commercial development of the RAC and some of the residential development with substandard lots. In addition, as an RAC, new development should follow the standard of one dwelling per 2.5 acres. Most of the large, undeveloped parcels which can accommodate lots of this size are found in upland areas, west of the commercial corridor. Typically, this development density (e.g., one unit per 2.5 acres) is too low to support a sewer system.

Figure 5-6 presents the proposed service area. This basis for this proposal is the area identified as the highest risk for contaminant transport to Hood Canal (Figure 5-5) coinciding with existing development density (Figure 3-3). Not all of the high risk area shown in Figure 5-5 is included within the service area. Areas excluded are either not buildable or currently lack any substantial development. One of the high risk areas is located in the northwest corner of the RAC and north of Finch Creek. None of this area is currently developed.

The Finch Creek Study of August 2000 considered a service area identified as Service Area 2 with a population of 139. The proposed service area is an expansion of Service Area 2. The expanded area contains residential development along Highway 101 south to Hill Creek, Cedardale Lane, parts of Old Mill Hill Road and North Schoolhouse Road,



LEGEND:

- HOODSPORT RAC
- PARCELS
- PROPOSED SERVICE AREA

N

0 750 1,500 Feet

MASON COUNTY

HOODSPORT RAC WASTEWATER FACILITY PLAN FIGURE 5-6

PROPOSED SERVICE AREA

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O:\CLIENTS\MasonCo\HOODSPORT RAC WW PLAN\FIG1-1.mxd

and North Hill Road. The estimated number of additional residential connections with this expanded area, arrived at through the 2005 "windshield" survey, is shown below:

• South along Highway 101, including Cedardale Lane	16
• Old Mill Hill Road	24
• North Schoolhouse Road	20
• North Hill Road	13
• North Harrison	10
	83

Including Service Area 2 and the expanded area, the population for the proposed service area is presented below in Table 5-7.

TABLE 5-7

Existing Service Area Population

Area	Population
Service Area 2(1)	139
Expanded Area(2)	207
Total	**346**

(1) Table 6-3, *Finch Creek Wastewater Feasibility Study* (August 2000).
(2) 83 residences x 2.49 ppc = 207.

[1] Puget Sound Notes, Number 39, June 1996, Puget Sound Water Quality Authority, p. 1.
[2] Lower Hood Canal Watershed Action Plan, Prepared by the Lower Hood Canal Watershed Management Committee, 1994, p. 2-3.
[3] Lower Hood Canal Watershed Action Plan, p. 2-3.
[4] Ibid., p. 2-3.

CHAPTER 6

WASTEWATER FLOWS AND LOADING

INTRODUCTION

Typically, wastewater is predominantly domestic in origin with lesser amounts contributed by commercial and industrial businesses and by public use facilities such as schools, parks, hospitals, and municipal functions. Infiltration and inflow contributions result from groundwater and surface water entering the sewer system during periods of rainfall and high groundwater levels.

Because there is not an existing wastewater treatment facility, unit flows and loadings from standard references sources or other utilities are utilized.

DEFINITION OF TERMS

In this Chapter, expected wastewater characteristics for the Hoodsport RAC will be analyzed and projections made for future conditions. The terms and abbreviations used in the analysis are described below.

WASTEWATER

Wastewater is water-carried waste from residential, business, and public use facilities that together with quantities of groundwater and surface water enter the sewer system through defective piping and direct surface water inlets. The total wastewater flow is quantitatively expressed in millions of gallons per day (mgd).

DOMESTIC WASTEWATER

Domestic wastewater is wastewater generated from single- and multi-family residences, mobile home courts, and group housing facilities such as nursing homes. Domestic wastewater flow is generally expressed as a unit flow based on the average contribution from each person per day. The unit quantity is expressed in terms of gallons per capita per day (gpcd).

EQUIVALENT RESIDENTIAL UNIT (ERU)

An Equivalent Residential Unit (ERU) is a baseline wastewater generator that represents the average single-family residential household. An ERU can also express the average annual flow contributed by a single-family household in units of gallons per day (gpd).

INDUSTRIAL WASTEWATER

Industrial wastewater is wastewater generated from process operations such as metal plating, photo processing, food industry, and similar operations. The Hoodsport area does not have any industrial operations.

NONRESIDENTIAL WASTEWATER

Nonresidential wastewater is wastewater generated from business activities, such as restaurants, retail and wholesale stores, service stations, and office buildings. Nonresidential wastewater quantities are expressed in this Plan in terms of ERUs.

INFILTRATION

Infiltration is groundwater entering a sewer system by means of defective pipes, pipe joints, or manhole walls. Infiltration quantities often exhibit seasonal variation in response to groundwater levels. Storm events or irrigation trigger a rise in the groundwater levels and increase infiltration. The greatest infiltration is observed following significant storm events or prolonged periods of precipitation. Infiltration and inflow following storm events is referred to as rain dependent infiltration/inflow (RDI/I). Since infiltration is related to the total amount of piping and appurtenances in the ground and not to any specific water use component, it is generally expressed in terms of the total land area being served. The unit quantity generally used is gallons per acre per day (gpd/acre), or gallons per day per capita (gpcd).

INFLOW

Inflow is surface water entering the sewer system from yard, roof and footing drains, from cross connections with storm drains, and through holes in manhole covers. Peak inflow occurs during heavy storm events when storm sewer systems are taxed beyond their capacity, resulting in hydraulic backups and local ponding. Inflow, like infiltration, can be expressed in terms of gallons per capita day or gallons per acre per day.

AVERAGE DRY WEATHER FLOW

Average Dry Weather Flow (ADWF) is wastewater flows during periods when the groundwater table is low and precipitation is at its lowest of the year. The dry weather flow period in western Washington normally occurs during June through September. During this time, the wastewater strength is highest, due to the lack of dilution with the ground and surface water components of infiltration and inflow. The higher strength coupled with higher temperatures and longer detention times in the sewer system create the greatest potential for system odors. The average dry weather flow is the average daily flow during the three lowest consecutive flow months of the year. ADWF covers average flows for July, August, and September.

AVERAGE ANNUAL FLOW

Average Annual Flow (AAF) is the average daily flow over a calendar year. This flow parameter is used to estimate annual operation and maintenance costs for treatment and pump station facilities.

MAXIMUM MONTH FLOW (TREATMENT DESIGN FLOW)

Maximum Month Flow (MMF) is the highest monthly flow during a calendar year. In western Washington, the maximum month flow occurs in the winter. This wintertime flow is composed of the normal domestic, commercial, and public use flows with contributions from inflow and infiltration. The predicted maximum month flow at the end of the design period is used as the design flow for sizing treatment processes and selecting treatment equipment.

PEAK HOUR FLOW

Peak Hour Flow (PHF) is the highest hourly flow during a calendar year. The peak hour flow may occur in response to a significant storm event preceded by prolonged periods of rainfall, which have previously developed a high groundwater table in the service area. Peak hour flows are used in sizing the hydraulic capacity of wastewater collection, treatment, and pumping components. Peak hour flow is typically determined from treatment plant flow records and/or accepted peaking factors.

BIOCHEMICAL OXYGEN DEMAND

Biochemical Oxygen Demand (BOD) is a measure of the oxygen required by microorganisms in the biochemical oxidation (digestion) of organic matter. The term BOD typically refers to a 5-day period, often written BOD_5, since the BOD_5 test is typically run for 5 days. BOD_5 is an indicator of the organic strength of the wastewater. If BOD_5 is discharged untreated to the environment, biodegradable organics will deplete natural oxygen resources and result in the development of septic (anaerobic) conditions. BOD_5 data together with other parameters are used in the sizing of the treatment facilities and provide a measurement for determining the effectiveness of the treatment process. BOD_5 is expressed as a concentration in terms of milligrams per liter (mg/L) and as a load in terms of pounds per day (lbs/day). The total BOD_5 of a wastewater is composed of two components – a carbonaceous oxygen demand (CBOD) and a nitrogenous oxygen demand (NBOD).

SUSPENDED SOLIDS

Suspended Solids is the solid matter carried in the waste stream. The Total Suspended Solids (TSS) in a wastewater sample is determined by filtering a known volume of the sample, drying the filter paper, and measuring the increase in weight of the filter paper. TSS is expressed in the same terms as BOD; milligrams per liter for concentration and

pounds per day for mass load. The amount of TSS in the wastewater is used in the sizing of treatment facilities and provides another measure of the treatment effectiveness. The concentration of TSS in wastewater affects the treatment facility biosolids production rate, storage requirements, and ultimate disposal requirements.

FECAL COLIFORM

Under WAC 246-272A, the Washington State Department of Health defines fecal coliform as bacteria common to the digestive systems of warm-blooded animals that are cultured in standard tests. Counts of these organisms are typically expressed as the number of colonies per 100 ml.

Raw wastewater may have a fecal coliform value of 1×10^6 colonies per 100 ml (*Wastewater Engineering Treatment Disposal and Reuse*, Metcalf and Eddy, Inc., 3rd Edition). Septic tank effluent will show some reduction or "die off" of fecal coliform to about 1×10^4 per 100 ml. For each gallon of wastewater discharged from a septic tank, there are an estimated 400,000 fecal coliform, or 4×10^5 FC. Further reductions in the number of fecal coliform occur through the drain field of an on-site system or through disinfection units of centralized wastewater treatment facilities.

The large numbers of fecal coliform associated with raw wastewater or septic tank effluent, when compared to DOH and Ecology standards, provide an indication of the scale of required reduction in fecal coliform. Level A and B treatment standards, as discussed in Chapter 4 for on-site wastewater systems require, respectively, 200 and 1,000 fecal coliform counts per 100 ml. The State's marine water quality standard is 14 fecal coliform per 100 ml. To achieve these types of standards requires either a well designed on-site system or disinfection unit.

OTHER CONTAMINANTS OF CONCERN

Other contaminants of concern in wastewater include nutrients, priority pollutants, heavy metals, and dissolved organics. Many of the more stringent permit standards that have been developed recently deal with the removal of nutrients and priority pollutants.

Nutrients such as nitrogen and phosphorus, along with carbon, are essential requirements for growth. When discharged to the aquatic environment, these nutrients can lead to the growth of undesirable aquatic life. When discharged in excessive amounts on land, they can also lead to the pollution of groundwater. Additionally, in too high a concentration, nutrients, particularly ammonia, can be toxic to aquatic life. For this Plan, nitrogen loading is particularly important due to the marine environment of Hood Canal.

Priority pollutants are organic and inorganic compounds selected on the basis of their known or suspected carcinogenicity, mutagenicity, teratogenicity, or high acute toxicity. Many of these compounds are found in wastewater. Inorganic constituents, including heavy metals, are often added to wastewater from commercial and industrial activities

and may have to be removed if the wastewater is to be reused, or if the presence of the metals will adversely affect the receiving water. Some heavy metals (most notably copper) can be present in wastewater due to leaching from drinking water pipes.

HISTORICAL DOMESTIC WASTEWATER FLOWS

Because there is not an existing wastewater treatment facility, there is not any historical data for the study area. Data, however, is available for the nearby North Bay-Case Inlet water reclamation facility and is presented in Table 6-1. The data in Table 6-1 covers only dry weather months and provides an estimate of domestic wastewater flows without infiltration/inflow (I/I).

TABLE 6-1

North Bay-Case Inlet Water Reclamation Facility Per Capita Flows

Month/Year	Average Flow (mgd)	Population Served	Per Capita Flow (gpcd)
July 2004	0.124	2,230	55
August 2004	0.124	2,230	55
September 2004	0.119	2,230	53
Average			**54**

In addition, data on water consumption for non-irrigation use in the Belfair Water District, Lakeland Village, and Union indicate an average per capita water consumption of 65 gpcd.

The Washington State Department of Ecology's Manual, *Criteria for Sewage Works Design*, recommends using an average per capita domestic contribution of 100 gpcd, which includes a normal infiltration allowance of 30 gpcd. However, where other information is available, it should be utilized.

For this Plan, an average unit wastewater flow of 65 gpcd will be utilized. For maximum month conditions a per capita flow of 80 gpcd will be used to account for higher I/I flows.

The North Bay-Case Inlet collection system consists of a combination of low pressure (grinder pump) and gravity pipelines. For the low pressure system, infiltration/inflow contributions are low but do exist due to sump pumps, building drains, and periodic flooding.

UNIT FLOWS AND LOADINGS

Flows and loading estimates were developed in the *Hoodsport-Skokomish Wastewater Management Alternatives Analysis* (October 2006) and are also utilized in this Plan. The unit flows and loading values are summarized in Table 6-2.

TABLE 6-2

Unit Flows and Loading Values

	Value
Flows: Residential	
Average Per Capita Flow, gpcd	65
Maximum Month Flow, gpcd	80
Peaking Factors	
Maximum Day to Average Day	2.0
Peak Hourly to Average Day	3.5
Flows: Commercial	
Equivalent Residential Unit (ERU), gpd	200
Restaurant	50 gpd/seat
Motel	65 gpd/room
Peaking Factors	
Maximum Month to Average Day	1.25
Maximum Day to Average Day	2.0
Peak Hourly to Average Day	3.5
Loadings: Residential	
BOD_5, lbs/capita/day	0.18
TSS, lbs/capita/day	0.20
TKN, lbs/capita/day	0.029
Peaking Factors	
Maximum Month to Average Day	1.25
Peak Day to Average Day	—
Loadings: Commercial	
BOD_5, lbs/ERU/day	0.45
TSS, lbs/ERU/day	0.50
TKN, lbs/ERU/day	0.072
Restaurant	0.2 lbs/day/seat for BOD_5 and TSS; 0.032 lbs/day/seat for TKN
Motel	0.26 lbs/day/room for BOD_5 and TSS; 0.042 lbs/day/room for TKN
Peaking Factors	
Maximum Month to Average Day	1.25
Peak Day to Average Day	—

Most of the commercial units listed in Table 6-2 would be expected to be small contributors of wastewater and will be equivalent to a single residential connection or

less. A single-family residential connection is defined as an equivalent residential unit (ERU). One ERU is 200 gpd (80 gpcd x 2.5 persons per unit = 200 gpd).

EXISTING FLOWS AND LOADINGS

Wastewater flows consist of contributions both from commercial and residential sources. Residential flows are based on population and unit flows of 65 or 80 gpcd. Commercial flows are based on the number of ERUs, restaurant seats, or rooms as shown below in Table 6-3.

TABLE 6-3

Hoodsport RAC Existing Commercial Wastewater Flows

Business Type	Number	Design Units (each)	Unit Flow (gpd)	Maximum Month Wastewater Flow (gpd)
Restaurants	6	10 seats	50	3,000
Vacant/Closed	6	0.5 ERU	200	600
Boutique/Hair Salon	4	1 ERU	200	800
Post Office/Library/Bank	3	0.5 ERU	200	300
Churches	2	1 ERU	200	400
Clinics	2	2 ERU	200	800
Hardware Store	2	0.5 ERU	200	200
National Forest/Park Office	2	0.5 ERU	200	200
Other	2	0.5 ERU	200	200
Real Estate	2	0.5 ERU	200	200
RV Storage/Auto Repair	2	0.5 ERU	200	200
Fire Station	1	2 ERU	200	400
Fish Hatchery	1	0.5 ERU	200	100
Gas Station	1	0.5 ERU	200	100
Motel	1	15 rooms	65	975
Nursery	1	0.5 ERU	200	100
Total	**38**			**8,575 gpd**

Table 6-4 presents both flow and loading estimates for existing conditions for the proposed service area. These estimates have been developed using current population and commercial development and unit values shown in Table 6-2.

TABLE 6-4

Existing Flows and Loadings Estimates

	Service Area
Wastewater Flows:	
Average Flow, gpd	29,652
Maximum Month Flow, gpd	36,495
Maximum Daily Flow, gpd	59,304
Peak Hour Flow, gpd	103,782
Wastewater Loadings:	
BOD_5:	
Average, lbs/day	92
Maximum Month, lbs/day	115
TSS:	
Average, lbs/day	97
Maximum Month, lbs/day	121
TKN:	
Average, lbs/day	14
Maximum Month, lbs/day	18

The flows and loading values presented in Table 6-4 indicate a wastewater strength concentration covering a range of 350 to 400 mg/L BOD_5. Historical values from the County's North Bay-Case Inlet facility suggest that this range is reasonable for planning purposes. Typically, the North Bay-Case Inlet facility has influent BOD_5 concentrations from 250 to 350 mg/L. In addition, where commercial flows include restaurants, higher BOD_5 concentrations can be expected.

FUTURE POPULATION AND PREDICTED FLOWS AND LOADINGS

Future, or predicted, flows and loadings are dependent upon growth within the RAC and changes in land use. In the Alternatives Analysis, an annual growth rate of 3.5 percent was recommended by Mason County for the Hoodsport RAC. This rate was utilized to project population through the year 2025 and resulted in an estimated population of 1,277 for the RAC.

With an area of 584 acres, a 2025 population of 1,277 would result in a density of about 2.2 persons per acre. While approximately one-third of the RAC is characterized by steep slopes, the remaining two-thirds are characterized by a relatively flat plateau. Currently, the south and west areas of the RAC are characterized by low-density development.

For the proposed service area for sewer, it is assumed that the growth rate for commercial flows will be 3.5 percent, but only 1.5 percent for residential population. Much of the

area within the service area is confined by shoreline and steep slopes. Without a conversion in land use (e.g., multifamily) and with the existing lot configuration, population growth is likely to be limited. It is assumed that higher population growth rates will occur elsewhere in the RAC.

Table 6-5 summarizes the population projections for the sewer service area through 2027.

TABLE 6-5

Population Projections

Area	2007	2017	2027
Sewer Service Area	346	401	466

Table 6-6 presents future flow and loading estimates for the sewer service area. The estimates are based on the unit values in Table 6-2, a growth estimate of 3.5 percent for commercial flows, and a growth estimate of 1.5 percent for population.

TABLE 6-6

Future Flows and Loadings

	Sewer Service Area		
	Existing	2017	2027
Wastewater Flows:			
Average Flow, gpd	29,652	35,892	44,153
Maximum Month Flow, gpd	36,495	44,175	54,609
Maximum Daily Flow, gpd	59,304	71,784	88,306
Peak Hour Flow, gpd	103,782	125,622	154,535
Wastewater Loadings:			
BOD_5:			
Average, lbs/day	92	109	136
Maximum Month, lbs/day	115	136	170
TSS:			
Average, lbs/day	97	119	147
Maximum Month, lbs/day	121	149	184
TKN:			
Average, lbs/day	14	18	22
Maximum Month, lbs/day	18	22	27

EQUIVALENT RESIDENTIAL UNITS (ERUS)

Equivalent Residential Units (ERUs) are a means to express residential and commercial flows in terms of single-family households.

The number of residential units was based on current Mason County Assessor records and the count from the "windshield" survey. While Mason County uses 2.49 persons per residential unit, it is likely that the per capita population in Hoodsport is less due to seasonal use of many of the residential units. In any case, each residential unit is counted as one ERU. For commercial connections, the unit value of 200 gallons per day is the basis for an ERU.

Table 6-7 provides estimates for the number of ERUs for 2007, 2017, and 2027. This projected growth, however, will not likely occur without construction of a sewer system. Therefore, for the first few years following 2007, the number of ERUs will continue to be approximately 189.

TABLE 6-7

Equivalent Residential Units

Area	Population	Commercial Flow (gpd)	Residential ERUs	Commercial ERUs	Total ERUs
2007					
Sewer Service Area	346	8,575	146	43	189
2017					
Sewer Service Area	401	12,095	161	60	221
2027					
Sewer Service Area	466	17,062	187	85	272

The number of ERUs will need to be periodically updated as residences and businesses are built or abandoned.

CHAPTER 7

EVALUATION OF WASTEWATER AND SOLIDS TREATMENT ALTERNATIVES

INTRODUCTION

The purpose of this Chapter is to identify alternate scenarios for centralized treatment systems for organic and nutrient removal and to develop design criteria and costs for construction and operation of these systems. These costs will include the initial capital costs for treatment and the long-term operation and maintenance costs.

SITE ASSESSMENT

Since there is not a wastewater facility within the Hoodsport RAC, several site reconnaissances were conducted to assess both the availability and suitability of property in the Vicinity of Hoodsport. In the *Finch Creek Wastewater Feasibility Study* (August 2000), a site adjacent to the Hoodsport Inn was identified as the most likely location for a wastewater treatment facility. However, the owner of this site has plans to construct a 10,000 square-foot store with parking, and his site plan shows use of all available space. There are other areas within this 12-acre parcel, but there is evidence of wetlands and Mason County has apparently stated that much of the property is not buildable.

Other site locations considered are listed and described below:

- **Haugen Property (Parcel No. 422114400250).** This 3/4-acre site is currently used for storage and a furniture repair/refinishing business. Its location is across from Lumberman's and between Finch Creek and Cushman Roads. It is an excellent site (e.g., central location, relatively flat, near existing utilities, etc.). However, the property is for sale and a sale is pending. The asking price is $359,000. If the sale is not completed, the location can be reconsidered. Otherwise, it does not appear to be available.

- **Rental Property Across from the Post Office (Parcel Nos. 42212511006 and 422125110014).** This site is between the library and Cushman Road and is approximately 100 feet by 100 feet, which is about the minimum size. An adjacent lot currently used for sewage disposal would add 40 feet by 100 feet. This site has a good central location, particularly if the disposal locations are upland or to Finch Creek. Currently, the property is occupied by an abandoned house with a "For Rent" sign. However, to obtain full usable space would require a soldier pile wall along the library property boundary.

- **Property East of the Fire Hall (Parcel Nos. 42211440220 and 42211440270).** Between the Fire Hall and the Haugen Property, there are four parcels which reportedly have on-site system problems. Each of these parcels is located at the base of a steep slope originating along North Schoolhouse Hill Road. Drainage from this slope will result in saturated soil conditions and likely problems with on-site systems. A local real estate agent also stated that the owner of two of these parcels may request a change in zoning from residential to commercial. Currently, the Fire Hall and the Haugen Property, four parcels to the east, are categorized as commercial and a conversion would be consistent with use in the vicinity. The advantages to a site in this area are identical to the Haugen Property (e.g., central location, relatively flat, near existing facilities, etc.). Two of the parcels, owned by one owner, cover approximately 1.0 acre. The disadvantage is the length of time and process for property acquisition.

- **Mike Purvis Property (Parcel Nos. 422125120002 and 42212512003).** Mr. Purvis is the owner of the property proposed for the 10,000 square-foot store. He also owns other property in the area including his drain field site located above his store property. Access to this site is up Old Mill Hill Road. It covers about 1.0 acre. The site is isolated on two sides by steep slopes and two residential dwellings to the south. The elevation across the site ranges from about 80 to 140 feet. The primary advantages of this location are that it is a large site, very likely would be available, and is centrally located.

  The disadvantages of this location are several. The usable site elevation appears to be approximately 120 to 140 feet and will require an additional lift station along Highway 101. Modeling for the collection system indicated a total dynamic head of 170 feet at some locations. While the typical grinder pump has a capability of up to 185 feet, pump use will cause a reduction in total dynamic head over time. In addition, site utilities such as water and three-phase power would need to be brought to the site at a cost higher than more central locations.

  This site is located in a residential neighborhood without any clearly designated easements to the site. The shortest route to the site is through a private driveway. An alternate easement is located near the end of North Old Mill Hill Road and would require approximately 2,000 linear feet of additional trench for the force main and power. The owner is working to resolve the easement problem.

- **Hoodsport Winery (Parcel No. 42214400010).** This area is located at the far end of the Hoodsport RAC adjacent to Hill Creek and Highway 101. This site is located about 1 mile south of the WDFW Hatchery.

> Under the Hoodsport Winery listing, there are four parcels, respectively, 10.70 acres, 3.10 acres, 1.9 acres, and 40 acres. Much of the property is uplands. The 40-acre parcel is located at an estimated elevation of 80 feet and is subdividable into 2.5-acre lots. At lower elevation near Highway 101, the winery maintains its operations. Behind the winery is a large flat area, which previously had been used for RV hookups. According to Dick Patterson, one of the owners, the winery with the exception of the tasting room is due to close in a year and the large 10.70-acre parcel is likely to be listed for $1.8 million. This site is reported to be the best large commercial site in the area. This site also has the size and topographic features well suited for a wastewater treatment facility, but the availability of the property is not known. In addition, it appears that the owners would prefer to maintain the large parcel intact. At this time, this site does not appear to be a feasible location.

Each of the site locations described above is shown on Figure 7-1. Three of the sites are centrally located in the commercial part of the Hoodsport RAC. Of these three, one, the Haugen Property, does not appear to be available. One other area, near the Fire Hall, will require further research before it is known to be available. A third, across from the Post Office, is known to be available, but will require more site development work than the other two sites within the central area of Hoodsport. The nearby property owned by Mike Purvis, however, would cost far more to develop due to the distance from Highway 101 and an additional lift station to reach the site.

For the purpose of this Chapter, the site identified as "Property East of the Fire Hall" will be used to develop preliminary site plans and costs. This site likely will be converted to commercial use and is large enough to accommodate the wastewater facility. If other sites become available, the cost differences are likely to be minimal since all three are in the vicinity of central Hoodsport.

INVENTORY OF APPLICABLE TECHNOLOGIES FOR THE TREATMENT FACILITY

In this section, treatment technologies are evaluated for use at the Hoodsport WWTF. Discharge of treated wastewater effluent into nearby surface water, such as Hood Canal or Finch Creek, is not an available option due to water quality impairment of Hood Canal. Therefore, production and use of reclaimed water is proposed. In Chapter 8, several uses for reclaimed water are evaluated as well as the reclaimed water quality requirements.

Based on a meeting with Ecology, the likely effluent limitations for BOD_5, TSS, dissolved oxygen, turbidity, total coliform, pH, and total nitrogen are shown in Table 7-1.

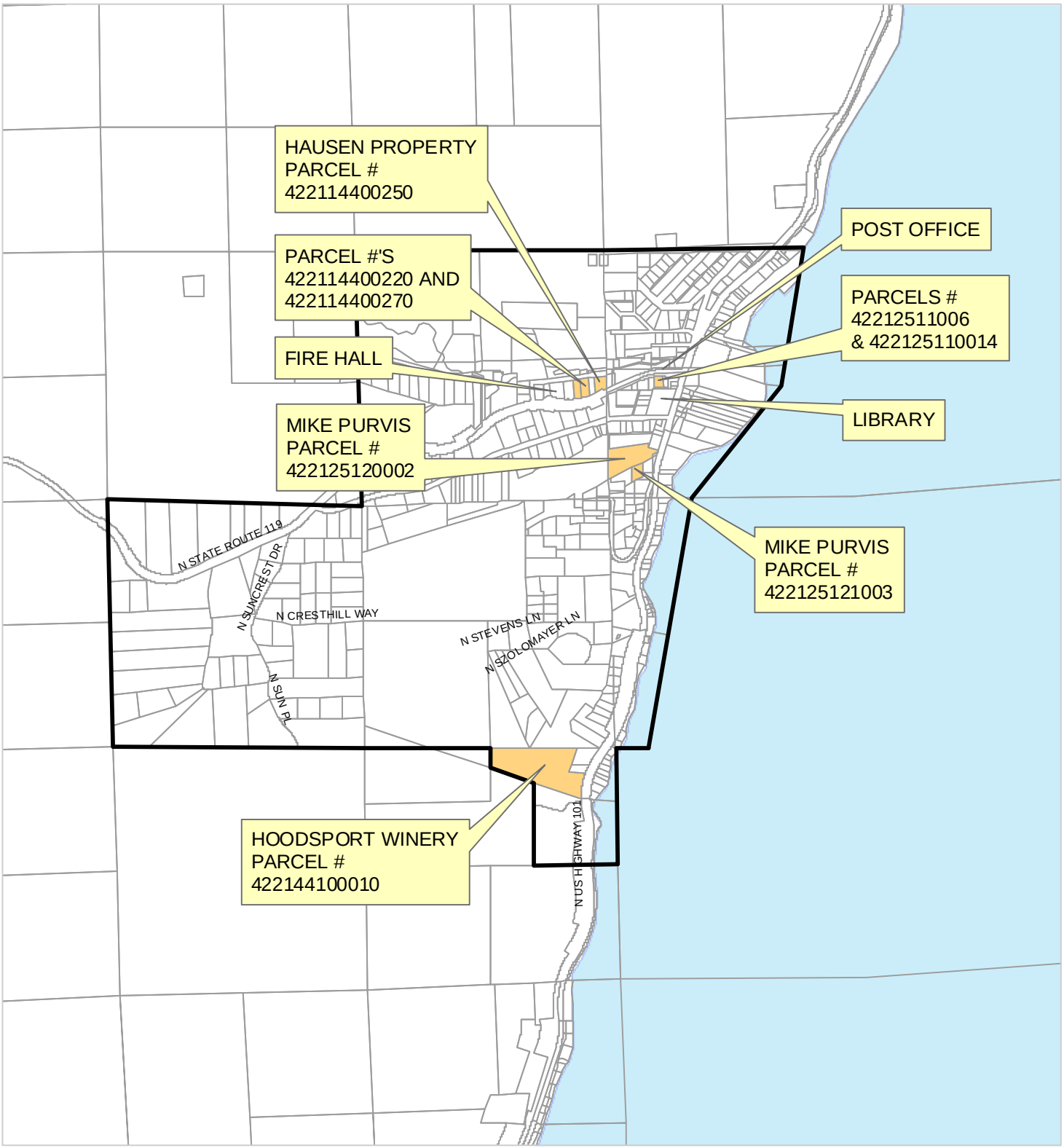
TABLE 7-1

Expected Effluent Limitations

Parameter	Average Monthly	Average Weekly	Location
Oxidized Wastewater			
BOD_5	15 mg/L	22 mg/L	Final Effluent
TSS	15 mg/L	22 mg/L	Final Effluent
Dissolved Oxygen	Shall be measurably present in effluent		Secondary Effluent
Parameter	**Average Monthly**	**Sample Maximum**	**Location**
Coagulated and Filtered Wastewater (1)			
Turbidity	2 NTU	5 NTU	Prior to Disinfection
Disinfected Reclaimed Water			
Total Coliform	2.2 cfu/100 ml	23 cfu/100 ml	Final Reclaimed Water
pH	Shall not be outside of the range of 6 to 9 units		Final Reclaimed Water
Total Nitrogen as N	10 mg/L	—	Final Reclaimed Water

(1) Where membrane systems are installed, Ecology is considering a standard for turbidity of 0.2 NTU (average monthly) to 0.5 NTU (sample maximum) and not requiring the coagulation process step.

The effluent limitations presented in Table 7-1 meet the requirements for Class A reclaimed water use with surface percolation ponds or spray irrigation. In addition to the effluent limitations shown in Table 7-1, there would also be groundwater limitations summarized in Table 7-2.



LEGEND:

- HOODSPORT RAC
- PARCELS

N

0 750 1,500 Feet

MASON COUNTY

HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE 7-1
TREATMENT PLANT SITE ALTERNATIVES

Gray & Osborne, Inc.
CONSULTING ENGINEERS

O:\CLIENTS\MasonCo\HOODSPORT RAC WW PLAN\FIG7-1.mxd

TABLE 7-2

Groundwater Limitations

Parameter	Groundwater Recharge (1) Criteria (sample maximum)
Nitrate as N	10 mg/L
Nitrite as N	1 mg/L
Arsenic	10 µg/L
Cadmium	5 µg/L
Chromium	100 µg/L
Lead	50 µg/L
Mercury	2 µg/L
Nickel	100 µg/L
Total Dissolved Solids	500 µg/L
Chloride	250 µg/L
Sulfate	250 µg/L
Copper	1,000 µg/L
Manganese	50 µg/L
Silver	100 µg/L
Zinc	5,000 µg/L
pH	6.5 to 8.5 standard units
Iron	0.3 mg/L
Toxics	No toxics in toxic amounts

(1) The sample maximum is the highest allowable concentration for any sample as measured in the groundwater at the top of the uppermost aquifer beneath or downgradient of the infiltration site.

In the Water Reclamation and Reuse Standards, two of the listed uses of reclaimed water are in fish hatchery basins and stream flow augmentation. Use in fish hatchery basins was discussed in the Finch Creek Study since the Washington State Department of Fish and Wildlife operates a fish hatchery located at the mouth of Finch Creek. As shown in Chapter 2, the average water intake at the hatchery is about 10 mgd and during the late summer significantly reduces flow in Finch Creek.

The effluent limitations would vary depending on the water reuse application. If either use in fish hatchery basins or stream flow augmentation is selected, the expected effluent limitations would need to be modified to include temperature limitations and specific dissolved oxygen concentrations. A comparison of beneficial uses will be presented in Chapter 8 of this Plan.

Applicable technologies to meet the requirements in Table 7-1 are the membrane bioreactor (MBR) process with disinfection and the sequencing batch reactor (SBR) with filtration and disinfection. Both technologies have proven capability for nutrient removal

and both require a relatively small "footprint," or site area. Both technologies are widely used for the level of flows and loadings presented in Chapter 6.

MBR facilities are in operation at the Tulalip Tribe, Stillaguamish, and the City of Duvall. Mason County operates SBR facilities at Hartstene Pointe and North Bay-Case Inlet. Among the MBR systems, there are several alternatives, including hollow-fiber microfilters manufactured by Zenon Corporation, and a flat plate design manufactured by Kubota. These MBR alternatives would need to be screened based on flows, capital, and annual O&M costs. There is less variability among SBR manufactured systems.

Between the two applicable technologies, MBR and SBR, the MBR systems have increasingly found greater use in western Washington. For small systems, the MBR systems produce a higher effluent quality and require less annual O&M. However, replacement of the membranes at approximately 10-year intervals is an added cost not found with the SBR systems. In addition to capital and annual O&M costs, both systems should be evaluated against non-cost factors such as the examples listed below:

- Proven reliability for nutrient and total coliform reduction;
- Highest effluent quality;
- Most expansion capability;
- Lowest maintenance requirements;
- Best aesthetics/visibility;
- Best noise and odor control;
- Least operational complexity; and
- Highest regulatory acceptance.

ALTERNATIVE NO. 1: MEMBRANE BIOREACTOR

The membrane bioreactor (MBR) process is a modification of the activated sludge process, in which the effluent is separated from the activated sludge by submerged membrane filtration units located in the aeration tanks. A typical activated sludge system utilizes separate aeration and clarification unit processes. The MBR process eliminates the clarification unit with the submerged filters. With a MBR a low-vacuum pump draws the effluent through the micropores of the membrane filter, resulting in a very high quality filtrate (permeate), typically <5 mg/L BOD_5 and <2 mg/L TSS. Fouling of the filtration units is controlled by air injection around the membranes and by chemical cleaning. The use of membrane filtration eliminates the need for secondary clarifiers and allows for the mixed liquor suspended solids (MLSS) level in the aeration tanks to be maintained at 8,000 mg/L or greater, thereby reducing the aeration tank volume required when compared with the conventional activated sludge process, which typically operates at MLSS concentrations of 2,000 to 4,000 mg/L. Because the biological activity is highly concentrated, the MBR process would require a much smaller footprint than other alternatives.

The treatment alternative consists of an anoxic tank, mixed liquor pumps, two membrane tanks, permeate pumps, an ultraviolet disinfection unit, a final lift station, and a sludge storage system.

The wastewater entering the WWTF site would first be flow metered and sampled, and then flow by gravity through an influent fine screen into the anoxic tank. Membrane filters are very sensitive to foreign objects, and membrane manufacturers typically require 2- or 3-mm screening of all material entering the membrane tanks.

The activated sludge mixed liquor would recirculate between the anoxic tank and the membrane tanks to provide for nitrogen removal, which would also result in more stable operation of the activated sludge system. Mixed liquor would be pumped from the anoxic tank to the membrane tanks, and overflow by gravity back to the anoxic tank. An alkalinity addition system will be provided, in case the alkalinity in the influent wastewater is insufficient to prevent pH drop and the resultant loss of nitrification efficiency.

Permeate (filter effluent) would be pulled through the membranes by the permeate pumps, which discharge to an ultraviolet disinfection system, for disinfection prior to conveyance to the reuse sites. The UV channel area will be provided with a canopy to protect the equipment and provide a covered area for UV lamp cleaning.

As an activated sludge system, the MBR process would require frequent removal of waste activated sludge (WAS) to keep the solids concentration in the tanks stable. Instead of treating the waste solids on-site to produce biosolids, it would be more cost effective to haul liquid sludge to another facility for further treatment such as one located near Shelton operated by Bio-Recycle. WAS pumps would remove excess sludge from the membrane tanks daily for conveyance to a sludge storage tank. The tank would provide two weeks of aerated storage of the sludge.

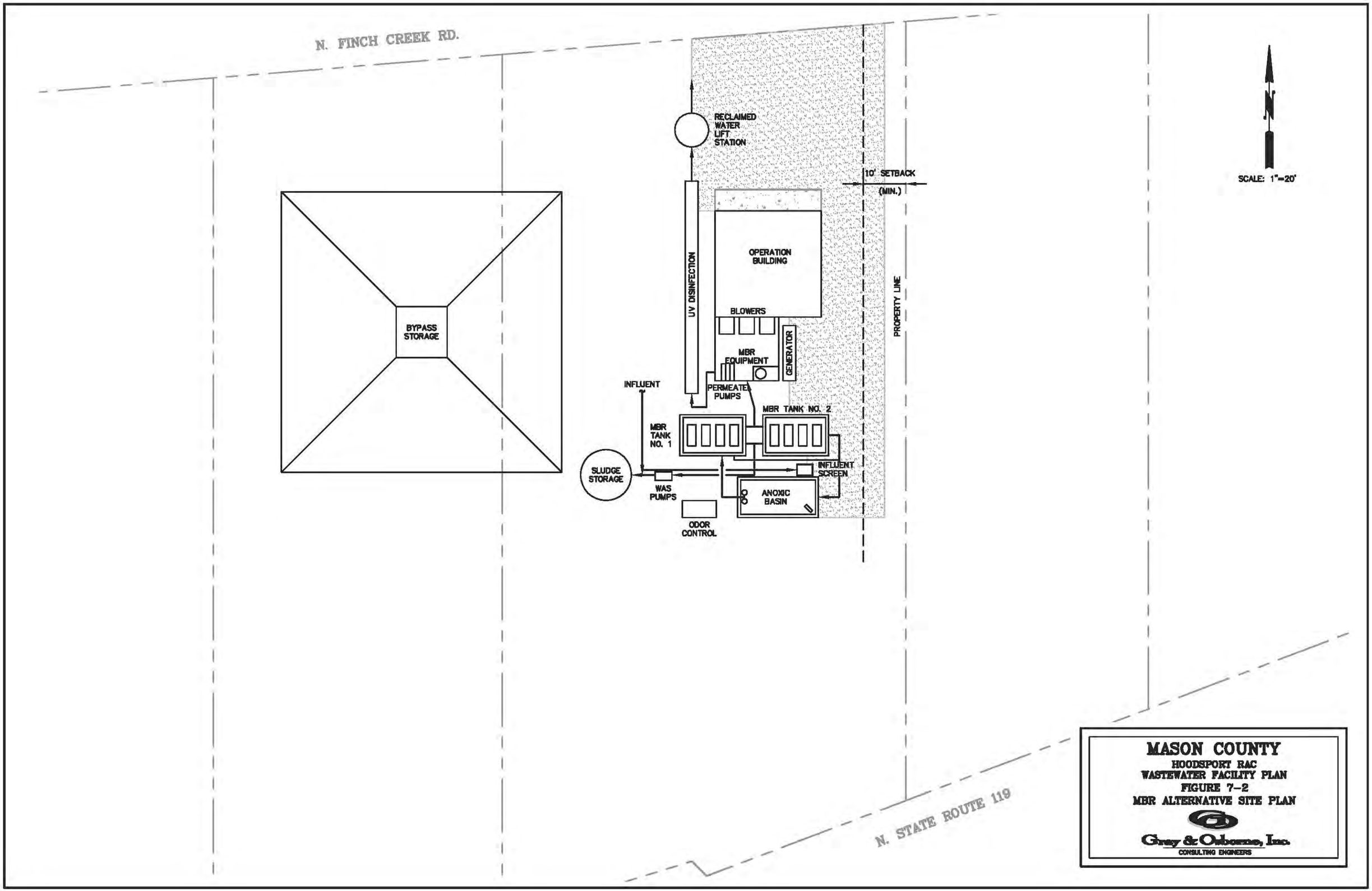
A building will be constructed to provide a small office, bench top laboratory, and a restroom for WWTF staff. The bench top laboratory will consist of a sink, sufficient counter space, and cabinets for storage of sample containers, chemicals, and supplies. The building will include an electrical room and an Americans with Disabilities Act (ADA) compliant restroom with a shower and locker space for employees. The MBR process equipment and controls will be located in a separate room in this building. It is anticipated that a building with 925 square feet will provide the required floor space.

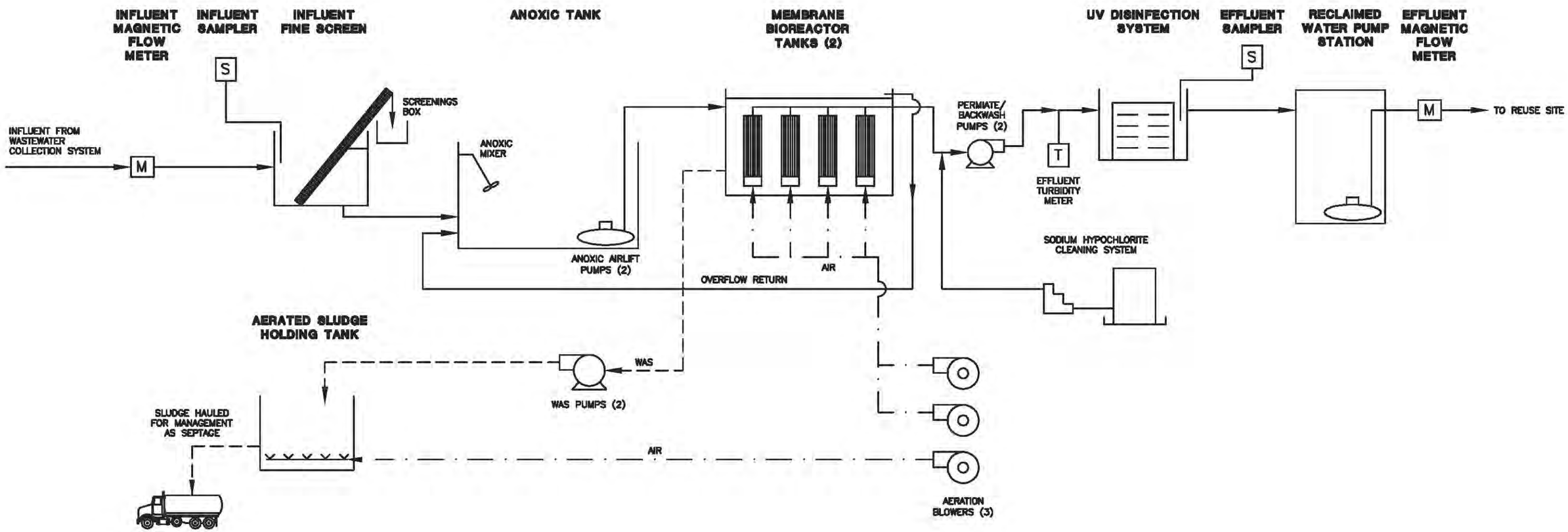
A site plan utilizing the MBR process is illustrated on Figure 7-2, and a process flow diagram is provided on Figure 7-3. The design criteria for the proposed WWTF are provided in Table 7-3. The design criteria are based on a preliminary design from Enviroquip, which markets KUBOTA membranes. The design criteria may vary if another MBR supplier is selected.

TABLE 7-3

Design Criteria for Alternative No. 1 – MBR

Parameter	Design Criteria
Total Hydraulic Residence Time (at MMF)	12.6 hours
Total Solids Residence Time (at MLSS of 8,000 mg/L)	30 days
Aerated Solids Residence Time (at MLSS of 8,000 mg/L)	19 days
Anoxic Tank	
Tank Volume	10,965 gallons
Anoxic Mixer	
Mixing Type	submersible mechanical mixer
Quantity	1
Mixer Capacity	5,000 gpm
Mixed Liquor Pumps	
Quantity	2
Pump Type	air-lift
Pump Capacity, each	142 gpm
Membrane Tanks	
Quantity	2
Tank Volume, each	8,850 gallons
Submerged Membrane Units	
Quantity	8 (4 per tank)
Membrane Type	flat-sheet
Aeration Type	coarse-bubble diffusers mounted below membrane units
Process/Scour Air Blowers	
Quantity	2
Blower Type	positive displacement
Blower Capacity, each	350 scfm
Blower Motor Size	20 hp
Permeate Pumps	
Quantity	2
Pump Type	self-priming centrifugal
Pump Capacity, each	110 gpm
Pump Motor Size	7.5 hp
UV Disinfection System	
Configuration	open-channel, horizontal
Lamp Type	low-pressure, low-intensity
Quantity of Banks	2 (1 duty, 1 standby)
Design UV Dose (at MDF of 88,306 gpd)	80 mJ/cm^2
Hydraulic Capacity	154,000 gpd


N. FINCH CREEK RD.
RECLAIMED WATER LIFT STATION
10' SETBACK (MIN.)
SCALE: 1"=20'
UV DISINFECTION
OPERATION BUILDING
BLOWERS
PROPERTY LINE
BYPASS STORAGE
MBR EQUIPMENT
GENERATOR
INFLUENT
PERMEATE PUMPS
MBR TANK NO. 2
MBR TANK NO. 1
SLUDGE STORAGE
INFLUENT SCREEN
WAS PUMPS
ANOXIC BASIN
ODOR CONTROL
N. STATE ROUTE 119
MASON COUNTY
HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE 7-2
MBR ALTERNATIVE SITE PLAN
Gray & Osborne, Inc.
CONSULTING ENGINEERS



MASON COUNTY
HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE 7-3
MBR ALTERNATIVE
PROCESS FLOW DIAGRAM

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CONSULTING ENGINEERS

M:\MASONCO\07570\FIGURES\7-3-PFD-MBR.DWG, PFD-MBR, 7/6/2007 11:27:31 AM, 1:1, BY: M NAGEL

TABLE 7-3 – (continued)

Design Criteria for Alternative No. 1 – MBR

Parameter	Design Criteria
WAS Pumps	
WAS Production Rate	72 lb/day
Quantity	2
Pump Type	rotary lobe
Pump Capacity, each	20 gpm @ 20' TDH
Pump Motor Size	2.2 hp
Sludge Storage Tank	
Quantity	1
Tank Volume, each	11,800 gallons
Detention Time	2 weeks
Sludge Tank Aeration Blower	
Quantity	1
Blower Type	positive displacement
Blower Capacity, each	30 scfm
Blower Motor Size	3.0 hp
Standby Generator	
Size	100 kW

The MBR process proposed is designed for nitrification in the membrane tanks, and denitrification in the anoxic tank. This alternative is typically capable of producing effluent with a total nitrogen concentration less than 10 mg/L. Table 7-4 provides the typical effluent quality for the MBR alternative.

TABLE 7-4

Typical Effluent Quality for Alternative No. 1 - MBR

Parameter	Design Criteria
Effluent BOD_5 Concentration	<5 mg/L
Effluent TSS Concentration	<2 mg/L
Effluent TKN Concentration	<3 mg/L
Effluent Nitrate Concentration	<7 mg/L
Effluent TN Concentration	<10 mg/L
Effluent Turbidity	0.1 NTU

A preliminary cost estimate is summarized in Table 7-5. The cost estimate is based on a budget quote received from Enviroquip. An annual operation and maintenance cost estimate for the MBR alternative is provided in Table 7-6. The operation and maintenance costs include a half-time operator. The components of the treatment facility

have an expected lifetime of greater than 20 years, except for the membrane modules, which may need to be replaced every 10 years.

Lift station costs associated with reuse are not included in Table 7-5. These costs are dependent upon the reuse alternative and are addressed in Chapter 8.

TABLE 7-5

Preliminary Capital Cost Estimate for Alternative No. 1 – MBR (2007 Dollars)

No.	Item	Quantity	Unit Price	Amount
1	Mobilization/Demobilization	1 LS	$175,000	$ 175,000
2	Site Work	1 LS	$100,000	$ 100,000
3	Influent and Effluent Flow Monitoring and Sample Collection	1 LS	$ 25,000	$ 25,000
4	MBR Equipment Package, incl. Tanks	1 LS	$825,000	$ 825,000
5	UV Disinfection	1 LS	$ 70,000	$ 70,000
6	Sludge Storage, Blower, and Pump	1 LS	$ 40,000	$ 40,000
7	Operations and Equipment Building	1 LS	$200,000	$ 200,000
8	Heating, Ventilation and Air Conditioning	1 LS	$ 60,000	$ 60,000
9	Generator	1 LS	$ 50,000	$ 50,000
10	Piping, Valves, and Gates	1 LS	$200,000	$ 200,000
11	Odor Control	1 LS	$ 30,000	$ 30,000
12	Laboratory Equipment	1 LS	$ 35,000	$ 35,000
13	Emergency Storage Pond	1 LS	$ 35,000	$ 35,000
14	Plant Drain Pump Station	1 LS	$ 30,000	$ 30,000
15	Non-Potable Water System	1 LS	$ 30,000	$ 30,000
16	Miscellaneous Metal	1 LS	$ 35,000	$ 35,000
17	Electrical	1 LS	$225,000	$ 225,000
18	Coatings	1 LS	$ 30,000	$ 30,000
19	Restoration/Fencing	1 LS	$ 20,000	$ 20,000

Engineer's Estimate $2,215,000
Contingency 15% ..... $ 332,250
8.3% Sales Tax ..... $ 211,422
Construction Cost $2,758,672

TABLE 7-6

Annual Operation and Maintenance for Alternative No. 1 – MBR (2007 Dollars)

No.	Item	Quantity	Unit Price	Amount
1	Administration	1 LS	$10,000	$ 10,000
2	Labor	1,040 HR	$35	$ 36,400
3	Power	220,000 kWh	$0.07	$ 15,400
4	Repair and Maintenance	1 LS	$15,000	$ 15,000
5	Membrane Replacement Reserves	1 LS	$5,000	$ 5,000
6	Sludge Hauling	200,000 GAL	$0.18	$ 36,000
7	Supplies/Miscellaneous	1 LS	$6,000	$ 6,000
Annual Operation and Maintenance Cost Estimate				**$123,800**

ALTERNATIVE NO. 2: SEQUENCING BATCH REACTOR (SBR)

Mason County operates SBR treatment plants at Hartstene Pointe and North Bay-Case Inlet. The facility at North Bay-Case Inlet operates as a water reclamation facility and includes two disk filters, a high level of disinfection, and a forest application site for reclaimed water.

Flow from the proposed service area would enter the treatment facilities through a concrete headworks structure equipped with a mechanical fine screen, grit channel, and a Parshall flume flow meter. A splitter box equipped with motorized slide gates will alternate flow between two SBR basins. One basin will fill while the other basin cycles through the steps of react, settle, and decant. Each SBR basin will contain a jet aeration system, decanter, sludge wasting pump, and control valves. Aeration is provided by a combination of blowers housed in an Equipment Building and the jet pump. By cycling the blowers "on" and "off," the SBR process alternates between aerobic conditions for nitrification and anoxic conditions for denitrification. Each step is controlled by a programmable logic controller (PLC) which will automatically open and close the motorized slide gates, control the aerobic and anoxic periods, the sludge wasting rate from each basin, and the motorized decant valves. Decanted effluent will be pumped from the SBR basin through the effluent filters to the UV disinfection units. The effluent filters remove additional solids from the effluent. Before reaching the filter, polymer will be added to the effluent for coagulation of solids, and the flash mixer and flocculation tank will be located upstream of the filter to ensure adequate dispersion of the polymer in the effluent.

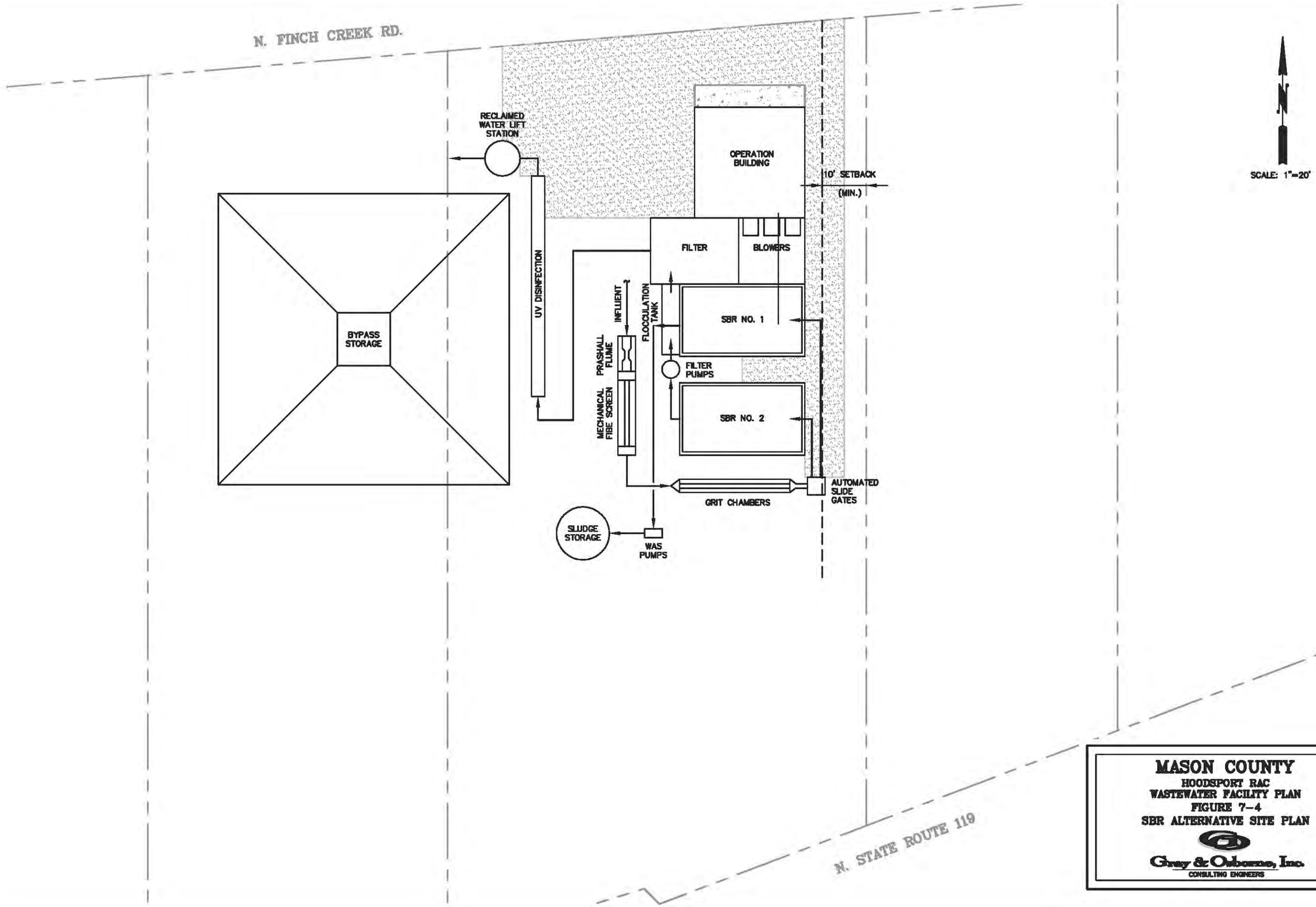
Similar to Alternative No. 1, WAS pumps would remove excess sludge from the SBR basins daily for conveyance to a sludge storage tank. The tank would provide 2 weeks of aerated storage of sludge. As required, a local septage hauler will remove sludge and haul it to Bio-Recycle near Shelton.

A site plan utilizing the SBR process is illustrated on Figure 7-4 and a process flow diagram on Figure 7-5. The design criteria for the SBR system are provided in Table 7-7. Site plan differences for the SBR alternative, compared to the MBR, are a larger building due to the filter unit, larger tankage for the SBR basins, and additional equipment for flocculation/coagulation. The SBR system has a larger "footprint" than the MBR alternative.

TABLE 7-7

Design Criteria for Alternative No. 2 – SBR

Parameter	Design Criteria
Mechanical Bar Screen	1
Bar Spacing	1/8 inch
Screen Diameter	12 inches
Drive Motor	1 hp
Parshall Flume	3 inches
Grit Removal	
Type	manual, channel
Detention Time	25 seconds
Dimensions	25' L x 1' W x 3'-0" H
Side Water Depth	0.93 foot
Channel Velocity at Pump Flow	1.0 fps
Motor Controlled Slide Gates	
Number	2
Electric Actuators	1/2 hp
Aeration System	
Tanks	
Quantity	2
Volume, each	0.0455 MG
Dimensions, each	27' L x 15' W x 18' H
Site Water Depth	15 feet
Food-to-Mass Ratio	0.06 # BOD/# MLSS/day
Solids Retention Time	12.14 days
Solids Wasted	105 lbs/day
Decant Depth	3 feet
Oxygen Requirements	275 lbs/day
Cycle Time, each tank	8 hours
Fill	4 hours
Fill Aerate	2.0 hour
Aerate	2.5 hours
Settle	0.75 hour
Decant	0.75 hour



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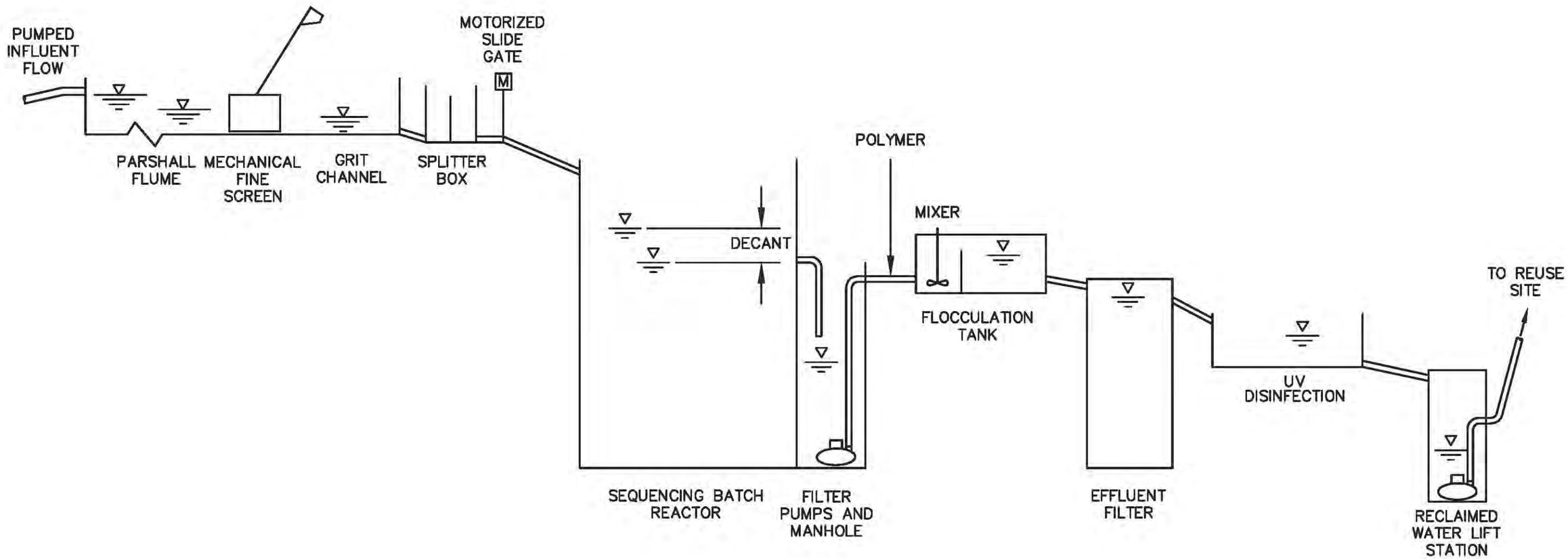

MASON COUNTY
HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE 7-5
SBR ALTERNATIVE
PROCESS FLOW DIAGRAM

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CONSULTING ENGINEERS

M:\MASONCO\07570\FIGURES\7-5-HYD-PRO-SBR.DWG, HYD-PRO, 7/6/2007 11:38:19 AM, 1:1, By: M NAGEL

TABLE 7-7 (continued)

Design Criteria for Alternative No. 2 – SBR

Parameter	Design Criteria
Blowers	
Quantity	3 (1 redundant)
Capacity	100 scfm
Motor	7.5 hp
Jet Aeration Pump	
Type	submersible
Quantity	2
Motor	7.5 hp
Waste Sludge Pump	
Type	submersible
Quantity	2
Capacity	25 gpm @ 20' TDH
Motor	3 hp
Decanter	
Type	motorized, floating
Quantity	2
Drive Motor	1/2 hp
Decant Rate	203 gpm
Flocculation System	
Theoretical Detention Time	44 minutes
Effective Detention Time (50% hydraulic effective)	22 minutes
Volume	4,480 gallons
Dimensions	16' L x 4' W x 9.4' H
Velocity Gradient (G)	75 sec^{-1}
Mixer Power	0.15 hp
Type of Flocculator	compressed air
Filtration Units	
Type	disk
Quantity	1 (4 disks)
Loading Rate	4 gpm/ft^2
Filter Feed Pumps	
Quantity	2
Capacity	203 gpm @ 25 feet
Motor	3 hp

TABLE 7-7 (continued)

Design Criteria for Alternative No. 2 – SBR

Parameter	Design Criteria
Disinfection	
Type	UV, low pressure
Configuration	open channel
Quantity of Banks	3 (2 duty, 1 standby)
Design UV Dose (at Decant Rate)	100 mJ/cm^2
Hydraulic Capacity	203 gpm
Sludge Handling and Disposal	
Type	sludge holding
Volume	14,400 gallons
Number of Tanks	1
Detention Time	11.5 days
Blowers	
Quantity	1
Capacity	30 scfm
Motor	3 hp
Standby Generator	
Size	100 kW

The SBR process is designed for nitrification and denitrification in the SBR basins similar to the facility at North Bay-Case Inlet. This alternative can typically produce an effluent with a total nitrogen concentration less than 10 mg/L. However, compared to Table 7-4 for the MBR system, it is not expected that the SBR system will consistently achieve the effluent quality as the MBR system. Table 7-8 provides the typical effluent quality for the SBR alternative.

TABLE 7-8

Typical Effluent Quality for Alternative No. 2 – SBR

Parameter	Design Criteria
Effluent BOD_5 Concentration	<10 mg/L
Effluent TSS Concentration	<5 mg/L
Effluent TKN Concentration	<3 mg/L
Effluent Nitrate Concentration	<7 mg/L
Effluent TN Concentration	<10 mg/L
Effluent Turbidity	<2 NTU

A preliminary cost estimate is summarized in Table 7-9 and an annual operation and maintenance cost estimate is provided in Table 7-10. The components of the treatment facility have an expected life of 20 years.

TABLE 7-9

Preliminary Capital Cost Estimate for Alternative No. 2 – SBR (2007 Dollars)

No.	Item	Quantity	Unit Price	Amount
1	Mobilization/Demobilization	1 LS	$175,000	$ 175,000
2	Site Work	1 LS	$100,000	$ 100,000
3	Concrete	1 LS	$220,000	$ 220,000
4	Mechanical Fine Screen	1 LS	$ 80,000	$ 80,000
5	Parshall Flume	1 LS	$ 5,000	$ 5,000
6	Motor Operated Gates	1 LS	$ 15,000	$ 15,000
7	Stop Gates	1 LS	$ 6,000	$ 6,000
8	Dissolved Oxygen Meters	1 LS	$ 10,000	$ 10,000
9	Ultrasonic Level Sensors	1 LS	$ 20,000	$ 20,000
10	Jet Mixing System and Decanters	1 LS	$160,000	$ 160,000
11	Aeration Blowers	1 LS	$ 60,000	$ 60,000
12	WAS Pumps	1 LS	$ 15,000	$ 15,000
13	Filter Feed Pumps	1 LS	$ 15,000	$ 15,000
14	Secondary Effluent Flow Meter	1 LS	$ 7,000	$ 7,000
15	Polymer System	1 LS	$ 15,000	$ 15,000
16	Flash and Flocculation Mixers	1 LS	$ 8,000	$ 8,000
17	Effluent Filter	1 LS	$100,000	$ 100,000
18	UV Disinfection System	1 LS	$100,000	$ 100,000
19	Aeration Diffuser Equipment	1 LS	$ 10,000	$ 10,000
20	Plant Drain Pump Station	1 LS	$ 30,000	$ 30,000
21	Nonpotable Water System	1 LS	$ 30,000	$ 30,000
22	Laboratory Equipment	1 LS	$ 35,000	$ 35,000
23	Painting	1 LS	$ 50,000	$ 50,000
24	Heating, Ventilation, and Air Condition	1 LS	$ 80,000	$ 80,000
25	Miscellaneous Metal	1 LS	$ 35,000	$ 35,000
26	Operations/Equipment Building	1 LS	$250,000	$ 250,000
27	Generator	1 LS	$ 50,000	$ 50,000
28	Emergency Storage Pond	1 LS	$ 35,000	$ 35,000
29	Odor Control	1 LS	$ 30,000	$ 30,000
30	Restoration/Fencing	1 LS	$ 20,000	$ 20,000

TABLE 7-9 (continued)

Preliminary Capital Cost Estimate for Alternative No. 2 – SBR (2007 Dollars)

No.	Item	Quantity	Unit Price	Amount
31	Piping	1 LS	$215,000	$ 215,000
32	Electrical, Control, and Instrumentation	1 LS	$240,000	$ 240,000
33	Composite Samplers	1 LS	$ 13,000	$ 13,000
Engineer's Estimate				$2,234,000
Contingency 15%				$ 335,100
8.3% Sales Tax				$ 213,235
Construction Cost				**$2,782,335**

TABLE 7-10

Annual Operation and Maintenance for Alternative No. 2 – SBR (2007 Dollars)

No.	Item	Quantity	Unit Price	Amount
1	Administration	1 LS	$10,000	$ 10,000
2	Labor	1,040 HR	$35	$ 36,400
3	Power	166,570 kWh	$0.07	$ 12,000
4	Repair and Maintenance	1 LS	$18,000	$ 18,000
5	Sludge Hauling	208,000 GAL	$0.18	$ 37,000
6	Supplies/Miscellaneous	1 LS	$6,000	$ 6,000
Annual Operation and Maintenance Cost Estimate				**$119,400**

ALTERNATIVE SELECTION

In order to compare the cost effectiveness of each alternative, the 20-year life-cycle costs were calculated. A discount rate of 4.875 percent over a period of 20 years was utilized to develop life-cycle costs along with an inflation factor of 3 percent.

Estimates for construction costs, annual O&M costs, and 20-year life-cycle costs are shown in Table 7-11.

TABLE 7-11

Treatment System Alternative Cost Comparison

Alternative	Construction	Annual O&M	20-Year Life Cycle
MBR	$2,758,672	$123,800	$4,758,515
SBR	$2,782,335	$119,400	$4,711,623

The summary in Table 7-11 shows the MBR system to be slightly lower for construction cost, but higher for annual O&M. For the 20-year life-cycle cost, the MBR alternative is slightly less cost effective than the SBR alternative.

There are several reasons to select the MBR over the SBR as highlighted below:

- Comparisons presented in Tables 7-4 and 7-8 show that the MBR systems provide a higher quality effluent.
- The SBR tanks are larger and there is additional process equipment required. As shown on Figures 7-2 and 7-4, the SBR site plan is significantly more crowded.
- Results from recent years have shown that the MBR system has a higher reliability.

The recommended alternative is, therefore, the MBR system.

CHAPTER 8

WATER RECLAMATION AND REUSE

EVALUATION OF WATER RECLAMATION AND REUSE

This Chapter presents an evaluation of the feasibility of water reclamation at the proposed WWTF and reuse of that water in the Hoodsport area. Wastewater reclamation and reuse can potentially be beneficial by reducing potable water demand or by providing environmental benefits.

WATER RECLAMATION AND REUSE REGULATORY REQUIREMENTS

The *Water Reclamation and Reuse Standards* have been issued jointly by the Washington State Departments of Health and Ecology. This discussion is based on the current standards dated September 1997, which are adopted by reference in RCW Chapter 90.46, Reclaimed Water Use.

The State of Washington reuse standards for municipal wastewater can be broken down into the four following areas:

1. Treatment Standards
2. Allowable Uses of Reclaimed Water
3. Use Area Requirements
4. Operational and Reliability Requirements

A key difference between water reuse and effluent disposal is in the level of reliability required within the treatment process, distribution, and use areas. The State of Washington's reuse treatment standards call for continuous compliance, meaning that the treatment standard must be met on a constant basis or the treated water cannot be used as reclaimed water.

TREATMENT CLASSIFICATIONS

The Reuse Standards classify reclaimed water based on the level of treatment the water receives. The classification is dependent upon the degree of stabilization and disinfection provided by the treatment process prior to any reuse application. There are four classifications for reclaimed water, Class A, B, C and D, with Class A being the highest. The treatment requirements for these four classes are presented in Table 8-1.

Based on the requirement of a higher level of treatment, Class A water has the most reuse potential and the fewest restrictions on its use. For reclaimed water to be classified as Class A, it must have been continuously oxidized, which is essentially the equivalent of

secondary wastewater treatment, and continuously coagulated and filtered, which is similar to conventional drinking water treatment. Finished water turbidity must not exceed a monthly average of 2 NTU and cannot exceed 5 NTU at any time. Under possible modifications to the Reuse Standards, a membrane bioreactor (MBR) would be required to achieve a turbidity standard of 0.5 NTU without continuous coagulation. The reclaimed water must also be highly disinfected, meeting a 7-day median value of ≤2.2 total coliform per 100 milliliters (100 ml) with no single sample exceeding 23 total coliform per 100 ml.

TABLE 8-1

Reclaimed Water Classification Requirements

Reuse Class	Continuously Oxidized(1)	Continuously Coagulated(2)	Continuously Filtered(3)	Disinfection(4) (Total Coliform Density)	
				7-Day Median Value	Single Sample
A	YES	YES	YES	≤2.2/100 ml	23/100 ml
B	YES	NO	NO	≤2.2/100 ml	23/100 ml
C	YES	NO	NO	≤23/100 ml	240/100 ml
D	YES	NO	NO	≤240/100 ml	no standard

(1) Continuous Oxidation. Oxidized wastewater is defined as wastewater in which the organic matter has been stabilized. The concentration of five-day biochemical oxygen demand (BOD_5) and total suspended solids (TSS) cannot exceed 30 mg/L on a monthly average basis. The wastewater must be non-putrescable, i.e., no foul smell, and must contain dissolved oxygen.

(2) Continuous Coagulation. Coagulated wastewater is defined as an oxidized wastewater in which colloidal and finely divided suspended matter have been destabilized and agglomerated prior to filtration by the addition of chemicals or an equally effective method.

(3) Continuous Filtration. Filtered wastewater is defined as an oxidized, coagulated wastewater that has been passed through natural undisturbed soils or filter media, such as sand or anthracite. The resulting turbidity, as determined by an approved laboratory method, cannot exceed an average operating turbidity of 2 nephelometric turbidity units (NTU) on a monthly average basis. The turbidity cannot exceed 5 NTU at any time. The turbidity must be monitored continuously.

(4) Disinfection. Disinfected wastewater is defined as wastewater in which pathogenic organisms have been destroyed by physical, chemical or biological means. Disinfection standards generally use coliform density as the representative measure of pathogen destruction.

Classes B, C, and D, respectively, are of lesser quality than Class A, based on lesser levels of treatment received. The primary differences of these classes from Class A are elimination of the coagulation and filtration requirement and decreasing disinfection requirements.

The classification requirements are "performance-based." This means that if the designated levels of treatment are performed on the reclaimed water and the water meets the designated water quality requirements, the reclaimed water is accepted or classified as the corresponding class of reclaimed water. Based on its reclaimed water classification, it is then accepted as safe for uses identified as requiring the corresponding

class of reclaimed water. Further verification of the safety of the reclaimed water is not required, e.g., pathogen testing. This acceptance of public safety is based on extensive research of the public health effects of various treatment levels and uses of reclaimed water.

POTENTIAL USES

The Reuse Standards identify approved uses for reclaimed water and the class of treatment necessary for application to various uses. Potential uses are presented in Table 8-2, along with the classification of reclaimed water necessary for each use. The list is not considered comprehensive, other proposed uses can be evaluated on a case-by-case basis. The primary factor to be considered is the potential for impact to public health. Therefore, the higher the potential for public contact with the reclaimed water, the higher the classification that will be required.

The WRR Standards allow for a number of other uses not shown in Table 8-2. However, the general basis for reuse criteria is that when unlimited public access to the reclaimed water is involved, the criteria will require Class A reclaimed water. Essentially, this means that for a water reclamation project to have any degree of flexibility as well as a potential for relatively unrestricted use, the reclaimed water should meet Class A reuse standards even if a lower classification is allowed.

TABLE 8-2

Reclaimed Water Potential Uses and Classification Requirements

Use	Class of Reclaimed Water Required			
	Class A	**Class B**	**Class C**	**Class D**
Irrigation of Non-Food Crops				
Trees and fodder, fiber, and seed crops	YES	YES	YES	YES
Sod, ornamental plants for commercial use, pasture to which milking cows or goats have access	YES	YES	YES	NO
Irrigation of Food Crops				
Spray Irrigation:				
All food crops	YES	NO	NO	NO
Food crops which undergo physical or chemical processing sufficient to destroy all pathogenic agents	YES	YES	YES	YES
Surface Irrigation:				
Food crops where there is no reclaimed water contact with edible portion of crop	YES	YES	NO	NO
Root crops	YES	NO	NO	NO
Orchards and vineyards	YES	YES	YES	YES
Food crops which undergo physical or chemical processing sufficient to destroy all pathogenic agents	YES	YES	YES	YES
Landscape Irrigation				
Restricted access areas (e.g., cemeteries, freeway landscaping)	YES	YES	YES	NO
Open access areas (e.g., golf courses, parks, playgrounds, etc.)	YES	NO	NO	NO
Impoundments				
Landscape impoundments	YES	YES	YES	NO
Restricted recreational impoundments	YES	YES	NO	NO
Nonrestricted recreational impoundments	YES	NO	NO	NO
Fish Hatchery Basins	YES	YES	NO	NO
Decorative Fountains	YES	NO	NO	NO
Flushing of Sanitary Sewers	YES	YES	YES	YES

TABLE 8-2 – (continued)

Reclaimed Water Potential Uses and Classification Requirements

Use	Class of Reclaimed Water Required			
	Class A	Class B	Class C	Class D
Street Cleaning				
Street sweeping, brush dampening	YES	YES	YES	NO
Street washing, spray	YES	NO	NO	NO
Washing of Corporation Yards, Lots, and Sidewalks	YES	YES	NO	NO
Dust Control (Dampening Unpaved Roads, Other Surfaces)	YES	YES	YES	NO
Dampening of Soil for Compaction (Construction, Landfills, etc)	YES	YES	YES	NO
Water Jetting for Consolidation of Backfill Around Pipelines				
Pipelines for reclaimed water, sewage, storm drainage, gas, electrical	YES	YES	YES	NO
Fire Fighting and Protection				
Dumping from aircraft	YES	YES	YES	NO
Hydrants or sprinkler systems in buildings	YES	NO	NO	NO
Toilet and Urinal Flushing	YES	NO	NO	NO
Ship Ballast	YES	YES	YES	NO
Washing Aggregate and Making Concrete	YES	YES	YES	NO
Industrial Boiler Feed	YES	YES	YES	NO
Industrial Cooling				
Aerosols or other mist not created	YES	YES	YES	NO
Aerosols or other mist created (e.g., cooling towers, spraying)	YES	NO	NO	NO
Industrial Process				
Without exposure of workers	YES	YES	YES	NO
With exposure of workers	YES	NO	NO	NO

Fish Hatchery

Both Class A and Class B reclaimed water may be used by fish hatcheries as an acceptable water supply for the fish hatchery basins. The only difference between Class A and Class B, discussed above, is that Class B reclaimed water is not required to be continuously coagulated and filtered. Class B reclaimed water must still meet the same disinfection requirements as Class A. Experience has shown that the disinfection requirements are difficult to meet without some level of either conventional or membrane filtration.

Approval for a proposal to use reclaimed water at a fish hatchery would be required from WDFW, as well as Ecology and DOH. It is anticipated that the use of reclaimed water at the fish hatchery would be permitted under an NPDES permit, since the ultimate fate of the reclaimed water would be surface water. The permit would include reclaimed water requirements, as well as monitoring requirements. The primary parameters of concern for the use of reclaimed water at a fish hatchery would be temperature, ammonia, dissolved oxygen, and pathogens. The permit would address these and other parameters of concern through reclaimed water quality limits established in the permit.

Stream Flow Augmentation

Reclaimed water may be discharged to surface water to provide flow augmentation to a stream for flow enhancement, fish and wildlife habitat, irrigation supply, or water right replenishment or transfer. A beneficial use of the reclaimed water must be established for the project to be accepted as a stream flow augmentation project. Discharge of reclaimed water for the purpose of stream flow augmentation must comply with Chapter 173-201A WAC, the Surface Water Quality Standards. Additional information about compliance with the Surface Water Quality Standards was presented in Chapter 4. A stream flow augmentation project would require review and approval by WDFW. If in-stream work was necessary, a Hydraulic Project Approval (HPA) from WDFW might also be required.

The use of reclaimed water for stream flow augmentation would be permitted under an NPDES permit issued to Mason County from the Department of Ecology. The permit would include reclaimed water requirements, as well as monitoring requirements. Similar to use of reclaimed water in fish hatcheries, the primary parameters of concern would be ammonia, dissolved oxygen, pathogens, and temperature. The permit would address these and other parameters of concern through reclaimed water quality limits established in the permit.

Groundwater Recharge

Chapter 90.46 RCW identifies groundwater recharge as an allowable and desirable use of reclaimed water. Groundwater recharge involves the application of reclaimed water in volumes over and above that required for irrigation needs, for the purpose of replenishing groundwater sources. Reclaimed water may be used to recharge groundwater by surface percolation or through direct injection.

In order to be used for groundwater recharge by surface percolation, the reclaimed water must meet Class A treatment criteria. Also, the treatment process must include an additional step to reduce nitrogen prior to the final discharge to groundwater. The basic water quality requirement is that the reclaimed water must meet the groundwater recharge criteria, which are defined in the Reuse Standards as the equivalent of the DOH Drinking Water Standards. A major contaminant of concern in groundwater recharge is

nitrate nitrogen (NO_3-N). Therefore, the treatment process provided must be capable of reducing nitrogen content in the final reclaimed water to the level required by the groundwater recharge criteria, i.e., 10 mg/L.

As stated previously, groundwater recharge projects must also be in compliance with the state's groundwater regulation, Chapter 173-200 WAC. The regulation contains groundwater quality criteria that are to be met in the saturated zone. The groundwater quality criteria are very similar to the Drinking Water Standards, and subsequently, similar the groundwater recharge criteria mentioned above. Chapter 90.46 RCW, however, includes language that allows additional flexibility for the use of reclaimed water. The legislation states that reclaimed water may be applied to groundwater if the reclaimed water meets the "groundwater recharge criteria." The groundwater recharge criteria are defined in RCW 90.46 as "contaminant criteria found in the drinking water quality standards adopted by the State Board of Health." This allowance, in effect, supersedes the anti-degradation policy stated in the Groundwater Quality Standards. When reclaimed water is used to recharge groundwater by surface spreading, it is only necessary that the application not cause the DOH Drinking Water Standards to be exceeded in the groundwater that is being recharged. This is a less stringent requirement than the anti-degradation policy presented under the Groundwater Standards.

Direct injection is permitted to a drinking water aquifer as well as a non-drinking water aquifer. The treatment criteria for direct injection, particularly to a drinking water aquifer, require additional treatment beyond that required to produce Class "A" reclaimed water. Since direct injection will not be evaluated in this study, it will not be discussed further.

Irrigation/Landscaping Use

Potential uses of reclaimed water include irrigation of play fields and school grounds, which require Class "A" reclaimed water per Table 8-2. The only public facility that may use significant irrigation water is the library (1.65 acres), near the center of Hoodsport. There is not any other large property nearby, such as a golf course, suitable for irrigation. Constructing a reclaimed water pipeline from the treatment facility to the library would make reclaimed water available to Hoodsport for future irrigation uses.

Irrigation usage rates are based on an irrigation rate of 11 inches per year and an irrigation season of 4 months per year. Table 8-3 lists estimated potential irrigation water usage.

TABLE 8-3

Potential Reclaimed Water Usage

	Total Area (acres)	Estimated Irrigated Area (acres)	Annual Usage (gal/year)	Peak Day (gpd)
Library	1.65	0.83	358,000	6,000

(1) Irrigation rate based on 11 inches per year over a 4-month irrigation season.
(2) Peak day irrigation rate based on 4.45 inches per month for the peak month, and irrigation 6 days per week.

Permitting

Recharge of groundwater with reclaimed water would require a State Waste Discharge Permit issued by Ecology. Ecology may also require the development of a groundwater monitoring program to ensure degradation does not occur. Application of Class "A" reclaimed water to land for the purpose of irrigation, if applied at agronomic rates with no intent to recharge the groundwater, does not require a permit or a groundwater monitoring program.

The parameters of major concern with the reuse of reclaimed water are nitrogen and pathogenic bacteria. The Reuse Standards require treatment equivalent to Class "A" reclaimed water for groundwater recharges by surface percolation. This treatment level is expected to ensure that pathogen levels in the groundwater will not exceed drinking water standards (<1 total coliform/100 ml).

DESIGN CONSIDERATIONS

Along with the treatment criteria previously discussed, the Reuse Standards and Ecology's *Criteria for Sewage Works Design* (revised 1998) contain requirements for providing reliability and additional protection of public health. The design considerations defined in these documents are discussed below.

RELIABILITY CRITERIA

The level of treatment reliability required for water reclamation facilities is a major difference from conventional wastewater treatment. The Reuse Standards require *continuous* compliance, which means that the treatment standard must be met on a continuous basis or the treated water cannot be used as reclaimed water.

Operation and Reliability Requirements

The Reuse Standards contain a number of operational and reliability requirements for the water reclamation facility. Several key requirements are summarized below:

- Equipment and process failures must be signaled by an alarm condition.
- Emergency storage or disposal must be provided in the event of plant failure.
- Bypassing of treatment facilities to the point of use is not allowed for untreated or partially treated water.
- Standby power supply must be provided for alarms and automatic actuating valves and other equipment and devices necessary to provide immediate short-term disposal or storage upon failure of any treatment system component.
- Minimum Class III Operator.
- Operating records must be provided to DOH, as well as Ecology.

Redundant Process Equipment and Units

Short-term storage or an alternative disposal system must be provided. The Reclaimed Water Standards require bypass storage capacity equal to 1 day flow capacity where no alternative disposal system exists. For example, an outfall must be provided for use in situations where the reclaimed water cannot be used due to bad weather, reduced demand, etc. Provision must also be made for storage or disposal of water that does not meet the treatment and water quality criteria, perhaps due to a treatment upset, equipment failure, etc. Diversion to a different type of reuse requiring a lesser quality of reclaimed water is also possible if the quality is sufficient for that particular use. Storage areas must be equipped with pumps and valving to route the inadequately treated water back through the reclamation facility once it is operating properly.

REUSE AREA CRITERIA

Class A water is approved for all identified uses of reclaimed water with the exception of direct aquifer recharge through groundwater injection. Class A reclaimed water has no public health limitations on its use, with the exception that it cannot be used for potable drinking water.

Setbacks from Potable Water Systems

The Reuse Standards establish criteria for siting and identifying water reclamation projects and their facilities. Water reclamation storage facilities, valves, and piping must be clearly labeled and adequate measures must be taken to prevent cross connections between potable water and reclaimed water lines. Minimum separation distances between reclaimed water lines and potable water lines are similar to those required for sewer lines. A minimum horizontal separation of 10 feet and a minimum vertical separation of 18 inches must be maintained between the two lines.

The Reuse Standards also include setback requirements for the four classifications of reclaimed water. Setback distances are required from potable water supply pipelines, wells, property lines, water bodies, etc. Distances vary depending on the class of reclaimed water. The Class A reclaimed water has the smallest setback requirements of the four classes. Table 8-4 summarizes setback requirements for water reclamation facilities.

TABLE 8-4

Setback Distances for Reclaimed Water
(in feet)

Reclaimed Water Use/Facility	Minimum Distance to Potable Water Well			
	Class A	Class B	Class C	Class D
Spray or Surface irrigation	50	50	100	300
Unlined storage pond or impoundment	500	500	500	1000
Lined storage pond or impoundment	100	100	100	200
Pipeline	50	100	100	300
Minimum distance between irrigation area and public areas	0	50	50	100

Cross Connection Control Requirements

The proponent of a water reuse program is required to establish a cross-connection control and inspection program consistent with WAC 246-290-490 to prevent contamination of the potable water supply. The program must be developed in coordination with the potable water supplier and be reviewed and approved by DOH. Documentation must address cross-connection control equipment, oversight responsibilities, and operation, inspection, and testing activities.

All valves, piping, outlets, and storage facilities in the reclaimed water system must be clearly identified as containing reclaimed water with a warning against use as drinking water. The public must be provided notification of the use of reclaimed water at all use areas with signs, written notices, or other methods.

Residual Chlorine Requirements for Distribution System Protection

The Reuse Standards recommend that a chlorine residual of 0.5 mg/L be maintained during conveyance from the reclamation plant to the use area. This provision is meant as an operation and maintenance measure to prevent biological growth in the pipeline and sprinkler heads. If this requirement would be detrimental to the end user (e.g., a fish hatchery), then the requirement may be waived.

Monitoring Requirements

A permit for the reclaimed water project will outline monitoring requirements for the Class A water reclamation facility. Due to the need for continuous compliance with the Class A criteria, frequent monitoring of the product water for total coliform, TSS, and turbidity are required. Total coliform and TSS in the product water must be sampled and tested daily; turbidity must be recorded continuously and monitored a minimum of every four hours. Generally, nitrogen compounds such as ammonia, nitrate, and TKN are required to be monitored monthly. Phosphorous monitoring may be required if the reclaimed water is being utilized for stream flow augmentation.

WATER RIGHTS

The Department of Ecology has stated that the water rights to reclaimed water belong to the entity producing the reclaimed water. The Reuse Standards require proponents of groundwater recharge projects to provide information on the intended water rights status (i.e., artificial storage or abandonment) of the reclaimed water. All reclaimed water projects must be addressed in the proponent's comprehensive water plan.

TREATMENT FOR WATER RECLAMATION

This Chapter considers groundwater recharge, irrigation, and stream augmentation as potential uses for Class "A" reclaimed water. Use within the Finch Creek Hatchery, while listed as a possible use under RCW 90.46, is not considered a feasible use. Based on a discussion at a meeting on May 2, 2007, WDFW personnel stated that the hatchery had no need for the water; salmon as a species is particularly sensitive and there was no clear benefit to the hatchery.

GROUNDWATER RECHARGE

The recommended plan for treatment is an MBR facility at a site located in the central area of Hoodsport.

Under RCW 90.46, Class A reclaimed water means reclaimed water that, at a minimum, is at all times an oxidized, coagulated, filtered, disinfected wastewater. Membrane

filtration is capable of being accepted as equivalent to coagulation and filtration for the purposes of water reclamation. However, instead of turbidity limits of 2 NTU (average monthly) and 5 NTU (sample maximum), the limits with an MBR would be 0.2 NTU and 0.5 NTU.

For groundwater recharge or spray irrigation, no additional treatment processes would be required other than those proposed for the MBR facility in Chapter 7.

The reclaimed water standards require bypass storage capacity equal to 1-day flow capacity (minimum), where no alternative disposal system exists. As shown on the site plan on Figure 7-2, the MBR facility includes bypass storage of about 3 days to provide additional flexibility.

As part of the initial stages of design, a formal reliability analysis would need to be prepared for the MBR facility to ensure there are adequate redundancy and alarm features in place in the event of failure. Key elements of this analysis will be a discussion of emergency power, spare parts and equipment (e.g., permeate pump, blowers, MBR plates, and UV lamps), and alarms for major and minor conditions. Where long-term storage is utilized solely as a reliability feature, the volume of bypass storage must be at least 20 days. None of the sites observed in the Hoodsport RAC can accommodate this volume. The formal reliability analysis will need to demonstrate that there are adequate spare parts and equipment to avoid a large long-term storage facility.

STREAM AUGMENTATION

For use of Class “A” reclaimed water for stream augmentation as described under RCW 90.46, modifications in the MBR treatment facility will be required. The rationale for this reuse option is that WDFW, as described in Chapter 2, withdraws a large volume of water from Finch Creek on a daily basis for use in its hatchery located at the mouth of the creek. During the warmer summer months, little of the flow remains in the creek. While flow data are limited, flow is known to be at least as low as 1.4 cfs (refer to Table 2-6). Class “A” reclaimed water from the MBR facility at Hoodsport can provide a modest benefit by replenishing some of the water used by the hatchery, particularly during summer months.

The Washington State Water Quality Standards were amended on November 20, 2006. These standards cover both marine and fresh water. For fresh water, the standards are based on aquatic life uses and then specific criteria established based on the use category. The aquatic uses and the key criteria are illustrated by the schematic below:

Aquatic Life Uses		Criteria
• Char spawning and rearing • Core summer salmonid habitat • Salmonid spawning, rearing, and migration • Salmonid rearing and migration only • Non-anadromous interior redband trout • Indigenous warm-water species	→	• Temperature • Dissolved Oxygen • Turbidity • Total Dissolved Gas • pH

The portion of Finch Creek of interest for stream augmentation is the part downstream of the hatchery diversion structure. WDFW has constructed a barrier across the creek, a diversion structure, and pipeline to the hatchery approximately 1/4 mile downstream. The aquatic use category which most accurately describes this stream segment is "salmonid spawning, rearing, and migration." Based on this use category, the key criteria are summarized in Table 8-5.

TABLE 8-5

Aquatic Criteria for Salmonid Spawning, Rearing, and Migration

Criteria	Limits
Temperature	• Highest 7-Day Average Daily Maximum: 17.5 degrees C • When the background condition is cooler than the WQS requirement (e.g., 17.5 degrees C or 63.5 degrees F), an incremental increase resulting from an individual point source activity must not, at any time, exceed 28/(T+7) as measured at the edge of a mixing zone boundary (where "T" represents the background temperature at a point or points unaffected by the discharge and representative of the highest ambient water temperature in the vicinity of the discharge.
Dissolved Oxygen	• Lowest 1-Day Minimum: 8.0 mg/L • Concentrations of dissolved oxygen are not to fall below the criteria in the table at a probability frequency of more than once every 10 years on average.
Turbidity	Turbidity Shall Not Exceed: • 5 NTU over background when the background is 50 NTU or less; or • A 10 percent increase in turbidity when the background turbidity is more than 50 NTU.
Total Dissolved Gas	Total dissolved gas shall not exceed 110 percent of saturation at any point of sample collection.
pH	pH shall be within the range of 6.5 to 8.5 with a human-caused variation within the above range of less than 0.5 unit.

Table 2-7 provides temperature collected by WDFW personnel for Finch Creek for 2004 through 2006. As presented in this table, the average stream temperature generally does not rise above 50 degrees F and the maximum recorded temperature over a 3-year period is 60 degrees F. Based on the equation in Table 8-5, the incremental increase cannot exceed 0.42 degree F at any time as measured at the edge of the mixing zone.

While there is not a wastewater facility in operation at Hoodsport, it can be expected that summer wastewater temperature may reach 68 degrees F. Under high use conditions, the reclaimed water may elevate stream temperature by nearly 1 degree F. This increase in temperature would not comply with the WQS under WAC 173-201A. It is expected that a "chiller" will be a necessary addition to the water reclamation facility.

In addition to cooling, the modifications to the facility would also include a reaeration step to ensure that the dissolved oxygen criteria are met.

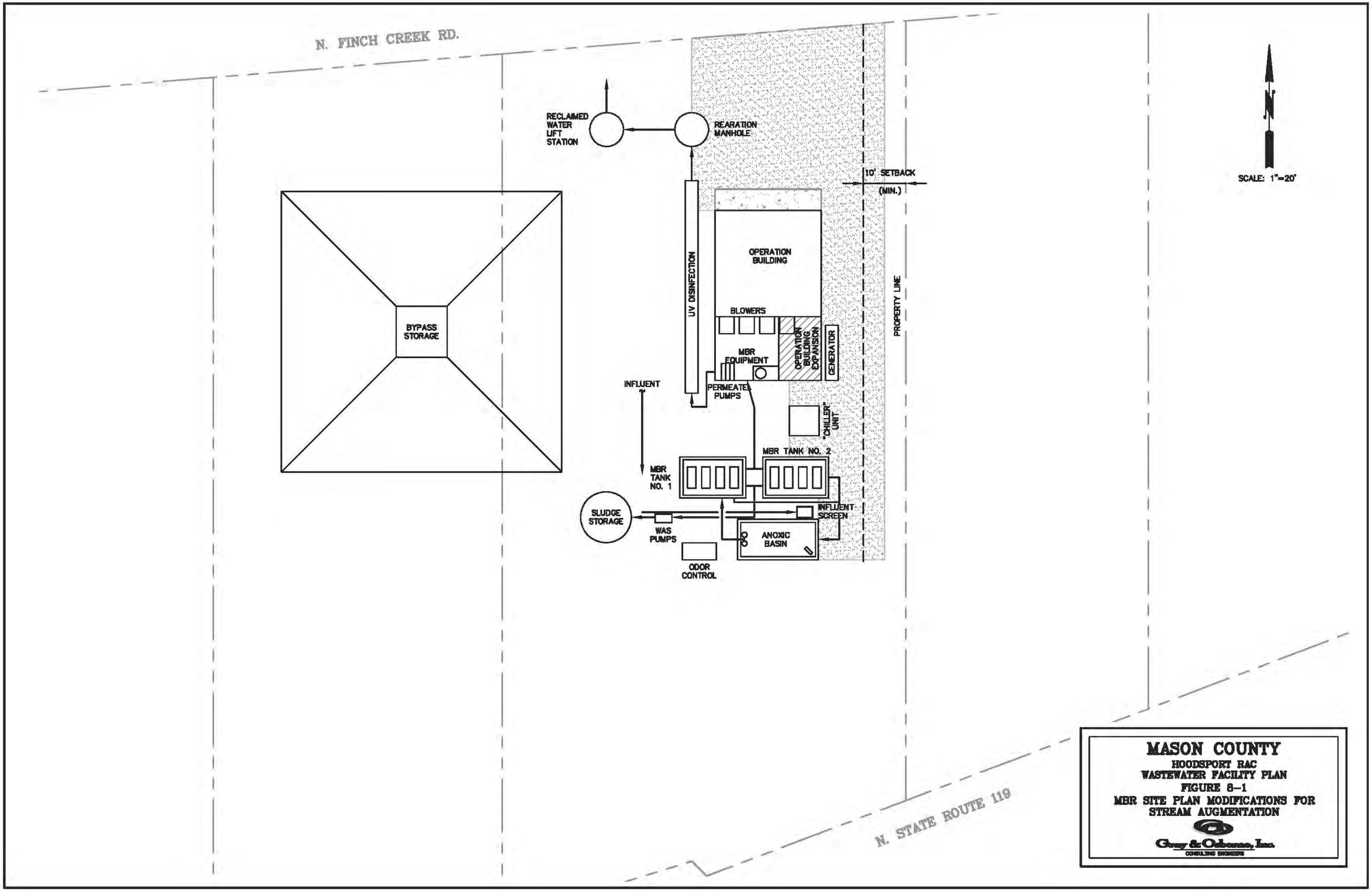
Figure 8-1 presents the modifications to the water reclamation facility for the stream augmentation alternative. These modifications include an expansion to the operations building for piping and a storage tank for the "chiller" operation. The "chiller" unit would be located outside on a concrete pad. The reaeration manhole would be located following UV disinfection and prior to the reclaimed water lift station. For the stream augmentation alternative, the pumps installed for the lift station would be low-horsepower units since the static lift to the diversion structure is only 10 to 15 feet and the force main only 500 lineal feet.

SITES FOR GROUNDWATER RECHARGE

In the Hoodsport area, any location for groundwater recharge by way of infiltration would need to be located in an upland area. Any pond or infiltration system located in a lowland area would be subject to groundwater seeps, springs, and intrusion. The few sites at lower elevations potentially large enough for an infiltration system are located adjacent to steep slopes. While curtain drains may provide a partial remedy for groundwater seeps, they would also direct water to adjacent property and other owners.

The preferred alternative for groundwater recharge is an infiltration pond similar to the one Mason County operates at North Bay-Case Inlet. The County also operates a forest spray field on a 20-acre site which it leases on DNR land. The forest site operates about 8 months of the year. However, whenever rainfall exceeds 1/2 inch during a 24-hour period, all reclaimed water is diverted to the pond. For the Hoodsport area with an annual average rainfall of 97 inches, there would be a significant number of days requiring use of a storage pond rather than a spray field.

Table 8-6 and other information following the table provide an evaluation of the Class "A" reclaimed water storage pond at North Bay. As presented below, the



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infiltration rate for this pond is 1 inch per day. For Hoodsport, the goal would be to locate soil locations at least as good, if not better, than exist at North Bay-Case Inlet.

TABLE 8-6

Evaluation of North Bay-Case Inlet Class "A" Reclaimed Water Storage Pond

Month	Rainfall (inches)	Evaporation (inches)	Total Flow (MG)
December 2002	10.8	0.1	3.817
January 2003	15.4	0.14	4.326
February 2003	2.1	0.473	2.865
March 2003	11.8	1.58	3.877
April 2003	5.4	3.08	3.210
May 2003	0.7	4.68	3.269
Totals	**46.2**	**10.053**	**21.364**

Inputs: Rainfall + Wastewater Flow
Outputs: Evaporation + Infiltration

Storage Volume (end of May) = Inputs – Outputs
6.745 MG = 6.046 MG (rainfall) + 21.364 MG (flow) – 0.963 MG (evaporation) – infiltration

Infiltration = 19.702 MG = 2,633,957 cubic feet
Infiltration Rate = Infiltration/Pond Surface Area × 0.75 factor = 29.72 inches/month = 0.99 inch/day

HWA GeoSciences conducted field reconnaissance and follow-up field evaluation for two sites in the vicinity of Hoodsport. These include a County-owned park, Foothills Park, approximately 2 miles west of Hoodsport, and property owned by Lewallen approximately 1/2 mile from Hoodsport. Both locations are shown on Figure 8-2. Foothills Park covers an area of 80 acres and property owned by Lewallen covers approximately 53.2 acres over five parcels. HWA GeoSciences report is included as Appendix D of this Plan.

The elevation differences between the two locations are significant. At Foothills Park, elevation at the access road for the Transfer Station is 560 feet, but rises to 640 feet at the playground area. Higher elevations for property owned by Lewallen cover a range from 280 to 320 feet.

EVALUATION OF RECLAIMED WATER REUSE ALTERNATIVES

Design criteria and preliminary construction and operation and maintenance cost estimates are developed for three reuse alternatives: (1) stream augmentation, (2) infiltration ponds located at Foothills Park, and (3) infiltration ponds located on

property owned by Lewallen. Each of these alternatives assumes an MBR treatment facility as presented in Chapter 7. The primary variables associated with the three alternatives are length of force main, motor horsepower, and temperature and dissolved oxygen requirements.

STREAM AUGMENTATION

The design criteria for the stream augmentation alternative are presented in Table 8-7 followed by construction and operation and maintenance cost estimates in Tables 8-8 and 8-9.

TABLE 8-7

Design Criteria for Stream Augmentation

Parameter	Design Criteria
"Chiller" System	
Quantity	1
Nominal Size	30 tons
Type	air cooled
Number of Compressors	2
Evaporator Flow Rate	80 gpm
Standard Chilled Water Temperature	50 degrees F
System Power	34 kW
Power Requirements	460 V, 60 Hz, 3 phase
Reaeration Manhole	
Diameter	10 feet
Depth	12 feet
Diffuser Type/Size	fine bubble, 9 inches
Aeration Blowers	
Quantity	2
Type	rotary, positive displacement
Capacity	59 cfm
Discharge Pressure	6 psig
Horsepower, each	3 horsepower
Reclaimed Water Lift Station	
Quantity	2
Pump Type	submersible
Pump Capacity	200 gpm
Pump Motor Size	3 horsepower
Force Main Discharge Diameter	4 inches

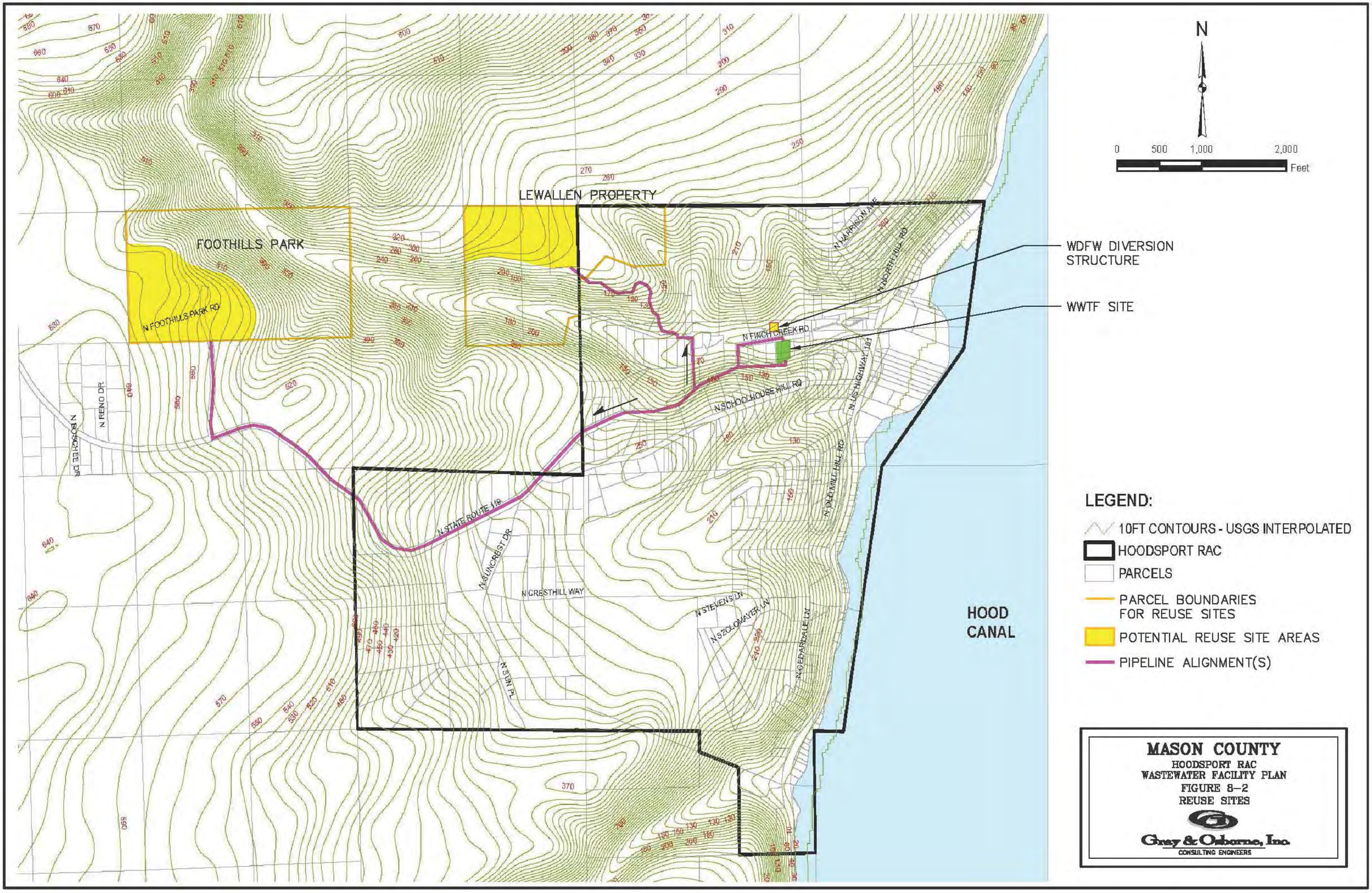

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TABLE 8-8

Preliminary Capital Cost Estimate for Stream Augmentation

No.	Item	Quantity	Unit Price	Amount
1	Mobilization/Demobilization	1 LS	$ 40,000	$ 40,000
2	Traffic Control	1 LS	$ 2,000	$ 2,000
3	Expansion of Operations Building	1 LS	$ 40,000	$ 40,000
4	"Chiller" System	1 LS	$ 45,000	$ 45,000
5	Reaeration Manhole	1 LS	$ 12,000	$ 12,000
6	Aeration Equipment	1 LS	$ 20,000	$ 20,000
7	Transmission Force Main	500 LF	$ 30	$ 15,000
8	Lift Station	1 LS	$140,000	$140,000
9	Restoration	1 LS	$ 10,000	$ 10,000

Engineer's Estimate $324,000
Contingency 15%.....$ 48,600
8.3% Sales Tax .....$ 30,926
Construction Cost $403,526

Table 8-9 presents the annual operation and maintenance cost estimate for the stream augmentation alternative. It is assumed that the "chiller" system will need to operate 3 months of the year, or the low flow periods in Finch Creek below the diversion structure.

TABLE 8-9

Annual Operation and Maintenance Cost for Stream Augmentation

No.	Item	Quantity	Unit Price	Amount
1	Administration	1 LS	$5,000	$ 5,000
2	Labor	200 HR	$35	$ 7,000
3	Power: Lift Station and Aeration Manhole	9,850 kWh	$0.07	$ 1,446
4	Power: "Chiller" System	25,000 kWh	$0.07	$ 1,750
5	Lift Station Repair and Maintenance	1 LS	$3,000	$ 3,000
6	"Chiller" Repair and Maintenance	1 LS	$1,500	$ 1,500
7	Force Main	0.25 MI	$3,000	$ 750
Annual Operation and Maintenance Cost Estimate				**$20,446**

FOOTHILLS PARK

The design criteria for the lift station, transmission pipeline, and reuse area located at Foothills Park are presented in Table 8-10 followed by construction and operation and maintenance cost estimates in Tables 8-11 and 8-12. The length of the force main and high head pumping requirements are two significant features with this cost estimate.

The results from the HWA report (Appendix D) for Foothills Park are limited. The limited number of excavation encountered some weathered till. If Foothills Park is the selected site, additional hydrogeological characterization will be required. For an infiltration rate, 1.25 inches per day is assumed in Table 8-10.

TABLE 8-10

Design Criteria for Foothills Park Reuse Alternative

Parameter	Design Criteria
Reclaimed Water Lift Station	
Quantity of Pumps	2
Pump Type	vertical turbine
Pump Capacity	110 gpm @ 660' TDH
Pump Motor Horsepower	40 horsepower
Power Requirement	460 V, 60 Hz, 3 phase
Force Main	
Diameter	4 inches
Material	ductile iron
Pressure Rating	350 psi
Class "A" Infiltration Ponds	
Quantity	2
Infiltration Rate	1.25 inches per day
Pond Area, each	1 acre
Pond Volume (maximum each)	2.3 million gallons
Water Surface Depth (maximum)	8 feet

TABLE 8-11

Preliminary Capital Cost Estimate for Foothills Park Reuse Alternative

No.	Item	Quantity	Unit Price	Amount
1	Mobilization/Demobilization	1 LS	$ 80,000	$ 80,000
2	Traffic Control	1 LS	$ 35,000	$ 35,000
3	4-Inch Force Main (Ductile Iron)	9,504 LF	$ 35	$ 332,640
4	Lift Station	1 LS	$220,000	$ 220,000
5	Infiltration Facilities	1 LS	$300,000	$ 300,000
6	Restoration	1 LS	$ 40,000	$ 40,000

Engineer's Estimate $1,007,640
Contingency 15%.....$ 151,146
8.3% Sales Tax .....$ 96,179
Construction Cost $1,254,965

In Table 8-12, the power usage for this alternative reflects the high-horsepower, high head pumping requirement to reach Foothills Park.

TABLE 8-12

Annual Operation and Maintenance Cost for Foothills Park Reuse Alternative

No.	Item	Quantity	Unit Price	Amount
1	Administration	1 LS	$5,000	$ 5,000
2	Labor	150 HR	$35	$ 5,250
3	Power: Lift Station	77,430 kWh	$0.07	$ 5,420
4	Lift Station Repair and Maintenance	1 LS	$4,000	$ 4,000
5	Force Main	1.8 MI	$3,000	$ 5,400
Annual Operation and Maintenance Cost Estimate				**$25,070**

PROPERTY OWNED BY LEWALLEN

The design criteria for the lift station, transmission pipeline, and reuse area located on property owned by the Lewallen family are presented in Table 8-13 followed by construction and operation and maintenance cost estimates in Tables 8-14 and 8-15. Both the length of force main and pumping requirements for the reuse area are reduced with this alternative.

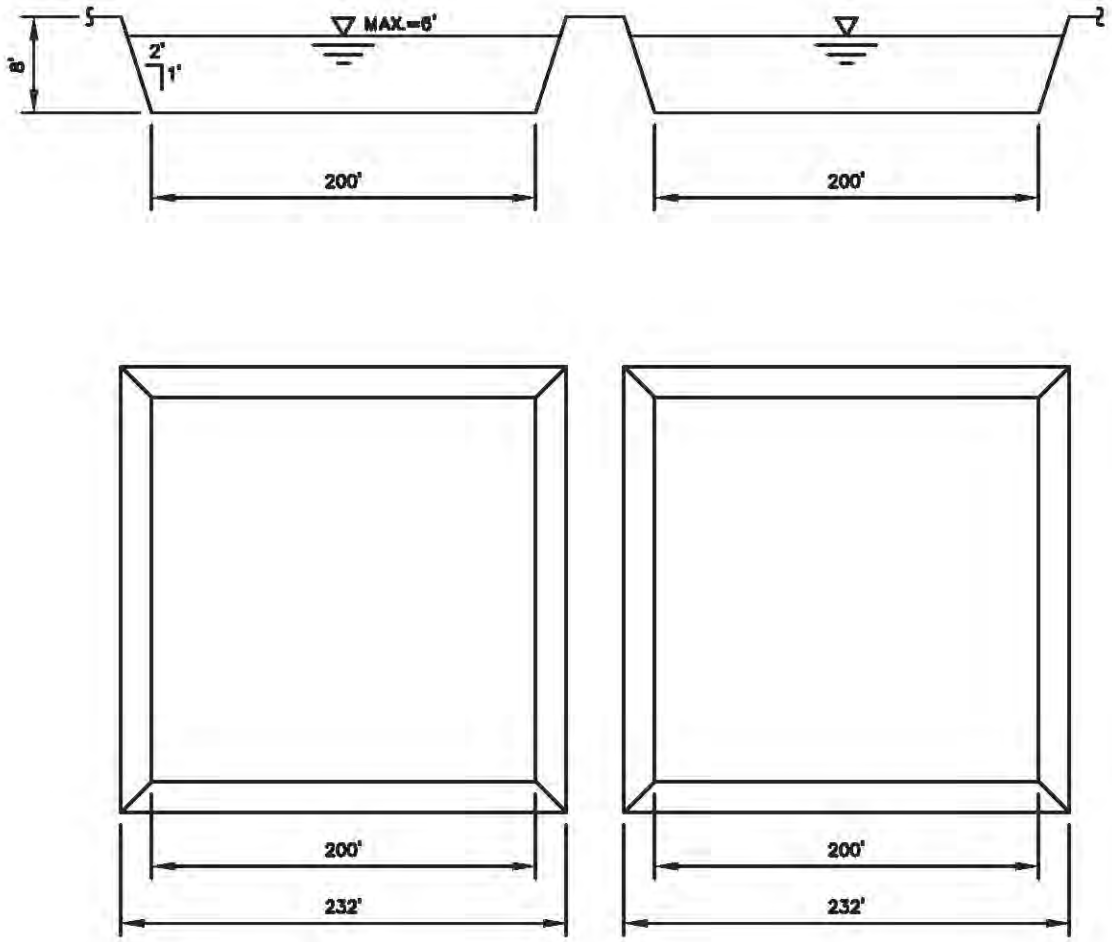
HWA GeoSciences estimated a long-term infiltration rate of 0.25 inch per hour for conditions on the Lewallen property (refer to page 7 of Appendix D). HWA used current

flow conditions of approximately 30,000 gpd to estimate the infiltration area required. Using Darcy's Law (refer to pages 7 to 8 of Appendix D), HWA estimated that an area of 1 acre would be required for 30,000 gpd. Future requirements for 2027 are an average flow of about 44,000 gpd and a maximum month flow of 54,000 gpd. In addition to wastewater flows the annual precipitation of 97 inches must also be considered for the infiltration area. Figure 8-3 presents the preliminary design covering 2 acres for two infiltration ponds. Two ponds are shown to allow temporary drainage and maintenance for each pond. Figure 8-3 shows the two ponds at one location, but for design they may be constructed at alternate locations.

TABLE 8-13

Design Criteria for Lewallen Property Reuse Alternative

Parameter	Design Criteria
Reclaimed Water Lift Station	
Quantity of Pumps	2
Pump Type	vertical turbine
Pump Capacity	110 gpm @ 320' TDH
Pump Motor Horsepower	15 horsepower
Power Requirements	460 V, 60 Hz, 3 phase
Force Main	
Diameter	4 inches
Material	PVC
Pressure Rating	235 psi
Class "A" Infiltration Ponds	
Quantity	2
Infiltration Rate	0.25 inches per hour
Pond Area, each	1 acre
Pond Volume (maximum each)	2.0 million gallons
Water Surface Depth (maximum)	6 feet
Storage @ 44,000 gpd, each	46 days



$V=1/3\ (h)\ (A+a+\sqrt{Aa})$

Where A=area at top of berm or W.S.

a=area at pond bottom

h=height to top of berm or W.S.

$V_{top\ of\ berm}$ =2.1 MG

$V_{w.s.}$ =2.0 MG

MASON COUNTY

HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE 8-3
INFILTRATION PONDS

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TABLE 8-14

Preliminary Capital Cost Estimate for Lewallen Property Reuse Alternative

No.	Item	Quantity	Unit Price	Amount
1	Mobilization/Demobilization	1 LS	$ 65,000	$ 65,000
2	Traffic Control	1 LS	$ 5,000	$ 5,000
3	4-Inch Force Main (DR 18)	4,750 LF	$ 30	$142,500
4	Lift Station	1 LS	$190,000	$190,000
5	Infiltration Area/Fencing/Monitoring Wells	1 LS	$290,000	$290,000
6	Restoration	1 LS	$ 30,000	$ 30,000

Engineer's Estimate $722,500
Contingency 15%.....$108,375
8.3% Sales Tax .....$ 68,963
Construction Cost $899,838

In Table 8-15, the annual operation and maintenance costs are presented for this alternative.

TABLE 8-15

Annual Operation and Maintenance Cost for Lewallen Property Reuse Alternative

No.	Item	Quantity	Unit Price	Amount
1	Administration	1 LS	$5,000	$ 5,000
2	Labor	150 HR	$35	$ 5,250
3	Power: Lift Station	29,000 kWh	$0.07	$ 2,030
4	Lift Station Repair and Maintenance	1 LS	$3,000	$ 3,000
5	Force Main	0.9 MI	$3,000	$ 2,700
Annual Operation and Maintenance Cost Estimate				**$17,980**

ALTERNATIVE SELECTION

In order to compare the cost effectiveness of each alternative, the 20-year life-cycle costs were calculated. A discount rate of 4.875 percent over a period of 20 years was utilized to develop lift-cycle costs along with an inflation factor of 3 percent.

Estimates for construction costs, annual costs, and 20-year lift-cycle costs are shown in Table 8-16 for each reuse alternative.

TABLE 8-16

Reuse Alternative Cost Comparison

Alternative	Construction	Annual O&M	20-Year Life Cycle
Stream Augmentation	$ 403,526	$20,446	$ 826,025
Foothills Park	$1,254,965	$25,070	$1,752,110
Lewallen Property	$ 899,838	$17,980	$1,282,502

The summary in Table 8-16 shows that the construction cost for stream augmentation is lower than either of the other two alternatives. For operation and maintenance, reuse at the Lewallen Property is the low-cost alternative.

The high-cost alternative, both for construction and annual operation and maintenance, is the Foothills Park alternative. The high head pumping requirements will require special class force main material and high-horsepower pumps. This alternative assumes reuse facilities with infiltration ponds. If this alternative is expanded to include forest spray application, an additional pumping step will be necessary since the pressure rating of the ductile iron force main is 350 psi and the additional pressure to operate the spray field (typically 50 psi) would leave no safety factor for the pipe. The additional lift station, if required for a spray field, would need to be located at Foothills Park.

The only advantage of the Foothills Park alternative is that it is a County-owned area covering 80 acres. This location covers a large area and is likely available for use. However, it is also the high-cost alternative by a substantial margin. The Foothills Park alternative is not recommended unless the property acquisition and/or permitting requirements cannot be fulfilled for the other two alternatives.

The low-cost alternative, based on the 20-year life-cycle cost, is stream augmentation. These costs are less due to the short force main and low-horsepower pumps. However, the costs do include a “chiller” unit, a reaeration manhole, and an expansion of the Operations Building. With the additional equipment and space, the annual operation and maintenance costs are greater than the reuse facilities located on the Lewallen property.

The difficulty with this alternative is permitting. Ecology’s policy with the Hood Canal basin is not to issue permits for new discharges to impaired water bodies, which include Hood Canal. While the proposed design criteria address the allowable uses for Class A reclaimed water under RCW 90.46 and the Water Quality Standards under WAC 173-201A, one significant unknown is the required nitrogen level. In Chapter 7, the MBR facility was proposed to meet a total effluent nitrogen concentration of 10 mg/L. If Ecology was to consider issuing an NPDES permit for stream augmentation to Finch Creek, which appears unlikely, there may be a nitrogen concentration requirement such as 5 mg/L, which cannot be reliably achieved with an activated sludge facility.

While the costs for stream augmentation presented in Table 8-16 favor this alternative, the risks and permitting requirements do not. Therefore, stream augmentation of Class "A" reclaimed water is not recommended.

Use of Class "A" reclaimed water for infiltration on the Lewallen property provides several design and implementation advantages. The pumping requirements do not require the exceptional pressure rating as the Foothills Park alternative or the high-horsepower pumps. The location of the reuse facilities is near the treatment facility, thus providing convenience for monitoring and operation and maintenance. Finally, Mason County staff operates similar reuse facilities at North Bay under Ecology's State Waste Discharge (SWD) Reclaimed Water Program. The primary difficulty with this alternative is completing the property acquisition needed to implement this alternative and providing access road improvements for the ponds. However, these difficulties appear to present a lower risk than stream augmentation and significantly lower costs than the Foothills Park site. Therefore, the recommended alternative for reuse is infiltration on property owned by Lewallen.

CHAPTER 9

COLLECTION SYSTEM ANALYSIS

INTRODUCTION

Collection and disposal of wastewater in the Hoodsport area is currently handled by on-site systems. There are a few advanced systems but generally most on-site systems are older, conventional gravity systems. It is unlikely that most of these on-site systems would meet current Mason County Department of Health or Washington State Department of Health requirements.

This Chapter uses much of the analysis completed for Hoodsport in the *Finch Creek Wastewater Feasibility Study* (August 2000). The Finch Creek Study evaluated four types of collection systems, and then several combinations for Service Area 2. Service Area 2 covered Finch Creek and part of the Highway 101 corridor. The proposed service area discussed in Chapter 5 is an expansion of Service Area 2.

A complete wastewater system consists of collection, treatment, and disposal. Typically, the collection component represents two-thirds, or more, of the overall system cost.

COLLECTION SYSTEM CONSIDERATIONS

Important factors for the selection of a collection system include topography, geology, design flows, system features, and lift station requirements.

TOPOGRAPHY

The topography of Hoodsport is characterized by relatively flat terrain along Highway 101 and the lower reaches of Finch Creek, but steep slopes west of the shoreline areas. Elevations within the service area range from near sea level along the shoreline to nearly 200 feet at the top of North Hill Road and Harrison Avenue.

GEOLOGY AND SOILS

For sewer system construction, the geology and soils along with the depth to groundwater determine the difficulty of pipeline trench construction. Surface soils in Hoodsport are described in detail in Appendix A. In general, surface soils are gravelly with hardpan at shallow depths. It is expected that shallow trenches (less than 4 feet) can be accomplished easily, but deep trenches typically required for gravity pipe would be increasingly difficult due to hardpan.

GROUNDWATER

Seasonally high groundwater exists along Finch Creek and a high groundwater table is found year round at the low elevations near Hood Canal. Deep excavations in these areas would require costly shoring and dewatering for pipeline installation.

DESIGN FLOWS

The design flows and criteria are presented in Chapter 6. Wastewater collection systems are designed for peak hour flow. In Table 6-4, the estimated peak hour flow in 2025 is 154,000 gallons per day. Gravity collection systems are constructed with a minimum diameter pipe of 8 inches. At minimum slope, the capacity of the gravity system is approximately 450,000 gallons per day. These lower design flows indicate other collection system alternatives in addition to a gravity system.

DESIGN CONSTRAINTS

There are three features of the Hoodsport RAC which significantly influence the layout and selection of the type of collection system. These are Finch Creek, Highway 101, and the Hood Canal shoreline.

Finch Creek

Finch Creek flows west to east into Hood Canal through the service area. Finch Creek Road crosses Finch Creek twice and Highway 101 crosses the creek near the fish hatchery. These crossings limit the ability to construct a gravity collection system. The options for crossing Finch Creek include trenchless construction below the creek bed or an attachment to the bridge. Attaching the sewer pipe to a bridge or other structure eliminates the gravity system as an option, and trenchless construction would result in deep excavations for downstream pipe. These deep excavations would significantly increase costs due to shoring and dewatering requirements.

Highway 101

The topography along Highway 101 is generally flat. In addition, Highway 101 is the major north-south highway and has both water and underground power as existing utilities. Without a natural grade, a gravity system will become increasingly deep in order to maintain downward slope for a scouring velocity of 2 feet per second. Even at minimum slope, elevation will fall 4 feet per 1,000 feet of pipe. Greater depths would result in increasingly wider trenches. For Highway 101, greater pipe depths and wide trenches would have a significant impact on traffic. The ability to detour traffic around construction along Highway 101 is limited by the lack of alternate routes. The combination of existing utilities and topography along Highway 101 eliminates the gravity collection system from further consideration.

Hood Canal Shoreline

Some of the residences and businesses along the eastern shoreline are located at lower elevations than Highway 101. As discussed above, service to these locations would require very deep excavations for gravity collection. However, another option for a collection system is a vacuum system. Vacuum systems can be installed in areas with level and rolling topography, but are limited in terms of suction head to about 15 feet. That is, this is the capability of each vacuum station. Several of the residences along Highway 101 are located 5 to 10 feet below the highway, particularly in the southern part of the service area. In the Finch Creek Study, the vacuum collection system was considered a feasible alternative, but not cost effective for Service Area 2. However, for the proposed service area, the vacuum collection system would require multiple vacuum stations in order to be feasible. Site constraints along Highway 101 indicate that a vacuum system would be an even more costly alternative for the proposed service area.

SCREENING OF THE COLLECTION SYSTEM ALTERNATIVES

The following list covers the potential types of collection systems for the Hoodsport RAC:

- Grinder pump collection system
- Septic tank effluent pump (STEP) collection system
- Septic tank effluent gravity (STEG) collection system

A description of each type of system is provided below.

Grinder Pump System

A grinder pump system consists of a pump and holding tank. Grinder pumps are used to grind solids and then transport wastewater from the building on the property to the main collection system. A typical configuration of a grinder pump is shown on Figure 9-1. The holding tank must have sufficient volume for storage during periods of power loss (24 hours is normal). The typical location of grinder pumps is next to the buildings they serve. The collection system consists of small-diameter force main made of PVC or polyethylene (PE) pipe with cleanouts and isolation valves installed for cleaning and maintenance of the lines.

Based upon the Department of Ecology's *Design Criteria for Sewage Works*, it would be the responsibility of the operating entity to own, operate, and maintain the grinder pumps. The operating entity would need easements or rights-of-entry to access private property for the installation and maintenance of the pumps. An alarm system will also be installed to signal pump system malfunctions.

The operating entity would be responsible from a cleanout located just upstream of the grinder pump to the property line. The property owner will be responsible from the building to the cleanout. These partitions are shown in Figure 9-1. To run the grinder pump, electric power will generally be obtained from the existing building service as shown on the elevation view on Figure 9-2. The owner will be responsible for the installation, operation, and maintenance of the electrical connection and the electrical bill, estimated at $3 per month for a typical residence.

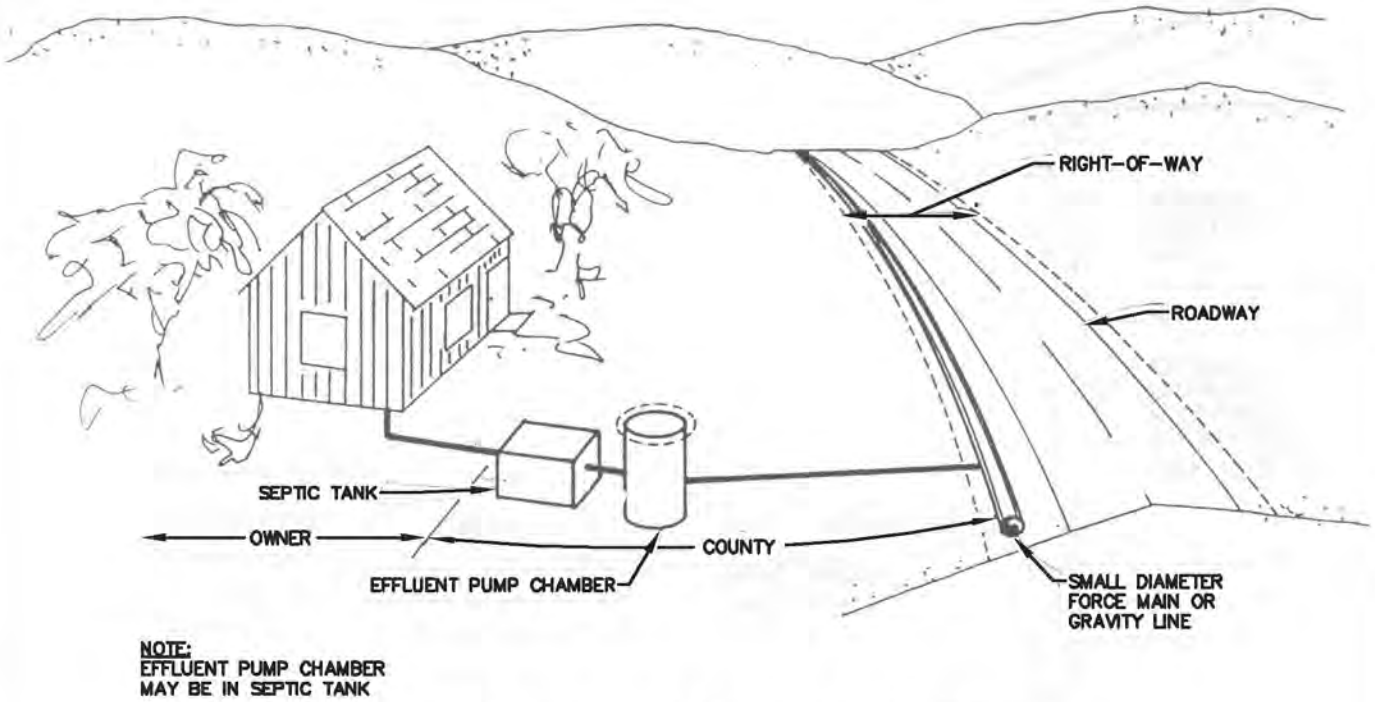
An alternate approach for electrical service involves PUD "drops" within public rights-of-way and providing power for a cluster of grinder pumps. Under this alternative, the operating entity would pay for the electrical costs and would recover these costs through monthly billings. This approach for electrical service may also apply to the operation of STEP pumps.

The advantage of the low-pressure grinder pump system over the STEP system is that the septic tank is not required. Therefore, the costs associated with installation and operation and maintenance of individual tanks would be eliminated. Grinder pumps have the ability to handle solids, where STEP pumps cannot. Grinder pumps are better able to handle wastewater from commercial buildings because they can accept increased solids and grease, as well as have a readily available explosion-proof pump made specifically for high-grease environments. Like STEP systems, grinder pump systems require minimal excavation for pipe installation (less than 3 feet). The excavation and road restoration costs are reduced significantly from those of the gravity system.

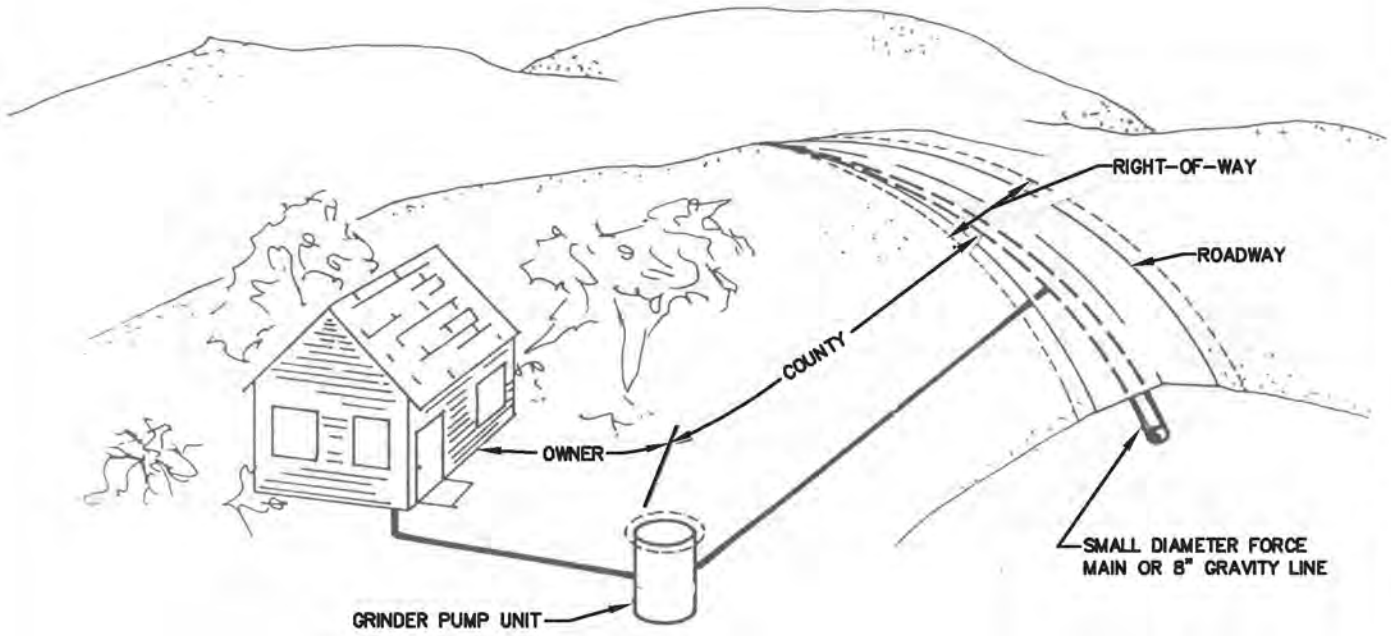
The main disadvantage of the grinder system, when compared to STEP systems, is that the pump on the grinder is typically larger, as it must also grind wastes. Operation of a grinder pump requires a 30-amp, two-pole circuit, 220-volt for its operation compared to a single 20-amp, 120-volt service for a STEP pump. For some existing service panels, the electrical requirements for a grinder pump cannot be accommodated. Like STEP systems, the grinder pump system can malfunction if stormwater enters the collection lines during periods of heavy rainfall. The system could also become hydraulically overloaded from sources of inflow such as illegal stormwater connections and from homeowners who pump flooded basements or garages into the system.

A standard progressing cavity grinder pump is sized for a capacity of about 10 gallons per minute at a total head of 140 feet. However, with recent improvements in the pump design, a total head of 180 feet can be reached. If the treatment facility site is located at a higher elevation, the grinder pump system must be capable of reaching the higher elevation under pressure. Otherwise, the grinder pump system would discharge to a community lift station.

Grinder pump systems are operating in Kitsap County, Pierce County, and Mason County.



STEP UNIT CONFIGURATION



GRINDER PUMP CONFIGURATION

MASON COUNTY
HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE 9-1
TYPICAL CONFIGURATION FOR STEP AND GRINDER PUMP SYSTEMS

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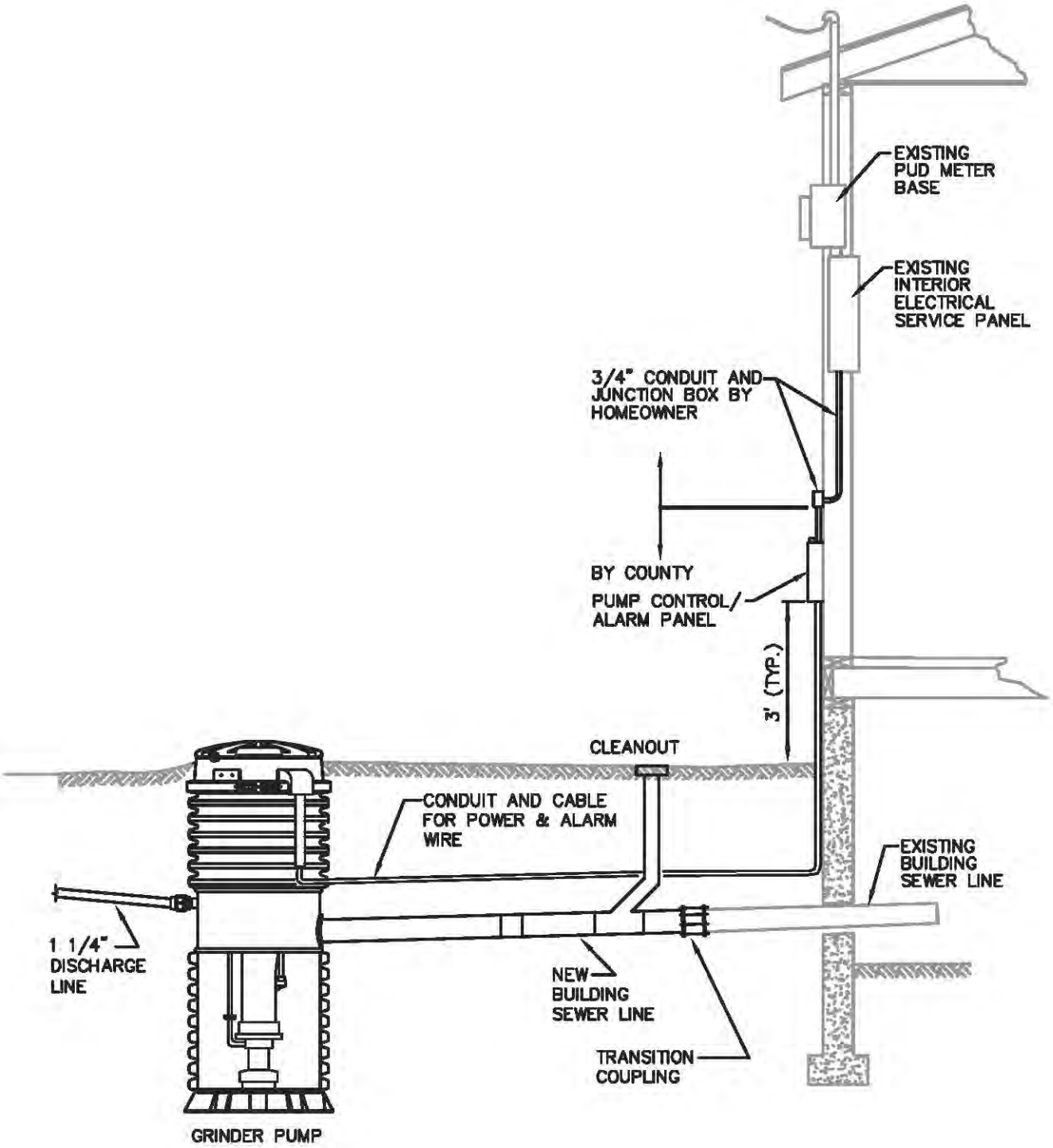
M:\MASONCO\07570\FIGURES\FIG 9-1.DWG, FIG 9-1, 7/6/2007 11:37:08 AM, 1:1, BY: M NAGEL



MASON COUNTY
HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE 9-2
GRINDER PUMP ELEVATION

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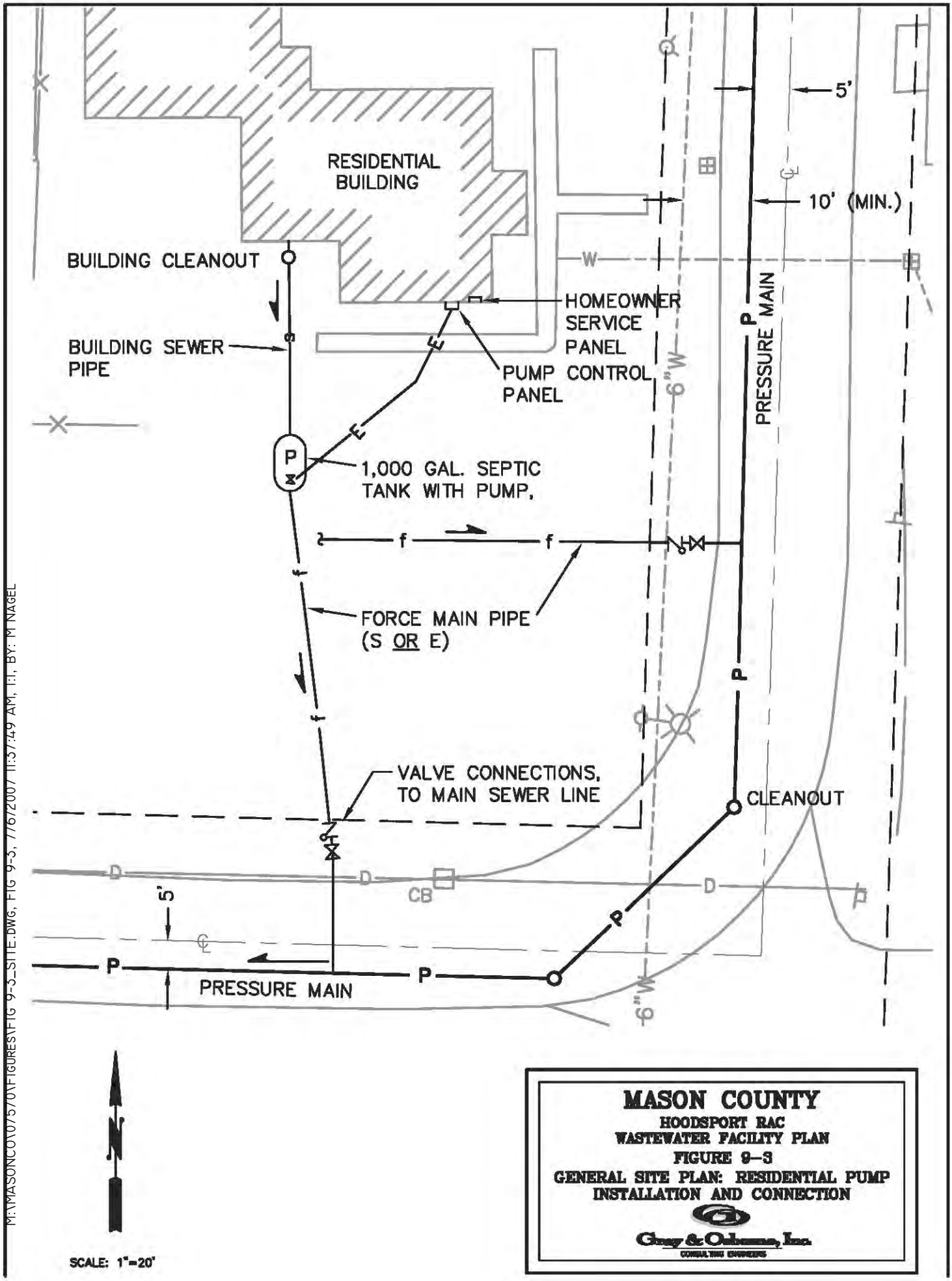
M:\MASONCO\07570\FIGURES\FIG 9-2.DWG, FIG 9-2, 7/6/2007 11:37:30 AM, 1:1, BY: M NAGEL



MASON COUNTY
HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE 9-3
GENERAL SITE PLAN: RESIDENTIAL PUMP INSTALLATION AND CONNECTION

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Grinder Pump Pressure System Feasibility

A preliminary analysis of a low-pressure grinder pump system for the Service Area was done by modeling the pipe network within the Service Area. Information from the "windshield survey," site visits, topographic maps, and the Mason County GIS website, which shows aerial photographs, roads, topographical maps, and plat information, was used to design the pipe network.

The analysis utilized a modeling program called E-One Design Assistant, which is proprietary software supplied by the manufacturer of E-One Sewer Systems, Environment One Corporation. Based on the results of the modeling, a grinder pump system may be feasible for the Service Area. The primary modeling input parameters are elevation changes and length of mains. The analysis was used to determine fluid velocity, pipe size, and total dynamic head (TDH) for each major section or zone of the piping network. A summarized version of the results is in Appendix E. Figure 9-4 shows pipe sizing as well as the physical layout of the piping network within the Service Area.

To model the Service Area, usage zones are defined which enable pipe sizing and definition of TDH and fluid velocity. The results are based on future wastewater design flows, the elevation of the lowest pumps within each zone, and the elevation of the treatment facility location. Modeling was used to evaluate several treatment facility locations as shown on Figure 7-1. The model indicated that a lift station would be required for one upland site, but not for any of the sites considered for the central area of Hoodsport.

Septic Tank Effluent Pump (STEP) System

A septic tank effluent pump (STEP) pressure system utilizes a septic tank at each property to provide partial treatment of the wastewater before the wastewater is transported to a treatment plant. Once solids are removed at the septic tank and are partially stabilized, the effluent from the septic tank is transported by pressure through small-diameter lines (1.25- to 4-inch) to a central wastewater treatment facility or lift station. STEP systems utilize low-horsepower pumps to transport the effluent. Figure 9-1 shows a typical configuration of a STEP system, Figure 9-3 shows a more detailed site plan, Figure 9-5 presents an elevation view of the STEP system, and Figure 9-4 shows the piping network and pump locations.

STEP systems can either incorporate the homeowner's existing septic tank or a new tank unit can be installed. If the existing tank can be used, a pump chamber would need to be placed downstream of the septic tank. Other concerns that need to be addressed when considering the use of existing septic tanks are listed below:

- The location of septic tanks is not always known or septic tanks may be located in an area that does not allow proper operation and maintenance.

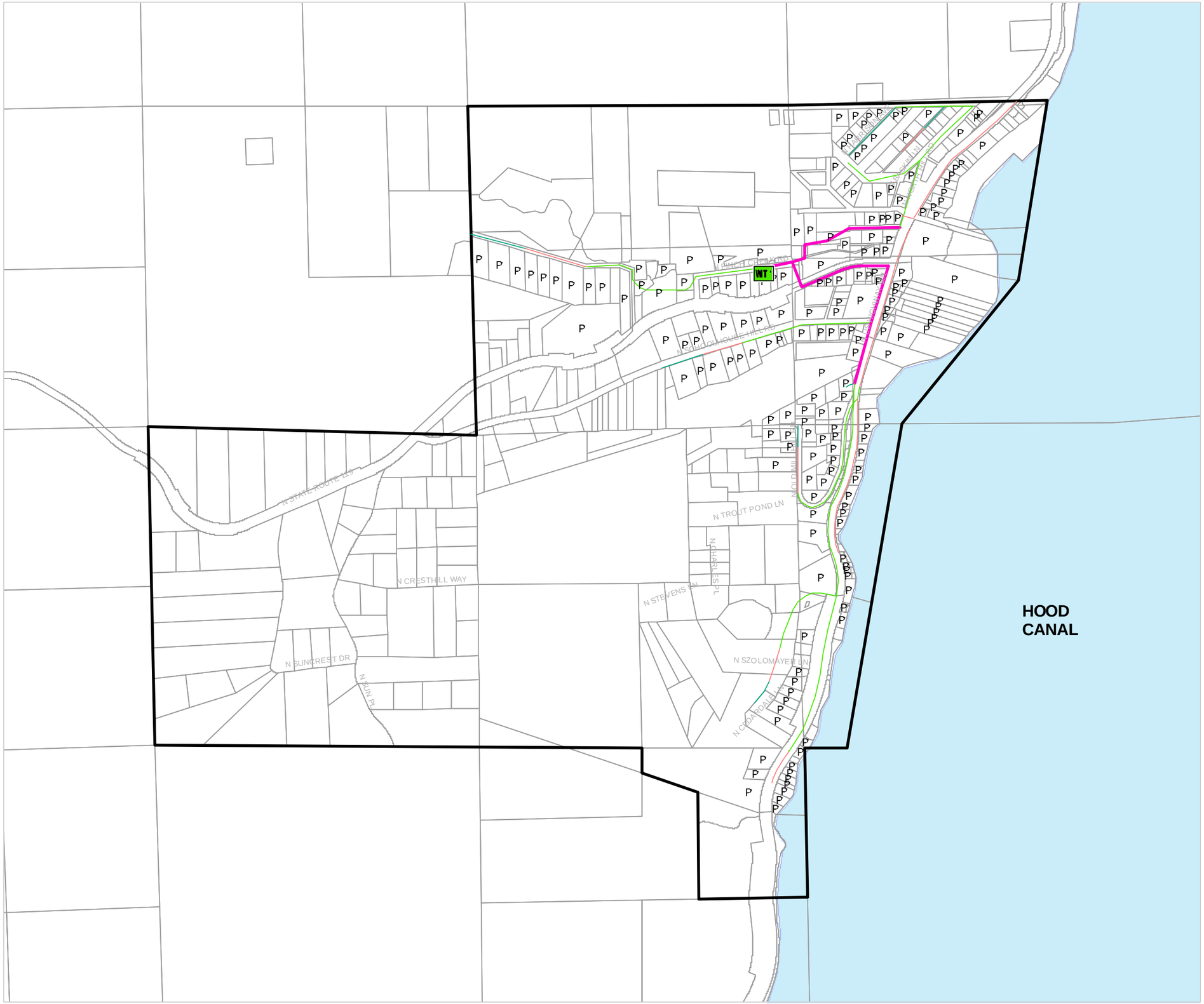
- The septic tank must be pumped and checked for structural integrity.
- The existing septic tank would have to be the correct size and have adequate baffling.
- The existing tank must be properly waterproofed to prevent high groundwater from entering the tank.

With older communities such as Hoodsport, it can be assumed that the existing septic tanks are not suitable for use with STEP pumps. Older concrete unbaffled tanks are typically not watertight. With a pump system, a significant amount of groundwater may be pumped where a leaking septic tank exists. Thus, use of existing tanks is not considered a feasible option.

With a new tank, the pump chamber will be located within the tank. A screen must be installed to prevent solids from entering the pumps and the collection lines. This is of extreme importance since most STEP systems do not maintain scouring velocity (greater than 2 feet per second flow velocity in the pipe) and can be easily clogged by solids entering the collection system.

Based upon the Department of Ecology's *Design Criteria for Sewage Works*, it would be the operating entity's responsibility to own, operate, and maintain the low-pressure system including septic tanks and pumps. It would need to obtain easements or rights-of-entry in order to access private property for the installation and maintenance of the septic tanks, pumps, and sewer lines. An alarm system will also be installed to signal pump system malfunctions. The septic tank will also have to be checked and pumped as needed. Because of the combination both of permanent and seasonal households, the pumping frequency will vary widely. There will need to be a plan for solids pumping and disposal to ensure solids are not discharged to the pressure collection system. Pumping the septic tanks may be entirely the operating entity's responsibility. Alternately, it may require the owner to pump the septic tank through a notification process.

The operating entity's responsibility for a STEP system would begin at the cleanout, which is installed 2 to 3 feet upstream of the septic tank. The STEP system would include the tank, pump, and piping system to the property line. Between the building and the cleanout is the responsibility of property owners. These partitions are shown in Figure 9-1. In addition, the electrical connection for the operation of the STEP pump is the responsibility of the operating entity, although the power bill is typically paid by the property owners. In the event of a power failure, wastewater will be stored in the septic tank. The typical electric cost is estimated at $3.00 per month for a typical residence.



N

0 400 800 1,600 Feet

SCALE 1" = 800'

LEGEND:

- WTP TREATMENT FACILITY
- P STEP / GRINDER PUMPS

GRINDER PUMP PIPING:

- 1.25"
- 1.5"
- 2"
- 3"
- 4"
- HOODSPORT RAC
- PARCELS

MASON COUNTY

HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE 9-4
STEP SYSTEM / GRINDER PUMP PIPING WITH STEP SYSTEM / GRINDER PUMP LOCATIONS

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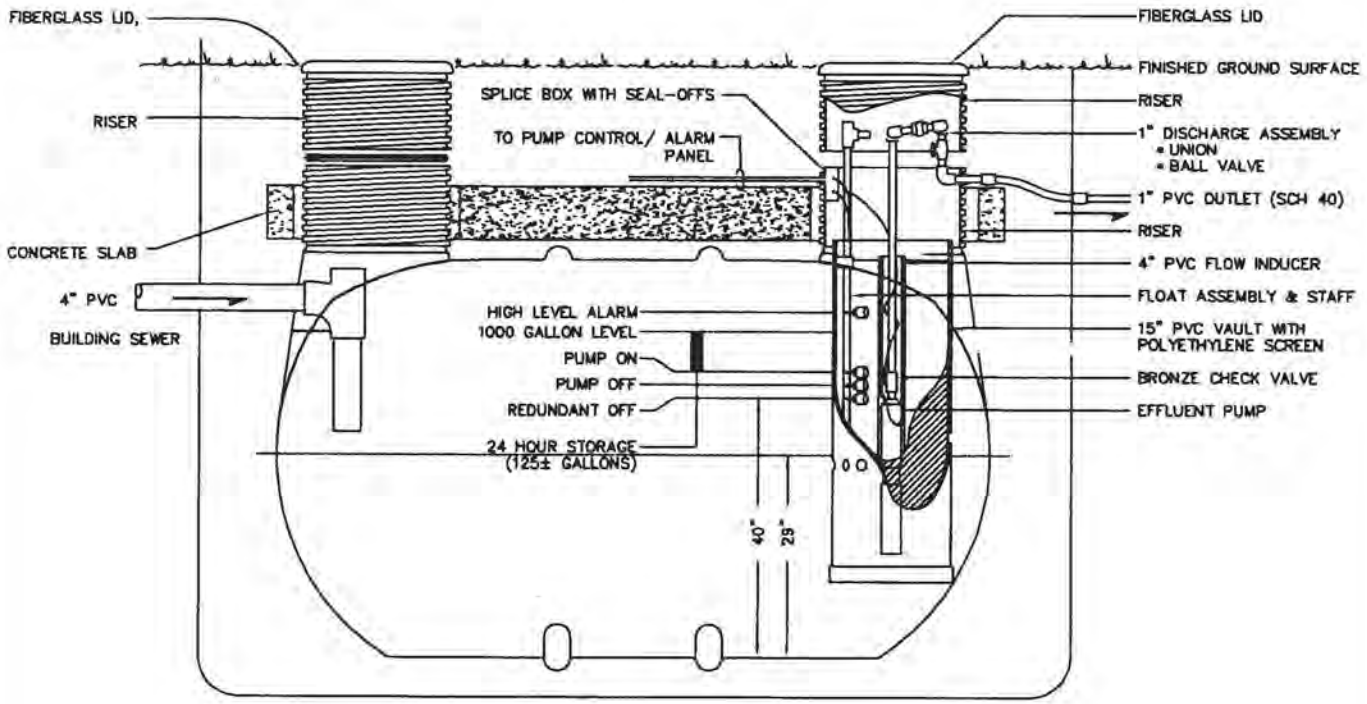
CONSULTING ENGINEERS

O:\CLIENTS\MasonCo\HOODSPORT RAC WW PLAN\FIG9-4.mxd



MASON COUNTY
HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE 9-5
STEP PUMP AND TANK ELEVATION

Gray & Osborne, Inc.
CONSULTING ENGINEERS

M:\MASONCO\07570\FIGURES\FIG 9-5.DWG, FIG 9-5, 7/6/2007 11:36:44 AM, 1:1, BY: M NAGEL

There are a number of advantages to the utilization of a STEP system. Small-diameter pipes can be buried at shallow depths (about 3 feet deep), which are less costly both in construction and material costs. The collection piping can be installed on the shoulder of the road, which would minimize the impact to the roads and traffic flow. Another cost reduction with STEP systems is the lower organic loading that the central treatment plant has to handle. The reason for this is that a portion of the BOD and TSS is removed in the septic tank.

A significant advantage of the STEP system over a grinder pump system is the capability to include 24 hour's storage. The use of a pump with a septic tank allows part of the septic tank to be reserved for emergency storage. A typical grinder pump unit has a small tank, typically sized for 70 gallons.

The disadvantages of STEP pressure systems are the high costs for installation and maintenance of the septic tank and pump for each property and the need for easements or rights-of-entry for their installation. A typical STEP system is contained with a 1,200-gallon tank compared to a 70-gallon grinder pump unit. Another concern with the STEP system is the low dissolved oxygen (DO) levels in the septic tank effluent. Low DO levels will also be produced in the force mains and septic tanks. Low DO conditions can cause elevated hydrogen sulfide levels producing odor problems as well as corrosion in pump station wet wells.

Another disadvantage of a STEP system is the problems associated with serving commercial establishments such as restaurants. Grease is a problem with most all collection systems, but more so with STEP pumps. Grease interceptor tanks are a necessity with a STEP system.

STEP pressure systems have the potential to malfunction during periods of heavy rainfall that can result in high levels of inflow. Inflow results from activities such as illegal stormwater connections and property owners pumping basements or garages into the STEP system tank. These sources of inflow can easily cause system overload due to the small diameter of the collection piping. With the excess stormwater in the lines, pressure builds up and some upstream units will not be able to pump because of the system overload. To avoid this possibility, each property should be reviewed prior to construction to eliminate stormwater inflows into the system.

STEP systems are in use for the Town of Edison in Skagit County and the City of Montesano in Grays Harbor County.

Septic Tank Effluent Gravity (STEG)

A STEG system differs from a STEP system by eliminating individual pump units. The STEG system requires septic tanks for individual properties, but utilizes small-diameter pipelines for effluent collection. Because the septic tanks remove solids, the STEG

system pipelines can have slopes less than standard gravity sewers and be small in diameter.

For Hoodsport, it is unlikely that the entire service area can be served by a STEG system. A STEG system must flow by gravity directly to a community lift station or a treatment facility. It cannot discharge to a pressure pipeline. However, in parts of the service area, it may be feasible to eliminate a number of individual pump units with a small lift station. One possible area is the Finch Creek corridor. The collection system would be referred to as a combination STEG/STEP.

EVALUATION OF COLLECTION SYSTEM ALTERNATIVES

Collection system schematics are presented for the grinder pump, STEP, and STEP/STEG alternatives in Figures 9-4 and 9-6.

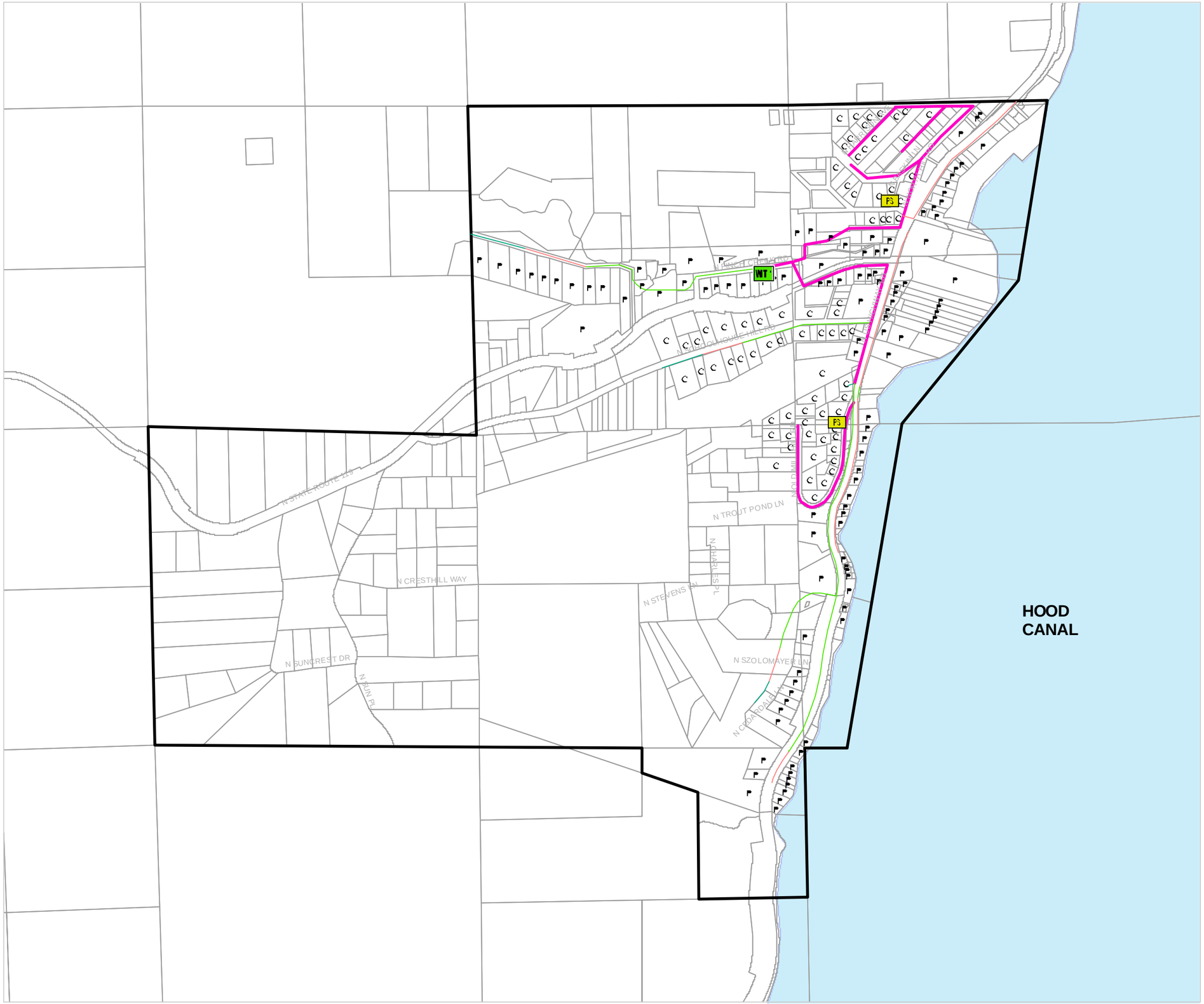
Collection system alternatives were evaluated for capital costs; operation and maintenance costs; and non-cost factors such as reliability, public and regulatory acceptance, and environmental factors.

CAPITAL AND OPERATION AND MAINTENANCE COSTS

Construction costs were developed from preliminary design criteria, preliminary quantity take-offs, and bid summaries from similar projects. Costs were developed based on the assumptions that existing residences and businesses would be connected to the system with new septic tanks and that the collection lines would serve buildout population. Construction cost estimates are presented in Appendix F.

Operation and maintenance costs were also developed for each alternative based on the categories of administration, labor, power, repair, and replacement. Factors that are important for establishing operation and maintenance (O&M) costs are the type and quantity of equipment required, system complexity, and operation requirements. O&M costs were developed from established costs for similar facilities in the State of Washington. A list of assumptions covering unit labor costs, power rates, pumping rates, and annual replacement costs is included in Appendix F.

In addition to the operation requirements, there also will be administrative costs with a sewer collection system. Potential administrative costs include billing (similar to a water system), notices and tracking for septic tank pumping, customer calls and complaints, and annual reports. When mechanical sewer system components are located on private property (e.g., STEP or grinder pumps), administration costs increase. Administrative costs for STEP systems will be higher than the grinder pump systems due to the additional task to manage septic tank pumping.


N STATE ROUTE 119
N CRESTHILL WAY
N SUNCREST DR
N SUN PL
N TROUT POND LN
N STEVENS LN
N CHARLES PL
N SZOLOMAYER LN
N GUADALUPE
N HOOD CANAL DR
N HOOD CANAL DR
N HOOD CANAL DR

In order to compare the cost effectiveness of each alternative, 20-year life cycle costs were calculated. A discount rate of 4.875 percent over a period of 20-years was utilized to develop life cycle costs along with an inflation factor of 3 percent.

Estimates for construction costs, annual O&M costs, and 20-year life cycle costs are shown in Table 9-1.

TABLE 9-1

Collection System Alternative Cost Comparison

Alternative	Construction	Annual O&M	20-Year Life Cycle
Grinder Pump	$3,791,648	$35,584	$4,366,465
Septic Tank Effluent Pump (STEP)	$3,661,125	$46,380	$4,410,339
Septic Tank Effluent Gravity (STEP/STEG)	$3,746,065	$51,250	$4,573,948

The collection system grinder pump is the slightly more cost-effective alternative when compared to the STEP system. The STEP/STEG system is the high-cost alternative.

The difference between the two low-cost alternatives is about 1 percent. For planning level estimates, these two alternatives may be considered equivalent. For initial screening of collection system alternatives, it is assumed power for individual residential pumps will be provided from the homeowner's service panel.

NON-COST FACTORS

Each of the collection system alternatives for the service area was evaluated for non-cost factors such as reliability, regulatory compliance, public acceptance such as odor control and aesthetics, and environmental considerations such as noise, odor, and aesthetics. These factors, along with construction and O&M costs, are included at the end of this chapter in a matrix that ranks each alternative.

Reliability

The quantity and complexity of mechanical equipment increases the potential for a system malfunction and thus for emergency response by the Town. The primary mechanical equipment for the collection system alternatives include pumps, either located at individual residences or at a central lift station. Ecology requires auxiliary power for lift stations and provisions for storage for individual STEP or grinder pump units.

Mason County PUD No. 1 owns and operates a water system with storage. In the event of a power outage, water service will continue unlike communities which are served by individual wells. Operation of the major sewer system components, therefore, need to continue during extended power outages.

Grinder Pump Pressure System

Grinder pumps would be installed on each property with an alarm system. If there is a pump malfunction or high water alarm, the owner is responsible for notification. The standard size grinder pump wet well contains only 70 gallons storage which may not be adequate beyond a 24-hour period. Either supplemental storage or a larger wet well (e.g., 120 gallons) can provide additional storage but also at an additional cost. The construction cost in Table 9-1 was based on the standard unit with 70 gallons of storage.

STEP Unit Pressure System

Similar to the grinder pumps, STEP pumps would be installed on each property with an alarm system. If there is a pump malfunction or high water alarm, the owner is responsible for notification. However, unlike the grinder pump installation, the STEP system includes a septic tank which can accommodate a large volume of emergency storage. The normal "pump on" level can be set such that 12 inches, or approximately 125 gallons, is reserved for storage.

STEP/STEG System

This alternative reduces the number of STEP pumps by about 50 percent, but at the cost of one or more lift stations. Still, the gravity component of this alternative improves system reliability by eliminating 94 individual pumps. The individual septic tanks can be installed with emergency storage by setting different inlet and outlet levels in the tank. Any lift station would be equipped with an auxiliary generator and an alarm and telemetry system. The telemetry system allows for a dial-out feature in the event of an alarm.

Table 9-2 rates each of the collection system alternatives with regard to reliability using a scale of one (lowest) to ten (highest).

TABLE 9-2

Collection System Alternative Ranking for Reliability

Alternative	Rating	Comments
Grinder Pump	4	Homeowner notification requirement. Minimum system storage.
STEP System	6	Homeowner notification requirement. Built-in storage with each septic tank.
STEP/STEG System	7	Reduces number of individual STEP pumps, but requires central lift station.

ENVIRONMENTAL FACTORS

Odors, noise, and aesthetics are the primary concerns of the public when new wastewater facilities are constructed. The source of most public complaints is odors and noise in collection system lift stations. Odor is a common concern with both STEP and grinder pump pressure systems because of the long length of force main required. However, of these two alternatives, STEP systems are a greater concern for odors due to the lengthy detention times associated with a septic tank. Odors will be a significant concern with the STEP/STEG system because of the discharge to a lift station instead of the treatment facility. Some odor control facilities will be required.

Aesthetics is an issue with each of the collection system alternatives. Installation of a grinder pump unit results in a 30-inch-diameter lid visible at grade. The STEP system contains a septic tank with two access lids.

Both STEP and grinder pump systems require electrical control boxes and alarms which can be seen and heard by the public. The STEP/STEG alternative, however, reduces visual and noise impacts by limiting the number of STEP pumps.

Each of the collection system alternatives is ranked according to the environmental factors of noise, odor, and aesthetics as presented in Table 9-3. A ranking of ten is highest (most acceptable) while a ranking of one is the lowest (least acceptable).

TABLE 9-3

Collection System Alternative Environmental Factors

Alternative	Noise	Odor	Aesthetics	Total
Grinder Pump	8	8	7	23
STEP System	8	7	7	22
STEP/STEG System	7	6	7	20

PUBLIC ACCEPTANCE FACTORS

The primary factor impacting public acceptance is typically the overall cost impact of the system. However, this section of this Chapter considers the significant additional factors of homeowner involvement and electrical requirements.

Homeowner involvement may mean such responsibilities as alarm notification or scheduling septic tank pumping. Typically, the less day-to-day responsibility, the higher degree of public acceptance.

Where individual pumps are installed on each property, these pumps will require power for their operation. Typically, but not always, the source of power is the homeowner's service panel. With a STEP pump, the electrical requirement is a 120-volt, single-phase service requiring a single 20-amp circuit breaker in the panel. This level of service is no different than an on-site system with a pressurized drain field. The electrical service with a grinder pump is 220-volt, single phase requiring a two-pole, 30-amp circuit breaker.

While this difference may appear to be minimal in older homes, panel capacity can be a significant issue with additional costs associated with providing panel upgrades for grinder pumps. Panel upgrades with STEP pumps are less likely because of less capacity required for their operation.

Individual homeowner electrical responsibility can be avoided with new PUD service within the right-of-way and serving a number of residences from a single meter. This approach works best for new construction and where residences are "clustered" in a cul-de-sac. Otherwise, this approach requires long conduit and conductor runs from the PUD meter or a significant number of new PUD services. This more compact type of development, however, does not describe existing development in Hoodsport.

The STEP/STEG alternative reduces the number of individual pump units and thus the electrical requirements.

Each of the collection system alternatives are ranked in Table 9-4 according to two public acceptance factors: (1) homeowner involvement, and (2) electrical requirements. A ranking of ten is the highest (most acceptable) while a ranking of one is the lowest (least acceptable).

TABLE 9-4

Collection System Alternative Public Acceptance Factors

Alternative	Homeowner Involvement	Electrical Requirements	Total
Grinder Pump	7	3	10
STEP System	6	4	10
STEP/STEG System	6	5	11

The non-cost factors from Tables 9-2, 9-3, and 9-4 are combined and summarized below in Table 9-5.

TABLE 9-5

Collection System Alternative Summary of Non-Cost Factors

Alternative	Reliability	Environmental	Public Acceptance	Total
Grinder Pump	4	23	10	37
STEP System	6	22	10	38
STEP/STEG System	7	20	11	38

SUMMARY OF ALTERNATIVES

In Table 9-1, the grinder pump collection is shown to be slightly more cost effective based on a 20-year life-cycle cost. The primary difference between the grinder pump and STEP systems is the cost to manage septic tank pumping in addition to repair of the pump units.

In Table 9-5, both the STEP and STEP/STEG systems rank slightly higher than the grinder pump system. With septic tanks, there is a larger storage volume available during extended power outages. In addition, the higher level of power service is a disadvantage for the grinder pump unit. However, the grinder pump unit results in a smaller footprint on individual property and would be expected to have fewer problems with odors.

A final consideration regarding the selection of a collection system is the type of system currently in use. The two most likely operating entities are the Mason County Department of Utilities and Mason County PUD No. 1. Both entities utilize grinder pumps. Because neither the cost summary in Table 9-1 nor the ranking of non-cost factors in Table 9-5 provides a substantial justification for changing the existing type of collection system, the grinder pump system is the recommended collection system alternative.

CHAPTER 10

SUMMARY AND RECOMMENDATIONS

DESCRIPTION OF THE RECOMMENDED PLAN

The recommended treatment alternative is the membrane bioreactor (MBR) process located on a site near the Fire Hall. The MBR system consists of an anoxic tank, mixed liquor pumps, two membrane tanks, permeate pumps, an ultraviolet disinfection unit, a reclaimed water lift station, temporary bypass storage for non-Class "A" water, and a sludge storage system.

Preliminary treatment shall consist of a magnetic flow meter to measure the influent flow rate, a composite sampler to measure the influent water quality, and an influent screen. Membrane filters are very sensitive to foreign objects, so the screen will be sized for 2 to 3 mm width. For this system, grit channels are not proposed since the collection system is low pressure without any gravity components. In addition, the anoxic tank may collect any grit which can be removed by a vactor truck.

Following fine screening, influent will enter the anoxic tank, which contains activated sludge mixed liquor. The mixed liquor will recirculate between the anoxic tank and the membrane tanks to provide nitrogen removal. Mixed liquor will be pumped from the anoxic tank to the membrane tanks and overflow by gravity to the anoxic tank.

Permeate (filter effluent) will be pulled through the membranes by permeate pumps which discharge to an ultraviolet disinfection system for disinfection to Class "A" standards prior to conveyance to the reuse sites. The UV channel area will be provided with a canopy to protect the equipment and provide a covered area for ultraviolet lamp cleaning. A composite sampler will be installed at the end of the ultraviolet channel.

The MBR system will be continuously monitored for turbidity, ultraviolet lamp status, and other system features. In the event of high turbidity, low ultraviolet intensity, or other events, effluent will automatically be discharged to a bypass pond until the problems can be remedied. During the predesign phase, a formal reliability analysis will be prepared to address equipment redundancy and alarm features in the event of failure.

WAS pumps will periodically remove excess sludge from the membrane tanks for conveyance to a sludge storage tank. This tank will provide 2 weeks of aerated storage of sludge.

A 925-square-foot Operations Building will be constructed at the site. The building will house a small office, a laboratory, a restroom, an electrical room, and an area for the MBR equipment (e.g., pumps, blowers, and monitoring equipment).

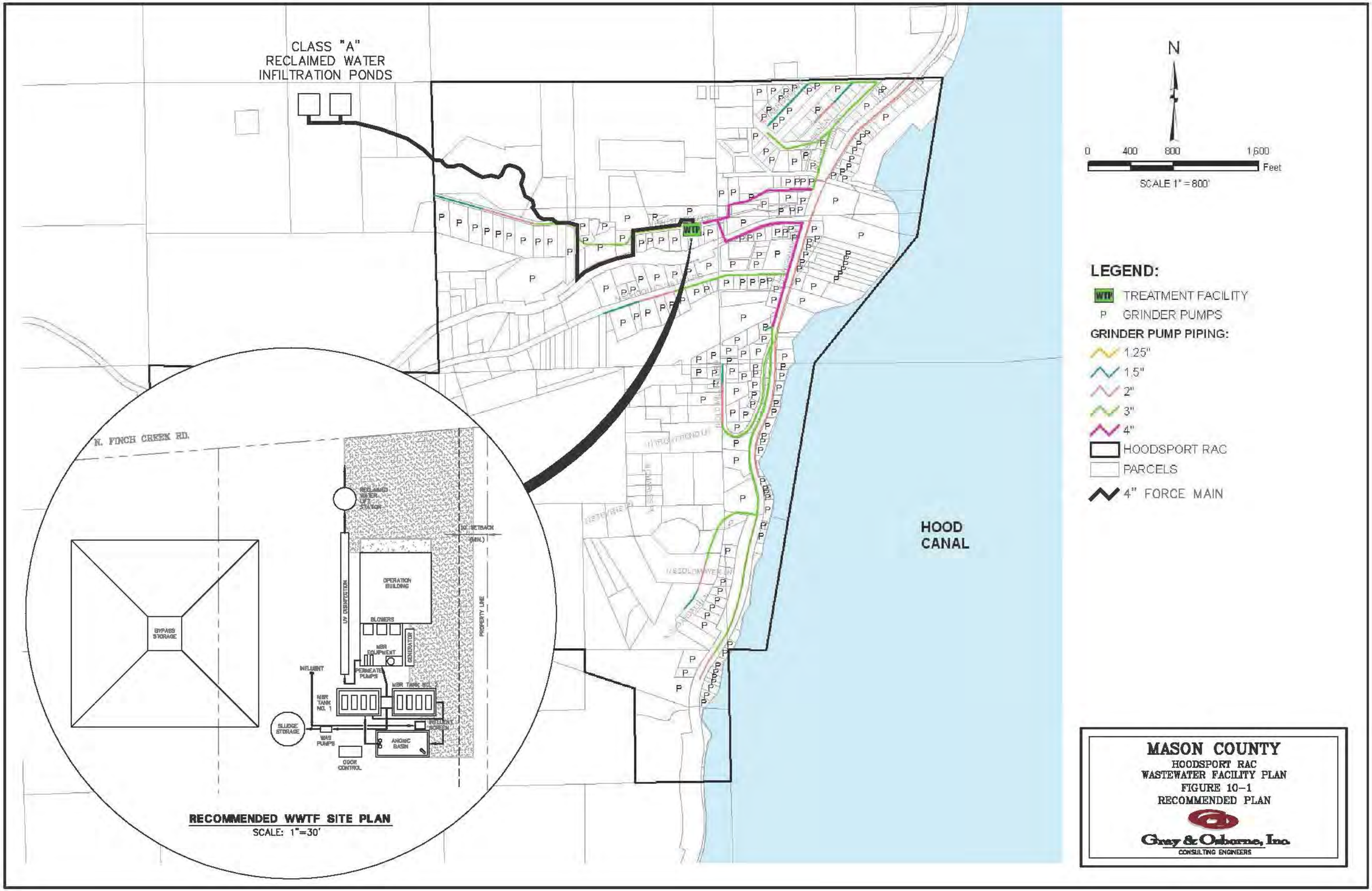
The recommended reuse area is property owned by Lewallen north of Finch Creek. Two Class "A" reclaimed water infiltration ponds will be constructed on this site. To reach the site, the reclaimed water lift station will be equipment with two 15-horsepower motors. Flow to the site will be measured by a magnetic flow meter.

The recommended sewer collection system is a grinder pump system. Each sewer connection will have a grinder pump unit with a check valve and shutoff valve located near the property line. Small-diameter pipelines will convey wastewater to the treatment site.

The major components of the recommended plan are presented on Figure 10-1.

SUMMARY OF COSTS

Chapters 7, 8, and 9 developed construction and annual operation and maintenance costs for each component of the wastewater system: treatment, reuse, and collection. Table 10-1 presents the cost summary of the recommended plan. The summary includes construction costs with a 15 percent contingency factor and an allowance of 8.3 percent for state sales tax. The construction cost estimate, together with engineering services, provides the total cost estimate.


CLASS "A"
RECLAIMED WATER
INFILTRATION PONDS
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0 400 800 1,600
Feet
SCALE 1" = 800'
LEGEND:
WTP TREATMENT FACILITY
P GRINDER PUMPS
GRINDER PUMP PIPING:
1.25"
1.5"
2"
3"
4"
HOODSPORT RAC
PARCELS
4" FORCE MAIN
HOOD CANAL
WTP
N. FINCH CREEK RD.
RECLAIMED WATER LIFT STATION
10' SETBACK (MIN.)
OPERATION BUILDING
UV DISINFECTION
BLOWERS
MBR EQUIPMENT
GENERATOR
PERMEATE PUMPS
INFLUENT
MBR TANK NO. 1
MBR TANKS NO. 2
SLUDGE STORAGE
WAS PUMPS
ANOXIC BASIN
INFLUENT SCREEN
CODK CONTROL
BYPASS STORAGE
PROPERTY LINE
RECOMMENDED WWTF SITE PLAN
SCALE: 1"=30'
MASON COUNTY
HOODSPORT RAC
WASTEWATER FACILITY PLAN
FIGURE 10-1
RECOMMENDED PLAN
Gray & Osborne, Inc.
CONSULTING ENGINEERS

TABLE 10-1

Cost Summary

Construction Cost	**Amount**
Treatment	$2,758,672
Reuse	$ 899,838
Collection	$3,791,648
Total Construction Cost	**$7,450,158**
Engineering Services (including Legal)	
Design	$ 500,000
Easements/ROEs	$ 60,000
Recording Fees	$ 10,000
Construction Support	$ 510,000
Record Drawings/Operation and Maintenance Manuals	$ 70,000
Land Acquisition	$ 350,000
Total Engineering Cost	**$1,500,000**
TOTAL PROJECT COST	**$8,950,158**
Annual Operation and Maintenance Cost	
Administration	$ 25,000
Treatment	$ 113,800
Reuse	$ 12,980
Collection	$ 25,584
Total Annual Operation and Maintenance Costs	**$ 177,364**

Table 10-1 assumes that the MBR facility and collection system will not be manned on a full-time basis. Instead, maintenance for the Hoodsport RAC will be shared with proposed facilities at Potlatch and the Skokomish Tribe.

IMPLEMENTATION

A number of legal and administrative actions will be required to ensure the long-term viability of the sewer system. The most significant of these are discussed below:

PREDESIGN/DESIGN

One of the requirements at the predesign stage will be a formal reliability analysis for the MBR treatment system and reuse area. This analysis will be submitted both to Ecology and DOH. This analysis will ensure that there are adequate redundancy, storage, and alarm features in place in the event of failure. Class “A” reclaimed water must be continuously oxidized, filtered, and disinfected.

PROPERTY ACQUISITION

Property will need to be acquired both for the treatment plant site and the reuse area. It is anticipated that the treatment plant site will be purchased. The reuse area may be purchased or leased.

ORDINANCE ESTABLISHING THE SEWER UTILITY

This ordinance would establish the service area, roles, and responsibilities and provisions for operating and funding the wastewater system. Mason County currently operates a sewer utility at the Community of Allyn and it is expected that the ordinance for the Hoodsport RAC would be similar.

One significant issue regarding the sewer utility is whether connection to the system within the service area will be mandatory. Because of the "impaired" condition of Hood Canal, it is expected that connection to the sewer system will be required. This issue and others should be addressed with a series of public meetings prior to enacting an ordinance.

EASEMENTS/RIGHT-OF-ENTRIES

Each participating property owner would need to execute an easement/right-of-way establishing rights and responsibilities. The County would be responsible for installing and maintaining the grinder pumps, utility mains and appurtenances. The owner would be required to allow access and not erect permanent structures over the sewer component. Easements/right-of-entries are legal documents which would be recorded with Mason County. Acquisition of easements/right-of-entries is work completed concurrent with sewer system design.

STATE WASTE DISCHARGE (SWD) PERMIT

The SWD permit is a permit issued by Ecology which addresses the operation of the treatment facility and reuse area. The permit sets up a testing schedule and limits on the effluent. Because the effluent discharge is to ground, there will be additional requirements for monitoring any impacts on groundwater. Primary constituents of concern will be metals and nitrogen. Typically, the SWD permit is prepared and issued is draft form by Ecology towards the end of construction.

OPERATIONS AND MAINTENANCE MANUAL/RECORD DRAWINGS

During construction, the Contractor will be required to submit operations and maintenance information for all major items of equipment installed on the project. Along with record drawings, the operation and maintenance manual becomes the project record. The engineer reviews both the operation and maintenance manual and record drawings for satisfactory completion prior to project closeout. In addition to the Contractor- and

manufacturer-provided items, the engineer will prepare a separate operation and maintenance manual which describes the system operation and addresses staffing requirements, routine maintenance, and safety. It is critical that these three items be complete in order for the County to operate and maintain the treatment facility and sewer system.

RULES AND REGULATIONS

A typical outline for rules and regulations governing use of the community sewer system is indicated below:

- Establishment of Policy
- Use and Connection to the Community Sewer System
- Sewer Construction Standards
- Plan Approval, Inspections, and Easements
- Fees
- Unlawful Use of the Community Sewer System
- Enforcement

In general, the rules and regulations establish responsibility for using and maintaining the sewer system, connection standards and procedures, unlawful uses of the sewer system, funding, and enforcement. The rules and regulations would be prepared in conjunction with the County's representatives, the engineer, and the regulatory agencies. Rules and regulations should be in place as soon as possible after construction. However, the period of time required for preparation, review, revisions, and adoption often exceeds 1 year so it is unlikely that the rules and regulations would be in place until the year after construction.

The two most important elements of the sewer use section of the rules and regulations are wastewater strength and maintenance of grease interceptors. Wastewater strength is typically not a primary concern with residential users but is with commercial connections, particularly restaurants. Commercial connections shall be required to discharge residential strength waste concentrations. Pretreatment may be required for some commercial users through the rules and regulations, and can be established by a sampling and testing protocol.

Failure to maintain grease interceptors will result in failure of downstream components (e.g., grinder pumps, small-diameter mains, etc.). To ensure that these failures do not occur, each grease interceptor should be inspected quarterly. Part of this inspection will include measuring grease levels within the tank. Pumping of grease interceptors shall be the owner's responsibility, not the County's.

CHAPTER 11

FINANCIAL ANALYSIS

The purpose of the financial section is to evaluate the financial impact of completing the capital program identified in the plan, and outlining necessary steps for the financial execution of the plan. Completing these projections for a start-up system requires relying more heavily on assumptions and estimates than for an existing system with available operating and cost history. Therefore, this chapter will list the set of assumptions that are used to project financial impacts as well as identify financial issues that may be dealt with in the utility formation process as it progresses.

Hoodsport is currently served by individual private septic systems. It is one of three areas that are jointly planning for, and evaluating financial feasibility of establishing a sewer utility, including the Core Skokomish and Potlatch Bubble areas. At study time, the potential Hoodsport sewer utility is assumed to be owned and managed by Mason County and the two areas on the Skokomish tribal lands would be owned and managed by the Skokomish Tribe. There is a water utility managed by Mason County PUD #1 in Hoodsport, although it is unlikely that the PUD will manage the new sewer utility.

This chapter includes:

1. Capital Cost Data and Inflationary Projections
2. Equivalent Residential Unit (ERU) Data and Projections
3. Available Funding Sources for Capital Projects
4. Capital Financing Assumptions Used for the Financial Impact Forecast
5. Capital Financing Scenarios Evaluated
6. Annual Revenue Needs Forecast
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CAPITAL COST DATA AND INFLATIONARY PROJECTIONS

The capital costs identified in this plan are provided in current (2007) dollars. It is anticipated that these projects will be constructed up to the projected 2011 first year of utility operation. An annual construction cost inflation rate of 4% has been used in forecasting capital costs for financing needs. Table 11-1 shows the capital cost timing projection as well as the costs escalated to the year of anticipated spending.

TABLE 11-1

Capital Program Summary

	2009	2010	2011	Total
Capital Cost				
Treatment	$ -	$2,758,672	$ -	$ 2,758,672
Collection		$1,549,963		1,549,963
Force Main/Reuse		$899,838		899,838
Onsite Collection Cost	-	-	$1,989,606	1,989,606
Decommissions			$252,079	252,079
Land Acquisition	$350,000			350,000
Recording Fees	$10,000			10,000
Easements/ROEs	$60,000			60,000
Design (P&S/Permits)	$500,000			500,000
Construction Support		$320,000	$190,000	510,000
Record Drawings/O&M Manuals			$70,000	70,000
	$ 920,000	$ 5,528,473	$ 2,501,685	$ 8,950,158
Escalated Cost	*$ 995,072*	*$ 6,218,780*	*$ 2,926,618*	*$ 10,140,470*

EQUIVALENT RESIDENTIAL UNIT (ERU) DATA AND PROJECTIONS

The Hoodsport service area is projected to grow at about 2% per year. Table 11-2 summarizes projected ERUs for the service area. Sewer facilities are planned to serve the 20-year growth horizon, or an estimated 272 ERUs.

TABLE 11-2

ERU and Growth Summary by Area

ERUs	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Residential	146	148	150	153	155	157	160	162	164	167	169
Commercial	43	45	46	48	49	51	53	55	57	59	61
	189	193	196	200	204	208	213	217	221	226	230
Residential Growth Rate	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%	1.50%
Commercial Growth Rate	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%
Effective Utility Annual Growth Rate		1.96%	1.96%	1.97%	1.98%	1.98%	1.99%	2.00%	2.00%	2.01%	2.02%

AVAILABLE FUNDING SOURCES FOR CAPITAL PROJECTS

Funding capital projects for utility formation requires consideration of unique constraints. In the case of an existing utility there could be cash reserves available either to pay directly for capital or to provide matching funds for low-cost loan programs. Existing cash also allows for short-term cash-flow management for grant programs that operate on a reimbursement basis only. An existing utility has existing revenue to pledge toward loan repayment and that may be made available for debt service that commences before

project completion (and therefore utility operation and revenue collection in the case of utility formation).

Since there are no existing cash reserves, nor revenue, financing utility formation requires funding sources that provide proceeds upfront and do not require repayment until project completion or utility operation and using these options not only to fund projects but to manage project cash flow during construction. Since many grant/loan programs are reimbursement-based, meaning that they pay the agency only after agency payment for incurred costs, cash flow is a vital consideration in project financing and management.

The following is a summary of the available programs and borrowing mechanisms that are available to the County for sewer infrastructure funding.

GOVERNMENT PROGRAMS

Department of Ecology

The Department's Water Quality Financial Assistance Program sponsors three grant and loan programs: the Centennial Clean Water Fund (grant), Federal 319 Programs (grant), and the State Revolving Fund Loan (SRF). Most of the funding goes to wastewater programs. The Centennial Fund grants are available for projects serving 110% of existing capacity (limiting funding of growth) and the SRF is available to fund 20 years of growth (based on Growth Management Act-compliant comprehensive plans). SRF loans require establishment of a reserve that can be built over the first five years of loan repayment, which begins within one year after the initiation of operation or project completion (maximum five years after the first disbursement). The benefit that repayment is delayed until operation or project completion is an important feature of this loan option for utility formation. However, the timeline for planning and design loans begins once those phases are complete, not when the project construction is complete.

When applying for DOE programs, application materials are considered for all three programs. The department awards eligible grants and loans as a package.

Based on the rate impacts presented herein, the financial hardship consideration for the Centennial Grant might apply to the County. The affordability factor for utility rates is a calculation of 1.5% of the area's median income. Any rates that exceed the 1.5% may qualify the rate as unaffordable.

DOE offers another program that might be available based on the unique financing needs of the Hoodsport sewering project. A significant portion of the costs are components on private property which include septic tank abandonment. DOE offers a program to loan funds to local governments to establish local loan funds. These loan programs should assist private citizens and small commercial enterprises by providing loans for water quality improvement projects. Examples listed in the FY 2007 Guidelines, - Volume I include lending money to rehabilitate on-site septic systems. Although it does not

specifically cite septic system abandonment for sewering, the private on-site costs might qualify and the County should pursue funds from this program to alleviate the cost burden of the portion of financing borne by private citizens.

Public Works Trust Fund

Historically the Public Works Trust Fund (PWTF) has been a commonly applied for and used, low-cost revolving-loan fund. It was established by the 1985 State Legislature to provide financial assistance to local governments for public works projects. Eligible projects have included repair, replacement, rehabilitation, reconstruction, or improvement of eligible public works systems to meet current standards for existing users. With recent revisions to the program, utility growth-related projects consistent with 20-year projected needs are now eligible. However, anticipated revisions to the PWTF program are that total funding of the program will continue to be reduced and qualifying projects will be limited to those that provide economic benefit, i.e. are growth-related. Whether PWTF will exist for sewer and water utility funding is currently in question; the Washington State Legislature is looking at the option of totally revising public works financial assistance programs. It is possible that this program will be eliminated altogether. At this point, PWTF loans continue to be a much sought after source of capital construction financing that the County might pursue.

PWTF loans are available at interest rates of 0.5 percent, 1 percent, and 2 percent, with the lower interest rates given to applicants who pay a larger share of the total project costs. The loan applicant must pay a minimum of 5 percent towards the project cost to qualify for a 2 percent loan, 10 percent for a 1-percent loan, and 15 percent for a 0.5 percent loan. The useful life of the project determines the loan term up to a maximum of 20 years. Proceeds from other debt, such as the existing County SRF loans, qualify as matching funds.

The applicant must be a local government and have an approved long-term plan for financing its public works needs. Local governments must compete for PWTF dollars since more funds are requested each year than are available. The Public Works Board evaluates each application and transmits a prioritized list of projects to the legislature. The legislature then indicates its approval by passing an appropriation from the Public Works Assistance Account to cover the cost of the approved loans. Once the Governor has signed the appropriations bill into law, the local governments receiving the loans are offered a formal loan agreement with the appropriate interest rate and term, as determined by the Public Works Board.

PWTF loans are a good option for low-cost financing with the added advantage that loan disbursements largely precede project expenditures. However, loan servicing begins in the year following receipt of the loan (beginning with one year of interest only payment), which means that for a multi-year construction of a new system, project debt repayment could begin before utility operation, and thus also before utility revenues are being generated.

Community Economic Revitalization Board

Managed by the Department of Community Trade and Economic Development (CTED), this program provides grants and loans to fund public facilities that result in specific private-sector development. Eligible projects include water, sewer, roads, and bridges. There are current legislative efforts to increase State funding of this program, perhaps with a redesignation of PWTF funding similar to what has taken place in 2005 and 2006. In this case, grants and loans for sewer projects with defined economic development benefits might qualify for this type of financial assistance.

Community Development Block Grant (CDBG) Program

A federal government program administered by the State Department of Community Trade and Economic Development, the CDBG program provides grants and loans for infrastructure improvements, including utility projects, for business development that create or retain jobs for low and moderate-income residents.

Federal USDA Rural Utility Services Loans and Grants

The USDA administers the Rural Utilities Services loan and grant program that includes a Water Environment Program that targets water and wastewater issues for rural communities, defined as having a population of less than 10,000 in a rural area, city or town. With less than 1,000 equivalent residential units in the service area considered, the Hoodsport sewering project area could meet the population criteria to qualify for assistance. There is a housing program that might be able to assist individual homeowners with loans, or in the case of low-income senior citizens, grant funds to make needed on-site improvements.

Federal EPA State and Tribal Assistance Grants

The Environmental Protection Agency administers the STAG program with the intent that it will assist states and tribes in carrying out activities to ensure compliance with environmental laws and standards, and for project outcomes to serve as examples to other jurisdictions. Applications and review processes are administered through regional offices of the EPA.

PUBLIC DEBT

There are two common forms of publicly issued debt that the County might consider for funding wastewater projects: revenue bonds and general obligation bonds. Revenue bonds are commonly used to fund utility capital improvements. The bond debt is secured by the future revenues of the issuing utility, and the debt obligation or credit lien would not extend to other County revenue sources. With this limited commitment, revenue bonds typically require security conditions related to the maintenance of dedicated

reserves (a bond reserve) and financial performance (annual bond debt service coverage). The County must agree to satisfy these requirements by ordinance as a condition of a bond sale. Revenue bonds typically bear a premium in market interest rates as compared to general obligation backed bond debt.

Revenue bonds can be issued in Washington without a public vote. There is no bonding limit, except perhaps the practical limit of a utility's ability to generate sufficient "net revenue" to repay the debt and meet the annual minimum debt service coverage test.

General obligation (G.O.) bonds are secured by the full faith and credit of the County, e.g., taxes. The County is authorized to issue general obligation debt to a limited degree without a public vote through the use of its "councilmatic" bonding capacity, with additional bonding capacity allowable subject to public vote. Included in the voted bonding capacity is an explicit provision for water and wastewater purposes.

Secured by the full financial strength of the County, G.O. debt typically does not require the additional stringent security conditions common for revenue bonds. In addition, the broader financial backing of all financial resources of the County makes G.O. bonds a more secure investment, a feature that is rewarded through a lower interest rate and an annual debt service coverage ratio of 1.0. Nonetheless, unless the County has sufficient non-voted G.O. bonding capacity to commit, the matter of getting an affirmative vote to sell the bonds remains problematic for most municipalities.

To the degree that the County relies on publicly issued debt, it is assumed that revenue bond debt would be used. Typically, competing uses for limited G.O. authority, especially for that which doesn't require a public vote, limit its accessibility to utilities. Further, the limitations on G.O. bonded indebtedness tend to inhibit the use for utilities, even when no current plans compete, simply due to the loss of flexibility which would occur. Therefore, as a conservative assumption for this financial plan, we have assumed that all future public debt financing will be via revenue bonds, with the commensurate security requirements and higher interest costs. However, the County might consider the use of "councilmatic" G.O. debt as a source of project cash flow, to be repaid from the utility upon completion of project funding and receipt of all material capital resources. The issuance of relatively short-term debt (e.g. 3-5 years) would provide a low-cost source of cash during construction while assuring recovery of available debt capacity within a relatively short period.

One benefit offered by public debt for a utility formation is that revenue bond debt can be structured to delay debt service payments until revenues commence, through features such as deferred principal maturities and capitalized interest. Thus, debt service could be delayed until the utility is in operation and generating revenues for debt repayment.

CAPITAL FINANCING ASSUMPTIONS USED FOR THE FINANCIAL IMPACT FORECAST

The combined funding available toward financing sewer infrastructure in the Hoodsport, Core Reservation, and Potlatch Bubble potential sewer service areas is summarized in Table 11-3.

TABLE 11-3

Summary of Current Available Funding

2003 STAG Grant - Hoodsport	$	667,800
2006 STAG Grant - Hoodsport		4,300,000
Centennial Clean Water Fund Grant		1,000,000
State Parks - Potlach Grant		1,050,000
Total Grant Funds Available	$	7,017,800

While the STAG grants are being restructured and the costs are in development for the service areas, the current method of allocating available funding for this planning effort is that half is available to Mason County for the Hoodsport sewering project, with the other half available to the Tribe toward the Core Reservation and Potlatch Bubble sewering projects. A total of $3,058,900 in grants is assumed to fund Hoodsport project costs.

With total costs of $10.1 million (escalated to year of projected spending), $6.6 million remains to be financed. While it is recommended that the County pursue first, all grant funds, and second, all low-cost state loans, it could be that neither will be secured for the total remaining funding need. The forecast assumes that a combination of PWTF loans (35%) and revenue bonds (65%) will be used to fund the remaining costs. Further, the analysis assumes that the County will capitalize interest until operation begins and service is being provided.

CAPITAL FINANCING SCENARIOS EVALUATED

The construction of a new sewer utility presents unique financial challenges as compared to major projects within an existing utility. Noted previously was the cash flow challenge of financing and managing completion of a major construction project without an ongoing revenue source. In addition, a new utility directly faces all costs of the initial system with the corresponding cost recovery burden. In contrast, the initial cost of most collection systems is imposed on development as it occurs, and is not a cost borne through utility rates. As a result, the projected rates for a new system, if they include such costs, are generally dramatically higher than comparable sewer rates in other utilities, and a potential obstacle to public acceptance and affordability.

This section contemplates three basic strategies for funding the initial capital costs of the system, and outlines three related scenarios: Scenario 1 assumes monthly sewer rates as

the primary means of funding operations, debt repayment and capital reinvestment; Scenario 2 assumes using ULID assessments to fund initial construction costs, with rates paying ongoing O&M costs and capital reinvestment needs; and Scenario 3 assumes 100% grant-funding of facilities, with rates funding annual operating costs. The following summaries describe the scenarios in more detail.

SCENARIO 1

In Scenario 1, utility rates are the primary source of ongoing funding and relied on to meet operating and maintenance needs (O&M), debt repayment, and capital reinvestment needs. Capital Facilities Charges are imposed on new development and used to fund capital reserves and projects, exclusively.

This scenario has the advantage of relatively simple execution of a cost recovery strategy based on the calculation of a sewer rate sufficient to meet all projected needs based on the initial ERUs served. However, with reliance on rates to fund the initial project capital costs, this scenario results in substantial sewer rates likely to exceed comparable rates in other sewer systems. The following table illustrates the capital funding mix assumed for Scenario 1.

TABLE 11-4

Annual Financing Assumptions for Scenario 1

	2009	2010	2011	Total
Costs to Finance	$ 999,751	$ 6,218,780	$ 2,926,618	$ 10,145,149
Funding Sources				
Grant	$ 999,751	$ 2,509,149	$ -	$ 3,508,900
PWTF	-	1,775,401	1,775,401	3,550,802
Assessment-backed Revenue Bond	-	-	-	-
Rate- backed Revenue Bond	-	1,934,230	1,151,217	3,085,447
	$ 999,751	$ 6,218,780	$ 2,926,618	$ 10,145,149
Capital Costs in Current Dollars	*$ 924,326*	*$ 5,528,473*	*$ 2,501,685*	*$ 8,954,484*

SCENARIO 2

In Scenario 2, a Utility Local Improvement District (ULID) is established to fund the initial capital costs of the collection and treatment system. Sewer rates are then used to fund ongoing operating and maintenance costs and a contribution toward capital reserves and reinvestment. Capital Facilities Charges are imposed only for new development not previously assessed, with those revenues used to fund capital reserves and future projects.

Formation of a ULID imposes an assessment directly on benefited properties. The authority and procedural requirements for such formation are defined in RCW 36.94.220-

300. In general terms, properties are assessed based on special benefit received, subject to formation process involving notification, estimation and finalization of assessments, and also subject to protest and petition rights as provided in statute.

In forming the ULID, an engineering analysis would determine an equitable basis for allocating costs to benefited properties. This could be based on any of a number of factors or combinations of factors, often including parcel size, front footage, anticipated demand (ERUs), and variations on these basic measurements. For this analysis, it is assumed that costs would be allocated in proportion to ERUs. In short, each property would be assigned and assessed for a given number of ERUs of capacity. For existing developed properties, the ERUs would be based on existing use. For undeveloped properties, the ERUs would be based on planning criteria for potential sewer demand. As properties develop or redevelop, demands in excess of assessed capacity would normally be charged for additional capacity using the utility Capital Facilities Charge, sometimes also referred to as an "in-lieu-of-assessment" charge.

In actual development and formation of the district, different criteria could be used for assessing costs, based on an engineering analysis. However, the average costs developed in this chapter should remain a reasonable basis for evaluating typical impacts.

The use of a ULID has the advantage of sharing costs to all benefited properties, not just those currently developed. This tends to lower the cost impact on developed properties. The assessments are also separately imposed, removing this cost burden from rates and enabling property owners to pre-pay assessments or pay over time. Up to a 20 year repayment period is provided by statute. The County can require that such assessments being paid in installments are fully paid off upon any transfer of ownership, or allow such obligations to transfer with the property. The County would establish the applicable interest rate imposed on such assessments. Typically, such rate is set at 1-2% (100 to 200 basis points) above the cost of debt. The County's source of financing is not constrained by the use of the ULID mechanism. If revenue bonds are used, the assessment structure is typically viewed as a more secure funding structure, and the coverage requirement of 1.25 is often reduced based on this enhanced security. This analysis has assumed that a coverage factor of 1.0 would apply for assessment-backed revenue bonds. An added advantage for homeowners is that the assessment amount adds to their cost basis for income tax purposes, and interest paid on the assessment is potentially tax deductible.

The formation of a ULID imposes additional costs for legal, engineering and procedural requirements. This cost can be substantial, depending on the level of opposition and protest and complexity of the district formed. Estimates ranging from 5-15% of project costs are common for the added cost of ULID formation. For this analysis, 5% of the project cost has been assumed as an added cost burden. The ULID process includes robust protection of property rights; as such, there are opportunities to oppose the formation or object to the assessment imposed which can increase such costs and potentially delay formation of the ULID and completion of the project.

TABLE 11-5

Annual Financing Assumptions for Scenario 2

	2009	2010	2011	Total
Capital Financing Summary				
Costs to Finance	$ 999,751	$ 6,218,780	$ 3,319,016	$ 10,537,547
Funding Sources				
Grant	$ 999,751	$ 2,509,149	$ -	$ 3,508,900
PWTF	-	1,775,401	1,775,401	3,550,802
Assessment-backed Revenue Bond	-	1,934,230	1,543,615	3,477,845
Rate- backed Revenue Bond	-	-	-	-
	$ 999,751	$ 6,218,780	$ 3,319,016	$ 10,537,547

SCENARIO 3

Scenario 3 assumes grants are made available for all project costs. Since grant funds disbursement occurs on a reimbursement basis, 60 days of initial capital costs would need to be financed ahead of grant availability. In each of the three scenarios, it is assumed that the County could secure a PWTF loan to be repaid once grant reimbursements are complete.

TABLE 11-6

Annual Financing Assumptions for Scenario 3

	2009	2010	2011	Total
Capital Financing Summary				
Costs to Finance	$ 1,003,029	$ 6,218,780	$ 2,926,618	$ 10,148,426
Funding Sources				
Grant	$ 1,003,029	$ 6,218,780	$ 2,926,618	$ 10,148,426
PWTF	-	-	-	-
Assessment-backed Revenue Bond	-	-	-	-
Rate- backed Revenue Bond	-	`	-	-
	$ 1,003,029	$ 6,218,780	$ 2,926,618	$ 10,148,426

ANNUAL REVENUE NEEDS FORECAST (20-YEAR)

The annual revenue needs forecast is comprised of the annual operating cost requirement, annual debt service, and any funds collected to establish minimum operating reserve levels. These are the items that must be included at a minimum level. There are certain policies related to the long-term financial health of operating a utility that should become a part of the annual rate revenue needs forecast, such as some reserve toward capital repair and replacement – usually based on annual depreciation expense on system assets. In order to minimize what will be a significant financial impact of funding the sewer

system at formation, such policies are recommended to be phased-in. The following tables summarize the annual revenue needs projection and the cost per ERU based on the three scenarios for how the revenue would be collected from customers. Costs are summarized as monthly costs per ERU.

TABLE 11-7

Annual Financial Impact Summary (3 Scenarios)

Scenario 1: Rate Revenue Net Financing

Annual Revenue Needs Summary	2009	2010	2011	2012	2013	2014	2019	2024	2029
Non-Capital Costs									
Administration & Overhead	$ -	$ -	$ 25,000	**$ 25,750**	$ 26,523	$ 27,318	$ 31,669	$ 36,713	$ 42,561
Operations and Maintenance	-	-	146,364	**150,755**	155,278	159,936	185,410	214,940	249,175
System Reinvestment Funding	-	-	-	**-**	-	-	-	-	-
Build-up of Reserves	-	-	14,437	**-**	-	-	-	-	-
Excise Tax	-	-	8,455	**15,032**	15,648	15,749	16,290	16,901	16,589
	$ -	$ -	$ 194,256	**$ 191,537**	$ 197,448	$ 203,003	$ 233,369	$ 268,555	$ 308,325
Debt Service									
State Loans	$ -	$ -	$ 8,877	**$ 204,638**	$ 203,704	$ 202,769	$ 198,097	$ 193,430	$ 188,763
Revenue Bond	-	-	130,046	**219,900**	219,900	219,900	219,900	219,900	219,900
	$ -	$ -	$ 138,923	**$ 424,538**	$ 423,604	$ 422,669	$ 417,997	$ 413,330	$ 408,663
Coverage Deficit Increment	$ -	$ -	$ 9,198	**$ -**	$ -	$ -	$ -	$ -	$ -
Operating Reserve Interest Earnings	$ -	$ -	$ -	**$ 941**	$ 927	$ 912	$ 1,067	$ 1,235	$ 1,427
Net Annual Costs	$ -	$ -	$ 342,376	**$ 615,134**	$ 620,124	$ 624,760	$ 650,300	$ 680,650	$ 715,561
Monthly Rate	**$ -**	**$ -**	**$ 145.22**	**$ 255.87**	**$ 252.94**	**$ 249.88**	**$ 235.52**	**$ 222.81**	**$ 219.44**
Monthly Assessment per ERU	$ -	$ -	$ -	**$ -**	$ -	$ -	$ -	$ -	$ -
Financing Customer Connections [a]	$ -	$ -	$ 7.58	**$ 7.58**	$ 7.58	$ 7.58	$ 7.58	$ 7.58	$ 7.58
Total Monthly Impact	**$ -**	**$ -**	**$ 152.79**	**$ 263.44**	**$ 260.52**	**$ 257.46**	**$ 243.10**	**$ 230.38**	**$ 227.01**
ERU Basis	**189**	**193**	**196**	**200**	**204**	**208**	**230**	**255**	**272**

[a] onsite costs - customer responsibility - e.g. septic decommisioning

In Scenario 1, the total customer impact includes the monthly rate and customer-financed onsite costs. The monthly rate supports operating costs and debt service repayment.

Scenario 2: ULID Net Financing

Annual Revenue Needs Summary	2009	2010	2011	2012	2013	2014	2019	2024	2029
Non-Capital Costs									
Administration & Overhead	$ -	$ -	$ 25,000	**$ 25,750**	$ 26,523	$ 27,318	$ 31,669	$ 36,713	$ 42,561
Operations and Maintenance	-	-	146,364	**150,755**	155,278	159,936	185,410	214,940	249,175
System Reinvestment Funding	-	-	-	**-**	-	-	71,395	142,789	142,789
Build-up of Reserves	-	-	14,437	**-**	-	-	-	-	-
Excise Tax	-	-	4,752	**4,836**	4,960	5,087	7,512	15,692	28,450
	$ -	$ -	$ 190,553	**$ 181,341**	$ 186,760	$ 192,341	$ 295,986	$ 410,135	$ 462,974
Debt Service									
State Loans	$ -	$ -	$ 8,877	**$ 204,638**	$ 203,704	$ 202,769	$ 198,097	$ 193,430	$ 188,763
Revenue Bond	-	-	130,046	**250,527**	250,527	250,527	250,527	250,527	250,527
	$ -	$ -	$ 138,923	**$ 455,165**	$ 454,231	$ 453,297	$ 448,624	$ 443,957	$ 439,290
Coverage Deficit Increment	$ -	$ -	$ -	**$ -**	$ -	$ -	$ -	$ -	$ -
Operating Reserve Interest Earnings	$ -	$ -	$ -	**$ 577**	$ 590	$ 602	$ 709	$ 819	$ 1,028
Net Annual Costs	$ -	$ -	$ 329,476	**$ 636,507**	$ 640,991	$ 645,637	$ 744,610	$ 854,093	$ 902,265
Monthly Rate	**$ -**	**$ -**	**$ 80.82**	**$ 75.19**	**$ 75.94**	**$ 76.69**	**$ 106.94**	**$ 133.99**	**$ 141.66**
Monthly Assessment per ERU	$ -	$ -	$ 50.31	**$ 164.85**	$ 164.51	$ 164.17	$ 162.48	$ 160.79	$ 159.10
Financing Customer Connections [a]	$ -	$ -	$ 7.58	**$ 7.58**	$ 7.58	$ 7.58	$ 7.58	$ 7.58	$ 7.58
Total Monthly Impact	**$ -**	**$ -**	**$ 138.71**	**$ 247.61**	**$ 248.02**	**$ 248.44**	**$ 277.00**	**$ 302.35**	**$ 308.34**
ERU Basis	**189**	**193**	**196**	**200**	**204**	**208**	**230**	**255**	**272**

[a] onsite costs - customer responsibility - e.g. septic decommisioning

The Scenario 2 total customer impact includes the monthly rate, which supports net operating costs, the ULID assessment that supports annual debt service repayment, and customer-financed onsite costs.

Scenario 3: Additional Grant Funding

Annual Revenue Needs Summary	2009	2010	2011	2012	2013	2014	2019	2024	2029
Non-Capital Costs									
Administration & Overhead	$ -	$ -	$ 25,000	**$ 25,750**	$ 26,523	$ 27,318	$ 31,669	$ 36,713	$ 42,561
Operations and Maintenance	-	-	146,364	**150,755**	155,278	159,936	185,410	214,940	249,175
System Reinvestment Funding	-	-	-	**-**	-	-	71,395	142,789	142,789
Build-up of Reserves	-	-	14,437	**-**	-	-	-	-	-
Excise Tax	-	-	4,752	**4,836**	4,960	5,087	7,512	15,663	28,396
	$ -	$ -	$ 190,553	**$ 181,341**	$ 186,760	$ 192,341	$ 295,986	$ 410,106	$ 462,921
Debt Service									
State Loans	$ -	$ -	$ -	**$ -**	$ -	$ -	$ -	$ -	$ -
Revenue Bond	-	-	-	**-**	-	-	-	-	-
	$ -	$ -	$ -	**$ -**	$ -	$ -	$ -	$ -	$ -
Coverage Deficit Increment	$ -	$ -	$ -	**$ -**	$ -	$ -	$ -	$ -	$ -
Operating Reserve Interest Earnings	$ -	$ -	$ -	**$ 577**	$ 590	$ 602	$ 709	$ 819	$ 1,340
Net Annual Costs	$ -	$ -	$ 190,553	**$ 180,764**	$ 186,170	$ 191,739	$ 295,277	$ 409,286	$ 461,581
Monthly Rate	**$ -**	**$ -**	**$ 80.82**	**$ 75.19**	**$ 75.94**	**$ 76.69**	**$ 106.94**	**$ 133.98**	**$ 141.55**
Monthly Assessment per ERU	$ -	$ -	$ -	**$ -**	$ -	$ -	$ -	$ -	$ -
Financing Customer Connections [a]	$ -	$ -	$ -	**$ -**	$ -	$ -	$ -	$ -	$ -
Total Monthly Impact	**$ -**	**$ -**	**$ 80.82**	**$ 75.19**	**$ 75.94**	**$ 76.69**	**$ 106.94**	**$ 133.98**	**$ 141.55**
ERU Basis	**189**	**193**	**196**	**200**	**204**	**208**	**230**	**255**	**272**

[a] onsite costs - customer responsibility - e.g. septic decommisioning

Scenario 3 represents the lowest cost impact, with the monthly rate set to recover net operating costs. There are no capital-related costs in this scenario.

A common affordability test for utility rates is a calculation of 1.5% of the area's median income. Any rates that exceed this threshold may qualify the rates an unaffordable under

some grant programs. The State of Washington's Office of Financial Management (OFM) projects the median income for Mason County to 2005 off of the 1999 Census data. Projecting six year out from that data point to 2011, a 3% annual income growth results in $52,530. The monthly equivalent at 1.5% is $66. As indicated in the above summaries, the projected average monthly rate exceeds the affordability threshold in each scenario.

LIST OF ASSUMPTIONS USED IN THE REVENUE NEEDS PROJECTION

The financial forecast is based on numerous assumptions related to costs, financing and customer base. In general, the extent and impact of those assumptions are greater than for improvements serving an existing utility, where existing costs and revenues dampen such effects. The key assumptions used in the forecast of costs and rates include:

• Capital Construction Costs	See Section 1
• ULID Formation Costs	5% of Capital Construction Cost
• Operations and Maintenance	$146,364 first year of operation
• Capital Reinvestment	Consistent with other County utilities, annual depreciation net of annual debt principal repayment – phased in after initial utility formation period
• Administration	$25,000 first year of operation
• State Excise Taxes	Composite 2.5% rate on all revenue
• Bond Terms	5% interest, 2% issuance, 25 years for Scenario 1 5% interest, 2% issuance, 20 years for Scenario 2
• Bond Coverage	1.25 for Scenario 1 1.0 for Scenario 2
• PWTF	0.5% 20 years
• Assessment Terms	5% interest, 20 years
• General Cost Inflation	3% annually

- Construction Cost Inflation 4% annually
- Growth *See ERU Section (Section 2)
- Operating Reserve Funded to 30 days of annual expenses

CAPITAL FACILITIES CHARGE

A Capital Facilities Charge (CFC) is calculated to determine the pro-rata share of costs that a new connection to a utility should pay in order to buy-in to ownership of capacity in the system.

CFCs are a form of connection charge authorized in the Revised Code of Washington 36.94.140. They are imposed on new customers connecting to the system as a condition of service, in addition to any other costs incurred to connect the customer. Typically, the basis for the CFC is the capital cost a utility will incur or has incurred to provide the system. In the case of utility formation, there are no existing costs and it is based entirely on the facility costs identified in order to construct the infrastructure necessary to provide sewer service. The capital costs identified in this plan and referenced in this chapter, along with the capacity provided by those improvements, provide the basis for the CFC calculation.

Capacity units for calculating the CFC are commonly expressed in equivalent residential units, or ERUs, based on the typical sewage flow generated by a single family home (1 ERU). For any other development seeking to connect to the system, estimated flow contribution is used to determine a number of ERUs being served, which is then used to determine the level of CFC attributable to the customer. The CFC calculation is then, the total capital costs divided by the total capacity being designed, expressed on an ERU basis.

The following table summarizes the CFC calculation. Under Scenario 1, an average cost of $8,914 per ERU is incurred, net of grants, to provide sewer service to the potential service area. CFCs are not applicable under Scenarios 2 and 3 since all infrastructure is assumed to be either ULID or grant funded.

TABLE 11-8

Capital Facilities Charge Calculation

Treatment		
Cost Basis		
CAPITAL PLAN		
Total Future Projects	$	3,751,829
less: ULID/Assessment-Funded Projects		-
less: Grants and Contributions		(1,327,238)
TOTAL FUTURE COST BASIS	**$**	**2,424,592**
Customer Base		**ERUs**
Existing Equivalent Residential Units		196
Remaining ERU Capacity		76
TOTAL CUSTOMER BASE		**272**
Resulting Charge		**Total**
Total Cost Basis	$	2,424,592
Total Customer Base		272
TOTAL CHARGE PER ERU	**$**	**8,914**

Collection/Transmission		
Cost Basis		
CAPITAL PLAN		
Total Future Projects	$	2,181,662
less: ULID/Assessment-Funded Projects		-
less: Grants and Contributions		(2,181,662)
TOTAL FUTURE COST BASIS	**$**	**-**
Customer Base		**ERUs**
Existing Equivalent Residential Units		196
Remaining ERU Capacity		76
TOTAL CUSTOMER BASE		**272**
Resulting Charge		**Total**
Total Cost Basis	$	-
Total Customer Base		272
TOTAL CHARGE PER ERU	**$**	**-**

The cost basis for total future projects excludes a portion of the total collection costs, assuming some of the collection system cost provides local service and does not provide system capacity for other users. This assumption would need to be refined in application. Also, we have assumed that grants are first used to fund local facilities costs, and then to the degree used to fund general facilities would be excluded from recovery in a general facilities charge such as a CFC. Applying grant funds first to collection and then to

treatment costs, the resulting charges are $8,914 for treatment and $0 for collection. However, various policy and practical issues can influence how grant resources are allocated between these two components, which would in practice alter this breakdown.

It is worth noting that although a CFC has been calculated for this plan, the unique circumstance of utility formation where the customer base already exists imposes practical limits on application of the charge. Existing development would not typically be charged a CFC, but instead bear their share of capital costs through rates or assessments in order to amortize those costs. The CFC remains potentially applicable for new development, and remains a valuable benchmark for determining the level of investment being incurred to provide service.

LIST OF UTILITY FORMATION FINANCIAL ISSUES TO CONSIDER

The formation of a new sewer utility poses unique financial and administrative challenges that require careful planning and execution. While this plan cannot definitively address all of those issues, it is prudent to identify key issues and concerns to be addressed as a financial action plan is assembled and undertaken. Those issues include:

START-UP CASH FLOW MANAGEMENT

As a new utility, no operating revenues will be generated until after project completion and start-up. Further, typical cycles of billing and receipting are likely to require several months of operation before material revenues can support ongoing activities. This poses several challenges:

- Some assistance sources, such as the Centennial fund, provide assistance through reimbursement after expenses are incurred. The project must therefore have a source of cash flow to fund expenses until reimbursed.

- Some sources, such as PWTF, impose debt repayment schedules based on when draws occur. Thus, material debt repayment could be required before the project is completed. Few funding sources allow payment of debt service as a use of grants, loans or bonds.

- Debt repayment during the first year of operation will be according to a specific schedule, such as PWTF payments which occur annually in June. Depending on when operations commence and the total lead time until debt service payments are due, there may be inadequate time to accumulate initial payments from rates.

REQUIREMENT FOR CONNECTION TO SYSTEM

In order to ensure that the new utility can fulfill its purpose to protect the environment, and to ensure the financial capacity to fund the project and its ongoing operation, the County should require connection to the system when available. Through its authority to impose rates and charges and to regulate and manage the system, such requirement should include penalties for non-compliance. Typically, utilities impose penalties equal to the applicable rates and charges for properties in violation of this requirement. This ensures that the financial plan does not create undue hardship on those customers complying with such requirements, and reduces motivation to avoid connection.

In some cases, a funding strategy can also offer added incentives for timely connection. For example, a funding program might enable customers to use available assistance or to fund their connection costs as part of the public project to be repaid through a rate surcharge or through their assessment. This could provide access to lower cost financing or possibly partial grant funding and reduce the cost burden. This could be structured to apply only for connections occurring prior to an established deadline.

CUSTOMER COSTS TO CONNECT TO THE SYSTEM

In addition to the construction cost of the public system, developed or developing properties will incur costs to retire or decommission existing septic systems and to connect to the public sewer system. Such costs are often directly borne by the developed properties, although there may be the possibility of extending assistance or funding programs for these costs. Due to limitations on the allowed use of public funds for private purpose or benefit, any assistance or funding program should be developed with careful attention to satisfying legal requirements.

REGULATING INTERIM DEVELOPMENT

A related issue for a newly forming utility relates to development occurring during the construction of the utility system. The County might consider interim development rules as related to wastewater that allow for temporary facilities in anticipation of the sewer system. For example, holding tanks and truckage of wastewater might be a viable short-term alternative as compared to installing a new onsite disposal system, only to be abandoned upon completion of the sewer utility. Such a transition strategy could allow ongoing development while reasonably mitigating or avoiding duplicative costs.

DEVELOPMENT OF FINANCIAL ADMINISTRATIVE SYSTEM

A new utility often does not have the benefit of an existing administrative infrastructure to support its day to day financial activities. The County manages several utilities and therefore has a financial structure to address utility enterprises. It also has utility billing capability and accounting systems in place.

The primary challenges for the new utility will be the development of a customer data base, establishment of rates and charges, and application of appropriate regulatory rules and requirements related to the management, operation, and extension of the system. This will include the application or development of appropriate fiscal policies.

RECOMMENDED FINANCIAL STRATEGY

At this point in the planning process, the financial plan relates to basic elements of funding, cost recovery and administration. The intent is to structure and quantify the basic financial relationships resulting from the planned project. More detailed financial programs would be developed as the project moves forward.

The recommended financial strategy focuses on two areas of activity: pursuit of project funding assistance; and development of a cost recovery system. Toward this end, it is recommended that the County:

- Pursue all available grant funds and low-cost loans. This includes Centennial and State Revolving Fund grants and loans, and economic development grants as applicable. A schedule of application cycles and deadlines should be developed to guide such activities.

- Consider the use of a Utility Local Improvement District (ULID) as an equitable and secure approach to allocate and recover the capital cost of the project. If pursued, establish a timeline for establishing the district and imposing assessments.

- Consider the use of short-term G.O. debt for cash management during construction and initial operations, to be repaid from utility resources.

- Develop and undertake a utility formation process that considers and evaluates utility formation issues and options and assembles a cohesive policy package for developing the utility. Define a schedule or timeline for activities related to completion of a financial administrative and policy structure for the new utility. Continue to refine the financial forecast as cost estimates become better defined, financing is secured, and guiding policies are codified.

- Develop sound financial policies addressing utility reserves, capital improvement and replacement funding, debt policies, rate equity, financial administration, and rate equity objectives (Consistent with other County-managed utility systems).

- Establish and adopt appropriate ordinances and resolutions to implement a system of rates and charges and execute the financial management of the utility.

APPENDIX A

HYDROGEOLOGIC EVALUATION, HOODSPORT RURAL ACTIVITY CENTER, HWA GEOSCIENCES, FEBRUARY 7, 2007

HWA GEOSCIENCES INC.
Geotechnical Engineering • Hydrogeology • Geoenvironmental Services • Inspection and Testing

February 7, 2007
HWA Project No. 2006-172

Mike Sharar Consulting
3515 Gainsborough Ct. SE
Olympia, WA 98501-7020

Attention: Mike Sharar

Subject: **MASON COUNTY**
WATER QUALITY PROJECT PLANNING
HOODSPORT RURAL ACTIVITY CENTER
MASON COUNTY, WASHINGTON

Dear Mr. Sharar:

HWA GeoSciences Inc. (HWA) is pleased to submit this soils and hydrogeologic evaluation of the Hoodsport Rural Activity Center (RAC), Mason County, Washington, in support of the Mason County Water Quality Project Planning.

INTRODUCTION

HWA GeoSciences Inc. was contracted by Mason County to evaluate areas within the Hoodsport RAC for potential of septic-related contamination impacting Hood Canal, based on geologic, soils, and physiographic criteria.

SOILS

Soils in the Hoodsport RAC area consist of mainly Hoodsport series soils in the upland areas, with isolated pockets of Grove series soils in some drainages, and smaller areas of fine grained (e.g., Cloquallum and Tanwax) and alluvial (e.g., Juno) soils (Ness, 1960). Figure 1 shows the mapped soil units in the Hoodsport RAC planning area.

Hoodsport soils (Hd, He, Hf) consist of well-drained, reddish soils on uplands, formed over granitic till that is highly stained by iron and contains considerable metamorphosed and basic igneous gravel and stone. The soil survey report lists Hd soils as having a “very limited” rating for septic tank absorption fields, due to slow water movement and shallow depth to saturated zone. He and Hf soils are also listed as having a “very limited” rating for septic tank absorption fields, due to slow water movement, shallow depth to saturated zone, and slope (Ness, 1960).

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Fax: 425.774.2714
www.hwageosciences.com

Grove series (Gh, Gk) soils consist of somewhat excessively drained, reddish-brown gravelly soils, that formed on large glacial outwash plains over Vashon glacial drift, modified considerably by inclusions of local basaltic rock and mixed material from the Olympic Mountain glaciers. The soil survey report lists Gh and Gk soils as having a "very limited" rating for septic tank absorption fields, due to "bottom layer seepage" (i.e., soils are too permeable) (Ness, 1960).

Cloquallum silt loam (Cc) is a moderately well drained, brown upland soil, developed over silty glacial-lacustrine (lake) sediments. The soil survey report lists Cc soils as having a "very limited" rating for septic tank absorption fields, due to slow water movement and shallow depth to saturated zone (Ness, 1960).

Tanwax peat (Tb) consists of brown peat formed in wet areas and bogs. The soil survey report lists Tb soils as having a "very limited" rating for septic tank absorption fields, due to shallow depth to saturated zone, subsidence, slow water movement, and ponding (Ness, 1960).

Juno Sandy Loam (Jb) consists of coarse textured, brown to reddish-brown alluvial soils, formed over glacial alluvium in small streams. The soil survey report lists Jb soils as having a "very limited" rating for septic tank absorption fields, due to flooding, bottom layer seepage, and filtering capacity (Ness, 1960).

Although the soil survey lists all soil types present in the RAC area as having "very limited" suitability for septic drainfields, HWA's opinion is that of the soils present, the Hd Hoodsport soils (5 to 15 percent slopes) have the best septic treatment potential and least off site septic contaminant transport risk. These soils are generally found on the till uplands, on relatively flat land. Steeper Hoodsport soils (He and Hf) have a higher potential to transport contaminants, due to increased slopes. Soils with the highest potential for septic contaminant transport include Grove and Juno soils, which are found in the drainages. The Grove soils pose an increased risk due to excessive permeability. Cloquallum and Tanwax soils have a low potential for transport, but also a low potential for treatment.

GENERAL GEOLOGIC CONDITIONS

Figure 2 shows the mapped geology in the Hoodsport RAC planning area. According to the Logan (2003) unconsolidated sediments mapped in the Hoodsport RAC planning area include the following:

Qgt - Till, late Wisconsinan (Pleistocene). Glacial till deposits generally consist of a compact unsorted mixture of clay, silt, sand, gravel, and boulders, deposited at the base of the Puget lobe of the Cordilleran ice sheet during the latest glaciation. Occasional sand and gravel lenses may be present. Till is

commonly referred to as “hardpan” due to its cement-like texture. Till does not provide a favorable infiltration medium, but may be suitable for septic drainfields if sufficient depth of soils and weathered till are present. Till acts as an aquitard that inhibits the flow of ground water, perches water on top of it where overlain by recessional outwash, and also confines water below it in the advance outwash. In general, the permeability of till ranges from low in weathered surficial deposits to relatively impermeable in very dense non-weathered materials (Logan, 2003).

Qga - Advance outwash, late Wisconsinan (Pleistocene). Advance outwash consists mostly of glaciofluvial sand and gravel, with some and lacustrine clay, silt, and sand deposited during the advance of glaciers. Sandy units are commonly thick, well sorted, and fine grained, with interlayered coarser sand, gravel, cobbles and silt (Logan, 2003). Advance outwash is typically permeable, often water-bearing, and denser than recessional outwash, having been overridden by glacial ice. Advance outwash is commonly overlain by till.

Qgo - Proglacial and recessional outwash, late Wisconsinan (Pleistocene). Recessional outwash typically includes poorly to moderately sorted, rounded gravel and sand with localized coarser- and finer-grained constituents. Some fine sand, silt, and clay form local overbank sediments may also occur. Recessional outwash thickness varies and is not well known. It most commonly occupies outwash channels scoured into or through till (Logan, 2003). Recessional outwash was not glacially overridden, and is generally poorly consolidated to loose. Typically outwash deposits exhibit moderate to high permeabilities and infiltration rates depending on silt content.

Qapo - Alpine outwash, pre–late Wisconsinan (Pleistocene). Alpine outwash consists of stratified sand, gravel, and cobbles, may include peat, silt, and clay, and may be capped by weathered loess. Clasts are generally more rounded than those in till and lack facets and striations.

Qa - Alluvium (Holocene). Alluvium may consist of silt, sand, and gravel deposited in streams and alluvial fans, locally may contain Alpine drift, peat, or landslide deposits.

The soils and geologic maps reviewed are not entirely consistent with regard to correlation of mapped glacial deposits with mapped overlying soils. For example, most of the areas mapped as outwash on the geologic maps are mapped as Hoodsport series on the soils maps. The only areas mapped as Grove soils correspond with areas mapped as alluvium on the geologic maps.

Some differences in geologic mapping based on different references also occurs, which is not uncommon. Field verification of soils and geology is therefore recommended prior to design or siting of any facility. Figure 3 shows the

mapped geology per Carson (1976), which is similar to the Logan map. The main till/outwash boundary (Qgt to Qga on the Logan map) is interpreted similarly in both maps.

RISK CLASSIFICATION

Our scope of work includes using available soils and septic system information to assess which areas in the Hoodsport RAC currently served by conventional septic systems have the highest, moderate and least likely probability of causing Hood Canal contamination.

Criteria contributing to relative risk of transmitting septic contamination to Hood Canal include:

- Soils and geology (soil treatment capacity and permeability)
- Slopes
- Distance to surface water
- Depth to ground water

Several of the criteria are overlapping, for example slopes, distance to surface water, and permeable outwash soils all coincide with the coastal areas and east-west drainages in the planning area.

Soils and geology are described above. Soils with increased risk of contaminant transport and reduced treatment capacity include those that are excessively drained, such as Grove soils. These soil types would provide less treatment than slower draining soils due to less organic content and decreased residence times. Grove soils on steep slopes in and near drainages (e.g., Gk) have an added element of risk due to thinner soil profiles, and steeper hydraulic gradients. Distance to surface water relates directly to potential for septic contaminants to reach Hood Canal. For reference, Chapter 246-272A WAC, On-Site Sewage Systems specifies a setback of 100 feet for drainfields from surface water, and 30 feet from any downgradient site feature that may allow effluent to surface.

Based on these criteria, areas ranked by relative risk of transmitting septic contamination to Hood Canal include:

- Low risk – Upland areas underlain by glacial till and Hoodsport soils, not near surface water drainages.
- Moderate risk – Areas mapped as having outwash soils, but not in or near surface water drainages.

- High risk – Areas within or adjacent to surface water drainages, including the Hood Canal coastline. Most of the areas in and near drainages also contain permeable soils which are more likely to transmit water and contaminants with minimum treatment.

Figure 4 shows mapped geology (Logan, 2003) topography, and land parcels. Figure 5 shows the major geologic contacts, topography, land parcels, and an aerial photograph, to provide some indication of land development status. Figure 5 includes the three risk areas delineated in the Hoodsport RAC.

Wastewater treatment/disposal options for future development include:

- Conventional on site sewage treatment/disposal systems
- Enhanced on site sewage treatment/disposal systems (single residence or combined)
- Conveyance to a centralized waste water treatment facility (including a variety of treatment processes, effluent qualities, and effluent disposal options)

Delineation of areas for varying types or levels of treatment in the planning process may be made qualitatively, based on relative risks as outlined above, or semi-quantitatively, by establishing maximum pollutant (e.g., nitrogen) loading or downgradient concentrations, then performing analytical modeling to predict estimated concentrations for various scenarios, including effluent quality, development density, etc.

REFERENCES

Carson, R. J., 1976. OFR 76-2. *Geologic Map of North Central Mason County, Washington,* 1 sheet, scale 1:62,500, Washington Division of Geology and Earth Resources, Open File Report 76-2.

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Washington. 45 x 36 in. color sheet, scale 1:100,000, Washington Division of Geology and Earth Resources, Open File Report 2003-15 http://www.dnr.wa.gov/geology/pdf/ofr03-15.pdf

Ness, A. 0., and Fowler, R. H., 1960. *Soil Survey Of Mason County, Washington,* Soil Conservation Service, United States Department of Agriculture, Washington Agricultural Experiment Stations. http://www.or.nrcs.usda.gov/pnw_soil/wa_reports.html

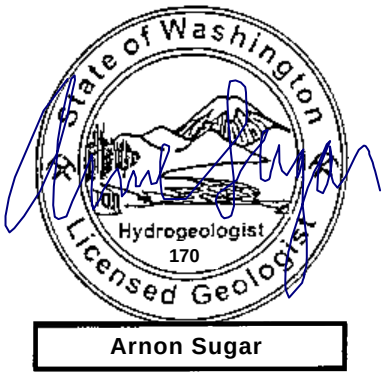
LIMITATIONS

The conclusions expressed by HWA are based solely on material referenced in this report. Observations were made under the conditions stated. Within the limitations of scope, schedule and budget, HWA attempted to execute these services in accordance with generally accepted professional principles and practices in the area at the time the report was prepared. No warranty, express or implied, is made. HWA's findings and conclusions must not be considered as scientific or engineering certainties, but rather as our professional opinion concerning the significance of the limited data gathered and interpreted during the course of the assessment.

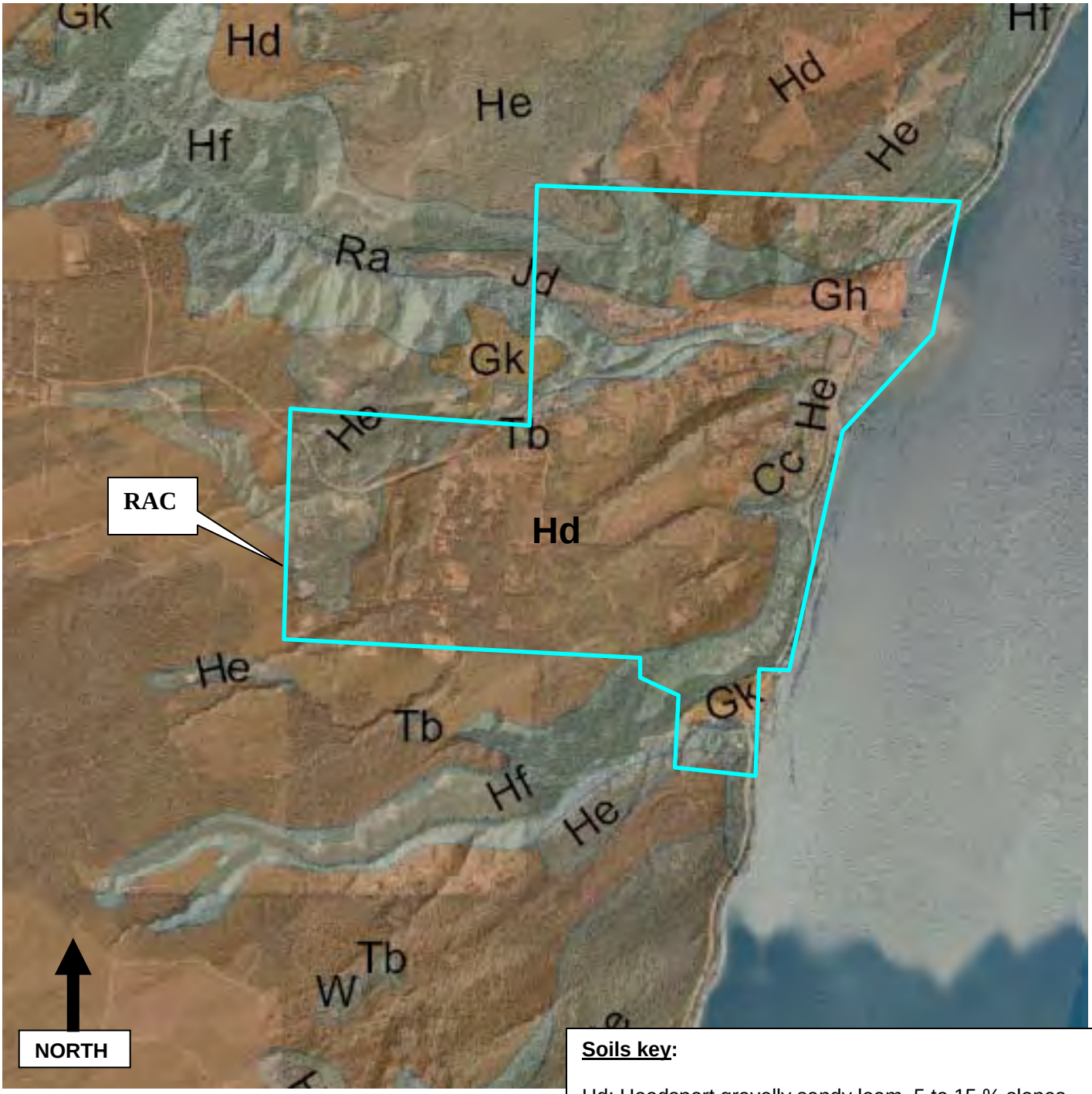
This study and report have been prepared on behalf of Mason County for the specific application to the subject property. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, nor the use of segregated portions of this report.

We appreciate the opportunity to provide our services. Please feel free to call us if you have any questions or need more information.

Sincerely,
HWA GEOSCIENCES INC.



Arnie Sugar, LG, LHG
Vice President



Soils key:

Hd: Hoodsport gravelly sandy loam, 5 to 15 % slopes
He: Hoodsport gravelly sandy loam, 15 to 30 % slopes
Hf: Hoodsport gravelly sandy loam, 30 to 45 % slopes
Gh: Grove gravelly sandy loam, 0 to 5 % slopes
Gk: Grove gravelly sandy loam, 5 to 15 % slopes
Cc: Cloquallum silt loam, 5 to 15 % slopes
Tb: Tanwax peat, 0 to 2 % slopes
Jd: Juno sandy loam, 0 to 3 % slopes

From: Ness, A. 0., and Fowler, R. H., 1960. *Soil Survey Of Mason County, Washington*, Soil Conservation Service, United States Department of Agriculture, Washington Agricultural Experiment Stations.
http://www.or.nrcs.usda.gov/pnw_soil/wa_reports.html

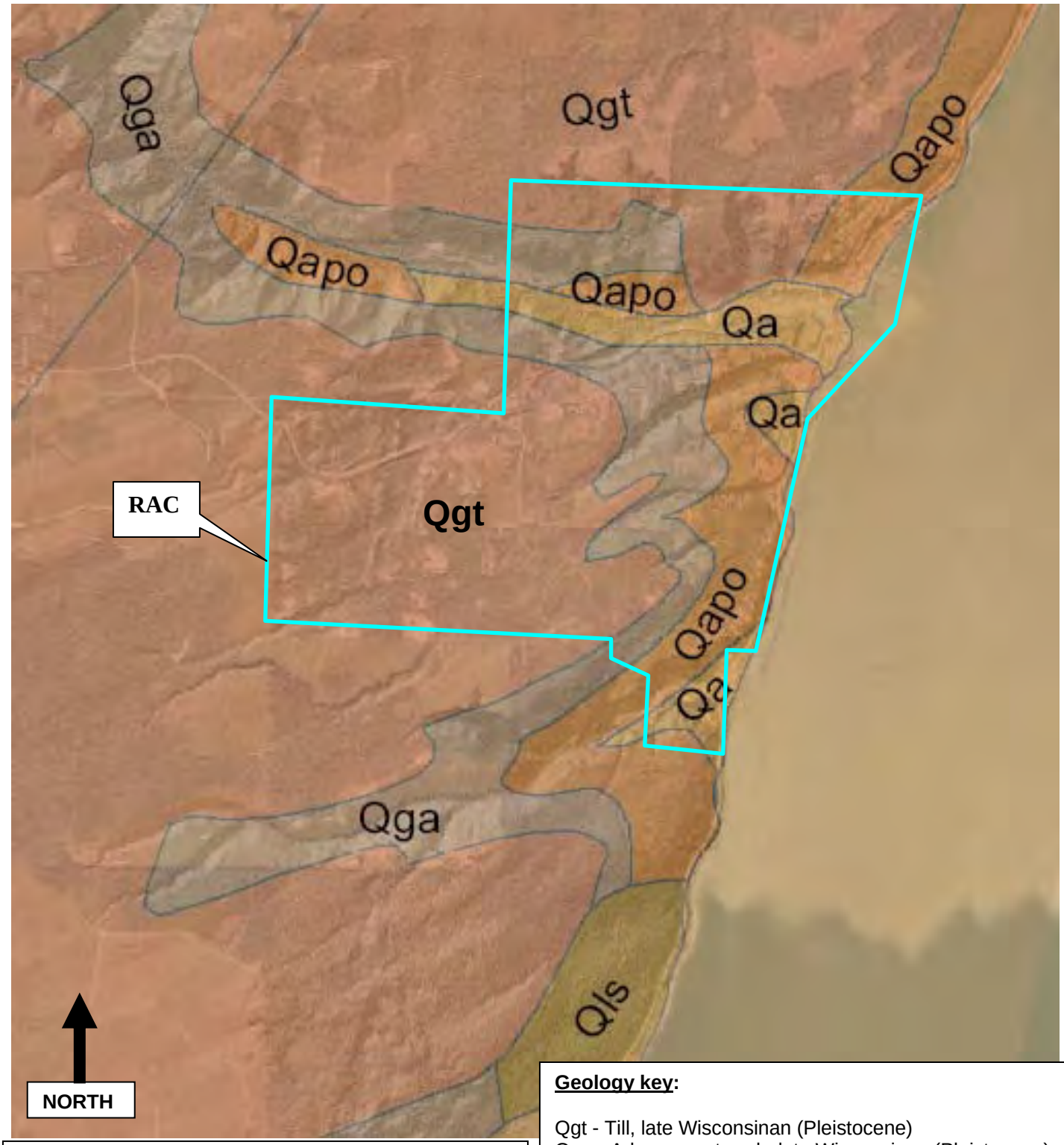
HWA GEOSCIENCES INC.

SOILS MAP

MASON COUNTY
WATER QUALITY PROJECT PLANNING
HOODSPORT RURAL ACTIVITY CENTER

FIGURE NO.
1

PROJECT NO.
2006-172



From: Logan, R. L., 2003. *Geologic Map of the Shelton 1:100,000 Quadrangle, Washington.* 45 x 36 in. color sheet, scale 1:100,000, Washington Division of Geology and Earth Resources, Open File Report 2003-15
http://www.dnr.wa.gov/geology/pdf/ofr03-15.pdf

Geology key:

Qgt - Till, late Wisconsinan (Pleistocene)
Qga - Advance outwash, late Wisconsinan (Pleistocene)
Qgo - Proglacial and recessional outwash, late Wisconsinan (Pleistocene)
Qapo - Alpine outwash, pre–late Wisconsinan (Pleistocene)
Qa - Alluvium (Holocene)

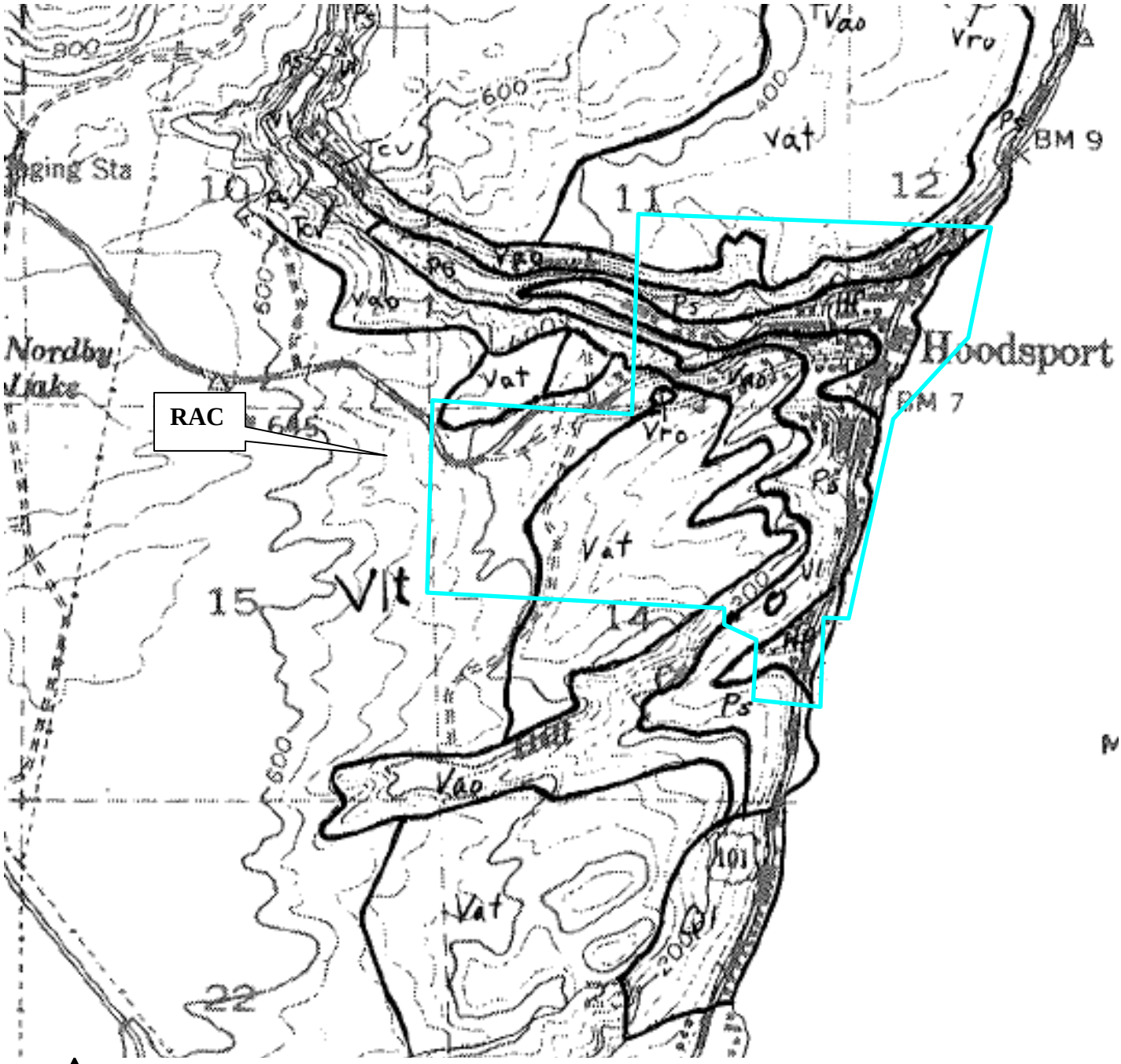
HWA GEOSCIENCES INC.

GEOLOGIC MAP (Logan, 2003)

MASON COUNTY
WATER QUALITY PROJECT PLANNING
HOODSPORT RURAL ACTIVITY CENTER

FIGURE NO.
2

PROJECT NO.
2006-172



Geology key:

Vat - Ablation Till
Vro - Recessional outwash
Vrd - Recessional outwash - deltas/alluvial fans
Vl - Lacustrine sediments
Ps - Salmon Springs Drift
Hf - Flood plain alluvium

From: Carson, R. J., OFR 76-2. Geologic Map of North Central Mason County, Washington, 1 sheet, scale 1:62,500, Washington Division of Geology and Earth Resources, Open File Report 76-2.

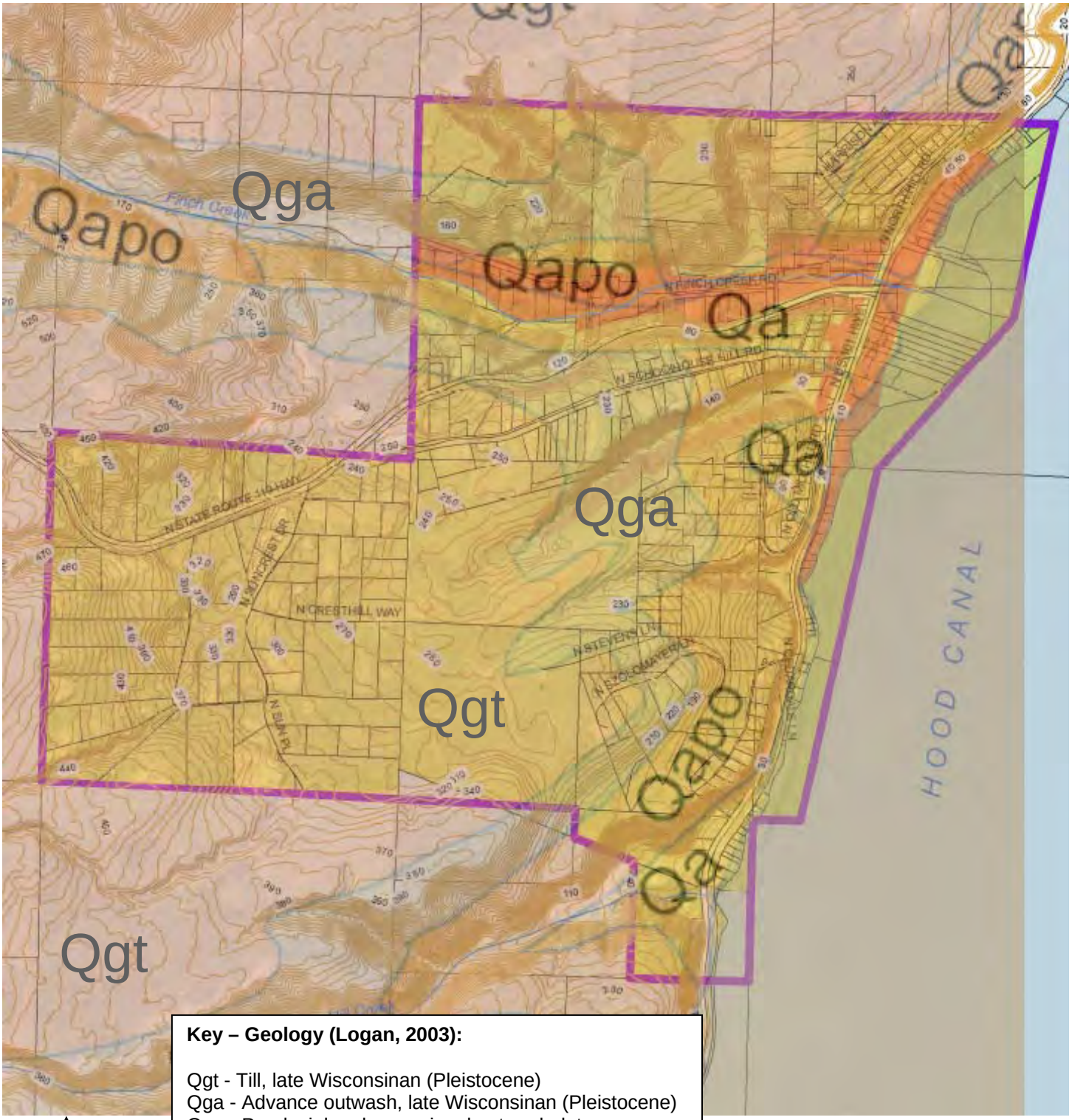
HWA GEOSCIENCES INC.

GEOLOGIC MAP (Carson, 1976)

MASON COUNTY
WATER QUALITY PROJECT PLANNING
HOODSPORT RURAL ACTIVITY CENTER

FIGURE NO.
3

PROJECT NO.
2006-172



Key – Geology (Logan, 2003):

Qgt - Till, late Wisconsinan (Pleistocene)
Qga - Advance outwash, late Wisconsinan (Pleistocene)
Qgo - Proglacial and recessional outwash, late Wisconsinan (Pleistocene)
Qapo - Alpine outwash, pre–late Wisconsinan (Pleistocene)

NORTH

Base mapping by: Mason County (topo & parcels) Geology by Logan, 2003

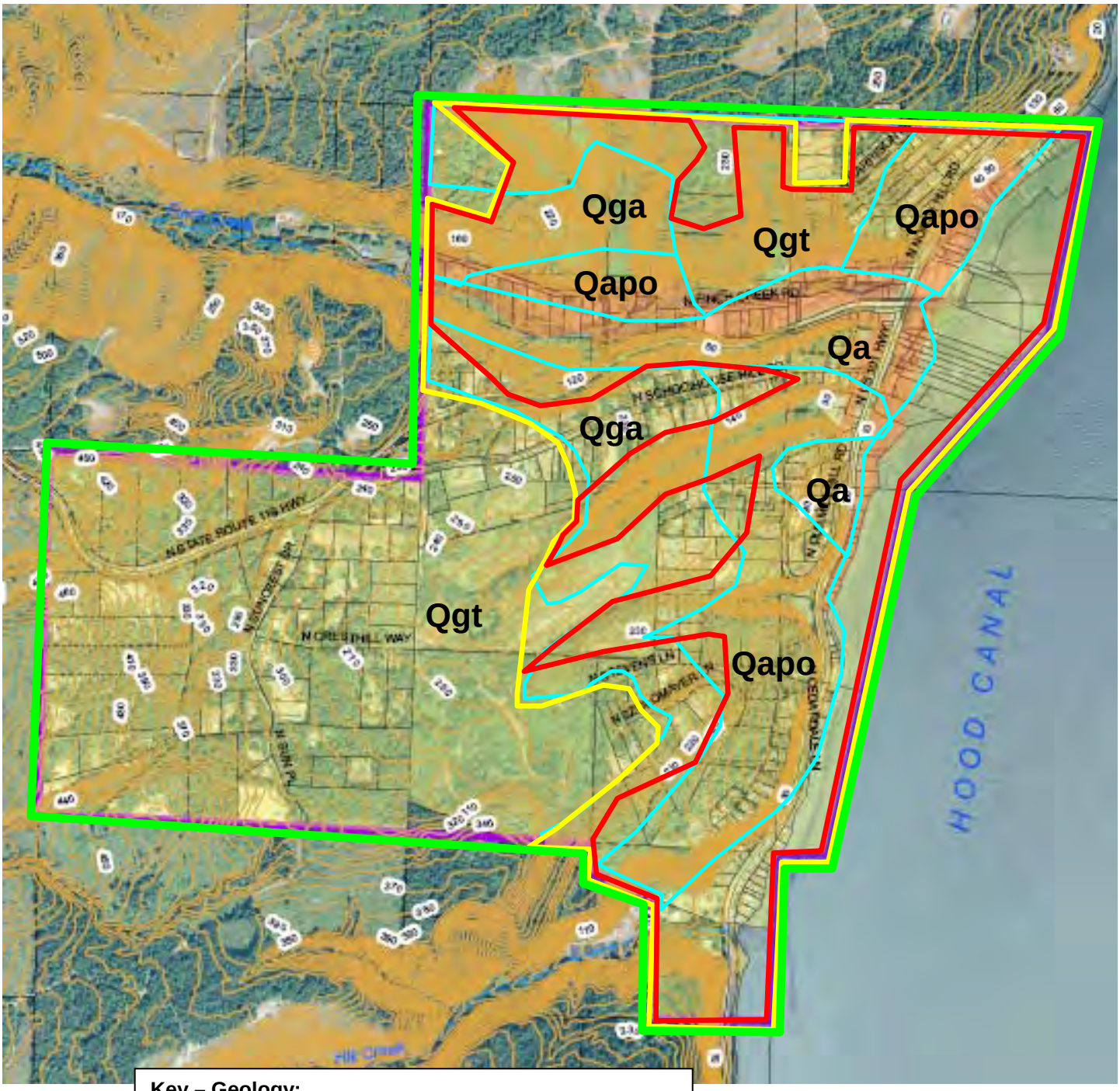
HWA GEOSCIENCES INC.

TOPO, GEOLOGY, & PARCELS

MASON COUNTY
WATER QUALITY PROJECT PLANNING
HOODSPORT RURAL ACTIVITY CENTER

FIGURE NO.
4

PROJECT NO.
2006-172



Key – Geology:

Qgt - Till, late Wisconsinan (Pleistocene)
Qga - Advance outwash, late Wisconsinan (Pleistocene)
Qgo - Proglacial and recessional outwash, late Wisconsinan (Pleistocene)
Qapo - Alpine outwash, pre–late Wisconsinan (Pleistocene)
Qa - Alluvium (Holocene)

Key - Relative contaminant transport risk:

Low
Medium
High

NORTH

Base mapping by: Mason County (aerial, topo & parcels), Geology by Logan, 2003

HWA GEOSCIENCES INC.

RELATIVE CONTAMINANT TRANSPORT RISK

MASON COUNTY
WATER QUALITY PROJECT PLANNING
HOODSPORT RURAL ACTIVITY CENTER

FIGURE NO. 5

PROJECT NO. 2006-172

APPENDIX B

HOODSPORT RAC RESIDENTIAL AND COMMERICAL COUNT

HOODSPORT POPULATION

North along Highway 101

	Water Side		**Inland Side**
1	ITT Rainier Building	2	Residences
1	Seafood Fish Mart	1	Hoodsport Winery
8	Residences	2	Residences
16	Residences	4	Residences
1	Hoodsport Café	2	Residences
7	Residences (behind businesses)		Old Mill Road (see below)
1	Hairstyle	1	West Realty
1	Pier 101 Boutque	1	Residence
1	Laurie's at Home	1	Hoodsport Inn
1	Hardware	1	Bob's Auto Repair
1	Gift & Liquor	1	76 Gas & Grocery
1	Lilly Pad Burgers	1	Timberland Library
1	Other Business	1	Family Clinic
5	Residences (behind businesses)	1	Pub & Eatery
	Finch Creek		SR 119
1	Fish Hatchery	1	Hamburger
1	Residence	1	West Coast Bank
1	Landmark Realty		
9	Residences		
1	Sunrise Motel		
13	**Commerical**	**10**	**Commerical**
46	**Residential**	**11**	**Residential**

Old Mill Road

24 Residences

Trout Pond Drive off Old Mill Road

2 Residences

View looking south from Trout Pond Drive

3 Residences

Old Schoolhouse Hill Road

20 Residences

North Hill Road

13 Residences

North Harrison

10 Residences

North Olympic

6 Residences

North Baskin Lane

3 Residences

0 Commercial
115 Residential

SR 119 (Cushman Road)

Southside

3 Residences
Suncrest
27 Residences
4 Residences
1 Faith Gardens (nursery & residence)
9 Residences
2 Businesses (closed)

3 Commercial
44 Residential

Northside

1 Post Office
1 Dentist
2 Businesses (vacant)
1 Business (vacant)
1 National Forest/Park Office
1 Lumbermans
1 RV Storage/Furniture Doctor (former Haugen Property)
Up Hill (SR 119)
3 Residences
1 Church
2 Residences
Schoolhouse Road on Left
3 Residences
Water Tank on Left
Up to Transfer Station (Nothing)

9 Commercial
8 Residential

Finch Creek

4	Residences
1	Church
1	National Park Compound
11	Residences
1	Fire Station
19	Residences

3	**Commercial**
34	**Residential**

38	Total Commercial
258	Total Residential

APPENDIX C

ON-SITE SEWAGE SYSTEM RULES

Rules and Regulations of the State Board of Health

On-site Sewage Systems Chapter 246-272A WAC

Effective July 1, 2007

Washington State Department of Health
Division of Environmental Health
Office of Shellfish and Water Protection

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Rules and Regulations of the State Board of Health

On-site Sewage Systems
Chapter 246-272A WAC

Effective July 1, 2007

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Mary Selecky
Secretary of Health

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Chapter 246-272A
On-site Sewage Systems

PURPOSE AND ADMINISTRATION

WAC 246-272A-0001 Purpose, Objectives, and Authority

(1) The purpose of this chapter is to protect the public health by minimizing:

(a) The potential for public exposure to sewage from on-site sewage systems; and

(b) Adverse effects to public health that discharges from on-site sewage systems may have on ground and surface waters.

(2) This chapter regulates the location, design, installation, operation, maintenance, and monitoring of on-site sewage systems to:

(a) Achieve effective long-term sewage treatment and effluent dispersal; and

(b) Limit the discharge of contaminants to waters of the state.

(3) The state board of health is authorized under RCW 43.20.050 to establish minimum requirements for the department of health and local boards of health, and consistent with RCW 43.70.310 integrating the preservation of public health with protection of the environment in order to endorse policies in common.

(4) This chapter is intended to coordinate with other applicable statutes and rules for the design of on-site sewage systems under chapter 18.210 RCW and chapter 196-33 WAC.

(5) This chapter is intended to coordinate with other applicable statutes for land use planning under chapters 36.70 and 36.70A RCW, and the statutes for subdivision of land under chapter 58.17 RCW.

WAC 246-272A-0005 Administration.

The local health officers and the department shall administer this chapter under the authority and requirements of chapters 70.05, 70.08, 70.118, 70.46, and 43.70 RCW. RCW 70.05.060(7) authorizes local health officers to charge fees for the administration of this chapter.

WAC 246-272A-0010 Definitions.

(1) Acronyms used in this chapter:

"ANSI" means American National Standards Institute.

"BOD" means biochemical oxygen demand, typically expressed in mg/L.

"$CBOD_5$" means carbonaceous biochemical oxygen demand, typically expressed in mg/L.

"FC" means fecal coliform, typically expressed in number colonies/100 ml.

"LOSS" means a large on-site sewage system (see chapter 246-272B WAC).

"NSF" means National Sanitation Foundation International.

"O&G" (formerly referred to as FOG) means oil and grease, a component of sewage typically originating from food stuffs (animal fats or vegetable oils) or consisting of compounds of alcohol or glycerol with fatty acids (soaps and lotions), typically expressed in mg/L.

"OSS" means on-site sewage system.

"RS&G" means recommended standards and guidance.

"SSAS" means a subsurface soil absorption system.

"TAC" means the technical advisory committee established in WAC 247-272A-0400.

"TN" means total nitrogen, typically expressed in mg/L.

"TSS" means total suspended solids, a measure of all suspended solids in a liquid, typically expressed in mg/L.

"USEPA" means United States Environmental Protection Agency.

(2) Definitions used in this chapter:

"Additive" means a commercial product added to an on-site sewage system intended to affect the performance or aesthetics of an on-site sewage system.

"Approved" means a written statement of acceptability issued by the local health officer or the department.

"Bed" means a soil dispersal component consisting of an excavation with a width greater than three feet.

"Building sewer" means that part of the horizontal piping of a drainage system extending from the building drain, which collects sewage from all the drainage pipes inside a building, to an on-site sewage system. It begins two feet outside the building wall and conveys sewage from the building drain to the remaining portions of the on-site sewage system.

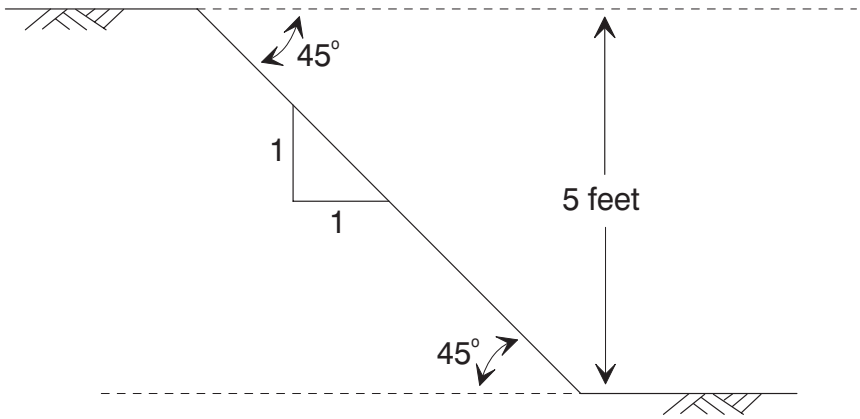
"Cesspool" means a pit receiving untreated sewage and allowing the liquid to seep into the surrounding soil or rock.

"Conforming system" means any on-site sewage system or component, meeting any of the following criteria:

(a) In full compliance with new construction requirements under this chapter; or
(b) Approved, installed and operating in accordance with requirements of previous editions of this chapter; or
(c) Permitted by the waiver process under WAC 246-272A-0420 that assures public health protection by higher treatment performance or other methods.

"Cover material" means soil placed over a soil dispersal component composed predominately of mineral material with no greater than ten percent organic content. Cover material may contain an organic surface layer for establishing a vegetative landscape to reduce soil erosion.

"Cuts and/or banks" means any naturally occurring or artificially formed slope greater than one hundred percent (forty-five degrees) and extending vertically at least five feet from the toe of the slope to the top of the slope as follows:



"Department" means the Washington state department of health.

"Designer" means a person who matches site and soil characteristics with appropriate on-site sewage technology. Throughout this chapter this term applies to both on-site sewage treatment system designers licensed under chapter 18.210 RCW and professional engineers licensed under chapter 18.43 RCW.

"Design flow" means the maximum volume of sewage a residence, structure, or other facility is estimated to generate in a twenty-four-hour period. It incorporates both an operating capacity and a surge capacity for the system during periodic heavy use events. The sizing and design of the on-site sewage system components are based on the design flow.

"Development" means the creation of a residence, structure, facility, subdivision, site, area, or similar activity resulting in the production of sewage.

"Disinfection" means the process of destroying pathogenic microorganisms in sewage through the application of ultraviolet light, chlorination, or ozonation.

"Distribution technology" means any arrangement of equipment and/or materials that distributes sewage within an on-site sewage system.

"Drain field" see subsurface soil absorption system (SSAS) and soil dispersal component.

"Drainrock" means clean washed gravel or crushed rock ranging in size from three-quarters inch to two and one-half inches, and containing no more than two percent by weight passing a US No. 8 sieve and no more than one percent by weight passing a US No. 200 sieve.

"Effluent" means liquid discharged from a septic tank or other on-site sewage system component.

"Expanding clay" means a clay soil with the mineralogy of clay particles, such as those found in the Montmorillonite/Smectite Group, which causes the clay particles to expand when they absorb water, closing the soil pores, and contract when they dry out.

"Expansion" means a change in a residence, facility, site, or use that:
(a) Causes the sewage quantity or quality to exceed the existing design flow of the on-site

system, for example, when a residence is increased from two to three bedrooms or a change in use from an office to a restaurant; or

(b) Reduces the treatment or dispersal capability of the existing on-site sewage system or the reserve area, for example, when a building is placed over a reserve area.

"Extremely gravelly" means soil with sixty percent or more, but less than ninety percent rock fragments by volume.

"Failure" means a condition of an on-site sewage system or component that threatens the public health by inadequately treating sewage or by creating a potential for direct or indirect contact between sewage and the public. Examples of failure include:

(a) Sewage on the surface of the ground;
(b) Sewage backing up into a structure caused by slow soil absorption of septic tank effluent;
(c) Sewage leaking from a sewage tank or collection system;
(d) Cesspools or seepage pits where evidence of ground water or surface water quality degradation exists;
(e) Inadequately treated effluent contaminating ground water or surface water; or
(f) Noncompliance with standards stipulated on the permit.

"Fecal coliform" means bacteria common to the digestive systems of warm-blooded animals that are cultured in standard tests. Counts of these organisms are typically used to indicate potential contamination from sewage or to describe a level of needed disinfection, generally expressed as colonies per 100 ml.

"Gravelly" means soils with fifteen percent or more, but less than thirty-five percent rock fragments by volume.

"Gray water" means sewage from bathtubs, showers, bathroom sinks, washing machines, dishwashers, and kitchen sinks. It includes sewage from any source in a residence or structure that has not come into contact with toilet wastes.

"Ground water" means subsurface water occupying the zone of saturated soil, permanently, seasonally, or as the result of the tides. Indications of ground water may include:

(a) Water seeping into or standing in an open excavation from the soil surrounding the excavation or monitoring ports.
(b) Spots or blotches of different color or shades of color interspersed with a dominant color in soil, caused by reduction and oxidation of iron. These color patterns are redoximorphic features, commonly referred to as mottling. Redoximorphic features often indicate the intermittent presence of ground water and may indicate poor aeration and impeded drainage. Also see "water table."

"Holding tank sewage system" means an on-site sewage system which incorporates a sewage tank without a discharge outlet, the services of a sewage pumper/hauler, and the off-site treatment and disposal for the sewage generated.

"Hydraulic loading rate" means the amount of effluent applied to a given treatment step, in this chapter expressed as gallons per square foot per day (gal/sq.ft./day).

"Industrial wastewater" means the water or liquid carried waste from an industrial process. These wastes may result from any process or activity of industry, manufacture, trade or business, from the development of any natural resource, or from animal operations such as feedlots, poultry houses, or dairies. The term includes contaminated storm water and leachate from solid waste facilities.

"Infiltrative surface" means the surface within a treatment component or soil dispersal component to which effluent is applied and through which effluent moves into original, undisturbed soil or other porous treatment media.

"Installer" means a person approved by the local health officer to install on-site sewage systems or components.

"Local health officer" means the health officer of the city, county, or city-county health department or district within the state of Washington, or a representative authorized by and under the direct supervision of the local health officer, as defined in chapter 70.05 RCW.

"Maintenance" means the actions necessary to keep the on-site sewage system components functioning as designed.

"Massive structure" means the condition of a soil layer in which the layer appears as a coherent or solid mass not separated into peds of any kind.

"Moderate structure" means well-formed distinct peds evident in undisturbed soil. When disturbed, soil material parts into a mixture of whole peds, broken peds, and material that is not in peds.

"Monitoring" means periodic or continuous checking of an on-site sewage system, which is performed by observations and measurements, to determine if the system is functioning as intended and if system maintenance is needed. Monitoring also includes maintaining accurate records that document monitoring activities.

"On-site sewage system" (OSS) means an integrated system of components, located on or nearby the property it serves, that conveys, stores, treats, and/or provides subsurface soil treatment and dispersal of sewage. It consists of a collection system, a treatment component or treatment sequence, and a soil dispersal component. An on-site sewage system also refers to a holding tank sewage system or other system that does not have a soil dispersal component.

"Operating capacity" means the average daily volume of sewage an OSS can treat and disperse on a sustained basis. The operating capacity, which is lower than the design flow, is an integral part of the design and is used as an index in OSS monitoring.

"Ordinary high-water mark" means the mark on lakes, streams, springs, and tidal waters, found by examining the beds and banks and ascertaining where the presence and action of waters are so common and usual, and so long continued in all ordinary years, as to mark upon the soil a character distinct from that of the abutting upland with respect to vegetation, as that condition exists on the effective date of this chapter, or as it may naturally change thereafter. The following definitions apply where the ordinary high-water mark cannot be found:

(a) The ordinary high-water mark adjoining marine water is the elevation at mean higher high tide; and

(b) The ordinary high-water mark adjoining freshwater is the line of mean high water.

"Ped" means a unit of soil structure such as blocks, column, granule, plate or prism formed by natural processes.

"Person" means any individual, corporation, company, association, society, firm, partnership, joint stock company, or any governmental agency, or the authorized agents of these entities.

"Planned unit development" means a subdivision characterized by a unified site design, clustered residential units and/or commercial units, and areas of common open space.

"Platy structure" means soil that contains flat peds that lie horizontally and often overlap. This type of structure will impede the vertical movement of water.

"Pressure distribution" means a system of small diameter pipes equally distributing effluent throughout a SSAS, as described in the department's "*Recommended Standards and Guidance for Pressure Distribution Systems*," 2001. A subsurface drip system may be used wherever the chapter requires pressure distribution.

"Professional engineer" means a person who is currently licensed as an engineer under the provisions of chapter 18.43 RCW.

"Proprietary product" means a sewage treatment and distribution technology, method, or material subject to a patent or trademark.

"Public domain technology" means a sewage treatment and distribution technology, method, or material not subject to a patent or trademark.

"Public sewer system" means a sewerage system:
(a) Owned or operated by a city, town, municipal corporation, county, or other approved ownership consisting of a collection system and necessary trunks, pumping facilities and a means of final treatment and disposal; and
(b) Approved by or under permit from the department of ecology, the department of health and/or a local health officer.

"Pumper" means a person approved by the local health officer to remove and transport sewage or septage from on-site sewage systems.

"Record drawing" means an accurate graphic and written record of the location and features of the OSS that are needed to properly monitor, operate, and maintain that system.

"Repair" means the relocation, replacement or reconstruction of a failed on-site sewage system.

"Reserve area" means an area of land approved for the installation of a conforming system that is protected and maintained for replacement of the OSS upon its failure.

"Residential sewage" means sewage having the constituency and strength typical of wastewater from domestic households.

"Restrictive layer" means a stratum impeding the vertical movement of water, air, and growth of plant roots, such as hardpan, claypan, fragipan, caliche, some compacted soils, bedrock and unstructured clay soils.

"Rock fragment" means rock or mineral fragments having a diameter of two millimeters or more; for example, gravel, cobbles, stones, and boulders.

"Seepage pit" means an excavation more than three feet deep where the sidewall of the excavation is designed to dispose of septic tank effluent. Seepage pits may also be called "dry wells."

"Septage" means the mixture of solid wastes, scum, sludge, and liquids pumped from within septic tanks, pump chambers, holding tanks, and other OSS components.

"Septic tank" means a watertight treatment receptacle receiving the discharge of sewage from a building sewer or sewers, designed and constructed to permit separation of settleable and floating solids from the liquid, detention and anaerobic digestion of the organic matter, prior to discharge of the liquid.

"Septic system" see "on-site sewage system" or "OSS."

"Sewage" means any urine, feces, and the water carrying human wastes, including kitchen, bath, and laundry wastes from residences, buildings, industrial establishments or other places.

"Sewage quality" means contents in sewage that include:
(a) $CBOD_5$, TSS, and O&G;
(b) Other parameters that can adversely affect treatment. Examples include pH, temperature, and dissolved oxygen;
(c) Other constituents that create concerns due to specific site sensitivity. Examples include fecal coliform and nitrogen.

"Sewage tank" means a prefabricated or cast-in-place septic tank, pump tank/dosing chamber, holding tank, grease interceptor, recirculating filter tank or any other tanks as they relate to on-site sewage systems including tanks for use with proprietary products.

"Soil dispersal component" means a technology that releases effluent from a treatment component into the soil for dispersal, final treatment and recycling.

"Soil log" means a detailed description of soil characteristics providing information on the soil's capacity to act as an acceptable treatment and dispersal medium for sewage.

"Soil scientist" means a person certified by the American Society of Agronomy as a Certified Professional Soil Scientist.

"Soil type" means one of seven numerical classifications of fine earth particles and rock fragments as described in WAC 246-272A-0220 (2)(e).

"Standard methods" means the *20th Edition of Standard Methods for the Examination of Water and Wastewater*, prepared and published jointly by the American Public Health Association, the American Water Works Association and the Water Environment Federation.

"Strong structure" means peds are distinct in undisturbed soil. They separate cleanly when soil is disturbed, and the soil material separates mainly into whole peds when removed.

"Subdivision" means a division of land or creation of lots or parcels, described under chapter 58.17 RCW, including both long and short subdivisions, planned unit developments, and mobile home parks.

"Subsurface drip system" means an efficient pressurized wastewater distribution system that can deliver small, precise doses of effluent to soil surrounding the drip distribution piping (called dripline) as described in the department's "*Recommended Standards and Guidance for Subsurface Drip Systems*."

"Subsurface soil absorption system" (SSAS) means a soil dispersal component of trenches or beds containing either a distribution pipe within a layer of drainrock covered with a geotextile, or an approved gravelless distribution technology, designed and installed in original, undisturbed, unsaturated soil providing at least minimal vertical separation as established in this chapter, with either gravity or pressure distribution of the treatment component effluent.

"Surface water" means any body of water, whether fresh or marine, flowing or contained in natural or artificial unlined depressions for significant periods of the year, including natural and artificial lakes, ponds, springs, rivers, streams, swamps, marshes, irrigation canals and tidal waters.

"Timed dosing" means delivery of discrete volumes of sewage at prescribed time intervals.

"Treatment component" means a technology that treats sewage in preparation for further treatment and/or dispersal into the soil environment. Some treatment components, such as mound systems, incorporate a soil dispersal component in lieu of separate treatment and soil dispersal components.

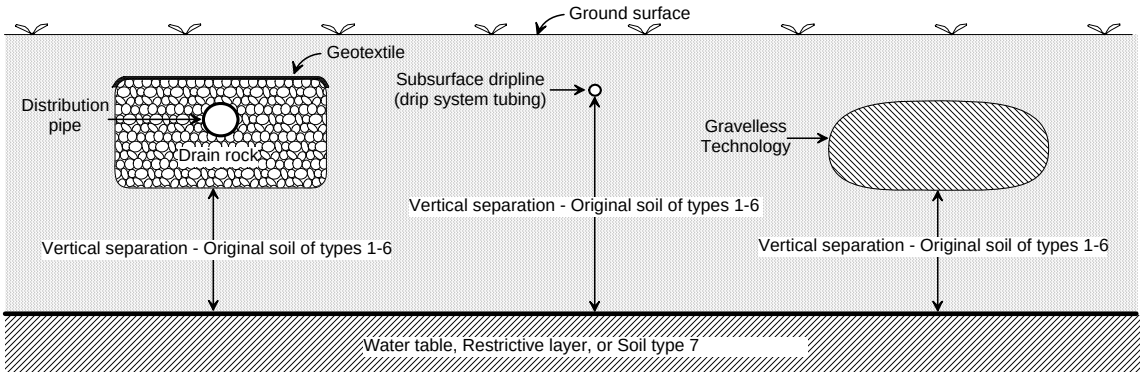
"Treatment level" means one of six levels (A, B, C, D, E, & N) used in these rules to:
(a) Identify treatment component performance demonstrated through requirements specified in WAC 246-272A-0110; and
(b) Match site conditions of vertical separation and soil type with treatment components. Treatment levels used in these rules are not intended to be applied as field compliance standards. Their intended use is for establishing treatment product performance in a product testing setting under established protocols by qualified testing entities.

"Treatment sequence" means any series of treatment components that discharges treated sewage to the soil dispersal component.

"Trench" means a soil dispersal component consisting of an excavation with a width of three feet or less.

"Unit volume of sewage" means:
(a) Flow from a single-family residence;
(b) Flow from a mobile home site in a mobile home park; or
(c) Four hundred fifty gallons of sewage per day where the proposed development is not single-family residences or a mobile home park.

"Vertical separation" means the depth of unsaturated, original, undisturbed soil of soil types 1-6 between the bottom infiltrative surface of a soil dispersal component and the highest seasonal water table, a restrictive layer, or soil type 7 as illustrated below by the profile drawing of subsurface soil absorption systems:



"Very gravelly" means soil containing thirty-five percent or more, but less than sixty percent rock fragments by volume.

"Water table" means the upper surface of the ground water, whether permanent or seasonal. Also see "ground water."

"Well" means any excavation that is constructed when the intended use of the well is for the location, diversion, artificial recharge, observation, monitoring, dewatering or withdrawal of ground water for agricultural, municipal, industrial, domestic, or commercial use. Excluded

are:

(a) A temporary observation or monitoring well used to determine the depth to a water table for locating an OSS;

(b) An observation or monitoring well used to measure the effect of an OSS on a water table; and

(c) An interceptor or curtain drain constructed to lower a water table.

WAC 246-272A-0015 Local management and regulation.

(1) By July 1, 2007, the local health officers of health jurisdictions in the twelve counties bordering Puget Sound shall develop a written plan that will provide guidance to the local health jurisdiction regarding development and management activities for all OSS within the jurisdiction. The plan must specify how the local health jurisdiction will:

(a) Progressively develop and maintain an inventory of all known OSS in operation within the jurisdiction;

(b) Identify any areas where OSS could pose an increased public health risk. The following areas shall be given priority in this activity:

(i) Shellfish protection districts or shellfish growing areas;

(ii) Sole source aquifers designated by the USEPA;

(iii) Areas in which aquifers used for potable water as designated under the Washington State Growth Management Act, chapter 36.70A RCW are critically impacted by recharge;

(iv) Designated wellhead protection areas for Group A public water systems;

(v) Up-gradient areas directly influencing water recreation facilities designated for swimming in natural waters with artificial boundaries within the waters as described by the Water Recreation Facilities Act, chapter 70.90 RCW;

(vi) Areas designated by the department of ecology as special protection areas under WAC 173-200-090, Water quality standards for ground waters of the state of Washington;

(vii) Wetland areas under production of crops for human consumption;

(viii) Frequently flooded areas including areas delineated by the Federal Emergency Management Agency and or as designated under the Washington State Growth Management Act, chapter 36.70A RCW;

(ix) Areas where nitrogen has been identified as a contaminant of concern; and

(x) Other areas designated by the local health officer.

(c) Identify operation, maintenance and monitoring requirements commensurate with risks posed by OSS within the geographic areas identified in (b) of this subsection;

(d) Facilitate education of homeowners regarding their responsibilities under this chapter and provide operation and maintenance information for all types of systems in use within the jurisdiction;

(e) Remind and encourage homeowners to complete the operation and maintenance inspections required by WAC 246-272A-0270;

(f) Maintain records required under this chapter, including of all operation and maintenance activities as identified; and

(g) Enforce OSS owner permit application, operation, monitoring and maintenance and failure repair requirements defined in WAC 246-272A-0200(1), 246-272A-0270, 246-272A-0275, and 246-272A-0280 (1) and (2);

(h) Describe the capacity of the local health jurisdiction to adequately fund the local OSS plan, including the ability to find failing and unknown systems; and

(i) Assure that it was developed to coordinate with the comprehensive land use plan of the entities governing development in the health officer's jurisdiction.

(2) After being approved by the local board of health following a public hearing, the local health officers required to develop a written plan under subsection (1) of this section shall:

(a) Supply a copy of the plan to the department;

(b) Supply a copy of the plan to the entities responsible for land use planning and development regulations in the health officer's jurisdiction; and

(c) Implement the plan described in subsection (1) of this section.

(3) The plans of local health jurisdictions required to develop a written plan under subsection (1) of this section shall be submitted to the department by July 1, 2007, and shall be reviewed to ensure the elements described in subsection (1) of this section have been addressed. The department shall provide in writing to the local board of health its review of the completeness of the plan.

(4) For purposes of this chapter, the local health jurisdictions in marine counties are Clallam, Island, Kitsap, Jefferson, Mason, San Juan, Seattle-King, Skagit, Snohomish, Tacoma-Pierce, Thurston and Whatcom.

(5) The local health officers for all other jurisdictions not required to develop a written plan under subsection (1) of this section shall develop a written plan that will provide guidance to the local jurisdiction regarding development and management activities for all OSS within the jurisdiction. At a minimum the plan shall include:

(a) A description of the capacity of the local health jurisdiction to provide education and operation and maintenance information for all types of systems in use within the jurisdiction;

(b) A description of how the local health officer will remind and encourage homeowners to complete the operation and maintenance inspection required by WAC 246-272A-0270; and

(c) A description of the capacity of the local health jurisdiction to adequately fund the local OSS plan.

(6) In order to implement the plan described in subsections (1) and (5) of this section, the local health officer shall require the owner of the OSS to:

(a) Comply with additional requirements identified in the plan for the location, design, or performance; and

(b) Comply with the conditions of the operational permit if one is required.

(7) In order to implement the plan described in subsections (1) and (5) of this section, the local health officer may require the owner of the OSS to:

(a) Ensure additional maintenance and monitoring of the OSS;

(b) Provide dedicated easements for inspections, maintenance, and potential future expansion of the OSS;

(c) Place a notice to title identifying any additional requirements for OSS operation, maintenance and monitoring; and

(d) Have an inspection of the OSS at the time of property transfer including the preparation of a "record drawing" if necessary.

(8) No later than July 1, 2006, the department shall develop guidance on local management programs to assist marine local health jurisdictions in plan development.

(9) Until such time as the local board of health decides to adopt its own rules, the local health officer shall enforce this chapter. Local boards of health may adopt and enforce local rules and regulations governing on-site sewage systems when the local regulations are:

(a) Consistent with, and at least as stringent as, this chapter; and

(b) Approved by the department prior to the effective date of local regulations.

(10) A local board of health shall apply for departmental approval of local regulations by initiating the following procedure:

(a) The local board shall submit the proposed local regulations to the department.

(b) Within ninety days of receipt, the department shall:

(i) Approve the regulation in writing; or

(ii) Signify automatic tacit approval with the local regulations and permitting local implementation by failing to act; or

(iii) Deny approval of the regulations. If the department determines local regulations are not consistent with this chapter, the department shall provide specific reasons for denial.

(11) Upon receipt of departmental approval or after ninety days without notification, whichever comes first, the local board may implement adopted regulations. The local board shall provide a copy of the adopted local regulations to the department.

(12) If the department denies approval of local regulations, the local board of health may:

(a) Resubmit revised regulations for departmental consideration; or

(b) Submit a written request for a review of the departmental denial within one hundred twenty days from the date the local board of health receives the written reasons for the denial.

(13) Upon receipt of written request for review of the departmental denial, the department shall:

(a) Acknowledge the receipt of the request in writing; and

(b) Form a mutually acceptable advisory panel consisting of:

(i) One departmental employee;

(ii) One employee from a local health jurisdiction other than that which requested the review; and

(iii) One member of the technical advisory committee.

(14) If good faith efforts to reach agreement are unsuccessful, the local board of health mayappeal the denial to the Washington state board of health for resolution.

(15) Nothing in this chapter shall prohibit the adoption and enforcement of more stringent regulations by local health departments.

(16) In the plan required in subsection (1) of this section and in local regulations, the local health officer may address water conservation and include options for the nonpotable reuse of gray water. Any treatment and dispersal of gray water outside the residence or structure must comply with this chapter.

GENERAL REQUIREMENTS

WAC 246-272A-0020 Applicability.

(1) The local health officer:

(a) Shall apply this chapter to OSS treating sewage and dispersing effluent from residential sources with design flows up to three thousand five hundred gallons per day;

(b) May apply this chapter to OSS for nonresidential sources of sewage if treatment, siting, design, installation, and operation and maintenance measures provide treatment and effluent dispersal equal to that required of residential sources.

(c) May not apply this chapter to industrial wastewater.

(2) The department shall apply this chapter for the registration of proprietary treatment and distribution products.

(3) A valid sewage system design approval or installation permit issued prior to the effective date of these regulations:

(a) Shall be acted upon in accordance with regulations in force at the time of issuance;

(b) Shall have a maximum validity period of five years from the date of issuance or remain valid for an additional year beyond the effective date of these regulations, whichever assures the most lenient expiration date; and

(c) May be modified to include additional requirements if the health officer determines that a serious threat to public health exists.

(4) This chapter does not apply to facilities regulated as reclaimed water use under chapter 90.46 RCW.

WAC 246-272A-0025 Connection to public sewer system.

(1) When adequate public sewer services are available within two hundred feet of the residence or facility, the local health officer, upon the failure of an existing on-site sewage system may:

(a) Require hook-up to a public sewer system; or

(b) Permit the repair or replacement of the on-site sewage system only if a conforming system can be designed and installed.

(2) Except as noted in subsection (1) of this section, the owner of a failure shall abandon the OSS under WAC 246-272A-0300 and connect the residence or other facility to a public sewer system when:

(a) The distance between the residence or other facility and an adequate public sewer is two hundred feet or less as measured along the usual or most feasible route of access; and

(b) The sewer utility allows the sewer connection.

(3) The owner of a residence or other facility served by a system meeting the requirements of Table IX of this chapter shall abandon the OSS according to the requirements specified in WAC 246-272A-0300, and connect the residence or other facility to a public sewer system when:

(a) Connection is deemed necessary to protect public health by the local health officer;

(b) An adequate public sewer becomes available within two hundred feet of the residence or other facility as measured along the usual or most economically feasible route of access; and

(c) The sewer utility allows the sewer connection.

(4) Local boards of health may require a new development to connect to a public sewer system to protect public health.

(5) Local boards of health shall require new development or a development with a failing system to connect to a public sewer system if it is required by the comprehensive land use plan or development regulations.

SEWAGE PRODUCTS AND TECHNOLOGIES

WAC 246-272A-0100 Sewage technologies.

(1) The department may develop recommended standards and guidance to assist local health officers in permitting different types of sewage treatment and distribution technologies including the following four broad categories:

(a) Public domain treatment technologies (e.g., sand filters);

(b) Proprietary treatment products (e.g., aerobic treatment systems and packed bed filters);

(c) Public domain distribution technologies (e.g., gravel or generic gravel substitutes, gravity and pressure distribution methods and materials);

(d) Proprietary distribution products (e.g., subsurface dripline products or gravelless distribution products).

(2) All types of sewage technologies must have either standards for use described in this chapter or departmental recommended standards and guidance before the local health officer may permit them. Recommended standards and guidance may include information and detail such as:

(a) Application;

(b) Design;

(c) Installation;

(d) Operation, monitoring and maintenance;

(e) Performance expectations; and

(f) Sources of information.

WAC 246-272A-0110 Proprietary treatment products--Certification and registration.

(1) Manufacturers shall register their proprietary treatment products with the department before the local health officer may permit their use.

(2) To qualify for product registration, manufacturers desiring to sell or distribute proprietary treatment products in Washington state shall:

(a) Verify product performance through testing using the testing protocol established in Table I and register their product with the department using the process described in WAC 246-272-0120;

(b) Report test results of influent and effluent sampling obtained throughout the testing period (including normal and stress loading phases) for evaluation of constituent reduction according to Table II;

(c) Demonstrate product performance according to Table III. All thirty-day averages and geometric means obtained throughout the test period must meet the identified threshold values to qualify for registration at that threshold level; and

(d) For registration at levels A, B, and C verify bacteriological reduction according to WAC 246-272A-0130.

(3) Manufacturers verifying product performance through testing according to the following standards or protocols shall have product testing conducted by a testing facility accredited by ANSI:

(a) ANSI/NSF Standard 40--Residential Wastewater Treatment Systems;

(b) NSF Standard 41: Non-Liquid Saturated Treatment Systems;

(c) NSF Protocol P157 Electrical Incinerating Toilets - Health and Sanitation; or

(d) Protocol for bacteriological reduction described in WAC 246-272A-0130.

TABLE I

Testing Requirements for Proprietary Treatment Products

Treatment Component/Sequence Category	Required Testing Protocol
Category 1 Designed to treat sewage with strength typical of a residential source when septic tank effluent is anticipated to be equal to or less than treatment level E.	ANSI/NSF 40--Residential Wastewater Treatment Systems (protocols dated between July 1996 and the effective date of these rules)
Category 2 Designed to treat high-strength sewage when septic tank effluent is anticipated to be greater than treatment level E. (Such as at restaurants, grocery stores, mini-marts, group homes, medical clinics, residences, etc.)	EPA/NSF Protocol for the Verification of Wastewater Treatment Technologies / EPA Environmental Technology Verification (April 2001)
Category 3 Black water component of residential sewage (such as composting and incinerating toilets).	NSF/ANSI Standard 41: Non-Liquid Saturated Treatment Systems (September 1999) NSF Protocol P157 Electrical Incinerating Toilets - Health and Sanitation (April 2000)
Total Nitrogen Reduction in Categories 1 & 2 (Above)	Protocol for the Verification of Residential Wastewater Treatment Technologies for Nutrient Reduction/EPA Environmental Technology Verification Program (November, 2000)

TABLE II
Test Results Reporting Requirements for Proprietary Treatment Products

Treatment Component/Sequence Category	Testing Results Reported
Category 1 Designed to treat sewage with strength typical of a residential source when septic tank effluent is anticipated to be equal to or less than treatment level E.	Report test results of influent and effluent sampling obtained throughout the testing period for evaluation of constituent reduction for the parameters: $CBOD_5$, and TSS: Average ▪ Standard Deviation Minimum Maximum Median Interquartile Range 30-day Average (for each month) For bacteriological reduction performance, report fecal coliform test results of influent and effluent sampling by geometric mean from samples drawn within thirty-day or monthly calendar periods, obtained from a minimum of three samples per week throughout the testing period. See WAC 246-272A-0130. Test report must also include the individual results of all samples drawn throughout the test period.
Category 2 Designed to treat high-strength sewage when septic tank effluent is anticipated to be greater than treatment level E. (Such as at restaurants, grocery stores, mini-marts, group homes, medical clinics, residences, etc.)	Report all individual test results and full test average values of influent and effluent sampling obtained throughout the testing period for: $CBOD_5$, TSS and O&G. Establish the treatment capacity of the product tested in pounds per day for $CBOD_5$.
Category 3 Black water component of residential sewage (such as composting and incinerating toilets).	Report test results on all required performance criteria according to the format prescribed in the NSF test protocol described in Table I.
Total Nitrogen Reduction in Categories 1 & 2 (Above)	Report test results on all required performance criteria according to the format prescribed in the test protocol described in Table I.

TABLE III
Product Performance Requirements for Proprietary Treatment Products

Treatment Component/Sequence Category	Product Performance Requirements				
Category 1 Designed to treat sewage with strength typical of a residential source when septic tank effluent is anticipated to be equal to or less than treatment level E.	**Treatment System Performance Testing Levels**				
	Level	**Parameters**			
		$CBOD_5$ (mg/L)	**TSS (mg/L)**	**O&G (mg/L)**	**FC (#/100 ml)**	**TN (mg/L)**
	A	10	10	----	200	----
	B	15	15	----	1,000	----
	C	25	30	----	50,000	----
	D	25	30	----	----	----
	E	125	80	20	----	----
	N	----	----	----	----	20
	Values for Levels A - D are 30-day values (averages for $CBOD_5$, TSS, and geometric mean for FC.) All 30-day averages throughout the test period must meet these values in order to be registered at these levels. Values for Levels E and N are derived from full test averages.					
Category 2 Designed to treat high-strength sewage when septic tank effluent is anticipated to be greater than treatment level E. (Such as at restaurants, grocery stores, mini-marts, group homes, medical clinics, residences, etc.)	All of the following requirements must be met: (1) All full test averages must meet Level E; and (2) Establish the treatment capacity of the product tested in pounds per day for $CBOD_5$.					
Category 3 Black water component of residential sewage (such as composting and incinerating toilets).	Test results must meet the performance requirements established in the NSF test protocol.					
Total Nitrogen Reduction in Categories 1 & 2 (Above)	Test results must establish product performance effluent quality meeting Level N, when presented as the full test average.					

(4) Manufacturers verifying product performance through testing according to the following standards or protocols shall have product testing conducted by a testing facility meeting the requirements established by the Testing Organization and Verification Organization, consistent with the test protocol and plan.

(a) EPA/NSF--Protocol for the Verification of Wastewater Treatment Technologies; or

(b) EPA Environmental Technology Verification Program protocol for the Verification of Residential Wastewater Treatment Technologies for Nutrient Reduction.

(5) Treatment levels used in these rules are not intended to be applied as field compliance standards. Their intended use is for establishing treatment product performance in a product testing setting under established protocols by qualified testing entities.

WAC 246-272A-0120 Proprietary treatment product registration-Process and requirements.

(1) Manufacturers shall register their proprietary treatment product(s) with the department by submitting a complete application in the format provided by the department, including:

(a) Manufacturer's name, mailing address, street address and phone number;

(b) Contact individual's name, mailing address, street address, and phone number. The contact individual must be vested with the authority to represent the manufacturer in this capacity;

(c) Name, including specific brand and model, of the proprietary treatment product;

(d) A description of the function of the proprietary treatment product along with any known limitation on the use of the product;

(e) Product description and technical information, including process flow drawings and schematics; materials and characteristics; component design specifications; design capacity, volumes and flow assumptions and calculations; components; dimensioned drawings and photos;

(f) For treatment systems in Category 2, daily capacity of the model or models in pounds per day of $CBOD_5$;

(g) Siting and installation requirements;

(h) Detailed description, procedure and schedule of routine service and system maintenance events;

(i) Estimated operational costs for the first five years of the treatment component's life. This shall include both estimated annual electricity costs, and routine maintenance costs, including replacement of parts;

(j) Identification of information subject to protection from disclosure of trade secrets;

(k) Copies of product brochures & manuals: *Sales & Promotional; Design; Installation; Operation & Maintenance; and Homeowner Instructions*;

(l) The most recently available product test protocol and results report;

(m) A signed and dated certification by the manufacturer's agent specifically including the following statement, "I certify that I represent (INSERT MANUFACTURING COMPANY NAME) and I am authorized to prepare or direct the preparation of this application for registration. I attest, under penalty of law, that this document and all attachments are true, accurate, and complete. I understand and accept that the product testing results reported with this application for registration are the parameters and values to be used for determining conformance with Treatment System Performance Testing Levels established in chapter 246-272A WAC";

(n) A signed and dated certification from the testing entity including the statement, "I certify that I represent (INSERT TESTING ENTITY NAME), that I am authorized to report the testing results for this proprietary treatment product. I attest, under penalty of law, that the report about the test protocol and results is true, accurate, and complete"; and

(o) The fee described in WAC 246-272A-990.

(2) Products within a single series or model line (sharing distinct similarities in design, materials, and capacities) may be registered under a single application, consistent with the provisions of their test protocol for the certification of other products within a product series. Products outside of the series or model line must be registered under separate applications.

(3) Upon receipt of an application the department shall:

(a) Verify that the application is complete;

(b) If complete, place the product on the list of proprietary treatment products.

(4) All registrations are valid for up to one year, expiring on December 31 of each year. Fees are not prorated.

(5) In order to renew technology registration, a manufacturer shall:

(a) Apply for renewal of product registration using the form or in the format provided by the department.

(b) Submit the results of retesting, if the product has completed retesting according to the protocol required for registration and a report from the testing entity has been issued since initial registration or previous renewal. Renewal shall be based on the most recent test results.

(c) Provide an affidavit to the department verifying whether or not the product has changed over the previous year. If the product has changed, the affidavit must also include a full description of the changes. If the product has changed in a way that affects performance, the product may not be renewed and shall meet the requirements for initial registration.

(d) Submit the fee established in WAC 246-272A-990.

(6) As part of product registration renewal the department shall:

(a) Request field assessment comments from local health officers no later than October 31st of each year. These comments may include concerns about a variety of field assessment issues, including product function, product reliability, and problems arising with operation and maintenance;

(b) Discuss with the TAC any field assessment information that may impact product registration renewal;

(c) Notify the manufacturer of any product to be discussed with the TAC, prior to discussion with the TAC, regarding the nature of comments received; and

(d) Renew the product registration unless:

(i) The manufacturer of a product does not apply for renewal; or

(ii) The department, after deliberation with the TAC, concludes product registration renewal should not be given or should be delayed until the manufacturer submits information that satisfactorily answers concerns and issues.

(7) The department shall maintain a list of proprietary treatment products meeting the registration requirements established in this chapter. The product registration is a condition of approval for use.

(8) Manufacturers shall have readily accessible information for designers, homeowners, regulators, system owners and other interested parties about their product including:

(a) Product manuals;

(b) Design instructions;

(c) Installation instructions;

(d) Operation and maintenance;

(e) Homeowner instructions; and

(f) A list of representatives and manufacturer certified service providers, if any.

WAC 246-272A-0125 Transition from the list of approved systems and products to the registered list-Treatment products.

(1) The department's list of approved systems and products shall:

(a) Become static on September 15, 2005. Subsequent changes, additions or deletions to the list of approved systems and products will only be made if approved by the department based on completed applications received prior to September 15, 2005.

(b) Remain in effect until March 15, 2007.

(2) Treatment products not on the department's list of approved systems and products on September 15, 2005, and not otherwise eligible for inclusion on the list by submittal of a completed application prior to September 15, 2005, must be registered with the department according to the requirements of this chapter before being permitted by the local health officer.

(3) Between September 15, 2005, and March 15, 2007, the local health officer may permit treatment products that are on the department's list of approved systems and products or registered with the department under the requirements of this chapter.

(4) After March 15, 2007, local health officers may only permit those treatment products registered under the requirements of this chapter.

(5) In order to be registered, manufacturers with treatment product models specified on the department's list of approved systems and products (excluding products being evaluated under the experimental systems program) on September 15, 2005, or subsequently added to the list as provided in subsection (1)(a) of this section, shall apply for product registration before March 15, 2007, using the following information:

(a) For treatment products approved for use with sewage typical of a residential source:

(i) If product approval was based on performance test results obtained from testing conducted according to a ANSI/NSF Standard 40 protocol dated prior to July 1996, the manufacturer may apply for registration as established by these rules using the performance test results obtained by a qualified testing facility from testing conducted according to a ANSI/NSF Standard 40 test protocol dated prior to July 1996;

(ii) In order to be registered, manufacturers must identify on their application for product registration if the reported product testing results use an excursion allowance. If an excursion allowance is used, only the excursion allowance provided in 1996 and later NSF protocols may be used;

(iii) Thirty-day averaging of sample results must meet the requirements established in 1996 and later NSF protocols;

(iv) If product approval was based upon the performance information obtained through the department's former experimental systems program, manufacturers may apply for registration under this chapter using the performance test results obtained from their experimental system program. This provision is valid for only those models on the list of approved systems and products;

(b) For products approved for use with high-strength residential or commercial sewage:

(i) Manufacturers may apply for product registration using the performance test results and other information previously provided to the department in support of product approval application.

(ii) If product approval was based upon the performance information obtained through the department's former experimental systems program, manufacturers may apply for registration under this chapter using the performance test results obtained from their experimental system program. This provision is valid for only those models on the list of approved systems and products;

(c) Test results for BOD_5 may be submitted in lieu of test results for $CBOD_5$. In these cases the numerical values for $CBOD_5$, will be determined using the following formula:

$$(BOD_5 \text{value} \times 0.83 = CBOD_5 \text{ value})$$

(d) In order to be registered for treatment levels A, B or C, a manufacturer shall provide data demonstrating that each of the parameters ($CBOD_5$, TSS and fecal coliform) is met;

(e) Fecal coliform reduction performance must be demonstrated according to the provisions and requirements established in WAC 246-272A-0130 Bacteriological reduction; and

(f) Manufacturers and treatment products must meet all other requirements established in these rules for product registration.

WAC 246-272A-0130 Bacteriological reduction.

This section establishes the requirements for registering bacteriological reduction processes.

(1) Manufacturers shall, for the purpose of product registration as described in WAC 246-272A-0110 and 246-272A-0120 for meeting treatment levels A, B, or C, verify bacteriological reduction performance by sampling for fecal coliform.

(a) For products not yet tested according to ANSI/NSF Standard 40 testing protocol dated July 1996 or later, the requirements of both ANSI/NSF Standard 40 and the protocol specified in subsection (2) of this section for verifying bacteriological reduction must be met.

(b) For products that have been tested according to ANSI/NSF Standard 40 dated July 1996 or later but have not yet been tested for bacteriological reduction, treatment performance of the treatment product or sequence may be established based on test results for $CBOD_5$ and TSS obtained from the previous ANSI/NSF Standard 40 testing and bacteriological reduction performance based on testing according to the protocol in subsection (2) of this section. Provided that the testing entity must verify the influent wastewater stream throughout the bacteriological testing period meets the influent threshold levels for $CBOD_5$ and TSS required by ANSI/NSF Standard 40 testing protocol.

(2) All test data submitted for product registration shall be produced by an ANSI accredited, third-party testing and certification organization whose accreditation is specific to on-site wastewater treatment products. Bacteriological reduction performance must be determined while the treatment product or sequence is tested according to the ANSI/NSF Standard 40 testing protocol. During this testing the following requirements apply:

(a) Collect samples from both the influent and effluent streams, identifying the treatment performance achieved by the full treatment process (component or sequence);

(b) Obtain influent characteristics falling within a range of 10^6 - 10^8 fecal coliform/100 mL calculated as thirty-day geometric means during the test.

(c) Test the influent to any disinfection unit and report the following at each occasion of sampling performed in (d) of this subsection:

(i) Flow rate;

(ii) pH;

(iii) Temperature;

(iv) Turbidity; and

(v) Color.

(d) Obtain samples for fecal coliform analysis during both the design loading and stress loading periods identified by NSF Standard 40. Grab samples shall be collected from both the influent and effluent on three separate days of the week. Each set of influent and effluent grab samples must be taken from a different dosing time frame (morning, afternoon, or evening) so that samples have been taken from each dosing time frame by the end of the week.

(e) Conduct analyses according to standard methods;

(f) Report the geometric mean of fecal coliform test results from all samples taken within thirty-day or monthly calendar periods;

(g) Report the individual results of all samples taken throughout the test period design and stress loading; and

(h) Report all maintenance and servicing conducted during the testing period, including for example, instances of cleaning a UV lamp, or replenishment of chlorine chemicals.

(3) Manufacturers may register products in treatment levels A and B using disinfection.

(4) Manufacturers may not register products for treatment level C using disinfection.

WAC 246-272A-0135 Transition from the list of approved systems and products to the registered list-Bacteriological reduction.

This section on how bacteriological reduction products on the list of approved systems and products can become registered.

(1) The department's list of approved systems and products shall:

(a) Become static on September 15, 2005. Subsequent changes, additions or deletions to the list of approved systems and products will only be made if approved by the department based on completed applications received prior to September 15, 2005.

(b) Remain in effect until March 15, 2007.

(2) Systems on the department's list of approved systems and products meeting the BOD_5 (or $CBOD_5$) and TSS requirements for treatment standards 1 and 2 may continue to be combined with disinfection equipment and methods specified by the on-site sewage system designer to meet or exceed the fecal coliform reduction performance required by treatment standards 1 and 2, until March 15, 2007.

(3) After March 15, 2007, the local health officer may permit only those treatment products registered as meeting bacteriological reduction portions of treatment level A, B, or C under the requirements of this chapter.

(4) Products that have been tested for bacteriological reduction and have met all the requirements of WAC 246-272A-0130, except the bacteriological influent and/or sampling frequency requirements, may be registered under this chapter to allow continued use of the product after March 15, 2007. In order to register their product, the manufacturer shall:

(a) Assure their product is on the department's list of approved systems and products that have been approved as meeting a bacteriological reduction standard on September 15, 2005, or subsequently added to the list as provided in subsection (1)(a) of this section;

(b) Apply for product registration before March 15, 2007; and

(c) Have their product tested for two additional months of testing using the testing protocol specified in WAC 246-272A-0130(2) to verify the bacteriological reduction performance.

WAC 246-272A-0140 Proprietary distribution products-Certification and registration.

(1) Manufacturers shall register proprietary distribution products, including gravelless distribution products and subsurface dripline products, with the department before the local health officer may permit their use.

(2) Manufacturers desiring to sell proprietary distribution products shall certify that the product(s) meets the standards established in this chapter and register their product(s) with the department using the process described in WAC 246-272A-0145.

(3) Proprietary gravelless distribution products shall:

(a) Be constructed or manufactured from materials that are nondecaying and nondeteriorating and do not leach chemicals when exposed to sewage and the subsurface soil environment;

(b) Provide liquid storage volume at least equal to the storage volume provided within the thirty percent void space in a twelve-inch layer of drainrock in a drainrock-filled distribution system. This storage volume must be established by the gravelless distribution products, system design and installation and must be maintained for the life of the system. This requirement may be met on a lineal-foot, or on an overall system design basis;

(c) Provide suitable effluent distribution to the infiltrative surface at the soil interface; and

(d) Maintain the integrity of the trench or bed. The material used, by its nature and its manufacturer-prescribed installation procedure, must withstand the physical forces of the soil sidewalls, soil backfill and the weight of equipment used in the backfilling.

(4) Proprietary subsurface dripline products shall:

(a) Be warranted by the manufacturer for use with sewage and for resistance to root intrusion.

(b) Incorporate emitters with a maximum nominal rated discharge of 1.3 gallons per hour. Emitter discharge rate may be controlled either by use of pressure-compensating emitters or with a pressure regulator.

(c) Be color-coded purple to identify that the pipe contains nonpotable water from a sewage source.

WAC 246-272A-0145 Proprietary distribution product registration-Process and requirements.

(1) Manufacturers shall register their proprietary distribution product(s) with the department by submitting a complete application in the format provided by the department, including:

(a) Manufacturer's name, mailing address, street address, and phone number;

(b) Contact individual's name, mailing address, street address, and phone number. The contact individual must be vested with the authority to act as the agent of the manufacturer in this capacity;

(c) Name, including specific brand and model, of the proprietary distribution product;

(d) A description of the function of the proprietary distribution product along with any known limitations on its use;

(e) Product description and technical information, including schematics; materials and characteristics; component design specifications; design capacity, volumes and flow assumptions and calculations; components; dimensioned drawings and photos;

(f) Siting and installation requirements;

(g) Detailed description, procedure and schedule of routine service and system maintenance events;

(h) Identification of information subject to protection from disclosure of trade secrets;

(i) Copies of product brochures and manuals: *Sales & Promotional; Design; Installation; Operation & Maintenance; and Homeowner Instructions*;

(j) For gravelless chamber systems a quantitative description of the actual exposed trench-bottom infiltrative surface area for each model seeking registration;

(k) A statement from a professional engineer that certifies the technology meets the standards established in WAC 246-272A-0140;

(l) A signed and dated certification by the manufacturer's agent specifically including the following statement, "I certify that I represent (INSERT MANUFACTURING COMPANY NAME) and I am authorized to prepare or direct the preparation of this application for product registration. I attest, under penalty of law, that this document and all attachments are true, accurate, and complete."

(m) A signed and dated certification from the licensed professional engineer including the statement, "I certify that I represent (INSERT PROFESSIONAL ENGINEERING FIRM NAME), that I am authorized to certify the performance characteristics for the proprietary distribution product presented in this application. I attest, under penalty of law, that the technology report is true, accurate, and complete."

(n) The fee established in WAC 246-272A-0990.

(2) Products within a single series or model line (sharing distinct similarities in design, materials, and capacities) may be registered under a single application. Products outside of the series or model line must be registered under separate applications.

(3) Upon receipt of an application the department shall:

(a) Verify that the application is complete;

(b) If complete, place the product on the list of proprietary distribution products.

(4) All registrations are valid for up to one year, expiring on December 31st of each year. Required fees are not prorated.

(5) In order to renew a proprietary distribution product registration, a manufacturer must:

(a) Apply for renewal of product registration using the form or in the format provided by the department;

(b) Provide an affidavit to the department verifying whether or not the product has changed over the previous year. If the product has changed, the affidavit must also include a full description of the changes. If the product has changed in a way that affects performance, the product may not be renewed and shall meet the requirements of initial registration; and

(c) Submit the fee established in WAC 246-272A-0990.

(6) As part of product registration renewal, the department shall:

(a) Request field assessment comments from local health officers no later than October 31st of each year. These comments may include concerns about a variety of field assessment issues, including product function, product reliability, and problems arising with operation and maintenance;

(b) Discuss with the TAC any field assessment information that may impact product registration renewal;

(c) Notify the manufacturer of any product to be discussed with the TAC, prior to discussion with the TAC, regarding the nature of comments received; and

(d) Renew the product registration unless:

(i) The manufacturer of a product does not apply for renewal; or

(ii) The department, after deliberation with the TAC, concludes product registration renewal should not be given or should be delayed until the manufacturer submits information that satisfactorily answers concerns and issues.

(7) The department shall maintain a list of proprietary distribution products meeting the registration requirements established in this chapter. Product registration is a condition of approval for use.

(8) Manufacturers shall have readily accessible information for designers, homeowners, regulators, system owners and other interested parties about their product including:

(a) Product manuals;

(b) Design instructions;

(c) Installation instructions;

(d) Operation and maintenance;

(e) Homeowner instructions; and

(f) A list of representatives and manufacturer certified service providers, if any.

WAC 246-272A-0150 Transition from the list of approved systems and products to the registered list-Distribution products.

(1) The department's list of approved systems and products shall:

(a) Become static on September 15, 2005. Subsequent changes, additions or deletions to the list of approved systems and products will only be made when approved by the department based on completed applications received prior to September 15, 2005.

(b) Remain in effect until March 15, 2007.

(2) Distribution products not on the department's list of approved systems and products on September 15, 2005, and not otherwise eligible for inclusion on the list by submittal of a completed application prior to September 15, 2005, must be registered with the department under this chapter before being permitted by the local health officer.

(3) Between September 15, 2005, and March 15, 2007, the local health officer may permit distribution products that are on the department's list of approved systems and products or registered by the department under the requirements of this chapter.

(4) After March 15, 2007, local health officers may only permit those distribution products registered under the requirements of this chapter.

(5) In order to be registered, manufacturers with distribution product models specified on the department's list of approved systems and products (excluding products being evaluated under the experimental systems program) on September 15, 2005, or subsequently added to the list as provided in subsection (1)(a) of this section, shall apply for product registration before March 15, 2007, using the following information:

(a) Manufacturers may apply for registration using the information previously provided to the department in support of product approval application, without further professional engineer certification.

(b) If product approval was based upon the performance information obtained through the department's former experimental systems program, the manufacturer may apply for registration as established by these rules using the performance test results obtained from their experimental system program, without further professional engineer certification. This provision is valid for only those models on the approved list of systems and products.

(c) Manufacturers and distribution products shall meet all other requirements established in these rules for product registration.

WAC 246-272A-0170 Product development permits.

(1) A local health officer may issue a product development permit (PDP) for any proprietary treatment component or sequence. In order to protect public health during the development period, a complete system meeting the requirements of this chapter and the site must be installed. The product under development may then be added to the treatment system allowing the product developer to gather data about the product's performance in the field. The PDP allows product developers to explore and develop new technologies prior to product testing and registration under WAC 246-272A-0110 and 246-272A-0120. The PDP is not an alternative to testing and registration.

(2) An application for a PDP shall include all of the following:

(a) Proof of an existing conforming system in compliance with all local requirements, or a permit for a conforming system. The conforming system must be installed in its entirety before the PDP becomes valid;

(b) A description of the product under development including performance goals and a description of how the system will be used to treat sewage;

(c) Documentation of financial assurance that will cover the correction of any potential public health threats or environmental damage resulting from the use of the product under development. Instruments of financial assurance include:

(i) An irrevocable letter of credit in the amount required by the local health officer issued by an entity authorized to issue letters of credit in Washington state;

(ii) Cash or security deposit payable to the local health jurisdiction in the amount required by the local health officer; or

(iii) Any other financial assurance that satisfies the local health officer.

(d) Documentation signed by the owner of the proposed product development site allowing access to the local health officer for inspection of the site; and

(e) Any other information required by the local health officer.

(3) The local health officer may stipulate additional requirements for a PDP necessary to assure the performance of the conforming system, including providing performance data to the local health officer.

(4) A PDP is a site-specific permit. Product development at multiple sites requires a PDP for each site.

(5) During the term of the PDP, product development, testing and sampling are under the full control of the product developer and all data collected is considered proprietary information.

(6) A PDP is valid for one year and may be renewed by the local health officer.

(7) The product development period is over when the original PDP or any subsequently renewed permits have expired. At this time the product developer:

(a) Shall, at the direction of the local health officer, remove the product under development from the site, reestablishing all appropriate plumbing and power connections for the conforming system.

(b) May subject the product to performance testing described in WAC 246-272A-0110 in order to allow the product to be eligible for registration with the department.

(8) The local health officer may revoke or amend a PDP:

(a) If the continued operation or presence of the product under development:

(i) Presents a risk to the public health or the environment;

(ii) Causes adverse effects on the proper function of the conforming system on the site; or

(iii) Leaks or discharges sewage on the surface of the ground.

(b) If the developer fails to comply with any requirements stipulated on the permit by the local health officer.

(9) The local health officer may charge fees adequate to administer the PDP program.

WAC 246-272A-0175 Transition from the experimental system program to application for product registration.

(1) The department's list of approved systems and products shall:

(a) Become static on September 15, 2005. Subsequent changes, additions or deletions to the list of approved systems and products will only be made when approved by the department based on completed applications received prior to September 15, 2005.

(b) Remain in effect until March 15, 2007.

(2) Persons representing experimental systems not on the department's list of approved systems and products on September 15, 2005, and not otherwise eligible for inclusion on the list by submittal of a completed application prior to September 15, 2005, may apply to a local health officer for a product development permit under WAC 246-272A-0170.

(3) Those persons representing experimental systems on the department's list of approved systems and products on September 15, 2005, may continue with the experimental testing according to the experimental testing protocol agreed to by the department until completed. Upon completion of the testing, the person may apply to the department for product registration under WAC 246-272A-0120 or 246-272A-0145. In considering the results of the experimental testing protocol, the department may seek a recommendation from the TAC. The department may determine:

(a) The product meets the requirements for registration and place it on the list of registered proprietary products; or

(b) The product does not meet the requirements for registration. Any further treatment product development and testing may continue under WAC 246-272A-0170, not under the department's previous experimental system program. The requirements of WAC 246-272A-0110, 246-272A-0130, or 246-272A-0140 apply to any further application for product registration.

SPECIFIC REQUIREMENTS

WAC 246-272A-0200 Permit requirements.

(1) Prior to beginning the construction process, a person proposing the installation, repair, modification, connection to, or expansion of an OSS, shall report the following and obtain a permit from the local health officer:

(a) General information including:

(i) Name and address of the property owner and the applicant at the head of each page of submission;

(ii) Parcel number and if available, the address of the site;

(iii) Source of drinking water supply;

(iv) Identification if the property is within the boundaries of a recognized sewer utility;

(v) Size of the parcel;

(vi) Type of permit for which application is being made, for example, new installation, repair, expansion, modification, or operational;

(vii) Source of sewage, for example, residence, restaurant, or other type of business;

(viii) Location of utilities;

(ix) Name of the site evaluator;

(x) Name, signature and stamp of the designer;

(xi) Date of application; and

(xii) Name and signature of the fee simple owner, the contract purchaser of the property or the owner's authorized agent.

(b) The soil and site evaluation as specified under WAC 246-272A-0220.

(c) A dimensioned site plan of the proposed initial system, the reserve area and those areas immediately adjacent that contain characteristics impacting design including:

(i) Designated areas for the proposed initial system and the reserve area;

(ii) The location of all soil logs and other soil tests for the OSS;

(iii) General topography and/or slope;

(iv) Drainage characteristics;

(v) The location of existing and proposed encumbrances affecting system placement, including legal access documents if any component of the OSS is not on the lot where the sewage is generated; and

(vi) An arrow indicating north.

(d) A detailed system design meeting the requirements under WAC 246-272A-0230, 246-272A-0232, 246-272A-0234, and 246-272A-0238 including:

(i) A drawing showing the dimensioned location of components of the proposed OSS, and the system designed for the reserve area if reserve site characteristics differ significantly from the initial area;

(ii) Vertical cross-section drawings showing:

(A) The depth of the soil dispersal component, the vertical separation, and depth of cover material; and

(B) Other new OSS components constructed at the site.

(iii) Calculations and assumptions supporting the proposed design, including:

(A) System operating capacity and design flow;

(B) Soil type; and

(C) Hydraulic loading rate in the soil dispersal component; and

(e) Any additional information as deemed necessary by the local health officer.

(2) A permit is not required for replacement, addition, or modification of broken or malfunctioning building sewers, risers and lids, sewage tank lids, sewage tank baffles, sewage tank pumps, pump control floats, pipes connecting multiple sewage tanks, and OSS inspection boxes and ports where a sewage tank, treatment component, or soil dispersal component does not need to be replaced. The local health officer may require the owner to submit information regarding these activities for recordkeeping purposes.

(3) The local health officer may develop the information required in subsection (1) of this section if authorized by local regulations.

(4) The local health officer shall:

(a) Respond to an application within thirty days as required in RCW 70.05.074.

(b) Permit only public domain technologies that have departmental RS&G. Permit only proprietary products that are registered by the department. During the period of transition from the list of approved systems and products to the registered list the local health officer may permit products on the list of approved systems and products.

(c) Issue a permit when the information submitted under subsection (1) of this section meets the requirements contained in this chapter and in local regulations;

(d) Identify the permit as a new installation, repair, expansion, modification, or operational permit;

(e) Specify the expiration date on the permit. The expiration date may not exceed five years from the date of permit issuance;

(f) Include a reminder on the permit application of the applicant's right of appeal; and

(g) If requiring an operational permit, state the period of validity and the date and conditions of renewal.

(5) The local health officer may revoke or deny a permit for just cause. Examples include, but are not limited to:

(a) Construction or continued use of an OSS that threatens the public health;

(b) Misrepresentation or concealment of material fact in information submitted to the local health officer; or

(c) Failure to meet conditions of the permit, this chapter or any local regulations.

(6) Before the local health officer issues a permit for the installation of an OSS to serve more than one development, the applicant shall show:

(a) An approved public entity owning or managing the OSS in perpetuity; or

(b) A management arrangement acceptable to the local health officer, recorded in covenant, lasting until the on-site system is no longer needed, and containing, but not limited to:

(i) A recorded easement allowing access for construction, operation, monitoring maintenance, and repair of the OSS; and

(ii) Identification of an adequate financing mechanism to assure the funding of operation, maintenance, and repair of the OSS.

(7) The local health officer shall not delegate the authority to issue permits.

(8) The local health officer may stipulate additional requirements for a particular permit if necessary for public health protection.

WAC 246-272A-0210 Location.

(1) Persons shall design and install OSS to meet the minimum horizontal separations shown in Table IV, Minimum Horizontal Separations:

(2) If any condition indicates a greater potential for contamination or pollution, the local health officer may increase the minimum horizontal separations. Examples of such conditions include excessively permeable soils, unconfined aquifers, shallow or saturated soils, dug wells, and improperly abandoned wells.

(3) The local health officer may allow a reduced horizontal separation to not less than two feet where the property line, easement line, in-ground swimming pool, or building foundation is up-gradient.

(4) The horizontal separation between an OSS dispersal component and an individual water well, individual spring, or surface water that is not a public water source can be reduced to a minimum of seventy-five feet, by the local health officer, and be described as a conforming system upon signed approval by the health officer if the applicant demonstrates:

Table IV
Minimum Horizontal Separations

Items Requiring Setback	From edge of soil dispersal component and reserve area	From sewage tank and distribution box	From building sewer, and nonperforated distribution pipe
Well or suction line	100 ft.	50 ft.	50 ft.
Public drinking water well	100 ft.	100 ft.	100 ft.
Public drinking water spring measured from the ordinary high-water mark	200 ft.	200 ft.	100 ft.
Spring or surface water used as drinking water source measured from the ordinary high-water mark[1]	100 ft.	50 ft.	50 ft.
Pressurized water supply line	10 ft.	10 ft.	10 ft.
Decommissioned well (decommissioned in accordance with chapter 173-160 WAC)	10 ft.	N/A	N/A
Surface water measured from the ordinary high-water mark	100 ft.	50 ft.	10 ft.
Building foundation/in-ground swimming pool	10 ft.	5 ft.	2 ft.
Property or easement line	5 ft.	5 ft.	N/A
Interceptor/curtain drains/foundation drains/drainage ditches			
Down-gradient[2]:	30 ft.	5 ft.	N/A
Up-gradient[2]:	10 ft.	N/A	N/A
Other site features that may allow effluent to surface			
Down-gradient[2]:	30 ft.	5 ft.	N/A
Up-gradient[2]:	10 ft.	N/A	N/A
Down-gradient cuts or banks with at least 5 ft. of original, undisturbed soil above a restrictive layer due to a structural or textural change	25 ft.	N/A	N/A
Down-gradient cuts or banks with less than 5 ft. of original, undisturbed soil above a restrictive layer due to a structural or textural change	50 ft.	N/A	N/A
Other adjacent soil dispersal components/subsurface storm water infiltration systems	10 ft.	N/A	N/A

[1]If surface water is used as a public drinking water supply, the designer shall locate the OSS outside of the required source water protection area.

[2]The item is down-gradient when liquid will flow toward it upon encountering a water table or a restrictive layer. The item is up-gradient when liquid will flow away from it upon encountering a water table or restrictive

layer.

(a) Adequate protective site-specific conditions, such as physical settings with low hydro-geologic susceptibility from contaminant infiltration. Examples of such conditions include evidence of confining layers and/or aquatards separating potable water from the OSS treatment zone, excessive depth to ground water, down-gradient contaminant source, or outside the zone of influence; or

(b) Design and proper operation of an OSS system assuring enhanced treatment performance beyond that accomplished by meeting the vertical separation and effluent distribution requirements described in WAC 246-272A-0230 Table VI; or

(c) Evidence of protective conditions involving both (a) and (b) of this subsection.

(5) Persons shall design and/or install a soil dispersal component only if:

(a) The slope is less than forty-five percent (twenty-four degrees);

(b) The area is not subject to:

(i) Encroachment by buildings or construction such as placement of power poles and underground utilities;

(ii) Cover by impervious material;

(iii) Vehicular traffic; or

(iv) Other activities adversely affecting the soil or the performance of the OSS.

(c) Sufficient reserve area for replacement exists to treat and dispose one hundred percent of the design flow;

(d) The land is stable; and

(e) Surface drainage is directed away from the site.

(6) The local health officer may approve a sewer transport line within ten feet of a water supply line if the sewer line is constructed in accordance with section C1-9 of the department of ecology's "*Criteria For Sewage Works Design*," December 1998.

WAC 246-272A-0220 Soil and site evaluation.

(1) Only professional engineers, designers, or local health officers may perform soil and site evaluations. Soil scientists may only perform soil evaluations.

(2) The person evaluating the soil and site shall:

(a) Report:

(i) A sufficient number of soil logs to evaluate conditions within:

The initial soil dispersal component; and

The reserve area.

(ii) The ground water conditions, the date of the observation, and the probable maximum height;

(iii) The topography of the proposed initial system, the reserve area, and those areas immediately adjacent that contain characteristics impacting the design;

(iv) The drainage characteristics of the proposed initial system, the reserve area and those areas immediately adjacent that contain characteristics impacting the design;

(v) The existence of structurally deficient soils subject to major wind or water erosion events such as slide zones and dunes;

(vi) The existence of designated flood plains and other areas identified in the local management plan required in WAC 246-272A-0015; and

(vii) The location of existing features affecting system placement, such as, but not limited to:

(A) Wells and suction lines;

(B) Water sources and supply lines;

(C) Surface water and stormwater infiltration areas;

(D) Abandoned wells;

(E) Outcrops of bedrock and restrictive layers;

(F) Buildings;

(G) Property lines and lines of easement;

(H) Interceptors such as footing drains, curtain drains, and drainage ditches;

(I) Cuts, banks, and fills;

(J) Driveways and parking areas;

(K) Existing OSS; and

(L) Underground utilities;

(b) Use the soil and site evaluation procedures and terminology in accordance with Chapter 5 of the *On-site Wastewater Treatment Systems Manual*, EPA 625/R-00/008, February 2002 except where modified by, or in conflict with, this chapter (available upon request to the department);

(c) Use the soil names and particle size limits of the United States Department of Agriculture Natural Resources Conservation Service classification system;

(d) Determine texture, structure, compaction and other soil characteristics that affect the treatment and water movement potential of the soil by using normal field and/or laboratory procedures such as particle size analysis; and

(e) Classify the soil as in Table V, Soil Type Descriptions:

(3) The owner of the property or his agent shall:

(a) Prepare the soil log excavation to:

(i) Allow examination of the soil profile in its original position by:

(A) Excavating pits of sufficient dimensions to enable observation of soil characteristics by visual and tactile means to a depth three feet deeper than the anticipated infiltrative surface at the bottom of the soil dispersal component; or

(B) Stopping at a shallower depth if a water table or restrictive layer is encountered;

(ii) Allow determination of the soil's texture, structure, color, bulk density or compaction, water absorption capabilities or permeability, and elevation of the highest seasonal water table; and

(b) Assume responsibility for constructing and maintaining the soil log excavation in a manner to prevent injury as required by chapter 296-155 WAC.

TABLE V
Soil Type Descriptions

Soil Type	Soil Textural Classifications
1	Gravelly and very gravelly coarse sands, all extremely gravelly soils excluding soil types 5 and 6, all soil types with greater than or equal to 90% rock fragments.
2	Coarse sands.
3	Medium sands, loamy coarse sands, loamy medium sands.
4	Fine sands, loamy fine sands, sandy loams, loams.
5	Very fine sands, loamy very fine sands; or silt loams, sandy clay loams, clay loams and silty clay loams with a moderate or strong structure (excluding platy structure).
6	Other silt loams, sandy clay loams, clay loams, silty clay loams.
7 **Unsuitable for treatment or dispersal**	Sandy clay, clay, silty clay, strongly cemented or firm soils, soil with a moderate or strong platy structure, any soil with a massive structure, any soil with appreciable amounts of expanding clays.

(4) The local health officer:

(a) Shall render a decision on the height of the water table within twelve months of receiving the application under precipitation conditions typical for the region;

(b) May require water table measurements to be recorded during months of probable high-water table conditions, if insufficient information is available to determine the highest seasonal water table;

(c) May require any other soil and site information affecting location, design, or installation; and

(d) May reduce the required number of soil logs for OSS serving a single-family residence if adequate soils information has previously been developed.

WAC 246-272A-0230 Design requirements - General.

(1) On-site sewage systems may only be designed by professional engineers, licensed under chapter 18.43 RCW or on-site sewage treatment system designers, licensed under chapter 18.210 RCW, except:

(a) If at the discretion of the local health officer, a resident owner of a single-family residence not adjacent to a marine shoreline is allowed to design a system for that residence; or

(b) If the local health officer performs the soil and site evaluation, the health officer is allowed to design a system.

(2) The designer shall use the following criteria when developing a design for an OSS:

(a) All sewage from the building served is directed to the OSS;

(b) Sewage tanks have been reviewed and approved by the department;

(c) Drainage from the surface, footing drains, roof drains, subsurface stormwater infiltration systems, and other nonsewage drains is prevented from entering the OSS, the area where the OSS is located, and the reserve area;

(d) The OSS is designed to treat and disperse the sewage volume as follows:

(i) For single-family residences:

(A) The operating capacity is based on 45 gpd per capita with two people per bedroom.

(B) The minimum design flow per bedroom per day is the operating capacity of ninety gallons multiplied by 1.33. This results in a minimum design flow of one hundred twenty gallons per bedroom per day.

(C) A factor greater than 0.33 to account for surge capacity may be required by the local health officer.

(D) The local health officer may require an increase of the design flow for dwellings with anticipated greater flows, such as larger dwellings.

(E) The minimum design flow is two hundred forty gallons per day.

(ii) For other facilities, the design flows noted in "*On-site Wastewater Treatment Systems Manual*," USEPA, EPA-625/R-00/008, February 2002 (available upon request to the department) shall be used. Sewage flows from other sources of information may be used in determining system design flows if they incorporate both an operating capacity and a surge capacity.

(e) The OSS is designed to address sewage quality as follows:

(i) For all systems, the designer shall consider:

(A) $CBOD_5$, TSS, and O&G;

(B) Other parameters that can adversely affect treatment anywhere along the treatment sequence. Examples include pH, temperature and dissolved oxygen;

(C) The sensitivity of the site where the OSS will be installed. Examples include areas where fecal coliform constituents can result in public health concerns, such as shellfish growing areas, designated swimming areas, and other areas identified by the local management plan required in WAC 246-272A-0015.

(D) Nitrogen contributions. Where nitrogen has been identified as a contaminant of concern by the local management plan required in WAC 246-272A-0015, it shall be addressed through lot size and/or treatment.

(ii) For OSS treating sewage from a nonresidential source, the designer shall provide the following information:

(A) Information to show the sewage is not industrial wastewater;

(B) Information regarding the sewage quality and identifying chemicals found in the sewage that are not found in sewage from a residential source; and

(C) A site-specific design providing the treatment level equal to that required of sewage from a residential source;

(f) The vertical separation to be used to establish the treatment levels and application rates. The selected vertical separation shall be used consistently throughout the design process.

(g) Treatment levels:

(i) Requirements for matching treatment component and method of distribution with soil conditions of the soil dispersal component are listed in Table VI. The treatment levels correspond with those established for treatment components under the product performance testing requirements in Table III of WAC 246-272A-0110. The method of distribution applies to the soil dispersal component.

TABLE VI
Treatment Component Performance Levels and Method of Distribution[1]

Vertical Separation in inches	Soil Type		
	1	2	3-6
12 < 18	**A** - pressure with timed dosing	**B** - pressure with timed dosing	**B** - pressure with timed dosing
≥ 18 < 24	**B** - pressure with timed dosing	**B** - pressure with timed dosing	**B** - pressure with timed dosing
≥ 24 < 36	**B** - pressure with timed dosing	**C** - pressure	**E** - pressure
≥ 36 < 60	**B** - pressure with timed dosing	**E** - pressure	**E** - gravity
≥ 60	**C** - pressure	**E** - gravity	**E** - gravity

[1]The treatment component performance levels correspond with those established for treatment components under the product testing requirements in WAC 246-272A-0110.

(ii) Disinfection may not be used to achieve the fecal coliform requirements to meet:

(A) Treatment levels A or B in Type 1 soils; or

(B) Treatment level C.

(3) The coarsest textured soil within the vertical separation selected by the designer shall determine the minimum treatment level and method of distribution.

(4) The local health officer shall not approve designs for:

(a) Cesspools; or

(b) Seepage pits.

(5) The local health officer may approve a design for the reserve area different from the design approved for the initial OSS, if both designs meet the requirements of this chapter for new construction.

WAC 246-272A-0232 Design requirements-Septic tank sizing.

Septic tanks shall:

(1) Have at least two compartments with the first compartment liquid volume equal to one-half to two-thirds of the total liquid volume. This standard may be met by one tank with two compartments or by two single compartment tanks in series.

(2) Have the following minimum liquid volumes:

(a) For a single family residence use Table VII, Required Minimum Liquid Volumes of Septic Tanks:

TABLE VII
Required Minimum Liquid Volumes of Septic Tanks

Number of Bedrooms	Required Minimum Liquid Tank Volume in Gallons
≤ 3	900
4	1000
Each additional bedroom	250

(b) For OSS treating sewage from a residential source, other than one single-family residence, two hundred fifty gallons per bedroom with a minimum of one thousand gallons;

(c) For OSS treating sewage from a nonresidential source, three times the design flow.

WAC 246-272A-0234 Design requirements--Soil dispersal components.

(1) All soil dispersal components, except one using a subsurface dripline product, shall be designed to meet the following requirements:

(a) Maximum hydraulic loading rates shall be based on the rates described in Table VIII;

(b) Calculation of the absorption area is based on:

(i) The design flow in WAC 246-272A-0230(2); and

(ii) Loading rates equal to or less than those in Table VIII applied to the infiltrative surface of the soil dispersal component or the finest textured soil within the vertical separation selected by the designer, whichever has the finest texture.

(c) Requirements for the method of distribution shall correspond to those in Table VI.

(d) Soil dispersal components having daily design flow between one thousand and three thousand five hundred gallons of sewage per day shall:

(i) Only be located in soil types 1-5;

TABLE VIII
Maximum Hydraulic Loading Rate

Soil Type	Soil Textural Classification Description	Loading Rate for Residential Effluent Using Gravity or Pressure Distribution (gal./sq. ft./day)
1	Gravelly and very gravelly coarse sands, all extremely gravelly soils excluding Soil types 5 & 6, all soil types with greater than or equal to 90% rock fragments.	1.0
2	Coarse sands.	1.0
3	Medium sands, loamy coarse sands, loamy medium sands.	0.8
4	Fine sands, loamy fine sands, sandy loams, loams.	0.6
5	Very fine sands, loamy very fine sands; or silt loams, sandy clay loams, clay loams and silty clay loams with a moderate structure or strong structure (excluding a platy structure).	0.4
6	Other silt loams, sandy clay loams, clay loams, silty clay loams.	0.2
7	Sandy clay, clay, silty clay and strongly cemented firm soils, soil with a moderate or strong platy structure, any soil with a massive structure, any soil with appreciable amounts of expanding clays.	Not suitable

(ii) Only be located on slopes of less than thirty percent, or seventeen degrees; and

(iii) Have pressure distribution including time dosing.

(2) All soil dispersal components using a subsurface dripline product must be designed to meet the following requirements:

(a) Calculation of the absorption area is based on:

(i) The design flow in WAC 246-272A-0230(2);

(ii) Loading rates that are dependent on the soil type, other soil and site characteristics, and the spacing of dripline and emitters;

(b) The dripline must be installed a minimum of six inches into original, undisturbed soil;

(c) Timed dosing; and

(d) Soil dispersal components having daily design flows greater than one thousand gallons of sewage per day may:

(i) Only be located in soil types 1-5;

(ii) Only be located on slopes of less than thirty percent, or seventeen degrees.

(3) All SSAS shall meet the following requirements:

(a) The infiltrative surface may not be deeper than three feet below the finished grade, except under special conditions approved by the local health officer. The depth of such system shall not exceed ten feet from the finished grade;

(b) A minimum of six inches of sidewall must be located in original undisturbed soil;

(c) Beds are only designed in soil types 1, 2, 3 or in fine sands with a width not exceeding ten feet;

(d) Individual laterals greater than one hundred feet in length must use pressure distribution;

(e) A layer of between six and twenty-four inches of cover material; and

(f) Other features shall conform with the "*On-site Wastewater Treatment Systems Manual*," United States Environmental Protection Agency EPA-625/R-00/008 February 2002 (available upon request to the department) except where modified by, or in conflict with this section or local regulations.

(4) For SSAS with drainrock and distribution pipe:

(a) A minimum of two inches of drainrock is required above the distribution pipe;

(b) The sidewall below the invert of the distribution pipe is located in original undisturbed soil.

(5) The local health officer may allow the infiltrative surface area in a SSAS to include six inches of the SSAS sidewall height when meeting the required absorption area where total recharge by annual precipitation and irrigation is less than twelve inches per year.

(6) The local health officer may permit systems consisting solely of a septic tank and a gravity SSAS in soil type 1 if all the following criteria are met:

(a) The system serves a single-family residence;

(b) The lot size is greater than two and one-half acres;

(c) Annual precipitation in the region is less than twenty-five inches per year as described by "*Washington Climate*" published jointly by the Cooperative Extension Service, College of Agriculture, and Washington State University (available for inspection at Washington state libraries);

(d) The system is located outside the twelve counties bordering Puget Sound; and

(e) The geologic conditions beneath the dispersal component must satisfy the minimum unsaturated depth requirements to ground water as determined by the local health officer. The method for determination is described by "*Design Guideline for Gravity Systems in Soil Type 1*" (available upon request to the department).

(7) The local health officer may increase the loading rate in Table VIII up to a factor of two for soil types 1-4 and up to a factor of 1.5 for soil types 5 and 6 if a product tested to meet treatment level D is used. This reduction may not be combined with any other SSAS size reductions.

(8) (a) The primary and reserve areas must be sized to at least one hundred percent of the loading rates listed in Table VIII.

(b) However, the local health officer may allow a legal lot of record created prior to the effective date of this chapter that cannot meet this primary and reserve area requirement to be developed if all the following conditions are met:

(i) The lot cannot meet the minimum primary and reserve area requirements due to the loading rates for medium sand, fine sand and very fine sand listed in Table VIII of this chapter;

(ii) The primary and reserve areas are sufficient to allow installation of a SSAS using maximum loading rates of 1.0 gallons/square foot per day for medium sand, 0.8 gallons/square foot/day for fine sand, and 0.6 gallons/square foot/day for very fine sand; and

(iii) A treatment product meeting at least Treatment Level D and pressure distribution with timed-dosing is used.

WAC 46-272A-0238 Design requirements-Facilitate operation, monitoring and maintenance.

(1) The OSS must be designed to facilitate operation, monitoring and maintenance according to the following criteria:

(a) For gravity systems, septic tank access for maintenance and inspection at finished grade is required. If effluent filters are used, access to the filter at finished grade is required. The local health officer may allow access for maintenance and inspection of a system consisting of a septic tank and gravity flow SSAS to be a maximum of six inches below finished grade provided a marker showing the location of the tank access is installed at finished grade.

(b) For all other systems, service access and monitoring ports at finished grade are required for all system components. Specific component requirements include:

(i) Septic tanks must have service access manholes and monitoring ports for the inlet and outlet. If effluent filters are used, access to the filter at finished grade is required;

(ii) Surge, flow equalization or other sewage tanks must have service access manholes;

(iii) Other pretreatment units (such as aerobic treatment units and packed-bed filters) must have service access manholes and monitoring ports;

(iv) Pump chambers, tanks and vaults must have service access manholes;

(v) Disinfection units must have service access and be installed to facilitate complete maintenance and cleaning; and

(vi) Soil dispersal components shall have monitoring ports for both distribution devices and the infiltrative surface.

(c) For systems using pumps, clearly accessible controls and warning devices are required including:

(i) Process controls such as float and pressure activated pump on/off switches, pump-run timers and process flow controls;

(ii) Diagnostic tools including dose cycle counters and hour meters on the sewage stream, or flow meters on either the water supply or sewage stream; and

(iii) Audible and visual alarms designed to alert a resident of a malfunction. The alarm must be placed on a circuit independent of the pump circuit.

(2) All accesses must be designed to allow for monitoring and maintenance and shall be secured to minimize injury or unauthorized access in a manner approved by the local health officer.

WAC 246-272A-0240 Holding tank sewage systems.

(1) A person may not install or use holding tank sewage systems for residential development or expansion of residences, whether seasonal or year-round, except as set forth under subsection (2) of this section.

(2) The local health officer may approve installation of holding tank sewage systems only:

(a) For permanent uses limited to controlled, part-time, commercial usage situations, such as recreational vehicle parks and trailer dump stations;

(b) For interim uses limited to handling of emergency situations; or

(c) For repairs as permitted under WAC 246-272A-0280 (1)(c)(i).

(3) A person proposing to use a holding tank sewage system shall:

(a) Follow design criteria established by the department;

(b) Submit a management program to the local health officer assuring ongoing operation, monitoring and maintenance before the local health officer issues the installation permit; and

(c) Use a holding tank reviewed and approved by the department.

WAC 246-272A-0250 Installation.

(1) Only installers may construct OSS, except as noted under subsection (2) of this section.

(2) The local health officer may allow the resident owner of a single-family residence not adjacent to a marine shoreline to install the OSS for that single-family residence.

(3) The installer described by either subsection (1) or (2) of this section shall:

(a) Follow the approved design;

(b) Have the approved design in possession during installation;

(c) Make no changes to the approved design without the prior authorization of the designer and the local health officer;

(d) Only install septic tanks, pump chambers, and holding tanks approved by the department;

(e) Be on the site at all times during the excavation and construction of the OSS;

(f) Install the OSS to be watertight, except for the soil dispersal component;

(g) Cover the installation only after the local health officer has given approval to cover; and

(h) Back fill with six to twenty-four inches of cover material and grade the site to prevent surface water from accumulating over any component of the OSS.

WAC 246-272A-0260 Inspection.

(1) For all activities requiring a permit, the local health officer shall:

(a) Visit the OSS site during the site evaluation, construction, or final construction inspection;

(b) Either inspect the OSS before cover or allow the designer of the OSS to perform the inspection before cover if the designer is not also named as installer of the system.

(c) Keep the record drawings on file, with the approved design documents.

(2) The person responsible for the final construction inspection shall assure the OSS meets the approved design.

WAC 246-272A-0265 Record drawings.

Upon completion of the new construction, alteration or repair of the OSS, a complete and detailed record drawing shall be submitted to both the health officer and the OSS owner that includes at a minimum the following:

(1) Measurements and directions accurate to +/- 1/2 foot, unless otherwise determined by the local health officer, to assure the following parts of the OSS can be easily located:

(a) All sewage tank openings requiring access;

(b) The ends, and all changes in direction, of installed and found buried pipes and electrical cables that are part of the OSS; and

(c) Any other OSS component which, in the judgment of the health officer or the designer, must be accessed for observation, maintenance, or operation;

(2) Location and dimensions of reserve area;

(3) Record that materials and equipment meet the specifications contained in the design;

(4) Initial settings of electrical or mechanical devices that must be known to operate the system in the manner intended by the designer or installer; and

(5) For proprietary products, manufacturer's standard product literature, including performance

specifications and maintenance recommendations needed for operation, monitoring, maintenance or repair of the OSS.

WAC 46-272A-0270 Operation, monitoring, and maintenance-Owner responsibilities.

(1) The OSS owner is responsible for operating, monitoring, and maintaining the OSS to minimize the risk of failure, and to accomplish this purpose, shall:

(a) Obtain approval from the local health officer before repairing, altering or expanding an OSS;

(b) Secure and renew contracts for periodic maintenance where required by the local health jurisdiction;

(c) Obtain and renew operation permits if required by the local health jurisdiction;

(d) Assure a complete evaluation of the system components and/or property to determine functionality, maintenance needs and compliance with regulations and any permits:

(i) At least once every three years for all systems consisting solely of a septic tank and gravity SSAS;

(ii) Annually for all other systems unless more frequent inspections are specified by the local health officer;

(e) Employ an approved pumper to remove the septage from the tank when the level of solids and scum indicates that removal is necessary;

(f) Provide maintenance and needed repairs to promptly return the system to a proper operating condition;

(g) Protect the OSS area and the reserve area from:

(i) Cover by structures or impervious material;

(ii) Surface drainage, and direct drains, such as footing or roof drains. The drainage must be directed away from the area where the OSS is located;

(iii) Soil compaction, for example by vehicular traffic or livestock; and

(iv) Damage by soil removal and grade alteration;

(h) Keep the flow of sewage to the OSS at or below the approved operating capacity and sewage quality;

(i) Operate and maintain systems as directed by the local health officer;

(j) Request assistance from the local health officer upon occurrence of a system failure or suspected system failure; and

(k) At the time of property transfer provide to the buyer, maintenance records, if available, in addition to the completed seller disclosure statement in accordance with chapter 64.06 RCW for residential real property transfers.

(2) Persons shall not:

(a) Use or introduce strong bases, acids or chlorinated organic solvents into an OSS for the purpose of system cleaning;

(b) Use a sewage system additive unless it is specifically approved by the department; or

(c) Use an OSS to dispose of waste components atypical of sewage from a residential source.

WAC 246-272A-0275 Operation, monitoring and maintenance-Food service establishments.

The local health officer shall require annual inspections of OSS serving food service establishments and may require pumping as needed.

WAC 246-272A-0280 Repair of failures.

(1) When an OSS failure occurs, the OSS owner shall:

(a) Repair or replace the OSS with a conforming system or component, or a system meeting the requirements of Table IX either on the:

(i) Property served; or

(ii) Nearby or adjacent property if easements are obtained; or

(b) Connect the residence or facility to a:

(i) Publicly owned LOSS;

(ii) Privately owned LOSS where it is deemed economically feasible; or

(iii) Public sewer; or

(c) Perform one of the following when requirements in (a) and (b) of this subsection are not feasible:

(i) Use a holding tank; or

(ii) Obtain a National Pollution Discharge Elimination System or state discharge permit from the Washington state department of ecology issued to a public entity or jointly to a public entity and the system owner only when the local health officer determines:

(A) An OSS is not feasible; and

(B) The only realistic method of final dispersal of treated effluent is discharge to the surface of the land or into surface water; or

(iii) Abandon the property.

(2) Prior to repairing the soil dispersal component, the OSS owner shall develop and submit information required under WAC 246-272A-0200(1).

(3) The local health officer shall permit a system that meets the requirements of Table IX only if the following are not feasible:

(a) Installation of a conforming system or component; and

(b) Connection to either an approved LOSS or a public sewer.

(4) The person responsible for the design shall locate and design repairs to:

(a) Meet the requirements of Table IX if the effluent treatment and soil dispersal component to be repaired or replaced is closer to any surface water, well, or spring than prescribed by the minimum separation required in Table IV of WAC 246-272A-0210(1). Pressure distribution with timed dosing in the soil dispersal component is required in all cases where a conforming system is not feasible.

(b) Protect drinking water sources and shellfish harvesting areas;

(c) Minimize nitrogen discharge in areas where nitrogen has been identified as a contaminant of concern in the local plan under WAC 246-272A-0015;

(d) Prevent the direct discharge of sewage to ground water, surface water, or upon the surface of the ground;

(e) Meet the horizontal separations under WAC 246-272A-0210(1) to public drinking water sources;

(f) Meet other requirements of this chapter to the maximum extent permitted by the site; and

TABLE IX
Treatment Component Performance Levels for Repair of OSS Not Meeting Vertical and Horizontal Separations[1]

Vertical Separation (in inches)	Horizontal Separation[2]											
	< 25 feet			25 < 50 feet			50 < 100 feet[3]			≥ 100 feet		
	Soil Type			Soil Type			Soil Type			Soil Type		
	1	2	3-6	1	2	3-6	1	2	3-6	1	2	3-6
< 12	A	A	A	A	A	A	A	A	B	B	B	B
≥ 12 < 18	A	A	A	A	B	B	A	B	B	Conforming Systems		
≥ 18 < 24	A	A	A	A	B	B	A	B	C			
≥ 24 < 36	A	B	B	B	C	C	B	C	C			
≥ 36	A	B	B	B	C	C	B	C	E			

[1] The treatment component performance levels correspond with those established for treatment components under the product performance testing requirements in Table III of WAC 246-272A-0110.
[2] The horizontal separation indicated in Table IX is the distance between the soil dispersal component and the surface water, well, or spring. If the soil dispersal component is up-gradient of a surface water, well, or spring to be used as a potable water source, or beach where shellfish are harvested, the next higher treatment level shall apply unless treatment level A is already required.
[3] On a site where there is a horizontal setback of 75 - 100 feet between an OSS dispersal component and an individual water well, individual spring, nonmarine surface water or surface water that is not a public water source and a vertical separation of greater than twelve inches, a conforming system that complies with WAC 246-272A-0210(4) shall be installed if feasible.

(g) Maximize the:

(i) Vertical separation;

(ii) Distance from a well, spring, or suction line; and

(iii) Distance to surface water.

(5) Prior to designing the repair system, the designer shall consider the contributing factors of the failure to enable the repair to address identified causes.

(6) If the vertical separation is less than twelve inches, the local health officer may permit ASTM C-33 sand or coarser to be used as fill to prevent direct discharge of treated effluent to ground water, surface water, or upon the surface of the ground.

(7) For a repair using the requirements of Table IX, disinfection may not be used to achieve the fecal coliform requirements to meet:

(a) Treatment levels A or B where there is less than eighteen inches of vertical separation;

(b) Treatment levels A or B in type 1 soils; or

(c) Treatment level C.

(8) The local health officer shall identify repair permits meeting the requirements of Table IX for the purpose of tracking future performance.

(9) An OSS owner receiving a repair permit for a system meeting the requirements of Table IX from the local health officer shall:

(a) Immediately report any failure to the local health officer;

(b) Comply with all local and state requirements stipulated on the permit.

WAC 246-272A-0290 Expansions.

(1) The local health officer shall require an OSS and a reserve area in full compliance with the new system construction standards specified in this chapter for an expansion of a residence or other facility.

(2) A local health officer may allow expansion of an existing on-site sewage system adjacent to a marine shoreline that does not meet the minimum horizontal separation between the soil dispersal component and the ordinary high-water mark required by WAC 246-272A-0210, Table IV, provided that:

(a) The system meets all requirements of WAC 246-272A-0230, 246-272A-0232, 246-272A-0234, and 246-272A-0238;

(b) The system complies with all other requirements of WAC 246-272A-0210 and this section;

(c) Horizontal separation between the soil dispersal component and the ordinary high-water mark is fifty feet or greater; and

(d) Vertical separation is two feet or greater.

WAC 246-272A-0300 Abandonment.

Persons permanently abandoning a septic tank, seepage pit, cesspool, or other sewage container shall:

(1) Have the septage removed by an approved pumper;

(2) Remove or destroy the lid; and

(3) Fill the void with soil or gravel.

WAC 246-272A-0310 Septage management.

(1) The local health officer shall approve an individual before they may remove septage from an OSS.

(2) Persons removing septage from an OSS shall:

(a) Transport septage or sewage only in vehicles clearly identified with the name of the business and approved by the local health officer;

(b) Record and report septage removal as required by the local health officer; and

(c) Dispose of septage, or apply septage biosolids to land only in a manner consistent with applicable laws.

WAC 246-272A-0320 Developments, subdivisions, and minimum land area requirements.

(1) A person proposing a subdivision where the use of OSS is planned shall obtain a recommendation for approval from the local health officer as required by RCW 58.17.150.

(2) The local health officer shall require the following prior to approving any development:

(a) Site evaluations as required under WAC 246-272A-0220, excluding subsections (3)(a)(i) and (4)(d);

(b) Where a subdivision with individual wells is proposed:

(i) Configuration of each lot to allow a one hundred-foot radius water supply protection zone to fit within the lot lines; or

(ii) Establishment of a one hundred-foot protection zone around each existing and proposed well site;

(c) Where preliminary approval of a subdivision is requested, provision of at least one soil log per proposed lot, unless the local health officer determines existing soils information allows fewer soil logs;

(d) Determination of the minimum lot size or minimum land area required for the development using Method I and/or Method II:

METHOD I. Table X, Single-Family Residence Minimum Lot Size or Minimum Land Area Required Per Unit Volume of Sewage, shows the minimum lot size required per single-family

residence. For developments other than single-family residences, the minimum land areas shown are required for each unit volume of sewage. However, the local health officer may require larger lot sizes where the local health officer has identified nitrogen as a concern either through planning activities described in WAC 246-272A-0015 or another process.

TABLE X
Minimum Land Area Requirement
Single-Family Residence or Unit Volume of Sewage

Type of Water Supply	Soil Type (defined by WAC 246-272A-0220)					
	1	**2**	**3**	**4**	**5**	**6**
Public	0.5 acre	12,500 sq. ft.	15,000 sq. ft.	18,000 sq. ft.	20,000 sq. ft.	22,000 sq. ft.
	2.5 acre[1]					
Individual, on each lot	1.0 acre	1 acre	1 acre	1 acre	2 acres	2 acres
	2.5 acres[1]					

[1] See WAC 246-272A-0234(6).

METHOD II. A minimum land area proposal using Method II is acceptable only when the applicant:

(i) Justifies the proposal through a written analysis of the:

(A) Soil type and depth;

(B) Area drainage, and/or lot drainage;

(C) Public health impact on ground and surface water quality;

(D) Setbacks from property lines, water supplies, etc.;

(E) Source of domestic water;

(F) Topography, geology, and ground cover;

(G) Climatic conditions;

(H) Availability of public sewers;

(I) Activity or land use, present, and anticipated;

(J) Growth patterns;

(K) Reserve areas for additional subsurface treatment and dispersal;

(L) Anticipated sewage volume;

(M) Compliance with current planning and zoning requirements;

(N) Types of proposed systems or designs, including the use of systems designed for removal of nitrogen;

(O) Existing encumbrances, such as those listed in WAC 246-272A-0200 (1)(c)(v) and 246-272A-0220 (2)(a)(vii); and

(P) Estimated nitrogen loading from OSS effluent to existing ground and surface water;

(Q) Any other information required by the local health officer.

(ii) Shows development with public water supplies having:

(A) At least twelve thousand five hundred square feet lot sizes per single-family residence;

(B) No more than 3.5 unit volumes of sewage per day per acre for developments other than single-family residences; and

(iii) Shows development with individual water supplies having at least one acre per unit volume of sewage; and

(iv) Shows land area under surface water is not included in the minimum land area calculation; and

(e) Regardless of which method is used for determining required minimum lot sizes or minimum land area, submittal to the health officer of information consisting of field data, plans, and reports supporting a conclusion the land area provided is sufficient to:

(i) Install conforming OSS;

(ii) Assure preservation of reserve areas for proposed and existing OSS;

(iii) Properly treat and dispose of the sewage; and

(iv) Minimize public health effects from the accumulation of contaminants in surface and ground water.

(3) The department shall develop guidelines for the application of Method II by July 1, 2008.

(4) The local health officer shall require lot areas of twelve thousand five hundred square feet or larger except when a person proposes:

(a) OSS within the boundaries of a recognized sewer utility having a finalized assessment roll; or

(b) A planned unit development with:

(i) A signed, notarized, and recorded deed covenant restricting any development of lots or parcels above the approved density with the overall density meeting the minimum land area requirements of subsection (2)(d) of this section;

(ii) A public entity responsible for operation and maintenance of the OSS, or a single individual owning the OSS;

(iii) Management requirements under chapter 246-272B WAC when installing a LOSS; and

(iv) Extinguishment of the deed covenant and higher density development allowed only when the development connects to public sewers.

(5) The local health officer may:

(a) Allow inclusion of the area to the centerline of a road or street right of way in a Method II determination under subsection (2)(d) of this section to be included in the minimum land

area calculation if:

(i) The dedicated road or street right of ways are along the perimeter of the development;

(ii) The road or street right of ways are dedicated as part of the proposed development; and

(iii) Lots are at least twelve thousand five hundred square feet in size.

(b) Require detailed plot plans and OSS designs prior to final approval of subdivision proposals;

(c) Require larger land areas or lot sizes to achieve public health protection;

(d) Prohibit development on individual lots within the boundaries of an approved subdivision if the proposed OSS design does not protect public health by meeting requirements of these regulations; and

(e) Permit the installation of an OSS, where the minimum land area requirements or lot sizes cannot be met, only when all of the following criteria are met:

(i) The lot is registered as a legal lot of record created prior to the effective date of this chapter;

(ii) The lot is outside an area identified by the local plan developed under WAC 246-272A-0015 where minimum land area has been listed as a design parameter necessary for public health protection; and

(iii) The proposed system meets all requirements of these regulations other than minimum land area.

(6) The use of a reduced-sized SSAS does not provide for a reduction in the minimum land area requirements established in this section. Site development incorporating reduced-sized SSAS must meet the minimum land area requirements established in state and local codes.

WAC 246-272A-0340 Certification of installers, pumpers, and maintenance service providers.

(1) OSS installers and pumpers must obtain approval from the local health officer prior to providing services within a local health jurisdiction.

(2) Local health officer may establish programs and requirements for approving maintenance service providers.

WAC 246-272A-0400 Technical advisory committee.

(1) The department shall:

(a) Maintain a technical advisory committee to advise the department regarding:

(i) OSS design and siting;

(ii) Public domain technologies and recommended standards and guidance for their use; and

(iii) Testing and design standards used for proprietary product registration and recommended standards and guidance for use of proprietary products.

(b) Select members for the technical advisory committee with technical or scientific knowledge applicable to OSS from agencies, professions, and organizations including:

(i) Local health departments;

(ii) Engineering firms;

(iii) The department of ecology;

(iv) Land sales, development and building industries;

(v) Public sewer utilities;

(vi) On-site sewage system design and installation firms;

(vii) Environmental organizations;

(viii) University/college academic communities;

(ix) On-site sewage system or related product manufacturers; and

(x) Other interested organizations or groups.

(c) Convene meetings as needed.

(2) The department may have a representative on the technical advisory committee.

WAC 246-272A-0410 Policy advisory committee.

(1) The department shall:

(a) Maintain a policy advisory committee to:

(i) Make recommendations concerning departmental policy and regulations;

(ii) Review program services; and

(iii) Provide input to the department regarding the on-site sewage program;

(b) Select members from agencies, professions, organizations having knowledge and interest in OSS, and groups which are affected by the regulations; and

(c) Convene meetings as needed.

(2) The department may have a representative on the policy advisory committee.

WAC 246-272A-0420 Waiver of state regulations.

(1) The local health officer may grant a waiver from specific requirements of this chapter if:

(a) The waiver request is evaluated by the local health officer on an individual, site-by-site basis;

(b) The local health officer determines that the waiver is consistent with the standards in, and the intent of, these rules;

(c) The local health officer submits quarterly reports to the department regarding any waivers approved or denied; and

(d) Based on review of the quarterly reports, if the department finds that the waivers previously granted have not been consistent with the standards in, and the intent of these rules, the department shall provide technical assistance to the local health officer to correct the inconsistency, and may notify the local and state boards of health of the department's concerns. If upon further review of the quarterly reports, the department finds that the inconsistency between the waivers granted and the state board of health standards has not been corrected, the department may suspend the authority of the local health officer to grant waivers under this section until such inconsistencies have been corrected.

(2) The department shall develop guidance to assist local health officers in the application of waivers.

WAC 246-272A-0425 Required rule review.

The department shall review this chapter to evaluate the effectiveness of the rules and determine areas where revisions may be necessary. The department will provide the results of their review along with their recommendations to the state board of health and all local health officers by September 2009 and every four years thereafter.

WAC 246-272A-0430 Enforcement.

(1) The department or the local health officer:

(a) Shall enforce the rules of chapter 246-272A WAC; or

(b) May refer cases within their jurisdiction to the local prosecutor's office or office of the attorney general, as appropriate.

(2) When a person violates the provisions under this chapter, the department, local health officer, local prosecutor's office, or office of the attorney general may initiate enforcement or disciplinary actions, or any other legal proceeding authorized by law including, but not limited to, any one or a combination of the following:

(a) Informal administrative conferences, convened at the request of the department or owner, to explore facts and resolve problems;

(b) Orders directed to the owner and/or operator of the OSS and/or person causing or responsible for the violation of the rules of chapter 246-272A WAC;

(c) Denial, suspension, modification, or revocation of permits, approvals, registrations, or certification;

(d) The penalties under chapter 70.05 RCW and RCW 43.70.190; and

(e) Civil or criminal action.

(3) Orders authorized under this section include the following:

(a) Orders requiring corrective measures necessary to effect compliance with chapter 246-272A WAC which may include a compliance schedule; and

(b) Orders to stop work and/or refrain from using any OSS or portion of the OSS or improvements to the OSS until all permits, certifications, and approvals required by rule or statute are obtained.

(4) Enforcement orders issued under this section shall:

(a) Be in writing;

(b) Name the person or persons to whom the order is directed;

(c) Briefly describe each action or inaction constituting a violation of the rules of chapter 246-272A WAC, or applicable local code;

(d) Specify any required corrective action, if applicable;

(e) Specify the effective date of the order, with time or times of compliance;

(f) Provide notice of the consequences of failure to comply or repeated violation, as appropriate. Such notices may include a statement that continued or repeated violation may subject the violator to:

(i) Denial, suspension, or revocation of a permit approval, or certification;

(ii) Referral to the office of the county prosecutor or attorney general; and/or

(iii) Other appropriate remedies.

(g) Provide the name, business address, and phone number of an appropriate staff person who may be contacted regarding an order.

(5) Enforcement orders shall be personally served in the manner of service of a summons in a civil action or in a manner showing proof of receipt.

(6) The department shall have cause to deny the application or reapplication for an operational permit or to revoke, suspend, or modify a required operational permit of any person who has:

(a) Failed or refused to comply with the provisions of chapter 246-272A WAC, or any other statutory provision or rule regulating the operation of an OSS; or

(b) Obtained or attempted to obtain a permit or any other required certificate or approval by misrepresentation.

(7) For the purposes of subsection (6) of this section and WAC 246-272A-0440, a person is defined to include:

(a) Applicant;

(b) Reapplicant;

(c) Permit holder; or

(d) Any individual associated with (a), (b) or (c) of this subsection including, but not limited to:

(i) Board members;

(ii) Officers;

(iii) Managers;

(iv) Partners;

(v) Association members;

(vi) Agents; and

(vii) Third persons acting with the knowledge of such persons.

WAC 246-272A-0440 Notice of decision-Adjudicative proceeding.

(1) All local boards of health shall:

(a) Maintain an administrative appeals process to consider procedural and technical conflicts arising from the administration of local regulations; and

(b) Establish rules for conducting hearings requested to contest a local health officer's actions.

(2) The department shall provide notice of the department's denial, suspension, modification or revocation of a permit, certification, or approval consistent with RCW 43.70.115, chapter 34.05 RCW, and chapter 246-10 WAC.

(3) A person contesting a departmental decision regarding a permit, certificate, or approval may file a written request for an adjudicative proceeding consistent with chapter 246-10 WAC.

(4) Department actions are governed under the Administrative Procedure Act chapter 34.05 RCW, RCW 43.70.115, this chapter, and chapter 246-10 WAC.

WAC 246-272A-0450 Severability.

If any provision of this chapter or its application to any person or circumstances is held invalid, the remainder of this chapter, or the application of the provision to other persons or circumstances shall not be affected.

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APPENDIX D

INFILTRATION EVALUATION, HOODSPORT PLANNING AREA, HWA GEOSCIENCES, JULY 26, 2007

HWA GEOSCIENCES INC.
Geotechnical Engineering · Hydrogeology · Geoenvironmental Services · Inspection and Testing

July 26, 2007
HWA Project No. 2006-172-500

Gray and Osborne
701 Dexter Avenue North, Suite 200
Seattle, Washington 981091

Attention: Mr. Harry Sellers, P.E.

Subject: **INFILTRATION EVALUATION**
WATER QUALITY PROJECT PLANNING
HOODSPORT PLANNING AREA
MASON COUNTY, WASHINGTON

Dear Mr. Sellers:

HWA GeoSciences Inc. (HWA) is pleased to submit this effluent disposal/infiltration feasibility review at the Hoodsport planning area in Mason County, Washington.

INTRODUCTION

HWA prepared a soils and hydrogeologic evaluation dated January 25, 2007 to evaluate areas within the Hoodsport Rural Activity Center (RAC) planning area for infiltration suitability and probability of septic-related contamination impacting Hood Canal, based on geologic, soils, and physiographic criteria (HWA, 2007) The following report describes site investigations and provides infiltration feasibility evaluation for two sites within the planning area.

Goals and Objectives

The goals and objectives of this study were to evaluate the infiltration potential and site suitability of the selected sites, by determining soil types, shallow ground water depths, and identifying potentially suitable infiltration receptor soils. Figure 1 shows the location of the areas investigated at the Hoodsport area; Figures 2 shows the sampling locations at Foothills Park (Test pits TP-16,-17, -23, and 24 and borings BH-1 and BH-2); and Figure 3 shows the sampling areas at the Lewallen property (Test pits TP-31 through TP-40).

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SITE EXPLORATIONS

HWA monitored the excavation of fourteen test pits and two soil borings in June and July, 2007. Excavation services were provided by Lot Hauling of Shelton, Washington and S&T Construction of Belfair, Washington, and soil boring services were provided by Boart Longyear of Puyallup, Washington. Figures 2 and 3 show the test pit and boring locations. Test pit and boring logs are included in Appendix A. The investigation areas are discussed below.

Foothills Park

HWA monitored the excavation of four test pits in this area designated TP-16,-17, -23, and 24. Subsequent to the test pit excavations, HWA also monitored the completion of two soil borings, BH-1 and BH-2. Figure 2 shows the test pit and boring locations.

This area is mapped as Pleistocene glacial till (Logan, 2003, Carson, 1976). Soils are mapped as Hoodsport gravelly sandy loam (till-derived) (Ness and Fowler, 1960). Test pits TP-16,-17, and -23 encountered 0.5 to two feet of gravelly topsoil over oxidized silty sands and gravels, interpreted to be oxidized glacial till. The soils graded to silty gravel in test pits TP-16 and TP-17 at depths of 4.5 to 7.5 feet, which was interpreted to be advance outwash. These test pits were located at the west end of Foothills Park and along the access road to the park and county transfer station, respectively.

HWA also completed two test pits at the county transfer station. The till extended to the total depth of eight feet in test pit TP-23, located at the east end of the transfer station. Test pit TP-24, located at the west end of the transfer station parcel, encountered approximately five feet of fill and debris over glacial till to the maximum depth of eight feet. Soils underlying the glacial till were not encountered at these two locations.

Based on the initial test pit findings, HWA completed two soil borings at the site to further assess the thickness of till near test pits TP-16 and TP-17, and to determine if outwash soils were present at depth. Boring BH-1 was completed at the northeast corner of the Foothills Park ballfield area. The boring encountered approximately seven feet of oxidized silty sand and gravel (oxidized till), with less-cemented silty gravels between seven and 25 feet. Boring BH-2 was completed adjacent to the park/transfer station access road near test pit TP-17. The boring encountered approximately three feet of fill and topsoil with oxidized silty sand and gravel (oxidized till) between three and 21.5 feet.

Ground water was not encountered to a maximum depth of 25 feet. Shallow ground water in this area likely drains to Finch Creek, to the north and east. Outwash soils may exist at depths beneath the surficial till at the site, but based on our explorations, infiltration ponds or basins are not feasible at this site due to the absence of suitable receptor soils at the practical depths to which infiltration facilities can be constructed (up

to 10 feet). Spray application of treated wastewater at land surface at this site may however be feasible.

Lewallen Property

This area includes several parcels of land north of North Finch Creek Road, with lowland areas adjacent to the road and Finch Creek, an east-west trending slope along the northern Finch Creek valley wall, and upland areas at the north portion of the property.

The upland areas are mapped as glacial till; the slope (valley wall) as advance outwash; and the valley floor as alpine outwash (Logan, 2003). Upland and valley wall soils are mapped as Hoodsport gravelly sandy loam (till-derived) (Ness and Fowler, 1960).

A portion of the Lewallen property was previously investigated by Ground Water Science Services (GWSS) for a preliminary hydrogeologic evaluation for wastewater application (GWSS, 2000). GWSS completed 6 test pits in the central portion of the property (Figure 3). In general, the test pit explorations encountered one to two feet of sandy silt soils over two to ten feet of sandy gravels. The gravels were underlain by silty materials and till at depths of approximately four to ten feet. GWSS performed three short-term falling head infiltration tests in the vicinity of their test pit TP-6. Soils reported in TP-6 consisted of sandy gravel topsoil overlying gravel and sand to a depth of approximately six feet below ground surface (bgs). GWSS encountered till-like soils at six feet bgs. GWSS conducted the tests in the upper one foot of soil in the area (likely gravels and sands). The three tests had reported infiltration rates of 6 to 20 inches per hour.

On July 6, 2007 HWA monitored the excavation of ten test pits at the Lewallen property designated TP-31 through TP-40. Figure 3 shows the test pit locations.

Test pit TP-31, at the north edge of the property, encountered sandy gravel over silty gravel at a depth of approximately nine feet. Test pits TP-32 through TP-35 encountered generally poorly-graded to well-graded gravels with sand to depths of up to nine feet. Test pits TP-37 through TP-40 were completed in the central portion of the property west and southeast of the GWSS test pit locations. These test pits generally encountered gravels and sands with silty layers, similar to soils observed by GWSS. Gravels and sands tended to be finer-grained and siltier than those observed in test pits TP-32 through -35.

Ground water was not encountered to a maximum depth of ten feet. Shallow ground water in this area likely drains to the south and east, toward Finch Creek and an unnamed tributary, respectively.

Surficial soils at the western upland portion of the Lewallen site appeared to consist of outwash-type sand and gravels, rather than till, as mapped. These soils appeared to be relatively consistent in composition, and have good potential for infiltration. Soils in the

eastern upland portion of the site consisted of finer-grained soils, including silty layers, which may include till or low-energy (fine-grained) alluvial soils. These soils were less consistent in composition and potential infiltration in this area would be limited by fine-grained perching layers within or underlying more granular soils.

INFILTRATION ESTIMATES - METHODS

The Washington State Department of Ecology (Ecology) 2005 *Stormwater Management Manual for Western Washington* recommends utilizing one of three methods for determining infiltration rates: ASTM grain size distribution, USDA textural analysis from soil samples, and in-situ field measurements.

This guidance document is intended primarily for stormwater, and therefore does not apply at this site, but contains results of recent research and principles of hydrogeology which can be used to estimate infiltration rates from other sources (e.g., treated waste water effluent). HWA utilized ASTM grain size distribution and USDA textural analysis to estimate infiltration rates for this project. HWA analyzed 15 soil samples collected from test pits and soil boring at the Foothills Park and Lewallen sites for grain size distribution and textural classification in accordance with these methodologies.

The infiltration rates estimated by the grain size methods assume a vertical gradient of 1, with no ground water or perching layers beneath the facility, i.e., no ground water mounding. HWA estimated flow rates for a given area assuming some degree of mounding, by adjustment of the vertical gradient to some value below 1, as described below. We then independently estimated mounding potential by several other analytical methods, also described below.

LABORATORY TESTING

Laboratory tests were conducted on selected soil samples to characterize relevant properties of the on-site soils. Laboratory testing included determination of moisture content and grain size distribution. All testing was conducted in accordance with appropriate ASTM standards. The test results and a discussion of laboratory test methodology are presented in Appendix B.

ASTM Grain Size Distribution

The ASTM grain size distribution method compares infiltration measurements from full-scale infiltration facilities to soil gradation data developed using the ASTM procedure (ASTM D422). Because this method compares data from existing full-scale infiltration facilities, the estimated infiltration rates are presented as estimated long-term infiltration rates. The estimated long-term infiltration rates assume an average degree of long-term facility maintenance, TSS (total suspended solids) control, and site variability in the subsurface conditions.

The ASTM grain size distribution method compares infiltration measurements from full-scale infiltration facilities to the D10, or grain size at which 10% of the sample is finer, of the soil, as measured using the ASTM procedure (ASTM D422). This method is not appropriate for soils with d10 less than 0.05 mm, which includes several samples from on site soils tested, therefore infiltration rates were not estimated using this technique for those samples. Table 1 shows the results of the grain size analyses and Appendix B presents the soil laboratory data.

USDA Soil Textural Classification

Infiltration rates can be estimated from grain size distribution data using the USDA textural analysis approach. HWA analyzed soil samples collected from test pits for grain size distribution and textural classification in accordance with ASTM test procedures, corrected to approximate the USDA procedures. To determine long-term infiltration rates based on the USDA method, Ecology recommends that the short-term infiltration rates be reduced by a correction factor based on the soil textural classification, average degree of long-term facility maintenance, TSS reduction through pretreatment, and site subsurface variability. Table 1 shows the results of the grain size analyses and Appendix B presents the soil laboratory data.

Table 1
Long-Term Infiltration Rates*
Based On USDA and ASTM Soil Textural Classification

Test Pit	Depth	ASTM description	USDA Classification	Ecology Long-term Infiltration Rates	
				ASTM (in/hr)	USDA (in/hr)
Hoodsport - Foothills Park					
TP-16	6	Poorly graded SAND with silt and gravel	Sandy loam	9	0.5
TP-17	8	Silty GRAVEL with sand	Sandy loam	N/A	0.5
Hoodsport - Lewallen Property					
TP-31	10	Silty GRAVEL with sand	Gravelly Sandy Loam	N/A	2
TP-32	6	Well graded GRAVEL with sand	Gravelly Sand	9	2
TP-33	5	Well graded GRAVEL with sand	Gravelly Sand	9	2
TP-33	7	Poorly graded GRAVEL with sand	Gravelly Sand	3.5	2
TP-34	9	Well graded GRAVEL with sand	Loamy sand	7.5	0.5
TP-35	8	Well graded GRAVEL with sand	Gravelly Loamy Sand	7.5	2
TP-36	8	Well graded GRAVEL with sand	Gravelly Sand	3.5	2
TP-37	7	Poorly graded SAND with silt and gravel	Loamy sand	1.5	0.5
TP-38	5	Silty SAND	Loamy sand	N/A	0.5
TP-38	9	Silty SAND	Sandy loam	N/A	0.25
TP-39	7	Well graded GRAVEL with sand and silt	Gravelly Loamy Sand	2.8	0.5
TP-40	4	Silty SAND with gravel	Loamy sand	N/A	0.5
TP-40	7	Poorly graded SAND	Sand	2	2

* based on *Stormwater Management Manual for Western Washington*, Ecology, 2005.
N/A – Not applicable by this method

INFILTRATION ESTIMATES - RESULTS

Vertical infiltration is limited by the least permeable layer in the soil profile. HWA did not analyze the fine grained soils (e.g., silts and silty sands) encountered in our explorations. The infiltration rates provided herein should therefore be used in conjunction with the test pit logs (Appendix A) and the mounding analyses (below) to evaluate infiltration feasibility.

Foothills Park

Infiltration rates shown for soils from the Foothills Park site are for granular soils encountered. Unsuitable fine grained, cemented, and till soils were not tested. The

gravelly soils at the Foothills Park site appeared to underlie or consist of oxidized or weathered till, and the depth and extent of these soils appeared to be variable, indicating that excavation for a proposed infiltration facility at this site may not be practical. However, the site may be suitable for spray application of wastewater over a large area.

Lewallen Property

Based on HWA's grain size testing, long term infiltration rates for soils encountered at the Lewallen property range from unsuitable to 9 in/hr using the ASTM method, and approximately 0.25 to 2 in/hr using the USDA method.

Soils in the western portion of the Lewallen site (vicinity of test pits TP-32 through TP-35 were generally granular and consistent in composition, and appear feasible for infiltration ponds or basins. Because infiltration is limited by the least permeable layer in the soil profile, 0.25 in/hr should be used to conservatively estimate site-wide infiltration rates for this preliminary evaluation. Design infiltration rates should be adjusted based on further ground water mounding studies, as recommended below.

GROUND WATER MOUNDING

Ground water mounding is a local raising of the ground water table due to infiltrating water from the surface. If a ground water mound reaches the infiltration facility, infiltration rates are greatly reduced, and facility failure may occur, depending on flow rates and storage volume.

To evaluate impacts to ground water flow due to the proposed infiltration facility, HWA used several methods, as described below.

Ecology/ Massmann method

Based on preliminary infiltration estimates of 0.25 in/hr at the Lewallen site, HWA estimated the area required for infiltration of an assumed 30,000 gallons per day (gpd). We used a variation of Darcy's law, which states Q = f i A, where:

Q = discharge	30,000 gpd
f = infiltration rate	0.25 in/hr
i = vertical gradient	see below
A = area	see below

Vertical gradients where depth to ground water is shallow can be estimated using a regression method (based on multiple sites with measured infiltration rates) outlined by Massmann (Ecology, 2005), where the vertical gradient for a pond is described by the following relationship: $i = (Dwt+Dp)/138.62*K^{0.1}) \times CF$, where:

Dwt = depth to water	50 feet (conservatively assuming perching layers or mounding)
Dp = pond depth	assumed 6 feet
K = hydraulic conductivity	100 feet/day (based on unsaturated soils, estimated from grain size testing results)
CF = a correction factor for pond size,	$CF= 0.73(A)^{-0.76}$ where A = area
i = vertical gradient	0.18

This equation generally will result in a calculated gradient of less than 1.0 for moderate to shallow ground water depths (or to a low permeability layer) below the facility, and conservatively accounts for the development of a ground water mound.

Solving for area yielded approximately 1 acre required for infiltration of 30,000 gpd, which is close to the design average daily discharge rate. The proposed pond area of approximately 2 acres would provide sufficient storage and infiltration capacity for peak flows (54,000 gpd), and allow for temporary drainage and maintenance of each pond.

These estimates should be considered preliminary, as ground water depths or potential perching layers have not been determined.

Hantush Method

HWA performed preliminary analytical flow modeling based on Hantush (1967) to simulate the maximum height of the water table beneath a rectangular recharge area. The following is a list of assumptions and model input variables used in the flow model:

- Hydraulic conductivity = 100 ft/day
- Specific yield = 0.2, typical for unconfined sand aquifers
- Initial saturated thickness = 20 ft, conservatively assumed in the absence of deeper subsurface information
- Area = 200 x 200 ft (approximately 1 acre)
- Recharge rate = 0.092 ft/day (1.1 in/day)= 30,000 gpd and 0.166 ft/day (54,000 gpd)
- Time 3,650 days (10 years)

For the assumed variables at the site, the aquifer mounding predicted with 30,000 gpd discharge was less than one foot above pre-infiltration conditions. Predicted head distribution with 54,000 gpd discharge (estimated peak flows) was approximately one foot above pre-infiltration conditions.

This minimal predicted mounding is due to the uniform, high assumed hydraulic conductivity. In actuality, the potential presence of layering and intervening fine grained deposits beneath the infiltration ponds will likely result in a greater degree of ground water mounding, which can not be modeled using this one-layer analytical model. Overall, the presence of permeable deposits underlying the proposed infiltration area, and in particular, directly under the proposed infiltration ponds at shallow depths, should

ensure that the wastewater is absorbed without mounding impacting the performance of the ponds.

SLOPE STABILITY / DRAINAGE IMPACTS

The Lewallen site appears favorable for infiltration ponds or basins. The upland area is generally flat, and is bounded to the south and east by slopes towards Finch Creek and its unnamed tributary. The south-facing valley wall (south of TP-32 through TP-35) slopes to approximately 63 percent (32 degrees).

According to Mason County Resource Ordinance (Ordinance No. 77 - 93), Chapter 17.01.100 – Landslide Hazard Area, Section E, Geotechnical Report, Category D, "Areas with slopes between 15 and 40 percent will require a geological assessment, and may further require a geotechnical report… ". Therefore, HWA recommends additional soil exploration in the vicinity of the proposed infiltration facility prior to construction to characterize the soils comprising the slope in order to evaluate the stability of the slope and provide recommendations for infiltration relative to slope stability.

In addition to potential slope instability concerns, infiltration in the upland area has the potential to create adverse drainage conditions downslope, including discharge on or at the base of the slope. There are currently several houses in the valley bottom downslope of the area around Test Pits TP-32 through TP-35.

WATER REUSE REGULATIONS

Ecology water reuse standards (1997) stipulate that a 500-foot setback is required between an infiltration facility and ground water or surface water drinking water source. A drinking water well and spring are present south of the proposed area (Figure 3). In the event that an infiltration facility is constructed in the western portion of the Lewallen site (vicinity of test pits TP-32 through TP-35), the facility should be constructed outside of a 500-foot radius from these sources. If the facility can not be sited outside these limits, the wells and springs should be properly abandoned or replaced.

A log of the well (William Gray) is included in Appendix A for reference. According to the driller's well log, the well is 39 feet deep, and soils at the well location consist of approximately 35 feet of "conglomerate" (possibly oxidized till) over water-bearing gravel (possibly advance outwash). Ground water at the well location is confined, and the depth to water in the well was eight feet bgs at the time of drilling. The spring is reportedly a collector excavated into shallow soils. Based on the elevation and depth of the well and spring, they would both likely be recharged by infiltrated water in the upslope area.

CONCLUSIONS

HWA conducted subsurface investigations at two sites in the Hoodsport Planning area to assess the suitability of those areas for potential wastewater infiltration facility siting and design. The investigations consisted of completing test pits and borings at the Foothills Park site and Lewallen property. HWA completed laboratory grain-size analysis of selected soil samples and used the results to estimate infiltration rates and potential ground water mounding at the site.

The Foothills Park site did not appear to be feasible for construction of infiltration ponds or basins due to the presence of low permeability soils to depths below those typical of infiltration facilities. This site may be feasible for spray application of wastewater, however, further evaluation was not conducted at the site.

The Lewallen property site soils consisted of typically well-graded gravels in the upland, western portion of the site (TP-32 through TP-35). These soils did not appear to have significant low-permeability layers to the investigation depth of approximately 10 feet bgs.

The infiltration rate based on soil grain size testing data was estimated at 0.25 inches/hour at the Lewallen Property. This value does not account for mounding due to perching layers or shallow ground water beneath the facility. Flow estimates assuming some degree of mounding indicate approximately 1 acre would be necessary to infiltrate the proposed 30,000 gpd. Preliminary ground water mounding estimates for the Lewallen site did not indicate significant impact from the proposed infiltration volumes.

These estimates should be considered preliminary, for planning purposes. Additional studies recommended for design are described below.

RECOMMENDATIONS

If this site is selected, HWA recommends an additional hydrogeologic investigation. Soil borings and monitoring wells should be installed and tested to establish ground water levels, quality, aquifer parameters, and to aid in slope stability evaluations. Seasonal ground water changes should be evaluated. Monitoring during one wet season at a minimum is recommended. Additional ground water mounding analysis and modeling to predict flow rates and impacts to nearby surface water features should be performed based on this data.

Pilot infiltration testing would be needed to size the facility for design flows. The pilot test typically entails a 17-24 hour period of infiltration at rates scaled to design flows, into an approximately 100 square-foot pit or 8 foot diameter steel ring excavated to the receptor soils. Discharge and water levels are monitored and long term infiltration rates can be approximated. Construction of multiple infiltration ponds in phases and

monitoring peak use and ground water mounding is also an option for facility development.

REFERENCES

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LIMITATIONS

The conclusions expressed by HWA are based solely on material referenced in this report. Observations were made under the conditions stated. Within the limitations of scope, schedule and budget, HWA attempted to execute these services in accordance with generally accepted professional principles and practices in the area at the time the report was prepared. No warranty, express or implied, is made. Experience has shown that subsurface soil and groundwater conditions can vary significantly over small distances. It is always possible that contamination may exist in areas that were not sampled. HWA's findings and conclusions must not be considered as scientific or engineering

certainties, but rather as our professional opinion concerning the significance of the limited data gathered and interpreted during the course of the assessment.

We recommend that HWA be retained to review the plans and specifications to verify that our recommendations have been interpreted and implemented as intended. Sufficient field monitoring, testing and consultation should be provided during construction to confirm that the conditions encountered are consistent with those indicated by explorations, and to provide recommendations should conditions revealed during construction differ from those anticipated. HWA does not practice or consult in the field of safety engineering. We do not direct the contractor's operations, and cannot be responsible for the safety of personnel other than our own on the site.

This study and report have been prepared on behalf of Gray and Osborne and Mason County, for the specific application to the subject property. This report should be provided in its entirety to prospective contractors for bidding and estimating purposes; however, the conclusions and interpretations presented in this report should not be construed as a warranty of the subsurface conditions. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, nor the use of segregated portions of this report.

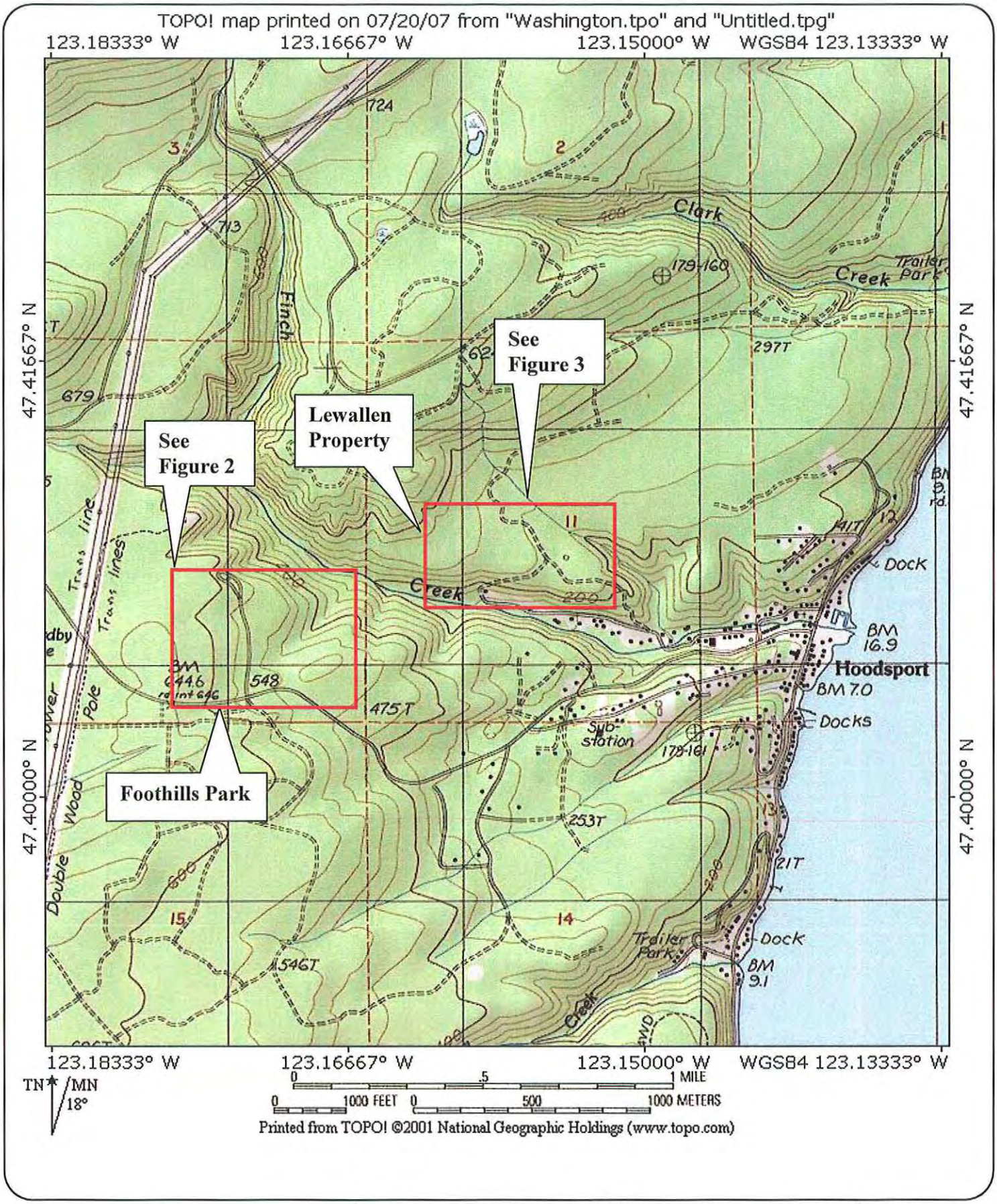
We appreciate the opportunity to provide our services. Please feel free to call us if you have any questions or need more information.

Sincerely,

HWA GEOSCIENCES INC.

Vance Atkins, LG, LHG
Senior Hydrogeologist

Arnie Sugar, LG, LHG
Vice President



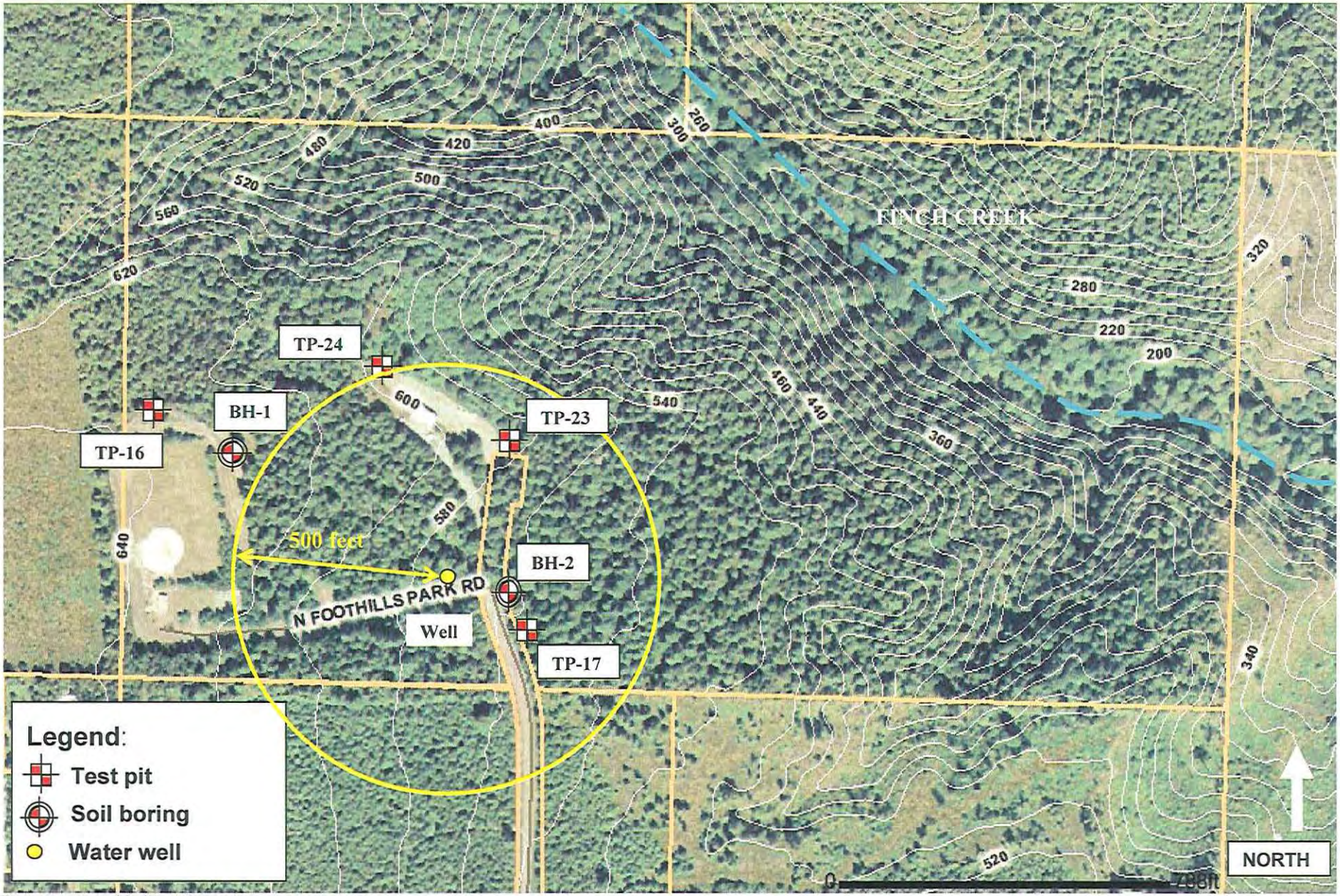
SITE VICINITY

MASON COUNTY
WATER QUALITY PROJECT PLANNING
HOODSPORT RAC PLANNING AREA

HWA GEOSCIENCES INC.

FIGURE NO.
1

PROJECT NO.
2006-172-500



Base map provided by Mason County

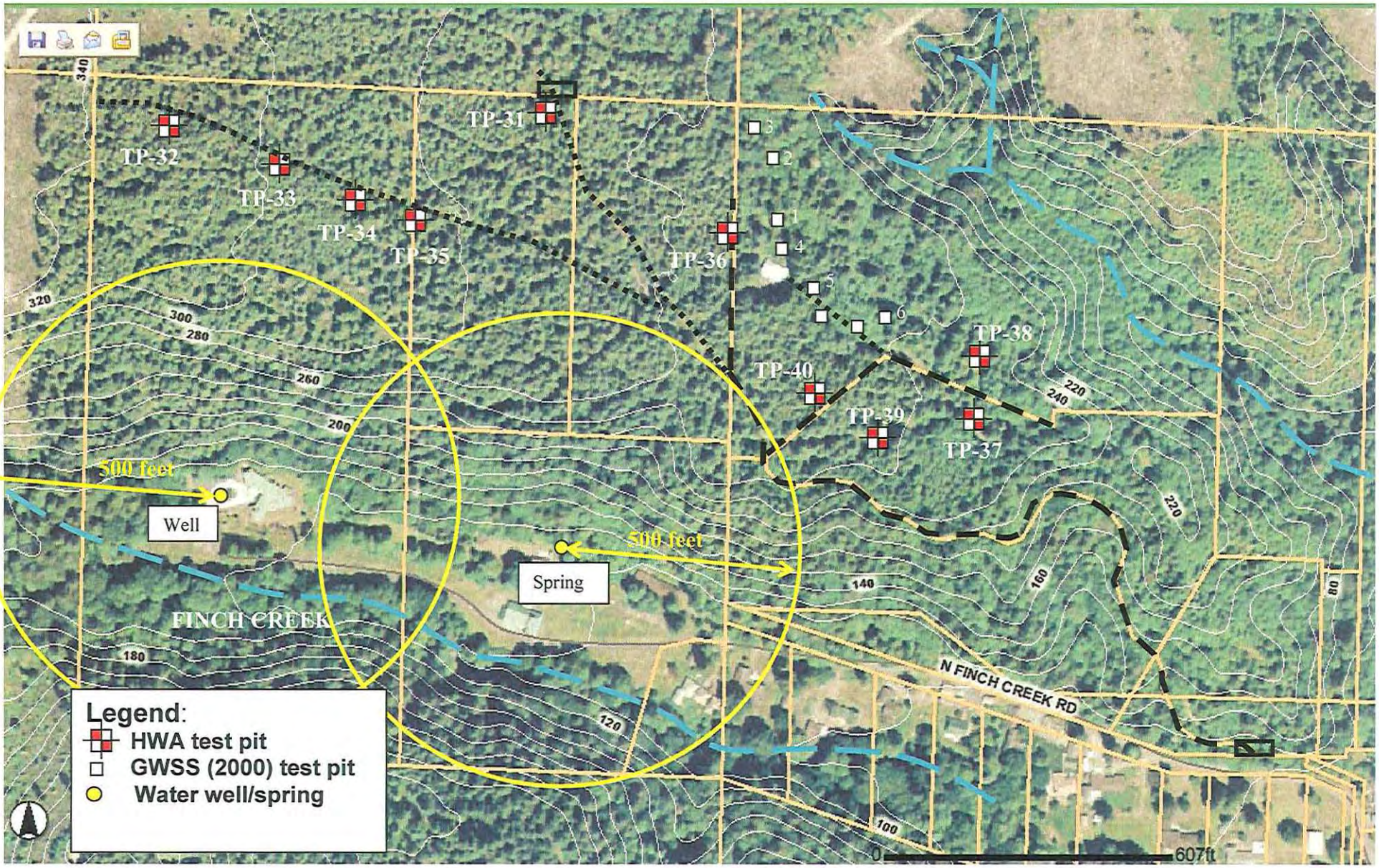
HWA GEOSCIENCES INC.

EXPLORATION LOCATIONS
FOOTHILLS PARK

MASON COUNTY
WATER QUALITY PROJECT PLANNING
HOODSPORT RAC PLANNING AREA

FIGURE NO.
2

PROJECT NO.
2006172-500



Base map provided by Mason County

HWA GEOSCIENCES INC.

EXPLORATION LOCATIONS
LEWALLEN PROPERTY

MASON COUNTY
WATER QUALITY PROJECT PLANNING
HOODSPORT RAC PLANNING AREA

FIGURE NO.
3

PROJECT NO.
2006172-500

APPENDIX A

TEST PIT AND BORING LOGS

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N-VALUE

COHESIONLESS SOILS			COHESIVE SOILS		
Density	N (blows/ft)	Approximate Relative Density(%)	Consistency	N (blows/ft)	Approximate Undrained Shear Strength (psf)
Very Loose	0 to 4	0 - 15	Very Soft	0 to 2	<250
Loose	4 to 10	15 - 35	Soft	2 to 4	250 - 500
Medium Dense	10 to 30	35 - 65	Medium Stiff	4 to 8	500 - 1000
Dense	30 to 50	65 - 85	Stiff	8 to 15	1000 - 2000
Very Dense	over 50	85 - 100	Very Stiff	15 to 30	2000 - 4000
			Hard	over 30	>4000

USCS SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP DESCRIPTIONS	
Coarse Grained Soils	Gravel and Gravelly Soils	Clean Gravel (little or no fines)	GW	Well-graded GRAVEL
			GP	Poorly-graded GRAVEL
	More than 50% of Coarse Fraction Retained on No. 4 Sieve	Gravel with Fines (appreciable amount of fines)	GM	Silty GRAVEL
			GC	Clayey GRAVEL
More than 50% Retained on No. 200 Sieve Size	Sand and Sandy Soils	Clean Sand (little or no fines)	SW	Well-graded SAND
			SP	Poorly-graded SAND
	50% or More of Coarse Fraction Passing No. 4 Sieve	Sand with Fines (appreciable amount of fines)	SM	Silty SAND
			SC	Clayey SAND
Fine Grained Soils	Silt and Clay	Liquid Limit Less than 50%	ML	SILT
			CL	Lean CLAY
			OL	Organic SILT/Organic CLAY
50% or More Passing No. 200 Sieve Size	Silt and Clay	Liquid Limit 50% or More	MH	Elastic SILT
			CH	Fat CLAY
			OH	Organic SILT/Organic CLAY
Highly Organic Soils			PT	PEAT

TEST SYMBOLS

%F	Percent Fines	
AL	Atterberg Limits:	PL = Plastic Limit LL = Liquid Limit
CBR	California Bearing Ratio	
CN	Consolidation	
DD	Dry Density (pcf)	
DS	Direct Shear	
GS	Grain Size Distribution	
K	Permeability	
MD	Moisture/Density Relationship (Proctor)	
MR	Resilient Modulus	
PID	Photoionization Device Reading	
PP	Pocket Penetrometer Approx. Compressive Strength (tsf)	
SG	Specific Gravity	
TC	Triaxial Compression	
TV	Torvane Approx. Shear Strength (tsf)	
UC	Unconfined Compression	

SAMPLE TYPE SYMBOLS

- 2.0" OD Split Spoon (SPT) (140 lb. hammer with 30 in. drop)
- Shelby Tube
- 3-1/4" OD Split Spoon with Brass Rings
- Small Bag Sample
- Large Bag (Bulk) Sample
- Core Run
- Non-standard Penetration Test (3.0" OD split spoon)

GROUNDWATER SYMBOLS

- Groundwater Level (measured at time of drilling)
- Groundwater Level (measured in well or open hole after water level stabilized)

COMPONENT DEFINITIONS

COMPONENT	SIZE RANGE
Boulders	Larger than 12 in
Cobbles	3 in to 12 in
Gravel	3 in to No 4 (4.5mm)
Coarse gravel	3 in to 3/4 in
Fine gravel	3/4 in to No 4 (4.5mm)
Sand	No. 4 (4.5 mm) to No. 200 (0.074 mm)
Coarse sand	No. 4 (4.5 mm) to No. 10 (2.0 mm)
Medium sand	No. 10 (2.0 mm) to No. 40 (0.42 mm)
Fine sand	No. 40 (0.42 mm) to No. 200 (0.074 mm)
Silt and Clay	Smaller than No. 200 (0.074mm)

COMPONENT PROPORTIONS

PROPORTION RANGE	DESCRIPTIVE TERMS
< 5%	Clean
5 - 12%	Slightly (Clayey, Silty, Sandy)
12 - 30%	Clayey, Silty, Sandy, Gravelly
30 - 50%	Very (Clayey, Silty, Sandy, Gravelly)
Components are arranged in order of increasing quantities.	

NOTES: Soil classifications presented on exploration logs are based on visual and laboratory observation. Soil descriptions are presented in the following general order:

Density/consistency, color, modifier (if any) GROUP NAME, additions to group name (if any), moisture content. Proportion, gradation, and angularity of constituents, additional comments. (GEOLOGIC INTERPRETATION)

Please refer to the discussion in the report text as well as the exploration logs for a more complete description of subsurface conditions.

MOISTURE CONTENT

DRY	Absence of moisture, dusty, dry to the touch.
MOIST	Damp but no visible water.
WET	Visible free water, usually soil is below water table.

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Mason County
Washington

LEGEND OF TERMS AND SYMBOLS USED ON EXPLORATION LOGS

PROJECT NO.: 2006-172-22 FIGURE: 1

EXCAVATION COMPANY: Lot Hauling
EXCAVATING EQUIPMENT: Case 580 backhoe
SURFACE ELEVATION: ± Feet

LOCATION: See Figure 2
DATE COMPLETED: 6/11/07
LOGGED BY: V. Atkins

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	MOISTURE CONTENT (%)	OTHER TESTS	GROUNDWATER
0			Yellowish red fine to medium silty sand TOPSOIL with root material and organics. Loose. Some slough.					
2		SM	Brown to brownish-yellow silty SAND with gravel to 2" , occasional cobbles. Cemented and oxidized. Dry to moist. Dense. (oxidized till)		TP-16-2			
4			Cementation decreases with depth					
		GP GM	Brownish yellow GRAVEL with sand and silt. Silt binder on gravel, moist, dense. (Advance Outwash)					
6					TP-16-6	6		
8			Test pit completed to 8 feet bgs. Ground water not encountered.		TP-16-8			
10								
12								

NOTE: For a proper understanding of the nature of subsurface conditions, this exploration log should be read in conjunction with the text of the geotechnical report. This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

PHOTOGRAPH OF TEST PIT

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Mason County Wastewater
Infiltration Evaluation
Mason County
Washington

LOG OF TEST PIT
TP-16

PROJECT NO.: 2006-172-22 FIGURE: 2

EXCAVATION COMPANY: Lot Hauling
EXCAVATING EQUIPMENT: Case 580 backhoe
SURFACE ELEVATION: ± Feet

LOCATION: See Figure 2
DATE COMPLETED: 6/11/07
LOGGED BY: V. Atkins

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	MOISTURE CONTENT (%)	OTHER TESTS	GROUNDWATER
0			Yellowish red fine to medium silty sand TOPSOIL, with root material, and organics. Loose. Some slough.					
2		SM	Grading brown to brownish-yellow silty SAND and GRAVEL to 2", occasional cobbles. Cemented and oxidized. Dry to moist. Dense to very dense. (Oxidixed Till) Increasing gravel.					
4					TP-17-5			
6			Decreasing cementation/oxidation. Increasing gravel and cobbles.					
		GM	Yellow-brown silty GRAVEL with sand, some oxidation/cementation, decreasing with depth. (Advance Outwash)					
8			Test pit completed to 8 feet bgs. Ground water not encountered.		TP-17-8	7		
10								
12								

PHOTOGRAPH OF TEST PIT

NOTE: For a proper understanding of the nature of subsurface conditions, this exploration log should be read in conjunction with the text of the geotechnical report. This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

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Mason County Wastewater
Infiltration Evaluation
Mason County
Washington

LOG OF TEST PIT
TP-17

PROJECT NO.: 2006-172-22 FIGURE: 3

EXCAVATION COMPANY: Lot Hauling
EXCAVATING EQUIPMENT: Case 580 backhoe
SURFACE ELEVATION: ± Feet

LOCATION: See Figure 2
DATE COMPLETED: 6/11/07
LOGGED BY: V. Atkins

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	MOISTURE CONTENT (%)	OTHER TESTS	GROUNDWATER
0			Dark brown sandy TOPSOIL/DUFF with organic material and roots.					
		SM	Brownsh-yellow to yellow-red silty SAND and gravel, medium dense, dry to moist. (Oxidized Till)					
2								
		SM	Yellow-red to yellow-gray cemented/oxidized silty SAND and GRAVEL, very dense.					
4			Boulder, incresing cobbles.					
6			Yellow-red cemented/oxidized silty SAND and GRAVEL, very dense, dry.		TP-23-6			
8			Test pit completed to 8 feet bgs. Ground water not encountered.		TP-23-8			
10								
12								

PHOTOGRAPH OF TEST PIT

Photograph not available

NOTE: For a proper understanding of the nature of subsurface conditions, this exploration log should be read in conjunction with the text of the geotechnical report. This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

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Mason County
Washington

LOG OF TEST PIT
TP-23

PROJECT NO.: 2006-172-22 FIGURE: 4

EXCAVATION COMPANY: Lot Hauling
EXCAVATING EQUIPMENT: Case 580 backhoe
SURFACE ELEVATION: ± Feet

LOCATION: See Figure 2
DATE COMPLETED: 6/11/07
LOGGED BY: V. Atkins

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	MOISTURE CONTENT (%)	OTHER TESTS	GROUNDWATER
0			Red-brown silty sand TOPSOIL/FILL with organic material and roots.					
2			Silty sand with burn fill and debris (glass, metal).					
4		SM	Red-brown to yellow-red silty SAND and GRAVEL, disturbed, medium dense, dry. (Fill)					
6		SM	Red-brown cemented/oxidized silty SAND and GRAVEL, undisturbed, dense to very dense. (Oxidized till)					
8			Test pit completed to 8 feet bgs. Ground water not encountered.		TP-24-8			
10								
12								

PHOTOGRAPH OF TEST PIT

NOTE: For a proper understanding of the nature of subsurface conditions, this exploration log should be read in conjunction with the text of the geotechnical report. This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

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Mason County Wastewater
Infiltration Evaluation
Mason County
Washington

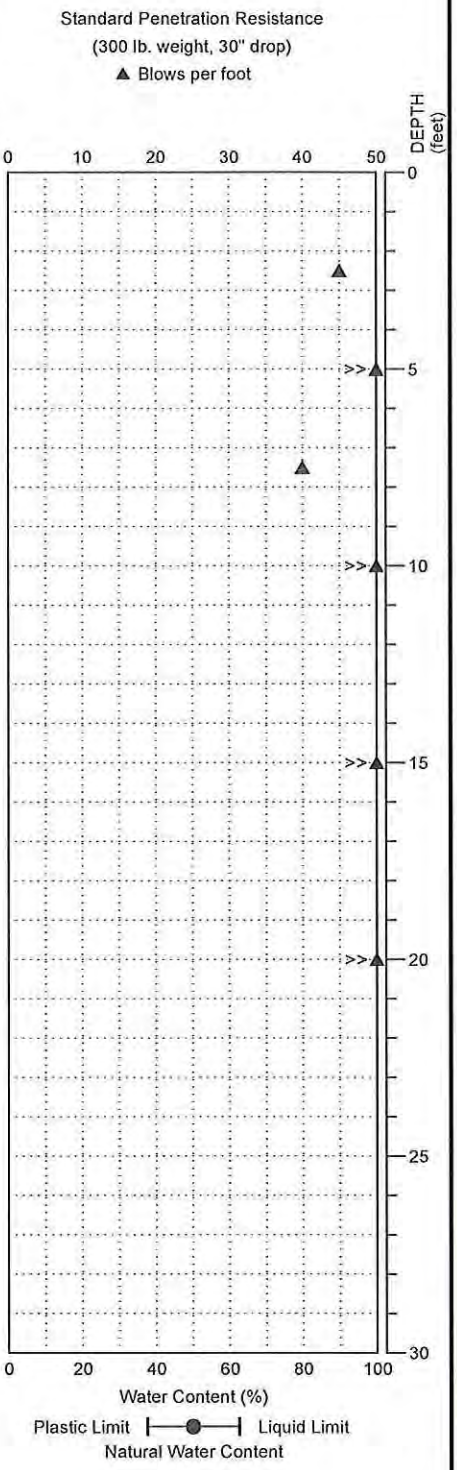
LOG OF TEST PIT
TP-24

PROJECT NO.: 2006-172-22 FIGURE: 5

DRILLING COMPANY: Boart Longyear
DRILLING METHOD: Mobile B-59 HSA w/ Cathead
SAMPLING METHOD: D&M Sampler
SURFACE ELEVATION: ± feet

LOCATION: See Figure 2
DATE STARTED: 7/11/2007
DATE COMPLETED: 7/11/2007
LOGGED BY: V. Atkins

DEPTH (feet)	SYMBOL	USCS SOIL CLASS	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	PEN. RESISTANCE (blows/6 inches)	OTHER TESTS	GROUNDWATER
0		GM	Brown TOPSOIL, gravel fill					
		SM	Yellow-red silty SAND and GRAVEL with cobbles to 4"					
			Grading brown silty SAND and GRAVEL, cemented at 3.5', dense, dry to moist (TILL)	■	2.5	2/14/31		
5			As above, cemented/oxidized, decreasing cobbbles, very dense, dry.	■	5	9/21/30		
		GM	Brown silty coarse GRAVEL and SAND, decreasing cementation, dense, dry.	■	7.5	2/14/26		
10			Brown silty coarse GRAVEL and SAND, gravel to 2", slight oxidation, very dense, dry.	■	10	30/50-5"		
15			Brown silty coarse GRAVEL and SAND, trace clay, gravel to 2", slight oxidation on gravels, very dense, dry with moist seams.	■	15	6/25/29		
20			Brown to red-brown cemented/oxidized silty SAND and GRAVEL, trace clay, very dense, moist seams.	■	20	14/24/36		
25			Boring completed to 25 feet bgs. Ground water not encountered.					
30								



For a proper understanding of the nature of subsurface conditions, this exploration log should be read in conjunction with the text of the geotechnical report.

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

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Mason County Wastewater
Infiltration Evaluation
Mason County
Washington

BORING:
BH-1

PAGE: 1 of 1

PROJECT NO.: 2006-172-22 FIGURE: 6

DRILLING COMPANY: Boart Longyear
DRILLING METHOD: Mobile B-59 HSA w/ Cathead
SAMPLING METHOD: D&M Sampler
SURFACE ELEVATION: ± feet

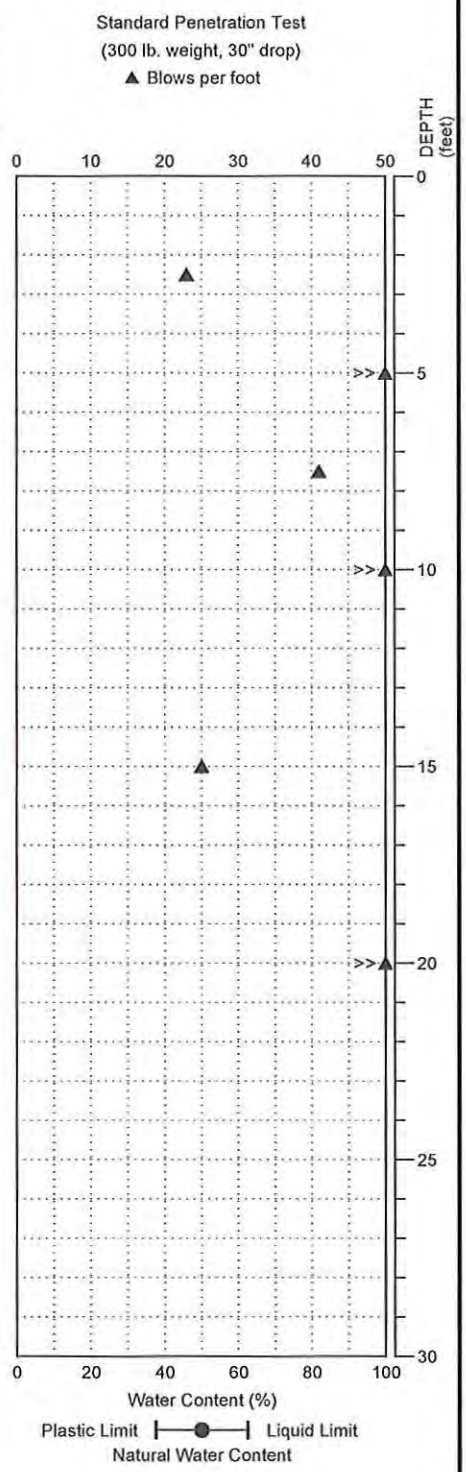
LOCATION: See Figure 2
DATE STARTED: 7/11/2007
DATE COMPLETED: 7/11/2007
LOGGED BY: V. Atkins

DEPTH (feet)	USCS SOIL CLASS	DESCRIPTION	SAMPLE NUMBER	PEN. RESISTANCE (blows/6 inches)
0	GM	Brown silty gravel FILL with wood debris		
	SM	Yellow-red silty SAND with gravel and root material, medium dense, dry (weathered TILL).	2.5	6/5/18
	SM	Yellow-gray to gray-brown silty SAND and GRAVEL, gravel to 1/2", trace oxidation, very dense, dry (TILL).	5	6/32/35
		Brown with gray seams silty SAND with gravel, gravel to 1", dense, moist.	7.5	11/19/22
10		Gray-brown silty SAND with gravel, trace clay, occasional oxidation, very dense, moist.	10	9/26/45
		Increasing rig chatter- cobbley/boulder.		
15		Gray-brown silty SAND with gravel, trace clay, very dense, moist.	15	5/7/18
		Gray-brown silty SAND with gravel, trace clay, occasional oxidation, very dense, moist.		
20			20	8/46/50-3"
		Boring completed to 20 feet bgs. Ground water not encontered.		
25				
30				

SYMBOL

OTHER TESTS

GROUNDWATER



For a proper understanding of the nature of subsurface conditions, this exploration log should be read in conjunction with the text of the geotechnical report.

NOTE: This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

Mason County Wastewater
Infiltration Evaluation
Mason County
Washington

BORING:
BH-2

PAGE: 1 of 1

PROJECT NO.: 2006-172-22 FIGURE: 7

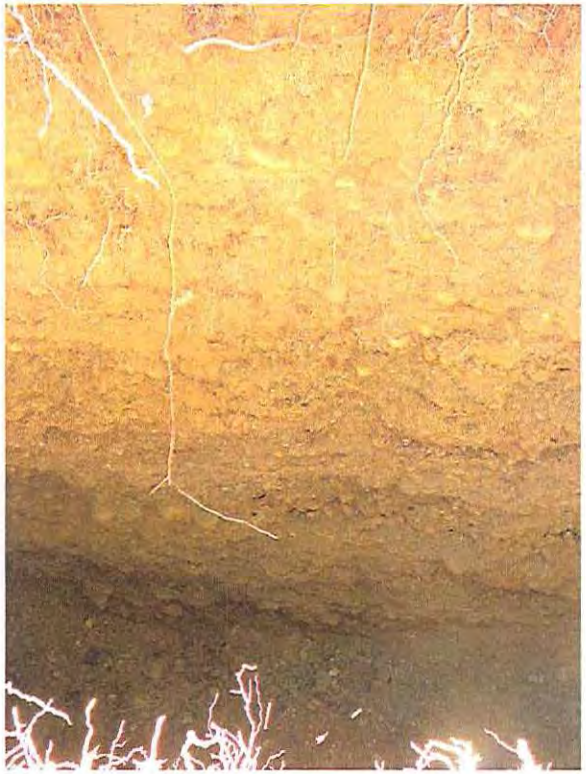
EXCAVATION COMPANY: S & J
EXCAVATING EQUIPMENT: Case 580 backhoe
SURFACE ELEVATION: ± Feet

LOCATION: See Figure 3
DATE COMPLETED: 7/6/07
LOGGED BY: V. Atkins

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	MOISTURE CONTENT (%)	OTHER TESTS	GROUNDWATER
0		SM	Red-brown gravelly TOPSOIL with root material, dry.					
2		GP	Grading yellow-brown sandy GRAVEL, well rounded, gravel to 3", dry.					
			Slight imbrication					
4								
			Grading gray, cobbly, moist					
6								
			Yellow-gray fine to coarse sandy GRAVEL, some cobbles, moist.		TP-31-7			
8			As above, with red-brown slightly oxidized layers.					
		GM	Yellow-gray fine to medium sandy GRAVEL with silty layers, moist.					
10			Test pit completed to 10 feet bgs. Ground water not encountered.		TP-31-10	9		
12								

NOTE: For a proper understanding of the nature of subsurface conditions, this exploration log should be read in conjunction with the text of the geotechnical report. This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

PHOTOGRAPH OF TEST PIT



HWA GEOSCIENCES INC.

Mason County Wastewater
Infiltration Evaluation
Mason County
Washington

LOG OF TEST PIT
TP-31

PROJECT NO.: 2006-172-22 FIGURE: 8

EXCAVATION COMPANY: S & J
EXCAVATING EQUIPMENT: Case 580 backhoe
SURFACE ELEVATION: ± Feet

LOCATION: See Figure 3
DATE COMPLETED: 7/6/07
LOGGED BY: V. Atkins

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	MOISTURE CONTENT (%)	OTHER TESTS	GROUNDWATER
0		GM	Brown gravelly TOPSOIL with cobbles and root material, dry.					
2		GW	Yellow-brown GRAVEL with sand and cobbles, rounded to well-rounded, decreasing root material, dry.					
			Yellow-gray to yellow-red cobbley GRAVEL, occasional boulder.					
4								
6			Yellow-red fine to coarse sandy GRAVEL, trace silty cementation on gravel, dense, dry to moist.		TP-32-6	6		
8			As above, moist, caving.		TP-32-9			
			Test pit completed to 9 feet bgs. Ground water not encountered.					
10								
12								

PHOTOGRAPH OF TEST PIT

Photograph not available

NOTE: For a proper understanding of the nature of subsurface conditions, this exploration log should be read in conjunction with the text of the geotechnical report. This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

Mason County Wastewater
Infiltration Evaluation
Mason County
Washington

LOG OF TEST PIT
TP-32

PROJECT NO.: 2006-172-22 FIGURE: 9

EXCAVATION COMPANY: S & J
EXCAVATING EQUIPMENT: Case 580 backhoe
SURFACE ELEVATION: ± Feet

LOCATION: See Figure 3
DATE COMPLETED: 7/6/07
LOGGED BY: V. Atkins

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	MOISTURE CONTENT (%)	OTHER TESTS	GROUNDWATER
0		GM	Red-brown to dark brown gravelly TOPSOIL with roots, dry.					
		GW	Grading red-brown fine to coarse GRAVEL with sand and cobbles, trace silt, occasional boulder, dry.					
2								
			Grading yellow-gray					
4			Occasional coarse sandy lenses.					
		GP	Yellow-gray fine GRAVEL with sand, tracel oxidation on gravels, dense, dry grading moist.		TP-33-5	4		
6								
			As above, occasional silty lenses, silty cementation on cobbles, moist.		TP-33-7	5		
8			Test pit completed to 8 feet bgs. Ground water not encountered.					
10								
12								

NOTE: For a proper understanding of the nature of subsurface conditions, this exploration log should be read in conjunction with the text of the geotechnical report. This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

PHOTOGRAPH OF TEST PIT

HWA GEOSCIENCES INC.

Mason County Wastewater
Infiltration Evaluation
Mason County
Washington

LOG OF TEST PIT
TP-33

PROJECT NO.: 2006-172-22 FIGURE: 10

EXCAVATION COMPANY: S & J
EXCAVATING EQUIPMENT: Case 580 backhoe
SURFACE ELEVATION: ± Feet

LOCATION: See Figure 3
DATE COMPLETED: 7/6/07
LOGGED BY: V. Atkins

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	MOISTURE CONTENT (%)	OTHER TESTS	GROUNDWATER
0		GM	Bed-brown gravelly TOPSOIL/duff, loose, dry.					
		GP	Yellow-red cobbley sandy GRAVEL, decreasing roots, gravel to 3", dry.					
2								
4								
		GW	Yellow-red GRAVEL with sand, gravel to 2" dry grading moist.		TP-34-5			
6								
8			Yellow-gray, moist.					
			Caving.		TP-34-9	5		
10			Test pit completed to 9 feet bgs. Ground water not encountered.					
12								

PHOTOGRAPH OF TEST PIT

Photograph not available

NOTE: For a proper understanding of the nature of subsurface conditions, this exploration log should be read in conjunction with the text of the geotechnical report. This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

Mason County Wastewater
Infiltration Evaluation
Mason County
Washington

LOG OF TEST PIT
TP-34

PROJECT NO.: 2006-172-22 FIGURE: 11

EXCAVATION COMPANY: S & J
EXCAVATING EQUIPMENT: Case 580 backhoe
SURFACE ELEVATION: ± Feet

LOCATION: See Figure 3
DATE COMPLETED: 7/6/07
LOGGED BY: V. Atkins

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	MOISTURE CONTENT (%)	OTHER TESTS	GROUNDWATER
0		GM	Gravelly TOPSOIL/old logging road bed					
		GW	Yellow-red cobbley sandy GRAVEL, well rounded, dense, dry.					
2								
4								
			Yellow-red cobbley sandy GRAVEL, well rounded, dense, moist.		TP-35-5			
6								
8			Red sandy fine to coarse GRAVEL with sand, well rounded, very dense, moist.		TP-35-8	4		
10			Test pit completed to 10 feet bgs. Ground water not encountered.					
12								

NOTE: For a proper understanding of the nature of subsurface conditions, this exploration log should be read in conjunction with the text of the geotechnical report. This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

PHOTOGRAPH OF TEST PIT

HWA GEOSCIENCES INC.

Mason County Wastewater
Infiltration Evaluation
Mason County
Washington

LOG OF TEST PIT
TP-35

PROJECT NO.: 2006-172-22 FIGURE: 12

EXCAVATION COMPANY: S & J
EXCAVATING EQUIPMENT: Case 580 backhoe
SURFACE ELEVATION: ± Feet

LOCATION: See Figure 3
DATE COMPLETED: 7/6/07
LOGGED BY: V. Atkins

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	MOISTURE CONTENT (%)	OTHER TESTS	GROUNDWATER
0		GM	Gravelley TOPSOIL/Duff					
2		GP GM	Yellow-red sandy GRAVEL with silt, coarse sand lenses, root material, dry.					
			Yellow-gray, coarse SAND and GRAVEL, decreasing root material, dry.					
4			Red-brown SILT with very fine sand, dry.		TP-36-4			
6		GW	Yellow-gray to yellow-red fine to coarse GRAVEL with sand, occasional cobbles, dry grading moist.					
8			As above, gray sand lenses, moist.		TP-36-8	5		
10			Test pit completed to 10 feet bgs. Ground water not encountered.					
12								

NOTE: For a proper understanding of the nature of subsurface conditions, this exploration log should be read in conjunction with the text of the geotechnical report. This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

PHOTOGRAPH OF TEST PIT

HWA GEOSCIENCES INC.

Mason County Wastewater
Infiltration Evaluation
Mason County
Washington

LOG OF TEST PIT
TP-36

PROJECT NO.: 2006-172-22 FIGURE: 13

EXCAVATION COMPANY: S & J
EXCAVATING EQUIPMENT: Case 580 backhoe
SURFACE ELEVATION: ± Feet

LOCATION: See Figure 3
DATE COMPLETED: 7/6/07
LOGGED BY: V. Atkins

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	MOISTURE CONTENT (%)	OTHER TESTS	GROUNDWATER
0		GP	Red-brown sandy GRAVEL, trace silt, with cobbles to 4", well-rounded, dry.					
2			GRAVEL with coarse sand lenses, no silt, gravels imbricated, some sloughing.					
4			Decreasing sloughing.					
			Red-brown sandy GRAVEL, moist.		TP-37-5			
6		SP SM	Yellow-gray medium to coarse SAND with silt and gravel, moist.					
8					TP-37-7	7		
			Test pit completed to 9 feet bgs. Ground water not encountered.					
10								
12								

NOTE: For a proper understanding of the nature of subsurface conditions, this exploration log should be read in conjunction with the text of the geotechnical report. This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

PHOTOGRAPH OF TEST PIT

HWA GEOSCIENCES INC.

Mason County Wastewater
Infiltration Evaluation
Mason County
Washington

LOG OF TEST PIT
TP-37

PROJECT NO.: 2006-172-22 FIGURE: 14

EXCAVATION COMPANY: S & J
EXCAVATING EQUIPMENT: Case 580 backhoe
SURFACE ELEVATION: ± Feet

LOCATION: See Figure 3
DATE COMPLETED: 7/6/07
LOGGED BY: V. Atkins

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	MOISTURE CONTENT (%)	OTHER TESTS	GROUNDWATER
0		GM	Red-brown gravelly TOPSOIL/old logging road bed.					
		GP	Red-brown sandy GRAVEL, occasional cobbles, dry grading moist.					
2								
4					TP-38-4			
		SM	Yellow-red fine silty fine SAND with gravel, occasional red silt and fine sand lenses, moist.		TP-38-5	11		
6								
8			Red SILT and fine SAND, slight oxidation, moist.					
			Test pit completed to 9 feet bgs. Ground water not encountered.		TP-38-9	13		
10								
12								

PHOTOGRAPH OF TEST PIT

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HWA GEOSCIENCES INC.

Mason County Wastewater
Infiltration Evaluation
Mason County
Washington

LOG OF TEST PIT
TP-38

PROJECT NO.: 2006-172-22 FIGURE: 15

EXCAVATION COMPANY: S & J
EXCAVATING EQUIPMENT: Case 580 backhoe
SURFACE ELEVATION: ± Feet

LOCATION: See Figure 3
DATE COMPLETED: 7/6/07
LOGGED BY: V. Atkins

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	MOISTURE CONTENT (%)	OTHER TESTS	GROUNDWATER
0		GP	Dark brown GRAVEL with wood debris.					
		GP	Yellow-red sandy GRAVEL, with cobbles, root material, dense, dry.					
2								
			Occasional boulder, decreasing roots.					
4								
		GW	Yellow-red fine to coarse GRAVEL with sand and silt, gravel to 2", moist.		TP-39-5			
6								
			As above, trace silty binder on gravels, dense, moist.		TP-39-7	8		
8								
			Test pit completed to 9 feet bgs. Ground water not encountered.					
10								
12								

PHOTOGRAPH OF TEST PIT

NOTE: For a proper understanding of the nature of subsurface conditions, this exploration log should be read in conjunction with the text of the geotechnical report. This log of subsurface conditions applies only at the specified location and on the date indicated and therefore may not necessarily be indicative of other times and/or locations.

HWA GEOSCIENCES INC.

Mason County Wastewater
Infiltration Evaluation
Mason County
Washington

LOG OF TEST PIT
TP-39

PROJECT NO.: 2006-172-22 FIGURE: 16

EXCAVATION COMPANY: S & J
EXCAVATING EQUIPMENT: Case 580 backhoe
SURFACE ELEVATION: ± Feet

LOCATION: See Figure 3
DATE COMPLETED: 7/6/07
LOGGED BY: V. Atkins

DEPTH (feet)	SYMBOL	USCS SOIL CLASS.	DESCRIPTION	SAMPLE TYPE	SAMPLE NUMBER	MOISTURE CONTENT (%)	OTHER TESTS	GROUNDWATER
0		GM	Silty gravel TOPSOIL/duff.					
		GP	Yellow-red sandy GRAVEL, trace silt and root material.					
			Decreasing roots					
2			Sandy GRAVEL with medium to coarse sand lenses.					
4		GM	Yellow-red to yellow-gray sandy GRAVEL with silt/fine sand lenses.		TP-40-4	7		
		GP	Sandy GRAVEL with medium to coarse sand lenses.					
6		SP	Gray SAND and GRAVEL, decreasing gravel.					
			Gray fine to coarse SAND, medium dense, moist.		TP-40-7	6		
8								
			Test pit completed to 9 feet bgs. Ground water not encountered.					
10								
12								

PHOTOGRAPH OF TEST PIT

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HWA GEOSCIENCES INC.

Mason County Wastewater
Infiltration Evaluation
Mason County
Washington

LOG OF TEST PIT
TP-40

PROJECT NO.: 2006-172-22 FIGURE: 17

File Original and First Copy with Department of Ecology
Second Copy — Owner's Copy
Third Copy — Driller's Copy

WATER WELL REPORT

STATE OF WASHINGTON

Application No.

Permit No.

(1) OWNER: Name William Gray Address PO Box 668 Woodsport Wa 98548

(2) LOCATION OF WELL: County Mason — ¼ ¼ Sec 11 T 22 N., R. 4 W.M.

Bearing and distance from section or subdivision corner

(3) PROPOSED USE: Domestic ☑ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☐ Other ☐

(4) TYPE OF WORK: Owner's number of well (if more than one)

New well ☑ Method: Dug ☐ Bored ☐
Deepened ☐ Cable ☑ Driven ☐
Reconditioned ☐ Rotary ☐ Jetted ☐

(5) DIMENSIONS: Diameter of well 6 inches.
Drilled 40 ft. Depth of completed well 39 ft.

(6) CONSTRUCTION DETAILS:

Casing installed: 6 " Diam. from 0 ft. to 39 ft.
Threaded ☐ " Diam. from ft. to ft.
Welded ☑ " Diam. from ft. to ft.

Perforations: Yes ☐ No ☑
Type of perforator used
SIZE of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

Screens: Yes ☐ No ☑
Manufacturer's Name
Type Model No.
Diam. Slot size from ft. to ft.
Diam. Slot size from ft. to ft.

Gravel packed: Yes ☐ No ☑ Size of gravel:
Gravel placed from ft. to ft.

Surface seal: Yes ☑ No ☐ To what depth? 18 ft.
Material used in seal Bentonite
Did any strata contain unusable water? Yes ☐ No ☑
Type of water? Depth of strata
Method of sealing strata off

(7) PUMP: Manufacturer's Name Flint & Walling
Type: Sub H.P. 1/2

(8) WATER LEVELS: Land-surface elevation above mean sea level ft.
Static level 8 ft. below top of well Date 9-4-80
Artesian pressure lbs. per square inch Date
Artesian water is controlled by (Cap, valve, etc.)

(9) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? Yes ☐ No ☑ If yes, by whom?
Yield: gal./min. with ft. drawdown after hrs.
" " " "
" " " "

Recovery data (time taken as zero when pump turned off) (water level measured from well top to water level)

Time	Water Level	Time	Water Level	Time	Water Level

Date of test
Bailer test 3.5 gal./min. with 5 ft. drawdown after 1 hrs.
Artesian flow g.p.m. Date
Temperature of water Was a chemical analysis made? Yes ☐ No ☑

(10) WELL LOG:

Formation: *Describe by color, character, size of material and structure, and show thickness of aquifers and the kind and nature of the material in each stratum penetrated, with at least one entry for each change of formation.*

MATERIAL	FROM	TO
Gravelly Topsoil brown	0	3
Conglomerate "	3	15
" Permeable "	15	35
Gravel & Water blue	35	40

RECEIVED OCT 11 1980 DEPT. OF ECOLOGY

Work started 9-3, 1980 Completed 9-5, 1980

WELL DRILLER'S STATEMENT:

This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.

NAME Cascadia Drilling Co (Person, firm, or corporation) (Type or print)

Address Shelton Wash

[Signed] Frank B Swope (Well Driller)

License No. 0477 Date 9-9, 1980

(USE ADDITIONAL SHEETS IF NECESSARY)

ECY 050-1-20

The Department of Ecology does NOT Warranty the Data and/or the Information on this Well Report.

APPENDIX B

LABORATORY TESTING

APPENDIX B

LABORATORY TESTING

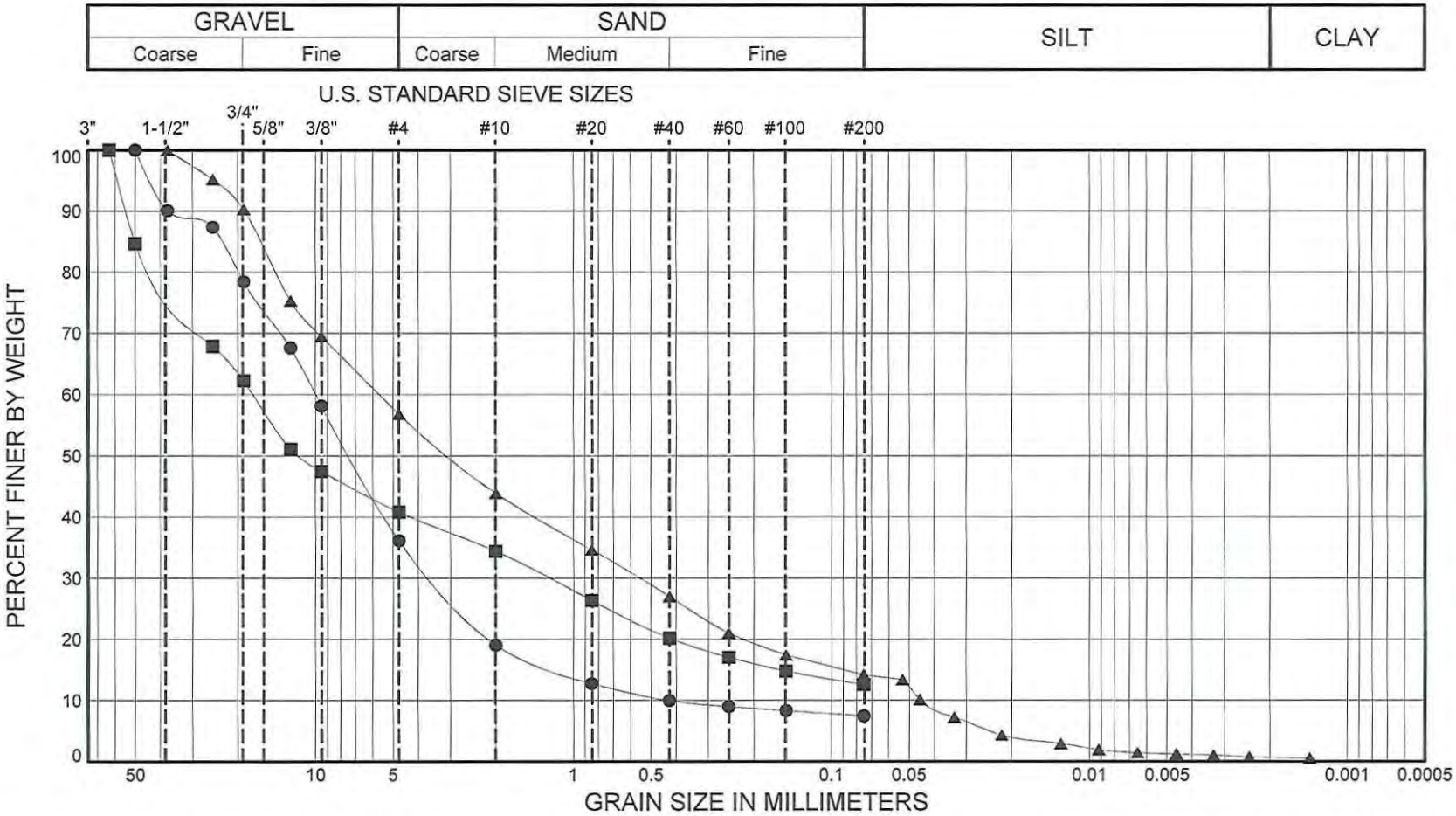
Representative soil samples obtained from the borings were returned to the HWA laboratory for further examination and testing. Laboratory tests were conducted on selected soil samples to characterize certain properties of the on-site soils. Laboratory tests, as described below, included determination grain size distribution.

MOISTURE CONTENT

The natural moisture contents of selected samples were determined in general accordance with ASTM D 2216. The results are plotted at the sampled intervals on the exploration log as appropriate.

GRAIN SIZE ANALYSIS

The grain size distribution of selected soil samples was determined in general accordance with ASTM D 422. Grain size distribution curves for the tested samples are presented in figures B-1 through B-5.



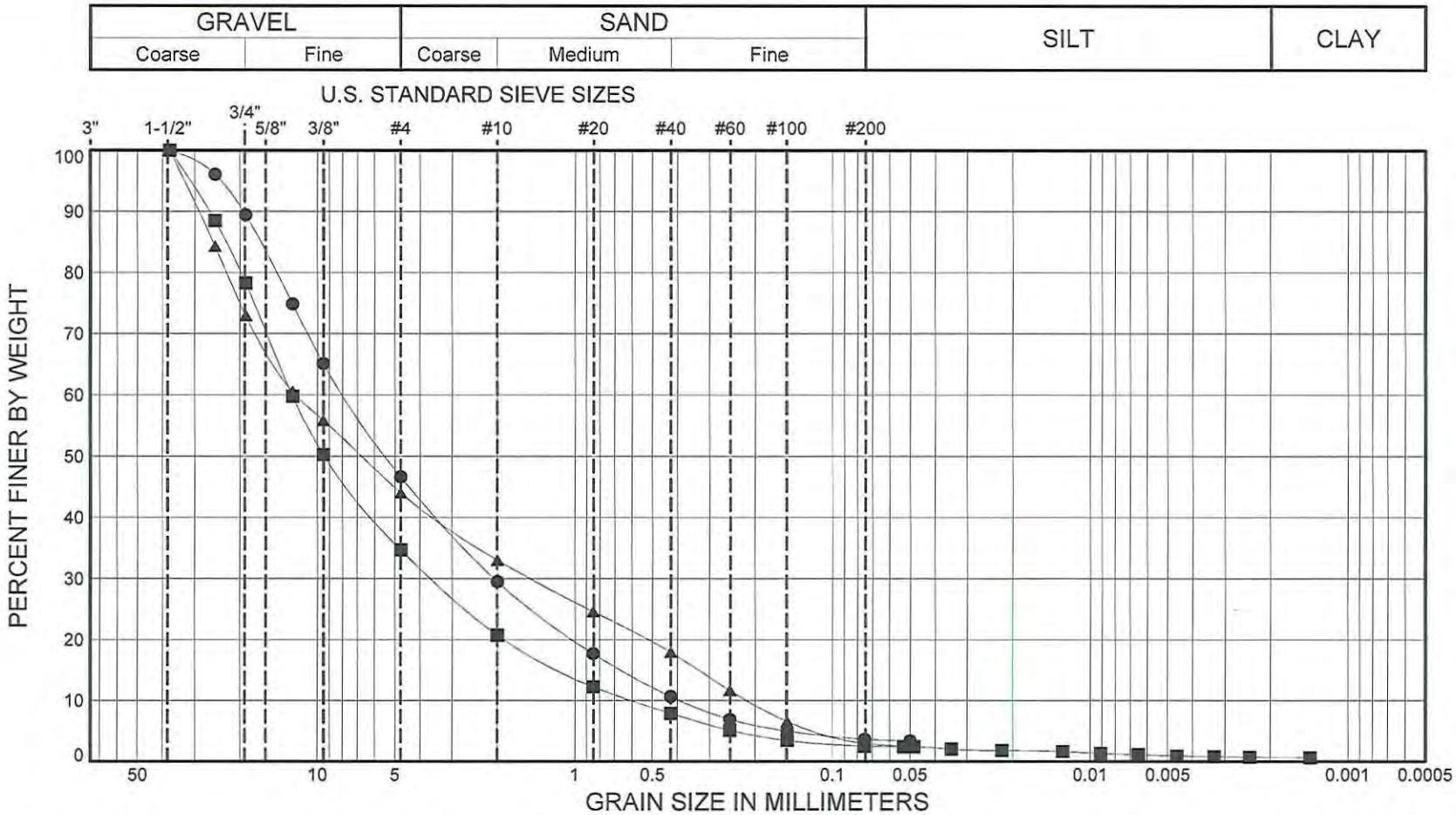
SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	TP-16	TP-16-6		(GW-GM) Light yellowsih brown, well graded GRAVEL with silt and sand	6				63.9	28.7	7.5
■	TP-17	TP-17-8		(GM) Brown, silty GRAVEL with sand	7				59.2	28.2	12.6
▲	TP-31	TP-31-10		(GM) Dark brown, silty GRAVEL with sand	9				43.2	42.6	14.2

HWA GEOSCIENCES INC.

Mason County Wastewater
Infiltration Evaluation
Mason County
Washington

PARTICLE-SIZE ANALYSIS
OF SOILS
METHOD ASTM D422

PROJECT NO.: 2006-172-22 FIGURE: 1



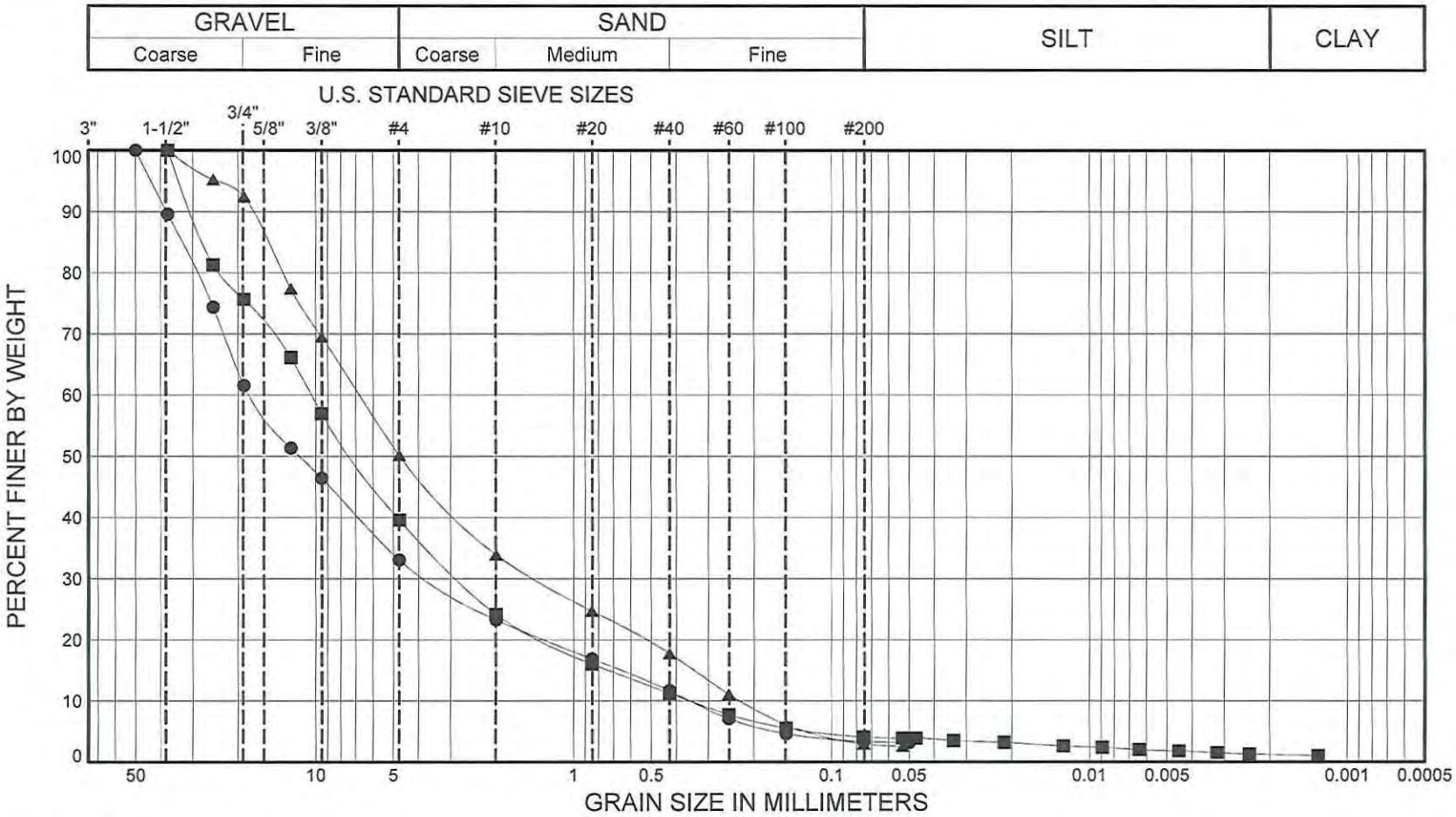
SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	TP-32	TP-32-6		(GW) Reddish brown, well graded GRAVEL with sand	6				53.4	43.0	3.6
■	TP-33	TP-33-5		(GW) Reddish brown, well graded GRAVEL with sand	4				65.3	32.2	2.5
▲	TP-33	TP-33-7		(GP) Brown, poorly graded GRAVEL with sand	5				56.0	41.1	2.9

HWA GEOSCIENCES INC.

Mason County Wastewater
Infiltration Evaluation
Mason County
Washington

PARTICLE-SIZE ANALYSIS
OF SOILS
METHOD ASTM D422

PROJECT NO.: 2006-172-22 FIGURE: 2



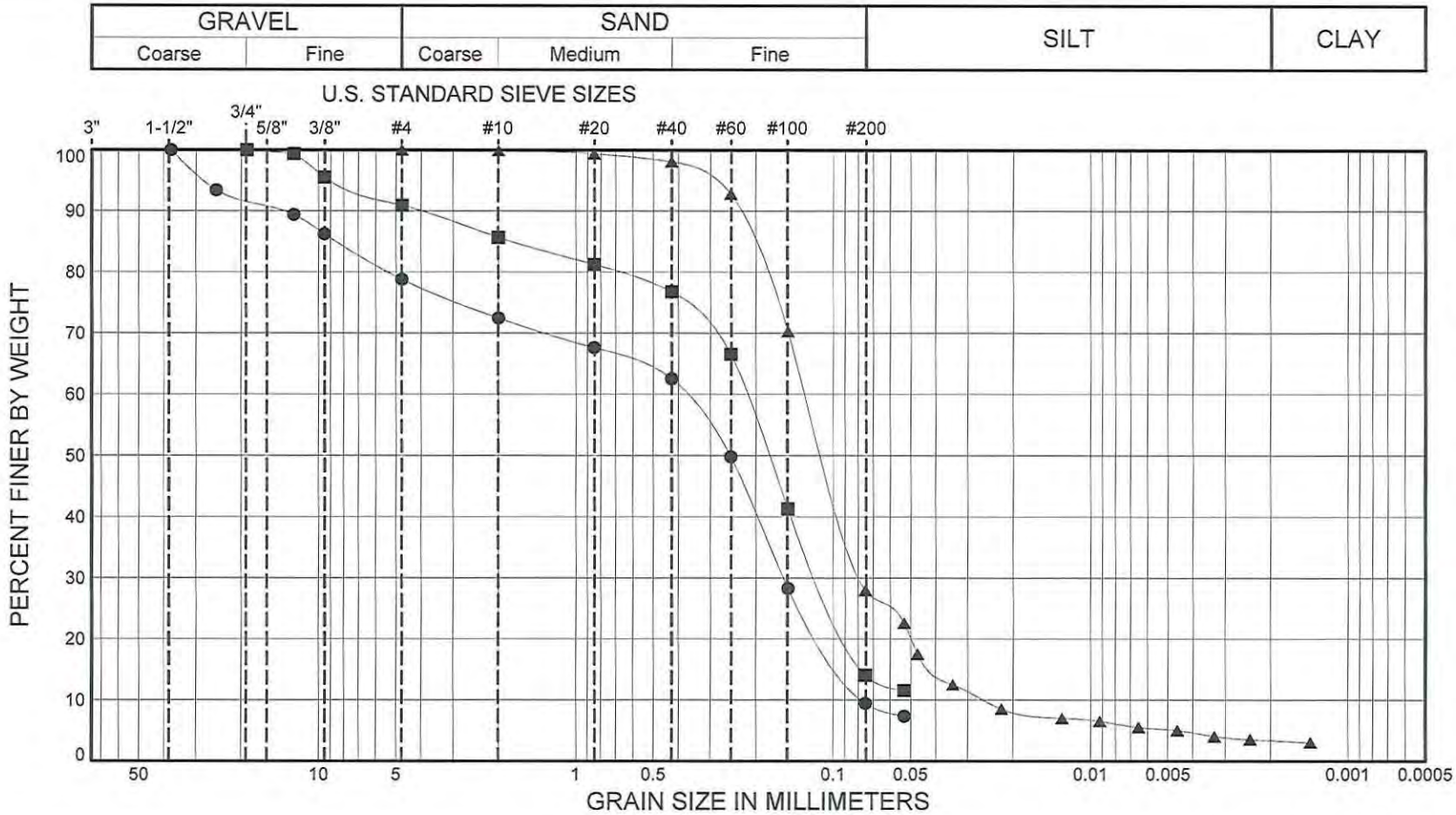
SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	TP-34	TP-34-9		(GW) Reddish brown, well graded GRAVEL with sand	5				66.9	29.7	3.3
■	TP-35	TP-35-8		(GW) Reddish brown, well graded GRAVEL with sand	4				60.4	35.5	4.1
▲	TP-36	TP-36-8		(GW) Dark grayish brown, well graded GRAVEL with sand	5				49.9	47.2	2.9

HWA GEOSCIENCES INC.

Mason County Wastewater
Infiltration Evaluation
Mason County
Washington

PARTICLE-SIZE ANALYSIS
OF SOILS
METHOD ASTM D422

PROJECT NO.: 2006-172-22 FIGURE: 3



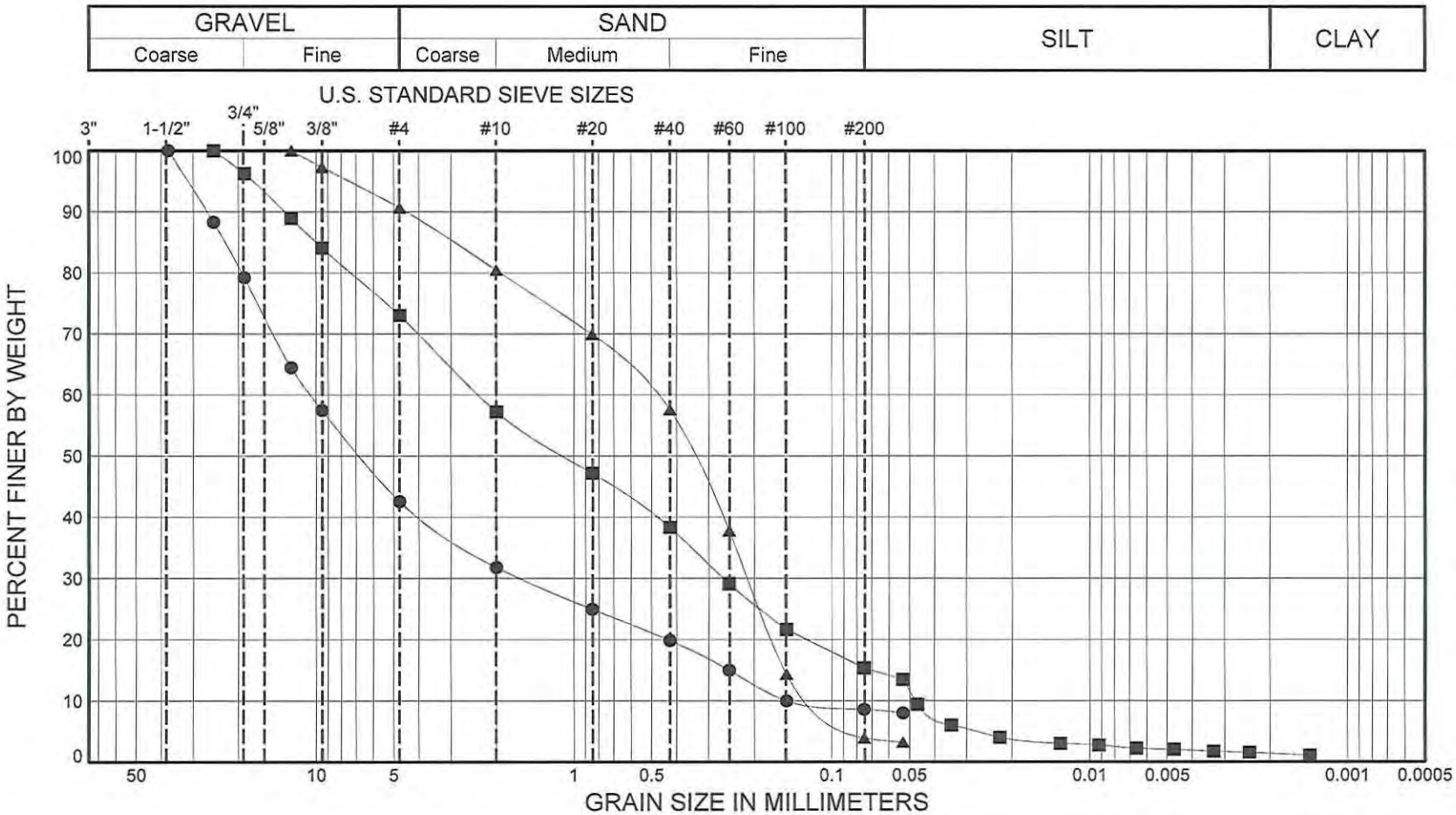
SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	TP-37	TP-37-7		(SP-SM) Olive brown, poorly graded SAND with silt and gravel	7				21.2	69.3	9.4
■	TP-38	TP-38-5		(SM) Reddish brown, silty SAND	11				9.1	76.8	14.1
▲	TP-38	TP-38-9		(SM) Reddish brown, silty SAND	13				0.0	72.0	28.0

HWA GEOSCIENCES INC.

Mason County Wastewater
Infiltration Evaluation
Mason County
Washington

PARTICLE-SIZE ANALYSIS
OF SOILS
METHOD ASTM D422

PROJECT NO.: 2006-172-22 FIGURE: 4



SYMBOL	SAMPLE		DEPTH (ft)	CLASSIFICATION OF SOIL- ASTM D2487 Group Symbol and Name	% MC	LL	PL	PI	Gravel %	Sand %	Fines %
●	TP-39	TP-39-7		(GW-GM) Brown, well graded GRAVEL with sand and silt	8				57.5	34.0	8.6
■	TP-40	TP-40-4		(SM) Light reddish brown, silty SAND with gravel	7				27.0	57.7	15.4
▲	TP-40	TP-40-7		(SP) Dark olive brown, poorly graded SAND	6				9.4	86.8	3.9

HWA GEOSCIENCES INC.

Mason County Wastewater
Infiltration Evaluation
Mason County
Washington

PARTICLE-SIZE ANALYSIS
OF SOILS
METHOD ASTM D422

PROJECT NO.: 2006-172-22 FIGURE: 5

APPENDIX E

PRELIMINARY GRINDER PUMP MODELING RESULTS

Preliminary Grinder Pump Modeling Results

Section of Main	Length of Main (Feet)	Pipe Size (Inches)	Min Scouring Velocity (Feet/Sec)	Accumulated Friciton Loss (Feet)	Lowest Pump Elevation (Feet)	Total Dynamic Head (Feet)
South End of HWY 101	800	1.25-2.00	2.92	71	15	86
South of Cederdale Lane on HWY 101	1700	1.25	2	45	8	50
Cederdale Lane	1500	1.5-2.00	2.92	79	120	-11
Cederdale Lane to Old Mill Hill Road on HWY 101	750	3.00	2.24	22	25	27
Old Mill Hill Road	500	1.5-2.00	2	55	100	-23
Trout Pond Lane	650	1.5-2.00	3.04	53	90	-7
W. Side of HWY 101 S. of Downtown	1700	1.25-2.00	2.92	63	8	85
W. Side of HWY 101 Downtown Area	1400	1.25-3.00	2.24	50	8	71
E. Side of HWY 101 Downtown Area	600	4.00	2.44	12	8	32
Schoolhouse Road	600	1.5-3.00	2.24	23	230	-15
E. Side of HWY 101 Schoolhouse Road to Finch Creek Road	700	4.00	2.17	14	10	36
Finch Creek Road	3625	1.5-4	3.04	17	20	137
N. Hill Road	600	1.5-3	3.04	23.48	9	133

APPENDIX F

SEWER SYSTEM CAPITAL AND O&M COST ESTIMATES

Hoodsport RAC Service Area
Grinder Pump Collection System Cost Estimate
Jul-07

Construction:

	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1.	Mobilization Demobilization	1	LS	$180,000	$180,000
2.	Traffic Control	1	LS	$25,000	$25,000
3.	4-Inch Pressure Sewer	2,000	LF	$37	$74,000
4.	3-Inch Pressure Sewer	7,350	LF	$32	$235,200
5.	2-Inch Pressure Sewer	7,150	LF	$28	$200,200
6.	1.5-Inch Pressure Sewer	1,650	LF	$20	$33,000
7.	1.25-Inch Pressure Sewer	3,550	LF	$20	$71,000
8.	Grinder P.S.'s with CP: Residential and Comm. Equilvalent	178	EA	$8,250	$1,468,500
9.	Grinder P.S.'s with CP: Commercial	7	EA	$18,000	$126,000
10.	Service Laterals	185		$600	$111,000
10.	Side Sewer Stubs	30	EA	$600	$18,000
11.	Mainline Cleanouts	12	EA	$1,800	$21,600
12.	Air Vacuum Assemblies	3	EA	$4,500	$13,500
13.	Abandon Septic Tanks	184	EA	$1,100	$202,400
14.	Creek Crossings	3	EA	$15,000	$45,000
15.	Restoration	1	LS	$220,000	$220,000

Engineer's Estimate	$3,044,400
Contingency 15%	$456,660
8.3% Sales Tax	$290,588
Construction Cost	$3,791,648

Operation and Maintenance:

	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1.	Administration	1	LS	$10,000	$10,000
2.	Res. Grinder Pump Repair and Maint.	177	EA	$84	$14,868
3.	Comm. Grinder Pump Repair and Maint.	7	EA	$168	$1,176
4.	Sewer Pipe	3.2	MI	$3,000	$9,540
	Annual Operation and Maintenance Cost Estimate				$35,584

Hoodsport RAC Service Area
STEP Pump Collection System Cost Estimate
Jul-07

Construction:

	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1.	Mobilization Demobilization	1	LS	$180,000	$180,000
2.	Traffic Control	1	LS	$25,000	$25,000
3.	4-Inch Pressure Sewer	2,000	LF	$37	$74,000
4.	3-Inch Pressure Sewer	7,350	LF	$32	$235,200
5.	2-Inch Pressure Sewer	7,150	LF	$30	$214,500
6.	1.5-Inch Pressure Sewer	1,650	LF	$20	$33,000
7.	1.25-Inch Pressure Sewer	3,550	LF	$20	$71,000
8.	STEP P.S.'s with CP: Residential and Comm. Equilvalent	178	EA	$8,000	$1,424,000
9.	STEP P.S.'s with CP: Commercial	7	EA	$18,000	$126,000
10.	Side Sewer Stubs	30	EA	$1,200	$36,000
11.	Mainline Cleanouts	12	EA	$1,800	$21,600
12.	Air Vacuum Assemblies	3	EA	$4,500	$13,500
13.	Abandon Septic Tanks	184	EA	$1,200	$220,800
14.	Creek Crossings	3	EA	$15,000	$45,000
15.	Restoration	1	LS	$220,000	$220,000

Engineer's Estimate	$2,939,600
Contingency 15%	$440,940
8.3% Sales Tax	$280,585
Construction Cost	$3,661,125

Operation and Maintenance:

	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1.	Administration	1	LS	$12,500	$12,500
2.	Res. STEP Pump Repair and Maint.	177	EA	$60	$10,620
3.	Comm. STEP Pump Repair and Maint.	7	EA	$120	$840
4.	STEP Pumping	184	EA	$70	$12,880
5.	Sewer Pipe	3.2	MI	$3,000	$9,540
	Annual Operation and Maintenance Cost Estimate				$46,380

Hoodsport RAC Service Area
STEG/STEP Collection System Cost Estimate
Jul-07

Construction:

	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1.	Mobilization Demobilization	1	LS	$180,000	$180,000
2.	Traffic Control	1	LS	$25,000	$25,000
3.	4-Inch Gravity w/Fittings	6,300	LF	$37	$233,100
4.	4-Inch Pressure Sewer	2,000	LF	$37	$74,000
5.	3-Inch Pressure Sewer	4,400	LF	$32	$140,800
6.	2-Inch Pressure Sewer	4,450	LF	$30	$133,500
7.	1.5-Inch Pressure Sewer	1,000	LF	$20	$20,000
8.	1.25-Inch Pressure Sewer	3,550	LF	$20	$71,000
9.	STEG Tanks	94	EA	$5,000	$470,000
10.	STEP P.S.'s with CP: Residential and Comm. Equilvalent	86	EA	$8,000	$688,000
11.	STEP P.S.'s with CP: Commercial	5	EA	$20,000	$100,000
12.	Side Sewer Stubs	30	EA	$1,200	$36,000
13.	Mainline Cleanouts	12	EA	$1,800	$21,600
14.	Abandon Septic Tanks	184	EA	$1,200	$220,800
15.	Lift Station: N of Finch Creek	1	LS	$160,000	$160,000
16.	Lift Station: Old Mill Hill Rd/Hwy 101	1	LS	$160,000	$160,000
17.	Air Vacuum Assemblies	2	EA	$4,500	$9,000
18.	Creek Crossings	3	EA	$15,000	$45,000
19.	Restoration	1	LS	$220,000	$220,000

Engineer's Estimate	$3,007,800
Contingency 15%	$451,170
8.3% Sales Tax	$287,095
Construction Cost	$3,746,065

Operation and Maintenance:

	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1.	Administration	1	LS	$12,500	$12,500
2.	Res. STEP Pump Repair and Maint.	86	EA	$60	$5,160
3.	Comm. STEP Pump Repair and Maint.	5	EA	$120	$600
4.	Tank Pumping	184	EA	$70	$12,880
5.	Labor: Lift Stations	300	HR	$35	$10,500
6.	Power: Lift Stations	1,000	kWH	$0.07	$70
4.	Sewer Pipe	3.2	MI	$3,000	$9,540
	Annual Operation and Maintenance Cost Estimate				$51,250