Figure
2.01

Figure 2.01
Hoodsport
Rural Activity Center (RAC)

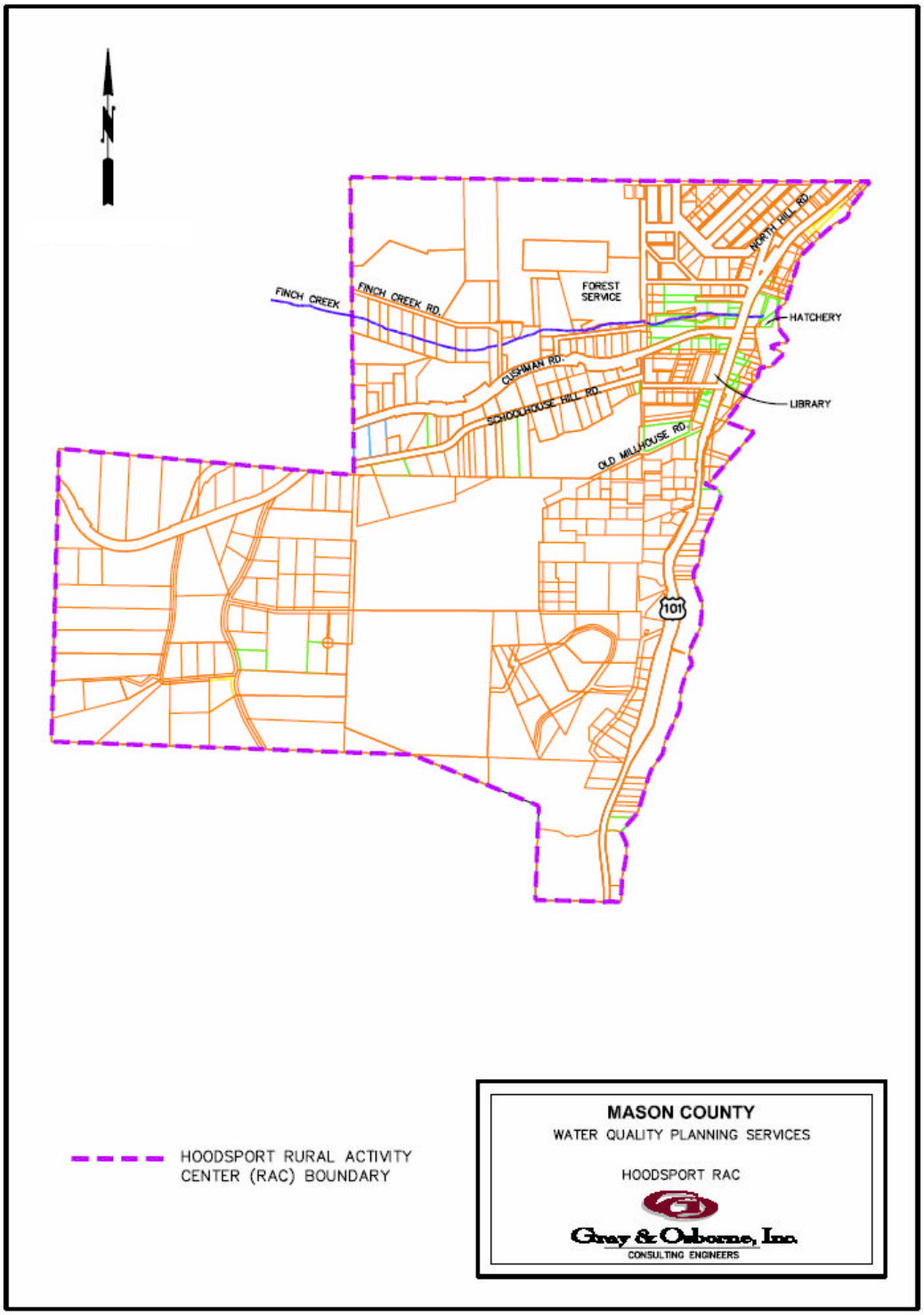

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Figure
2.02

Figure 2.02
Hoodsport
Service Area 1 Alternative

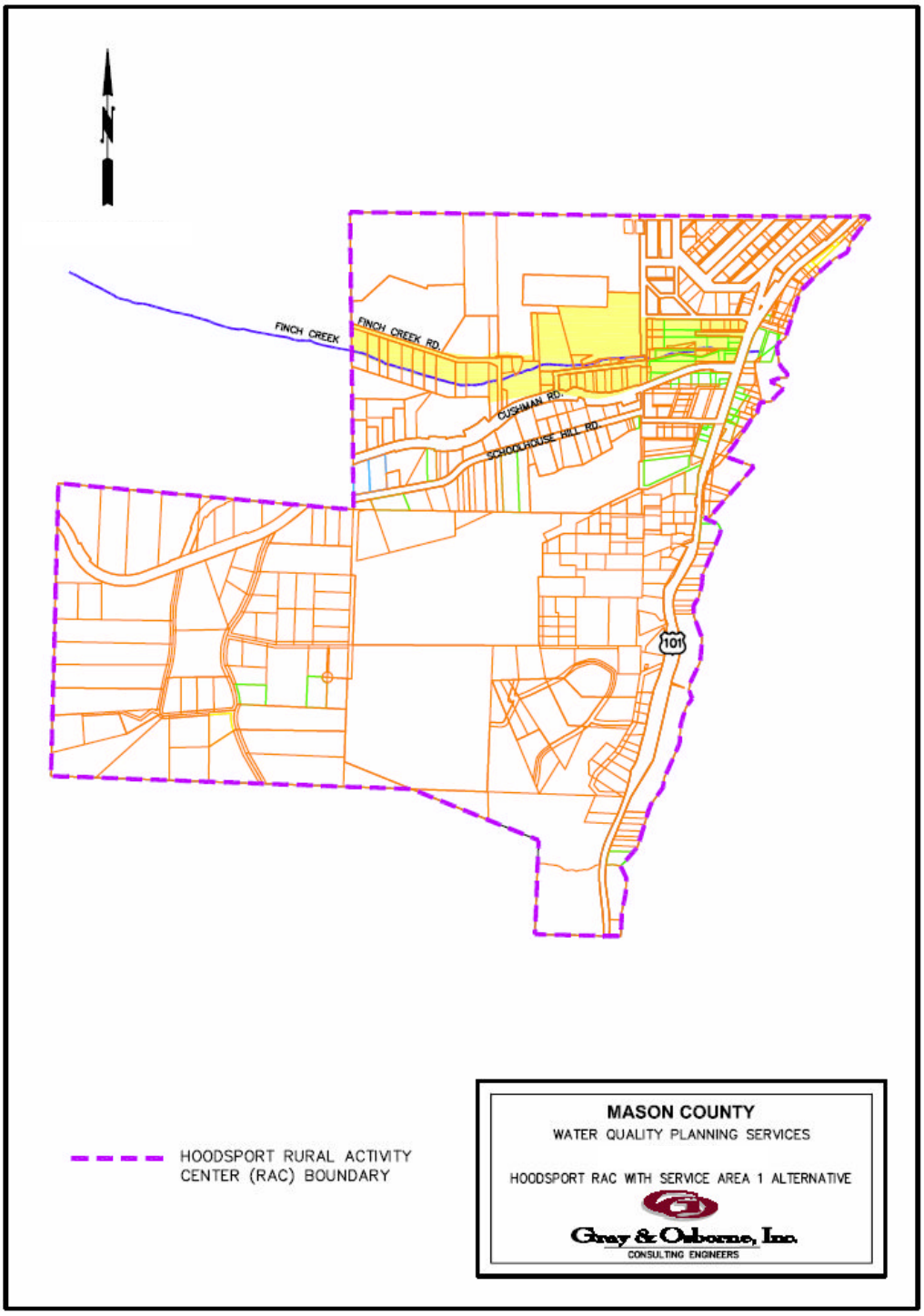

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Figure
2.03

Figure 2.03
Hoodsport
Service Area 2 Alternative

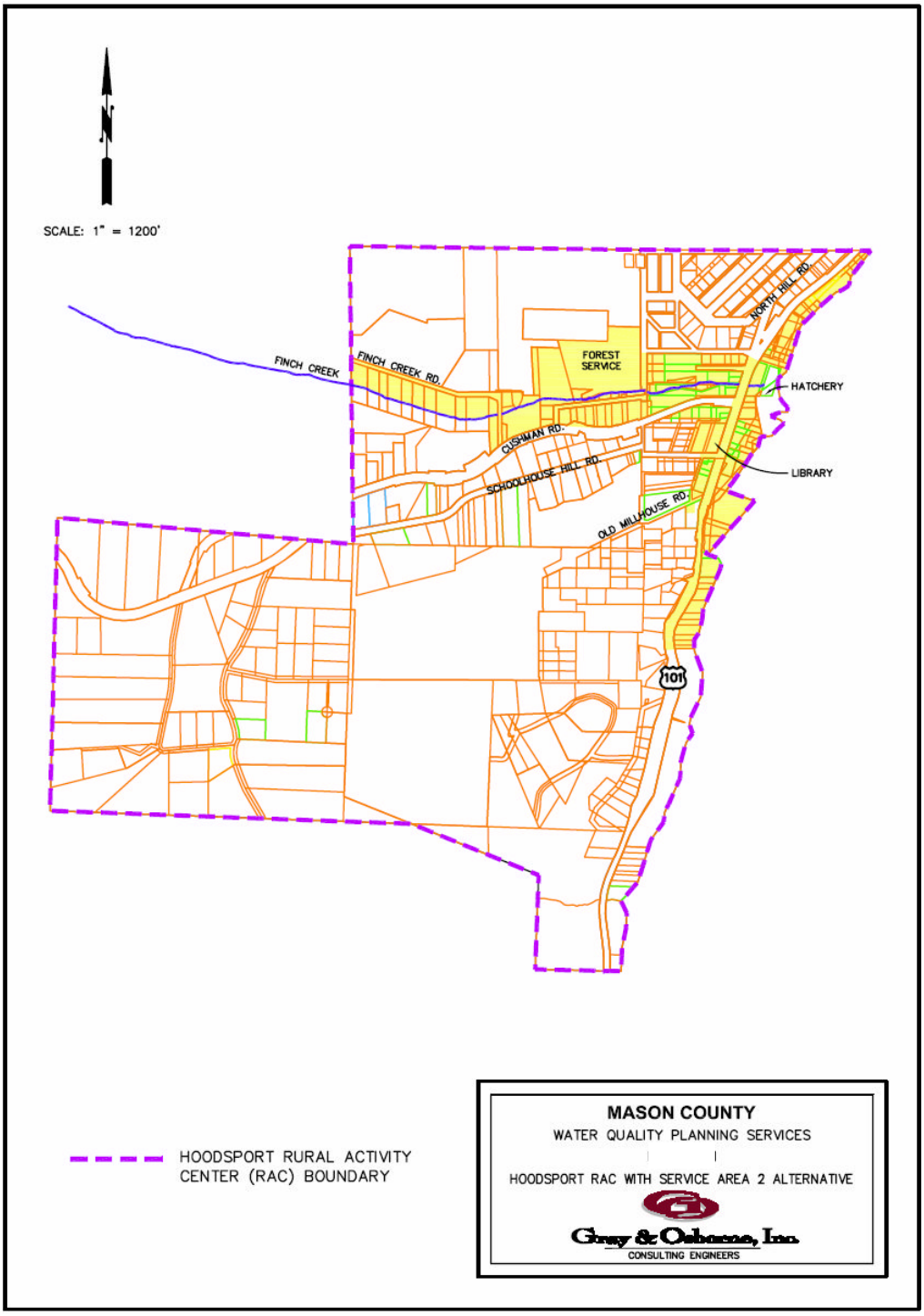

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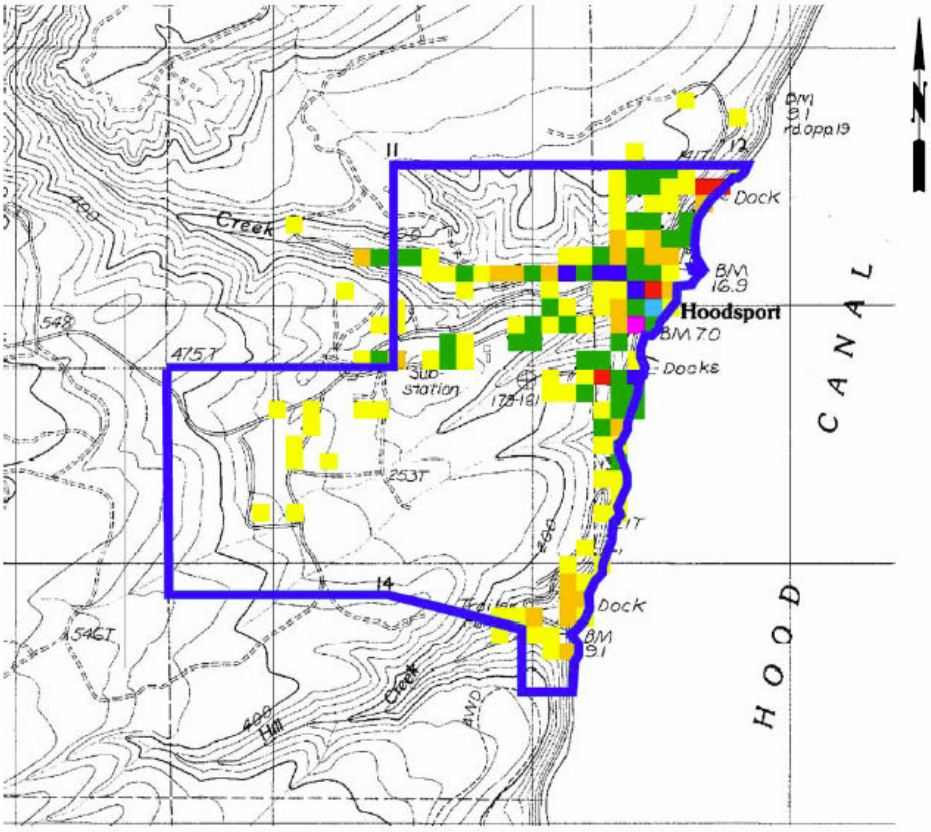
Figure
2.04

Figure 2.04
Hoodsport
Population Density



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
WATER QUALITY PLANNING SERVICES

POPULATION DENSITY

Gray & Osborne, Inc.
CONSULTING ENGINEERS

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Figure
2.05

Figure 2.05
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).

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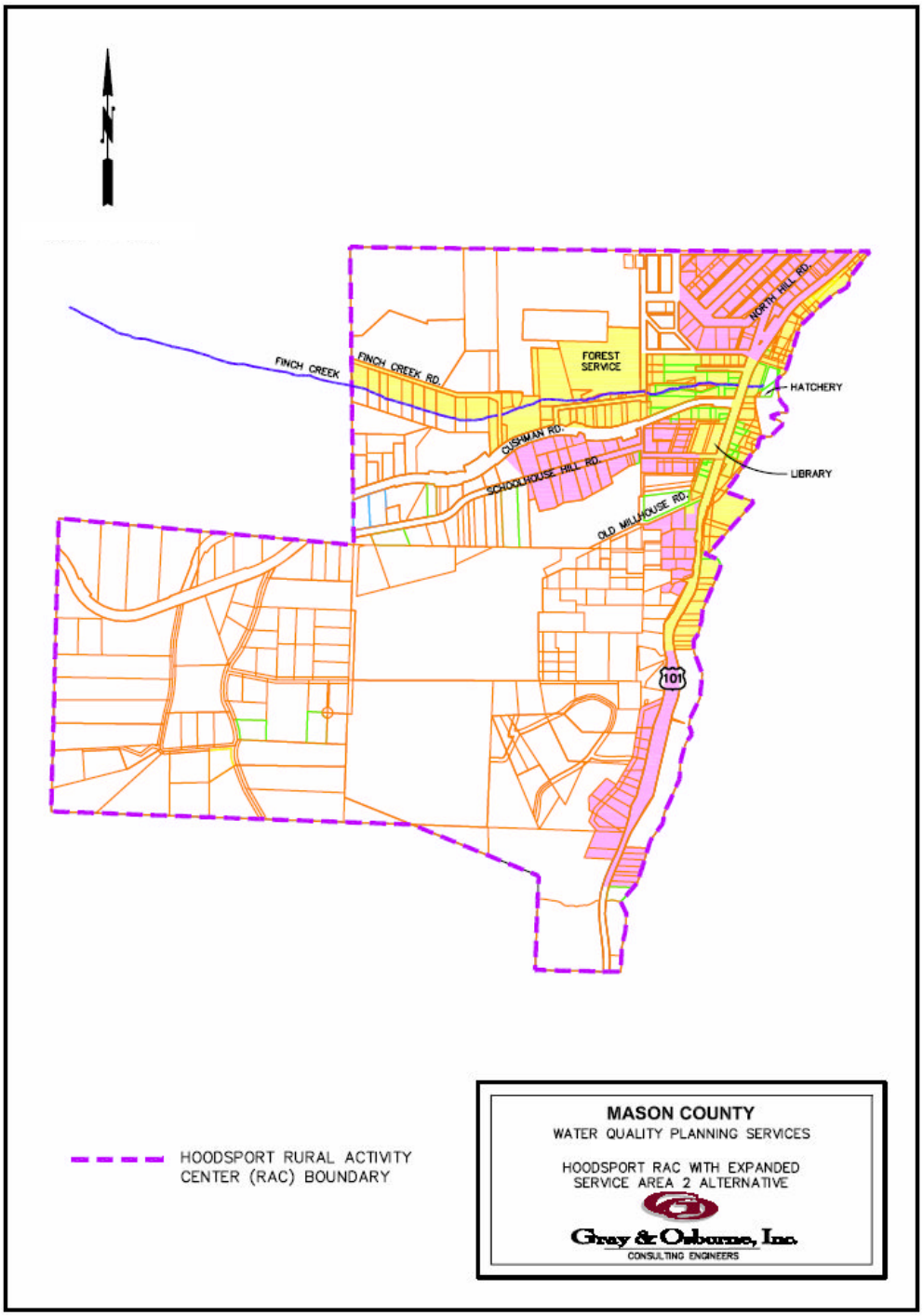
Figure 2.06

Hoodsport
Expanded Service Area 2 Alternative



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Figures
2.07
a, b, c

Figure 2.07a
Existing Population

Area	Existing Population
Service Area 1	62 (1)
Service Area 2	139 (2)
Expanded Service Area 2	346 (3)
Hoodsport RAC	642 (4)

(1) Table 6-3, *Finch Creek Wastewater Feasibility Study* (August 2000).
(2) Table 6-3, *Finch Creek Wastewater Feasibility Study* (August 2000).
(3) (83 residences x 2.49 ppc) + 139 population for Service Area 2 = 346.
(4) Table 3-5, *Hoodsport-Skokomish Wastewater Management Alternatives Analysis* (October 2006)

Figure 2.07b
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**

Figure 2.07c
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.

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Figure 2.08

Figure 2.08
Unit Flows and Loading Values

	Report Alternatives Analysis	Finch Creek Study (1)
Flows: Residential		
Average Per Capita Flow, gpcd	65	90
Maximum Month Flow, gpcd	80	135
Peaking Factors		
Maximum Day to Average Day	2.0	2.0
Peak Hourly to Average Day	3.5	—
Flows: Commercial		
Equivalent Residential Unit (ERU), gpd	200	198
Restaurant	50 gpd/seat	—
Motel	65 gpd/room	—
Peaking Factors		
Maximum Month to Average Day	1.25	2.0
Maximum Day to Average Day	2.0	2.4
Peak Hourly to Average Day	3.5	—
Loadings: Residential		
BOD_5, lbs/capita/day	0.18	0.2
TSS, lbs/capita/day	0.20	0.2
TKN, lbs/capita/day	0.029	50 mg/L
Peaking Factors		
Maximum Month to Average Day	1.25	1.5
Peak Day to Average Day	—	2.0
Loadings: Commercial		
BOD_5, lbs/ERU/day	0.45	0.43
TSS, lbs/ERU/day	0.50	0.43
TKN, lbs/ERU/day	0.072	0.077
Restaurant	0.2 lbs/day/seat for BOD_5 and TSS; 0.032 lbs/day/seat for TKN	0.2 lbs/day/seat for BOD_5 and TSS
Motel	0.26 lbs/day/room for BOD_5 and TSS; 0.042 lbs/day/room for TKN	0.26 lbs/day/room for BOD_5 and TSS
Peaking Factors		
Maximum Month to Average Day	1.25	2.0
Peak Day to Average Day	—	2.4

(1) Service Area 2. For Service Area 1, the design criterion for flow was 360 gpd per bedroom.

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Figure
2.09

Figure 2.09
Existing Flows and Loadings Estimates

	Hoodsport RAC	*Service Area 2*	*Expanded Service Area 2*
Wastewater Flows:			
Average Flow, gpd	48,697	16,002	29,652
Maximum Month Flow, gpd	59,935	19,695	36,495
Maximum Daily Flow, gpd	97,394	32,004	59,304
Peak Hour Flow, gpd	170,439	56,006	103,782
Wastewater Loadings:			
BOD_5:			
Average, lbs/day	142	54	92
Maximum Month, lbs/day	178	68	115
TSS:			
Average, lbs/day	155	55	97
Maximum Month, lbs/day	194	69	121
TKN:			
Average, lbs/day	23	8	14
Maximum Month, lbs/day	29	10	18

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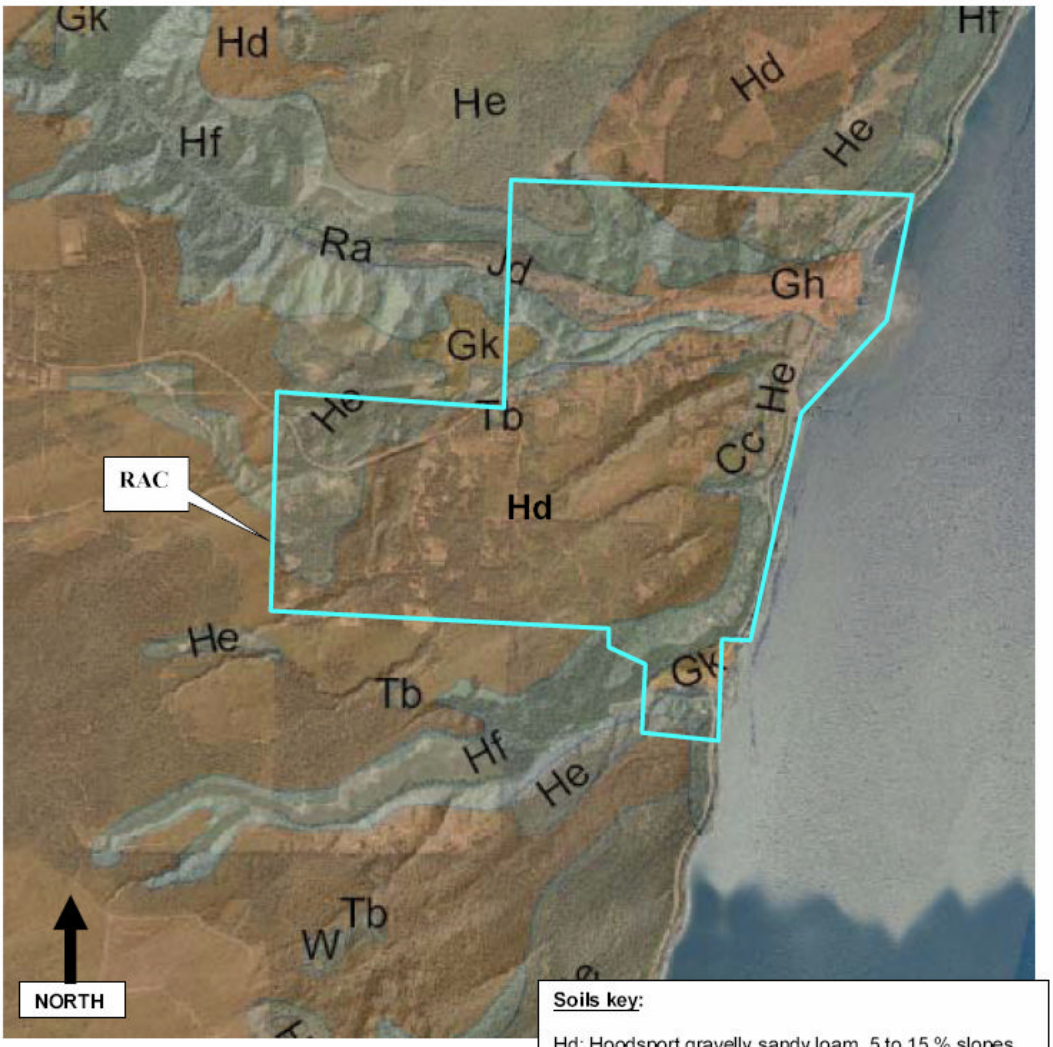
Figure
2.10

Figure 2.10
Soils Map



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. O., 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

PROJECT NO.
2006-172

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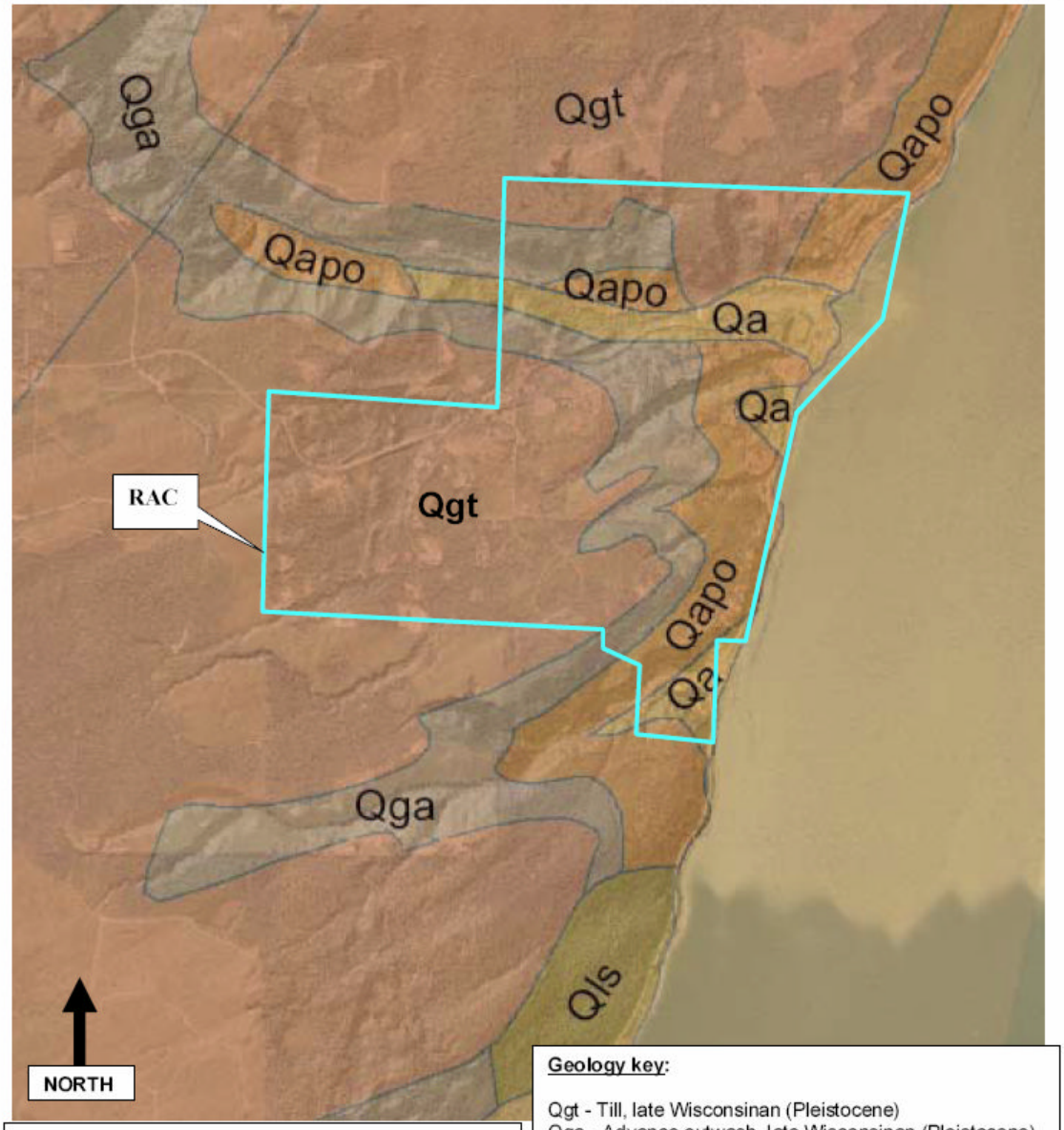
Figure
2.11

Figure 2.11
Geologic Map (Logan)



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 outw
Wisconsinan (Pleistocene)
Qapo - Alpine outwash, pre–late Wisconsinan
(Pleistocene)
Qa - Alluvium (Holocene)

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GEOLOGIC MAP (Logan, 2003)

MASON COUNTY
WATER QUALITY PROJECT PLANNING
HOODSPORT RURAL ACTIVITY CENTER

FIGURE NO.

PROJECT NO.
2006-172

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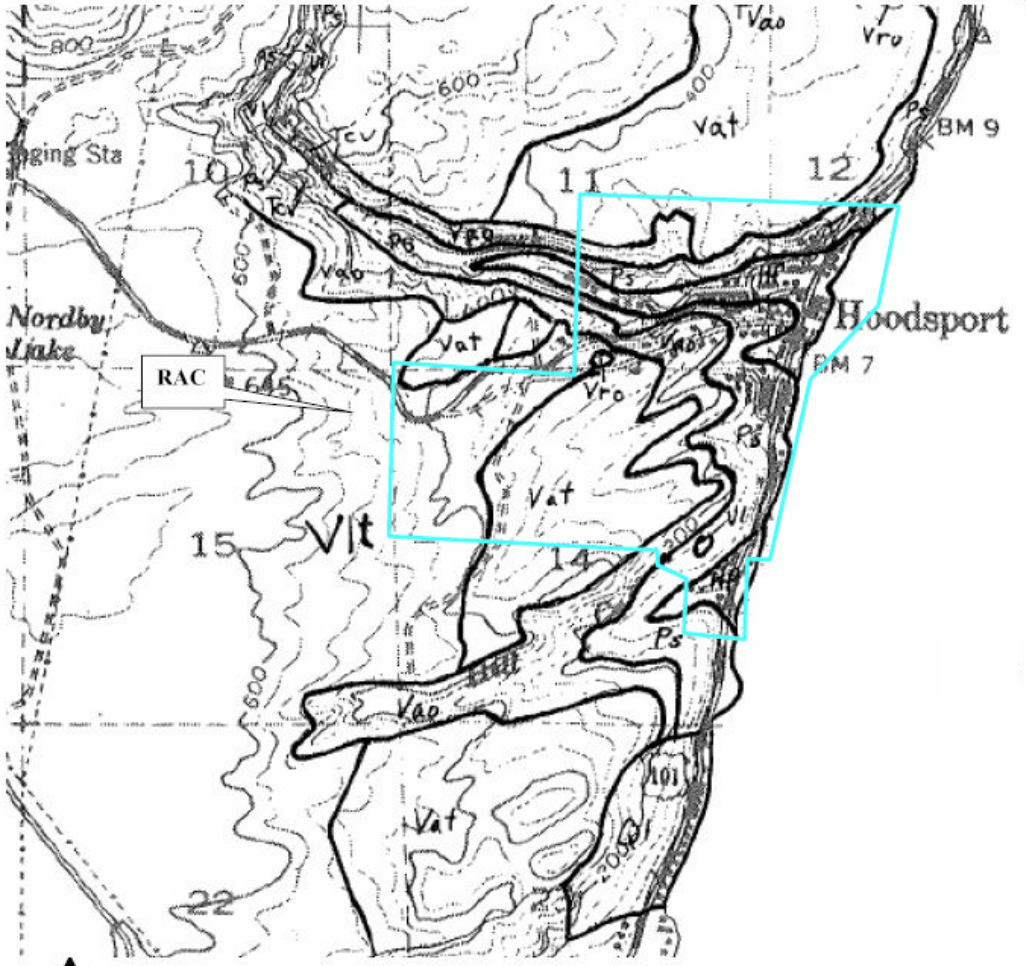
Figure
2.12

Figure 2.12
Geologic Map (Carson)



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.

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

HWA GEOSCIENCES INC.

GEOLOGIC MAP (Carson, 1976)

MASON COUNTY
WATER QUALITY PROJECT PLANNING
HOODSPORT RURAL ACTIVITY CENTER

PROJECT NO.
2006-172

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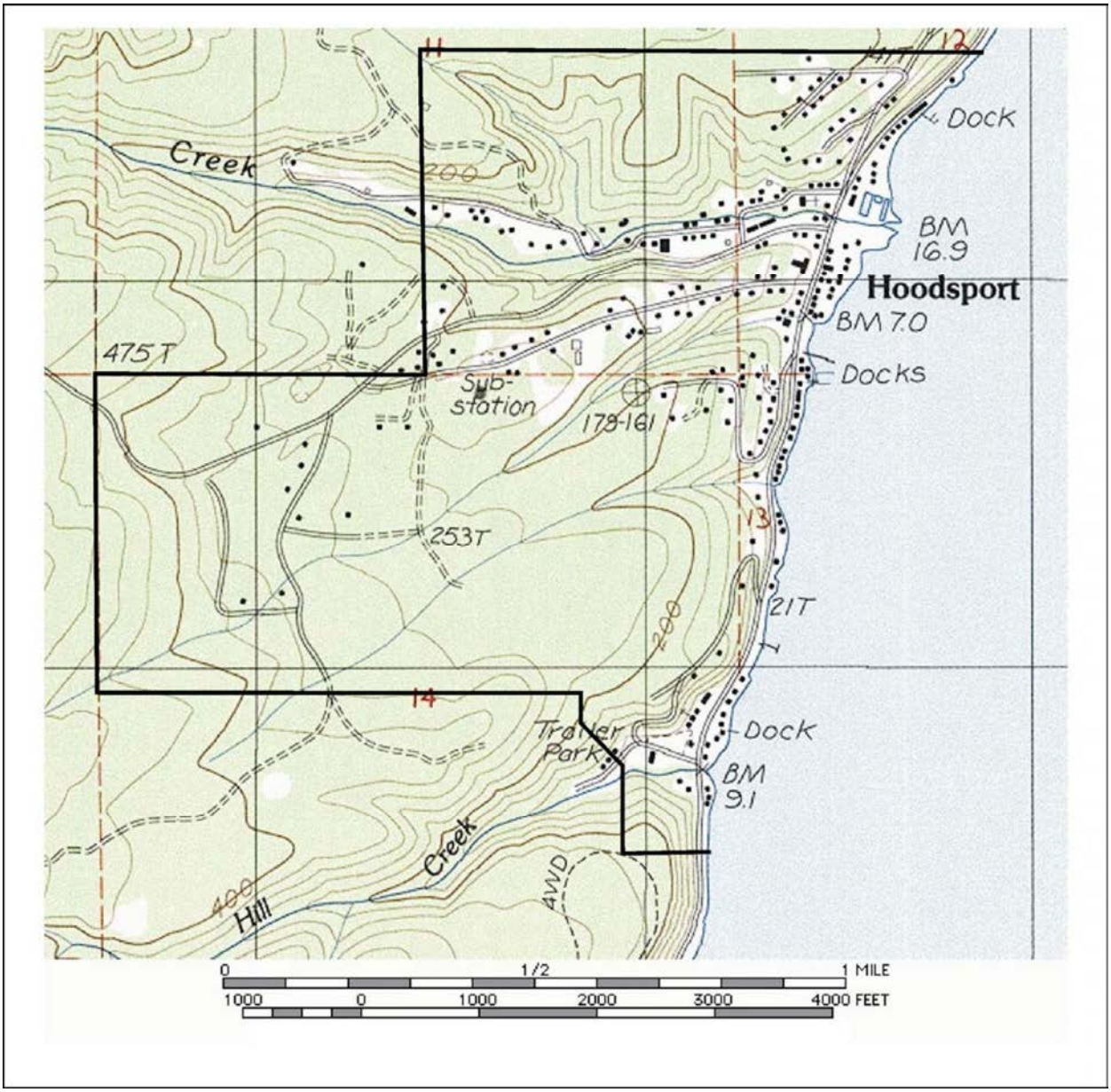
Figure
2.13

Figure 2.13



The Hoodsport RAC, Mason County, Washington

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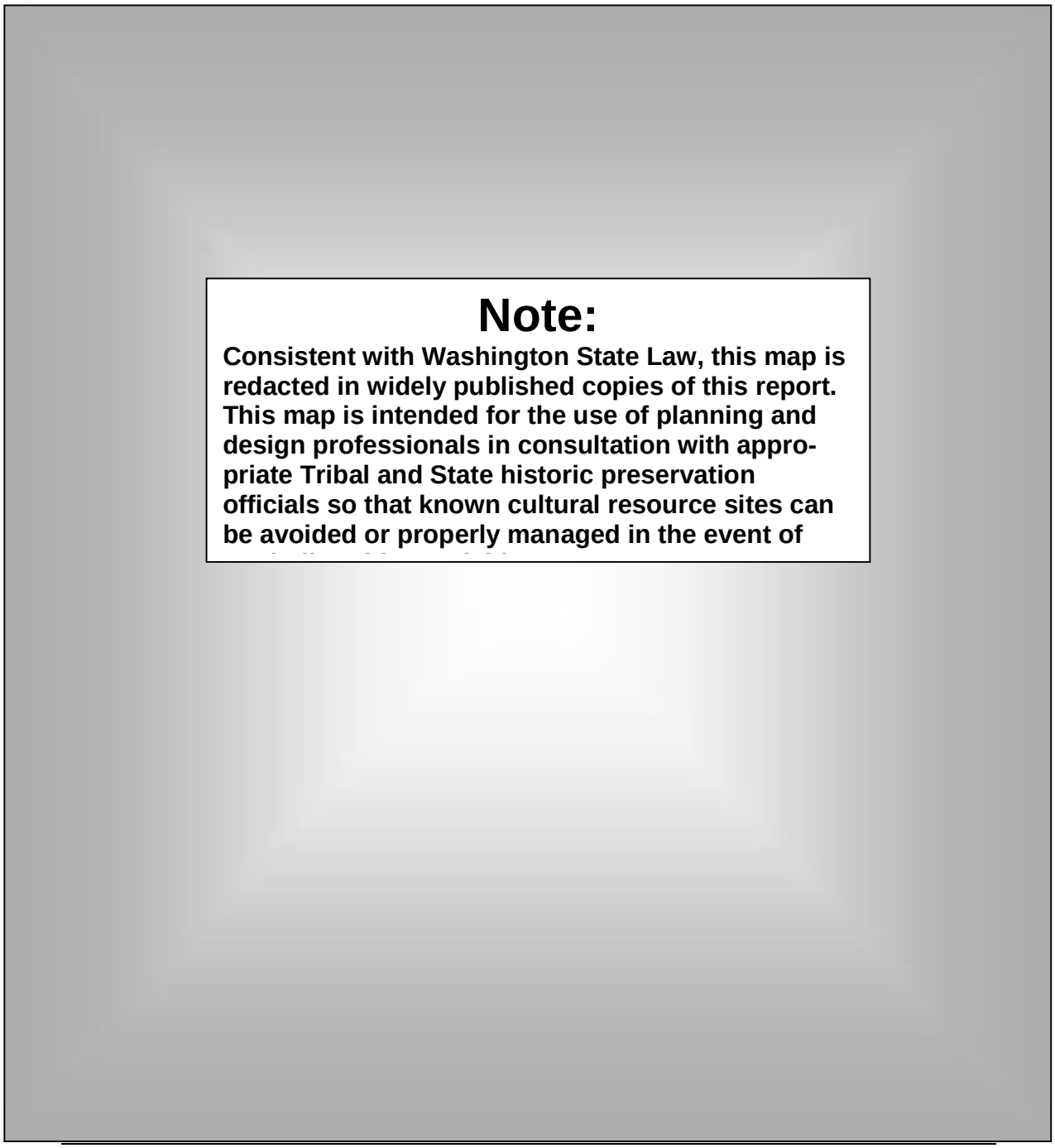
Figure
2.14

Figure 2.14



Ethnographic sites in the Hoodsport RAC, Mason County, Washington

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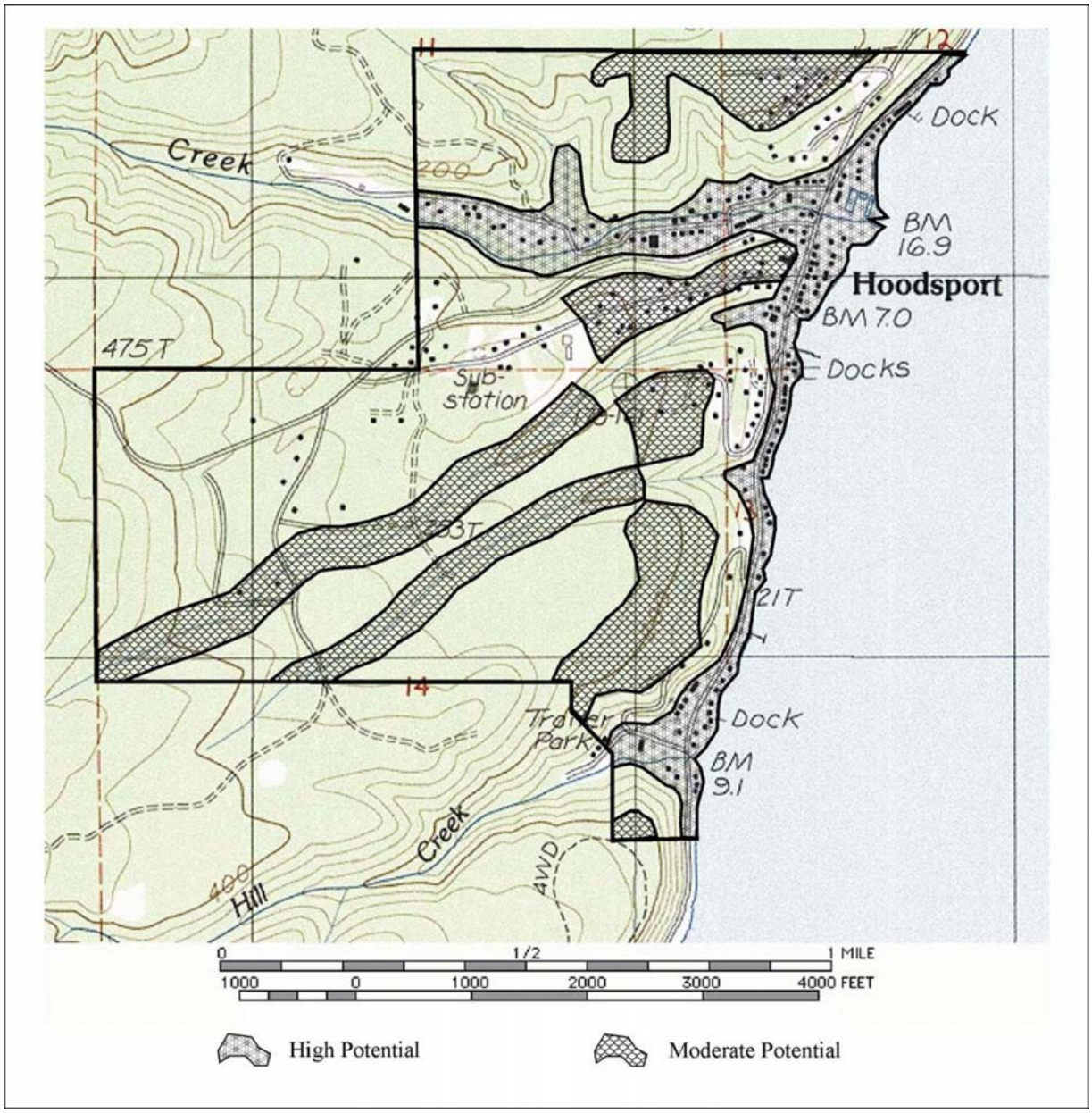
Figure
2.15

Figure 2.15



Archaeological Potentially Sensitive Zones in the Hoodsport RAC,
Mason County, Washington.

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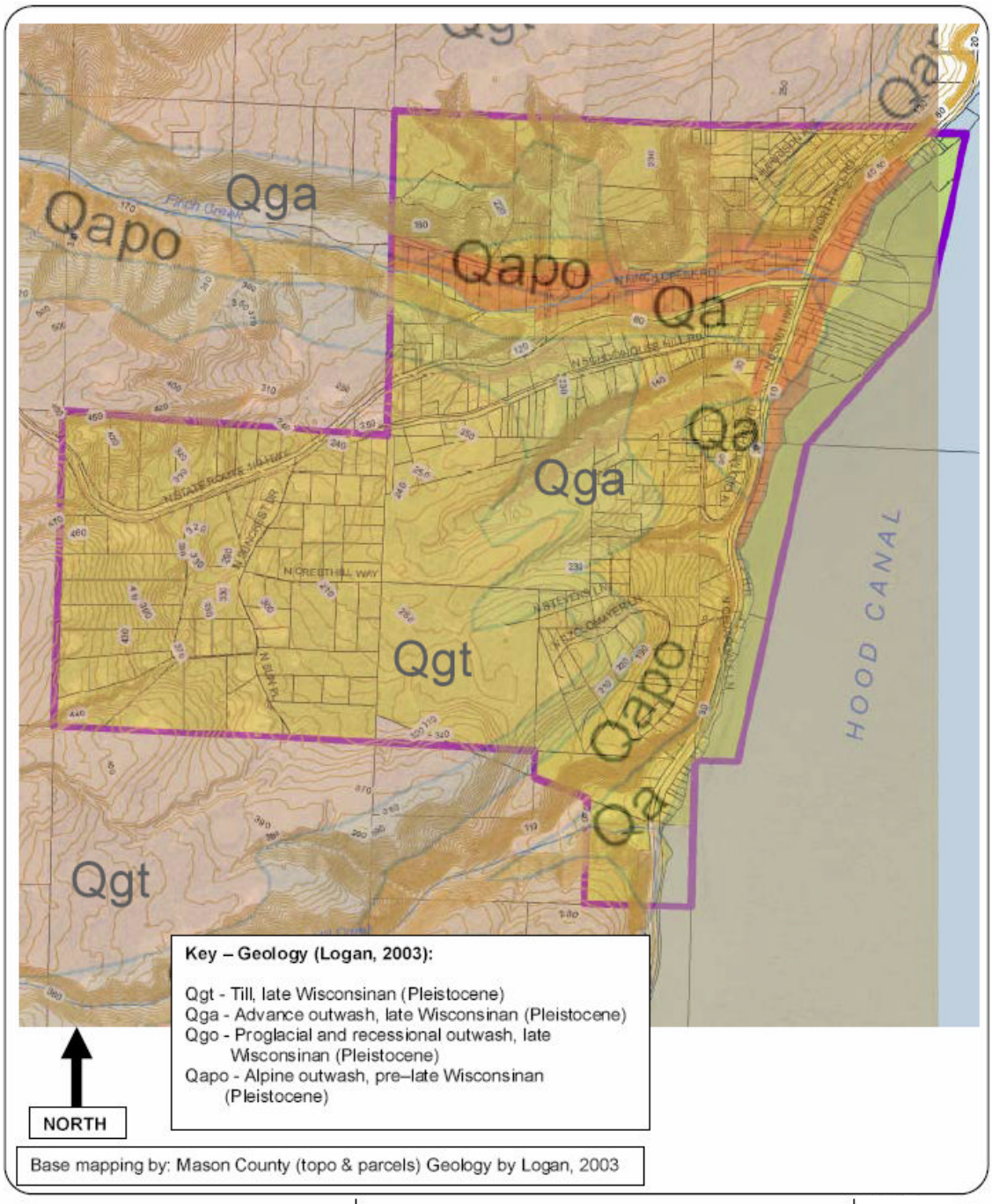
Figure 2.16

Topo, Geology & Parcels



HWA GEOSCIENCES INC.

TOPO, GEOLOGY, & PARCELS

MASON COUNTY
WATER QUALITY PROJECT PLANNING
HOODSPORT RURAL ACTIVITY CENTER

PROJECT NO.
2006-172

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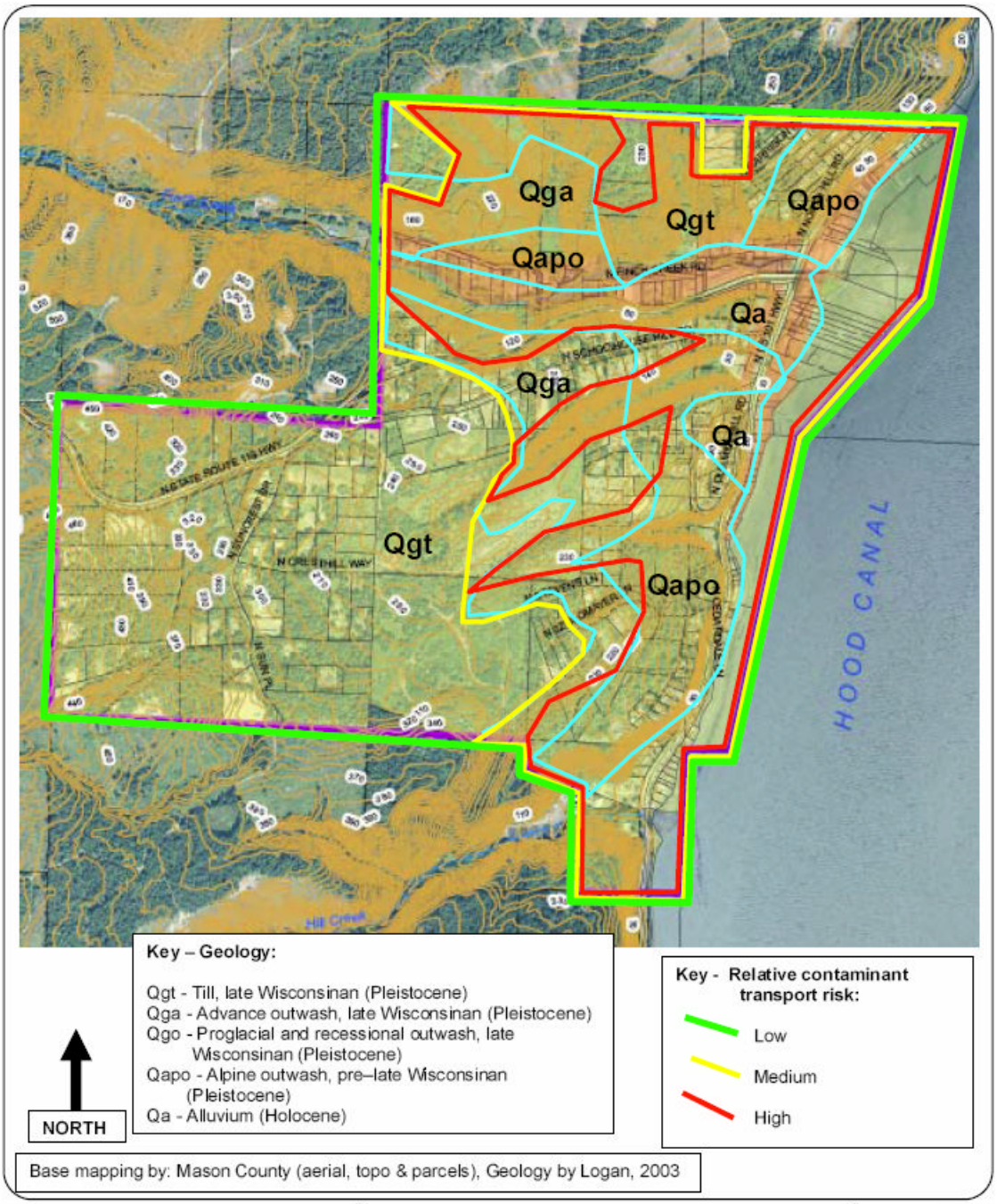
Figure
2.17

Figure 2.17
Relative Contaminant Transport Risk



HWA GEOSCIENCES INC.

RELATIVE CONTAMINANT TRANSPORT RISK

MASON COUNTY
WATER QUALITY PROJECT PLANNING
HOODSPORT RURAL ACTIVITY CENTER

PROJECT NO.
2006-172

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Figure 2.18a
Population Projections

Area	2005	2015	2025
Hoodsport RAC	642	906	1,277
Service Area 2	139	161	187
Expanded Service Area 2	346	401	466

Figure 2.18b
Future Flows and Loadings

	Hoodsport RAC			Service Area 2			Expanded Service Area 2		
	Existing	2015	2025	Existing	2015	2025	Existing	2015	2025
Wastewater Flows:									
Average Flow, gpd	48,697	68,691	96,897	16,002	20,292	26,018	29,652	35,892	44,153
Maximum Month Flow, gpd	59,935	84,543	119,258	19,695	24,975	32,022	36,495	44,175	54,609
Maximum Daily Flow, gpd	97,394	137,382	193,794	32,004	40,584	52,036	59,304	71,784	88,306
Peak Hour Flow, gpd	170,439	240,418	339,139	56,006	71,022	91,063	103,782	125,622	154,535
Wastewater Loadings:									
BOD_5:									
Average, lbs/day	142	20	282	54	69	89	92	109	136
Maximum Month, lbs/day	178	250	352	68	87	112	115	136	170
TSS:									
Average, lbs/day	155	220	310	55	71	92	97	119	147
Maximum Month, lbs/day	194	274	386	69	89	115	121	149	184
TKN:									
Average, lbs/day	23	32	45	8	11	14	14	18	22
Maximum Month, lbs/day	29	40	57	10	13	17	18	22	27

Figures
2.18
a, b

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Figure
2.19

Figure 2.19
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.

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Figure
2.20

Figure 2.20
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.

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Figure 2.21
ERU Cluster System Estimated Capital Cost

System Type	*Septic Tank*	*STEP System[1]*	*Piping*	*Treatment*	*Effluent*	*Total*
Existing Septic Tanks (7)	N/A	7 @ $5,000 each = **$35,000**	**$15,000**	**$20,000**	**$20,000**	**$90,000** ($12,860/ERU)
New Septic Tanks (7)	7 @ $12,000 each = **$84,000**	Included with Tank	**$15,000**	**$20,000**	**$20,000**	**$139,000** ($19,860/ERU)

[1] Pump to convey septic tank effluent to treatment system

Figure
2.21

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Figure 2.22

Example Cluster System

Figure 2.22

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Figure 2.23a

Figure 2.23a
Hoodsport RAC Cost Summary

* = engineer's estimate		Expanded Service Area 2	Service Area 2	
Treatment Plant Estimate				
Engineer's Estimate		$1,860,000	$1,605,000	*
Contingency		$279,000	$240,750	*
8.3% Sales Tax		$177,537	$153,197	*
Construction Cost		$2,316,537	$1,998,947	*
Grinder Pump Collection System Estimate				
Engineer's Estimate		$2,859,000	$1,641,700	*
Contingency		$428,850	$328,340	*
8.3% Sales Tax		$272,892	$163,513	*
Construction Cost		$3,560,742	$2,133,553	*
Effluent Force Main and Fate Estimate				
Engineer's Estimate		$715,000	$715,000	*
Contingency		$107,250	$107,250	*
8.3% Sales Tax		$68,247	$68,247	*
Construction Cost		$890,497	$890,497	*
Advanced Cluster On-site Systems (assumes 6 clusters serving 45 ERUs)				
Engineer's Estimate		$736,071		*
Contingency		$110,411		
8.3% Sales Tax		$71,105		
Construction Cost		$917,587		
Total Construction Cost Estimates (sums similar lines above)				
Engineer's Estimate		$6,170,071	$3,961,700	
Contingency		$925,511	$676,340	
8.3% Sales Tax		$589,780	$384,957	
Construction Cost		$7,685,362	$5,022,997	
Other Costs to Complete (some a % of Construction Cost)				
Facilites Plan and Env Documentation		$108,683	$108,683	
Design Engineering[1]	12%	$922,243	$602,760	
Assistance During Const.[2]	8%	$614,829	$401,840	
Administration[3]	2%	$153,707	$100,460	
Design/Admin Contingency[4]	3%	$230,561	$150,690	
Cluster System Land[5]		$90,000		
Sewer System Land[6]		$250,000	$210,000	
		$2,370,023	$1,574,432	
Total Cost to Complete				
Grand Total		$10,055,385	$6,597,430	
Annual Operating Costs (engineer's estimates)				
Sewer SystemOperations		$169,634	$143,704	*
Cluster System Operations		$22,500		*
Total Annual Operating Cost Estimate		$192,134	$143,704	

Notes

1 For large scale projects 10% is commonly used. Small scale projects require a larger percentage of construction costs to pay for design.

2 Assistance during construction includes not only inspection and change-order tracking, but also operator training, O&M manuals, etc.

3 Administration covers local agency project management costs

4 This contingency amount is based on construction cost. It amounts to a 15% contingency on the ~25% of construction that is assigned for design and administration.

5 See land cost estimate in Section 2.2.4.1, Section 2 Page 15.

6 This estimate is very preliminary and should be considered a "place holder."

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Figure 2.23b

Hoodsport RAC
Expanded Service Area 2
MBR Treatment Plant
Jan. 2007

Construction:

	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1.	Mobilization Demobilization	1	LS	$150,000	$150,000
2.	Site Work	1	LS	$60,000	$60,000
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	$65,000	$65,000
6.	Sludge Storage, Blower and Pump	1	LS	$40,000	$40,000
7.	Operations and Equipment Building	1	LS	$160,000	$160,000
8.	Generator	1	LS	$50,000	$50,000
9.	Piping, Valves, and gates	1	LS	$200,000	$200,000
10.	Misc. Metal	1	LS	$35,000	$35,000
11.	Electrical	1	LS	$200,000	$200,000
12.	Coatings	1	LS	$30,000	$30,000
13.	Restoration	1	LS	$20,000	$20,000

Engineer's Estimate	$1,860,000
Contingency 15%	$279,000
8.3% Sales Tax	$177,537
Construction Cost	$2,316,537

Operation and Maintenance:

	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1.	Administration	1	LS	$10,000	$10,000
2.	Labor	1,040	HRS	$35	$36,400
3.	Power	220,000	KwH	$0.07	$15,400
4.	Repair and Maintenance	1	LS	$15,000	$15,000
3.	Membrane Replacement reserves	1	LS	$5,000	$5,000
4.	Sludge Hauling	200,000.0	GAL	$0.18	$36,000
	Annual Operation and Maintenance Cost Estimate				$117,800

Hoodsport RAC
Expanded Service Area 2
Grinder Pump Collection System Cost Estimate
Jan. 2007

Construction:

	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1.	Mobilization Demobilization	1	LS	$180,000	$180,000
2.	Traffic Control	1	LS	$20,000	$20,000
3.	4-Inch Pressure Sewer	7,250	LF	$37	$268,250
4.	3-Inch Pressure Sewer	4,000	LF	$32	$128,000
5.	2-Inch Pressure Sewer	5,650	LF	$30	$169,500
6.	Grinder P.S.'s with CP: Residential and Comm. Equilvalent	178	EA	$8,000	$1,424,000
7.	Grinder P.S.'s with CP: Commercial	7	EA	$20,000	$140,000
8.	Side Sewer Stubs	30	EA	$1,200	$36,000
9.	Mainline Cleanouts	18	EA	$1,800	$32,400
11.	Abandon Septic Tanks	184	EA	$1,200	$220,800
12.	Creek Crossings	3	EA	$10,000	$30,000
14.	Restoration	1	LS	$210,000	$210,000

Engineer's Estimate	$2,859,000
Contingency 15%	$428,850
8.3% Sales Tax	$272,892
Construction Cost	$3,560,742

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

Figure
2.23b

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Figure 2.23c

Hoodsport RAC
Expanded Service Area 2
Force Main and Reuse Area
Jan. 2007

Construction:

	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1.	Mobilization Demobilization	1	LS	$70,000	$70,000
2.	Traffic Control	1	LS	$5,000	$5,000
3.	4-Inch Force Main	5,000	LF	$30	$150,000
4.	Lift Station	1	LS	$160,000	$160,000
12.	Infiltration Area	1	LS	$300,000	$300,000
14.	Restoration	1	LS	$30,000	$30,000
				Engineer's Estimate	$715,000
				Contingency 15%	$107,250
				8.3% Sales Tax	$68,247
				Construction Cost	$890,497

Operation and Maintenance:

	ITEM	QUANTITY		UNIT PRICE	AMOUNT
1.	Administration	1	LS	$5,000	$5,000
2.	Labor	150	HRS	$35	$5,250
3.	Lift Station Repair and Maintenance	1	LS	$3,000	$3,000
4.	Force Main	1.0	MI	$3,000	$3,000
				Annual Operation and Maintenance Cost Estimate	$16,250

Advanced On-site Cluster System Cost Extensions
Table from Figure 2.21 (engineer's estimates)

System Type	*Septic Tank*	*STEP System* [1]	*Piping*	*Treatment*	*Effluent*	*Total*
Existing Septic Tanks (7)	N/A	7 @ $5,000 each = **$35,000**	**$15,000**	**$20,000**	**$20,000**	**$90,000** ($12,860/ ERU)
New Septic Tanks (7)	7 @ $12,000 each = **$84,000**	Included with Tank	**$15,000**	**$20,000**	**$20,000**	**$139,000** ($19,860/ ERU)

Average Estimated Cost for one 7 ERU cluster	$114,500	based on engineer's estimates
Rough estimate ERUs served by advanced clusters	45	
Estimated number of clusters	6	
Estimate	$736,071	based on engineer's estimates
Contingency 15%	$110,411	
8.3% Sales Tax	$71,105	
Sub-total	$917,587	
Land Cost per Cluster (midpoint of estimate)	$14,000	based on engineer's estimates
Total Estimated Land Cost	$90,000	
Construction Cost (including land)	$1,007,587	
Annual Operating Cost @ $3.5K per Cluster	$22,500	based on engineer's estimates

Figure
2.23c

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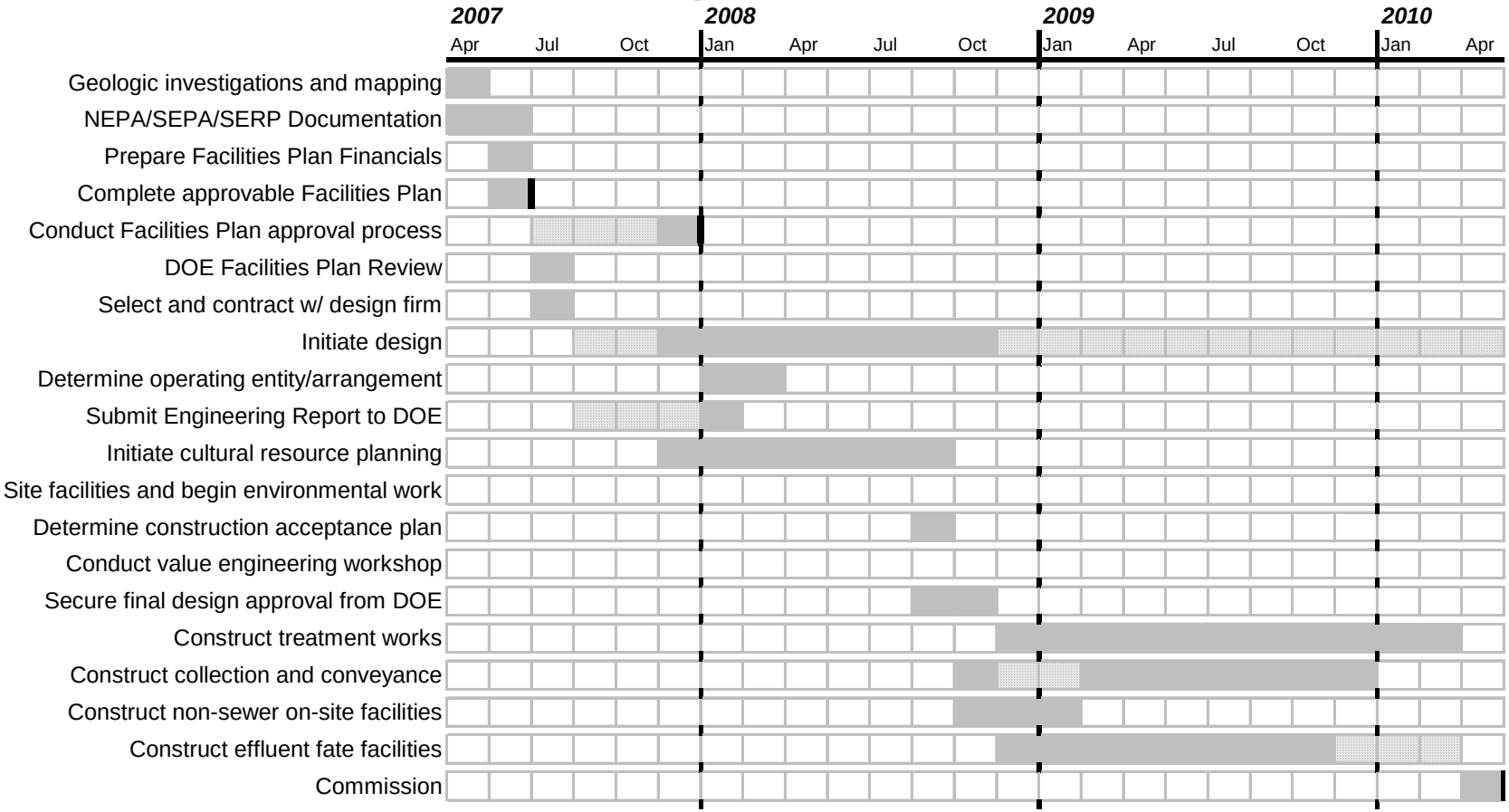
Figure 2.24

Example Schedule



Figure
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Figure 2.25
Hoodsport Expanded Service Area

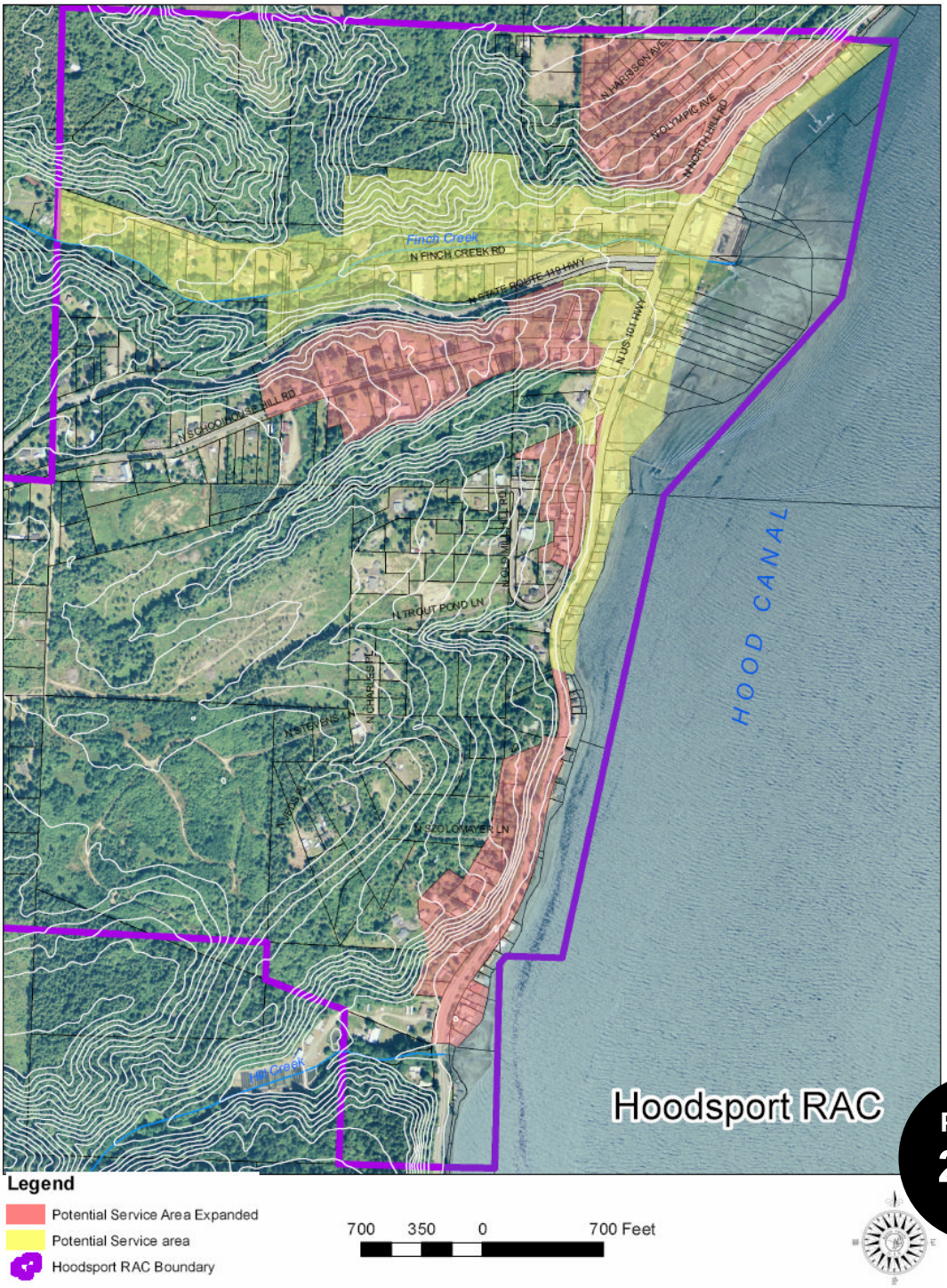

Figure 2.25

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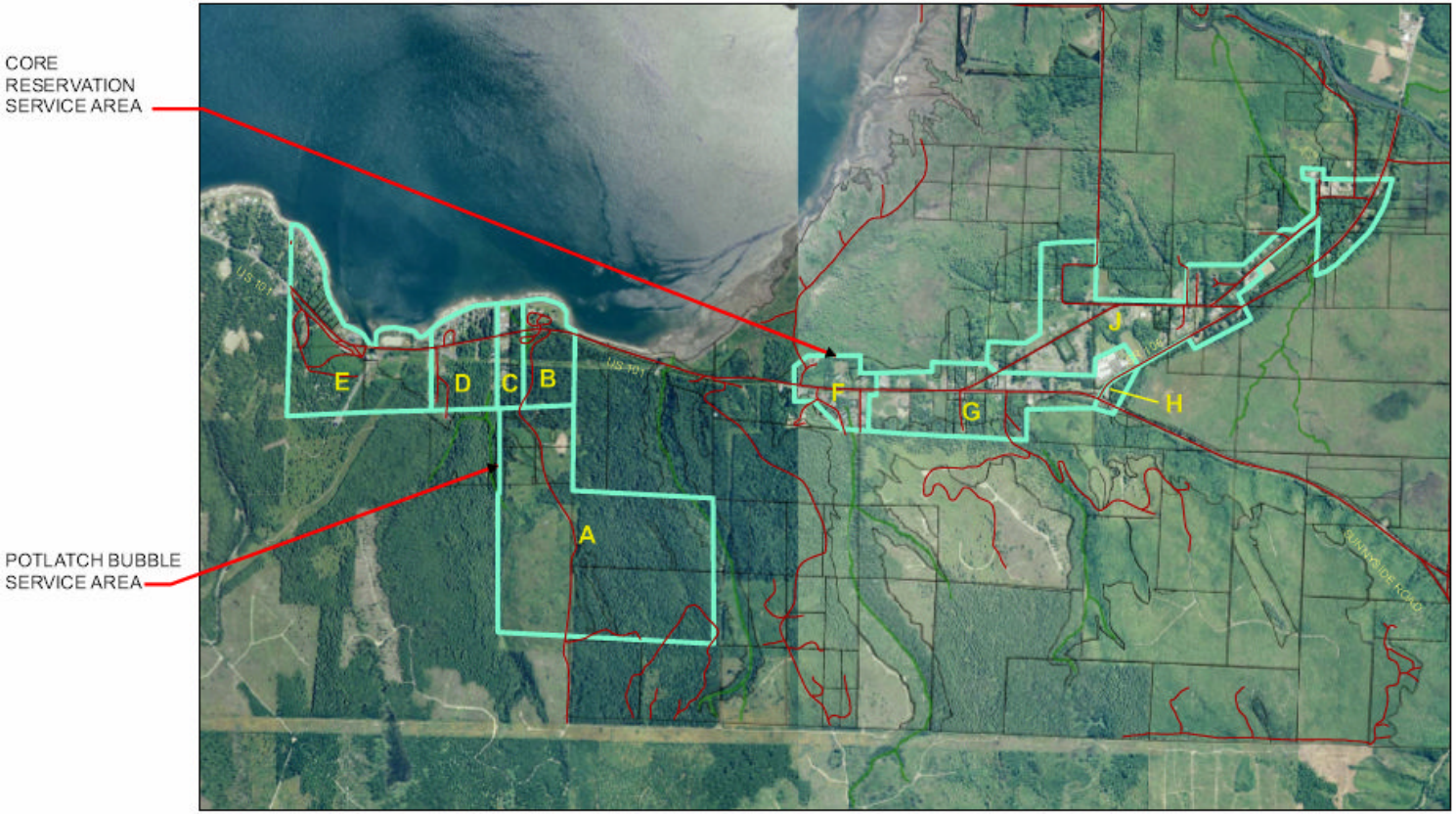
Figure 3.01



Legend

Service Area Parcel Boundary

Feet
0 1,000 2,000

WASTEWATER SERVICE AREAS*
WITH AERIAL PHOTO
SKOKOMISH RESERVATION

Cascade Design Professionals, 2007

* Based on Skokomish Reservation mapping prepared by the Natural Resources Department of the Skokomish Tribe

Figure
3.01

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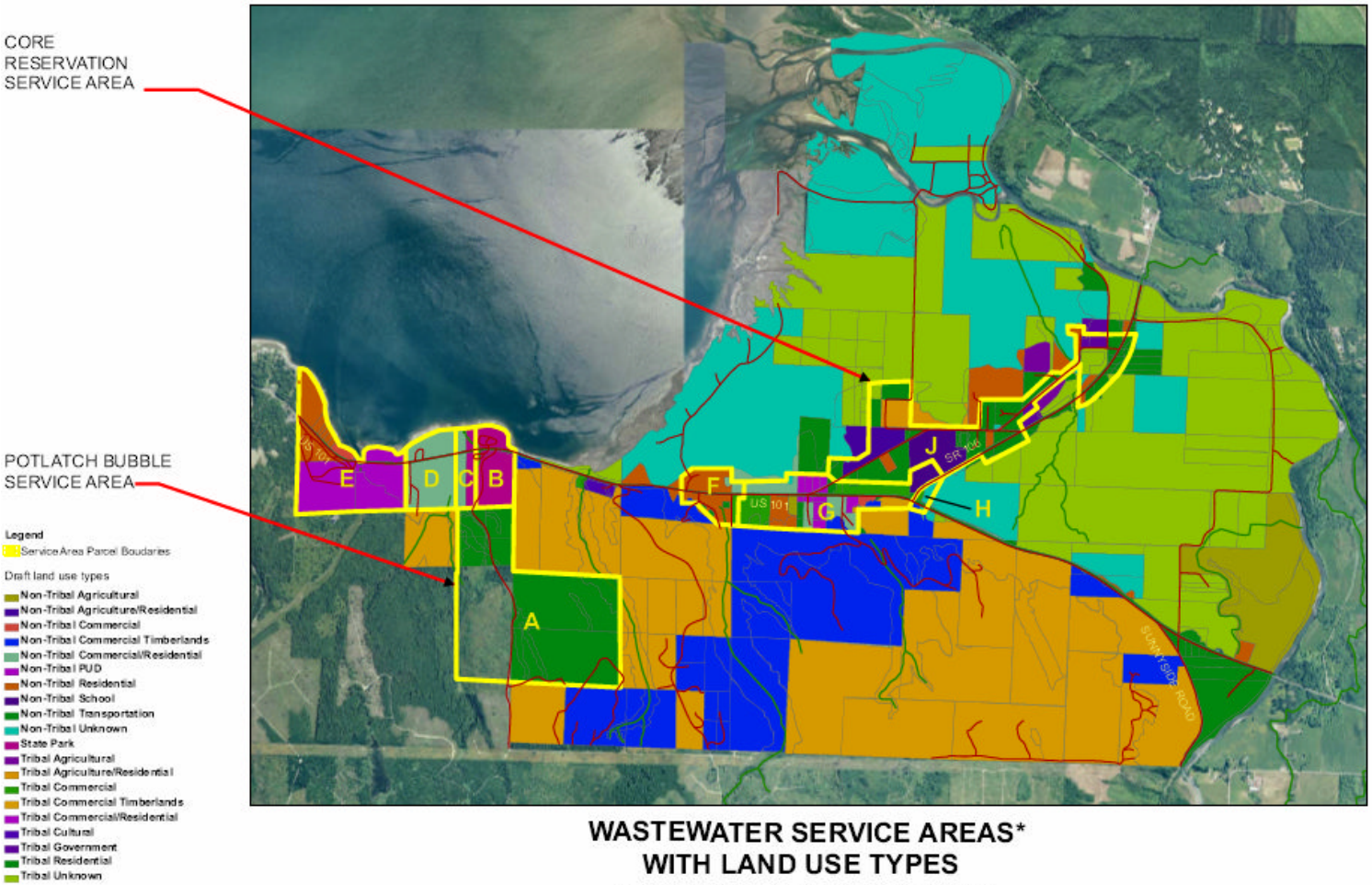
Figure 3.02



WASTEWATER SERVICE AREAS*
WITH LAND USE TYPES
SKOKOMISH RESERVATION

Cascade Design Professionals, 2007

* Based on Skokomish Reservation existing land use mapping prepared by the Natural Resources Department of the Skokomish Tribe

Figure
3.02

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Figure 3.03

Wastewater Flow for Potlatch Area – Phase 1

Description	Number of Sites	Number of Services	Population	Usage per Capita	Avg Flow (gpd)	ERU's	Peak Flow, (peak hourly) (gpd)
A. Tribal Housing							
Single Family Home	50	50	208	100	20800	50	83200
Community Center	1	1	10	15	150	1	600
Total		**51**	**218**		**20950**	**51**	**83800**
B. Potlatch State Park							
Picnic	20	1	100	5	500	1	2000
Campground w/Central Comfort Station	19	1	48	35	1663	4	6650
RV Servicing	18	1	45	50	2250	5	9000
RV Hookups	18	1	45	80	3600	9	14400
Residence/Park Office and Shop	1	1	2	90	180	0	720
Total		**5**	**240**		**8193**	**20**	**32770**
C. Minerva RV Park							
Laundromat	22 loads/day	1	-	50 g/load	1100	3	4400
Campground w/Central Comfort Station	14	-	35	35	1225	3	4900
RV's & Mobile Homes (west)	21	1	53	80	4200	10	-
Permanent Residences (east)	32	1	80	80	6400	15	25600
Residence/Park Office and Shop	1	-	2	90	180	0	720
Total		**3**	**170**		**13105**	**31**	**52420**
Grand Total			**627**		**42248**	**102**	**168990**

Figure
3.03

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Figure 3.04

Wastewater Flows for Potlatch Area - Ultimate

Description	Number of Sites	Number of Services	Population	Usage per Capita	Avg Flow (gpd)	ERU's	Peak Flow, (peak hourly) (gpd)
A. Tribal Housing							
Single Family Home	135	135	562	100	56160	135	224640
Community Center	1	1	45	15	675	2	2700
Total			**607**		**56835**	**137**	**227340**
B. Potlatch State Park							
Picnic	20	1	100	5	500	1	2000
Campground w/Central Comfort Station	19	1	48	35	1663	4	6650
RV Servicing	18	1	45	50	2250	5	9000
RV Hookups	18	1	45	80	3600	9	14400
Residence/Park Office and Shop	1	1	2	90	180	0	720
Total			**240**		**8193**	**20**	**32770**
C. Minerva RV Park							
Laundromat	22 loads/day	1	-	50 g/load	1100	3	4400
Campground w/Central Comfort Station	14	-	35	35	1225	3	4900
Future Westside Residences	66	1	165	100	16500	39	66000
Permanent Residences (east)	32	1	80	80	6400	15	25600
Residence/Park Office and Shop	1	-	2	90	180	0	720
Total			**282**		**25405**	**61**	**101620**
D. Potlatch Bubble Service Creep Area							
Waterfront at Potlatch	1	1	25 staff & visitors	15 gpdpc	375	1	1500
PUD #1	1	1	5 staff	35 gpdpc	175	0	700
Women's Clubs	1	1	25 staff & visitors	15 gpdpc	375	1	1500
Potlatch Power Plant	1	1	5 staff	35 gpdpc	175	0	700
Future Commercial	2	2	25 staff	15 gpdpc	750	2	3000
Residential	58	58	240	100	24012	57	96046
Total	64		**240**		**25862**	**62**	**103446**
E. Potlatch Bubble North Reservation Boundary Area							
Residential	55	55	229	100	22880	55	91520
Commercial	6 acres	6 acres	-	525 gpd/acre	3150	8	12600
Total			**229**		**26030**	**62**	**104120**
Grand Total			**1357**		**142324**	**341**	**569296**

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Figure
3.05

Figure 3.05

Skokomish Reservation and 319 Water Quality Streams of Concern

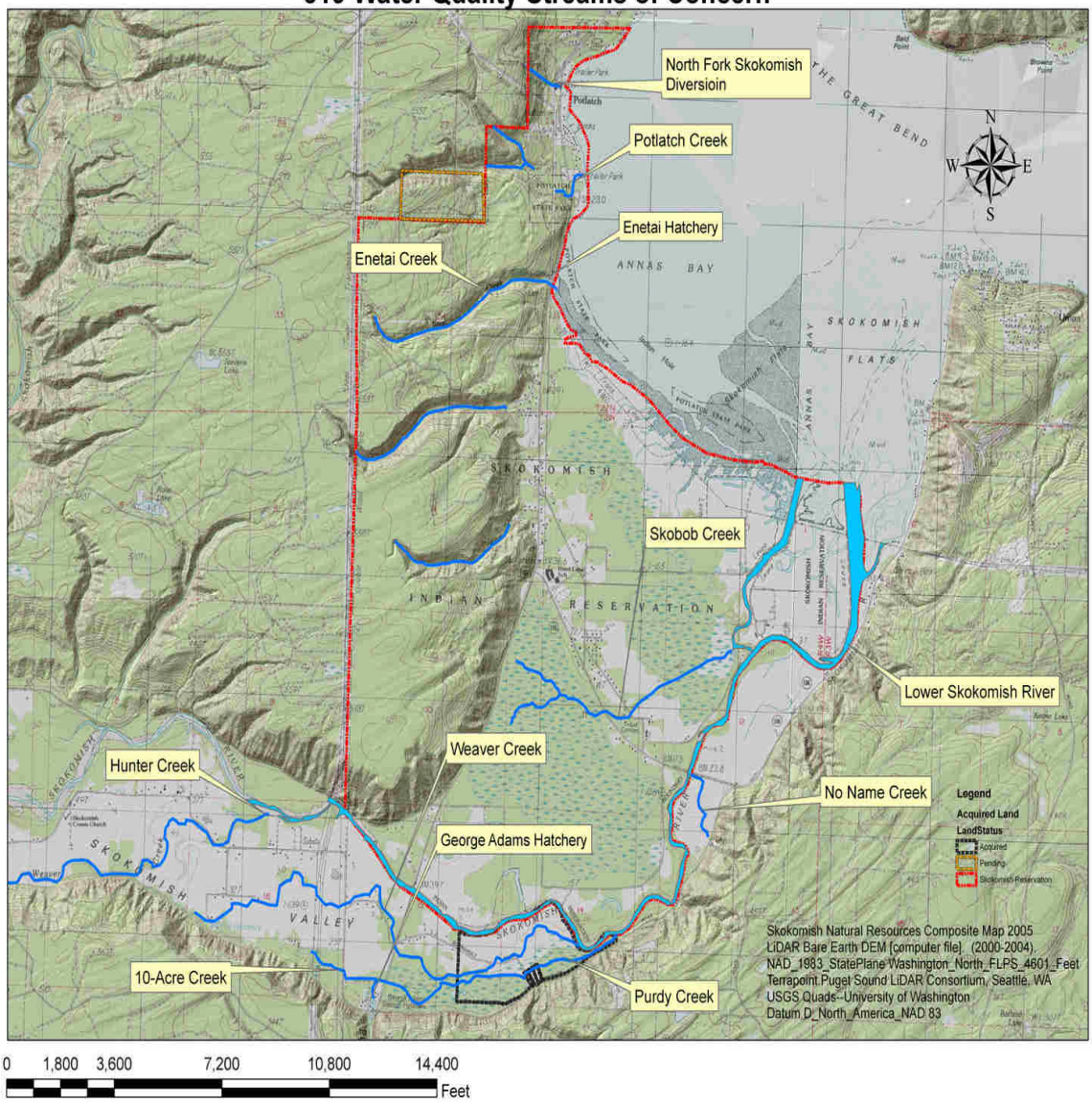

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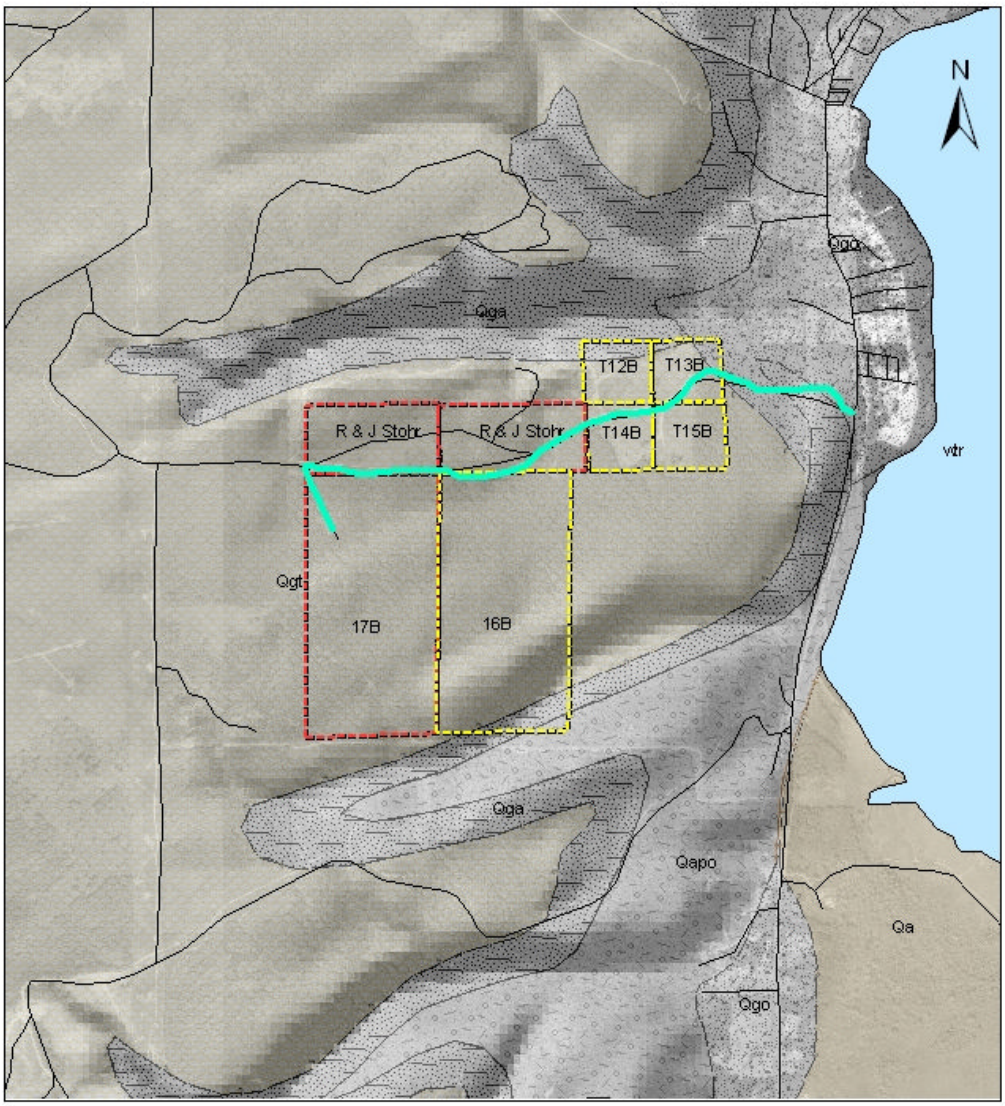
Figure 3.06

Skokomish Tribal Housing Project
Geololgical Profile

Figure
3.06



0 950 1,900 3,800 Feet

Skokomish Natural Resources Composite Map
Using Lidar Datum: D_North_American_1983 Source File
Puget Sound LIDAR Consortium Re: Ken Puhn
WEST Consultants, Inc. DEM Conversion Shade Files.
Ortho Quads–University of Washington USGS
Datum D_North_American_1983 Source File.
Geological Datum R J Logan –Charles Cruthers
Washington Department of Natural Resources
Nad 27 State Plain South --Shifted
BIA Tribal Parcel Datum–Nad 27--Shifted

Legend

Skokomish Project
- Skokomish Reservation Boundary
- Probable Project Bounds
- Possible Project Bounds

Geological Unit
- Qa
- Qapo
- Qga
- Qgo
- Qgt

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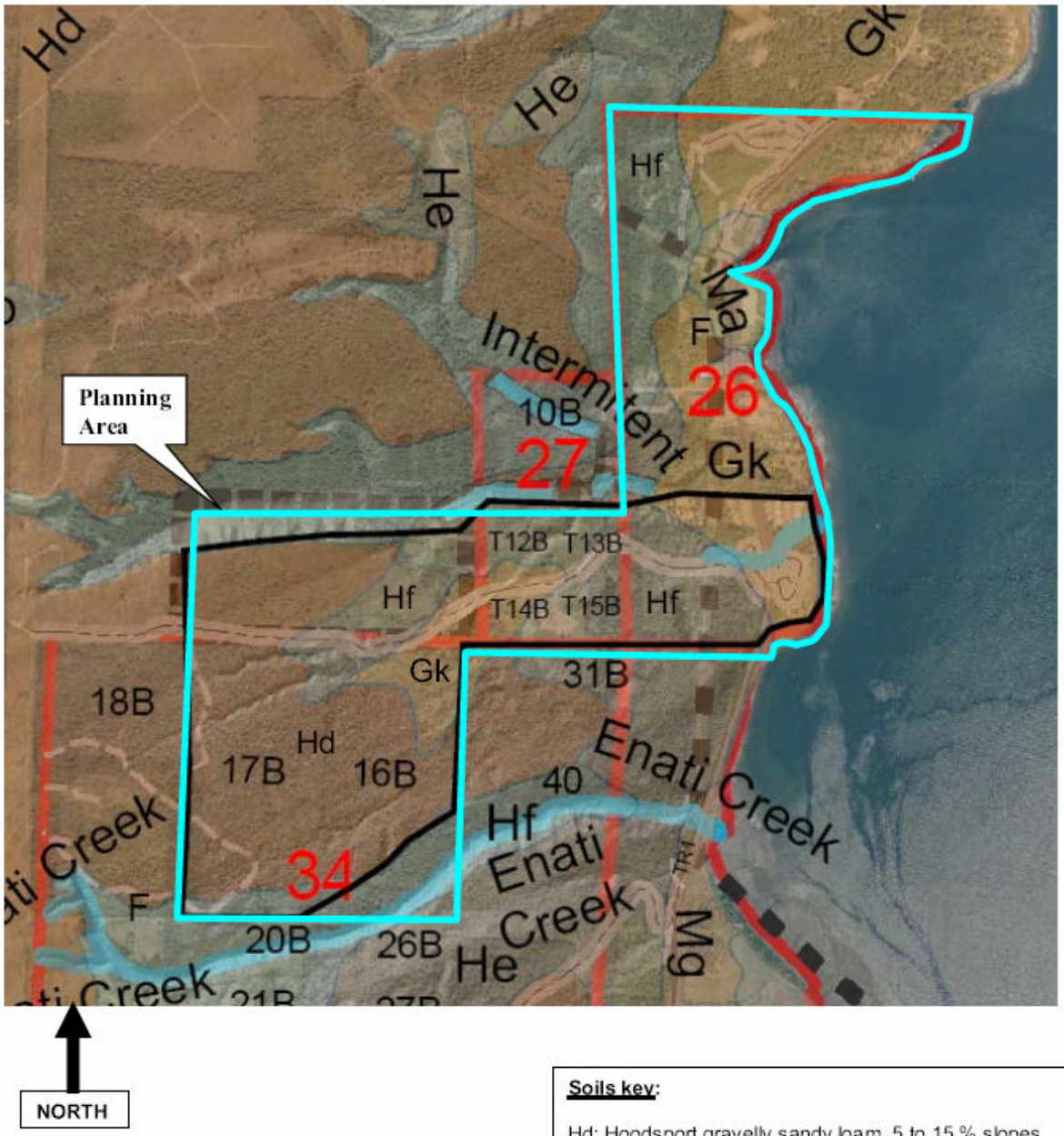
Figure 3.07

Soils Mapping



NORTH

From: Ness, A. O., 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

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
Ma - Made land

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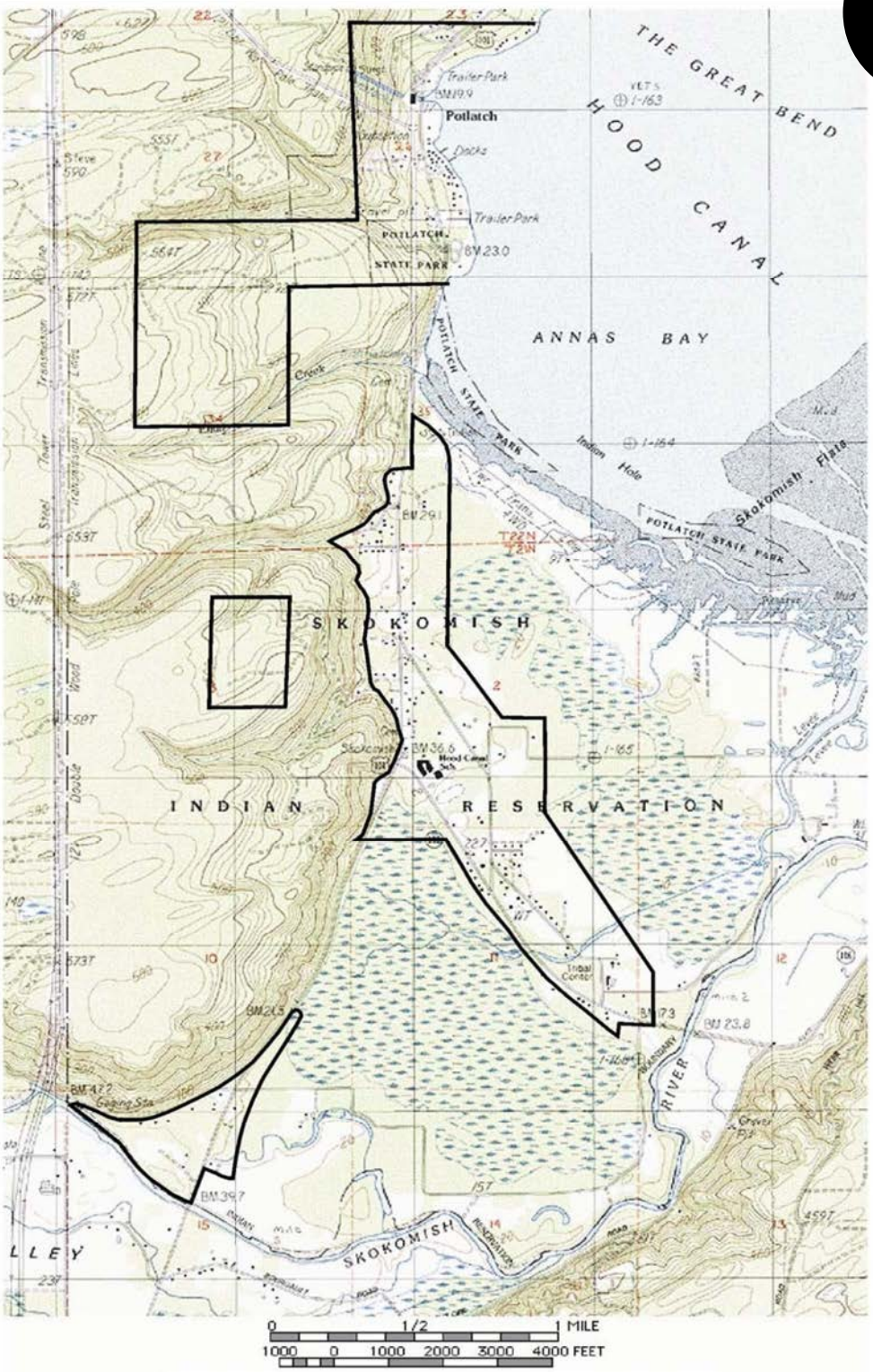
Figure 3.08

Figure
3.08



The Potlatch & Skokomish Indian Reservation Study Area, Mason County, WA

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Figure 3.09

Figure
3.09

Note:

Consistent with Washington State Law, this map is redacted in widely published copies of this report. This map is intended for the use of planning and design professionals in consultation with appro-priate Tribal and State historic preservation officials so that known cultural resource sites can be avoided or properly managed in the event of earth

Archaeological and ethnographic sites in and near the Potlatch & Skokomish Indian Reservation Study Area, Mason County, WA

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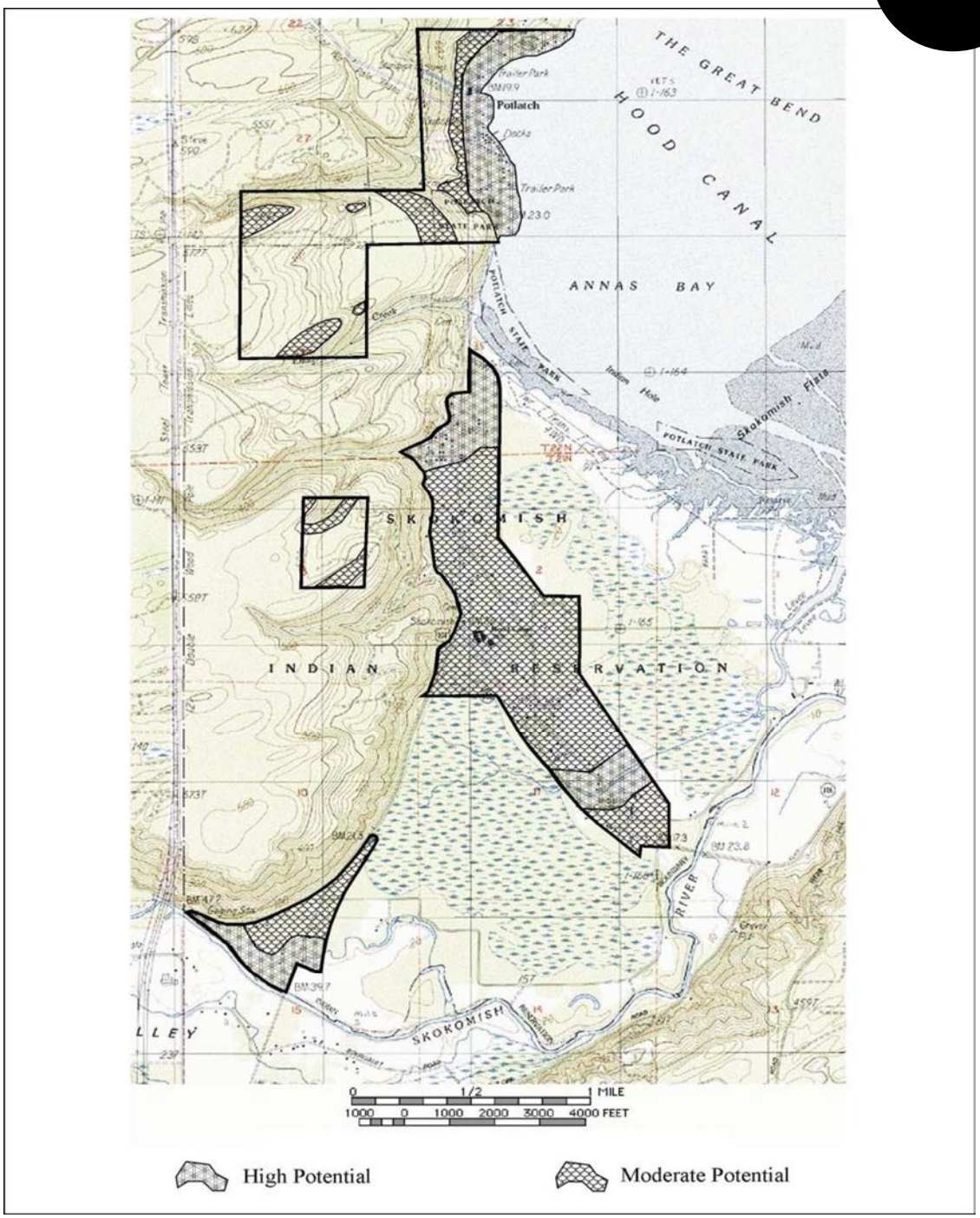
Figure 3.10



Archaeological potential zones in the Potlatch & Skokomish Indian Reservation Study Area, Mason County, WA

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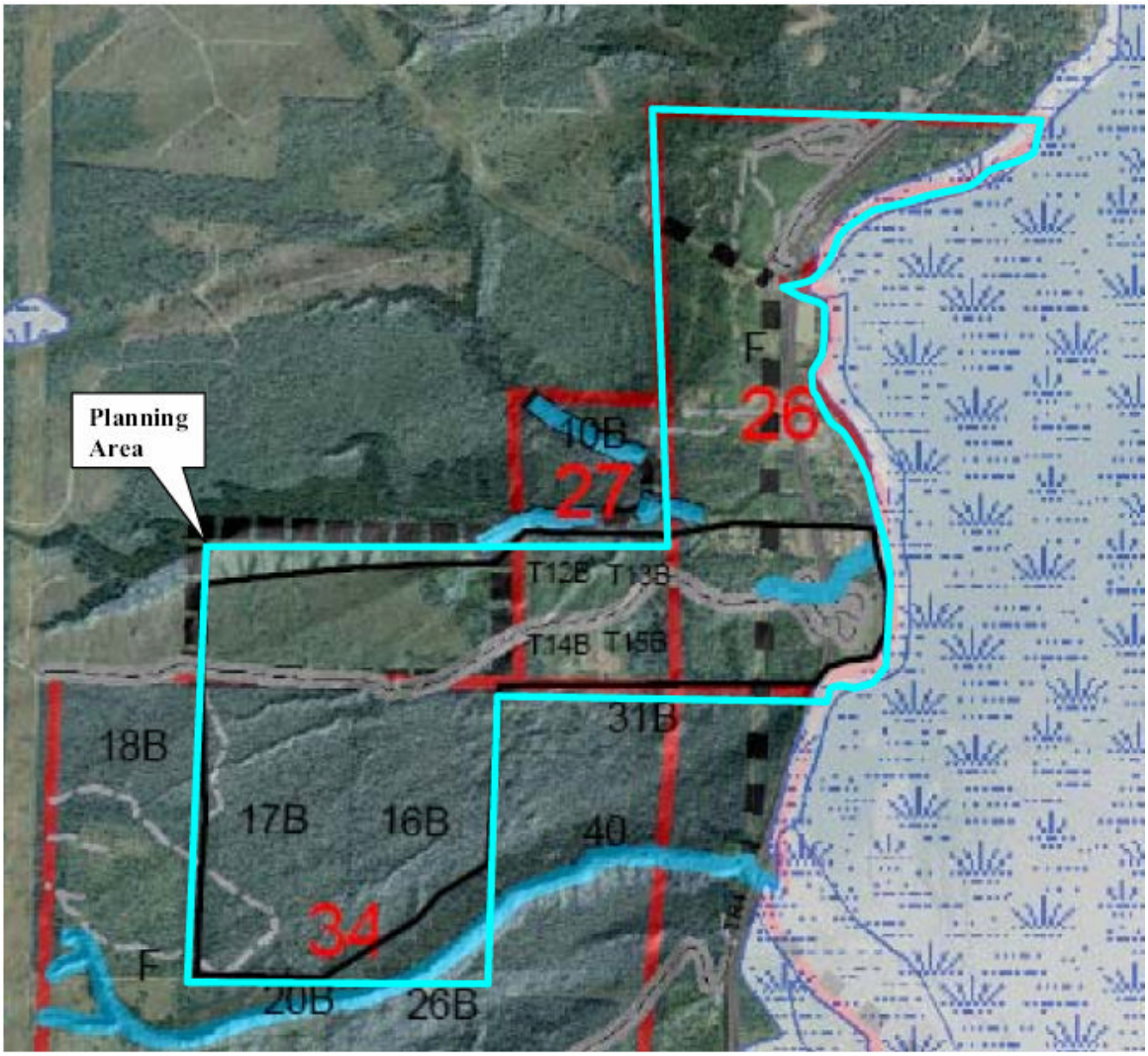
Figure
3.11

Figure 3.11



Wetlands

NORTH

From: Skokomish Tribe GIS Services

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Figure 4.01
Wastewater Flow for Core Area – Phase 1

Description	Number of Sites	Number of Services	Population	Usage per Capita	Avg Flow (gpd)	ERU's	Peak Flow, (peak hourly) (gpd)
G. Hwy 101 Commercial Area, N. of Hwy 106 to WSDOT property (including WSDOT)							
Tribal Center, including Public & Social Services (future)	1	1	200 staff & visitors	15 gpdpc	3000	7	12000
Twin Totems/ Lucky Dog	1	1	800 slots	45 gpd/slot	36000	206	144000
Residential	7	7	29	100	2912	7	11648
Total		**9**	**29**		**41912**	**220**	**167648**
J. Reservation Rd & Hwy 106 mixed use							
Hood Canal School	1	1	300 students	15 gpdpc	4500	11	18000
Boys & Girls Club and Community Center	1	1	50 children	15 gpdpc	750	2	3000
Tribal Center, including Health Center	4	4	120 staff & visitors	15 gpdpc	1800	4	7200
Fire and Natural Resources	2	2	20 staff & visitors	15 gpdpc	300	1	1200
Residential	108	108	449	100	44928	107	179712
Total		**118**	**449**		**52278**	**125**	**209112**
Grand Total		**127**	**478**		**94190**	**345**	**376760**

Figure
4.01

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Figure 4.02
Wastewater Flow for Core Area – Ultimate

Description	Number of Sites	Number of Services	Population	Usage per Capita	Avg Flow (gpd)	ERU's	Peak Flow, (peak hourly) (gpd)
F. Hwy 101 Residential Area, N. of WSDOT property							
Residential	22	22	92	100	9152	22	36608
Total		**22**	**92**		**9152**	**22**	**36608**
G. Hwy 101 Commercial Area, N. of Hwy 106 to WSDOT property (including WSDOT)							
Tribal Center, including Public & Social Services (future)	1	1	200 staff & visitors	15 gpdpc	3000	7	12000
Twin Totems/ Lucky Dog	1	1	800 slots	45 gpd/slot	36000	206	144000
Future Commercial	-	30 acres	30 acres	525 gpd/acre	15750	38	63000
Residential	47	47	197	100	19702	47	78807
Total		**49**	**197**		**74452**	**299**	**297807**
H. Junction Hwys 101 & 106							
Future Commercial	6 acres	6 acres	-	525 gpd/acre	3150	8	12600
Total			**-**		**3150**	**8**	**12600**
J. Reservation Rd & Hwy 106 mixed use							
Hood Canal School	1	1	450 students	15 gpdpc	6750	16	27000
Boys & Girls Club and Community Center	1	1	50 children & visitors	15 gpdpc	750	2	3000
Tribal Center, including Health Center	4	4	5 staff & visitors	15 gpdpc	75	0	300
Fire and Natural Resources	2	2	20 staff & visitors	15 gpdpc	300	1	1200
Residential	136	136	566	100	56576	136	226304
Total		**144**			**64451**	**155**	**257804**
Grand Total		**215**	**289**		**151205**	**483**	**604819**

Figure 4.02

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Figure 5.01

Land Area Requirements for Treatment and Disposal

All Units in Acres

System	*MBR*	*SBR*	*Rapid Infiltration*	*Irrigation*	*Storage Pond*
Potlatch	1.7	2.0	3.5	20.9	7.8
Core	1.8	2.2	4.4	26.1	9.8
Combined	2.0	2.4	7.9	47.0	17.6

Figure
5.01

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Figure 5.02

COMPARISON OF SYSTEM ALTERNATIVES SEPARATE SYSTEM - POTLATCH BUBBLE					
Item	**Description**	**Alt 1A**	**Alt 1B**	**Alt 1C**	**Alt 1D**
	CONVEYANCE				
1	Gravity sewer for new Tribal Housing connection	750 LF pipe , 2 manholes			
2	Potlatch State Park system improvements	Upgrade pump station, 5 commercial services			
3	Minerva RV Park system improvements	2040 LF pipe, 3 commercial services			
4	Service Area Creep plus North Boundary Area (Area D & E) system improvements	6250 LF pipe, 113 residential services, 3 commercial services			
	WASTEWATER TREATMENT				
5	Wastewater Treatment Plant	MBR, 142,300 gpd, 1.7 acres, 1.5 staff, reliable Class A effluent		SBR, 142,300 gpd, 1.5 staff, less reliable Class A effluent	
	DISPOSAL				
6	Effluent Disposal	Rapid infiltration near access road, 2.0 acres, 0.5 staff, beneficial increased flow to unnamed stream	Upslope forest irrigation (27 acres), 20 Hp pump station, storage pond (10 acres), 0.5 staff	Rapid infiltration near access road, 2.0 acres, 0.5 staff, beneficial increased flow to unnamed stream	Upslope forest irrigation (27 acres), 20 Hp pump station, storage pond (10 acres), 0.5 staff

Figure
5.02

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Figure 5.03

COMPARISON OF SYSTEM ALTERNATIVES SEPARATE SYSTEM - CORE AREA					
Item	**Description**	**Alt 2A**	**Alt 2B**	**Alt 2C**	**Alt 2D**
	CONVEYANCE				
1	Hwy 101 (Areas F, G & H) system improvements	11,500 LF pipe, future tribal center, 47 residential services, 7 commercial services			
2	Reservation Road (Area J) system improvements	18,150 LF pipe, school, 108 residential services, 9 commercial services			
	WASTEWATER TREATMENT				
3	Wastewater Treatment Plant	MBR, 151,200 gpd, 1.8 acres, 2.0 staff, reliable Class A effluent		SBR, 151,200 gpd, 2.2 acres, 2.0 staff, less reliable Class A effluent	
	DISPOSAL				
4	Effluent Disposal	Rapid infiltration east of Hwy 101, 2.0 acres, 0.5 staff, beneficial increased flow to northern slough area	Upslope forest irrigation (26 acres), 20 Hp pump station, storage pond (9.8 acres), 0.5 staff	Rapid infiltration east of Hwy 101, 2.0 acres, 0.5 staff, beneficial increased flow to northern slough area	Upslope forest irrigation (26 acres), 20 Hp pump station, storage pond (9.8 acres), 0.5 staff

Figure
5.03

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Figure 5.04

COMPARISON OF SYSTEM ALTERNATIVES COMBINED SYSTEM - CORE AREA					
Item	**Description**	**Alt 3A**	**Alt 3B**	**Alt 3C**	**Alt 3D**
	CONVEYANCE				
1	Gravity sewer for new Tribal Housing connection	750 LF pipe , 2 manholes			
2	Potlatch State Park system improvements	Upgrade pump station, 5 commercial services			
3	Minerva RV Park system improvements	2040 LF pipe, 3 commercial services			
4	Service Area Creep plus North Boundary Area (Area D &	6250 LF pipe, 113 residential services, 3 commercial services			
5	Hwy 101 (Areas F, G & H) system improvements	11,500 LF pipe, future tribal center, 47 residential services, 7 commercial			
6	Reservation Road (Area J) system improvements	18,150 LF pipe, school, 108 residential services, 9 commercial services			
	WASTEWATER TREATMENT				
7	Wastewater Treatment Plant	MBR, 293,500 gpd, 2.0 acres, 2.0 staff, reliable Class A effluent		SBR, 293,500 gpd, 2.4 acres, 2.0 staff, less reliable Class A effluent	
	DISPOSAL				
8	Effluent Disposal	Rapid infiltration east of Hwy 101, 4.0 acres, 0.5 staff, beneficial increased flow to northern slough area	Upslope forest irrigation (55 acres), 35 Hp pump station, storage pond (21 acres), 1.0 staff	Rapid infiltration east of Hwy 101, 4.0 acres, 0.5 staff, beneficial increased flow to northern slough area	Upslope forest irrigation (55 acres), 35 Hp pump station, storage pond (21 acres), 1.0 staff

Figure
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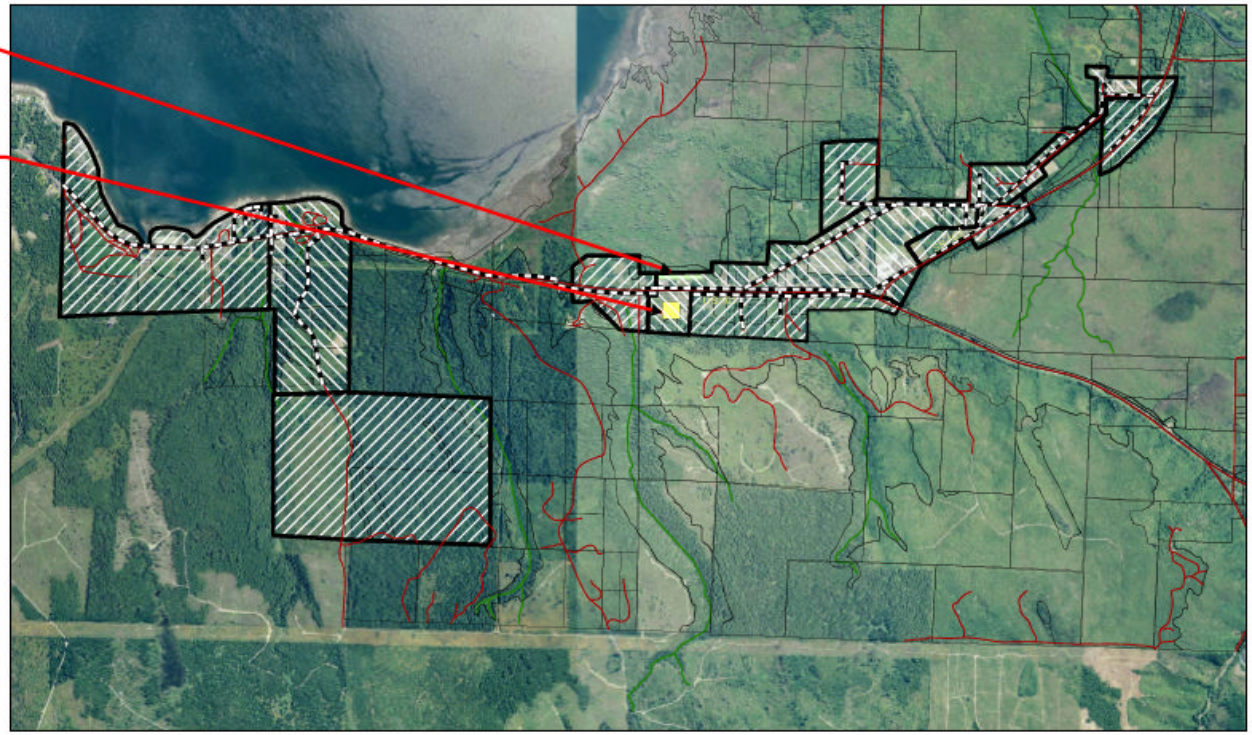
Figure 5.05



Legend

- Proposed Sewer
- Phase 1 Service Area
- Ultimate Service Area

POTLATCH BUBBLE & CORE RESERVATION SERVICE AREAS

COMBINED TREATMENT SYSTEMS

Cascade Design Professionals, 2007

0 1,000 2,000 Feet

*Based on Skokomish Reservation mapping prepared by the Natural Resources Department of the Skokomish Tribe

Figure 5.05

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Figure 5.06

Life Cycle Cost Comparison

Alternative	Capital Cost	Total Annual Cost	Present Worth
1A - MBR & Rapid Infiltration	$8,105,240	$388,665	**$13,387,322**
1B - MBR & Forest Irrigation	$10,343,190	$473,986	**$16,784,816**
1C - SBR & Rapid Infiltration	$7,112,820	$352,128	**$11,898,358**
1D - SBR & Forest Irrigation	$9,329,320	$436,660	**$15,263,670**
2A - MBR & Rapid Infiltration	$10,926,630	$445,966	**$16,987,458**
2B - MBR & Forest Irrigation	$12,897,170	$522,419	**$19,997,019**
2C - SBR & Rapid Infiltration	$9,602,450	$397,216	**$15,000,742**
2D - SBR & Forest Irrigation	$11,816,090	$482,619	**$18,375,034**
3A - MBR & Rapid Infiltration	$20,261,670	$763,107	**$30,632,537**
3B - MBR & Forest Irrigation	$24,330,020	$918,745	**$36,816,063**
3C - SBR & Rapid Infiltration	$18,298,280	$690,823	**$27,686,790**
3D - SBR & Forest Irrigation	$22,227,920	$841,355	**$33,662,204**

Figure
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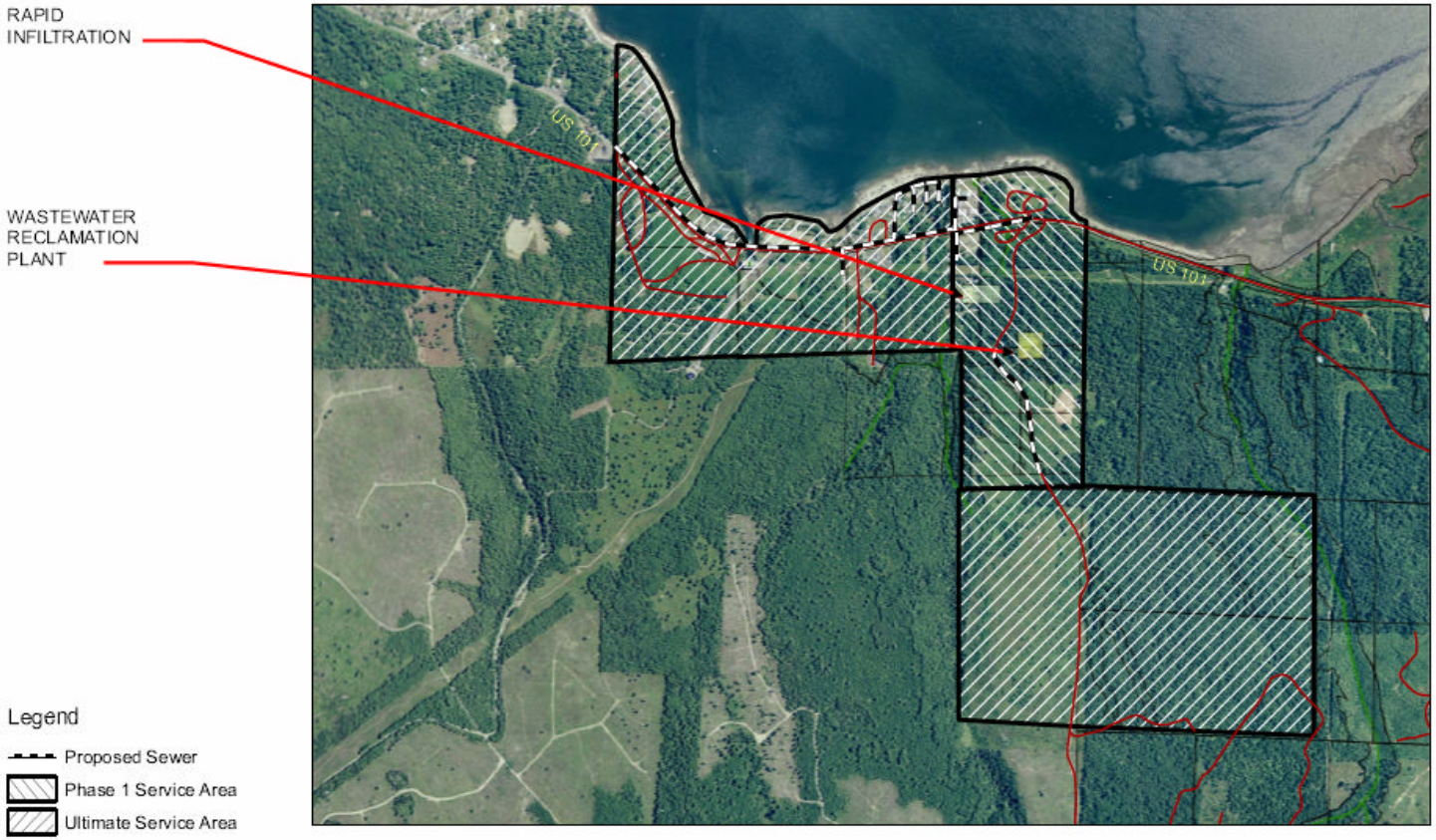
Figure 5.07



POTLATCH BUBBLE SERVICE AREA

SEPARATE TREATMENT SYSTEMS

Cascade Design Professionals, 2007

*Based on Skokomish Reservation mapping prepared by the Natural Resources Department of the Skokomish Tribe

Figure
5.07

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Figure 5.08

COST COMPARISONS - PHASED
(MBR & RAPID INFILTRATION)

Alt.	Description	Conveyance	Treatment	Disposal	Construction Total	Contingency	Eng, Admin & Perm	Total	Cost / ERU
	PHASE 1								
1A	Potlatch Bubble, separate treatment	294,000	1,917,000	190,000	2,401,000	600,250	432,180	3,433,430	33,661
2A	Core Area, separate treatment	1,722,000	2,565,000	234,000	4,521,000	1,130,250	813,780	6,465,030	18,739
3A	Combined Treatment	3,210,000	3,546,000	317,000	7,073,000	1,768,250	1,273,140	10,114,390	22,627
	PHASE 2								
1A	Potlatch Bubble, separate treatment	1,208,000	1,917,000	142,000	3,267,000	816,750	588,060	4,671,810	19,547
2A	Core Area, separate treatment	1,467,000	1,539,000	114,000	3,120,000	780,000	561,600	4,461,600	32,330
3A	Combined Treatment	2,700,000	4,082,000	314,000	7,096,000	1,774,000	1,277,280	10,147,280	26,916
	TOTAL								
1A	Potlatch Bubble, separate treatment	1,502,000	3,834,000	332,000	5,668,000	1,417,000	1,020,240	8,105,240	23,769
2A	Core Area, separate treatment	3,189,000	4,104,000	348,000	7,641,000	1,910,250	1,375,380	10,926,630	22,622
3A	Combined Treatment	5,910,000	7,628,000	631,000	14,169,000	3,542,250	2,550,420	20,261,670	24,589

Figure
5.08

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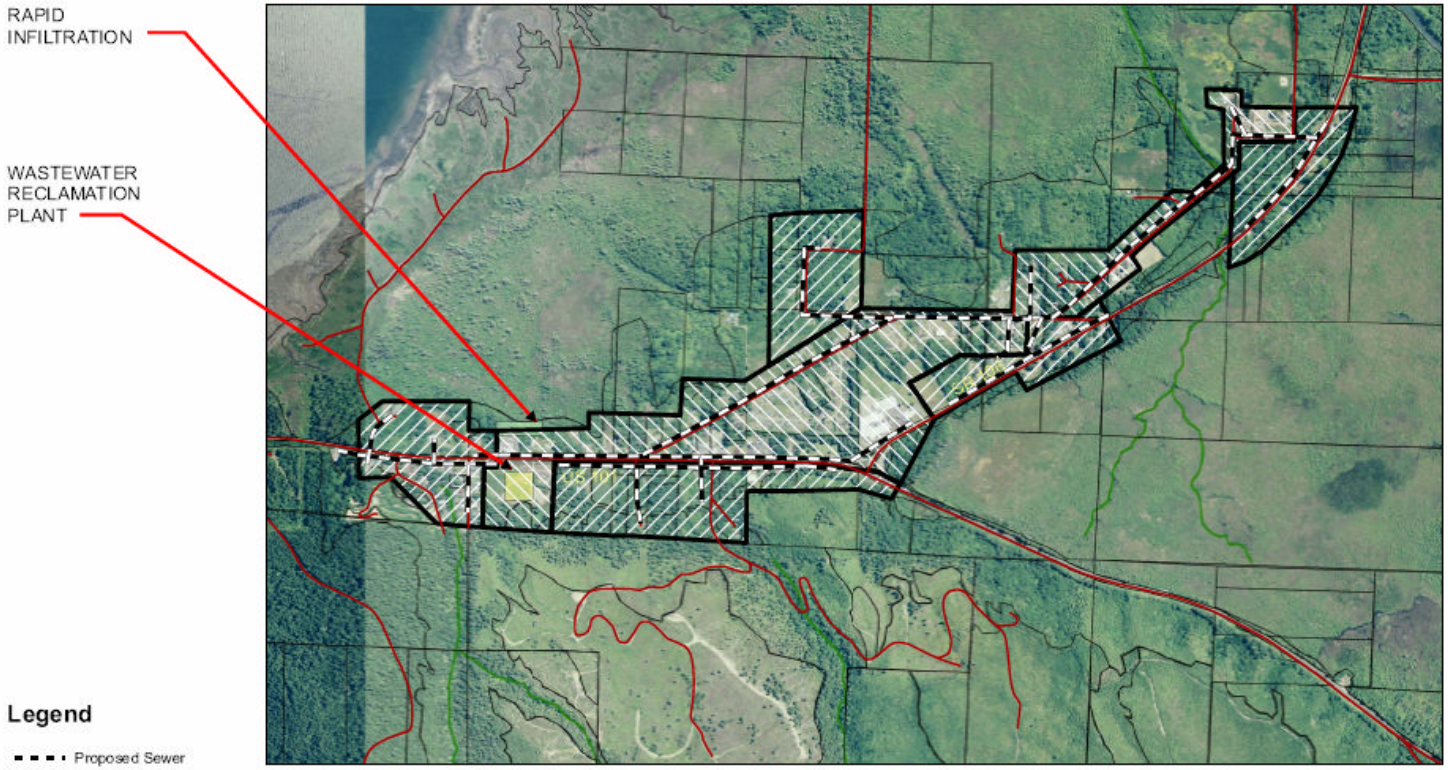
Figure 5.09



Legend

- Proposed Sewer
- Phase 1 Service Area
- Ultimate Service Area

CORE RESERVATION SERVICE AREA

SEPARATE TREATMENT SYSTEMS

Cascade Design Professionals, 2007

*Based on Skokomish Reservation mapping prepared by the Natural Resources Department of the Skokomish Tribe

0 600 1,200 Feet

Figure
5.09

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Figure 7.01

Hoodsport-Skokomish Facilities Planning Summary

Activity	Hoodsport	Potlatch	Core Res	Pot + Core
Engineering	$24,516			$38,424
Hydrogeology + Survey	$31,500	$15,750	$15,750	$31,500
Environmental Documentation	$30,000	$30,000	$30,000	$60,000
Financial	$22,667	$22,667	$22,667	$45,333
	$108,683	$68,417	$68,417	$175,257

Funding available for Facilities Planning as of March 22, 2007

Hoodsport RAC Cost Summary

* = engineer's estimate		Expanded Service Area 2	Service Area 2
Total Construction Cost Estimates (sums similar lines above)			
Engineer's Estimate		$6,170,071	$3,961,700
Contingency		$925,511	$676,340
8.3% Sales Tax		$589,780	$384,957
Construction Cost		$7,685,362	$5,022,997
Other Costs to Complete (some a % of Construction Cost)			
Facilites Plan and Env Documentation		$108,683	$108,683
Design Engineering	12%	$922,243	$602,760
Assistance During Const.	8%	$614,829	$401,840
Administration	2%	$153,707	$100,460
Design/Admin Contingency	3%	$230,561	$150,690
Cluster System Land		$90,000	
Sewer System Land		$250,000	$210,000
		$2,370,023	$1,574,432
Total Cost to Complete			
Grand Total		$10,055,385	$6,597,430

Figure 5.08

COST COMPARISONS - PHASED

(MBR & RAPID INFILTRATION)

Alt.		Conveyance	Treatment	Disposal	Construction Total	Contingency	Eng, Admin & Perm	Total	Cost/ERU
	PHASE 1								
1A	Potlatch Bubble, separate treatment	294,000	1,917,000	190,000	2,401,000	600,250	432,180	3,433,430	33,661
2A	Core Reservation, separate treatment	1,722,000	2,565,000	234,000	4,521,000	1,130,250	813,780	6,465,030	18,739
3S	Combined Treatment	3,210,000	3,548,000	317,000	7,075,000	1,768,750	1,273,500	10,117,250	22,627

Figure 7.01

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