CITY OF MONROE
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COMMUNITY DEVELOPMENT

Preliminary Drainage Report
Chain Lake Estates
PFN: M2013-

for

Rick Hansen
P.O. Box 2289
Snohomish, WA 98291

SITE LOCATION:
14301, 14305, 14325 Chain Lake Road
Monroe, WA 98272

JOSEPH M. SMEBY
STATE OF WASHINGTON
18835
REGISTERED
PROFESSIONAL ENGINEER
2/27/13

Prepared by:
Joseph M. Smeby, P.E.

Job No: 13-0203
February 2013

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1. INTRODUCTION

This document is intended to provide engineering information necessary to support the preliminary plat application to the City of Monroe for the 25 lot sub-division proposed on this site. The site covers 5.90 acres, of which approximately 5.44 acres will be cleared as a result of this project. Improvements to the east side of Chain Lake Road along this projects frontage along with a new road connection to Mountain Ridge Road and a new public road within the sub-division will be part of the application. A small wetland has been identified near the northeast side of these parcels.

This project proposes to construct a new public road within the plat to serve the future lots with some lots taking access off of Mountain Ridge Road or a private access tract. In addition, a new 5-foot sidewalk will be constructed along the east side of Chain Lake Road. This project will require the construction of driveways for each future lot, stormwater facilities and other utilities. The existing on-site soils will be amended per the Geotechnical recommendations to provide treatment of the storm water during infiltration. This system is designed to treat and infiltrate all runoff associated with the on-site developed project.

2. DRAINAGE INFORMATION SUMMARY FORM

Project: **Chain Lake Estates**
PFN: **M2013-**
Engineer: **Omega Engineering, Inc.**
2829 Rockefeller Avenue
Everett, WA 98201
Attention: Joseph Smeby, P.E.

Total site area: **5.90 acres**
Offsite area: **0.12 acres**
Disturbed area: **5.56 acres**

Applicant: **Hanson Homes**
P.O. Box 2289
Snohomish, WA 98291

Number of lots/Bldg: **25**

Drainage Basin Information	**On-Site**	**Roof (Each)**
On-site Developed Area	0.99 acres	0.06 acres
Off-site Improved Area	0.00 acres	0.00 acres
Types of storage proposed	Infiltration	Infiltration Trench
Approximate total storage volume	varies	224 cf per calc
Soil Types	Type C	Type C
Basin Data		
Pre-developed run-off rates: 2-year	0.03 cfs	0.004 cfs
10-year	0.05 cfs	0.009 cfs
100-year	0.08 cfs	0.016 cfs
Post-developed run-off rates: 2-year	0.00 cfs	0.00 cfs
10-year	0.00 cfs	0.00 cfs
100-year	0.00 cfs	0.00 cfs

3. EXISTING SITE CHARACTERISTICS and ASSUMPTIONS

The site is located east of Chain Lake Road and north of Mountain Ridge Road, and in Section 31, Township 28N, Range 7E, Willamette Meridian. See Figure 1 - Vicinity Map. The entire property consists of a single lot totaling 5.90 acres after the proposed BLA.

Land use around the site is single-family residential with a commercial property west of Chain Lake Road. This site currently contains three single-family buildings. Each lot is accessed separately via a gravel driveway. Frontage improvements will be required along Chain Lake Road which for this project only includes the construction of a new 5-foot sidewalk adjacent to the newly deeded R.O.W. line.

The existing site is irregular in shape approximately 600-feet long running east-west and 500-feet running north-south with a portion of the southern lot reduced in size due to the existence of Mountain Ridge Road. The grades on the site are flat. The vegetation found on the existing property is a mixture of landscaping including grasses and shrubs and native vegetation around the perimeter and along the road frontages.

Grades on the site generally run from north to south except in the northeast portion of the site where they run southwest to northeast in the area of the existing wetland and future cul-de-sac. The existing soils on this site are highly permeable so any runoff that is generated from this site, sheet flows across the south property line or is collected in the on-site wetland which drains to the north. Please refer to the attached geotechnical report in Appendix C for further discussion of the existing on-site soils. A site visit was conducted on October 10, 2008. The weather was clear with temperatures in the 60's. No surface water was observed on this site.

The soil hydrologic types for this site have been identified as Type C or Till from the Snohomish County Soil Survey Map, see figure 5. The soil type mapped for this site is Ragnar fine sandy loam. Soil tests on this site found a sandy gravel under laying the top layer of silt or silty sand, therefore infiltration will be used for this project. Refer to Geotechnical Report in Appendix C. The long-term recommended infiltration rates for the top silt/silty sand layer is 0.5-inches/hr and 2.0-inches/hr for the sandy gravel underneath. Therefore the infiltration systems will be designed to infiltrate into the sandy gravel layer with a long-term design infiltration rate of 2.0 inches per hour. This design is based on the bottom elevation for each facility relative to the existing ground.

4. NARRATIVE OF DEVELOPED SITE CHARACTERISTICS

This development proposes to create 25 new lots with one of the existing SFRs to remain on future lot 24. It was calculated that approximately 40% of the total site would be converted to impervious surfaces, however none of the proposed impervious surfaces will be considered effective impervious surfaces since the runoff from these areas will be fully infiltrated up to the 100-year storm event.

Site Areas

	Total Area (ac)	Roof (ac)	Roads/ Driveway (ac)	Walks (ac)	Landscaping / Open Space (ac)	Undisturbed (ac)
On-Site	5.90	1.44	0.70	0.14	3.16	0.46
Off-Site	0.12	0.00	0.00	0.07	0.05	0.00

This is shown in the stormwater calculations in Appendix A.

The undisturbed area is in the northeast portion of the site in Tracts 996 & 999. This area will drain naturally offsite to the north. The storm drainage systems for this project have been designed to collect, treat and infiltrate all of the new landscaping and impervious areas on this site. The off-site new impervious areas will not be collected since they only consist of a new sidewalk and the existing drainage system will not be affected.

The infiltration trenches and dry wells have been designed using the WWHM3 software and meet the current State and City standards.

4A. DOE MINIMUM REQUIREMENTS

MINIMUM REQUIREMENT #1: PREPARATION OF STORMWATER SITE PLANS

This project proposes to construct new impervious surfaces in excess of the minimum threshold so a final stormwater site plan will be prepared with the full engineering plans for this project.

MINIMUM REQUIREMENT #2: CONSTRUCTION STORMWATER POLLUTION PREVENTION (SWPPP)

1: Mark Clearing Limits
One of the first steps in the "Construction Sequence" included on the clearing and grading plan sheets is for a surveyor to stake the limits of clearing and to have construction or silt fencing placed along the limits prior to any other construction activity.

2: Establish Construction Access
The SWPPP calls for the proposed construction entrance to be installed as the second step after the staking of clearing limits. A detail is provided on the plans.

3: Control Flow Rates
This project will infiltrate 100% of the site runoff so no additional flow control is necessary. However, protection of the proposed infiltration areas which includes the infiltration trenches will be critical in the function of the future infiltration capacity of the site.

4: Install Sediment Controls
This site and SWPPP proposes to construct a construction entrance to collect and contain the sediment on this site. In addition, inlet filters will be installed in the existing catch basins adjacent to the site within the Mountain Ridge R.O.W. and straw bale check dams will be installed in the ditch along the east side of Chain Lake Road. These features are intended to minimize the opportunity for sediment to leave the site via stormwater or on vehicles. The construction of these features is one of the first items required in the "Construction Sequence".

5: Stabilize Soils
The "Construction Sequence" and "TESC Notes" call for the stabilization of soils that remain unworked for certain lengths of time based on the time of year. Stabilization techniques may include but not limited to mulching, plastic sheeting or hydroseeding, notes have been added to the plan regarding protection for the stock pile area if necessary.

6: Protect Slopes
No slopes are expected on this site; however, any stockpile area will be protected as noted above.

7: Protect Drain Inlets
All existing catch basins and proposed area drains will have inlet filters installed to protect the conveyance system and future infiltration system.

8: Stabilize Channels and Outlets
Straw bale check dams will be used in the ditch along the east side of Chain Lake Road to protect the existing channel during construction.

9: Control Pollutants
No outside chemicals are expected to be necessary for the construction of this project. All vehicles working on and around the site would need to meet the State requirements for emissions.

10: Control DeWatering
Dewatering is not expected for this project based on the permeability of the existing soils. However, if utility construction is performed during the winter months dewatering may be necessary. Runoff from any dewatering should be spread over the existing vegetation to be retained along the north and west sides of the project. The contractor shall monitor the area of runoff disposal and change outfall locations regularly to ensure no erosion or excessive sedimentation occurs in the disposal areas.

11: Maintain BMPs
The construction supervisor will be responsible for maintaining all BMPs during construction and working with the County to relocate or add BMPs as necessary as site conditions change.

12: Manage the Project
It will be the responsibility of the Contractor and Developer to manage this project and coordinate with the County Inspector and Engineer.

Inspection and Monitoring:
Site inspections shall be done by a person who is knowledgeable in the principles and practices of erosion and sediment control. The person must have skills to first assess the site conditions and construction activities that could impact the quality of stormwater, and second assess the effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges.
Whenever inspection and/or monitoring reveals that the BMPs identified in the Construction SWPPP are inadequate, due to the actual discharge of or potential to discharge a significant amount of any pollutant, appropriate BMPs or design changes shall be implemented as soon as possible.

Maintaining an Updated Construction SWPPP:
The construction SWPPP shall be retained on-site or within reasonable access to the site.

The SWPPP shall be modified whenever there is a change in the design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the state.

The SWPPP shall be modified if, during inspections or investigations conducted by the owner/operator, or the applicable local or stae regulatory authority, it is determined that the SWPPP is ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site. The SWPPP shall be modified as necessary to include additional or modified BMPs designed to correct problems identified. Revisions to the SWPPP shall be completed within seven days following inspection.

MINIMUM REQUIREMENT #3: SOURCE CONTROL OF POLLUTANTS

The improvements proposed on this site will create 25-lots and a new public road. Residential sub-divisions do not require additional source control BMPS, but full-infiltration is proposed on this site.

MINIMUM REQUIREMENT #4: PRESERVATION OF NATURAL DRAINAGE SYSTEMS AND OUTFALLS

Full infiltration will be used so no downstream system will be affected.

MINIMUM REQUIREMENT #5: ON-SITE STORMWATER MANAGEMENT

Runoff from the new public road will be collected CBs and conveyed to one of three infiltration systems for this project. In addition, an infiltration system has been sized for both the Tract 997 access and the proposed fire lane. Roof runoff from each future SFR will be directed to an individual infiltration trench sized for each roof area. The landscaping will be graded to infiltrate naturally into the existing soils on each lot and a dry well detail will be provided for the contractor to install if a low point is created on an individual lot.

MINIMUM REQUIREMENT #6: RUNOFF TREATMENT

The existing soil at the bottom of the proposed infiltration trenches will be reviewed by the project Geotech during construction to ensure it meets the treatment criteria provided in the DOE manual. On-site recommendations will be provided during construction as needed to amend the soils to meet the minimum standard.

MINIMUM REQUIREMENT #7: FLOW CONTROL

The design and analysis for this project requires the construction of infiltration systems that have been sized using the WWHM3 software. This site will fully infiltrate the 100-year storm event from the developed site.

MINIMUM REQUIREMENT #8: WETLAND PROTECTION

By infiltrating all site runoff this project will mimic the existing condition and provide ground water recharge in the areas around the existing wetland.

MINIMUM REQUIREMENT #9: BASIN/WATERSHED PLANNING

The scope of this project is too small to justify a Watershed Plan. In addition, the site due to 100% infiltration will have 0% effective impervious area.

MINIMUM REQUIREMENT #10: OPERATION AND MAINTENANCE

A complete O&M manual will be provided with the full drainage report.

5. DESCRIPTION OF PROPOSED EROSION CONTROL BMP's

Clearing, grading, and temporary erosion and sediment control plans have be prepared as part of this phase. However, since a construction site is dynamic it will be necessary to re-assess the erosion control BMP's during construction and install additional measures when and if necessary.

Proposed temporary measures for this project will include the following BMP's:
-Installation of stabilized rock construction entrance(s).
-Interceptor/Infiltration swales
-Rip-Rap check dams
-Straw mulch, hydroseed or other mulching and planting method to stabilized unworked areas.
-Silt Fencing

Permanent measures to reduce or eliminate erosion or water quality degradation will include the following BMP's: (Under Future Phase/Permit)
-Paving all traffic areas
-Drainage collection system, including catch basins and floatable material separators
-Permanent landscaping in pervious areas.
-Limiting cut and fill slopes to 2:1 maximum
-Routine maintenance and inspection of the grounds and response to developing problems.

These proposed erosion control BMP's have been engineered for anticipated conditions in compliance with DOE guidelines. With proper installation, maintenance and inspection the proposed BMP's should result in minimal impact to the surrounding environment. The City retains the authority by code to require additional measures should the existing measures prove insufficient.

A. SITE GRADING/EROSION CONTROL RISK ASSESSMENT

SLOPE: Existing grades onsite slope down from north to south to northwest to southeast ranging from 0.5% to approximately 2.0%. The proposed internal road grades will be no greater than 2%.
CRITICAL AREAS: A small on-site wetland is located in the northeast corner of the site.
SOILS: In the development area of the site soils are Ragnar fine sandy loam, hydrologic group B/C, (from Geotechnical Report).
GROUND MOVEMENT POTENTIAL: N/A
SOURCES OF WATER FOR EROSION: Rainfall will be the only significant source of onsite runoff.
NEAREST DOWNSTREAM BODY OF WATER OTHER THAN ROAD DITCHES: Woods Creek, is the nearest significant water body downstream of the site.
MEASURES PROPOSED TO PREVENT/MINIMIZE EROSION:
TEMPORARY MEASURES: Mulch cover, rock construction entrance(s), diversion/infiltration swales, silt fencing are all proposed to be used to prevent or minimize erosion and siltation during construction.
PERMANENT MEASURES: Future measures will include permanent vegetative cover in pervious areas, limiting permanent cut and fill slopes to 2:1 maximum unless protected with a rockery face, asphalt pavement to stabilize all vehicle traffic areas and a piped conveyance system to control the location of runoff release. Routine maintenance of the grounds and response to developing problems will be a function of the property owner.
CONCLUSION: Proposed erosion control BMP's in compliance with DOE guidelines have been engineered for anticipated conditions. Civil construction plans include a detailed ESC plan that provides details and notes for the proposed BMP's. With proper installation, maintenance and inspection, the proposed BMP's should result in minimal impact to the surrounding environment. Based on the above information the Erosion Risk for this site is Low to Moderate. Reports, studies and designs for this site include:

SEPA Checklist, by Others
Preliminary Engineering Construction Plans, by Omega Engineering, Inc.
Getechnical Report, by Western Geotechnical Consultants, Inc.

B. Minimum Elements

1: Mark Clearing Limits
One of the first steps in the "Construction Sequence" included on the clearing and grading plan sheets is for a surveyor to stake the limits of clearing and to have construction or silt fencing placed along the limits prior to any other construction activity.

2: Establish Construction Access
The SWPPP calls for the proposed construction entrance to be installed as the second step after the staking of clearing limits. A detail is provided on the plans.

3: Control Flow Rates
This project will infiltrate 100% of the site runoff so no additional flow control is necessary. However, protection of the proposed infiltration areas which includes the infiltration trenches will be critical in the function of the future infiltration capacity of the site.

4: Install Sediment Controls
This site and SWPPP proposes to construct a construction entrance to collect and contain the sediment on this site. In addition, inlet filters will be installed in the existing catch basins adjacent to the site within the Mountain Ridge R.O.W. and straw bale check dams will be installed in the ditch along the east side of Chain Lake Road. These features are intended to minimize the opportunity for sediment to leave the site via stormwater or on vehicles. The construction of these features is one of the first items required in the "Construction Sequence".

5: Stabilize Soils
The "Construction Sequence" and "TESC Notes" call for the stabilization of soils that remain unworked for certain lengths of time based on the time of year. Stabilization techniques may include but not limited to mulching, plastic sheeting or hydroseeding, notes have been added to the plan regarding protection for the stock pile area if necessary.

6: Protect Slopes
No slopes are expected on this site; however, any stockpile area will be protected as noted above.

7: Protect Drain Inlets
All existing catch basins and proposed area drains will have inlet filters installed to protect the conveyance system and future infiltration system.

8: Stabilize Channels and Outlets
Straw bale check dams will be used in the ditch along the east side of Chain Lake Road to protect the existing channel during construction.

9: Control Pollutants
No outside chemicals are expected to be necessary for the construction of this project. All vehicles working on and around the site would need to meet the State requirements for emissions.

10: Control DeWatering

Dewatering is not expected for this project based on the permeability of the existing soils. However, if utility construction is performed during the winter months dewatering may be necessary. Runoff from any dewatering should be spread over the existing vegetation to be retained along the north and west sides of the project. The contractor shall monitor the area of runoff disposal and change outfall locations regularly to ensure no erosion or excessive sedimentation occurs in the disposal areas.

11: Maintain BMPs
The construction supervisor will be responsible for maintaining all BMPs during construction and working with the County to relocate or add BMPs as necessary as site conditions change.

12: Manage the Project
It will be the responsibility of the Contractor and Developer to manage this project and coordinate with the County Inspector and Engineer.

Inspection and Monitoring:
Site inspections shall be done by a person who is knowledgeable in the principles and practices of erosion and sediment control. The person must have skills to first assess the site conditions and construction activities that could impact the quality of stormwater, and second assess the effectiveness of erosion and sediment control measures used to control the quality of stormwater discharges.
Whenever inspection and/or monitoring reveals that the BMPs identified in the Construction SWPPP are inadequate, due to the actual discharge of or potential to discharge a significant amount of any pollutant, appropriate BMPs or design changes shall be implemented as soon as possible.

Maintaining an Updated Construction SWPPP:
The construction SWPPP shall be retained on-site or within reasonable access to the site.

The SWPPP shall be modified whenever there is a change in the design, construction, operation, or maintenance at the construction site that has, or could have, a significant effect on the discharge of pollutants to waters of the state.

The SWPPP shall be modified if, during inspections or investigations conducted by the owner/operator, or the applicable local or stae regulatory authority, it is determined that the SWPPP is ineffective in eliminating or significantly minimizing pollutants in stormwater discharges from the site. The SWPPP shall be modified as necessary to include additional or modified BMPs designed to correct problems identified. Revisions to the SWPPP shall be completed within seven days following inspection.

6. OFFSITE DRAINAGE ANALYSIS - UPSTREAM

From field observation and review of the available topography, it appears that the only location, which will contribute offsite flows onto this site, is along the northern and southeastern property lines of this property. In addition, the existing road detention pond east of this project has an outfall that drains to a shallow channel in the northeast corner of the site. These flows are currently flowing across the property and leaving along the northern property line. No change will be made to these offsite flows due to construction, therefore they will be allowed to flow through the site undisturbed.

7. OFFSITE DRAINAGE ANALYSIS - DOWNSTREAM

The project lies near along the edge of a broad basin which ultimately drains to the Skykomish River. This project proposes to infiltrate 100% of the stormwater generated on-site. This will reduce the demand on the downstream system which consists of a series of ditches, pipes and catch basins or manholes.

8. DETENTION STORAGE CALCULATIONS

Current City code requires this site be analyzed using the 2005 DOE manual and the WWHM3 stormwater software. Since this site proposes using infiltration the software will be used to size the infiltration systems necessary.

The proposed infiltration trenches are located throughout the site. The road runoff will be infiltrated in one of three systems located in the proposed R.O.W. or within future tract 998. The fire lane runoff will be infiltrated within the access and utility easement and the Tract 997 runoff will be infiltrated within the tract. Finally, each lot has been designed with a roof infiltration system and there is a typical dry well detail for the contractor to install in any low area created on any lot during the grading of the site.

Since the WWHM3 does not have a gravel trench facility option to account for the void ratio in the trench or pavement section the depth of a vault was adjusted to provide the same volume of storage as a gravel trench or pavement section with a void ratio of 35%. This was done by reducing the depth of the trenches from 4 to 1.4-feet and using the 100% void ratio as provided with a vault design. The only affect this would have on the analysis would be if side-wall infiltration were used, and for this project only the bottom area was used for analysis.

Refer to appendix 'A' for the full output from the WWHM3 software.

9. WATER QUALITY DESIGN

Water quality for this project will be provided in the form of existing or amended soils beneath the proposed infiltration trenches designed to receive runoff from PGIS. The Geotechnical engineer has provided recommendations for the treatment layer of soil if needed. The design will included a 2-foot layer of material beneath the bottom of the trench section which provides a minimum organic content of 5% and a cation exchange capacity (CEC) of 5 milliequivalents/100 grams. Some amendment of the existing soils may be necessary to provide the full 2-foot thickness for the treatment layer. The project Geotech will be required to be on-site while the trenches are being excavated and prior to backfill to ensure the soils meet the treatment requirements.

In addition, special inspection by a geotechnical engineer will be required to ensure the treatment layer meets these requirements based on the following DOE requirements:

- One sample per 1,000 sf of facility area shall be tested. (Sample shall be a composite of subsamples taken throughout the depth of the treatment layer).
- Organic content shall be measured on a dry weight basis using ASTM D2974.
- CEC shall be tested using EPA lab method 9081.
- Certification by a soils testing lab that the treatment soil layer meets the organic content and CEC criteria above shall be provided to the City of Monroe Inspector and Engineering Department.
- Animal manures may not be used unless properly sterilized.

10. CONVEYANCE CALCULATIONS

To be provided with full drainage report

11. OPERATIONS AND MAINTENANCE MANUAL

The Property Owners and HOA will be responsible for maintaining the stormwater and landscaping facilities within this development. Included in this manual are checklists for each feature specific to this project. Copies should be made of the checklists as necessary during routine inspections and required maintenance. Specific problems can be recorded along with the appropriate action taken.

These checklists are a guide for inspections and maintenance. The frequency of the inspections/maintenance is identified in the left hand column with the following abbreviations:

A = Annual (March or April preferred)
M = Monthly
S = After Major Storms (Use 1-inch in 24 hours as a guideline)

Routine inspections and maintenance will improve the long-term performance of the stormwater facilities. If at any time you are unsure if a problem exists or how to address a specific problem contact a Professional Engineer.

Refer to Appendix B for a list of each facility to be maintained and the appropriate maintenance checklist. (To be provided with full drainage report)

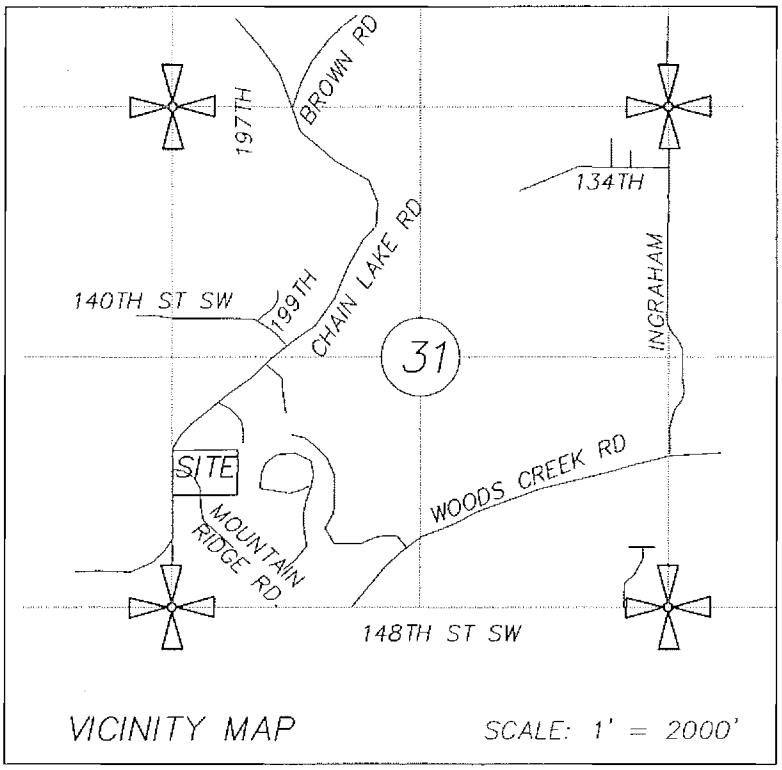

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FIG. 1

OMEGA
ENGINEERING, INC.
2829 Rockefeller Ave.
Everett, WA 98201
(o)425.387.3820 (f) 425.259.1958

VICINITY MAP
CHAIN LAKE ESTATES

DATE	JOB NO.	SCALE	SHEET
2/26/13	13-0203	1" = 2000'	1 OF 1

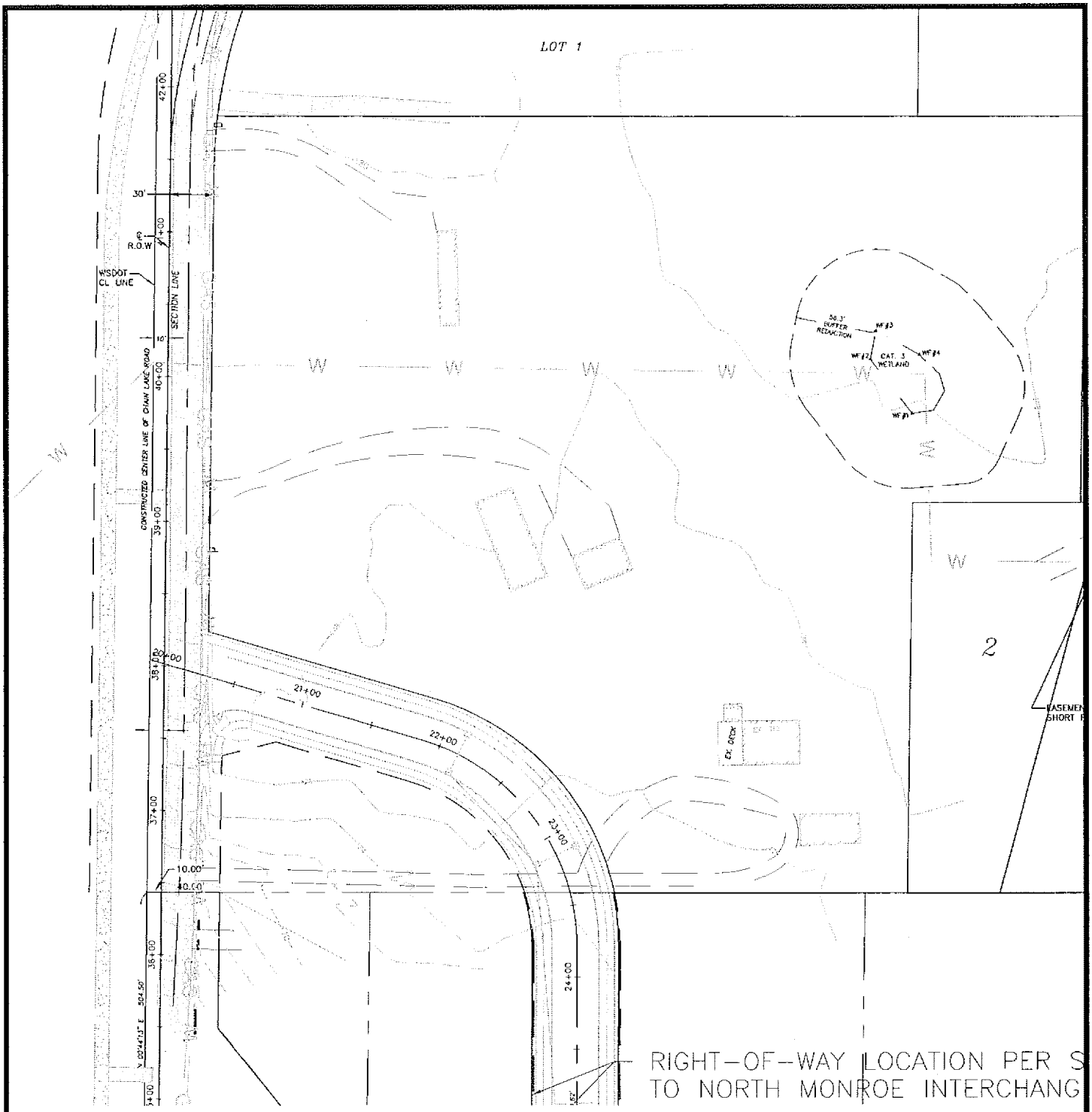


FIG. 2

OMEGA
ENGINEERING, INC.
2829 Rockefeller Ave.
Everett, WA 98201
(o)425.387.3820 (f) 425.259.1958

EXISTING BASIN MAP
CHAIN LAKE ESTATES

DATE	JOB NO.	SCALE	SHEET
2/26/13	13-0203	1" = 100'	1 OF 1

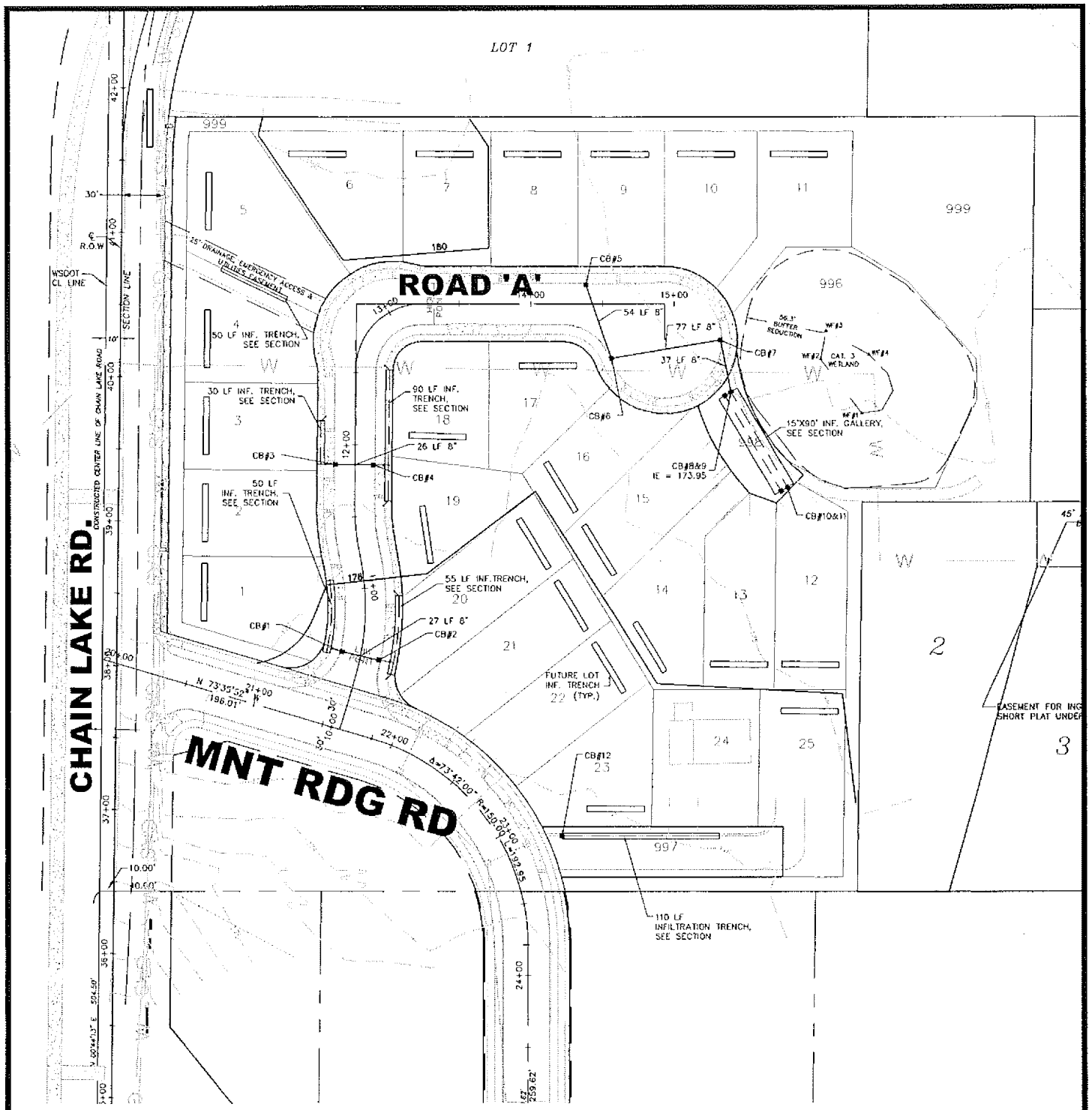


FIG. 3

OMEGA
ENGINEERING, INC.
2829 Rockefeller Ave.
Everett, WA 98201
(o)425.387.3820 (f) 425.259.1958

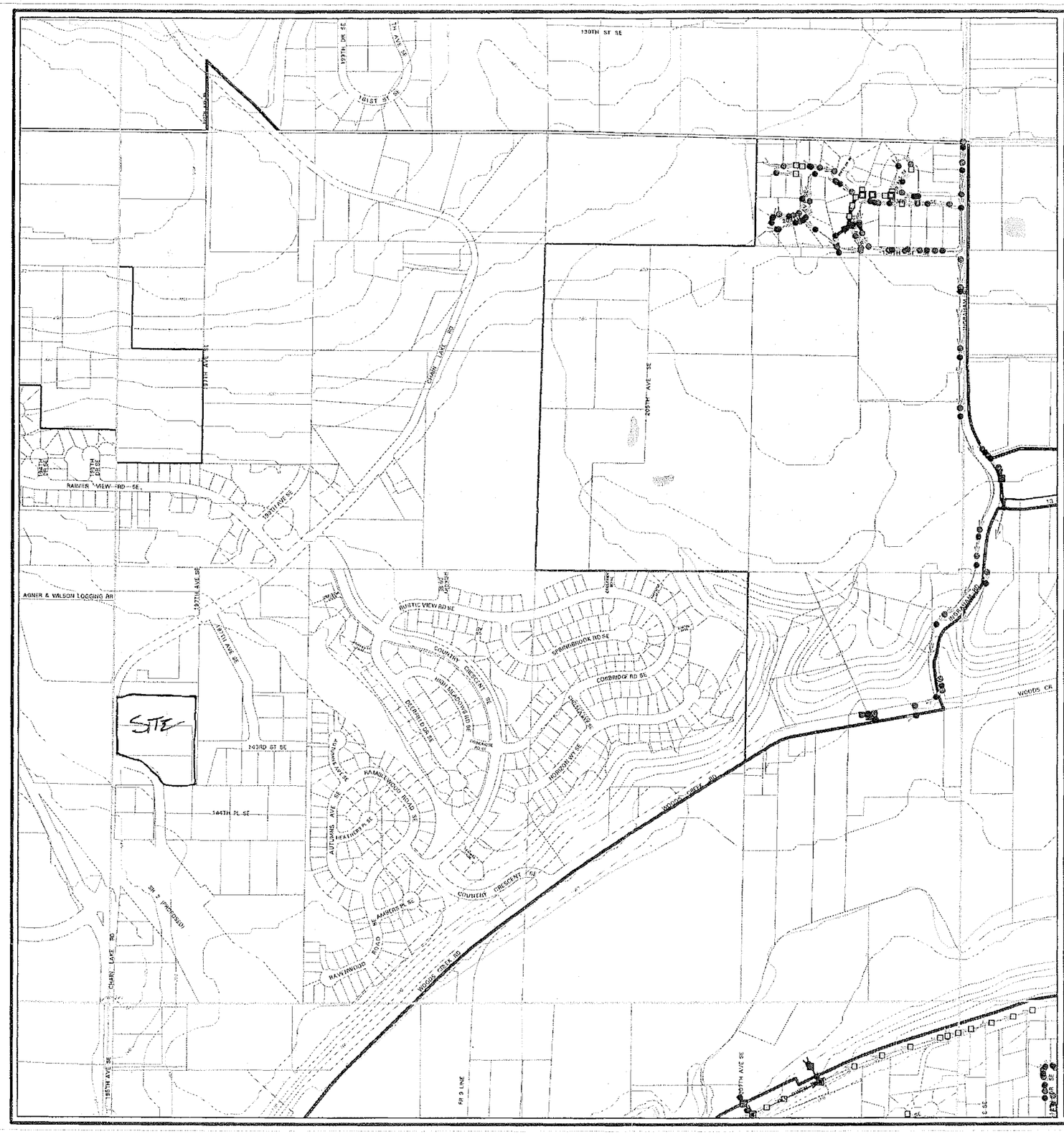
EXISTING BASIN MAP
CHAIN LAKE ESTATES

DATE	JOB NO.	SCALE	SHEET
2/26/13	13-0203	1" = 100'	1 OF 1

Fig. 4

1 3/4 1/2 1/4 0
1 0.5 0

SC.



Snohomish County

Drainage Inventory

Map date: December 20, 2008

Section 31
T 28 N, R 7 E

Legend

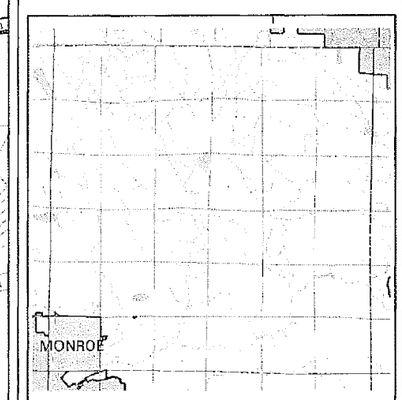
Drainage Network
- Open Channel System
- Surface Flow
- Pipe Diameter 12 & undat
- Pipe Diameter 15 to 21
- Pipe Diameter 24 to 30
- Pipe Diameter 36 & greater
- Arched Pipe

Base Map Features
- Section
- Quarter Section
- Parcel Boundary
- City Boundary
- Urban Growth Boundary
- 20 Ft Contours
- Water

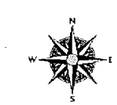
Drainage Features
- Pipe In
- Pipe Out
- Pipe Invert (Flow direction unclear)
- Other Drainage Feature

Catch Basins
- CB Yard Drain
- CB Type 1 Inlet
- CB Type 1
- CB Type 2
- CB Type 2 Flow/Poll
- Other CBs

Access Points
- Vault Access
- Detention Pipe Access



Township 28, Range 7



0 500 1000 1500

feet

Scale 1:4800

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Data collected by Snohomish County Public Works, Surface Water Management Division. Data and field measurements of drainage conditions are the chief data collection. Data should not be used for final engineering design. The Snohomish County Surface Water Management Division is not responsible for any engineering, construction, or operation, and is not responsible for the consequences arising from any use of the County's maps and other data in the inventory report.

Digital data and metadata available from Snohomish County PW-SWM/GIS

Snohomish County

PUBLIC WORKS
Surface Water Management
Drainage Infrastructure Program
(425) 388-3464

Map produced by PW-SWM/GIS
December 20, 2008

Fig. 5

APPENDIX A

STORMWATER CALCULATIONS

Western Washington Hydrology Model
PROJECT REPORT

Project Name: Road NE
Site Address: 14305 Chain Lake Road
City : Monroe
Report Date : 2/22/2013
Gage : Everett
Data Start : 1948/10/01
Data End : 1997/09/30
Precip Scale: 1.20
WWHM3 Version:

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Forest, Flat	.42

Impervious Land Use	Acres

Element Flows To:
Surface Interflow Groundwater

Name : Road NE
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Lawn, Flat	.06

Impervious Land Use	Acres
ROADS FLAT	0.36

Element Flows To:
Surface Interflow Groundwater
Trench 1, Trench 1,

Name : Trench 1
Width : 15 ft.

Length : 80 ft.
Depth: 1.5ft.
Infiltration On
Infiltration rate : 2
Infiltration saftey factor : 1
Discharge Structure
Riser Height: 1.4 ft.
Riser Diameter: 12 in.

Element Flows To:
Outlet 1 Outlet 2

Vault Hydraulic Table

Stage(ft)	Area(acr)	Volume(acr-ft)	Dschrg(cfs)	Infilt(cfs)
100.0	0.028	0.000	0.000	0.000
100.0	0.028	0.000	0.000	0.056
100.0	0.028	0.001	0.000	0.056
100.1	0.028	0.001	0.000	0.056
100.1	0.028	0.002	0.000	0.056
100.1	0.028	0.002	0.000	0.056
100.1	0.028	0.003	0.000	0.056
100.1	0.028	0.003	0.000	0.056
100.1	0.028	0.004	0.000	0.056
100.2	0.028	0.004	0.000	0.056
100.2	0.028	0.005	0.000	0.056
100.2	0.028	0.005	0.000	0.056
100.2	0.028	0.006	0.000	0.056
100.2	0.028	0.006	0.000	0.056
100.2	0.028	0.006	0.000	0.056
100.3	0.028	0.007	0.000	0.056
100.3	0.028	0.007	0.000	0.056
100.3	0.028	0.008	0.000	0.056
100.3	0.028	0.008	0.000	0.056
100.3	0.028	0.009	0.000	0.056
100.3	0.028	0.009	0.000	0.056
100.4	0.028	0.010	0.000	0.056
100.4	0.028	0.010	0.000	0.056
100.4	0.028	0.011	0.000	0.056
100.4	0.028	0.011	0.000	0.056
100.4	0.028	0.011	0.000	0.056
100.4	0.028	0.012	0.000	0.056
100.5	0.028	0.012	0.000	0.056
100.5	0.028	0.013	0.000	0.056
100.5	0.028	0.013	0.000	0.056
100.5	0.028	0.014	0.000	0.056
100.5	0.028	0.014	0.000	0.056
100.5	0.028	0.015	0.000	0.056
100.6	0.028	0.015	0.000	0.056
100.6	0.028	0.016	0.000	0.056
100.6	0.028	0.016	0.000	0.056
100.6	0.028	0.017	0.000	0.056
100.6	0.028	0.017	0.000	0.056
100.6	0.028	0.017	0.000	0.056
100.7	0.028	0.018	0.000	0.056

100.7	0.028	0.018	0.000	0.056
100.7	0.028	0.019	0.000	0.056
100.7	0.028	0.019	0.000	0.056
100.7	0.028	0.020	0.000	0.056
100.7	0.028	0.020	0.000	0.056
100.8	0.028	0.021	0.000	0.056
100.8	0.028	0.021	0.000	0.056
100.8	0.028	0.022	0.000	0.056
100.8	0.028	0.022	0.000	0.056
100.8	0.028	0.022	0.000	0.056
100.8	0.028	0.023	0.000	0.056
100.9	0.028	0.023	0.000	0.056
100.9	0.028	0.024	0.000	0.056
100.9	0.028	0.024	0.000	0.056
100.9	0.028	0.025	0.000	0.056
100.9	0.028	0.025	0.000	0.056
100.9	0.028	0.026	0.000	0.056
101.0	0.028	0.026	0.000	0.056
101.0	0.028	0.027	0.000	0.056
101.0	0.028	0.027	0.000	0.056
101.0	0.028	0.028	0.000	0.056
101.0	0.028	0.028	0.000	0.056
101.0	0.028	0.028	0.000	0.056
101.1	0.028	0.029	0.000	0.056
101.1	0.028	0.029	0.000	0.056
101.1	0.028	0.030	0.000	0.056
101.1	0.028	0.030	0.000	0.056
101.1	0.028	0.031	0.000	0.056
101.1	0.028	0.031	0.000	0.056
101.2	0.028	0.032	0.000	0.056
101.2	0.028	0.032	0.000	0.056
101.2	0.028	0.033	0.000	0.056
101.2	0.028	0.033	0.000	0.056
101.2	0.028	0.034	0.000	0.056
101.2	0.028	0.034	0.000	0.056
101.3	0.028	0.034	0.000	0.056
101.3	0.028	0.035	0.000	0.056
101.3	0.028	0.035	0.000	0.056
101.3	0.028	0.036	0.000	0.056
101.3	0.028	0.036	0.000	0.056
101.3	0.028	0.037	0.000	0.056
101.4	0.028	0.037	0.000	0.056
101.4	0.028	0.038	0.000	0.056
101.4	0.028	0.038	0.000	0.056
101.4	0.028	0.039	0.000	0.056
101.4	0.028	0.039	0.021	0.056
101.4	0.028	0.039	0.059	0.056
101.5	0.028	0.040	0.109	0.056
101.5	0.028	0.040	0.168	0.056
101.5	0.028	0.041	0.234	0.056
101.5	0.028	0.041	0.308	0.056
101.5	0.028	0.042	0.388	0.056
101.5	0.000	0.000	0.474	0.000

MITIGATED LAND USE

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.012846
5 year	0.018792
10 year	0.02341
25 year	0.030076
50 year	0.035684
100 year	0.041876

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0
5 year	0
10 year	0
25 year	0
50 year	0
100 year	0

Yearly Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1950	0.008	0.000
1951	0.022	0.000
1952	0.009	0.000
1953	0.009	0.000
1954	0.012	0.000
1955	0.020	0.000
1956	0.021	0.000
1957	0.015	0.000
1958	0.022	0.000
1959	0.020	0.000
1960	0.013	0.000
1961	0.012	0.000
1962	0.013	0.019
1963	0.018	0.000
1964	0.028	0.000
1965	0.012	0.000
1966	0.012	0.000
1967	0.007	0.000
1968	0.015	0.000
1969	0.017	0.000
1970	0.021	0.000
1971	0.009	0.000
1972	0.013	0.000
1973	0.011	0.000
1974	0.009	0.000
1975	0.011	0.000
1976	0.009	0.000
1977	0.009	0.000
1978	0.008	0.000
1979	0.010	0.000
1980	0.030	0.000
1981	0.010	0.000

1982	0.011	0.000
1983	0.011	0.000
1984	0.012	0.000
1985	0.013	0.000
1986	0.016	0.000
1987	0.036	0.000
1988	0.018	0.000
1989	0.009	0.000
1990	0.014	0.000
1991	0.012	0.000
1992	0.012	0.000
1993	0.010	0.000
1994	0.007	0.000
1995	0.008	0.000
1996	0.012	0.000
1997	0.021	0.000
1998	0.047	0.032

Ranked Yearly Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0469	0.0317
2	0.0362	0.0188
3	0.0299	0.0000
4	0.0281	0.0000
5	0.0217	0.0000
6	0.0215	0.0000
7	0.0212	0.0000
8	0.0207	0.0000
9	0.0205	0.0000
10	0.0200	0.0000
11	0.0197	0.0000
12	0.0180	0.0000
13	0.0177	0.0000
14	0.0168	0.0000
15	0.0157	0.0000
16	0.0148	0.0000
17	0.0148	0.0000
18	0.0141	0.0000
19	0.0134	0.0000
20	0.0134	0.0000
21	0.0127	0.0000
22	0.0125	0.0000
23	0.0124	0.0000
24	0.0121	0.0000
25	0.0120	0.0000
26	0.0119	0.0000
27	0.0119	0.0000
28	0.0119	0.0000
29	0.0115	0.0000
30	0.0115	0.0000
31	0.0112	0.0000
32	0.0112	0.0000
33	0.0112	0.0000
34	0.0109	0.0000
35	0.0104	0.0000
36	0.0101	0.0000

37	0.0095	0.0000
38	0.0094	0.0000
39	0.0093	0.0000
40	0.0092	0.0000
41	0.0090	0.0000
42	0.0090	0.0000
43	0.0088	0.0000
44	0.0087	0.0000
45	0.0078	0.0000
46	0.0078	0.0000
47	0.0075	0.0000
48	0.0071	0.0000
49	0.0068	0.0000

POC #1
The Facility PASSED

The Facility PASSED.

Flow(CFS)	Predev	Dev	Percentage	Pass/Fail
0.0064	4096	4	0	Pass
0.0067	3635	4	0	Pass
0.0070	3206	4	0	Pass
0.0073	2852	4	0	Pass
0.0076	2545	4	0	Pass
0.0079	2260	4	0	Pass
0.0082	1998	4	0	Pass
0.0085	1774	4	0	Pass
0.0088	1574	4	0	Pass
0.0091	1384	4	0	Pass
0.0094	1219	4	0	Pass
0.0097	1092	4	0	Pass
0.0100	984	4	0	Pass
0.0103	879	4	0	Pass
0.0106	782	4	0	Pass
0.0109	684	4	0	Pass
0.0112	594	4	0	Pass
0.0114	533	4	0	Pass
0.0117	477	4	0	Pass
0.0120	426	4	0	Pass
0.0123	388	4	1	Pass
0.0126	352	4	1	Pass
0.0129	320	4	1	Pass
0.0132	298	4	1	Pass
0.0135	269	4	1	Pass
0.0138	246	4	1	Pass
0.0141	232	4	1	Pass
0.0144	215	4	1	Pass
0.0147	201	4	1	Pass
0.0150	187	4	2	Pass
0.0153	179	4	2	Pass
0.0156	170	4	2	Pass
0.0159	154	4	2	Pass
0.0162	148	4	2	Pass
0.0165	142	4	2	Pass
0.0168	134	4	2	Pass

0.0171	125	4	3	Pass
0.0174	123	4	3	Pass
0.0177	118	4	3	Pass
0.0180	116	4	3	Pass
0.0182	112	4	3	Pass
0.0185	110	4	3	Pass
0.0188	108	2	1	Pass
0.0191	103	2	1	Pass
0.0194	97	2	2	Pass
0.0197	93	2	2	Pass
0.0200	90	2	2	Pass
0.0203	89	2	2	Pass
0.0206	84	2	2	Pass
0.0209	81	2	2	Pass
0.0212	79	2	2	Pass
0.0215	75	2	2	Pass
0.0218	72	2	2	Pass
0.0221	69	2	2	Pass
0.0224	69	2	2	Pass
0.0227	67	2	2	Pass
0.0230	64	2	3	Pass
0.0233	62	2	3	Pass
0.0236	61	2	3	Pass
0.0239	60	2	3	Pass
0.0242	59	2	3	Pass
0.0245	59	2	3	Pass
0.0247	55	2	3	Pass
0.0250	55	2	3	Pass
0.0253	54	2	3	Pass
0.0256	53	2	3	Pass
0.0259	52	2	3	Pass
0.0262	49	2	4	Pass
0.0265	49	2	4	Pass
0.0268	48	1	2	Pass
0.0271	45	1	2	Pass
0.0274	44	1	2	Pass
0.0277	42	1	2	Pass
0.0280	40	1	2	Pass
0.0283	38	1	2	Pass
0.0286	37	1	2	Pass
0.0289	36	1	2	Pass
0.0292	35	1	2	Pass
0.0295	34	1	2	Pass
0.0298	33	1	3	Pass
0.0301	31	1	3	Pass
0.0304	30	1	3	Pass
0.0307	29	1	3	Pass
0.0310	28	1	3	Pass
0.0313	27	1	3	Pass
0.0315	26	1	3	Pass
0.0318	26	0	0	Pass
0.0321	25	0	0	Pass
0.0324	22	0	0	Pass
0.0327	22	0	0	Pass
0.0330	20	0	0	Pass
0.0333	18	0	0	Pass
0.0336	18	0	0	Pass

0.0339	16	0	0	Pass
0.0342	14	0	0	Pass
0.0345	14	0	0	Pass
0.0348	12	0	0	Pass
0.0351	12	0	0	Pass
0.0354	12	0	0	Pass
0.0357	12	0	0	Pass

Water Quality BMP Flow and Volume for POC 1.
On-line facility volume: 0 acre-feet
On-line facility target flow: 0 cfs.
Adjusted for 15 min: 0 cfs.
Off-line facility target flow: 0 cfs.
Adjusted for 15 min: 0 cfs.

Perlnd and Implnd Changes

No changes have been made.

This program and accompanying documentation is provided 'as-is' without warranty of any kind. The entire risk regarding the performance and results of this program is assumed by the user. Clear Creek Solutions and the Washington State Department of Ecology disclaims all warranties, either expressed or implied, including but not limited to implied warranties of program and accompanying documentation. In no event shall Clear Creek Solutions and/or the Washington State Department of Ecology be liable for any damages whatsoever (including without limitation to damages for loss of business profits, loss of business information, business interruption, and the like) arising out of the use of, or inability to use this program even if Clear Creek Solutions or the Washington State Department of Ecology has been advised of the possibility of such damages.

Western Washington Hydrology Model
PROJECT REPORT

Project Name: Road NW
Site Address: 14305 Chain Lake Road
City : Monroe
Report Date : 2/22/2013
Gage : Everett
Data Start : 1948/10/01
Data End : 1997/09/30
Precip Scale: 1.20
WWHM3 Version:

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Forest, Flat	.2

Impervious Land Use	Acres

Element Flows To:
Surface Interflow Groundwater

Name : Road NE
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Lawn, Flat	.02

Impervious Land Use	Acres
ROADS FLAT	0.18

Element Flows To:
Surface Interflow Groundwater
Trench 1, Trench 1,

Name : Trench 1
Width : 5 ft.

Length : 120 ft.
Depth: 1.5ft.
Infiltration On
Infiltration rate : 2
Infiltration saftey factor : 1
Discharge Structure
Riser Height: 1.4 ft.
Riser Diameter: 12 in.

Element Flows To:
Outlet 1 Outlet 2

Vault Hydraulic Table

Stage(ft)	Area(acr)	Volume(acr-ft)	Dschrg(cfs)	Infilt(cfs)
100.0	0.014	0.000	0.000	0.000
100.0	0.014	0.000	0.000	0.028
100.0	0.014	0.000	0.000	0.028
100.1	0.014	0.001	0.000	0.028
100.1	0.014	0.001	0.000	0.028
100.1	0.014	0.001	0.000	0.028
100.1	0.014	0.001	0.000	0.028
100.1	0.014	0.002	0.000	0.028
100.1	0.014	0.002	0.000	0.028
100.2	0.014	0.002	0.000	0.028
100.2	0.014	0.002	0.000	0.028
100.2	0.014	0.003	0.000	0.028
100.2	0.014	0.003	0.000	0.028
100.2	0.014	0.003	0.000	0.028
100.2	0.014	0.003	0.000	0.028
100.3	0.014	0.003	0.000	0.028
100.3	0.014	0.004	0.000	0.028
100.3	0.014	0.004	0.000	0.028
100.3	0.014	0.004	0.000	0.028
100.3	0.014	0.004	0.000	0.028
100.3	0.014	0.005	0.000	0.028
100.4	0.014	0.005	0.000	0.028
100.4	0.014	0.005	0.000	0.028
100.4	0.014	0.005	0.000	0.028
100.4	0.014	0.006	0.000	0.028
100.4	0.014	0.006	0.000	0.028
100.4	0.014	0.006	0.000	0.028
100.5	0.014	0.006	0.000	0.028
100.5	0.014	0.006	0.000	0.028
100.5	0.014	0.007	0.000	0.028
100.5	0.014	0.007	0.000	0.028
100.5	0.014	0.007	0.000	0.028
100.5	0.014	0.007	0.000	0.028
100.6	0.014	0.008	0.000	0.028
100.6	0.014	0.008	0.000	0.028
100.6	0.014	0.008	0.000	0.028
100.6	0.014	0.008	0.000	0.028
100.6	0.014	0.008	0.000	0.028
100.6	0.014	0.009	0.000	0.028
100.7	0.014	0.009	0.000	0.028

100.7	0.014	0.009	0.000	0.028
100.7	0.014	0.009	0.000	0.028
100.7	0.014	0.010	0.000	0.028
100.7	0.014	0.010	0.000	0.028
100.7	0.014	0.010	0.000	0.028
100.8	0.014	0.010	0.000	0.028
100.8	0.014	0.011	0.000	0.028
100.8	0.014	0.011	0.000	0.028
100.8	0.014	0.011	0.000	0.028
100.8	0.014	0.011	0.000	0.028
100.8	0.014	0.011	0.000	0.028
100.9	0.014	0.012	0.000	0.028
100.9	0.014	0.012	0.000	0.028
100.9	0.014	0.012	0.000	0.028
100.9	0.014	0.012	0.000	0.028
100.9	0.014	0.013	0.000	0.028
100.9	0.014	0.013	0.000	0.028
101.0	0.014	0.013	0.000	0.028
101.0	0.014	0.013	0.000	0.028
101.0	0.014	0.014	0.000	0.028
101.0	0.014	0.014	0.000	0.028
101.0	0.014	0.014	0.000	0.028
101.0	0.014	0.014	0.000	0.028
101.1	0.014	0.014	0.000	0.028
101.1	0.014	0.015	0.000	0.028
101.1	0.014	0.015	0.000	0.028
101.1	0.014	0.015	0.000	0.028
101.1	0.014	0.015	0.000	0.028
101.1	0.014	0.016	0.000	0.028
101.2	0.014	0.016	0.000	0.028
101.2	0.014	0.016	0.000	0.028
101.2	0.014	0.016	0.000	0.028
101.2	0.014	0.017	0.000	0.028
101.2	0.014	0.017	0.000	0.028
101.2	0.014	0.017	0.000	0.028
101.3	0.014	0.017	0.000	0.028
101.3	0.014	0.017	0.000	0.028
101.3	0.014	0.018	0.000	0.028
101.3	0.014	0.018	0.000	0.028
101.3	0.014	0.018	0.000	0.028
101.3	0.014	0.018	0.000	0.028
101.4	0.014	0.019	0.000	0.028
101.4	0.014	0.019	0.000	0.028
101.4	0.014	0.019	0.000	0.028
101.4	0.014	0.019	0.000	0.028
101.4	0.014	0.020	0.021	0.028
101.4	0.014	0.020	0.059	0.028
101.5	0.014	0.020	0.109	0.028
101.5	0.014	0.020	0.168	0.028
101.5	0.014	0.020	0.234	0.028
101.5	0.014	0.021	0.308	0.028
101.5	0.014	0.021	0.388	0.028
101.5	0.000	0.000	0.474	0.000

MITIGATED LAND USE

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.006117
5 year	0.008949
10 year	0.011147
25 year	0.014322
50 year	0.016993
100 year	0.019941

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0
5 year	0
10 year	0
25 year	0
50 year	0
100 year	0

Yearly Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1950	0.004	0.000
1951	0.010	0.000
1952	0.004	0.000
1953	0.004	0.000
1954	0.006	0.000
1955	0.010	0.000
1956	0.010	0.000
1957	0.007	0.000
1958	0.010	0.000
1959	0.009	0.000
1960	0.006	0.000
1961	0.006	0.000
1962	0.006	0.005
1963	0.009	0.000
1964	0.013	0.000
1965	0.005	0.000
1966	0.005	0.000
1967	0.003	0.000
1968	0.007	0.000
1969	0.008	0.000
1970	0.010	0.000
1971	0.004	0.000
1972	0.006	0.000
1973	0.005	0.000
1974	0.004	0.000
1975	0.005	0.000
1976	0.004	0.000
1977	0.004	0.000
1978	0.004	0.000
1979	0.005	0.000
1980	0.014	0.000
1981	0.005	0.000

1982	0.005	0.000
1983	0.005	0.000
1984	0.006	0.000
1985	0.006	0.000
1986	0.007	0.000
1987	0.017	0.000
1988	0.008	0.000
1989	0.004	0.000
1990	0.007	0.000
1991	0.006	0.000
1992	0.006	0.000
1993	0.005	0.000
1994	0.003	0.000
1995	0.004	0.000
1996	0.006	0.000
1997	0.010	0.000
1998	0.022	0.000

Ranked Yearly Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0223	0.0052
2	0.0172	0.0000
3	0.0142	0.0000
4	0.0134	0.0000
5	0.0103	0.0000
6	0.0103	0.0000
7	0.0101	0.0000
8	0.0099	0.0000
9	0.0098	0.0000
10	0.0095	0.0000
11	0.0094	0.0000
12	0.0086	0.0000
13	0.0084	0.0000
14	0.0080	0.0000
15	0.0075	0.0000
16	0.0071	0.0000
17	0.0070	0.0000
18	0.0067	0.0000
19	0.0064	0.0000
20	0.0064	0.0000
21	0.0061	0.0000
22	0.0060	0.0000
23	0.0059	0.0000
24	0.0057	0.0000
25	0.0057	0.0000
26	0.0057	0.0000
27	0.0057	0.0000
28	0.0056	0.0000
29	0.0055	0.0000
30	0.0055	0.0000
31	0.0054	0.0000
32	0.0053	0.0000
33	0.0053	0.0000
34	0.0052	0.0000
35	0.0049	0.0000
36	0.0048	0.0000

37	0.0045	0.0000
38	0.0045	0.0000
39	0.0044	0.0000
40	0.0044	0.0000
41	0.0043	0.0000
42	0.0043	0.0000
43	0.0042	0.0000
44	0.0041	0.0000
45	0.0037	0.0000
46	0.0037	0.0000
47	0.0036	0.0000
48	0.0034	0.0000
49	0.0032	0.0000

POC #1
The Facility PASSED

The Facility PASSED.

Flow(CFS)	Predev	Dev	Percentage	Pass/Fail
0.0031	4098	2	0	Pass
0.0032	3635	2	0	Pass
0.0033	3206	2	0	Pass
0.0035	2853	2	0	Pass
0.0036	2547	2	0	Pass
0.0038	2260	2	0	Pass
0.0039	1998	2	0	Pass
0.0040	1774	2	0	Pass
0.0042	1575	2	0	Pass
0.0043	1384	2	0	Pass
0.0045	1219	2	0	Pass
0.0046	1092	2	0	Pass
0.0047	984	2	0	Pass
0.0049	878	2	0	Pass
0.0050	782	2	0	Pass
0.0052	680	0	0	Pass
0.0053	594	0	0	Pass
0.0055	531	0	0	Pass
0.0056	477	0	0	Pass
0.0057	426	0	0	Pass
0.0059	388	0	0	Pass
0.0060	352	0	0	Pass
0.0062	319	0	0	Pass
0.0063	298	0	0	Pass
0.0064	268	0	0	Pass
0.0066	246	0	0	Pass
0.0067	232	0	0	Pass
0.0069	215	0	0	Pass
0.0070	201	0	0	Pass
0.0071	187	0	0	Pass
0.0073	179	0	0	Pass
0.0074	170	0	0	Pass
0.0076	154	0	0	Pass
0.0077	148	0	0	Pass
0.0078	142	0	0	Pass
0.0080	134	0	0	Pass

0.0081	125	0	0	Pass
0.0083	123	0	0	Pass
0.0084	118	0	0	Pass
0.0085	116	0	0	Pass
0.0087	112	0	0	Pass
0.0088	110	0	0	Pass
0.0090	108	0	0	Pass
0.0091	103	0	0	Pass
0.0093	97	0	0	Pass
0.0094	93	0	0	Pass
0.0095	90	0	0	Pass
0.0097	89	0	0	Pass
0.0098	84	0	0	Pass
0.0100	81	0	0	Pass
0.0101	80	0	0	Pass
0.0102	75	0	0	Pass
0.0104	72	0	0	Pass
0.0105	70	0	0	Pass
0.0107	69	0	0	Pass
0.0108	67	0	0	Pass
0.0109	64	0	0	Pass
0.0111	62	0	0	Pass
0.0112	61	0	0	Pass
0.0114	60	0	0	Pass
0.0115	59	0	0	Pass
0.0116	59	0	0	Pass
0.0118	55	0	0	Pass
0.0119	55	0	0	Pass
0.0121	54	0	0	Pass
0.0122	53	0	0	Pass
0.0123	52	0	0	Pass
0.0125	49	0	0	Pass
0.0126	49	0	0	Pass
0.0128	48	0	0	Pass
0.0129	45	0	0	Pass
0.0131	44	0	0	Pass
0.0132	42	0	0	Pass
0.0133	40	0	0	Pass
0.0135	38	0	0	Pass
0.0136	37	0	0	Pass
0.0138	36	0	0	Pass
0.0139	35	0	0	Pass
0.0140	34	0	0	Pass
0.0142	33	0	0	Pass
0.0143	31	0	0	Pass
0.0145	30	0	0	Pass
0.0146	29	0	0	Pass
0.0147	28	0	0	Pass
0.0149	27	0	0	Pass
0.0150	26	0	0	Pass
0.0152	26	0	0	Pass
0.0153	25	0	0	Pass
0.0154	22	0	0	Pass
0.0156	22	0	0	Pass
0.0157	20	0	0	Pass
0.0159	18	0	0	Pass
0.0160	18	0	0	Pass

0.0161	16	0	0	Pass
0.0163	14	0	0	Pass
0.0164	14	0	0	Pass
0.0166	12	0	0	Pass
0.0167	12	0	0	Pass
0.0169	12	0	0	Pass
0.0170	12	0	0	Pass

Water Quality BMP Flow and Volume for POC 1.
On-line facility volume: 0 acre-feet
On-line facility target flow: 0 cfs.
Adjusted for 15 min: 0 cfs.
Off-line facility target flow: 0 cfs.
Adjusted for 15 min: 0 cfs.

Perlnd and Implnd Changes
No changes have been made.

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Western Washington Hydrology Model
PROJECT REPORT

Project Name: Road SW
Site Address: 14305 Chain Lake Road
City : Monroe
Report Date : 2/22/2013
Gage : Everett
Data Start : 1948/10/01
Data End : 1997/09/30
Precip Scale: 1.20
WWHM3 Version:

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Forest, Flat	.17

Impervious Land Use	Acres

Element Flows To:
Surface Interflow Groundwater

Name : Road NE
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Lawn, Flat	.02

Impervious Land Use	Acres
ROADS FLAT	0.15

Element Flows To:
Surface Interflow Groundwater
Trench 1, Trench 1,

Name : Trench 1
Width : 5 ft.

Length : 105 ft.
Depth: 1.5ft.
Infiltration On
Infiltration rate : 2
Infiltration saftey factor : 1
Discharge Structure
Riser Height: 1.4 ft.
Riser Diameter: 12 in.

Element Flows To:
Outlet 1 Outlet 2

Vault Hydraulic Table

Stage(ft)	Area(acr)	Volume(acr-ft)	Dschrg(cfs)	Infilt(cfs)
100.0	0.012	0.000	0.000	0.000
100.0	0.012	0.000	0.000	0.024
100.0	0.012	0.000	0.000	0.024
100.1	0.012	0.001	0.000	0.024
100.1	0.012	0.001	0.000	0.024
100.1	0.012	0.001	0.000	0.024
100.1	0.012	0.001	0.000	0.024
100.1	0.012	0.001	0.000	0.024
100.1	0.012	0.002	0.000	0.024
100.2	0.012	0.002	0.000	0.024
100.2	0.012	0.002	0.000	0.024
100.2	0.012	0.002	0.000	0.024
100.2	0.012	0.002	0.000	0.024
100.2	0.012	0.003	0.000	0.024
100.2	0.012	0.003	0.000	0.024
100.3	0.012	0.003	0.000	0.024
100.3	0.012	0.003	0.000	0.024
100.3	0.012	0.003	0.000	0.024
100.3	0.012	0.004	0.000	0.024
100.3	0.012	0.004	0.000	0.024
100.3	0.012	0.004	0.000	0.024
100.4	0.012	0.004	0.000	0.024
100.4	0.012	0.004	0.000	0.024
100.4	0.012	0.005	0.000	0.024
100.4	0.012	0.005	0.000	0.024
100.4	0.012	0.005	0.000	0.024
100.4	0.012	0.005	0.000	0.024
100.5	0.012	0.005	0.000	0.024
100.5	0.012	0.006	0.000	0.024
100.5	0.012	0.006	0.000	0.024
100.5	0.012	0.006	0.000	0.024
100.5	0.012	0.006	0.000	0.024
100.5	0.012	0.006	0.000	0.024
100.6	0.012	0.007	0.000	0.024
100.6	0.012	0.007	0.000	0.024
100.6	0.012	0.007	0.000	0.024
100.6	0.012	0.007	0.000	0.024
100.6	0.012	0.007	0.000	0.024
100.6	0.012	0.008	0.000	0.024
100.7	0.012	0.008	0.000	0.024

100.7	0.012	0.008	0.000	0.024
100.7	0.012	0.008	0.000	0.024
100.7	0.012	0.008	0.000	0.024
100.7	0.012	0.009	0.000	0.024
100.7	0.012	0.009	0.000	0.024
100.8	0.012	0.009	0.000	0.024
100.8	0.012	0.009	0.000	0.024
100.8	0.012	0.009	0.000	0.024
100.8	0.012	0.010	0.000	0.024
100.8	0.012	0.010	0.000	0.024
100.8	0.012	0.010	0.000	0.024
100.9	0.012	0.010	0.000	0.024
100.9	0.012	0.010	0.000	0.024
100.9	0.012	0.011	0.000	0.024
100.9	0.012	0.011	0.000	0.024
100.9	0.012	0.011	0.000	0.024
100.9	0.012	0.011	0.000	0.024
101.0	0.012	0.011	0.000	0.024
101.0	0.012	0.012	0.000	0.024
101.0	0.012	0.012	0.000	0.024
101.0	0.012	0.012	0.000	0.024
101.0	0.012	0.012	0.000	0.024
101.0	0.012	0.012	0.000	0.024
101.1	0.012	0.013	0.000	0.024
101.1	0.012	0.013	0.000	0.024
101.1	0.012	0.013	0.000	0.024
101.1	0.012	0.013	0.000	0.024
101.1	0.012	0.013	0.000	0.024
101.1	0.012	0.014	0.000	0.024
101.2	0.012	0.014	0.000	0.024
101.2	0.012	0.014	0.000	0.024
101.2	0.012	0.014	0.000	0.024
101.2	0.012	0.014	0.000	0.024
101.2	0.012	0.015	0.000	0.024
101.2	0.012	0.015	0.000	0.024
101.3	0.012	0.015	0.000	0.024
101.3	0.012	0.015	0.000	0.024
101.3	0.012	0.015	0.000	0.024
101.3	0.012	0.016	0.000	0.024
101.3	0.012	0.016	0.000	0.024
101.3	0.012	0.016	0.000	0.024
101.4	0.012	0.016	0.000	0.024
101.4	0.012	0.016	0.000	0.024
101.4	0.012	0.017	0.000	0.024
101.4	0.012	0.017	0.000	0.024
101.4	0.012	0.017	0.021	0.024
101.4	0.012	0.017	0.059	0.024
101.5	0.012	0.017	0.109	0.024
101.5	0.012	0.018	0.168	0.024
101.5	0.012	0.018	0.234	0.024
101.5	0.012	0.018	0.308	0.024
101.5	0.012	0.018	0.388	0.024
101.5	0.000	0.000	0.474	0.000

MITIGATED LAND USE

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.013152
5 year	0.01924
10 year	0.023967
25 year	0.030792
50 year	0.036534
100 year	0.042873

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0
5 year	0
10 year	0
25 year	0
50 year	0
100 year	0

Yearly Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1950	0.008	0.000
1951	0.022	0.000
1952	0.009	0.000
1953	0.010	0.000
1954	0.012	0.000
1955	0.020	0.000
1956	0.021	0.000
1957	0.015	0.000
1958	0.022	0.000
1959	0.020	0.000
1960	0.013	0.000
1961	0.012	0.000
1962	0.014	0.000
1963	0.018	0.000
1964	0.029	0.000
1965	0.012	0.000
1966	0.012	0.000
1967	0.007	0.000
1968	0.015	0.000
1969	0.017	0.000
1970	0.022	0.000
1971	0.009	0.000
1972	0.014	0.000
1973	0.012	0.000
1974	0.009	0.000
1975	0.011	0.000
1976	0.009	0.000
1977	0.009	0.000
1978	0.008	0.000
1979	0.010	0.000
1980	0.031	0.000
1981	0.010	0.000

1982	0.012	0.000
1983	0.011	0.000
1984	0.012	0.000
1985	0.013	0.000
1986	0.016	0.000
1987	0.037	0.000
1988	0.018	0.000
1989	0.009	0.000
1990	0.014	0.000
1991	0.012	0.000
1992	0.013	0.000
1993	0.011	0.000
1994	0.007	0.000
1995	0.008	0.000
1996	0.012	0.000
1997	0.021	0.000
1998	0.048	0.000

Ranked Yearly Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0480	0.0000
2	0.0371	0.0000
3	0.0306	0.0000
4	0.0288	0.0000
5	0.0222	0.0000
6	0.0220	0.0000
7	0.0217	0.0000
8	0.0212	0.0000
9	0.0210	0.0000
10	0.0204	0.0000
11	0.0202	0.0000
12	0.0184	0.0000
13	0.0181	0.0000
14	0.0172	0.0000
15	0.0161	0.0000
16	0.0152	0.0000
17	0.0151	0.0000
18	0.0145	0.0000
19	0.0137	0.0000
20	0.0137	0.0000
21	0.0130	0.0000
22	0.0128	0.0000
23	0.0127	0.0000
24	0.0124	0.0000
25	0.0123	0.0000
26	0.0122	0.0000
27	0.0122	0.0000
28	0.0121	0.0000
29	0.0118	0.0000
30	0.0118	0.0000
31	0.0115	0.0000
32	0.0115	0.0000
33	0.0115	0.0000
34	0.0112	0.0000
35	0.0106	0.0000
36	0.0104	0.0000

37	0.0098	0.0000
38	0.0097	0.0000
39	0.0095	0.0000
40	0.0094	0.0000
41	0.0092	0.0000
42	0.0092	0.0000
43	0.0090	0.0000
44	0.0089	0.0000
45	0.0080	0.0000
46	0.0080	0.0000
47	0.0077	0.0000
48	0.0073	0.0000
49	0.0070	0.0000

POC #1
The Facility PASSED

The Facility PASSED.

Flow(CFS)	Predev	Dev	Percentage	Pass/Fail
0.0066	4096	0	0	Pass
0.0069	3635	0	0	Pass
0.0072	3206	0	0	Pass
0.0075	2852	0	0	Pass
0.0078	2545	0	0	Pass
0.0081	2259	0	0	Pass
0.0084	1998	0	0	Pass
0.0087	1774	0	0	Pass
0.0090	1575	0	0	Pass
0.0093	1384	0	0	Pass
0.0096	1219	0	0	Pass
0.0099	1092	0	0	Pass
0.0102	984	0	0	Pass
0.0105	880	0	0	Pass
0.0108	782	0	0	Pass
0.0111	683	0	0	Pass
0.0114	596	0	0	Pass
0.0117	531	0	0	Pass
0.0120	477	0	0	Pass
0.0123	426	0	0	Pass
0.0126	389	0	0	Pass
0.0129	352	0	0	Pass
0.0132	319	0	0	Pass
0.0135	298	0	0	Pass
0.0138	269	0	0	Pass
0.0141	246	0	0	Pass
0.0144	232	0	0	Pass
0.0147	216	0	0	Pass
0.0150	201	0	0	Pass
0.0154	187	0	0	Pass
0.0157	179	0	0	Pass
0.0160	170	0	0	Pass
0.0163	154	0	0	Pass
0.0166	148	0	0	Pass
0.0169	142	0	0	Pass
0.0172	134	0	0	Pass

0.0175	125	0	0	Pass
0.0178	123	0	0	Pass
0.0181	118	0	0	Pass
0.0184	116	0	0	Pass
0.0187	112	0	0	Pass
0.0190	110	0	0	Pass
0.0193	108	0	0	Pass
0.0196	103	0	0	Pass
0.0199	97	0	0	Pass
0.0202	93	0	0	Pass
0.0205	90	0	0	Pass
0.0208	89	0	0	Pass
0.0211	84	0	0	Pass
0.0214	81	0	0	Pass
0.0217	79	0	0	Pass
0.0220	75	0	0	Pass
0.0223	72	0	0	Pass
0.0226	69	0	0	Pass
0.0229	69	0	0	Pass
0.0232	67	0	0	Pass
0.0235	64	0	0	Pass
0.0238	62	0	0	Pass
0.0241	61	0	0	Pass
0.0244	60	0	0	Pass
0.0247	59	0	0	Pass
0.0250	59	0	0	Pass
0.0253	55	0	0	Pass
0.0256	55	0	0	Pass
0.0259	54	0	0	Pass
0.0262	53	0	0	Pass
0.0265	52	0	0	Pass
0.0269	49	0	0	Pass
0.0272	49	0	0	Pass
0.0275	48	0	0	Pass
0.0278	45	0	0	Pass
0.0281	44	0	0	Pass
0.0284	42	0	0	Pass
0.0287	40	0	0	Pass
0.0290	38	0	0	Pass
0.0293	37	0	0	Pass
0.0296	36	0	0	Pass
0.0299	35	0	0	Pass
0.0302	34	0	0	Pass
0.0305	33	0	0	Pass
0.0308	31	0	0	Pass
0.0311	30	0	0	Pass
0.0314	29	0	0	Pass
0.0317	28	0	0	Pass
0.0320	27	0	0	Pass
0.0323	26	0	0	Pass
0.0326	26	0	0	Pass
0.0329	25	0	0	Pass
0.0332	22	0	0	Pass
0.0335	22	0	0	Pass
0.0338	19	0	0	Pass
0.0341	18	0	0	Pass
0.0344	18	0	0	Pass

0.0347	16	0	0	Pass
0.0350	14	0	0	Pass
0.0353	14	0	0	Pass
0.0356	12	0	0	Pass
0.0359	12	0	0	Pass
0.0362	12	0	0	Pass
0.0365	12	0	0	Pass

Water Quality BMP Flow and Volume for POC 1.
On-line facility volume: 0 acre-feet
On-line facility target flow: 0 cfs.
Adjusted for 15 min: 0 cfs.
Off-line facility target flow: 0 cfs.
Adjusted for 15 min: 0 cfs.

Perlnd and Implnd Changes
No changes have been made.

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Western Washington Hydrology Model
PROJECT REPORT

Project Name: Fire Lane
Site Address: 14305 Chain Lake Road
City : Monroe
Report Date : 2/22/2013
Gage : Everett
Data Start : 1948/10/01
Data End : 1997/09/30
Precip Scale: 1.20
WWHM3 Version:

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Forest, Flat	.05

Impervious Land Use	Acres

Element Flows To:
Surface Interflow Groundwater

Name : Road NE
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Lawn, Flat	.02

Impervious Land Use	Acres
ROADS FLAT	0.05

Element Flows To:
Surface Interflow Groundwater
Trench 1, Trench 1,

Name : Trench 1
Width : 4 ft.

Length : 50 ft.
Depth: 1.5ft.
Infiltration On
Infiltration rate : 2
Infiltration saftey factor : 1
Discharge Structure
Riser Height: 1.4 ft.
Riser Diameter: 12 in.

Element Flows To:
Outlet 1 Outlet 2

Vault Hydraulic Table

Stage(ft)	Area(acr)	Volume(acr-ft)	Dschrg(cfs)	Infilt(cfs)
100.0	0.005	0.000	0.000	0.000
100.0	0.005	0.000	0.000	0.009
100.0	0.005	0.000	0.000	0.009
100.1	0.005	0.000	0.000	0.009
100.1	0.005	0.000	0.000	0.009
100.1	0.005	0.000	0.000	0.009
100.1	0.005	0.000	0.000	0.009
100.1	0.005	0.001	0.000	0.009
100.1	0.005	0.001	0.000	0.009
100.2	0.005	0.001	0.000	0.009
100.2	0.005	0.001	0.000	0.009
100.2	0.005	0.001	0.000	0.009
100.2	0.005	0.001	0.000	0.009
100.2	0.005	0.001	0.000	0.009
100.2	0.005	0.001	0.000	0.009
100.3	0.005	0.001	0.000	0.009
100.3	0.005	0.001	0.000	0.009
100.3	0.005	0.001	0.000	0.009
100.3	0.005	0.001	0.000	0.009
100.3	0.005	0.001	0.000	0.009
100.3	0.005	0.002	0.000	0.009
100.4	0.005	0.002	0.000	0.009
100.4	0.005	0.002	0.000	0.009
100.4	0.005	0.002	0.000	0.009
100.4	0.005	0.002	0.000	0.009
100.4	0.005	0.002	0.000	0.009
100.4	0.005	0.002	0.000	0.009
100.5	0.005	0.002	0.000	0.009
100.5	0.005	0.002	0.000	0.009
100.5	0.005	0.002	0.000	0.009
100.5	0.005	0.002	0.000	0.009
100.5	0.005	0.002	0.000	0.009
100.5	0.005	0.002	0.000	0.009
100.6	0.005	0.003	0.000	0.009
100.6	0.005	0.003	0.000	0.009
100.6	0.005	0.003	0.000	0.009
100.6	0.005	0.003	0.000	0.009
100.6	0.005	0.003	0.000	0.009
100.6	0.005	0.003	0.000	0.009
100.7	0.005	0.003	0.000	0.009

100.7	0.005	0.003	0.000	0.009
100.7	0.005	0.003	0.000	0.009
100.7	0.005	0.003	0.000	0.009
100.7	0.005	0.003	0.000	0.009
100.7	0.005	0.003	0.000	0.009
100.8	0.005	0.003	0.000	0.009
100.8	0.005	0.004	0.000	0.009
100.8	0.005	0.004	0.000	0.009
100.8	0.005	0.004	0.000	0.009
100.8	0.005	0.004	0.000	0.009
100.8	0.005	0.004	0.000	0.009
100.9	0.005	0.004	0.000	0.009
100.9	0.005	0.004	0.000	0.009
100.9	0.005	0.004	0.000	0.009
100.9	0.005	0.004	0.000	0.009
100.9	0.005	0.004	0.000	0.009
100.9	0.005	0.004	0.000	0.009
101.0	0.005	0.004	0.000	0.009
101.0	0.005	0.004	0.000	0.009
101.0	0.005	0.005	0.000	0.009
101.0	0.005	0.005	0.000	0.009
101.0	0.005	0.005	0.000	0.009
101.0	0.005	0.005	0.000	0.009
101.1	0.005	0.005	0.000	0.009
101.1	0.005	0.005	0.000	0.009
101.1	0.005	0.005	0.000	0.009
101.1	0.005	0.005	0.000	0.009
101.1	0.005	0.005	0.000	0.009
101.1	0.005	0.005	0.000	0.009
101.2	0.005	0.005	0.000	0.009
101.2	0.005	0.005	0.000	0.009
101.2	0.005	0.005	0.000	0.009
101.2	0.005	0.006	0.000	0.009
101.2	0.005	0.006	0.000	0.009
101.2	0.005	0.006	0.000	0.009
101.3	0.005	0.006	0.000	0.009
101.3	0.005	0.006	0.000	0.009
101.3	0.005	0.006	0.000	0.009
101.3	0.005	0.006	0.000	0.009
101.3	0.005	0.006	0.000	0.009
101.3	0.005	0.006	0.000	0.009
101.4	0.005	0.006	0.000	0.009
101.4	0.005	0.006	0.000	0.009
101.4	0.005	0.006	0.000	0.009
101.4	0.005	0.006	0.000	0.009
101.4	0.005	0.007	0.021	0.009
101.4	0.005	0.007	0.059	0.009
101.5	0.005	0.007	0.109	0.009
101.5	0.005	0.007	0.168	0.009
101.5	0.005	0.007	0.234	0.009
101.5	0.005	0.007	0.308	0.009
101.5	0.005	0.007	0.388	0.009
101.5	0.000	0.000	0.474	0.000

MITIGATED LAND USE

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.001529
5 year	0.002237
10 year	0.002787
25 year	0.00358
50 year	0.004248
100 year	0.004985

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0
5 year	0
10 year	0
25 year	0
50 year	0
100 year	0

Yearly Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1950	0.001	0.000
1951	0.003	0.000
1952	0.001	0.000
1953	0.001	0.000
1954	0.001	0.000
1955	0.002	0.000
1956	0.002	0.000
1957	0.002	0.000
1958	0.003	0.000
1959	0.002	0.000
1960	0.002	0.000
1961	0.001	0.000
1962	0.002	0.000
1963	0.002	0.000
1964	0.003	0.000
1965	0.001	0.000
1966	0.001	0.000
1967	0.001	0.000
1968	0.002	0.000
1969	0.002	0.000
1970	0.003	0.000
1971	0.001	0.000
1972	0.002	0.000
1973	0.001	0.000
1974	0.001	0.000
1975	0.001	0.000
1976	0.001	0.000
1977	0.001	0.000
1978	0.001	0.000
1979	0.001	0.000
1980	0.004	0.000
1981	0.001	0.000

1982	0.001	0.000
1983	0.001	0.000
1984	0.001	0.000
1985	0.001	0.000
1986	0.002	0.000
1987	0.004	0.000
1988	0.002	0.000
1989	0.001	0.000
1990	0.002	0.000
1991	0.001	0.000
1992	0.001	0.000
1993	0.001	0.000
1994	0.001	0.000
1995	0.001	0.000
1996	0.001	0.000
1997	0.002	0.000
1998	0.006	0.000

Ranked Yearly Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0056	0.0000
2	0.0043	0.0000
3	0.0036	0.0000
4	0.0033	0.0000
5	0.0026	0.0000
6	0.0026	0.0000
7	0.0025	0.0000
8	0.0025	0.0000
9	0.0024	0.0000
10	0.0024	0.0000
11	0.0023	0.0000
12	0.0021	0.0000
13	0.0021	0.0000
14	0.0020	0.0000
15	0.0019	0.0000
16	0.0018	0.0000
17	0.0018	0.0000
18	0.0017	0.0000
19	0.0016	0.0000
20	0.0016	0.0000
21	0.0015	0.0000
22	0.0015	0.0000
23	0.0015	0.0000
24	0.0014	0.0000
25	0.0014	0.0000
26	0.0014	0.0000
27	0.0014	0.0000
28	0.0014	0.0000
29	0.0014	0.0000
30	0.0014	0.0000
31	0.0013	0.0000
32	0.0013	0.0000
33	0.0013	0.0000
34	0.0013	0.0000
35	0.0012	0.0000
36	0.0012	0.0000

37	0.0011	0.0000
38	0.0011	0.0000
39	0.0011	0.0000
40	0.0011	0.0000
41	0.0011	0.0000
42	0.0011	0.0000
43	0.0010	0.0000
44	0.0010	0.0000
45	0.0009	0.0000
46	0.0009	0.0000
47	0.0009	0.0000
48	0.0008	0.0000
49	0.0008	0.0000

POC #1
The Facility PASSED

The Facility PASSED.

Flow(CFS)	Predev	Dev	Percentage	Pass/Fail
0.0008	4107	0	0	Pass
0.0008	3645	0	0	Pass
0.0008	3217	0	0	Pass
0.0009	2853	0	0	Pass
0.0009	2547	0	0	Pass
0.0009	2264	0	0	Pass
0.0010	2002	0	0	Pass
0.0010	1776	0	0	Pass
0.0010	1582	0	0	Pass
0.0011	1385	0	0	Pass
0.0011	1221	0	0	Pass
0.0012	1093	0	0	Pass
0.0012	984	0	0	Pass
0.0012	880	0	0	Pass
0.0013	782	0	0	Pass
0.0013	683	0	0	Pass
0.0013	596	0	0	Pass
0.0014	533	0	0	Pass
0.0014	478	0	0	Pass
0.0014	426	0	0	Pass
0.0015	388	0	0	Pass
0.0015	352	0	0	Pass
0.0015	320	0	0	Pass
0.0016	298	0	0	Pass
0.0016	269	0	0	Pass
0.0016	246	0	0	Pass
0.0017	232	0	0	Pass
0.0017	216	0	0	Pass
0.0017	201	0	0	Pass
0.0018	187	0	0	Pass
0.0018	179	0	0	Pass
0.0019	170	0	0	Pass
0.0019	154	0	0	Pass
0.0019	148	0	0	Pass
0.0020	142	0	0	Pass
0.0020	134	0	0	Pass

0.0020	125	0	0	Pass
0.0021	123	0	0	Pass
0.0021	118	0	0	Pass
0.0021	116	0	0	Pass
0.0022	112	0	0	Pass
0.0022	110	0	0	Pass
0.0022	108	0	0	Pass
0.0023	103	0	0	Pass
0.0023	97	0	0	Pass
0.0023	93	0	0	Pass
0.0024	90	0	0	Pass
0.0024	89	0	0	Pass
0.0025	84	0	0	Pass
0.0025	81	0	0	Pass
0.0025	80	0	0	Pass
0.0026	75	0	0	Pass
0.0026	72	0	0	Pass
0.0026	69	0	0	Pass
0.0027	69	0	0	Pass
0.0027	67	0	0	Pass
0.0027	64	0	0	Pass
0.0028	62	0	0	Pass
0.0028	61	0	0	Pass
0.0028	60	0	0	Pass
0.0029	59	0	0	Pass
0.0029	59	0	0	Pass
0.0029	55	0	0	Pass
0.0030	55	0	0	Pass
0.0030	54	0	0	Pass
0.0031	53	0	0	Pass
0.0031	52	0	0	Pass
0.0031	49	0	0	Pass
0.0032	49	0	0	Pass
0.0032	48	0	0	Pass
0.0032	45	0	0	Pass
0.0033	44	0	0	Pass
0.0033	42	0	0	Pass
0.0033	40	0	0	Pass
0.0034	38	0	0	Pass
0.0034	37	0	0	Pass
0.0034	36	0	0	Pass
0.0035	35	0	0	Pass
0.0035	34	0	0	Pass
0.0035	33	0	0	Pass
0.0036	31	0	0	Pass
0.0036	30	0	0	Pass
0.0036	29	0	0	Pass
0.0037	28	0	0	Pass
0.0037	27	0	0	Pass
0.0038	26	0	0	Pass
0.0038	26	0	0	Pass
0.0038	25	0	0	Pass
0.0039	22	0	0	Pass
0.0039	22	0	0	Pass
0.0039	20	0	0	Pass
0.0040	18	0	0	Pass
0.0040	18	0	0	Pass

0.0040	16	0	0	Pass
0.0041	14	0	0	Pass
0.0041	14	0	0	Pass
0.0041	12	0	0	Pass
0.0042	12	0	0	Pass
0.0042	12	0	0	Pass
0.0042	12	0	0	Pass

Water Quality BMP Flow and Volume for POC 1.
On-line facility volume: 0 acre-feet
On-line facility target flow: 0 cfs.
Adjusted for 15 min: 0 cfs.
Off-line facility target flow: 0 cfs.
Adjusted for 15 min: 0 cfs.

Perlnd and Implnd Changes
No changes have been made.

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Western Washington Hydrology Model
PROJECT REPORT

Project Name: TR 997
Site Address: 14305 Chain Lake Road
City : Monroe
Report Date : 2/22/2013
Gage : Everett
Data Start : 1948/10/01
Data End : 1997/09/30
Precip Scale: 1.20
WWHM3 Version:

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Forest, Flat	.13

Impervious Land Use	Acres

Element Flows To:
Surface Interflow Groundwater

Name : Road NE
Bypass: No

GroundWater: No

Pervious Land Use	Acres

Impervious Land Use	Acres
ROADS FLAT	0.13

Element Flows To:
Surface Interflow Groundwater
Trench 1, Trench 1,

Name : Trench 1
Width : 4 ft.
Length : 110 ft.

Depth: 1.5ft.
Infiltration On
Infiltration rate : 2
Infiltration saftey factor : 1
Discharge Structure
Riser Height: 1.4 ft.
Riser Diameter: 12 in.

Element Flows To:
Outlet 1 Outlet 2

Vault Hydraulic Table

Stage(ft)	Area(acr)	Volume(acr-ft)	Dschrg(cfs)	Infilt(cfs)
100.0	0.010	0.000	0.000	0.000
100.0	0.010	0.000	0.000	0.020
100.0	0.010	0.000	0.000	0.020
100.1	0.010	0.001	0.000	0.020
100.1	0.010	0.001	0.000	0.020
100.1	0.010	0.001	0.000	0.020
100.1	0.010	0.001	0.000	0.020
100.1	0.010	0.001	0.000	0.020
100.1	0.010	0.001	0.000	0.020
100.2	0.010	0.002	0.000	0.020
100.2	0.010	0.002	0.000	0.020
100.2	0.010	0.002	0.000	0.020
100.2	0.010	0.002	0.000	0.020
100.2	0.010	0.002	0.000	0.020
100.2	0.010	0.002	0.000	0.020
100.3	0.010	0.003	0.000	0.020
100.3	0.010	0.003	0.000	0.020
100.3	0.010	0.003	0.000	0.020
100.3	0.010	0.003	0.000	0.020
100.3	0.010	0.003	0.000	0.020
100.3	0.010	0.003	0.000	0.020
100.4	0.010	0.004	0.000	0.020
100.4	0.010	0.004	0.000	0.020
100.4	0.010	0.004	0.000	0.020
100.4	0.010	0.004	0.000	0.020
100.4	0.010	0.004	0.000	0.020
100.4	0.010	0.004	0.000	0.020
100.5	0.010	0.005	0.000	0.020
100.5	0.010	0.005	0.000	0.020
100.5	0.010	0.005	0.000	0.020
100.5	0.010	0.005	0.000	0.020
100.5	0.010	0.005	0.000	0.020
100.5	0.010	0.005	0.000	0.020
100.6	0.010	0.006	0.000	0.020
100.6	0.010	0.006	0.000	0.020
100.6	0.010	0.006	0.000	0.020
100.6	0.010	0.006	0.000	0.020
100.6	0.010	0.006	0.000	0.020
100.6	0.010	0.006	0.000	0.020
100.7	0.010	0.007	0.000	0.020
100.7	0.010	0.007	0.000	0.020

100.7	0.010	0.007	0.000	0.020
100.7	0.010	0.007	0.000	0.020
100.7	0.010	0.007	0.000	0.020
100.7	0.010	0.007	0.000	0.020
100.8	0.010	0.008	0.000	0.020
100.8	0.010	0.008	0.000	0.020
100.8	0.010	0.008	0.000	0.020
100.8	0.010	0.008	0.000	0.020
100.8	0.010	0.008	0.000	0.020
100.8	0.010	0.008	0.000	0.020
100.9	0.010	0.009	0.000	0.020
100.9	0.010	0.009	0.000	0.020
100.9	0.010	0.009	0.000	0.020
100.9	0.010	0.009	0.000	0.020
100.9	0.010	0.009	0.000	0.020
100.9	0.010	0.009	0.000	0.020
101.0	0.010	0.010	0.000	0.020
101.0	0.010	0.010	0.000	0.020
101.0	0.010	0.010	0.000	0.020
101.0	0.010	0.010	0.000	0.020
101.0	0.010	0.010	0.000	0.020
101.0	0.010	0.010	0.000	0.020
101.1	0.010	0.011	0.000	0.020
101.1	0.010	0.011	0.000	0.020
101.1	0.010	0.011	0.000	0.020
101.1	0.010	0.011	0.000	0.020
101.1	0.010	0.011	0.000	0.020
101.1	0.010	0.011	0.000	0.020
101.2	0.010	0.012	0.000	0.020
101.2	0.010	0.012	0.000	0.020
101.2	0.010	0.012	0.000	0.020
101.2	0.010	0.012	0.000	0.020
101.2	0.010	0.012	0.000	0.020
101.2	0.010	0.012	0.000	0.020
101.3	0.010	0.013	0.000	0.020
101.3	0.010	0.013	0.000	0.020
101.3	0.010	0.013	0.000	0.020
101.3	0.010	0.013	0.000	0.020
101.3	0.010	0.013	0.000	0.020
101.3	0.010	0.013	0.000	0.020
101.4	0.010	0.014	0.000	0.020
101.4	0.010	0.014	0.000	0.020
101.4	0.010	0.014	0.000	0.020
101.4	0.010	0.014	0.000	0.020
101.4	0.010	0.014	0.021	0.020
101.4	0.010	0.014	0.059	0.020
101.5	0.010	0.015	0.109	0.020
101.5	0.010	0.015	0.168	0.020
101.5	0.010	0.015	0.234	0.020
101.5	0.010	0.015	0.308	0.020
101.5	0.010	0.015	0.388	0.020
101.5	0.000	0.000	0.474	0.000

MITIGATED LAND USE

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.003976
5 year	0.005817
10 year	0.007246
25 year	0.009309
50 year	0.011045
100 year	0.012962

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0
5 year	0
10 year	0
25 year	0
50 year	0
100 year	0

Yearly Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1950	0.002	0.000
1951	0.007	0.000
1952	0.003	0.000
1953	0.003	0.000
1954	0.004	0.000
1955	0.006	0.000
1956	0.006	0.000
1957	0.005	0.000
1958	0.007	0.000
1959	0.006	0.000
1960	0.004	0.000
1961	0.004	0.000
1962	0.004	0.000
1963	0.006	0.000
1964	0.009	0.000
1965	0.004	0.000
1966	0.004	0.000
1967	0.002	0.000
1968	0.005	0.000
1969	0.005	0.000
1970	0.007	0.000
1971	0.003	0.000
1972	0.004	0.000
1973	0.003	0.000
1974	0.003	0.000
1975	0.003	0.000
1976	0.003	0.000
1977	0.003	0.000
1978	0.002	0.000
1979	0.003	0.000
1980	0.009	0.000
1981	0.003	0.000
1982	0.003	0.000

1983	0.003	0.000
1984	0.004	0.000
1985	0.004	0.000
1986	0.005	0.000
1987	0.011	0.000
1988	0.005	0.000
1989	0.003	0.000
1990	0.004	0.000
1991	0.004	0.000
1992	0.004	0.000
1993	0.003	0.000
1994	0.002	0.000
1995	0.002	0.000
1996	0.004	0.000
1997	0.006	0.000
1998	0.015	0.000

Ranked Yearly Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0145	0.0000
2	0.0112	0.0000
3	0.0093	0.0000
4	0.0087	0.0000
5	0.0067	0.0000
6	0.0067	0.0000
7	0.0066	0.0000
8	0.0064	0.0000
9	0.0064	0.0000
10	0.0062	0.0000
11	0.0061	0.0000
12	0.0056	0.0000
13	0.0055	0.0000
14	0.0052	0.0000
15	0.0049	0.0000
16	0.0046	0.0000
17	0.0046	0.0000
18	0.0044	0.0000
19	0.0042	0.0000
20	0.0041	0.0000
21	0.0039	0.0000
22	0.0039	0.0000
23	0.0038	0.0000
24	0.0037	0.0000
25	0.0037	0.0000
26	0.0037	0.0000
27	0.0037	0.0000
28	0.0037	0.0000
29	0.0036	0.0000
30	0.0036	0.0000
31	0.0035	0.0000
32	0.0035	0.0000
33	0.0035	0.0000
34	0.0034	0.0000
35	0.0032	0.0000
36	0.0031	0.0000
37	0.0029	0.0000

38	0.0029	0.0000
39	0.0029	0.0000
40	0.0028	0.0000
41	0.0028	0.0000
42	0.0028	0.0000
43	0.0027	0.0000
44	0.0027	0.0000
45	0.0024	0.0000
46	0.0024	0.0000
47	0.0023	0.0000
48	0.0022	0.0000
49	0.0021	0.0000

POC #1
The Facility PASSED

The Facility PASSED.

Flow(CFS)	Predev	Dev	Percentage	Pass/Fail
0.0020	4097	0	0	Pass
0.0021	3640	0	0	Pass
0.0022	3212	0	0	Pass
0.0023	2853	0	0	Pass
0.0024	2547	0	0	Pass
0.0024	2260	0	0	Pass
0.0025	2000	0	0	Pass
0.0026	1774	0	0	Pass
0.0027	1577	0	0	Pass
0.0028	1384	0	0	Pass
0.0029	1221	0	0	Pass
0.0030	1092	0	0	Pass
0.0031	984	0	0	Pass
0.0032	878	0	0	Pass
0.0033	782	0	0	Pass
0.0034	680	0	0	Pass
0.0035	595	0	0	Pass
0.0035	531	0	0	Pass
0.0036	477	0	0	Pass
0.0037	426	0	0	Pass
0.0038	388	0	0	Pass
0.0039	352	0	0	Pass
0.0040	319	0	0	Pass
0.0041	298	0	0	Pass
0.0042	268	0	0	Pass
0.0043	246	0	0	Pass
0.0044	232	0	0	Pass
0.0045	215	0	0	Pass
0.0045	201	0	0	Pass
0.0046	187	0	0	Pass
0.0047	179	0	0	Pass
0.0048	169	0	0	Pass
0.0049	154	0	0	Pass
0.0050	148	0	0	Pass
0.0051	142	0	0	Pass
0.0052	134	0	0	Pass
0.0053	125	0	0	Pass

0.0054	123	0	0	Pass
0.0055	118	0	0	Pass
0.0056	116	0	0	Pass
0.0056	112	0	0	Pass
0.0057	110	0	0	Pass
0.0058	108	0	0	Pass
0.0059	103	0	0	Pass
0.0060	97	0	0	Pass
0.0061	93	0	0	Pass
0.0062	90	0	0	Pass
0.0063	89	0	0	Pass
0.0064	84	0	0	Pass
0.0065	81	0	0	Pass
0.0066	79	0	0	Pass
0.0067	75	0	0	Pass
0.0067	72	0	0	Pass
0.0068	69	0	0	Pass
0.0069	69	0	0	Pass
0.0070	67	0	0	Pass
0.0071	64	0	0	Pass
0.0072	62	0	0	Pass
0.0073	61	0	0	Pass
0.0074	60	0	0	Pass
0.0075	59	0	0	Pass
0.0076	59	0	0	Pass
0.0077	55	0	0	Pass
0.0078	55	0	0	Pass
0.0078	54	0	0	Pass
0.0079	53	0	0	Pass
0.0080	52	0	0	Pass
0.0081	49	0	0	Pass
0.0082	49	0	0	Pass
0.0083	48	0	0	Pass
0.0084	45	0	0	Pass
0.0085	44	0	0	Pass
0.0086	42	0	0	Pass
0.0087	40	0	0	Pass
0.0088	38	0	0	Pass
0.0088	37	0	0	Pass
0.0089	36	0	0	Pass
0.0090	35	0	0	Pass
0.0091	34	0	0	Pass
0.0092	33	0	0	Pass
0.0093	31	0	0	Pass
0.0094	30	0	0	Pass
0.0095	29	0	0	Pass
0.0096	28	0	0	Pass
0.0097	27	0	0	Pass
0.0098	26	0	0	Pass
0.0099	26	0	0	Pass
0.0099	25	0	0	Pass
0.0100	22	0	0	Pass
0.0101	22	0	0	Pass
0.0102	20	0	0	Pass
0.0103	18	0	0	Pass
0.0104	18	0	0	Pass
0.0105	16	0	0	Pass

0.0106	14	0	0	Pass
0.0107	14	0	0	Pass
0.0108	12	0	0	Pass
0.0109	12	0	0	Pass
0.0110	12	0	0	Pass
0.0110	12	0	0	Pass

Water Quality BMP Flow and Volume for POC 1.
On-line facility volume: 0 acre-feet
On-line facility target flow: 0 cfs.
Adjusted for 15 min: 0 cfs.
Off-line facility target flow: 0 cfs.
Adjusted for 15 min: 0 cfs.

Perlnd and Implnd Changes
No changes have been made.

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Western Washington Hydrology Model
PROJECT REPORT

Project Name: Lot
Site Address: 14305 Chain Lake Road
City : Monroe
Report Date : 2/22/2013
Gage : Everett
Data Start : 1948/10/01
Data End : 1997/09/30
Precip Scale: 1.20
WWHM3 Version:

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	Acres
C, Forest, Flat	.16

Impervious Land Use	Acres

Element Flows To:

Surface	Interflow	Groundwater

Name : Road NE
Bypass: No

GroundWater: No

Pervious Land Use	Acres

Impervious Land Use	Acres
ROOF TOPS FLAT	0.06

Element Flows To:

Surface	Interflow	Groundwater
Trench 1,	Trench 1,	

Name : Trench 1
Width : 4 ft.
Length : 40 ft.

Depth: 1.5ft.
Infiltration On
Infiltration rate : 2
Infiltration saftey factor : 1
Discharge Structure
Riser Height: 1.4 ft.
Riser Diameter: 12 in.

Element Flows To:
Outlet 1 Outlet 2

Vault Hydraulic Table

Stage(ft)	Area(acr)	Volume(acr-ft)	Dschrg(cfs)	Infilt(cfs)
100.0	0.004	0.000	0.000	0.000
100.0	0.004	0.000	0.000	0.007
100.0	0.004	0.000	0.000	0.007
100.1	0.004	0.000	0.000	0.007
100.1	0.004	0.000	0.000	0.007
100.1	0.004	0.000	0.000	0.007
100.1	0.004	0.000	0.000	0.007
100.1	0.004	0.000	0.000	0.007
100.1	0.004	0.000	0.000	0.007
100.2	0.004	0.001	0.000	0.007
100.2	0.004	0.001	0.000	0.007
100.2	0.004	0.001	0.000	0.007
100.2	0.004	0.001	0.000	0.007
100.2	0.004	0.001	0.000	0.007
100.2	0.004	0.001	0.000	0.007
100.3	0.004	0.001	0.000	0.007
100.3	0.004	0.001	0.000	0.007
100.3	0.004	0.001	0.000	0.007
100.3	0.004	0.001	0.000	0.007
100.3	0.004	0.001	0.000	0.007
100.3	0.004	0.001	0.000	0.007
100.4	0.004	0.001	0.000	0.007
100.4	0.004	0.001	0.000	0.007
100.4	0.004	0.001	0.000	0.007
100.4	0.004	0.001	0.000	0.007
100.4	0.004	0.002	0.000	0.007
100.4	0.004	0.002	0.000	0.007
100.5	0.004	0.002	0.000	0.007
100.5	0.004	0.002	0.000	0.007
100.5	0.004	0.002	0.000	0.007
100.5	0.004	0.002	0.000	0.007
100.5	0.004	0.002	0.000	0.007
100.5	0.004	0.002	0.000	0.007
100.6	0.004	0.002	0.000	0.007
100.6	0.004	0.002	0.000	0.007
100.6	0.004	0.002	0.000	0.007
100.6	0.004	0.002	0.000	0.007
100.6	0.004	0.002	0.000	0.007
100.6	0.004	0.002	0.000	0.007
100.7	0.004	0.002	0.000	0.007
100.7	0.004	0.002	0.000	0.007

100.7	0.004	0.003	0.000	0.007
100.7	0.004	0.003	0.000	0.007
100.7	0.004	0.003	0.000	0.007
100.7	0.004	0.003	0.000	0.007
100.8	0.004	0.003	0.000	0.007
100.8	0.004	0.003	0.000	0.007
100.8	0.004	0.003	0.000	0.007
100.8	0.004	0.003	0.000	0.007
100.8	0.004	0.003	0.000	0.007
100.8	0.004	0.003	0.000	0.007
100.9	0.004	0.003	0.000	0.007
100.9	0.004	0.003	0.000	0.007
100.9	0.004	0.003	0.000	0.007
100.9	0.004	0.003	0.000	0.007
100.9	0.004	0.003	0.000	0.007
100.9	0.004	0.003	0.000	0.007
101.0	0.004	0.003	0.000	0.007
101.0	0.004	0.004	0.000	0.007
101.0	0.004	0.004	0.000	0.007
101.0	0.004	0.004	0.000	0.007
101.0	0.004	0.004	0.000	0.007
101.0	0.004	0.004	0.000	0.007
101.1	0.004	0.004	0.000	0.007
101.1	0.004	0.004	0.000	0.007
101.1	0.004	0.004	0.000	0.007
101.1	0.004	0.004	0.000	0.007
101.1	0.004	0.004	0.000	0.007
101.1	0.004	0.004	0.000	0.007
101.2	0.004	0.004	0.000	0.007
101.2	0.004	0.004	0.000	0.007
101.2	0.004	0.004	0.000	0.007
101.2	0.004	0.004	0.000	0.007
101.2	0.004	0.004	0.000	0.007
101.2	0.004	0.005	0.000	0.007
101.3	0.004	0.005	0.000	0.007
101.3	0.004	0.005	0.000	0.007
101.3	0.004	0.005	0.000	0.007
101.3	0.004	0.005	0.000	0.007
101.3	0.004	0.005	0.000	0.007
101.3	0.004	0.005	0.000	0.007
101.4	0.004	0.005	0.000	0.007
101.4	0.004	0.005	0.000	0.007
101.4	0.004	0.005	0.000	0.007
101.4	0.004	0.005	0.000	0.007
101.4	0.004	0.005	0.021	0.007
101.4	0.004	0.005	0.059	0.007
101.5	0.004	0.005	0.109	0.007
101.5	0.004	0.005	0.168	0.007
101.5	0.004	0.005	0.234	0.007
101.5	0.004	0.006	0.308	0.007
101.5	0.004	0.006	0.388	0.007
101.5	0.000	0.000	0.474	0.000

MITIGATED LAND USE

ANALYSIS RESULTS

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.004894
5 year	0.007159
10 year	0.008918
25 year	0.011458
50 year	0.013594
100 year	0.015953

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0
5 year	0
10 year	0
25 year	0
50 year	0
100 year	0

Yearly Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1950	0.003	0.000
1951	0.008	0.000
1952	0.003	0.000
1953	0.004	0.000
1954	0.005	0.000
1955	0.008	0.000
1956	0.008	0.000
1957	0.006	0.000
1958	0.008	0.000
1959	0.008	0.003
1960	0.005	0.000
1961	0.005	0.000
1962	0.005	0.010
1963	0.007	0.000
1964	0.011	0.000
1965	0.004	0.000
1966	0.004	0.000
1967	0.003	0.000
1968	0.006	0.000
1969	0.006	0.000
1970	0.008	0.000
1971	0.003	0.000
1972	0.005	0.000
1973	0.004	0.000
1974	0.004	0.000
1975	0.004	0.000
1976	0.003	0.000
1977	0.003	0.000
1978	0.003	0.000
1979	0.004	0.000
1980	0.011	0.000
1981	0.004	0.000
1982	0.004	0.000

1983	0.004	0.000
1984	0.005	0.000
1985	0.005	0.000
1986	0.006	0.000
1987	0.014	0.008
1988	0.007	0.000
1989	0.003	0.000
1990	0.005	0.000
1991	0.005	0.000
1992	0.005	0.000
1993	0.004	0.000
1994	0.003	0.000
1995	0.003	0.000
1996	0.005	0.000
1997	0.008	0.000
1998	0.018	0.018

Ranked Yearly Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0179	0.0179
2	0.0138	0.0102
3	0.0114	0.0081
4	0.0107	0.0031
5	0.0083	0.0000
6	0.0082	0.0000
7	0.0081	0.0000
8	0.0079	0.0000
9	0.0078	0.0000
10	0.0076	0.0000
11	0.0075	0.0000
12	0.0068	0.0000
13	0.0067	0.0000
14	0.0064	0.0000
15	0.0060	0.0000
16	0.0056	0.0000
17	0.0056	0.0000
18	0.0054	0.0000
19	0.0051	0.0000
20	0.0051	0.0000
21	0.0048	0.0000
22	0.0048	0.0000
23	0.0047	0.0000
24	0.0046	0.0000
25	0.0046	0.0000
26	0.0045	0.0000
27	0.0045	0.0000
28	0.0045	0.0000
29	0.0044	0.0000
30	0.0044	0.0000
31	0.0043	0.0000
32	0.0043	0.0000
33	0.0043	0.0000
34	0.0042	0.0000
35	0.0039	0.0000
36	0.0039	0.0000
37	0.0036	0.0000

38	0.0036	0.0000
39	0.0035	0.0000
40	0.0035	0.0000
41	0.0034	0.0000
42	0.0034	0.0000
43	0.0033	0.0000
44	0.0033	0.0000
45	0.0030	0.0000
46	0.0030	0.0000
47	0.0029	0.0000
48	0.0027	0.0000
49	0.0026	0.0000

POC #1
The Facility PASSED

The Facility PASSED.

Flow(CFS)	Predev	Dev	Percentage	Pass/Fail
0.0024	4093	13	0	Pass
0.0026	3637	13	0	Pass
0.0027	3206	13	0	Pass
0.0028	2853	12	0	Pass
0.0029	2547	12	0	Pass
0.0030	2261	12	0	Pass
0.0031	1998	11	0	Pass
0.0032	1774	11	0	Pass
0.0033	1576	11	0	Pass
0.0035	1384	11	0	Pass
0.0036	1219	11	0	Pass
0.0037	1092	11	1	Pass
0.0038	984	11	1	Pass
0.0039	879	11	1	Pass
0.0040	782	11	1	Pass
0.0041	682	11	1	Pass
0.0042	594	11	1	Pass
0.0044	531	11	2	Pass
0.0045	477	11	2	Pass
0.0046	426	11	2	Pass
0.0047	388	11	2	Pass
0.0048	352	11	3	Pass
0.0049	319	10	3	Pass
0.0050	298	10	3	Pass
0.0051	268	9	3	Pass
0.0053	246	9	3	Pass
0.0054	232	9	3	Pass
0.0055	215	8	3	Pass
0.0056	201	8	3	Pass
0.0057	187	8	4	Pass
0.0058	179	8	4	Pass
0.0059	170	8	4	Pass
0.0061	154	8	5	Pass
0.0062	148	8	5	Pass
0.0063	142	8	5	Pass
0.0064	134	8	5	Pass
0.0065	125	8	6	Pass

0.0066	123	8	6	Pass
0.0067	118	8	6	Pass
0.0068	116	8	6	Pass
0.0070	112	8	7	Pass
0.0071	110	8	7	Pass
0.0072	108	8	7	Pass
0.0073	103	7	6	Pass
0.0074	97	7	7	Pass
0.0075	93	6	6	Pass
0.0076	90	6	6	Pass
0.0077	89	6	6	Pass
0.0079	84	6	7	Pass
0.0080	81	5	6	Pass
0.0081	79	5	6	Pass
0.0082	75	4	5	Pass
0.0083	72	4	5	Pass
0.0084	69	4	5	Pass
0.0085	69	3	4	Pass
0.0086	67	3	4	Pass
0.0088	64	3	4	Pass
0.0089	62	3	4	Pass
0.0090	61	3	4	Pass
0.0091	60	3	5	Pass
0.0092	59	3	5	Pass
0.0093	59	3	5	Pass
0.0094	55	3	5	Pass
0.0095	55	2	3	Pass
0.0097	54	2	3	Pass
0.0098	53	2	3	Pass
0.0099	52	2	3	Pass
0.0100	49	2	4	Pass
0.0101	49	2	4	Pass
0.0102	48	1	2	Pass
0.0103	45	1	2	Pass
0.0104	44	1	2	Pass
0.0106	42	1	2	Pass
0.0107	40	1	2	Pass
0.0108	38	1	2	Pass
0.0109	37	1	2	Pass
0.0110	36	1	2	Pass
0.0111	35	1	2	Pass
0.0112	34	1	2	Pass
0.0113	33	1	3	Pass
0.0115	31	1	3	Pass
0.0116	30	1	3	Pass
0.0117	29	1	3	Pass
0.0118	28	1	3	Pass
0.0119	27	1	3	Pass
0.0120	26	1	3	Pass
0.0121	26	1	3	Pass
0.0122	25	1	4	Pass
0.0124	22	1	4	Pass
0.0125	22	1	4	Pass
0.0126	19	1	5	Pass
0.0127	18	1	5	Pass
0.0128	18	1	5	Pass
0.0129	16	1	6	Pass

0.0130	14	1	7	Pass
0.0131	14	1	7	Pass
0.0133	13	1	7	Pass
0.0134	12	1	8	Pass
0.0135	12	1	8	Pass
0.0136	12	1	8	Pass

Water Quality BMP Flow and Volume for POC 1.
On-line facility volume: 0 acre-feet
On-line facility target flow: 0 cfs.
Adjusted for 15 min: 0 cfs.
Off-line facility target flow: 0 cfs.
Adjusted for 15 min: 0 cfs.

Perlnd and Implnd Changes
No changes have been made.

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APPENDIX B

MAINTENANCE & OPERATIONS MANUAL
(To Be Provided W/ Final Drainage Report)

APPENDIX C

GEOTECHNICAL REPORT

Western Geotechnical Consultants, Inc.

4183 Saltsprings Dr., Ferndale, WA 98248 Phone/FAX (360)380-2507

October 13, 2008

Steve Harris
18008 124th St. SE
Snohomish, Washington 98290

Re: Geotechnical Site Investigation
Village at Stevens Court
14325 Chain Lake Road
Monroe, WA

Western Geotechnical Consultants, Inc. is pleased to provide this geotechnical engineering report prepared for the above referenced property. On September 30, 2008 a geotechnical engineer from our firm traveled to the site to oversee the excavation of 5 test pits at the approximate locations shown on the attached Site Plan, Figure 1. The property is composed of three rectangular parcels, namely parcels A, B, and C. The project plan is to construct six, three story twelve plexes on the property which will be constructed for senior retirement housing.

The USDA Soils Classification Service "Soil Survey of Snohomish County Area, Washington" has classified the soils as Everett gravelly sandy loam. Everett soils are very deep, well drained soils and are located on glacial outwash plains. The soil formed in glacial outwash. Permeability is moderately rapid, runoff is slow and the threat of water erosion is slight.

The purpose of our investigation was to evaluate the site with respect to developing the site using Low Impact Development (LID) design methodology and to obtain soil infiltration rates, depth to groundwater, pavement recommendations, foundation design information and other geotechnical issues. The specific scope of our investigation for the site included the following services:

- Review available published geologic, geotechnical and topographic information for the area including soil and groundwater information for nearby properties contained in our files.
- Excavate 5 test pits and obtain samples to explore soil and groundwater conditions across the site. Piezometers were installed in 4 of the test pits for future monitoring of groundwater levels, if deemed necessary.
- Classify soils in accordance with the Unified Soils Classification System (USCS).
- Perform field and laboratory testing as deemed necessary in support of our conclusions and recommendations. Lab testing included grain size/hydrometer analyses performed in accordance with the USDA textural triangle methodology so as to determine design infiltration rates for the site soils. We also performed cation exchange capacity testing to determine if stormwater pretreatment will be required.
- Prepare this engineering report including a summary of work performed and our conclusions and recommendations regarding:
  - Soil and groundwater information for use in designing infiltration facilities and possible porous asphalt concrete access roads/parking within the site.
  - Provide design infiltration rates for use in designing stormwater facilities.

- Provide recommended subgrade strength values (California Bearing Ratio) and typical pavement sections for use in designing the parking areas.
- Provide seismic design parameters for structural design.
- Provide geotechnical recommendations for building construction on the site including foundations, earth supported floor slabs and drainage.
- Provide rough stripping criteria and the depth to suitable bearing soil for relatively light foundations and paved areas.
- Structural fill criteria including the suitability of on site material for use as structural fill.
- General site development recommendations with respect to geotechnical issues identified during our field investigation.

Site Conditions

Surface Conditions

The property is composed of three relatively flat, rectangular parcels that are located on the east side of Chain Lake Road in Monroe, Washington. The property presently contains two existing occupied homes with outbuildings and lawns. There is also a gravel driveway, and forested areas on the property. The area proposed for development is at a slightly higher elevation than the northeast portion of the property where a wetland buffer is present. Figure 1 is a site plan showing the site layout and proposed building and pavement locations.

Subsurface Conditions

Subsurface soil and groundwater conditions were explored on September 30, 2008 when a total of five test pits were advanced using a small tracked excavator with a 1.5-foot wide bucket. The test pits were excavated at the approximate locations shown on the attached Site Plan, Figure 1. Soil and groundwater conditions were continuously logged using the Unified Soils Classification System (USCS) and soil samples were obtained for inspection and testing. Edited tabulated test pit logs are included in this report together with a USCS chart explaining soil descriptions.

Subsurface conditions were found to be relatively similar across the property. Test Pits 1 through 4 were advanced where development is proposed while Test Pit 5 was advanced at the edge of the wetland buffer. The subsurface profile consists of about a foot of dark brown sandy organic SILT to silty SAND (topsoil) with numerous roots and organic debris (OL/SM by USCS) that was in a relatively soft state. Below the topsoil layer we typically encountered a fine to medium SAND with some silt and gravel (SP/SM to SM by USCS) that extended to a depth of 2.4 to 3.2 feet below grade. Below the silty sand we encountered a well graded to gap graded sandy GRAVEL (GP to GW by USCS) with zones of gravelly SAND (SP by USCS). This material extended to the base of the excavations in all of the test pits except for Test Pit 5, which was not excavated in the proposed development area. Test Pit 5 logged gap graded sands and gravels below a sandy SILT layer (SM by USCS) extending to 4-1/2 feet.

From 4-1/2 feet to 5-1/2 feet below grade an orange gray mottled silty fine SAND to sandy SILT (SM/ML by USCS) was encountered that was in a wet state. At 5-1/2 feet we encountered sandy GRAVEL soils (GP to GW by USCS), and they were wet. Sidewall caving and seepage were encountered at 6.2 feet.

Groundwater

No groundwater was encountered in any of the site development test pits at the time of the investigation on 9/30/2008. In Test Pit 5, where no development is planned, groundwater seepage was encountered at 6.2 feet below grade. Piezometers were installed in Test Pits 1 through 4 for future monitoring of the groundwater levels, if required.

Laboratory Testing

Laboratory tests were performed on selected soil samples obtained during our test pit investigation. Laboratory testing included soil inspection under controlled laboratory conditions and moisture content determination. Cation Exchange capacity tests were also performed to evaluate the need for pretreatment of stormwater. This testing included grain size analyses and organic content tests. The moisture content test results are included in the tabulated log of test pits and the results of the cation exchange capacity testing are attached to this report and in the Cation Exchange Capacity section to this report. The grain size/hydrometer tests are attached to this report in the form of grain size distribution curves, and we also plotted the grain size test results on the USDA Textural Triangle for classification purposes and all of the soil tested is classified as a sand.

Conclusions and Recommendations

General

Based on our geotechnical investigation, we conclude that the site is conducive for the type of development proposed. The buildings can be supported on conventional shallow spread footings and the low impact development (LID) infiltration using porous asphalt appears to be feasible as part of the development of the property.

The following sections to this report provide long term (design) infiltration rates for the near surface soils, the need for pretreatment of stormwater before it is infiltrated, and general site development recommendations for the property.

Infiltration Rate

We determined the infiltration rate for representative soils encountered in the test pits at the site in accordance with the 2005 edition of the Washington Department of Ecology (DOE) Stormwater Management Manual for Western Washington. Representative, relatively free-draining soil samples taken from beneath the topsoil and near surface silty soils were tested. The soils were classified in the field and are documented on the test pit logs as silty SAND (SM by the USCS) and SAND (SP by USCS). A total of 6 grain size/hydrometer analyses were performed.

Based on the testing the Textural Class of the upper silty sand soil is loamy sand. Table 3.7, Vol. 3 of the 2005 Stormwater Management Manual recommends a long term (design) infiltration rate of 0.5 inches an hour for loamy sand.

Cation Exchange Capacity

The requirements for soil treatment exceptions are specified by the Washington DOE "Stormwater Management Manual for Western Washington" and a cation exchange capacity of greater than 5 meq. per 100 grams is required to meet the soil treatment exemption criteria. The exemption is satisfied if the following criteria are met.

The first 2 feet or more of the soil beneath an infiltration facility must meet one of the following specifications for general protection of groundwater:

a) The soil must have an organic content greater than 0.5% to meet the a cation exchange capacity greater than 5 meq. per 100 grams AND
b) The soil must be composed of less than 25% gravel by weight with at least 75% of the soil passing the #4 sieve, and the portion passing the #4 sieve must meet one of the following gradations:

Most of the site does not meet the minimum 2-foot thickness criteria (see Test Pits 1-3), but we still ran organic tests to determine if thickening the loamy sand layer to greater than 2 feet would provide the required cation exchange capacity to preclude the requirements of pretreatment.

We analyzed site soils using a) organic content. The results are summarized below.

	TP-1/S-2	TP-3/S-1
Organic Content	2.95%	1.68%

We also analyzed the site soils using b)1., namely less than 25% gravel with at least 75% passing the #4 sieve, at least 25% must pass the US #40 sieve, and at least 2% must pass the US #100 sieve. The results of our analyses are summarized below.

Grain Size Distributions for the Soil Treatment Exemption (Category b)1

Test Pit No./ Sample No.	TP-1/S-2	TP-3/S-1
Sample Depth	1.3'	2.0'
No. 4 Sieve (Required Passing 75%)	89%	88%
No. 40 Sieve (Required Passing 25 %)	33%	44%
No. 100 Sieve (Required Passing 5%)	20%	17%

As the results indicate the site soils meet the Soil Treatment Exemption criteria under category b) 1 and the upper silty SAND (SM by USCS) meets the minimum organic content criteria but the soil unit is typically less than 2 feet thick. The underlying gravelly soils would not meet the minimum organic content criteria. Therefore, pretreatment will be required by using bioswale, amending the upper 2 feet of soil with organic silt or other methods. If the on site soils are amended to meet the pretreatment criteria the resulting soil would classify as a loamy sand, which has a long term design infiltration rate of 0.5 inches an hour. A copy of the grain size distribution curves including the organic contest test results are attached to this report.

General Site Development

The following sections of this report contain recommendations for general site development. Note that these recommendations are based on the limited scope of subsurface exploration performed as a part of our geotechnical services for the project.

Site Preparation: All topsoil or other organic, soft or deleterious material and old foundations, must be stripped and removed from those areas to be developed. Based on our test pit investigation, a stripping depth of about 1 foot should be anticipated. Note that deeper over-excavation may be required where deeper unsuitable soils such as old foundations and tree root balls are encountered.

International Building Code (IBC) Site Classification: Based on our geotechnical investigation the site soils are classified as soil type D, stiff soil profile. The earthquake spectral responses (S_{ms} and S_{m1}) may be computed using Soil Class D and Tables 1615.1.2 (1) and 1615.1.2(2) of the IBC (2003 ed.).

Foundation Support: We understand that the proposed 12 plexes will be of wood frame construction. The on site, non-organic, sandy, gravelly soils (GP and GW by USCS) will support the proposed structures using conventional shallow spread footings. Wall footings and column footings should have minimum dimensions of 16-inches and 24-inches respectively. We recommend that footings be proportioned using a maximum allowable bearing capacity of 2500 pounds per square foot (psf).

This value may be increased by 1/3 for transient wind and seismic loading. All footings should be founded a minimum of 18 inches below the lowest adjacent grade for frost protection. If continuous foundation loads exceed 5,000 plf or if column footing loads exceed 22,500 pounds when proportioning foundations using 2,500 psf, Western Geotechnical Consultants, Inc. should be contacted so we can assess foundation loading and perform an additional foundation investigation, if deemed appropriate.

Inspection of the foundation excavations by a geotechnical engineer should be performed prior to forming for footings. This is necessary to verify that foundation soils remain in a stiff to very stiff state throughout the foundation level, and to verify that foundation soil is in an undisturbed state.

Settlement of spread footing foundations depends on the foundation size and bearing pressure as well as the strength and compressibility characteristics of the underlying bearing soils.

Assuming construction is accomplished as recommended above and for the loads anticipated, we estimate total settlement of the foundation should be less than about one inch and differential settlement between two adjacent load bearing components should be less than about half the total settlement estimate. Most of the settlement should take place relatively rapidly during construction as loads are applied. We recommend that footing excavations be observed by a geotechnical engineer to confirm that our design assumptions are met.

Structural Fill and Compaction: We assume that some structural fill will be required where over-excavation is required. Structural fill is defined as compacted fill material supporting buildings, parking areas, driveways, etc. All structural fill should be placed and compacted on a horizontal subgrade surface. Structural fill should extend beyond the edge of any future structural improvements by a distance equal to the thickness of the fill beneath the structural improvements.

The on site non-organic sandy, gravelly soils below the silty sand soils can be used as structural fill provided the moisture content can be controlled and provided adequate compaction can be achieved.

Otherwise, we recommend using an import fill material consisting of relatively clean sandy gravel containing less than 5% fines (GW by USCS). Structural fill should be placed in maximum 8- to 10-inch loose, horizontal lifts and be thoroughly compacted. All structural fill should be compacted to a minimum of 95% of maximum dry density as determined by the ASTM D-1557 test procedure.

Drainage and Grading Considerations

The ground surface directly adjacent to the buildings should be graded such that storm runoff is directed away from the building. We recommend a minimum slope gradient of 2% around building.

We recommend that an exterior footing drain system be constructed around the perimeter of the building foundation. The footing drain system is typically constructed with a perforated 4-inch rigid pipe placed in clean, free-draining coarse sand or gravel with less than 3% by weight passing the U.S. No. 200 sieve size, based on a wet sieve analysis of that portion passing the U.S. No. 4 sieve. The pipe may be bedded in pea gravel. The perforated pipe should be placed at or below the level of the base of the footings and 1/2 foot outside the footings.

The footing drains should discharge to the approved storm drainage system for the area. Roof drainage must not be introduced into the perimeter footing drain, but should be discharged separately to an approved storm drainage system by tightline.

Floor Slab Support: We have assumed that the lower level of the building may have an earth supported floor slab. Preparation of the building areas in a manner described in the previous sections of this report should provide an adequate base for the floor slab support. We recommend that all earth-supported floor slabs be underlain by a minimum of four inches of clean crushed gravel, which will act as a capillary break to prevent moisture wicking up to the slab.

The capillary break should be placed over undisturbed, compact native soil or a minimum of four inches of compacted structural fill on the undisturbed, compact native soil. A vapor barrier, consisting of polyethylene sheeting, may be placed below the floor slab if desired.

If a vapor barrier is used, it should be covered with a thin layer of clean sand or crushed gravel to protect it during concrete placement and to aid in concrete curing.

It is important that drainage is provided such that the 4-inch capillary layer located below the vapor barrier will drain via gravity from beneath the floor slab. This can be accomplished by installing 2-inch diameter PVC pipes through the stem wall that outlet into the footing drain system or by extending the capillary break layer under the footing.

In addition, the Portland Cement Association recommends the following, "... to prevent problems with floor covering materials caused by concrete itself, the following steps should be taken (Design and Control of Concrete Mixture, Portland Cement Association, 13th Edition:

1) use low water-cement ratio concrete
2) moisture-cure the slab for five to seven days
3) allow the slab a two or more month drying period, and
4) test the slab moisture condition before installing the floor covering.

Parking Lot Subgrade Strength Design Parameters

On the basis of our review of site soil conditions on the property a minimum CBR value of 7 has been assumed for the near surface sandy soils. This value is based on correlation of soil type and our experience at sites with similar soil conditions.

Some of the important factors that affect the durability of pavement surfacing include stability and permeability of the subgrade soils and base materials, the presence of ground water, design life of the road section, the traffic volume, and the frequency of heavy truck traffic. The road section design should include the factors listed above.

The pavement section should be installed over firm sub-grade. Following excavation and/or filling to establish sub-grade elevation, but immediately prior to paving, the sub-grade surface should be proof rolled with a loaded 10 cubic yard dump truck, or equivalent. Any soft areas exposed by the proof rolling, which cannot be easily compacted should be over-excavated and back filled with compacted granular fill.

We assume that most of the paved areas on the site will be used primarily for cars and light trucks, except that portion of the paved areas, such as entrance and drive lanes that would need to be designed to accommodate heavier trucks. In the lighter loaded areas, we assume that occasional heavier trucks may use portions of the site for deliveries, etc. Typical recommended pavement sections for car and light truck parking consists of a minimum of 2 inches of asphalt over at least 4 inches of crushed rock base on a properly prepared subgrade. Two inches of asphalt treated base (ATB) may be substituted for the 4 inches of crushed rock. Areas where heavy truck loading will be present should consist of a minimum of 3 inches of asphalt over 5 inches of crushed rock base or 2.5 inches of ATB. Given the small area of pavement we recommend that the asphalt pavement be designed to accommodate heavy truck loading conditions.

The pavement sections provided above are recommended by the Asphalt Institute, IS-91, "Full Depth Asphalt Pavements for Parking Lots, Service Stations and Driveways". The design of pavement sections may be refined if vehicle loading, frequency and duration are known along with pavement design life.

Erosion Control: Erosion control during construction of the proposed facilities can be accomplished through placement of proper sedimentation control facilities. We recommend siltation control facilities, consisting of either hay bales or silt fences, be fabricated around all construction areas. Typical details for siltation control facilities using either hay bales or silt fences are attached to this report.

Siltation devices should be placed down gradient of all construction areas and cleared areas to provide siltation control during construction. All siltation control devices should be maintained in operable condition during construction, and left in operable condition until the site has been revegetated and siltation is no longer a threat. At that time the siltation facilities should be removed.

Thank you for the opportunity to be of assistance to you on this project. If you have any questions regarding the contents of this report or if we can be of further assistance please contact our office.

Sincerely,

Western Geotechnical Consultants, Inc.

Theodore A. Hammer, P.E.
Geotechnical Engineer

THEODORE A. HAMMER
STATE OF WASHINGTON
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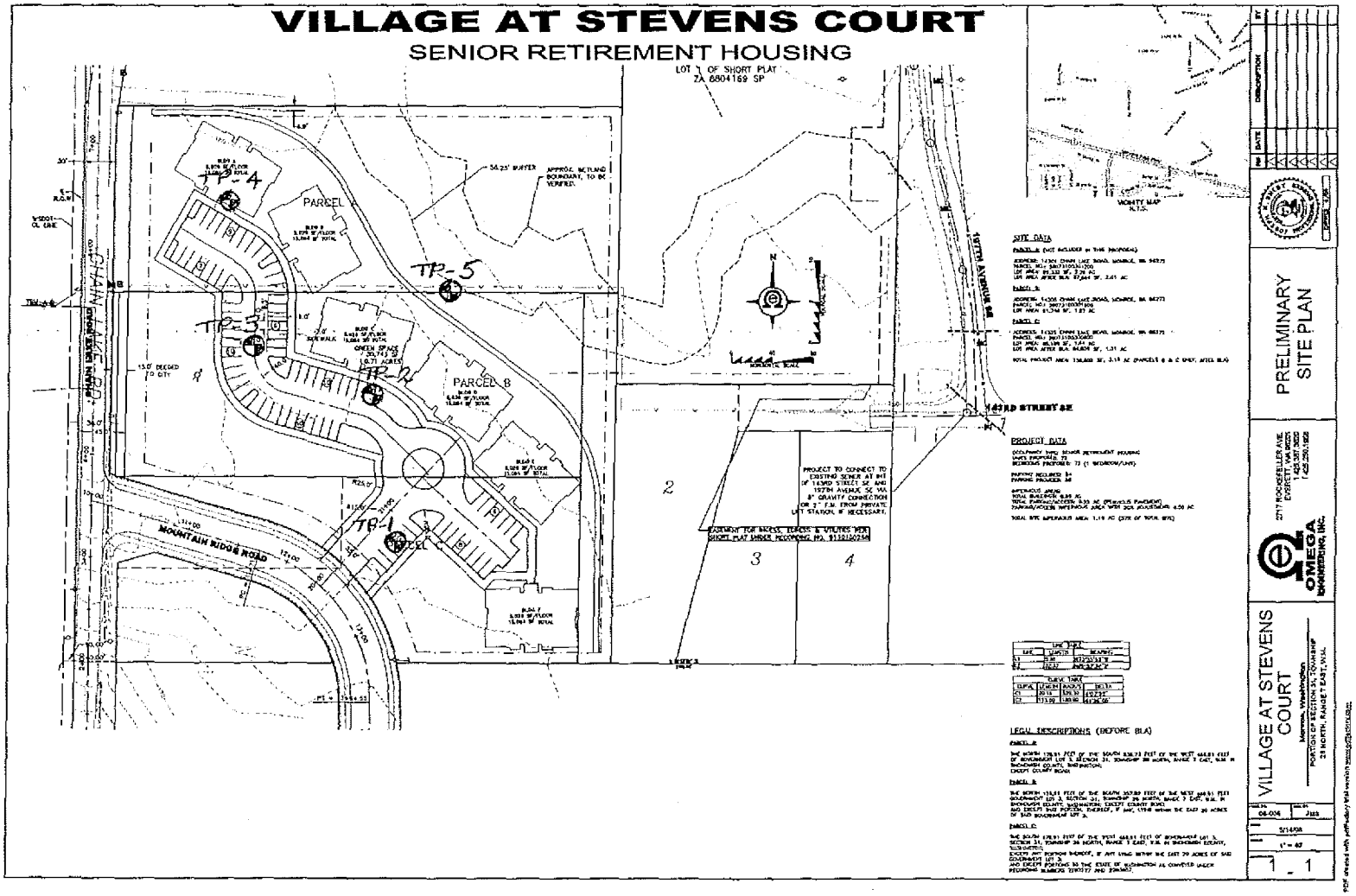
REGISTERED
PROFESSIONAL ENGINEER
EXPIRES 12/27/09

Inclusions: Figure 1, Site Plan Sketch
USCS Classification Chart
Log of Test Pits

Attachments: Grain Size Distribution Curves
Organic Content Test Results
USDA Textural Triangle
Typical Siltation Control Facilities

File: 08 104 1

Figure 1
Site Plan & Test Pit Locations
Village at Stevens Court Property
Monroe, Washington



USCS Chart & Key to Test Pit Descriptions

UNIFIED SOIL CLASSIFICATION CHART (USCS)

MAJOR DIVISIONS			GRAPH SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES) <5%		GW	WELL-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL-SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES) <12%		GM	SILTY GRAVELS, GRAVEL-SAND-SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL-SAND-CLAY MIXTURES
	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES) <5%		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	MORE THAN 50% OF COARSE FRACTION PASSING NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES) <12%		SM	SILTY SANDS, SAND-SILT MIXTURES
				SC	CLAYEY SANDS, SAND-CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS RO CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE				CH	INORGANIC CLAYS OF HIGH PLASTICITY, FAT CLAYS
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

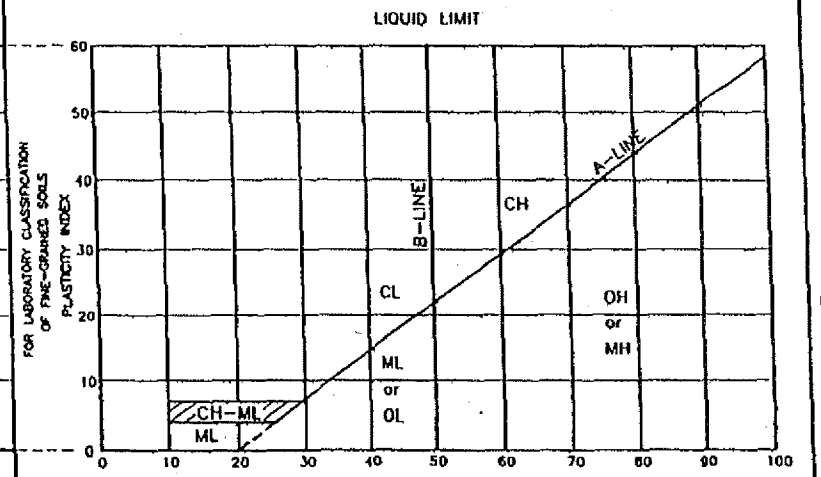
GRADATION CHART

MATERIAL SIZE		PARTICLE SIZE			
		LOWER LIMIT		UPPER LIMIT	
		MILLIMETERS	SIEVE SIZE	MILLIMETERS	SIEVE SIZE
SAND	FINE	.074	#200 *	0.42	#40 *
	MEDIUM	0.42	#40 *	2.00	#10 *
	COARSE	2.00	#10 *	4.76	#4 *
GRAVEL	FINE	4.76	#4 *	191	3/4" *
	COARSE	191	3/4" *	762	3" *
COBBLES		76.2	3" *	304.8	12" *
BOULDERS		304.8	12" *	914.4	

* U.S. STANDARD • CLEAR SQUARE OPENINGS

5–12% FINES (SILT & CLAY) DUAL CLASS

PLASTICITY CHART



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Key to Test Pit Logs Using the Unified Soil Classification System

DATE: 8/11/93 SCALE: H: N/A V: N/A

			Log of Test Pits		File: 08 104 1	
Test Pit No.	Depth Interval (feet)	USCS Class.	Soil Description	Sample No./ Depth (feet)	Water Content (%)	Lab Testing
TP-1	0.0-0.8	OL/SM	Dark brown sandy organic SILT to silty SAND with some gravel, numerous roots and organic debris (soft)	1-1/0.5'	8.1%	
	0.8-2.5	SM to SP/SM	Orange brown slightly silty to silty fine to medium SAND, some fine gravel (gravel is rounded) (fine to medium SAND zones (SP))	1-2/1.3'	9.7%	*GS/OC
	2.5-6.5	GP to GW	Brown gray fine to coarse sandy GRAVEL and cobbles with gravelly sand lenses (gravel is rounded 9" minus @ 4-1/2') (12" minus cobble @ 5-1/2')	1-3/3.5' 1-4/6.0'	4.4% 3.8%	

- Test Pit terminated on 09/30/08 at 6.5 feet.
- No groundwater seepage encountered.
- Piezometer installed full depth.
- Test pit backfilled upon completion.
- *GS/OC means grain size/hydrometer test and organic test performed.

			Log of Test Pits		File: 08 104 1	
Test Pit No.	Depth Interval (feet)	USCS Class.	Soil Description	Sample No./ Depth (feet)	Water Content (%)	Lab Testing
TP-2	0.0-1.3	OL/SM	Dark brown sandy organic SILT to silty SAND with some gravel, numerous roots and organic debris (soft)			
	1.3-3.2	SM	red brown silty fine to medium SAND (moist, relatively compact)	2-1/2.0'	16.8%	
	3.2-7.5	GP/GW	Gray fine to coarse sandy GRAVEL, occasional cobbles (moist, relatively compact) (gravel is rounded 8 inch minus) (grades very moist at 6-1/2 feet)	2-2/6.5'	3.2%	

- Test Pit terminated on 09/30/08 at 7.5 feet.
- No groundwater seepage encountered.
- Piezometer installed full depth.
- Test pit backfilled upon completion.
- *GS/OC means grain size/hydrometer test and organic test performed.

			Log of Test Pits		File: 08 104 1	
Test Pit No.	Depth Interval (feet)	USCS Class.	Soil Description	Sample No./ Depth (feet)	Water Content (%)	Lab Testing
TP-3	0.0-1.1	OL/SM	Dark brown sandy organic SILT to silty SAND with some gravel, numerous roots and organic debris (soft)			
	1.1-2.8	SM	Orange brown slightly silty to silty fine to medium SAND, some fine gravel (gravel is rounded)	3-1/2.0	8.0%	*GS/OC
	2.8-7.5	GP to GW	Gray fine to coarse sandy GRAVEL, occasional cobbles (moist, relatively compact) (gravel is rounded)	3-2/5.0	4.8%	

- Test Pit terminated on 09/30/08 at 7.5 feet.
- No groundwater seepage encountered.
- Piezometer installed full depth.
- Test pit backfilled upon completion.
- *GS/OC means grain size/hydrometer test and organic test performed.

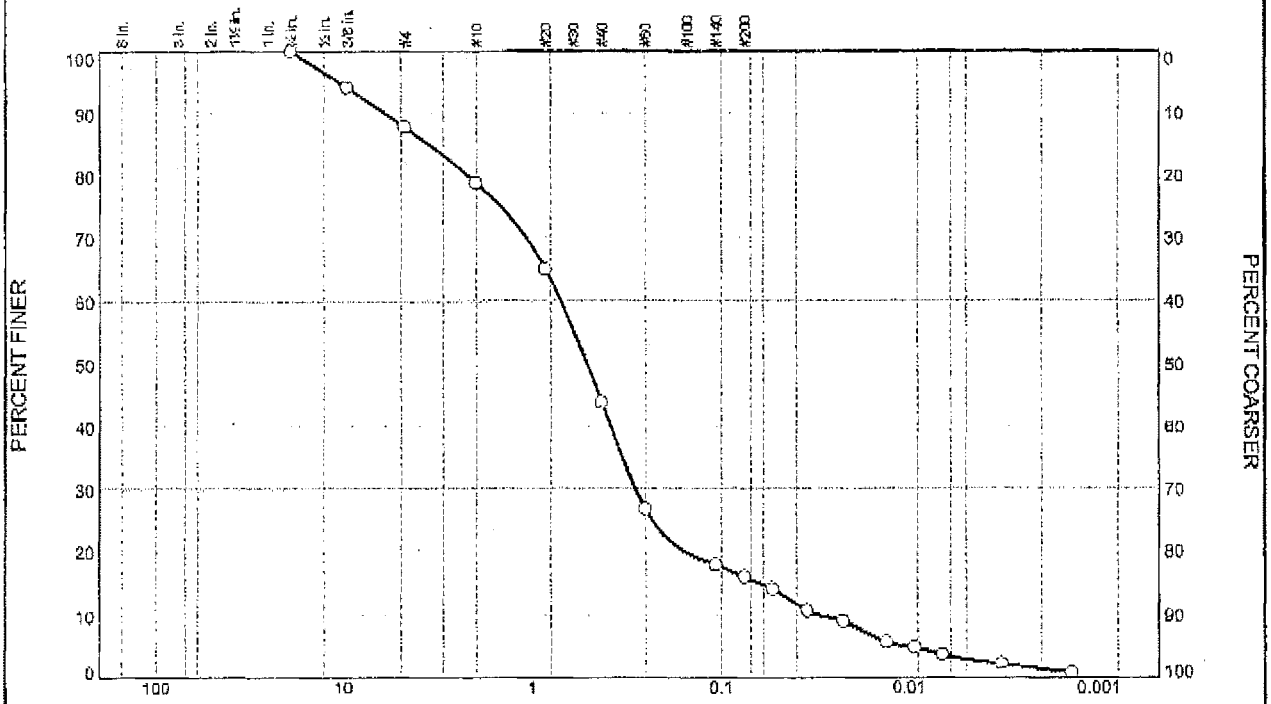
			Log of Test Pits		File: 08 104 1	
Test Pit No.	Depth Interval (feet)	USCS Class.	Soil Description	Sample No./ Depth (feet)	Water Content (%)	Lab Testing
TP-4	0.0-1.0	OL/SM	Dark brown sandy organic SILT to silty SAND with some gravel, numerous roots and organic debris (soft)			
	1.0-2.4	SM	Orange brown slightly silty to silty fine to medium SAND, some fine gravel (gravel is rounded) (fine to medium SAND zones (SP))	4-1/1.5'	7.2%	
	2.4-3.6	SP	Brown fine to medium SAND, trace rounded gravel (moist, relatively compact)	4-2/3.0'	1.2%	
	3.6-7.5	GW to GP	Gray fine to coarse sandy GRAVEL, occasional cobbles (contains fine to medium sand zones (SP) @ 2.5 to 3.5 feet) (hard at 6-1/2', cobbly) (moist, relatively compact)	4-3/5.5'	4.5%	

- Test Pit terminated on 09/30/08 at 7.5 feet.
- No groundwater seepage encountered.
- Piezometer installed full depth.
- Test pit backfilled upon completion.
- *GS/OC means grain size/hydrometer test and organic test performed.

			Log of Test Pits		File: 08 104 1	
Test Pit No.	Depth Interval (feet)	USCS Class.	Soil Description	Sample No./ Depth (feet)	Water Content (%)	Lab Testing
TP-5	0.0-0.5	OL/SM	Black sandy organic SILT to silty SAND with some gravel, numerous roots and organic debris (soft)	5-1/0.3'	8.1%	
	0.5-1.0	SM	Orange brown slightly silty to silty fine to medium SAND, some fine gravel (wet, relatively compact) (gravel is rounded) (fine to medium SAND zones (SP))	5-2/1.0'	25.2%	
	1.0-4.5	SP/GP	Brown fine to medium SAND and rounded gravel) (moist, relatively compact) (grading gray and wet at 4')			
	4.5-5.5	SM/ML	Orange gray moist silty fine SAND to fine sandy SILT (wet, relatively compact)	5-3/5.0'	15.3%	
	5.5-6.5	GP to GW	Gray fine to coarse sandy GRAVEL, occasional cobbles (seepage at 6.2', sidewall caving)			

- Test Pit terminated on 09/30/08 at 6.5 feet.
- No groundwater seepage encountered.
- Piezometer installed full depth.
- Test pit backfilled upon completion.
- *GS/OC means grain size/hydrometer test and organic test performed.

Particle Size Distribution Report



% Stones	% +3"	% Gravel Coarse	% Gravel Medium	% Gravel Fine	% Sand V. Crs.	% Sand Crs.	% Sand Med.	% Sand Fine	% Sand V. Fine	% Silt Crs.	% Silt Fine	% Clay
0	0	0	12	9	10	20	22	10	3	6	7	1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100		
3/8"	94		
#4	88		
#10	79		
#20	65		
#40	44		
#60	27		
#140	18		
#200	16		
#270	14		

* (no specification provided)

Material Description

loamy sand

Atterberg Limits

PL= np LL= nv PI=

Coefficients

D_{90}= 6.0605 D_{85}= 3.5925 D_{60}= 0.7016
D_{50}= 0.5089 D_{30}= 0.2826 D_{15}= 0.0636
D_{10}= 0.0309 C_u= 22.69 C_c= 3.68

Classification

USCS= SM AASHTO= A-1-b

Remarks

Organic Content: 1.68%

Location: Harris Native (3-1)
Sample Number: 6536

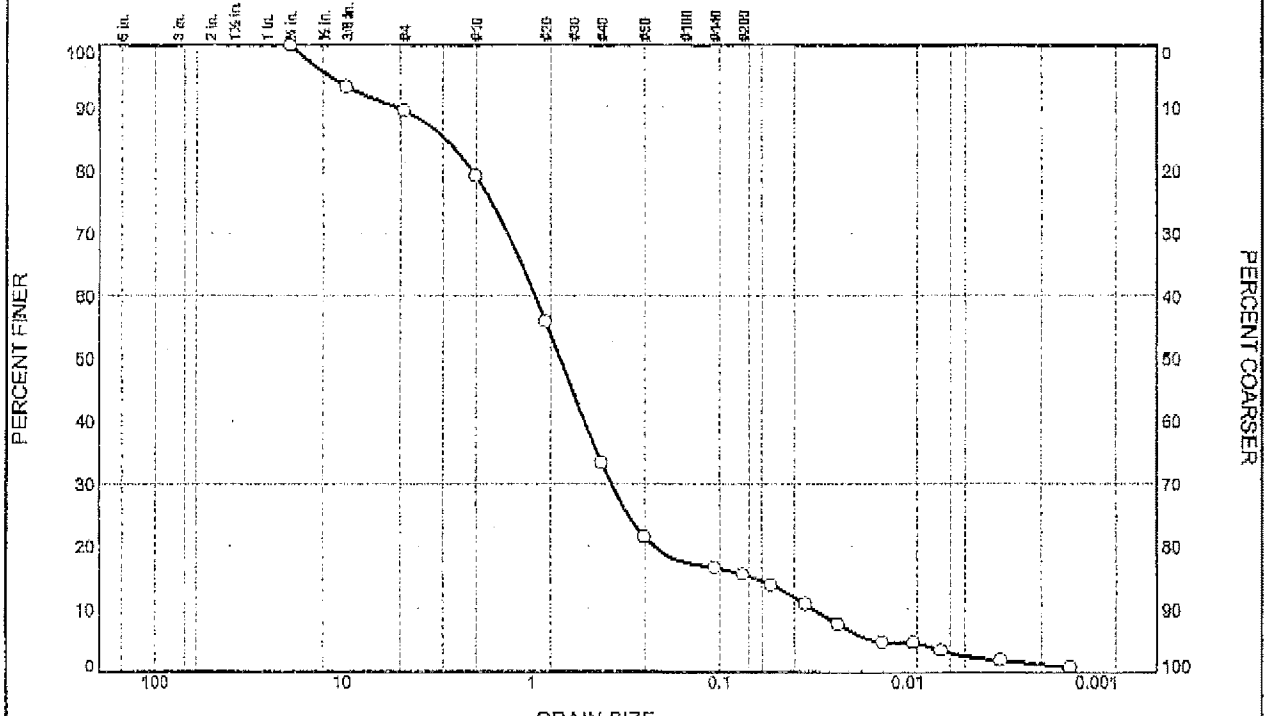
Date: 10-1-08

GEOTEST
741 Marine Drive
Bellingham, WA 98225
www.GeoTest-Inc.com

Client: Western Geotechnical
Project: General Services
Project No: 08-0042 **Report** S17-6536

Tested By: ES **Checked By:** GR

Particle Size Distribution Report



% Stones	% +3"	% Gravel			% Sand					% Silt		% Clay
		Coarse	Medium	Fine	V. Crs.	Crs.	Med.	Fine	V. Fine	Crs.	Fine	
0	0	0	11	10	18	23	17	5	2	8	5	1

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
3/4"	100		
3/8"	93		
#4	89		
#10	79		
#20	56		
#40	33		
#60	21		
#140	17		
#200	15		
#270	14		

* (no specification provided)

Material Description

loamy sand

Atterberg Limits

PL= np LL= nv PI=

Coefficients

D_{90}= 5.2403 D_{85}= 2.9041 D_{60}= 0.9685
D_{50}= 0.7143 D_{30}= 0.3771 D_{15}= 0.0677
D_{10}= 0.0316 C_u= 30.66 C_c= 4.65

Classification

USCS= SM AASHTO= A-1-b

Remarks

Organic content: 2.95%

Location: Harris Native (1-2)
Sample Number: 6537

Date: 10-1-08

GEOTEST
741 Marine Drive
Bellingham, WA 98225
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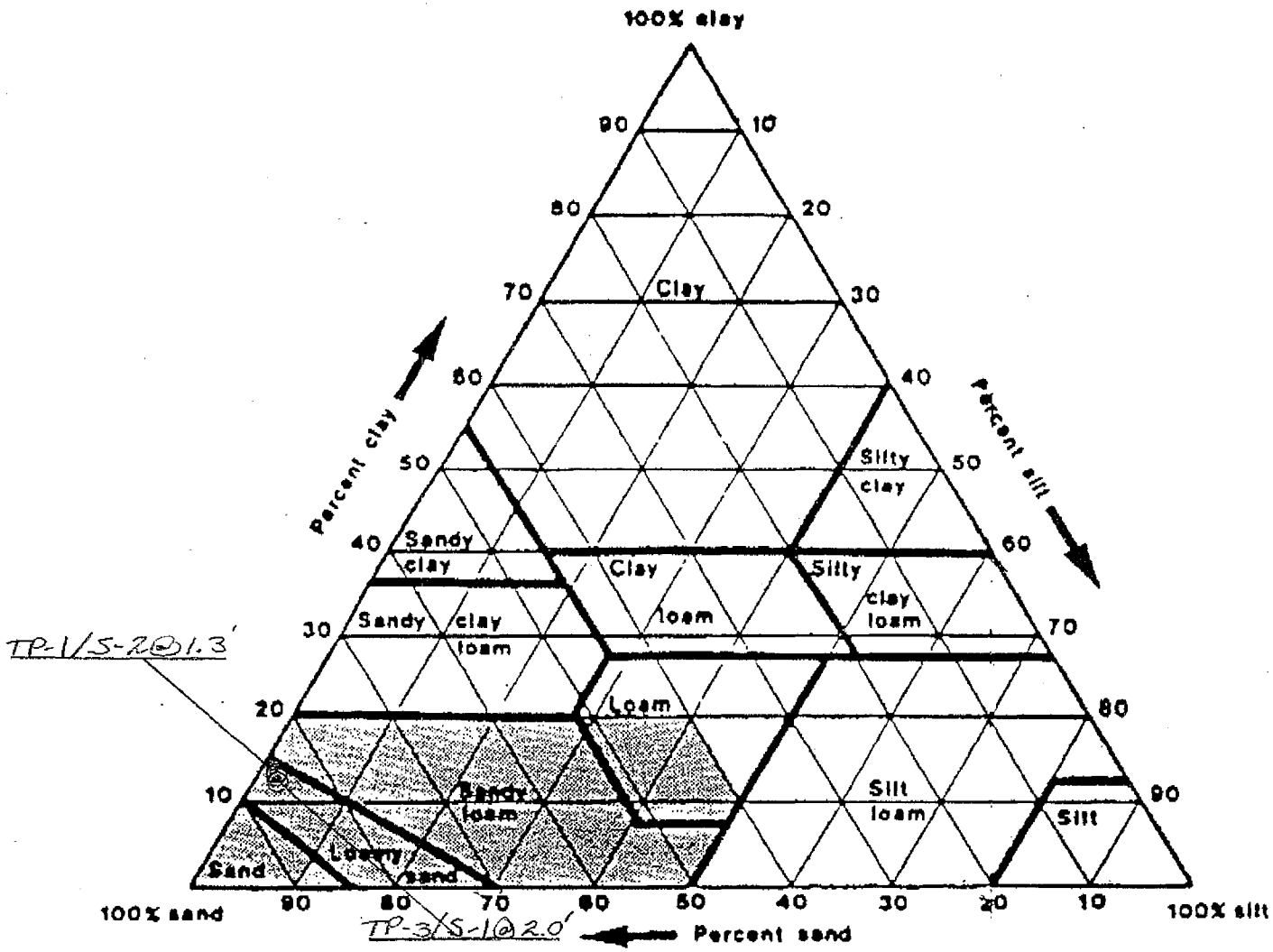
Textural Triangle U.S.D.A.



JOB NO.: 08 104 1	Western Geotechnical Consultants	Village at Stevens Court
DESIGNED BY: JMH	4163 Salt Spring Drive	14325 Chain Lake Road
DRAWN BY:	Ferndale, WA 98248 (360) 380-2507	Monroe, Washington
CHECKED BY:		DATE 10/11/08 SCALE N/A

Loamy Sand $i_{long\ term} = 0.5''/hr$