Garry Oaks Drive
10 Unit Townhome site

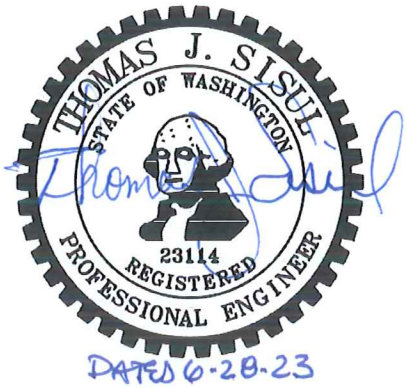
Parcel #03-30-19-84-0060

Sequim, WA

J.O. SVA 23-008

June 25, 2023

TECHNICAL INFORMATION REPORT AND HYDROLOGY CALCULATIONS



SISUL ENGINEERING

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Appendix C – Operation and Maintenance Specifications
Appendix D – Storm Drainage and SWPPP Plan Sheets
Appendix E – FEMA Product Report for the Sequim area
Appendix F – Web Soil Survey

SECTION A – PROJECT OVERVIEW:

EXISTING SITE INFORMATION:
The site, currently without an address, is on the east side of Garry Oaks Drive, with a small access strip to N. Fifth Avenue. The parcel lies to the west of parcel with the address of 615 N. Fifth Avenue. The site parcel has a Parcel # of 03-30-19-84-0060. The site is 33,718 SF (0.77 acres) according to Assessor records, (0.78 acres per the Thompson PUD plat). While there are no existing structures on the site, a portion of the site has been paved to serve existing structures on for the parcel to the east (615 N. Fifth Avenue), Driveway connections exist on the parcel to the east to N. Fifth Avenue, to the west to Garry Oaks Drive and to the north to a parcel with the address of 645 N. Fifth Avenue.

There are no known storm drainage facilities on the site. There is approximately 12,375 SF of existing impervious asphalt on the site currently.

DEVELOPED SITE INFORMATION:
Ten (10) attached townhome style dwellings (in 2 groups of 5) will be constructed on the site. The dwellings will have rear entry garages coming off a shared driveway that has connection to North Fifth Avenue.

The new impervious area (buildings, sidewalk, and pavement areas) will be approximately 18,000 SF and the remaining existing impervious area on the site will total approximately 8,000 SF. The landscape area will total approximately 7,718 SF. (Impervious area based on the Designer's plans dated 10-25-22, with some estimation to be conservative on the amount of impervious area).

5 foot Contour Map of the site area

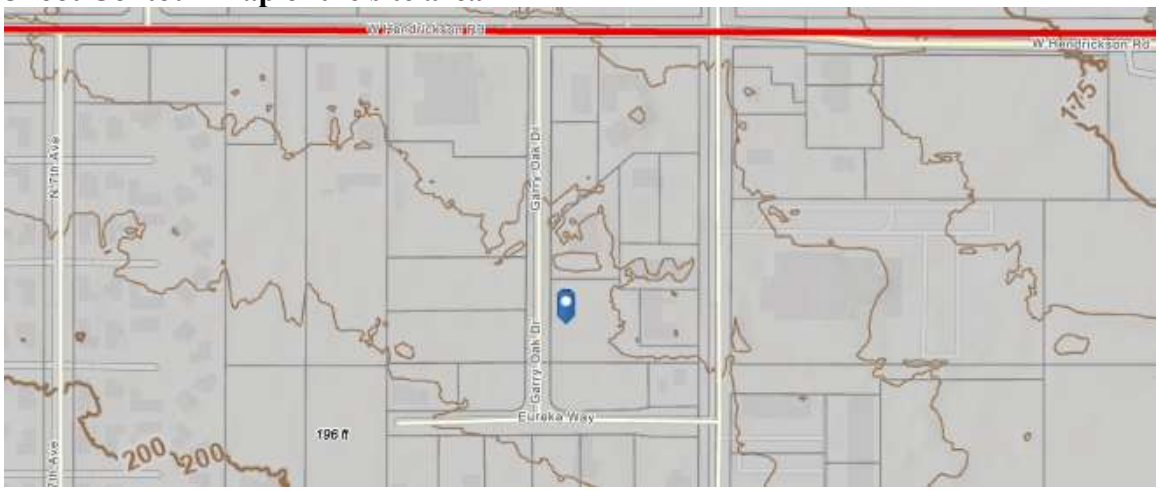


Figure 1

Aerial of the site



Figure 2

Proposed Infiltration
The soils on the site will accept infiltration, the site's drainage runoff will be infiltrated via StormTech chambers under the driveway area.

SOIL SURVEY INFORMATION:
According to the geotechnical report prepared by Zenovic & Associates, Inc. dated November 2, 2022, the soil on the site consists of topsoil for a depth of 8 inches and then Very Clobbly Loamy Sandy Gravel to a depth of 30 inches and then Very Clobbly Sandy Gravel to a depth of 72 inches. The infiltration rate was determined to 25.7 inches per hour. Zenovic recommended a design infiltration rate of 12.5 inches per hour be used, providing for a Factor of Safety of 2.

The site basin is the site itself as well as the parcel to the south as it appears the ground drains in a southwesterly to northeasterly direction from contours maps. There are no known flooding issues. The existing site condition is a flat site with pasture type grasses. See Figure 3 below for the proposed improvement plan.

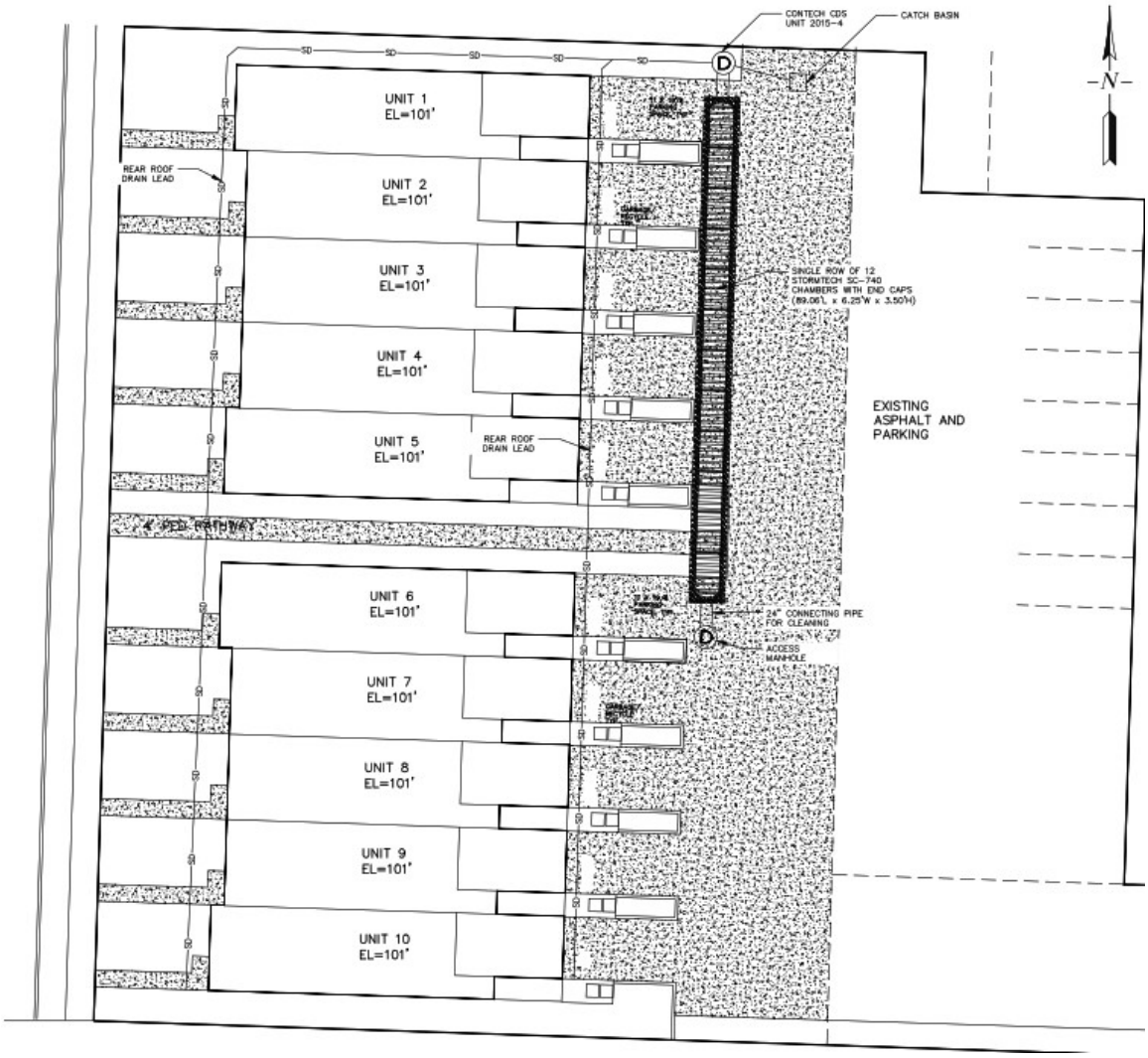


Figure 3

AREA SUMMARY TABLE

Total Site Area	**33,718 SF = 0.77 Acres**
Existing Pervious Area	21,343 SF = 0.49 Acres
Existing Impervious Areas	12,375 SF = 0.28 Acres
Construction Site Areas	
New Building Roof Area	9,145 SF = 0.21 Acres
Walkways and Driveway Area	16,855 SF = 0.38 Acres
TOTAL IMPERVIOUS	**26,000 SF = 0.60 Acres**
Landscape Area	7,718 SF = 0.18 Acres

Table 1

SECTION B – Core and Special Requirements:

CORE REQUIREMENT 1: Discharge at the Natural Location

The site has no obvious drainage release point, and we anticipate that onsite drainage currently infiltrates. With the proposed development, onsite runoff will be infiltrated into the ground via infiltration chambers.

CORE REQUIREMENT 2: Offsite Analysis

As the site's drainage will be directed to an infiltration system, an offsite analysis was felt not to be necessary.

CORE REQUIREMENT 3: Flow Control Facilities

As the site runoff will be infiltrated flow control facilities are not necessary. Sizing for the infiltration facility was per the Stage-Storage-Discharge Table for the number and size of StormTech Chambers used and the void space of the surrounding drain rock as specified in the plans.

CORE REQUIREMENT 4: Conveyance System

The conveyance system will be internal private storm drain piping directed to the infiltration chambers under the parking lot. During larger events that exceed the base infiltration rate of the soil, there could be some detention within the storm drain chamber that will back up into the site's conveyance system. However, this backup will not exceed the ground elevations in areas of the conveyance system.

CORE REQUIREMENT 5: Construction Stormwater Pollution Prevention

The project will provide erosion and sediment controls (ESC) to prevent, to the maximum extent practical, the transport of sediment from the project site. As the site is virtually flat and the site infiltrates, it is expect that sediment controls to prevent sediment from being carried off the site via vehicle tires will need to be the main focus of sediment controls.

CORE REQUIREMENT 6: Maintenance and Operations

Maintenance and operation of all drainage and onsite conveyance facilities will be the responsibility of the property owner and/or property lessee. Maintenance and operation guidelines are provided in Section C.

CORE REQUIREMENT 7: Financial Guarantees and Liability

All stormwater facilities and BMPs will be located on the subject property. Therefore, no financial guarantees are required.

CORE REQUIREMENT 8: Water Quality Facilities

The water quality facility on the site, ahead of the infiltration chamber system will be a Contech CDS 2015-4 manhole unit. We note that peak runoff rate for the site per the WWHM printout for the 100 year event is 0.12 CFS and the CDS 2015-4 unit is capable of treating 0.7 CFS for pretreatment per the Washington Dept. of Ecology.
In addition, the single StormTech chamber row will be setup as an isolator row to further provide sediment protection from clogging the infiltration system. The isolator row will have a maintenance access to allow cleaning of this chamber row.

CORE REQUIREMENT 9: Flow Control BMPs

As the site area will be drain into an infiltration system on site, no flow control is necessary. However, the infiltration system will consist of 12 SC-740 StormTech Chambers within a infiltration area consisting of 556 SF, with 6 inches of drain rock above and below the 30 inch tall chambers.

SPECIAL REQUIREMENT #1: Other Adopted Area-Specific Requirements

No other area specific requirements are imposed on this property.

SPECIAL REQUIREMENT #2: Flood Hazard Area Delineation

The site is not known to be in a flood hazard area.

SPECIAL REQUIREMENT #3: Flood Protection Facilities

As the subject site is not believed to be in a flood hazard area, it would be exempt from flood protection measures.

SPECIAL REQUIREMENT #4: Source Control

As the site requires a residential (multi-family) building and site permit the source control requirements are applicable. The water quality source controls will be designed in to meet the City of Sequim requirements.

SPECIAL REQUIREMENT #5: Oil Control

This multi-family site is not considered a "high-use site" as parking areas are not the intended to be captured by the oil control thresholds. Oils from the small parking lot, which may get into the runoff, will be trapped in the Contech CDS manhole.

SECTION C- Flow Control, Water Quality and Conveyance:

SECTION C1 – FLOW CONTROL CALCULATIONS:

Flow Control is not required as the site will be infiltrated through the 100 year storm event. The infiltration facility was sized using the WWHM2012 program. Below are the WWHM program inputs.

Predeveloped - Existing Conditions

A/B, Pasture, Flat	0.49 Acres	(hydrologic group A/B, Pasture, Flat Slope)
Driveways/Flat	0.28 Acres	(Driveways, Flat)

Mitigated - Developed Conditions

A/B, Lawn, Flat	0.018 Acres	(hydrologic group A/B, Lawn, Flat Slope)
Roof Tops, Flat	0.21 Acres	(Roof Tops, Flat)
Driveways, Flat	0.38 Acres	(Driveways, Flat)

StormTech 1 – Chamber Model 740
Length: 89 feet
Number of Chambers: 12
Number of End Caps: 2
Top Stone Depth: 6 inches
Bottom Stone Depth: 6 inches

Infiltration: Yes
Measured Infiltration Rate: 25.7 inches/hr
Reduction Factor: 0.5
Use Wetted Surface Area (sidewalls): No

WWHM Results:

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.080364
5 year	0.109815
10 year	0.130181
25 year	0.156906
50 year	0.177541
100 year	0.198805

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

The results above show that the Mitigated flows into the infiltration chamber are totally infiltrated through the 100 year event. See attached WWHM Report. (Appendix B).

SECTION C2 – WATER QUALITY CALCULATIONS:

Contech CDS 2015-4 water quality manhole along with StormTech Chamber isolator row is used for catching oils and sediment in the runoff.

SECTION C3 – CONVEYANCE CALCULATIONS:

Any changes to off-site flows, will be to decrease off-site flows as the currently uncontrolled runoff from the existing site will be collected and directed to an infiltration system as part of the redevelopment of the site.

SECTION D- Special Reports or Studies

GEOTECHNICAL REPORT

A geotechnical study, including an infiltration analysis was prepared by Zenovic & Associates dated November 2, 2022 is included in Appendix A.

SECTION E- Other Permits

Permits required for this project include:

- Building Construction Permit

SECTION F- Erosion Control and Sediment Control

THE 12 ELEMENTS:

Element #1 – Mark Clearing Limits:
The site work will generally be limited to area bounded by Garry Oak Drive on the west, and property boundaries to the south, and north, and on the east by the existing pavement. Where not bounded by impervious surfaces silt fence shall be placed along the outside line of the work area to mark the work limits.

Element #2 – Establish Construction Entrance:
The proposed entrance, off Garry Oaks Drive will be used as the primary access to the site. This will serve as the access point for the project. If sediment is tracked off site during construction, it shall be cleaned thoroughly by shoveling or pick up sweeper by the end of the day or more frequently if during wet weather.

Element #3 – Control Flow Rates:
The area of improvement is self contained as it does not have run through from off-site flows. Flow control measures will be a part of the system improvements. During construction care runoff from the site will be directed to created depressions.

Element #4 – Installation of Sediment Controls
Prior to beginning of construction the clearing limits shall be marked and sediment fencing shall be place along side of all the work areas. All inlets in, close to of the work area shall be protected by inlet inserts installed prior to starting of site work. All sediment control facilities shall be in place prior to the starting of construction.

Element #5 – Stabilize Soils:
The proposed project construction schedule will be several months. However, initial groundwork has been scheduled to be constructed during the early fall and winter months. The site is flat. The work area will be protected by sediment fences and other BMP's to keep the any runoff from the work area clean. Each section shall be covered as soon as the work is completed with straw, compost or other means to prevent rainfall from disturbing the ground exposed by the work completed. Any stockpiles that would be created will be protected to prevent the erosion and degradation of the existing infiltration facilities presently functioning on the site.

Element #6 – Protect Slopes:
There are no slopes existing or to be created in the work area that will need protection.

Element #7 – Protect Drain Inlets:
The existing inlets and new inlets will be protected during construction and until ground cover is established, by inlet sediment bags at each inlet. The inlet protection shall be installed on the inlets in or near the construction areas prior to the beginning of construction.

Element #8 – Stabilize Channels and Outlets:
No stabilization of channels or outlets are needed during the duration of construction.

Element #9 – Control Pollutants:
The construction equipment shall be kept in one location when not in use. This area shall be inspected regularly to ensure any leaking or spillage is caught and cleaned up immediately. During establishment of the new landscaping fertilizers and pest control shall be kept to a minimum to prevent runoff of these pollutants.

Element #10 – Control De-Watering:
De-Watering is not anticipated to be required due to the well draining soils on site.

Element #11 – Maintain BMP'S:
As required the BMP's used to help control pollution will be maintained on a regular ongoing schedule as required by the erosion control plan. They shall be inspected regularly and after any big events to ensure the BMP's are in place and functioning.

Element #12 – Manage the Project:
The project will be built at one time, excavation spoils will need to be immediately placed in truck and hauled off. Large excavation spoils piles are not permitted. The work will be managed closely to minimize the open work part of the project. As each part of the project is completed, it will be finished up by establishing ground cover on that section before moving onward to the next section.

SECTION G- Operations and Maintenance

The owner and/or lessee of the site shall be responsible for maintaining the stormwater facilities. Proper maintenance is important for proper functioning of the stormwater facilities.

The following maintenance practices should be followed:

.

- Site catch basin(s) shall be check quarterly to insure that there is not build up of debris in the catch basins or the Contech CDS water quality manhole. If sediment or debris is noted, the material shall be removed and properly disposed of.
- It is recommended that a Vactor truck service be hired for removal of sediment and debris removal from the StormTech isolator row chambers, on a yearly basis.

TECHNICAL APPENDIX INDEX

Appendix A - Geotechnical Report by Landau Associates
Appendix B – WWHM Report
Appendix C - Operation and Maintenance Specifications
Appendix D - Storm Drainage and SWPPP Plan Sheets
Appendix E – FEMA Product Report for SeaTac area Flood Maps
Appendix F – Web Soil Survey

Appendix A
Geotechnical Report by
Zenovic & Associates

ZENOVIC & ASSOCIATES
INCORPORATED

CIVIL ENGINEERING

301 East 6th Street, Suite 1
Port Angeles, Washington 98362
(360) 417-0501
E-mail: office@zenovic.net

November 2, 2022

Grubb Construction
Attn: Mr. Caleb Grubb
234 West Hammond Street
Sequim, WA 98382

Re: N. Garry Oak Drive, Sequim, WA 98382
Parcel #03-30-19-84-0060
Onsite Soils Analysis

Dear Caleb:

As per the City of Sequim's requirements for building permit approval, we completed an onsite soils analysis on the property referenced above to determine onsite soil infiltration rates. The site a 0.77 acre lot located on the east side of N. Garry Oak Drive on the south side of W. Hendrickson Road in Sequim. The site is currently vacant. This analysis consisted of excavation of one test pit to determine the soil profile and to collect as soil sample for a sieve analysis. The test pit was excavated on the west side of the site (generally central in the north-south direction) and a soil sample was obtained at a depth of approximately 48 inches below ground surface

The soil profile observed in the test pit was as follows:

Test pit log:

0 – 8" Topsoil
8 - 30" Very Cobbly Loamy Sandy Gravel
30 – 72" Very Cobbly Sandy Gravel

No water was encountered or other indication of high groundwater table.
No restrictive layer was observed.

Sieve Analysis

To determine a design infiltration rate for the site, a sieve analysis was performed on the soil sample in accordance with section 5.4 of Volume V of the *2019 Stormwater Management Manual for Western Washington (ECY)*. This method utilizes the soil distribution curve to estimate infiltration rates for unconsolidated outwash soils. Based on this analysis, an infiltration rate of 25.7 inches per hour was estimated. It is recommended that an additional factor of safety of 2 be applied and a design infiltration rate of 12.5 inches per hour to be utilized. The sieve analysis and calculations are included with this letter.

Please contact me if you have any questions or if you need further information.

Sincerely,
Zenovic & Associates, Inc.



Seth J. Rodman, P.E.
Senior Design Engineer

11/2/2022

Enclosures

Fc: JN 22403

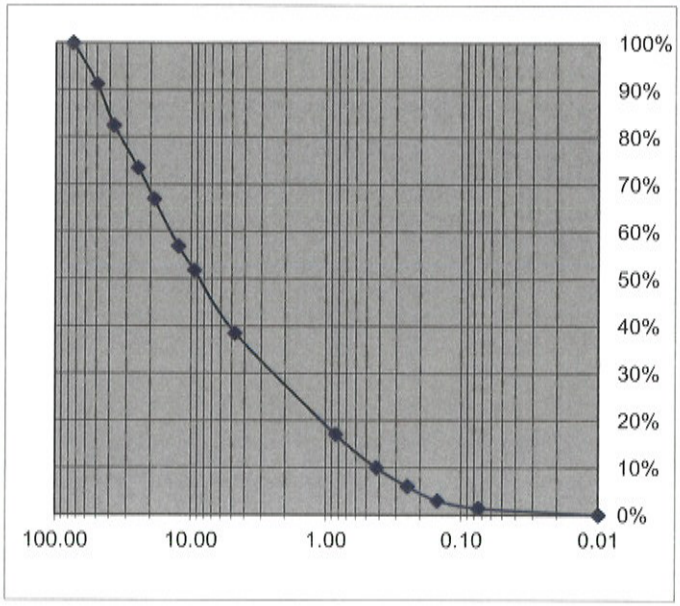
CONSTRUCTION INSPECTION SERVICES LLC
PO Box 3129 Port Angeles WA 98362
360-809-3329 cis.si@outlook.com

DATE:	10/27/2022
CLIENT:	Zenovic & Associates
ADDRESS:	301 East 6th St. Suite 1, PA WA
EMAIL:	seth@zenovic.net
PROJECT:	Caleb Grubb property
MATERIAL TYPE:	GW or GP
MATERIAL SOURCE:	North Gary Oak Drive, Sequim WA
TESTED BY:	Sean Wright
SAMPLE ID:	3020-29

ASTM C136 - SIEVE ANALYSIS OF FINE AND COARSE AGGREGATE

D10/ D30/ D60/ D90 DETERMINATION

DIA -MM	Sieve Size	Wt. (grams)	% Retained	% Passing
75.000	3"	0.0	0.0%	100.0%
50.000	2"	1855.1	8.7%	91.3%
37.500	1 1/2"	1870.4	8.8%	82.5%
25.000	1"	1902.7	9.0%	73.5%
19.000	3/4"	1413.5	6.7%	66.8%
12.500	1/2"	2126.5	10.0%	56.8%
9.500	3/8"	1079.4	5.1%	51.8%
4.750	No. 4	2814.7	13.3%	38.5%
0.850	No. 20	4559.1	21.5%	17.0%
0.425	No. 40	1490.6	7.0%	10.0%
0.250	No. 60	839.8	4.0%	6.1%
0.150	No. 100	641.4	3.0%	3.0%
0.075	No. 200	344.2	1.6%	1.4%
	Pan	301.7	1.4%	



D10	D30	D60	D90
0.42	2.50	15.00	48.00

End Weight:	20937.4	Cu:	35.71
Start Weight:	21239.1	Cc:	0.99
Washed Weight:	20937.4		

REMARKS:

Material sampled by Zenovic and Associates. Material was tested using ASTM C 136 Procedure A.

The information provided in this report is for the sole intended use of the contracted client. This report may not be reproduced without written consent of CIS.

INFILTRATION RATE CALCULATION - GRAIN SIZE ANALYSIS

PROJECT: Grubb Construction
LOCATION: N. Garry Oak Drive, Sequim
PARCEL NO: 03-30-19-84-0060

ZENOVIC & ASSOCIATES
301 EAST 6TH STREET, SUITE 1
PORT ANGELES, WA 98362
DATE: 11/2/2022
JOB NO. 22403
AUTHOR: SJR

Location TP #1

D_{10}	0.42
D_{60}	15
D_{90}	48
Fines	0.014

K_{sat}initial (cm/s)	0.063
CF_v	0.8
CF_t	0.4
CF_m	0.9
K_{sat}design (cm/s)	0.0182
K_{sat}design (in/hr)	25.7

Location

D_{10}	
D_{60}	
D_{90}	
Fines	

K_{sat}initial (cm/s)	
CF_v	
CF_t	
CF_m	
K_{sat}design (cm/s)	
K_{sat}design (in/hr)	

Location

D_{10}	
D_{60}	
D_{90}	
Fines	

K_{sat}initial (cm/s)	
CF_v	
CF_t	
CF_m	
K_{sat}design (cm/s)	
K_{sat}design (in/hr)	

$$\log_{10}(K_{sat}) = -1.57 + 1.90D_{10} + 0.015D_{60} - 0.013D_{90} - 2.08f_{fines}$$

Total Correction Factor, $CF_T = CF_v \times CF_t \times CF_m$

K_{sat} design $= K_{sat}$ initial $\times CF_T$

Table 3.3.1
Correction Factors to be Used With In-Situ Saturated Hydraulic Conductivity Measurements to Estimate Design Rates.

Issue	Partial Correction Factor
Site variability and number of locations tested	CF_v = 0.33 to 1.0
Test Method	
Large-scale PIT	CF_t = 0.75
Small-scale PIT	= 0.50
Other small-scale (e.g. Double ring, falling head)	= 0.40
Grain Size Method	= 0.40
Degree of influent control to prevent siltation and bio-buildup	CF_m = 0.9

Appendix B
WWHM Report

WWHM2012
PROJECT REPORT

Project Name: 6-26-23 run - 12 chambers
Site Name: Garry Oaks 10
Site Address: 915 N. Fifth Avenue
City : Sequim
Report Date: 6/28/2023
Gage : Port Angelis
Data Start : 1948/10/01
Data End : 2009/09/30
Precip Scale: 0.80
Version Date: 2021/08/18
Version : 4.2.18

Low Flow Threshold for POC 1 : 50 Percent of the 2 Year

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Pasture, Flat	.49
Pervious Total	**0.49**

Impervious Land Use	acre
DRIVEWAYS FLAT	0.28
Impervious Total	**0.28**
Basin Total	**0.77**

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
A B, Lawn, Flat	.18
Pervious Total	0.18

Impervious Land Use	acre
ROOF TOPS FLAT	0.21
DRIVEWAYS FLAT	0.38
Impervious Total	0.59
Basin Total	0.77

Element Flows To:

Surface	Interflow	Groundwater
StormTech 1	StormTech 1	

Name : StormTech 1
Facility Name: StormTech 1

Chamber Model: 740
Dimensions
Max Row Length : 89
Number of Chambers: 12
Number of Endcaps : 2
Top Stone Depth : 6
Bottom Stone Depth: 6
Infiltration On
Infiltration rate: 25.7
Infiltration safety factor: 0.5
Total Volume Infiltrated (ac-ft.): 41.986
Total Volume Through Riser (ac-ft.): 0
Total Volume Through Facility (ac-ft.): 41.986
Percent Infiltrated: 100
Total Precip Applied to Facility: 0
Total Evap From Facility: 0
Discharge Structure
Riser Height: 0 ft.
Riser Diameter: 0 in.

Element Flows To:

Outlet 1	Outlet 2

StormTech Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
2.0000	0.009	0.000	0.000	0.000
2.0833	0.009	0.000	0.000	0.120

2.1667	0.009	0.000	0.000	0.120
2.2500	0.009	0.000	0.000	0.120
2.3333	0.009	0.001	0.000	0.120
2.4167	0.009	0.001	0.000	0.120
2.5000	0.009	0.001	0.000	0.120
2.5833	0.009	0.002	0.000	0.120
2.6667	0.009	0.003	0.000	0.120
2.7500	0.009	0.003	0.000	0.120
2.8333	0.009	0.004	0.000	0.120
2.9167	0.009	0.005	0.000	0.120
3.0000	0.009	0.005	0.000	0.120
3.0833	0.009	0.006	0.000	0.120
3.1667	0.009	0.007	0.000	0.000
3.2500	0.009	0.007	0.000	0.000
3.3333	0.009	0.008	0.000	0.000
3.4167	0.009	0.009	0.000	0.000
3.5000	0.009	0.009	0.000	0.000
3.5833	0.009	0.010	0.000	0.000
3.6667	0.009	0.010	0.000	0.000
3.7500	0.009	0.011	0.000	0.000
3.8333	0.009	0.012	0.000	0.000
3.9167	0.009	0.012	0.000	0.000
4.0000	0.009	0.013	0.000	0.000
4.0833	0.009	0.013	0.000	0.000
4.1667	0.009	0.014	0.000	0.000
4.2500	0.009	0.014	0.000	0.000
4.3333	0.009	0.015	0.000	0.000
4.4167	0.009	0.016	0.000	0.000
4.5000	0.009	0.016	0.000	0.000
4.5833	0.009	0.016	0.000	0.000
4.6667	0.009	0.017	0.000	0.000
4.7500	0.009	0.017	0.000	0.000
4.8333	0.009	0.018	0.000	0.000
4.9167	0.009	0.018	0.000	0.000
5.0000	0.009	0.018	0.000	0.000
5.0833	0.009	0.019	0.000	0.000
5.1667	0.009	0.019	0.000	0.000
5.2500	0.009	0.019	0.000	0.000
5.3333	0.009	0.020	0.000	0.000
5.4167	0.009	0.020	0.000	0.000
5.5000	0.009	0.020	0.000	0.000

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:0.49
Total Impervious Area:0.28

Mitigated Landuse Totals for POC #1

Total Pervious Area:0.18
Total Impervious Area:0.59

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.080364
5 year	0.109815
10 year	0.130181
25 year	0.156906
50 year	0.177541
100 year	0.198805

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

Stream Protection Duration
Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.106	0.000
1950	0.071	0.000
1951	0.145	0.000
1952	0.050	0.000
1953	0.118	0.000
1954	0.117	0.000
1955	0.093	0.000
1956	0.072	0.000
1957	0.069	0.000
1958	0.082	0.000
1959	0.102	0.000
1960	0.090	0.000
1961	0.082	0.000
1962	0.062	0.000
1963	0.079	0.000
1964	0.144	0.000
1965	0.055	0.000
1966	0.061	0.000
1967	0.086	0.000
1968	0.076	0.000
1969	0.068	0.000
1970	0.101	0.000
1971	0.188	0.000
1972	0.102	0.000
1973	0.077	0.000
1974	0.041	0.000
1975	0.107	0.000
1976	0.093	0.000
1977	0.061	0.000
1978	0.061	0.000
1979	0.127	0.000

1980	0.065	0.000
1981	0.121	0.000
1982	0.113	0.000
1983	0.087	0.000
1984	0.060	0.000
1985	0.150	0.000
1986	0.093	0.000
1987	0.177	0.000
1988	0.072	0.000
1989	0.076	0.000
1990	0.087	0.000
1991	0.094	0.000
1992	0.079	0.000
1993	0.048	0.000
1994	0.043	0.000
1995	0.042	0.000
1996	0.052	0.000
1997	0.072	0.000
1998	0.068	0.000
1999	0.087	0.000
2000	0.116	0.000
2001	0.043	0.000
2002	0.079	0.000
2003	0.055	0.000
2004	0.078	0.000
2005	0.097	0.000
2006	0.072	0.000
2007	0.171	0.000
2008	0.063	0.000
2009	0.052	0.000

Stream Protection Duration
Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.1880	0.0000
2	0.1766	0.0000
3	0.1707	0.0000
4	0.1504	0.0000
5	0.1455	0.0000
6	0.1437	0.0000
7	0.1274	0.0000
8	0.1212	0.0000
9	0.1185	0.0000
10	0.1171	0.0000
11	0.1155	0.0000
12	0.1128	0.0000
13	0.1073	0.0000
14	0.1063	0.0000
15	0.1019	0.0000
16	0.1018	0.0000
17	0.1011	0.0000
18	0.0968	0.0000
19	0.0936	0.0000
20	0.0932	0.0000
21	0.0931	0.0000
22	0.0929	0.0000

23	0.0904	0.0000
24	0.0874	0.0000
25	0.0873	0.0000
26	0.0868	0.0000
27	0.0858	0.0000
28	0.0823	0.0000
29	0.0821	0.0000
30	0.0791	0.0000
31	0.0791	0.0000
32	0.0788	0.0000
33	0.0778	0.0000
34	0.0772	0.0000
35	0.0759	0.0000
36	0.0758	0.0000
37	0.0720	0.0000
38	0.0720	0.0000
39	0.0718	0.0000
40	0.0718	0.0000
41	0.0714	0.0000
42	0.0690	0.0000
43	0.0681	0.0000
44	0.0677	0.0000
45	0.0645	0.0000
46	0.0633	0.0000
47	0.0623	0.0000
48	0.0610	0.0000
49	0.0609	0.0000
50	0.0608	0.0000
51	0.0599	0.0000
52	0.0550	0.0000
53	0.0548	0.0000
54	0.0520	0.0000
55	0.0520	0.0000
56	0.0503	0.0000
57	0.0482	0.0000
58	0.0431	0.0000
59	0.0426	0.0000
60	0.0418	0.0000
61	0.0414	0.0000

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0064	1588	0	0	Pass
0.0068	1428	0	0	Pass
0.0071	1287	0	0	Pass
0.0075	1154	0	0	Pass
0.0078	1032	0	0	Pass
0.0081	929	0	0	Pass
0.0085	830	0	0	Pass
0.0088	730	0	0	Pass
0.0092	647	0	0	Pass

0.0095	578	0	0	Pass
0.0098	520	0	0	Pass
0.0102	467	0	0	Pass
0.0105	408	0	0	Pass
0.0109	377	0	0	Pass
0.0112	337	0	0	Pass
0.0115	292	0	0	Pass
0.0119	268	0	0	Pass
0.0122	239	0	0	Pass
0.0126	218	0	0	Pass
0.0129	199	0	0	Pass
0.0132	181	0	0	Pass
0.0136	159	0	0	Pass
0.0139	147	0	0	Pass
0.0143	129	0	0	Pass
0.0146	120	0	0	Pass
0.0150	112	0	0	Pass
0.0153	105	0	0	Pass
0.0156	96	0	0	Pass
0.0160	92	0	0	Pass
0.0163	85	0	0	Pass
0.0167	80	0	0	Pass
0.0170	73	0	0	Pass
0.0173	70	0	0	Pass
0.0177	64	0	0	Pass
0.0180	60	0	0	Pass
0.0184	54	0	0	Pass
0.0187	52	0	0	Pass
0.0190	49	0	0	Pass
0.0194	43	0	0	Pass
0.0197	37	0	0	Pass
0.0201	35	0	0	Pass
0.0204	33	0	0	Pass
0.0207	33	0	0	Pass
0.0211	31	0	0	Pass
0.0214	29	0	0	Pass
0.0218	26	0	0	Pass
0.0221	25	0	0	Pass
0.0225	25	0	0	Pass
0.0228	24	0	0	Pass
0.0231	23	0	0	Pass
0.0235	21	0	0	Pass
0.0238	21	0	0	Pass
0.0242	20	0	0	Pass
0.0245	19	0	0	Pass
0.0248	18	0	0	Pass
0.0252	16	0	0	Pass
0.0255	14	0	0	Pass
0.0259	13	0	0	Pass
0.0262	13	0	0	Pass
0.0265	12	0	0	Pass
0.0269	12	0	0	Pass
0.0272	12	0	0	Pass
0.0276	12	0	0	Pass
0.0279	11	0	0	Pass
0.0282	11	0	0	Pass
0.0286	11	0	0	Pass

0.0289	9	0	0	Pass
0.0293	8	0	0	Pass
0.0296	8	0	0	Pass
0.0300	7	0	0	Pass
0.0303	7	0	0	Pass
0.0306	7	0	0	Pass
0.0310	7	0	0	Pass
0.0313	7	0	0	Pass
0.0317	6	0	0	Pass
0.0320	5	0	0	Pass
0.0323	4	0	0	Pass
0.0327	4	0	0	Pass
0.0330	4	0	0	Pass
0.0334	4	0	0	Pass
0.0337	3	0	0	Pass
0.0340	3	0	0	Pass
0.0344	3	0	0	Pass
0.0347	3	0	0	Pass
0.0351	3	0	0	Pass
0.0354	3	0	0	Pass
0.0357	3	0	0	Pass
0.0361	3	0	0	Pass
0.0364	3	0	0	Pass
0.0368	3	0	0	Pass
0.0371	3	0	0	Pass
0.0375	3	0	0	Pass
0.0378	3	0	0	Pass
0.0381	3	0	0	Pass
0.0385	3	0	0	Pass
0.0388	2	0	0	Pass
0.0392	2	0	0	Pass
0.0395	2	0	0	Pass
0.0398	2	0	0	Pass
0.0402	1	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.**

LID Report

LID Technique	Used for Water Quality Treatment?	Total Volume Percent Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft.)	Cumulative Infiltration Volume	Percent Infiltrated	Comment Water Quality Treated	Credit
Total Volume Infiltrated		0.00	0.00	0.00	0.00	0.00	0%	No Treat. Credit

Compliance with LID Standard 8
Duration Analysis Result = Passed

Perlnd and Implnd Changes

No changes have been made.

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Appendix C
Operation and Maintenance Specifications

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Save Valuable Land and Protect Water Resources



Isolator® Row O&M Manual

StormTech® Chamber System for Stormwater Management

1.0 The Isolator® Row

1.1 INTRODUCTION

An important component of any Stormwater Pollution Prevention Plan is inspection and maintenance. The StormTech Isolator Row is a patented technique to inexpensively enhance Total Suspended Solids (TSS) removal and provide easy access for inspection and maintenance.



Looking down the Isolator Row from the manhole opening, woven geotextile is shown between the chamber and stone base.

1.2 THE ISOLATOR ROW

The Isolator Row is a row of StormTech chambers, either SC-310, SC-310-3, SC-740, DC-780, MC-3500 or MC-4500 models, that is surrounded with filter fabric and connected to a closely located manhole for easy access. The fabric-wrapped chambers provide for settling and filtration of sediment as storm water rises in the Isolator Row and ultimately passes through the filter fabric. The open bottom chambers and perforated sidewalls (SC-310, SC-310-3 and SC-740 models) allow storm water to flow both vertically and horizontally out of the chambers. Sediments are captured in the Isolator Row protecting the storage areas of the adjacent stone and chambers from sediment accumulation.

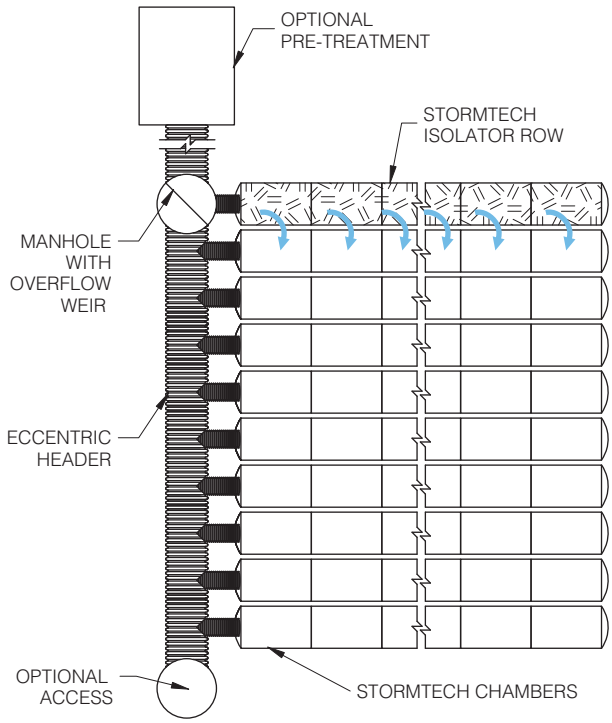
Two different fabrics are used for the Isolator Row. A woven geotextile fabric is placed between the stone and the Isolator Row chambers. The tough geotextile provides a media for storm water filtration and provides a durable surface for maintenance operations. It is also designed to prevent scour of the underlying stone and remain intact during high pressure jetting. A non-woven fabric is placed over the chambers to provide a filter media for flows passing through the perforations in the sidewall of the chamber. The non-woven fabric is not required over the DC-780, MC-3500 or MC-4500 models as these chambers do not have perforated side walls.

The Isolator Row is typically designed to capture the "first flush" and offers the versatility to be sized on a volume basis or flow rate basis. An upstream manhole not only provides access to the Isolator Row but typically includes a high flow weir such that storm water flowrates or volumes that exceed the capacity of the Isolator Row overtop the over flow weir and discharge through a manifold to the other chambers.

The Isolator Row may also be part of a treatment train. By treating storm water prior to entry into the chamber system, the service life can be extended and pollutants such as hydrocarbons can be captured. Pre-treatment best management practices can be as simple as deep sump catch basins, oil-water separators or can be innovative storm water treatment devices. The design of the treatment train and selection of pretreatment devices by the design engineer is often driven by regulatory requirements. Whether pretreatment is used or not, the Isolator Row is recommended by StormTech as an effective means to minimize maintenance requirements and maintenance costs.

Note: See the StormTech Design Manual for detailed information on designing inlets for a StormTech system, including the Isolator Row.

StormTech Isolator Row with Overflow Spillway
(not to scale)



2.0 Isolator Row Inspection/Maintenance

2.1 INSPECTION

The frequency of Inspection and Maintenance varies by location. A routine inspection schedule needs to be established for each individual location based upon site specific variables. The type of land use (i.e. industrial, commercial, residential), anticipated pollutant load, percent imperviousness, climate, etc. all play a critical role in determining the actual frequency of inspection and maintenance practices.

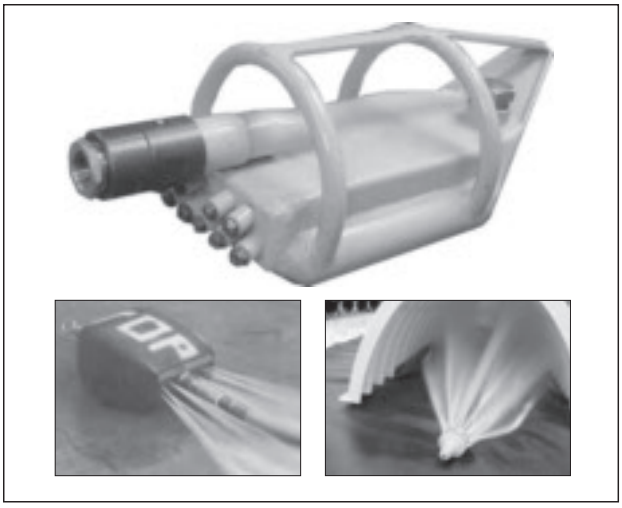
At a minimum, StormTech recommends annual inspections. Initially, the Isolator Row should be inspected every 6 months for the first year of operation. For subsequent years, the inspection should be adjusted based upon previous observation of sediment deposition.

The Isolator Row incorporates a combination of standard manhole(s) and strategically located inspection ports (as needed). The inspection ports allow for easy access to the system from the surface, eliminating the need to perform a confined space entry for inspection purposes.

If upon visual inspection it is found that sediment has accumulated, a stadia rod should be inserted to determine the depth of sediment. When the average depth of sediment exceeds 3 inches throughout the length of the Isolator Row, clean-out should be performed.

2.2 MAINTENANCE

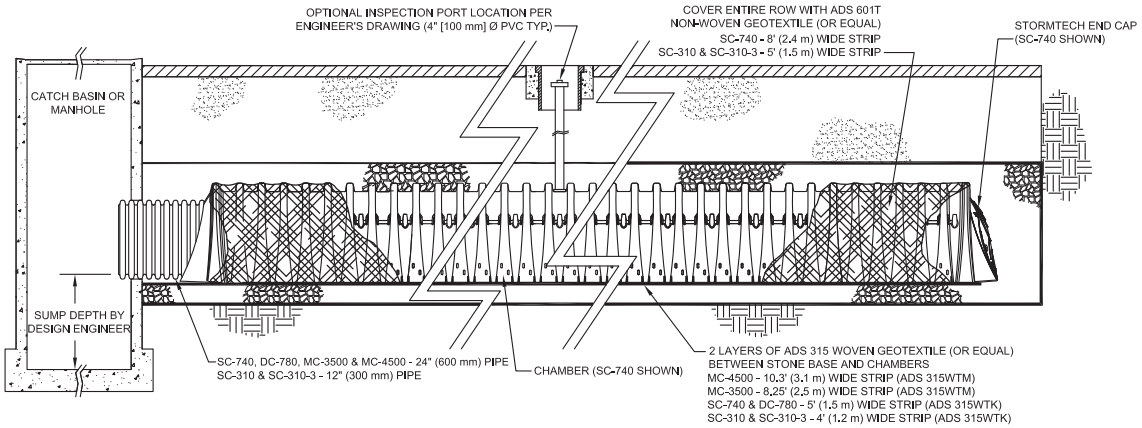
The Isolator Row was designed to reduce the cost of periodic maintenance. By "isolating" sediments to just one row, costs are dramatically reduced by eliminating the need to clean out each row of the entire storage bed. If inspection indicates the potential need for maintenance, access is provided via a manhole(s) located on the end(s) of the row for cleanout. If entry into the manhole is required, please follow local and OSHA rules for a confined space entries.



Examples of culvert cleaning nozzles appropriate for Isolator Row maintenance. (These are not StormTech products.)

Maintenance is accomplished with the JetVac process. The JetVac process utilizes a high pressure water nozzle to propel itself down the Isolator Row while scouring and suspending sediments. As the nozzle is retrieved, the captured pollutants are flushed back into the manhole for vacuuming. Most sewer and pipe maintenance companies have vacuum/JetVac combination vehicles. Selection of an appropriate JetVac nozzle will improve maintenance efficiency. Fixed nozzles designed for culverts or large diameter pipe cleaning are preferable. Rear facing jets with an effective spread of at least 45" are best. Most JetVac reels have 400 feet of hose allowing maintenance of an Isolator Row up to 50 chambers long. **The JetVac process shall only be performed on StormTech Isolator Rows that have AASHTO class 1 woven geotextile (as specified by StormTech) over their angular base stone.**

StormTech Isolator Row (not to scale)



NOTE: NON-WOVEN FABRIC IS ONLY REQUIRED OVER THE INLET PIPE CONNECTION INTO THE END CAP FOR DC-780, MC-3500 AND MC-4500 CHAMBER MODELS AND IS NOT REQUIRED OVER THE ENTIRE ISOLATOR ROW.

3.0 Isolator Row Step By Step Maintenance Procedures

Step 1) Inspect Isolator Row for sediment

A) Inspection ports (if present)

i. Remove lid from floor box frame

ii. Remove cap from inspection riser

iii. Using a flashlight and stadia rod, measure depth of sediment and record results on maintenance log.

iv. If sediment is at, or above, 3 inch depth proceed to Step 2. If not proceed to step 3.

B) All Isolator Rows

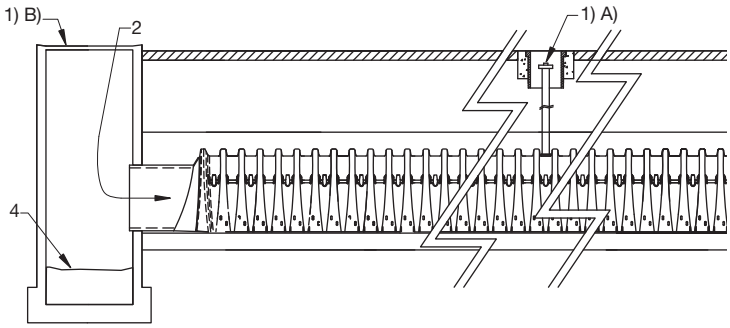
i. Remove cover from manhole at upstream end of Isolator Row

ii. Using a flashlight, inspect down Isolator Row through outlet pipe

1. Mirrors on poles or cameras may be used to avoid a confined space entry
2. Follow OSHA regulations for confined space entry if entering manhole

iii. If sediment is at or above the lower row of sidewall holes (approximately 3 inches) proceed to Step 2. If not proceed to Step 3.

StormTech Isolator Row (not to scale)



Step 2) Clean out Isolator Row using the JetVac process

A) A fixed culvert cleaning nozzle with rear facing nozzle spread of 45 inches or more is preferable

B) Apply multiple passes of JetVac until backflush water is clean

C) Vacuum manhole sump as required

Step 3) Replace all caps, lids and covers, record observations and actions

Step 4) Inspect & clean catch basins and manholes upstream of the StormTech system

Sample Maintenance Log

Date	Stadia Rod Readings		Sediment Depth (1) - (2)	Observations/Actions	Inspector
	Fixed point to chamber bottom (1)	Fixed point to top of sediment (2)			
3/15/01	6.3 ft.	none		New installation. Fixed point is CI frame at grade	djm
9/24/01		6.2	0.1 ft.	Some grit felt	sm
6/20/03		5.8	0.5 ft.	Mucky feel, debris visible in manhole and in Isolator row, maintenance due	rv
7/7/03	6.3 ft.		0	System jetted and vacuumed	djm

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CDS® Inspection and Maintenance Guide



CDS TECHNOLOGIES

Maintenance

The CDS system should be inspected at regular intervals and maintained when necessary to ensure optimum performance. The rate at which the system collects pollutants will depend more heavily on site activities than the size of the unit. For example, unstable soils or heavy winter sanding will cause the grit chamber to fill more quickly but regular sweeping of paved surfaces will slow accumulation.

Inspection

Inspection is the key to effective maintenance and is easily performed. Pollutant transport and deposition may vary from year to year and regular inspections will help ensure that the system is cleaned out at the appropriate time. At a minimum, inspections should be performed twice per year (e.g. spring and fall) however more frequent inspections may be necessary in climates where winter sanding operations may lead to rapid accumulations, or in equipment washdown areas. Installations should also be inspected more frequently where excessive amounts of trash are expected.

The visual inspection should ascertain that the system components are in working order and that there are no blockages or obstructions in the inlet and separation screen. The inspection should also quantify the accumulation of hydrocarbons, trash, and sediment in the system. Measuring pollutant accumulation can be done with a calibrated dipstick, tape measure or other measuring instrument. If absorbent material is used for enhanced removal of hydrocarbons, the level of discoloration of the sorbent material should also be identified during inspection. It is useful and often required as part of an operating permit to keep a record of each inspection. A simple form for doing so is provided.

Access to the CDS unit is typically achieved through two manhole access covers. One opening allows for inspection and cleanout of the separation chamber (cylinder and screen) and isolated sump. The other allows for inspection and cleanout of sediment captured and retained outside the screen. For deep units, a single manhole access point would allows both sump cleanout and access outside the screen.

The CDS system should be cleaned when the level of sediment has reached 75% of capacity in the isolated sump or when an appreciable level of hydrocarbons and trash has accumulated. If absorbent material is used, it should be replaced when significant discoloration has occurred. Performance will not be impacted until 100% of the sump capacity is exceeded however it is recommended that the system be cleaned prior to that for easier removal of sediment. The level of sediment is easily determined by measuring from finished grade down to the top of the sediment pile. To avoid underestimating the level of sediment in the chamber, the measuring device must be lowered to the top of the sediment pile carefully. Particles at the top of the pile typically offer less resistance to the end of the rod than consolidated particles toward the bottom of the pile. Once this measurement is recorded, it should be compared to the as-built drawing for the unit to determine weather the height of the sediment pile off the bottom of the sump floor exceeds 75% of the total height of isolated sump.

Cleaning

Cleaning of a CDS systems should be done during dry weather conditions when no flow is entering the system. The use of a vacuum truck is generally the most effective and convenient method of removing pollutants from the system. Simply remove the manhole covers and insert the vacuum hose into the sump. The system should be completely drained down and the sump fully evacuated of sediment. The area outside the screen should also be cleaned out if pollutant build-up exists in this area.

In installations where the risk of petroleum spills is small, liquid contaminants may not accumulate as quickly as sediment. However, the system should be cleaned out immediately in the event of an oil or gasoline spill should be cleaned out immediately. Motor oil and other hydrocarbons that accumulate on a more routine basis should be removed when an appreciable layer has been captured. To remove these pollutants, it may be preferable to use absorbent pads since they are usually less expensive to dispose than the oil/water emulsion that may be created by vacuuming the oily layer. Trash and debris can be netted out to separate it from the other pollutants. The screen should be power washed to ensure it is free of trash and debris.

Manhole covers should be securely seated following cleaning activities to prevent leakage of runoff into the system from above and also to ensure that proper safety precautions have been followed. Confined space entry procedures need to be followed if physical access is required. Disposal of all material removed from the CDS system should be done in accordance with local regulations. In many jurisdictions, disposal of the sediments may be handled in the same manner as the disposal of sediments removed from catch basins or deep sump manholes.



CDS Model	Diameter		Distance from Water Surface to Top of Sediment Pile		Sediment Storage Capacity	
	ft	m	ft	m	y^3	m^3
CDS1515	3	0.9	3.0	0.9	0.5	0.4
CDS2015	4	1.2	3.0	0.9	0.9	0.7
CDS2015	5	1.3	3.0	0.9	1.3	1.0
CDS2020	5	1.3	3.5	1.1	1.3	1.0
CDS2025	5	1.3	4.0	1.2	1.3	1.0
CDS3020	6	1.8	4.0	1.2	2.1	1.6
CDS3025	6	1.8	4.0	1.2	2.1	1.6
CDS3030	6	1.8	4.6	1.4	2.1	1.6
CDS3035	6	1.8	5.0	1.5	2.1	1.6
CDS4030	8	2.4	4.6	1.4	5.6	4.3
CDS4040	8	2.4	5.7	1.7	5.6	4.3
CDS4045	8	2.4	6.2	1.9	5.6	4.3
CDS5640	10	3.0	6.3	1.9	8.7	6.7
CDS5653	10	3.0	7.7	2.3	8.7	6.7
CDS5668	10	3.0	9.3	2.8	8.7	6.7
CDS5678	10	3.0	10.3	3.1	8.7	6.7

Table 1: CDS Maintenance Indicators and Sediment Storage Capacities



Support

- Drawings and specifications are available at www.contechstormwater.com.
- Site-specific design support is available from our engineers.

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CDS Inspection & Maintenance Log

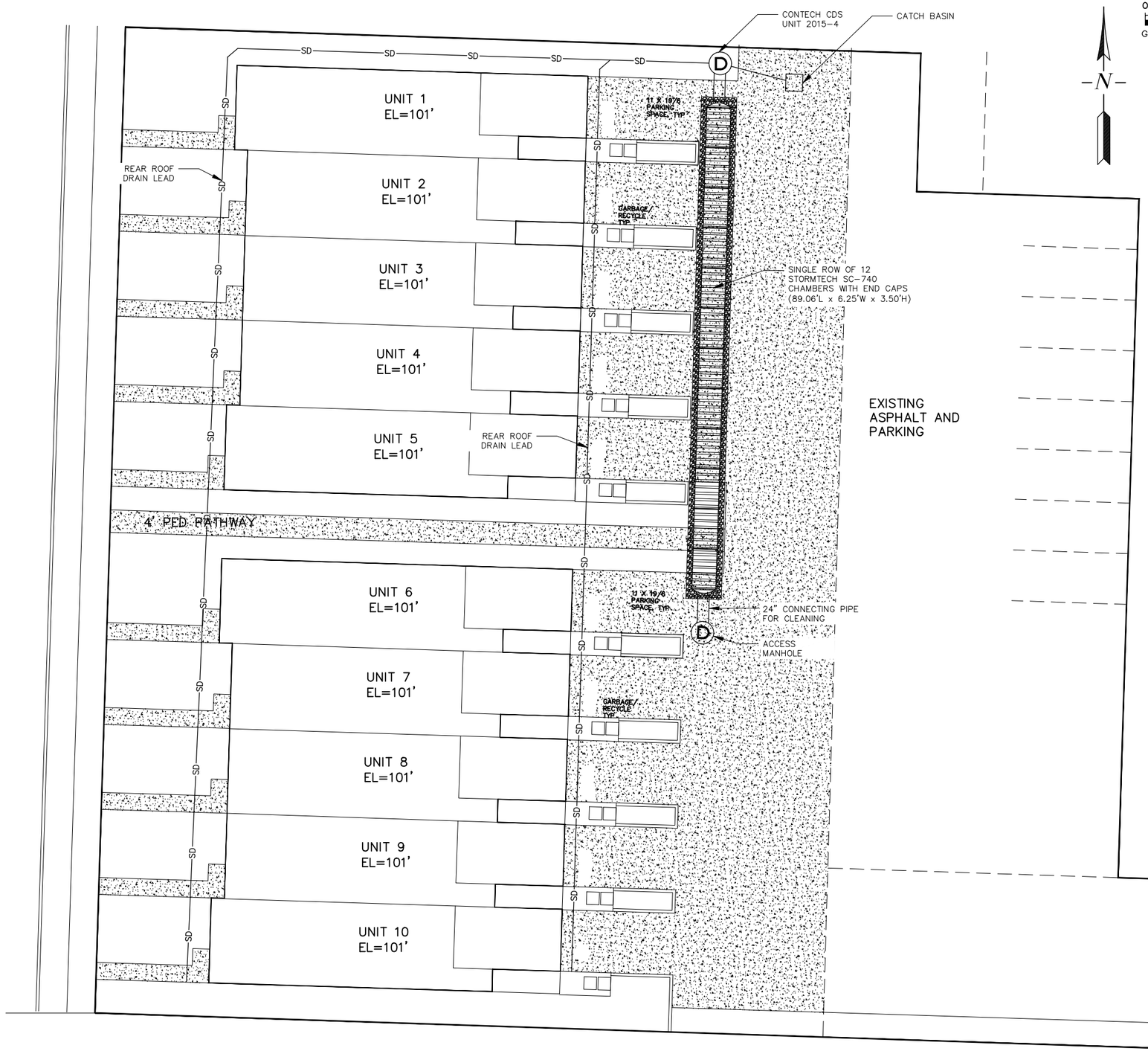
CDS Model: _____ Location: _____

Date	Water depth to sediment[1]	Floatable Layer Thickness[2]	Describe Maintenance Performed	Maintenance Personnel	Comments

1. The water depth to sediment is determined by taking two measurements with a stadia rod: one measurement from the manhole opening to the top of the sediment pile and the other from the manhole opening to the water surface. If the difference between these measurements is less than the values listed in table 1 the system should be cleaned out. **Note: to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile.**

2. For optimum performance, the system should be cleaned out when the floating hydrocarbon layer accumulates to an appreciable thickness. In the event of an oil spill, the system should be cleaned immediately.

Appendix D
Storm Drainage and SWPPP Plan Sheets



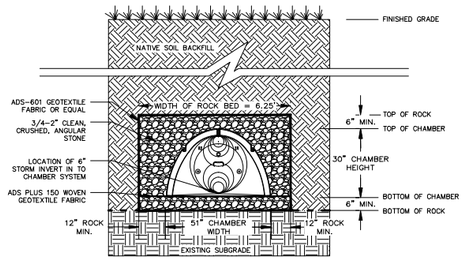
0 10' 20'

GRAPHIC SCALE 1"=10'

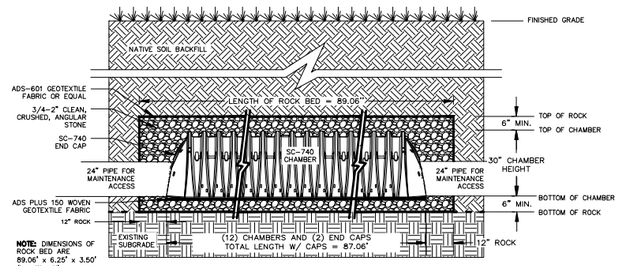
N

NOTES

1. ONSITE STORM SYSTEM CONVEYANCE SYSTEM TO BE DEVELOPER DESIGNED.
2. ALL ONSITE DRAINAGE IS TO BE ROUTED THROUGH THE CONTECH CDS STORM MANHOLE.



CONTECH SC-740 CHAMBER - FRONT VIEW
N.T.S.



CONTECH SC-740 CHAMBER - SIDE VIEW
N.T.S.

THOMAS J. STAHL
STATE OF WASHINGTON
23114
REGISTERED PROFESSIONAL ENGINEER

REVISIONS	BY

Sequim 10-Plex on Garry Oaks Road

GRUBB CONSTRUCTION

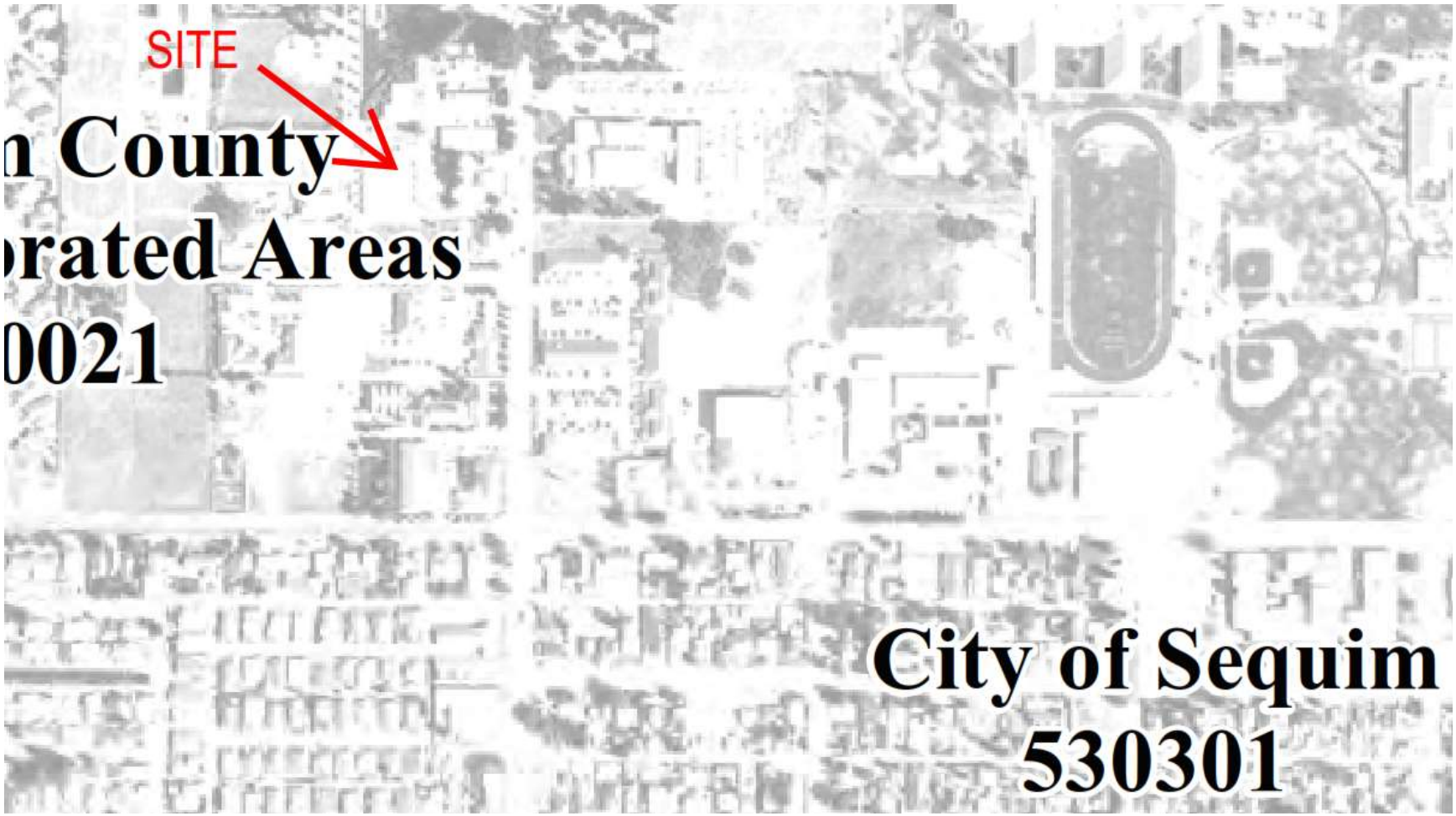
Storm Plan

SISUL ENGINEERING
375 PORTLAND AVENUE
GLADSTONE, OREGON 97027
(503) 657-0188

DRAWING: 223-008 BASE.dwg

DATE	JUNE 2023
SCALE	AS NOTED
DRAWN	JDM
JOB	SVA23-008
SHEET	1
OF	1 SHEETS

Appendix E
FEMA Product Report for Sequim area Flood Maps


SITE
n County
rated Areas
0021
City of Sequim
530301

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTPS://MSC.FEMA.GOV

SPECIAL FLOOD HAZARD AREAS	Without Base Flood Elevation (BFE) *Zone A, V, A99*
	With BFE or Depth *Zone AE, AO, AH, VE, AR*
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	Area with Reduced Flood Risk due to Levee See Notes. *Zone X*
	Area with Flood Risk due to Levee *Zone D*
OTHER AREAS	NO SCREEN Area of Minimal Flood Hazard *Zone X*
	Area of Undetermined Flood Hazard *Zone D*
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
OTHER FEATURES	E 18.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
	8 Coastal Transect
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
	513 Base Flood Elevation Line (BFE)
	Limit of Study
	Jurisdiction Boundary



NATIONAL FLOOD INSURANCE PROGRAM

FLOOD INSURANCE RATE MAP

CLALLAM COUNTY, WASHINGTON

And Incorporated Areas

PANEL 1255 OF 1850

FEMA

Panel Contains:

COMMUNITY	NUMBER	PANEL	SUFFIX
CLALLAM COUNTY	530021	1255	F
JAMESTOWN S'KLALLAM TRIBE	535537	1255	F
SEQUIM, CITY OF	530301	1255	F

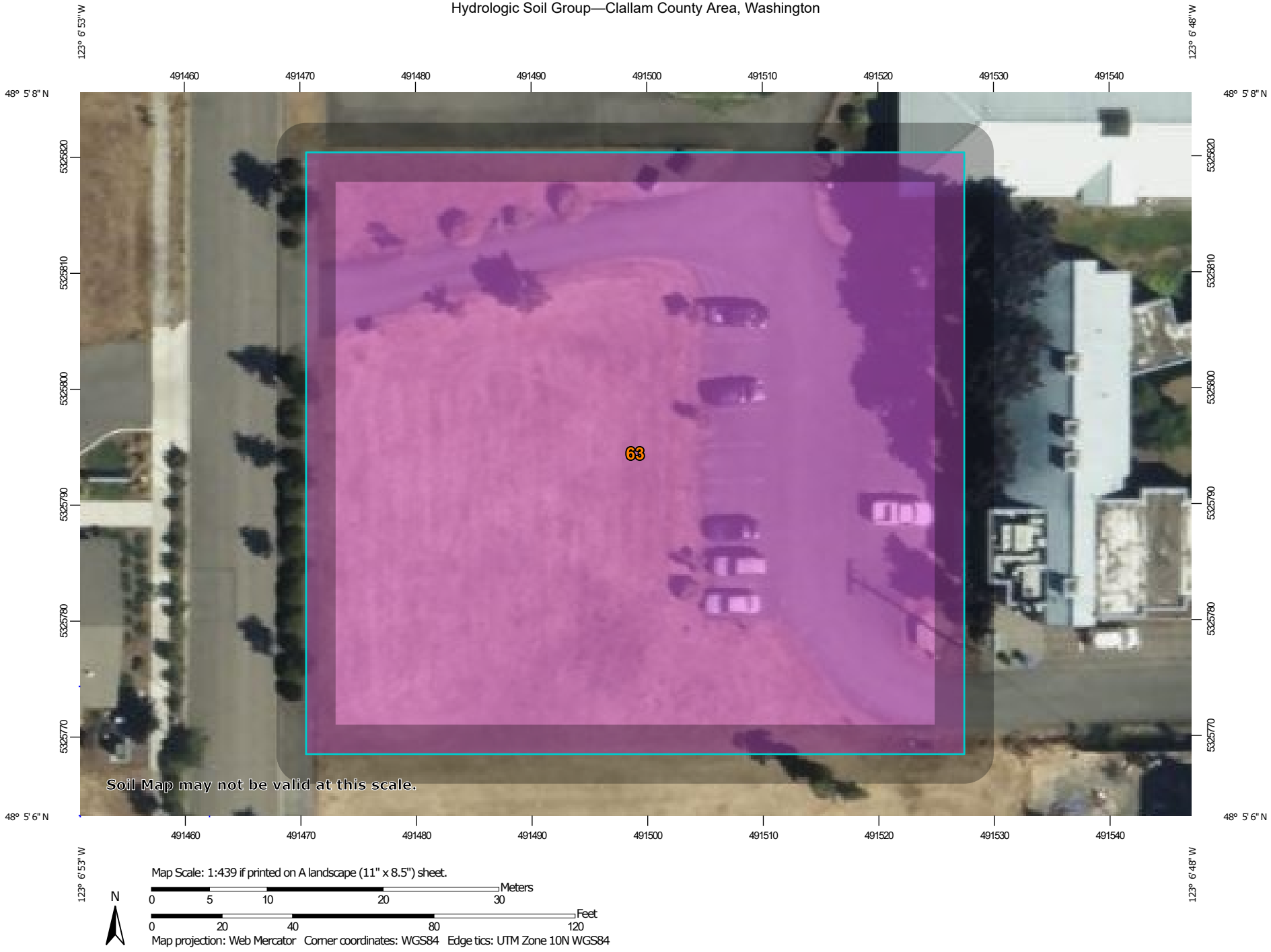
PRELIMINARY
10/31/2019

VERSION NUMBER
2.3.2.2

MAP NUMBER
53009C1255F

EFFECTIVE DATE

Appendix F
Web Soil Survey



Map Scale: 1:439 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 5 10 20 30

Feet
0 20 40 80 120

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

Soil Rating Polygons

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Lines

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Soil Rating Points

- A
- A/D
- B
- B/D
- C
- C/D
- D
- Not rated or not available

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Clallam County Area, Washington
Survey Area Data: Version 20, Aug 30, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Aug 8, 2022—Aug 29, 2022

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
63	Sequim very gravelly sandy loam	A	0.7	100.0%
Totals for Area of Interest			**0.7**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Report—Engineering Properties

Absence of an entry indicates that the data were not estimated. The asterisk '*' denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba). Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Engineering Properties–Clallam County Area, Washington

Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			In				*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*	*L-R-H*
63—Sequim very gravelly sandy loam														
Sequim	100	A	0-10	Very gravelly sandy loam	GM, SM	A-1	0- 0- 0	10-13-15	50-58-65	40-48-55	25-33-40	10-18-25	0-7 -14	NP
			10-23	Very cobbly loamy sand, very gravelly loamy sand, extremely cobbly loamy sand	GM, GP-GM, SM, SP-SM	A-1	0- 0- 0	15-30-45	45-55-65	25-40-55	20-30-40	5-13- 20	0-7 -14	NP
			23-60	Very gravelly loamy sand, very gravelly sand, extremely cobbly sand	GP, SP, SP-SM, GP-GM	A-1	0- 0- 0	20-33-45	45-53-60	20-35-50	15-25-35	0- 5- 10	0-7 -14	NP

Data Source Information

Soil Survey Area: Clallam County Area, Washington
Survey Area Data: Version 20, Aug 30, 2022

Report—Physical Soil Properties

Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Physical Soil Properties–Clallam County Area, Washington														
Map symbol and soil name	Depth	Sand	Silt	Clay	Moist bulk density	Saturated hydraulic conductivity	Available water capacity	Linear extensibility	Organic matter	Erosion factors			Wind erodibility group	Wind erodibility index
										Kw	Kf	T		
	In	*Pct*	*Pct*	*Pct*	*g/cc*	*micro m/sec*	*In/In*	*Pct*	*Pct*					
63—Sequim very gravelly sandy loam														
Sequim	0-10	-68-	-22-	5-10- 15	0.85-0.98 -1.10	42.00-92.00-14 1.00	0.05-0.06-0. 07	0.0- 1.5- 2.9	2.0- 3.5- 5.0	.05	.10	5	6	48
	10-23	-83-	-14-	0- 3- 5	0.85-0.98 -1.10	42.00-92.00-14 1.00	0.02-0.03-0. 04	0.0- 1.5- 2.9	1.0- 1.5- 2.0	.05	.20			
	23-60	-99-	—	0- 3- 5	0.85-0.98 -1.10	42.00-92.00-14 1.00	0.01-0.02-0. 02	0.0- 1.5- 2.9	0.5- 0.8- 1.0					

Data Source Information

Soil Survey Area: Clallam County Area, Washington
Survey Area Data: Version 20, Aug 30, 2022