PRELIMINARY
STORMWATER DRAINAGE REPORT
FOR
43rd AVE MULTI-FAMILY

FEBRUARY 8, 2022

PRELIMINARY
STORMWATER DRAINAGE REPORT

FOR

43rd AVE MULTI-FAMILY

A portion of the NW Quarter of the NE Quarter of Section 9, Township 19 North, Range 4 East, W.M. City of Puyallup, Pierce County, Washington

Prepared for:

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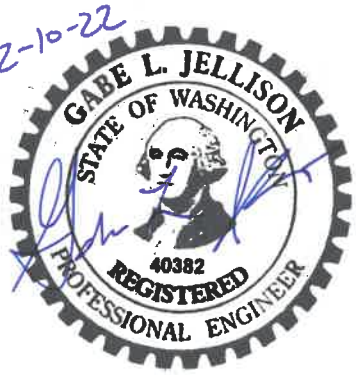
2-10-22



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CHAPTER 1 – PROJECT OVERVIEW

The proposed project, 43rd Ave Multi-Family, is located within Section 9, Township 19 North, Range 4 East, City of Puyallup, Pierce County, Washington. Please refer to Figure 1- Vicinity Map, for a general location. Stormwater mitigation for the project shall meet the 2014 Stormwater Management Manual for Western Washington (SWMMWW) per City of Puyallup direction.

The project site includes parcel number 4320000160 and is approximately 1.67 acres. The frontage improvements extend onto the site yielding approximately 1.56 acres of developable area. The project site is a proposed multi-family residential development that includes the following:

- Apartment complex building with an associated driveway and sidewalks.
- Internal parking area.
- Storm drainage system.
- Utility installations.
- Frontage improvements along 43rd Ave and 7th St. SW

Access to the proposed project will be from 7th St SW to the east.

The site is generally heavily vegetated with some trees. The site is bordered on the northern and western sides by single-family developments, bordered on the southern side by 43rd Ave SW, and bordered on the eastern side by 7th St SW.

The site generally has moderate slopes ranging from about five to 30 percent. The project has one threshold discharge area. Runoff from the project sheet flows to the west, discharges at the northwest corner, and ultimately discharges to the Black Swamp Pothole. Run-on is considered minimal, as any potential run-on will be collected by the 43rd Ave and 7th St improvements.

Per the Geotechnical report from Georesources, on-site soils consist of Everett very gravelly sandy loam soils, which are derived from sandy and gravelly glacial outwash. The report lists the soils as hydrologic soil group A, which is consistent with SWMMWW. Design infiltration rates are recommended at 2.0 inches per hour.

Drainage from the right of way improvements is proposed to utilize the landscape areas for a bioretention swale for flow control. The sidewalk areas on-site and within the frontage will

utilize pervious concrete. Discharge from the on-site drive isle and roof area will be collected and conveyed to a Stormtech Chamber System beneath the parking area to infiltrate.

Per the SWMMWW existing conditions are to be modeled as "forest" coverage. Improvements draining to the onsite and right-of-way storm facilities will result in the approximate coverages as summarized in the following table:

Table 1.1: On-Site Basin

	Existing Basin	Developed Basin
Impervious Area (ac)	0	1.18 +/-
Pervious Area - Forest (ac)	1.56 +/-	0
Pervious Area - Lawn (ac)	0	0.38 +/-
Total Area (ac)	*1.56 +/-*	*1.56 +/-*

Table 1.2: 43rd Ave Basin

	Existing Basin	Developed Basin
Impervious Area (ac)	0.06 +/-	0.14 +/-
Pervious Area - Forest (ac)	0.12 +/-	0
Pervious Area - Lawn (ac)	0	0.04 +/-
Total Area (ac)	*0.18 +/-*	*0.18 +/-*

Table 1.3: 7th St Basin

	Existing Basin	Developed Basin
Impervious Area (ac)	0.06 +/-	0.17 +/-
Pervious Area - Forest (ac)	0.14 +/-	0
Pervious Area - Lawn (ac)	0	0.03 +/-
Total Area (ac)	*0.20 +/-*	*0.20 +/-*

Per Figure I-2.4.1 from the SWMMWW, all minimum requirements apply to the new impervious surfaces and converted pervious surfaces proposed under this project. The minimum requirements are listed below with a short narrative of how each is being met.

1. *Minimum Requirement #1: Preparation of Stormwater Site Plans:*

   Preparation of the Site Development plans, and this Drainage Report should meet Minimum Requirement #1.

2. *Minimum Requirement #2: Construction Stormwater Pollution Prevention:*

   Refer to Chapter 5, the Construction Stormwater Pollution Prevention Plan (CWSPPP), should meet Minimum Requirement #2.

3. *Minimum Requirement #3: Source Control of Pollution:*

   Source control will be provided as outlined in Attachment B of the Operation and Maintenance Manual, to be provided with the site development submittal.

4. *Minimum Requirement: #4: Preservation of Natural Drainage System and Outfalls:*

   The proposed project should not affect any natural drainage systems and is proposed to mimic the existing drainage courses to the maximum extent practicable. The project is proposing infiltration of stormwater runoff. No new drainage patterns should be created.

5. *Minimum Requirement: #5: On-site Stormwater Management:*

   Landscaped areas are proposed to meet the Post Construction Soil Quality and Depth (BMP T5.13) criteria outlined in Volume V, Chapter 5 of the SWMMWW. Frontage improvements will be mitigated via Bioretention Swales (BMP T7.30). On-site improvements will be mitigated via Infiltration Basins (BMP T7:10).

6. *Minimum Requirement: #6: Runoff Treatment:*

   Runoff from the on-site improvements will be directed to media filter catch basins (GULD approved) for treatment per the SWMMWW Chapter V-12. Runoff from the frontage improvements will be directed to a bioretention swale. Refer to Chapter 4 for additional information.

7. *Minimum Requirement: #7: Flow Control:*

   Runoff from the roof and internal parking area is proposed to be directed to Stormtech chambers for infiltration which will provide flow control. Sidewalks will be pervious concrete to mitigate runoff. The frontage improvements will utilize bioretention for flow control. Refer to Chapter 4 for additional information.

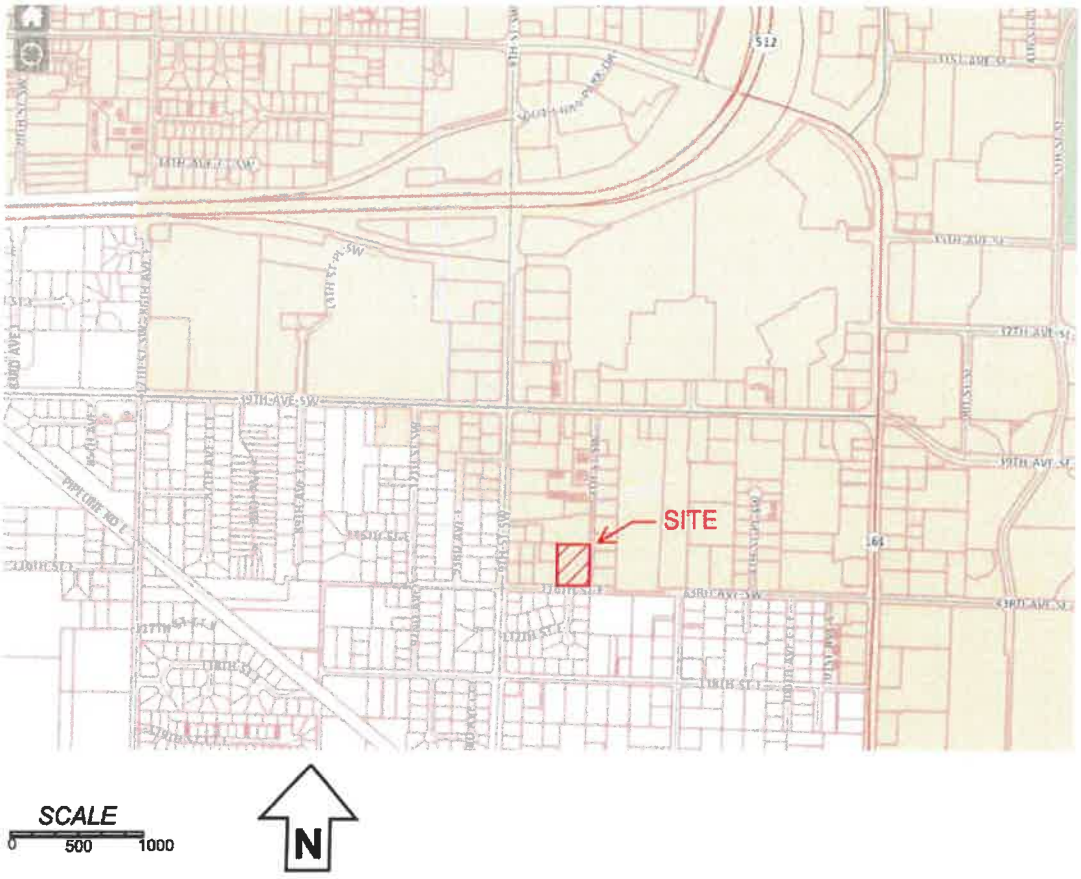
8. *Minimum Requirement: #8: Wetlands Protection:*

   N/A – Per Pierce County GIS, there are no wetlands onsite.

9. *Minimum Requirement: #9: Operation and Maintenance:*

   Refer to the Chapter 8. The Operation and Maintenance Manual is to provided with the site development submittal, which should meet Minimum Requirement #9.

FIGURE 1.1 VICINITY MAP



CHAPTER 2 –EXISTING CONDITIONS SUMMARY

The site is generally heavily vegetated with some trees. The site is bordered on the northern and western sides by single-family developments, bordered on the southern side by 43rd Ave SW, and bordered on the eastern side by 7th St SW.

The site generally has moderate slopes ranging from about 5 to 30 percent. The project has one threshold discharge area. Runoff from the project sheet flows to the west, discharges at the northwest corner, and ultimately discharges to the Black Swamp Pothole. Run-on is considered minimal, as any potential run-on will be collected by the 43rd Ave and 7th St improvements.

On-site soils consist of Everett very gravelly sandy loam soils, which are derived from sandy and gravelly glacial outwash. Design infiltration rates are recommended at 2.0 inches per hour. A geotechnical report was prepared for the project site by Georesources and should be referenced for additional information regarding the onsite soils.

Per Pierce County GIS information, the project site does not include any wetlands or geologic hazard areas.

The project is not located within a known floodplain and/or floodway per FEMA mapping. Refer to the FEMA FIRM included as Figure 2.1 of this report.

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations** (BFEs) and/or **floodways** have been determined, users are encouraged to consult the Flood Profiles and Floodway Data and/or Summary of Stillwater Elevations tables contained within the Flood Insurance Study (FIS) Report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS Report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the Summary of Stillwater Elevations table in the Flood Insurance Study Report for this jurisdiction. Elevations shown in the Summary of Stillwater Elevations table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the Flood Insurance Study Report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures. Refer to Section 2.4 "Flood Protection Measures" of the Flood Insurance Study Report for information on flood control structures for this jurisdiction.

The projection used in the preparation of this map was Universal Transverse Mercator (UTM) zone 10. **The horizontal datum** was NAD 83, GRS 1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRMs for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same **vertical datum.** For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at http://www.ngs.noaa.gov or contact the National Geodetic Survey at the following address:

NGS Information Services
NOAA, N/NGS12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, Maryland 20910-3282
(301) 713-3242

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713- 3242**, or visit its website at http://www.ngs.noaa.gov.

Base map information shown on this FIRM was derived from multiple sources. Base map files were provided in digital format by Pierce County GIS, WA DNR, WSDOT, USFWS, Washington State Department of Ecology, and Puget Sound Regional Council. This information was compiled at scales of 1:1,200 to 1:24,000 during the time period 1998-2012.

The profile baselines depicted on this map represent the hydraulic modeling baselines that match the flood profiles in the FIS report. As a result of improved topographic data, **the profile baseline,** in some cases, may deviate significantly from the channel centerline or appear outside the SFHA.

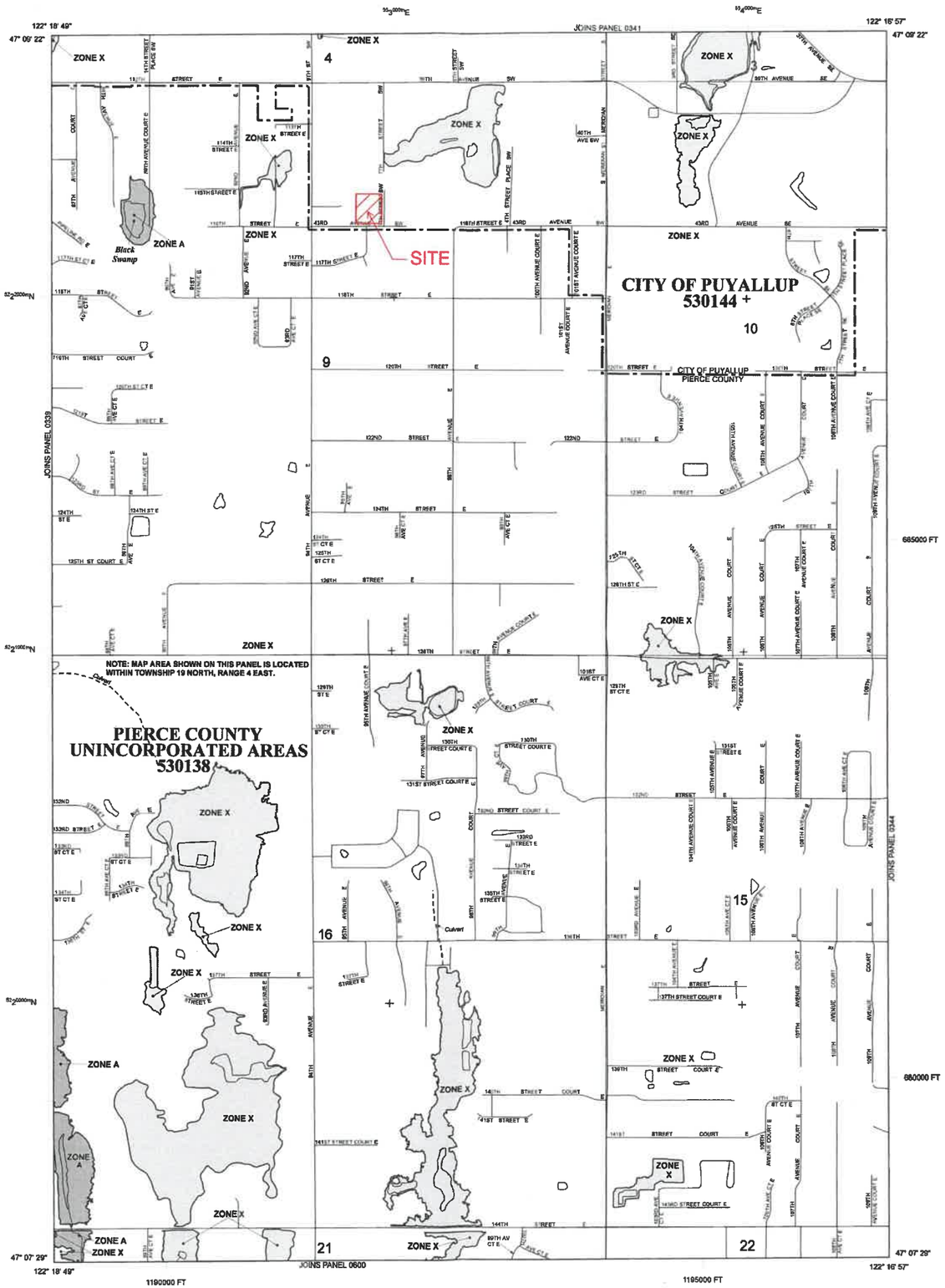
Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed Map Index for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information on available products associated with this FIRM visit the **Map Service Center (MSC)** website at http://msc.fema.gov. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the MSC website.

If you have **questions about this map,** how to order products, or the National Flood Insurance Program in general, please call the **FEMA Map Information eXchange (FMIX)** at **1-877-FEMA-MAP (1-877-336-2627)** or visit the FEMA website at http://www.fema.gov/business/nfip.

FIGURE 2.1: FEMA FIRM



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V, and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A	No Base Flood Elevations determined.
ZONE AE	Base Flood Elevations determined.
ZONE AH	Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.
ZONE AO	Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.
ZONE AR	Special Flood Hazard Areas formerly protected from the 1% annual chance flood by a flood control system that was subsequently decertified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.
ZONE A99	Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.
ZONE V	Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.
ZONE VE	Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X	Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X	Areas determined to be outside the 0.2% annual chance floodplain.
ZONE D	Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

- 1% Annual Chance Floodplain Boundary
- 0.2% Annual Chance Floodplain Boundary
- Floodway boundary
- Zone D boundary
- CBRS and OPA boundary
- Boundary dividing Special Flood Hazard Area Zones and boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths, or flood velocities.
- 513 — Base Flood Elevation line and value; elevation in feet*
- (EL 987) — Base Flood Elevation value where uniform within zone; elevation in feet*

*Referenced to the North American Vertical Datum of 1988

- A — A — Cross section line
- 23 — 23 — Transect line
- Culvert
- Bridge
- 45° 02' 08", 93° 02' 12" — Geographic coordinates referenced to the North American Datum of 1983 (NAD 83) Western Hemisphere
- 1000-meter Universal Transverse Mercator grid values, zone 10
- DX5510 × — Bench mark (see explanation in Notes to Users section of this FIRM panel)
- M1.5 — River Mile

MAP REPOSITORIES
Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP
March 7, 2017

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET
150 0 150 300 METERS

NFIP
NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0343E

FIRM

FLOOD INSURANCE RATE MAP

PIERCE COUNTY, WASHINGTON AND INCORPORATED AREAS

PANEL 343 OF 1375
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
PIERCE COUNTY	530138	0343	E
PUYALLUP, CITY OF	530144	0343	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
53053C0343E
EFFECTIVE DATE
MARCH 7, 2017

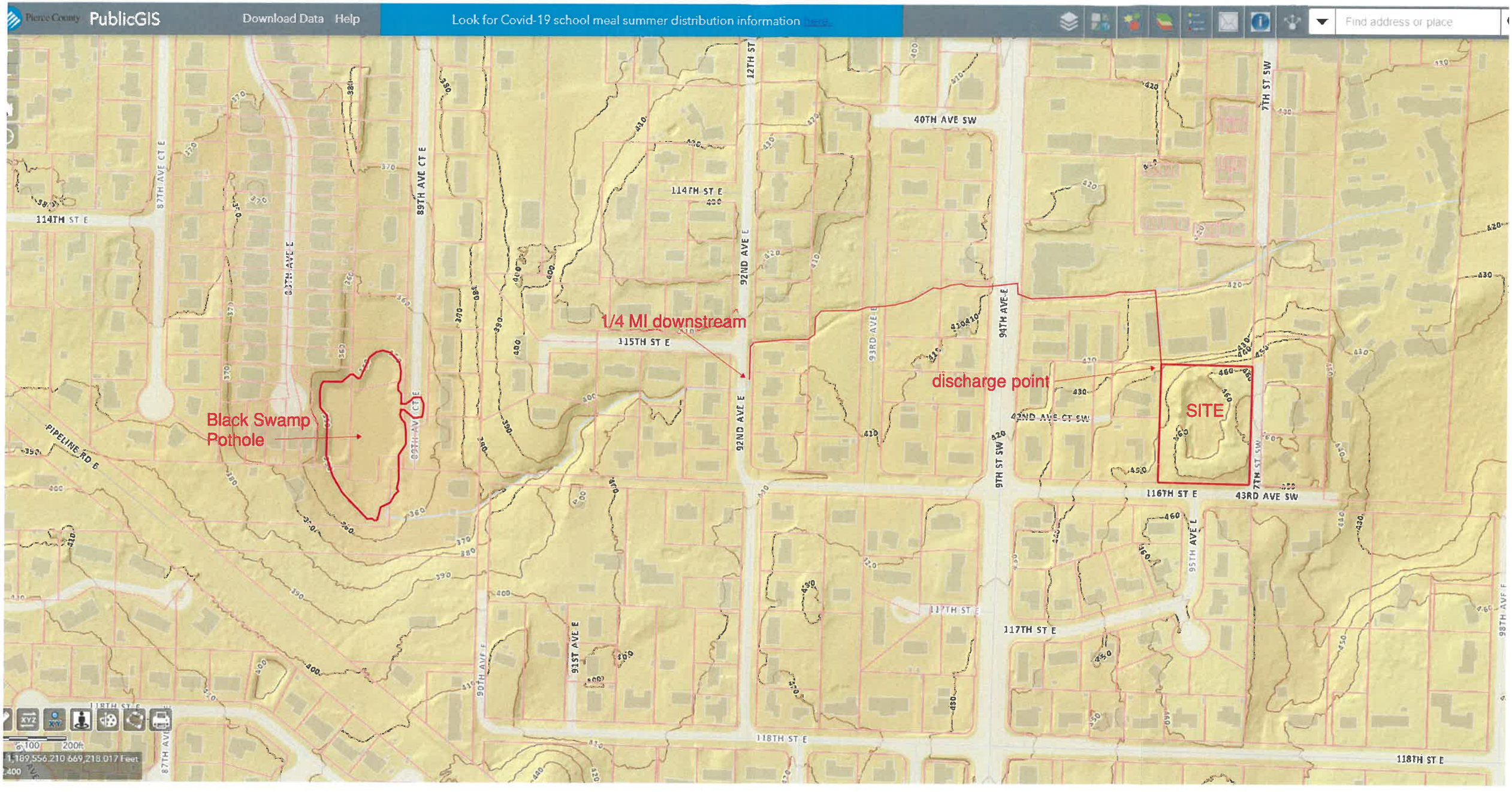
Federal Emergency Management Agency

CHAPTER 3 - OFF-SITE ANALYSIS

A downstream study was completed and aided by Pierce County's GIS information. The downstream flow paths and drainage features are approximate locations based on Pierce County GIS map contours and existing drainage systems. There is one point of discharge from the site, and any other point on the site meets the same downstream flow path within a quarter mile downstream and therefore it is assumed to be one threshold discharge area (TDA). Upon development, runoff shall mimic the existing drainage conditions as closely as possible.

The storm system is designed to infiltrate 100 percent of runoff, but emergency overflow would discharge near the northwest corner via overland flow and enter the storm culvert beneath 9th St SW. It then continues traveling west via overland flow, then flows south along 92nd Ave E. Runoff reaches the one-quarter mile point downstream, before ultimately discharging to the Black Swamp Pothole.

There are no known emergency services located within ¼-mile down gradient from the project site.


Pierce County PublicGIS
Download Data
Help
Look for Covid-19 school meal summer distribution information here.
Find address or place
1/4 MI downstream
discharge point
SITE
Black Swamp Pothole
PIPELINE RD E
87TH AVE CT E
87TH AVE E
89TH AVE CT E
92ND AVE E
93RD AVE E
94TH AVE E
95TH AVE E
90TH AVE E
91ST AVE E
98TH AVE E
12TH ST
7TH ST SW
9TH ST SW
40TH AVE SW
42ND AVE CT SW
43RD AVE SW
114TH ST E
115TH ST E
116TH ST E
117TH ST E
118TH ST E
0 100 200ft
1,189,556.210 669,218.017 Feet

CHAPTER 4 – PERMANENT STORMWATER CONTROL PLAN

Part 1 – Existing Site Hydrology

The site is generally heavily vegetated with some trees. The site generally has moderate slopes ranging from about 5 to 30 percent. The project has one threshold discharge area. Runoff from the project sheet flows to the west, discharges near the northwest corner, and ultimately discharges to the Black Swamp Pothole.

Refer to the Pre-Developed Basin Map included in Appendix C for additional information.

Summary of Pre-developed Site Land Cover

Sub-Basin ID	Land Use and Cover Condition	Acreage
PREDEV SITE	A/B, Forest, Mod	1.56 +/-

Summary of Pre-developed Condition Event Output: WWHM2012

Sub-Basin ID: PREDEV	
	Peak Flow (cfs)
2-year pre-developed	0.0010
10-year pre-developed	0.0014
25-year pre-developed	0.0015
100-year pre-developed	0.0016

Summary of Pre-developed 7th St Frontage Land Cover

Sub-Basin ID	Land Use and Cover Condition	Acreage
PREDEV 7TH	A/B, Forest, Mod	0.20 +/-

Summary of Pre-developed 7th St Event Output: WWHM2012

Sub-Basin ID: PREDEV	
	Peak Flow (cfs)
2-year pre-developed	0.0001
10-year pre-developed	0.0002
25-year pre-developed	0.0002
100-year pre-developed	0.0003

Summary of Pre-developed 43rd Ave Frontage Land Cover

Sub-Basin ID	Land Use and Cover Condition	Acreage
PREDEV 43RD	A/B, Forest, Mod	0.18 +/-

Summary of Pre-developed 43rd Ave Event Output: WWHM2012

Sub-Basin ID: PREDEV	
	Peak Flow (cfs)
2-year pre-developed	0.0001
10-year pre-developed	0.0002
25-year pre-developed	0.0002
100-year pre-developed	0.0003

Part 2 – Developed Site Hydrology

Drainage from the on-site development is proposed to be collected by catch basins and conveyed to an enhanced treatment facility (BioPod, Filterra, Modular Wetland, or approved equal) then directed to infiltration chambers for flow control. Discharge from the frontage improvements will be directed to a proposed conveyance system and mitigated within the right-of-way via bioretention. Sidewalk improvements will utilize pervious concrete.

Refer to the Developed Basin Map included in Appendix C for additional information.

Summary of Developed Site Land Cover to Onsite System

Sub-Basin ID (WEST)	Land Use and Cover Condition	Acreage
DEV PLAT	Roads - Flat	0.646+/-
DEV PLAT	Roof Tops/Driveways - Flat	0.425 +/-
DEV PLAT	Sidewalk - Flat	0.079 +/-
DEV PLAT	A/B, Pasture, Flat	0.410 +/-

Summary of Developed Site Event Output: WWHM2012 – Developed Inflow

Sub-Basin ID: DEV	
	Peak Flow (cfs)
2-year developed	0.403
10-year developed	0.641
25-year developed	0.779
100-year developed	1.006

Summary of Developed Site Event Output: WWHM2012 - Mitigated

Sub-Basin ID: DEV	
	Peak Flow (cfs)
2-year developed	0.00
10-year developed	0.00
25-year developed	0.00
100-year developed	0.00

Summary of Developed 7th St Land Cover to Onsite System

Sub-Basin ID (EAST)	Land Use and Cover Condition	Acreage
DEV PLAT	Roads - Flat	0.120 +/-
DEV PLAT	Sidewalk - Flat	0.052 +/-
DEV PLAT	A/B, Pasture, Flat	0.032 +/-

Summary of Developed 7th St Event Output: WWHM2012 – Developed Inflow

Sub-Basin ID: DEV	
	Peak Flow (cfs)
2-year developed	0.0630
10-year developed	0.0998
25-year developed	0.1210
100-year developed	0.1560

Summary of Developed 7th St Event Output: WWHM2012 - Mitigated

Sub-Basin ID: DEV	
	Peak Flow (cfs)
2-year developed	0.00
10-year developed	0.00
25-year developed	0.00
100-year developed	0.00

Summary of Developed 43rd Ave Land Cover to Onsite System

Sub-Basin ID (EAST)	Land Use and Cover Condition	Acreage
DEV PLAT	Roads - Flat	0.094 +/-
DEV PLAT	Sidewalks - Flat	0.045 +/-
DEV PLAT	A/B, Pasture, Flat	0.043 +/-

Summary of Developed 43rd Ave Event Output: WWHM2012 – Developed Inflow

Sub-Basin ID: DEV	
	Peak Flow (cfs)
2-year developed	0.051
10-year developed	0.081
25-year developed	0.098
100-year developed	0.126

Summary of Developed 43rd Ave Event Output: WWHM2012 - Mitigated

Sub-Basin ID: DEV	
	Peak Flow (cfs)
2-year developed	0.00
10-year developed	0.00
25-year developed	0.00
100-year developed	0.00

Part 3 - Performance Standards and Goals

Drainage from the on-site improvements is proposed to drain to infiltration chambers for flow control per SWMMWW Volume III 3.2. Drainage from the frontage improvements is proposed to be mitigated by bioretention swales within the landscape strip. Sidewalks are proposed to utilize pervious concrete. Water quality treatment will be treated via Oldcastle BioPod filter vaults approved by Ecology's TAPE program for enhanced treatment, per SWMMWW Chapter V-12 Emerging Technologies.

The proposed infiltration facilities were modeled in WWHM for 100% infiltration of runoff. The infiltration facilities, therefore, meet the LID performance standard, which states that stormwater discharges shall match developed discharge durations to pre-developed durations for the range of pre-developed discharge rates from 8% of the 2-year peak flow up to 50% of the 2-year peak flow

Part 4 - Flow Control System

Drainage from the on-site improvements is proposed to drain to infiltration chambers for flow control. Drainage from the frontage improvements is proposed to drain to bioretention swales within the right-of-way. Pervious concrete will mitigate the sidewalk runoff.

The proposed infiltration facilities were sized using WWHM for 100% infiltration of runoff. The infiltration chambers meet Stormtech's sizing methodology.

The WWHM2012 software was utilized to determine the required infiltration volumes. It should be noted that the final configuration of the facilities may differ from the calculated dimensions upon final design.

Refer to the Engineering Calculations included in Appendix C for additional details, and to the plan set for the infiltration chamber location.

Part 5 - Water Quality System

Drainage from on-site development is proposed to be collected by the proposed conveyance system and directed to an Oldcastle BioPod for water quality treatment. The water quality flow rate for the drive isle is 0.098 cfs as calculated by WWHM, the 6-ft x 8-ft BioPod vault can handle a treatment capacity of 0.128 cfs. The right of way improvements will be treated by soil media of the bioretention swale. Sizing will be included in the site development permit drainage report, Appendix C Engineering Calculations.

Part 6 - Conveyance System Analysis and Design

Stormwater conveyance will utilize catch basins and 12" ADS-N12 pipe to direct runoff to the proposed infiltration facilities, which should be adequate for the site. If required, the conveyance system analysis will be completed with the site development permit in Appendix C.

CHAPTER 5 – CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN

A Construction Stormwater Pollution Prevention Plan will be included with the grading/site development permit.

CHAPTER 6 – SPECIAL REPORTS AND STUDIES

A preliminary geotechnical report was prepared for the project site by GeoResources on April 15th, 2020. PIT tests will be performed during the wet season, prior to the site development permit. The report recommends a design infiltration rate of 2.0 inches per hour. A copy of the report has been included within Appendix D and should be referenced for additional information regarding the onsite soils. A final Geotech report will be included in the site development submittal after wet season tests are finalized.

CHAPTER 7 – OTHER PERMITS

There are no other known permits with more restrictive drainage-related requirements.

A Construction Stormwater General Permit may be required as the site will disturb more than 1-acre.

CHAPTER 8 – OPERATION AND MAINTENANCE MANUAL

An Operation and Maintenance Manual will be included with the site development permit.

CHAPTER 9 – BOND QUANTITIES WORKSHEET

A bond quantities worksheet will be prepared as necessary with the site development permit.

I:\35043\Docs-Reports\Reports\Prelim Storm Report\35043_Drainage Report_011321.doc

APPENDIX A

OPERATION AND MAINTENANCE (O & M) MANUAL
(TO BE PROVIDED WITH SITE DEVELOPMENT PERMIT)

APPENDIX B

CONSTRUCTION STORMWATER
POLLUTION PREVENTION PLAN
(TO BE PROVIDED WITH SITE DEVELOPMENT PERMIT)

APPENDIX C

ENGINEERING CALCULATIONS

SWMMWW - FLOW CHARTS

Figure I-2.4.1 Flow Chart for Determining Requirements for New Development

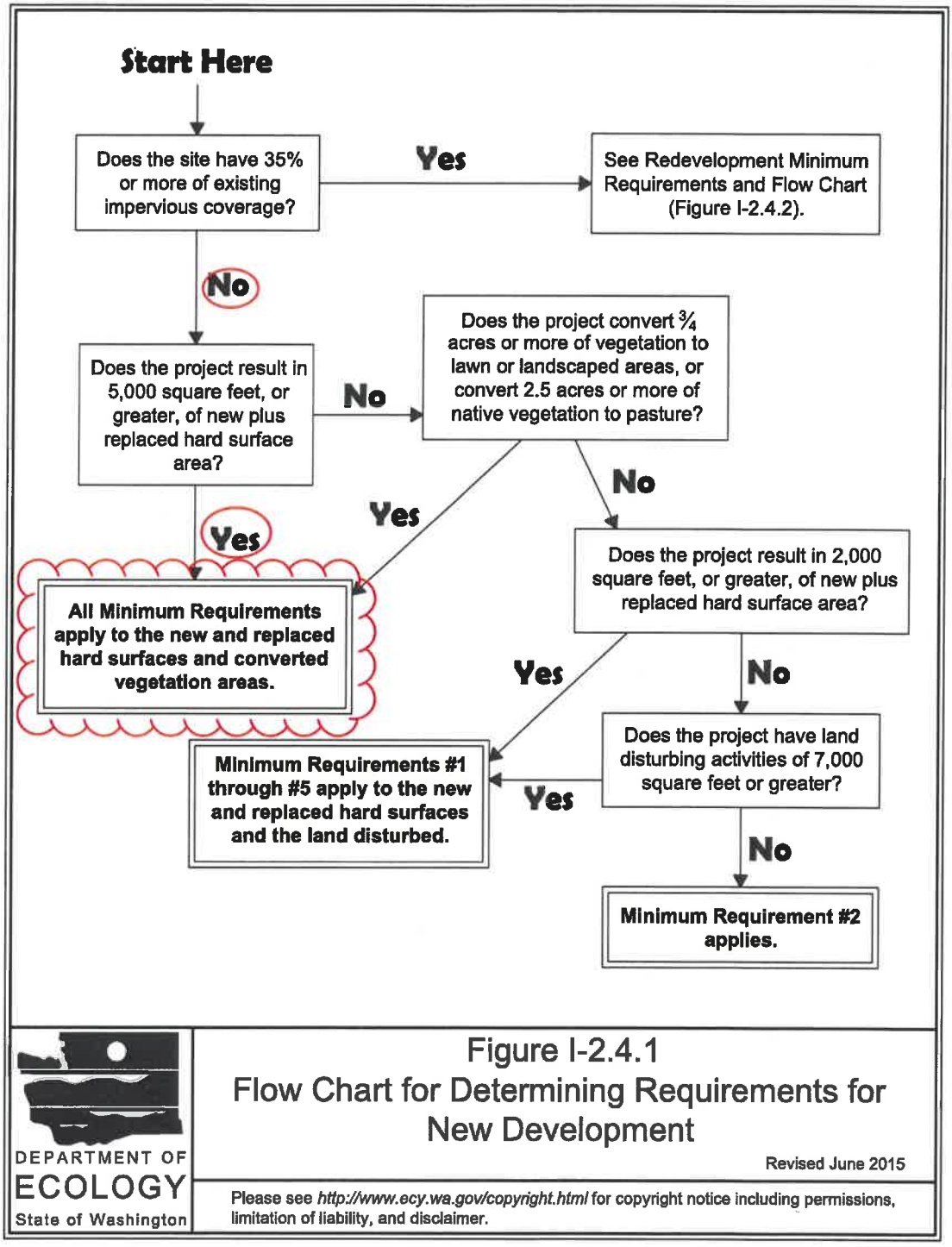


Figure I-2.5.1 Flow Chart for Determining LID MR #5 Requirements

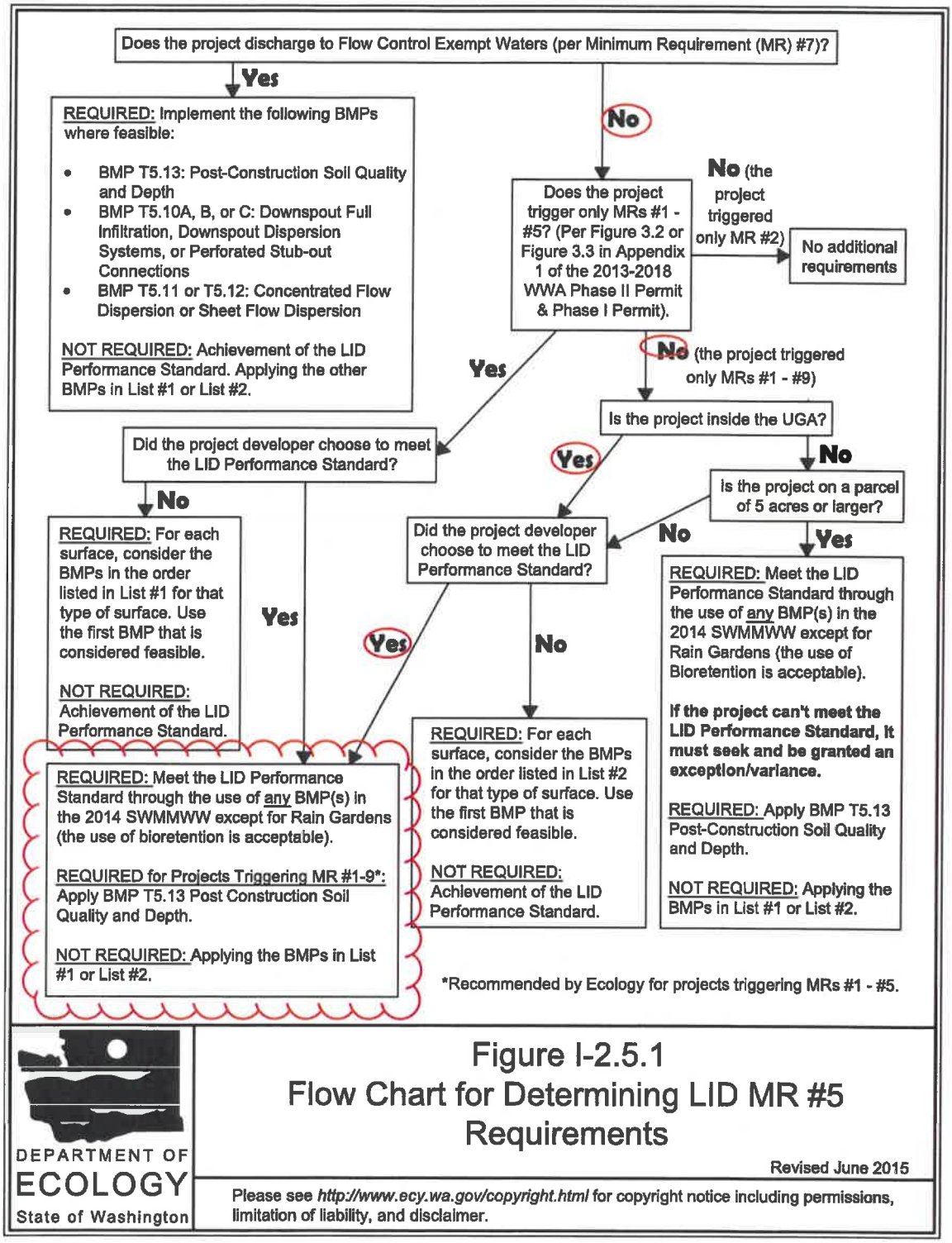
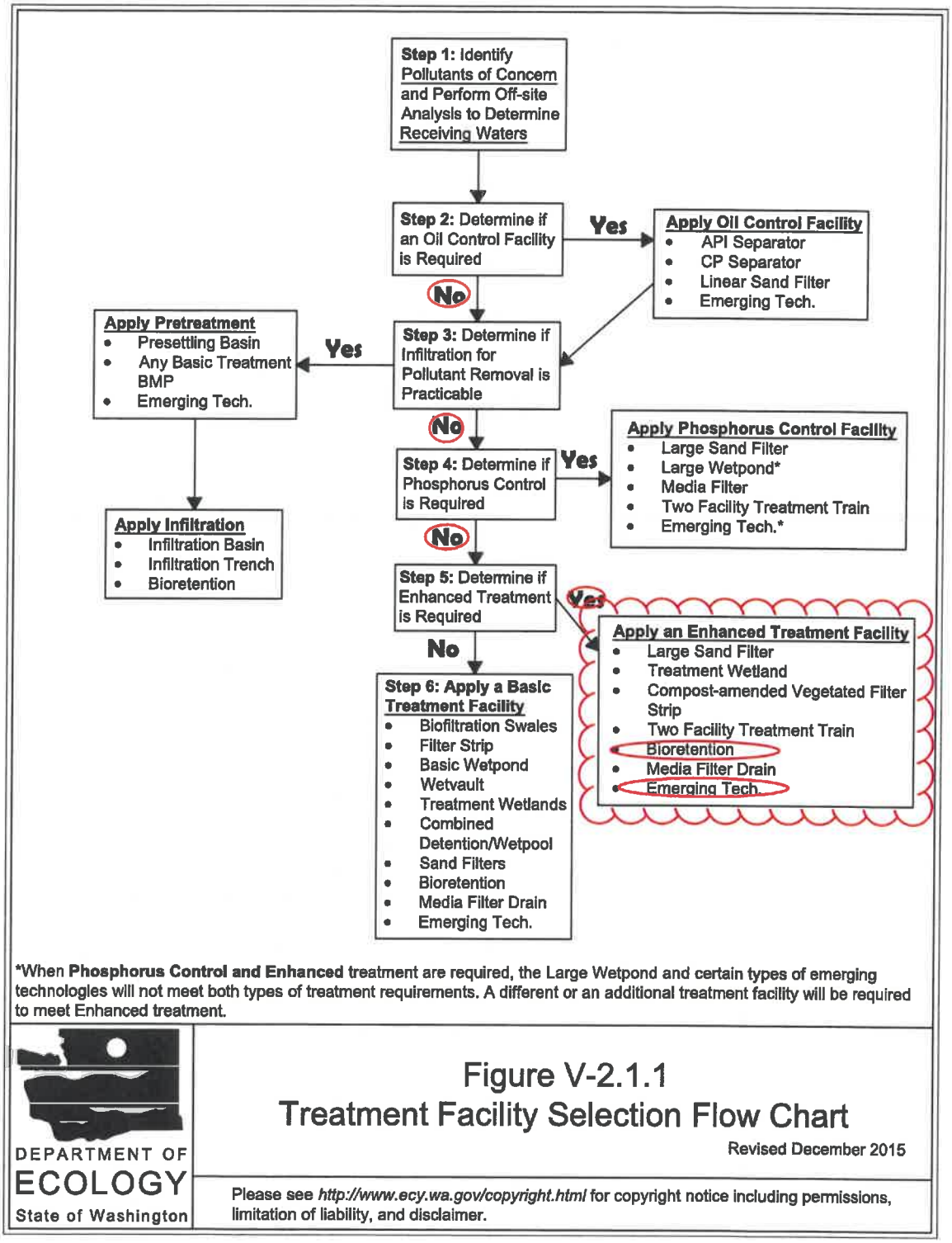


Figure V-2.1.1 Treatment Facility Selection Flow Chart



BASIN ANALYSIS

GRAPHIC SCALE

40 0 20 40 80

(IN FEET)

1 inch = 40 ft.

PRE-DEVELOPED BASIN MAP

Apex Engineering LLC
2601 South 35th St., Suite 200
Tacoma, Washington 98409-7479
(253) 473-4494 FAX: (253) 473-0599

35043

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35043

LEGEND

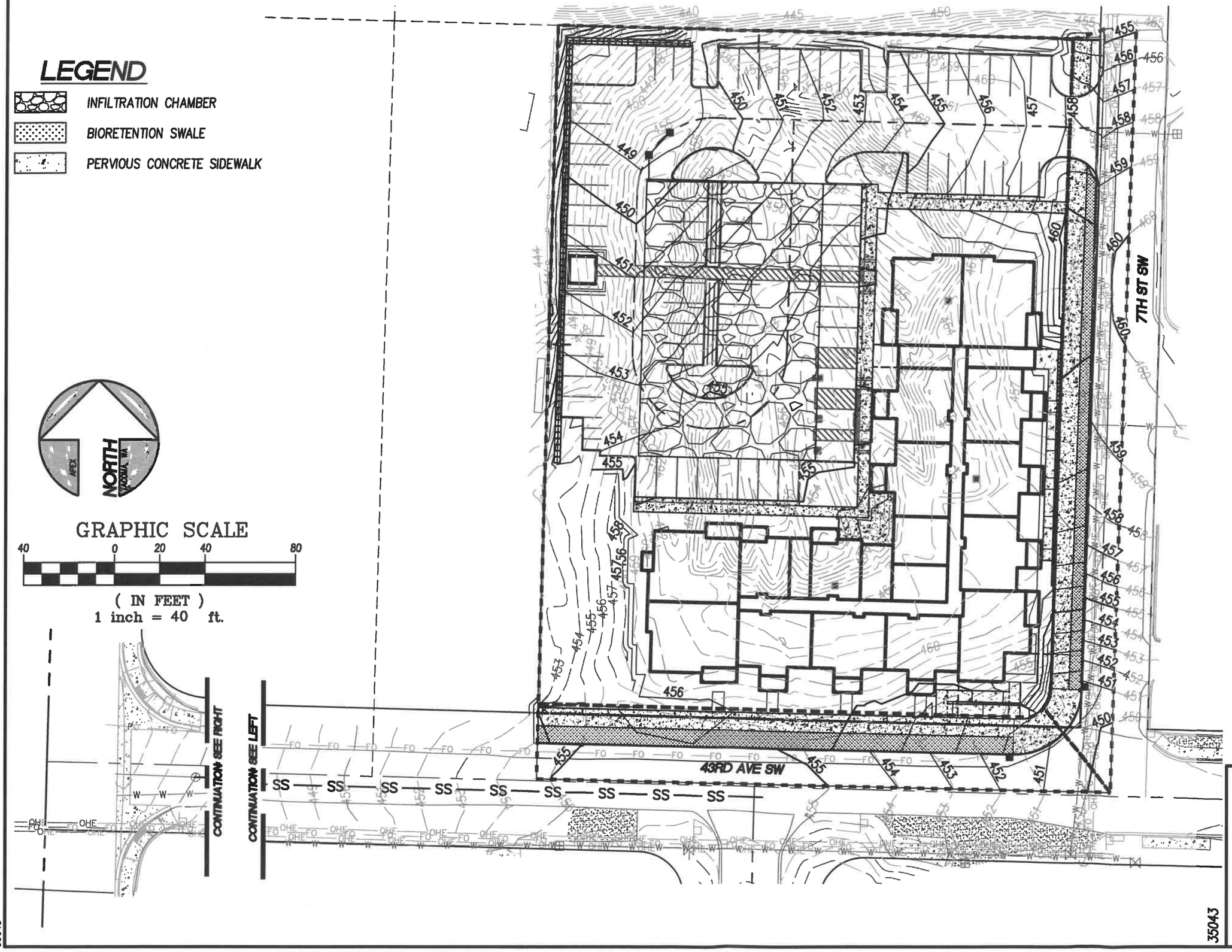
- INFILTRATION CHAMBER
- BIORETENTION SWALE
- PERVIOUS CONCRETE SIDEWALK

NORTH

GRAPHIC SCALE

40 0 20 40 80

(IN FEET)
1 inch = 40 ft.



DEVELOPED BASIN MAP

Apex Engineering LLC
2601 South 35th St., Suite 200
Tacoma, Washington 98409-7479
(253) 473-4494 FAX: (253) 473-0599

35043

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35043

FLOW CONTROL CALCULATIONS

WWHM2012
PROJECT REPORT

Project Name: 35043_Chmb
Site Name: 43rd Multi
Site Address:
City :
Report Date: 2/9/2022
Gage : 38 IN CENTRAL
Data Start : 10/01/1901
Data End : 09/30/2059
Precip Scale: 1.00
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
A B, Forest, Mod	1.481
Pervious Total	1.481

Impervious Land Use	acre
Impervious Total	0
Basin Total	1.481

Element Flows To:
Surface **Interflow** **Groundwater**

Name : Walk
Bypass: No

GroundWater: No

Pervious Land Use	acre
A B, Forest, Mod	.079

Pervious Total	0.079

Impervious Land Use	acre
Impervious Total	0
Basin Total	0.079

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Basin 1
Bypass: No

GroundWater: No

Pervious Land Use	acre
A B, Pasture, Flat	.41
Pervious Total	0.41

Impervious Land Use	acre
ROADS FLAT	0.646
ROOF TOPS FLAT	0.425
Impervious Total	1.071
Basin Total	1.481

Element Flows To:

Surface	Interflow	Groundwater
Gravel Trench Bed 1	Gravel Trench Bed 1	

Name : Gravel Trench Bed 1
Bottom Length: 178.00 ft.
Bottom Width: 19.00 ft.
Trench bottom slope 1: 0.01 To 1
Trench Left side slope 0: 0.01 To 1
Trench right side slope 2: 0.01 To 1
Material thickness of first layer: 0.5
Pour Space of material for first layer: 0.4
Material thickness of second layer: 1.33
Pour Space of material for second layer: 0.775

Material thickness of third layer: 0.5
Pour Space of material for third layer: 0.4
Infiltration On
Infiltration rate: 2
Infiltration safety factor: 1
Total Volume Infiltrated (ac-ft.): 430.897
Total Volume Through Riser (ac-ft.): 0
Total Volume Through Facility (ac-ft.): 430.897
Percent Infiltrated: 100
Total Precip Applied to Facility: 0
Total Evap From Facility: 0
Discharge Structure
Riser Height: 2.32 ft.
Riser Diameter: 1000 in.

Element Flows To:
Outlet 1 **Outlet 2**

Gravel Trench Bed Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.077	0.000	0.000	0.000
0.0259	0.077	0.000	0.000	0.156
0.0518	0.077	0.001	0.000	0.156
0.0777	0.077	0.002	0.000	0.156
0.1036	0.077	0.003	0.000	0.156
0.1294	0.077	0.004	0.000	0.156
0.1553	0.077	0.004	0.000	0.156
0.1812	0.077	0.005	0.000	0.156
0.2071	0.077	0.006	0.000	0.156
0.2330	0.077	0.007	0.000	0.156
0.2589	0.077	0.008	0.000	0.156
0.2848	0.077	0.008	0.000	0.156
0.3107	0.077	0.009	0.000	0.156
0.3366	0.077	0.010	0.000	0.156
0.3624	0.077	0.011	0.000	0.156
0.3883	0.077	0.012	0.000	0.156
0.4142	0.077	0.012	0.000	0.156
0.4401	0.077	0.013	0.000	0.156
0.4660	0.077	0.014	0.000	0.156
0.4919	0.077	0.015	0.000	0.156
0.5178	0.077	0.016	0.000	0.156
0.5437	0.077	0.018	0.000	0.156
0.5696	0.077	0.020	0.000	0.156
0.5954	0.077	0.021	0.000	0.156
0.6213	0.077	0.023	0.000	0.156
0.6472	0.077	0.024	0.000	0.156
0.6731	0.077	0.026	0.000	0.156
0.6990	0.077	0.027	0.000	0.156
0.7249	0.077	0.029	0.000	0.156
0.7508	0.077	0.030	0.000	0.156
0.7767	0.077	0.032	0.000	0.156
0.8026	0.077	0.034	0.000	0.156
0.8284	0.077	0.035	0.000	0.156

0.8543	0.077	0.037	0.000	0.156
0.8802	0.077	0.038	0.000	0.156
0.9061	0.077	0.040	0.000	0.156
0.9320	0.077	0.041	0.000	0.156
0.9579	0.077	0.043	0.000	0.156
0.9838	0.077	0.044	0.000	0.156
1.0097	0.077	0.046	0.000	0.156
1.0356	0.077	0.048	0.000	0.156
1.0614	0.077	0.049	0.000	0.156
1.0873	0.077	0.051	0.000	0.156
1.1132	0.077	0.052	0.000	0.156
1.1391	0.077	0.054	0.000	0.156
1.1650	0.077	0.055	0.000	0.156
1.1909	0.077	0.057	0.000	0.156
1.2168	0.077	0.058	0.000	0.156
1.2427	0.077	0.060	0.000	0.156
1.2686	0.077	0.062	0.000	0.156
1.2944	0.077	0.063	0.000	0.156
1.3203	0.077	0.065	0.000	0.156
1.3462	0.077	0.066	0.000	0.156
1.3721	0.077	0.068	0.000	0.156
1.3980	0.077	0.069	0.000	0.156
1.4239	0.077	0.071	0.000	0.156
1.4498	0.077	0.073	0.000	0.156
1.4757	0.077	0.074	0.000	0.156
1.5016	0.077	0.076	0.000	0.156
1.5274	0.077	0.077	0.000	0.156
1.5533	0.077	0.079	0.000	0.156
1.5792	0.077	0.080	0.000	0.156
1.6051	0.077	0.082	0.000	0.156
1.6310	0.077	0.083	0.000	0.156
1.6569	0.077	0.085	0.000	0.156
1.6828	0.077	0.087	0.000	0.156
1.7087	0.077	0.088	0.000	0.156
1.7346	0.077	0.090	0.000	0.156
1.7604	0.077	0.091	0.000	0.156
1.7863	0.077	0.093	0.000	0.156
1.8122	0.077	0.094	0.000	0.156
1.8381	0.077	0.095	0.000	0.156
1.8640	0.077	0.096	0.000	0.156
1.8899	0.077	0.097	0.000	0.156
1.9158	0.077	0.098	0.000	0.156
1.9417	0.077	0.098	0.000	0.156
1.9676	0.077	0.099	0.000	0.156
1.9934	0.077	0.100	0.000	0.156
2.0193	0.077	0.101	0.000	0.156
2.0452	0.077	0.102	0.000	0.156
2.0711	0.077	0.102	0.000	0.156
2.0970	0.077	0.103	0.000	0.156
2.1229	0.077	0.104	0.000	0.156
2.1488	0.077	0.105	0.000	0.156
2.1747	0.077	0.106	0.000	0.156
2.2006	0.077	0.106	0.000	0.156
2.2264	0.077	0.107	0.000	0.156
2.2523	0.077	0.108	0.000	0.156
2.2782	0.077	0.109	0.000	0.156
2.3041	0.077	0.110	0.000	0.156

2.3300	0.077	0.111	0.885	0.156

Name : Walk
Bypass: No

GroundWater: No

Pervious Land Use	acre
Pervious Total	0

Impervious Land Use	acre
SIDEWALKS FLAT	0.079
Impervious Total	0.079
Basin Total	0.079

Element Flows To:

Surface	Interflow	Groundwater
Gravel Trench Bed 2	Gravel Trench Bed 2	

Name : Gravel Trench Bed 2
Bottom Length: 692.00 ft.
Bottom Width: 5.00 ft.
Trench bottom slope 1: 0.01 To 1
Trench Left side slope 0: 0.01 To 1
Trench right side slope 2: 0.01 To 1
Material thickness of first layer: 0.5
Pour Space of material for first layer: 0.33
Material thickness of second layer: 0
Pour Space of material for second layer: 0
Material thickness of third layer: 0
Pour Space of material for third layer: 0
Infiltration On
Infiltration rate: 2
Infiltration safety factor: 1
Total Volume Infiltrated (ac-ft.): 30.591
Total Volume Through Riser (ac-ft.): 0
Total Volume Through Facility (ac-ft.): 30.591
Percent Infiltrated: 100
Total Precip Applied to Facility: 0
Total Evap From Facility: 0
Discharge Structure
Riser Height: 0.49 ft.
Riser Diameter: 1000 in.

Element Flows To:

Outlet 1	Outlet 2

Gravel Trench Bed Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.079	0.000	0.000	0.000
0.0056	0.079	0.000	0.000	0.160
0.0111	0.079	0.000	0.000	0.160
0.0167	0.079	0.000	0.000	0.160
0.0222	0.079	0.000	0.000	0.160
0.0278	0.079	0.000	0.000	0.160
0.0333	0.079	0.000	0.000	0.160
0.0389	0.079	0.001	0.000	0.160
0.0444	0.079	0.001	0.000	0.160
0.0500	0.079	0.001	0.000	0.160
0.0556	0.079	0.001	0.000	0.160
0.0611	0.079	0.001	0.000	0.160
0.0667	0.079	0.001	0.000	0.160
0.0722	0.079	0.001	0.000	0.160
0.0778	0.079	0.002	0.000	0.160
0.0833	0.079	0.002	0.000	0.160
0.0889	0.079	0.002	0.000	0.160
0.0944	0.079	0.002	0.000	0.160
0.1000	0.079	0.002	0.000	0.160
0.1056	0.079	0.002	0.000	0.160
0.1111	0.079	0.002	0.000	0.160
0.1167	0.079	0.003	0.000	0.160
0.1222	0.079	0.003	0.000	0.160
0.1278	0.079	0.003	0.000	0.160
0.1333	0.079	0.003	0.000	0.160
0.1389	0.079	0.003	0.000	0.160
0.1444	0.079	0.003	0.000	0.160
0.1500	0.079	0.003	0.000	0.160
0.1556	0.079	0.004	0.000	0.160
0.1611	0.079	0.004	0.000	0.160
0.1667	0.079	0.004	0.000	0.160
0.1722	0.079	0.004	0.000	0.160
0.1778	0.079	0.004	0.000	0.160
0.1833	0.079	0.004	0.000	0.160
0.1889	0.079	0.005	0.000	0.160
0.1944	0.079	0.005	0.000	0.160
0.2000	0.079	0.005	0.000	0.160
0.2056	0.079	0.005	0.000	0.160
0.2111	0.079	0.005	0.000	0.160
0.2167	0.079	0.005	0.000	0.160
0.2222	0.079	0.005	0.000	0.160
0.2278	0.079	0.006	0.000	0.160
0.2333	0.079	0.006	0.000	0.160
0.2389	0.079	0.006	0.000	0.160
0.2444	0.079	0.006	0.000	0.160
0.2500	0.079	0.006	0.000	0.160
0.2556	0.079	0.006	0.000	0.160
0.2611	0.079	0.006	0.000	0.160
0.2667	0.079	0.007	0.000	0.160
0.2722	0.079	0.007	0.000	0.160
0.2778	0.079	0.007	0.000	0.160
0.2833	0.079	0.007	0.000	0.160

0.2889	0.079	0.007	0.000	0.160
0.2944	0.079	0.007	0.000	0.160
0.3000	0.079	0.007	0.000	0.160
0.3056	0.079	0.008	0.000	0.160
0.3111	0.079	0.008	0.000	0.160
0.3167	0.079	0.008	0.000	0.160
0.3222	0.079	0.008	0.000	0.160
0.3278	0.079	0.008	0.000	0.160
0.3333	0.079	0.008	0.000	0.160
0.3389	0.079	0.008	0.000	0.160
0.3444	0.079	0.009	0.000	0.160
0.3500	0.079	0.009	0.000	0.160
0.3556	0.079	0.009	0.000	0.160
0.3611	0.079	0.009	0.000	0.160
0.3667	0.079	0.009	0.000	0.160
0.3722	0.079	0.009	0.000	0.160
0.3778	0.079	0.009	0.000	0.160
0.3833	0.079	0.010	0.000	0.160
0.3889	0.079	0.010	0.000	0.160
0.3944	0.079	0.010	0.000	0.160
0.4000	0.079	0.010	0.000	0.160
0.4056	0.079	0.010	0.000	0.160
0.4111	0.079	0.010	0.000	0.160
0.4167	0.079	0.010	0.000	0.160
0.4222	0.079	0.011	0.000	0.160
0.4278	0.079	0.011	0.000	0.160
0.4333	0.079	0.011	0.000	0.160
0.4389	0.079	0.011	0.000	0.160
0.4444	0.079	0.011	0.000	0.160
0.4500	0.079	0.011	0.000	0.160
0.4556	0.079	0.012	0.000	0.160
0.4611	0.079	0.012	0.000	0.160
0.4667	0.079	0.012	0.000	0.160
0.4722	0.079	0.012	0.000	0.160
0.4778	0.079	0.012	0.000	0.160
0.4833	0.079	0.012	0.000	0.160
0.4889	0.079	0.012	0.000	0.160
0.4944	0.079	0.013	0.262	0.160
0.5000	0.079	0.013	0.885	0.160

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:1.56
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:0.41
Total Impervious Area:1.15

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.001016
5 year	0.001254
10 year	0.001365
25 year	0.001468
50 year	0.001526
100 year	0.001571

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
1902	0.001	0.000
1903	0.000	0.000
1904	0.001	0.000
1905	0.001	0.000
1906	0.001	0.000
1907	0.001	0.000
1908	0.001	0.000
1909	0.001	0.000
1910	0.001	0.000
1911	0.001	0.000
1912	0.001	0.000
1913	0.001	0.000
1914	0.001	0.000
1915	0.001	0.000
1916	0.001	0.000
1917	0.001	0.000
1918	0.001	0.000
1919	0.001	0.000
1920	0.001	0.000
1921	0.001	0.000
1922	0.001	0.000
1923	0.001	0.000
1924	0.001	0.000
1925	0.001	0.000
1926	0.001	0.000
1927	0.001	0.000
1928	0.001	0.000
1929	0.001	0.000
1930	0.001	0.000
1931	0.001	0.000
1932	0.001	0.000
1933	0.001	0.000
1934	0.001	0.000

1935	0.001	0.000
1936	0.001	0.000
1937	0.001	0.000
1938	0.001	0.000
1939	0.001	0.000
1940	0.001	0.000
1941	0.001	0.000
1942	0.001	0.000
1943	0.001	0.000
1944	0.001	0.000
1945	0.001	0.000
1946	0.001	0.000
1947	0.001	0.000
1948	0.001	0.000
1949	0.001	0.000
1950	0.001	0.000
1951	0.001	0.000
1952	0.001	0.000
1953	0.001	0.000
1954	0.001	0.000
1955	0.000	0.000
1956	0.000	0.000
1957	0.001	0.000
1958	0.001	0.000
1959	0.001	0.000
1960	0.001	0.000
1961	0.001	0.000
1962	0.001	0.000
1963	0.001	0.000
1964	0.001	0.000
1965	0.001	0.000
1966	0.001	0.000
1967	0.001	0.000
1968	0.001	0.000
1969	0.001	0.000
1970	0.001	0.000
1971	0.001	0.000
1972	0.001	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	0.001	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	0.001	0.000
1987	0.001	0.000
1988	0.001	0.000
1989	0.001	0.000
1990	0.001	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	0.001	0.000
1998	0.001	0.000
1999	0.001	0.000
2000	0.001	0.000
2001	0.000	0.000
2002	0.001	0.000
2003	0.001	0.000
2004	0.001	0.000
2005	0.001	0.000
2006	0.001	0.000
2007	0.001	0.000
2008	0.001	0.000
2009	0.001	0.000
2010	0.001	0.000
2011	0.001	0.000
2012	0.001	0.000
2013	0.001	0.000
2014	0.001	0.000
2015	0.001	0.000
2016	0.001	0.000
2017	0.001	0.000
2018	0.001	0.000
2019	0.001	0.000
2020	0.001	0.000
2021	0.001	0.000
2022	0.001	0.000
2023	0.001	0.000
2024	0.001	0.000
2025	0.001	0.000
2026	0.001	0.000
2027	0.001	0.000
2028	0.000	0.000
2029	0.001	0.000
2030	0.001	0.000
2031	0.000	0.000
2032	0.001	0.000
2033	0.000	0.000
2034	0.001	0.000
2035	0.001	0.000
2036	0.001	0.000
2037	0.001	0.000
2038	0.001	0.000
2039	0.001	0.000
2040	0.001	0.000
2041	0.001	0.000
2042	0.001	0.000
2043	0.001	0.000
2044	0.001	0.000
2045	0.001	0.000
2046	0.001	0.000
2047	0.001	0.000
2048	0.001	0.000

2049	0.001	0.000
2050	0.001	0.000
2051	0.001	0.000
2052	0.001	0.000
2053	0.001	0.000
2054	0.001	0.000
2055	0.001	0.000
2056	0.000	0.000
2057	0.001	0.000
2058	0.001	0.000
2059	0.001	0.000

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

Rank	Predeveloped	Mitigated
1	0.0014	0.0000
2	0.0013	0.0000
3	0.0013	0.0000
4	0.0013	0.0000
5	0.0013	0.0000
6	0.0013	0.0000
7	0.0013	0.0000
8	0.0013	0.0000
9	0.0012	0.0000
10	0.0012	0.0000
11	0.0012	0.0000
12	0.0012	0.0000
13	0.0012	0.0000
14	0.0012	0.0000
15	0.0012	0.0000
16	0.0012	0.0000
17	0.0012	0.0000
18	0.0012	0.0000
19	0.0012	0.0000
20	0.0012	0.0000
21	0.0012	0.0000
22	0.0012	0.0000
23	0.0012	0.0000
24	0.0012	0.0000
25	0.0012	0.0000
26	0.0012	0.0000
27	0.0012	0.0000
28	0.0012	0.0000
29	0.0012	0.0000
30	0.0012	0.0000
31	0.0012	0.0000
32	0.0012	0.0000
33	0.0012	0.0000
34	0.0012	0.0000
35	0.0012	0.0000
36	0.0012	0.0000
37	0.0012	0.0000
38	0.0012	0.0000
39	0.0012	0.0000
40	0.0012	0.0000
41	0.0012	0.0000

42	0.0012	0.0000
43	0.0012	0.0000
44	0.0012	0.0000
45	0.0012	0.0000
46	0.0012	0.0000
47	0.0012	0.0000
48	0.0012	0.0000
49	0.0012	0.0000
50	0.0012	0.0000
51	0.0012	0.0000
52	0.0012	0.0000
53	0.0012	0.0000
54	0.0012	0.0000
55	0.0012	0.0000
56	0.0012	0.0000
57	0.0012	0.0000
58	0.0012	0.0000
59	0.0012	0.0000
60	0.0012	0.0000
61	0.0011	0.0000
62	0.0011	0.0000
63	0.0011	0.0000
64	0.0011	0.0000
65	0.0011	0.0000
66	0.0011	0.0000
67	0.0011	0.0000
68	0.0011	0.0000
69	0.0011	0.0000
70	0.0011	0.0000
71	0.0011	0.0000
72	0.0011	0.0000
73	0.0011	0.0000
74	0.0011	0.0000
75	0.0011	0.0000
76	0.0011	0.0000
77	0.0011	0.0000
78	0.0011	0.0000
79	0.0011	0.0000
80	0.0011	0.0000
81	0.0011	0.0000
82	0.0011	0.0000
83	0.0011	0.0000
84	0.0011	0.0000
85	0.0011	0.0000
86	0.0011	0.0000
87	0.0010	0.0000
88	0.0010	0.0000
89	0.0010	0.0000
90	0.0010	0.0000
91	0.0010	0.0000
92	0.0010	0.0000
93	0.0010	0.0000
94	0.0010	0.0000
95	0.0010	0.0000
96	0.0010	0.0000
97	0.0010	0.0000
98	0.0010	0.0000

99	0.0010	0.0000
100	0.0010	0.0000
101	0.0010	0.0000
102	0.0010	0.0000
103	0.0010	0.0000
104	0.0010	0.0000
105	0.0010	0.0000
106	0.0010	0.0000
107	0.0010	0.0000
108	0.0010	0.0000
109	0.0010	0.0000
110	0.0010	0.0000
111	0.0010	0.0000
112	0.0010	0.0000
113	0.0009	0.0000
114	0.0009	0.0000
115	0.0009	0.0000
116	0.0009	0.0000
117	0.0009	0.0000
118	0.0009	0.0000
119	0.0009	0.0000
120	0.0009	0.0000
121	0.0009	0.0000
122	0.0008	0.0000
123	0.0008	0.0000
124	0.0008	0.0000
125	0.0008	0.0000
126	0.0008	0.0000
127	0.0008	0.0000
128	0.0008	0.0000
129	0.0008	0.0000
130	0.0008	0.0000
131	0.0008	0.0000
132	0.0007	0.0000
133	0.0007	0.0000
134	0.0007	0.0000
135	0.0007	0.0000
136	0.0007	0.0000
137	0.0007	0.0000
138	0.0007	0.0000
139	0.0007	0.0000
140	0.0007	0.0000
141	0.0007	0.0000
142	0.0006	0.0000
143	0.0006	0.0000
144	0.0006	0.0000
145	0.0006	0.0000
146	0.0006	0.0000
147	0.0006	0.0000
148	0.0006	0.0000
149	0.0005	0.0000
150	0.0005	0.0000
151	0.0005	0.0000
152	0.0005	0.0000
153	0.0004	0.0000
154	0.0004	0.0000
155	0.0004	0.0000

156	0.0003	0.0000
157	0.0003	0.0000
158	0.0003	0.0000

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0005	3718	0	0	Pass
0.0005	3551	0	0	Pass
0.0005	3395	0	0	Pass
0.0005	3255	0	0	Pass
0.0005	3127	0	0	Pass
0.0006	3013	0	0	Pass
0.0006	2893	0	0	Pass
0.0006	2789	0	0	Pass
0.0006	2687	0	0	Pass
0.0006	2596	0	0	Pass
0.0006	2491	0	0	Pass
0.0006	2406	0	0	Pass
0.0006	2313	0	0	Pass
0.0006	2230	0	0	Pass
0.0007	2157	0	0	Pass
0.0007	2078	0	0	Pass
0.0007	2021	0	0	Pass
0.0007	1954	0	0	Pass
0.0007	1888	0	0	Pass
0.0007	1828	0	0	Pass
0.0007	1759	0	0	Pass
0.0007	1697	0	0	Pass
0.0007	1632	0	0	Pass
0.0007	1573	0	0	Pass
0.0008	1494	0	0	Pass
0.0008	1430	0	0	Pass
0.0008	1340	0	0	Pass
0.0008	1301	0	0	Pass
0.0008	1246	0	0	Pass
0.0008	1204	0	0	Pass
0.0008	1160	0	0	Pass
0.0008	1122	0	0	Pass
0.0008	1054	0	0	Pass
0.0008	1009	0	0	Pass
0.0009	963	0	0	Pass
0.0009	921	0	0	Pass
0.0009	899	0	0	Pass
0.0009	855	0	0	Pass
0.0009	814	0	0	Pass
0.0009	786	0	0	Pass
0.0009	742	0	0	Pass
0.0009	695	0	0	Pass
0.0009	679	0	0	Pass
0.0010	646	0	0	Pass
0.0010	614	0	0	Pass

0.0010	568	0	0	Pass
0.0010	544	0	0	Pass
0.0010	517	0	0	Pass
0.0010	490	0	0	Pass
0.0010	475	0	0	Pass
0.0010	439	0	0	Pass
0.0010	398	0	0	Pass
0.0010	371	0	0	Pass
0.0011	350	0	0	Pass
0.0011	328	0	0	Pass
0.0011	301	0	0	Pass
0.0011	280	0	0	Pass
0.0011	265	0	0	Pass
0.0011	245	0	0	Pass
0.0011	232	0	0	Pass
0.0011	210	0	0	Pass
0.0011	197	0	0	Pass
0.0011	185	0	0	Pass
0.0012	169	0	0	Pass
0.0012	153	0	0	Pass
0.0012	138	0	0	Pass
0.0012	121	0	0	Pass
0.0012	107	0	0	Pass
0.0012	88	0	0	Pass
0.0012	74	0	0	Pass
0.0012	58	0	0	Pass
0.0012	30	0	0	Pass
0.0012	11	0	0	Pass
0.0013	1	0	0	Pass
0.0013	1	0	0	Pass
0.0013	1	0	0	Pass
0.0013	1	0	0	Pass
0.0013	1	0	0	Pass
0.0013	1	0	0	Pass
0.0013	1	0	0	Pass
0.0013	1	0	0	Pass
0.0014	1	0	0	Pass
0.0014	1	0	0	Pass
0.0014	1	0	0	Pass
0.0014	0	0	0	Pass
0.0014	0	0	0	Pass
0.0014	0	0	0	Pass
0.0014	0	0	0	Pass
0.0014	0	0	0	Pass
0.0014	0	0	0	Pass
0.0014	0	0	0	Pass
0.0015	0	0	0	Pass
0.0015	0	0	0	Pass
0.0015	0	0	0	Pass
0.0015	0	0	0	Pass
0.0015	0	0	0	Pass
0.0015	0	0	0	Pass
0.0015	0	0	0	Pass

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0.1235 **acre-feet**
On-line facility target flow: 0.1704 **cfs.**
Adjusted for 15 min: 0.1704 **cfs.**
Off-line facility target flow: 0.0981 **cfs.**
Adjusted for 15 min: 0.0981 **cfs.**

LID Report

LID Technique	Used for Water Quality Treatment?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft.)	Cumulative Volume Infiltration Credit	Comment
Gravel Trench Bed 1 POC	N	392.12			N	
Gravel Trench Bed 2 POC	N	27.84			N	
Total Volume Infiltrated		419.95	0.00	0.00		
100.00 0.00	0%	No Treat. Credit				

Compliance with LID Standard 8
Duration Analysis Result = Passed

Perlnd and Implnd Changes

No changes have been made.

Chamber Analysis

BASIN #	AREA (SF) REQ'D	VOLUME (CF) REQ'D	AREA PROVIDED	VOLUME PROVIDED
On-Site	3382	4839	3990	4950

WWHM Calculation

Length	178	ft
Width	19	ft
Area	3382	sf

Porosity Analysis

Material	Thickness	Porosity	Volume (CF)
Stone	0.5	40%	676.4
Chamber	1.33	78%	3486.0
Stone	0.5	40%	676.4
Trench	*2.33*	*61%*	*4838.8*

ADS

USA | English | Imperial

Print System Specifications | Design Tool Instructional Videos | Create Account | Sign In

100%

Enable Panning Tool

Volume (cf)	Length (ft)	Width (ft)	Area (sf)	Chambers	Caps
4950.17	113.73	34.83	3895.7	149	20

- Project Information
- Background & Tools
- Multi-Bed Management
- System Parameters

Product Type:

StormTech | LandMax

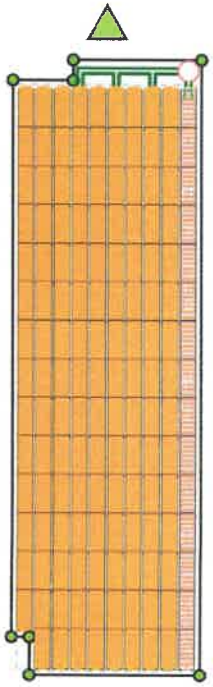
SC-310

Storage Volume (cf)	4839
Available length (ft)	122
Available width (ft)	76
Stone Above Chambers (in)	6
Stone Below Chambers (in)	6
Base Stone Elevation (ft)	0
Stone Porosity (%):	40
Average Cover (in)	18

Include Outlet (NO)

Generate Design

Reset Design



WWHM2012
PROJECT REPORT

Project Name: 35043_43rd
Site Name: 43rd Multi
Site Address:
City :
Report Date: 12/29/2021
Gage : 38 IN CENTRAL
Data Start : 10/01/1901
Data End : 09/30/2059
Precip Scale: 1.00
Version Date: 2018/10/10
Version : 4.2.16

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

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Road_Lnd
Bypass: No

GroundWater: No

Pervious Land Use	acre
A B, Forest, Mod	.137
Pervious Total	0.137

Impervious Land Use	acre
Impervious Total	0
Basin Total	0.137

Element Flows To:

Surface	Interflow	Groundwater

Name : Pervious S/W
Bypass: No

GroundWater: No

Pervious Land Use	acre
A B, Forest, Mod	.045

Pervious Total	0.045

Impervious Land Use	acre
Impervious Total	0
Basin Total	0.045

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Road_Lnd
Bypass: No

GroundWater: No

Pervious Land Use	acre
A B, Pasture, Flat	.043
Pervious Total	0.043

Impervious Land Use	acre
ROADS FLAT	0.094
Impervious Total	0.094
Basin Total	0.137

Element Flows To:

Surface	Interflow	Groundwater
Surface retention 1	Surface retention 1	

Name : Pervious S/W
Bypass: No

GroundWater: No

Pervious Land Use	acre
Pervious Total	0

Impervious Land Use	acre
SIDEWALKS FLAT	0.045

Impervious Total	**0.045**
Basin Total	**0.045**

Element Flows To:

Surface	Interflow	Groundwater
Gravel Trench Bed 1	Gravel Trench Bed 1	

Name : Gravel Trench Bed 1
Bottom Length: 247.10 ft.
Bottom Width: 8.00 ft.
Trench bottom slope 1: 0.01 To 1
Trench Left side slope 0: 0.01 To 1
Trench right side slope 2: 0.01 To 1
Material thickness of first layer: 0.5
Pour Space of material for first layer: 0.33
Material thickness of second layer: 0
Pour Space of material for second layer: 0
Material thickness of third layer: 0
Pour Space of material for third layer: 0
Infiltration On
Infiltration rate: 2
Infiltration safety factor: 1
Total Volume Infiltrated (ac-ft.): 19.195
Total Volume Through Riser (ac-ft.): 0
Total Volume Through Facility (ac-ft.): 19.195
Percent Infiltrated: 100
Total Precip Applied to Facility: 0
Total Evap From Facility: 0
Discharge Structure
Riser Height: 0.49 ft.
Riser Diameter: 1000 in.

Element Flows To:

Outlet 1	Outlet 2

Gravel Trench Bed Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.045	0.000	0.000	0.000
0.0056	0.045	0.000	0.000	0.091
0.0111	0.045	0.000	0.000	0.091
0.0167	0.045	0.000	0.000	0.091
0.0222	0.045	0.000	0.000	0.091
0.0278	0.045	0.000	0.000	0.091
0.0333	0.045	0.000	0.000	0.091
0.0389	0.045	0.000	0.000	0.091
0.0444	0.045	0.000	0.000	0.091

0.0500	0.045	0.000	0.000	0.091
0.0556	0.045	0.000	0.000	0.091
0.0611	0.045	0.000	0.000	0.091
0.0667	0.045	0.001	0.000	0.091
0.0722	0.045	0.001	0.000	0.091
0.0778	0.045	0.001	0.000	0.091
0.0833	0.045	0.001	0.000	0.091
0.0889	0.045	0.001	0.000	0.091
0.0944	0.045	0.001	0.000	0.091
0.1000	0.045	0.001	0.000	0.091
0.1056	0.045	0.001	0.000	0.091
0.1111	0.045	0.001	0.000	0.091
0.1167	0.045	0.001	0.000	0.091
0.1222	0.045	0.001	0.000	0.091
0.1278	0.045	0.001	0.000	0.091
0.1333	0.045	0.002	0.000	0.091
0.1389	0.045	0.002	0.000	0.091
0.1444	0.045	0.002	0.000	0.091
0.1500	0.045	0.002	0.000	0.091
0.1556	0.045	0.002	0.000	0.091
0.1611	0.045	0.002	0.000	0.091
0.1667	0.045	0.002	0.000	0.091
0.1722	0.045	0.002	0.000	0.091
0.1778	0.045	0.002	0.000	0.091
0.1833	0.045	0.002	0.000	0.091
0.1889	0.045	0.002	0.000	0.091
0.1944	0.045	0.002	0.000	0.091
0.2000	0.045	0.003	0.000	0.091
0.2056	0.045	0.003	0.000	0.091
0.2111	0.045	0.003	0.000	0.091
0.2167	0.045	0.003	0.000	0.091
0.2222	0.045	0.003	0.000	0.091
0.2278	0.045	0.003	0.000	0.091
0.2333	0.045	0.003	0.000	0.091
0.2389	0.045	0.003	0.000	0.091
0.2444	0.045	0.003	0.000	0.091
0.2500	0.045	0.003	0.000	0.091
0.2556	0.045	0.003	0.000	0.091
0.2611	0.045	0.003	0.000	0.091
0.2667	0.045	0.004	0.000	0.091
0.2722	0.045	0.004	0.000	0.091
0.2778	0.045	0.004	0.000	0.091
0.2833	0.045	0.004	0.000	0.091
0.2889	0.045	0.004	0.000	0.091
0.2944	0.045	0.004	0.000	0.091
0.3000	0.045	0.004	0.000	0.091
0.3056	0.045	0.004	0.000	0.091
0.3111	0.045	0.004	0.000	0.091
0.3167	0.045	0.004	0.000	0.091
0.3222	0.045	0.004	0.000	0.091
0.3278	0.045	0.004	0.000	0.091
0.3333	0.045	0.005	0.000	0.091
0.3389	0.045	0.005	0.000	0.091
0.3444	0.045	0.005	0.000	0.091
0.3500	0.045	0.005	0.000	0.091
0.3556	0.045	0.005	0.000	0.091
0.3611	0.045	0.005	0.000	0.091

0.3667	0.045	0.005	0.000	0.091
0.3722	0.045	0.005	0.000	0.091
0.3778	0.045	0.005	0.000	0.091
0.3833	0.045	0.005	0.000	0.091
0.3889	0.045	0.005	0.000	0.091
0.3944	0.045	0.005	0.000	0.091
0.4000	0.045	0.006	0.000	0.091
0.4056	0.045	0.006	0.000	0.091
0.4111	0.045	0.006	0.000	0.091
0.4167	0.045	0.006	0.000	0.091
0.4222	0.045	0.006	0.000	0.091
0.4278	0.045	0.006	0.000	0.091
0.4333	0.045	0.006	0.000	0.091
0.4389	0.045	0.006	0.000	0.091
0.4444	0.045	0.006	0.000	0.091
0.4500	0.045	0.006	0.000	0.091
0.4556	0.045	0.006	0.000	0.091
0.4611	0.045	0.006	0.000	0.091
0.4667	0.045	0.007	0.000	0.091
0.4722	0.045	0.007	0.000	0.091
0.4778	0.045	0.007	0.000	0.091
0.4833	0.045	0.007	0.000	0.091
0.4889	0.045	0.007	0.000	0.091
0.4944	0.045	0.007	0.262	0.091
0.5000	0.045	0.007	0.885	0.091

Name : Bioretention 1
Bottom Length: 210.00 ft.
Bottom Width: 3.50 ft.
Material thickness of first layer: 0.25
Material type for first layer: SMMWW 12 in/hr
Material thickness of second layer: 1.5
Material type for second layer: SMMWW
Material thickness of third layer: 3.5
Material type for third layer: GRAVEL
Infiltration On
Infiltration rate: 2
Infiltration safety factor: 1
Total Volume Infiltrated (ac-ft.): 47.813
Total Volume Through Riser (ac-ft.): 0
Total Volume Through Facility (ac-ft.): 47.813
Percent Infiltrated: 100
Total Precip Applied to Facility: 16.164
Total Evap From Facility: 10.933
Underdrain not used
Discharge Structure
Riser Height: 0.499 ft.
Riser Diameter: 12 in.

Element Flows To:
Outlet 1 **Outlet 2**

Bioretention 1 Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.1299	0.0000	0.0000	0.0000
0.0687	0.1292	0.0003	0.0000	0.0000
0.1373	0.1276	0.0006	0.0000	0.0000
0.2060	0.1260	0.0009	0.0000	0.0001
0.2747	0.1244	0.0012	0.0000	0.0003
0.3434	0.1228	0.0015	0.0000	0.0008
0.4120	0.1212	0.0018	0.0000	0.0009
0.4807	0.1196	0.0022	0.0000	0.0015
0.5494	0.1180	0.0025	0.0000	0.0026
0.6180	0.1164	0.0029	0.0000	0.0037
0.6867	0.1149	0.0033	0.0000	0.0041
0.7554	0.1133	0.0038	0.0000	0.0060
0.8240	0.1117	0.0042	0.0000	0.0084
0.8927	0.1101	0.0047	0.0000	0.0090
0.9614	0.1086	0.0051	0.0000	0.0093
1.0301	0.1070	0.0056	0.0000	0.0113
1.0987	0.1054	0.0062	0.0000	0.0146
1.1674	0.1039	0.0067	0.0000	0.0174
1.2361	0.1023	0.0072	0.0000	0.0185
1.3047	0.1008	0.0078	0.0000	0.0230
1.3734	0.0992	0.0084	0.0000	0.0281
1.4421	0.0977	0.0090	0.0000	0.0293
1.5107	0.0962	0.0097	0.0000	0.0337
1.5794	0.0946	0.0103	0.0000	0.0340
1.6481	0.0931	0.0110	0.0000	0.0340
1.7168	0.0916	0.0117	0.0000	0.0340
1.7854	0.0900	0.0124	0.0000	0.0340
1.8541	0.0885	0.0132	0.0000	0.0340
1.9228	0.0870	0.0140	0.0000	0.0340
1.9914	0.0855	0.0148	0.0000	0.0340
2.0601	0.0840	0.0156	0.0000	0.0340
2.1288	0.0825	0.0165	0.0000	0.0340
2.1975	0.0810	0.0173	0.0000	0.0340
2.2661	0.0795	0.0182	0.0000	0.0340
2.3348	0.0780	0.0191	0.0000	0.0340
2.4035	0.0765	0.0201	0.0000	0.0340
2.4721	0.0750	0.0210	0.0000	0.0340
2.5408	0.0735	0.0220	0.0000	0.0340
2.6095	0.0720	0.0230	0.0000	0.0340
2.6781	0.0705	0.0240	0.0000	0.0340
2.7468	0.0691	0.0250	0.0000	0.0340
2.8155	0.0676	0.0261	0.0000	0.0340
2.8842	0.0661	0.0272	0.0000	0.0340
2.9528	0.0646	0.0283	0.0000	0.0340
3.0215	0.0632	0.0294	0.0000	0.0340
3.0902	0.0617	0.0305	0.0000	0.0340
3.1588	0.0603	0.0317	0.0000	0.0340
3.2275	0.0588	0.0329	0.0000	0.0340
3.2962	0.0574	0.0341	0.0000	0.0340
3.3648	0.0559	0.0365	0.0000	0.0340
3.4335	0.0545	0.0390	0.0000	0.0340
3.5022	0.0530	0.0416	0.0000	0.0340
3.5709	0.0516	0.0442	0.0000	0.0340
3.6395	0.0502	0.0468	0.0000	0.0340
3.7082	0.0488	0.0495	0.0000	0.0340

3.7769	0.0473	0.0522	0.0000	0.0340
3.8455	0.0459	0.0550	0.0000	0.0340
3.9142	0.0445	0.0578	0.0000	0.0340
3.9829	0.0431	0.0606	0.0000	0.0340
4.0515	0.0417	0.0635	0.0000	0.0340
4.1202	0.0403	0.0665	0.0000	0.0340
4.1889	0.0389	0.0694	0.0000	0.0340
4.2576	0.0375	0.0725	0.0000	0.0340
4.3262	0.0361	0.0755	0.0000	0.0340
4.3949	0.0347	0.0787	0.0000	0.0340
4.4636	0.0333	0.0818	0.0000	0.0340
4.5322	0.0319	0.0850	0.0000	0.0340
4.6009	0.0305	0.0883	0.0000	0.0340
4.6696	0.0291	0.0916	0.0000	0.0340
4.7383	0.0278	0.0949	0.0000	0.0340
4.8069	0.0264	0.0983	0.0000	0.0340
4.8756	0.0250	0.1017	0.0000	0.0340
4.9443	0.0236	0.1052	0.0000	0.0340
5.0129	0.0223	0.1087	0.0000	0.0340
5.0816	0.0209	0.1123	0.0000	0.0340
5.1503	0.0196	0.1159	0.0000	0.0340
5.2189	0.0182	0.1196	0.0000	0.0340
5.2500	0.0169	0.1212	0.0000	0.0340

Surface retention 1 Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Wetted Surface
5.2500	0.1299	0.1212	0.0000	0.1238	0.0000
5.3187	0.1315	0.1302	0.0000	0.1238	0.0000
5.3873	0.1332	0.1393	0.0000	0.1284	0.0000
5.4560	0.1348	0.1485	0.0000	0.1331	0.0000
5.5247	0.1364	0.1578	0.0000	0.1378	0.0000
5.5934	0.1380	0.1672	0.0000	0.1425	0.0000
5.6620	0.1397	0.1768	0.0000	0.1471	0.0000
5.7307	0.1413	0.1864	0.0000	0.1518	0.0000
5.7994	0.1429	0.1962	0.1198	0.1565	0.0000
5.8680	0.1446	0.2060	0.4315	0.1612	0.0000
5.9367	0.1462	0.2160	0.8316	0.1658	0.0000
6.0054	0.1479	0.2261	1.2563	0.1705	0.0000
6.0740	0.1495	0.2363	1.6422	0.1752	0.0000
6.1427	0.1512	0.2466	1.9384	0.1799	0.0000
6.2114	0.1528	0.2571	2.1292	0.1845	0.0000
6.2490	0.1537	0.2629	2.2952	0.1871	0.0000

Name : Surface retention 1

Element Flows To:

Outlet 1	**Outlet 2**
Bioretention 1	

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:0.182
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:0.043
Total Impervious Area:0.139

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.00012
5 year	0.000157
10 year	0.000183
25 year	0.000217
50 year	0.000244
100 year	0.000272

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
1902	0.000	0.000
1903	0.000	0.000
1904	0.000	0.000
1905	0.000	0.000
1906	0.000	0.000
1907	0.000	0.000
1908	0.000	0.000
1909	0.000	0.000
1910	0.000	0.000
1911	0.000	0.000
1912	0.000	0.000
1913	0.000	0.000
1914	0.000	0.000
1915	0.000	0.000
1916	0.000	0.000
1917	0.000	0.000
1918	0.000	0.000
1919	0.000	0.000
1920	0.000	0.000
1921	0.000	0.000
1922	0.000	0.000
1923	0.000	0.000

1924	0.000	0.000
1925	0.000	0.000
1926	0.000	0.000
1927	0.000	0.000
1928	0.000	0.000
1929	0.000	0.000
1930	0.000	0.000
1931	0.000	0.000
1932	0.000	0.000
1933	0.000	0.000
1934	0.000	0.000
1935	0.000	0.000
1936	0.000	0.000
1937	0.000	0.000
1938	0.000	0.000
1939	0.000	0.000
1940	0.000	0.000
1941	0.000	0.000
1942	0.000	0.000
1943	0.000	0.000
1944	0.000	0.000
1945	0.000	0.000
1946	0.000	0.000
1947	0.000	0.000
1948	0.000	0.000
1949	0.000	0.000
1950	0.000	0.000
1951	0.000	0.000
1952	0.000	0.000
1953	0.000	0.000
1954	0.000	0.000
1955	0.000	0.000
1956	0.000	0.000
1957	0.000	0.000
1958	0.000	0.000
1959	0.000	0.000
1960	0.000	0.000
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1968	0.000	0.000
1969	0.000	0.000
1970	0.000	0.000
1971	0.000	0.000
1972	0.000	0.000
1973	0.000	0.000
1974	0.000	0.000
1975	0.000	0.000
1976	0.000	0.000
1977	0.000	0.000
1978	0.000	0.000
1979	0.000	0.000
1980	0.000	0.000

1981	0.000	0.000
1982	0.000	0.000
1983	0.000	0.000
1984	0.000	0.000
1985	0.000	0.000
1986	0.000	0.000
1987	0.000	0.000
1988	0.000	0.000
1989	0.000	0.000
1990	0.000	0.000
1991	0.000	0.000
1992	0.000	0.000
1993	0.000	0.000
1994	0.000	0.000
1995	0.000	0.000
1996	0.000	0.000
1997	0.000	0.000
1998	0.000	0.000
1999	0.000	0.000
2000	0.000	0.000
2001	0.000	0.000
2002	0.000	0.000
2003	0.000	0.000
2004	0.000	0.000
2005	0.000	0.000
2006	0.000	0.000
2007	0.000	0.000
2008	0.000	0.000
2009	0.000	0.000
2010	0.000	0.000
2011	0.000	0.000
2012	0.000	0.000
2013	0.000	0.000
2014	0.000	0.000
2015	0.000	0.000
2016	0.000	0.000
2017	0.000	0.000
2018	0.000	0.000
2019	0.000	0.000
2020	0.000	0.000
2021	0.000	0.000
2022	0.000	0.000
2023	0.000	0.000
2024	0.000	0.000
2025	0.000	0.000
2026	0.000	0.000
2027	0.000	0.000
2028	0.000	0.000
2029	0.000	0.000
2030	0.000	0.000
2031	0.000	0.000
2032	0.000	0.000
2033	0.000	0.000
2034	0.000	0.000
2035	0.000	0.000
2036	0.000	0.000
2037	0.000	0.000

2038	0.000	0.000
2039	0.000	0.000
2040	0.000	0.000
2041	0.000	0.000
2042	0.000	0.000
2043	0.000	0.000
2044	0.000	0.000
2045	0.000	0.000
2046	0.000	0.000
2047	0.000	0.000
2048	0.000	0.000
2049	0.000	0.000
2050	0.000	0.000
2051	0.000	0.000
2052	0.000	0.000
2053	0.000	0.000
2054	0.000	0.000
2055	0.000	0.000
2056	0.000	0.000
2057	0.000	0.000
2058	0.000	0.000
2059	0.001	0.000

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

Rank	Predeveloped	Mitigated
1	0.0007	0.0000
2	0.0004	0.0000
3	0.0002	0.0000
4	0.0002	0.0000
5	0.0001	0.0000
6	0.0001	0.0000
7	0.0001	0.0000
8	0.0001	0.0000
9	0.0001	0.0000
10	0.0001	0.0000
11	0.0001	0.0000
12	0.0001	0.0000
13	0.0001	0.0000
14	0.0001	0.0000
15	0.0001	0.0000
16	0.0001	0.0000
17	0.0001	0.0000
18	0.0001	0.0000
19	0.0001	0.0000
20	0.0001	0.0000
21	0.0001	0.0000
22	0.0001	0.0000
23	0.0001	0.0000
24	0.0001	0.0000
25	0.0001	0.0000
26	0.0001	0.0000
27	0.0001	0.0000
28	0.0001	0.0000
29	0.0001	0.0000
30	0.0001	0.0000

31	0.0001	0.0000
32	0.0001	0.0000
33	0.0001	0.0000
34	0.0001	0.0000
35	0.0001	0.0000
36	0.0001	0.0000
37	0.0001	0.0000
38	0.0001	0.0000
39	0.0001	0.0000
40	0.0001	0.0000
41	0.0001	0.0000
42	0.0001	0.0000
43	0.0001	0.0000
44	0.0001	0.0000
45	0.0001	0.0000
46	0.0001	0.0000
47	0.0001	0.0000
48	0.0001	0.0000
49	0.0001	0.0000
50	0.0001	0.0000
51	0.0001	0.0000
52	0.0001	0.0000
53	0.0001	0.0000
54	0.0001	0.0000
55	0.0001	0.0000
56	0.0001	0.0000
57	0.0001	0.0000
58	0.0001	0.0000
59	0.0001	0.0000
60	0.0001	0.0000
61	0.0001	0.0000
62	0.0001	0.0000
63	0.0001	0.0000
64	0.0001	0.0000
65	0.0001	0.0000
66	0.0001	0.0000
67	0.0001	0.0000
68	0.0001	0.0000
69	0.0001	0.0000
70	0.0001	0.0000
71	0.0001	0.0000
72	0.0001	0.0000
73	0.0001	0.0000
74	0.0001	0.0000
75	0.0001	0.0000
76	0.0001	0.0000
77	0.0001	0.0000
78	0.0001	0.0000
79	0.0001	0.0000
80	0.0001	0.0000
81	0.0001	0.0000
82	0.0001	0.0000
83	0.0001	0.0000
84	0.0001	0.0000
85	0.0001	0.0000
86	0.0001	0.0000
87	0.0001	0.0000

88	0.0001	0.0000
89	0.0001	0.0000
90	0.0001	0.0000
91	0.0001	0.0000
92	0.0001	0.0000
93	0.0001	0.0000
94	0.0001	0.0000
95	0.0001	0.0000
96	0.0001	0.0000
97	0.0001	0.0000
98	0.0001	0.0000
99	0.0001	0.0000
100	0.0001	0.0000
101	0.0001	0.0000
102	0.0001	0.0000
103	0.0001	0.0000
104	0.0001	0.0000
105	0.0001	0.0000
106	0.0001	0.0000
107	0.0001	0.0000
108	0.0001	0.0000
109	0.0001	0.0000
110	0.0001	0.0000
111	0.0001	0.0000
112	0.0001	0.0000
113	0.0001	0.0000
114	0.0001	0.0000
115	0.0001	0.0000
116	0.0001	0.0000
117	0.0001	0.0000
118	0.0001	0.0000
119	0.0001	0.0000
120	0.0001	0.0000
121	0.0001	0.0000
122	0.0001	0.0000
123	0.0001	0.0000
124	0.0001	0.0000
125	0.0001	0.0000
126	0.0001	0.0000
127	0.0001	0.0000
128	0.0001	0.0000
129	0.0001	0.0000
130	0.0001	0.0000
131	0.0001	0.0000
132	0.0001	0.0000
133	0.0001	0.0000
134	0.0001	0.0000
135	0.0001	0.0000
136	0.0001	0.0000
137	0.0001	0.0000
138	0.0001	0.0000
139	0.0001	0.0000
140	0.0001	0.0000
141	0.0001	0.0000
142	0.0001	0.0000
143	0.0001	0.0000
144	0.0001	0.0000

145	0.0001	0.0000
146	0.0001	0.0000
147	0.0001	0.0000
148	0.0001	0.0000
149	0.0001	0.0000
150	0.0001	0.0000
151	0.0001	0.0000
152	0.0001	0.0000
153	0.0001	0.0000
154	0.0001	0.0000
155	0.0001	0.0000
156	0.0001	0.0000
157	0.0001	0.0000
158	0.0000	0.0000

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0001	6332	0	0	Pass
0.0001	6183	0	0	Pass
0.0001	5828	0	0	Pass
0.0001	5534	0	0	Pass
0.0001	5227	0	0	Pass
0.0001	4917	0	0	Pass
0.0001	4610	0	0	Pass
0.0001	4313	0	0	Pass
0.0001	4152	0	0	Pass
0.0001	3935	0	0	Pass
0.0001	3661	0	0	Pass
0.0001	3430	0	0	Pass
0.0001	3207	0	0	Pass
0.0001	3039	0	0	Pass
0.0001	2874	0	0	Pass
0.0001	2792	0	0	Pass
0.0001	2656	0	0	Pass
0.0001	2524	0	0	Pass
0.0001	2385	0	0	Pass
0.0001	2254	0	0	Pass
0.0001	2147	0	0	Pass
0.0001	1980	0	0	Pass
0.0001	1917	0	0	Pass
0.0001	1793	0	0	Pass
0.0001	1683	0	0	Pass
0.0001	1570	0	0	Pass
0.0001	1460	0	0	Pass
0.0001	1342	0	0	Pass
0.0001	1224	0	0	Pass
0.0001	1162	0	0	Pass
0.0001	1074	0	0	Pass
0.0001	993	0	0	Pass
0.0001	918	0	0	Pass
0.0001	821	0	0	Pass

0.0001	750	0	0	Pass
0.0001	681	0	0	Pass
0.0001	645	0	0	Pass
0.0001	586	0	0	Pass
0.0001	545	0	0	Pass
0.0001	467	0	0	Pass
0.0001	373	0	0	Pass
0.0001	318	0	0	Pass
0.0001	265	0	0	Pass
0.0001	227	0	0	Pass
0.0001	169	0	0	Pass
0.0001	110	0	0	Pass
0.0001	38	0	0	Pass
0.0001	15	0	0	Pass
0.0001	15	0	0	Pass
0.0002	14	0	0	Pass
0.0002	14	0	0	Pass
0.0002	13	0	0	Pass
0.0002	12	0	0	Pass
0.0002	12	0	0	Pass
0.0002	12	0	0	Pass
0.0002	12	0	0	Pass
0.0002	12	0	0	Pass
0.0002	12	0	0	Pass
0.0002	12	0	0	Pass
0.0002	11	0	0	Pass
0.0002	11	0	0	Pass
0.0002	11	0	0	Pass
0.0002	11	0	0	Pass
0.0002	11	0	0	Pass
0.0002	11	0	0	Pass
0.0002	11	0	0	Pass
0.0002	11	0	0	Pass
0.0002	11	0	0	Pass
0.0002	11	0	0	Pass
0.0002	11	0	0	Pass
0.0002	11	0	0	Pass
0.0002	11	0	0	Pass
0.0002	11	0	0	Pass
0.0002	11	0	0	Pass
0.0002	11	0	0	Pass
0.0002	10	0	0	Pass
0.0002	10	0	0	Pass
0.0002	10	0	0	Pass
0.0002	10	0	0	Pass
0.0002	9	0	0	Pass
0.0002	9	0	0	Pass
0.0002	9	0	0	Pass
0.0002	9	0	0	Pass
0.0002	9	0	0	Pass
0.0002	9	0	0	Pass
0.0002	9	0	0	Pass
0.0002	9	0	0	Pass
0.0002	7	0	0	Pass
0.0002	7	0	0	Pass
0.0002	6	0	0	Pass
0.0002	6	0	0	Pass

0.0002	6	0	0	Pass
0.0002	6	0	0	Pass
0.0002	6	0	0	Pass
0.0002	6	0	0	Pass
0.0002	6	0	0	Pass
0.0002	6	0	0	Pass
0.0002	5	0	0	Pass
0.0002	5	0	0	Pass
0.0002	5	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 Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft.)	Cumulative Volume Infiltration Credit	Comment
Gravel Trench Bed 1 POC	N	17.47			N	
retention 1 POC	N	43.51			N	
Total Volume Infiltrated		60.98	0.00	0.00		

Percent 100.00 Volume 0.00 Infiltrated 0% Percent Treated No Treat. Credit
Compliance with LID Standard 8
Duration Analysis Result = Passed

Perlnd and Implnd Changes

No changes have been made.

WWHM2012
PROJECT REPORT

Project Name: 35043_7th
Site Name: 43rd Multi
Site Address:
City :
Report Date: 12/14/2021
Gage : 38 IN CENTRAL
Data Start : 10/01/1901
Data End : 09/30/2059
Precip Scale: 1.00
Version Date: 2018/10/10
Version : 4.2.16

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

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : Road_Lnd
Bypass: No

GroundWater: No

Pervious Land Use	acre
A B, Forest, Mod	.152
Pervious Total	0.152

Impervious Land Use	acre
Impervious Total	0
Basin Total	0.152

Element Flows To:

Surface	Interflow	Groundwater

Name : Pervious S/W
Bypass: No

GroundWater: No

Pervious Land Use	acre
A B, Forest, Mod	.052

Pervious Total	0.052

Impervious Land Use	acre
Impervious Total	0
Basin Total	0.052

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : Road_Lnd
Bypass: No

GroundWater: No

Pervious Land Use	acre
A B, Pasture, Flat	.032
Pervious Total	0.032

Impervious Land Use	acre
ROADS FLAT	0.12
Impervious Total	0.12
Basin Total	0.152

Element Flows To:

Surface	Interflow	Groundwater
Surface retention 1	Surface retention 1	

Name : Pervious S/W
Bypass: No

GroundWater: No

Pervious Land Use	acre
Pervious Total	0

Impervious Land Use	acre
SIDEWALKS FLAT	0.052

Impervious Total	**0.052**
Basin Total	**0.052**

Element Flows To:

Surface	Interflow	Groundwater
Gravel Trench Bed 1	Gravel Trench Bed 1	

Name : Gravel Trench Bed 1
Bottom Length: 283.60 ft.
Bottom Width: 8.00 ft.
Trench bottom slope 1: 0.01 To 1
Trench Left side slope 0: 0.01 To 1
Trench right side slope 2: 0.01 To 1
Material thickness of first layer: 0.5
Pour Space of material for first layer: 0.33
Material thickness of second layer: 0
Pour Space of material for second layer: 0
Material thickness of third layer: 0
Pour Space of material for third layer: 0
Infiltration On
Infiltration rate: 2
Infiltration safety factor: 1
Total Volume Infiltrated (ac-ft.): 22.348
Total Volume Through Riser (ac-ft.): 0
Total Volume Through Facility (ac-ft.): 22.348
Percent Infiltrated: 100
Total Precip Applied to Facility: 0
Total Evap From Facility: 0
Discharge Structure
Riser Height: 0.49 ft.
Riser Diameter: 1000 in.

Element Flows To:

Outlet 1	Outlet 2

Gravel Trench Bed Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.052	0.000	0.000	0.000
0.0056	0.052	0.000	0.000	0.105
0.0111	0.052	0.000	0.000	0.105
0.0167	0.052	0.000	0.000	0.105
0.0222	0.052	0.000	0.000	0.105
0.0278	0.052	0.000	0.000	0.105
0.0333	0.052	0.000	0.000	0.105
0.0389	0.052	0.000	0.000	0.105
0.0444	0.052	0.000	0.000	0.105

0.0500	0.052	0.000	0.000	0.105
0.0556	0.052	0.001	0.000	0.105
0.0611	0.052	0.001	0.000	0.105
0.0667	0.052	0.001	0.000	0.105
0.0722	0.052	0.001	0.000	0.105
0.0778	0.052	0.001	0.000	0.105
0.0833	0.052	0.001	0.000	0.105
0.0889	0.052	0.001	0.000	0.105
0.0944	0.052	0.001	0.000	0.105
0.1000	0.052	0.001	0.000	0.105
0.1056	0.052	0.001	0.000	0.105
0.1111	0.052	0.001	0.000	0.105
0.1167	0.052	0.002	0.000	0.105
0.1222	0.052	0.002	0.000	0.105
0.1278	0.052	0.002	0.000	0.105
0.1333	0.052	0.002	0.000	0.105
0.1389	0.052	0.002	0.000	0.105
0.1444	0.052	0.002	0.000	0.105
0.1500	0.052	0.002	0.000	0.105
0.1556	0.052	0.002	0.000	0.105
0.1611	0.052	0.002	0.000	0.105
0.1667	0.052	0.002	0.000	0.105
0.1722	0.052	0.003	0.000	0.105
0.1778	0.052	0.003	0.000	0.105
0.1833	0.052	0.003	0.000	0.105
0.1889	0.052	0.003	0.000	0.105
0.1944	0.052	0.003	0.000	0.105
0.2000	0.052	0.003	0.000	0.105
0.2056	0.052	0.003	0.000	0.105
0.2111	0.052	0.003	0.000	0.105
0.2167	0.052	0.003	0.000	0.105
0.2222	0.052	0.003	0.000	0.105
0.2278	0.052	0.003	0.000	0.105
0.2333	0.052	0.004	0.000	0.105
0.2389	0.052	0.004	0.000	0.105
0.2444	0.052	0.004	0.000	0.105
0.2500	0.052	0.004	0.000	0.105
0.2556	0.052	0.004	0.000	0.105
0.2611	0.052	0.004	0.000	0.105
0.2667	0.052	0.004	0.000	0.105
0.2722	0.052	0.004	0.000	0.105
0.2778	0.052	0.004	0.000	0.105
0.2833	0.052	0.004	0.000	0.105
0.2889	0.052	0.005	0.000	0.105
0.2944	0.052	0.005	0.000	0.105
0.3000	0.052	0.005	0.000	0.105
0.3056	0.052	0.005	0.000	0.105
0.3111	0.052	0.005	0.000	0.105
0.3167	0.052	0.005	0.000	0.105
0.3222	0.052	0.005	0.000	0.105
0.3278	0.052	0.005	0.000	0.105
0.3333	0.052	0.005	0.000	0.105
0.3389	0.052	0.005	0.000	0.105
0.3444	0.052	0.005	0.000	0.105
0.3500	0.052	0.006	0.000	0.105
0.3556	0.052	0.006	0.000	0.105
0.3611	0.052	0.006	0.000	0.105

0.3667	0.052	0.006	0.000	0.105
0.3722	0.052	0.006	0.000	0.105
0.3778	0.052	0.006	0.000	0.105
0.3833	0.052	0.006	0.000	0.105
0.3889	0.052	0.006	0.000	0.105
0.3944	0.052	0.006	0.000	0.105
0.4000	0.052	0.006	0.000	0.105
0.4056	0.052	0.007	0.000	0.105
0.4111	0.052	0.007	0.000	0.105
0.4167	0.052	0.007	0.000	0.105
0.4222	0.052	0.007	0.000	0.105
0.4278	0.052	0.007	0.000	0.105
0.4333	0.052	0.007	0.000	0.105
0.4389	0.052	0.007	0.000	0.105
0.4444	0.052	0.007	0.000	0.105
0.4500	0.052	0.007	0.000	0.105
0.4556	0.052	0.007	0.000	0.105
0.4611	0.052	0.007	0.000	0.105
0.4667	0.052	0.008	0.000	0.105
0.4722	0.052	0.008	0.000	0.105
0.4778	0.052	0.008	0.000	0.105
0.4833	0.052	0.008	0.000	0.105
0.4889	0.052	0.008	0.000	0.105
0.4944	0.052	0.008	0.262	0.105
0.5000	0.052	0.008	0.885	0.105

Name : Bioretention 1
Bottom Length: 210.00 ft.
Bottom Width: 1.50 ft.
Material thickness of first layer: 0.25
Material type for first layer: SMMWW 12 in/hr
Material thickness of second layer: 1.5
Material type for second layer: SMMWW
Material thickness of third layer: 3.5
Material type for third layer: GRAVEL
Infiltration On
Infiltration rate: 2
Infiltration safety factor: 1
Total Volume Infiltrated (ac-ft.): 64.635
Total Volume Through Riser (ac-ft.): 0
Total Volume Through Facility (ac-ft.): 64.635
Percent Infiltrated: 100
Total Precip Applied to Facility: 19.624
Total Evap From Facility: 9.347
Underdrain not used
Discharge Structure
Riser Height: 0.499 ft.
Riser Diameter: 12 in.

Element Flows To:
Outlet 1 **Outlet 2**

Bioretention 1 Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.1193	0.0000	0.0000	0.0000
0.0687	0.1186	0.0001	0.0000	0.0000
0.1373	0.1170	0.0003	0.0000	0.0000
0.2060	0.1154	0.0004	0.0000	0.0000
0.2747	0.1138	0.0006	0.0000	0.0001
0.3434	0.1122	0.0008	0.0000	0.0003
0.4120	0.1107	0.0010	0.0000	0.0004
0.4807	0.1091	0.0012	0.0000	0.0007
0.5494	0.1075	0.0014	0.0000	0.0011
0.6180	0.1059	0.0017	0.0000	0.0016
0.6867	0.1044	0.0020	0.0000	0.0018
0.7554	0.1028	0.0022	0.0000	0.0026
0.8240	0.1012	0.0026	0.0000	0.0036
0.8927	0.0997	0.0029	0.0000	0.0039
0.9614	0.0981	0.0032	0.0000	0.0040
1.0301	0.0966	0.0036	0.0000	0.0048
1.0987	0.0950	0.0040	0.0000	0.0063
1.1674	0.0935	0.0044	0.0000	0.0075
1.2361	0.0919	0.0048	0.0000	0.0079
1.3047	0.0904	0.0052	0.0000	0.0099
1.3734	0.0889	0.0057	0.0000	0.0120
1.4421	0.0873	0.0062	0.0000	0.0126
1.5107	0.0858	0.0067	0.0000	0.0145
1.5794	0.0843	0.0072	0.0000	0.0146
1.6481	0.0828	0.0077	0.0000	0.0146
1.7168	0.0813	0.0083	0.0000	0.0146
1.7854	0.0798	0.0089	0.0000	0.0146
1.8541	0.0782	0.0095	0.0000	0.0146
1.9228	0.0767	0.0102	0.0000	0.0146
1.9914	0.0752	0.0108	0.0000	0.0146
2.0601	0.0737	0.0115	0.0000	0.0146
2.1288	0.0722	0.0122	0.0000	0.0146
2.1975	0.0708	0.0129	0.0000	0.0146
2.2661	0.0693	0.0137	0.0000	0.0146
2.3348	0.0678	0.0145	0.0000	0.0146
2.4035	0.0663	0.0152	0.0000	0.0146
2.4721	0.0648	0.0161	0.0000	0.0146
2.5408	0.0633	0.0169	0.0000	0.0146
2.6095	0.0619	0.0177	0.0000	0.0146
2.6781	0.0604	0.0186	0.0000	0.0146
2.7468	0.0589	0.0195	0.0000	0.0146
2.8155	0.0575	0.0204	0.0000	0.0146
2.8842	0.0560	0.0213	0.0000	0.0146
2.9528	0.0546	0.0223	0.0000	0.0146
3.0215	0.0531	0.0233	0.0000	0.0146
3.0902	0.0517	0.0243	0.0000	0.0146
3.1588	0.0502	0.0253	0.0000	0.0146
3.2275	0.0488	0.0263	0.0000	0.0146
3.2962	0.0474	0.0274	0.0000	0.0146
3.3648	0.0459	0.0296	0.0000	0.0146
3.4335	0.0445	0.0318	0.0000	0.0146
3.5022	0.0431	0.0340	0.0000	0.0146
3.5709	0.0417	0.0363	0.0000	0.0146
3.6395	0.0402	0.0386	0.0000	0.0146
3.7082	0.0388	0.0410	0.0000	0.0146

3.7769	0.0374	0.0435	0.0000	0.0146
3.8455	0.0360	0.0459	0.0000	0.0146
3.9142	0.0346	0.0484	0.0000	0.0146
3.9829	0.0332	0.0510	0.0000	0.0146
4.0515	0.0318	0.0536	0.0000	0.0146
4.1202	0.0304	0.0562	0.0000	0.0146
4.1889	0.0290	0.0589	0.0000	0.0146
4.2576	0.0276	0.0616	0.0000	0.0146
4.3262	0.0262	0.0644	0.0000	0.0146
4.3949	0.0249	0.0672	0.0000	0.0146
4.4636	0.0235	0.0701	0.0000	0.0146
4.5322	0.0221	0.0730	0.0000	0.0146
4.6009	0.0207	0.0760	0.0000	0.0146
4.6696	0.0194	0.0790	0.0000	0.0146
4.7383	0.0180	0.0820	0.0000	0.0146
4.8069	0.0167	0.0851	0.0000	0.0146
4.8756	0.0153	0.0882	0.0000	0.0146
4.9443	0.0139	0.0914	0.0000	0.0146
5.0129	0.0126	0.0946	0.0000	0.0146
5.0816	0.0112	0.0979	0.0000	0.0146
5.1503	0.0099	0.1012	0.0000	0.0146
5.2189	0.0086	0.1045	0.0000	0.0146
5.2500	0.0072	0.1061	0.0000	0.0146

Surface retention 1 Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Wetted Surface
5.2500	0.1193	0.1061	0.0000	0.0530	0.0000
5.3187	0.1209	0.1143	0.0000	0.0530	0.0000
5.3873	0.1225	0.1227	0.0000	0.0550	0.0000
5.4560	0.1241	0.1312	0.0000	0.0571	0.0000
5.5247	0.1257	0.1397	0.0000	0.0591	0.0000
5.5934	0.1274	0.1484	0.0000	0.0611	0.0000
5.6620	0.1290	0.1572	0.0000	0.0631	0.0000
5.7307	0.1306	0.1661	0.0000	0.0651	0.0000
5.7994	0.1322	0.1752	0.1198	0.0671	0.0000
5.8680	0.1338	0.1843	0.4315	0.0691	0.0000
5.9367	0.1355	0.1935	0.8316	0.0711	0.0000
6.0054	0.1371	0.2029	1.2563	0.0731	0.0000
6.0740	0.1387	0.2124	1.6422	0.0751	0.0000
6.1427	0.1404	0.2220	1.9384	0.0771	0.0000
6.2114	0.1420	0.2317	2.1292	0.0791	0.0000
6.2490	0.1429	0.2370	2.2952	0.0802	0.0000

Name : Surface retention 1

Element Flows To:

Outlet 1	**Outlet 2**
Bioretention 1	

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:0.204
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:0.032
Total Impervious Area:0.172

Flow Frequency Return Periods for Predeveloped. POC #1

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

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
1902	0.000	0.000
1903	0.000	0.000
1904	0.000	0.000
1905	0.000	0.000
1906	0.000	0.000
1907	0.000	0.000
1908	0.000	0.000
1909	0.000	0.000
1910	0.000	0.000
1911	0.000	0.000
1912	0.000	0.000
1913	0.000	0.000
1914	0.000	0.000
1915	0.000	0.000
1916	0.000	0.000
1917	0.000	0.000
1918	0.000	0.000
1919	0.000	0.000
1920	0.000	0.000
1921	0.000	0.000
1922	0.000	0.000
1923	0.000	0.000

1924	0.000	0.000
1925	0.000	0.000
1926	0.000	0.000
1927	0.000	0.000
1928	0.000	0.000
1929	0.000	0.000
1930	0.000	0.000
1931	0.000	0.000
1932	0.000	0.000
1933	0.000	0.000
1934	0.000	0.000
1935	0.000	0.000
1936	0.000	0.000
1937	0.000	0.000
1938	0.000	0.000
1939	0.000	0.000
1940	0.000	0.000
1941	0.000	0.000
1942	0.000	0.000
1943	0.000	0.000
1944	0.000	0.000
1945	0.000	0.000
1946	0.000	0.000
1947	0.000	0.000
1948	0.000	0.000
1949	0.000	0.000
1950	0.000	0.000
1951	0.000	0.000
1952	0.000	0.016
1953	0.000	0.000
1954	0.000	0.000
1955	0.000	0.000
1956	0.000	0.000
1957	0.000	0.000
1958	0.000	0.000
1959	0.000	0.000
1960	0.000	0.000
1961	0.000	0.000
1962	0.000	0.000
1963	0.000	0.000
1964	0.000	0.000
1965	0.000	0.000
1966	0.000	0.000
1967	0.000	0.000
1968	0.000	0.000
1969	0.000	0.000
1970	0.000	0.000
1971	0.000	0.000
1972	0.000	0.000
1973	0.000	0.000
1974	0.000	0.000
1975	0.000	0.000
1976	0.000	0.000
1977	0.000	0.000
1978	0.000	0.000
1979	0.000	0.000
1980	0.000	0.000

1981	0.000	0.000
1982	0.000	0.000
1983	0.000	0.000
1984	0.000	0.000
1985	0.000	0.000
1986	0.000	0.000
1987	0.000	0.000
1988	0.000	0.000
1989	0.000	0.000
1990	0.000	0.000
1991	0.000	0.000
1992	0.000	0.000
1993	0.000	0.000
1994	0.000	0.000
1995	0.000	0.000
1996	0.000	0.000
1997	0.000	0.000
1998	0.000	0.000
1999	0.000	0.000
2000	0.000	0.000
2001	0.000	0.000
2002	0.000	0.000
2003	0.000	0.000
2004	0.000	0.000
2005	0.000	0.000
2006	0.000	0.000
2007	0.000	0.000
2008	0.000	0.000
2009	0.000	0.000
2010	0.000	0.000
2011	0.000	0.000
2012	0.000	0.000
2013	0.000	0.000
2014	0.000	0.000
2015	0.000	0.000
2016	0.000	0.000
2017	0.000	0.000
2018	0.000	0.000
2019	0.000	0.000
2020	0.000	0.000
2021	0.000	0.000
2022	0.000	0.000
2023	0.000	0.000
2024	0.000	0.000
2025	0.000	0.000
2026	0.000	0.000
2027	0.000	0.000
2028	0.000	0.000
2029	0.000	0.000
2030	0.000	0.000
2031	0.000	0.000
2032	0.000	0.000
2033	0.000	0.000
2034	0.000	0.000
2035	0.000	0.000
2036	0.000	0.000
2037	0.000	0.000

2038	0.000	0.000
2039	0.000	0.000
2040	0.000	0.000
2041	0.000	0.000
2042	0.000	0.000
2043	0.000	0.000
2044	0.000	0.000
2045	0.000	0.000
2046	0.000	0.000
2047	0.000	0.000
2048	0.000	0.000
2049	0.000	0.000
2050	0.000	0.000
2051	0.000	0.000
2052	0.000	0.000
2053	0.000	0.000
2054	0.000	0.000
2055	0.000	0.000
2056	0.000	0.000
2057	0.000	0.000
2058	0.000	0.000
2059	0.001	0.000

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

Rank	Predeveloped	Mitigated
1	0.0008	0.0162
2	0.0005	0.0000
3	0.0003	0.0000
4	0.0002	0.0000
5	0.0002	0.0000
6	0.0002	0.0000
7	0.0002	0.0000
8	0.0002	0.0000
9	0.0002	0.0000
10	0.0002	0.0000
11	0.0002	0.0000
12	0.0002	0.0000
13	0.0002	0.0000
14	0.0002	0.0000
15	0.0002	0.0000
16	0.0002	0.0000
17	0.0002	0.0000
18	0.0002	0.0000
19	0.0002	0.0000
20	0.0002	0.0000
21	0.0002	0.0000
22	0.0002	0.0000
23	0.0002	0.0000
24	0.0002	0.0000
25	0.0002	0.0000
26	0.0002	0.0000
27	0.0002	0.0000
28	0.0002	0.0000
29	0.0002	0.0000
30	0.0002	0.0000

31	0.0002	0.0000
32	0.0002	0.0000
33	0.0002	0.0000
34	0.0002	0.0000
35	0.0002	0.0000
36	0.0002	0.0000
37	0.0002	0.0000
38	0.0002	0.0000
39	0.0002	0.0000
40	0.0002	0.0000
41	0.0002	0.0000
42	0.0002	0.0000
43	0.0002	0.0000
44	0.0002	0.0000
45	0.0002	0.0000
46	0.0002	0.0000
47	0.0002	0.0000
48	0.0002	0.0000
49	0.0002	0.0000
50	0.0002	0.0000
51	0.0002	0.0000
52	0.0002	0.0000
53	0.0002	0.0000
54	0.0002	0.0000
55	0.0002	0.0000
56	0.0002	0.0000
57	0.0002	0.0000
58	0.0002	0.0000
59	0.0002	0.0000
60	0.0002	0.0000
61	0.0002	0.0000
62	0.0002	0.0000
63	0.0002	0.0000
64	0.0002	0.0000
65	0.0002	0.0000
66	0.0002	0.0000
67	0.0002	0.0000
68	0.0002	0.0000
69	0.0002	0.0000
70	0.0002	0.0000
71	0.0002	0.0000
72	0.0002	0.0000
73	0.0002	0.0000
74	0.0002	0.0000
75	0.0002	0.0000
76	0.0002	0.0000
77	0.0002	0.0000
78	0.0002	0.0000
79	0.0001	0.0000
80	0.0001	0.0000
81	0.0001	0.0000
82	0.0001	0.0000
83	0.0001	0.0000
84	0.0001	0.0000
85	0.0001	0.0000
86	0.0001	0.0000
87	0.0001	0.0000

88	0.0001	0.0000
89	0.0001	0.0000
90	0.0001	0.0000
91	0.0001	0.0000
92	0.0001	0.0000
93	0.0001	0.0000
94	0.0001	0.0000
95	0.0001	0.0000
96	0.0001	0.0000
97	0.0001	0.0000
98	0.0001	0.0000
99	0.0001	0.0000
100	0.0001	0.0000
101	0.0001	0.0000
102	0.0001	0.0000
103	0.0001	0.0000
104	0.0001	0.0000
105	0.0001	0.0000
106	0.0001	0.0000
107	0.0001	0.0000
108	0.0001	0.0000
109	0.0001	0.0000
110	0.0001	0.0000
111	0.0001	0.0000
112	0.0001	0.0000
113	0.0001	0.0000
114	0.0001	0.0000
115	0.0001	0.0000
116	0.0001	0.0000
117	0.0001	0.0000
118	0.0001	0.0000
119	0.0001	0.0000
120	0.0001	0.0000
121	0.0001	0.0000
122	0.0001	0.0000
123	0.0001	0.0000
124	0.0001	0.0000
125	0.0001	0.0000
126	0.0001	0.0000
127	0.0001	0.0000
128	0.0001	0.0000
129	0.0001	0.0000
130	0.0001	0.0000
131	0.0001	0.0000
132	0.0001	0.0000
133	0.0001	0.0000
134	0.0001	0.0000
135	0.0001	0.0000
136	0.0001	0.0000
137	0.0001	0.0000
138	0.0001	0.0000
139	0.0001	0.0000
140	0.0001	0.0000
141	0.0001	0.0000
142	0.0001	0.0000
143	0.0001	0.0000
144	0.0001	0.0000

145	0.0001	0.0000
146	0.0001	0.0000
147	0.0001	0.0000
148	0.0001	0.0000
149	0.0001	0.0000
150	0.0001	0.0000
151	0.0001	0.0000
152	0.0001	0.0000
153	0.0001	0.0000
154	0.0001	0.0000
155	0.0001	0.0000
156	0.0001	0.0000
157	0.0001	0.0000
158	0.0000	0.0000

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0000	64043	0	0	Pass
0.0000	61329	0	0	Pass
0.0000	58503	0	0	Pass
0.0000	55844	0	0	Pass
0.0000	53927	0	0	Pass
0.0000	51750	0	0	Pass
0.0000	49661	0	0	Pass
0.0000	47833	0	0	Pass
0.0000	46409	0	0	Pass
0.0000	44620	0	0	Pass
0.0000	42913	0	0	Pass
0.0000	41373	0	0	Pass
0.0000	40077	0	0	Pass
0.0000	38553	0	0	Pass
0.0000	37251	0	0	Pass
0.0000	36188	0	0	Pass
0.0000	35124	0	0	Pass
0.0000	34010	0	0	Pass
0.0000	32902	0	0	Pass
0.0000	32143	0	0	Pass
0.0000	31229	0	0	Pass
0.0000	30238	0	0	Pass
0.0000	29407	0	0	Pass
0.0000	28637	0	0	Pass
0.0000	27706	0	0	Pass
0.0000	26842	0	0	Pass
0.0000	26299	0	0	Pass
0.0000	25595	0	0	Pass
0.0000	24914	0	0	Pass
0.0000	24193	0	0	Pass
0.0000	23617	0	0	Pass
0.0000	23013	0	0	Pass
0.0000	22310	0	0	Pass
0.0000	21767	0	0	Pass

0.0000	21302	0	0	Pass
0.0000	20808	0	0	Pass
0.0000	20188	0	0	Pass
0.0000	19795	0	0	Pass
0.0000	19351	0	0	Pass
0.0000	18914	0	0	Pass
0.0000	18465	0	0	Pass
0.0000	18155	0	0	Pass
0.0000	17734	0	0	Pass
0.0000	17296	0	0	Pass
0.0000	16936	0	0	Pass
0.0000	16581	0	0	Pass
0.0000	16216	0	0	Pass
0.0000	15845	0	0	Pass
0.0000	15568	0	0	Pass
0.0000	15252	0	0	Pass
0.0000	14903	0	0	Pass
0.0000	14581	0	0	Pass
0.0000	14260	0	0	Pass
0.0000	13900	0	0	Pass
0.0000	13656	0	0	Pass
0.0000	13340	0	0	Pass
0.0000	13097	0	0	Pass
0.0000	12875	0	0	Pass
0.0000	12598	0	0	Pass
0.0000	12388	0	0	Pass
0.0000	12088	0	0	Pass
0.0000	11850	0	0	Pass
0.0000	11629	0	0	Pass
0.0000	11468	0	0	Pass
0.0000	11224	0	0	Pass
0.0000	10997	0	0	Pass
0.0000	10737	0	0	Pass
0.0000	10565	0	0	Pass
0.0000	10321	0	0	Pass
0.0001	10077	0	0	Pass
0.0001	9878	0	0	Pass
0.0001	9678	0	0	Pass
0.0001	9496	0	0	Pass
0.0001	9313	0	0	Pass
0.0001	9197	0	0	Pass
0.0001	9047	0	0	Pass
0.0001	8908	0	0	Pass
0.0001	8759	0	0	Pass
0.0001	8620	0	0	Pass
0.0001	8476	0	0	Pass
0.0001	8360	0	0	Pass
0.0001	8249	0	0	Pass
0.0001	8105	0	0	Pass
0.0001	8005	0	0	Pass
0.0001	7867	0	0	Pass
0.0001	7767	0	0	Pass
0.0001	7645	0	0	Pass
0.0001	7523	0	0	Pass
0.0001	7385	0	0	Pass
0.0001	7280	0	0	Pass
0.0001	7185	0	0	Pass

0.0001	7069	0	0	Pass
0.0001	6975	0	0	Pass
0.0001	6875	0	0	Pass
0.0001	6753	0	0	Pass
0.0001	6631	0	0	Pass
0.0001	6548	0	0	Pass
0.0001	6465	0	0	Pass
0.0001	6393	0	0	Pass
0.0001	6294	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	Total Volume Percent Treatment? Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft.)	Cumulative Volume Infiltration Credit	Comment
Gravel Trench Bed 1 POC	N	20.34			N	
100.00						
retention 1 POC	N	58.82			N	
100.00						
Total Volume Infiltrated		79.15	0.00	0.00		
100.00 0.00	0%	No Treat. Credit				

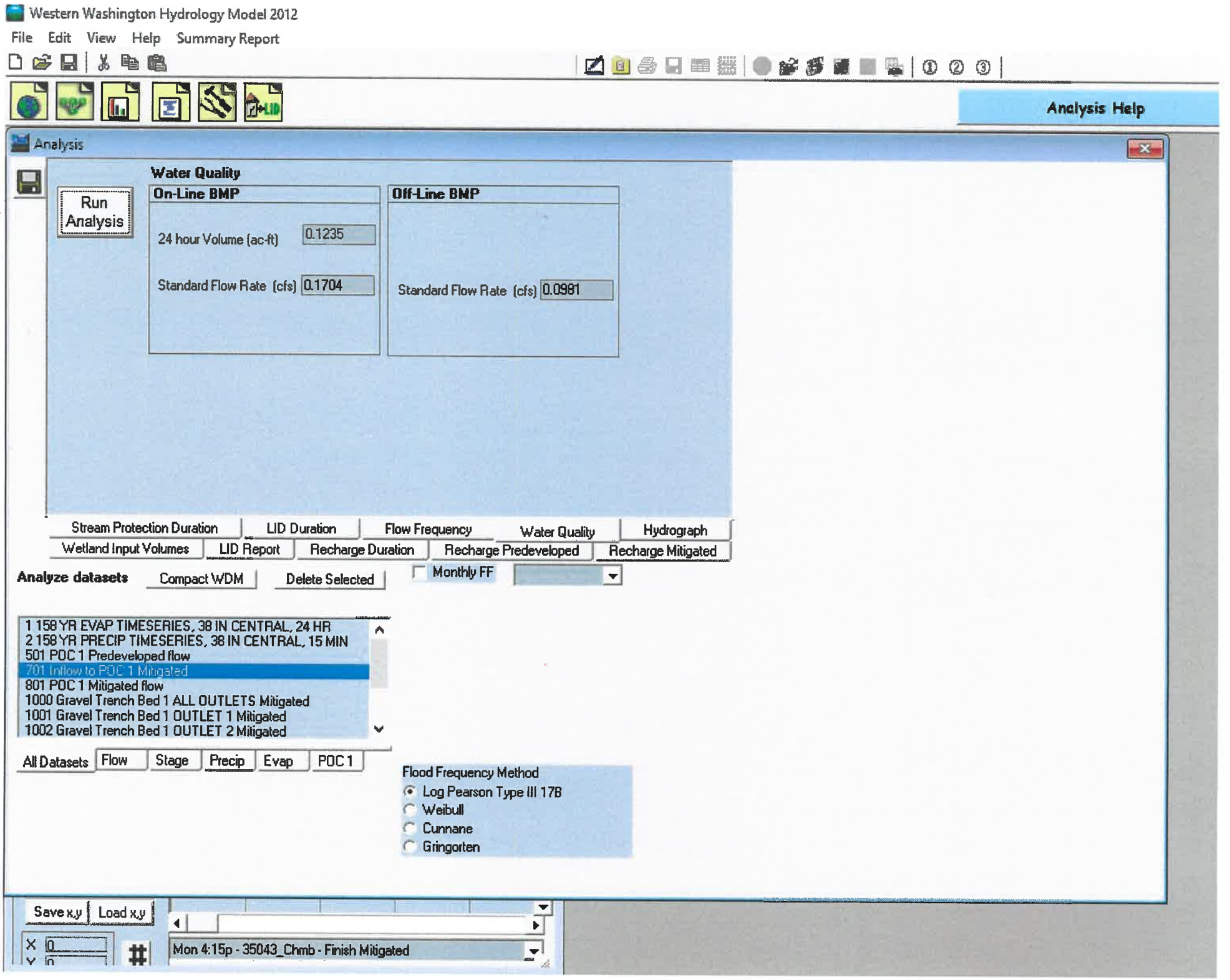
Compliance with LID Standard 8
Duration Analysis Result = Passed

Perlnd and Implnd Changes

No changes have been made.

WATER QUALITY TREATMENT CALCULATIONS

(FINAL SIZING/ANALYSIS TO BE PROVIDED WITH SITE DEVELOPMENT PERMIT)


Western Washington Hydrology Model 2012
File Edit View Help Summary Report
Analysis Help
Analysis
Water Quality
Run Analysis
On-Line BMP
24 hour Volume (ac-ft) 0.1235
Standard Flow Rate (cfs) 0.1704
Off-Line BMP
Standard Flow Rate (cfs) 0.0981
Stream Protection Duration
LID Duration
Flow Frequency
Water Quality
Hydrograph
Wetland Input Volumes
LID Report
Recharge Duration
Recharge Predeveloped
Recharge Mitigated
Analyze datasets
Compact WDM
Delete Selected
Monthly FF
1 158 YR EVAP TIMESERIES, 38 IN CENTRAL, 24 HR
2 158 YR PRECIP TIMESERIES, 38 IN CENTRAL, 15 MIN
501 POC 1 Predeveloped flow
701 Inflow to POC 1 Mitigated
801 POC 1 Mitigated flow
1000 Gravel Trench Bed 1 ALL OUTLETS Mitigated
1001 Gravel Trench Bed 1 OUTLET 1 Mitigated
1002 Gravel Trench Bed 1 OUTLET 2 Mitigated
All Datasets
Flow
Stage
Precip
Evap
POC 1
Flood Frequency Method
Log Pearson Type III 17B
Weibull
Cunnane
Gringorten
Save x,y
Load x,y
Mon 4:15p - 35043_Chmb - Finish Mitigated

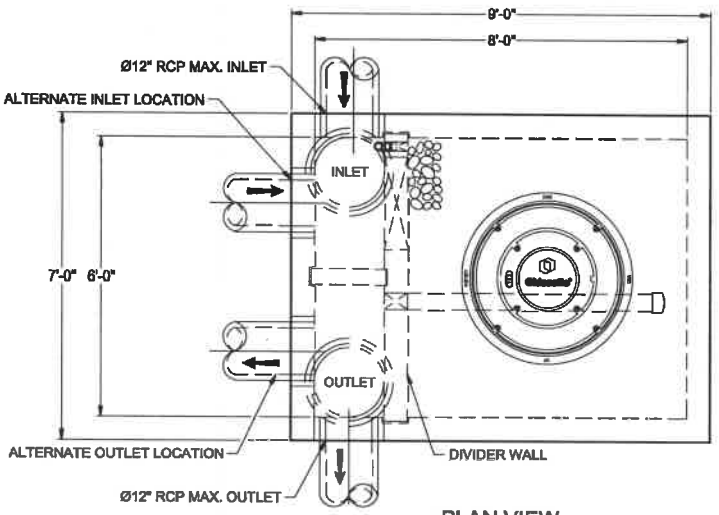
SITE SPECIFIC DATA	
Structure ID	ID
Treatment Flow Rate (cfs)	-
Peak Flow Rate (cfs)	-
Rim Elevation	-
Top of Vault Elevation	-

Pipe Data	Pipe Location	Pipe Size	Pipe Type	Invert Elevation
Inlet	-	-	-	-
Outlet	-	-	-	-

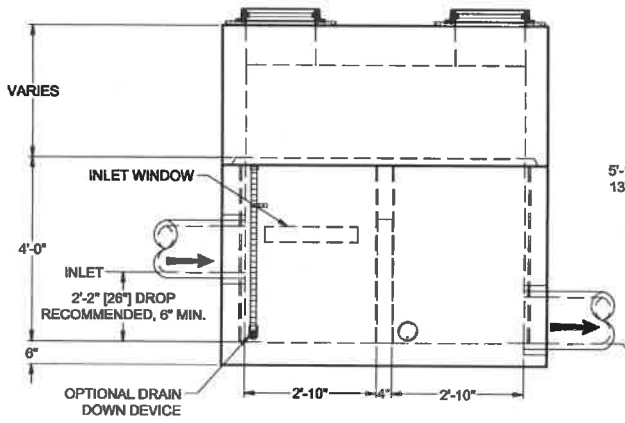
Notes:

PERFORMANCE SPECIFICATIONS	
Treatment Flow Capacities:*	
NJDEP 80% Removal, 75 micron	0.144 cfs
WA Ecology GULD - Basic, Enhanced & Phosphorus	0.128 cfs
Bypass Capacity	5.0 cfs

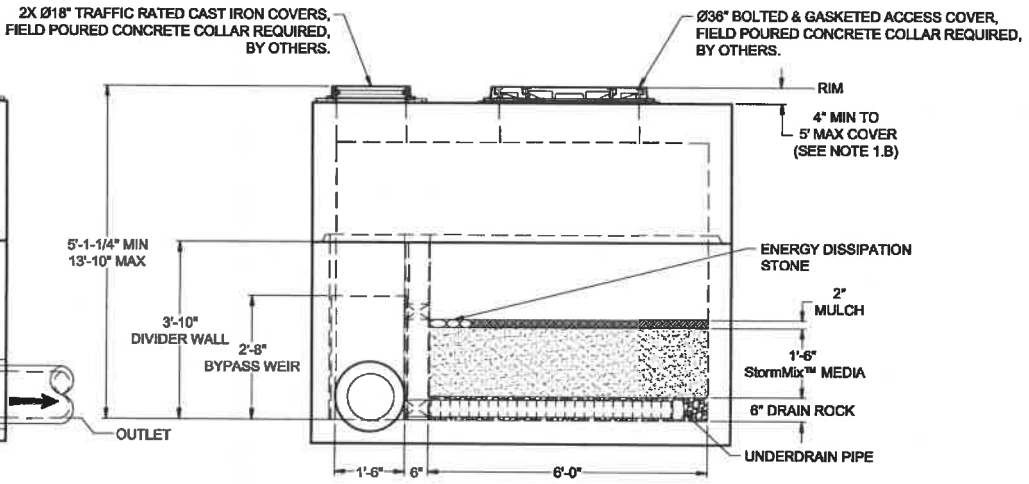
*Contact Oldcastle for alternative treatment flow capacities.



PLAN VIEW



LEFT END VIEW



ELEVATION VIEW

NOTES:

1. DESIGN LOADINGS:
   A. AASHTO HS-20-44 (WITH IMPACT)
   B. DESIGN SOIL COVER: 6'-0" MAXIMUM
   C. ASSUMED WATER TABLE: BELOW BASE OF PRECAST (ENGINEER-OF-RECORD TO CONFIRM SITE WATER TABLE ELEVATION)
   D. LATERAL EARTH PRESSURE: 45 PCF (DRAINED)
   E. LATERAL LIVE LOAD SURCHARGE: 80 PSF (APPLIED TO 8'-0" BELOW GRADE)
   F. NO LATERAL SURCHARGE FROM ADJACENT BUILDINGS, WALLS, PIERS, OR FOUNDATIONS.
2. CONCRETE 28-DAY MINIMUM COMPRESSIVE STRENGTH: 5,000 PSI MINIMUM.
3. REINFORCING: REBAR, ASTM A615/A706, GRADE 60
4. CEMENT: ASTM C150
5. REQUIRED ALLOWABLE SOIL BEARING CAPACITY: 2,500 PSF
6. REFERENCE STANDARD:
   A. ASTM C890
   B. ASTM C913
   C. ACI 318-14
7. THIS STRUCTURE IS DESIGNED TO THE PARAMETERS NOTED HEREIN. ENGINEER-OF-RECORD SHALL VERIFY FY THAT NOTED PARAMETERS MEET OR EXCEED PROJECT REQUIREMENTS. IF DESIGN PARAMETERS ARE INCORRECT, REVIEWING ENGINEER/AUTHORITY SHALL NOTIFY OLDCASTLE INFRASTRUCTURE UPON REVIEW.
8. INLET AND OUTLET HOLES WILL BE FACTORY CORED/CAST PER PLANS AND CUSTOMER REQUIREMENTS. INLET AND OUTLET LOCATIONS CAN BE MIRRORED.
9. CONTRACTOR RESPONSIBLE TO VERIFY ALL SIZES, LOCATIONS, AND ELEVATIONS OF OPENINGS.
10. CONTRACTOR RESPONSIBLE TO ENSURE ADEQUATE BEARING SURFACE IS PROVIDED (I.E. COMPACTED AND LEVEL PER PROJECT SPECIFICATIONS).
11. SECTION HEIGHTS, SLAB/WALL THICKNESSES, AND KEYWAYS ARE SUBJECT TO CHANGE AS REQUIRED FOR SITE REQUIREMENTS AND/OR DUE TO PRODUCT AVAILABILITY AND PRODUCTION FACILITY CONSTRAINTS.
12. MAXIMUM PICK WEIGHTS*:
   A. TOP: XX,XXX LBS
   B. BASE: XX,XXX LBS*
   (* COMBINED WEIGHT OF BASE INCLUDES BYPASS WEIR, DIVIDER WALL, ROCK & MEDIA)
13. INTERNALS SHALL CONSIST OF UNDERDRAIN PIPE, ROCK, STORMMIX™ MEDIA, MULCH, DIVIDER WALL, BYPASS WEIR AND OPTIONAL DRAIN DOWN.

Oldcastle Infrastructure

BioPod™ Biofilter System (STANDARD)

Underground Vault with Internal Bypass

CUSTOMER
-

PROJECT NAME
-

SHEET NAME	REVISION	SHEET
Specifier Drawing BPU-68IB	- REV DATE -	1 OF 1

CONVEYANCE CALCULATIONS

(TO BE PROVIDED WITH SITE DEVELOPMENT PERMIT, IF REQUIRED)

APPENDIX D

(PRELIMINARY) GEOTECHNICAL REPORT

GEORESOURCES
earth science & geotechnical engineering
5007 Pacific Hwy E., Suite 16 | Fife, WA 98424 | 253.896.1011 | www.georesources.rocks

April 15, 2020

AVT Services, LLC
1633 S Geiger Street
Tacoma, Washington 98465
(253) 579-8018
Vtcaci1978@yahoo.com

Geotechnical Engineering Report
Proposed Multi-Family Development
xxx- 7th Street Southwest
Puyallup, Washington
PN: 4320000160
Doc ID: AVTServices.7thStSW.RG

INTRODUCTION

This geotechnical engineering report summarizes our site observations, our subsurface explorations, geotechnical data review and engineering analyses, and provides geotechnical recommendations and design criteria for the proposed multi-family residential development to be constructed on the above referenced parcel. Our understanding of the project is based on our discussions with the project owner, Mr. Vladimir Tkach and the project Civil Engineer, Mr. Tres Kirkebo, our experience in the site area, and our understanding of the City of Puyallup Critical Areas and development codes. We understand the current proposal is to construct a multi-family residential development at the site that includes four new structures, and a paved parking area. We anticipate each new structure will be two to three stories, with 12 to 18 units each, and will be of wood frame construction founded on shallow spread footings. Additional development will include typical underground utilities and a stormwater facility. Based on the proposed site plan, we anticipate the stormwater facility will be constructed below grade, within the parking area.

SCOPE

The scope of our services was to evaluate the surface and subsurface conditions across the site as a basis for developing recommendations and conclusions to aid in development of the site, including addressing potential geologic hazards and the potential for stormwater infiltration. Specifically, the scope of services included the following:

1. Reviewing the readily available geologic, hydrogeologic and geotechnical data for the site area;
2. Conducting a geologic reconnaissance of the site area;
3. Exploring the subsurface conditions by monitoring the excavation of six test pits at the site with a subcontracted backhoe to depths of 8 to 12 feet;
4. Collecting soil samples from the explorations and conducting two grain size analyses on selected samples;

5. Installing open standpipe piezometers at one test pit location to a depth of 10 feet.
6. Return to the site to collect water level data from the piezometer during the wet season
7. Addressing the appropriate criteria for potential geologic hazards per the current City of Puyallup Municipal Code (PMC) Chapter 21.06 Geologically Hazardous Areas;
8. Providing recommendations for development on or near sloping ground based on City of Puyallup development codes;
9. Providing recommended seismic design criteria, including seismic site class;
10. Providing geotechnical conclusions for shallow foundation design, including allowable bearing capacity;
11. Providing recommendations for earthwork including site preparation, fill placement and compaction and an evaluation of on-site materials for use as structural fill;
12. Performing one small scale pilot infiltration test (PIT) at the site;
13. Providing our evaluation of site drainage issues, including an evaluation of the feasibility of onsite infiltration of stormwater or the use of Low Impact Development best management practices;
14. Preparing a written Geotechnical *Engineering Report* summarizing our site observations and conclusions, and our geotechnical recommendations and design criteria, along with the supporting data.

The above scope of work was summarized in our Proposal for Geotechnical Engineering Services dated February 20, 2020. We received written authorization to proceed with our scope of services from you the same day.

SITE CONDITIONS

Surface Conditions

The site is an unaddressed parcel located adjacent west of the existing single-family residence at 629 – 43rd Avenue southwest in Puyallup, Washington. Based on information obtained from Pierce County Public GIS the site is generally rectangular in shape, measures approximately 305 feet wide (north to south) by 240 feet deep (east to west) and encompasses approximately 1.67 acres. The site is bounded by existing multi-family residential development to the north, existing single-family residences to the west, 43rd Avenue Southwest to the south, and 7th Street Southwest to the east.

Based on topographic data obtained from the Pierce County Public GIS website and our site observations, other than a small open depression along 7th Street Southwest, the ground surface of the site generally slopes up in all directions towards the center of the site at 20 to 35 percent. These slopes truncate somewhat abruptly and then slope down towards the center of the site in all directions at 50 to more than 100 percent, forming a topographic depression approximately 6 to 12 feet in depth. Along the northern property boundary, the site slopes down to the north at 30 to 40 percent. This slope continues offsite and steepens to approximately 100 percent. Total topographic relief across the site is on the order of 14 to 18 feet. Topographic relief of the steep offsite slope is on the order of 14 to 32 feet. The existing site topography is shown on the Site and Exploration Map, Figure 2.

Vegetation across the site generally consists of a dense to very dense stand of mature conifers with a typical understory of native and invasive plants and shrubs. No areas of seeps, springs, or standing water were observed at the time of our reconnaissance. No areas of erosion or slope instability

were noted at the site at the time of our reconnaissance.

Site Soils

The USDA Natural Resources Conservation Service (NRCS) Web Soil Survey maps the site as being underlain by Everett very gravelly sandy loam (13B) soils. The Everett very gravelly sandy loam soils are derived from sandy and gravelly glacial outwash, form on slopes of 0 to 8 percent, have a "slight" erosion hazard when exposed, and are included in hydrologic soils group A. A copy of the soils map for the site area is shown as Figure 3.

Site Geology

The draft *Geologic Map of the Puyallup 7.5-minute Quadrangle, Washington* by K. W. Troost (in review) maps the site as being underlain by Steilacoom Gravel-Bradley Channel ($Qvsb_2$). Steilacoom gravel is described as consisting of gravel and cobbles with lesser amounts of poorly to well sorted sand, deposited by episodic discharges from glacial Lake Puyallup. The Steilacoom gravel deposits are generally in a medium dense condition and considered normally consolidated. An excerpt of the above referenced geologic map is included as Figure 4.

Subsurface Explorations

On February 22, 2020, a GeoResources geologist was on site and monitored the excavation of 6 test pits to a depth of 6 to 9.5 feet below existing ground surface. The test pit explorations were excavated by a small track-mounted machine (Cat 304) and operator provided by you. The specific number, locations, and depths of our explorations were selected by GeoResources personnel based on the configuration of the proposed development and were adjusted in the field based on site access limitations. Our exploration locations were limited by the dense spacing of mature conifers and steep slopes the track-mounted machine could not negotiate. Our geologist continuously monitored the explorations, maintained logs of the subsurface conditions encountered, obtained representative soil samples, and observed pertinent site features. The soil densities presented on the logs was based on the difficulty of excavation and our experience. Representative soil samples obtained from the explorations were placed in sealed containers and taken to our laboratory for further examination and testing as deemed necessary. Each test pit was then backfilled and bucket tamped in place, but not otherwise compacted.

The subsurface explorations excavated as part of this evaluation indicate the subsurface conditions at specific locations only, as actual subsurface conditions can vary across the site. Furthermore, the nature and extent of such variation would not become evident until additional explorations are performed or until construction activities have begun. Given the access limitations at the time of exploration, we recommend additional explorations are performed prior to final design or construction.

The soils encountered were visually classified in accordance with the Unified Soil Classification System (USCS) and ASTM D: 2488. The USCS is included in Appendix A as Figure A-1. The approximate locations of our explorations are indicated on the attached Site and Exploration Map, Figure 2, while the descriptive logs of our explorations and are included in Appendix A. The exploration locations were determined by taping, pacing, and estimating from permanent site features or by terrain association. The approximate elevation of each exploration was determined by interpolating between contours shown on Pierce County public GIS data. Accordingly, the locations and elevations of our explorations should only be considered accurate to the degree implied by our measurement methods.

Subsurface Conditions

The soils encountered at the site generally consist of brown poorly graded gravel with silt and sand with some occasional cobbles and trace boulders in a medium dense to dense, moist condition. We interpret these soils to be consistent with gravelly recessional outwash soils. These soils were encountered in all of our test pits and were encountered to the full extent explored in test pits TP-2, TP-3, and TP-5. In test pits TP-1, TP-4, TP-6 we observed tan poorly graded sand in a medium dense, moist condition underlying the gravelly recessional outwash. We interpret these soils to be consistent with sandy recessional outwash. These soils were encountered to the full extent explored in test pits TP-1, TP-4, and TP-6. We interpret subsurface conditions to consist of three soil units: topsoil, gravelly recessional outwash, and sandy recessional outwash.

Laboratory Testing

Geotechnical laboratory tests were performed on select samples retrieved from the borings and test pits to determine soil index and engineering properties encountered. Laboratory testing included visual soil classification per ASTM D: 2488, moisture content determinations per ASTM D: 2216, and grain size analyses per ASTM D: 6913 standard procedures. The results of the laboratory tests are included in Appendix B.

Groundwater Conditions

No groundwater or evidence of groundwater was observed within the depth explored at the time of excavation. Based on the nature of the near surface soils, we anticipate fluctuations in the local groundwater levels may occur in response to precipitation patters, off-site construction activities, and site utilization. Based on our experience in the area and our review of water well logs within the site vicinity, we anticipate that the regional groundwater table is many tens of feet below the existing ground surface.

ENGINEERING CONCLUSIONS AND RECOMMENDATIONS

Based on the results of our data review, site reconnaissance, subsurface explorations and our experience in the area, it is our opinion that the site is suitable for the proposed development. Pertinent conclusions and geotechnical recommendations regarding the design and construction of the proposed development are presented below.

Landslide Hazards per PMC 21.06.1210(3)(b)

The PMC defines landslide hazard areas as areas subject to landslides based on a combination of geologic, topographic, and hydrologic factors. They include any areas susceptible to landslide

because of any combination of bedrock, soil, slope (gradient), slope aspect, structure, hydrology, or other factors, and include, at a minimum, the following:

1. Areas of historic failures, such as:
    a. Those areas delineated by the United States Department of Agriculture Natural Resources Conservation Service as having a significant limitation for building site development;
    b. Those coastal areas mapped as class u (unstable), uos (unstable old slides), and urs (unstable recent slides) in the Department of Ecology Washington coastal atlas; or
    c. Areas designated as quaternary slumps, earthflows, mudflows, lahars, or landslides on maps published by the United States Geological Survey or Washington Department of Natural Resources.
2. Areas with all three of the following characteristics:
    a. Slopes steeper than 15 percent;
    b. Hillsides intersecting geologic contacts with a relatively permeable sediment overlying a relatively impermeable sediment or bedrock; and
    c. Springs or groundwater seepage.
3. Areas that have shown movement during the holocene epoch (from 10,000 years ago to the present) or which are underlain or covered by mass wastage debris of this epoch;
4. Slopes that are parallel or subparallel to planes of weakness (such as bedding planes, joint systems, and fault planes) in subsurface materials;
5. Slopes having gradients steeper than eighty percent subject to rockfall during seismic shaking
6. Areas potentially unstable as a result of rapid stream incision, stream bank erosion, and undercutting by wave action, including stream channel migration zones;
7. Areas that show evidence of, or are at risk from snow avalanches;
8. Areas located in a canyon or on an active alluvial fan, presently or potentially subject to inundation by debris flows or catastrophic flooding; and
9. Any area with a slope of 40 percent or steeper and with a vertical relief of 10 or more feet except areas composed of bedrock. A slope is delineated by establishing its toe and top and measured by averaging the inclination over at least 10 feet of vertical relief.

PMC Chapter 21.06.1210(3)(b) uses the above referenced 9 item checklist to define a landslide hazard area. Based on our observations of the site and review of published information, we offer the following comments.

No areas of the site are delineated by the United Stated Department of Agriculture Natural Resources Conservation Service as having a significant limitation for building site development. The site is not in a coastal area and is not mapped in the Washington Department of Ecology Coastal Atlas. No areas of the site or site area are designated as quaternary slumps, earthflows, mudflows, lahars, or landslides. No areas at the site are mapped as having shown movement during the Holocene epoch or underlain or covered by mass wastage debris. No planes of weakness, slopes steeper than 80 percent subject to rockfall during seismic shaking, areas potentially unstable as a result of rapid stream incision, stream bank erosion, and undercutting by wave action were observed at the site. The site is not at risk from snow avalanches, located in a canyon or active alluvial fan, subject to inundation by debris flow or catastrophic flooding. There are areas of slopes steeper than 40 percent with more than 10 feet of vertical relief.

Based on the above, the site exhibits one of above landslide hazard indicators on or within 200 feet of the site (slopes with inclinations greater than 40 percent with a vertical of relief of more than 10 feet. In accordance with PMC 21.06.1240, a 25-foot native vegetation buffer should be established from the top of any portion of the steep slope area in the northern portion of the site that is steeper than 40 percent with a vertical height of more than 10 feet. We anticipate the site will be regraded to a generally level condition to accommodate the development. Regrading should effectively reduce any hazard associated with these slopes. The slopes around the central depression have a vertical height of 10 feet or less. Accordingly, regrading should be allowed per PMC 21.06.1240.

Seismic Hazards per PMC 21.06.1210(3)(c)

The PMC defines seismic hazard areas as "areas subject to severe risk of damage as a result of earthquake-induced ground shaking, slope failure, settlement, soil liquefaction, lateral spreading, or surface faulting. Settlement and soil liquefaction conditions occur in areas underlain by cohesionless, loose, or soft-saturated soils of low density, typically in association with a shallow ground water table".

Liquefaction is a phenomenon where there is a reduction or complete loss of soil strength due to an increase in pore water pressure. The increase in pore water pressure is induced by seismic vibrations. Liquefaction mainly affects geologically recent deposits of loose, fine-grained sands that located below the groundwater table. The soils observed at the site generally consisted gravelly outwash soils. Additionally, the site is located within an area mapped as having a very low susceptibility to liquefaction. An excerpt from the published liquefaction susceptibility map for the site area is included as Figure 6. In our opinion, the potential for liquefaction and lateral spreading is not significant because of the gravelly nature of the on-site soils and lack of a shallow groundwater table.

The ground surface within the site boundaries consists of moderate slopes that we anticipate will be regraded to a generally level condition; therefore, the potential for earthquake-induced slope instability on the site is low. The prescriptive 25-foot native vegetation buffer should ameliorate the potential hazards of earthquake induced slope stability of the on and offsite northern steep slope. The site is approximately X miles from the nearest mapped location of the Tacoma fault and no evidence of ground fault rupture was observed during our site reconnaissance. Therefore, in our opinion the potential for ground surface fault rupture is also low.

Volcanic Hazards per PMC 21.06.1210(3)(d)

The PMC defines volcanic hazard areas as "those areas subject to pyroclastic flows, lava flows, debris avalanche, and inundation by debris flows, lahars, mudflows, or related flooding resulting from volcanic activity". Volcanic hazard areas shall be classified as Case I or Case II lahars, as identified in the report Sedimentology, Behavior, and Hazards of Debris Flows at Mount Rainier, Washington, U.S. Geological Survey Professional Paper 1547, 1995. The site is not mapped as being in an area of the lahar flow path from Mt Rainer, as mapped by the Washington Department of Natural Resources. Accordingly, the risk of inundation via lahar, mudflow, or lava flow should be considered low. An excerpt from The Volcanic Hazard Areas map (WA State DNR) for the site area is provided as Figure 7.

Recommended Setback

Proposed structures may require a building setback from slopes steeper than 3H:1V (Horizontal: Vertical) percent to satisfy requirements of the International Building Code (IBC) Section

1805. The typical IBC setback from the top of the slope equals the lesser of one third the height of the slope or 40 feet unless evaluated and reduced, and/or a "structural setback" is provided, by a licensed geotechnical engineer. Based on the vertical height of the steep slope area north of the site, an IBC building setback of 5 to 12 feet would be required. However, it is our opinion the prescriptive 25-foot native vegetation buffer provides

Seismic Design

Based on our observations and the subsurface units mapped at the site, we interpret the structural site conditions to correspond to a seismic Site Class "D" in accordance with the 2015 IBC documents and American Society of Civil Engineers (ASCE) standard 7-10 Chapter 20 Table 20.3-1. This is based on the soil types encountered in the site area. These conditions were assumed to be representative for the subsurface conditions for the site. The U.S. Geological Survey (USGS) completed probabilistic seismic hazard analyses (PSHA) for the entire country in November 1996, which were updated and republished in 2002 and 2008. We used the *ATC Hazard by Location* website to estimate seismic design parameters at the site. Table 1, below, summarizes the recommended design parameters.

TABLE1:
2015 IBC Parameters for Design of Seismic Structures

Spectral Response Acceleration (SRA) and Site Coefficients	Short Period	1 Second Period
Mapped SRA	S_s = 1.247	S_1 = 0.48
Site Coefficients (Site Class C)	F_a = 1.001	F_v = 1.52
Maximum Considered Earthquake SRA	S_{MS} = 1.248	S_{M1} = 0.729
Design SRA	S_{DS} = 0.832	S_{D1} = 0.486

The mapped peak ground acceleration (PGA) for this site is 0.50g. To account for site class, the PGA is multiplied by a site amplification factor (F_{PGA}) of 1.0. The resulting site modified peak ground acceleration (PGA_M) is 0.50g. In general, estimating seismic earth pressures (k_h) by the Mononobe-Okabe method or seismic inputs for slope stability analysis are taken as 30 to 50 percent of the PGA_M, or 0.15g to 0.25g.

Foundation Support

Based on the subsurface conditions encountered at the locations explored, we recommend that spread footings be founded on the medium dense native gravelly recessional outwash soils, or on structural fill that extends to suitable native soils.

The soil at the base of the footing excavations should be disturbed as little as possible. All loose, soft or unsuitable material should be removed from the excavation. A representative from our firm should observe the foundation excavations to determine if suitable bearing surfaces have been prepared.

We recommend a minimum width of 24 inches for isolated footings and at least 16 inches for continuous wall footings. All footing elements should be embedded at least 18 inches below grade for frost protection. Footings founded on the native, undisturbed outwash soils or appropriately prepared structural fill can be designed using an allowable soil bearing capacity of 3,000 psf (pounds per square foot) for combined dead and long-term live loads. The weight of the footing and any overlying backfill may be neglected. The allowable bearing value may be increased by one-third for transient loads such as those induced by seismic events or wind loads.

Lateral loads may be resisted by friction on the base of footings and floor slabs and as passive pressure on the sides of footings. We recommend that an allowable coefficient of friction of 0.35 be used to calculate friction between the concrete and the underlying soil. Passive pressure may be determined using an allowable equivalent fluid density of 350 pcf (pounds per cubic foot). Factors of safety have been applied to these values.

We estimate that settlements of footings designed and constructed as recommended will be on the order of 1 inch for the anticipated load conditions, with differential settlements between comparably loaded footings of 1/2 inch or less over a span of 50 feet. Most of the settlements should occur essentially as loads are being applied. However, disturbance of the foundation subgrade during construction could result in larger settlements than predicted.

Floor Slab Support

Slab-on-grade floors, where constructed, should be supported on the native outwash soils or appropriately prepared structural fill.

We recommend that floor slabs be directly underlain by a minimum 6-inch thickness capillary break material such as coarse sand, pea gravel, or crushed rock containing less than 2 percent fines. The capillary break material should be placed in one lift and compacted to an unyielding condition.

A synthetic vapor retarder is recommended to control moisture migration through the slabs. This is of particular importance where the foundation elements are underlain by the silty alluvial subgrade, or where moisture migration through the slab is an issue, such as where adhesives are used to anchor carpet or tile to the slab or where slabs are present below heated, enclosed spaces.

A subgrade modulus of 300 pci (pounds per cubic inch) may be used for floor slab design. We estimate that settlement of the floor slabs designed and constructed as recommended, will be ½- inch or less over a span of 50 feet.

Subgrade/Basement Walls

Adequate drainage behind retaining structures is imperative. Positive drainage can be accomplished by placing a zone of drainage behind the walls. Granular drainage material should contain less than 2 percent fines and at least 30 percent greater than the US No. 4 sieve. A geocomposite drain mat may also be used instead of free draining soils, provided it is installed in accordance with the manufacturer's instructions. The soil drainage zone should extend horizontally at least 18 inches from the back of the wall and extend from the base of the wall to within 1 foot of the top of the wall. The soil drainage zone should be compacted to approximately 90 percent of the MDD (maximum dry density) as determined by ASTM D: 1557. Over-compaction should be avoided as this can lead to excessive lateral pressures. Typical wall drainage and backfilling details are shown in Figure 4. Recommended earth pressures for the native and fill soils are shown in Figure 5.

A minimum 4-inch diameter perforated or slotted PVC pipe should be placed in the drainage zone along the base and behind the wall to provide an outlet for accumulated water and direct accumulated water to an appropriate discharge location. We recommend that a nonwoven geotextile filter fabric be placed between the soil drainage material and the remaining wall backfill to reduce silt migration into the drainage zone. The infiltration of silt into the drainage zone can, with time, reduce the permeability of the granular material. The filter fabric should be placed such that it fully separates the drainage material and the backfill and should be extended over the top of the drainage zone.

For walls backfilled with granular well-drained soil and a level backslope, the design active pressure may be taken as 35 pcf (equivalent fluid density). For walls that are braced or otherwise restrained, the design active pressure may be taken as 55 pcf. For the condition of an inclined back slope, higher lateral pressures would act on the walls. For a 3H:1V (Horizontal to Vertical) slope above the wall, the active pressure may be taken as 48 pcf; for a 2H:1V back slope condition, a wall design pressures of 55 pcf may be assumed If basement walls taller than 6 feet are required, as seismic surcharge of 10H should be included where required by the code. If walls will be constructed with a backslope and will be braced or otherwise restrained against movement, we should be notified so that we can evaluate the anticipated conditions and recommend an appropriate at-rest earth pressure.

Lateral loads may be resisted by friction on the base of footings and as passive pressure on the sides of footings and the buried portion of the wall, as described in the "**Foundation Support**" section.

Temporary Excavations

All job site safety issues and precautions are the responsibility of the contractor providing services/work. The following cut/fill slope guidelines are provided for planning purposes only. Temporary cut slopes will likely be necessary during grading operations or utility installation. All excavations at the site associated with confined spaces, such as utility trenches and retaining walls, must be completed in accordance with local, state, or federal requirements including Washington Administrative Code (WAC) and Washington Industrial Safety and Health Administration (WISHA). Excavation, trenching, and shoring is covered under WAC 296-155 Part N.

Based on WAC 296-155-66401, it is our opinion that the medium dense recessional and outwash soils on the site would be classified as Type C soils. According to WAC 296-155-66403, for temporary excavations of less than 20 feet in depth, the side slopes in Type C soils should be sloped at a maximum inclination of 1½H:1V or flatter from the toe to top of the slope. All exposed slope faces should be covered with a durable reinforced plastic membrane during construction to prevent slope raveling and rutting during periods of precipitation. These guidelines assume that all surface loads are kept at a minimum distance of at least one half the depth of the cut away from the top of the slope and that significant seepage is not present on the slope face. Flatter cut slopes will be necessary where significant raveling or seepage occurs, or if construction materials will be stockpiled along the slope crest.

Where it is not feasible to slope the site soils back at these inclinations, a retaining structure should be considered. Retaining structures greater than 4-feet in height (bottom of footing to top of structure) or that have slopes of greater than 15 percent above them, should be engineered per Washington Administrative Code (WAC 51-16-080 item 5). This information is provided solely for the benefit of the owner and other design consultants, and should not be construed to imply that GeoResources assumes responsibility for job site safety. It is understood that job site safety is the sole responsibility of the project contractor.

Site Drainage

All ground surfaces, pavements and sidewalks at the site should be sloped away from the structures. Surface water runoff should be controlled by a system of curbs, berms, drainage swales, and or catch basins, and conveyed to an appropriate discharge point.

We recommend that footing drains are installed for the development in accordance with IBC 1805.4.2, and basement walls (if utilized) have a wall drain as describe above. The roof drain should not be connected to the footing drain.

Stormwater Infiltration

The City of Puyallup uses the Department of Ecology's (Ecology) Stormwater Management Manual for Western Washington. We reviewed the *2012 Stormwater Management Manual for Western Washington, as Amended in December 2014* (*2014 SWMMWW*).

Per the *2014 SWMMWW*, Volume III, Section 3.3.7, *Site Selection Criteria-5*, a minimum of 5 feet of separation is required between the bottom of a proposed infiltration facility and the top of seasonal high groundwater, bedrock, or other low permeability layer. No evidence of seasonal high groundwater was observed was observed in our subsurface explorations. Based on our review of the above referenced documents, our subsurface explorations, and our laboratory testing, it is our opinion that stormwater infiltration is feasible onsite.

Test Method

For the purposes of this project we used the small-scale pilot infiltration test method as defined by (2014 SWMMWW).

Preliminary Design Infiltration Rate

The design infiltration rate is determined based on the procedure provided in Volume III, Appendix III section 3.3.6 of the 2014 SWMMWW. Three correction factors are applied to the measured infiltration rate to account for site variability (CF_y), test method used (CF_t), and influent control to prevent siltation and bio-buildup (CF_m). The design infiltration rate is determined as follows:

$$I_{design} = I_{measured} * CF_y * CF_t * CF_m$$

Where:
I_{design} = Infiltration rate to be used for design of infiltration facility
$I_{measured}$ = Infiltration rate measured in the field or estimated by grain size analysis
CF_y = Accounts for number of tests relative to infiltration area and site variability (0.33 to 1)
CF_t = Test method used (Small Scale PIT = 0.5)
CF_m = Degree of influent control to prevent siltation and bio-buildup (0.9)

Based on our observations, we used a value of 0.5 for CF_y, a value of 0.5 for CF_t, and a value of 0.9 for CF_m. Applying these correction factors to the measured infiltration rate, as outlined in Volume III, Section 3.3.6 of the 2014 SWMMWW results in a preliminary long-term (design) infiltration rates. Based on the sample collected and our analysis, we recommend using a **preliminary long-term design rate of 2.0 inches per hour.** Additional information regarding preliminary infiltration rates is included in Appendix C.

For the purposes of estimating a preliminary infiltration and to reflect the early design stages of the project, we selected relatively conservative correction factors. It is possible, that during the design process these values may be reduced potentially resulting in a higher design infiltration rate.

Construction Considerations

We recommend that a representative from our firm be onsite at the time of excavation of the proposed infiltration facilities to verify that the soils encountered during construction are consistent with the soils observed in our subsurface explorations. Verification infiltration testing should also be performed at the time of construction to verify the recommended infiltration rate per the 2014 SWMMWW.

Appropriate design, construction and maintenance measures will be required to ensure the infiltration rate can be effectively maintained over time. Appropriate temporary erosion and sediment control methods should be included in the project plans and specifications to minimize the potential for fines contamination of infiltration facility utilized at the site. To further reduce the potential for fines migration, the infiltration system should not be connected to the stormwater runoff system until after construction is complete and the site area is landscaped, paved or otherwise protected.

Additional measures may also be taken during construction to minimize the potential of fines contamination of the proposed infiltration system, such as utilizing an alternative storm water management location during construction or leaving the bottom of the permanent systems 1 to 2 feet high, and subsequently excavating to the finished grade once the site soils have been stabilized. All contractors working on the site (builders and subcontractors) should divert sediment laden stormwater away from proposed infiltration facilities during construction and landscaping activities. No concrete trucks should be washed or cleaned, and washout areas should not be within the vicinity of the proposed infiltration facilities. After construction activities have been completed, periodic sweeping of the paved areas will help extend the life of the infiltration system.

EARTHWORK RECOMMENDATIONS

Site Preparation

All structural areas on the site to be developed should be stripped of vegetation, organic surface soils, and other deleterious materials including existing structures, foundations or abandoned utility lines. Organic topsoil is not suitable for use as structural fill, but may be used for limited depths in non-structural areas. Stripping depths ranging from 8 to 16 inches should be expected to remove these unsuitable soils. Areas of thicker topsoil or organic debris may be encountered in areas of heavy vegetation or depressions. Initial estimation of stripping depths should consider the limitations of the initial subsurface exploration program and contingencies should be incorporated into the grading plan and bid documents for the project until additional explorations can be completed.

Where placement of fill material is required, the stripped/exposed subgrade areas should be compacted to a firm and unyielding surface prior to placement of any fill. Excavations for debris removal should be backfilled with structural fill compacted to the densities described in the **"Structural Fill"** section of this report.

We recommend that a member of our staff evaluate the exposed subgrade conditions after removal of vegetation and topsoil stripping is completed and prior to placement of structural fill. The exposed subgrade soil should be proof-rolled with heavy rubber-tired equipment during dry weather or probed with a 1/2-inch-diameter steel rod during wet weather conditions.

Soft, loose or otherwise unsuitable areas delineated during proofrolling or probing should be recompacted, if practical, or over-excavated and replaced with structural fill. The depth and extent of overexcavation should be evaluated by our field representative at the time of construction. The areas of old fill material should be evaluated during grading operations to determine if they need mitigation; recompaction or removal.

Structural Fill

All material placed as fill associated with mass grading, as utility trench backfill, under building areas, or under roadways should be placed as structural fill. The structural fill should be placed in horizontal lifts of appropriate thickness to allow adequate and uniform compaction of each lift. Structural fill should be compacted to at least 95 percent of MDD as determined in accordance with ASTM D: 1557.

The appropriate lift thickness will depend on the structural fill characteristics and compaction equipment used. We recommend that the appropriate lift thickness be evaluated by our field representative during construction. We recommend that our representative be present during site grading activities to observe the work and perform field density tests.

The suitability of material for use as structural fill will depend on the gradation and moisture content of the soil. As the amount of fines (material passing US No. 200 sieve) increases, soil becomes increasingly sensitive to small changes in moisture content and adequate compaction becomes more difficult to achieve. During wet weather, we recommend use of well-graded sand and gravel with less than 5 percent (by weight) passing the US No. 200 sieve based on that fraction passing the 3/4-inch sieve, such as *Gravel Backfill for Walls* (WSDOT 9-03.12(2)). If prolonged dry weather prevails during the earthwork and foundation installation phase of construction, higher fines content (up to 10 to 12 percent) may be acceptable.

Material placed for structural fill should be free of debris, organic matter, trash, and cobbles greater than 6-inches in diameter. The moisture content of the fill material should be adjusted as necessary for proper compaction.

Suitability of On-Site Materials as Fill

During dry weather construction, non-organic on-site soil may be considered for use as structural fill; provided it meets the criteria described above in the **"Structural Fill"** section and can be compacted as recommended. If the moisture content of the soil material is over-optimum when excavated, it will be necessary to aerate or dry the soil prior to placement as structural fill. We generally did not observe the site soils to be excessively moist at the time of our subsurface exploration program.

The native gravelly outwash at the site generally consisted of gravel with sand. These soils are generally comparable to *Common Borrow* (WSDOT) 9-03.14(3). According to our grain size analysis, the outwash soils had a fines content of approximately 0.7 to 5.4 percent. These soils should be suitable for use as structural fill provided the moisture content is maintained within 3 percent of the optimum moisture level. Because of the low fines content and gravelly nature of the outwash soils, these soils are considered moderately moisture sensitive and should be suitable for reuse in a wider range of moisture conditions and periods of wet weather.

We recommend that completed graded-areas be restricted from traffic or protected prior to wet weather conditions. The graded areas may be protected by paving, placing asphalt-treated base,

a layer of free-draining material such as pit run sand and gravel or clean crushed rock material containing less than 5 percent fines, or some combination of the above.

Erosion Control

Weathering, erosion and the resulting surficial sloughing and shallow land sliding are natural processes. As noted, no evidence of surficial raveling or sloughing was observed at the site. To manage and reduce the potential for these natural processes, we recommend erosion protection measures will need to be in place prior to grading activity on the site. Erosion hazards can be mitigated by applying Best Management Practices (BMP's).

Wet Weather and Wet Condition Considerations

In the Puget Sound area, wet weather generally begins about mid-October and continues through about May, although rainy periods could occur at any time of year. Therefore, it is strongly encouraged that earthwork be scheduled during the dry weather months of June through September. Most of the soil at the site contains sufficient fines to produce an unstable mixture when wet. Such soil is highly susceptible to changes in water content and tends to become unstable and impossible to proof-roll and compact if the moisture content exceeds the optimum.

In addition, during wet weather months, the groundwater levels could rise, resulting in seepage into site excavations. Performing earthwork during dry weather would reduce these problems and costs associated with rainwater, construction traffic, and handling of wet soil. However, should wet weather/wet condition earthwork be unavoidable, the following recommendations are provided:

- The ground surface in and surrounding the construction area should be sloped as much as possible to promote runoff of precipitation away from work areas and to prevent ponding of water.
- Work areas or slopes should be covered with plastic. The use of sloping, ditching, sumps, dewatering, and other measures should be employed as necessary to permit proper completion of the work.
- Earthwork should be accomplished in small sections to minimize exposure to wet conditions. That is, each section should be small enough so that the removal of unsuitable soils and placement and compaction of clean structural fill could be accomplished on the same day. The size of construction equipment may have to be limited to prevent soil disturbance. It may be necessary to excavate soils with a backhoe, or equivalent, and locate them so that equipment does not pass over the excavated area. Thus, subgrade disturbance caused by equipment traffic would be minimized.
- Fill material should consist of clean, well-graded, sand and gravel, of which not more than 5 percent fines by dry weight passes the No. 200 mesh sieve, based on wet-sieving the fraction passing the ¾-inch mesh sieve. The gravel content should range from between 20 and 50 percent retained on a No. 4 mesh sieve. The fines should be non-plastic.
- No exposed soil should be left uncompacted and exposed to moisture. A smooth-drum vibratory roller, or equivalent, should roll the surface to seal out as much water as possible.
- In-place soil or fill soil that becomes wet and unstable and/or too wet to suitably compact should be removed and replaced with clean, granular soil (see gradation requirements above).

- Excavation and placement of structural fill material should be observed on a full-time basis by a geotechnical engineer (or representative) experienced in wet weather/wet condition earthwork to determine that all work is being accomplished in accordance with the project specifications and our recommendations.
- Grading and earthwork should not be accomplished during periods of heavy, continuous rainfall.

We recommend that the above requirements for wet weather/wet condition earthwork be incorporated into the contract specifications.

LIMITATIONS

We have prepared this report for use by AVT Services LLC, and other members of the design team, for use in the design of a portion of this project. The data used in preparing this report and this report should be provided to prospective contractors for their bidding or estimating purposes only. Our report, conclusions and interpretations are based on our subsurface explorations, data from others and limited site reconnaissance, and should not be construed as a warranty of the subsurface conditions.

Variations in subsurface conditions are possible between the explorations and may also occur with time. A contingency for unanticipated conditions should be included in the budget and schedule. Sufficient monitoring, testing and consultation should be provided by our firm during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether earthwork and foundation installation activities comply with contract plans and specifications.

The scope of our services does not include services related to environmental remediation and construction safety precautions. Our recommendations are not intended to direct the contractor's methods, techniques, sequences or procedures, except as specifically described in our report for consideration in design.

If there are any changes in the loads, grades, locations, configurations or type of facilities to be constructed, the conclusions and recommendations presented in this report may not be fully applicable. If such changes are made, we should be given the opportunity to review our recommendations and provide written modifications or verifications, as appropriate.

◆ ◆ ◆

We have appreciated the opportunity to be of service to you on this project. If you have any questions or comments, please do not hesitate to call at your earliest convenience.

Respectfully submitted,
GeoResources, LLC

Davis Carlsen
Staff Geologist

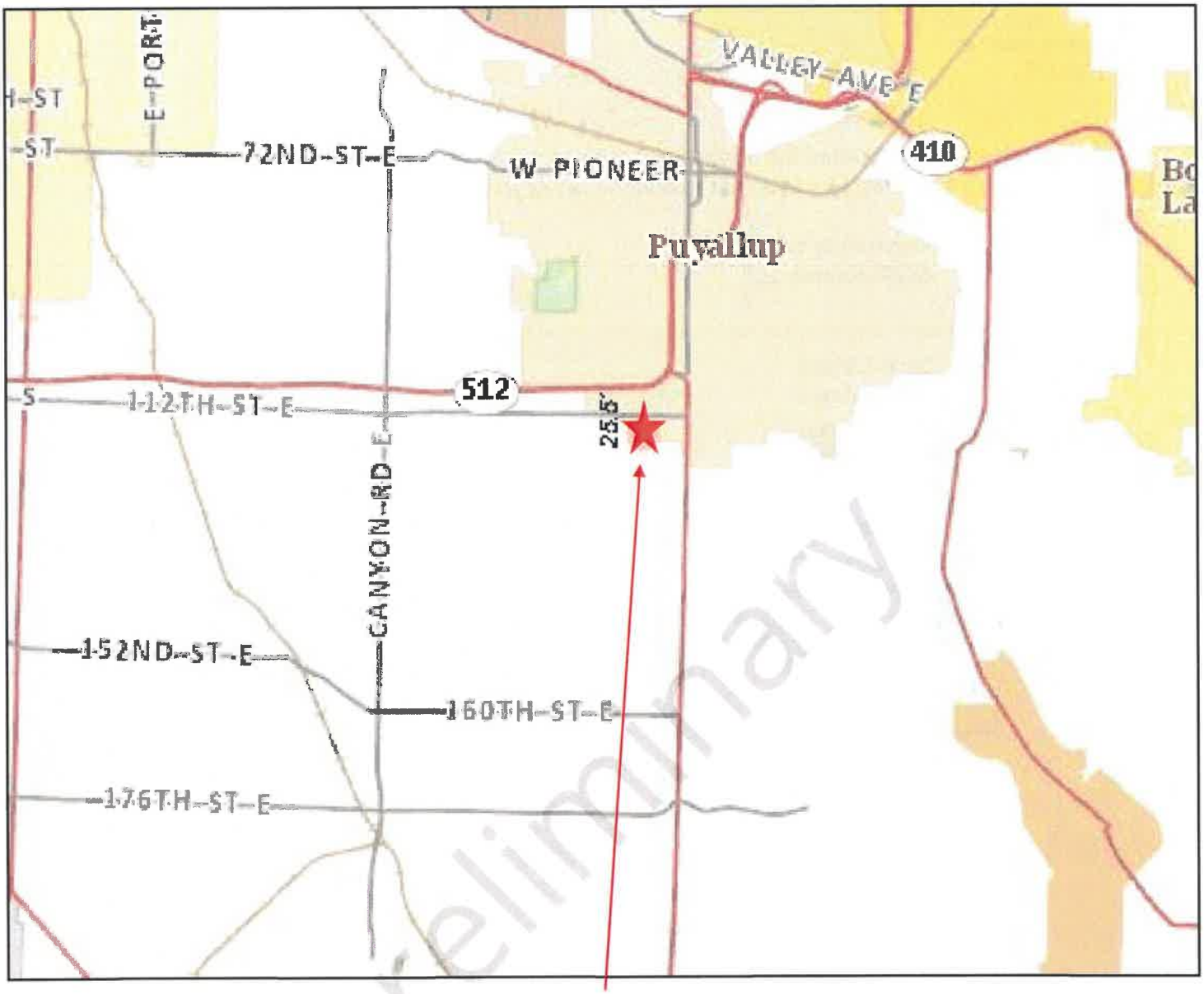
State of Washington 3237 Licensed Geologist
4/15/2020
Seth Mattos

Seth Mattos, LG
Senior Geologist

ERIC WILLIAM HELLER STATE OF WASHINGTON 43471 REGISTERED PROFESSIONAL ENGINEER
4/15/2020

Eric W. Heller, PE, LG
Senior Geotechnical Engineer

STM:EWH/dc
DocID:AVTServices.7thStSW.RG
Attachments:
Figure 1: Site Location Map
Figure 2: Site and Exploration Map
Figure 3: NRCS Soils Map
Figure 4: Geologic Map
Figure 5: WA DNR Landslide Susceptibility Map
Figure 6: Liquefaction Susceptibility Map
Figure 7: WA DNR Volcanic Hazards Map
Appendix "A" - Subsurface Explorations
Appendix "B" - Laboratory Test results



Approximate Site Location

Map created from Pierce County Public GIS (https://matterhornwab.co.pierce.wa.us/publicgis/)

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Not to Scale

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Site Location Map
Proposed Multi-family Development
xxx - 7th Street SW
Puyallup, Washington
PN: 4320000160

DocID: AVTServices.7thStSW.F	April 2020	Figure 1

Map created from Pierce County Public GIS
(https://matterhornwab.co.pierce.wa.us/publicgis/)

Number and approximate location of test pit

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Site and Exploration Map
Proposed Multi-family Development
xxx - 7th Street SW
Puyallup, Washington
PN: 4320000160

Doc ID: AVTServices.7thStSW.F	April 2020	Figure 2

Approximate Site Location

Map created from Web Soil Survey (http://websoilsurvey.sc.egov.usda.gov/App/WebSoilSurvey.aspx)

Soil Type	Soil Name	Parent Material	Slopes	Erosion Hazard	Hydrologic Soils Group
13B	Everett very gravelly sandy loam	Sandy and gravelly glacial outwash	0 to 8	Slight	A
13C			8 to 15	Slight to moderate	

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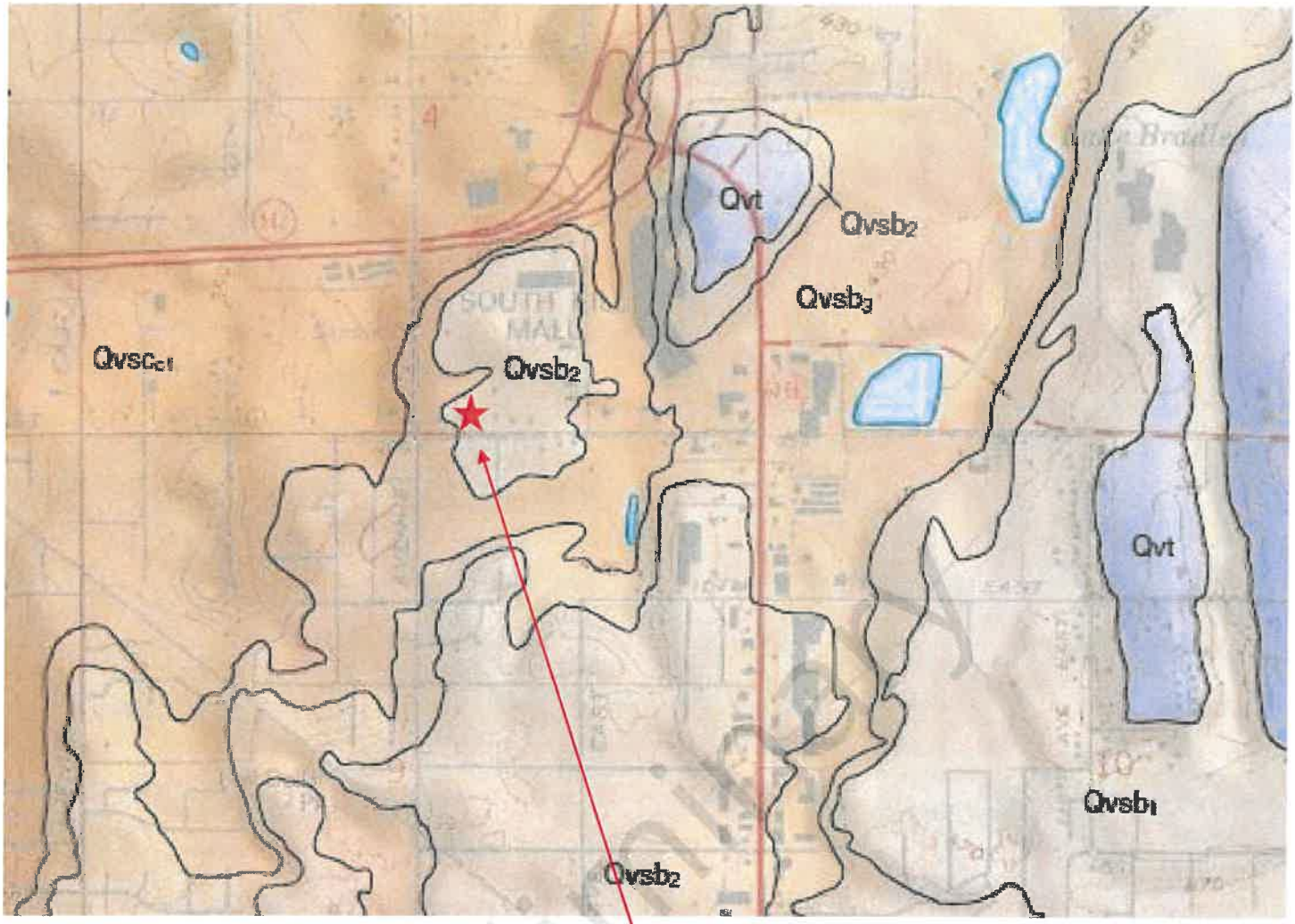
NRCS Soils Map

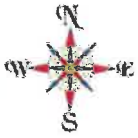
Proposed Multi-family Development
xxx - 7th Street SW
Puyallup, Washington
PN: 4320000160



Approximate Site Location

An excerpt from *the draft Geologic Map of the Puyallup 7.5-minute Quadrangle, Washington,* by Troost, K.G.

$Qvsb_3$	Steilacoom Gravel-Bradley Channel
$Qvsb_2$	Steilacoom Gravel-Bradley Channel
$Qvsc_{c1}$	Steilacoom Gravel-Clover Creek Channel



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Geologic Map

Proposed Multi-family Development
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Puyallup, Washington
PN: 4320000160

Doc ID: AVTServices.7thStSW.F	April 2020	Figure 4

Shallow Susceptibility

- Moderate
- High

Deep Susceptibility

- Moderate
- High

Approximate Site Location

Map created from the Washington State Department of Natural Resources Landslide Inventory
(Information Portal https://geologyportal.dnr.wa.gov/)

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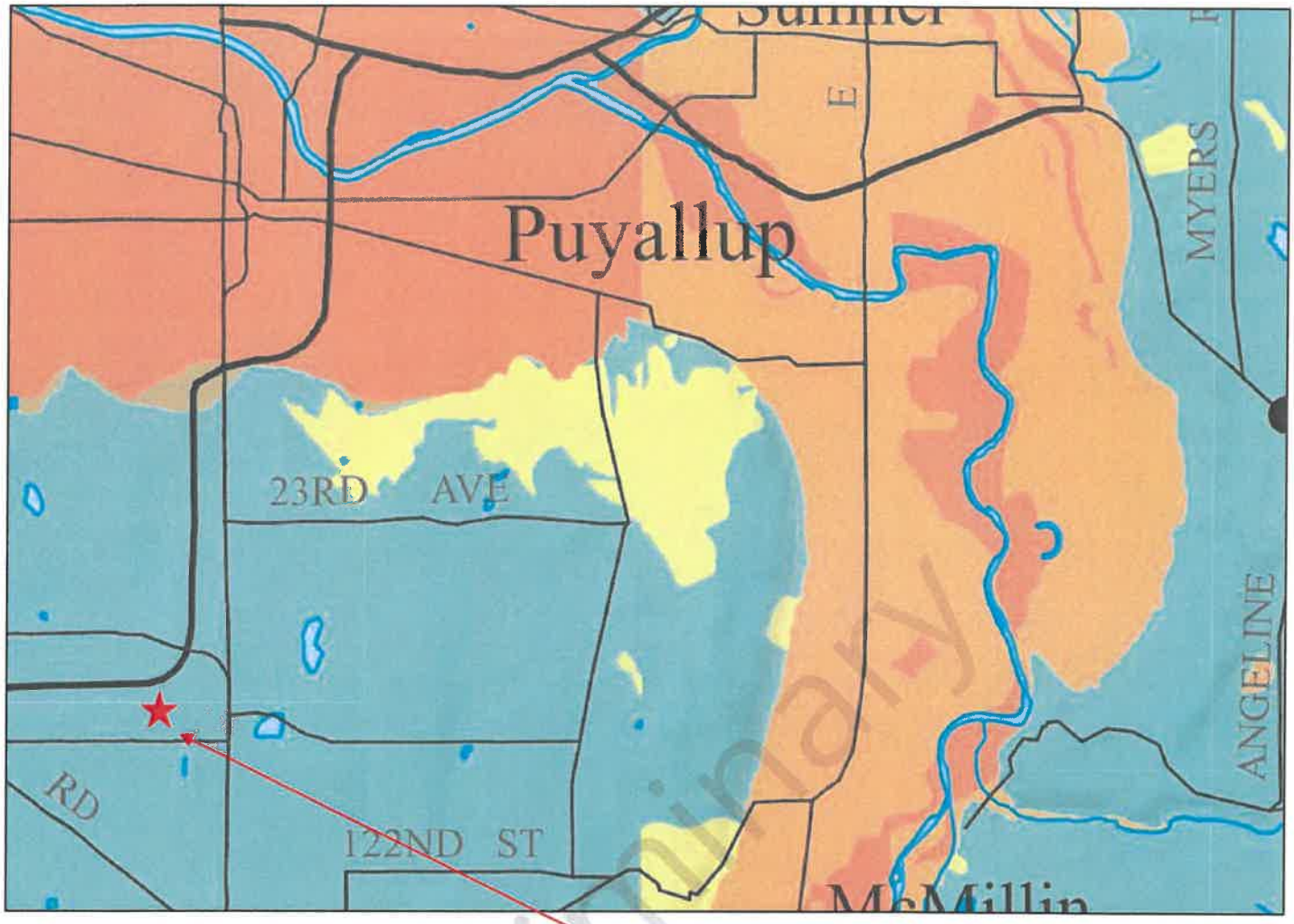
WA DNR Landslide Susceptibility Map

Proposed Multi-family Development
xxx - 7th Street SW
Puyallup, Washington
PN: 4320000160

Doc ID: AVTServices.7thStSW.F	April 2020	Figure 5



Approximate Site Location

An excerpt from the *Liquefaction Susceptibility Map of Pierce County, Washington* by Palmer, et al. (2004)

EXPLANATION

- Liquefaction susceptibility: HIGH
- Liquefaction susceptibility: MODERATE to HIGH
- Liquefaction susceptibility: MODERATE
- Liquefaction susceptibility: LOW to MODERATE
- Liquefaction susceptibility: LOW
- Liquefaction susceptibility: VERY LOW to LOW
- Liquefaction susceptibility: VERY LOW

Not to Scale

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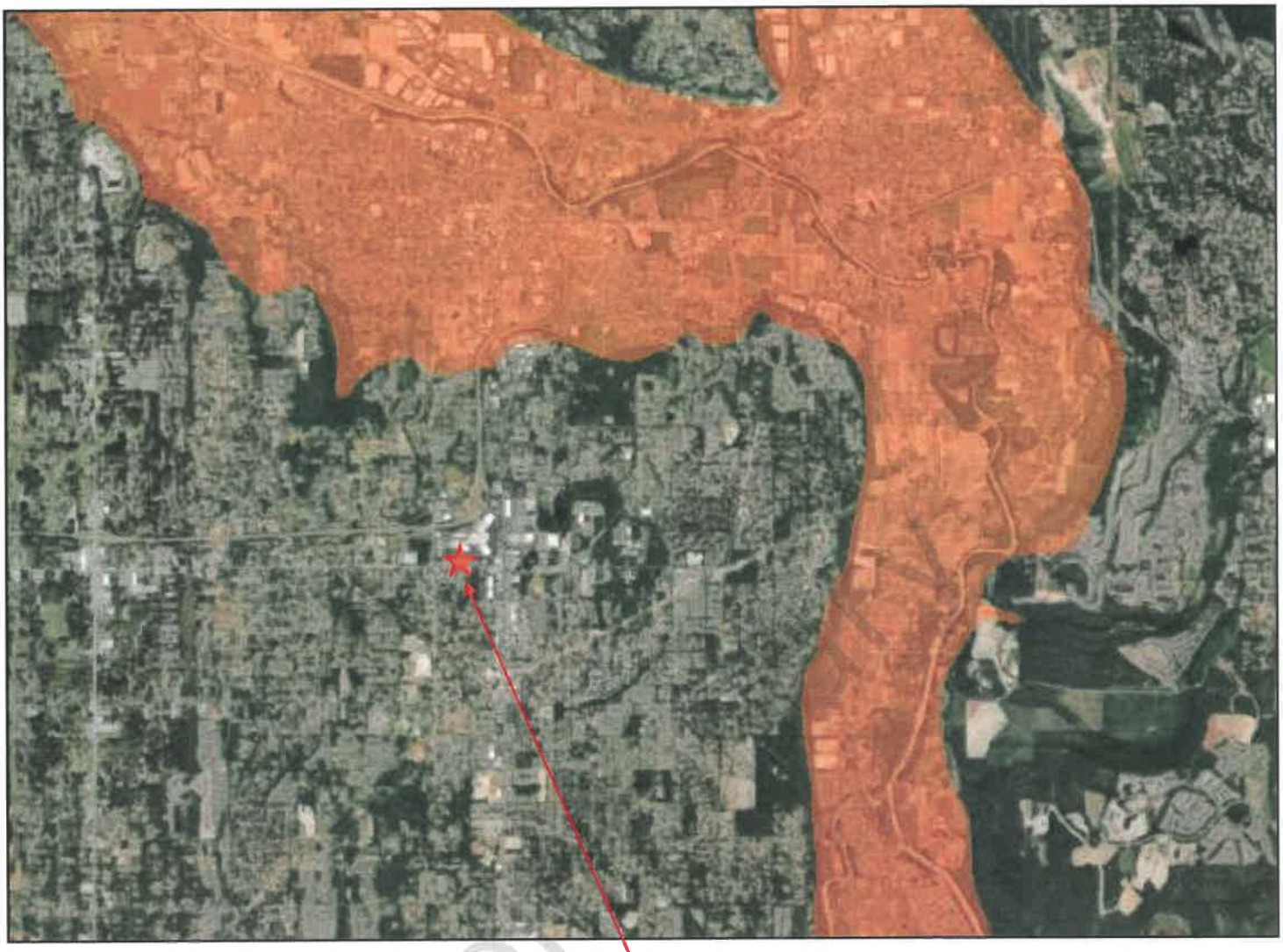
Liquefaction Susceptibility Map

Proposed Multi-family Development
xxx - 7th Street SW
Puyallup, Washington
PN: 4320000160

Doc ID: AVTServices.7thStSW.F	April 2020	Figure 6



Approximate Site Location

Map created from the Washington State Department of Natural Resources Volcanic Hazards Map
(Information Portal https:// geologyportal.dnr.wa.gov/)

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WA DNR Volcanic Hazards Map

Proposed Multi-family Development
xxx - 7th Street SW
Puyallup, Washington
PN: 4320000160

Doc ID: AVTServices.7thStSW.F	April 2020	Figure 7

Appendix A
Subsurface Explorations

SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE GRAINED SOILS More than 50% Retained on No. 200 Sieve	GRAVEL More than 50% Of Coarse Fraction Retained on No. 4 Sieve	CLEAN GRAVEL	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND More than 50% Of Coarse Fraction Passes No. 4 Sieve	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY-GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE GRAINED SOILS More than 50% Passes No. 200 Sieve	SILT AND CLAY Liquid Limit Less than 50	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILT AND CLAY Liquid Limit 50 or more	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT

NOTES:

1. Field classification is based on visual examination of soil in general accordance with ASTM D2488-90.
2. Soil classification using laboratory tests is based on ASTM D6913.
3. Description of soil density or consistency are based on interpretation of blow count data, visual appearance of soils, and or test data.

SOIL MOISTURE MODIFIERS:

Dry- Absence of moisture, dry to the touch

Moist- Damp, but no visible water

Wet- Visible free water or saturated, usually soil is obtained from below water table

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Unified Soils Classification System

Proposed Multi-family Development
xxx - 7th Street SW
Puyallup, Washington
PN: 4320000160

Test Pit TP-1

Location: Eastern extent of site
Approximate Elevation: 460 feet (NAVD88)

Depth (ft)			Soil Type	Soil Description
0.0	-	1.25	-	Dark brown topsoil/forest duff (loose, moist)
1.25	-	3.5	GP	Light brown to orange-brown sandy GRAVEL with silt to silty GRAVEL with sand (medium dense, moist) (recessional outwash)
3.5	-	8.5	SP	Tan gravelly SAND with trace cobbles (medium dense, moist) (recessional outwash)

Terminated at 8.5 feet below the existing ground surface.
No iron oxide staining observed at time of excavation
No caving observed at time of excavation
No groundwater seepage observed at time of excavation

Test Pit TP-2

Location: Southeast corner of site
Approximate Elevation: 464 feet (NAVD88)

Depth (ft)			Soil Type	Soil Description
0.0	-	1.0	-	Dark brown topsoil/forest duff (loose, moist)
1.0	-	2.5	GP	Orange-reddish brown poorly graded GRAVEL with silt and sand (medium dense, moist) (recessional outwash)
2.5	-	7.5	GP	Orange-reddish brown poorly graded GRAVEL with silt and sand, occasional cobble, trace boulders (medium dense to dense, moist) (recessional outwash)

Terminated at 7.5feet below the existing ground surface.
No iron oxide staining observed at the time of excavation.
No caving observed at the time of excavation.
No groundwater seepage observed at the time of excavation.

Logged by: STM

Excavated on: February 20, 2020

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PN: 4320000160

Test Pit TP-3

Location: Southern extent of site
Approximate Elevation: 456 feet (NAVD88)

Depth (ft)			Soil Type	Soil Description
0.0	-	1.0	-	Dark brown topsoil/forest duff (loose, moist)
1.0	-	3.0	GP	Orange-reddish brown poorly graded GRAVEL with silt and sand (medium dense, moist) (recessional outwash)
2.0	-	6.0	GP	Orange-reddish brown poorly graded GRAVEL with silt and sand, occasional cobble, trace boulders (medium dense to dense, moist) (recessional outwash)

Terminated at 6.0 feet below the existing ground surface.
No iron oxide staining observed at the time of excavation.
No caving observed at the time of excavation.
No groundwater seepage observed at the time of excavation.

Test Pit TP-4

Location: Southwest portion of site
Approximate Elevation: 456 feet (NAVD88)

Depth (ft)			Soil Type	Soil Description
0.0	-	1.0	-	Dark brown topsoil/forest duff (loose, moist)
1.0	-	2.5	GP	Weathered dark brown poorly graded GRAVEL with silt and sand (medium dense, moist) (recessional outwash)
2.5	-	4.0	GP	Brown poorly graded GRAVEL with silt and sand, occasional cobble, trace boulders (medium dense to dense, moist) (recessional outwash)
4.0	-	7.5	SP	Tan poorly graded SAND (medium dense, moist) (recessional outwash)

Terminated at 7.5 feet below the existing ground surface.
No iron oxide staining observed at the time of excavation.
No caving observed at the time of excavation.
No groundwater seepage observed at the time of excavation.

Logged by: STM

Excavated on: February 20, 2020

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PN: 4320000160

Test Pit TP-5

Location: Northeast corner of the site
Approximate Elevation: 458 feet (NAVD88)

Depth (ft)			Soil Type	Soil Description
0.0	-	0.75	-	Dark brown topsoil/forest duff (loose, moist)
0.75	-	2.5	GP	Weathered dark brown poorly graded GRAVEL with silt and sand (medium dense, moist) (recessional outwash)
2.5	-	9.5	GP	Brown poorly graded GRAVEL (Medium dense to dense, moist) (recessional outwash)

Terminated at 9.5 feet below the existing ground surface.
No iron oxide staining observed at the time of excavation.
No caving observed at the time of excavation.
No groundwater seepage observed at the time of excavation.

Test Pit TP-6

Location: Eastern edge of site
Approximate Elevation: 460 feet (NAVD88)

Depth (ft)			Soil Type	Soil Description
0.0	-	0.75	-	Dark brown topsoil/forest duff (loose, moist)
0.75	-	4.0	GP	Orange brown GRAVEL with sand (medium dense, moist) (recessional outwash)
1.8	-	9.0	SP	Tan fine to medium sand (medium dense, moist) (recessional outwash)

Terminated at 9.0 feet below the existing ground surface.
No iron oxide staining observed at the time of excavation.
No caving observed at the time of excavation.
No groundwater seepage observed at the time of excavation.

Logged by: STM

Excavated on: February 20, 2020

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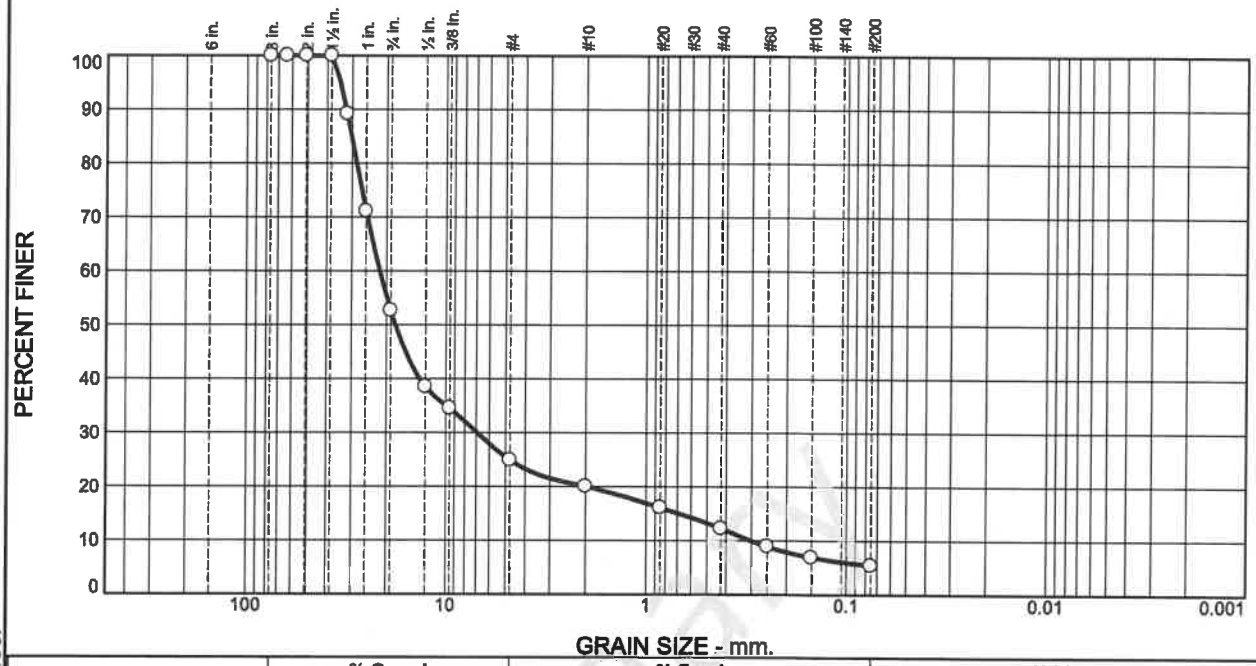
Puyallup, Washington
PN: 4320000160

Appendix B

Laboratory Test Results

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	47.4	27.7	4.9	7.8	6.8	5.4	

Test Results (ASTM D 6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3.0	100.0		
2.5	100.0		
2.0	100.0		
1.5	100.0		
1.25	89.2		
1	71.1		
.75	52.6		
.5	38.5		
0.375	34.5		
#4	24.9		
#10	20.0		
#20	16.1		
#40	12.2		
#60	8.9		
#100	6.9		
#200	5.4		

* (no specification provided)

Material Description

poorly graded gravel with silt and sand

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NV

Classification

USCS (D 2487)= GP-GM AASHTO (M 145)= A-1-a

Coefficients

D_{90}= 32.0883 D_{85}= 30.1172 D_{60}= 21.6665
D_{50}= 18.0484 D_{30}= 6.9144 D_{15}= 0.6881
D_{10}= 0.3018 C_u= 71.80 C_c= 7.31

Remarks

Date Received: _____ **Date Tested:** 2/20/2020

Tested By: DC

Checked By: STM

Title: PM

Location: TP-2 S-1 **Date Sampled:** 2/20/2020

Sample Number: 099315 **Depth:** 1.5'-2.5'

GeoResources, LLC

Fife, WA

Client: AVT Services

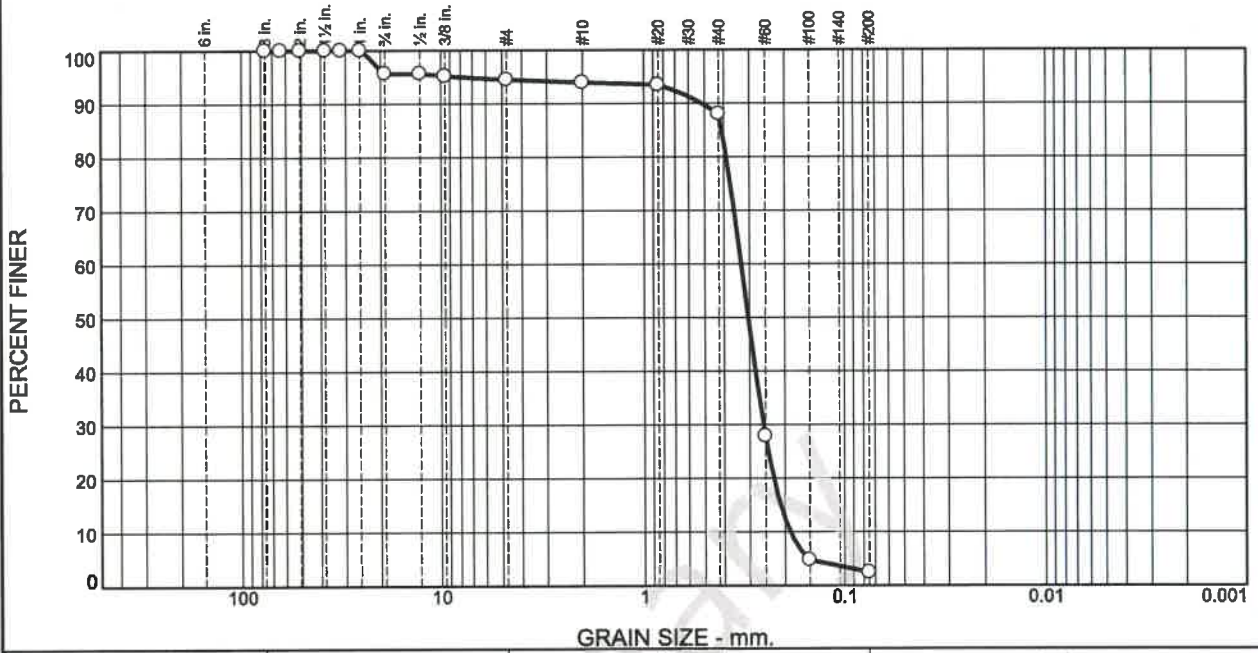
Project: AVT.Services.7thStSW

Project No: **Figure**

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical samples.

Tested By: _____ **Checked By:** _____

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	4.3	1.2	0.5	6.0	85.6	2.4	

Test Results (ASTM D 6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3.0	100.0		
2.5	100.0		
2.0	100.0		
1.5	100.0		
1.25	100.0		
1	100.0		
.75	95.7		
.5	95.7		
0.375	95.2		
#4	94.5		
#10	94.0		
#20	93.4		
#40	88.0		
#60	27.9		
#100	4.8		
#200	2.4		

* (no specification provided)

Material Description

poorly graded sand

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NV

Classification

USCS (D 2487)= SP AASHTO (M 145)= A-3

Coefficients

D_{90}= 0.5166 D_{85}= 0.4099 D_{60}= 0.3283
D_{50}= 0.3034 D_{30}= 0.2555 D_{15}= 0.2101
D_{10}= 0.1880 C_u= 1.75 C_c= 1.06

Remarks

Date Received: _____ **Date Tested:** 2/20/2020

Tested By: DC

Checked By: STM

Title: PM

Location: TP-4 S-1 **Date Sampled:** 2/20/2020

Sample Number: 099317 **Depth:** 6'

GeoResources, LLC

Fife, WA

Client: AVT Services

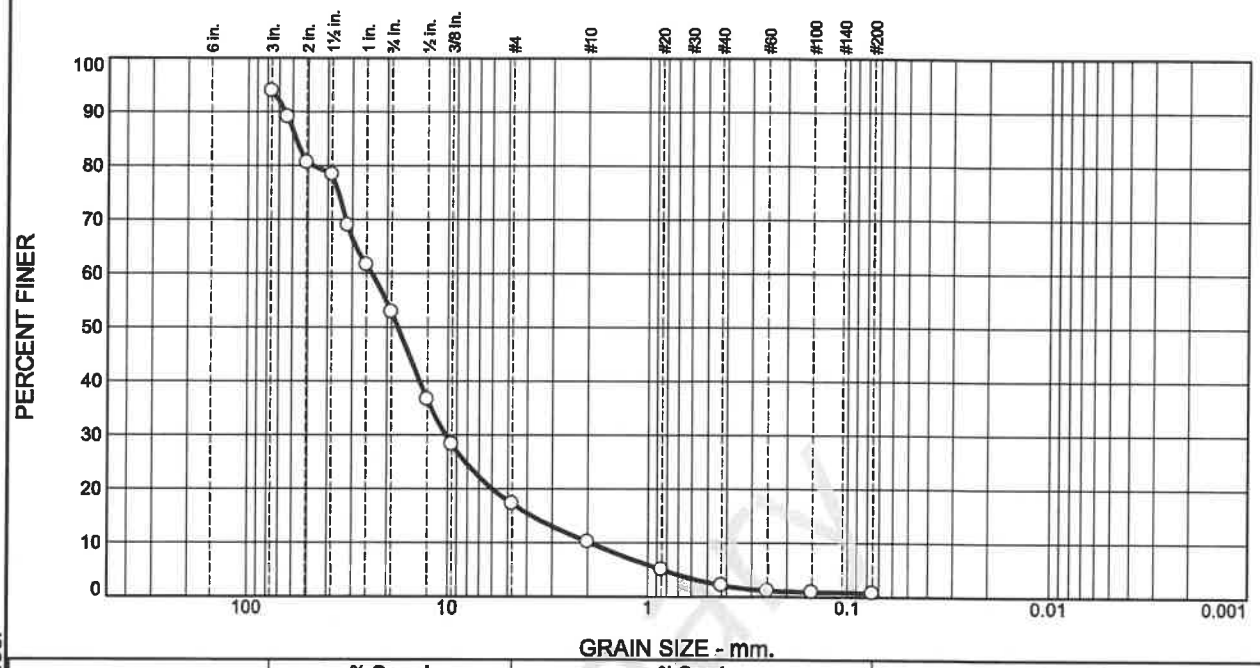
Project: AVT.Services.7thStSW

Project No: **Figure**

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical samples.

Tested By: _____ **Checked By:** _____

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
	41.0	35.7	7.1	8.0	1.4	0.7	

Test Results (ASTM D 6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3.0	93.9		
2.5	89.1		
2.0	80.6		
1.5	78.4		
1.25	68.9		
1	61.6		
.75	52.9		
.5	36.6		
0.375	28.3		
#4	17.2		
#10	10.1		
#20	5.0		
#40	2.1		
#60	1.1		
#100	0.9		
#200	0.7		

* (no specification provided)

Material Description

well-graded gravel with sand

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NP

Classification

USCS (D 2487)= GW AASHTO (M 145)= A-1-a

Coefficients

D_{90}= 65.2363 D_{85}= 57.6816 D_{60}= 23.9129
D_{50}= 17.6724 D_{30}= 10.2243 D_{15}= 3.7892
D_{10}= 1.9640 C_u= 12.18 C_c= 2.23

Remarks

Date Received: 2/20/2020 **Date Tested:** 2/20/2020

Tested By: DC

Checked By: STM

Title: PM

Location: TP-4 S-2 **Date Sampled:**

Sample Number: 099318 **Depth:** 8'

GeoResources, LLC

Fife, WA

Client: AVT Services

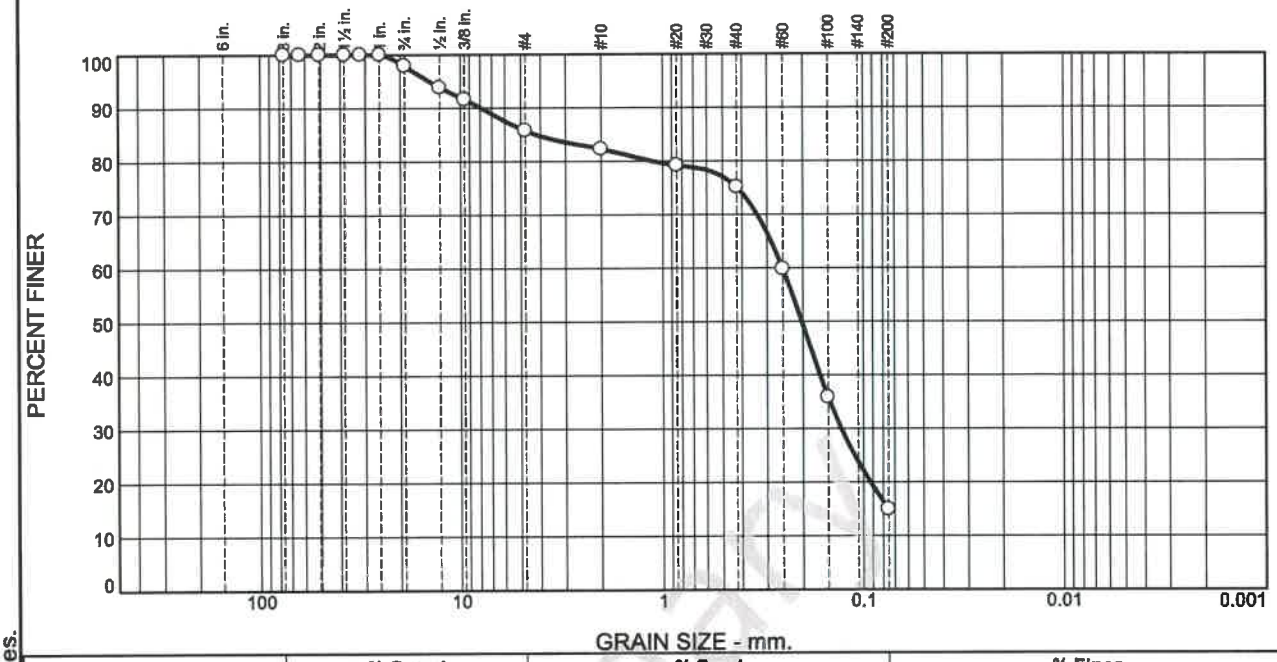
Project: AVT.Services.7thStSW

Project No: **Figure**

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical samples.

Tested By: _____ **Checked By:** _____

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0.0	2.1	12.2	3.4	7.2	60.2	14.9	

Test Results (ASTM D 6913 & ASTM D 1140)

Opening Size	Percent Finer	Spec.* (Percent)	Pass? (X=Fail)
3.0	100.0		
2.5	100.0		
2.0	100.0		
1.5	100.0		
1.25	100.0		
1	100.0		
.75	97.9		
.5	93.9		
0.375	91.6		
#4	85.7		
#10	82.3		
#20	79.2		
#40	75.1		
#60	59.8		
#100	35.8		
#200	14.9		

* (no specification provided)

Material Description

silty sand

Atterberg Limits (ASTM D 4318)

PL= NP LL= NV PI= NV

Classification

USCS (D 2487)= SM AASHTO (M 145)= A-2-4(0)

Coefficients

D_{90}= 7.8667 D_{85}= 4.1971 D_{60}= 0.2510
D_{50}= 0.2023 D_{30}= 0.1290 D_{15}= 0.0753
D_{10}= C_u= C_c=

Remarks

Date Received: _____ **Date Tested:** 2/20/2020

Tested By: DC

Checked By: STM

Title: PM

Location: TP-5 S-1 **Date Sampled:** 2/20/2020
Sample Number: 099319 **Depth:** 7'-7.5'

GeoResources, LLC

Fife, WA

Client: AVT Services
Project: AVT.Services.7thStSW

Project No: **Figure**

These results are for the exclusive use of the client for whom they were obtained. They apply only to the samples tested and are not indicitive of apparently identical samples.

Tested By: _____ **Checked By:** _____