

FINAL STORM DRAINAGE REPORT

FOR

**1200 7th Ave SE Townhomes
Puyallup, Washington**

**Revised July 2022
March 2021**

**Prepared for:
Tac Build, LLC
729 N. Stadium Way
Tacoma, WA 98403**



**Prepared by:
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**Approved By:
Daniel Smith, P.E., Project Manager**

REPORT #19078

“I hereby state that this Drainage and Erosion/Sediment Control Plan for the 1200 7th Ave SE Townhomes project has been prepared by me or under my supervision and meets the standard of care and expertise which is usual and customary in this community of professional engineers. I understand that City of Puyallup does not and will not assume liability for the sufficiency, suitability or performance of drainage facilities prepared by me.”

This analysis is based on data and records either supplied to, or obtained by, C.E.S. NW, Inc. These documents are referenced within the text of the analysis. The analysis has been prepared utilizing procedures and practices within the standard accepted practices of the industry.

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STORM DRAINAGE

1. Project Overview

This report accompanies the site development plans, as submitted to the City of Puyallup for review and approval. This document provides site information, and the analysis used to prepare the storm drainage design for the 1200 7th Ave SE Townhome project. The *Washington State Department of Ecology Stormwater Management Manual for Western Washington, 2014 (Manual)*, and the City of Puyallup's modifications to that document establishes the methodology and design criteria used for this project.

The 1200 7th Ave SE Townhome project proposes 6 townhomes on a 0.48-acre parcel (7845001330). The project site is accessed from 7th Ave SE with a new commercial driveway approach. The project is located in the Puyallup River Water Resources Inventory Area (WRIA 10). The Vicinity Map has been included in Appendix 'A' of this report. A project summary is as follows:

Permit Applied for – Site Development and Building Permits

Address – 1200 7th Ave SE Puyallup, WA 98372

Parcel Numbers – 7845001330

Legal description – (Per statutory warranty deed filed under recording number 201910110806).

The west 33 feet of block 77, and the east 50 feet of block 78, Frank R. Spinning's first addition to the Town of Puyallup, according to the plat thereof recorded in Book 4 of Plats, page 86, in Pierce County, Washington.

Situate in the County of Pierce, State of Washington.

The property has historically been used as a single-family residence. Currently there is a single-family residence, a detached garage and sheds on site as depicted on the pre-developed basin map (Appendix 'B'). The existing house and garage are to be removed when construction permits are approved. The property has frontage along 7th Ave SE, which provides access to 6 units from a temporary asphalt driveway approach. Frontage improvements are not proposed since the City

has a capital improvement project 7th Ave SE which is to be completed Summer 2022. A fee in-lieu of frontage improvements will be paid to the City. Sewer, water, and stormwater improvements will be permitted under the site development permit. The project site proposes approximately 4,690 sq.ft. of rooftops, 6,195 sq.ft. of pavement, patios and walkways; therefore, according to Figure 2.4.1 of Volume I of the Manual, the project must evaluate all minimum requirements; see Section 5 of this report for a detailed discussion of each of the minimum requirements. A detention tank is proposed in the northwestern portion of the site for flow control. The project proposes 4,800 sq.ft. of pollution generating impervious surfaces (PGIS); therefore, runoff treatment is not required. Perforated stub-outs are proposed to connect the rooftops to the tank. All disturbed areas which are not converted to impervious surface will have soil amended (BMP T5.13).

2. Existing Conditions Summary

In the existing condition, the site is used as a single-family residence and yard. The existing topography is relatively flat with elevations between 53-54 (NAVD 88) and gradually slopes towards 7th Ave SE. Stormwater runoff from this site is currently collected by a closed conveyance system within 7th Ave SE which consists of a 30-inch concrete storm line on the north side of the roadway. Current site accessed is provided by a gravel driveway approach from 7th Ave SE which will be replaced with a temporary asphalt driveway approach as part of the site development permit.

Onsite soils have been identified as Puyallup fine sandy loam (31A a Type B soil) determined by the USDA SCS maps of Pierce County, Washington. A description of the USDA soils and a copy of the soil map for this portion of Pierce County have been included in Appendix 'A' of this report. A geotechnical engineer's report has been prepared by ESNW, dated April 9, 2020 and updated January 21, 2021, which documents poorly graded sands with fine content up to 87.50% across six test pits. Groundwater seepage observed at a depth between 3.5-feet to 5-feet. A small-scale PIT was performed in TP-5 at a depth of 3.5-feet and an infiltration rate was measured at 0-inches per hour. A copy of the geotechnical report is included in Appendix 'D'.

There is an existing gravity sewer main in 23rd Avenue Southwest, which will service the properties. There are no known aquifer recharge or wellhead protection areas that affect this

property. There are no known well or septic systems onsite. If a septic system or well is discovered onsite during construction, it will be decommissioned per Tacoma-Pierce County Health Department standards. The parcel and all the proposed improvements are located within Zone X, which is considered outside of the 100-year floodplain, per FEMA Map # 53053C0342E. A copy of the FIRM Panel map can be found in Appendix ‘B’ of this report.

3. Off-site Analysis Report

A quarter mile downstream analysis is required by the City of Puyallup. The project proposed an onsite detention tank to mitigate stormwater runoff from the post-developed site. The tank’s riser releases stormwater matching 50 percent of the predeveloped 2-year storm event up to the predeveloped 50-year storm event, which discharges to a 30-inch public conveyance system on the north side of 7th Ave SE. Based on public GIS information, the runoff is conveyed west within 7th Ave SE towards 10th Street SE and an overpass with SR 512. The runoff outfalls to a 72-inch WSDOT conveyance pipe that flows north along SR 512. The ¼ mile drainage path concludes in WSDOT right-of-way. The runoff ultimately outfalls to the Puyallup River approximately 0.7 miles downstream of the site. A downstream map is included in Appendix ‘B’. No adverse impacts are anticipated to the downstream system as a result of the development due to the proposed detention tank and bio-swale.

4. Permanent Stormwater Control Plan

Existing Site Hydrology

The existing site slopes towards 7th Ave SE as sheet flow. For pond sizing purposes the pre-developed basin (.491-acres) is modeled as a flat forested condition for C type soils.

The following is a summary of the pre-developed flow rates:

2-year.....	0.011-cfs
10-year.....	0.021-cfs
50-year.....	0.027-cfs
100-year.....	0.029-cfs

Please refer to the Appendix ‘B’ for more information of the existing site.

Developed Site Hydrology

Under the developed condition, the project site proposes approximately 4,690 sq.ft. of rooftops, 6,195 sq.ft. of pavement, patios and walkways. The landscape and yard areas can be modeled as “pasture” due to soil amendment per Ecology BMP T5.13. The runoff from rooftops will connect to the detention tank with a perforated stub-outs BMP T5.10C. The post developed basin is summarized in the below:

Sub-Basin	Land-use	WWM Description	Area (acre)
Basin A	Landscaping (Amended Soils)	C, Pasture, Flat.	0.195
Basin B	Parking Lot and Walkways	Parking Lot, Flat	0.120
Basin C	Rooftops	Rooftops Flat	0.108
Bypass A	Landscaping (Amended Soils)	C, Pasture, Mod.	0.044
Bypass B	Driveway Approach	Parking Lot, Mod.	0.018
Bypass C	Walkway	Sidewalk, Flat	0.006
Total			0.491

Table 1 – Post Developed Basin

Storm Event	Pre-Developed Flow Rate (cfs)	Mitigated Flow Rate (cfs)
2	0.011	0.012
5	0.017	0.017
10	0.021	0.020
25	0.024	0.026
50	0.027	0.031
100	0.029	0.037

Table 2 –Flow Rate Summary

An 18-inch open top flat riser with three orifices is provided to control the mitigated discharge rates from the detention tank (facility). The following is a summary of the riser schedule:

Elevation	Type	Size.
48.00	Orifice	0.250-in
52.87	Orifice	0.500-in
53.66	Orifice	0.750-in

Table 3 – Pond Riser Schedule

Facility Sizing

The detention tank is designed to release stormwater matching 50 percent of 2-year storm event up to the 50-year storm event of the predeveloped site’s condition. As modelled by the WWHM computer program, the detention tank requires 514-linear feet of 5-foot diameter tank with a 4-foot riser. Since the project proposes less than 5,000 sq.ft. of PGIS it is exempt from runoff treatment. WWHM modeling report is included in Appendix ‘C’.

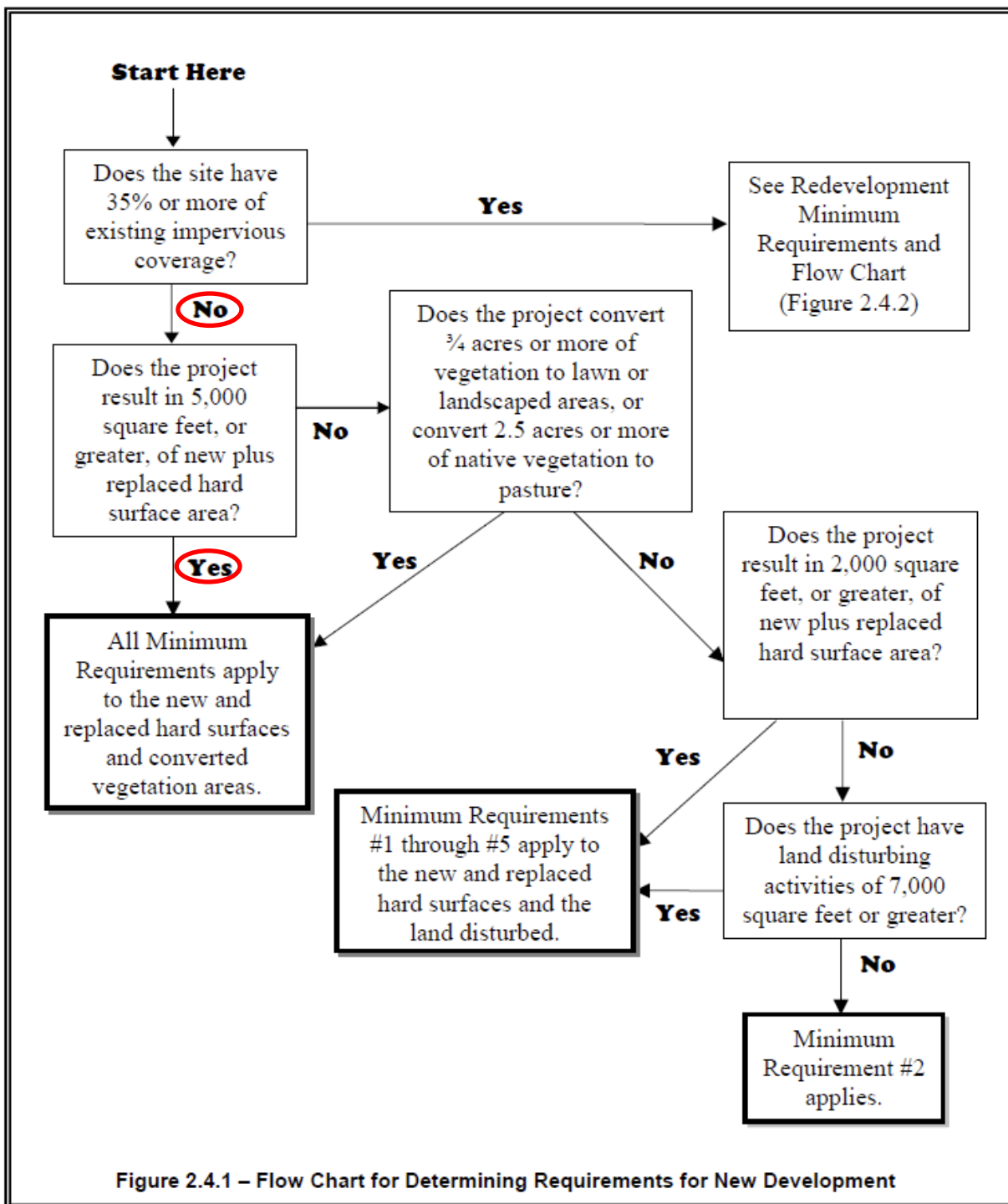
Conveyance Calculations

The project proposes an onsite closed conveyance system with catch basins, PVC and ductile iron pipes. To demonstrate the system’s capacity the shallowest pipe’s is analyzed with the manning’s equation and the total site’s 100-year storm event as calculated by the WWHM computer program. The pipe analyzed is 50-linear foot ductile iron pipe that connects to the existing storm system in 7th Ave SE. Computer modeling results are provided in Appendix ‘C’. A summary of the calculations is provided below:

- Pipe Reach Name: **Pipe 1**
- Structure Tributary Area: **0.446-ac**
- Pipe Diameter (in): **12-in**
- Pipe Length (ft): **50-ft**
- Pipe Slope (%): **1.62 %**
- Manning’s Coefficient (n): **0.012 (DI CL50)**
- Design Flow (cfs): **0.22-cfs (100-year)**
- Pipe-Full Flow (cfs): **2.73-cfs**
- Water Depth at Design Flow (in): **2.4-inches**
- Critical Depth (in): **2.4-inches**
- Velocity at Design Flow (fps): **1.95-fps**
- Velocity at Pipe-Full Flow (fps): **3.47-fps**
- Percent full at Design Flow (%): **15%**
- HGL for each Pipe Reach (elev): **50.03-feet**

5. Discussion of Minimum Requirements

The project proposes more than 5,000 sq.ft. of impervious surfaces; therefore, as required by Figure 2.4.1 of Volume I of the Manual each minimum requirement applies.



The following is a summary of the minimum requirements as described in Chapter 2 of Volume I of SMMWW2012.

5.1 Minimum Requirement #1: Preparation of a Stormwater Site Plan

The Stormwater Site Plan is prepared and is provided with this document.

5.2 Minimum Requirement #2: Construction Stormwater Pollution Prevention (SWPP)

A SWPP Plan is provided as a separate document.

5.3 Minimum Requirement #3: Source Control of Pollution

Permanent source control BMPs are required for the development's daily operations, and the stormwater facilities must be maintained as described in the Operations and Maintenance Manual, which is included as a separate document.

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

Under existing conditions, stormwater runoff is discharged into the public conveyance system on the north side of 7th Avenue Southeast. After being detained by the proposed tanks runoff will continue to be discharged to the public conveyance system.

5.5 Minimum Requirement #5: Onsite Stormwater Management

This project must meet minimum requirements 1-9; therefore, this project will evaluate List 2 for onsite stormwater management compliance. BMPs from List 2 were evaluated as follows:

Lawn and Landscape Areas

- Soil Preservation and Amendment (Ecology BMP T5.13).
All disturbed areas which are not converted to impervious areas shall apply soil amendment per Ecology BMP T5.13.

Roof Areas

- 65/10 Dispersion was deemed **infeasible** since the required forested or native condition is not available on site.
- Downspout infiltration was deemed **infeasible** since the measured infiltration rate is 0-inches per hour.
- Bioretention was deemed **infeasible** since the measured infiltration rate is 0-inches per hour.
- Downspout dispersion is deemed **infeasible** since 25-foot flow paths and trench sizes cannot be provided onsite.
- Perforated Stub-out Connections are deemed **feasible** above elevation of 51.50 (NAVD 88) and are proposed for the rooftops.

Other Hard Surfaces

- 65/10 Dispersion was deemed **infeasible** since the required forested or native condition is not available onsite.
- Permeable pavement and bioretention were deemed **infeasible** since the measured infiltration rate is 0-inches per hour.
- Sheet flow dispersion is deemed **infeasible** for the parking lot since the minimum flow paths are not available onsite.

5.6 Minimum Requirement #6: Runoff Treatment

The project proposes less than 5,000 square feet of pollution generating impervious surfaces (PGIS); therefore, minimum requirement #6 is not applicable to this project.

5.7 Minimum Requirement #7: Flow Control

Detention tanks located under the parking lot is proposed for flow control. The detention tanks are sized with WWHM modeling program to match a pre-developed forested condition between ½ 2-year to the full 50-year storm events.

5.8 Minimum Requirement #8: Wetlands Protection

This requirement is not applicable to the project since there are no existing wetlands onsite or adjacent to the site.

5.9 Minimum Requirement #9: Operation and Maintenance

An Operation and Maintenance Manual is included as a separate document.

6. Other Permits

Other necessary permits and approvals include:

- Right of Way
- Sanitary Side Sewer Permits
- Water Service Permits
- Building Permits
- PSE

APPENDIX A

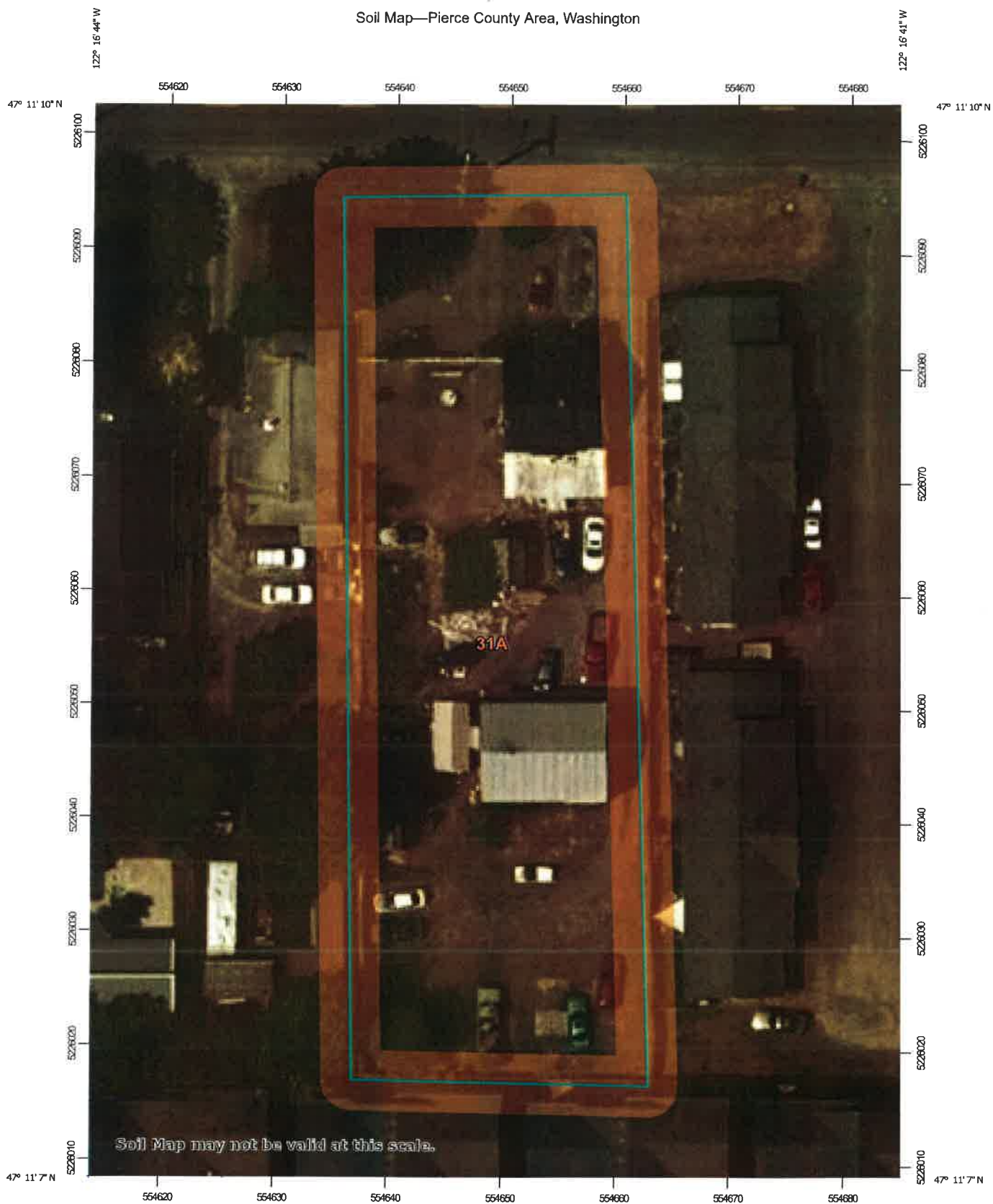
General Exhibits

Vicinity Map	A-1
Soils Map and Description (NRCS)	A-2



VICINITY MAP

Soil Map—Pierce County Area, Washington



Soil Map may not be valid at this scale.



Map Scale: 1:458 if printed on A portrait (8.5" x 11") sheet.

0 5 10 20 30 Meters


0 20 40 80 120 Feet

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



MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Pierce County Area, Washington

Survey Area Data: Version 14, Sep 10, 2018

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

Date(s) aerial images were photographed: Jul 8, 2014—Jul 15, 2014

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
31A	Puyallup fine sandy loam	0.5	100.0%
Totals for Area of Interest		0.5	100.0%

Pierce County Area, Washington

31A—Puyallup fine sandy loam

Map Unit Setting

National map unit symbol: 2hq9
Elevation: 0 to 390 feet
Mean annual precipitation: 35 to 60 inches
Mean annual air temperature: 50 degrees F
Frost-free period: 170 to 200 days
Farmland classification: All areas are prime farmland

Map Unit Composition

Puyallup and similar soils: 85 percent
Minor components: 2 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Puyallup

Setting

Landform: Flood plains, terraces
Parent material: Alluvium

Typical profile

H1 - 0 to 13 inches: ashy fine sandy loam
H2 - 13 to 29 inches: loamy fine sand
H3 - 29 to 60 inches: fine sand

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): High
(1.98 to 5.95 in/hr)
Depth to water table: About 48 to 72 inches
Frequency of flooding: Occasional
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.6 inches)

Interpretive groups

Land capability classification (irrigated): 3w
Land capability classification (nonirrigated): 3w
Hydrologic Soil Group: A
Forage suitability group: Droughty Soils (G002XN402WA)
Hydric soil rating: No

Minor Components

Briscot

Percent of map unit: 2 percent
Landform: Depressions

Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Pierce County Area, Washington
Survey Area Data: Version 14, Sep 10, 2018

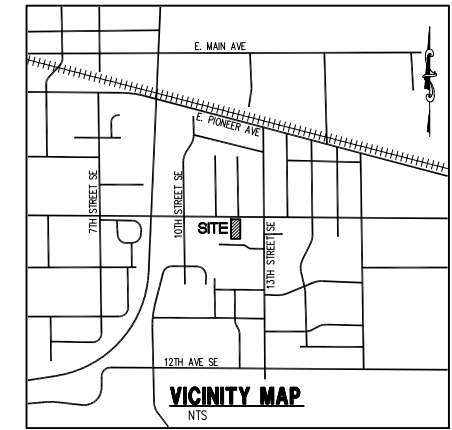
APPENDIX B

Basin Exhibits

Predeveloped Basin Map	B-1
Post Developed Basin Map	B-2
Downstream Condition Map	B-3
FIRM Panel (#53053C0342E)	B-4

1200 7TH AVE SE TOWNHOMES

A PORTION OF SEC. 03, T19N, R04E
WILLAMETTE MERIDIAN, PIERCE COUNTY, WASHINGTON



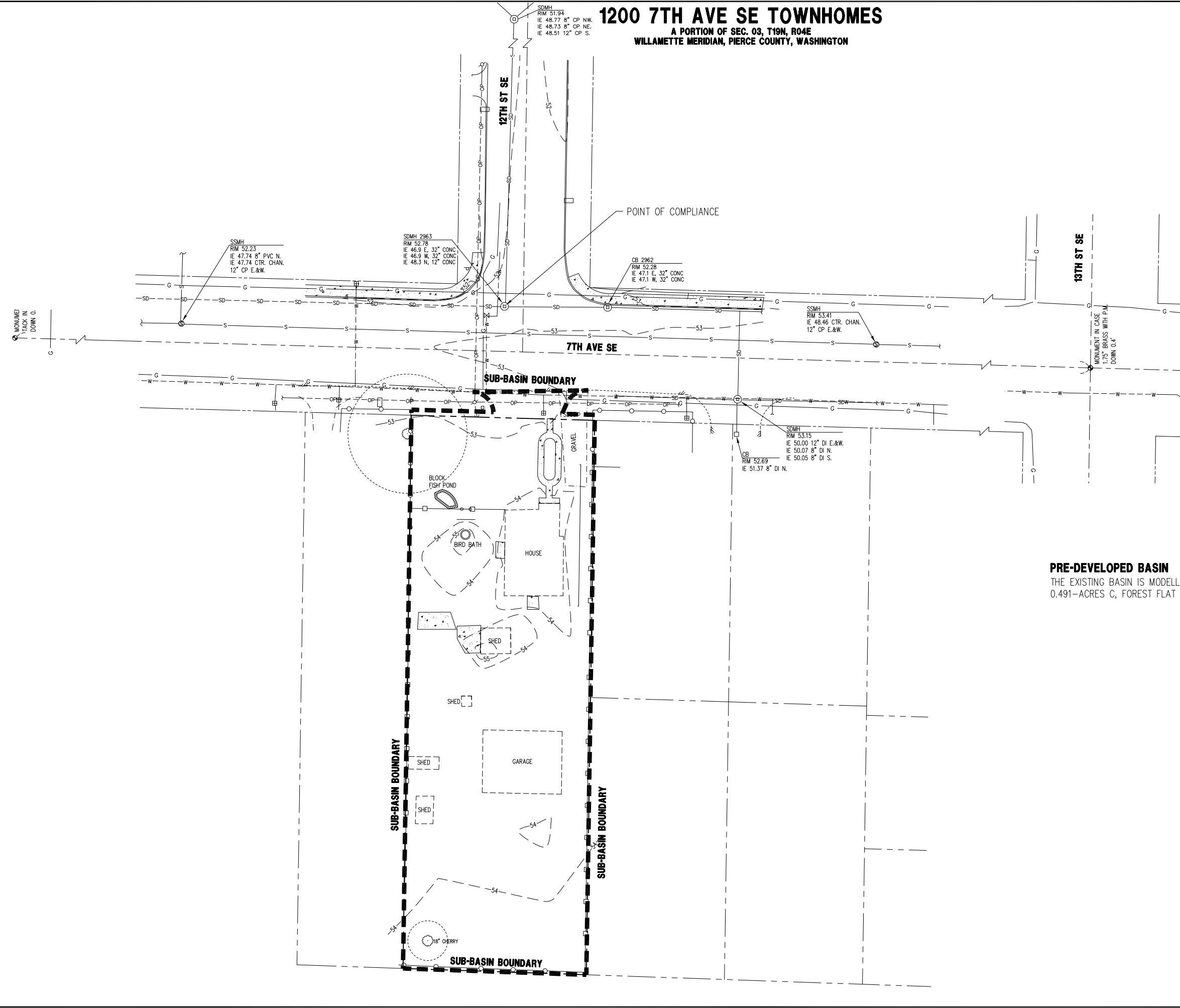
No.	Revision:	Int.	Date:



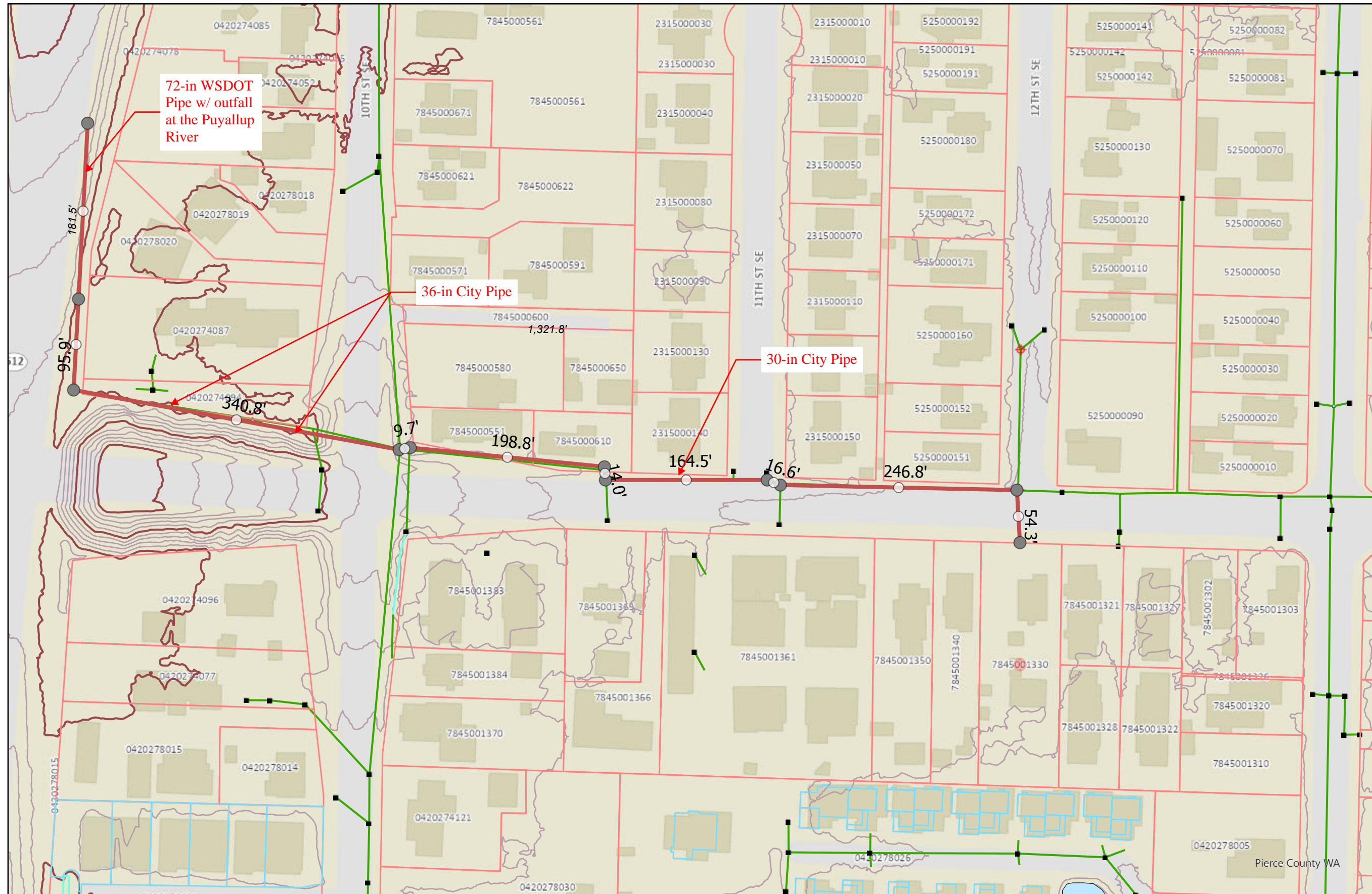
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429 - 20TH ST. NE, SUITE D
PULLMAN, WA 99172
PH: (509) 949-4382
cesurvey@cesnwinc.com

1200 7TH AVE SE TOWNHOMES
PRE-DEVELOPED BASIN MAP
TAC BUILD, LLC
729 N. STADIUM WAY, TACOMA, WA 98403

Project: 1200 7TH AVE SE TOWNHOMES
Client: TAC BUILD, LLC
Designed: DPB
Drawn: DPB
Checked: DPB
Scale: 1"=20'
Date: 07/27/2022
Job No.: 19078
Sheet No.: **B-1**
1 of 2 Sheets



Downstream Map



Legend

Tax Parcels

- Base Parcel (Red outline)
- Condominium (Blue outline)

Drainage - Puyallup

- Manholes - Puyallup (Red diamond)
- Inlets - Puyallup (Black square)
- Channels - Puyallup (Cyan line)
- Pipes - Puyallup (Green line)
- Stormwater Facilities - Puyallup (Light blue area)

Contours - 2017

- 10' Contour Line (Red line)
- 2' Contour Line (Grey line)

0 20 40 80 Feet

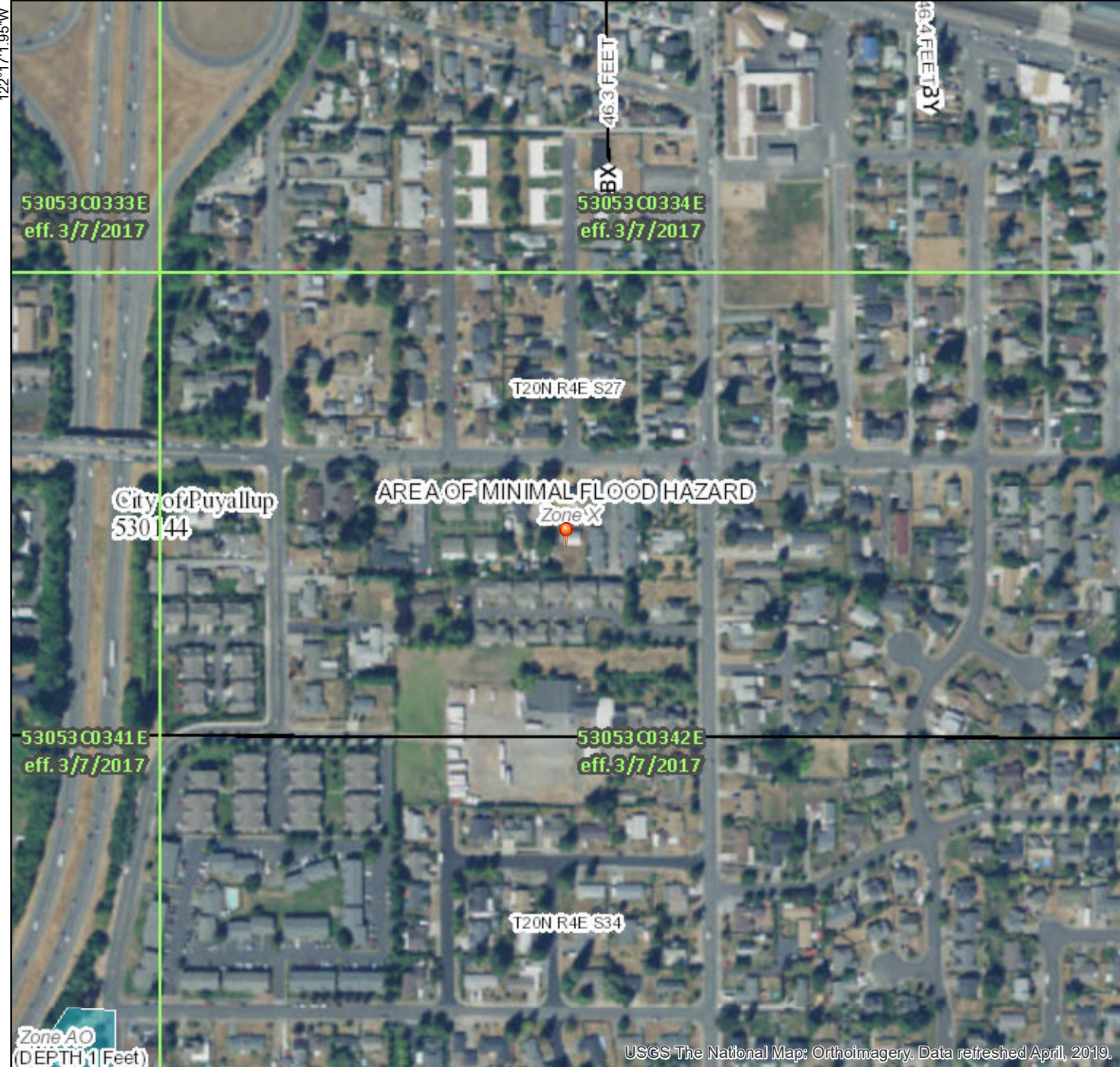
CES • NW
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 PH: 253.848.4282
 www.cesnwinc.com

The map features are approximate and are intended only to provide an indication of said feature. Additional areas that have not been mapped may be present. This is not a survey. Orthophotos and other data may not align. The County assumes no liability for variations ascertained by actual survey. ALL DATA IS EXPRESSLY PROVIDED 'AS IS' AND 'WITH ALL FAULTS'. The County makes no warranty of fitness for a particular purpose.

National Flood Hazard Layer FIRMette



47° 11' 20.64" N



USGS The National Map: Orthoimagery. Data refreshed April, 2019.

47° 10' 56.19" N

Legend

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

- | | | |
|------------------------------------|--|--|
| SPECIAL FLOOD HAZARD AREAS | | Without Base Flood Elevation (BFE)
<i>Zone A, V, A99</i> |
| | | With BFE or Depth <i>Zone AE, AO, AH, VE, AR</i> |
| | | Regulatory Floodway |
| OTHER AREAS OF FLOOD HAZARD | | 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile <i>Zone X</i> |
| | | Future Conditions 1% Annual Chance Flood Hazard <i>Zone X</i> |
| | | Area with Reduced Flood Risk due to Levee. See Notes. <i>Zone X</i> |
| | | Area with Flood Risk due to Levee <i>Zone D</i> |
| OTHER AREAS | | NO SCREEN Area of Minimal Flood Hazard <i>Zone X</i> |
| | | Effective LOMRs |
| | | Area of Undetermined Flood Hazard <i>Zone D</i> |
| GENERAL STRUCTURES | | Channel, Culvert, or Storm Sewer |
| | | Levee, Dike, or Floodwall |
| OTHER FEATURES | | 20.2 Cross Sections with 1% Annual Chance Water Surface Elevation |
| | | 17.5 |
| | | Coastal Transect |
| | | Base Flood Elevation Line (BFE) |
| | | Limit of Study |
| | | Jurisdiction Boundary |
| | | Coastal Transect Baseline |
| | | Profile Baseline |
| | | Hydrographic Feature |
| MAP PANELS | | Digital Data Available |
| | | No Digital Data Available |
| | | Unmapped |



The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 4/2/2020 at 6:13:10 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

122° 16' 24.49" W

APPENDIX C

Computer Printouts

WWHM Modeling Results

C-1

WWHM2012
PROJECT REPORT

General Model Information

Project Name: 19078
Site Name: 1200 7th Street
Site Address: 1200 7th Street
City: Puyallup, WA
Report Date: 7/27/2022
Gage: 40 IN EAST
Data Start: 10/01/1901
Data End: 09/30/2059
Timestep: 15 Minute
Precip Scale: 1.000
Version Date: 2021/08/18
Version: 4.2.18

POC Thresholds

Low Flow Threshold for POC1:	50 Percent of the 2 Year
High Flow Threshold for POC1:	50 Year

Landuse Basin Data

Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use C, Forest, Flat	acre 0.491
Pervious Total	0.491
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.491

Element Flows To:		
Surface	Interflow	Groundwater

Mitigated Land Use

Post Dev

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Pasture, Flat	0.195
Pervious Total	0.195
Impervious Land Use	acre
ROOF TOPS FLAT	0.108
PARKING FLAT	0.12
Impervious Total	0.228
Basin Total	0.423

Element Flows To:		
Surface	Interflow	Groundwater
Tank 1	Tank 1	

Bypass

Bypass:	Yes
GroundWater:	No
Pervious Land Use C, Pasture, Mod	acre 0.044
Pervious Total	0.044
Impervious Land Use SIDEWALKS FLAT PARKING MOD	acre 0.006 0.018
Impervious Total	0.024
Basin Total	0.068

Element Flows To:		
Surface	Interflow	Groundwater

Routing Elements
Predeveloped Routing

Mitigated Routing

Tank 1

Dimensions
 Depth: 5 ft.
 Tank Type: Circular
 Diameter: 5 ft.
 Length: 514 ft.
 Discharge Structure
 Riser Height: 4 ft.
 Riser Diameter: 18 in.
 Orifice 1 Diameter: 0.25 in. Elevation:0 ft.
 Orifice 2 Diameter: 0.5 in. Elevation:2.87 ft.
 Orifice 3 Diameter: 0.75 in. Elevation:3.66 ft.
 Element Flows To:
 Outlet 1 Outlet 2

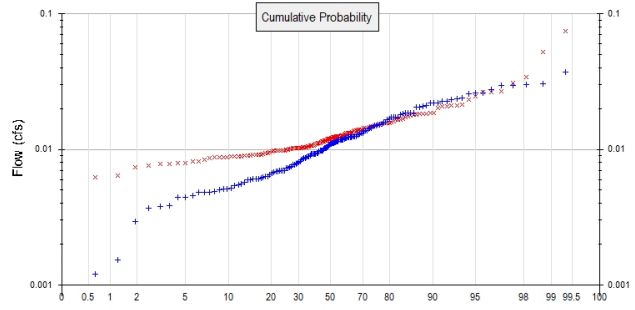
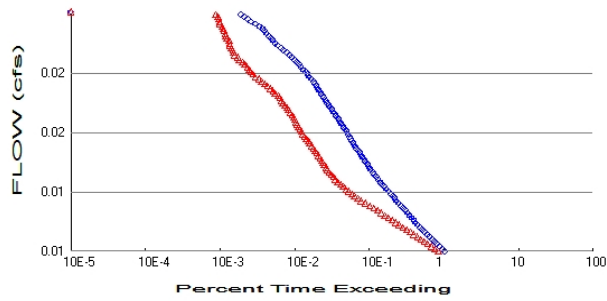
Tank Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.000	0.000	0.000	0.000
0.0556	0.012	0.000	0.000	0.000
0.1111	0.017	0.001	0.000	0.000
0.1667	0.021	0.002	0.000	0.000
0.2222	0.024	0.003	0.000	0.000
0.2778	0.027	0.005	0.000	0.000
0.3333	0.029	0.006	0.001	0.000
0.3889	0.031	0.008	0.001	0.000
0.4444	0.033	0.010	0.001	0.000
0.5000	0.035	0.012	0.001	0.000
0.5556	0.037	0.014	0.001	0.000
0.6111	0.038	0.016	0.001	0.000
0.6667	0.040	0.018	0.001	0.000
0.7222	0.041	0.020	0.001	0.000
0.7778	0.042	0.023	0.001	0.000
0.8333	0.044	0.025	0.001	0.000
0.8889	0.045	0.027	0.001	0.000
0.9444	0.046	0.030	0.001	0.000
1.0000	0.047	0.033	0.001	0.000
1.0556	0.048	0.035	0.001	0.000
1.1111	0.049	0.038	0.001	0.000
1.1667	0.049	0.041	0.001	0.000
1.2222	0.050	0.043	0.001	0.000
1.2778	0.051	0.046	0.001	0.000
1.3333	0.052	0.049	0.002	0.000
1.3889	0.052	0.052	0.002	0.000
1.4444	0.053	0.055	0.002	0.000
1.5000	0.054	0.058	0.002	0.000
1.5556	0.054	0.061	0.002	0.000
1.6111	0.055	0.064	0.002	0.000
1.6667	0.055	0.067	0.002	0.000
1.7222	0.056	0.070	0.002	0.000
1.7778	0.056	0.073	0.002	0.000
1.8333	0.056	0.077	0.002	0.000
1.8889	0.057	0.080	0.002	0.000
1.9444	0.057	0.083	0.002	0.000

2.0000	0.057	0.086	0.002	0.000
2.0556	0.058	0.089	0.002	0.000
2.1111	0.058	0.093	0.002	0.000
2.1667	0.058	0.096	0.002	0.000
2.2222	0.058	0.099	0.002	0.000
2.2778	0.058	0.102	0.002	0.000
2.3333	0.058	0.106	0.002	0.000
2.3889	0.058	0.109	0.002	0.000
2.4444	0.059	0.112	0.002	0.000
2.5000	0.059	0.115	0.002	0.000
2.5556	0.059	0.119	0.002	0.000
2.6111	0.058	0.122	0.002	0.000
2.6667	0.058	0.125	0.002	0.000
2.7222	0.058	0.128	0.002	0.000
2.7778	0.058	0.132	0.002	0.000
2.8333	0.058	0.135	0.002	0.000
2.8889	0.058	0.138	0.003	0.000
2.9444	0.058	0.141	0.004	0.000
3.0000	0.057	0.145	0.005	0.000
3.0556	0.057	0.148	0.005	0.000
3.1111	0.057	0.151	0.006	0.000
3.1667	0.056	0.154	0.006	0.000
3.2222	0.056	0.157	0.007	0.000
3.2778	0.056	0.161	0.007	0.000
3.3333	0.055	0.164	0.007	0.000
3.3889	0.055	0.167	0.008	0.000
3.4444	0.054	0.170	0.008	0.000
3.5000	0.054	0.173	0.008	0.000
3.5556	0.053	0.176	0.008	0.000
3.6111	0.052	0.179	0.009	0.000
3.6667	0.052	0.182	0.010	0.000
3.7222	0.051	0.185	0.013	0.000
3.7778	0.050	0.187	0.015	0.000
3.8333	0.049	0.190	0.016	0.000
3.8889	0.049	0.193	0.017	0.000
3.9444	0.048	0.196	0.018	0.000
4.0000	0.047	0.198	0.019	0.000
4.0556	0.046	0.201	0.228	0.000
4.1111	0.045	0.203	0.609	0.000
4.1667	0.044	0.206	1.096	0.000
4.2222	0.042	0.208	1.659	0.000
4.2778	0.041	0.211	2.272	0.000
4.3333	0.040	0.213	2.906	0.000
4.3889	0.038	0.215	3.534	0.000
4.4444	0.037	0.217	4.129	0.000
4.5000	0.035	0.219	4.665	0.000
4.5556	0.033	0.221	5.124	0.000
4.6111	0.031	0.223	5.495	0.000
4.6667	0.029	0.225	5.782	0.000
4.7222	0.027	0.226	6.003	0.000
4.7778	0.024	0.228	6.279	0.000
4.8333	0.021	0.229	6.499	0.000
4.8889	0.017	0.230	6.711	0.000
4.9444	0.012	0.231	6.917	0.000
5.0000	0.000	0.231	7.118	0.000
5.0556	0.000	0.000	7.312	0.000

Analysis Results

POC 1



+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1

Total Pervious Area: 0.491
 Total Impervious Area: 0

Mitigated Landuse Totals for POC #1

Total Pervious Area: 0.239
 Total Impervious Area: 0.252

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.011094
5 year	0.017069
10 year	0.020523
25 year	0.024264
50 year	0.02667
100 year	0.028758

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.011886
5 year	0.016577
10 year	0.020384
25 year	0.026082
50 year	0.031038
100 year	0.036664

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1902	0.009	0.012
1903	0.007	0.013
1904	0.012	0.018
1905	0.006	0.009
1906	0.003	0.009
1907	0.017	0.012
1908	0.012	0.010
1909	0.012	0.010
1910	0.017	0.013
1911	0.011	0.012

1912	0.037	0.026
1913	0.017	0.015
1914	0.004	0.034
1915	0.007	0.009
1916	0.011	0.013
1917	0.004	0.006
1918	0.012	0.013
1919	0.009	0.008
1920	0.011	0.011
1921	0.012	0.010
1922	0.012	0.014
1923	0.010	0.010
1924	0.005	0.014
1925	0.006	0.008
1926	0.011	0.011
1927	0.008	0.010
1928	0.008	0.010
1929	0.017	0.014
1930	0.011	0.015
1931	0.010	0.010
1932	0.008	0.010
1933	0.009	0.010
1934	0.023	0.021
1935	0.010	0.009
1936	0.009	0.011
1937	0.015	0.014
1938	0.009	0.009
1939	0.001	0.009
1940	0.010	0.016
1941	0.006	0.017
1942	0.015	0.015
1943	0.008	0.012
1944	0.016	0.018
1945	0.012	0.012
1946	0.007	0.012
1947	0.005	0.008
1948	0.024	0.011
1949	0.021	0.015
1950	0.006	0.009
1951	0.008	0.016
1952	0.031	0.020
1953	0.028	0.018
1954	0.010	0.010
1955	0.009	0.009
1956	0.005	0.008
1957	0.015	0.009
1958	0.030	0.074
1959	0.018	0.021
1960	0.005	0.009
1961	0.018	0.023
1962	0.010	0.010
1963	0.005	0.008
1964	0.005	0.024
1965	0.021	0.017
1966	0.006	0.009
1967	0.009	0.013
1968	0.010	0.011
1969	0.009	0.010

1970	0.014	0.012
1971	0.022	0.012
1972	0.014	0.031
1973	0.019	0.018
1974	0.010	0.014
1975	0.023	0.021
1976	0.012	0.017
1977	0.006	0.007
1978	0.020	0.018
1979	0.006	0.011
1980	0.012	0.014
1981	0.011	0.012
1982	0.005	0.009
1983	0.018	0.013
1984	0.008	0.012
1985	0.013	0.016
1986	0.011	0.009
1987	0.021	0.014
1988	0.013	0.009
1989	0.012	0.008
1990	0.014	0.011
1991	0.011	0.015
1992	0.014	0.016
1993	0.015	0.012
1994	0.022	0.012
1995	0.005	0.009
1996	0.024	0.021
1997	0.010	0.010
1998	0.012	0.012
1999	0.001	0.013
2000	0.009	0.011
2001	0.005	0.009
2002	0.016	0.017
2003	0.014	0.011
2004	0.012	0.012
2005	0.022	0.027
2006	0.007	0.011
2007	0.007	0.013
2008	0.012	0.011
2009	0.008	0.009
2010	0.007	0.011
2011	0.006	0.010
2012	0.009	0.010
2013	0.007	0.010
2014	0.005	0.010
2015	0.009	0.016
2016	0.004	0.011
2017	0.017	0.015
2018	0.030	0.052
2019	0.030	0.019
2020	0.009	0.013
2021	0.015	0.012
2022	0.006	0.014
2023	0.013	0.018
2024	0.026	0.026
2025	0.011	0.010
2026	0.018	0.015
2027	0.007	0.013

2028	0.006	0.006
2029	0.012	0.010
2030	0.023	0.016
2031	0.008	0.006
2032	0.004	0.009
2033	0.007	0.010
2034	0.007	0.008
2035	0.026	0.017
2036	0.014	0.010
2037	0.004	0.013
2038	0.011	0.012
2039	0.002	0.021
2040	0.007	0.010
2041	0.009	0.011
2042	0.026	0.014
2043	0.013	0.013
2044	0.017	0.014
2045	0.011	0.010
2046	0.013	0.014
2047	0.010	0.010
2048	0.013	0.009
2049	0.011	0.012
2050	0.008	0.010
2051	0.012	0.015
2052	0.007	0.011
2053	0.012	0.013
2054	0.015	0.019
2055	0.006	0.010
2056	0.005	0.013
2057	0.009	0.008
2058	0.010	0.014
2059	0.018	0.016

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0373	0.0743
2	0.0306	0.0519
3	0.0301	0.0343
4	0.0298	0.0309
5	0.0295	0.0270
6	0.0277	0.0265
7	0.0262	0.0263
8	0.0259	0.0245
9	0.0258	0.0232
10	0.0239	0.0215
11	0.0236	0.0212
12	0.0232	0.0210
13	0.0227	0.0208
14	0.0226	0.0207
15	0.0220	0.0203
16	0.0219	0.0186
17	0.0219	0.0186
18	0.0211	0.0183
19	0.0207	0.0183
20	0.0205	0.0182
21	0.0204	0.0180
22	0.0186	0.0179

23	0.0185	0.0177
24	0.0185	0.0175
25	0.0185	0.0172
26	0.0183	0.0167
27	0.0181	0.0166
28	0.0174	0.0165
29	0.0172	0.0165
30	0.0172	0.0160
31	0.0172	0.0159
32	0.0168	0.0157
33	0.0167	0.0156
34	0.0159	0.0156
35	0.0158	0.0155
36	0.0153	0.0154
37	0.0153	0.0153
38	0.0153	0.0151
39	0.0150	0.0151
40	0.0149	0.0150
41	0.0147	0.0148
42	0.0145	0.0147
43	0.0144	0.0146
44	0.0143	0.0144
45	0.0139	0.0144
46	0.0138	0.0143
47	0.0136	0.0143
48	0.0132	0.0140
49	0.0132	0.0140
50	0.0131	0.0139
51	0.0129	0.0139
52	0.0128	0.0138
53	0.0125	0.0138
54	0.0124	0.0137
55	0.0124	0.0137
56	0.0124	0.0133
57	0.0124	0.0132
58	0.0123	0.0132
59	0.0123	0.0131
60	0.0123	0.0131
61	0.0121	0.0131
62	0.0121	0.0130
63	0.0120	0.0129
64	0.0119	0.0127
65	0.0118	0.0126
66	0.0118	0.0126
67	0.0118	0.0126
68	0.0117	0.0126
69	0.0117	0.0125
70	0.0115	0.0125
71	0.0114	0.0125
72	0.0114	0.0124
73	0.0113	0.0123
74	0.0112	0.0123
75	0.0111	0.0123
76	0.0111	0.0123
77	0.0111	0.0121
78	0.0110	0.0121
79	0.0110	0.0120
80	0.0109	0.0119

81	0.0108	0.0119
82	0.0105	0.0119
83	0.0104	0.0118
84	0.0102	0.0117
85	0.0102	0.0116
86	0.0102	0.0115
87	0.0100	0.0115
88	0.0099	0.0115
89	0.0098	0.0114
90	0.0098	0.0113
91	0.0098	0.0112
92	0.0097	0.0111
93	0.0095	0.0111
94	0.0094	0.0111
95	0.0094	0.0110
96	0.0093	0.0110
97	0.0093	0.0108
98	0.0092	0.0107
99	0.0092	0.0107
100	0.0092	0.0106
101	0.0090	0.0106
102	0.0088	0.0105
103	0.0088	0.0105
104	0.0087	0.0104
105	0.0086	0.0104
106	0.0086	0.0104
107	0.0085	0.0104
108	0.0084	0.0103
109	0.0082	0.0103
110	0.0080	0.0103
111	0.0079	0.0103
112	0.0078	0.0102
113	0.0077	0.0102
114	0.0077	0.0102
115	0.0075	0.0101
116	0.0074	0.0100
117	0.0073	0.0100
118	0.0073	0.0100
119	0.0070	0.0099
120	0.0070	0.0098
121	0.0070	0.0098
122	0.0069	0.0098
123	0.0068	0.0098
124	0.0068	0.0098
125	0.0068	0.0098
126	0.0067	0.0097
127	0.0065	0.0096
128	0.0063	0.0094
129	0.0063	0.0094
130	0.0062	0.0093
131	0.0062	0.0092
132	0.0061	0.0092
133	0.0061	0.0091
134	0.0060	0.0091
135	0.0060	0.0090
136	0.0060	0.0090
137	0.0057	0.0090
138	0.0055	0.0089

139	0.0055	0.0088
140	0.0054	0.0088
141	0.0052	0.0088
142	0.0051	0.0088
143	0.0051	0.0087
144	0.0050	0.0087
145	0.0049	0.0087
146	0.0048	0.0086
147	0.0048	0.0083
148	0.0048	0.0082
149	0.0045	0.0081
150	0.0044	0.0079
151	0.0044	0.0079
152	0.0039	0.0078
153	0.0038	0.0078
154	0.0037	0.0076
155	0.0030	0.0073
156	0.0015	0.0064
157	0.0012	0.0062
158	0.0008	0.0059

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0055	56841	46381	81	Pass
0.0058	52415	41589	79	Pass
0.0060	48365	37262	77	Pass
0.0062	44609	33418	74	Pass
0.0064	41213	30138	73	Pass
0.0066	38238	27052	70	Pass
0.0068	35473	24338	68	Pass
0.0070	32958	21844	66	Pass
0.0073	30526	19606	64	Pass
0.0075	28432	17568	61	Pass
0.0077	26493	15684	59	Pass
0.0079	24742	13967	56	Pass
0.0081	23130	12482	53	Pass
0.0083	21678	11191	51	Pass
0.0085	20315	9933	48	Pass
0.0087	19063	8920	46	Pass
0.0090	17856	8039	45	Pass
0.0092	16714	7152	42	Pass
0.0094	15606	6371	40	Pass
0.0096	14620	5623	38	Pass
0.0098	13717	4902	35	Pass
0.0100	12903	4310	33	Pass
0.0102	12099	3866	31	Pass
0.0105	11401	3507	30	Pass
0.0107	10681	3208	30	Pass
0.0109	9989	2916	29	Pass
0.0111	9368	2691	28	Pass
0.0113	8770	2466	28	Pass
0.0115	8199	2270	27	Pass
0.0117	7734	2072	26	Pass
0.0119	7257	1945	26	Pass
0.0122	6792	1835	27	Pass
0.0124	6426	1708	26	Pass
0.0126	6122	1597	26	Pass
0.0128	5828	1520	26	Pass
0.0130	5557	1464	26	Pass
0.0132	5277	1382	26	Pass
0.0134	5005	1321	26	Pass
0.0137	4790	1266	26	Pass
0.0139	4538	1209	26	Pass
0.0141	4339	1156	26	Pass
0.0143	4159	1088	26	Pass
0.0145	3944	1033	26	Pass
0.0147	3713	980	26	Pass
0.0149	3537	932	26	Pass
0.0151	3369	883	26	Pass
0.0154	3227	844	26	Pass
0.0156	3090	794	25	Pass
0.0158	2970	744	25	Pass
0.0160	2851	708	24	Pass
0.0162	2740	678	24	Pass
0.0164	2610	649	24	Pass
0.0166	2477	623	25	Pass

0.0169	2359	601	25	Pass
0.0171	2267	573	25	Pass
0.0173	2159	555	25	Pass
0.0175	2058	537	26	Pass
0.0177	1950	509	26	Pass
0.0179	1837	478	26	Pass
0.0181	1749	455	26	Pass
0.0183	1661	435	26	Pass
0.0186	1578	406	25	Pass
0.0188	1510	385	25	Pass
0.0190	1447	365	25	Pass
0.0192	1367	348	25	Pass
0.0194	1297	332	25	Pass
0.0196	1243	301	24	Pass
0.0198	1182	283	23	Pass
0.0201	1131	261	23	Pass
0.0203	1083	240	22	Pass
0.0205	1026	219	21	Pass
0.0207	980	199	20	Pass
0.0209	925	183	19	Pass
0.0211	871	163	18	Pass
0.0213	819	152	18	Pass
0.0215	772	143	18	Pass
0.0218	717	136	18	Pass
0.0220	668	128	19	Pass
0.0222	629	119	18	Pass
0.0224	588	110	18	Pass
0.0226	549	100	18	Pass
0.0228	508	96	18	Pass
0.0230	473	87	18	Pass
0.0233	428	84	19	Pass
0.0235	393	82	20	Pass
0.0237	363	78	21	Pass
0.0239	330	76	23	Pass
0.0241	300	74	24	Pass
0.0243	281	73	25	Pass
0.0245	264	67	25	Pass
0.0247	248	66	26	Pass
0.0250	233	65	27	Pass
0.0252	219	62	28	Pass
0.0254	205	61	29	Pass
0.0256	186	59	31	Pass
0.0258	163	55	33	Pass
0.0260	144	55	38	Pass
0.0262	129	53	41	Pass
0.0265	117	52	44	Pass
0.0267	105	48	45	Pass

Water Quality

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 Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Tank 1 POC	<input type="checkbox"/>	109.14			<input type="checkbox"/>	0.00			
Total Volume Infiltrated		109.14	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

No PERLND changes have been made.

IMPLND Changes

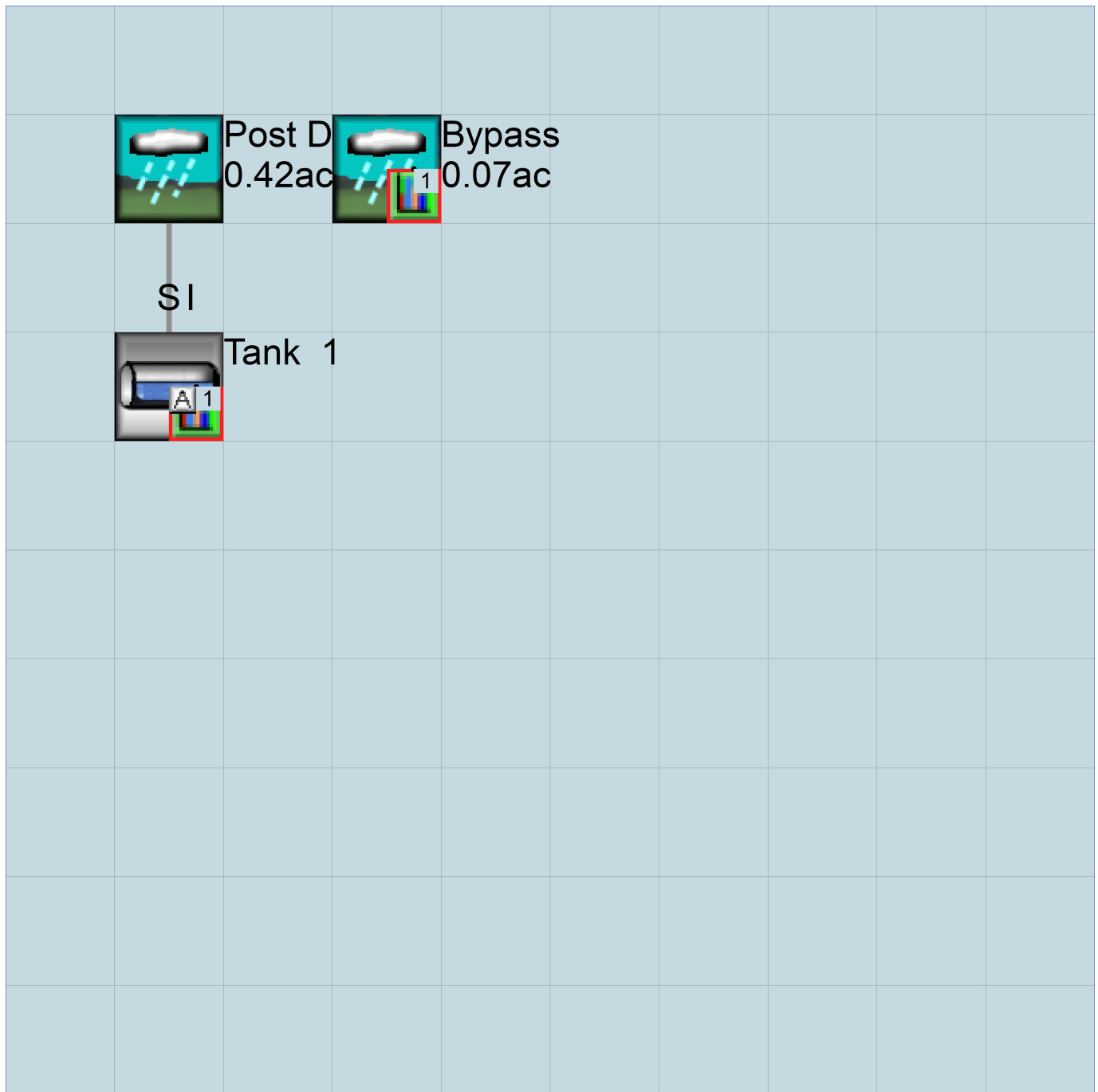
No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Basin 1
0.49ac

Mitigated Schematic



Predeveloped UCI File

RUN

GLOBAL

```
WVHM4 model simulation
START      1901 10 01      END      2059 09 30
RUN INTERP OUTPUT LEVEL  3      0
RESUME     0 RUN      1
UNIT SYSTEM 1
```

END GLOBAL

FILES

```
<File> <Un#> <-----File Name----->***
<-ID->                                     ***
WDM      26      19078.wdm
MESSU    25      Pre19078.MES
          27      Pre19078.L61
          28      Pre19078.L62
          30      POC190781.dat
```

END FILES

OPN SEQUENCE

```
INGRP          INDELT 00:15
  PERLND        10
  COPY          501
  DISPLY        1
```

END INGRP

END OPN SEQUENCE

DISPLY

DISPLY-INFO1

```
# - #<-----Title----->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
1   Basin 1          MAX          1   2   30   9
```

END DISPLY-INFO1

END DISPLY

COPY

TIMESERIES

```
# - # NPT NMN ***
1   1   1
501 1   1
```

END TIMESERIES

END COPY

GENER

OPCODE

```
# # OPCD ***
```

END OPCODE

PARM

```
# # K ***
```

END PARM

END GENER

PERLND

GEN-INFO

```
<PLS ><-----Name----->NBLKS  Unit-systems  Printer ***
# - #          User  t-series  Engl Metr ***
          in  out          ***
```

```
10      C, Forest, Flat      1   1   1   1   27   0
```

END GEN-INFO

*** Section PWATER***

ACTIVITY

```
<PLS > ***** Active Sections *****
# - # ATMP SNOW PWAT  SED  PST  PWG  PQAL MSTL PEST NITR PHOS TRAC ***
10   0   0   1   0   0   0   0   0   0   0   0   0
```

END ACTIVITY

PRINT-INFO

```
<PLS > ***** Print-flags ***** PIVL  PYR
# - # ATMP SNOW PWAT  SED  PST  PWG  PQAL MSTL PEST NITR PHOS TRAC *****
10   0   0   4   0   0   0   0   0   0   0   0   0   1   9
```

END PRINT-INFO

```

PWAT-PARM1
<PLS > PWATER variable monthly parameter value flags ***
# - # CSNO RTOP UZFG VCS VUZ VNN VIFW VIRC VLE INFC HWT ***
10 0 0 0 0 0 0 0 0 0 0 0
END PWAT-PARM1

PWAT-PARM2
<PLS > PWATER input info: Part 2 ***
# - # ***FOREST LZSN INFILT LSUR SLSUR KVARY AGWRC
10 0 4.5 0.08 400 0.05 0.5 0.996
END PWAT-PARM2

PWAT-PARM3
<PLS > PWATER input info: Part 3 ***
# - # ***PETMAX PETMIN INFEXP INFILD DEEPFR BASETP AGWETP
10 0 0 2 2 0 0 0
END PWAT-PARM3

PWAT-PARM4
<PLS > PWATER input info: Part 4 ***
# - # CEPSC UZSN NSUR INTFW IRC LZETP ***
10 0.2 0.5 0.35 6 0.5 0.7
END PWAT-PARM4

PWAT-STATE1
<PLS > *** Initial conditions at start of simulation
ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
# - # *** CEPS SURS UZS IFWS LZS AGWS GWVS
10 0 0 0 0 2.5 1 0
END PWAT-STATE1

END PERLND

IMPLND
GEN-INFO
<PLS ><-----Name-----> Unit-systems Printer ***
# - # User t-series Engl Metr ***
in out ***

END GEN-INFO
*** Section IWATER***

ACTIVITY
<PLS > ***** Active Sections *****
# - # ATMP SNOW IWAT SLD IWG IQAL ***
END ACTIVITY

PRINT-INFO
<ILS > ***** Print-flags ***** PIVL PYR
# - # ATMP SNOW IWAT SLD IWG IQAL *****
END PRINT-INFO

IWAT-PARM1
<PLS > IWATER variable monthly parameter value flags ***
# - # CSNO RTOP VRS VNN RTLI ***
END IWAT-PARM1

IWAT-PARM2
<PLS > IWATER input info: Part 2 ***
# - # *** LSUR SLSUR NSUR RETSC
END IWAT-PARM2

IWAT-PARM3
<PLS > IWATER input info: Part 3 ***
# - # ***PETMAX PETMIN
END IWAT-PARM3

IWAT-STATE1
<PLS > *** Initial conditions at start of simulation
# - # *** RETS SURS
END IWAT-STATE1

```

END IMPLND

SCHEMATIC

<-Source->	<Name> #	<--Area-->	<-factor-->	<-Target->	MBLK	***
Basin	1***				Tbl#	***
PERLND	10	0.491		COPY 501	12	
PERLND	10	0.491		COPY 501	13	

*****Routing*****
END SCHEMATIC

NETWORK

<-Volume->	<-Grp>	<-Member->	<--Mult-->	Tran	<-Target vols>	<-Grp>	<-Member->	***
<Name>	#	<Name> #	#	<-factor-->strg	<Name> #	#	<Name> #	***
COPY	501	OUTPUT	MEAN	1 1 48.4	DISPLY	1	INPUT	TIMSER 1

<-Volume->	<-Grp>	<-Member->	<--Mult-->	Tran	<-Target vols>	<-Grp>	<-Member->	***
<Name>	#	<Name> #	#	<-factor-->strg	<Name> #	#	<Name> #	***

END NETWORK

RCHRES

GEN-INFO	RCHRES	Name	Nexits	Unit Systems	Printer	***
# - #	<----->	<---->	User	T-series	Engl Metr	LKFG
			in	out		***

END GEN-INFO
*** Section RCHRES***

ACTIVITY

<PLS > ***** Active Sections *****

#	-	#	HYFG	ADFG	CNFG	HTFG	SDFG	GQFG	OXFG	NUFG	PKFG	PHFG	***
#	-	#	HYFG	ADFG	CNFG	HTFG	SDFG	GQFG	OXFG	NUFG	PKFG	PHFG	***

END ACTIVITY

PRINT-INFO

<PLS > ***** Print-flags ***** PIVL PYR

#	-	#	HYDR	ADCA	CONS	HEAT	SED	GQL	OXRX	NUTR	PLNK	PHCB	PIVL	PYR	*****
#	-	#	HYDR	ADCA	CONS	HEAT	SED	GQL	OXRX	NUTR	PLNK	PHCB	PIVL	PYR	*****

END PRINT-INFO

HYDR-PARM1

RCHRES	Flags for each HYDR Section	***	ODGTFG for each	FUNCT for each	***
# - #	VC A1 A2 A3	ODFVFG for each	***	ODGTFG for each	FUNCT for each
	FG FG FG FG	possible exit	***	possible exit	possible exit
	* * * *	* * * * *		* * * * *	***

END HYDR-PARM1

HYDR-PARM2

#	-	#	FTABNO	LEN	DELTH	STCOR	KS	DB50	***
<----->	<----->	<----->	<----->	<----->	<----->	<----->	<----->	<----->	***

END HYDR-PARM2

HYDR-INIT

RCHRES	Initial conditions for each HYDR section	***
# - #	*** VOL	Initial value of COLIND
	*** ac-ft	for each possible exit
		Initial value of OUTDGT
		for each possible exit
<----->	<----->	<----->

END HYDR-INIT

END RCHRES

SPEC-ACTIONS

END SPEC-ACTIONS

FTABLES

END FTABLES

EXT SOURCES

<-Volume->	<Member>	SsysSgap	<--Mult-->	Tran	<-Target vols>	<-Grp>	<-Member->	***
<Name>	#	<Name> #	tem	strg	<-factor-->strg	<Name> #	#	<Name> #
WDM	2	PREC	ENGL	1	PERLND	1 999	EXTNL	PREC
WDM	2	PREC	ENGL	1	IMPLND	1 999	EXTNL	PREC

```
WDM      1 EVAP      ENGL      1          PERLND    1 999 EXTNL  PETINP
WDM      1 EVAP      ENGL      1          IMPLND    1 999 EXTNL  PETINP
```

END EXT SOURCES

EXT TARGETS

```
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>      #      <Name> # #<-factor->strg <Name>      # <Name>      tem strg strg***
COPY      501 OUTPUT MEAN    1 1      48.4      WDM      501 FLOW      ENGL      REPL
END EXT TARGETS
```

MASS-LINK

```
<Volume>   <-Grp> <-Member-><--Mult-->   <Target>           <-Grp> <-Member->***
<Name>     #      <Name> # #<-factor->   <Name>           <Name> # #***
  MASS-LINK      12
PERLND      PWATER SURO           0.083333   COPY           INPUT  MEAN
  END MASS-LINK      12
```

```
  MASS-LINK      13
PERLND      PWATER IFWO           0.083333   COPY           INPUT  MEAN
  END MASS-LINK      13
```

END MASS-LINK

END RUN

Mitigated UCI File

RUN

GLOBAL

WVHM4 model simulation
START 1901 10 01 END 2059 09 30
RUN INTERP OUTPUT LEVEL 3 0
RESUME 0 RUN 1 UNIT SYSTEM 1
END GLOBAL

FILES

<File>	<Un#>	<-----File Name----->	***
<-ID->			***
WDM	26	19078.wdm	
MESSU	25	Mit19078.MES	
	27	Mit19078.L61	
	28	Mit19078.L62	
	30	POC190781.dat	

END FILES

OPN SEQUENCE

INGRP INDELT 00:15
PERLND 13
IMPLND 4
IMPLND 11
PERLND 14
IMPLND 8
IMPLND 12
RCHRES 1
COPY 1
COPY 501
COPY 601
DISPLY 1

END INGRP

END OPN SEQUENCE

DISPLY

DISPLY-INF01

#	-	#	<-----Title----->	***	TRAN	PIVL	DIG1	FIL1	PYR	DIG2	FIL2	YRND
1			Tank 1		MAX				1	2	30	9

END DISPLY-INF01

END DISPLY

COPY

TIMESERIES

#	-	#	NPT	NMN	***
1			1	1	
501			1	1	
601			1	1	

END TIMESERIES

END COPY

GENER

OPCODE

#	#	OPCD	***
---	---	------	-----

END OPCODE

PARM

#	#	K	***
---	---	---	-----

END PARM

END GENER

PERLND

GEN-INFO

<PLS >	<-----Name----->	NBLKS	Unit-systems		Printer		***
#	#		User	t-series	Engl	Metr	***
			in	out			***
13	C, Pasture, Flat	1	1	1	1	27	0
14	C, Pasture, Mod	1	1	1	1	27	0

END GEN-INFO

*** Section PWATER***

ACTIVITY

<PLS > ***** Active Sections *****

```

# - # ATMP SNOW PWAT SED PST PWG PQAL MSTL PEST NITR PHOS TRAC ***
13      0      0      1      0      0      0      0      0      0      0      0      0
14      0      0      1      0      0      0      0      0      0      0      0      0
END ACTIVITY

```

PRINT-INFO

```

<PLS > ***** Print-flags ***** PIVL  PYR
# - # ATMP SNOW PWAT SED PST PWG PQAL MSTL PEST NITR PHOS TRAC *****
13      0      0      4      0      0      0      0      0      0      0      0      1      9
14      0      0      4      0      0      0      0      0      0      0      0      1      9
END PRINT-INFO

```

PWAT-PARM1

```

<PLS > PWATER variable monthly parameter value flags ***
# - # CSNO RTOP UZFG VCS VUZ VNN VIFW VIRC VLE INFC HWT ***
13      0      0      0      0      0      0      0      0      0      0      0
14      0      0      0      0      0      0      0      0      0      0      0
END PWAT-PARM1

```

PWAT-PARM2

```

<PLS > PWATER input info: Part 2 ***
# - # ***FOREST LZSN INFILT LSUR SLSUR KVARY AGWRC
13      0      4.5      0.06      400      0.05      0.5      0.996
14      0      4.5      0.06      400      0.1      0.5      0.996
END PWAT-PARM2

```

PWAT-PARM3

```

<PLS > PWATER input info: Part 3 ***
# - # ***PETMAX PETMIN INFEXP INFILD DEEPFR BASETP AGWETP
13      0      0      2      2      0      0      0
14      0      0      2      2      0      0      0
END PWAT-PARM3

```

PWAT-PARM4

```

<PLS > PWATER input info: Part 4 ***
# - # CEPSC UZSN NSUR INTFW IRC LZETP ***
13      0.15      0.4      0.3      6      0.5      0.4
14      0.15      0.4      0.3      6      0.5      0.4
END PWAT-PARM4

```

PWAT-STATE1

```

<PLS > *** Initial conditions at start of simulation
ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
# - # *** CEPS SURS UZS IFWS LZS AGWS GWVS
13      0      0      0      0      2.5      1      0
14      0      0      0      0      2.5      1      0
END PWAT-STATE1

```

END PERLND

IMPLND

GEN-INFO

```

<PLS ><-----Name-----> Unit-systems Printer ***
# - # User t-series Engr Metr ***
in out ***
4      ROOF TOPS/FLAT      1      1      1      27      0
11     PARKING/FLAT      1      1      1      27      0
8      SIDEWALKS/FLAT     1      1      1      27      0
12     PARKING/MOD      1      1      1      27      0
END GEN-INFO
*** Section IWATER***

```

ACTIVITY

```

<PLS > ***** Active Sections *****
# - # ATMP SNOW IWAT SLD IWG IQAL ***
4      0      0      1      0      0      0
11     0      0      1      0      0      0
8      0      0      1      0      0      0
12     0      0      1      0      0      0
END ACTIVITY

```

PRINT-INFO

<ILS > ***** Print-flags ***** PIVL PYR										
#	-	#	ATMP	SNOW	IWAT	SLD	IWG	IQAL	*****	
4			0	0	4	0	0	0	1	9
11			0	0	4	0	0	0	1	9
8			0	0	4	0	0	0	1	9
12			0	0	4	0	0	0	1	9

END PRINT-INFO

IWAT-PARM1

<PLS > IWATER variable monthly parameter value flags ***								
#	-	#	CSNO	RTOP	VRS	VNM	RTL	***
4			0	0	0	0	0	
11			0	0	0	0	0	
8			0	0	0	0	0	
12			0	0	0	0	0	

END IWAT-PARM1

IWAT-PARM2

<PLS > IWATER input info: Part 2 ***							
#	-	#	***	LSUR	SLSUR	NSUR	RETSC
4				400	0.01	0.1	0.1
11				400	0.01	0.1	0.1
8				400	0.01	0.1	0.1
12				400	0.05	0.1	0.08

END IWAT-PARM2

IWAT-PARM3

<PLS > IWATER input info: Part 3 ***					
#	-	#	***	PETMAX	PETMIN
4				0	0
11				0	0
8				0	0
12				0	0

END IWAT-PARM3

IWAT-STATE1

<PLS > *** Initial conditions at start of simulation					
#	-	#	***	RETS	SURS
4				0	0
11				0	0
8				0	0
12				0	0

END IWAT-STATE1

END IMPLND

SCHEMATIC

<-Source->		<--Area-->	<-Target->	MBLK	***
<Name>	#	<-factor->	<Name>	#	Tbl#
Post Dev	***				
PERLND	13	0.195	RCHRES	1	2
PERLND	13	0.195	RCHRES	1	3
IMPLND	4	0.108	RCHRES	1	5
IMPLND	11	0.12	RCHRES	1	5
Bypass	***				
PERLND	14	0.044	COPY	501	12
PERLND	14	0.044	COPY	601	12
PERLND	14	0.044	COPY	501	13
PERLND	14	0.044	COPY	601	13
IMPLND	8	0.006	COPY	501	15
IMPLND	8	0.006	COPY	601	15
IMPLND	12	0.018	COPY	501	15
IMPLND	12	0.018	COPY	601	15

*****Routing*****

PERLND	13	0.195	COPY	1	12
IMPLND	4	0.108	COPY	1	15
IMPLND	11	0.12	COPY	1	15
PERLND	13	0.195	COPY	1	13

0.333333	0.029434	0.006633	0.000979
0.388889	0.031602	0.008330	0.001058
0.444444	0.033580	0.010141	0.001131
0.500000	0.035399	0.012058	0.001199
0.555556	0.037083	0.014072	0.001264
0.611111	0.038649	0.016176	0.001326
0.666667	0.040112	0.018364	0.001385
0.722222	0.041481	0.020631	0.001441
0.777778	0.042766	0.022972	0.001496
0.833333	0.043975	0.025382	0.001548
0.888889	0.045114	0.027857	0.001599
0.944444	0.046187	0.030393	0.001648
1.000000	0.047199	0.032988	0.001696
1.055556	0.048155	0.035636	0.001743
1.111111	0.049057	0.038337	0.001788
1.166667	0.049908	0.041086	0.001832
1.222222	0.050711	0.043881	0.001875
1.277778	0.051468	0.046720	0.001917
1.333333	0.052181	0.049599	0.001958
1.388889	0.052852	0.052517	0.001999
1.444444	0.053482	0.055471	0.002038
1.500000	0.054074	0.058459	0.002077
1.555556	0.054627	0.061478	0.002115
1.611111	0.055144	0.064528	0.002153
1.666667	0.055625	0.067605	0.002190
1.722222	0.056071	0.070708	0.002226
1.777778	0.056484	0.073834	0.002261
1.833333	0.056863	0.076983	0.002296
1.888889	0.057209	0.080152	0.002331
1.944444	0.057524	0.083339	0.002365
2.000000	0.057807	0.086543	0.002399
2.055556	0.058059	0.089761	0.002432
2.111111	0.058281	0.092993	0.002464
2.166667	0.058472	0.096236	0.002497
2.222222	0.058634	0.099490	0.002528
2.277778	0.058766	0.102751	0.002560
2.333333	0.058868	0.106019	0.002591
2.388889	0.058941	0.109291	0.002621
2.444444	0.058985	0.112567	0.002652
2.500000	0.058999	0.115844	0.002682
2.555556	0.058985	0.119122	0.002711
2.611111	0.058941	0.122398	0.002741
2.666667	0.058868	0.125670	0.002770
2.722222	0.058766	0.128938	0.002798
2.777778	0.058634	0.132199	0.002827
2.833333	0.058472	0.135452	0.002855
2.888889	0.058281	0.138696	0.002881
2.944444	0.058059	0.141927	0.002906
3.000000	0.057807	0.145146	0.002929
3.055556	0.057524	0.148350	0.002950
3.111111	0.057209	0.151537	0.002969
3.166667	0.056863	0.154706	0.002985
3.222222	0.056484	0.157855	0.002999
3.277778	0.056071	0.160981	0.003011
3.333333	0.055625	0.164084	0.003021
3.388889	0.055144	0.167161	0.003028
3.444444	0.054627	0.170210	0.003033
3.500000	0.054074	0.173230	0.003036
3.555556	0.053482	0.176218	0.003037
3.611111	0.052852	0.179172	0.003035
3.666667	0.052181	0.182090	0.003031
3.722222	0.051468	0.184969	0.003025
3.777778	0.050711	0.187807	0.003017
3.833333	0.049908	0.190603	0.003007
3.888889	0.049057	0.193352	0.002995
3.944444	0.048155	0.196052	0.002981
4.000000	0.047199	0.198701	0.002965
4.055556	0.046187	0.201296	0.002947
4.111111	0.045114	0.203832	0.002927
4.166667	0.043975	0.206307	0.002904

```

4.222222 0.042766 0.208717 1.659765
4.277778 0.041481 0.211058 2.272392
4.333333 0.040112 0.213324 2.906782
4.388889 0.038649 0.215513 3.534867
4.444444 0.037083 0.217617 4.129241
4.500000 0.035399 0.219631 4.665341
4.555556 0.033580 0.221548 5.124227
4.611111 0.031602 0.223359 5.495822
4.666667 0.029434 0.225055 5.782567
4.722222 0.027029 0.226625 6.003411
4.777778 0.024317 0.228053 6.279069
4.833333 0.021181 0.229319 6.498982
4.888889 0.017394 0.230395 6.711685
4.944444 0.012369 0.231230 6.917845
5.000000 0.001000 0.231689 7.118031

```

END FTABLE 1

END FTABLES

EXT SOURCES

```

<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member-> ***
<Name> # <Name> # tem strg<-factor->strg <Name> # # <Name> # # ***
WDM 2 PREC ENGL 1 PERLND 1 999 EXTNL PREC
WDM 2 PREC ENGL 1 IMPLND 1 999 EXTNL PREC
WDM 1 EVAP ENGL 1 PERLND 1 999 EXTNL PETINP
WDM 1 EVAP ENGL 1 IMPLND 1 999 EXTNL PETINP

```

END EXT SOURCES

EXT TARGETS

```

<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name> # <Name> # #<-factor->strg <Name> # <Name> tem strg strg***
RCHRES 1 HYDR RO 1 1 1 WDM 1002 FLOW ENGL REPL
RCHRES 1 HYDR STAGE 1 1 1 WDM 1003 STAG ENGL REPL
COPY 1 OUTPUT MEAN 1 1 48.4 WDM 701 FLOW ENGL REPL
COPY 501 OUTPUT MEAN 1 1 48.4 WDM 801 FLOW ENGL REPL
COPY 601 OUTPUT MEAN 1 1 48.4 WDM 901 FLOW ENGL REPL

```

END EXT TARGETS

MASS-LINK

```

<Volume> <-Grp> <-Member-><--Mult--> <Target> <-Grp> <-Member->***
<Name> <Name> # #<-factor-> <Name> <Name> # #***
MASS-LINK 2
PERLND PWATER SURO 0.083333 RCHRES INFLOW IVOL
END MASS-LINK 2

MASS-LINK 3
PERLND PWATER IFWO 0.083333 RCHRES INFLOW IVOL
END MASS-LINK 3

MASS-LINK 5
IMPLND IWATER SURO 0.083333 RCHRES INFLOW IVOL
END MASS-LINK 5

MASS-LINK 12
PERLND PWATER SURO 0.083333 COPY INPUT MEAN
END MASS-LINK 12

MASS-LINK 13
PERLND PWATER IFWO 0.083333 COPY INPUT MEAN
END MASS-LINK 13

MASS-LINK 15
IMPLND IWATER SURO 0.083333 COPY INPUT MEAN
END MASS-LINK 15

MASS-LINK 16
RCHRES ROFLOW COPY INPUT MEAN
END MASS-LINK 16

```

END MASS-LINK

END RUN

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

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Local (360)943-0304

www.clearcreeksolutions.com

Channel Report

<Name>

Circular

Diameter (ft) = 1.00

Invert Elev (ft) = 1.00

Slope (%) = 0.50

N-Value = 0.012

Calculations

Compute by: Known Q

Known Q (cfs) = 0.22

Highlighted

Depth (ft) = 0.20

Q (cfs) = 0.220

Area (sqft) = 0.11

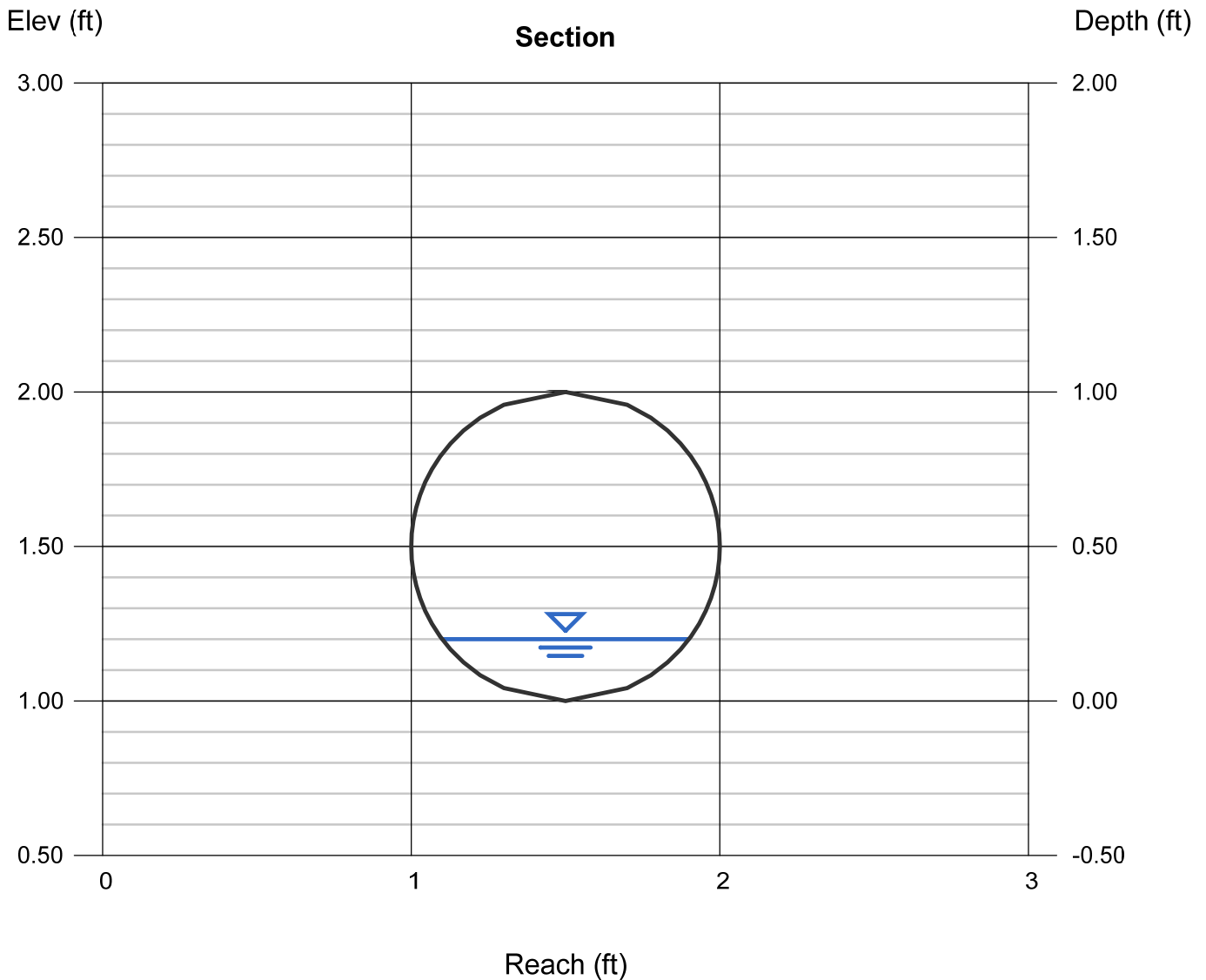
Velocity (ft/s) = 1.95

Wetted Perim (ft) = 0.93

Crit Depth, Y_c (ft) = 0.20

Top Width (ft) = 0.80

EGL (ft) = 0.26



**WWHM2012
PROJECT REPORT**

Project Name: 19078
Site Name: 1200 7th Street
Site Address: 1200 7th Street
City : Puyallup, WA
Report Date: 6/14/2022
Gage : 40 IN EAST
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

<u>Pervious Land Use</u>	<u>acre</u>
C, Forest, Flat	.49
Pervious Total	0.49
<u>Impervious Land Use</u>	<u>acre</u>
Impervious Total	0
Basin Total	0.49

Element Flows To:

Surface	Interflow	Groundwater
---------	-----------	-------------

MITIGATED LAND USE

Name : Post Dev
Bypass: No

GroundWater: No

<u>Pervious Land Use</u>	<u>acre</u>
C, Pasture, Flat	.209
Pervious Total	0.209
<u>Impervious Land Use</u>	<u>acre</u>
ROOF TOPS FLAT	0.108
PARKING FLAT	0.129
Impervious Total	0.237
Basin Total	0.446

Flow Frequency Return Periods for Predeveloped. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0.011071
5 year	0.017034
10 year	0.020481
25 year	0.024215
50 year	0.026616
100 year	0.0287

Flow Frequency Return Periods for Mitigated. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0.087681
5 year	0.117746
10 year	0.139606
25 year	0.169531
50 year	0.193554
100 year	0.219108

PerlnD and Implnd Changes

No changes have been made.

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Channel Report

8-inch PVC @ 0.30%; 80% Full

Circular

Diameter (ft) = 0.67

Invert Elev (ft) = 100.00

Slope (%) = 0.30

N-Value = 0.013

Calculations

Compute by: Known Depth

Known Depth (ft) = 0.54

Highlighted

Depth (ft) = 0.54

Q (cfs) = 0.660

Area (sqft) = 0.30

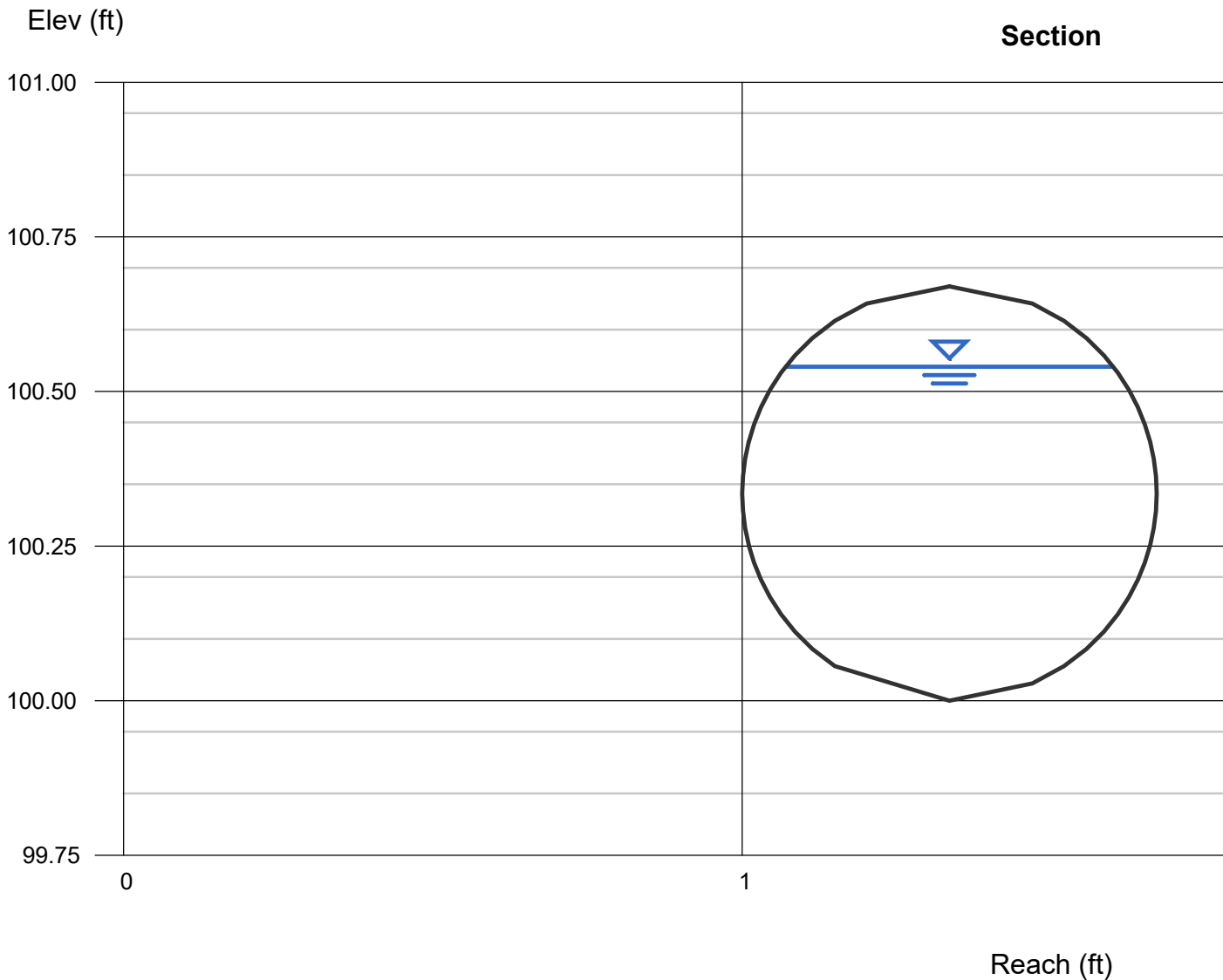
Velocity (ft/s) = 2.17

Wetted Perim (ft) = 1.49

Crit Depth, Yc (ft) = 0.39

Top Width (ft) = 0.53

EGL (ft) = 0.61



Channel Report

8-inch PVC @ 0.30%; 100-year 0.22-CFS

Circular

Diameter (ft) = 0.67

Invert Elev (ft) = 100.00

Slope (%) = 0.30

N-Value = 0.013

Calculations

Compute by: Known Q

Known Q (cfs) = 0.22

Highlighted

Depth (ft) = 0.27

Q (cfs) = 0.220

Area (sqft) = 0.13

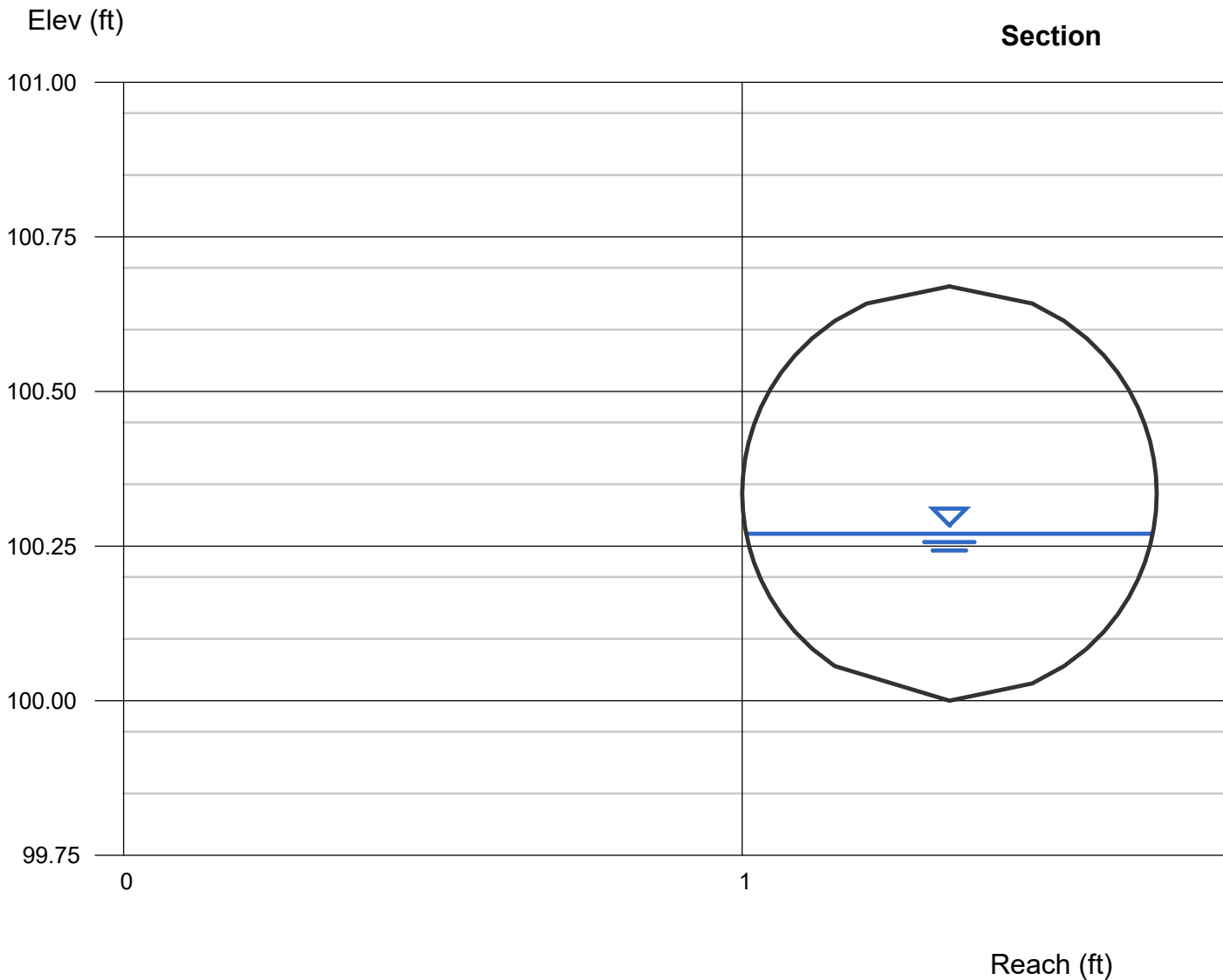
Velocity (ft/s) = 1.64

Wetted Perim (ft) = 0.92

Crit Depth, Yc (ft) = 0.22

Top Width (ft) = 0.66

EGL (ft) = 0.31



APPENDIX D

Other Studies

Geotechnical Study Report

D-1



Earth Solutions NW LLC

Geotechnical Engineering, Construction
Observation/Testing and Environmental Services

April 9, 2020
Updated January 21, 2021
ES-7182

Tac Build, LLC
729 North Stadium Way
Tacoma, Washington 98403

Attention: Mr. Michael Hopkins

**Subject: Preliminary Geotechnical Evaluation
Proposed Townhomes
1200 – 7th Avenue Southeast
Puyallup, Washington**

Reference: CES NW, Inc.
Preliminary Site Plan, dated June 9, 2020

Puyallup Municipal Code (PMC) Chapter 21.06: Critical Areas

J. Eric Schuster et al.
Geologic Map of the Tacoma 1:100,000-scale Quadrangle, Washington, 2015

Stephen P. Palmer et al.
Liquefaction Susceptibility Map of Pierce County, Washington, 2004

United States Department of Agriculture (USDA)
Natural Resources Conservation Service (NRCS)
Online Web Soil Survey (WSS) resource

Washington State Department of Ecology
2014 Stormwater Management Manual for Western Washington

Dear Mr. Hopkins:

As requested, Earth Solutions NW, LLC (ESNW), has prepared this letter for the proposed project. The letter was prepared in general accordance with the scope of services outlined in the November 2020 change order to our original proposal, which was authorized by you. A summary of the subsurface exploration on site and preliminary geotechnical recommendations to aid with the site design are provided in this letter.

Project Description

We understand that the existing improvements will be razed, and a new townhome development will be constructed. The proposal consists of six townhomes, a parking area (providing access from 7th Avenue Southeast), and an open space area between the proposed townhomes and the southern property line.

The referenced preliminary site plan indicates the parking area is to be comprised of pervious pavement. Based on our discussion with the project civil engineer as a result of our subsurface exploration, we understand that the stormwater management scheme may be modified.

Surface Conditions

The subject site is located south of the intersection between 7th Avenue Southeast and 12th Street Southeast, in Puyallup, Washington. The approximate location of the property is illustrated on Plate 1 (Vicinity Map). The site consists of one tax parcel (Pierce County Parcel No. 7845001330), totaling about 20,000 square feet. The site is surrounded to the east, south, and west by residential structures and to the north by 7th Avenue Southeast.

Subsurface Conditions

An ESNW representative observed, logged, and sampled three test pits on March 5, 2020. Three additional test pits were excavated on December 22, 2020. The test pits were excavated within accessible site areas, using a mini trackhoe and operator retained by ESNW. The test pits were completed to evaluate and classify site soils, characterize groundwater conditions within accessible site areas, and perform in-situ infiltration testing.

The approximate locations of the test pits are depicted on Plate 2 (Test Pit Location Plan). Please refer to the attached test pit logs for a more detailed description of subsurface conditions. Representative soil samples collected at the test pit locations were analyzed in general accordance with both Unified Soil Classification System (USCS) and USDA methods and procedures.

Topsoil and Fill

Where encountered at surface grades, the topsoil was about 6 to 12 inches thick. The topsoil was characterized by the observed dark brown hue, the presence of fine organics, and small root intrusions.

Fill was encountered at test pit locations TP-1, TP-2, TP-5, and TP-6 to depths of about two to four feet below the existing ground surface (bgs). The fill was characterized as sandy silt and poorly graded sand with silt, in a loose to medium dense and moist to wet condition. Small pieces of brick and glass were observed in the fill.

Native Soil

Underlying the topsoil and fill, native soil consisted primarily of poorly graded sand (USCS: SP or SP-SM) with layers of sandy silt (USCS: ML) present. The poorly graded sand layer ranged in thickness between about three feet to more than seven feet. The in-situ density of the native soil was characterized primarily as "medium dense" at each test location, and the in-situ moisture content was characterized as "moist" or "wet" depending on the presence of groundwater. The maximum exploration depth was approximately nine feet bgs.

Geologic Setting

The referenced geologic map resource identifies alluvium (Qa) as the primary native soil unit underlying the subject site and proximate areas. As reported on the geologic map resource, alluvium is typified by well-rounded and moderately to well-sorted beds of fluvial silt, sand, and gravel. The referenced WSS resource identifies Puyallup fine sandy loam (Map Unit Symbol: 31A) as the primary soil unit underlying the subject development area. The Puyallup series was formed in alluvial deposits as a result of the Mount Rainier watershed. Based on our field observations, the on-site native soil is consistent with the local geologic mapping of alluvium.

Groundwater

The groundwater table was encountered at all test pits during our March 2020 and December 2020 explorations at depths of about three and one-half to five-and-one-half feet bgs. Groundwater was allowed to stabilize at TP-4 to a depth of approximately four feet bgs. Shallower groundwater seepage was encountered at depths of roughly two-and-one-half and three feet bgs. It should be noted that seepage rates and elevations fluctuate depending on many factors, including precipitation duration and intensity, the time of year, and soil conditions. In general, groundwater flow rates are higher during the winter, spring, and early summer months.

Geologically Hazardous Areas

We reviewed the referenced PMC chapter to determine the presence of geologically hazardous areas on site. Based on our field observations and our review of the PMC, the subject site lies within a seismic hazard area. The three remaining geologically hazardous areas recognized by the PMC—erosion hazard area, landslide hazard area, and volcanic hazard area—are not applicable to the subject site.

According to PMC 21.06.1210(3)(c), seismic hazard areas are defined as “areas subject to severe risk of damage as a result of earthquake-induced ground shaking, slope failure, settlement or subsidence, soil liquefaction, or tsunamis.” The referenced liquefaction susceptibility map indicates the site and surrounding areas possess high liquefaction susceptibility. Based on our field observations, it is our opinion that the site is correctly mapped within a seismic hazard area, and the site possesses moderate to high susceptibility to liquefaction during a seismic event. Given the level of existing development surrounding the subject site, it is our opinion that the presence of a seismic hazard area does not preclude the proposed townhome development; however, appropriate mitigation measures should be incorporated into the plans, as discussed in this letter.

Preliminary Geotechnical Recommendations

The primary geotechnical considerations for the proposal are associated with structural fill placement and compaction, earthwork and grading activities, foundation support, and stormwater management. Based on our field observations and our understanding of the proposed development, pertinent geotechnical recommendations and design parameters are provided below.

In-situ and Imported Soil

The native alluvium is moisture sensitive, and successful use of the native alluvium as structural fill will largely be dictated by the moisture content at the time of placement and compaction. If the native alluvium cannot be successfully compacted, the use of an imported soil may be necessary.

Performing grading activities during summer months of relatively low rainfall activity is recommended to minimize site degradation. In our opinion, a contingency should be provided in the project budget for the export of soil that cannot be successfully compacted as structural fill, particularly if grading activities take place during periods of extended rainfall activity. In general, soil with an appreciable fines content (greater than 5 percent) typically degrades rapidly when exposed to periods of rainfall.

Imported soil intended for use as structural fill should be evaluated by ESNW during construction. The imported soil must be able to achieve the necessary moisture content, as determined by the Modified Proctor Method (ASTM D1557), at the time of placement and compaction. During wet weather conditions, imported soil intended for use as structural fill should consist of a well-graded, granular soil with a fines content of 5 percent or less (where the fines content is defined as the percent passing the Number 200 sieve, based on the minus three-quarter-inch fraction).

Structural Fill

Structural fill is defined as compacted soil placed in foundation, slab-on-grade, roadway, permanent slope, retaining wall, and utility trench backfill areas. Structural fill placed and compacted during site grading activities should meet the following specifications:

- | | |
|----------------------------------|-------------------------------|
| • Structural fill material | Granular soil* |
| • Moisture content | At or slightly above optimum† |
| • Relative compaction (minimum) | 95 percent (Modified Proctor) |
| • Loose lift thickness (maximum) | 12 inches |

* *The existing soil may not be suitable for use as structural fill unless the soil is at (or slightly above) the optimum moisture content at the time of placement and compaction*

† *Soil shall not be placed dry of optimum and should be evaluated by ESNW during construction*

Foundations

The proposed residential structures may be supported on conventional continuous and spread footing foundations bearing on either compact structural fill or competent native soil. In general, competent native soil should be encountered at a depth of roughly two to three feet bgs. Existing fill intended for reuse as structural fill must be free of debris and should be evaluated by ESNW prior to use. In general, if loose or unsuitable soil conditions are exposed at foundation subgrade elevations, additional mechanical compactive effort or overexcavation and replacement with suitable structural fill will likely be necessary.

Provided foundations will be supported as prescribed, the following parameters may be used for design:

- Allowable soil bearing capacity 2,500 psf
- Passive earth pressure 250 pcf (equivalent fluid)
- Coefficient of friction 0.35

A one-third increase in the allowable soil bearing capacity may be assumed for short-term wind and seismic loading conditions. The above passive pressure and friction values include a factor-of-safety of 1.5. With structural loading as expected, about one inch of total static settlement and about one-half inch of differential static settlement is anticipated. Most of the anticipated settlement should occur during construction when dead loads are applied.

Seismic Design

The 2015 International Building Code recognizes the American Society of Civil Engineers (ASCE) for seismic site class definitions. Based on the soil conditions observed at the test pit locations, in accordance with Table 20.3-1 of the ASCE Minimum Design Loads for Buildings and Other Structures manual, Site Class E should be used for design.

As summarized in the *Geologically Hazardous Areas* section of this letter, site susceptibility to liquefaction is characterized as moderate to high. Based on our experience with alluvial soil, liquefaction-induced settlement of the native soil may be roughly two to four inches and would likely not occur uniformly. ESNW can provide supplementary recommendations for soil improvement if the settlement estimates provided in this section are not tolerable, which may include a surcharge program, using grid foundations supported on at least two feet of structural fill, or pile-supported foundations.

Slab-on-Grade Floors

Slab-on-grade floors for the proposed residential structures should be supported on firm and unyielding subgrades comprised of competent native soil, compacted structural fill, or new structural fill. Unstable or yielding subgrade areas should be recompacted or overexcavated and replaced with suitable structural fill prior to slab construction.

A capillary break, consisting of at least four inches of free-draining crushed rock or gravel, should be placed below each slab. The free-draining material should have a fines content of 5 percent or less (where the fines content is defined as the percent passing the Number 200 sieve, based on the minus three-quarter-inch fraction). In areas where slab moisture is undesirable, installation of a vapor barrier below each slab should be considered. If a vapor barrier is to be utilized, it should be a material specifically designed for use as a vapor barrier and should be installed in accordance with the specifications of the manufacturer.

Retaining Walls

Retaining walls must be designed to resist earth pressures and applicable surcharge loads. The following parameters may be used for design:

- Active earth pressure (unrestrained condition) 40 pcf (equivalent fluid)
- At-rest earth pressure (restrained condition) 60 pcf
- Traffic surcharge* (passenger vehicles) 70 psf (rectangular distribution)
- Passive earth pressure 250 pcf (equivalent fluid)
- Coefficient of friction 0.35
- Seismic surcharge 8H psf[†]

* Where applicable

† Where H equals the retained height (in feet)

The above design parameters are based on a level backfill condition and level grade at the wall toe under the assumption that native soil will be retained. If a significant zone of imported structural fill will be retained directly behind the wall, less stringent design parameters can be provided. Revised design values will be necessary if sloping grades are to be used above or below retaining walls. Additional surcharge loading from adjacent foundations, sloped backfill, or other relevant loads should be included in the retaining wall design.

Retaining walls should be backfilled with free-draining material that extends along the height of the wall and a distance of at least 18 inches behind the wall. The upper 12 inches of the wall backfill may consist of a less permeable soil if desired. A perforated drainpipe should be placed along the base of the wall and connected to an approved discharge location. A typical retaining wall drainage detail is provided on Plate 3. If drainage is not provided, hydrostatic pressures should be included in the wall design.

Drainage

Groundwater will likely be encountered in site excavations, especially those necessary to construct utility trenches. Temporary measures to control surface water runoff and groundwater during construction would likely involve interceptor trenches and sumps. ESNW should be consulted during preliminary grading to both identify areas of seepage and provide recommendations to reduce the potential for seepage-related instability.

Finish grades must be designed to direct surface drain water away from structures and slopes. Water must not be allowed to pond adjacent to structures. In our opinion, foundation drains should be installed along building perimeter footings. A typical foundation drain detail is provided on Plate 4.

Infiltration Evaluation

The referenced preliminary site plan indicates the parking area will be comprised of pervious pavement. ESNW performed one small-scale Pilot Infiltration Test (PIT) at TP-5 at a depth of approximately three and one-half feet bgs. The PIT was performed outside of the building footprint. During the soaking and test periods, no measurable rate was obtained, i.e., the infiltration rate was 0 inches per hour. After the PIT was deemed complete, the test pit was advanced an additional five and one-half feet. Groundwater seepage was observed directly beneath the test depth and on intermittent silt layers, to the maximum exploration depth of about nine feet bgs.

Based on the results of our testing, ESNW interprets the sandy silt to represent an impermeable layer. Per the guidance provided in BMP T5.15 of the referenced 2014 Manual, endorsed by the City of Puyallup, it is our opinion that the impermeable sandy silt layer would create saturated conditions within one foot of the bottom of the lowest pavement gravel base course. As such, permeable pavement should not be considered feasible from a geotechnical standpoint. In addition, the presence of relatively shallow groundwater would preclude the use of deeper infiltration galleries.

In general, based on our field observations, the subject site is not suitable for infiltration. The presence of both uniform, shallow groundwater conditions and a uniformly present impermeable layer render infiltration impracticable from a geotechnical standpoint.

Limitations

This letter has been prepared for the exclusive use of Tac Build, LLC, and its representatives. No warranty, express or implied, is made. The recommendations and conclusions provided in this letter are professional opinions consistent with the level of care and skill that is typical of other members in the profession currently practicing under similar conditions in this area. Variations in the soil and groundwater conditions encountered at the test pit locations may exist and may not become evident until construction. ESNW should reevaluate the contents of this letter if variations are encountered.

We trust this letter meets your current needs. Please call if you have any questions about this letter or if we can be of further assistance.

Sincerely,

EARTH SOLUTIONS NW, LLC



Samuel E. Suruda, G.I.T.
Staff Geologist



Keven D. Hoffmann, P.E.
Senior Project Manager

Attachments: Plate 1 – Vicinity Map
Plate 2 – Test Pit Location Plan
Plate 3 – Retaining Wall Drainage Detail
Plate 4 – Footing Drain Detail
Test Pit Logs
Grain Size Distribution

cc: CES NW, Inc.
Attention: Mr. Daniel Smith, P.E. (Email only)



Reference:
Pierce County, Washington
OpenStreetMap.org

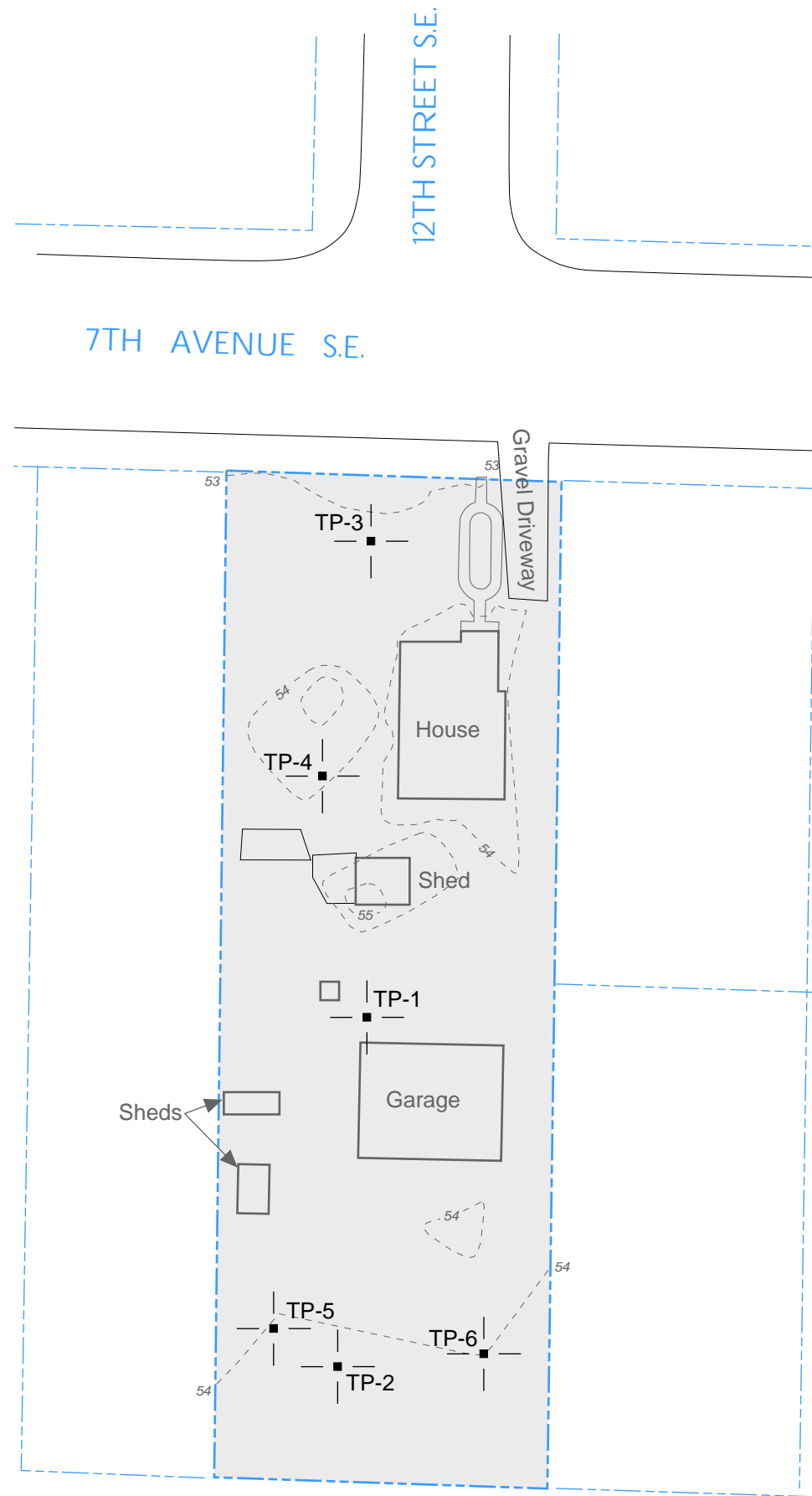



Earth Solutions NW LLC
 Geotechnical Engineering, Construction
 Observation/Testing and Environmental Services

Vicinity Map
1200 – 7th Ave Townhomes
Puyallup, Washington

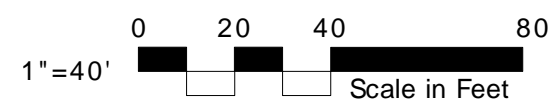
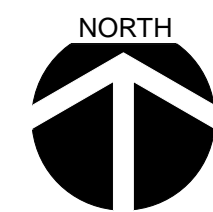
Drwn. MRS	Date 01/19/2021	Proj. No. 7182
Checked SES	Date Jan. 2021	Plate 1

NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.



LEGEND

- TP-1 | Approximate Location of ESNW Test Pit, Proj. No. ES-7182, Mar./Dec. 2020
- ▭ Subject Site
- ▭ Existing Building



NOTE: The graphics shown on this plate are not intended for design purposes or precise scale measurements, but only to illustrate the approximate test locations relative to the approximate locations of existing and / or proposed site features. The information illustrated is largely based on data provided by the client at the time of our study. ESNW cannot be responsible for subsequent design changes or interpretation of the data by others.

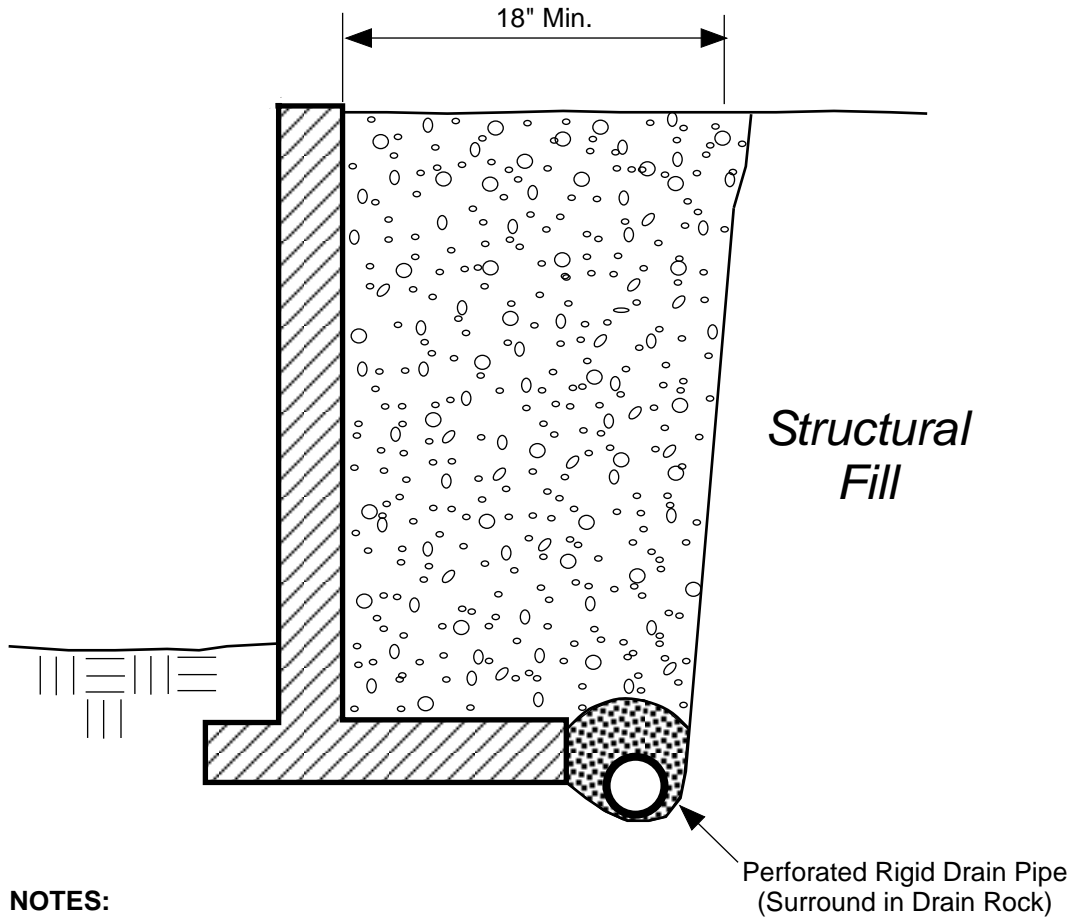
NOTE: This plate may contain areas of color. ESNW cannot be responsible for any subsequent misinterpretation of the information resulting from black & white reproductions of this plate.

Test Pit Location Plan
1200 – 7th Ave Townhomes
Puyallup, Washington

Earth Solutions NW LLC
Geotechnical Engineering, Construction
Observation/Testing and Environmental Services



Drwn. By MRS
Checked By SES
Date 01/19/2021
Proj. No. 7182
Plate 2

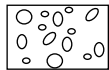


NOTES:

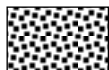
- Free-draining Backfill should consist of soil having less than 5 percent fines. Percent passing No. 4 sieve should be 25 to 75 percent.
- Sheet Drain may be feasible in lieu of Free-draining Backfill, per ESNW recommendations.
- Drain Pipe should consist of perforated, rigid PVC Pipe surrounded with 1-inch Drain Rock.

SCHMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING


LEGEND:

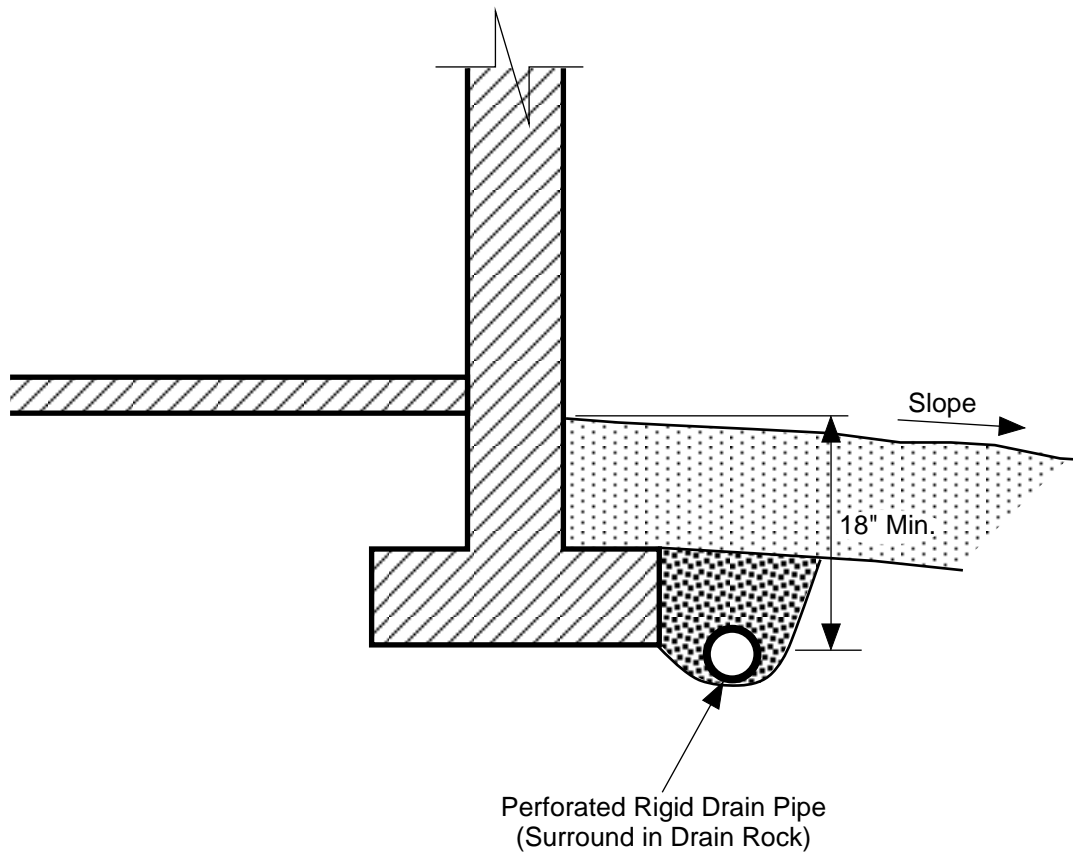


Free-draining Structural Backfill



1-inch Drain Rock

		Earth Solutions NW_{LLC} Geotechnical Engineering Construction Observation/Testing and Environmental Services	
Retaining Wall Drainage Detail 1200 – 7th Ave Townhomes Puyallup, Washington			
Drwn. MRS	Date 01/19/2021	Proj. No. 7182	
Checked SES	Date Jan. 2021	Plate 3	

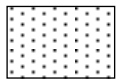


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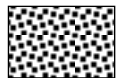
- Do NOT tie roof downspouts to Footing Drain.
- Surface Seal to consist of 12" of less permeable, suitable soil. Slope away from building.

SCHEMATIC ONLY - NOT TO SCALE
NOT A CONSTRUCTION DRAWING

LEGEND:



Surface Seal: native soil or other low-permeability material.



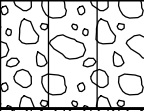
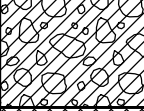

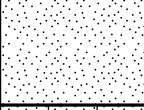
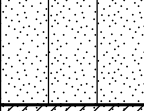
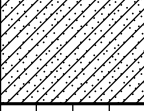
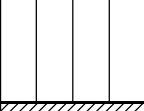
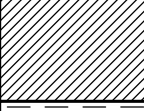
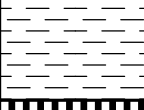


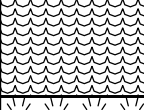




1-inch Drain Rock

	Earth Solutions NW_{LLC} Geotechnical Engineering, Construction Observation/Testing and Environmental Services	
	Footing Drain Detail 1200 – 7th Ave Townhomes Puyallup, Washington	
Drwn. MRS	Date 01/19/2021	Proj. No. 7182
Checked SES	Date Jan. 2021	Plate 4

Earth Solutions NW_{LLC}

SOIL CLASSIFICATION CHART

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

DUAL SYMBOLS are used to indicate borderline soil classifications.




The discussion in the text of this report is necessary for a proper understanding of the nature of the material presented in the attached logs.



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TEST PIT NUMBER TP-1

PROJECT NUMBER ES-7182 PROJECT NAME 1200 – 7th Ave Townhomes
 DATE STARTED 3/5/20 COMPLETED 3/5/20 GROUND ELEVATION 55 ft TEST PIT SIZE _____
 EXCAVATION CONTRACTOR NW Excavating GROUND WATER LEVELS:
 EXCAVATION METHOD _____ ∇ AT TIME OF EXCAVATION 5.5 ft
 LOGGED BY SES CHECKED BY KDH AT END OF EXCAVATION ---
 NOTES Depth of Topsoil & Sod 12": grass AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0					
			TPSL		Dark brown TOPSOIL (Fill) 54.0
		MC = 8.7% Fines = 7.9%	SP-SM		Dark gray poorly graded SAND with silt, loose to medium dense, moist (Fill) -moderate caving to BOH -groundwater seepage [USDA Classification: slightly gravelly SAND] 51.0
5		MC = 32.2%	ML		Dark gray sandy SILT, medium dense, wet ∇ -groundwater table, becomes water bearing 48.0
		MC = 27.7%			




Test pit terminated at 7.0 feet below existing grade due to caving. Groundwater seepage encountered at 3.0 feet and groundwater table encountered at 5.5 feet during excavation. Caving observed from 2.0 feet to BOH.



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TEST PIT NUMBER TP-2

PROJECT NUMBER ES-7182 PROJECT NAME 1200 – 7th Ave Townhomes
 DATE STARTED 3/5/20 COMPLETED 3/5/20 GROUND ELEVATION 54 ft TEST PIT SIZE _____
 EXCAVATION CONTRACTOR NW Excavating GROUND WATER LEVELS:
 EXCAVATION METHOD _____ ∇ AT TIME OF EXCAVATION 5.5 ft
 LOGGED BY SES CHECKED BY KDH AT END OF EXCAVATION ---
 NOTES Surface Conditions: grass AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0					
		MC = 33.0% Fines = 87.5%	ML		Gray sandy SILT, loose to medium dense, wet (Fill) -mottled texture [USDA Classification: slightly gravelly LOAM] 52.0
5		MC = 17.4% Fines = 5.8%	SP-SM		Dark gray poorly graded SAND with silt, medium dense, moist -groundwater seepage -moderate caving to BOH -becomes wet [USDA Classification: gravelly SAND] 48.0 ∇ -groundwater table
		MC = 71.6% MC = 31.9% Fines = 25.3%	ML		Gray SILT, medium dense, water bearing -wood debris [USDA Classification: slightly gravelly LOAM] 46.0

Test pit terminated at 8.0 feet below existing grade. Groundwater seepage encountered at 3.0 feet and groundwater table encountered at 5.5 feet during excavation. Caving observed from 4.0 feet to BOH



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TEST PIT NUMBER TP-3

PROJECT NUMBER ES-7182 PROJECT NAME 1200 – 7th Ave Townhomes
 DATE STARTED 3/5/20 COMPLETED 3/5/20 GROUND ELEVATION 53 ft TEST PIT SIZE _____
 EXCAVATION CONTRACTOR NW Excavating GROUND WATER LEVELS:
 EXCAVATION METHOD _____ ∇ AT TIME OF EXCAVATION 5.0 ft
 LOGGED BY SES CHECKED BY KDH AT END OF EXCAVATION ---
 NOTES Surface Conditions: grass AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0					
		MC = 26.9% Fines = 56.3%	ML		Brown sandy SILT, medium dense, moist -root intrusions to 1.5' -massive (blocky) bedding, iron oxide staining [USDA Classification: slightly gravelly LOAM] -groundwater seepage at 2.5'
		MC = 19.9% Fines = 4.0%			Dark gray poorly graded SAND, medium dense, wet [USDA Classification: slightly gravelly coarse SAND] -moderate caving to BOH
5		MC = 25.3%	SP		∇ -groundwater table, becomes water bearing
		MC = 45.9%			-wood debris to BOH

2.5

50.5

8.5

44.5

Test pit terminated at 8.5 feet below existing grade. Groundwater seepage encountered at 2.5 feet and groundwater table encountered at 5.0 feet during excavation. Caving observed from 4.0 feet to BOH.



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TEST PIT NUMBER TP-4

PAGE 1 OF 1

PROJECT NUMBER ES-7182 PROJECT NAME 1200 – 7th Ave Townhomes
 DATE STARTED 12/22/20 COMPLETED 12/22/20 GROUND ELEVATION 54 ft TEST PIT SIZE _____
 EXCAVATION CONTRACTOR NW Excavating GROUND WATER LEVELS:
 EXCAVATION METHOD _____ ∇ AT TIME OF EXCAVATION 5.0 ft
 LOGGED BY SES CHECKED BY KDH AT END OF EXCAVATION ---
 NOTES Depth of Topsoil & Sod 6": grass AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION		
0			TPSL		Dark brown TOPSOIL, minimal root intrusions	53.5	
		MC = 8.5%	SP		Black poorly graded SAND, medium dense, damp		
		MC = 14.8%					
5						-groundwater table (after excavation) ∇ -moderate caving to BOH -groundwater table (during excavation)	
		MC = 28.8%				47.0	





Test pit terminated at 7.0 feet below existing grade. Groundwater table stabilized at 4.0 feet during excavation. Caving observed from 4.0 feet to BOH.



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TEST PIT NUMBER TP-5

PROJECT NUMBER ES-7182 PROJECT NAME 1200 – 7th Ave Townhomes
 DATE STARTED 12/22/20 COMPLETED 12/22/20 GROUND ELEVATION 54 ft TEST PIT SIZE _____
 EXCAVATION CONTRACTOR NW Excavating GROUND WATER LEVELS:
 EXCAVATION METHOD _____ AT TIME OF EXCAVATION ---
 LOGGED BY SES CHECKED BY KDH AT END OF EXCAVATION ---
 NOTES Depth of Topsoil & Sod 12": grass AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0						
			TPSL		Dark brown TOPSOIL, shallow root intrusions (Fill)	53.0
			Fill		Construction debris (bricks, wood) (Fill)	51.5
5		MC = 39.3% Fines = 71.9%	ML		Gray sandy SILT, stiff, wet -infiltration test [USDA Classification: slightly gravelly LOAM] -groundwater seepage -moderate caving to BOH	49.0
		MC = 34.7%	SP		Black poorly graded SAND, medium dense, wet -interbedded silt layers -wood pieces present in silt	
		MC = 22.2% Fines = 1.3%			[USDA Classification: slightly gravelly SAND]	45.0

Test pit terminated at 9.0 feet below existing grade. Groundwater seepage encountered at 3.5 feet during excavation. Caving observed from 4.0 feet to BOH.



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TEST PIT NUMBER TP-6

PROJECT NUMBER ES-7182 PROJECT NAME 1200 – 7th Ave Townhomes
 DATE STARTED 12/22/20 COMPLETED 12/22/20 GROUND ELEVATION 54 ft TEST PIT SIZE _____
 EXCAVATION CONTRACTOR NW Excavating GROUND WATER LEVELS:
 EXCAVATION METHOD _____ ∇ AT TIME OF EXCAVATION 7.0 ft
 LOGGED BY SES CHECKED BY KDH AT END OF EXCAVATION ---
 NOTES Depth of Topsoil & Sod 12": grass AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0						
			TPSL		Dark brown TOPSOIL, minimal root intrusions (Fill)	53.0
			Fill		Construction debris in ML (bricks, wood) (Fill)	51.5
		MC = 41.1%	ML		Gray sandy SILT, stiff, wet -mottled texture -groundwater seepage, moderate caving to BOH	49.0
5			SP-SM		Black poorly graded SAND with silt, medium dense, wet -interbedded ML layers 1.5" thick ∇ -groundwater table	46.0

MC = 36.5%
 Test pit terminated at 8.0 feet below existing grade. Groundwater table encountered at 7.0 feet and groundwater seepage encountered at 3.5 feet during excavation. Caving observed from 3.5 feet to BOH.

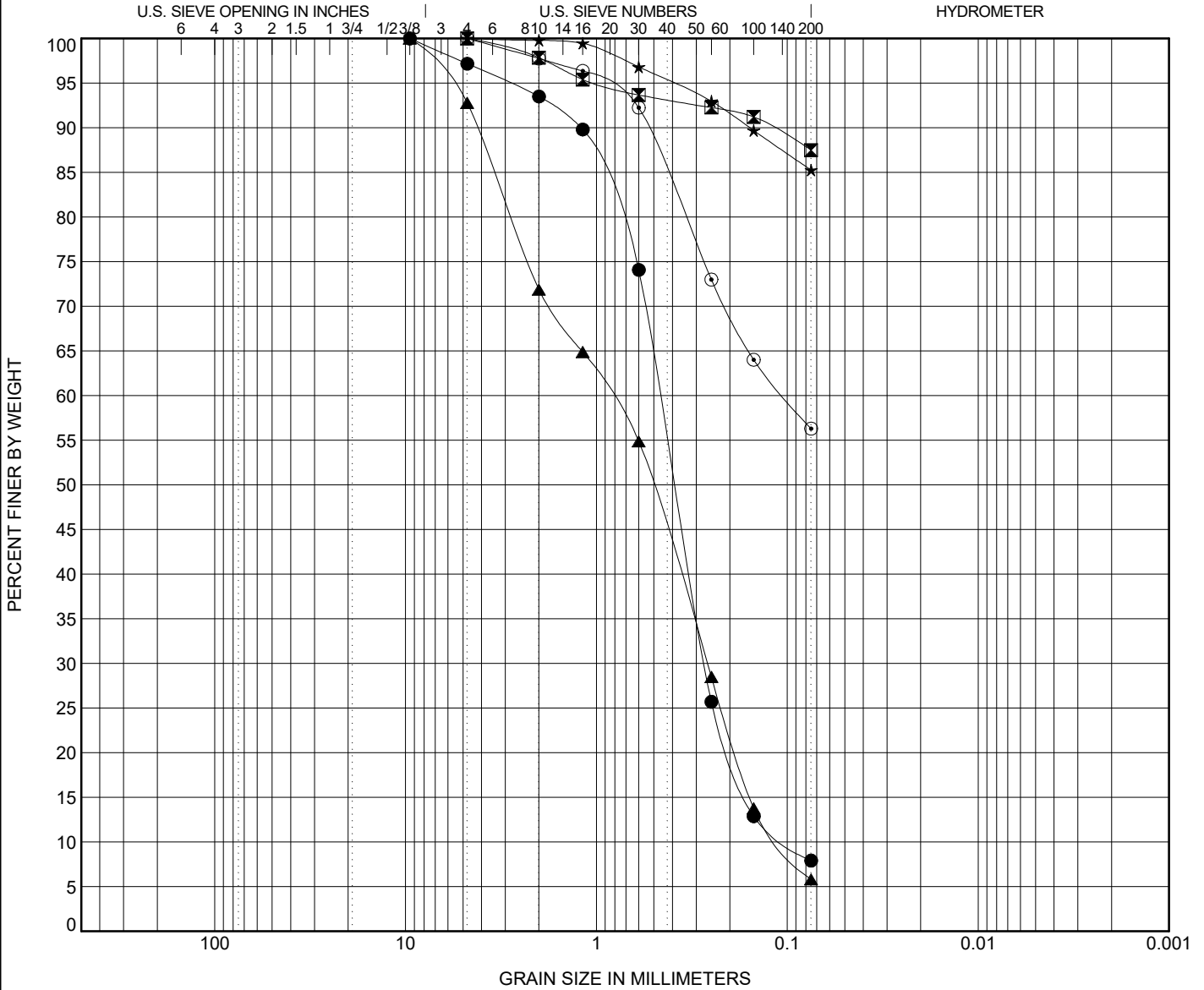


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GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-7182

PROJECT NAME 1200 - 7th Ave Townhomes



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification	Classification							Cc	Cu	
● TP-01 3.0ft.	USDA: Dark Gray Slightly Gravelly Sand. USCS: SP-SM.							1.56	4.63	
▣ TP-02 1.5ft.	USDA: Gray Slightly Gravelly Loam. USCS: ML.									
▲ TP-02 5.0ft.	USDA: Dark Gray Gravelly Sand. USCS: SP-SM.							0.75	7.86	
★ TP-02 7.0ft.	USDA: Gray Slightly Gravelly Loam. USCS: ML.									
⊙ TP-03 1.0ft.	USDA: Brown Slightly Gravelly Loam. USCS: Sandy ML.									
Specimen Identification	D100	D90	D60	D30	D10	LL	PL	PI	%Silt	%Clay
● TP-01 3.0ft.	9.5	1.215	0.465	0.27	0.1				7.9	
▣ TP-02 1.5ft.	4.75	0.12							87.5	
▲ TP-02 5.0ft.	9.5	4.232	0.849	0.263	0.108				5.8	
★ TP-02 7.0ft.	4.75	0.157							85.3	
⊙ TP-03 1.0ft.	4.75	0.542	0.105						56.3	

GRAIN SIZE USDA WITH D90 ES-7182 1200 - 7TH AVE TOWNHOMES.GPJ GINT US LAB.GDT 4/9/20

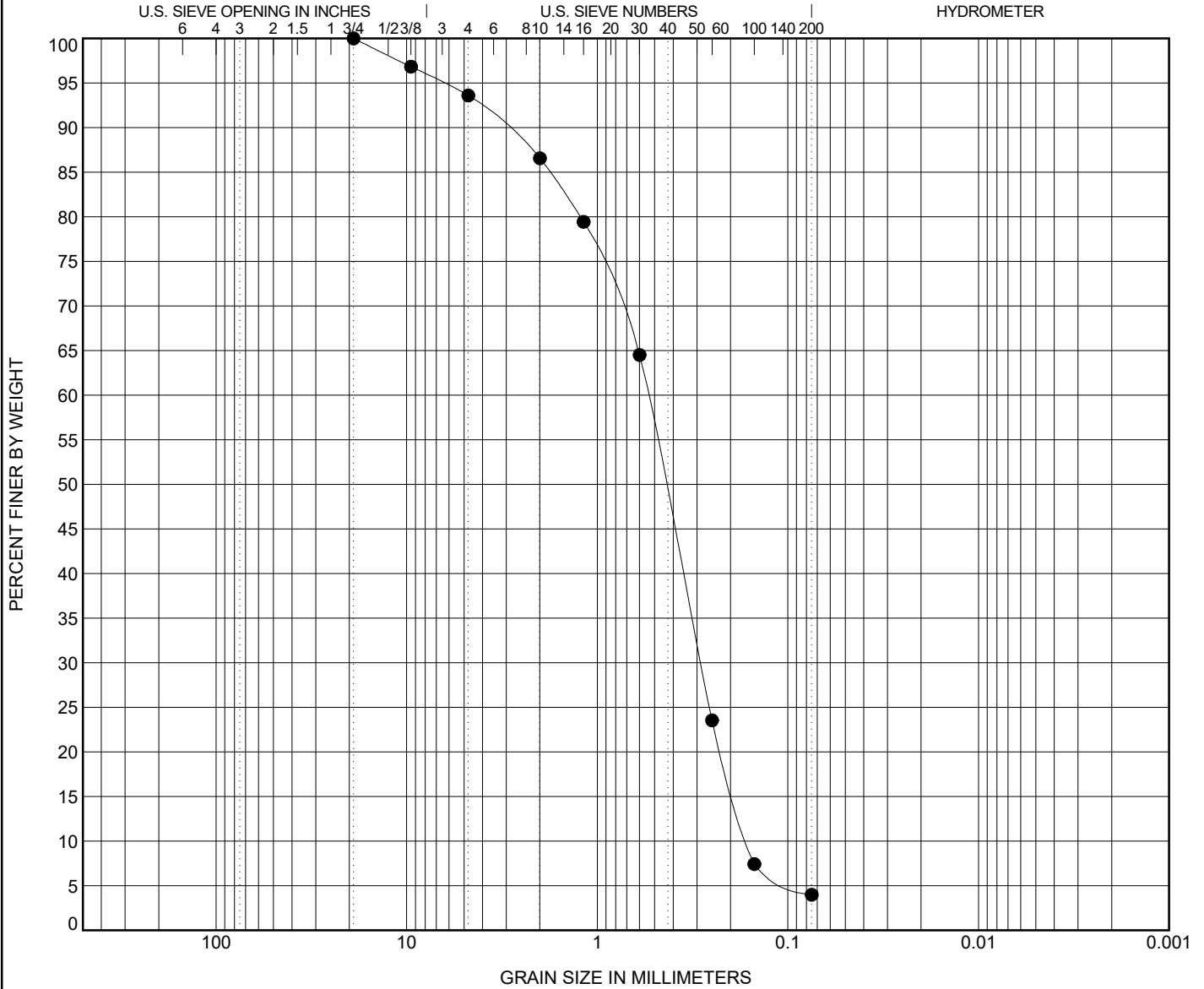


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GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-7182

PROJECT NAME 1200 - 7th Ave Townhomes



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification		Classification							Cc	Cu
●	TP-03 3.0ft.	UDSA: Dark Gray Slightly Gravelly Coarse Sand. USCS: SP.							0.93	3.35

Specimen Identification		D100	D90	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	TP-03 3.0ft.	19	3.051	0.545	0.287	0.163				4.0	

GRAIN SIZE USDA WITH D90 ES-7182 1200 - 7TH AVE TOWNHOMES.GPJ GINT US LAB.GDT 4/9/20

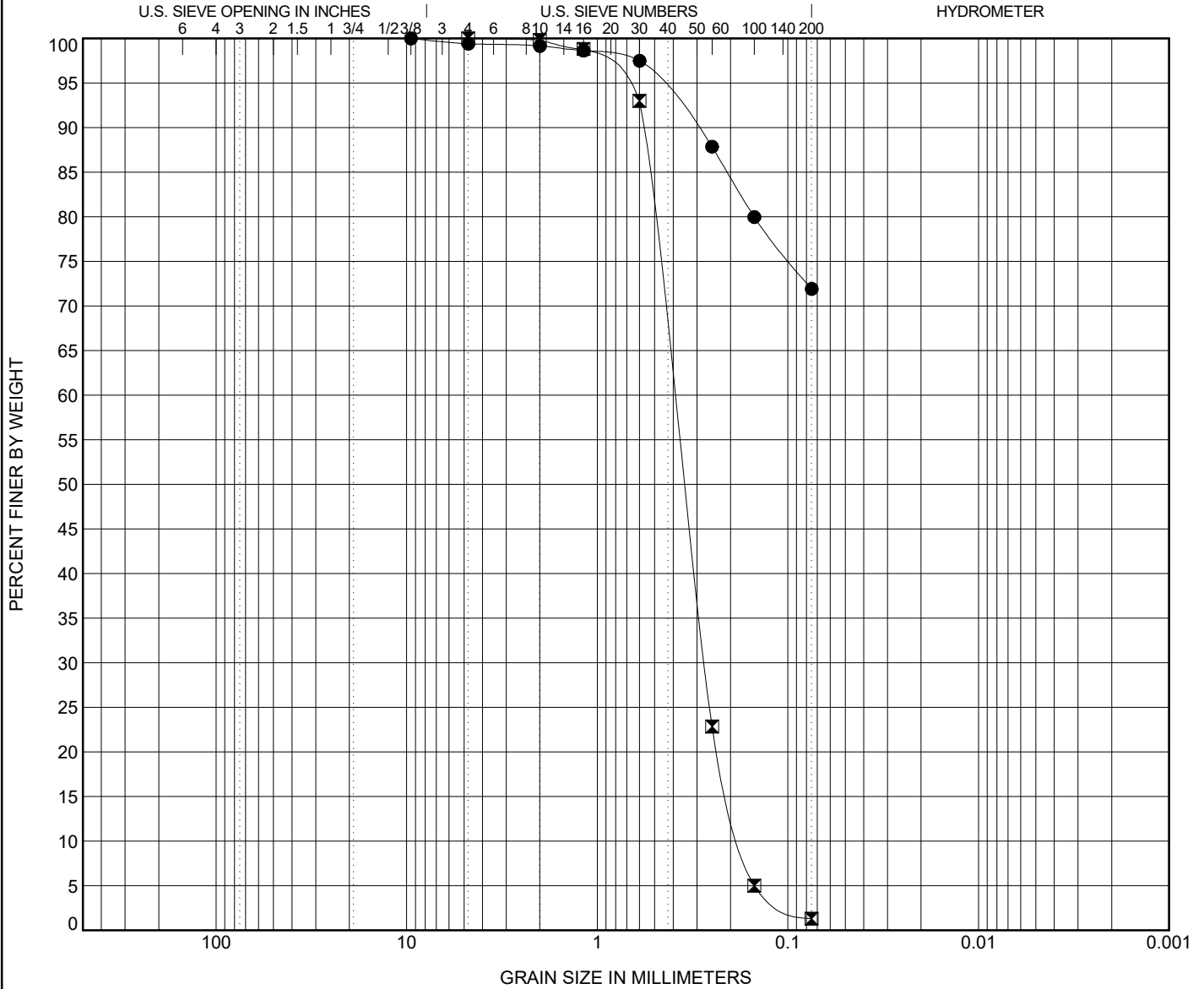


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GRAIN SIZE DISTRIBUTION

PROJECT NUMBER ES-7182

PROJECT NAME 1200 - 7th Ave Townhomes



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

Specimen Identification			Classification						Cc	Cu	
●	TP-05	3.50ft.	USDA: Gray Slightly Gravelly Loam. USCS: ML with Sand.								
⊠	TP-05	9.00ft.	USDA: Gray Slightly Gravelly Sand. USCS: SP.						1.09	2.30	
Specimen Identification			D100	D60	D30	D10	LL	PL	PI	%Silt	%Clay
●	TP-05	3.5ft.	9.5							71.9	
⊠	TP-05	9.0ft.	4.75	0.397	0.273	0.173				1.3	

GRAIN SIZE USDA ES-7182 1200 - 7TH AVE TOWNHOMES.GPJ GINT US LAB.GDT 12/28/20