STORM DRAINAGE REPORT

FOR

BPLC North
Puyallup, Washington

Revised April 2025
January 2025

Prepared for:
BPLC Properties, LLC

Prepared by:
Daniel Smith, P.E., Senior Project Manager

Approved By:

Daniel Smith, P.E., Senior Project Manager

REPORT #20083

"I hereby state that this Drainage and Erosion/Sediment Control Plan for the BPLC North 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.

TABLE OF CONTENTS

STORM DRAINAGE

1. Project Overview

This report accompanies the civil engineering 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. The *Washington State Department of Ecology Stormwater Management Manual for Western Washington, 2019 (Manual),* and the City of Puyallup's modifications to that document establishes the methodology and design criteria used for this project.

The BPLC North project proposes the remodel of an existing commercial industrial building and portable building on a 1.86-acre site comprised of three parcels (2105200180, 2105200191 and 2105200192) zoned Limited Manufacturing (ML). The site is accessed from Inter Ave 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 – Building Permit and Site Development
Address – 2511 Inter Ave Puyallup, WA 98372
Parcel Numbers – 2105200180, 2105200192 and 2105200192
Legal description – Parcel A, TPN. 2105200191

The west 85 feet of the south 120 feet of the west half of tract 10 of Ackerson's Second Addition to Puyallup, according to the map thereof recorded in volume 8 of plats, page 25, records of Pierce County, Washington.

Parcel B, TPN. 2105200192

The west half of Block 10 of Ackerson's Second Addition to Puyallup, according to the plat thereof recorded in Volume 8 of Plats, page 25, records of Pierce County, Washington.

Except the south 120 feet of the west 85 feet thereof.

Parcel C, TPN. 2105200180

The east one-half of Block 10 of Ackerson's Second Addition to Puyallup, according to the plat thereof recorded in Volume 8 of Plats, page 25, records of Pierce County, Washington.

All situate in the County of Pierce, State of Washington.

The project site has historically been used as a commercial property with an converted single family residence, storage building, portable building and existing gravel lot as depicted on the pre-developed basin map (Appendix 'B'). The existing site is to be redeveloped with landscaping and pave the existing gravel parking with permeable pavement (BMP T5.15) when construction permits are approved. The property has frontage along Inter Ave which provides access with a new commercial driveway approach. Improvements are proposed along Inter Ave which include curb, gutter and sidewalk extended across the property's frontage. The project site proposes approximately 33,628 sq.ft. of paving, that does not include overlaying the existing asphalt, across onsite and offsite improvements and 14,113 sq.ft. of landscaping; therefore, according to Figure 2.4.1 and 2.4.2 of Volume I of the Manual, the project must evaluate all minimum requirements for the new and replaced surfaces; see Section 5 of this report for a detailed discussion of the minimum requirements. The project proposes permeable pavement for flow control of the newly paved and landscaped surfaces. Runoff treatment is provided by the native soils underlying the permeable pavement since they meet the CEC and organic requirements of Section 4.4.2 of Volume V of the Manual. All disturbed areas which are not converted to impervious surface will apply soil amendments per BMP T5.13.

2. Existing Conditions Summary

The existing site's current use is a commercially converted single family residence, commercial storage building and gravel paved storage yard. The site is relatively flat between elevations 61-62 (NAVD 88) which gradually slopes towards Inter Avenue. Stormwater runoff from this site is currently collected by an onsite closed conveyance system that outfalls into Inter Avenue's public closed conveyance system. This public closed conveyance system is comprised of 12-inch concrete pipes and flows west approximately 1,500-feet towards offsite wetlands and Upper Deer Creek. The site is accessed by an existing gravel driveway from Inter Avenue.

Onsite soils have been identified as Briscot loam (6A a Type D 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 draft geotechnical engineer's report has been prepared by GeoResources, dated January 21, 2021, with an addendum, dated February 14, 2022, where they documented 0.5-feet to 1.0-feet of topsoil over silty alluvium. Mottling was observed at a depth 0.5 to 1.0-feet with groundwater observed at a depth of 0.5-feet. An EPA falling head test and small-scale PIT was performed within the native alluvium soils and a 0.6-inch per hour infiltration design rate is provided. Although, the permeable pavement is sized with an infiltration rate of 0.1-inches per hour. A copy of the geotechnical report is included in Appendix 'D'. Permeable ballast fill is proposed in the paving area so the permeable pavement storage reservoir course meets the separation requirements from the seasonal high groundwater table.

There is an existing gravity sewer main in Inter Avenue which currently serves the property. 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 # 53053C0334E. 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 proposes permeable pavement for flow control. The overflow from the permeable pavement is collected and conveyed to the existing public closed conveyance system in Inter Avenue. Based on a field survey and public GIS information, the runoff is conveyed west within Inter Avenue's closed conveyance system towards Upper Deer Creek. The ¼ mile drainage path ends at the outfall to Upper Deer Creek. Existing wetlands are located at the outfall to Upper Deer Creek. The runoff ultimately outfalls to the Puyallup River which is located approximately 0.9-miles downstream located northwest of the project 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 is collected by an existing closed conveyance system that outfalls to the public storm system in Inter Avenue. The existing site is analyzed to demonstrate that the project meets both the flow control and LID performance standards. The pre-developed basin is 1.096 acres C, Forest, Flat. The following is a summary of the pre-developed site flows:

2-year..... 0.025-cfs
10-year..... 0.046-cfs
50-year..... 0.060-cfs
100-year..... 0.064-cfs

Please refer to the Pre-Developed Basin Map in Appendix 'B' and the WWHM computer results in Appendix 'C'.

Developed Site Hydrology

Under the developed condition, the project site proposes 33,628 sq.ft. of paving, that does not include overlaying the existing asphalt, across onsite and offsite improvements and 14,113 sq.ft. of landscaping. The landscape and yard areas can be modeled as "pasture" due to soil amendment per Ecology BMP T5.13. For the purpose of sizing the overflow conveyance system the permeable pavement is modelled as C, Lawn, Flat with the WWHM computer program. The post developed basin is summarized in the below:

Sub-Basin	Land-use	WWHM Description	Area (ac)
Onsite A	Yards and Landscape (Amended Soils) To permeable pavement	C, Pasture, Flat	0.194
Onsite B	Curbing To permeable pavement	Roadway, Flat	0.011
Onsite C	Permeable Pavement	C, Lawn, Flat	0.641
Bypass A	Frontage Improvements Roadway/Sidewalk	Roadway, Flat	0.084
Bypass B	Onsite Paving	Roadway, Flat	0.036
Bypass C	Landscaping Planters	C, Pastures, Flat	0.130
Total			**1.096**

Table 1 – Post Developed Basin

The following is a summary of the post developed site flows:

2-year.....0.045-cfs
10-year.....0.071-cfs
50-year.....0.099-cfs
100-year.....0.112-cfs

Please refer to the Post Developed Basin Map in Appendix 'B' and the WWHM computer results in Appendix 'C'.

Facility Sizing

The project proposes permeable pavement to control the runoff from the newly paved parking lot area. Additionally, planters are constructed as part of the parking lot improvements which are to have their soils amended per BMP T5.13. The areas of the site that are modified as part of this permit are modelled with WWHM computer program to demonstrate the project's compliance with both the flow control and LID performance standards. The permeable pavement's subbasin is summarized in Table 2 below:

Sub-Basin	Land-use	WWHM Description	Area (ac)
Onsite A	Yards and Landscape (Amended Soils)	C, Pasture, Flat	0.194
Onsite B	Curbing	Roadway, Flat	0.011
Onsite C	Permeable Pavement	Permeable Pavement WWHM Element	0.641
Total			**0.846**

Table 2 – Permeable Pavement Basin

As a factor of safety, the permeable pavement is modelled with an infiltration rate of 0.1 inches per hour and 0.5 effective volume factor. As computed by WWHM, a pavement section comprised of 6.5-inch-thick permeable asphalt over 2.5-inches of permeable ballast can fully infiltrate the basin summarized in Table 2. Any additional permeable ballast placed below the pavement is for structural purposes and is not needed for stormwater storage. The underlying soils meet the CEC and organic content requirements of Section 4.4.2 of Volume V of the Manual so runoff treatment is provided for the permeable pavement area. The portions of the site that are being improved the project meets the flow control and LID performance standards. A copy of the WWHM computer report is included in Appendix C.

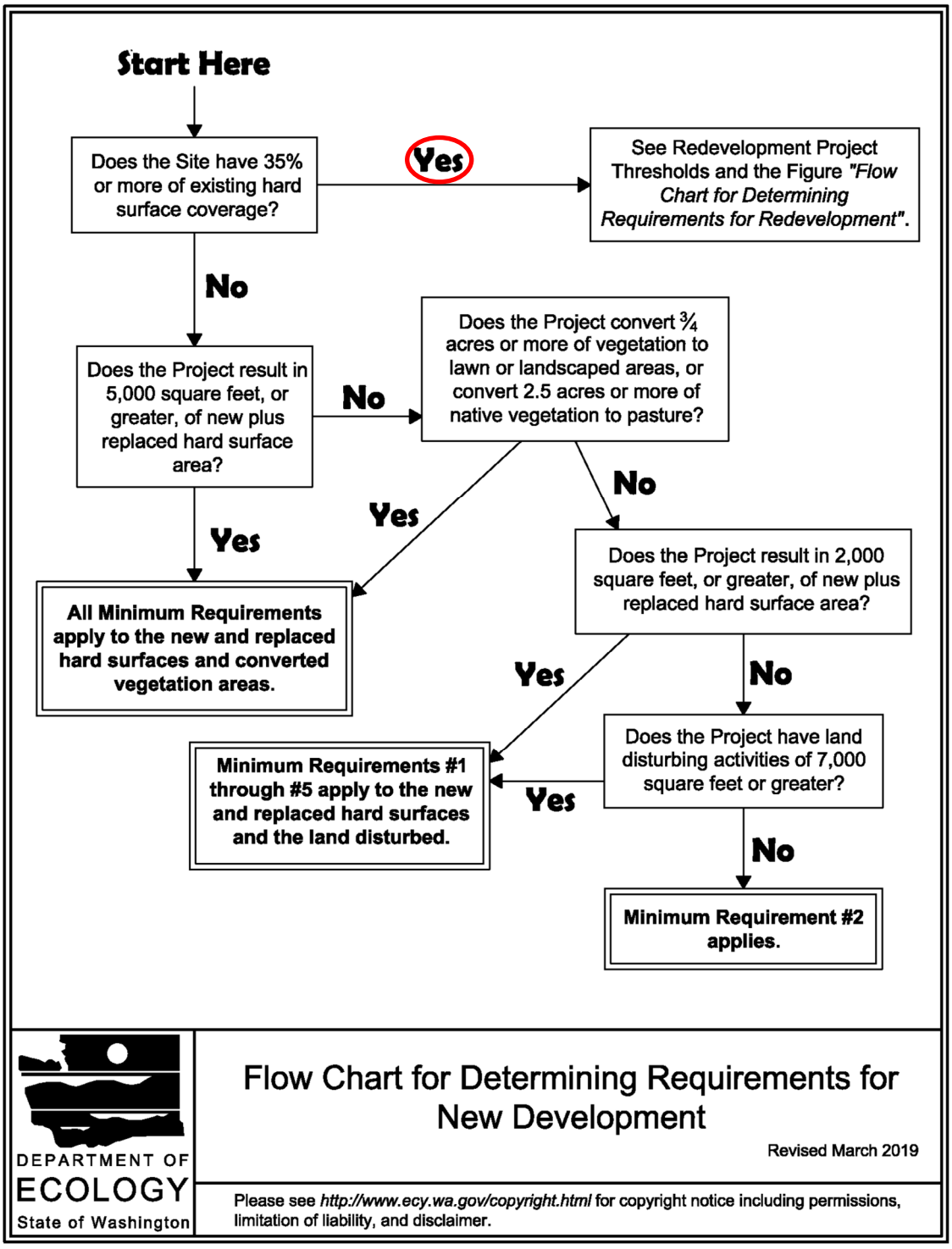
Conveyance Calculations

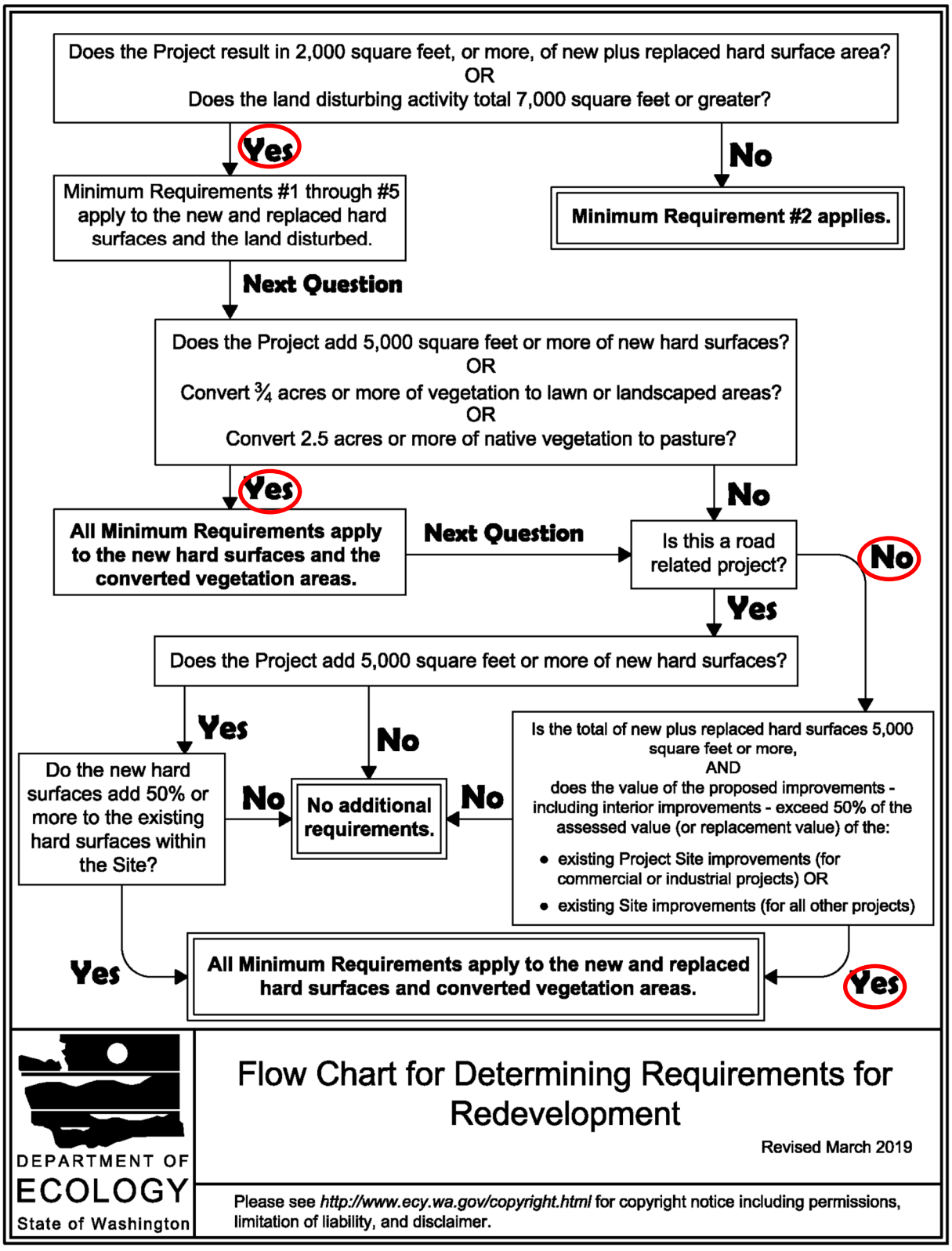
The project proposes an extension of the existing conveyance system within Inter Ave to an onsite overflow conveyance system. This system is comprised of catch basins, PVC pipes and ductile iron pipe. The shallowest pipe is analyzed to demonstrate that the system's ability to convey the site's overflow 100-year event as calculated by the WWHM computer program. Computer modeling results are provided in Appendix 'C'. A summary of the calculations is provided below:

- Pipe Reach Name: **DIP**
- Structure Tributary Area: **0.997-ac**
- Pipe Diameter (in): **12-in**
- Pipe Length (ft): **NA**
- Pipe Slope (%): **0.50%**
- Manning's Coefficient (n): **0.012 (DIP)**
- Design Flow (cfs): **0.33-cfs (100-year)**
- Pipe-Full Flow (cfs): **2.73-cfs**
- Water Depth at Design Flow (in): **2.88-in**
- Critical Depth (in): **2.88-in**
- Velocity at Design Flow (fps): **2.28-fps**
- Velocity at Pipe-Full Flow (fps): **3.47-fps**
- Percent full at Design Flow (%): **24%**
- HGL for each Pipe Reach (elev): **0.24-ft**

5. Discussion of Minimum Requirements

The project is the redevelopment of two parcels that proposes more than 5,000 sq.ft. of new plus replaced hard surfaces; therefore, as required by Figure I-3.1 and I-3.2 of Volume I of the Manual all minimum requirement applies to the new and replaced surfaces.




Does the Project result in 2,000 square feet, or more, of new plus replaced hard surface area?
OR
Does the land disturbing activity total 7,000 square feet or greater?
Yes
No
Minimum Requirements #1 through #5 apply to the new and replaced hard surfaces and the land disturbed.
Minimum Requirement #2 applies.
Next Question
Does the Project add 5,000 square feet or more of new hard surfaces?
OR
Convert ¾ acres or more of vegetation to lawn or landscaped areas?
OR
Convert 2.5 acres or more of native vegetation to pasture?
Yes
No
All Minimum Requirements apply to the new hard surfaces and the converted vegetation areas.
Next Question
Is this a road related project?
No
Yes
Does the Project add 5,000 square feet or more of new hard surfaces?
Yes
No
Do the new hard surfaces add 50% or more to the existing hard surfaces within the Site?
No
No additional requirements.
No
Is the total of new plus replaced hard surfaces 5,000 square feet or more,
AND
does the value of the proposed improvements - including interior improvements - exceed 50% of the assessed value (or replacement value) of the:
• existing Project Site improvements (for commercial or industrial projects) OR
• existing Site improvements (for all other projects)
Yes
All Minimum Requirements apply to the new and replaced hard surfaces and converted vegetation areas.
Yes
DEPARTMENT OF ECOLOGY
State of Washington
Flow Chart for Determining Requirements for Redevelopment
Revised March 2019
Please see http://www.ecy.wa.gov/copyright.html for copyright notice including permissions, limitation of liability, and disclaimer.

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

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 has been prepared. It is submitted alongside this report as the erosion control report.

5.3 Minimum Requirement #3: Source Control of Pollution

Permanent source control BMPs are required for the development's daily operations as described in the Pollution Source Control Manual for Commercial/Industrial Activities included as a separate document.

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

Under existing conditions, stormwater runoff is collected onsite and discharged into the public conveyance system in Inter Avenue south of the site.

5.5 Minimum Requirement #5: Onsite Stormwater Management

This project must meet minimum requirements 1-9; therefore, this project must either evaluate List 2 for onsite stormwater management compliance or meet the LID Performance Standard. The project meets the LID Performance Standard with the use of permeable pavement (BMP T5.15) and soil preservation and amendment (Ecology BMP T5.13).

5.6 Minimum Requirement #6: Runoff Treatment

The project provides runoff treatment with permeable pavement. The underlying soils meet the CEC and organic requirements of Section 4.4.2 of Volume V of the Manual.

5.7 Minimum Requirement #7: Flow Control

The project meets the Flow Control Performance Standard with the use of permeable pavement (BMP T5.15) and soil amendments. (BMP T5.13)

5.8 Minimum Requirement #8: Wetlands Protection

This requirement is not applicable to the project since the closest wetland is more than ¼ mile downstream of the site at Inter Ave's outfall to Upper Deer Creek.

5.9 Minimum Requirement #9: Operation and Maintenance

An Operation and Maintenance Manual is submitted alongside this report.

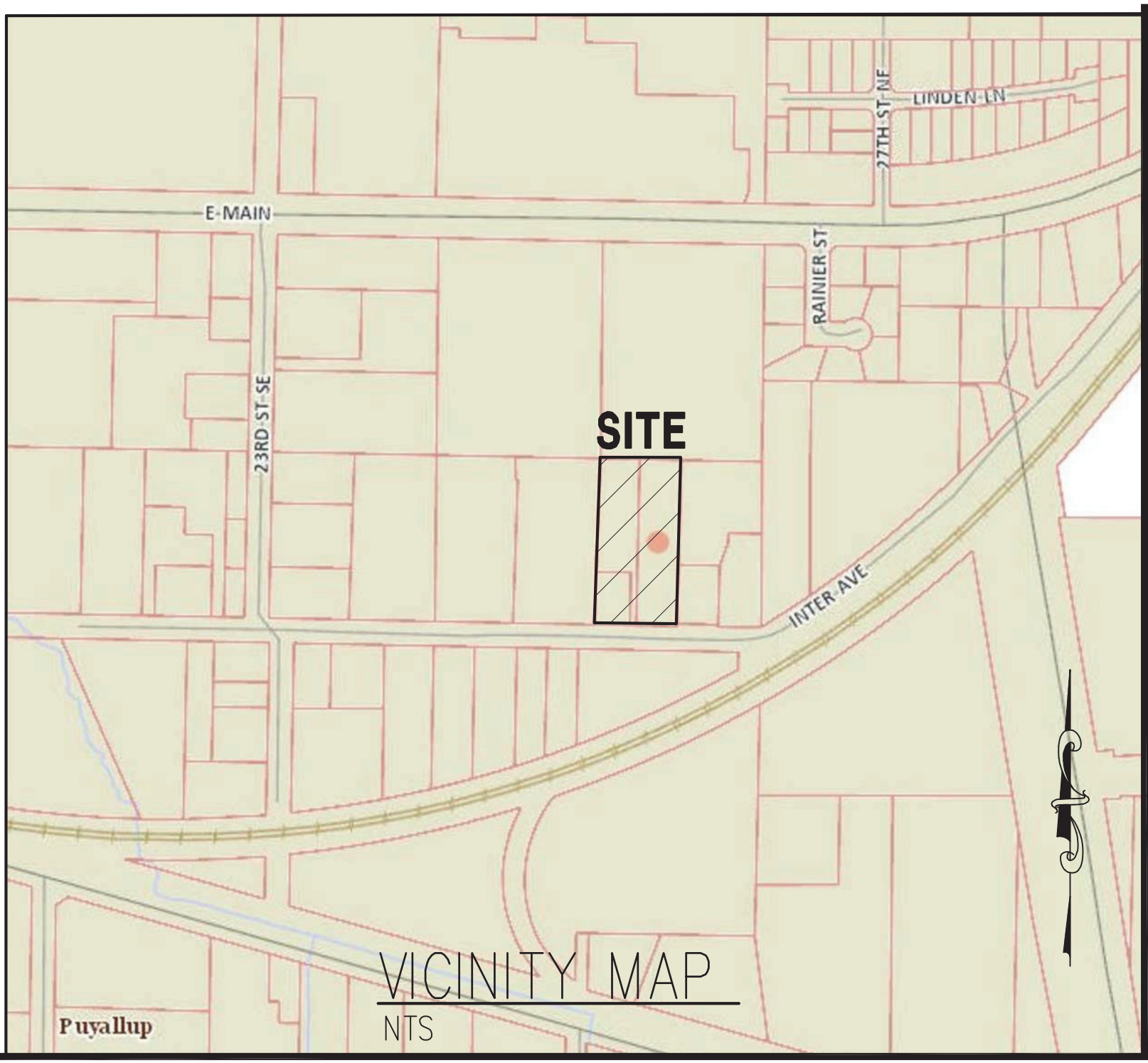
6. Other Permits

Other necessary permits and approvals include:

- Right of Way
- Sanitary Side Sewer Permits
- Building Remodel Permits
- CSWGP

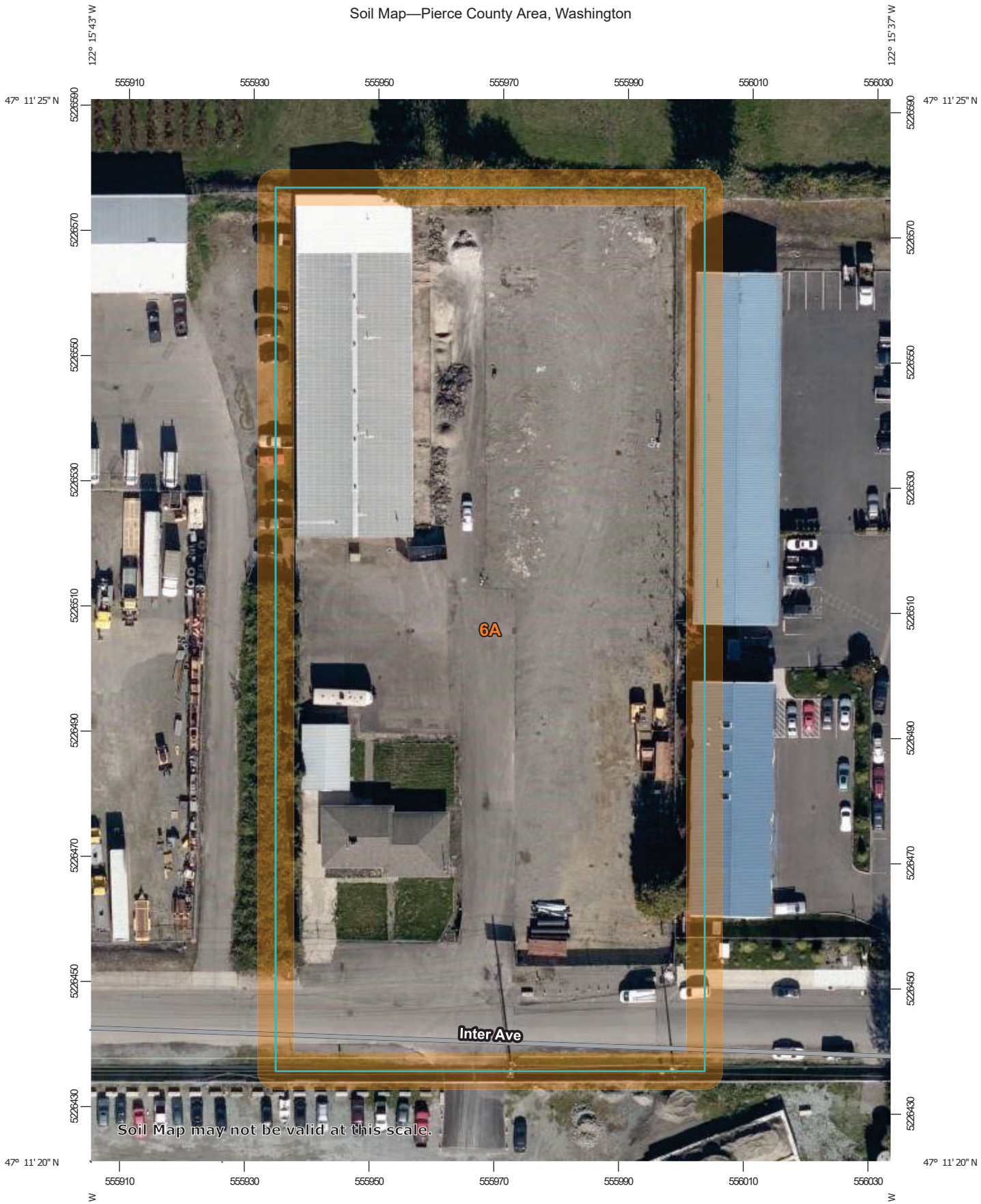
APPENDIX A

General Exhibits



VICINITY MAP

NTS



Map Scale: 1:826 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 10 20 40 60

Feet
0 40 80 160 240

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 16, Jun 4, 2020

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

Date(s) aerial images were photographed: Jul 29, 2018—Jul 22, 2019

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
6A	Briscot loam	2.4	100.0%
Totals for Area of Interest		**2.4**	**100.0%**

APPENDIX B

Basin Exhibits

BPLC NORTH

A PORTION OF NW1/4 OF THE SE1/4 OF SEC. 26, T20N, R04E
WILLAMETTE MERIDIAN, PIERCE COUNTY, WASHINGTON

30 0 15 30 60
1 inch = 30 feet.

APPROVED

BY _____
CITY OF PUYALLUP
ENGINEERING SERVICES

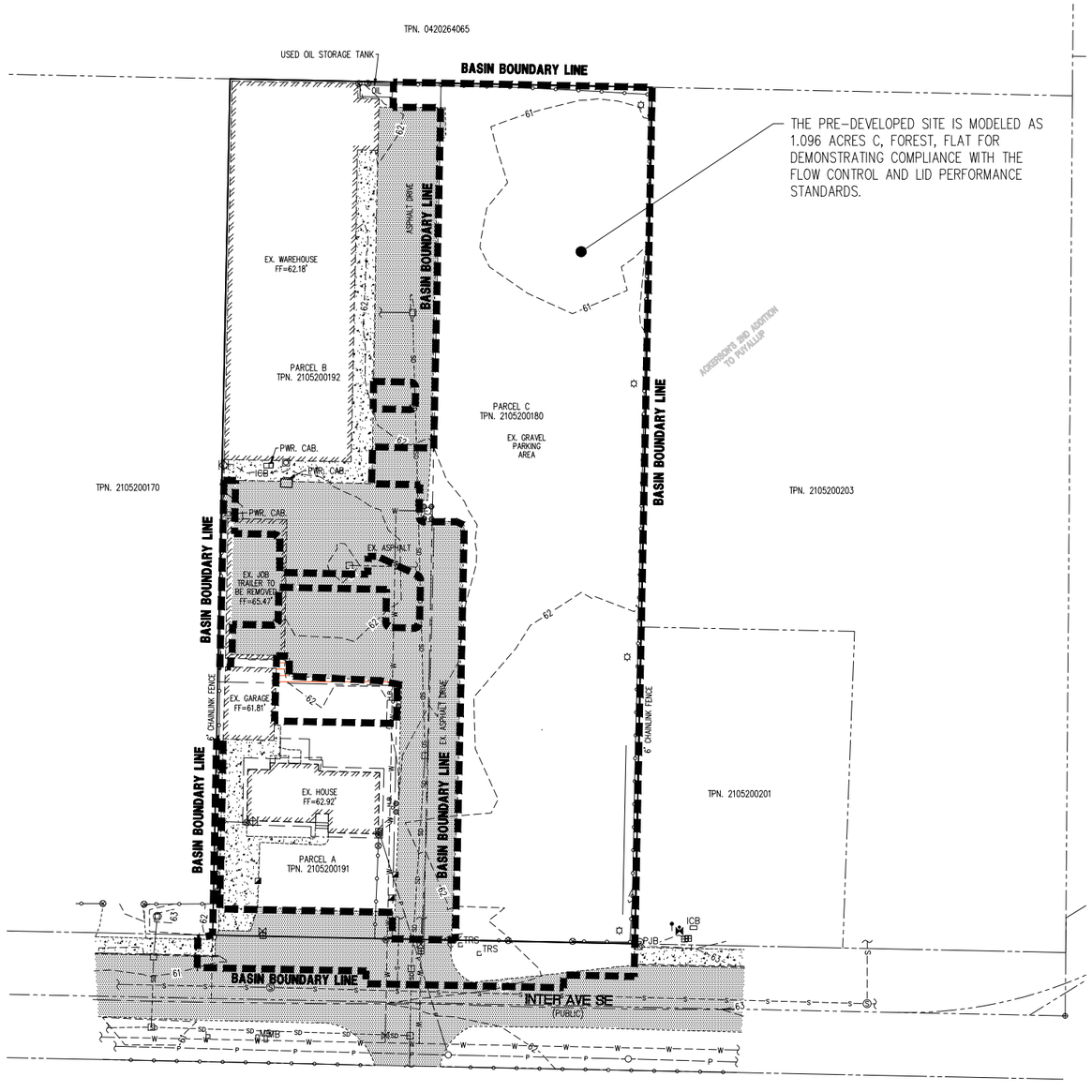
DATE _____

NOTE:
THIS APPROVAL IS VOID AFTER 180 DAYS FROM APPROVAL DATE.

THE CITY WILL NOT BE RESPONSIBLE FOR ERRORS AND/OR OMISSIONS ON THESE PLANS.

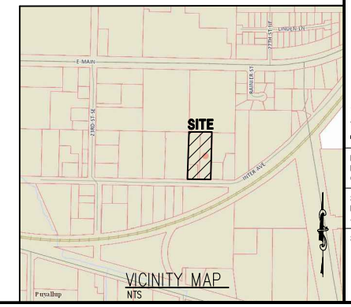
FIELD CONDITIONS MAY DICTATE CHANGES TO THESE PLANS AS DETERMINED BY THE CITY ENGINEER.

No.	Revision:	Int.	Date:



LEGEND

EXISTING	DESCRIPTION	PROPOSED
⊕	MONUMENT	⊕
	MONUMENT LINE	
	PROPERTY LINE	
	RIGHT OF WAY LINE	
	EASEMENT LINE	
	BUILDING SETBACK LINE	
	CHAIN LINK FENCE	
	WOOD FENCE	
	CURB & GUTTER	
	EDGE OF PAVEMENT	
300	CONTOURS	300
	STREET SIGN	
	STORM DRAIN CATCH BASIN	
Ⓓ	STORM DRAIN MANHOLE	Ⓓ
	STORM DRAIN CLEANOUT	
SD	STORM DRAIN LINE	SD
RD	ROOF DRAIN LINE	RD
Ⓢ	SANITARY SEWER MANHOLE	Ⓢ
	SANITARY SEWER CLEANOUT	
S	SANITARY SEWER LINE	S
SS	SANITARY SEWER STUB	SS
	FIRE HYDRANT	
	WATER VALVE	
	WATER METER	
	THRUST BLOCKING	
W	WATER MAIN	W
	LUMINAIRE	
	POWER/UTILITY POLE	
	GUY WIRE	
	SAWCUT LINE	
	ASPHALT CONCRETE	
	CEMENT CONCRETE	
	GRAVEL	
	LANDSCAPE AREAS	



C.E.S. NW INC.
CIVIL ENGINEERING & SURVEYING
429 – 29TH ST. NE, SUITE D
PUYALLUP, WA 98372
PH. (253) 848-4282
ceservices@cesnwinc.com

BPLC NORTH
PRE-DEVELOPED BASIN MAP

Project:

Client: BPLC PROPERTIES, LLC
2412 INTER AVE PUYALLUP, WA 98372

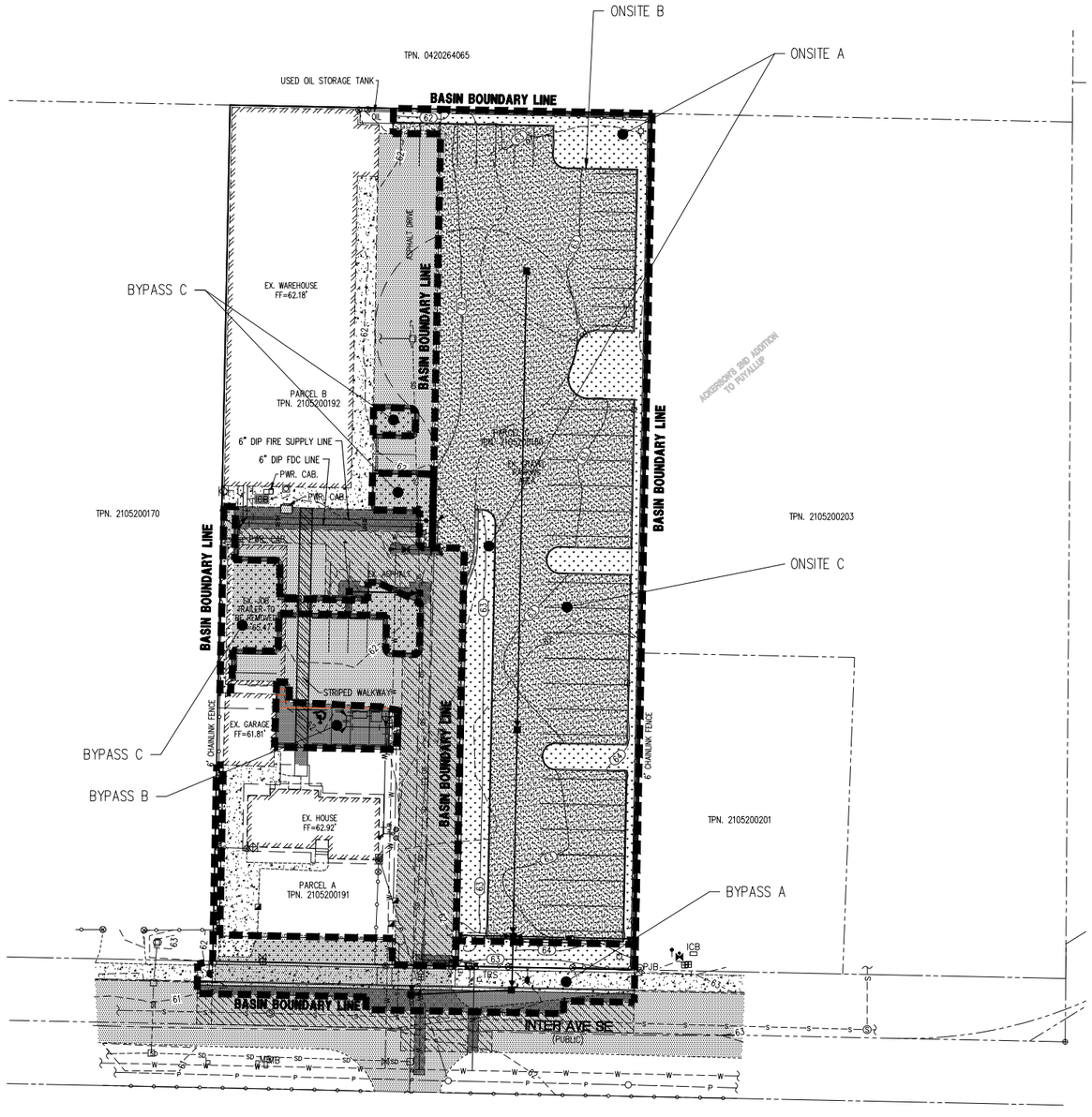
Designed:	DPS
Drawn:	JEH
Checked:	CAD
Scale:	1"=30'
Date:	01/20/25
Job No.:	20083

Sheet No.:
B1
1 of 2 Sheets

CALL 48 HOURS BEFORE YOU DIG DIAL 811

BPLC NORTH

A PORTION OF NW1/4 OF THE SE1/4 OF SEC. 26, T20N, R04E
WILLAMETTE MERIDIAN, PIERCE COUNTY, WASHINGTON



1 inch = 30 feet.

APPROVED

BY _____
CITY OF PUYALLUP
ENGINEERING SERVICES

DATE _____

NOTE:
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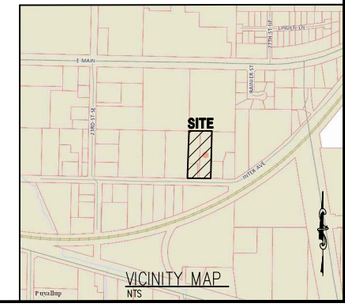
Bypass B	Onsite Paving	Roadway, Flat	0.036
Bypass C	Landscaping Planters	C, Pastures, Flat	0.130
Total			**1.096**

POST DEVELOPED BASIN

LEGEND

EXISTING	DESCRIPTION	PROPOSED
⊕	MONUMENT	⊕
	MONUMENT LINE	
	PROPERTY LINE	
	RIGHT OF WAY LINE	
	EASEMENT LINE	
	BUILDING SETBACK LINE	
	CHAIN LINK FENCE	
	WOOD FENCE	
	CURB & GUTTER	
	EDGE OF PAVEMENT	
300	CONTOURS	300
	STREET SIGN	
	STORM DRAIN CATCH BASIN	
	STORM DRAIN MANHOLE	
	STORM DRAIN CLEANOUT	
SD	STORM DRAIN LINE	SD
RD	ROOF DRAIN LINE	RD
	SANITARY SEWER MANHOLE	
	SANITARY SEWER CLEANOUT	
S	SANITARY SEWER LINE	S
SS	SANITARY SEWER STUB	SS
	FIRE HYDRANT	
	WATER VALVE	
	WATER METER	
	THRUST BLOCKING	
W	WATER MAIN	W
	LUMINAIRE	
	POWER/UTILITY POLE	
	GUY WIRE	
	SAWCUT LINE	
	ASPHALT CONCRETE	
	CEMENT CONCRETE	
	GRAVEL	
	LANDSCAPE AREAS	



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ceservices@cesnwinc.com

BPLC NORTH
POST DEVELOPED BASIN MAP

Project:

Client: BPLC PROPERTIES LLC
2412 INTER AVE, PUYALLUP, WA 98372

Designed: DPS
Drawn: JEH
Checked: CAD

Scale: 1"=30'
Date: 01/20/25
Job No.: 20083

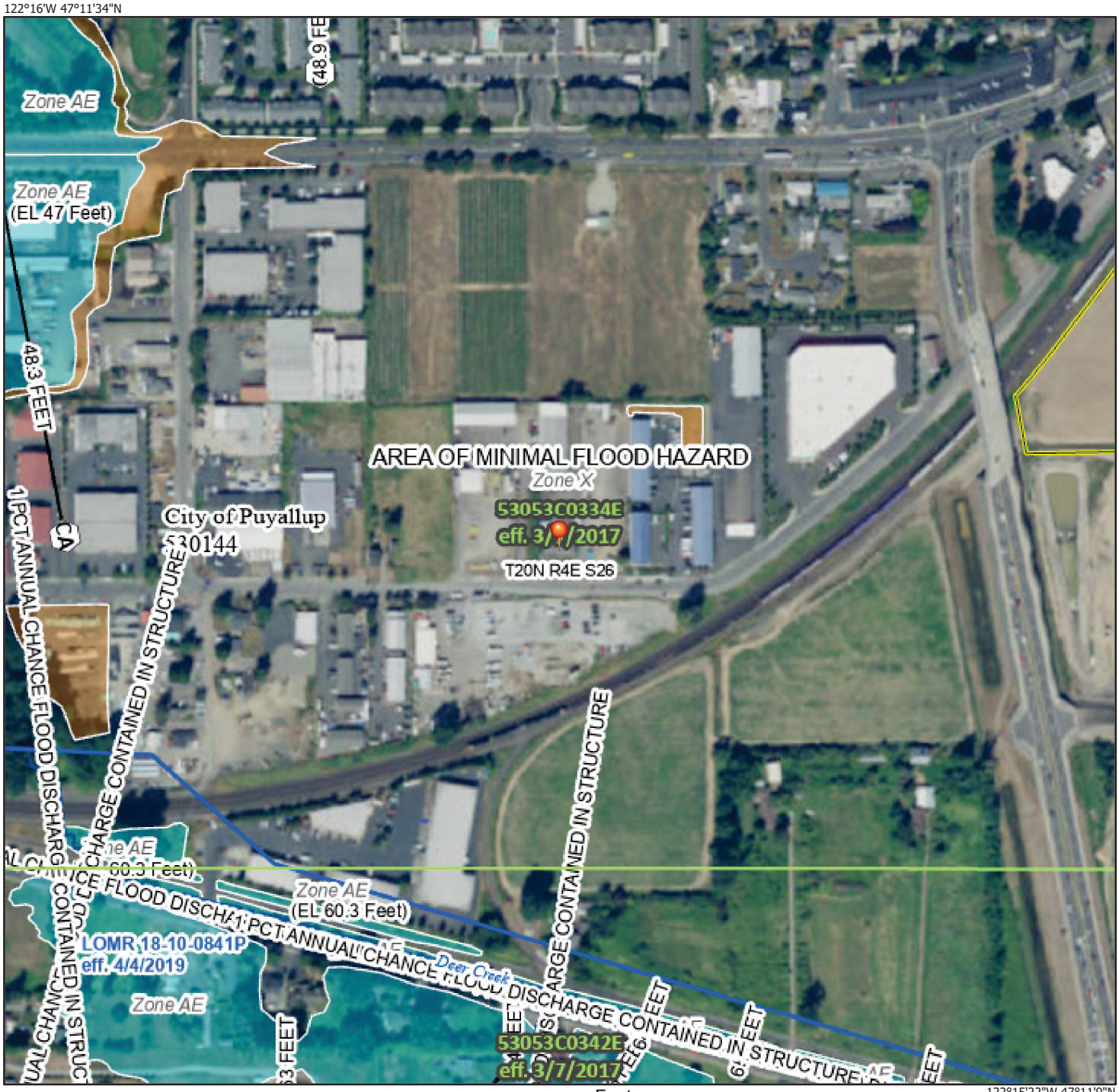
Sheet No.:
B2
2 of 2 Sheets

CALL 48 HOURS BEFORE YOU DIG DIAL 811

National Flood Hazard Layer FIRMette

FEMA

122°16'W 47°11'34"N



122°15'22"W 47°11'9"N

0 250 500 1,000 1,500 2,000 Feet

1:6,000

Basemap: USGS National Map: Orthoimagery: Data refreshed October, 2020

Legend

SEE FIS REPORT

SPECIAL FLO
HAZARD ARE

OTHER AREAS
FLOOD HAZA

OTHER ARE

GENER
STRUCTUR

OTH
FEATUR

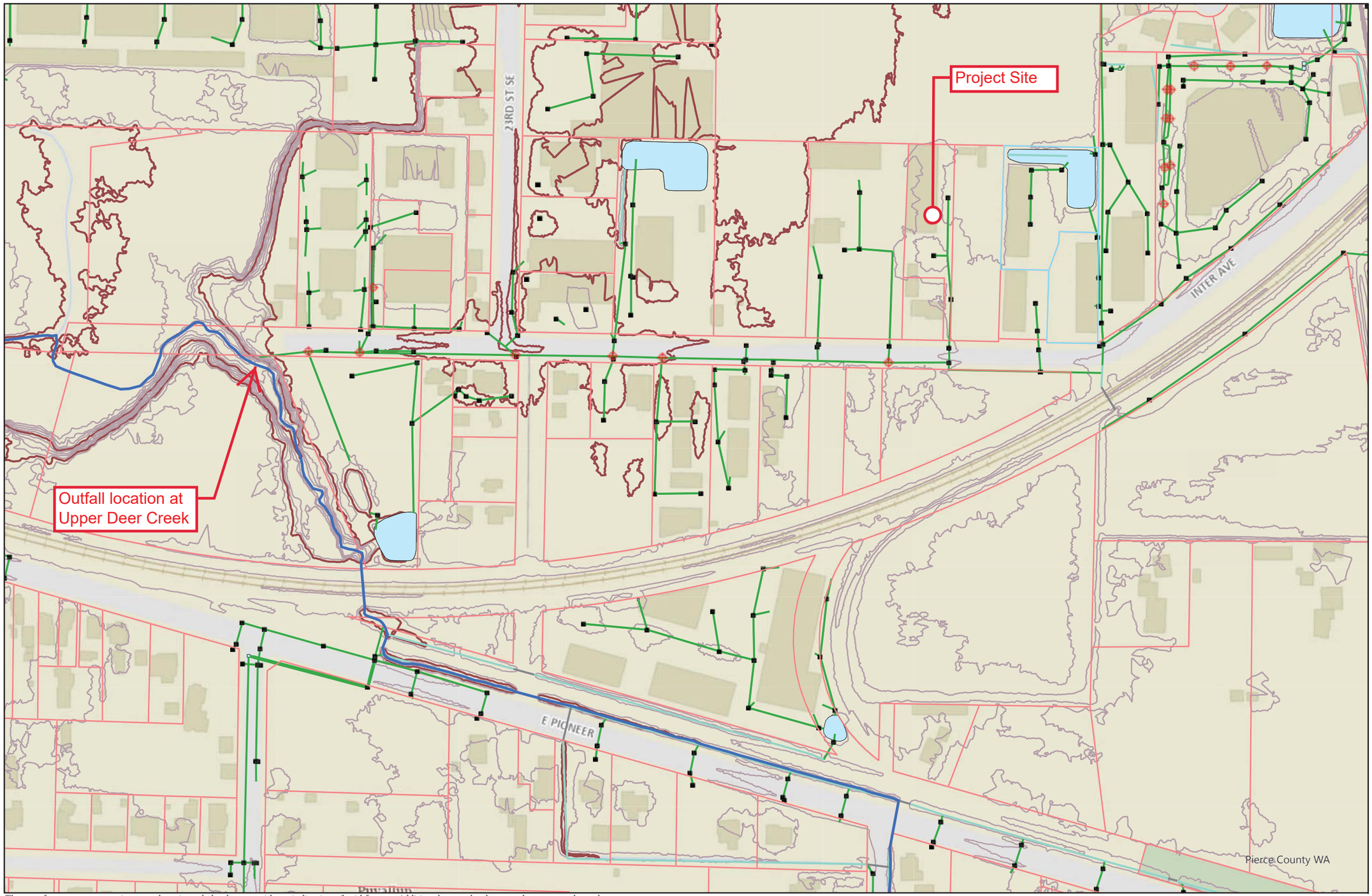
MAP PAN

This map
digital flo
The base
accuracy

The flood
authorita
was expo
reflect ch
time. The
become s

This map
elements
legend, s
FIRM pan
unmappe
regulatory

Downstream Map



Legend

- Streams - Puyallup

Tax Parcels

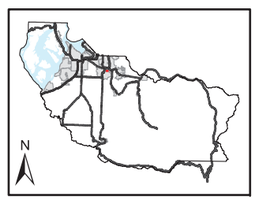
- Base Parcel
- Condominium
- Drainage - Manholes - Puyallup
- Drainage - Inlets - Puyallup
- Drainage - Culverts - Puyallup
- Drainage - Channels - Puyallup
- Drainage - Pipes - Puyallup
- Drainage - Stormwater Facilities - Puyallup

Contours - 2017

- 10' Contour Line
- 2' Contour Line

Hydro - Centerline Labels

- Hydro - Centerline Labels



0 45 90 180 Feet

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APPENDIX C

Computer Modelling Results

WWHM2012

PROJECT REPORT

General Model Information

WWHM2012 Project Name: 20083 Permeable Pavement2024.03

Site Name:	Olson Bros
Site Address:	2511 Inter Ave
City:	Puyallup, WA
Report Date:	3/19/2024
Gage:	40 IN EAST
Data Start:	10/01/1901
Data End:	09/30/2059
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2023/01/27
Version:	4.2.19

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

Pre-Dev

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	1.096
Pervious Total	1.096
Impervious Land Use	acre
Impervious Total	0
Basin Total	1.096

Mitigated Land Use

Bypass

Bypass:	Yes
GroundWater:	No

Pervious Land Use	acre
C, Pasture, Flat	0.13
Pervious Total	0.13

Impervious Land Use	acre
ROADS FLAT	0.084
PARKING FLAT	0.036
Impervious Total	0.12
Basin Total	0.25

Landscaping

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Pasture, Flat	.194

Curbing

Bypass:	No
Impervious Land Use	acre
ROADS FLAT LAT	0.011

Routing Elements
Predeveloped Routing

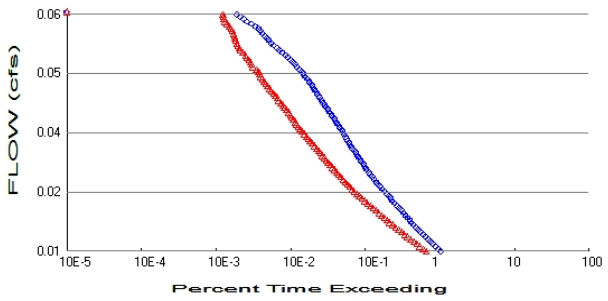
Mitigated Routing

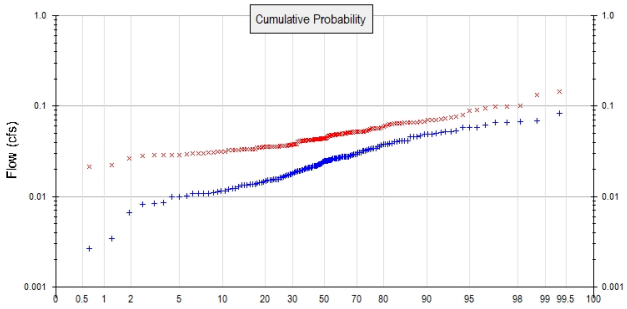
Permeable Parkling Lot

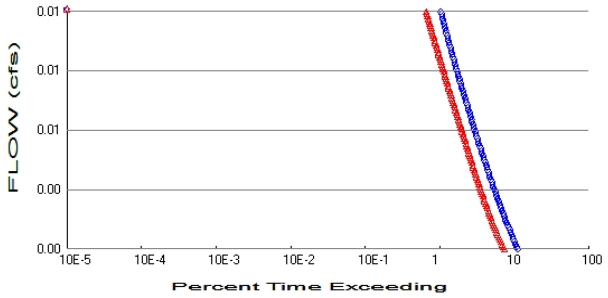
Pavement Area:0.6410 acre.Pavement Length:	167.10 ft.
Pavement Width:	167.10 ft.
	Pavement slope 1:0.05 To 1
Pavement thickness:	0.54
Pour Space of Pavement:	0.3
Material thickness of second layer:	0.21
Pour Space of material for second layer:	0.3
Material thickness of third layer:	0
Pour Space of material for third layer:	0
Infiltration On	
Infiltration rate:	0.1
Infiltration safety factor:	1
Total Volume Infiltrated (ac-ft.):	276.822
Total Volume Through Riser (ac-ft.):	0
Total Volume Through Facility (ac-ft.):	276.822
Percent Infiltrated:	100
Total Precip Applied to Facility:	0
Total Evap From Facility:	24.299

Analysis Results

POC 1







\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 1.096
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.324
Total Impervious Area: 0.77201

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	0.024764
5 year	0.038101
10 year	0.045811
25 year	0.054161
50 year	0.059533
100 year	0.064194

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	0.044713
5 year	0.060081
10 year	0.071259
25 year	0.086568
50 year	0.09886
100 year	0.11194

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1902	0.020	0.051
1903	0.015	0.056
1904	0.026	0.071
1905	0.013	0.029
1906	0.007	0.033
1907	0.038	0.048
1908	0.028	0.037
1909	0.027	0.043
1910	0.038	0.044
1911	0.025	0.048
1912	0.083	0.095
1913	0.039	0.033
1914	0.010	0.144
1915	0.016	0.031
1916	0.025	0.054
1917	0.008	0.021
1918	0.026	0.043
1919	0.021	0.029
1920	0.025	0.038
1921	0.027	0.034
1922	0.028	0.052
1923	0.022	0.035
1924	0.011	0.063
1925	0.014	0.028
1926	0.024	0.051
1927	0.018	0.044
1928	0.019	0.033
1929	0.038	0.062
1930	0.025	0.065
1931	0.023	0.032
1932	0.018	0.035
1933	0.020	0.036
1934	0.050	0.059
1935	0.023	0.029
1936	0.021	0.041
1937	0.033	0.052
1938	0.021	0.030
1939	0.002	0.036
1940	0.023	0.065
1941	0.014	0.071
1942	0.034	0.051
1943	0.017	0.049
1944	0.036	0.070
1945	0.027	0.052
1946	0.016	0.043
1947	0.011	0.031
1948	0.053	0.044
1949	0.046	0.066
1950	0.013	0.037
1951	0.017	0.057
1952	0.068	0.073
1953	0.062	0.067
1954	0.022	0.037
1955	0.019	0.033
1956	0.010	0.030
1957	0.033	0.036

1958	0.066	0.048
1959	0.041	0.049
1960	0.012	0.035
1961	0.041	0.098
1962	0.022	0.042
1963	0.011	0.031
1964	0.011	0.092
1965	0.046	0.044
1966	0.014	0.035
1967	0.021	0.051
1968	0.022	0.041
1969	0.021	0.038
1970	0.032	0.044
1971	0.049	0.044
1972	0.032	0.132
1973	0.042	0.076
1974	0.023	0.057
1975	0.052	0.065
1976	0.028	0.066
1977	0.012	0.026
1978	0.046	0.050
1979	0.013	0.048
1980	0.027	0.049
1981	0.024	0.044
1982	0.012	0.036
1983	0.041	0.051
1984	0.019	0.050
1985	0.030	0.058
1986	0.025	0.030
1987	0.047	0.049
1988	0.029	0.031
1989	0.027	0.029
1990	0.031	0.038
1991	0.025	0.052
1992	0.032	0.050
1993	0.033	0.056
1994	0.049	0.042
1995	0.011	0.031
1996	0.053	0.043
1997	0.022	0.037
1998	0.026	0.047
1999	0.003	0.049
2000	0.020	0.043
2001	0.011	0.033
2002	0.035	0.066
2003	0.030	0.037
2004	0.027	0.052
2005	0.049	0.101
2006	0.016	0.047
2007	0.016	0.053
2008	0.026	0.043
2009	0.017	0.033
2010	0.015	0.042
2011	0.014	0.044
2012	0.021	0.043
2013	0.016	0.040
2014	0.011	0.038
2015	0.021	0.067

2016	0.009	0.041
2017	0.038	0.063
2018	0.067	0.046
2019	0.066	0.067
2020	0.021	0.049
2021	0.034	0.042
2022	0.014	0.064
2023	0.029	0.081
2024	0.058	0.100
2025	0.026	0.042
2026	0.041	0.048
2027	0.015	0.052
2028	0.013	0.020
2029	0.028	0.036
2030	0.051	0.070
2031	0.017	0.022
2032	0.010	0.035
2033	0.015	0.044
2034	0.015	0.034
2035	0.058	0.050
2036	0.031	0.035
2037	0.008	0.047
2038	0.025	0.049
2039	0.003	0.089
2040	0.015	0.037
2041	0.019	0.045
2042	0.058	0.052
2043	0.028	0.057
2044	0.037	0.040
2045	0.025	0.033
2046	0.029	0.036
2047	0.022	0.043
2048	0.029	0.035
2049	0.026	0.053
2050	0.018	0.041
2051	0.026	0.060
2052	0.016	0.043
2053	0.027	0.036
2054	0.034	0.076
2055	0.014	0.041
2056	0.012	0.057
2057	0.019	0.028
2058	0.023	0.053
2059	0.040	0.067

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0833	0.1437
2	0.0682	0.1322
3	0.0672	0.1014
4	0.0664	0.0996
5	0.0659	0.0979
6	0.0619	0.0951
7	0.0584	0.0916
8	0.0578	0.0888
9	0.0575	0.0806
10	0.0534	0.0759

11	0.0527	0.0757
12	0.0518	0.0735
13	0.0508	0.0712
14	0.0505	0.0705
15	0.0490	0.0705
16	0.0489	0.0696
17	0.0488	0.0674
18	0.0472	0.0668
19	0.0463	0.0666
20	0.0458	0.0666
21	0.0455	0.0665
22	0.0415	0.0664
23	0.0413	0.0657
24	0.0413	0.0650
25	0.0412	0.0650
26	0.0409	0.0646
27	0.0403	0.0643
28	0.0388	0.0630
29	0.0384	0.0626
30	0.0383	0.0617
31	0.0383	0.0601
32	0.0376	0.0594
33	0.0372	0.0577
34	0.0356	0.0572
35	0.0353	0.0567
36	0.0342	0.0567
37	0.0341	0.0565
38	0.0341	0.0565
39	0.0335	0.0558
40	0.0333	0.0541
41	0.0328	0.0531
42	0.0323	0.0530
43	0.0320	0.0525
44	0.0318	0.0525
45	0.0309	0.0522
46	0.0308	0.0520
47	0.0304	0.0519
48	0.0295	0.0518
49	0.0295	0.0517
50	0.0292	0.0517
51	0.0287	0.0515
52	0.0286	0.0510
53	0.0280	0.0509
54	0.0277	0.0508
55	0.0277	0.0506
56	0.0277	0.0503
57	0.0276	0.0497
58	0.0275	0.0497
59	0.0274	0.0496
60	0.0274	0.0489
61	0.0271	0.0489
62	0.0270	0.0488
63	0.0269	0.0488
64	0.0265	0.0487
65	0.0264	0.0485
66	0.0264	0.0485
67	0.0264	0.0484
68	0.0261	0.0483

69	0.0261	0.0482
70	0.0257	0.0477
71	0.0255	0.0475
72	0.0254	0.0468
73	0.0252	0.0466
74	0.0251	0.0466
75	0.0249	0.0459
76	0.0248	0.0449
77	0.0247	0.0445
78	0.0246	0.0443
79	0.0245	0.0442
80	0.0242	0.0441
81	0.0240	0.0440
82	0.0233	0.0438
83	0.0233	0.0437
84	0.0229	0.0436
85	0.0229	0.0436
86	0.0227	0.0434
87	0.0224	0.0433
88	0.0220	0.0431
89	0.0220	0.0431
90	0.0219	0.0430
91	0.0218	0.0428
92	0.0216	0.0427
93	0.0211	0.0426
94	0.0210	0.0425
95	0.0210	0.0423
96	0.0207	0.0423
97	0.0207	0.0423
98	0.0206	0.0420
99	0.0206	0.0420
100	0.0205	0.0414
101	0.0201	0.0414
102	0.0198	0.0413
103	0.0197	0.0409
104	0.0194	0.0409
105	0.0192	0.0404
106	0.0192	0.0400
107	0.0189	0.0381
108	0.0187	0.0379
109	0.0183	0.0378
110	0.0178	0.0377
111	0.0176	0.0373
112	0.0175	0.0369
113	0.0173	0.0368
114	0.0172	0.0367
115	0.0168	0.0366
116	0.0165	0.0365
117	0.0162	0.0364
118	0.0162	0.0362
119	0.0156	0.0359
120	0.0156	0.0359
121	0.0155	0.0358
122	0.0155	0.0357
123	0.0153	0.0357
124	0.0153	0.0355
125	0.0152	0.0355
126	0.0149	0.0354

127	0.0145	0.0353
128	0.0141	0.0352
129	0.0141	0.0351
130	0.0138	0.0349
131	0.0138	0.0338
132	0.0135	0.0338
133	0.0135	0.0335
134	0.0134	0.0335
135	0.0134	0.0333
136	0.0133	0.0333
137	0.0127	0.0328
138	0.0123	0.0326
139	0.0123	0.0325
140	0.0121	0.0324
141	0.0116	0.0314
142	0.0114	0.0311
143	0.0113	0.0311
144	0.0111	0.0308
145	0.0109	0.0307
146	0.0108	0.0303
147	0.0108	0.0303
148	0.0107	0.0303
149	0.0101	0.0294
150	0.0099	0.0289
151	0.0099	0.0287
152	0.0086	0.0286
153	0.0084	0.0285
154	0.0082	0.0279
155	0.0066	0.0262
156	0.0034	0.0222
157	0.0027	0.0215
158	0.0017	0.0202

LID Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0020	613285	406751	66	Pass
0.0021	592787	391738	66	Pass
0.0022	573397	377611	65	Pass
0.0023	555114	364592	65	Pass
0.0024	537663	352182	65	Pass
0.0025	520988	340492	65	Pass
0.0026	505143	329745	65	Pass
0.0027	489963	319495	65	Pass
0.0028	475448	309690	65	Pass
0.0029	461543	300604	65	Pass
0.0030	448025	291906	65	Pass
0.0031	435061	283374	65	Pass
0.0032	422430	275175	65	Pass
0.0033	410297	267419	65	Pass
0.0035	398552	259884	65	Pass
0.0036	387195	252959	65	Pass
0.0037	376447	246090	65	Pass
0.0038	366143	239608	65	Pass
0.0039	356282	233347	65	Pass
0.0040	346642	227198	65	Pass
0.0041	337390	221381	65	Pass
0.0042	328415	215675	65	Pass
0.0043	319772	210135	65	Pass
0.0044	311462	204927	65	Pass
0.0045	303208	199775	65	Pass
0.0046	295396	194733	65	Pass
0.0047	287806	189913	65	Pass
0.0048	280493	185204	66	Pass
0.0049	273513	180717	66	Pass
0.0050	266643	176285	66	Pass
0.0051	259995	172074	66	Pass
0.0052	253569	167975	66	Pass
0.0053	247198	163820	66	Pass
0.0054	241159	159942	66	Pass
0.0056	235342	156119	66	Pass
0.0057	229636	152518	66	Pass
0.0058	223985	149028	66	Pass
0.0059	218500	145482	66	Pass
0.0060	213182	142213	66	Pass
0.0061	208029	138889	66	Pass
0.0062	202988	135621	66	Pass
0.0063	198113	132352	66	Pass
0.0064	193404	129416	66	Pass
0.0065	188750	126480	67	Pass
0.0066	184263	123599	67	Pass
0.0067	180052	120773	67	Pass
0.0068	175952	118114	67	Pass
0.0069	171964	115400	67	Pass
0.0070	167975	112740	67	Pass
0.0071	164152	110136	67	Pass
0.0072	160496	107699	67	Pass
0.0073	156895	105317	67	Pass
0.0074	153349	102824	67	Pass

0.0075	149970	100497	67	Pass
0.0077	146590	98225	67	Pass
0.0078	143321	96009	66	Pass
0.0079	140164	93793	66	Pass
0.0080	137006	91633	66	Pass
0.0081	133903	89638	66	Pass
0.0082	130967	87588	66	Pass
0.0083	128031	85649	66	Pass
0.0084	125150	83766	66	Pass
0.0085	122380	81938	66	Pass
0.0086	119610	80165	67	Pass
0.0087	116951	78337	66	Pass
0.0088	114347	76619	67	Pass
0.0089	111854	74902	66	Pass
0.0090	109416	73240	66	Pass
0.0091	107034	71633	66	Pass
0.0092	104763	70082	66	Pass
0.0093	102491	68475	66	Pass
0.0094	100331	66924	66	Pass
0.0095	98170	65594	66	Pass
0.0097	96120	64099	66	Pass
0.0098	94015	62714	66	Pass
0.0099	92076	61329	66	Pass
0.0100	90137	59943	66	Pass
0.0101	88309	58614	66	Pass
0.0102	86536	57395	66	Pass
0.0103	84597	56010	66	Pass
0.0104	82879	54902	66	Pass
0.0105	81162	53733	66	Pass
0.0106	79555	52620	66	Pass
0.0107	77893	51462	66	Pass
0.0108	76397	50370	65	Pass
0.0109	74735	49262	65	Pass
0.0110	73350	48232	65	Pass
0.0111	71855	47151	65	Pass
0.0112	70525	46176	65	Pass
0.0113	69029	45113	65	Pass
0.0114	67755	44149	65	Pass
0.0115	66370	43118	64	Pass
0.0116	65151	42237	64	Pass
0.0118	63877	41251	64	Pass
0.0119	62714	40415	64	Pass
0.0120	61495	39528	64	Pass
0.0121	60331	38764	64	Pass
0.0122	59112	37861	64	Pass
0.0123	58004	37130	64	Pass
0.0124	56841	36276	63	Pass

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0124	56841	36276	63	Pass
0.0129	52475	32914	62	Pass
0.0133	48392	29833	61	Pass
0.0138	44609	27052	60	Pass
0.0143	41268	24615	59	Pass
0.0148	38249	22371	58	Pass
0.0152	35523	20387	57	Pass
0.0157	32980	18520	56	Pass
0.0162	30526	16903	55	Pass
0.0167	28459	15429	54	Pass
0.0171	26509	14061	53	Pass
0.0176	24747	12825	51	Pass
0.0181	23146	11762	50	Pass
0.0186	21684	10792	49	Pass
0.0190	20349	9922	48	Pass
0.0195	19080	9091	47	Pass
0.0200	17856	8343	46	Pass
0.0205	16731	7673	45	Pass
0.0210	15612	7036	45	Pass
0.0214	14620	6426	43	Pass
0.0219	13728	5911	43	Pass
0.0224	12881	5451	42	Pass
0.0229	12094	5006	41	Pass
0.0233	11396	4611	40	Pass
0.0238	10659	4241	39	Pass
0.0243	10000	3930	39	Pass
0.0248	9357	3649	38	Pass
0.0252	8753	3419	39	Pass
0.0257	8205	3176	38	Pass
0.0262	7723	2965	38	Pass
0.0267	7241	2773	38	Pass
0.0271	6792	2583	38	Pass
0.0276	6415	2429	37	Pass
0.0281	6111	2282	37	Pass
0.0286	5834	2137	36	Pass
0.0291	5551	2004	36	Pass
0.0295	5271	1870	35	Pass
0.0300	5005	1751	34	Pass
0.0305	4782	1654	34	Pass
0.0310	4532	1557	34	Pass
0.0314	4339	1462	33	Pass
0.0319	4157	1390	33	Pass
0.0324	3937	1310	33	Pass
0.0329	3713	1229	33	Pass
0.0333	3537	1150	32	Pass
0.0338	3364	1073	31	Pass
0.0343	3227	1009	31	Pass
0.0348	3088	956	30	Pass
0.0352	2965	899	30	Pass
0.0357	2851	840	29	Pass
0.0362	2738	783	28	Pass
0.0367	2599	743	28	Pass
0.0371	2477	699	28	Pass

0.0376	2357	664	28	Pass
0.0381	2263	635	28	Pass
0.0386	2159	598	27	Pass
0.0391	2056	567	27	Pass
0.0395	1949	546	28	Pass
0.0400	1837	515	28	Pass
0.0405	1748	485	27	Pass
0.0410	1659	453	27	Pass
0.0414	1578	433	27	Pass
0.0419	1510	410	27	Pass
0.0424	1443	383	26	Pass
0.0429	1367	364	26	Pass
0.0433	1297	347	26	Pass
0.0438	1241	326	26	Pass
0.0443	1182	305	25	Pass
0.0448	1129	288	25	Pass
0.0452	1079	269	24	Pass
0.0457	1026	255	24	Pass
0.0462	979	244	24	Pass
0.0467	922	231	25	Pass
0.0471	872	220	25	Pass
0.0476	819	213	26	Pass
0.0481	771	206	26	Pass
0.0486	718	193	26	Pass
0.0491	668	174	26	Pass
0.0495	629	165	26	Pass
0.0500	588	159	27	Pass
0.0505	549	152	27	Pass
0.0510	507	142	28	Pass
0.0514	472	138	29	Pass
0.0519	427	126	29	Pass
0.0524	392	116	29	Pass
0.0529	363	113	31	Pass
0.0533	329	108	32	Pass
0.0538	300	105	35	Pass
0.0543	281	101	35	Pass
0.0548	264	99	37	Pass
0.0552	248	97	39	Pass
0.0557	233	95	40	Pass
0.0562	218	91	41	Pass
0.0567	205	88	42	Pass
0.0572	186	83	44	Pass
0.0576	163	78	47	Pass
0.0581	142	73	51	Pass
0.0586	129	70	54	Pass
0.0591	117	69	58	Pass
0.0595	105	68	64	Pass

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
Permeable Parkling Lot POC	☑	251.91	276.82	276.82	☑	100.00	276.82	100.00	Treat. Credit
Total Volume Infiltrated		251.91	276.82	276.82		100.00	276.82	277 / 277 = 100%	Treat. Credit = 100%
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Passed

POC 2

POC #2 was not reported because POC must exist in both scenarios and both scenarios must have been run.

Model Default Modifications

Total of 0 changes have been made.

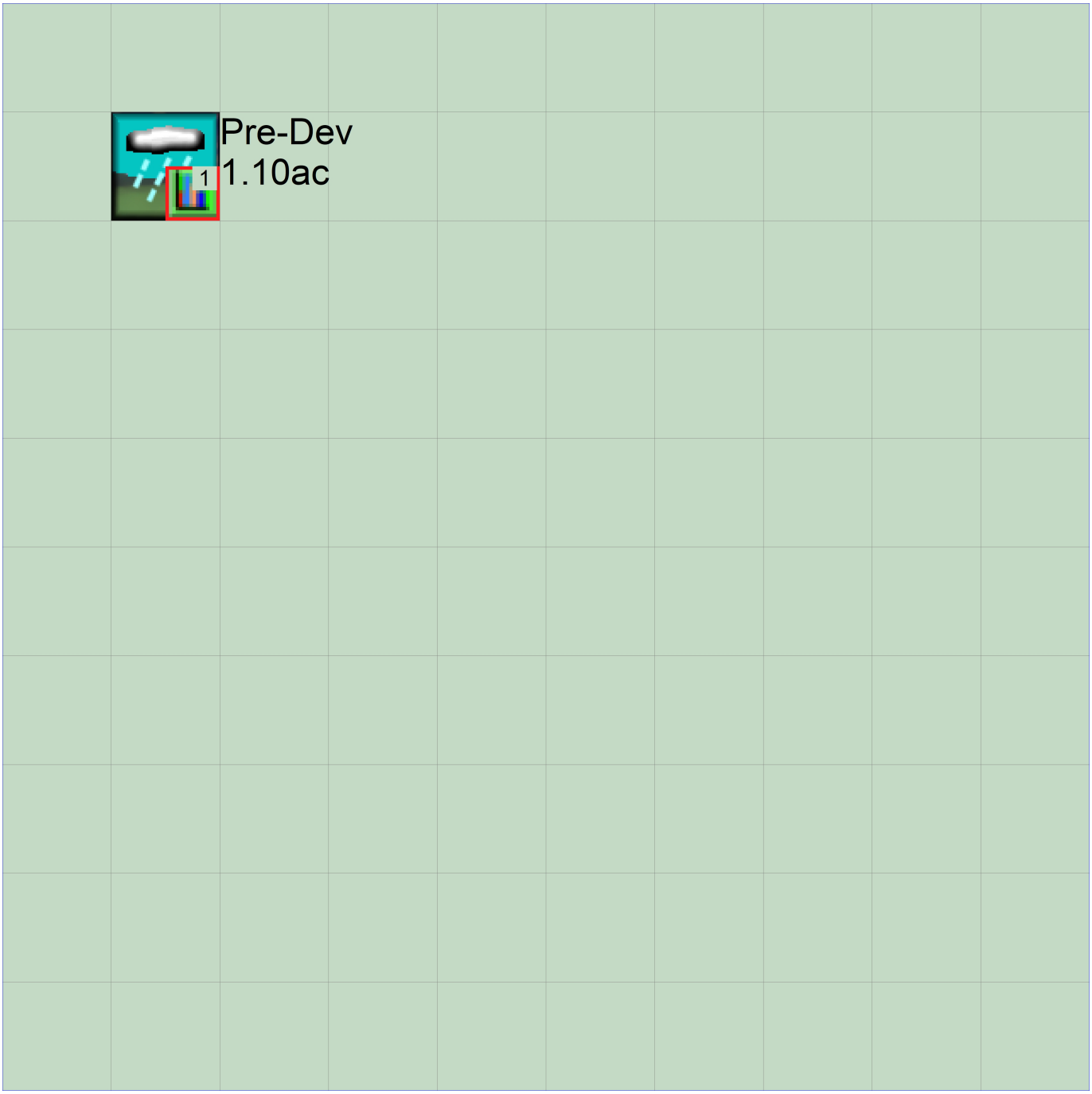
PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic

Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 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   20083 Permeable Pavement2024.03.wdm
MESSU       25   Pre20083 Permeable Pavement2024.03.MES
            27   Pre20083 Permeable Pavement2024.03.L61
            28   Pre20083 Permeable Pavement2024.03.L62
            30   POC20083 Permeable Pavement2024.031.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        Pre-Dev                   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->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Pre-Dev***
PERLND  10                       1.096     COPY   501     12
PERLND  10                       1.096     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 ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* 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                                  ***
    # -  #  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     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        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
  WWHM4 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   20083 Permeable Pavement2024.03.wdm
MESSU       25   Mit20083 Permeable Pavement2024.03.MES
            27   Mit20083 Permeable Pavement2024.03.L61
            28   Mit20083 Permeable Pavement2024.03.L62
            30   POC20083 Permeable Pavement2024.031.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      13
      IMPLND       1
      IMPLND      11
      PERLND      38
      IMPLND      17
      IMPLND      16
      RCHRES       1
      COPY         1
      COPY       501
      COPY       601
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Permeable Parkling Lot      MAX                    1    2   30    9
  END DISPLY-INFO1
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
   38     C, Pasture, 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 ***
   13         0    0    1    0    0    0    0    0    0    0    0    0
   38         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    0    1    9
   38         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 ***
   13         0    0    0    0    0    0    0    0    0    0    0
   38         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
   38              0       4.5      0.06       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
   13              0         0         2         2         0         0         0
   38              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
   38           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
   38              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           ***
    1      ROADS/FLAT             1    1    1   27    0
   11      PARKING/FLAT           1    1    1   27    0
   17     ROADS/FLAT LAT          1    1    1   27    0
   16      Porous Pavement        1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    1         0    0    1    0    0    0
   11         0    0    1    0    0    0
   17         0    0    1    0    0    0
   16         0    0    1    0    0    0
  END ACTIVITY
```

```
  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    1         0    0    4    0    0    4    1    9
   11         0    0    4    0    0    0    1    9
   17         0    0    4    0    0    0    1    9
   16         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    1         0    0    0    0    0
   11         0    0    0    0    0
   17         0    0    0    0    0
   16         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    1            400      0.01       0.1       0.1
   11            400      0.01       0.1       0.1
   17            400      0.01       0.1       0.1
   16            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    1              0         0
   11              0         0
   17              0         0
   16              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    1              0         0
   11              0         0
   17              0         0
   16              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                 <--Area-->     <-Target->   MBLK   ***
<Name>   #                 <-factor->     <Name>   #   Tbl#   ***
Landscaping***
PERLND  38                     0.3026     IMPLND  16     54
PERLND  38                     0.3026     IMPLND  16     55
Curbing***
IMPLND  17                     0.0172     IMPLND  16     53
IMPLND  16                      0.641     RCHRES   1      5
Bypass***
PERLND  13                       0.13     COPY   501     12
PERLND  13                       0.13     COPY   601     12
PERLND  13                       0.13     COPY   501     13
PERLND  13                       0.13     COPY   601     13
IMPLND   1                      0.084     COPY   501     15
IMPLND   1                      0.084     COPY   601     15
IMPLND  11                      0.036     COPY   501     15
IMPLND  11                      0.036     COPY   601     15

******Routing******
PERLND  38                      0.194     COPY     1     12
PERLND  38                      0.194     COPY     1     13
IMPLND  17                      0.011     COPY     1     15
```

```
RCHRES   1                           1     COPY   501     17
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                            ***
    1     Permeable Parkli-010    2    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                      ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *          ***
    1        0  1  0  0    4  5  0  0  0       0  0  0  0  0       2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
    1              1      0.03       0.0       0.0       0.5       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                         ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
         *** ac-ft     for each possible exit       for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1           0          4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
  FTABLE      1
   91    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.641010  0.000000  0.000000  0.000000
  0.019444  0.641010  0.001870  0.000000  0.064635
  0.038889  0.641010  0.003739  0.000000  0.064635
  0.058333  0.641010  0.005609  0.000000  0.064635
  0.077778  0.641010  0.007478  0.000000  0.064635
  0.097222  0.641010  0.009348  0.000000  0.064635
```

0.116667	0.641010	0.011218	0.000000	0.064635
0.136111	0.641010	0.013087	0.000000	0.064635
0.155556	0.641010	0.014957	0.000000	0.064635
0.175000	0.641010	0.016827	0.000000	0.064635
0.194444	0.641010	0.018696	0.000000	0.064635
0.213889	0.641010	0.020566	0.000000	0.064635
0.233333	0.641010	0.022435	0.000000	0.064635
0.252778	0.641010	0.024305	0.000000	0.064635
0.272222	0.641010	0.026175	0.000000	0.064635
0.291667	0.641010	0.028044	0.000000	0.064635
0.311111	0.641010	0.029914	0.000000	0.064635
0.330556	0.641010	0.031783	0.000000	0.064635
0.350000	0.641010	0.033653	0.000000	0.064635
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0.408333	0.641010	0.039262	0.000000	0.064635
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0.466667	0.641010	0.044871	0.000000	0.064635
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```
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  1.730556  0.641010  0.706714  34.74566  0.064635
  1.750000  0.641010  0.719178  36.14203  0.064635
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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
WDM      1 EVAP     ENGL    1              RCHRES   1     EXTNL  POTEV

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     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        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       17
RCHRES     OFLOW  OVOL   1                 COPY           INPUT  MEAN
  END MASS-LINK   17

  MASS-LINK       53
IMPLND     IWATER SURO                     IMPLND         EXTNL  SURLI
  END MASS-LINK   53

  MASS-LINK       54
PERLND     PWATER SURO                     IMPLND         EXTNL  SURLI
  END MASS-LINK   54

  MASS-LINK       55
PERLND     PWATER IFWO                     IMPLND         EXTNL  SURLI
```

```
  END MASS-LINK   55

END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

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Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Monday, Feb 14 2022

100-year 12-inch DIP @ 0.50%

Circular

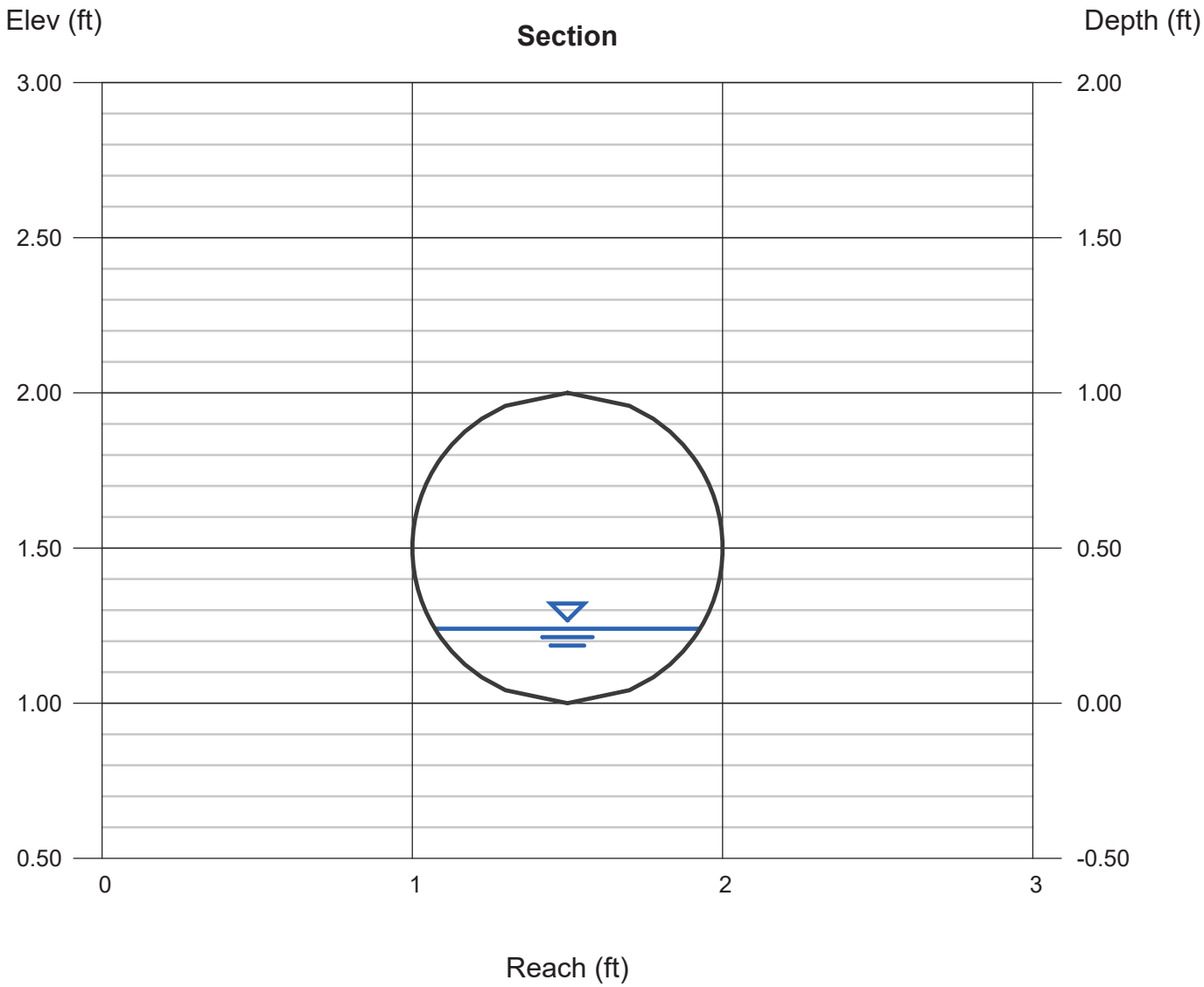
Diameter (ft)	= 1.00
Invert Elev (ft)	= 1.00
Slope (%)	= 0.50
N-Value	= 0.012

Calculations

Compute by:	Known Q
Known Q (cfs)	= 0.33 100-year flow rate

Highlighted

Depth (ft)	= 0.24
Q (cfs)	= 0.331
Area (sqft)	= 0.15
Velocity (ft/s)	= 2.28
Wetted Perim (ft)	= 1.02
Crit Depth, Yc (ft)	= 0.24
Top Width (ft)	= 0.85
EGL (ft)	= 0.32



APPENDIX D

Geotechnical Engineer's Report

GEORESOURCES
earth science & geotechnical engineering
4809 Pacific Hwy. E. | Fife, Washington 98424 | 253.896.1011 | www. georesources.rocks

December 10, 2021

Olson Brothers Pro Vac, LLC
c/o C.E.S. NW, Inc.
310 – 29th Street NE, Suite 101
Puyallup, Washington 98372
(253) 848-4282

Attn: Mr. Craig Deaver
cdeaver@cesnwinc.com

Stormwater Soils Report: Infiltration Feasibility
Proposed Permeable Pavement
2511 Inter Avenue
Puyallup, Washington
PN: 2105200-180, -192
Doc ID: CES.ProVac.InterAve.SR

INTRODUCTION

This *soils report* evaluates the feasibility of the site soils to support shallow infiltration of stormwater runoff from the proposed new hard surfacing to be installed at 2511 Inter Avenue in Puyallup, Washington. The site is currently a gravel surfaced contractor's yard. The approximate site location is shown on the attached Site Location Map, Figure 1.

Our understanding of the project is based on our email correspondence with Mr. Craig Deaver of C.E.S. NW, our review of the provided Cover Sheet by C.E.S NW Inc. dated October 21, 2020 our review of the available geologic and soils data, our December 9, 2020 site visit and subsurface explorations, our groundwater monitoring throughout the 2020/21 wet season, our understanding of the City of Puyallup development codes, and our experience in the area.

We understand the site consists of two separate tax parcels that are currently developed with an existing repair shop, paved and gravel parking areas, and utilities. We further understand that you would like to place an additional 8,771 square feet of new asphalt pavement at the site.

Because of the amount of proposed hard surfacing associated with the project, we understand the City of Puyallup is requiring a *Soils Report* be prepared in accordance with the 2014 Stormwater Management Manual for Western Washington (SWMMWW), which includes in-situ infiltration testing and wet season groundwater monitoring.

SCOPE

The purpose of our services was to evaluate the surface and subsurface conditions at the site as a basis for determining the feasibility for onsite stormwater infiltration and providing pertinent conclusions and recommendations relative to stormwater management for the proposed permeable pavement. Specifically, our scope of services for the project included the following:

1. Reviewing the available geologic, hydrogeologic, and geotechnical data for the site area;

2. Exploring surface and subsurface conditions by reconnoitering the site and monitoring the excavation of two test pits to depths of 5.0 feet below existing grades at select locations across the site, and installing two shallow piezometers in each test pit;
3. Performing one EPA falling test in-situ infiltration test;
4. Describing surface and subsurface conditions, including soil type, depth to groundwater, and an estimate of seasonal high groundwater levels;
5. Monitoring groundwater levels at the site during the prescriptive wet season;
6. Providing our opinion about the feasibility of onsite infiltration in accordance with the 2014 SWMMWW, including a preliminary design infiltration rate based on grain size analysis and in-situ testing, as applicable;
7. Preparing this written *Soils Report* summarizing our site observations and conclusions, and our geotechnical recommendations and design criteria, along with the supporting data; and
8. Preparing a written *Addendum Report* following the groundwater monitoring period, which ends in April.

The above scope of work was completed in accordance with our *Proposal for Geotechnical Engineering Services* dated November 18, 2020. We received written authorization to proceed from you on November 19, 2020.

SITE CONDITIONS

Surface Conditions

The site consists of two contiguous parcels located at 2511 Inter Avenue within the City of Puyallup, Washington, within an area of existing residential and commercial development. Based on the information provided the Cover Sheet prepared by C.E.S. NW and Pierce County GIS, the west parcel is generally flagpole in shape, and the east parcel is generally rectangular in shape. When combined, these parcels form an irregularly shaped site. The full site measures approximately 115 to 195 feet wide (east to west) by about 408 feet long (north to south) and encompasses about 1.59 acres. The site is bounded by Inter Avenue to the south, by existing commercial development to the east and west, and by land being developed to the north.

The site is generally level, with a slight slope of about 1 percent down to the north. A large office and repair shop building is located in the northwest portion of the site, and the rest of the site is developed with gravel parking stalls for the ProVac trucks and paved or concrete parking stalls for automobiles. Total topographic relief across the site is on the order of about 1 to 2 feet.

Vegetation across the site generally was generally cleared, except for typical landscaping grass lawn surrounding the residence located southwest and adjacent to the site. Standing water was observed throughout the gravel parking area.

Site Soils

The USDA Natural Resources Conservation Service (NRCS) Web Soil Survey maps the site as being underlain by Briscot silt loam (6A) soils. A copy of the NRCS soils map for the site area is included as Figure 3.

- *Briscot silt loam (6A)*: The Briscot soils are derived from alluvium and are included in hydrologic soils group B/D. These soils typically form on slopes of 0 to 2 percent and are listed as having a "slight" erosion hazard when exposed.

Site Geology

The draft *Geologic Map of the Puyallup 7.5-minute Quadrangle, Washington* by K.G. Troost maps the site as being underlain by alluvium (Qal). An excerpt of the above referenced geologic map is included as Figure 4.

- *Alluvium (Qal)*: Alluvial soils generally consist of normally consolidated, stratified deposits of sand, silt, clay, and occasional peat that were deposited along the Puyallup River channel. The existing topography, as well as the surficial and shallow soils in the area, are the result of fluvial action, including down-cutting by the river, channel meandering and migration, and flood deposits. Alluvium typically offers unfavorable infiltration characteristics because of the silty nature of the soils.

Subsurface Explorations

On December 9, 2020, a representative from GeoResources, LLC (GeoResources) visited the site and monitored the excavation of two test pits at selected locations across the site to depths of about 5.0 feet below the existing ground surface. The test pits were excavated by a licensed earthwork contractor under contract to GeoResources. Piezometers were installed at the termination depth of each test pit.

The specific number, locations, and depths of our explorations were selected based on the configuration of the proposed development and were adjusted in the field based on consideration for underground utilities, existing site conditions, site access limitations, and encountered stratigraphy. Test pit TP-1 was excavated on the adjacent property to the proposed project site because no other areas on the site were clear of utilities. The densities presented in the logs were based on the difficulty of excavation and our experience. Representative soil samples obtained from the test pits were placed in sealed plastic bags then taken to a laboratory for further examination and testing as deemed necessary. The test pits were then backfilled with the excavated soils and bucket tamped, but not otherwise compacted.

The subsurface explorations indicate the subsurface conditions at specific locations only, as actual subsurface conditions can vary across the site. Furthermore, the nature and extent of such variation would not become evident until additional explorations are performed or until construction activities have begun. Based on our experience, it is our opinion that the soils encountered in the explorations are generally representative of the soils at the site.

The approximate locations and numbers of our explorations are shown on the attached Site & Exploration Plan, Figure 2. The soils encountered were visually classified in accordance with the Unified Soil Classification System (USCS) and ASTM D2488. The USCS is included in Appendix A as Figure A-1, while the descriptive logs of our explorations are included as Figure A-2.

Subsurface Conditions

Our explorations encountered relatively uniform subsurface conditions that, in our opinion, generally confirmed the mapped stratigraphy. Our test pits generally encountered about ½-foot of dark-colored topsoil with roots or 1 foot of crushed rock and reddish brown silty sand with gravel,

consistent with fill. Beneath the topsoil and fill, we observed about 0.8 feet of medium dense brown, orange iron stained silty sand or sandy silt in a moist to wet condition, mantling about 2.5 to 2.8 feet of soft gray, orange iron oxide stained silt in a moist condition. Medium dense gray orange iron oxide stained fine sand with silt was observed beneath the surficial soils to the termination depth of each test pit. We interpret these soils to be consistent with native alluvium soils. Table 1, below, summarizes the approximate thicknesses, depths, and elevations of selected soil layers.

TABLE 1:
APPROXIMATE THICKNESS, DEPTHS, AND ELEVATION OF SOIL TYPES ENCOUNTERED IN EXPLORATIONS

Exploration Number	Thickness of Topsoil/Fill (feet)	Thickness of Silty Alluvium (feet)	Depth to Mottling (feet)	Depth to Groundwater (feet)	Elevation of Sandy Alluvium (feet)
TP-1	0.5	3.3	0.5	2.0(perched)/5.0	57.2
TP-2	1.0	3.5	1.0	N/E	57.5

Notes: Elevation datum: Provided *Cover Sheet* by CES NW Inc dated October 21, 2020 N/E: Not encountered

Groundwater Conditions

Perched groundwater was encountered at the time of excavation in TP-1 at a depth of 2.0 feet below the existing ground surface on top of the gray, orange iron oxide stained sandy silt alluvium. Additional groundwater seepage was observed at about 5 feet below existing grades in the sandy alluvium. No groundwater seepage was observed in test pit TP-2 at the time of excavation; however, an old drainage pipe with washed rock was encountered in the western portion of the test pit during the over dig of the infiltration test. Orange iron oxide staining, a form of mottling was observed throughout the soils in each of our test pit explorations. Mottling can be indicative of a seasonal or fluctuating groundwater table. We anticipate fluctuations in the local groundwater levels may occur in response to season, precipitation patterns, off-site construction activities, and site utilization.

We returned to the site throughout the prescriptive wet season observe the depth to groundwater within the piezometers installed in each test pit. Both piezometers had seasonal high groundwater at about 0.5 feet below existing grades. Table 2 summarizes the approximate depths and elevations of groundwater and mottling observed at the time of our explorations and our subsequent readings in both piezometers. We were unable to record groundwater levels during some days in TP-2 because a car had parked over the piezometer. The measurements from our groundwater monitoring are attached in Appendix B.

TABLE 2:
APPROXIMATE DEPTHS, AND ELEVATION OF GROUNDWATER ENCOUNTERED IN EXPLORATIONS

Exploration Number	Depth to Groundwater (feet)	Elevation of Groundwater (feet)	Dated Measured
TP-1	2(perched), 5	59(perched), 56	12/9/2020
	0.5	60.5	12/21/2020
	0.5	60.5	12/31/2020
	0.5	60.5	1/8/2021
	0.5	60.5	1/14/2021
	1.1	59.9	1/29/2021
	1.8	59.2	2/5/2021
	1.7	59.3	2/12/2021
	0.5	60.5	2/16/2021
	1.5	59.5	3/5/2021
	2.4	58.6	3/12/2021
	2.4	58.6	3/19/2021
	1.7	59.3	3/26/2021
	2.1	58.9	4/1/2021
TP-2	NE	NE	12/9/2020
	0.5	61.5	12/21/2020
	1.0	61.0	12/31/2020
	0.7	61.3	1/8/2021
	0.5	61.5	1/14/2021
	1.9	60.1	1/29/2021
	1.2	60.8	2/5/2021
	2.3	59.7	2/12/2021
	Inaccessible	-	2/16/2021
	Inaccessible	-	3/5/2021
	Inaccessible	-	3/12/2021
	Inaccessible	-	3/19/2021
	2.2	59.8	3/26/2021
	Inaccessible	-	4/1/2021

Laboratory Testing

Geotechnical laboratory tests were performed on selected samples retrieved from the test pits to estimate index engineering properties of the soils encountered. Laboratory testing included visual soil classification per ASTM D2488 and ASTM D2487. We also submitted representative samples to an independent analytical laboratory for determination of organic content and cation exchange capacity. Organic content was determined per ASTM D2974 and cation exchange capacity was determined per SW846 9081. Test results are included in Appendix B.

CONCLUSIONS AND RECOMMENDATIONS

Based on our site reconnaissance and subsurface explorations, it is our opinion that the infiltration of stormwater runoff generated onsite by the proposed development is not feasible for the site.

Infiltration Recommendations

Mottled silty sand was encountered near the surface in both of our subsurface explorations, and groundwater was observed at about 0.5 feet below existing grades during our December 21, 2020 site visit to check the groundwater levels in each piezometer.

The City of Puyallup uses the 2012 *Stormwater Management Manual for Western Washington, with 2014 updates* (2014 SWMMWW). Per the 2014 SWMMWW, Volume V, BMP T5.15, a minimum of 1 foot of separation is required between the bottom of the storage course for permeable pavement and the top of an impermeable layer, such as mottling, or the sandy silt soils encountered at the site. Based on the conditions encountered, permeable pavement appears to be infeasible. We performed an EPA falling head test in the brown mottled silty sand in test pit TP-2 and measured an initial rate of 0.6 inches per hour. An EPA falling head test was chosen for this project because the use of a PIT would interfere with the function of the ProVac yard for that day, and in our opinion, would give an inaccurate rate for the soils encountered in our test pits. Based on the above, a long-term design rate of 0.04 inches per hour is applicable for this project, if the site grades can be adjusted to meet the required vertical separation to the seasonal high groundwater. This would require site grades to be raised on the order of 2 to 3 feet.

Per the 2014 SWMMWW, minimum cation exchange capacity of 5 milliequivalents per 100 milligrams of soil and 1 percent organic content is required for soils to provide adequate water quality treatment to the stormwater. Testing was conducted on the shallow soils at the site located at about 2 feet below existing grades by a third party laboratory. The organic content of the site soils were determined to be 5.79 and 9.94 percent per ASTM D: 2974-13, with a cation exchange capacity of 18.0 and 17.6 milliequivalents per 100 grams as determined by SW-846 Test Method 9081. The shallow onsite soils have the required treatment capacity per the 2014 SWMMWW.

Alternative stormwater management methods, such as detention or dispersion, should be considered for this project in accordance with the 2014 SWMMWW. All minimum setback requirements and infeasibility criteria per the 2014 SWMMWW should be considered prior to the selection of any stormwater facility for the proposed development.

LIMITATIONS

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

Variations in subsurface conditions are possible between the explorations and may also occur with time. A contingency for unanticipated conditions should be included in the budget and schedule. Sufficient monitoring, testing and consultation should be provided by our firm during construction to confirm that the conditions encountered are consistent with those indicated by the explorations, to

provide recommendations for design changes should the conditions revealed during the work differ from those anticipated, and to evaluate whether earthwork and foundation installation activities comply with contract plans and specifications.

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

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

◆ ◆ ◆

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

Respectfully submitted,

GeoResources, LLC

Andrew Schnitger, EIT
Engineer in Training

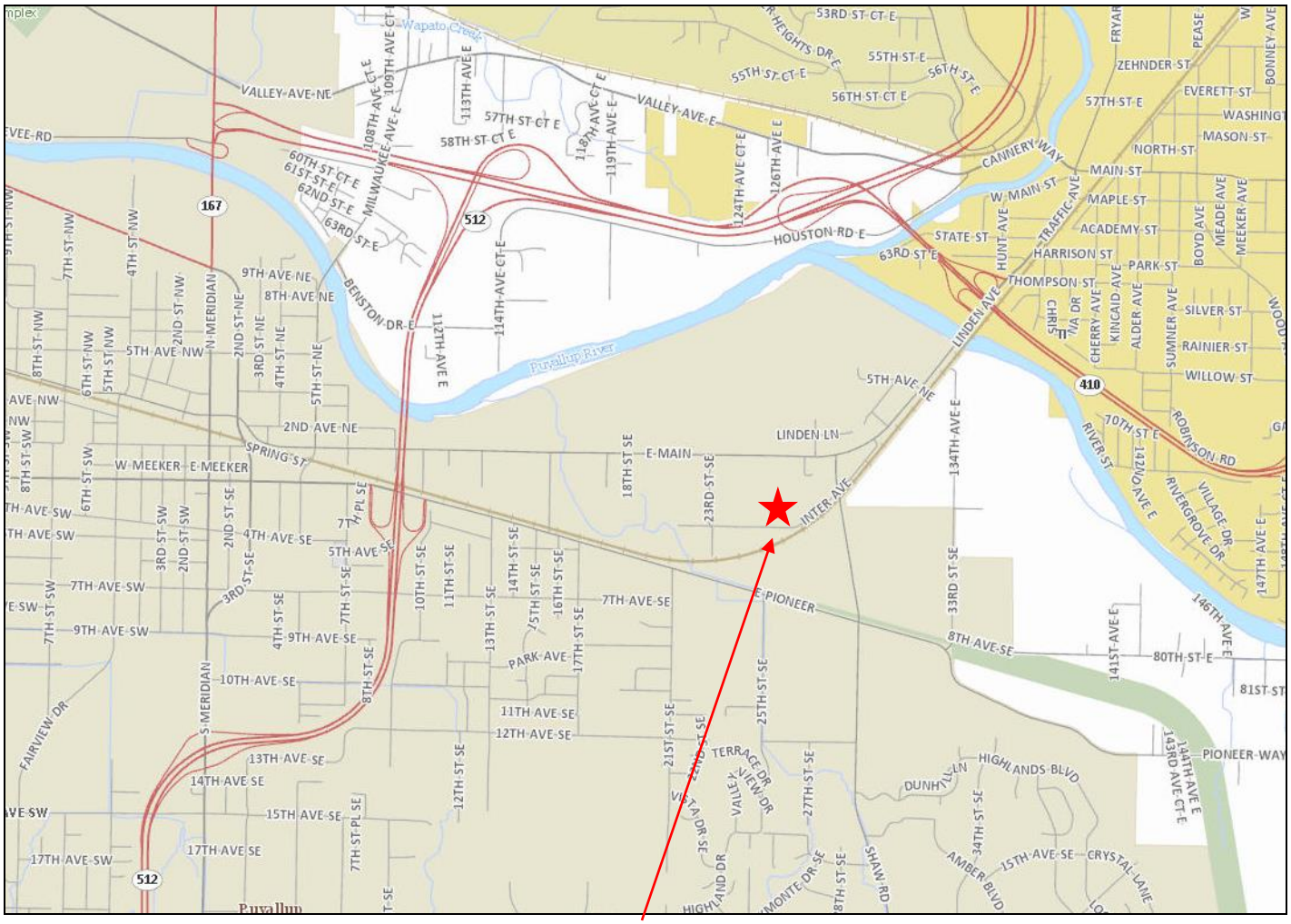
State of Washington
Engineering Geologist
925
Licensed Geologist
12/10/2021
KEITH SCOTT SCHEMBS

Keith S. Schembs, LEG
Principal

ERIC WILLIAM HELLER
STATE OF WASHINGTON
43471
REGISTERED
PROFESSIONAL ENGINEER
12/10/2021

Eric W. Heller, PE, LG
Senior Geotechnical Engineer

AES:KSS:KEB/aes
DocID: CES.ProVac.InterAve.SR
Attachments: Figure 1: Site Location Map
Figure 2: Site & Exploration Plan
Figure 3: NRCS Soils Map
Figure 4: USGS Geologic Map
Appendix A – Subsurface Explorations
Appendix B – Laboratory Test Results



Approximate Site Location

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

Not to Scale

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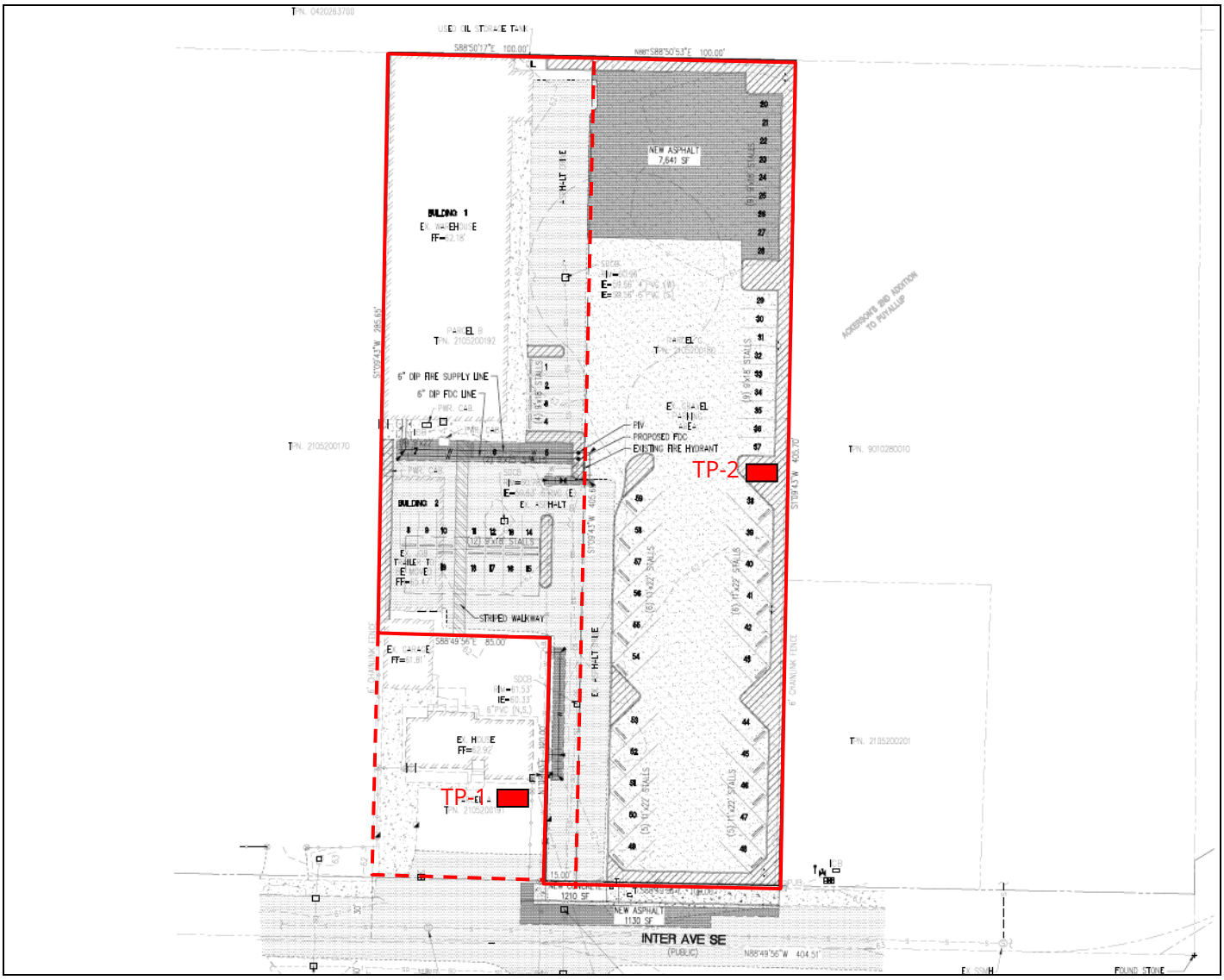
Site Location Map

Olson Brothers Storage
2511 Inter Avenue
Puyallup, Washington
PN: 2105200-180, -192

DocID: CES.ProVac.InterAve.F	December 2021	Figure 1



Approximate Site Location

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

Approximate test pit and piezometer location

Approximate site boundary

Approximate locations of property lines

Not to Scale

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Site & Exploration Plan

Olson Brothers Storage
2511 Inter Avenue
Puyallup, Washington
PN: 2105200-180, -192

DocID: CES.ProVac.InterAve.F	December 2021	Figure 2

Approximate Site Location

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

Soil Type	Soil Name	Parent Material	Slopes	Erosion Hazard	Hydrologic Soils Group
6A	Briscot silt loam	Alluvium	0 to 2	Slight	B/D

Not to Scale

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NRCS Soils Map

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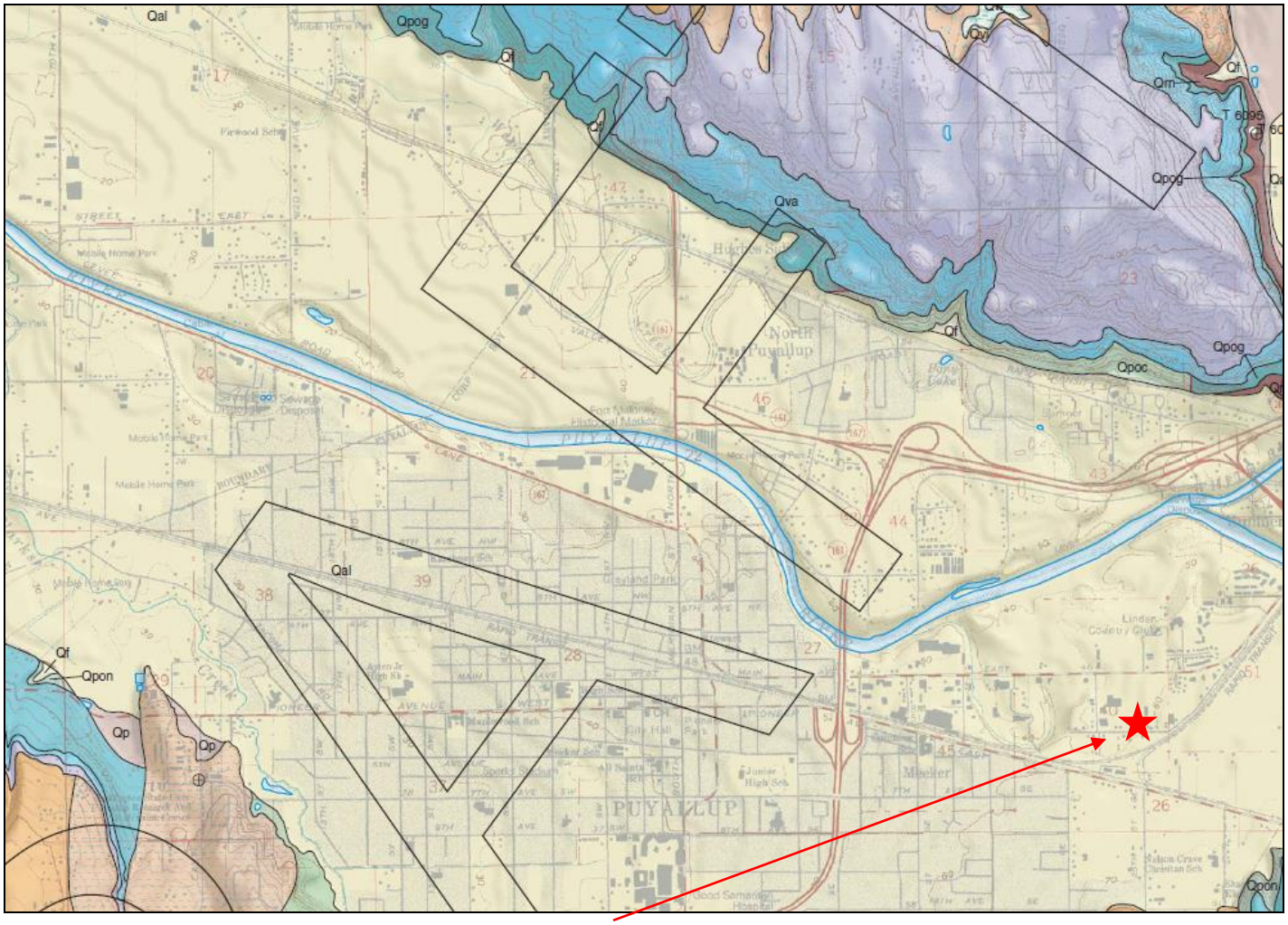

Approximate Site Location

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

Qal	Alluvium

Not to Scale

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USGS Geologic Map

Olson Brothers Storage
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Appendix A

Subsurface Explorations

SOIL CLASSIFICATION SYSTEM

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

NOTES:

1. Field classification is based on visual examination of soil in general accordance with ASTM D2488-90.
2. Soil classification using laboratory tests is based on ASTM D2487-90.
3. Description of soil density or consistency are based on interpretation of blow count data, visual appearance of soils, and or test data.

SOIL MOISTURE MODIFIERS:

Dry- Absence of moisture, dry to the touch

Moist- Damp, but no visible water

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

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Unified Soils Classification System

Olson Brothers Storage
2511 Inter Avenue
Puyallup, Washington
PN: 2105200-180, -192

Test Pit TP-1

Location: South of existing residence, off of proposed permeable area
Approximate Elevation: 61’

Depth (ft)			Soil Type	Soil Description
0	-	0.5	-	Topsoil
0.5	-	1.3	SM	Brown, orange iron oxide stained silty fine SAND (loose, moist) (alluvium)
1.3	-	3.8	SM	Gray, orange iron oxide stained silty fine SAND (loose, moist) (alluvium)
3.8	-	5.0	SP-SM	Gray, orange iron oxide stained fine SAND with some silt (medium dense, moist) (alluvium)

Terminated at 5.0 feet below ground surface.
Caving observed 2 feet below existing ground surface.
Perched groundwater observed at 2 feet below existing grades, fast groundwater seepage observed at termination depth of test pit.
Mottling observed throughout entire excavation.

Test Pit TP-2

Location: Central portion of site, near eastern site boundary
Approximate Elevation: 62’

Depth (ft)			Soil Type	Soil Description
0	-	0.5	-	Crushed rock (dense, moist) (fill)
0.5	-	1.0	SM	Reddish brown silty SAND with gravel (dense, moist) (fill)
1.0	-	1.7	SM	Brown, orange iron oxide stained silty SAND (loose, moist) (alluvium)
1.7	-	4.5	ML	Gray, orange iron oxide stained SILT (soft, moist) (alluvium) (drainage pipe encountered during overdig at about 3 feet)
4.5	-	5.0	SP-SM	Gray, orange iron oxide stained fine SAND with some silt (medium dense, moist) (alluvium)

Terminated at 5.5 feet below ground surface.
No caving observed at the time of excavation.
No groundwater seepage observed at time of excavation.
Mottling observed throughout entire excavation.
Infiltration test performed at about 1.5 feet below existing grades.

Logged by: AES **Excavated on: December 9, 2020**

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Test Pit Logs
Olson Brothers Storage
2511 Inter Avenue
Puyallup, Washington
PN: 2105200-180, -192

Appendix B

Laboratory Results

SPECTRA Laboratories ...Where experience matters

2221 Ross Way • Tacoma, WA 98421 • (253) 272-4850 • Fax (253) 572-9838 • www.spectra-lab.com

11/18/2021

GeoResources, LLC
4809 Pacific Hwy E
Fife, WA 98424

Project: CES.Provac
Sample Matrix: Soil
Date Sampled: 11/12/2021
Date Received: 11/15/2021
Spectra Project: 2021110413
Rush

Client ID	Spectra #	Analyte	Result	Units	Method	Analyzed
TP-1, 1'	1	Organic Matter	5.79	wt. % Dry	ASTM D-2974-13	11/17/2021
TP-1, 1'	1	Cation Exchange Capacity	18.0	Na, mEq/ 100g	SW846 9081	11/18/2021
TP-2, 1'	2	Organic Matter	9.94	wt. % Dry	ASTM D-2974-13	11/17/2021
TP-2, 1'	2	Cation Exchange Capacity	17.6	Na, mEq/ 100g	SW846 9081	11/18/2021

SPECTRA LABORATORIES

Ben Frans, Laboratory Manager

a7/scj

SPECTRA Laboratories

2221 Ross Way, Tacoma, WA 98421
(253) 272-4850 Fax (253) 572-9838
www.spectra-lab.com info@spectra-lab.com

SPECIAL INSTRUCTIONS/COMMENTS:

CHAIN OF CUSTODY

SPECTRA PROJECT # 2021110413

Return Samples: Y N Page _____ of _____ STANDARD ☐ RUSH ☑

CLIENT: GeoResources ADDRESS: 4809 Pacific Hwy E, Fife WA ADDRESS CHANGE ☐

PROJECT: CES. Provac

CONTACT: Andrews

SAMPLED BY: Andrews

PHONE: 253 896 1004 FAX:

e-MAIL: Andrews@Georesources.y Prefer FAX ☐ or e-MAIL ☑

PURCHASE ORDER #

SAMPLE ID	DATE SAMPLED	TIME SAMPLED	MATRIX	NUMBER OF CONTAINERS	HYDROCARBONS: NWTPH-HCID	BTEX	BTEX/NWTPH-G	NWTPH-G	NWTPH-Dx	1664 SGT-HEM (TPH)	1664 HEM (FOG)	ORGANICS: 8260/624 VOA	8260 CHLOR SOLVENTS	8270-625 SEMI VOA	8270 PAH/PNA	8082/608 PCB	METALS: TOTAL METALS RCRA 8	TOTAL METALS (SPECIFY)	TCLP METALS RCRA 8	TCLP METALS (SPECIFY)	OTHER: PH 9040/9045	TX/TOX/EOX	TURBIDITY	FLASH POINT	BOD	SOLIDS (SPECIFY)	Cation Exchange	organic content
1 TP-1, 1'	11/12/21	1700	Soil	1																							X	X
2 TP-2, 1'	11/12/21	1705	Soil	1																							X	X
3																												
4																												
5																												
6																												
7																												
8																												
9																												
10																												

LAB USE ONLY

	SIGNATURE	PRINTED NAME	COMPANY	DATE	TIME
RELINQUISHED BY	Andrew	Andrew Schmitger	GeoResources	11/15/21	1058
RECEIVED BY	Taylor Burkhart	Taylor Burkhart	Spectra	11/15/21	1058
RELINQUISHED BY					
RECEIVED BY					

Payment Terms: Net 30 days. Past due accounts subject to 1 1/2% per month interest. Customer agrees to pay all costs of collection including reasonable attorney's fees and all other costs of collection regardless of whether suit is filed in Pierce Co., WA venue. *Spectra Laboratories, LLC*

Appendix C

Groundwater Monitoring Logs

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MONITORING WELL LOGS

Project ID: CES.ProVac.InterAve

*****Depths are in reference with ground surface*****

Date:	12/9/2020 (ATD)
Field Tech:	AES
Well #	**Depth** (ft)
1	2 (perched), 5
2	NE

Date:	12/21/2020
Field Tech:	AES
Well #	**Depth** (ft)
1	0.5
2	0.5

Date:	12/31/2020
Field Tech:	AES
Well #	**Depth** (ft)
1	0.5
2	1.0

Date:	1/8/2021
Field Tech:	AES
Well #	**Depth** (ft)
1	0.5
2	0.7

Date:	1/14/2021
Field Tech:	AES
Well #	**Depth** (ft)
1	0.5
2	0.5

Date:	1/29/2021
Field Tech:	AES
Well #	**Depth** (ft)
1	1.1
2	1.9

Date:	2/5/2021
Field Tech:	AES
Well #	**Depth** (ft)
1	1.8
2	1.2

Date:	2/12/2021
Field Tech:	AES
Well #	**Depth** (ft)
1	1.7
2	2.3

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MONITORING WELL LOGS

Project ID: CES.ProVac.InterAve

*****Depths are in reference with ground surface*****

Date:	2/16/2021
Field Tech:	AES
Well #	**Depth** (ft)
1	0.5
2	Unaccessable

Date:	3/5/2021
Field Tech:	AES
Well #	**Depth** (ft)
1	1.5
2	Unaccessable

Date:	3/12/2021
Field Tech:	CB
Well #	**Depth** (ft)
1	2.4
2	Unaccessable

Date:	3/19/2021
Field Tech:	CB
Well #	**Depth** (ft)
1	2.4
2	Unaccessable

Date:	3/26/2021
Field Tech:	CB
Well #	**Depth** (ft)
1	1.7
2	2.2

Date:	4/1/2021
Field Tech:	CB
Well #	**Depth** (ft)
1	2.1
2	Unaccessable

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February 14, 2022

Olson Brothers Pro Vac, LLC
c/o C.E.S. NW, Inc.
310 – 29th Street NE, Suite 101
Puyallup, Washington 98372
(253) 848-4282

Attn: Mr. Craig Deaver
cdeaver@cesnwinc.com

Soils Report Addendum: Supplemental Infiltration Testing
Proposed Permeable Pavement
2511 Inter Avenue
Puyallup, Washington
PN: 2105200-180, -192
Doc: CES.ProVac.InterAve.SRa.rev2

INTRODUCTION

We are pleased to submit this addendum to our previously prepared *soils report* dated December 10, 2021. On December 21, 2021, we returned to the site to perform one Pilot Infiltration Test (PIT) in the green space on the southern portion of the site, in the front yard of the existing residence. The bottom of the PIT was excavated approximately 1 foot below the existing grades. The soils at the bottom of the PIT were consistent with the native alluvium soils described in our original report of a medium dense brown, orange iron stained silty sand or sandy silt that was in a moist to wet condition.

At the time of our testing, water was being pumped out from beneath the crawl space of the existing residence, and the surface water ponding on the gravel surface and adjacent sod area was flowing towards our PIT. No groundwater was encountered in our PIT, but the surface water was flowing into our PIT. Our excavation slowly started to fill in as the rate of inflow as greater than the infiltration rate of the soils. During the limited time of our testing prior to surface water inflow, the measured rate appeared consistent with the rates provided in our December 2021 report, and those rates are still appropriate. We also monitored groundwater during the winter of 2020/2021. The results of our groundwater monitoring and original infiltration testing are summarized in our December 10, 2021 report.

Based on the Paving & Utility Plan by C.E.S. NW Inc., dated February 9, 2022, the grades at the site will be raised by 2 feet to meet the vertical separation requirements for permeable pavement. Catch basins and overflows will also be implemented. It is our opinion that vertical separation requirements can be met at the site once the site grades have been raised, and permeable pavement would therefore be feasible for this project.

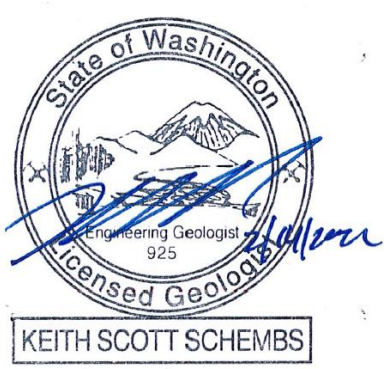
◆ ◆ ◆

CLOSURE

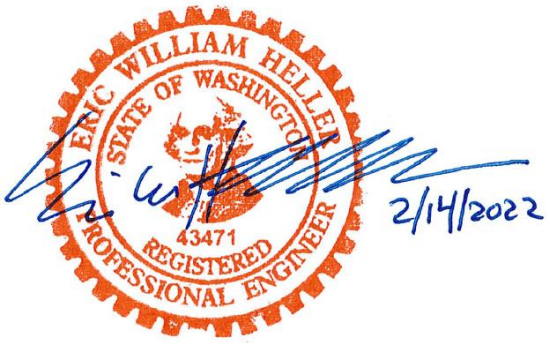
We trust that this is sufficient for your needs. If you have any questions regarding the content of this letter, please call.

Yours very truly
GeoResources, LLC

Andrew Schnitger, EIT
Engineer in Training



Keith Schembs, LEG
Principal



Eric W. Heller, PE, LG
Senior Geotechnical Engineer

AES:KSS:EWH/aes
DocID: CES.ProVac.InterAve.SRa.rev2

Memo

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To: Olson Brothers Pro Vac, LLC

CES – Dan Smith

From: Keith Schembs, LEG, Kyle Billingsley, PE

Date: April 25, 2025

Re: Pervious Asphalt Pavement Section Design

As requested, we are providing this pervious asphalt pavement section design for the proposed new hard surfacing to be installed at 2511 Inter Avenue in Puyallup, Washington. The site is currently a gravel surfaced contractor's yard. We previously prepared a *Stormwater Soils Report: Infiltration* and a *Soils Report: Supplemental Infiltration testing,* dated December 10, 2021 and February 14, 2022, respectively.

Our understanding of the project is based on our conversations with you; our review of the provided Cover Sheet by C.E.S. NW Inc. dated October 21, 2020; our review of the available geologic and soils data, our previously prepared reports and subsurface explorations; our groundwater monitoring throughout the 2020/21 wet season; our understanding of the City of Puyallup development codes; and our experience in the area. We have prepared this pavement section design in accordance with the 1993 AASHTO flexible pavement design method using subsurface soil properties estimated from our onsite explorations, assumed traffic loading conditions, and reduced layer coefficients for permeable pavement applications.

The AASHTO 93 design method quantifies traffic loading in terms of 18-Kip ESALs (equivalent single axle loads). The estimated ESALs over the entire design life were determined using assumed vehicle loads, assumed Average Weekday Daily Traffic (AWDT), and extending the daily value over a 20-year design life. We assumed that each vacuum truck applies an average of 1.11 ESALs and equivalent subgrade modulus values of 25 ksi and 7 ksi for permeable ballast and subgrade soils, respectively. Our traffic assumptions should be verified prior to construction, and we should be notified and allowed to review our design if not correct. The AASHTO 93 design calculation output is included as Figure 1.

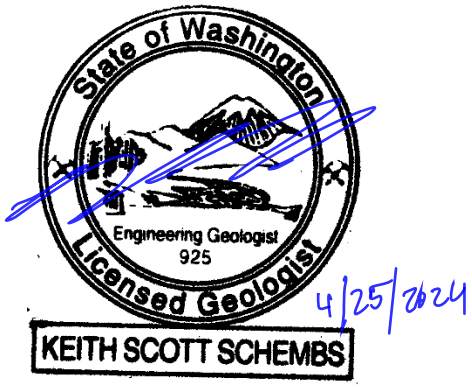
MINIMUM PAVEMENT SECTION THICKNESS RECOMMENDATIONS

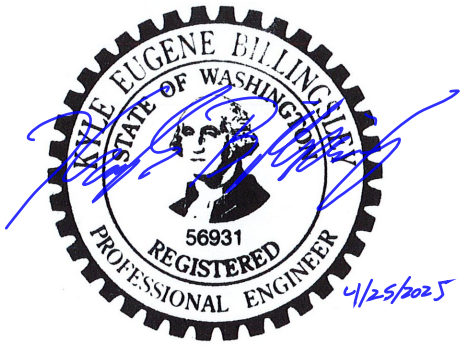
Section	Recommended Section Thickness (inches)
Pervious Pavement	4.0
Permeable Ballast	8.5
Notes: "*Permeable Ballast*" per WSDOT 9-03.9(2)	

The above recommended section thicknesses meet the AASHTO 93 design standards based on the assumed traffic loading with a 85 percent reliability. Additional loading may contribute to premature failure of the pavement section. The permeable ballast section is a minimum recommended section. Actual permeable ballast section should be determined by the civil engineer for storage capacity and may exceed the minimum structural thickness referenced above.

We have appreciated working for you on this project. Please do not hesitate to call at your earliest convenience if you have any questions or comments.

Respectfully submitted,
GeoResources, LLC





Keith S. Schembs, LEG
Principal

Kyle E. Billingsley, PE
Senior Geotechnical Engineer

KSS:KEB/keb
Doc ID: CES.ProVac.InterAve.M_PerviousHMA
Attachments: Figure 1: AASHTO 93 Design and ESALs

1993 AASHTO Empirical Equation for Flexible Pavements

Equation Solver | Variable Descriptions and Typical Values | Precautions

Type in data in the grey boxes and click the calculate button to see the output. To make additional calculations, change the desired input data and click the calculate button again. Click on the text descriptions of the input or output variables for more information.

INPUT

1. Loading

Total Design ESALs (W_{18}): 109668

2. Reliability

Reliability Level in percent (R): 85

Combined Standard Error (S_0): 0.5

3. Servicabilty

Initial Servicability Index (p_i): 4.5

Terminal Servicability Index (p_t): 2.3

4. Layer Parameters

Number of Base Layers: 1

	a	m	M_R	Min. Depth
Surface	0.4	1.0	N/A	0
Base 1	0.1	1	25000	
Subgrade	N/A	N/A	7000	N/A

OUTPUT

1. Calculation Parameters

Standard Normal Deviate (z_R): -1.037

ΔPSI: 2.2

Design Structural Number (SN): 2.445

2. Layer Depths (to the nearest 1/2 inch)

Surface: 4

Base 1: 8.5

Total SN based on layer depths: 2.450

See Solution Details

Comments

Type	Load Factor	% Total of AADT	Lane AWDT	ESALS/Day
Vac Truck	1.11	100.0%	19	21.1
			Total Daily	21.1
			Total Year	5,483
			Design Life	20
			Total Life	109,668

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AASHTO 93 Design and ESALs

Pavement Section Design
Proposed Permeable Pavement
PN: 2105200-180, -192
Pierce County, Washington