W Meeker Ave Public Parking

Preliminary

Stormwater Site Plan

Prepared for:

City of Puyallup

Department of Planning Services

333 S Meridian

Puyallup, Washington

By:

City of Puyallup

Capital Improvements Projects Division

333 S Meridian

Puyallup, Washington

October 2022

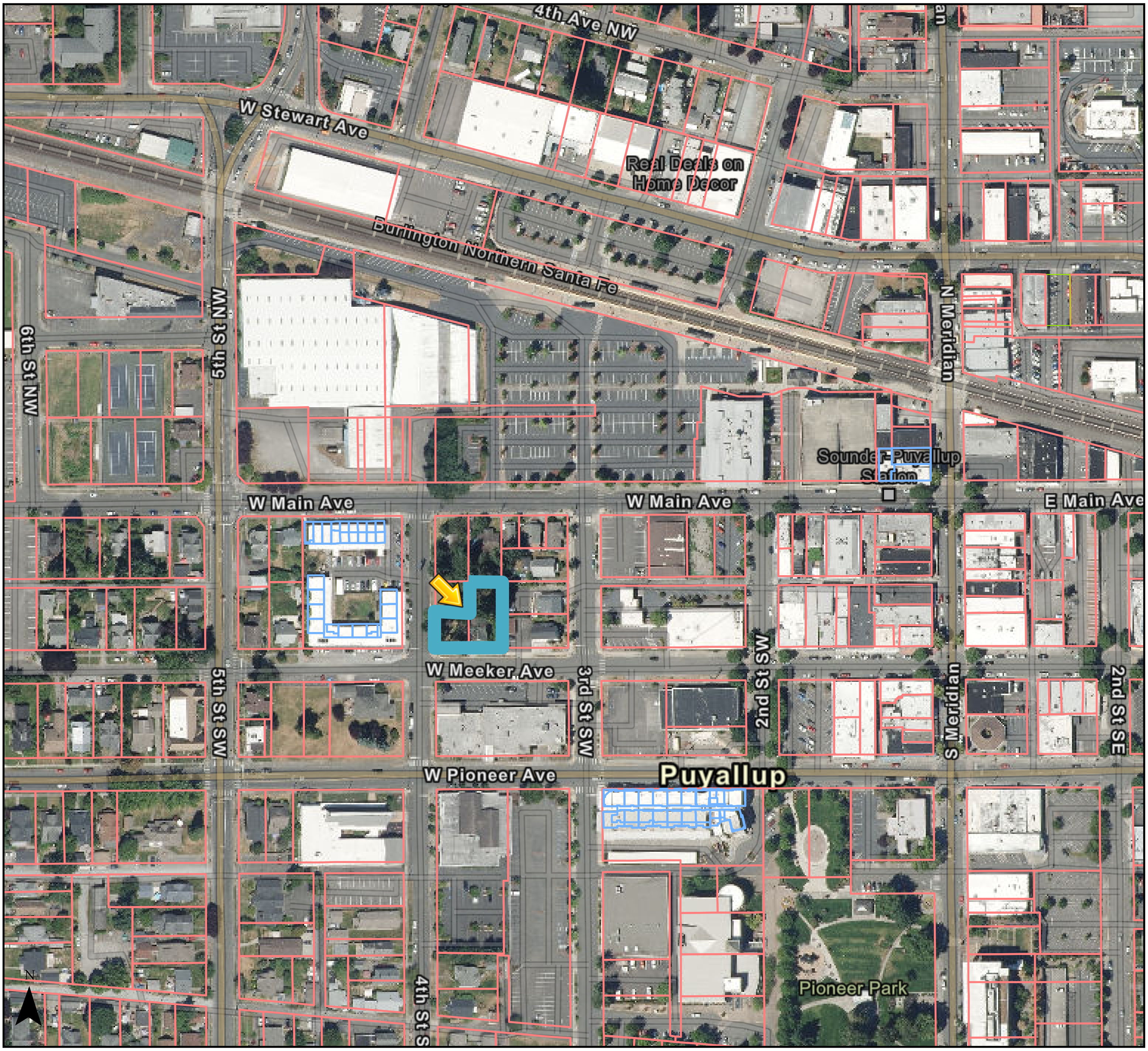
Revised February 10, 2023

Table of Contents

TABLES

ATTACHMENTS

City of Puyallup Engineering Division
Vicinity Map



Legend

Override 1

Override 1

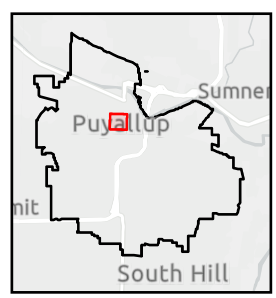
Tax Parcels

Base Parcel

Condominium

Other

City Limits



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Scale: 1:4,514

Map produced using City of Puyallup GIS web apps.

Date: 10/31/2022

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1.0 Project Overview

The W Meeker Ave Parking Project is located on the northeast corner of 4th street SW and W Meeker Ave. The associated parcels (7060000242 & 7060000230) have respective addresses of 321 and 313 W Meeker Ave. The total project area amounts to approximately 11,656 square feet (0.25 acres).

The 321 parcel has historically been undeveloped with grass and dead trees with their tops removed. The 313 parcel was developed with a single-family residence, shed and driveway. The storm drainage for each parcel appears to infiltrate onsite. Any offsite runoff flows into W Meeker Ave or 4th Street SW and into the public conveyance system. The existing 1,656 square feet of buildings and other hard surfaces were recently demolished under demolition permit # B-21-0994. The project proposes 7,214 square feet of new/replaced hard surface. The developed features will include a permeable pavement parking lot, barrier curb, accompanying 10-foot perimeter landscaping buffer, a new “entrance only” driveway on 4th Street and relocated “exit-only” driveway on W Meeker.

This Stormwater Site Plan has been prepared to document how the Minimum Requirements of the 2019 Department of Ecology Stormwater Management Manual for Western Washington (ECY Manual) and the City of Puyallup – City Standards Section 200, Stormwater Management (rev. 2019) are applied and addressed for the project Review Plans, as of Decemeber 2022.

2.0 Existing Site Conditions

The project site is in the RM-Core Zone, with flat topography. There are existing utilities in the western portion of the site serving the north adjacent single-family residence.

There is an existing storm inlet in the northeast corner of the 4th Street SW and W Meeker Ave intersection.

There are no known critical areas within or adjacent to the project site. There are no known areas of contaminated soils within the project site. There are no known historical drainage problems within the project site or downstream of the project.

NV5 performed a site soil investigation for the project on November 1, 2022 to assess the feasibility of soils for infiltration and treatment (see soils report in a separate CityView attachment). Two test pits were excavated, and small-scale Pilot Infiltration Tests (PIT) were completed at each location, at a depth of 2.5 feet below grade, to measure initial infiltration rate or saturated hydraulic conductivity (K_{sat}). Subsurface conditions at the site are predominantly silty sand-alluvium with about 1 foot of surface layer fill. The PIT measured K_{sat} varied between 6.8-7.6 in/hr. Correction factors were used to adjust the K_{sat} values to estimate a design (long-term) infiltration rate of 2.5-2.7 in/hr. Laboratory testing on soils from both test pits indicate a cation exchange capacity (CEC) at between 3.4 and 3.8 meq/100 grams and organic greater than 1.0% so soil amendment is anticipated to achieve the required CEC of at least 5 meq/100 grams. The depth to groundwater was a minimum of 7 feet. Although testing was performed prior to the wet season, Continuous wet weather groundwater monitoring will be performed to confirm groundwater depths.

Based on these soil characteristics, NV5 advises the use of permeable pavements for the project site is feasible. See the geotechnical report in Section 6.0.

3.0 Off-Site Analysis Report

A qualitative analysis of existing downstream drainage network from the project site was performed, utilizing GIS information and topographic mapping. Figure 2 shows the downstream drainage path for the threshold discharge area (TDA) within the project site. The following are the findings of this analysis:

The W Meeker project area is comprised of one TDA. Where runoff does not infiltrate, it begins as sheet flow and travels over landscape to the existing public stormwater closed conveyance system with inlets located in the northeast corner of the 4th Street SW and W Meeker intersection. The runoff flows south in 4th Street SW in an 8-inch and then 10-inch pipe for 670 feet (0.13 miles) where it turns west into 4th Ave SW in a 24 in pipe for the duration of the ¼ mile downstream analysis approximately in front of Parcel 0420284052 (506 4th Ave SW).

PUYALLUP
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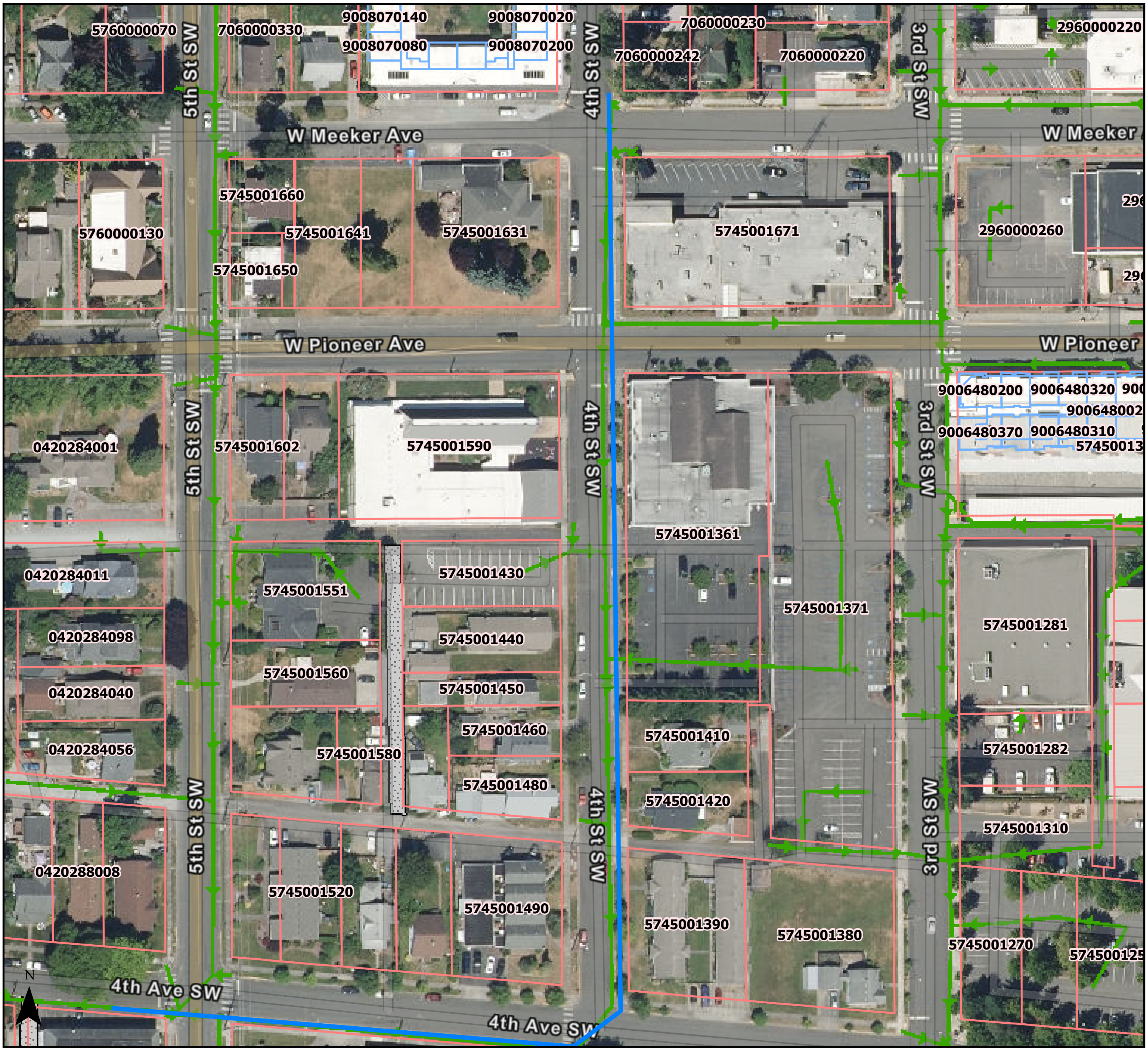
City of Puyallup Engineering Division
W Meeker Downstream Map



Legend
Override 1

Tax Parcels
Base Parcel
Condominium

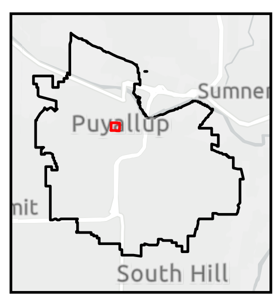
City Limits

Stormwater Facilities
Facility Type
Vault
Permeable

Stormwater Pipes

Stormwater Manholes

Stormwater Inlets



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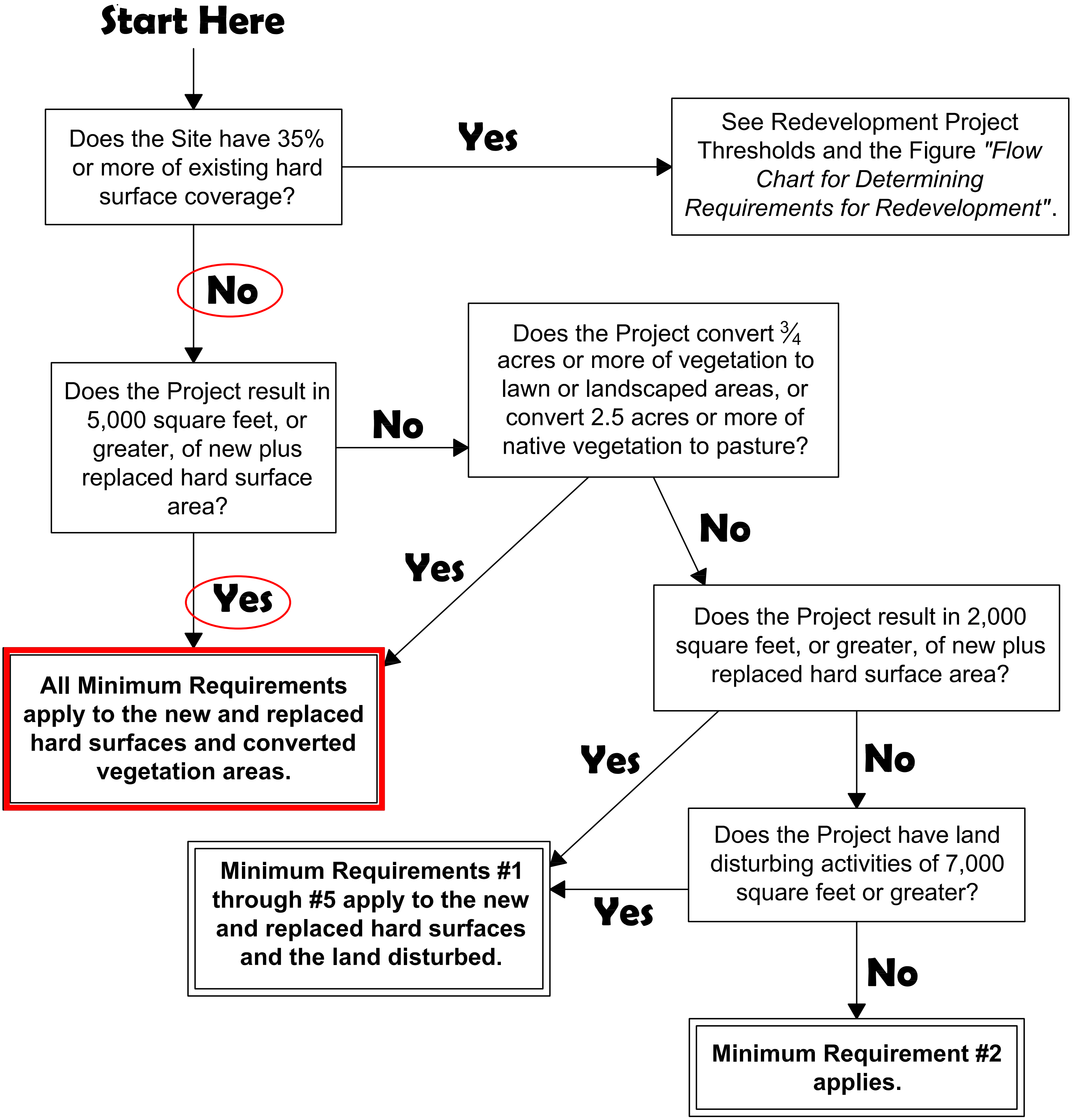
Map produced using City of Puyallup GIS web apps.

Date: 8/22/2022



DEPARTMENT OF ECOLOGY
State of Washington

Flow Chart for Determining Requirements for New Development

Revised March 2019

4.0 Permanent Stormwater Control Plan

The existing and proposed conditions for the project are summarized in Table 1

Table 1 –Threshold Discharge Areas

Description[a]	Onsite	Offsite	Total
Existing Conditions			
Total Project Area[b] (ft²)	10,813	866	11,679
Existing hard surface (ft²)	1,656	706	2,372
Existing vegetation area (ft²)	9,147	160	9,307
Proposed Conditions			
Total Project Area[b] (ft²)	10,813	866	11,679
Amount of new hard surface (ft²)	4,698	160	4,858
Amount of new pollution generating hard surface (PGHS)[c] (ft²)	6,098	177	6,275
Amount of replaced hard surface (ft²)	1,656	706	2,362
Amount of replaced PGHS[d] (ft²)	275	280	483
Amount of new plus replaced hard surface (ft²)	6,415	906	7,321
Amount of new + replaced PGHS (ft²)	6,373	417	6,790
Amount of existing hard surfaces converted to vegetation (ft²)	0	0	0
Amount of Land Disturbed (ft²)	10,813	866	11,679
Vegetation to Lawn/Landscaped (acres)	0.1	0	0.1
Native Vegetation to Pasture (acres)	0	0	0
Existing hard surface to remain unaltered (ft²)	0	0	0
Existing vegetation area to remain unaltered (ft²)	0	0	0

a. All terms are defined in the 2019 Ecology Manual glossary.
b. The total project area in the existing condition should typically match the total project area in the proposed condition.
c. The "amount of new PGHS" should be part of or all of "amount of new hard surfaces"
d. The "amount of replaced PGHS" should be part of or all of the "amount of replaced hard surfaces".

This project is classified as a new development project since the existing site has less than 35% hard surface cover. In this case, the applicability of Minimum Requirements is determined by using Figure I-3.1 Flow Chart for Determining Requirements for New Development (ECY, Vol. 1-3.3). The project proposes more than 5,000 square feet of new plus replaced hard surfaces, therefore all Minimum Requirements (MR) #1 through #9 apply to the new and replaced hard surfaces and converted vegetation areas.

MR #1: Preparation of Stormwater Site Plans

This storm report and the associated Review Plans satisfy the requirements for a Stormwater Site Plan.

MR #2: Construction Stormwater Pollution Prevention

MR #2 will be satisfied through the provided Construction Stormwater Pollution Prevention Plan (CSWPPP). This will be added prior to final engineering in Appendix C.

MR #3: Source Control of Pollution

All known, available and reasonable operational, structural, and construction Source Control BMPs must be selected, designed, and maintained in accordance with the Ecology Manual. The project will satisfy S453 BMPs through assigning the maintenance to The City Public Works department, the pollution prevention team of the City. They will include this site in their operational source control plan and add it to their regular maintenance schedule. There are already City programs in place for S456, S457, S458, and S411 BMPs (Employee training, Inspections, Record Keeping, and Landscaping and Lawn/Vegetation Management). Structural Source Control BMPs are not applicable as there are no proposed buildings for the project. Construction source control BMPs will be identified in the CSWPPP required as part of MR #2.

MR #4: Preservation of Natural Drainage Systems and Outfalls

The project will maintain existing downstream patterns that flow into City of Puyallup piped drainage systems (see Figure 2).

MR #5 On-Site Stormwater Management

The project area does not contain any native vegetation; therefore, none will be retained.

List #2 has three surface categories that must be mitigated for to meet MR#5. This project will impact lawn and landscaped areas because of new hard surface installation as a parking lot with landscape buffers. There are no roofs in the scope of the project. Other hard surfaces include “new and replaced” hard surfaces and are quantified in Table 1.

Lawn and Landscape Areas: Post Construction Soil Quality and Depth BMP T5.13 will be used in all landscaped areas.

Roofs: N/A

Other Hard Surfaces:

BMP T5.30 Full Dispersion:

Full dispersion is infeasible due to site constraints with impervious surfaces confined by barrier curb and lack of cleared area to preserve for dispersion.

BMP T5.15 Permeable Pavements:

Permeable Pavement is feasible because the soils investigation showed the design infiltration rate exceeds the DOE recommended minimum KSAT of 0.3 in/hr for BMP T5.15 and the site meets groundwater separation criteria (See Section 2). Continuous modeling of the project hard surfaces was performed using the Western Washington Hydrology Model (WWHM) with a pavement section consisting of 5” permeable HMA over 6” permeable base material. The results demonstrated 100% infiltration capacity for generated runoff (see Appendix B). The design section consists of 3” porous HMA over 2” permeable asphalt treated base over 6” permeable ballast material, which provides comparable storage capacity. The Site Plan provided in CityView for the project shows the extent to which porous HMA will be used throughout the site. In the event the system is inundated, runoff will flow into a 4” perforated pipe located in the southwestern portion of the parking lot. Overflow will then drain to the nearby catch basin in the intersection of 4th Street SW and W Meeker Avenue.

If high groundwater is observed during the continuous wet weather groundwater monitoring, the project must consider and design the next feasible BMP from list #2 as an alternative mitigation measure.

BMP T7.30 Bioretention:

Bioretention will not be feasible if the site has groundwater 1 foot below the bottom of the treatment layer which is the same criterion for the permeable pavement BMP.

BMP T5.12 Sheet Flow Dispersion or T5.11 Concentrated Flow Dispersion:

Both dispersion BMPs are infeasible due to lack of space for the minimum 20’ flow path distances.

Since no other BMPs would be feasible from List #2 if high groundwater is observed in the wet weather months, the infiltration system has been designed with a redundant overflow into the public system with a shallow perorated stub.

MR #6 Runoff Treatment

Ecology recognizes the permeable pavement BMP as a basic treatment BMP if the native soils below the permeable pavement can infiltrate at a rate of 12 in/hr or less, the cation exchange capacity (CEC) is greater than or equal to 5 milliequivalents CEC/100 g dry soil, the depth of the applicable soil is 12 inches, contains 1 percent organic content, and has no waste fill material. As stated in Section 2, the geotechnical report shows the site does not meet these criteria so the site will be required to amend the soils (per Section V-1.3.2 of the Ecology Manual) with organic content down to 2 feet below the bottom of the permeable pavement storage layer to bring the soil up to standards and satisfy the treatment requirements. NV5 will be retained to perform additional testing when amendment practices are completed.

MR #7 Flow Control

The project proposes to fully infiltrate onsite using asphalt permeable pavement and utilizing the public storm conveyance for emergency overflow purposes.

MR #8 Wetlands Protection

The downstream analysis determined the absence of wetlands within one quarter mile of the downstream flow path; thus MR #8 does not apply.

MR #9 Operations and Maintenance

An operations and maintenance manual for the proposed stormwater facilities will be added to this report prior to final engineering in section 8.0 of this report.

5.0 Construction Stormwater Pollution Prevention Plan

The CSWPPP will be provided in this section prior to Final Engineering.

6.0 Special Reports and Studies

The following reports are included in this section:

- Geotechnical Report by NV5 Dated November 30, 2022
- WWHM Report for Permeable pavement design

REPORT OF GEOTECHNICAL ENGINEERING SERVICES

City of Puyallup
321 West Meeker and 208 West Main Parking Lots
321 and 313 West Meeker and 208 West Main
Puyallup, Washington

For
City of Puyallup
November 30, 2022

Project: Puyallup-7-01

NV5

November 30, 2022

City of Puyallup
333 South Meridian
Puyallup, WA 98371

Attention: Drew Young, P.E.
Lance Hollingsworth, E.I.T.

Report of Geotechnical Engineering Services
City of Puyallup
321 West Meeker and 208 West Main Parking Lots
321 and 313 West Meeker and 208 West Main
Puyallup, Washington
Project: Puyallup-7-01

NV5 is pleased to submit this report of geotechnical engineering services to support the City of Puyallup's 321 West Meeker and 208 West Main Parking Lots Project located in Puyallup, Washington. This report has been prepared in accordance with our Professional Services contract dated August 16, 2022.

We appreciate the opportunity to be of service to you. Please contact us if you have questions regarding this report.
Sincerely,

NV5

Kevin J. Lamb, P.E.
Principal Engineer

11/30/2022

EIL:KJL:kt
Attachments
One copy submitted (via email only)
Document ID: Puyallup-7-01-11XX22-geor.docx

19201 120TH AVENUE NE, SUITE 201 | BOTHELL, WA 98011 | WWW.NV5.COM | OFFICE 206.838.9900

TABLE OF CONTENTS **PAGE NO.**

ACRONYMS AND ABBREVIATIONS

AASHTO	American Association of State Highway and Transportation Officials
AC	asphalt concrete
ASTM	American Society for Testing and Materials
BGS	below ground surface
CEC	cation exchange capacity
DOE	Washington State Department of Ecology
meq	milliequivalent
PIT	pilot infiltration test
SMMWW	Stormwater Management Manual for Western Washington
WSS	Washington Standard Specifications for Road, Bridge, and Municipal Construction (2020)

1.0 INTRODUCTION

This report presents the results of NV5's geotechnical engineering services for the City of Puyallup's (City) 321/313 West Meeker and 208 West Main Parking Lots Project located in Puyallup, Washington.

We understand that the lots located at 321 and 313 West Meeker and 208 West Main will be developed with parking lots consisting of permeable HMA drive lanes and passenger vehicle parking stalls. Each parking lot will also include PCC curb and gutter along with adjacent hardscape areas. Shallow infiltrative stormwater elements are anticipated at each parking lot to manage storm water.

The site location relative to the surrounding physical features is shown on Figure 1. Acronyms and abbreviations used herein are defined above, immediately following the Table of Contents.

2.0 SCOPE OF SERVICES

The purpose of this study was to gather and review available subsurface information, evaluate subsurface conditions, and provide geotechnical recommendations to support design and construction of the planned improvements. We performed the following:

- Reviewed preliminary plans and readily available geotechnical, geological, and environmental reports
- Planned, coordinated, and managed the field explorations that included soil borings, and test pit excavations.
- Performed geotechnical laboratory analyses on disturbed soil samples collected from the explorations.
- Prepared this report summarizing our findings, conclusions, and recommendations.

3.0 SITE CONDITIONS

We observed the existing conditions during site visits to mark the boring and test pit locations; check utility locates; and complete the subsurface explorations.

3.1 SURFACE CONDITIONS

3.1.1 Meeker Site

The site includes the properties addressed 321 and 313 West Meeker are bordered to the west by 4th Street SW, to the south by West Meeker Avenue and to the north by residential properties. The property addressed 313 Meeker was previously developed with single-family residential house that has been demolished with most of the debris removed. The 321 West Meeker property does not appear to have been developed based on aerial images dating back to 1940.

The site is relatively flat lying with less than approximately 3 feet of vertical relief across the site. The lots at 321 and 313 West Meeker are presently surfaced with various vegetation, including trees and construction debris from the demolition of the existing residence at 313 West Meeker.

3.1.2 West Main Site

The site at 208 West Main is bordered to the south by an alleyway, to the north by West Main Avenue, to the east by a parking lot, and to the west by a single-story CMU structure owned by the Puyallup School District. The site is relatively flat lying with less than approximately 3 feet of vertical relief across the site. The site is presently surfaced with crushed rock and sparse grass vegetation.

3.2 SUBSURFACE CONDITIONS

Subsurface conditions at the sites were evaluated through a review of existing geologic maps and by exploratory borings and test pits. Surficial geology of the area is mapped as alluvium. Subsurface conditions encountered in the explorations are similar at the two sites and generally consist of a surficial layer of fill underlain by fine grain alluvium.

Boring B-1 and test pits TP-1 and TP-2 were completed on the Meeker site to explore subsurface conditions. Boring B-1 was completed to a depth of 31.5 feet and the test pits were completed to depths of up to 8.5 feet.

Boring B-2 and test pits TP-3 and TP-4 were completed on the West Main site to similar depths and encountered similar subsurface conditions as those encountered on the Meeker site.

A description of the field exploration and laboratory testing programs, logs of the boring and test pits, and results of laboratory testing are presented in Appendix A.

Subsurface conditions encountered during our field exploration program are described below.

3.2.1 Fill

Fill was encountered within each test pit and boring location. Fill encountered in boring B-1 and test pits TP-1 and TP-2, completed on the Meeker site, was generally composed of disturbed native alluvial soils and construction debris associated with the demolition of the structure previously located at 313 West Meeker. Fill was encountered to a depth of approximately 1 foot in boring B-1 and test pits TP-1 and TP-2. The fill is generally loose based on hand probing and exaction difficulty.

Fill was encountered at the West Main site in boring B-2, TP-3 and TP-4 and is composed of crushed rock, The crushed gravel ranged appeared to consist of a mixture of quarry spalls and base course crushed rock. The fill extends to a depth of approximately 1.5 feet at the exploration locations and is generally loose

3.2.2 Alluvium – Fine Grain

Alluvium was encountered within each test pit and boring below fill and extending to termination depth of each test pit and boring. The alluvium is generally composed of interbedded lenses to layers of sand with silt, silty sand and silt with sand. Trace organics and wood debris was encountered within the alluvium. Based on SPT blow counts, the fine-grained alluvium composed of silty sand or sand is generally loose and fine grain layers of silt to sand silt vary from very soft to stiff. All of the explorations were completed within the Alluvium.

3.3 GROUNDWATER

Groundwater was encountered at 7 feet BGS in boring B-1 and B-2 during drilling. The test pit explorations were excavated after completion of small-scale pilot infiltration tests.

Standpipe piezometers, 2—inch diameter, were installed in borings B-1 and B-2 to a depth of 20 feet BGS, with a 10-feet long well. The wells were constructed in general accordance with WAC 173-160. A 0.010-inch well screen was installed between 10 and 20 feet BGS in each well. The annular space between the casing and the wells were backfilled with 10/20 silica sand. After installation, each well was allowed to equilibrate and groundwater was measured within the wells on November 8, 2022, at a depth of 6.9 feet and 7.1 BGS in B-1 and B-2, respectively.

A blank PVC section with bentonite chip backfill extends up to the monument at the surface of each well. The wells were completed at the surface with a cast iron flush-mount monument. The DOE well tag for the well in B-1 on the Meeker site is number BMR 649 and the DOE well tag for the well in B-2, on the West Main site, is BMS 549.

We installed a pressure transducer with automated data collection on November 8, 2022, in the wells in B-1 and B-2 to monitor groundwater levels over the wet season. Data is still being collected and an addendum will be provided summarizing the groundwater level monitoring results.

3.4 INFILTRATION TESTING

Small-scale PITs were performed in the test pit explorations in general accordance with the 2019 SMMWW (DOE, 2019). The test pits were generally rectangular and ranged from 2 to 3 feet wide and approximately 6 to 7 feet long, exceeding the minimum 12-square-foot area requirement for small-scale PITs. All test pits were completed within City owned property.

The tests were performed near the anticipated bottom of proposed stormwater elements at a depth of 2.5 feet BGS. All of the tests were completed within the alluvium. Water was added to the test pits for a saturation period of two to four hours prior to measuring the short-term infiltration rate. After the saturation period, the test pits were filled with up to approximately 6 to 12 inches of water and regular measurements were made as the water level dropped to determine the short-term infiltration rate. The tests were repeated at each location as time permitted. The results of the infiltration testing at the project locations are summarized in Table 1

Table 1. In Situ Infiltration Test Results

Infiltration Location	Soil Type	Averaged Short-Term Infiltration Rate (inches per hour)
Meeker Site		
TP-1	Silty Sand – Alluvium	6.8
TP-2	Silty Sand – Alluvium	7.6
West Main Site		
TP-3	Silty Sand – Alluvium	5.5
TP-4	Silty Sand – Alluvium	4.0

4.0 LABORATORY TESTING

Laboratory testing for geotechnical purposes was conducted on specific soil samples collected from the explorations to assist in the characterization of certain physical parameters of the soil. Index tests that were performed included the determination of natural water content and percent fines content. All testing was conducted in general accordance with appropriate ASTM standards (ASTM, 2020). A discussion of laboratory test methodology and test results are presented in Appendix A. Test results are also displayed where appropriate on the exploration logs in Appendix A.

5.0 DESIGN RECOMMENDATIONS

5.1 GENERAL

Based on the development history of the project area and the results of our explorations, laboratory testing, and analyses, it is our opinion that the proposed improvements and infiltrative stormwater management elements are feasible with regards to geotechnical conditions.

- Stormwater management using infiltrative BMP's is feasible based on the in situ infiltration rates measured in the PITs.
- Groundwater is present in boring B-1 at the Meeker site at a depth of 6.9 feet BGS and in boring B-2 at the West Main site at a depth of 7.1 feet BGS, as measured on November 8, 2022. Seasonal fluctuations of groundwater levels of up to a few feet should be anticipated.
- Sufficient separation between the base of the shallow stormwater infiltration elements and the local groundwater table is feasible and the base of the infiltration method/facility should be planned using a depth to groundwater of 7 feet below existing site grades.
- Lateral flow from infiltration will occur but is not expected to impact adjacent properties or slopes.
- The loose and very soft alluvium will be prone to sloughing and raveling in open trench excavations; shielding or shoring will be required along with dewatering where excavations extend below a depth of 4 feet BGS.
- Based on anticipated depth of site utilities of up to 5 feet, we anticipate dewatering for utility construction will not be required.
- Temporary trench shoring consisting of trench box shielding along with steel plates is anticipated to support trench excavations.
- Undesirable construction debris, fill and vegetation including large diameter trees are present on the Meeker site and should be removed prior to subgrade preparation.
- Near-surface soil generally consists alluvium with a fines content generally in excess of 15 percent, which will be susceptible to deterioration during wet weather. We anticipate that some on-site soil will be usable for fill during the dry summer months when moisture conditioning can be performed, provided deleterious material is removed.

Our specific design recommendations are provided below

5.2 INFILTRATION

As discussed in the "Subsurface Conditions" section, the soil encountered near the anticipated base of the proposed stormwater elements consists of locally derived fill or alluvial deposits.

5.2.1 Design Infiltration Rates

The SMMWW, adopted by the City, provides correction factors to be applied to the measured short-term infiltration rates determined in the PIT's.

- Correction factor CF_V accounts for uncertainties in testing methods. A correction factor of 0.8 is recommended.
- Correction factor CF_t accounts for the influence of facility geometry and depth to the water table or impervious strata on the actual infiltration rate. A correction factor of 0.5 is recommended.
- Correction factor CF_m accounts for reduction infiltration rates over the long term due to siltation and bio-buildup. We recommend a correction factor of 0.9.

The total correction factor to be applied is obtained by multiplying the individual correction factors. We recommend a cumulative correction factor of 0.36 should be applied to the measured short-term infiltration rates. The infiltration test results along with the correction factor are summarized in Table 2.

Table 2. Soil Infiltration Rate Analysis[1]

Infiltration Location	Soil Type	Measured Short-Term Infiltration Rate (inches per hour)	Long-Term Design Infiltration Rate[1] (inches per hour)
Meeker Site			
TP-1	Silty Sand – Alluvium	6.8	2.5
TP-2	Silty Sand – Alluvium	7.6	2.7
West Main Site			
TP-3	Silty Sand – Alluvium	5.5	2.0
TP-4	Silty Sand – Alluvium	4.0	1.4

1. Based on the recommended combined correction factor of 0.36 in accordance with the 2019 SMMWW.

5.2.2 Groundwater Separation

Based on our borings completed on site and nearby well logs, groundwater is at approximately 7 feet below existing site grades during the wet season at both project locations. Section V-7.4 Best Management Practices for Infiltration and Bioretention Treatment of the 2019 SMMWW requires a minimum of 1-foot of separation for permeable pavement and 3 feet of separation for other infiltrative BMPS's between the seasonal high groundwater level or other impervious layers and the infiltration facility. Infiltration facilities should be designed to meet the minimum separation requirements of the SMMWW.

5.2.3 Soil Suitability for Treatment

CEC and organic content testing were performed on samples located at or near the anticipated base of the infiltration elements to evaluate soil capacity for water quality treatment. The CEC tests and organic content tests were performed by AMTest Laboratories. The test results are summarized in Table 3.

Table 3. CEC and Organic Content Analytical Results Summary

Exploration	Sample Depth (feet BGS)	Soil Type	CEC (meq per 100 grams)	Organic Content (percent)
TP-1	2.5-3	Silty Sand	3.4	1.1
TP-2	2.5-3	Silty Sand	3.8	1.3
TP-3	2.5-3	Silty Sand	4.1	1.4
TP-4	2.5-3	Silty Sand	4.7	1.4

1. Suitability for Water Quality Treatment: CEC greater than 5 meq per 100 grams and organic content a minimum of 1.0 percent (DOE, 2019)

The analytical laboratory test report of the CEC and organic content test results is presented in Appendix B.

A CEC of at least 5 meq per 100 grams and a minimum organic content of 1.0 percent are required for treatment. The CEC value of the soil encountered in the test pits is slightly less than the required 5 meq per 100 grams. We anticipate that soil amendment will be required to achieve the required CEC of at least 5 meq per 100 grams. Alternatively, additional testing can be completed during construction after site grading to confirm that amendment is necessary.

5.3 UTILITIES

5.3.1 General

Based on our explorations, we anticipate soil encountered during excavation will consist primarily of silty sand and silt. The loose and very soft alluvial soil will tend to ravel and slough during excavation. Temporary sidewall support will be required to maintain trench sidewalls and prevent the width of the excavation from growing. Where excavations exceed a depth of 4 feet BGS, temporary sidewall support will be required. We anticipate that excavation sloughing may extend horizontally perpendicular to the trench approximately one-quarter the depth of the excavation.

During our explorations, groundwater was encountered below a depth of 6.9 feet and 7.1 BGS in B-1 (Meeker site) and B-2 (West Main site), respectively. Based on the anticipated excavation depths of up to 5 feet BGS for utilities, dewatering is not anticipated.

5.3.2 Pipe Foundation Support

Soil conditions at the invert elevations between 2 to 30 feet are expected to consist of loose silty sand or very soft to medium stiff silt. The alluvium is expected to provide adequate support for utilities, however, subgrade stabilization measures may be required when loose saturated material is encountered at the bottom of excavations.

The stabilized subgrade should be constructed by over-excavation and in accordance with WSS 7-08.3(1)A – Trenches. The over-excavation should extend to a minimum depth of 1 foot below the pipe bedding. Over-excavation should be completed with a smooth-bladed bucket to reduce soil disturbance at the base of the excavation. Stabilization material should then be placed up to the bottom of the trench and pushed/compacted into the remaining soft material until the subgrade becomes firm and unyielding. A heavy-duty geosynthetic that provides stabilization and separation should then be placed over the stabilization material to support the pipe bedding. The stabilization material and heavy-duty geosynthetic are defined in the "Fill Materials" and "Geosynthetics" sections.

Over-excavation activities should be completed at the direction of the City and/or their construction representative.

5.3.3 Soil Parameters for Pipeline Design

The soil load that will be imposed on a buried pipe is dependent on soil and groundwater conditions, the type of pipe, the width of the trench, the height of bedding material around the pipe, the depth of cover over the pipe, the method of pipe placement, and backfill conditions. Recommended soil parameters for evaluating soil overburden loads are as follows:

- Dry soil density of 100 pcf
- Moist soil density of 115 pcf
- Soil friction angle of 32 degrees
- Soil to clay pipe friction angle of 26 degrees

The soil load factor to be used in estimating pipe deflections using the modulus of soil reaction (E') should be calculated based on the prism load, which is the weight of a column of soil over a unit length of the pipe with a width equal to the pipe diameter and a height equal to the cover over the top of the pipe.

The modulus of soil reaction (E') is used in the Reclamation Equation not the Iowa Formula for estimating vertical pipe deflections (Howard, 2006). We anticipate that the trench width will be approximately 4 feet or at least 3 pipe diameters and that the backfill material and the degree of compaction of the backfill will be consistent with the report recommendations. The existing soil encountered in the boring is typically loose to medium dense at the anticipated pipe embedment depths. The native soil adjacent to the trench will not greatly affect deflections based on the width of the City's standard trench; a composite E' value of 3,500 psi is recommended for use in the Reclamation Equation for estimating pipe deflections.

5.3.4 Pipe Bedding and Backfill

We recommend providing a bedding layer of at least 6 inches thick to provide a smooth and stable working surface for establishing proper grades and installing utilities. The pipe zone bedding material should also be used to cover the top of the pipe a minimum of 6 inches in accordance with City Standard 06.01.01.

Per City Standard 06.01.01, the pipe zone bedding material should consist of "Gravel Backfill for Pipe Zone Bedding" as defined by WSS 9-03.12(3). Gravel backfill for trenches shall conform to "Gravel Backfill for Foundations, Class A" as defined by WSS 9-03.12(1)A.

Pipe zone backfill should also consist of bedding material and should be brought up evenly around the pipe and extend at least 6 inches above the crown of the pipe. During placement, it should be manually worked under the haunches of the pipe by slicing with a shovel, vibration, or other approved procedures.

The initial lift of trench fill over the top of the pipe should be approximately 2 feet thick and compacted to a firm condition. Successive lifts should meet the minimum compaction criteria. Trench backfill should be compacted to a relative density of at least 95 percent of the maximum dry density, as determined by ASTM D1557. Trench backfill should be placed in lifts with a maximum uncompacted thickness of 8 inches for walk-behind compactors and up to 18 inches for larger driven equipment.

5.4 EXCAVATION

5.4.1 General

The soil at the project area can be excavated with conventional earthwork equipment. Excavations should stand near vertical to a depth of approximately 4 feet, with minor sloughing, provided groundwater seepage is not observed in the trench walls. Open excavation techniques may be used to excavate utility trenches, provided the walls of the excavation are cut at appropriate cut slopes determined by the contractor or supported using contractor-designed temporary shoring or shielding.

Significant caving and sloughing should be expected below a depth of 4 feet BGS where trench walls are unsupported or where the shielding is not tight against the face of the excavation. Where caving and sloughing occur, the excavation width may extend outward an additional horizontal distance equal to the depth of the excavation from the original sidewall location.

5.4.2 Temporary Shoring

Excavations that extend below a depth of 4 feet BGS will require temporary support. If a conventional shield (such as a trench box) is used, the contractor should limit the length of open trench. If shoring is used, we recommend that the type and design of the shoring system be the responsibility of the contractor, who is in the best position to choose a system that fits the overall plan of operation and the subsurface conditions. All excavations should be made in accordance with applicable OSHA, local, and state regulations.

Under drained conditions, we recommend temporary shoring or shielding elements be designed for an equivalent fluid density of 35 pcf for active soil conditions. The design should include appropriate lateral pressures caused by surcharge loads located within a horizontal distance equal to or less than the height of the wall. We recommend a lateral surcharge pressure of 70 psf to account for traffic loading adjacent to the trench.

5.5 PAVEMENT DESIGN – POROUS AC

We understand porous HMA may be used to pave the parking areas at both sites to address stormwater management. Provided below are recommendations for the constructing the parking areas using porous AC.

5.5.1 Recommended Pavement Section

Appropriate permeable pavement sections composed of porous HMA, based on the assumed traffic loading for parking areas, are provided in Table 4.

Table 4. Permeable Pavement Sections

Layer	Porous HMA Section (inches)	Alternate Porous HMA Section (inches)
Permeable HMA		
Porous Asphalt Wearing Layer	2	3
ATPB	3	--
Choker	--	2 maximum
Storage Aggregate	6 minimum	8 minimum

The use of a choker course is provided under "Alternate Porous HMA Section" in Table 4. A choker course layer will facilitate grading; without it the exposed storage aggregate is susceptible to rutting under dump trucks and may require hand grading during paving operations. The thickness of the storage aggregate layer is a minimum thickness required for structural support of the pavement. The thickness may need to be increased based on hydraulic storage requirements.

5.5.2 Subgrade Preparation

The subgrade below permeable pavement areas can be sloped up to approximately 2 percent but should be relatively flat, if possible, to prevent uneven ponding of water within the storage aggregate. On sloping sites, the subgrade can be stepped, and the lowest step should be flat or sloped back into the slope 1 to 2 percent to help decrease downslope seepage from the storage aggregate layer.

The native subgrade should be protected to limit construction traffic over it. If construction traffic is routed over the exposed subgrade, prior to placing the storage aggregate, it should be scarified to a depth of 12 inches and compacted to a firm condition under the direction of the geotechnical engineer. We recommend compacting the exposed subgrade to between 90 and 92 percent of the maximum dry density, as determined by ASTM D1557.

If soft areas are identified during subgrade preparation or areas deflect under construction equipment traffic, the material should be excavated and replaced with storage aggregate.

Utilities within the parking area should be backfilled with storage aggregate or alternatively clean sand and gravel fill meeting WSS 9-03.12(2) – Gravel Backfill for Walls. Trench dams should be placed intermittently to reduce lateral flow within the pipe bedding. The trench dams can be constructed using native silty sand and gravel, controlled density fill, or lean-mix concrete.

Exposed subgrades will be moisture sensitive and deteriorate under construction traffic loading during wet conditions. If earthwork construction is expected to extend into the wet season, we recommend limiting the size of the work area and stabilizing the exposed surface by placing the storage aggregate to protect the subgrade. Construction traffic should be minimized or restricted from trafficking over the permeable pavement subgrade.

A geotextile should be placed between the storage aggregate and the underlying subgrade for separation. A heavy-duty geotextile with high permittivity and flow rate should be used, as specified in the "Permeable Pavement Materials" section.

After subgrade preparation measures are completed, the infiltration rate of the prepared subgrade should be verified through in-situ infiltration tests using small-scale pilot infiltration tests in accordance with test procedures provided in Puget Sound Partnership (2012). We can provide an average short-term rate that the verification tests should meet after we complete in-situ infiltration tests to support the design of LID BMP elements.

5.5.3 Permeable Pavement Materials

5.5.3.1 Porous AC

AC used for porous asphalt pavement should be designed as a ½- to ¾-inch, nominal, open-graded HMA. Selection of the preferred aggregate size should be based on the desired surface texture and the required layer thickness limitations. Approximate "broad band" gradations for recommended aggregate gradation for porous asphalt are provided in Table 5.

Table 5. Porous HMA Gradation (3/8 inch)

Sieve Size	3/8 inch Percent Passing	½ inch Percent Passing	¾ inch Percent Passing
1 inch	--	--	99 – 100
¾ inch	--	100	85 – 96
½ inch	99 – 100	90 – 98	55 – 71
3/8 inch	90 – 100	55 – 90	--
#4	22 – 40	10 – 40	10 – 24
#8	5 – 15	0 – 13	6 – 16
#200	0 – 3	0 – 3	0 – 3
Recommended Maximum Layer Thickness (inches)	2.5	3	4

The actual mix design should be completed under the direction of a competent mix design technician familiar with the WSDOT mix design procedures.

The preferred and recommended asphalt binder is PG 70-22ER (polymer modified); however, its availability can be limited because some of the local asphalt suppliers limit their on-hand binder to PG 64-22. PG 70-22ER is available but is typically stocked by asphalt suppliers for a specific project, which requires pre-ordering it so that it is available when needed. Suppliers prefer a project size of approximately 600 tons of asphalt in order to use a complete tanker volume of the binder. Its availability and use is further restricted to the warm months of the year because of its stiffness, so it is not readily available between October and May. Projects specifying PG 70-22ER should be scheduled accordingly and specifications should address supplier availability.

The binder should be between 6.0 and 6.5 percent of the pavement section by weight of total (dry aggregate) mix.

Warm-mix asphalt technology with a proper mix design and appropriate additives can be used to construct the porous asphalt. Use of the warm-mix additives may require a longer curing time for the asphalt prior to allowing cars to traffic over the surface.

Compaction of the porous asphalt should consist of approximately two to four complete passes by an 8-ton, dual-steel roller compactor working in static mode only. Compaction of the porous asphalt should be to a target air voids content of 15 to 18 percent (82 to 85 percent of maximum theoretical [Rice] density). A nuclear density gage should be used to monitor compaction.

We recommended that porous asphalt specifications are prepared in conformance with those approved by the APWA-WA Construction Materials Committee. The specifications have now been integrated into the WSDOT Local Agency GSPs and are now available at http://www.wsdot.wa.gov/partners/apwa/Division_5_Page.htm.

5.5.3.2 Choker Aggregate

Imported granular material used as choker aggregate beneath permeable pavements should be clean crushed rock that meets a No. 57 size gradation according to AASHTO M 43, as provided in Table 6.

Table 6. Permeable Pavement Choker Aggregate (AASHTO No. 57)

Sieve Size	Percent Passing
1½ inches	100
1 inch	95 – 100
½ inch	25 – 60
No. 4	0 – 10
No. 8	0 – 5

The percent fracture should be a minimum of 75 percent and a minimum of two fracture faces. Alternatively, aggregate for bituminous surface treatment [WSS 9-03.4(2) – Grading and Quality], 5/8-inch or 3/4-inch washed crushed rock, which is available from local suppliers, will also be suitable. The aggregate should have at least two mechanically fractured faces.

5.5.3.3 Storage Aggregate

Imported granular material used as storage aggregate beneath pervious pavement should be clean crushed rock or crushed gravel and sand that meets a No. 2 or No. 3 size gradation according to AASHTO M 43 or clean crushed rock that conforms to WSS 9-03.9(2) – Permeable Ballast. Recommended gradations for acceptable storage aggregate are provided in Table 7.

Table 7. Storage Aggregate

Sieve Size	AASHTO No. 2 Percent Passing	AASHTO No. 3 Percent Passing	WSS 9-03.9(2) – Permeable Ballast Percent Passing
2 ½ inches	100	100	90 – 100
2 inches	35 – 70	90 – 100	65 – 100
1 ½ inches	0 – 15	35 – 70	--
1 inch	--	0 – 15	40 – 80
¾ inch	0 – 5	--	--
½ inch	--	0 – 5	--
No. 4	--	--	0 – 5

"Rail ballast" or "clean ballast" products available from local quarries will typically meet the AASHTO gradation criteria. The percent fracture should be greater than 75 percent to improve interlocking between fragments, and the aggregate should have a minimum WSS degradation value of 30. We anticipate that the storage aggregate gradations specified above will have between 35 and 40 percent voids compaction in the field.

The storage aggregate should be placed in one lift and compacted to a firm and unyielding condition. Over-compaction and construction traffic should be avoided.

5.5.3.4 Subgrade Geotextile

A layer of geotextile fabric should be placed as a barrier between the native soil subgrade and the pavement storage aggregate. A heavy-duty geotextile, such as Mirafi RS380i, should be used and equivalent products should conform to WSS 9-33.2(1) – Geotextile Properties, Table 4, Permanent Erosion Control, High Survivability, Woven and Table 5, Class A.

5.6 PAVEMENT DESIGN – DENSE AC

Provided below are recommendations for dense AC pavement that can be used in the event dense AC is preferred for paving the parking areas and other infiltrative BMP's, such as bioswales, are used instead of permeable pavement.

5.6.1 City Standard Section

The City does not provide a standard detail for City operated parking areas. Based on anticipated traffic loading the City's standard cross section 01.01.10 for Alley's is appropriate. The cross section for low traffic volume alleys consists of 3 inches of HMA over 2 inches of crushed surfacing top course over 10 inches of crushed surface base course.

An alternative dense AC pavement section typically used for private parking areas consists of 3 inches of AC over 6-inches of aggregate base.

5.6.2 Subgrade Preparation

Subgrade preparation beneath dense AC pavement and hardscape areas should consist of scarifying to a depth of 12 inches, moisture conditioning, and compacting the subgrade. The subgrade should be compacted to 95 percent of the maximum dry density, as determined by ASTM D1557. Based on soil moisture contents observed in samples collected from the explorations, this will require moisture conditioning of the subgrade. Soil moisture should be maintained within 2 percent of the optimum moisture content to achieve the required compaction.

6.0 CONSTRUCTION CONSIDERATIONS

6.1 SITE PREPARATION

Site preparation activities will include vegetation and undesirable material; site grading; and subgrade preparation. Recommendations for these activities are discussed in the following sections.

6.1.1 Removal of Vegetation and Undesirable Material

The site surface of the site at 321/313 West Meeker consists of vegetation including large diameter trees and construction debris. Undesirable fill was encountered to a depth of approximately 1 foot within our boring and test pit exploration at the lots located at 321 and 313 West Meeker. Prior to subgrade preparation, all vegetation and construction debris should be removed from the site.

6.1.2 Site Grading

Fill required to increase site grades in improved areas should consist of structural fill as defined in the "Fill Materials" section. The use of on-site excavation spoils as structural fill will be dependent on the material composition and weather conditions. We anticipate that some of the on-site material will be suitable for use but will be limited to use during the dry season.

6.1.3 Subgrade Verification

Exposed subgrades should be evaluated by a representative from NV5 to verify conditions are as anticipated and will provide the required support. Where pavement or hardscaped areas will be constructed, the exposed subgrade should be evaluated by proof rolling. The subgrade should be proof rolled with a fully loaded dump truck or similar heavy, rubber tire construction equipment to identify soft, loose, or unsuitable areas.

6.2 FILL MATERIALS

Fill material may be required for site grading, backfilling over-excavations, and installing utilities. We assume the on-site soil generated from excavation will not be suitable for fill due to the high fines content and susceptibility to deterioration when wet. We anticipate imported fill materials will be required. The Aggregate Source Approval certificates for imported fill, should not be used as the sole acceptance criteria for imported fill materials that are coming from WSDOT-approved borrow pits. Confirmation sampling and testing should be performed on all proposed imported fill materials. The recommended fill materials are discussed below.

6.2.1 Structural Fill

Imported granular material used for structural fill should be naturally occurring pit- or quarry-run rock, crushed rock, or crushed gravel and sand and should meet the specifications provided in WSS 9-03.14(1) – Gravel Borrow, with the exception that the percentage passing the U.S. Standard No. 200 sieve does not exceed 5 percent by dry weight. The reduced percentage passing the U.S.

Standard No. 200 sieve results in a material less susceptible to deteriorating under wet weather conditions.

6.2.2 Hardscape/Pavement Base Course

Imported granular material used as aggregate base beneath hardscape areas should consist of 1¼-inch-minus material meeting the specifications provided in the WSS 9 03.9(3) – Crushed Surfacing Base Course or Top Course material, with the exception that the aggregate should have less than 5 percent by dry weight passing the U.S. Standard No. 200 sieve and at least two mechanically fractured faces. The imported granular material should be placed in lifts with a maximum uncompacted thickness of 12 inches and compacted to not less than 95 percent of the maximum dry density, as determined by ASTM D1557.

6.2.3 Trench Backfill

Backfill for utility trenches beneath improved areas should consist of structural fill, as defined above, and compacted in accordance with the specifications for structural fill. Utility trenches beneath unimproved areas, such as landscaped areas, or areas where structural support is not necessary for surface improvements may be backfilled with on-site excavation spoils or common borrow meeting WSS 9-03.14(3) – Common Borrow, Option 3 and compacted to a minimum of 90 percent of the maximum dry density, as determined by ASTM D1557.

6.2.4 Stabilization Material

Stabilization material to backfill over-excavations or to stabilize soft subgrade areas may consist of either:

- WSS 9-03.9(2) – Permeable Ballast, or
- WSS 9-13.7(2) – Backfill for Rock Wall

The initial lift of stabilization material used to fill over-excavations should be 12 inches thick and compacted to a firm condition. Successive lifts should be 12 inches thick and compacted to a dense and unyielding condition.

To prevent migration of the fine-grained subgrade soil upwards or structural fill, stabilization fabric should be placed between the stabilization material prior to placing structural fill. The geotextile should conform to the specifications for woven stabilization geotextile as defined in the "Geosynthetics" section.

6.3 GEOSYNTHETICS

If geotextiles are used on this project, the geotextiles should be installed in conformance with the specifications provided in WSS 2 12 – Construction Geosynthetic.

6.3.1 Stabilization Geotextile

To provide subgrade stabilization, reinforcement, and drainage, a geosynthetic is recommended in areas where soft subgrade conditions are encountered. This can be accomplished using a two-layer system composed of biaxial or triaxial geogrid and non-woven geotextile filter fabric or with the use of a single layer of heavy-duty geotextile with high permittivity characteristics such as Mirafi RS380i. The geotextile should conform to the specifications for woven soil stabilization material provided in WSS 9-33.2(1) – Geotextile Properties, Table 3 Geotextile for Separation or Soil Stabilization and meet the apparent opening size and water permittivity requirements in WSS 9-33.2(1) – Geotextile Properties, Table 5, Class A.

6.4 WET WEATHER CONSIDERATIONS

This section describes additional recommendations with potential budget and schedule impacts that may affect the owner and site contractor if earthwork occurs during the wet season. These recommendations are based on site conditions and our experience on previous construction projects completed in the area.

- Soil encountered in the explorations contains a variable amount of silt. The material will be susceptible to deterioration during wet weather. If construction is completed or extends into the wet season, we recommend stabilizing the areas of the site where construction traffic is anticipated using a gravel working pad.
- Earthwork should be accomplished in small sections to minimize exposure to wet weather.
- Excavation or the removal of unsuitable soil should be followed promptly by the placement of appropriate stabilization material.
- The size of construction equipment and access to the area should be limited to prevent soil disturbance.
- Increased handling, excavation, and disposal of wet and disturbed surface material should be expected.
- Protection of exposed soil subgrades and stockpiles will be required.
- Heavy rainfall can occur during winter months and can compromise earthwork schedules in this region.
- Frozen ground should not be proof rolled or compacted, and fill should not be placed over frozen ground.

7.0 OBSERVATION OF CONSTRUCTION

Recommendations provided in this report assume that NV5 will be retained to provide geotechnical consultation and observation services during construction. Satisfactory earthwork performance depends to a large degree on the quality of construction. Subsurface conditions observed during construction should be compared with those encountered during the subsurface explorations. Recognition of changed conditions often requires experience; therefore, NV5 personnel should visit the site with sufficient frequency to detect whether subsurface conditions change significantly from those anticipated and to verify that the work is completed in accordance with the construction drawings and specifications.

Observation and laboratory testing of the proposed fill material should be completed to verify that it is in conformance with our recommendations. Observation of the placement and compaction of the fill should be performed to verify it meets the required compaction and will be capable of providing the structural support for the proposed infrastructure. A sufficient number of in-place density tests should be performed as the fill is placed to verify the required relative compaction is being achieved.

8.0 LIMITATIONS

We have prepared this report for use by the City and its consultants in design of this project. The data and report can be used for bidding or estimating purposes, but our report, conclusions, and interpretations should not be construed as warranty of the subsurface conditions and are not applicable to other nearby building sites.

Exploration observations indicate soil conditions only at specific locations and only to the depths penetrated. They do not necessarily reflect soil strata or water level variations that may exist between exploration locations. If subsurface conditions differing from those described are noted during the course of excavation and construction, re-evaluation will be necessary.

The site development plans and design details were preliminary at the time this report was prepared. If design changes are made, we request that we be retained to review our conclusions and recommendations and to provide a written modification or verification.

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

Within the limitations of scope, schedule, and budget, our services have been executed in accordance with generally accepted practices in this area at the time this report was prepared. No warranty, express or implied, should be understood.

♦ ♦ ♦

We appreciate the opportunity to be of continued service to you. Please call if you have questions concerning this report or if we can provide additional services.

Sincerely,

NV5

Eric Larson, E.I.T.
Project Manager

Kevin J. Lamb, P.E.
Principal Engineer

05/03/2016

11/30/2022

EIL:KJL:sn
Attachments
One copy submitted
Document ID: Puyallup-7-01-113022-geor

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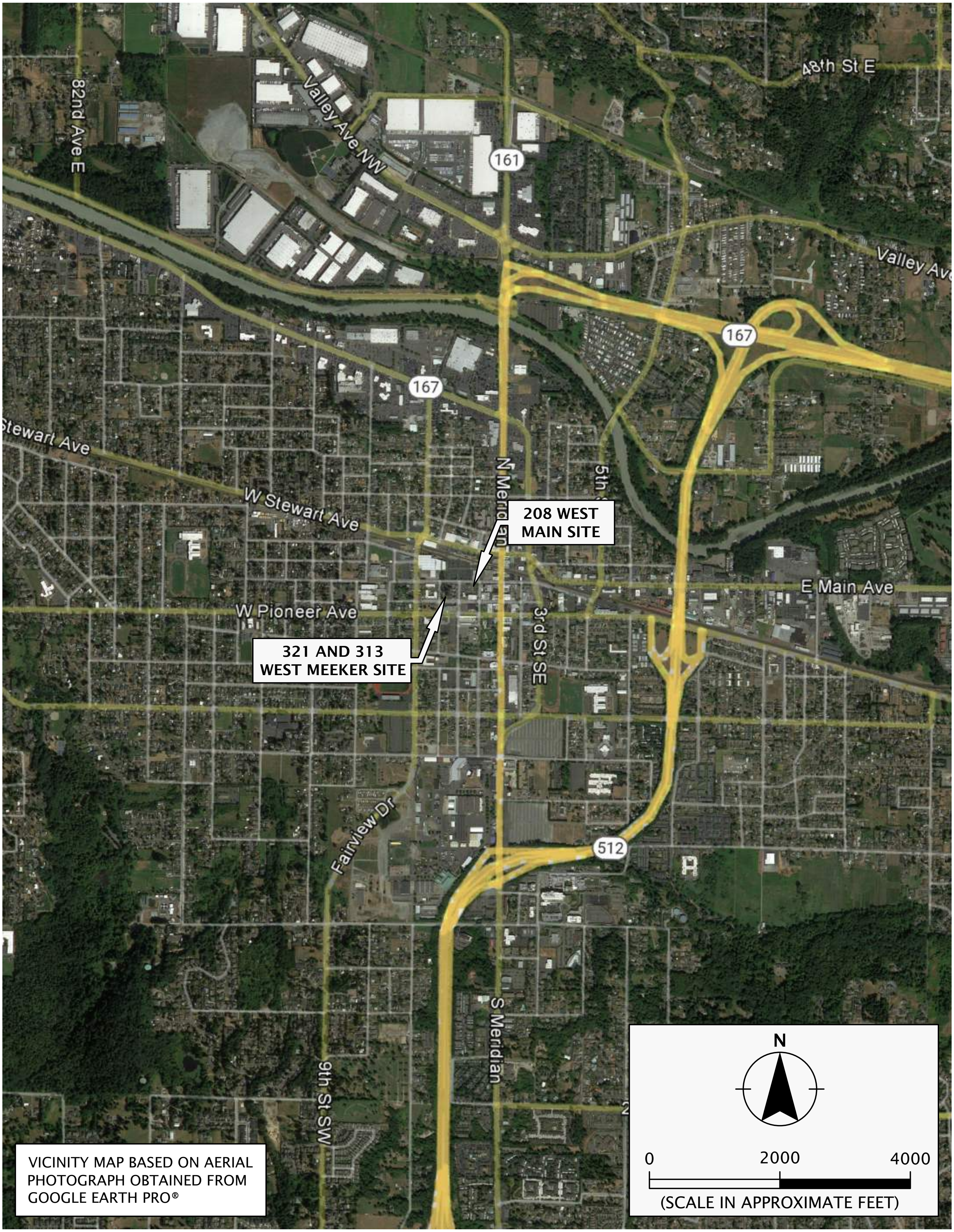

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File Name: J:\M-R\Puyallup\Puyallup-7\Puyallup-7-01\Figures\CAD\Puyallup-7-01-VM01.dwg | Layout: FIGURE 1

NV5	PUYALLUP-7-01	VICINITY MAP	
	NOVEMBER 2020	321 W MEEKER/208 W MAIN PUBLIC PARKING LOTS PUYALLUP, WA	FIGURE 1

LEGEND:

B-1 BORING

TP-1 TEST PIT

N

0 40 80

(SCALE IN FEET)

SITE PLAN BASED ON AERIAL PHOTOGRAPH DATED AUGUST 14, 2020, OBTAINED FROM GOOGLE EARTH PRO.

NV5

PUYALLUP-7-01

NOVEMBER 2020

SITE PLAN - 321 AND 313 WEST MEEKER

321 W MEEKER/208 W MAIN PUBLIC PARKING LOTS
PUYALLUP, WA

FIGURE 2

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LEGEND:

B-2 BORING

TP-3 TEST PIT

N

0 40 80

(SCALE IN FEET)

SITE PLAN BASED ON AERIAL PHOTOGRAPH DATED AUGUST 14, 2020, OBTAINED FROM GOOGLE EARTH PRO.

FIGURE 3

SITE PLAN - 208 WEST MAIN

321 W MEEKER/208 W MAIN PUBLIC PARKING LOTS
PUYALLUP, WA

PUYALLUP-7-01

NOVEMBER 2020

NV5

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APPENDIX A

FIELD EXPLORATIONS

GENERAL

We explored subsurface conditions by drilling two borings (B-1 and B-2) to depths of 31.5 feet BGS and excavating four test pits (TP-1 through TP-4) to depths between 7 and 8.5 feet BGS. A standpipe piezometer was installed in B-1 and B-2 to monitor groundwater levels. Drilling services were provided by Boretec1 Inc. of Auburn, Washington, on November 1, 2022, using an excavator-mounted drill rig with hollow-stem auger techniques. Test pit excavation services were provided by Continental Dirt Contractors of Auburn, Washington on September 14, 2022 and September 15, 2022 using an excavator. The boring and test pit exploration logs are presented in this appendix. A summary of the pavement borings is provided in Table 1. The locations of the explorations were determined based on existing conditions, field measurements, and a hand-held GPS. This information should be considered accurate to the degree implied by the methods used.

SOIL SAMPLING

We collected representative samples of the various soils encountered during drilling. Samples were collected from the borings using 1½-inch-inside diameter split-spoon sampler (SPT) in general accordance with ASTM D1586. The sampler was driven into the soil with a 140-pound automatic trip hammer free falling 30 inches. The sampler was driven a total distance of 18 inches. The number of blows required to drive the sampler the final 12 inches is recorded on the boring logs, unless otherwise noted. Representative disturbed samples of soil observed in the test pit explorations were collected using hand operated equipment. Sampling methods and intervals are shown on the exploration logs.

The hammer used to conduct the SPTs was lifted using a rope and cathead system. The hammer was raised using two wraps of the rope around the cathead to conduct the SPTs.

SOIL CLASSIFICATION

The soil samples were classified in accordance with the "Exploration Key" (Table A-1) and "Soil Classification System" (Table A-2), which are presented in this appendix. The exploration logs indicate the depths at which the soil or their characteristics change, although the change could be gradual. If the change occurred between sample locations, the depth was interpreted. Classifications are shown on the exploration logs.

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	BLOW COUNT	INSTALLATION AND COMMENTS
0	Loose, brown-gray, silty GRAVEL with sand (GM); moist - **FILL**.	35.0				Flush-mount monument with 1.5 feet of concrete backfill
1.0	Loose, brown, silty SAND (SM); moist, sand is fine to medium - **ALLUVIUM**.	34.0 / 1.0		X	8	Bentonite chips
4.5	Soft, brown-gray SILT with sand (ML), trace debris (wood); wet, interbeds of silty SAND (3 to 6 inches thick), sand is fine to medium - **ALLUVIUM**.	30.5 / 4.5		X	2	▼ 6.9 feet on 11/8/22; ▽ 7.0 feet, during drilling
	medium stiff at 7.5 feet			X	7	2-inch, Schedule 40 PVC well casing
	stiff at 10.0 feet			X	11	10/20 filter pack sand
12.0	Loose, brown, silty SAND (SM), trace debris (wood); wet, sand is fine to medium - **ALLUVIUM**.	23.0 / 12.0		X	8	2-inch, Schedule 40 PVC screen, 0.010-inch slot width
14.0	Loose, brown SAND with silt (SP-SM); wet, sand is fine to coarse - **ALLUVIUM**.	21.0 / 14.0		X	10	
				X	19	Well #BMR 649 set at 20.0 feet
				X	26	
				X	17	
31.5	Exploration completed at a depth of 31.5 feet.	3.5 / 31.5				
	SPT completed using two wraps with a cathead.					

Legend: ▲ BLOW COUNT ● MOISTURE CONTENT % RQD% CORE REC% (scale 0 – 50 – 100)

DRILLED BY: Boretec1 LOGGED BY: E. Larson COMPLETED: 11/01/22

BORING METHOD: hollow-stem auger (see document text) BORING BIT DIAMETER: 6 inches

NV5	PUYALLUP-7-01	**BORING B-1**	
	NOVEMBER 2022	321 W MEEKER/208 W MAIN PUBLIC PARKING LOTS PUYALLUP, WA	**FIGURE A-1**

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION / DEPTH	BLOW COUNT	INSTALLATION AND COMMENTS
0	CRUSHED ROCK - **FILL**.	36.0		Flush-mount monument with 1.3 feet of concrete backfill
1.5	Loose, brown SAND with silt (SP-SM); moist, sand is fine to medium - **ALLUVIUM**.	34.5 / 1.5	6	Bentonite chips
4.5	Very soft, gray SILT with sand (ML); wet, trace organics, interbeds of gray, silty SAND (approximately 3 to 9 inches thick) - **ALLUVIUM**.	31.5 / 4.5	1; 2	7.1 feet on 11/8/22; 7.0 feet, during drilling; 2-inch, Schedule 40 PVC well casing
10	medium stiff at 10.0 feet		5; 5	10/20 filter pack sand; 2-inch, Schedule 40 PVC screen, 0.010-inch slot width
14.0	Medium dense, brown, silty SAND (SM), trace debris (wood); wet - **ALLUVIUM**.	22.0 / 14.0	12; 26	Drilled through wood debris from 18.0 to 20.0 feet. Well #BM5 549 set at 20.0 feet
24.0	Medium dense, gray SAND with silt (SP-SM); wet - **ALLUVIUM**.	12.0 / 24.0	15; 16	
31.5	Exploration completed at a depth of 31.5 feet. SPT completed using two wraps with a cathead.	4.5 / 31.5		

Chart legend: ▲ BLOW COUNT; ● MOISTURE CONTENT %; RQD%; CORE REC% (scale 0–50–100)

DRILLED BY: Boretec1 LOGGED BY: E. Larson COMPLETED: 11/01/22

BORING METHOD: hollow-stem auger (see document text) BORING BIT DIAMETER: 6 inches

NV5

PUYALLUP-7-01

NOVEMBER 2022

BORING B-2

321 W MEEKER/208 W MAIN PUBLIC PARKING LOTS
PUYALLUP, WA

FIGURE A-2

TP-1

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	MOISTURE CONTENT (%)	COMMENTS
0.0		35.0				
	Loose, brown-gray, silty SAND with gravel (SM); moist - **FILL**.	34.0 / 1.0				
	Loose, gray, silty SAND (SM); moist, sand is fine - **ALLUVIUM**.					
2.5				☒		PIT at 2.5 feet.
5.0	Soft, brown-gray SILT with sand (ML); wet, sand is fine - **ALLUVIUM**.	29.5 / 5.5				Slow groundwater seepage observed at 5.5 feet.
7.5	Exploration completed at a depth of 8.0 feet.	27.0 / 8.0				No caving observed to the depth explored. Surface elevation was not measured at the time of exploration.
10.0						
12.5						

TP-2

DEPTH FEET	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	MOISTURE CONTENT (%)	COMMENTS
0.0		36.0				
	Loose, gray, silty SAND (SM); moist, sand is fine - **FILL**.	35.0 / 1.0				
	Loose, gray, silty SAND (SM); moist, sand is fine to coarse - **ALLUVIUM**.					
2.5				☒		PIT at 2.5 feet.
5.0	Soft, brown-gray, sandy SILT (ML); wet, sand is fine - **ALLUVIUM**.	30.0 / 6.0				Slow groundwater seepage observed at 6.0 feet.
7.5	Loose, gray SAND with silt (SP-SM); wet, sand is fine to coarse - **ALLUVIUM**.	29.0 / 7.0				
	Exploration completed at a depth of 8.5 feet.	27.5 / 8.5				No caving observed to the depth explored. Surface elevation was not measured at the time of exploration.
10.0						
12.5						

Moisture content scale: 0 50 100

EXCAVATED BY: Continental Dirt Contractors LOGGED BY: E. Larson COMPLETED: 09/14/22

EXCAVATION METHOD:

NV5

PUYALLUP-7-01

NOVEMBER 2022

TEST PIT

321 W MEEKER/208 W MAIN PUBLIC PARKING LOTS
PUYALLUP, WA

FIGURE A-3

DEPTH FEET	GRAPHIC LOG	MATERIAL DESCRIPTION	ELEVATION / DEPTH	TESTING	SAMPLE	● MOISTURE CONTENT (%) 0 50 100	COMMENTS
TP-3							
0.0		CRUSHED ROCK (18.0 inches) - **FILL**.	37.0				
		Loose, brown-gray, silty SAND (SM); moist, sand is fine to medium - **ALLUVIUM**.	35.5 / 1.5		☒		PIT at 2.5 feet. Minor caving observed at 4.0 feet.
		Soft, gray SILT (ML); wet - **ALLUVIUM**.	30.5 / 6.5				
		Exploration completed at a depth of 8.5 feet.	28.5 / 8.5				No groundwater seepage observed to the depth explored. Surface elevation was not measured at the time of exploration.
TP-4							
0.0		CRUSHED ROCK (20.4 inches) - **FILL**.	37.0				
		Loose, brown-gray, silty SAND (SM); moist, sand is fine to medium - **ALLUVIUM**.	35.3 / 1.7		☒		PIT at 2.5 feet. Severe caving observed at 5.0 feet.
		Exploration terminated at a depth of 7.0 feet due to caving.	30.0 / 7.0				No groundwater seepage observed to the depth explored. Surface elevation was not measured at the time of exploration.

EXCAVATED BY: Continental Dirt Contractors LOGGED BY: E. Larson COMPLETED: 09/15/22

EXCAVATION METHOD:

NV5

PUYALLUP-7-01

NOVEMBER 2022

TEST PIT

321 W MEEKER/208 W MAIN PUBLIC PARKING LOTS
PUYALLUP, WA

FIGURE A-4

APPENDIX B

CEC AND ORGANIC CONTENT TESTING

CEC

CEC testing was completed by AMTest Laboratories to help assess the suitability of on-site soil for water quality treatment. The test results are presented in this appendix.

ORGANIC CONTENT

Organic content testing was completed by AMTest Laboratories to help assess the suitability of on-site soil for water quality treatment. The test results are presented in this appendix.

Am Test Inc.
13600 NE 126TH PL
Suite C
Kirkland, WA 98034
(425) 885-1664
www.amtestlab.com

Professional Analytical Services

ANALYSIS REPORT

NV5
19201 120TH AVE NE
BOTHELL, WA 98011
Attention: ERIC LARSON
Project Name: 208 W MAIN/321 W MEDER
Project #: PUYALLUP -701
PO Number: PUYALLUP-701
All results reported on an as received basis.

Date Received: 09/22/22
Date Reported: 9/30/22

AMTEST Identification Number **22-A016183**
Client Identification **TP-1 2.5-3**
Sampling Date **09/14/22, 09:00**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Cation Exchange Capacity	3.4	meq/100g		0.5	SW-846 9081	CM	09/30/22

Miscellaneous

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANLST	DATE
Organic Matter	1.1	%			SM 2540G	FG	09/28/22

AMTEST Identification Number **22-A016184**
Client Identification **TP-2 2.5-3**
Sampling Date **09/14/22, 08:00**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Cation Exchange Capacity	3.8	meq/100g		0.5	SW-846 9081	CM	09/30/22

Miscellaneous

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANLST	DATE
Organic Matter	1.3	%			SM 2540G	FG	09/28/22

AMTEST Identification Number **22-A016185**
Client Identification **TP-3 2.5-3**
Sampling Date **09/15/22, 09:00**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Cation Exchange Capacity	4.1	meq/100g		0.5	SW-846 9081	CM	09/30/22

Miscellaneous

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANLST	DATE
Organic Matter	1.4	%			SM 2540G	FG	09/28/22

AMTEST Identification Number **22-A016186**
Client Identification **TP-4 2.5-3**
Sampling Date **09/15/22, 08:00**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Cation Exchange Capacity	4.7	meq/100g		0.5	SW-846 9081	CM	09/30/22

Miscellaneous

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANLST	DATE
Organic Matter	1.4	%			SM 2540G	FG	09/28/22

Kathy Fugiel
President

WWHM2012

PROJECT REPORT

General Model Information

Project Name:	default
Site Name:	W Meeker Public Parking
Site Address:	311;321 W Meeker
City:	Puyallup
Report Date:	12/8/2022
Gage:	
Data Start:	10/01/1901
Data End:	09/30/2059
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2021/08/18
Version:	4.2.18

POC Thresholds

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

Landuse Basin Data
Predeveloped Land Use

Mitigated Land Use

Area to Permeable Pavement

Bypass:	No
Impervious Land Use	acre
ROADS FLAT	0.165

Element Flows To:

Outlet 1	Outlet 2
Permeable Pavement 1	

Routing Elements
Predeveloped Routing

Mitigated Routing

Permeable Pavement 1

Pavement Area:0.1657 acre.Pavement Length:100.00 ft.
Pavement Width: 72.20 ft.

100 ft x 72.2 ft = 7,220 SF (Total new plus replaced hard surface area)

Pavement slope 1:0 To 1

Pavement thickness: 0.4167

3" HMA + 2" ATB= 5"

Pour Space of Pavement: 0.4
Material thickness of second layer: 0.5

6" Storage Layer

Pour Space of material for second layer: 0.33
Material thickness of third layer: 0
Pour Space of material for third layer: 0
Infiltration On
Infiltration rate: 2.5
Infiltration safety factor: 1
Total Volume Infiltrated (ac-ft.): 127.26
Total Volume Through Riser (ac-ft.): 0
Total Volume Through Facility (ac-ft.): 127.26
Percent Infiltrated: 100
Total Precip Applied to Facility: 0
Total Evap From Facility: 5.542
Element Flows To:
Outlet 1 Outlet 2

Permeable Pavement Hydraulic Table

Stage(feet)	**Area(ac.)**	**Volume(ac-ft.)**	**Discharge(cfs)**	**Infilt(cfs)**
0.0000	0.165	0.000	0.000	0.000
0.0167	0.165	0.000	0.000	0.417
0.0333	0.165	0.001	0.000	0.417
0.0500	0.165	0.002	0.000	0.417
0.0667	0.165	0.003	0.000	0.417
0.0833	0.165	0.004	0.000	0.417
0.1000	0.165	0.005	0.000	0.417
0.1167	0.165	0.006	0.000	0.417
0.1333	0.165	0.007	0.000	0.417
0.1500	0.165	0.008	0.000	0.417
0.1667	0.165	0.009	0.000	0.417
0.1833	0.165	0.010	0.000	0.417
0.2000	0.165	0.010	0.000	0.417
0.2167	0.165	0.011	0.000	0.417
0.2333	0.165	0.012	0.000	0.417
0.2500	0.165	0.013	0.000	0.417
0.2667	0.165	0.014	0.000	0.417
0.2833	0.165	0.015	0.000	0.417
0.3000	0.165	0.016	0.000	0.417
0.3167	0.165	0.017	0.000	0.417
0.3333	0.165	0.018	0.000	0.417
0.3500	0.165	0.019	0.000	0.417
0.3667	0.165	0.020	0.000	0.417
0.3833	0.165	0.021	0.000	0.417
0.4000	0.165	0.021	0.000	0.417
0.4167	0.165	0.022	0.000	0.417
0.4333	0.165	0.023	0.000	0.417
0.4500	0.165	0.024	0.000	0.417
0.4667	0.165	0.025	0.000	0.417

0.4833	0.165	0.026	0.000	0.417
0.5000	0.165	0.027	0.000	0.417
0.5167	0.165	0.028	0.000	0.417
0.5333	0.165	0.029	0.000	0.417
0.5500	0.165	0.030	0.000	0.417
0.5667	0.165	0.031	0.000	0.417
0.5833	0.165	0.032	0.000	0.417
0.6000	0.165	0.034	0.000	0.417
0.6167	0.165	0.035	0.000	0.417
0.6333	0.165	0.036	0.000	0.417
0.6500	0.165	0.037	0.000	0.417
0.6667	0.165	0.038	0.000	0.417
0.6833	0.165	0.039	0.000	0.417
0.7000	0.165	0.040	0.000	0.417
0.7167	0.165	0.041	0.000	0.417
0.7333	0.165	0.042	0.000	0.417
0.7500	0.165	0.043	0.000	0.417
0.7667	0.165	0.045	0.000	0.417
0.7833	0.165	0.046	0.000	0.417
0.8000	0.165	0.047	0.000	0.417
0.8167	0.165	0.048	0.000	0.417
0.8333	0.165	0.049	0.000	0.417
0.8500	0.165	0.050	0.000	0.417
0.8667	0.165	0.051	0.000	0.417
0.8833	0.165	0.052	0.000	0.417
0.9000	0.165	0.053	0.000	0.417
0.9167	0.165	0.055	0.000	0.417
0.9333	0.165	0.057	0.051	0.417
0.9500	0.165	0.060	0.146	0.417
0.9667	0.165	0.063	0.268	0.417
0.9833	0.165	0.066	0.413	0.417
1.0000	0.165	0.068	0.578	0.417
1.0167	0.165	0.071	0.759	0.417
1.0333	0.165	0.074	0.957	0.417
1.0500	0.165	0.077	1.170	0.417
1.0667	0.165	0.079	1.396	0.417
1.0833	0.165	0.082	1.635	0.417
1.1000	0.165	0.085	1.886	0.417
1.1167	0.165	0.088	2.149	0.417
1.1333	0.165	0.090	2.424	0.417
1.1500	0.165	0.093	2.709	0.417
1.1667	0.165	0.096	3.004	0.417
1.1833	0.165	0.099	3.310	0.417
1.2000	0.165	0.101	3.625	0.417
1.2167	0.165	0.104	3.949	0.417
1.2333	0.165	0.107	4.283	0.417
1.2500	0.165	0.110	4.626	0.417
1.2667	0.165	0.113	4.977	0.417
1.2833	0.165	0.115	5.337	0.417
1.3000	0.165	0.118	5.705	0.417
1.3167	0.165	0.121	6.081	0.417
1.3333	0.165	0.124	6.465	0.417
1.3500	0.165	0.126	6.857	0.417
1.3667	0.165	0.129	7.256	0.417
1.3833	0.165	0.132	7.663	0.417
1.4000	0.165	0.135	8.078	0.417
1.4167	0.165	0.137	8.499	0.417
1.4333	0.165	0.140	8.928	0.417

1.4500	0.165	0.143	9.363	0.417
1.4667	0.165	0.146	9.805	0.417
1.4833	0.165	0.148	10.25	0.417
1.5000	0.165	0.151	10.71	0.417

Analysis Results

POC 1

POC #1 was not reported because POC must exist in both scenarios and both scenarios must have been run.

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.

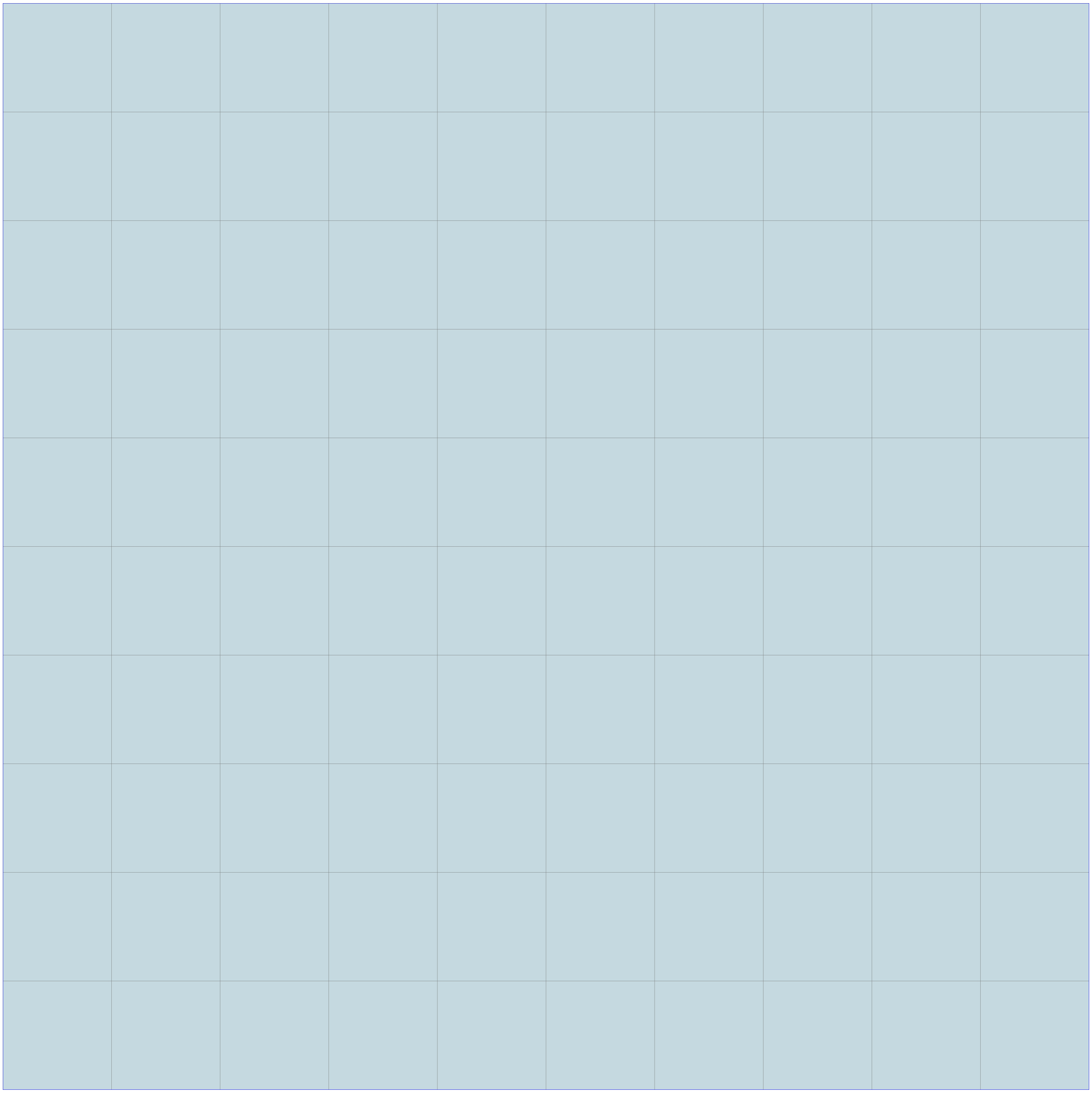
PERLND Changes

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   default.wdm
MESSU      25   Predefault.MES
           27   Predefault.L61
           28   Predefault.L62
           30   POCdefault1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      10
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin  1                   MAX                      1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                            User  t-series Engl Metr ***
                                            in  out           ***
   10     C, Forest, Flat         1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

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

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

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

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

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   10              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                     ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   10            0.2       0.5      0.35         6       0.5       0.7
  END PWAT-PARM4

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

END PERLND

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

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

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

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

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

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

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

```
END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin  1***
PERLND  10                       1.082     COPY   501     12
PERLND  10                       1.082     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   default.wdm
MESSU      25   Mitdefault.MES
           27   Mitdefault.L61
           28   Mitdefault.L62
           30   POCdefault1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      IMPLND      17
      IMPLND      16
      RCHRES       1
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Permeable Pavement  1       MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                            User  t-series Engl Metr ***
                                             in  out           ***
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
  END PRINT-INFO
```

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

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                               ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
  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
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                    User  t-series Engl Metr ***
                                     in  out           ***
   17      ROADS/FLAT            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   ***
   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    *********
   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     ***
   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
   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
   17              0         0
   16              0         0
```

```
  END IWAT-PARM3

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

END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
IMPLND  16                      0.1657     RCHRES   1      5
Area to Permeable Pavement***
IMPLND  17                      0.9955     IMPLND  16     53

******Routing******
IMPLND  17                       0.165     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 Paveme-004    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      0.02       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  0.165748  0.000000  0.000000  0.000000
  0.016667  0.165748  0.000912  0.000000  0.417824
  0.033333  0.165748  0.001823  0.000000  0.417824
  0.050000  0.165748  0.002735  0.000000  0.417824
  0.066667  0.165748  0.003646  0.000000  0.417824
  0.083333  0.165748  0.004558  0.000000  0.417824
  0.100000  0.165748  0.005470  0.000000  0.417824
  0.116667  0.165748  0.006381  0.000000  0.417824
  0.133333  0.165748  0.007293  0.000000  0.417824
  0.150000  0.165748  0.008205  0.000000  0.417824
  0.166667  0.165748  0.009116  0.000000  0.417824
  0.183333  0.165748  0.010028  0.000000  0.417824
  0.200000  0.165748  0.010939  0.000000  0.417824
  0.216667  0.165748  0.011851  0.000000  0.417824
  0.233333  0.165748  0.012763  0.000000  0.417824
  0.250000  0.165748  0.013674  0.000000  0.417824
  0.266667  0.165748  0.014586  0.000000  0.417824
  0.283333  0.165748  0.015497  0.000000  0.417824
  0.300000  0.165748  0.016409  0.000000  0.417824
  0.316667  0.165748  0.017321  0.000000  0.417824
  0.333333  0.165748  0.018232  0.000000  0.417824
  0.350000  0.165748  0.019144  0.000000  0.417824
  0.366667  0.165748  0.020056  0.000000  0.417824
  0.383333  0.165748  0.020967  0.000000  0.417824
  0.400000  0.165748  0.021879  0.000000  0.417824
  0.416667  0.165748  0.022790  0.000000  0.417824
  0.433333  0.165748  0.023702  0.000000  0.417824
  0.450000  0.165748  0.024614  0.000000  0.417824
  0.466667  0.165748  0.025525  0.000000  0.417824
  0.483333  0.165748  0.026437  0.000000  0.417824
  0.500000  0.165748  0.027348  0.000000  0.417824
  0.516667  0.165748  0.028453  0.000000  0.417824
  0.533333  0.165748  0.029558  0.000000  0.417824
  0.550000  0.165748  0.030663  0.000000  0.417824
  0.566667  0.165748  0.031768  0.000000  0.417824
  0.583333  0.165748  0.032873  0.000000  0.417824
  0.600000  0.165748  0.033978  0.000000  0.417824
  0.616667  0.165748  0.035083  0.000000  0.417824
  0.633333  0.165748  0.036188  0.000000  0.417824
  0.650000  0.165748  0.037293  0.000000  0.417824
  0.666667  0.165748  0.038398  0.000000  0.417824
  0.683333  0.165748  0.039503  0.000000  0.417824
  0.700000  0.165748  0.040608  0.000000  0.417824
  0.716667  0.165748  0.041713  0.000000  0.417824
  0.733333  0.165748  0.042818  0.000000  0.417824
  0.750000  0.165748  0.043923  0.000000  0.417824
  0.766667  0.165748  0.045028  0.000000  0.417824
  0.783333  0.165748  0.046133  0.000000  0.417824
  0.800000  0.165748  0.047238  0.000000  0.417824
  0.816667  0.165748  0.048343  0.000000  0.417824
  0.833333  0.165748  0.049448  0.000000  0.417824
  0.850000  0.165748  0.050553  0.000000  0.417824
  0.866667  0.165748  0.051658  0.000000  0.417824
  0.883333  0.165748  0.052763  0.000000  0.417824
  0.900000  0.165748  0.053868  0.000000  0.417824
  0.916667  0.165748  0.054973  0.000000  0.417824
```

```
  0.933333  0.165748  0.057736  0.051576  0.417824
  0.950000  0.165748  0.060498  0.146099  0.417824
  0.966667  0.165748  0.063261  0.268536  0.417824
  0.983333  0.165748  0.066023  0.413541  0.417824
  1.000000  0.165748  0.068786  0.578028  0.417824
  1.016667  0.165748  0.071548  0.759914  0.417824
  1.033333  0.165748  0.074311  0.957669  0.417824
  1.050000  0.165748  0.077073  1.170110  0.417824
  1.066667  0.165748  0.079835  1.396283  0.417824
  1.083333  0.165748  0.082598  1.635401  0.417824
  1.100000  0.165748  0.085360  1.886797  0.417824
  1.116667  0.165748  0.088123  2.149898  0.417824
  1.133333  0.165748  0.090885  2.424205  0.417824
  1.150000  0.165748  0.093648  2.709278  0.417824
  1.166667  0.165748  0.096410  3.004724  0.417824
  1.183333  0.165748  0.099173  3.310191  0.417824
  1.200000  0.165748  0.101935  3.625361  0.417824
  1.216667  0.165748  0.104698  3.949944  0.417824
  1.233333  0.165748  0.107460  4.283674  0.417824
  1.250000  0.165748  0.110223  4.626306  0.417824
  1.266667  0.165748  0.112985  4.977617  0.417824
  1.283333  0.165748  0.115748  5.337395  0.417824
  1.300000  0.165748  0.118510  5.705447  0.417824
  1.316667  0.165748  0.121273  6.081590  0.417824
  1.333333  0.165748  0.124035  6.465654  0.417824
  1.350000  0.165748  0.126798  6.857479  0.417824
  1.366667  0.165748  0.129560  7.256913  0.417824
  1.383333  0.165748  0.132322  7.663816  0.417824
  1.400000  0.165748  0.135085  8.078052  0.417824
  1.416667  0.165748  0.137847  8.499493  0.417824
  1.433333  0.165748  0.140610  8.928018  0.417824
  1.450000  0.165748  0.143372  9.363513  0.417824
  1.466667  0.165748  0.146135  9.805867  0.417824
  1.483333  0.165748  0.148897  10.25498  0.417824
  1.500000  0.165748  0.151660  10.71074  0.417824
  END FTABLE  1
END FTABLES

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

END MASS-LINK

END RUN
```

Mitigated HSPF Message File

Disclaimer

Legal Notice

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7.0 Other Permits

The following permits are associated with this project:

- Demolition Permit: B-21-0994
- CUP Permit: TMPPL20220000634

8.0 Operation and Maintenance Manual

The operation and Maintenance manual will be provided prior to final engineering.

9.0 Declaration of Covenant for Privately Maintained Flow Control and Runoff Treatment BMPs

The permeable pavement facility will be maintained by public works; therefore, a declaration of covenant is not applicable

10.0 Declaration of Covenant for Privately Maintained LID BMPs

The permeable pavement facility will be maintained by public works; therefore, a declaration of covenant is not applicable.

11.0 Bond Quantities Worksheet

The bond quantities is not applicable due to this being a publicly funded project.