

Stormwater Management Report

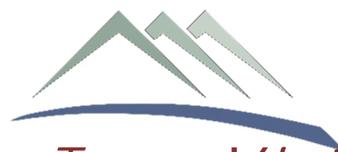
November 15, 2023

Jensen Park Improvements

Prepared for:

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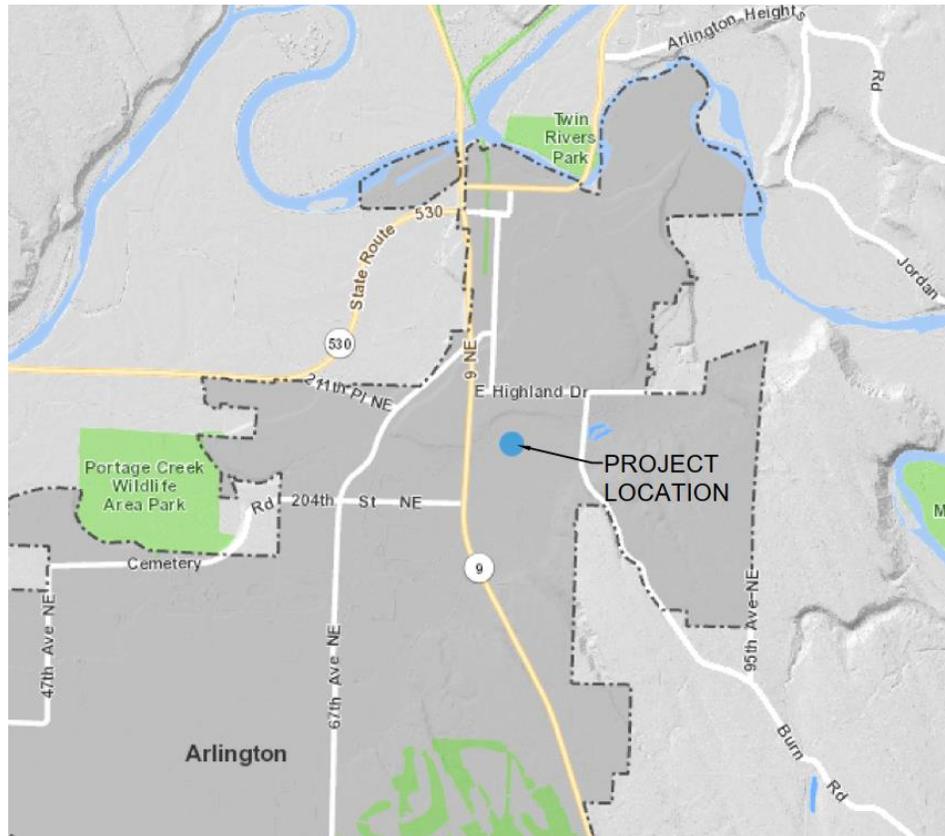
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Project Overview

Site Location

The project is located off of Jensen Farm Lane, approximately 800' northwest of the intersection with 207th St NE at 7801 Jensen Farm Lane, Arlington.



Code Compliance

The project will comply with:

- [WSDOT] STANDARD SPECIFICATIONS for ROAD, BRIDGE and MUNICIPAL CONSTRUCTION, WSDOT, 2018 Edition with amendments
- [ADCS] Arlington Design and Construction Standards, dated July 2008
- [AMC] Arlington Municipal Code
- [SWMMWW] 2019 Stormwater Management Manual for Western Washington

Executive Summary

The proposed park improvements include removing and replacing the existing parking facilities, adding a restroom facility, and providing a drainage system for the new hard surfaces. The total onsite area is 2.59 acres, however only the area affected by these proposed improvements is being analyzed. This impacted area is 0.3 acres in size. Stormwater mitigation will utilize an infiltration system. Both roof runoff and onsite pollutant generating surfaces will be combined into a common system. No

groundwater was located on the site so clearance requirements between the infiltration facility and the groundwater level will be met.

Existing Conditions

The existing site is a developed community park. Topography is essentially flat. Jensen Farm Lane is to the south. The majority of the site area to be improved is composed of grass, playground surfaces, asphalt walks, and asphalt parking lot.

Soils

The three test pits conducted for this study encountered a layer of topsoil that extended to a depth of approximately 1.0 to 1.5 feet. Beneath this layer of topsoil, a medium dense, brown to black, gravelly, silty sand with cobbles was encountered to a depth of approximately 3.0 to 4.5 feet. This soil was interpreted to be undocumented fill. At the third test pit, soils underlying the topsoil were observed to be a medium dense, brown to gray, poorly graded sand with gravel and cobbles to a depth of 9.0 feet. These soils were interpreted to be native Marysville Sand soils. This has been chosen as the location for stormwater mitigation. No groundwater was located in the test pits. The Design Infiltration Rate was determined to be 10.0 in/hr for underlying soils at depths below 3.0 feet.

Refer to soils report in Appendix B for additional information.

Proposed Conditions

The proposed park improvements include removing and replacing the existing parking facilities, adding a restroom facility, and providing a drainage system for the new hard surfaces. The total onsite area is 2.59 acres, however only the area affected by these proposed improvements is being analyzed. This impacted area is 0.3 acres in size. Stormwater mitigation will utilize an infiltration system. Both roof runoff and onsite pollutant generating surfaces will be combined into a common system. No groundwater was located on the site so clearance requirements between the infiltration facility and the groundwater level will be met.

Pervious/Impervious Areas

For use in determining stormwater mitigation fees the following areas represent the true pervious/impervious area for the entire site.

Existing Onsite Pervious / Impervious Area

Total impervious surface.....	0.15 ac
Total pervious surface.....	2.44 ac
TOTAL ONSITE AREA.....	2.59 ac

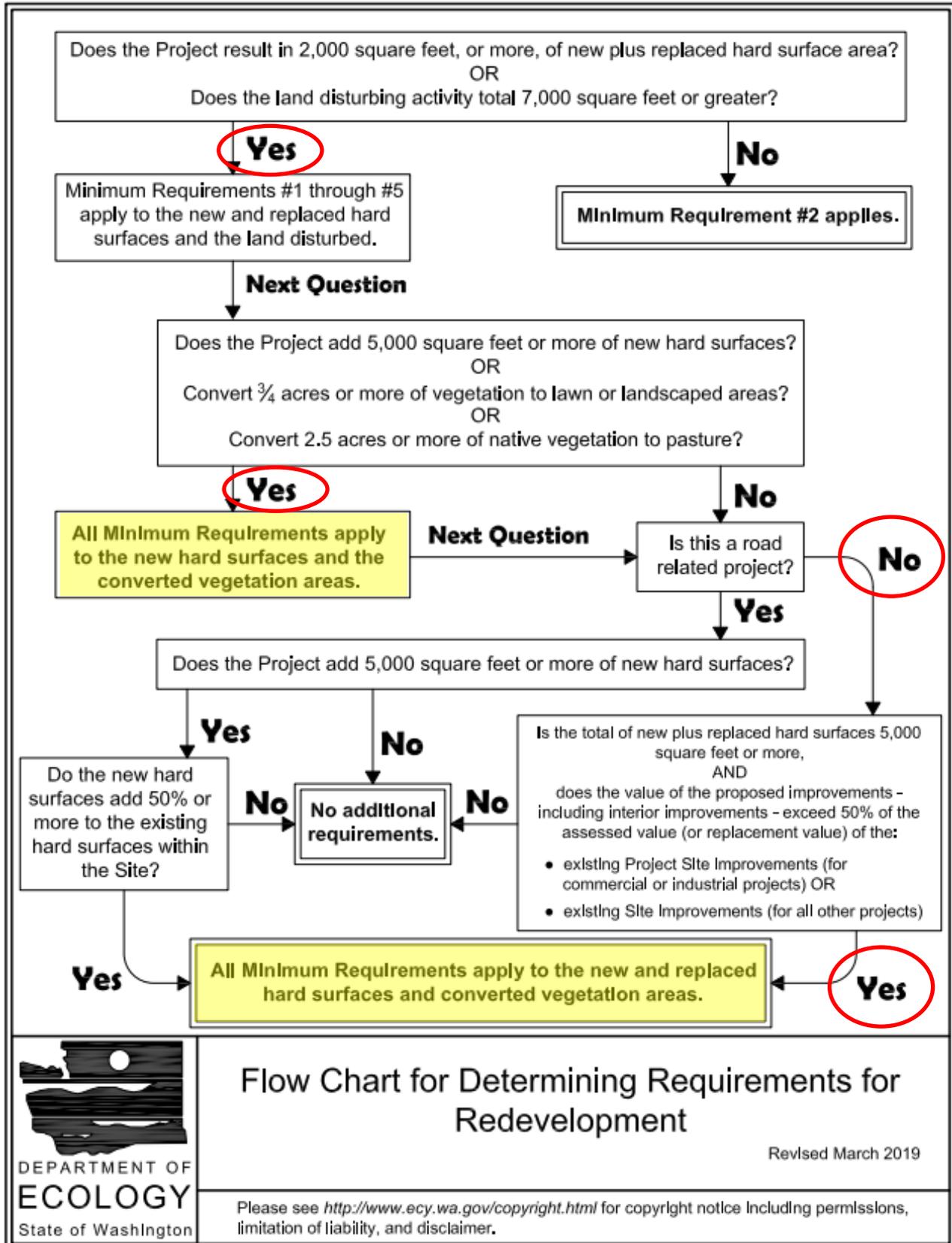
Proposed & Existing Onsite Pervious / Impervious Area

Total impervious surface.....	0.21 ac
Total pervious surface.....	2.38 ac
TOTAL ONSITE AREA.....	2.59 ac

Minimum Stormwater Management Requirements

Overview of Minimum Requirements

Minimum requirements 1-9 shall apply to the project.



1-Preparation of Stormwater Site Plans

Stormwater site plans were prepared in accordance with Volume I, Chapter 3 of the SWMMWW.

2-Construction Stormwater Pollution Prevention Plan (SWPPP)

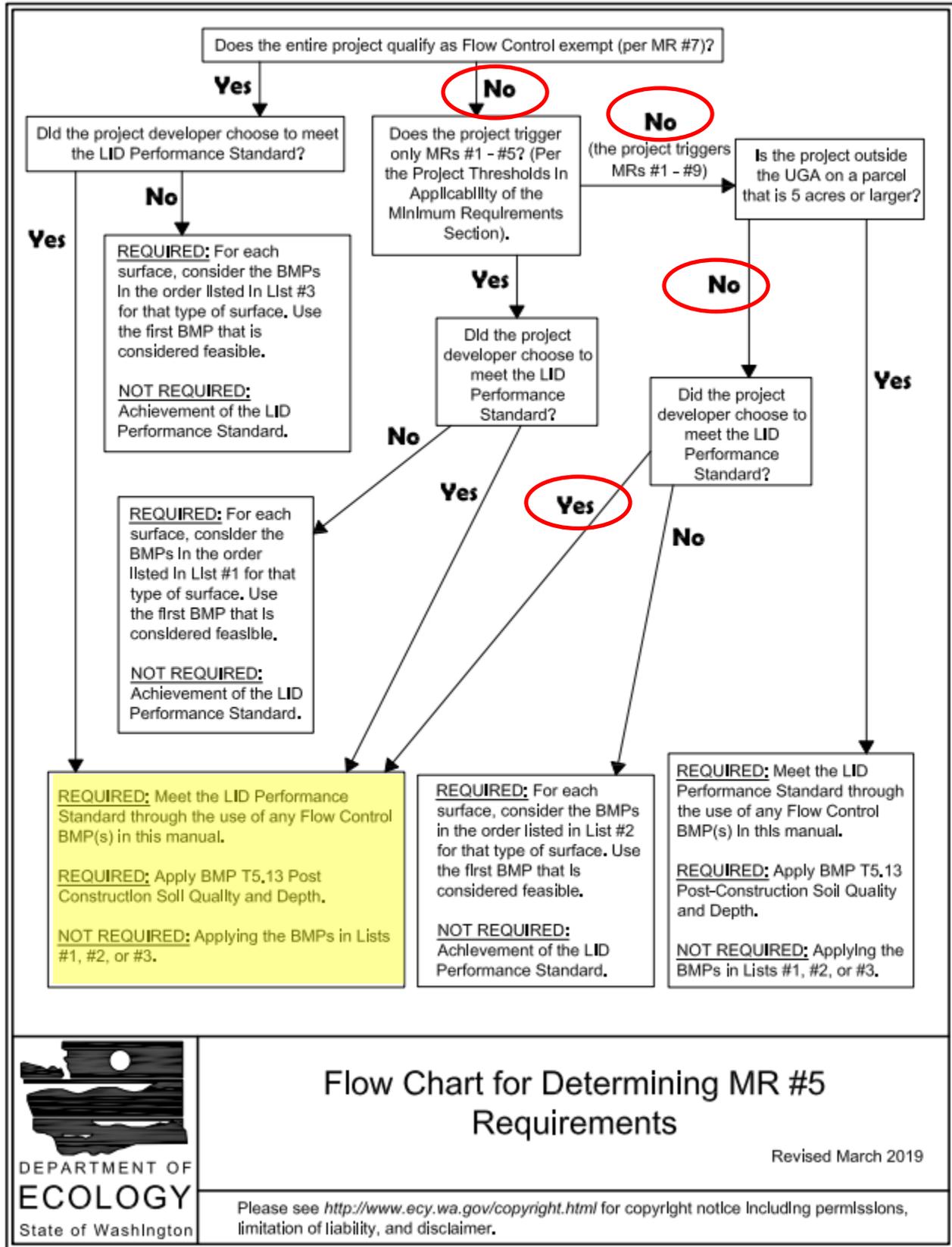
A SWPPP narrative has been prepared and is included in Appendix A and on the plan set. The erosion potential for the site is very low to non-existent. The onsite soils are highly infiltratable so no runoff during construction is anticipated.

3-Source Control of Pollution

The project will not pose any source of pollution for the site. The site is not considered a high use site. The SWPPP provided will address the source control of pollution during the construction phase.

4-Preservation of Natural Drainage Systems and Outfalls

Existing regional drainage infiltrates into the soils. Proposed drainage system will also infiltrate; therefore, preservation of natural drainage systems and outfall is being met.



5-Onsite Stormwater Management

For the expansion area of the site, both roof runoff and onsite pollutant generating surfaces will be combined into the infiltration system.

Western Washington Hydrology Model (WWHM) 2012 was used to calculate the size of the required infiltration facility for 0.14-acre of new/replaced impervious surface that is tributary to the infiltration system. The drainage system is designed to infiltrate 100% of the stormwater therefore meeting and exceeding the LID stormwater requirements including other minimum requirements. The portions of impervious areas that are not tributary to the infiltration system will sheet flow into the grass area and infiltrate at that location.

[SSC-4](#) of the SWMMWW requires that infiltration facilities that are utilized for treatment purposes must document that the water quality design storm volume (indicated by WWHM or MGS Flood, or runoff from a 6-month, 24-hour rain event) can infiltrate through the infiltration basin surface within 48 hours. The infiltration facility is designed to infiltrate 100% of the stormwater within the 2.0' depth of the storage layer. The water quality storm, which is less than all storms contained within the model, will also be contained within the 2.0' storage layer of the infiltration facilities. SSC-4 is therefore met.

Upstream Analysis

The surrounding area has flat topography with high infiltration soils. No stormwater from offsite areas are anticipated to flow onto the project site.

Downstream Analysis

The proposed storm drain mitigation for the project site will infiltrate 100% of the stormwater. Therefore, no impacts to the downstream system are anticipated.

In the event that onsite drainage systems are overwhelmed by excessive rainfall, the stormwater will continue to stay onsite due to the topography of the site. Stormwater will not leave the site nor back up into the buildings.

BMP T5.13: Post-Construction Soil Quality and Depth

BMP T5.13 is required as part of Minimum Requirement #5. The Contractor has the option of stockpiling existing topsoil material or import topsoil material to meet the requirements of BMP T5.13.

6-Runoff Treatment

The site will meet the basic level of treatment, as the project does not meet the thresholds for enhanced treatment, phosphorous removal, or oil treatment as described in [Section V-3](#) of the SWMMWW.

Pollutant generating impervious areas (PGIS) will drain to an infiltration system that utilizes an 18" layer of sand for filtration, as the existing soils do not meet the site suitability requirements of SSC-6. The sand layer will be below the gravel infiltration system. The system is similar to that used by permeable pavements for treatment, as part of BMP T5.15, whereby stormwater passes through a gravel storage layer, followed by a sand layer, and then final infiltration into the native soil.

7-Flow Control

This is being met with 100% infiltration of the stormwater onsite.

8-Wetland Protection

No wetlands are present on the site.

9-Operation and Maintenance

Operation and maintenance procedures are included in Appendix D.

Appendix A

Construction Stormwater Pollution Prevent Plan (SWPPP)

SWPPP ELEMENTS

1 – PRESERVE VEGETATION/MARK CLEARING LIMITS

The land disturbance activities for development requires the consideration to be given to minimize the removal of existing trees, disturbance and compaction of native soils, except as needed for building purposes. The duff layer, native soil and vegetation shall be retained in an undisturbed state to the minimum degree practicable.

Best Management Practices (BMPs) to be used:

- BMP C103: High Visibility Fence

2-ESTABLISH CONSTRUCTION ACCESS

A construction entrance will be required.

Best Management Practices (BMPs) to be used:

- BMP C105: Stabilized Construction Entrance

3-CONTROL FLOW RATES

Flow rates will be controlled by using SWPPP Element #4, sediment controls.

4-INSTALL SEDIMENT CONTROLS

Due to the permeability of the site soils, surface flows from the site are expected to be negligible and therefore no sediment controls are needed. If the contractor notices that dirty storm water is leaving the site, then the contractor shall place silt fencing down slope from the disturbed areas as shown on the SWPPP.

Best Management Practices (BMPs) to be used:

- None required

5-STABILIZED SOILS

We do not expect any stockpiles on this project. All new exposed areas are expected to be covered with sand or building within 48 hours of exposure.

If required, all exposed soil and any soil stockpile will be stabilized. The soil stockpile will be located within the disturbed area shown on the SWPPP plan. Any stockpiles will be covered in plastic if left un-worked. No soils shall remain exposed and unworked for more than 2 days between October 1 and April 30. Any land disturbed areas outside of the proposed horse arena will be permanently seeded.

Best Management Practices (BMPs) to be used:

- None required

6-PROTECT SLOPES

There are no cut or fill slopes with this project.

Best Management Practices (BMPs) to be used:

- None required

7-PROTECT PERMANENT DRAIN INLETS

Existing and proposed storm drain inlets will be protected during construction.

Best Management Practices (BMPs) to be used:

- BMP C220: Storm Drain Inlet Protection

8-STABILIZE CHANNELS AND OUTLETS

There are no existing channels. The proposed construction does create a new channel.

Best Management Practices (BMPs) to be used:

- None required

9-CONTROL POLLUTANTS

Any and all chemicals, liquid projects, petroleum projects, and other materials that have the potential to pose a threat to human or the environment will be covered, contained and protected from vandalism. All such products will either be locked in a trailer or locked in a leak proof container. Any on-site fueling will have secondary containment to prevent possibility of spills. Any heavy equipment/vehicles will only be on-site temporarily. Any spills will be cleaned immediately. Fertilizers and pesticides will be applied per the manufacturers label requirements for application rate and procedures. No pH modifying sources such as cement kiln dust, fly ash, concrete washing treatment, curing waters, etc. are anticipated; if however they are, we will contain and/or remove the polluted substance from the site per manufacturer's recommendations.

Best Management Practices (BMPs) to be used:

- None required

10-CONTROL DEWATERING

For the proposed building, dewatering is not expected to be required; thus, dewatering control will not be required for this project.

Best Management Practices (BMPs) to be used:

- None Required

11-MAINTAIN BEST MANAGEMENT PRACTICES

BMPs will be inspected and maintained after storms and during construction.

12-MANAGE THE PROJECT

This SWPPP will be implemented at all times and will be modified whenever there is a significant change to the site conditions. The Erosion control BMPs will be implemented in the following sequence:

1. Mark the clearing limits.
2. Establish staging areas for storage and handling polluted materials and BMPs.
3. Install sediment control BMPs.
4. Hand grade and install stabilization measure for disturbed areas
5. Maintain BMPs until final site stabilization, at which time they may be removed.

13-PROTECT ON-SITE STORMWATER BMPS

On-site storm water BMPs, existing and proposed, will be protected at all times from siltation and compaction during construction. The approved plans have both construction sequencing and appropriate SWPPP BMPs to minimize the risk to storm water BMPs.

Best Management Practices (BMPs) to be used:

- None Required

Appendix B

Geotechnical Report

Infiltration Feasibility and Limited Geotechnical Report

Proposed Parking Lot Expansion and Restroom
Jensen Park

7801 Jensen Farm Lane
Arlington, WA 98223

Prepared For:

TerraVista NW, LLC

3204 Smokey Point Drive, Suite 207
Arlington, WA 98223

Attn: Mr. Eric Scott



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August 9, 2023
Project No. 23-2025

TerraVista NW, LLC
3204 Smokey Point Drive, Suite 207
Arlington, WA 98223

Attention: Mr. Eric Scott

Regarding: Infiltration Feasibility and Limited Geotechnical Report
Proposed Parking Lot Expansion and Restroom
Jensen Park
7801 Jensen Farm Lane
Arlington, WA 98223
Parcel No. 00875500099900

Dear Mr. Scott,

GeoTest Services, Inc. [GeoTest] is pleased to submit the following report summarizing the results of our infiltration feasibility and limited geotechnical engineering evaluation for the proposed parking lot expansion and restroom additions to Jensen Park in Arlington, WA (see *Vicinity Map*, Figure 1). This report has been prepared in general accordance with the terms and conditions established in our services agreement dated May 3, 2023 and authorized by yourself.

GeoTest appreciates the opportunity to provide geotechnical services on this project and look forward to assisting you during the construction phase. Should you have any further questions regarding the information contained within the report, or if we may be of service in other regards, please contact the undersigned.

Respectfully,
GeoTest Services, Inc.

Coire McCabe, L.G.
Staff Geologist



Gerry D. Bautista, Jr., P.E.
Project Geotechnical Engineer

Enclosure: Infiltration Feasibility and Limited Geotechnical Report



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PURPOSE AND SCOPE OF SERVICES

The purpose of this evaluation is to establish general subsurface conditions beneath the site from which conclusions and recommendations pertaining to project design can be formulated. Our scope of services includes the following tasks:

- Explore soil and groundwater conditions underlying the site by advancing three test pit explorations at predetermined locations using a track-mounted excavator provided by the City of Arlington.
- Perform laboratory testing on representative samples to classify and evaluate the engineering characteristics of the soils encountered.
- Provide a preliminary assessment of the on-site infiltration capability based on USDA textural classification based on the *Stormwater Management Manual of Western Washington [Manual]*. This is the manual currently adopted by the City of Arlington.
- Provide a written report containing a description of subsurface conditions and exploration logs. The findings and recommendations in this report pertain to site preparation and earthwork, fill and compaction, seismic design, foundation recommendations, infiltration feasibility, temporary and permanent slopes, pavement sections, geotechnical consultation, and construction monitoring.
- Assess Geologically Hazardous Areas (if present) per Arlington Municipal Code (AMC).

PROJECT DESCRIPTION

GeoTest understands that the City of Arlington is planning on expanding the parking area and erecting a semi-permanent, prefabricated restroom facility on the southern portion of the park, near the current parking area. The extent of the parking lot expansion and location/type of the proposed restroom structure was not determined at the time this report was written. The City of Arlington is requesting information regarding infiltration feasibility, site and stripping recommendations, foundation recommendations for the proposed restroom building (if applicable), and pavement subgrade preparation.

SITE CONDITIONS

This section includes a description of the general surface and subsurface conditions observed at the project site during the time of our field investigation. Interpretations of site conditions are based on a review of available information, site reconnaissance, subsurface explorations, laboratory testing, and previous experience in the project vicinity.

Surface Conditions

The project area currently contains an open public park and is generally flat with less than 5 feet of elevation change across the site. The park is located on the north side of Jensen Farm Lane in Arlington, just east of Kent Prairie Elementary School. The subject property is surrounded by residential housing, but also borders Portage Creek to the north and Jensen Farm Lane to the south. Empty grass fields with a few sparse deciduous trees make up most of the project area, but the site also contains walking paths, a gazebo, picnic benches, and a playground. A small parking lot sits in the southwestern corner of the park and consists of approximately six parking stalls.



Images 1 and 2: Grassy landscape north of the existing parking lot, facing north (Image 1). Existing playground and gazebo in the central portion of Jensen Park, facing northeast (Image 2). Images 1 and 2 taken on June 23, 2023.

Subsurface Soil Conditions

Subsurface conditions were explored and documented by advancing three test pits (TP-1 through TP-3) on July 11, 2023, under the direction of a Licensed Geologist. Soils were classified in general accordance with the guidelines of the American Society for Testing and Materials (ASTM) D2487 and D2488. Approximate locations of these explorations have been plotted on the *Site and Exploration Plan* (Figure 2). A *Soil Classification System and Key* can be found as Figure 3, detailed test pit logs are presented as Figures 4 and 5, with laboratory results as Figure 6.

Test pit explorations consisted of the excavation of shallow open pits with the use of a rubber tracked excavator and operator provided by the City of Arlington. Select grab samples were obtained at approximately 2-foot intervals or upon changes in soil stratigraphy. Depths of the test pit explorations ranged to depths of approximately 7 to 10 feet below the ground surface (BGS).



Images 3 and 4: General soil sequence observed in the northwestern area of the park where uncontrolled fill sections were observed (TP-2 – Image 3). Soil sequence in the southern portion of the park near the parking lot, where native sands and gravels were observed (TP-2 – Image 4). Images 3 and 4 taken on July 11, 2023.

The on-site subsurface soils in all three test pits consisted of approximately 1 to 1.5 feet of topsoil, which was medium dense, gray, dry, gravelly, silty sand with scattered organics (grass and roots). At location TP-1, underlying the topsoil was medium dense, brown, moist, gravelly, silty sand with cobbles. At 2.5 feet BGS, a 0.5-foot-thick bed of dense, dark gray, moist, silty, very sandy gravel with cobbles and boulders, GeoTest interpreted these soils to be moderately compacted fill. From 3 to 4.5 feet BGS, a relict topsoil was observed consisting of loose, black, moist, very silty sand with trace gravel and scattered grasses. From 4.5 feet BGS to the end of the exploration at 10 feet BGS, GeoTest observed loose, black, moist, very silty sand with trace gravel with wood and organics, interpreted to be old farm soils.

At the location of TP-2, underlying the topsoil was loose, brown, moist, poorly graded sand with silt and trace gravel with occasional roots interpreted to be reworked uncontrolled fill. From 2.75 feet BGS to 5.5 feet BGS, a medium dense, dark brown, moist, sandy, very silty gravel with garbage and construction debris, which was interpreted to be uncontrolled fill. A 1-foot-thick section of medium stiff, gray, moist, gravelly, very sandy silt, was observed from 5.5 to 6.5 feet BGS. From 6.5 feet BGS to the terminal depth of 8.5 feet BGS, GeoTest observed dense, dark gray, moist, silty, very sandy gravel with abundant amounts of concrete and wood, which was interpreted as uncontrolled fill and construction debris.

At the TP-3 location, GeoTest observed approximately 1.5 feet of uncontrolled fill underlying the topsoil. This uncontrolled fill consisted of dense, brown to black, moist, silty, sandy gravel with cobbles and boulders. From a depth of 3 feet BGS to the terminal depth of 9 feet, GeoTest observed medium dense, brown to gray, moist, poorly graded sands with gravel and cobbles. GeoTest interpreted these soils to be native Marysville Sand soils.

General Geologic Conditions

Geologic information for the project site was obtained from the *Geologic map of the Arlington East quadrangle, Snohomish County, Washington* (Minard, J.P., 1985) and from the *Washington Geologic Information Portal*. According to these publications, geology within the vicinity of the project site consists of Recessional Outwash (Marysville Sand member, map unit Qvrm) and originated in the last Pleistocene. Till (map unit Qvt) is mapped atop the hillside to the southeast of the project area and also originates from Pleistocene glacial periods, also referred to as “Vashon Till.” Recessional Outwash, (Arlington Gravel member map unit Qvra) is mapped to the north of the project area and originated in the late Pleistocene period.

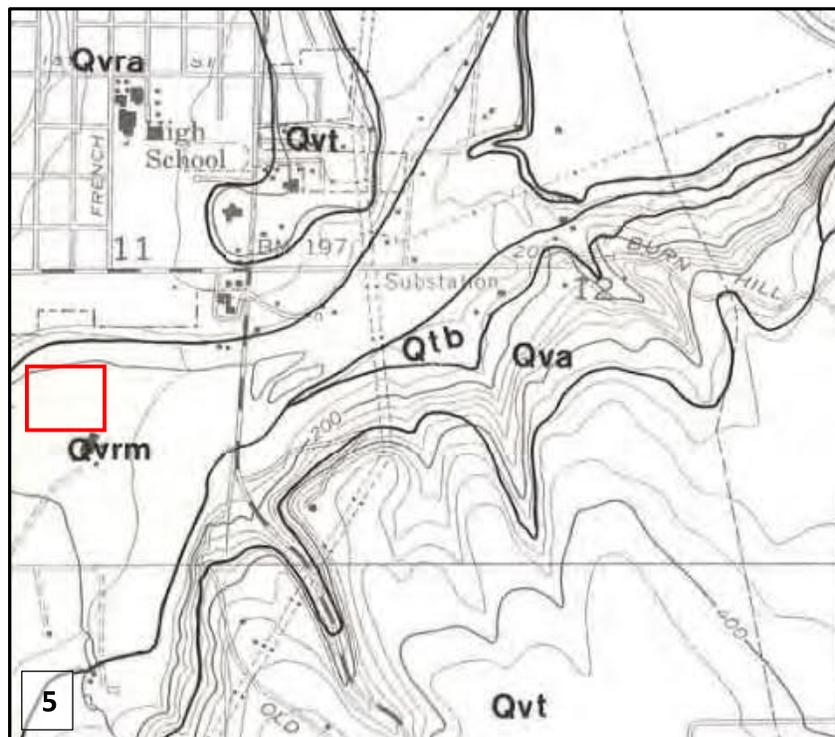


Image 5. Clip from the *Geologic map of the Arlington East 7.5-minute quadrangle, Snohomish County, Washington*, illustrating that the subject property is underlain by mapped Marysville Sand soils (map unit deposits Minard, J.P., 1985). Approximate site vicinity encapsulated by the red polygon.

During the Fraser Glaciation, glaciers advanced south to the vicinity of the project area and the depositional environment transitioned to a subglacial one. Here, the height, weight, and horizontal velocity of the advancing and receding glaciers created a grinding-like, geologic, depositional environment in which Till is created. These soils generally consist of glacially

consolidated clays, silts, sands, and gravels, in which are non-sorted, matrix supported, and rest unconformably on older geologic units. Till can also typically be described as a concrete-like mixture of sediment that is very dense or hard due to very large glaciers overriding and densifying these soils during glacial advance and retreat.

The Recessional Outwash will generally consist of beds of clean, gray, sands and/or gravels but tends to be less dense and sits stratigraphically on top of Till. Recessional Outwash is formed during the retreating of the glacier. The entire subject property is mapped as Recessional Outwash (Marysville Sand member); our field explorations indicate the site is consistent with the Maryville Sand member of the Recessional Outwash. It is GeoTest’s opinion that the flat topography on and around the site supports this interpretation.

Groundwater

At the time of our site visit on July 11, 2023, neither perched groundwater seepage nor a free groundwater condition was encountered. The groundwater conditions reported on the exploration logs are for the specific locations and dates indicated, and therefore may not be indicative of other locations and/or times. Groundwater and seepage levels are variable and groundwater conditions will fluctuate depending on local subsurface conditions, precipitation, and changes in on-site and off-site use. Seasonal groundwater monitoring is not currently part of our scope of services.

Web Soil Survey

According to the United States Department of Agriculture (USDA) Natural Resource Conservation Service (NRCS) *Web Soil Survey* website, one primary soil type is present within the vicinity of the subject property.

Table 1 USDA NRCS Soil Classifications	
Map Unit Symbol	39
Map Unit Name	Norma loam
Soil Description	Ashy loam to sandy loam
Landform	Drainageways, depressions
Parent Material	Alluvium
Land Capability Classification	5w
Erosion K Factor, Whole Soil	.28

This soil is classified as Norma loam. See Table 1 above for a summary of the USDA *Web Soil Survey* classification information. The value of K range from 0.02 to 0.69; the higher the value, the more susceptible the soil is to sheet and rill erosion by water. It is interpreted that the site has a **moderate** erosion factor based on the findings in Table 1.

GEOLOGIC HAZARDS

Based on Arlington Municipal Code (AMC) 20.93.600, *Geologic Hazard Areas* mean “areas susceptible to erosion, sliding, earthquakes, liquefaction, or other geological events.” Geologically hazardous areas shall be classified based upon the history or existence of landslides, unstable soils, steep slopes, high erosion potential or seismic hazards. In determining the significance of a geologically hazardous area the following criteria shall be used:

- (1) Potential economic, health, safety, and environmental impact related to construction in the area;
- (2) Soil type, slope, vegetative cover, and climate of the area;
- (3) Available documentation of history of soil movement, the presence of mass wastage, debris flow, rapid stream incision, stream bank erosion or undercutting by wave action, or the presence of an alluvial fan which may be subject to inundation, debris flows, or deposition of stream-transported sediments.

The following sections provide a discussion of the Geologic Hazard Areas that we observed on or in the vicinity of the subject property. After careful review of publicly available geologic literature pertaining to the area, it should be noted that geologic hazards associated with “other geologic events” such as volcanic eruptions, tsunami events, etc., were not found to be applicable to this project due to the location of the proposed development.

Erosion Hazard Areas

Per AMC 20.93.600(b.1) *Erosion Hazard Areas: are as defined by the USDA Soil Conservation Service, United States Geologic Survey, or by the Department of Ecology Coastal Zone Atlas. The following classes are high erosion hazard areas:*

- (1) *Class 3, class U (unstable) includes severe erosion hazards and rapid surface runoff areas;*
- (2) *Class 4, class UOS (unstable old slides) includes areas having severe limitations due to slope; and,*
- (3) *Class 5, class URS (unstable recent slides).*

Due to the current nature and use of the project area, the relatively flat topography, and abundance of vegetation, there is little chance for rilling or erosion. Soils on-site per the NRCS, are not considered to have a severe erosion factor. Similarly, the soils on site generally have moderate infiltration capabilities near the southern portion of the site. Based on the above AMC

criteria and other site considerations, it is GeoTest’s interpretation that **the site is not an Erosion Hazard**.

Erosion Mitigation

GeoTest recommends that the following be implemented to prevent and mitigate excessive erosion from occurring during clearing and grading for the proposed development:

- All clearing and grading activities for future residence construction will need to incorporate Best Management Practices (BMPs) for erosion control in compliance with current City of Arlington codes and standards.
- GeoTest recommends that appropriate silt fencing be incorporated into the construction plan for erosion control.
- GeoTest recommends that on-site BMPs be implemented during construction.
- Planting additional brush and vegetation within the subject site and in areas disturbed by excavation activities will help maintain near-surface stability by providing a stable root base within the near-surface soils.
- Proper drainage controls have a significant effect on erosion. All collected stormwater should be directed to an appropriate collection system.

In addition to the preceding recommendations, typical erosion control measures during construction will be required. These measures can include a rocked construction entrance or silt fencing, depending on City of Arlington regulations.

Landslide Hazard Areas

Based on AMC 20.93.600(b.2), *Landslide Hazard Areas* means “*areas subject to severe risk of landslide based on a combination of geologic, topographic and hydrologic factors. Some of these areas may be identified in the Department of Ecology Coastal Zone Atlas, or through site-specific criteria. Landslide hazard areas include any of the following:*

(A) Areas characterized by slopes greater than fifteen percent and impermeable soils (typically silt and clay) frequently interbedded with permeable granular soils (predominantly sand and gravel) or impermeable soils overlain with permeable soils or springs or groundwater seepage;

(B) Any area that has exhibited movement during the Holocene epoch (from ten thousand years ago to present) or which is underlain by mass wastage debris of that epoch;

(C) Any area potentially unstable due to rapid stream incision, stream bank erosion or undercutting by wave action;

(D) Any area located on an alluvial fan presently subject to or potentially subject to inundation by debris flows or deposition of stream-transported sediments;

(E) Any area with a slope of thirty-three percent or greater and with a vertical relief of ten or more feet except areas composed of consolidated rock;

(F) Any area with slope defined by the United States Department of Agriculture Soil Conservation Service as having a severe limitation for building site development; and

(G) Any shoreline designated or mapped as class U, UOS, or URS by the Department of Ecology Coastal Zone Atlas.

According to the *Snohomish County PDS Map Portal* there are no hillsides in the vicinity of the project area that has a slope equal to or greater than 33 percent. There are no indications from our onsite investigation or aerial reconnaissance indicating recent movement in the area. Portage Creek is contained within a vegetated conveyance and does not show signs of undercutting the gentle slope of the creek bed. Therefore, GeoTest believes that the landslide risk is negligible on the subject property and that the site **is not a Landslide Hazard Area**. Development of the project site will not need to include modifications for Landslide Hazard Areas.

Seismic Hazard Areas

Seismic Hazard Areas are typically defined as areas that, due to a combination of soil and groundwater conditions, are subject to severe risk of ground shaking, subsidence, or liquefaction of soils during earthquakes. These areas are typically underlain by soft or loose saturated soils, have a shallow groundwater table, and are typically located on the floors of river valleys.

AMC 20.93.600(b.4) describes “*Seismic Hazard Areas*” as “*areas subject to severe risk of earthquake damage as a result of seismic induced settlement, shaking, slope failure or soil liquefaction. These conditions occur in areas underlain by cohesion less soils of low density usually in association with a shallow groundwater table.*”

According to the *Washington Geologic Information Portal* and the *PDS Map Portal*, the subject property is mapped as having a **low to moderate** potential for seismic liquefaction. According to the *Geologic Information Portal* and *United States Geological Survey (USGS)*, the closest known faults are part of the Darrington-Devils Mountain Fault Zone, approximately 10 miles north of the project area. Similarly, there are mapped faults in vicinity of Mukilteo, WA approximately 20 miles southwest of the project area. These mapped faults are part of the Southern Whidbey Island Fault Zone.

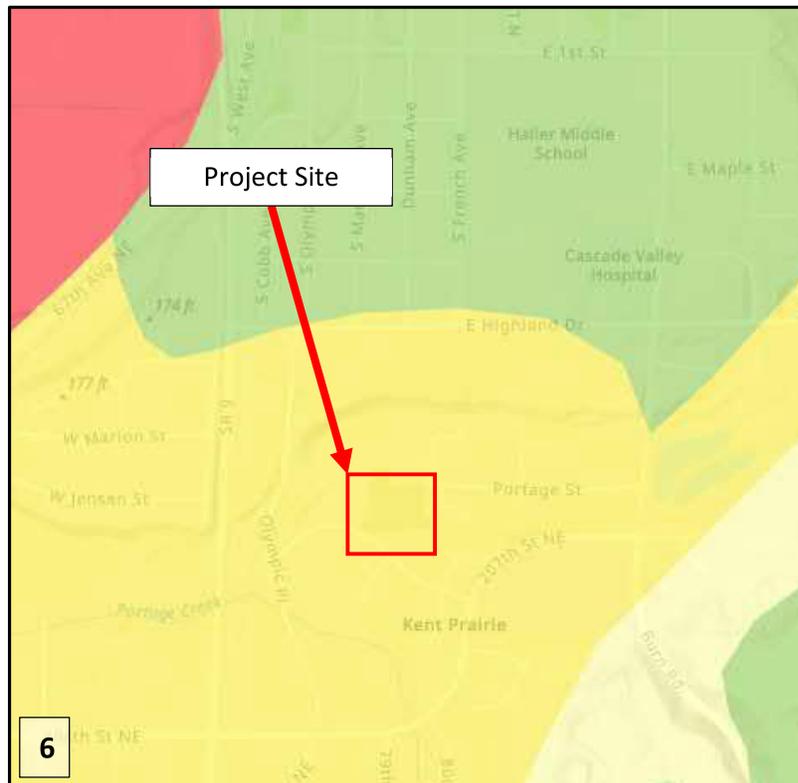


Image 6. Screenshot from the DNR *Geologic Information Portal*, in which the entire project site is considered to possess a **low to moderate** liquefaction susceptibility (shown in yellow).

Based on our understanding of the local geology, it is GeoTest’s opinion that **the subject property is not a Seismic Hazard**. Outside of compliance with current building codes, GeoTest does not recommend specific mitigations for the planned construction to address potential seismic hazards that exist in the region.

Please keep in mind that the Pacific Northwest is seismically active. Large Cascadia subduction zone earthquakes with possible magnitudes of 8 or 9 could produce ground shaking events with the potential to significantly impact the subject property regardless of the topography or subsurface conditions. Cascadia subduction zone earthquakes have occurred 6 times in the last 3,500 years with the most recent taking place in 1700, approximately 322 years ago. They have been determined to have an average recurrence interval of approximately 300 to 700 years (Atwater and Haley, 1997).

CONCLUSIONS AND RECOMMENDATIONS

Based on the evaluation of the data collected during this investigation, it is our opinion that the subsurface conditions at the site are suitable for the proposed development, provided the recommendations contained herein are incorporated into the project design.

As previously mentioned, the northern portion of the site is relatively flat and underlain by medium dense, dark gray to black, moist, gravelly, silty sand that was interpreted to be uncontrolled fill (TP-1 and TP-2). It is historically known that the subject property used to be the location of the Jensen Farm. This is supported by observed organic-rich soils and construction debris at depth. However, in the southern portion of the site near TP-3, soils consisted of medium dense, moist, poorly graded sand with gravels typical of the Marysville Sand member. The Marysville Sand member was generally observed within 3 feet of existing site grades in this portion of the property. The native Marysville Sand soils are suitable for shallow conventional foundation support when recompacted to a firm and unyielding condition with a hoe-pack compactor or large vibratory drum roller. Once stripping is completed near the existing parking lot and TP-3, the surface should be recompacted to a firm and unyielding condition. The foundations can bear directly on the prepared native subgrade, or on compacted Structural Fill placed atop prepared native subgrades. Further recommendations regarding the placement and compaction of Structural Fill can be found in the *Fill and Compaction* section of this report.

We recommend that the Owner plan for a typical stripping depth of 1 to 2 feet in the vicinity of TP-3 to remove near-surface topsoil, existing asphalt (if encountered), and organic materials. GeoTest anticipates that the proposed restroom structure will be sited on the southern half of the park area, where we only expect nominal stripping depths of about 1 to 2 feet, as observed in TP-3. That said, stripping depths are expected to vary, and it is expected that these stripping depths could be thicker due to the inconsistent thicknesses of uncontrolled fill and unknown thicknesses of asphalt. It is expected that significantly more stripping and grading will need to be done in the northern half of the site near the locations of TP-1 and TP-2, if improvements are planned for these areas. Uncontrolled fill is not recommended for reuse as Structural Fill due to the high percentage of debris and organics.

Depending on the type of prefabricated restroom structure that is selected for this project, the structure can either be placed directly on a Structural Fill pad, or on poured concrete footings supported on properly prepared native subgrade. Details regarding the proposed restroom structure for this project were not known at the time that this report was written.

Based on the native soils encountered in the exploration near the southern portion of the project area (TP-3), it appears that the subject site is suitable for stormwater infiltration. Groundwater was not encountered at the time of our explorations on July 11, 2023. Our explorations occurred during the “dry season” and are not representative of a seasonal groundwater table. GeoTest is assuming that the preliminary stormwater design will have facilities placed in the upper Marysville Sand soils, and that more than 5 vertical feet of separation will exist between the bottom of stormwater facilities and seasonal groundwater highs.

It must be understood that, at the time of this report, a development plan showing proposed stormwater facilities does not exist. Thus, it must be expected that additional design services, possibly paired with additional field work and collaboration with the project Civil Engineer, may

be needed to complete the stormwater design. GeoTest is currently not contracted to perform a Pilot Infiltration Test (PIT).

Site Preparation and Earthwork

The portions of the site proposed for foundation(s), pavement and/or sidewalks development should be prepared by removing existing pavements, topsoil, deleterious material, and significant accumulations of organics. Based on our TP-3 exploration in the southern portion of the park where improvements are planned, GeoTest anticipates approximately 1 to 2 feet of asphalt and topsoil removal to expose native soils and/or suitable existing fill soils, depending on where development occurs. As stated previously, thicker stripping depths can be expected if improvements are planned in the northern portion of the park area (vicinities of TP-1 and TP-2).

Prior to placement of any foundation elements or Structural Fill, the exposed subgrade under foundation areas should be recompact to a firm and unyielding condition. Verification of compaction can be accomplished through proof rolling with a loaded dump truck, large self-propelled vibrating roller, or similar piece of equipment applicable to the size of the excavation. The purpose of this effort is to identify loose or soft soil deposits so that, if feasible, the soil disturbed during site work can be recompact.

Proof rolling should be carefully observed by qualified geotechnical personnel. Areas exhibiting significant deflection, pumping, or over-saturation that cannot be readily compacted should be overexcavated to firm soil. Alternatively, Dynamic Cone Penetrometers or soil probing by a qualified GeoTest representative can confirm firm and unyielding conditions in localized areas if a proof roll cannot be performed. Overexcavated areas should be backfilled with compacted granular material placed in accordance with subsequent recommendations for Structural Fill. During periods of wet weather, proof rolling could damage the exposed subgrade. Under these conditions, qualified geotechnical personnel should observe subgrade conditions to determine if proof rolling is feasible.

Fill and Compaction

Structural Fill used to obtain final elevations for footings must be properly placed and compacted. In most cases, suitable, non-organic, predominantly granular soil may be used for fill material provided the material is properly moisture conditioned prior to placement and compaction, and the specified degree of compaction is obtained. Material containing topsoil, wood, trash, organic material, or construction debris is not suitable for reuse as Structural Fill and should be properly disposed off-site or placed in nonstructural areas.

Soils containing more than approximately 5 percent fines are considered moisture sensitive and are difficult to compact to a firm and unyielding condition when over the optimum moisture content by more than approximately 2 percent. The optimum moisture content is that which allows the greatest dry density to be achieved at a given level of compactive effort.

Reuse of On-Site Soil

Due to the high percentage of organics and debris observed in the uncontrolled fill sections, GeoTest does not recommend reusing the uncontrolled fill as Structural Fill.

The non-organic, native Marysville Sand soils may be suitable for reuse as Structural Fill when placed at or near optimum moisture contents, as determined by ASTM D1557 and if allowed for in the project plans and specifications. If using on-site materials, the Contractor or Owner should be prepared to manage over-optimum moisture content soils. The moisture content of the soils may be difficult to control during periods of wet weather.

During our exploration investigation on-site, in more than one instance, GeoTest observed oversized materials consisting of cobbles within the test pit excavations. It is GeoTest's opinion that there is a likelihood that cobbles will be encountered during grading and/or excavation activities. The Client and/or Owner should anticipate their presence and issues associated with them during the construction phase. Screening of oversized materials should be anticipated.

Imported Structural Fill

GeoTest recommends that imported Structural Fill consist of clean, well-graded sandy gravel, gravelly sand, or other approved naturally occurring granular material (pit run) or a well-graded crushed rock. We recommend Structural Fill for dry weather construction meet Washington State Department of Transportation (WSDOT) Standard Specification 9-03.14(2) for "Select Borrow" with the added requirement than 100 percent pass a 4-inch-square sieve.

Soil containing more than about 5 percent fines (that portion passing the U.S. No. 200 sieve) cannot consistently be compacted to a dense, non-yielding condition when the water content is greater than optimum. Accordingly, GeoTest recommends that imported Structural Fill for wet weather construction meet WSDOT Standard Specification 9-03.14(1) for "Gravel Borrow" with the added requirement that no more than 5 percent pass the U.S. No. 200 sieve. Due to wet weather or wet site conditions, soil moisture contents could be high enough that it may be very difficult to compact even 'clean' imported select granular fill to a firm and unyielding condition. Soils with over-optimum moisture contents should be scarified and dried back to more suitable moisture contents during periods of dry weather or removed and replaced with fill soils at a more suitable range of moisture contents.

Backfill and Compaction

Structural Fill should be placed in horizontal lifts. The Structural Fill must measure 8 to 10 inches in loose thickness and be thoroughly compacted. All Structural Fill placed under load bearing areas should be compacted to at least 95 percent of the maximum dry density, as determined using test method ASTM D1557. The top of the compacted Structural Fill should extend outside

all foundations and other structural improvements a minimum distance equal to the thickness of the fill. We recommend that compaction be tested after placement of each lift in the fill pad.

Wet Weather Earthwork

The fill soils on site in the upper 1 to 3 feet have a significant amount of fines content. As such, these soils may be susceptible to degradation during wet weather. If construction takes place during wet weather, GeoTest recommends that Structural Fill consist of imported, clean, well-graded sand or sand and gravel as described above. If fill is to be placed or earthwork is to be performed in wet conditions, the contractor may reduce soil disturbance by:

- Limiting the size of areas that are stripped of topsoil and left exposed
- Accomplishing earthwork in small sections
- Limiting construction traffic over unprotected soil
- Sloping excavated surfaces to promote runoff
- Limiting the size and type of construction equipment used
- Providing gravel 'working mats' over areas of prepared subgrade
- Removing wet surficial soil prior to commencing fill placement each day
- Sealing the exposed ground surface by rolling with a smooth drum compactor or rubber-tired roller at the end of each working day
- Providing up-gradient perimeter ditches or low earthen berms and using temporary sumps to collect runoff and prevent water from ponding and damaging exposed subgrades

Seismic Design Considerations

The Pacific Northwest is seismically active, and the site could be subject to movement from a moderate or major earthquake. Consequently, moderate levels of seismic shaking should be accounted for during the design life of the project, and the proposed structure should be designed to resist earthquake loading using appropriate design methodology.

For structures designed using the seismic design provisions of the 2018 International Building Code, the medium-dense Marysville Sand soils underlying the site are classified as Site Class D, according to ASCE 7-22. The structural engineer should select the appropriate design response spectrum based on Site Class D soil and the geographical location of the proposed development.

Foundation Support

Continuous or isolated spread footings founded on proof-rolled, firm and unyielding, native Marysville Sand soils or on properly compacted Structural Fill placed directly over undisturbed, firm and unyielding, native soil can provide foundation support for the proposed improvements. We recommend that qualified geotechnical personnel confirm that suitable bearing conditions have been reached prior to placement of Structural Fill or foundation formwork. To provide

proper support, GeoTest recommends that existing topsoil, existing fill, and/or loose upper portions of the native soil be removed from beneath the building foundation area.

Continuous and isolated spread footings should be founded 18 inches, minimum, below the lowest adjacent final grade for freeze/thaw protection. The footings should be sized in accordance with the structural engineer's prescribed design criteria and seismic considerations.

Allowable Bearing Capacity

Assuming the above foundation support criteria are satisfied, continuous or isolated spread footings founded directly on native, firm and unyielding, Marysville Sand soils or on compacted Structural Fill placed directly over undisturbed native soils may be proportioned using a net allowable soil bearing pressure of 1,500 pounds per square foot (psf).

The 'net allowable bearing pressure' refers to the pressure that can be imposed on the soil at foundation level. This pressure includes all dead loads, live loads, the weight of the footing, and any backfill placed above the footing. The net allowable bearing pressure may be increased by one-third for transient wind or seismic loads.

Foundation Settlement

Settlement of shallow foundations depends on foundation size and bearing pressure, as well as the strength and compressibility characteristics of the underlying soil. If construction is accomplished as recommended and at the maximum allowable soil bearing pressure, GeoTest estimates the total settlement of building foundations under static conditions to be less than one inch. Differential settlement between two adjacent load-bearing components supported on competent soil is estimated to be less than one half the total settlement.

Temporary and Permanent Slopes

The contractor is responsible for construction slope configurations and maintaining safe working conditions, including temporary excavation stability. All applicable local, state, and federal safety codes should be followed. All open cuts should be monitored during and after excavation for any evidence of instability. If instability is detected, the contractor should flatten the side slopes or install temporary shoring.

Temporary excavations in excess of 4 feet should be shored or sloped in accordance with Safety Standards for Construction Work Part N, WAC 296-155-66403. Marysville Sand soils are classified as a Type B soil according to WAC 296-155-66401 and may be sloped as steep as 1:1 (Horizontal: Vertical). All soils encountered are classified as Type C soil in the presence of groundwater seepage and may be sloped as steep as 1.5:1. Flatter slopes or temporary shoring may be required in areas where groundwater flow is present and unstable conditions develop.

Temporary slopes and excavations should be protected as soon as possible using appropriate methods to prevent erosion from occurring during periods of wet weather.

GeoTest recommends that permanent cut or fill slopes be designed for inclinations of 2H:1V or flatter. Permanent cuts or fills used in detention ponds, retention ponds, or earth slopes intended to hold water should be 3H:1V or flatter. All permanent slopes should be vegetated or otherwise protected to limit the potential for erosion as soon as practical after construction.

Utilities

Utility trenches must be properly backfilled and compacted to reduce cracking or localized loss of foundation or pavement support. Excavations for new shallow underground utilities are expected to be placed within the Marysville Sand soils or Structural Fill on the subject parcel.

Trench backfill in improved areas (beneath structures, pavements, sidewalks, etc.) should consist of Structural Fill as defined in the *Fill and Compaction* section of this report. Outside of improved areas, trench backfill may consist of reused native material provided the backfill can be compacted to the project specifications. Trench backfill should be placed and compacted in general accordance with the recommendations presented in the *Fill and Compaction* section of this report.

Surcharge loads on trench support systems due to construction equipment, stockpiled material, and vehicle traffic should be included in the design of any anticipated shoring system. The contractor should implement measures to prevent surface water runoff from entering trenches and excavations. In addition, vibration as a result of construction activity and traffic may cause caving of the trench walls.

The contractor is responsible for trench configurations. All applicable local, state, and federal safety codes should be followed. All open cuts should be monitored by the contractor during excavation for any evidence of instability. If instability is detected, the contractor should flatten the side slopes or install temporary shoring. If groundwater or groundwater seepage is present, and the trench is not properly dewatered, the soil within the trench zone may be prone to caving, channeling, and running. Trench widths may be substantially wider than under dewatered conditions.

Pavement Subgrade Preparation

GeoTest recommends that pavement sections be founded on firm and unyielding, dense to very dense native soils or on compacted Structural Fill placed directly over firm and unyielding native subgrade. Where existing fill soils are present and consist of mineral soil, it should be expected that these fill soils will be scarified to a depth of 18 inches below the bottom of pavement

elevations and recompact to the requirements for Structural Fill. Existing fill with elevated levels of organics should be overexcavated and replaced with Structural Fill.

Site grading plans should include provisions for the sloping of subgrade soils in the proposed pavement areas so that passive drainage of the pavement section(s) can proceed uninterrupted during the life of the project. The discussion below represents typical pavement sections used at similar projects in the site vicinity. The final pavement design is to be determined by the project Civil Engineer.

It should be noted that the City of Arlington may have typical pavement details and specifications for parking lots and access driveways in park areas. If these requirements are equivalent or more stringent than the recommendations presented here, the City's details and specifications should govern.

Flexible Pavement Sections – Light Duty

If utilized within light vehicle parking and lower traffic areas, GeoTest recommends a standard, or "light duty", pavement section that consists of 3 inches of Class ½-inch HMA asphalt above 2 inches of crushed surfacing top course (CSTC) meeting criteria set forth in the Washington State Department of Transportation (WSDOT) Standard Specification 9-03.9[3]. The base material for the pavement section should consist of 6 inches of crushed surface base course (CSBC). This would result in a total of 8 inches of rock (CSTC and CSBC) underlying the asphalt.

Flexible Pavement Sections – Heavy Duty

Fire truck and general heavy access or high-volume lanes will require a thicker asphalt section and should be designed using a paving section consisting of 4 inches of Class ½-inch HMA asphalt above 2 inches of CSTC meeting criteria set forth in the WSDOT Standard Specification 9-03.9[3]. The base material for the road section should consist of 6 inches of CSBC. This would result in a total of 8 inches of rock (CSTC and CSBC) underlying the asphalt.

Concrete Hardscape Sections

Concrete pavements could be used for sidewalks and other features such as parking or access areas. Design of concrete pavements is a function of concrete strength, reinforcement steel, and the anticipated loading conditions for the roads. For design purposes, a vertical modulus of subgrade reaction of 200 pounds per cubic inch (pci) should be expected for concrete elements constructed over properly prepared, firm and unyielding native soil, or on properly placed and compacted Structural Fill over properly prepared native soil. GeoTest expects that concrete pavement sections, if utilized, will be at least 8 inches thick and be founded on a minimum of 8 inches of compacted CSBC. The design of concrete access and parking areas will need to be performed by a Structural Engineer. GeoTest recommends that subgrade soils supporting

concrete pavement sections include minor grade changes to allow for passive drainage away from the pavement.

GeoTest is available to further consult, review, and/or modify our pavement section recommendations based on further discussion with the project team/owner. The above pavement sections are initial recommendations and may be accepted and/or modified by the site Civil Engineer based on the actual finished site grading elevations and/or the owner's preferences.

Stormwater Infiltration Potential

The presence of native, medium dense, poorly graded sands with gravel within our subsurface exploration at the TP-3 location (south portion of site), appear to be suitable for infiltration at depths of 3 or greater feet BGS. Silt lenses, if encountered, may present challenges during construction of the planned facilities. We recommend that silt lenses, if encountered, be removed from the footprint of the planned stormwater infiltration facilities.

As the site is underlain by Marysville Sand soils near TP-3, in situ testing, such as Pilot Infiltration Testing (PIT), can be used to confirm or augment the infiltration rates established by the grain size approach, as presented in the next section. GeoTest can perform a PIT at a later date and provide design level infiltration rates.

Design Considerations

GeoTest is assuming that the bottom of infiltration facilities will be located within the Marysville Sand soils and likely at a depth of between 3 and 5 feet below finished site grades if installed near TP-3. As such, GeoTest elected to run our sieve analyses for samples encountered 4 to 6.5 feet below existing site grades from TP-3. Based on the results presented in Table 2, it is GeoTest's opinion that the Marysville Sands are permeable and have physical characteristics that would allow it to infiltrate water. Groundwater was not encountered at depths and is not expected to impact the design of shallow infiltration facilities.

For facility bottoms within the shallow Marysville Sand soils, GeoTest recommends that the Civil Engineer use an infiltration rate of **no greater than 10 inches per hour** for preliminary design purposes. Please note that the rates given in this section are based on a soil grain size calculation. GeoTest can perform a PIT test upon the completion of Civil design services. The PIT test can confirm or augment the infiltration rates established by the grain size approach.

Table 2 Preliminary Infiltration Results Based on Grain Size Analysis		
Test Pit ID & Depth	Geologic Unit	Preliminary, Corrected K_{sat} Infiltration Rate [in/hr]
TP-3 (4 feet)	Marysville Sand	10*
TP-3 (6 feet)	Marysville Sand	10*
Notes: - K_{sat} = Initial Saturated Hydraulic Conductivity - Correction Factors Used: $CF_v = 0.4$, $CF_t = 0.40$, $CF_m = 0.9$ - Total Correction Factor = 0.144 * GeoTest does not recommend utilizing an infiltration rate greater than 10 inches per hour without first verifying with an in situ field infiltration test.		

Stormwater Treatment

The on-site stormwater facilities may require some form of pollutant pretreatment with an amended soil prior to on-site infiltration or off-site discharge. The reuse of on-site topsoil is often the most sustainable and cost-effective method for pollutant treatment purposes. Cation exchange capacities, organic contents, and pH of site subsurface soils were also tested to determine possible pollutant treatment suitability.

Cation exchange capacity, organic content, and pH tests were performed by Northwest Agricultural Consultants on two soil samples collected from the explorations shown in Table 3. A summary of the laboratory test results is presented in Table 3 below.

Table 3 Cation Exchange Capacity, Organic Content, and pH Laboratory Test Results					
Test Pit ID	Sample Depth (ft)	Geologic Unit	Cation Exchange Capacity (meq/100 grams)	Organic Content (%)	pH
TP-1	2.0	Relict Topsoil	13.4	4.23	6.0
TP-2	0.5	Topsoil	20.2	7.00	5.8

Suitability for on-site pollutant treatment is determined in accordance with SSC-6 of the *Manual*. Soils with an organic content greater than or equal to 1 percent and a cation exchange capacity of greater than or equal to 5 meq/100 grams are characterized as suitable soils for stormwater treatment. Based on the results shown in Table 3 the topsoil layers observed on-site are suitable for stormwater treatment purposes.

Geotechnical Consultation and Construction Monitoring

GeoTest recommends that we be involved in the project design review process. The purpose of the review is to verify that the recommendations presented in this report are understood and incorporated in the design and specifications.

We also recommend that geotechnical construction monitoring services be provided. These services should include observation by GeoTest personnel during Structural Fill placement, compaction activities and subgrade preparation operations to confirm that design subgrade conditions are obtained beneath the areas of improvement.

Periodic field density testing should be performed to verify that the appropriate degree of compaction is obtained. The purpose of these services is to observe compliance with the design concepts, specifications, and recommendations of this report. In the event that subsurface conditions differ from those anticipated before the start of construction, GeoTest would be pleased to provide revised recommendations appropriate to the conditions revealed during construction.

GeoTest is available to provide a full range of materials testing and special inspection during construction as required by the local building department and the International Building Code. This may include specific construction inspections on materials such as reinforced concrete, reinforced masonry, wood framing, and structural steel. These services are supported by our fully accredited materials testing laboratories.

USE OF THIS REPORT

GeoTest Services, Inc. has prepared this preliminary report for the exclusive use of TerraVista NW, LLC and their design consultants for specific application to the design of the proposed parking expansion and restroom development located at Jensen Park in Arlington, WA. Use of this report by others is at the user's sole risk. This report is not applicable to other site locations. Our services are conducted in accordance with accepted practices of the geotechnical engineering profession; no other warranty, express or implied, is made as to the professional advice included in this report.

Our site explorations indicate subsurface conditions at the dates and locations indicated. It is not warranted that these conditions are representative of conditions at other locations and times. The analyses, conclusions, and recommendations contained in this report are based on site conditions to the limited depth and time of our explorations, a geological reconnaissance of the area, and a review of previously published geological information for the site. If variations in subsurface conditions are encountered during construction that differs from those contained within this report, GeoTest should be allowed to review the recommendations and, if necessary, make revisions. If there is a substantial lapse of time between submission of this report and the start of construction, or if conditions change due to construction operations at or adjacent to the

project site, we recommend that we review this report to determine the applicability of the conclusions and recommendations contained herein.

The earthwork contractor is responsible for performing all work in conformance with all applicable WISHA/OSHA regulations. GeoTest Services, Inc. is not responsible for job site safety on this project, and this responsibility is specifically disclaimed.

Attachments:	Figure 1	Vicinity Map
	Figure 2	Site and Exploration Plan
	Figure 3	Soil Classification System and Key
	Figures 4 – 5	Log of Test Pits
	Figure 6	Grain Size Test Data
	Attachment	NW Agricultural Consultants Test Results
	Attachment	Report Limitations and Guidelines for Its Use (4 pages)

REFERENCES

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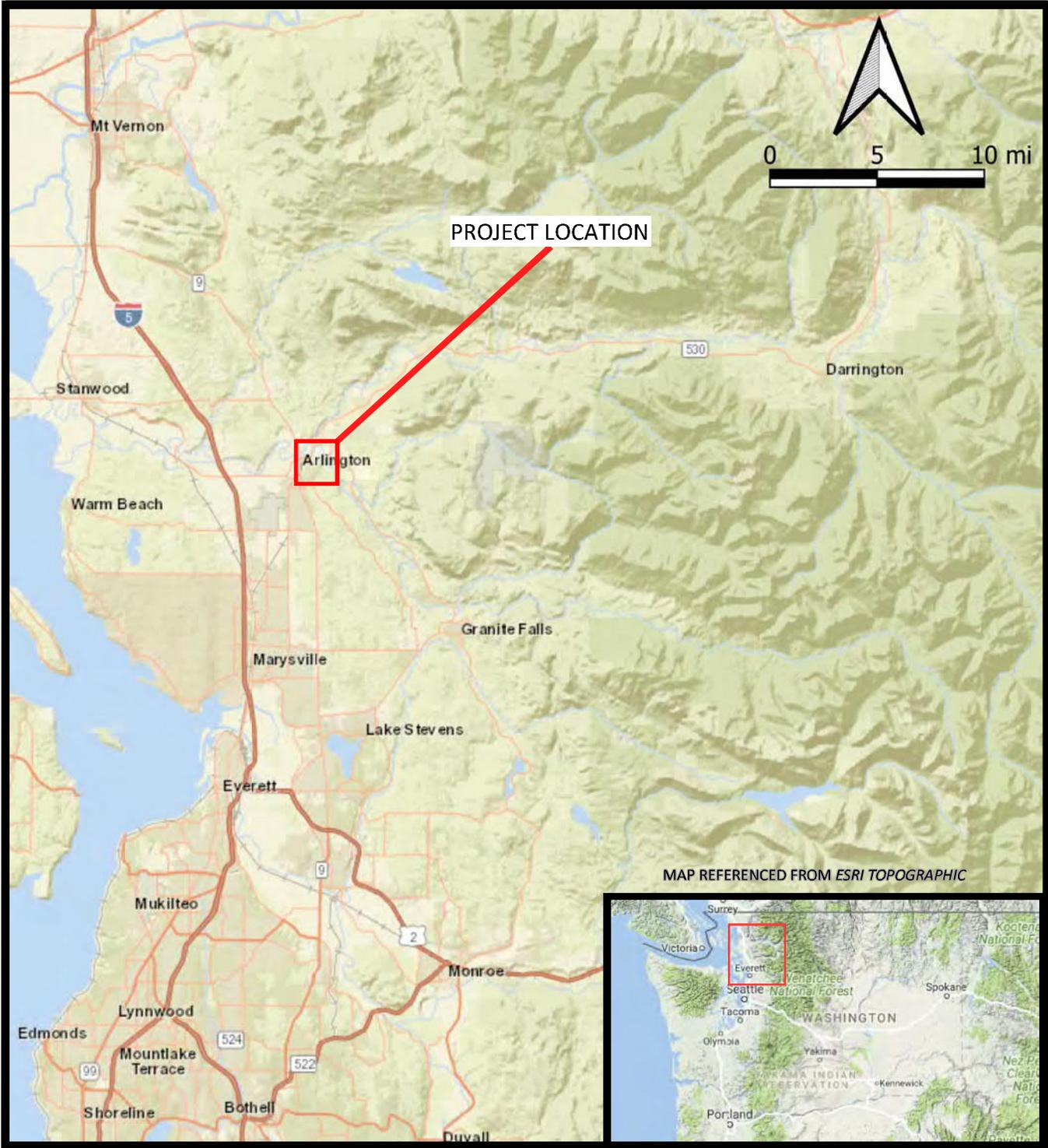
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Date: 7-6-2023

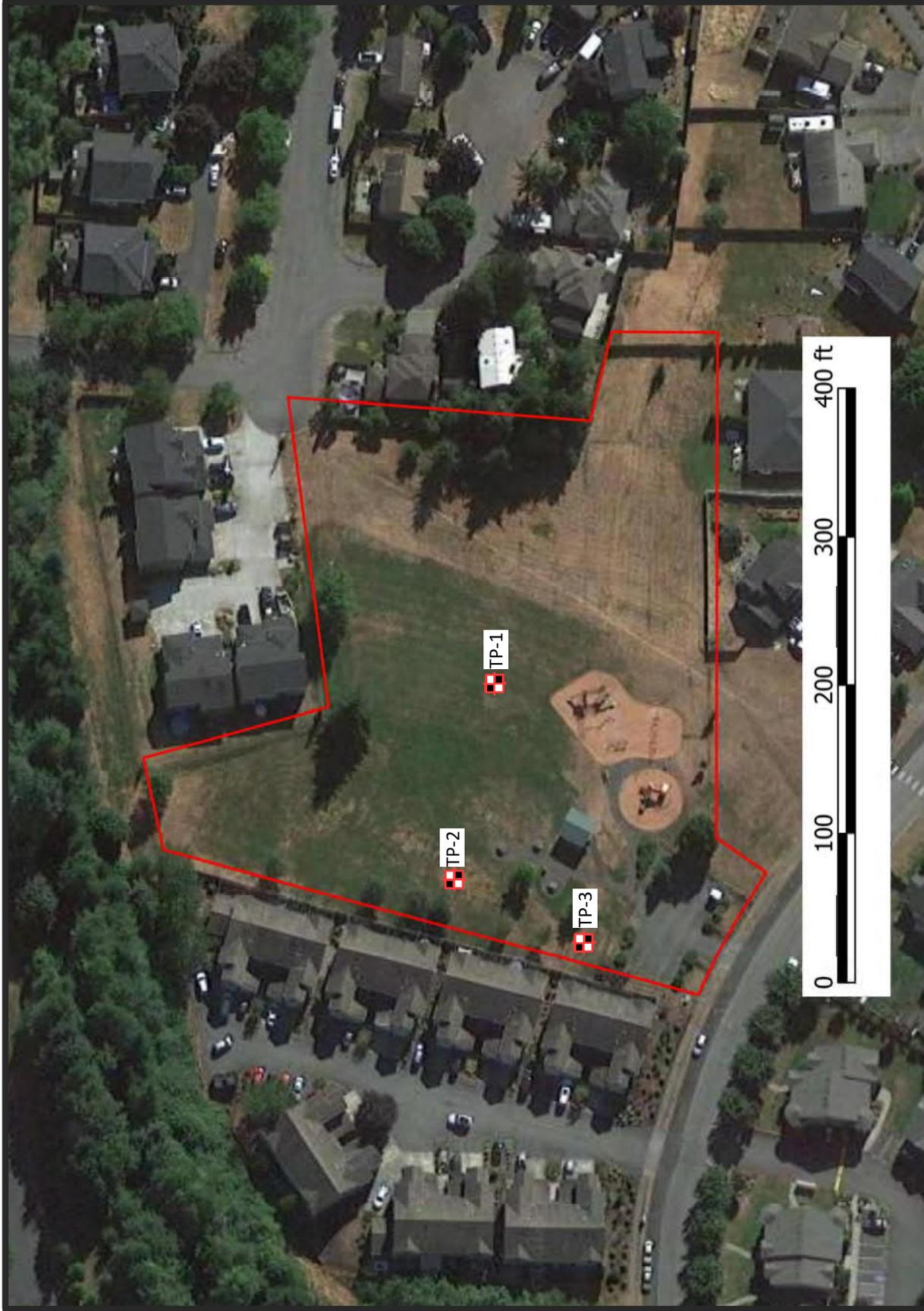
By: CM

Scale: As Shown

Project
23-2025

VICINITY MAP
JENSEN PARK - LOT EXPANSION AND RESTROOM
7801 JENSEN FARM LANE
ARLINGTON, WA 98223

Figure
1



- TP-# = Approximate Test Pit Location**
- Notes:**
- 1) Parcel shapefile sourced from Snohomish County PDS Map Portal
 - 2) Approximate project area outlined in RED
 - 3) Map image created using QGIS 3.22.6.



Date: 7-11-2023 By: CM Scale: As Shown

SITE AND EXPLORATION PLAN
JENSEN PARK - LOT EXPANSION AND RESTROOM
7801 JENSEN FARM LANE
ARLINGTON, WA 98223

Project
23-2025

Figure
2

Soil Classification System

	MAJOR DIVISIONS	CLEAN GRAVEL (Little or no fines)	GRAPHIC SYMBOL	USCS LETTER SYMBOL	TYPICAL DESCRIPTIONS ⁽¹⁾⁽²⁾
COARSE-GRAINED SOIL (More than 50% of material is larger than No. 200 sieve size)	GRAVEL AND GRAVELLY SOIL (More than 50% of coarse fraction retained on No. 4 sieve)	CLEAN GRAVEL (Little or no fines)		GW	Well-graded gravel; gravel/sand mixture(s); little or no fines
		GRAVEL WITH FINES (Appreciable amount of fines)		GP	Poorly graded gravel; gravel/sand mixture(s); little or no fines
	SAND AND SANDY SOIL (More than 50% of coarse fraction passed through No. 4 sieve)	CLEAN SAND (Little or no fines)		SW	Well-graded sand; gravelly sand; little or no fines
		SAND WITH FINES (Appreciable amount of fines)		SP	Poorly graded sand; gravelly sand; little or no fines
				SM	Silty sand; sand/silt mixture(s)
				SC	Clayey sand; sand/clay mixture(s)
FINE-GRAINED SOIL (More than 50% of material is smaller than No. 200 sieve size)	SILT AND CLAY (Liquid limit less than 50)		ML	Inorganic silt and very fine sand; rock flour; silty or clayey fine sand or clayey silt with slight plasticity	
			CL	Inorganic clay of low to medium plasticity; gravelly clay; sandy clay; silty clay; lean clay	
			OL	Organic silt; organic, silty clay of low plasticity	
	SILT AND CLAY (Liquid limit greater than 50)		MH	Inorganic silt; micaceous or diatomaceous fine sand	
			CH	Inorganic clay of high plasticity; fat clay	
			OH	Organic clay of medium to high plasticity; organic silt	
	HIGHLY ORGANIC SOIL		PT	Peat; humus; swamp soil with high organic content	

OTHER MATERIALS	GRAPHIC SYMBOL	LETTER SYMBOL	TYPICAL DESCRIPTIONS
PAVEMENT		AC or PC	Asphalt concrete pavement or Portland cement pavement
ROCK		RK	Rock (See Rock Classification)
WOOD		WD	Wood, lumber, wood chips
DEBRIS		DB	Construction debris, garbage

- Notes: 1. Soil descriptions are based on the general approach presented in the *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure)*, as outlined in ASTM D 2488. Where laboratory index testing has been conducted, soil classifications are based on the *Standard Test Method for Classification of Soils for Engineering Purposes*, as outlined in ASTM D 2487.
2. Soil description terminology is based on visual estimates (in the absence of laboratory test data) of the percentages of each soil type and is defined as follows:

- Primary Constituent: > 50% - "GRAVEL," "SAND," "SILT," "CLAY," etc.
- Secondary Constituents: > 30% and ≤ 50% - "very gravelly," "very sandy," "very silty," etc.
- > 12% and ≤ 30% - "gravelly," "sandy," "silty," etc.
- Additional Constituents: > 5% and ≤ 12% - "slightly gravelly," "slightly sandy," "slightly silty," etc.
- ≤ 5% - "trace gravel," "trace sand," "trace silt," etc., or not noted.

Drilling and Sampling Key		Field and Lab Test Data		
SAMPLE NUMBER & INTERVAL	SAMPLER TYPE	Code	Description	
	Code			
		Description		
	a	3.25-inch O.D., 2.42-inch I.D. Split Spoon	PP = 1.0	Pocket Penetrometer, tsf
	b	2.00-inch O.D., 1.50-inch I.D. Split Spoon	TV = 0.5	Torvane, tsf
	c	Shelby Tube	PID = 100	Photoionization Detector VOC screening, ppm
d	Grab Sample	W = 10	Moisture Content, %	
e	Other - See text if applicable	D = 120	Dry Density, pcf	
1	300-lb Hammer, 30-inch Drop	-200 = 60	Material smaller than No. 200 sieve, %	
2	140-lb Hammer, 30-inch Drop	GS	Grain Size - See separate figure for data	
3	Pushed	AL	Atterberg Limits - See separate figure for data	
4	Other - See text if applicable	GT	Other Geotechnical Testing	
		CA	Chemical Analysis	
Groundwater				
	Approximate water elevation at time of drilling (ATD) or on date noted. Groundwater levels can fluctuate due to precipitation, seasonal conditions, and other factors.			



Proposed Parking Lot
Expansion and Restroom
7801 Jensen Farm Lane
Arlington, WA 98223

Soil Classification System and Key

Figure
3

TP-1

SAMPLE DATA			SOIL PROFILE			GROUNDWATER
Depth (ft) 0 2 4 6 8 10 12	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: <u>Tracked Excavator</u> Ground Elevation (ft): <u>133</u> Excavated By: <u>City of Arlington/C. McCabe</u>
	1	d		[Symbol]	SM	Groundwater not encountered.
	2	d		[Symbol]	SM	
	3	d		[Symbol]	GM SM	
	4	d		[Symbol]	SM	
	5	d		[Symbol]	SM	
Test Pit Completed 07/11/23 Total Depth of Test Pit = 10.0 ft.						

TP-2

SAMPLE DATA			SOIL PROFILE			GROUNDWATER
Depth (ft) 0 2 4 6 8 10 12	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: <u>Tracked Excavator</u> Ground Elevation (ft): <u>132</u> Excavated By: <u>City of Arlington/C. McCabe</u>
	6	d		[Symbol]	SM	Groundwater not encountered.
	7	d		[Symbol]	SP- SM	
	8	d	W = 11 GS	[Symbol]	SM	
	9	d		[Symbol]	ML	
	10	d		[Symbol]	GM	
Test Pit Completed 07/11/23 Total Depth of Test Pit = 8.5 ft.						

Notes: Approximate Elevation Obtained from Snohomish County PDS Map Portal



Proposed Parking Lot
Expansion and Restroom
7801 Jensen Farm Lane
Arlington, WA 98223

Log of Test Pits

Figure
4

TP-3

SAMPLE DATA		SOIL PROFILE			GROUNDWATER		
Depth (ft) 0 2 4 6 8 10 12	Sample Number & Interval	Sampler Type	Test Data	Graphic Symbol	USCS Symbol	Excavation Method: <u>Tracked Excavator</u> Ground Elevation (ft): <u>132</u> Excavated By: <u>City of Arlington/C. McCabe</u>	Groundwater not encountered.
	11	d			SM	Medium dense, tan, dry, gravelly, silty SAND with grass and roots (Topsoil)	
	12	d			GM	Dense, brown to black, moist, silty, sandy GRAVEL with cobbles and boulders (Fill)	
	13	d	W = 7 GS		SP	Medium dense, brown, moist, poorly graded SAND with gravel and cobbles (Weathered Marysville Sand)	
	14	d	W = 3 GS		SP	Medium dense, gray, moist, poorly graded SAND with gravel (Marysville Sand)	
15	d						
Test Pit Completed 07/11/23 Total Depth of Test Pit = 9.0 ft.							

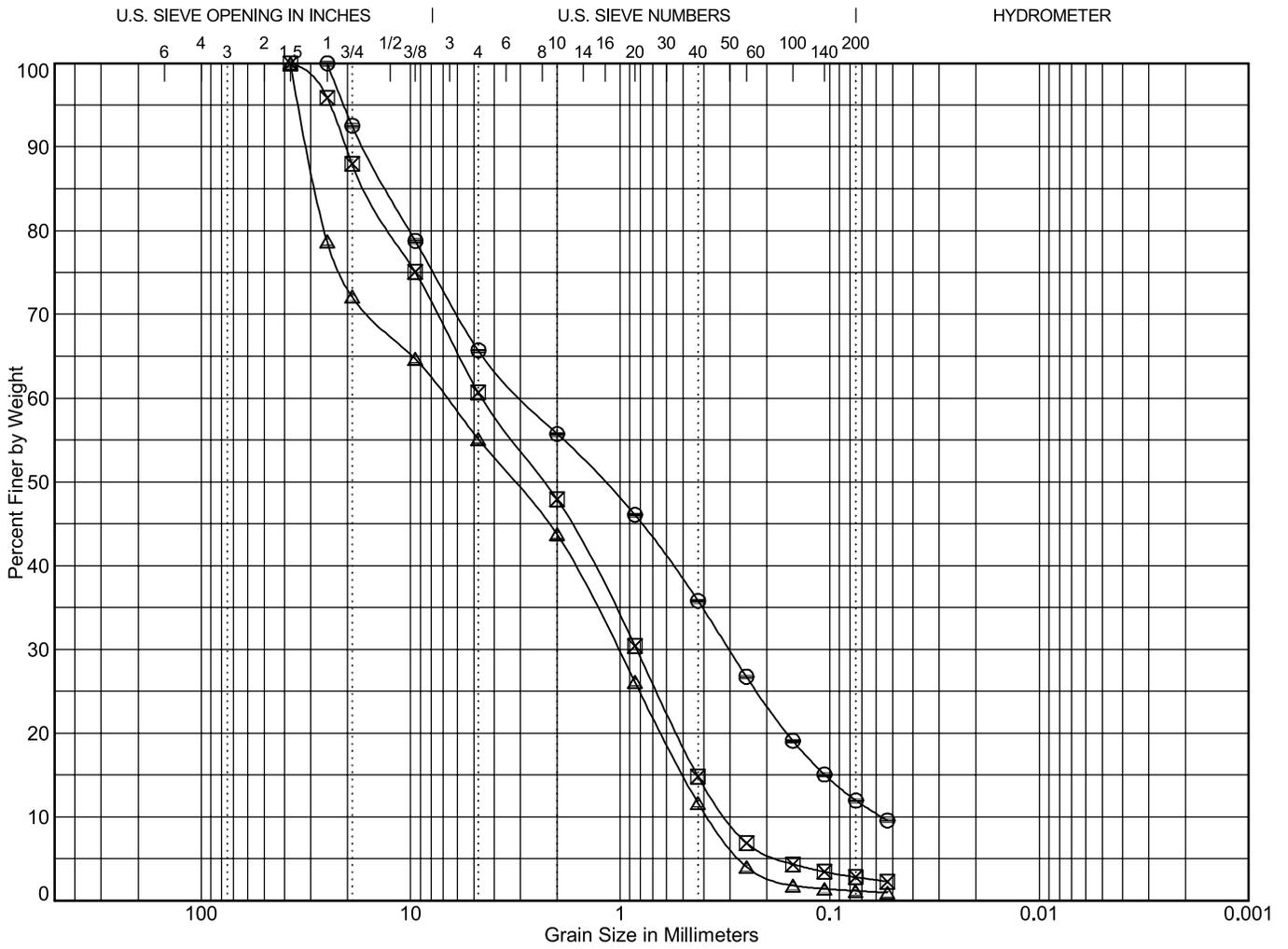
Notes: Approximate Elevation Obtained from Snohomish County PDS Map Portal



Proposed Parking Lot
Expansion and Restroom
7801 Jensen Farm Lane
Arlington, WA 98223

Log of Test Pits

Figure
5



Cobbles	Gravel		Sand			Silt or Clay
	coarse	fine	coarse	medium	fine	

Point	Depth	Classification	LL	PL	PI	C _c	C _u
⊖	TP-2 4.0	SILTY, VERY GRAVELLY SAND (SM)				0.56	51.36
⊠	TP-3 4.0	POORLY GRADED SAND with GRAVEL (SP)				0.50	14.72
⊠	TP-3 6.0	POORLY GRADED SAND with GRAVEL (SP)				0.41	17.80

Point	Depth	D ₉₀	D ₆₀	D ₅₀	D ₃₀	D ₁₀	% Coarse Gravel	% Fine Gravel	% Coarse Sand	% Medium Sand	% Fine Sand	% Fines
⊖	TP-2 4.0	16.709	2.9	1.206	0.303	0.056	7.4	26.9	10.0	19.9	23.8	11.9
⊠	TP-3 4.0	20.383	4.534	2.304	0.834	0.308	12.0	27.3	12.8	33.1	12.0	2.8
⊠	TP-3 6.0	30.996	6.753	3.217	1.027	0.379	27.9	17.0	11.4	32.1	10.5	1.2

$C_c = D_{30}^2 / (D_{60} * D_{10})$ To be well graded: $1 < C_c < 3$ and
 $C_u = D_{60} / D_{10}$ $C_u > 4$ for GW or $C_u > 6$ for SW



Proposed Parking Lot Expansion and Restroom
 7801 Jensen Farm Lane
 Arlington, WA 98223

Grain Size Test Data

Figure 6



**Northwest Agricultural
Consultants**

2545 W Falls Avenue
Kennewick, WA 99336
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www.nwag.com
lab@nwag.com

PAP-Accredited



GeoTest Services Inc.
741 Marine Drive
Bellingham, WA 98225

Report: 64430-1-1
Date: July 13, 2023
Project No: 23-2025
Project Name: Jensen Park

Sample ID	pH	Organic Matter	Cation Exchange Capacity
TP-1 @ 2.0'	6.0	4.23%	13.4 meq/100g
TP-2 @ 0.5'	5.8	7.00%	20.2 meq/100g
Method	SM 4500-H⁺ B	ASTM D2974	EPA 9081



REPORT LIMITATIONS AND GUIDELINES FOR ITS USE¹

Subsurface issues may cause construction delays, cost overruns, claims, and disputes. While you cannot eliminate all such risks, you can manage them. The following information is provided to help:

Geotechnical Services are Performed for Specific Purposes, Persons, and Projects

At GeoTest our geotechnical engineers and geologists structure their services to meet specific needs of our clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of an owner, a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared solely for the client. No one except you should rely on your geotechnical engineer who prepared it. And no one – not even you – should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report is Based on a Unique Set of Project-Specific Factors

GeoTest's geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the clients goals, objectives, and risk management preferences; the general nature of the structure involved its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless GeoTest, who conducted the study specifically states otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.



Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed, for example, from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed construction,
- alterations in drainage designs; or
- composition of the design team; the passage of time; man-made alterations and construction whether on or adjacent to the site; or by natural alterations and events, such as floods, earthquakes or groundwater fluctuations; or project ownership.

Always inform GeoTest's geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.

Subsurface Conditions Can Change

This geotechnical or geologic report is based on conditions that existed at the time the study was performed. Do not rely on the findings and conclusions of this report, whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. Always contact GeoTest before applying the report to determine if it is still relevant. A minor amount of additional testing or analysis will help determine if the report remains applicable.

Most Geotechnical and Geologic Findings are Professional Opinions

Our site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. GeoTest's engineers and geologists review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ – sometimes significantly – from those indicated in your report. Retaining GeoTest who developed this report to provide construction observation is the most effective method of managing the risks associated with anticipated or unanticipated conditions.



A Report's Recommendations are Not Final

Do not over-rely on the construction recommendations included in this report. Those recommendations are not final, because geotechnical engineers or geologists develop them principally from judgment and opinion. GeoTest's geotechnical engineers or geologists can finalize their recommendations only by observing actual subsurface conditions revealed during construction. GeoTest cannot assume responsibility or liability for the report's recommendations if our firm does not perform the construction observation.

A Geotechnical Engineering or Geologic Report may be Subject to Misinterpretation

Misinterpretation of this report by other design team members can result in costly problems. Lower that risk by having GeoTest confer with appropriate members of the design team after submitting the report. Also, we suggest retaining GeoTest to review pertinent elements of the design teams plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having GeoTest participate in pre-bid and preconstruction conferences, and by providing construction observation.

Do not Redraw the Exploration Logs

Our geotechnical engineers and geologists prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors of omissions, the logs included in this report should never be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable; but recognizes that separating logs from the report can elevate risk.

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, but preface it with a clearly written letter of transmittal. In that letter, consider advising the contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with GeoTest and/or to conduct additional study to obtain the specific types of information they need or prefer. A pre-bid conference can also be valuable. Be sure contractors have sufficient time to perform additional study. Only then might you be in a position to give contractors the best information available, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.



In addition, it is recommended that a contingency for unanticipated conditions be included in your project budget and schedule.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering or geology is far less exact than other engineering disciplines. This lack of understanding can create unrealistic expectations that can lead to disappointments, claims, and disputes. To help reduce risk, GeoTest includes an explanatory limitations section in our reports. Read these provisions closely. Ask questions and we encourage our clients or their representative to contact our office if you are unclear as to how these provisions apply to your project.

Environmental Concerns Are Not Covered in this Geotechnical or Geologic Report

The equipment, techniques, and personnel used to perform an environmental study differ significantly from those used to perform a geotechnical or geologic study. For that reason, a geotechnical engineering or geologic report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated containments, etc. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk management guidance. Do not rely on environmental report prepared for some one else.

Obtain Professional Assistance to Deal with Biological Pollutants

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts biological pollutants from growing on indoor surfaces. Biological pollutants includes but is not limited to molds, fungi, spores, bacteria and viruses. To be effective, all such strategies should be devised for the express purpose of prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional biological pollutant prevention consultant. Because just a small amount of water or moisture can lead to the development of severe biological infestations, a number of prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of this study, the geotechnical engineer or geologist in charge of this project is not a biological pollutant prevention consultant; none of the services performed in connection with this geotechnical engineering or geological study were designed or conducted for the purpose of preventing biological infestations.

Appendix C

Infiltration Mat Drainage Calculations

WWHM2012
PROJECT REPORT

General Model Information

Project Name: Jensen Park Infiltration
Site Name: Jensen Park
Site Address: Jensen Farm Rd
City: Arlington
Report Date: 11/16/2023
Gage: Everett
Data Start: 1948/10/01
Data End: 2009/09/30
Timestep: 15 Minute
Precip Scale: 1.200
Version Date: 2021/08/18
Version: 4.2.18

POC Thresholds

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

Landuse Basin Data
Predeveloped Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use A B, Forest, Flat	acre 0.14
Pervious Total	0.14
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.14

Element Flows To:		
Surface	Interflow	Groundwater

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
Pervious Total	0
Impervious Land Use	acre
PARKING FLAT	0.14
Impervious Total	0.14
Basin Total	0.14

Element Flows To:

Surface	Interflow	Groundwater
Gravel Trench Bed 1	Gravel Trench Bed 1	

Routing Elements
Predeveloped Routing

Mitigated Routing

Gravel Trench Bed 1

Bottom Length:	25.00 ft.
Bottom Width:	14.00 ft.
Trench bottom slope 1:	0.001 To 1
Trench Left side slope 0:	0.001 To 1
Trench right side slope 2:	0.001 To 1
Material thickness of first layer:	2
Pour Space of material for first layer:	0.33
Material thickness of second layer:	0
Pour Space of material for second layer:	0
Material thickness of third layer:	0
Pour Space of material for third layer:	0
Infiltration On	
Infiltration rate:	10
Infiltration safety factor:	1
Total Volume Infiltrated (ac-ft.):	26.455
Total Volume Through Riser (ac-ft.):	0.001
Total Volume Through Facility (ac-ft.):	26.456
Percent Infiltrated:	100
Total Precip Applied to Facility:	0
Total Evap From Facility:	0
Discharge Structure	
Riser Height:	1.9 ft.
Riser Diameter:	12 in.
Element Flows To:	
Outlet 1	Outlet 2

Gravel Trench Bed Hydraulic Table

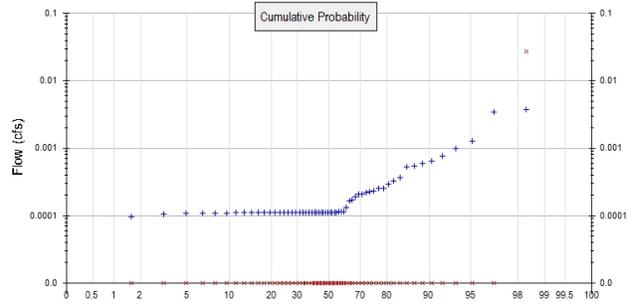
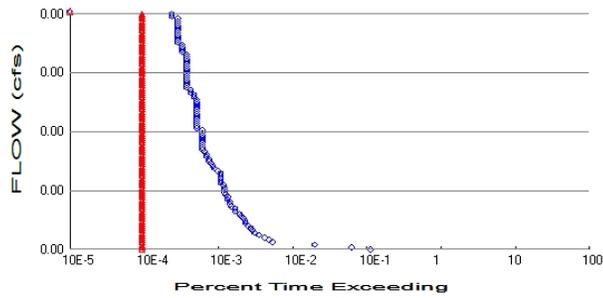
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.008	0.000	0.000	0.000
0.0222	0.008	0.000	0.000	0.081
0.0444	0.008	0.000	0.000	0.081
0.0667	0.008	0.000	0.000	0.081
0.0889	0.008	0.000	0.000	0.081
0.1111	0.008	0.000	0.000	0.081
0.1333	0.008	0.000	0.000	0.081
0.1556	0.008	0.000	0.000	0.081
0.1778	0.008	0.000	0.000	0.081
0.2000	0.008	0.000	0.000	0.081
0.2222	0.008	0.000	0.000	0.081
0.2444	0.008	0.000	0.000	0.081
0.2667	0.008	0.000	0.000	0.081
0.2889	0.008	0.000	0.000	0.081
0.3111	0.008	0.000	0.000	0.081
0.3333	0.008	0.000	0.000	0.081
0.3556	0.008	0.000	0.000	0.081
0.3778	0.008	0.001	0.000	0.081
0.4000	0.008	0.001	0.000	0.081
0.4222	0.008	0.001	0.000	0.081
0.4444	0.008	0.001	0.000	0.081
0.4667	0.008	0.001	0.000	0.081
0.4889	0.008	0.001	0.000	0.081
0.5111	0.008	0.001	0.000	0.081

0.5333	0.008	0.001	0.000	0.081
0.5556	0.008	0.001	0.000	0.081
0.5778	0.008	0.001	0.000	0.081
0.6000	0.008	0.001	0.000	0.081
0.6222	0.008	0.001	0.000	0.081
0.6444	0.008	0.001	0.000	0.081
0.6667	0.008	0.001	0.000	0.081
0.6889	0.008	0.001	0.000	0.081
0.7111	0.008	0.001	0.000	0.081
0.7333	0.008	0.001	0.000	0.081
0.7556	0.008	0.002	0.000	0.081
0.7778	0.008	0.002	0.000	0.081
0.8000	0.008	0.002	0.000	0.081
0.8222	0.008	0.002	0.000	0.081
0.8444	0.008	0.002	0.000	0.081
0.8667	0.008	0.002	0.000	0.081
0.8889	0.008	0.002	0.000	0.081
0.9111	0.008	0.002	0.000	0.081
0.9333	0.008	0.002	0.000	0.081
0.9556	0.008	0.002	0.000	0.081
0.9778	0.008	0.002	0.000	0.081
1.0000	0.008	0.002	0.000	0.081
1.0222	0.008	0.002	0.000	0.081
1.0444	0.008	0.002	0.000	0.081
1.0667	0.008	0.002	0.000	0.081
1.0889	0.008	0.002	0.000	0.081
1.1111	0.008	0.002	0.000	0.081
1.1333	0.008	0.003	0.000	0.081
1.1556	0.008	0.003	0.000	0.081
1.1778	0.008	0.003	0.000	0.081
1.2000	0.008	0.003	0.000	0.081
1.2222	0.008	0.003	0.000	0.081
1.2444	0.008	0.003	0.000	0.081
1.2667	0.008	0.003	0.000	0.081
1.2889	0.008	0.003	0.000	0.081
1.3111	0.008	0.003	0.000	0.081
1.3333	0.008	0.003	0.000	0.081
1.3556	0.008	0.003	0.000	0.081
1.3778	0.008	0.003	0.000	0.081
1.4000	0.008	0.003	0.000	0.081
1.4222	0.008	0.003	0.000	0.081
1.4444	0.008	0.003	0.000	0.081
1.4667	0.008	0.003	0.000	0.081
1.4889	0.008	0.003	0.000	0.081
1.5111	0.008	0.004	0.000	0.081
1.5333	0.008	0.004	0.000	0.081
1.5556	0.008	0.004	0.000	0.081
1.5778	0.008	0.004	0.000	0.081
1.6000	0.008	0.004	0.000	0.081
1.6222	0.008	0.004	0.000	0.081
1.6444	0.008	0.004	0.000	0.081
1.6667	0.008	0.004	0.000	0.081
1.6889	0.008	0.004	0.000	0.081
1.7111	0.008	0.004	0.000	0.081
1.7333	0.008	0.004	0.000	0.081
1.7556	0.008	0.004	0.000	0.081
1.7778	0.008	0.004	0.000	0.081
1.8000	0.008	0.004	0.000	0.081

1.8222	0.008	0.004	0.000	0.081
1.8444	0.008	0.004	0.000	0.081
1.8667	0.008	0.005	0.000	0.081
1.8889	0.008	0.005	0.000	0.081
1.9111	0.008	0.005	0.012	0.081
1.9333	0.008	0.005	0.064	0.081
1.9556	0.008	0.005	0.138	0.081
1.9778	0.008	0.005	0.229	0.081
2.0000	0.008	0.005	0.333	0.081

Analysis Results

POC 1



+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1

Total Pervious Area: 0.14
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1

Total Pervious Area: 0
Total Impervious Area: 0.14

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.000161
5 year	0.000349
10 year	0.000559
25 year	0.000976
50 year	0.001443
100 year	0.002093

Flow Frequency Return Periods for Mitigated. POC #1

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

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.000	0.000
1950	0.000	0.000
1951	0.000	0.000
1952	0.000	0.000
1953	0.000	0.000
1954	0.001	0.000
1955	0.001	0.000
1956	0.000	0.000
1957	0.000	0.000
1958	0.000	0.000

1959	0.000	0.000
1960	0.000	0.000
1961	0.001	0.027
1962	0.000	0.000
1963	0.000	0.000
1964	0.000	0.000
1965	0.000	0.000
1966	0.000	0.000
1967	0.000	0.000
1968	0.000	0.000
1969	0.000	0.000
1970	0.000	0.000
1971	0.001	0.000
1972	0.000	0.000
1973	0.000	0.000
1974	0.000	0.000
1975	0.000	0.000
1976	0.000	0.000
1977	0.000	0.000
1978	0.000	0.000
1979	0.000	0.000
1980	0.000	0.000
1981	0.000	0.000
1982	0.000	0.000
1983	0.000	0.000
1984	0.000	0.000
1985	0.000	0.000
1986	0.001	0.000
1987	0.001	0.000
1988	0.000	0.000
1989	0.000	0.000
1990	0.000	0.000
1991	0.000	0.000
1992	0.000	0.000
1993	0.000	0.000
1994	0.000	0.000
1995	0.000	0.000
1996	0.001	0.000
1997	0.003	0.000
1998	0.000	0.000
1999	0.000	0.000
2000	0.000	0.000
2001	0.000	0.000
2002	0.000	0.000
2003	0.000	0.000
2004	0.000	0.000
2005	0.000	0.000
2006	0.004	0.000
2007	0.000	0.000
2008	0.000	0.000
2009	0.000	0.000

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.0037	0.0274
2	0.0035	0.0000
3	0.0013	0.0000

4	0.0010	0.0000
5	0.0008	0.0000
6	0.0006	0.0000
7	0.0006	0.0000
8	0.0005	0.0000
9	0.0005	0.0000
10	0.0004	0.0000
11	0.0003	0.0000
12	0.0003	0.0000
13	0.0003	0.0000
14	0.0003	0.0000
15	0.0002	0.0000
16	0.0002	0.0000
17	0.0002	0.0000
18	0.0002	0.0000
19	0.0002	0.0000
20	0.0002	0.0000
21	0.0002	0.0000
22	0.0002	0.0000
23	0.0001	0.0000
24	0.0001	0.0000
25	0.0001	0.0000
26	0.0001	0.0000
27	0.0001	0.0000
28	0.0001	0.0000
29	0.0001	0.0000
30	0.0001	0.0000
31	0.0001	0.0000
32	0.0001	0.0000
33	0.0001	0.0000
34	0.0001	0.0000
35	0.0001	0.0000
36	0.0001	0.0000
37	0.0001	0.0000
38	0.0001	0.0000
39	0.0001	0.0000
40	0.0001	0.0000
41	0.0001	0.0000
42	0.0001	0.0000
43	0.0001	0.0000
44	0.0001	0.0000
45	0.0001	0.0000
46	0.0001	0.0000
47	0.0001	0.0000
48	0.0001	0.0000
49	0.0001	0.0000
50	0.0001	0.0000
51	0.0001	0.0000
52	0.0001	0.0000
53	0.0001	0.0000
54	0.0001	0.0000
55	0.0001	0.0000
56	0.0001	0.0000
57	0.0001	0.0000
58	0.0001	0.0000
59	0.0001	0.0000
60	0.0001	0.0000
61	0.0001	0.0000

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0001	2393	2	0	Pass
0.0001	1333	2	0	Pass
0.0001	422	2	0	Pass
0.0001	113	2	1	Pass
0.0001	103	2	1	Pass
0.0001	89	2	2	Pass
0.0002	76	2	2	Pass
0.0002	66	2	3	Pass
0.0002	62	2	3	Pass
0.0002	58	2	3	Pass
0.0002	54	2	3	Pass
0.0002	50	2	4	Pass
0.0002	49	2	4	Pass
0.0003	47	2	4	Pass
0.0003	43	2	4	Pass
0.0003	41	2	4	Pass
0.0003	36	2	5	Pass
0.0003	36	2	5	Pass
0.0003	32	2	6	Pass
0.0003	31	2	6	Pass
0.0004	31	2	6	Pass
0.0004	29	2	6	Pass
0.0004	29	2	6	Pass
0.0004	27	2	7	Pass
0.0004	26	2	7	Pass
0.0004	26	2	7	Pass
0.0004	26	2	7	Pass
0.0005	25	2	8	Pass
0.0005	23	2	8	Pass
0.0005	23	2	8	Pass
0.0005	23	2	8	Pass
0.0005	23	2	8	Pass
0.0005	23	2	8	Pass
0.0005	21	2	9	Pass
0.0005	19	2	10	Pass
0.0006	18	2	11	Pass
0.0006	17	2	11	Pass
0.0006	16	2	12	Pass
0.0006	16	2	12	Pass
0.0006	15	2	13	Pass
0.0006	15	2	13	Pass
0.0006	14	2	14	Pass
0.0007	13	2	15	Pass
0.0007	13	2	15	Pass
0.0007	13	2	15	Pass
0.0007	13	2	15	Pass
0.0007	13	2	15	Pass
0.0007	13	2	15	Pass
0.0007	13	2	15	Pass
0.0008	13	2	15	Pass
0.0008	13	2	15	Pass
0.0008	11	2	18	Pass
0.0008	11	2	18	Pass

0.0008	11	2	18	Pass
0.0008	11	2	18	Pass
0.0008	11	2	18	Pass
0.0009	11	2	18	Pass
0.0009	11	2	18	Pass
0.0009	11	2	18	Pass
0.0009	11	2	18	Pass
0.0009	11	2	18	Pass
0.0009	11	2	18	Pass
0.0009	11	2	18	Pass
0.0009	11	2	18	Pass
0.0010	10	2	20	Pass
0.0010	10	2	20	Pass
0.0010	9	2	22	Pass
0.0010	9	2	22	Pass
0.0010	8	2	25	Pass
0.0010	8	2	25	Pass
0.0010	8	2	25	Pass
0.0011	8	2	25	Pass
0.0011	8	2	25	Pass
0.0011	8	2	25	Pass
0.0011	8	2	25	Pass
0.0011	8	2	25	Pass
0.0011	8	2	25	Pass
0.0011	8	2	25	Pass
0.0011	8	2	25	Pass
0.0011	8	2	25	Pass
0.0012	8	2	25	Pass
0.0012	8	2	25	Pass
0.0012	8	2	25	Pass
0.0012	8	2	25	Pass
0.0012	8	2	25	Pass
0.0012	7	2	28	Pass
0.0012	7	2	28	Pass
0.0013	7	2	28	Pass
0.0013	7	2	28	Pass
0.0013	6	2	33	Pass
0.0013	6	2	33	Pass
0.0013	6	2	33	Pass
0.0013	6	2	33	Pass
0.0013	6	2	33	Pass
0.0013	6	2	33	Pass
0.0014	6	2	33	Pass
0.0014	6	2	33	Pass
0.0014	6	2	33	Pass
0.0014	6	2	33	Pass
0.0014	6	2	33	Pass
0.0014	5	2	40	Pass
0.0014	5	2	40	Pass

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume: 0 acre-feet

On-line facility target flow: 0 cfs.

Adjusted for 15 min: 0 cfs.

Off-line facility target flow: 0 cfs.

Adjusted for 15 min: 0 cfs.

LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Gravel Trench Bed 1 POC	<input type="checkbox"/>	24.08			<input type="checkbox"/>	100.00			
Total Volume Infiltrated		24.08	0.00	0.00		100.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Passed

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

No PERLND changes have been made.

IMPLND Changes

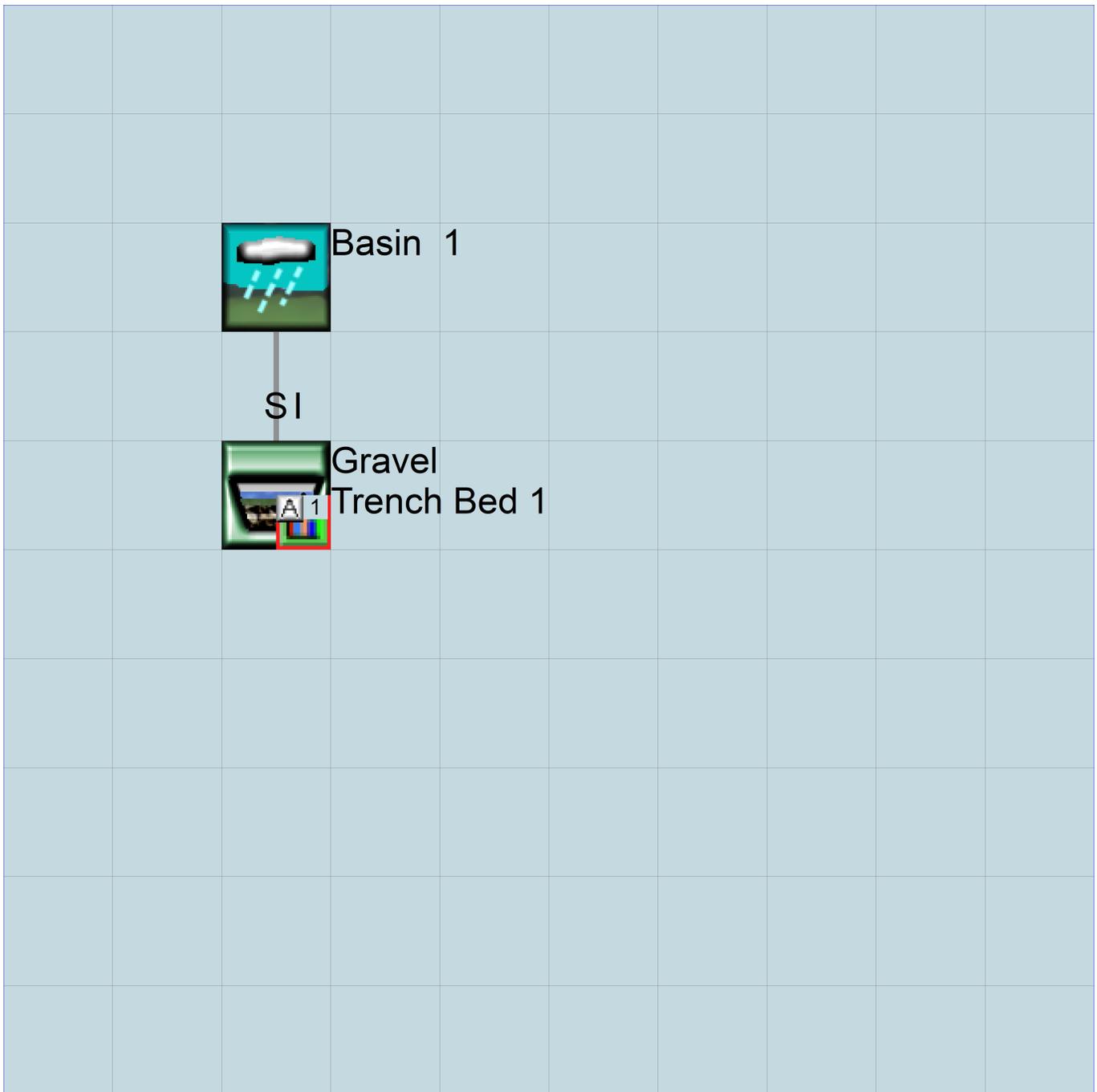
No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Basin 1
0.14ac

Mitigated Schematic



Predeveloped UCI File

RUN

GLOBAL

```
WVHM4 model simulation
START      1948 10 01      END      2009 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      Jensen Park Infiltration.wdm
MESSU    25      PreJensen Park Infiltration.MES
          27      PreJensen Park Infiltration.L61
          28      PreJensen Park Infiltration.L62
          30      POCJensen Park Infiltration1.dat
```

END FILES

OPN SEQUENCE

```
INGRP          INDELT 00:15
  PERLND        1
  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          ***
1      A/B, 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 ***
1      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 *****
1      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 ***
1 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
1 0 5 2 400 0.05 0.3 0.996
END PWAT-PARM2

PWAT-PARM3
<PLS > PWATER input info: Part 3 ***
# - # ***PETMAX PETMIN INFEXP INFILD DEEPFR BASETP AGWETP
1 0 0 2 2 0 0 0
END PWAT-PARM3

PWAT-PARM4
<PLS > PWATER input info: Part 4 ***
# - # CEPSC UZSN NSUR INTFW IRC LZETP ***
1 0.2 0.5 0.35 0 0.7 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
1 0 0 0 0 3 1 0
END PWAT-STATE1

END PERLND

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

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

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

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

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

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

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

```

END IMPLND

SCHEMATIC

<-Source->	<Name> #	<--Area-->	<-factor-->	<-Target->	MBLK	Tbl#	***
Basin	1***						
PERLND	1	0.14		COPY	501	12	
PERLND	1	0.14		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	***	ODGTFG	for each	FUNCT	for each	***
# - #	VC A1 A2 A3	ODFVFG	for each	***	ODGTFG	for each	FUNCT	for each	***	
	FG FG FG FG	possible	exit	***	possible	exit	possible	exit	***	
	* * * *	* * * *	* * * *		* * * *	* * * *	* * * *	* * * *		

END HYDR-PARM1

HYDR-PARM2

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

END HYDR-PARM2

HYDR-INIT

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

<-----><-----> <-----><-----><-----><-----><-----> <-----><-----><-----><-----><----->

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	1.2	PERLND	1 999	EXTNL	PREC
WDM	2	PREC	ENGL	1.2	IMPLND	1 999	EXTNL	PREC

```
WDM      1 EVAP      ENGL      0.76          PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP      ENGL      0.76          IMPLND   1 999 EXTNL  PETINP
```

END EXT SOURCES

EXT TARGETS

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

MASS-LINK

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

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

END MASS-LINK

END RUN

Mitigated UCI File

RUN

GLOBAL

```
WVHM4 model simulation
START      1948 10 01      END      2009 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      Jensen Park Infiltration.wdm
MESSU    25      MitJensen Park Infiltration.MES
          27      MitJensen Park Infiltration.L61
          28      MitJensen Park Infiltration.L62
          30      POCJensen Park Infiltration1.dat
```

END FILES

OPN SEQUENCE

```
INGRP          INDELT 00:15
  IMPLND        11
  RCHRES         1
  COPY           1
  COPY          501
  DISPLY         1
```

END INGRP

END OPN SEQUENCE

DISPLY

DISPLY-INF01

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

END DISPLY-INF01

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 VIRG 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 ***
11 PARKING/FLAT 1 1 1 27 0
END GEN-INFO
*** Section IWATER***

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

PRINT-INFO
<ILS > ***** Print-flags ***** PIVL PYR
# - # ATMP SNOW IWAT SLD IWG IQAL *****
11 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 ***
11 0 0 0 0 0
END IWAT-PARM1

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

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

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

```

END IMPLND

SCHEMATIC

<-Source->	<--Area-->	<-Target->	MBLK	***
<Name> #	<-factor->	<Name> #	Tbl#	***
Basin 1***				
IMPLND 11	0.14	RCHRES 1	5	

*****Routing*****

IMPLND 11	0.14	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	Gravel Trench Be-007	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	***	ODGTFG for each	FUNCT for each	***
# - #	VC A1 A2 A3	ODFVFG for each	*** possible exit	*** possible exit	possible exit
	FG FG FG FG	* * * * *	* * * * *	* * * * *	* * * * *
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	0.01	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
92 5

Depth (ft)	Area (acres)	Volume (acre-ft)	Outflow1 (cfs)	Outflow2 (cfs)	Velocity (ft/sec)	Travel Time*** (Minutes)***
0.000000	0.008035	0.000000	0.000000	0.000000		
0.022222	0.008035	0.000059	0.000000	0.081019		
0.044444	0.008035	0.000118	0.000000	0.081019		
0.066667	0.008035	0.000177	0.000000	0.081019		
0.088889	0.008035	0.000236	0.000000	0.081019		
0.111111	0.008035	0.000295	0.000000	0.081019		
0.133333	0.008035	0.000354	0.000000	0.081019		
0.155556	0.008035	0.000412	0.000000	0.081019		
0.177778	0.008035	0.000471	0.000000	0.081019		
0.200000	0.008035	0.000530	0.000000	0.081019		
0.222222	0.008035	0.000589	0.000000	0.081019		
0.244444	0.008035	0.000648	0.000000	0.081019		
0.266667	0.008035	0.000707	0.000000	0.081019		
0.288889	0.008035	0.000766	0.000000	0.081019		
0.311111	0.008035	0.000825	0.000000	0.081019		
0.333333	0.008035	0.000884	0.000000	0.081019		
0.355556	0.008036	0.000943	0.000000	0.081019		
0.377778	0.008036	0.001002	0.000000	0.081019		
0.400000	0.008036	0.001061	0.000000	0.081019		
0.422222	0.008036	0.001120	0.000000	0.081019		
0.444444	0.008036	0.001179	0.000000	0.081019		
0.466667	0.008036	0.001237	0.000000	0.081019		
0.488889	0.008036	0.001296	0.000000	0.081019		
0.511111	0.008036	0.001355	0.000000	0.081019		
0.533333	0.008036	0.001414	0.000000	0.081019		
0.555556	0.008036	0.001473	0.000000	0.081019		
0.577778	0.008036	0.001532	0.000000	0.081019		
0.600000	0.008036	0.001591	0.000000	0.081019		
0.622222	0.008036	0.001650	0.000000	0.081019		
0.644444	0.008036	0.001709	0.000000	0.081019		
0.666667	0.008036	0.001768	0.000000	0.081019		
0.688889	0.008036	0.001827	0.000000	0.081019		
0.711111	0.008036	0.001886	0.000000	0.081019		
0.733333	0.008036	0.001945	0.000000	0.081019		
0.755556	0.008036	0.002004	0.000000	0.081019		
0.777778	0.008036	0.002062	0.000000	0.081019		
0.800000	0.008036	0.002121	0.000000	0.081019		
0.822222	0.008036	0.002180	0.000000	0.081019		
0.844444	0.008036	0.002239	0.000000	0.081019		
0.866667	0.008036	0.002298	0.000000	0.081019		
0.888889	0.008036	0.002357	0.000000	0.081019		
0.911111	0.008037	0.002416	0.000000	0.081019		
0.933333	0.008037	0.002475	0.000000	0.081019		
0.955556	0.008037	0.002534	0.000000	0.081019		
0.977778	0.008037	0.002593	0.000000	0.081019		
1.000000	0.008037	0.002652	0.000000	0.081019		
1.022222	0.008037	0.002711	0.000000	0.081019		
1.044444	0.008037	0.002770	0.000000	0.081019		
1.066667	0.008037	0.002829	0.000000	0.081019		
1.088889	0.008037	0.002888	0.000000	0.081019		
1.111111	0.008037	0.002946	0.000000	0.081019		
1.133333	0.008037	0.003005	0.000000	0.081019		
1.155556	0.008037	0.003064	0.000000	0.081019		
1.177778	0.008037	0.003123	0.000000	0.081019		
1.200000	0.008037	0.003182	0.000000	0.081019		
1.222222	0.008037	0.003241	0.000000	0.081019		
1.244444	0.008037	0.003300	0.000000	0.081019		
1.266667	0.008037	0.003359	0.000000	0.081019		
1.288889	0.008037	0.003418	0.000000	0.081019		
1.311111	0.008037	0.003477	0.000000	0.081019		
1.333333	0.008037	0.003536	0.000000	0.081019		
1.355556	0.008037	0.003595	0.000000	0.081019		
1.377778	0.008037	0.003654	0.000000	0.081019		
1.400000	0.008037	0.003713	0.000000	0.081019		
1.422222	0.008037	0.003772	0.000000	0.081019		

1.444444	0.008037	0.003831	0.000000	0.081019
1.466667	0.008038	0.003890	0.000000	0.081019
1.488889	0.008038	0.003948	0.000000	0.081019
1.511111	0.008038	0.004007	0.000000	0.081019
1.533333	0.008038	0.004066	0.000000	0.081019
1.555556	0.008038	0.004125	0.000000	0.081019
1.577778	0.008038	0.004184	0.000000	0.081019
1.600000	0.008038	0.004243	0.000000	0.081019
1.622222	0.008038	0.004302	0.000000	0.081019
1.644444	0.008038	0.004361	0.000000	0.081019
1.666667	0.008038	0.004420	0.000000	0.081019
1.688889	0.008038	0.004479	0.000000	0.081019
1.711111	0.008038	0.004538	0.000000	0.081019
1.733333	0.008038	0.004597	0.000000	0.081019
1.755556	0.008038	0.004656	0.000000	0.081019
1.777778	0.008038	0.004715	0.000000	0.081019
1.800000	0.008038	0.004774	0.000000	0.081019
1.822222	0.008038	0.004833	0.000000	0.081019
1.844444	0.008038	0.004892	0.000000	0.081019
1.866667	0.008038	0.004951	0.000000	0.081019
1.888889	0.008038	0.005009	0.000000	0.081019
1.911111	0.008038	0.005068	0.012432	0.081019
1.933333	0.008038	0.005127	0.064540	0.081019
1.955556	0.008038	0.005186	0.138729	0.081019
1.977778	0.008038	0.005245	0.229424	0.081019
2.000000	0.008038	0.005304	0.333520	0.081019
2.022222	0.008039	0.005483	0.448641	0.081019

END FTABLE 1

END FTABLES

EXT SOURCES

<-Volume->	<Member>	SsysSgap	<--Mult-->	Tran	<-Target vols>	<-Grp>	<-Member->	***	
<Name>	#	<Name>	#	tem strg	<-factor-->	strg	<Name>	# #	***
WDM	2	PREC		ENGL	1.2		PERLND	1 999	EXTNL PREC
WDM	2	PREC		ENGL	1.2		IMPLND	1 999	EXTNL PREC
WDM	1	EVAP		ENGL	0.76		PERLND	1 999	EXTNL PETINP
WDM	1	EVAP		ENGL	0.76		IMPLND	1 999	EXTNL PETINP

END EXT SOURCES

EXT TARGETS

<-Volume->	<-Grp>	<-Member->	<--Mult-->	Tran	<-Volume->	<Member>	Tsys	Tgap	Amd	***	
<Name>	#	<Name>	#	<-factor-->	strg	<Name>	#	<Name>	tem strg	strg	***
RCHRES	1	HYDR	RO	1	1	1	WDM	1000	FLOW	ENGL	REPL
RCHRES	1	HYDR	O	1	1	1	WDM	1001	FLOW	ENGL	REPL
RCHRES	1	HYDR	O	2	1	1	WDM	1002	FLOW	ENGL	REPL
RCHRES	1	HYDR	STAGE	1	1	1	WDM	1003	STAG	ENGL	REPL
COPY	1	OUTPUT	MEAN	1	1	48.4	WDM	701	FLOW	ENGL	REPL
COPY	501	OUTPUT	MEAN	1	1	48.4	WDM	801	FLOW	ENGL	REPL

END EXT TARGETS

MASS-LINK

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

END MASS-LINK

END RUN

Predeveloped HSPF Message File

Mitigated HSPF Message File

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Appendix D

Operation and Maintenance

The following maintenance standards are as described in [Volume V, Section 4.6.6, Table 5.3](#) of the SWMMWW.

Table V-4.5.2(2)			
Maintenance Standards - Infiltration			
Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash & Debris	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Poisonous/Noxious Vegetation	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Contaminants and Pollution	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Rodent Holes	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
Storage Area	Sediment	Water ponding in infiltration pond after rainfall ceases and appropriate time allowed for infiltration. Treatment basins should infiltrate Water Quality Design Storm Volume within 48 hours, and empty within 24 hours after cessation of most rain events	Sediment is removed and/or facility is cleaned so that infiltration system works according to design.

		(A percolation test pit or test of facility indicates facility is only working at 90% of its designed capabilities. Test every 2 to 5 years. If two inches or more sediment is present, remove).	
Filter Bags (if applicable)	Filled with Sediment and Debris	Sediment and debris fill bag more than 1/2 full.	Filter bag is replaced or system is redesigned.
Rock Filters	Sediment and Debris	By visual inspection, little or no water flows through filter during heavy rain storms.	Gravel in rock filter is replaced.
Side Slopes of Pond	Erosion	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
Emergency Overflow Spillway and Berms over 4 feet in height.	Tree Growth	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Piping	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
Emergency Overflow Spillway	Rock Missing	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
	Erosion	See "Detention Ponds" (No. 1).	See "Detention Ponds" (No. 1).
Pre-settling Ponds and Vaults	Facility or sump filled with Sediment and/or debris	6" or designed sediment trap depth of sediment.	Sediment is removed.

Table V-4.5.2(5)			
Maintenance Standards - Catch Basins			
Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance Is Performed
General	Trash and Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%.	No Trash or debris located immediately in front of catch basin or on grate opening.
		Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe.	No trash or debris in the catch basin.
		Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height.	Inlet and outlet pipes free of trash or debris.
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within the catch basin.

	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch (Intent is to make sure no material is running into basin).	Top slab is free of holes and cracks
		Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/Bottom	Maintenance person judges that structure is unsound.	Basin replaced or repaired to design standards.
		Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Pipe is regouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.

	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening.	No vegetation blocking opening to basin.
		Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation or root growth present
	Contamination and Pollution	See "Detention Ponds" (No. 1).	No pollution present.
Catch Basin Cover	Cover Not in Place	Cover is missing or only partially in place. Any open catch basin requires maintenance.	Catch basin cover is closed
	Locking Mechanism Not Working	Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread.	Mechanism opens with proper tools.
	Cover Difficult to Remove	One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.)	Cover can be removed by one maintenance person.
Ladder	Ladder Rungs Unsafe	Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges.	Ladder meets design standards and allows maintenance person safe access.
Metal Grates (If Applicable)	Grate Opening Unsafe	Grate with opening wider than 7/8 inch.	Grate opening meets design standards.
	Trash and Debris	Trash and debris that is blocking more than 20% of grate surface inletting capacity.	Grate free of trash and debris.
	Damaged or Missing	Grate missing or broken member(s) of the grate.	Grate is in place and meets design standards.

Table V-4.5.2(18)			
Maintenance Standards - Catchbasin Inserts			
Maintenance Component	Defect	Conditions When Maintenance Is Needed	Results Expected When Maintenance is Performed
General	Sediment Accumulation	When sediment forms a cap over the insert media of the insert and/or unit.	No sediment cap on the insert media and its unit.
	Trash and Debris Accumulation	Trash and debris accumulates on insert unit creating a blockage/restriction.	Trash and debris removed from insert unit. Runoff freely flows into catch basin.
	Media Insert Not Removing Oil	Effluent water from media insert has a visible sheen.	Effluent water from media insert is free of oils and has no visible sheen.
	Media Insert Water Saturated	Catch basin insert is saturated with water and no longer has the capacity to absorb.	Remove and replace media insert.
	Media Insert-Oil Saturated	Media oil saturated due to petroleum spill that drains into catch basin.	Remove and replace media insert.
	Media Insert Use Beyond Normal Product Life	Media has been used beyond the typical average life of media insert product.	Remove and replace media at regular intervals, depending on insert product.