WETRABBIT
EXPRESS CAR WASH

7530 204th St NE
Arlington, Washington 98223

Preliminary Stormwater Site Plan

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PRELIMINARY

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Executive Summary

The project site is located along the southeast quadrant of the intersection of 204th Street NE and State Route 9 and is comprised of two Snohomish County tax parcels. Tax Parcel 310514-001-006-00 is a developed site with a property address of 7530 204th Street NE in Arlington, Washington. This parcel encompasses 0.76 acres of relatively level land with an unoccupied commercial building formerly occupied by Arlington Family Medicine located in the southeastern portion of the parcel. The building is a 3,520 square foot, one-story, wood-framed structure reportedly build in 1984. Asphalt surfaced drive lanes and parking are found to the north, west, and south of the commercial building. The development is serviced by underground utilities and includes an underground stormwater conveyance system. Vegetation includes ornamental plantings in parking lot islands and around the building, a row of large trees along the west and south property lines which appear to serve as a wind block, and a lawn south of the building. Asphalt pavements near the west and south rows of trees exhibit moderate root damage.

Tax Parcel 310514-001-010-00 is a relatively level, undeveloped site located east of and adjoining the southern portion of the above discussed developed parcel's east property line. The parcel is irregular in shape and encompasses 0.76 acres. It appears that some underground utilities may be located near the east property line. Vegetation within the undeveloped parcel primarily consists of well-developed tall grasses with dense blackberry brush along its west and north property lines.

The project consists of demolishing the existing medical office building, all existing surface and underground (utilities) site improvements. A +/- 4,920 sf Wet Rabbit Express Car Wash (conveyor type) and a +/- 450 sf canopy structure for attended, point-of-sale transactions will be constructed along with surface parking for employees, vacuum stalls, landscaping, access drive between 204th St NE and 77th Ave NE, and supporting utility infrastructure.

The project will manage stormwater runoff for both flow control and water quality per 2014 DOE requirements. The roof drainage will be collected and conveyed to the underground stormwater infiltration facility (gravel filled trench) located west of the building beneath the drive aisle. The balance of the site including the access drive on the neighboring parcel will manage stormwater runoff via multiple catch basin inlets strategically placed at low points. The runoff will then be conveyed underground via a network of storm piping. Prior to entering the infiltration facility oil control will be provided via a CPS separator. The stormwater infiltration system will infiltrate 100% of all stormwater runoff generated by the project. The native soils below the infiltration facility will complete the water quality treatment process as they meet DOE requirements with respect to organic content and cation exchange capacity (CEC). A piped overflow from the infiltration facility to the municipal system will be provided as an added precaution for large storm events.

Design Criteria:

The City of Arlington has adopted the 2014 Washington State Department of Ecology Stormwater Management Manual for Western Washington (SMMWW). The site development will result in more than 5,000 sf of new hard surfaces therefore must comply with Minimum Requirements 1-9. Applicable stormwater requirements are outlined in **Table 1** below.

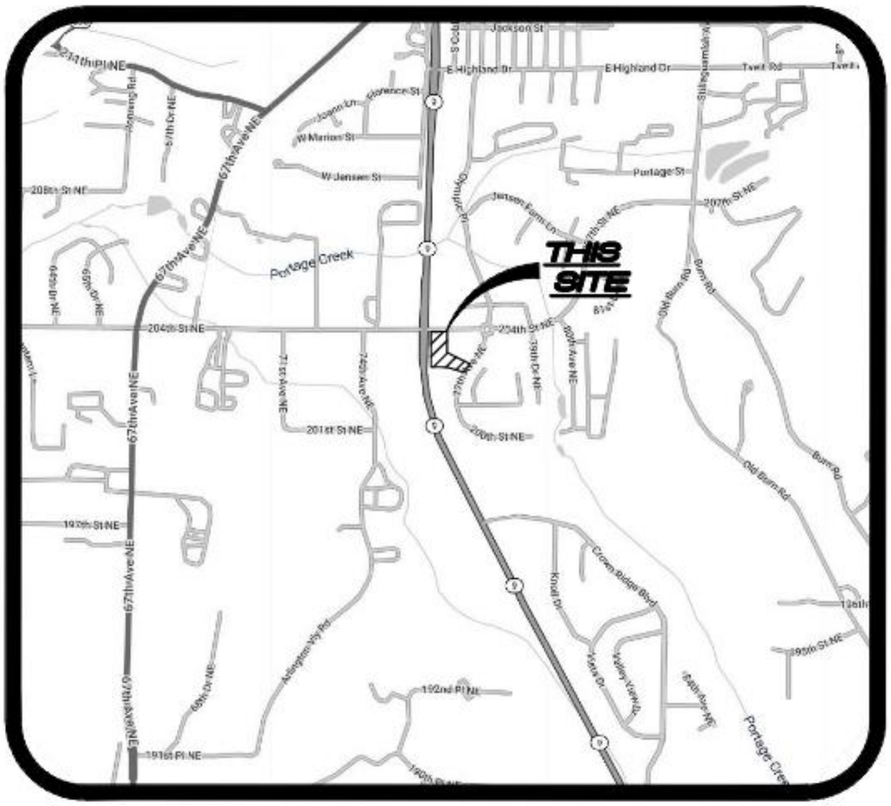
Table 1 (2014 DOE SMMWW)

Jurisdictional Requirements	
Peak Runoff Control:	Match the pre-developed discharge rates from 50% of the 2-year peak flow up through the full 50-year peak flow. Projects discharging directly to approved water bodies may omit this requirement.
Water Quality:	Upstream of detention: 91% of runoff volume Downstream of detention: Full 2-year release rate
Conveyance Design:	25-year event
Hydrologic Design Method:	Western Washington Hydrology Model (WWHM2012, updated 1/27/23) for water quality and water quantity analysis

Proposed Drainage System:
The project will manage stormwater runoff for both flow control and water quality per 2014 DOE requirements. The roof drainage will be collected and conveyed to the underground stormwater infiltration facility (gravel filled trench) located west of the building beneath the drive aisle. The balance of the site including the access drive on the neighboring parcel will manage stormwater runoff via multiple catch basin inlets strategically placed at low points. The runoff will then be conveyed underground via a network of storm piping. Prior to entering the infiltration facility oil control will be provided via a CPS separator. The stormwater infiltration system will infiltrate 100% of all stormwater runoff generated by the project. The native soils below the infiltration facility will complete the water quality treatment process as they meet DOE requirements with respect to organic content and cation exchange capacity (CEC). A piped overflow from the infiltration facility to the municipal system will be provided as an added precaution for large storm events.

Construction of the new storm drainage facilities will be in accordance with the Washington State Department of Ecology's 2014 SMMWW as required by the City of Arlington.

Section 1 – Project Overview



VICINITY MAP

NOT TO SCALE

Figure 1.0 - Site Location

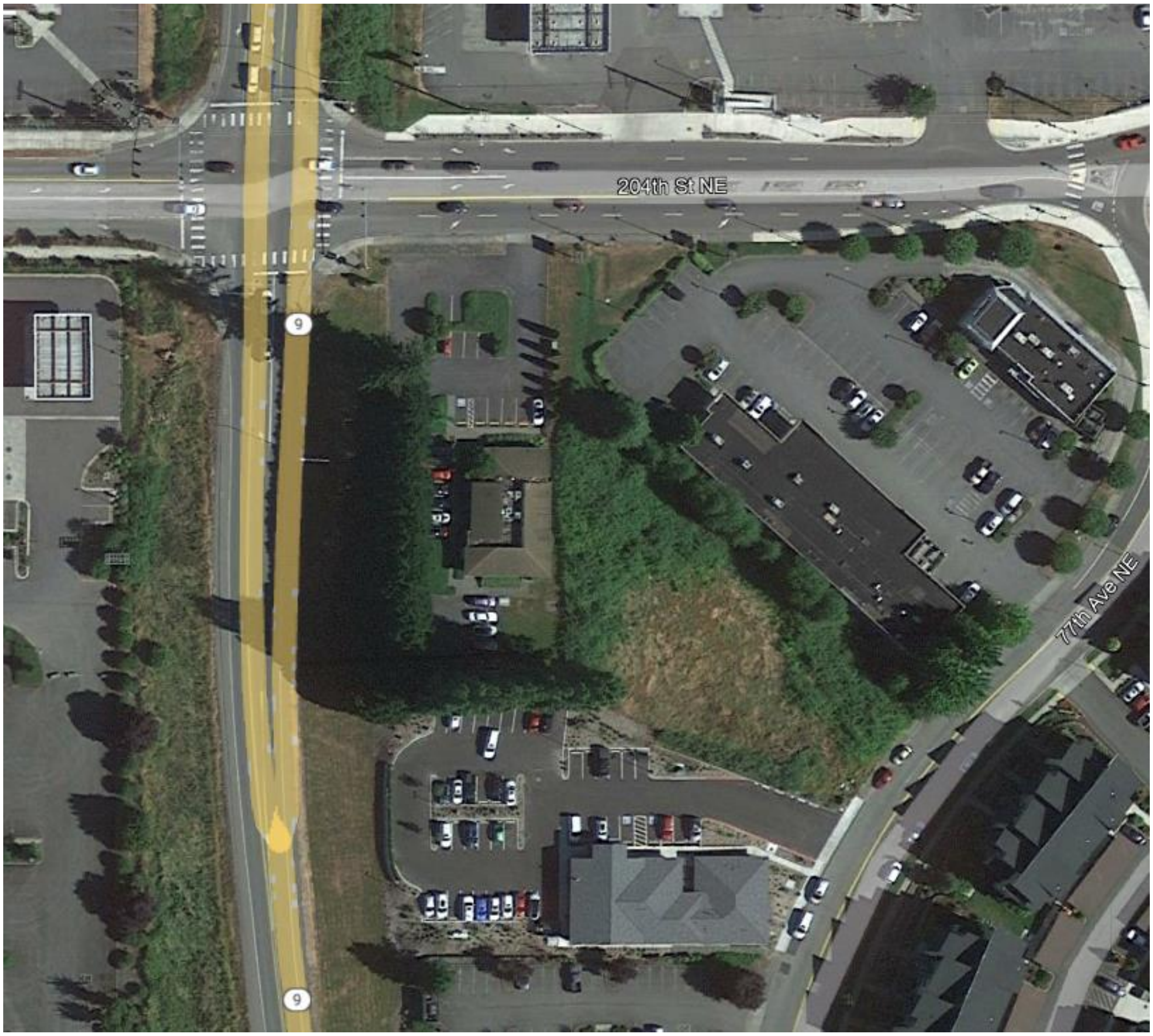


Figure 1.1 – Aerial Image (from Google Maps)

Location: 7530 204th Street NE, Arlington, Washington, 98223

Section/Township/Range: A portion of the NW ¼ of Section 14, Township 31 North, Range 5 East, W.M.

Parcel/Tax Lot: 310514-001-006-00 (0.76 AC) and 310514-001-010-00 (0.76 AC)

Disturbed Area: +/- 1.33 AC

City, County, State: Arlington, Snohomish County, Washington

Governing Agency: City of Arlington

Design Criteria: 2014 Washington State Department of Ecology Stormwater Management Manual for Western Washington (SMMWW).

Soils:

Geotechnical Report

Per the Geotechnical Engineering Report prepared by ZipperGeo, dated October 30, 2023; The subsurface evaluation completed by ZGA for this project included four borings (B-1 through B-4) and one cone penetrometer test (CPT-01). CPT-01 was completed near the center of the proposed car wash development (currently developed western parcel) and extended to a depth of about 60 feet below grade. The CPT exploration included seismic shear wave velocity measurements. Borings B-1 and B-2 were completed in the north and south portions of the western parcel's existing parking lot, respectively, and extended about 36½ feet below grade. Borings B-3 and B-4 were completed in the undeveloped eastern parcel and extended about 31½ to 36½ feet below grade. Groundwater monitoring wells were installed in borings B-1 through B-3 to evaluate changes in groundwater levels through the wet season. At the time drilling groundwater was observed in borings B-1 through B-3 about 25 to 30 below existing ground surface.

Soil conditions observed in the site explorations are consistent with normally consolidated glacial recessional outwash deposits of the Marysville Sand Member and generally consist of the following.

- Loose to medium dense sand with variable silt and silt with variable sand content in the upper 5 to 7½ feet. Soil mottling was observed in some of the samples collected in this depth range.
- From about 5 to 7½ feet down to about 15 to 17½ feet, the outwash generally consists of medium dense to very dense gravelly sand to sandy gravel with trace to some silt.
- From about 15 to 17½ feet to the maximum depth explored at 60 feet below grade, the outwash generally consists of loose to medium dense sand with trace to some silt.

Based on the results of the subsurface exploration and analysis, stormwater infiltration systems appear geotechnically feasible. A summary of grain size analysis tests relative to stormwater infiltration is provided below.

Summary of Grain Size Analysis Tests Relative to Stormwater Infiltration					
Exploration	Sample Number	Sample Depth (ft)	Soil Formation	Initial (unfactored) Saturated Hydraulic Conductivity (in/hr)	Design Infiltration Rate[2] (in/hr)
B-1	S-3	7½	Marysville Sand Member	20.2	3.6
B-1	S-4	10	Marysville Sand Member	37.1	6.7
B-1	S-5	10	Marysville Sand Member	19.3	3.5
B-2	S-2	5	Marysville Sand Member	3.8	0.7
B-2	S-3	7½	Marysville Sand Member	12.6	2.3
B-2	S-4	10	Marysville Sand Member	15.6	2.8
B-2	S-5	15	Marysville Sand Member	14.7	2.6
B-3	S-2	5	Marysville Sand Member	39.9	7.2
B-3	S-3	7½	Marysville Sand Member	2.0	0.4
B-3	S-4	10	Marysville Sand Member	4.4	0.8
B-3	S-5	15	Marysville Sand Member	4.5	0.8
B-4	S-2	5	Marysville Sand Member	11.9	2.2
B-4	S-3	7½	Marysville Sand Member	8.3	1.5
B-4	S-5	15	Marysville Sand Member	28.4	5.1
1. Includes Correction Factors: CFv = 0.5, CFt = 0.4, and CFm = 0.9					

For additional details this report is included in **Appendix C.**

Section 2 - Existing Conditions Summary

The project site is located along the southeast quadrant of the intersection of 204th Street NE and State Route 9 and is comprised of two Snohomish County tax parcels. Tax Parcel 310514-001-006-00 is a developed site with a property address of 7530 204th Street NE in Arlington, Washington. This parcel encompasses 0.76 acres of relatively level land with an unoccupied commercial building formerly occupied by Arlington Family Medicine located in the southeastern portion of the parcel. The building is a 3,520 square foot, one-story, wood-framed structure reportedly build in 1984. Asphalt surfaced drive lanes and parking are found to the north, west, and south of the commercial building. The development is serviced by underground utilities and includes an underground stormwater conveyance system. The existing stormwater management system does not appear to be connected to the municipal system, so it is assumed that the stormwater infiltrates into the underlying soils. Vegetation includes ornamental plantings in parking lot islands and around the building, a row of large trees along the west and south property lines which appear to serve as a wind block, and a lawn south of the building. Asphalt pavements near the west and south rows of trees exhibit moderate root damage.

Tax Parcel 310514-001-010-00 is a relatively level, undeveloped site located east of and adjoining the southern portion of the above discussed developed parcel's east property line. The parcel is irregular in shape and encompasses 0.76 acres. It appears that some underground utilities may be located near the east property line. Vegetation within the undeveloped parcel primarily consists of well-developed tall grasses with dense blackberry brush along its west and north property lines. Stormwater runoff appears to sheet flow from SE to NE where it either infiltrates directly into the underlying soils or to the drainage ditch along the northern property boundary.

Section 3 – Developed Conditions Summary

The project will manage stormwater runoff for both flow control and water quality per 2014 DOE requirements. The roof drainage will be collected and conveyed to the underground stormwater infiltration facility (gravel filled trench) located west of the building beneath the drive aisle. The balance of the site including the access drive on the neighboring parcel will manage stormwater runoff via multiple catch basin inlets strategically placed at low points. The runoff will then be conveyed underground via a network of storm piping. Prior to entering the infiltration facility oil control will be provided via a CPS separator. The stormwater infiltration system will infiltrate 100% of all stormwater runoff generated by the project. The native soils below the infiltration facility will complete the water quality treatment process as they meet DOE requirements with respect to organic content and cation exchange capacity (CEC). A piped overflow from the infiltration facility to the municipal system will be provided as an added precaution for large storm events.

Section 4 - Off-Site Analysis

Upstream Analysis

Due to the topography of the area, the site does not experience a significant amount of off-site run-on. The public right-of-way to the west and north of the car wash parcel are down gradient. The area west of the car wash parcel is comprised of an existing drainage ditch down gradient from parking area. South of car wash site is an existing parking area which is situated approximately 5' higher than the parking area however it is contained within curbing. The area between the two parking areas is approximately 10 – 12 feet with no significant stormwater run-on generated due to the tree canopy above. and surrounding properties along the north, south, and west sides of the site are downgradient from the project and minimal stormwater run-on is anticipated.

Downstream Analysis

This design proposes to route all runoff from target impervious surfaces generated from the project to an underground infiltration facility. The infiltration facility has been designed to infiltrate 100% of all surface water runoff. With a conservatively large trench, it is unlikely that the piped overflow from infiltration facility to the municipal system will be used. Therefore, the proposed development is not anticipated to have a significant impact to the existing downstream stormwater conveyance system.

Section 5 - Conditions and Requirements

As required by the 2014 Stormwater Management Manual for Western Washington (SWMMWW) this project is subject to full drainage review. Therefore, the storm drainage design for this project is required to comply with all nine (9) Minimum Requirements. The requirements have been met as follows:

Minimum Requirement #1: **Preparation of Stormwater Site Plans**
This project proposes to replace greater than 2,000 square feet of impervious surface; thus, Minimum requirement #1 applies and a Stormwater Site Plan must be prepared for review by the local jurisdiction.

Response: *This Storm Drainage Report has been prepared to address this requirement.*

Minimum Requirement #2: **Construction Stormwater Pollution Prevention**
All erosion and sediment control measures shall be governed by the requirements of Department of Ecology's 2014 Stormwater Management Manual for Western Washington and the General Permit for Construction Stormwater. The thirteen elements as identified in the manual and provided below will be incorporated into the TESC plans:

Element 1: *Preserve Vegetation/Mark Clearing Limits*
Element 2: *Establish Construction Access*
Element 3: *Control Flow Rates*
Element 4: *Install Sediment Controls*
Element 5: *Stabilize Soils*
Element 6: *Protect Slopes*
Element 7: *Protect Drain Inlets*
Element 8: *Stabilize Channels and Outlets*
Element 9: *Control Pollutants*
Element 10: *Control De-watering*
Element 11: *Maintain BMPs*
Element 12: *Manage the Project*
Element 13: *Protect Low Impact Development BMPs*

Response: *Erosion and sediment control measures will be implemented during construction to address the above elements as needed. See **Section 10** of this report for a complete description of the construction and erosion control strategies being implemented. A Construction SWPPP will be provided at the time of construction permit submittal.*

Minimum Requirement #3: **Source Control of Pollution**
All known, available and reasonable source control BMPs must be applied to all projects. Source control BMPs must be selected, designed, and maintained according to the 2014 SMMWW.

Response: *Source control will be provided as needed per Volume IV of the SMMWW.*

Minimum Requirement #4: **Preservation of Natural Drainage Systems and Outfalls**
Natural drainage patterns shall be maintained, and discharges from the project site shall occur at the natural location, to the maximum extent practicable. The manner by which runoff is discharged from the project site must not cause a significant adverse impact to downstream receiving waters and downgradient properties. All outfalls require energy dissipation.

Response: *The developed site will discharge to the same locations as in the current condition. Stormwater runoff within the development area will be routed underground to a subsurface infiltration facility. The proposed site improvements will not alter the existing drainage patterns, thus preserving the natural drainage system/outfall. Construction of the new storm drainage facilities will be in accordance with the Washington State Department of Ecology's 2014 SMMWW, as required by the City of Arlington.*

Minimum Requirement #5: **On-site Stormwater Management**
Projects shall employ On-site Stormwater Management BMPs in accordance with the following projects thresholds, standards, and lists to infiltrate, disperse, and retain stormwater runoff on-site to the extent feasible without causing flooding or erosion impacts.

Response: *This project has chosen to meet the Low Impact Development Performance Standard by infiltrating 100% of the stormwater runoff generated by the development. Additionally, amended soils shall be utilized for all disturbed landscape areas per BMP T5.13: Post-Construction Soil Quality and Depth.*

Minimum Requirement #6: **Runoff Treatment**
Projects in which the total of effective, pollution-generating hard surface (PGHS) is 5,000 SF or more in a threshold discharge area of the project require construction of stormwater treatment facilities. Projects in which the total of pollution-generating pervious surfaces (PGPS) is three-quarters (3/4) of an acre or more in a threshold discharge area, and from which there is a surface discharge in a natural or man-made conveyance system from the site also require treatment facilities.

Response: *Target Pollutant-generating impervious surfaces (PGIS) associated with the project are comprised primarily of the private roadway, drive aisles and parking areas throughout the site. Runoff from sidewalks that drain to these areas are also included in the PGIS total area. PGIS surfaces from the project will be treated for oil control via a CPS O/W separator prior to entering the underground infiltration facility. The native soils below the infiltration facility will complete the water quality treatment process as they meet DOE requirements with respect to organic content and cation exchange capacity (CEC). See* ***Section 6*** *of this report for water quality treatment design.*

Minimum Requirement #7: **Flow Control**
Projects must provide flow control to reduce the impacts of stormwater runoff from hard surfaces and land cover conversions. The requirement below applies to projects that discharge stormwater directly, or indirectly through a conveyance system, into a fresh waterbody. Stormwater discharges shall match developed discharge durations for the range of pre-developed discharge rates from 50% of the pre-developed 2-year peak flow up to the full 50 -year peak flow. The pre-developed condition should match a forested land cover. Proper Flow Control BMPs shall be selected and designed according to the current SMMWW.

Response: *Per SMMWW requirements, existing conditions will be treated as fully forested. Flow control will be achieved through 100% infiltration of the stormwater runoff generated from the project. See* ***Section 6*** *of this report for flow control design.*

Minimum Requirement #8: Wetlands Protection
The thresholds identified in Minimum Requirement #6 and Minimum Requirement #7 shall also be applied for any discharge to wetlands.

Response: *This Minimum Requirement is not applicable, as the project does not discharge to a wetland.*

Minimum Requirement #9: Operation and Maintenance
An operation and maintenance manual that is consistent with the provisions in the SMMWW shall be provided for proposed runoff treatment and Flow Control BMPs, and the parties responsible for maintenance and operation shall be identified.

Response: *A Stormwater Facility Operation and Maintenance Manual will be provided at the time of construction permit submittal.*

Section 6 - Flow Control and Water Quality Facility Analysis

The City of Arlington standards reference the 2014 SMMWW and require that the developed discharge durations match the pre-developed durations for 50% of the pre-developed 2-year peak flow up to the full 50-year peak flow. The pre-developed condition shall be considered as a forested land cover.

Hydrologic Analysis
Hydrologic analysis for evaluating the flow frequency comparison between the existing conditions and proposed conditions for the project was performed using the Washington Department of Ecology's Wester Washington Hydrologic Method of computer modeling WWHM2012 program. The model utilizes design data for specific soil types and vegetative covers to simulate runoff. The software program routes the flows generated from the basin analysis through a proposed conveyance system to storm water BMPs or structural detention facilities. The model is designed to meet the standard requirements stated in the Department of Ecology's Stormwater Management Manual for Western Washington.

A single model was created to analyze the existing conditions in comparison with the proposed conditions to determine the anticipated increase in peak flows for the project. Refer to **Appendix B**, for model results.

Existing Site Hydrology
Tax Parcel 310514-001-006-00 (Parcel 1) encompasses 0.76 acres of relatively level land with an unoccupied commercial building formerly occupied by Arlington Family Medicine located in the southeastern portion of the parcel. The building is a 3,520 square foot, one-story, wood-framed structure reportedly build in 1984. Asphalt surfaced drive lanes and parking are found to the north, west, and south of the commercial building. The development is serviced by underground utilities and includes an underground stormwater conveyance system. The existing stormwater management system does not appear to be connected to the municipal system, so it is assumed that the stormwater infiltrates into the underlying soils. Vegetation includes ornamental plantings in parking lot islands and

around the building, a row of large trees along the west and south property lines which appear to serve as a wind block, and a lawn south of the building.

Tax Parcel 310514-001-010-00 (Parcel 2) is a relatively level, undeveloped site located east of and adjoining the southern portion of the above discussed developed parcel's east property line. The parcel is irregular in shape and encompasses 0.76 acres. Vegetation within the undeveloped parcel primarily consists of well-developed tall grasses with dense blackberry brush along its west and north property lines. Stormwater runoff appears to sheet flow from SE to NE where it either infiltrates directly into the underlying soils or to the drainage ditch along the northern property boundary.

The pre-developed conditions for the project site are shown in **Table 2A & 2B** below. Existing peak runoff rates were determined using the WWHM2012 modeling software and the calculations can be found in **Appendix B**.

Table 2A –Car Wash Site (Parcel 1)

Pre-Developed (Existing) Conditions	
Land Cover	**Area (AC)**
Roof	0.08
Landscape	0.22
Sidewalk	0.04
Pavement/Gravel	0.42
Total	**0.76**

*Per the requirements of the SMMWW, all existing conditions shall be modeled as forested conditions.

Table 2B – Future Development Site (Parcel 2)

Pre-Developed (Existing) Conditions	
Land Cover	**Area (AC)**
Undeveloped – Grass & Shrubs	0.76
Total	**0.76**

*Per the requirements of the SMMWW, all existing conditions shall be modeled as forested conditions.

Developed Site Hydrology

The project will manage stormwater runoff for both flow control and water quality per 2014 DOE requirements. The roof drainage will be collected and conveyed to the underground stormwater infiltration facility (gravel filled trench) located west of the building beneath the drive aisle. The balance of the site including the access drive on the neighboring parcel (Parcel 2) will manage stormwater runoff via multiple catch basin inlets strategically placed at low points. The runoff will then be conveyed underground via a network of storm piping. Prior to entering the infiltration facility oil control will be provided via a CPS separator. The stormwater infiltration system will infiltrate 100% of all stormwater runoff generated by the project. The native soils below the infiltration facility will complete the water quality treatment process as they meet DOE requirements with respect to organic content and cation exchange capacity (CEC). A piped overflow from the infiltration facility to the municipal system will be provided as an added precaution for large storm events.

Construction of the new storm drainage facilities will be in accordance with the Washington State Department of Ecology's 2014 SMMWW, as required by the City of Arlington.

Refer to **Appendix B** for detailed WWHM analysis results. The developed conditions for the project site are shown in **Tables 3A & 3B** below.

Table 3A - Car Wash Site (Parcel 1)

Developed (Proposed) Conditions	
Land Cover	**Area (AC)**
Roof/Canopy	0.142
Landscape	0.218
Sidewalk	0.025
Pavement	0.425
Total	**0.810**

Table 3B - Future Development Site (Parcel 2)

Developed (Proposed) Conditions	
Land Cover	**Area (AC)**
Roof/Canopy	0.000
Landscape	0.510
Sidewalk	0.000
Pavement	0.198
Total	**0.708**

The area within the public right-of-way has been excluded from developed conditions as the stormwater runoff from this area is currently managed by the municipal stormwater system.

Flow Control System

The project will manage stormwater runoff for flow control per 2014 DOE requirements by implementing a below grade infiltration system. The infiltration gallery is 20'W x 150'L x 6'D and comprised of gravel trench with a network of perforated pipes configured as a manifold. The system has been designed to infiltrate 100% of the stormwater runoff generated by the project (includes parcels 1 & 2).

Refer to **Appendix B**, for WWHM model results.

Table 4 Peak Runoff Rates (Parcels 1 & 2 have been combined)

Basin Totals		
Event	**Pre-Developed Peak Flow Rate (cfs)**	**Mitigated Peak Flow Rate (cfs)**
2-year	0.051	0.000
5-year	0.078	0.000

10-year	0.099	0.000
25-year	0.129	0.000
50-year	0.154	0.000
100-year	0.182	0.000

Water Quality System

Per the 2014 SWMMWW, the water quality facilities shall be sized to treat the 91st percentile of the 24-hour runoff model upstream of detention and the full 2-year release rate downstream of detention. Upstream of the infiltration facility oil control will be provided via a CPS O/W separator. The native soils below the infiltration facility will complete the water quality treatment process as they meet DOE requirements with respect to SSC-6 Soil physical and Chemical Suitability for Treatment.

Section 7 - Conveyance System Analysis and Design

Conveyance

On-site storm water conveyance shall be calculated through gravity flow analysis of the piping network. Based on a 100-year storm event, peak runoff shall be routed through the system and determined to be adequate. A Uniform Flow Analysis utilizing Manning's equation was employed with a Manning's "n" value of 0.012.

Manning's equation -

$$Q = \frac{1.49}{n} \times A \times R^{2/3} \times S^{1/2}$$

With: Q = Flow from 100-year storm event (1.36 CFS)
n = Manning's Roughness Coefficient (0.012)
A = Flow Area (SF)
R = Hydraulic Radius = Area /Wetted Perimeter (LF)
S = Slope of the pipe (ft/ft)

Conveyance calculations are included in **Appendix B.**

100-Year Flood/Overflow Condition

Review of the current FEMA FIRM maps (map # 53061C0392F) indicates that the project site lies within the Zone designation X, meaning the subject property is within an area determined to be outside the 500-year floodplain. During extreme storm events the stormwater runoff will pond and then sheet flow west to the private road tract area.

The stormwater system for this project has been designed to address storm events in accordance with design criteria described previously. In the event of a larger storm, it is unlikely that the system would fail. A piped overflow to the municipal system has been incorporated into the design as an added precaution during extreme storm events.

Section 8 - Special Reports and

The following Special Reports and Studies were used or have been completed for this project:

- *Arborist Report*, prepared by Greenforest Incorporated, dated October 12, 2023.
- *Geotechnical Engineering Investigation Report,* prepared by ZipperGeo, dated October 30, 2023.
- *Phase I Environmental Site Assessment,* prepared by ZipperGeo, dated October 24, 2023.
- *Wetland Letter of Findings,* prepared by Harmsen, dated October 24, 2023.

Section 9 - Other Permits

The following governmental approvals or permits will likely be required for this project:

- Zoning Permit
- Design Review
- SEPA
- Construction Permit (Civil)
- Building Permit
- Construction Stormwater General Permit/NPDES Permit – Department of Ecology

These permits will require approval by the City of Arlington and Department of Ecology.

Section 10 - CSWPPP Analysis and Design

All erosion and sediment control measures shall be governed by the requirements Department of Ecology's 2014 Storm Water Management for Western Washington. A Stormwater Pollution Prevention Plan (SWPPP) will be prepared for this project.

A temporary erosion and sedimentation control plan will be prepared to assist the contractor in complying with these requirements. The Erosion and Sediment Control (ESC) plan will be included with the construction plans.

1. Construction Sequence and Procedure

The proposed development will include an erosion/sedimentation control plan designed to prevent sediment-laden run-off from leaving the site during construction. The erosion potential of the site is influenced by four major factors: soil characteristics, vegetative cover, topography, and climate. Erosion/sedimentation control is achieved by a combination of structural measures, cover measures, and construction practices that are tailored to fit the specific site.

The contractor will be responsible for implementing the following erosion control and storm water management control measures. The contractor may designate these tasks to certain subcontractors as they see fit, but the ultimate responsibility for implementing these controls and ensuring their proper functioning remains with the contractor. The order of activities will be as follows.

Phase 1

1. Prior to any construction work on the site, representatives from the City of Arlington must approve the storm water pollution prevention plan.
2. Mark clearing limits.
3. Install inlet protection to all existing catch basins.
4. Install temporary stabilized construction entrance. Existing paved area to remain and be utilized until construction phasing requires removal.
5. Install perimeter silt fences, interceptor swales, etc.
6. Install sediment control pond and/or tank(s).
7. Remove any existing structures that may be on site.
8. Protect and stabilize slopes.
9. Begin clearing and grubbing operations. Clearing and grubbing done from October 1st through April 30th is authorized as long as there are erosion and sediment control measures.
10. Commence site grading.

Phase 2

1. Disturbed areas of the site where construction activity has ceased for more than 7 days between May 1 and September 30 or 2 days between October 1 and April 30 shall be temporarily seeded and watered.
2. Construct building pad and install concrete wash out area.
3. Construct permanent storm water facilities. Remove temporary sedimentation ponds.
4. Install utilities, underdrains, storm sewers, curbs and gutters.
5. Install inlet/outlet protection at the locations of all grate inlets, curb inlets, and at the ends of all exposed storm sewer pipes.
6. Prepare site for paving. Finalize pavement subgrade preparation.

7. Remove inlet protection around inlets and manholes no more than 48 hours prior to placing stabilized base course.
8. Install base material as required for pavement. Pave site. Do not pave over catch basins.
9. Complete final grading in non-parking areas and install permanent seeding and planting.
10. Remove silt fencing only after all paving is complete and exposed surfaces are stabilized.
11. Remove temporary construction exits only prior to pavement construction in these areas (These areas are to be paved last).

The degree of erosion risk on the proposed project site is high given the proximity to a steep slope. The contractor shall refer to the geotechnical report for further recommendations.

2. Temporary Soil Stabilization

Temporary stabilization practices for this project include:

- Temporary seeding and planting of all unpaved areas using the hydro-mulching grass seeding technique.
- Mulching exposed areas.
- Installation of rolled erosion control products.

Structural practices for this project include the following. Refer to the Erosion Control plans for specific locations and details:

- Inlet protection using fiber fabric.
- Perimeter protection using silt fences.
- Stabilized construction entrance/exit points and staging area.
- Temporary sediment tank.
- Silt fence.

Daily inspection of the erosion control measures will be required during construction. Any sediment buildup shall be removed and disposed offsite at an appropriate disposal facility.

Vehicle tracking of mud off-site shall be avoided. A gravel construction entrance/exit will be installed at a location to enter the site. The construction entrance/exit is a minimum requirement and may be supplemented if tracking of mud onto public streets becomes excessive. In the event that mud is tracked off site, it shall be swept and disposed of offsite on a daily basis.

Because vegetative cover is the most important form of erosion control, construction practices must adhere to stringent cover requirements. More specifically, the contractor will not be allowed to leave soils open for more than 7 days between May 1st and September 30th and 2 days between October 1st and April 30th. Soils shall be stabilized at the end of the shift before a holiday or weekend if needed based on the weather forecast. Applicable practices include, but are not limited to, temporary and permanent seeding, sodding, mulching, plastic covering, and soil application of polyacrylamide.

Soil stockpiles must be stabilized from erosion, protected with sediment trapping measures, and, where possible, be located away from storm drain inlets, waterways and drainage channels.

3. Temporary Sediment Control

Construction storm water shall be detained on-site during construction in a temporary sediment control tank located at the northeast corner of the project. The DOE requires temporary sediment storage to be designed to manage the 2-year developed peak flow.

4. Permanent Erosion Control and Site Restoration

Upon completion of the project, areas of the site that are not stabilized with paving, rooftops, or landscaping as shown on the site plans will be protected with either grass, ground cover/plantings or existing vegetation as shown on the Landscape Plans.

5. Inspection Sequence

The construction site operator will periodically inspect its sites. Because our project disturbs more than one acre, a certified erosion and sediment control lead will be identified within the SWPPP. This individual will be present on site or on call at all times.

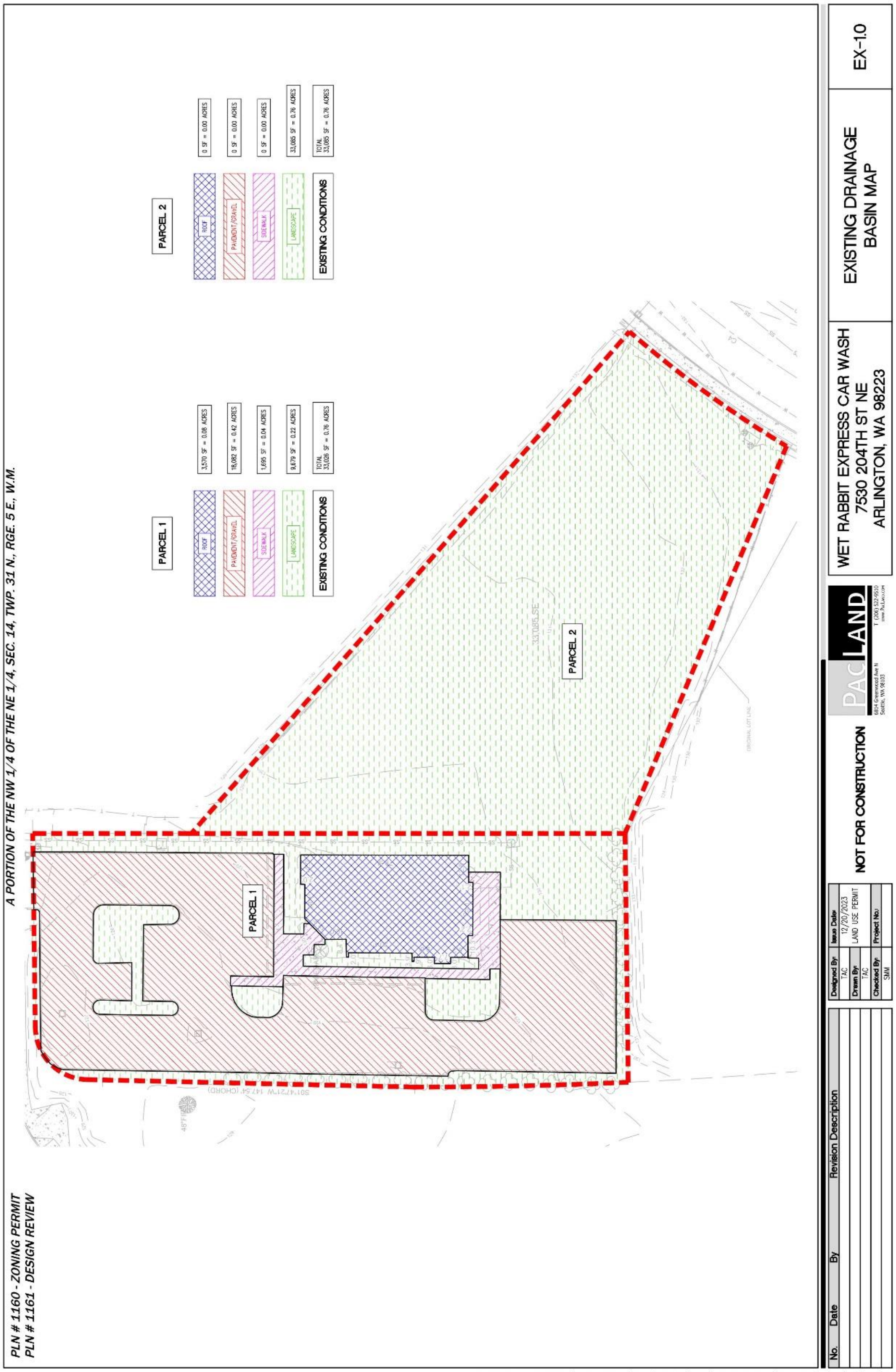
6. Control of Pollutants Other than Sediments

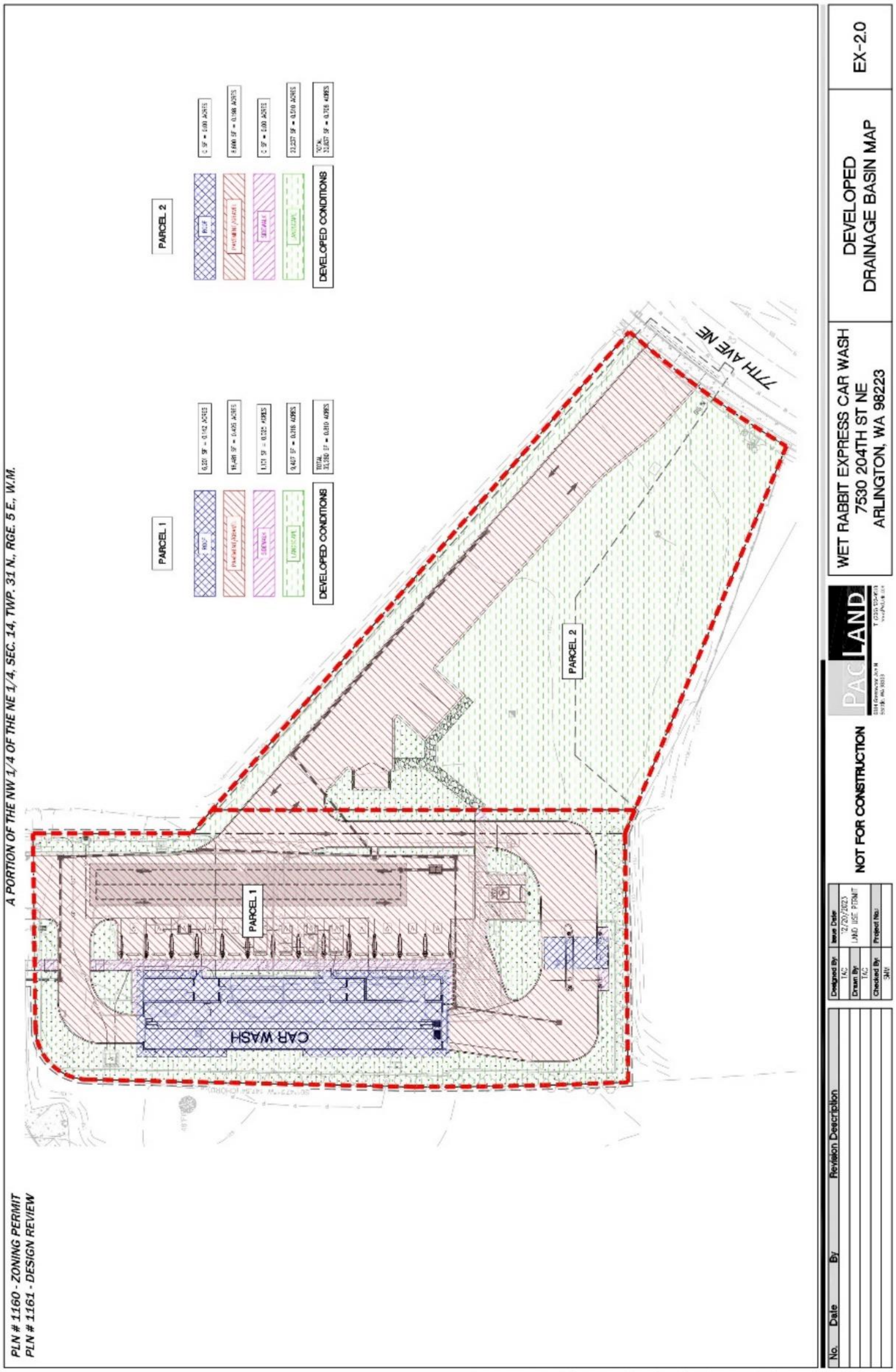
Pollutants shall be controlled on the work site through the utilization of a centralized area for equipment, a concrete truck washout, and an area designated for temporary storage of debris and stockpiled materials.

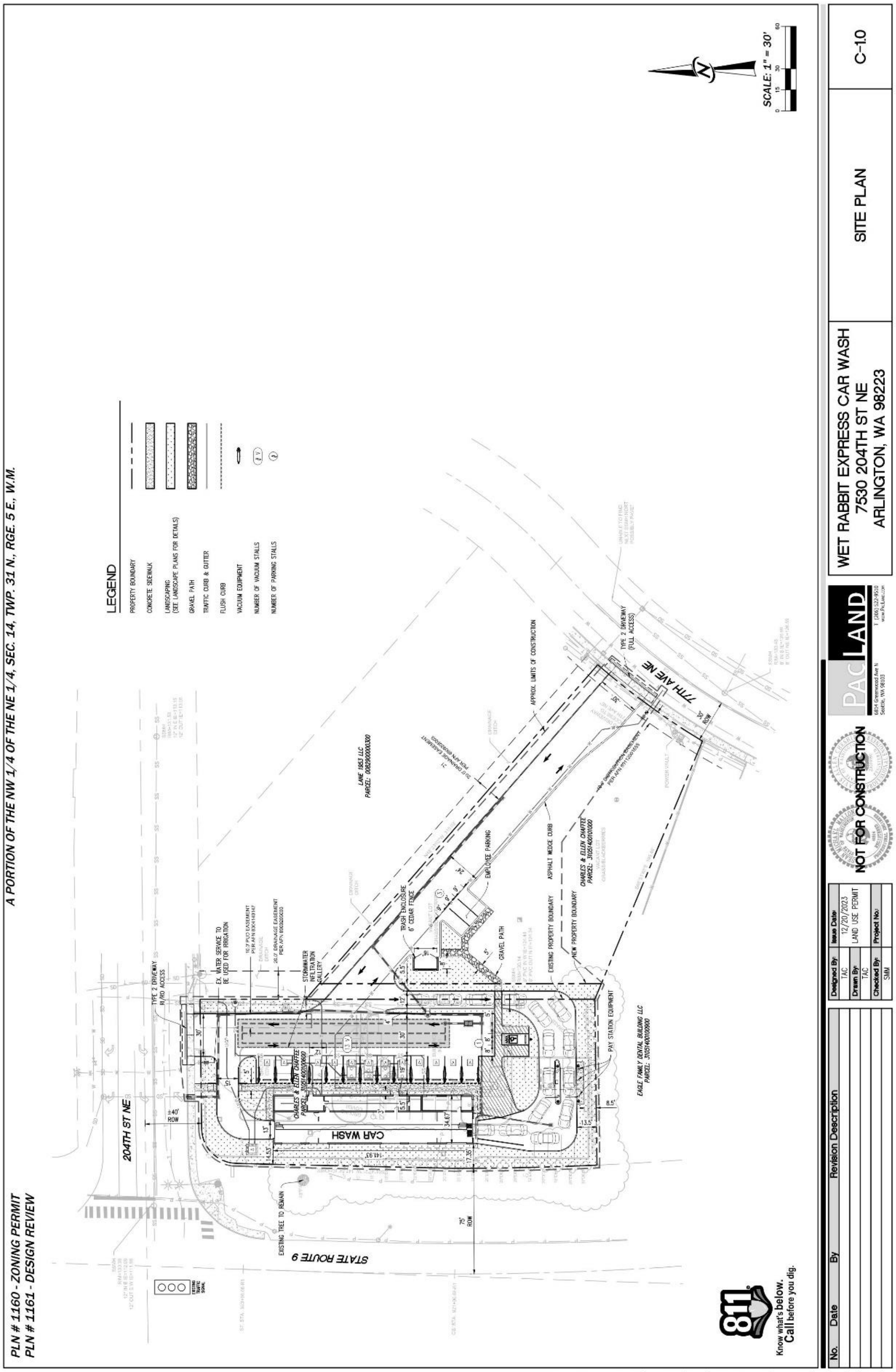
Section 11 - Operations and Maintenance

A manual detailing the operations and maintenance for all privately maintained conveyance and collection facilities will be provided at the time construction permit submittal.

Appendix A – Basin Maps & Civil Plans


A PORTION OF THE NW 1/4 OF THE NE 1/4, SEC. 14, TWP. 31 N., RGE. 5 E., W.M.
PARCEL 1
ROOF
3,570 SF = 0.08 ACRES
PAVEMENT/GRAVEL
18,082 SF = 0.42 ACRES
SIDEWALK
1,695 SF = 0.04 ACRES
LANDSCAPE
9,679 SF = 0.22 ACRES
EXISTING CONDITIONS
TOTAL 33,026 SF = 0.76 ACRES
PARCEL 2
ROOF
0 SF = 0.00 ACRES
PAVEMENT/GRAVEL
0 SF = 0.00 ACRES
SIDEWALK
0 SF = 0.00 ACRES
LANDSCAPE
33,085 SF = 0.76 ACRES
EXISTING CONDITIONS
TOTAL 33,085 SF = 0.76 ACRES
PARCEL 1
PARCEL 2
PLN # 1160 - ZONING PERMIT
PLN # 1161 - DESIGN REVIEW
No. Date By Revision Description
Designed By: TAC
Drawn By: TAC
Checked By: SMM
Issue Date: 12/20/2023
LAND USE PERMIT
Project No.:
NOT FOR CONSTRUCTION
PACLAND
WET RABBIT EXPRESS CAR WASH
7530 204TH ST NE
ARLINGTON, WA 98223
EXISTING DRAINAGE BASIN MAP
EX-1.0


A PORTION OF THE NW 1/4 OF THE NE 1/4, SEC. 14, TWP. 31 N., RGE. 5 E., W.M.
PLN # 1160 - ZONING PERMIT
PLN # 1161 - DESIGN REVIEW
PARCEL 1
DEVELOPED CONDITIONS
PARCEL 2
DEVELOPED CONDITIONS
77TH AVE NE
CAR WASH
PARCEL 1
PARCEL 2
NOT FOR CONSTRUCTION
PACLAND
WET RABBIT EXPRESS CAR WASH
7530 204TH ST NE
ARLINGTON, WA 98223
DEVELOPED
DRAINAGE BASIN MAP
EX-2.0
Revision Description
No. Date By


A PORTION OF THE NW 1/4 OF THE NE 1/4, SEC. 14, TWP. 31 N., RGE. 5 E., W.M.
PLN # 1160 - ZONING PERMIT
PLN # 1161 - DESIGN REVIEW
LEGEND
PROPERTY BOUNDARY
CONCRETE SIDEWALK
LANDSCAPING (SEE LANDSCAPE PLANS FOR DETAILS)
GRAVEL PATH
TRAFFIC CURB & GUTTER
FLUSH CURB
VACUUM EQUIPMENT
NUMBER OF VACUUM STALLS
NUMBER OF PARKING STALLS
CAR WASH
204TH ST NE
STATE ROUTE 9
77TH AVE NE
SCALE: 1" = 30'
Know what's below. Call before you dig.
NOT FOR CONSTRUCTION
PACLAND
WET RABBIT EXPRESS CAR WASH
7530 204TH ST NE
ARLINGTON, WA 98223
SITE PLAN
C-1.0

Appendix B – Design Calculations

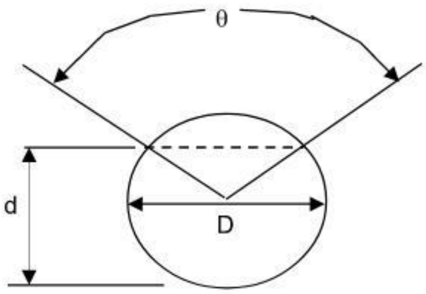
- **Conveyance**
- **WWHM Analysis**

MANNING'S EQUATION FOR PIPE FLOW

Project:	WET RABBIT	Location:	ARLINGTON, WA
By:	TAC	Date:	
Chk. By:	SMM	Date:	

mdo version 12.8.00

Clear Data Entry Cells



INPUT

D=	12	inches
d=	11.28	inches
n=	0.012	mannings coeff
θ=	56.7	degrees
S=	0.005	slope in/in

Mannings Formula

$Q=(1.486/n)AR_h^{2/3}S^{1/2}$

R=A/P

A=cross sectional area

P=wetted perimeter

S=slope of channel

n=Manning's roughness coefficient

$V=(1.49/n)R_h^{2/3}S^{1/2}$

$Q=V \times A$

Solution to Mannings Equation

Area, ft^2	Wetted Perimeter, ft	Hydraulic Radius, ft	velocity ft/s	flow, cfs
0.77	2.65	0.29	3.83	2.94

Manning's n-values

PVC	0.01
PE (<9"dia)	0.015
PE (>12"dia)	0.02
PE(9-12"dia)	0.017
CMP	0.025
ADS N12	0.012
HCMP	0.023
Conc	0.013

Created by: Mike O'Shea

WWHM2012
PROJECT REPORT

General Model Information

WWHM2012 Project Name: Arlington Wet Rabbit - Flow Control

Site Name:	Arlington Wet Rabbit
Site Address:	7530 204th St NE
City:	Arlington
Report Date:	12/18/2023
Gage:	Everett
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	1.200
Version Date:	2023/01/27
Version:	4.2.19

POC Thresholds

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

Landuse Basin Data
Predeveloped Land Use

Basin A1 (Pre)

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	0.76
Pervious Total	0.76
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.76

Basin A2 (Pre)

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Forest, Flat	0.76
Pervious Total	0.76
Impervious Land Use	acre
Impervious Total	0
Basin Total	0.76

Mitigated Land Use

Basin A1 (Post)

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Lawn, Flat	0.218
Pervious Total	0.218
Impervious Land Use	acre
ROOF TOPS FLAT	0.142
SIDEWALKS FLAT	0.025
PARKING FLAT	0.425
Impervious Total	0.592
Basin Total	0.81

Basin A2 (Post)

Bypass:	No
GroundWater:	No
Pervious Land Use	acre
C, Pasture, Flat	0.51
Pervious Total	0.51
Impervious Land Use	acre
PARKING FLAT	0.198
Impervious Total	0.198
Basin Total	0.708

Routing Elements
Predeveloped Routing

Mitigated Routing

Gravel Trench Bed 1

Bottom Length:	20.00 ft.
Bottom Width:	150.00 ft.
Trench bottom slope 1:	0 To 1
Trench Left side slope 0:	0 To 1
Trench right side slope 2:	0 To 1
Material thickness of first layer:	6
Pour Space of material for first layer:	0.4
Material thickness of second layer:	0
Pour Space of material for second layer:	0
Material thickness of third layer:	0
Pour Space of material for third layer:	0
Infiltration On	
Infiltration rate:	2.3
Infiltration safety factor:	1
Total Volume Infiltrated (ac-ft.):	214.988
Total Volume Through Riser (ac-ft.):	0
Total Volume Through Facility (ac-ft.):	214.988
Percent Infiltrated:	100
Total Precip Applied to Facility:	0
Total Evap From Facility:	0

Discharge Structure
Riser Height: 5 ft.
Riser Diameter: 12 in.
Element Flows To:
Outlet 1 Outlet 2

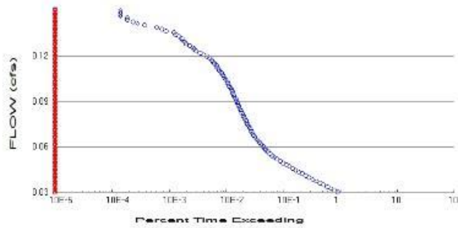
Gravel Trench Bed Hydraulic Table

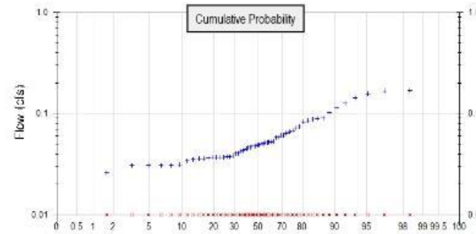
Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.068	0.000	0.000	0.000
0.0667	0.068	0.001	0.000	0.159
0.1333	0.068	0.003	0.000	0.159
0.2000	0.068	0.005	0.000	0.159
0.2667	0.068	0.007	0.000	0.159
0.3333	0.068	0.009	0.000	0.159
0.4000	0.068	0.011	0.000	0.159
0.4667	0.068	0.012	0.000	0.159
0.5333	0.068	0.014	0.000	0.159
0.6000	0.068	0.016	0.000	0.159
0.6667	0.068	0.018	0.000	0.159
0.7333	0.068	0.020	0.000	0.159
0.8000	0.068	0.022	0.000	0.159
0.8667	0.068	0.023	0.000	0.159
0.9333	0.068	0.025	0.000	0.159
1.0000	0.068	0.027	0.000	0.159
1.0667	0.068	0.029	0.000	0.159
1.1333	0.068	0.031	0.000	0.159
1.2000	0.068	0.033	0.000	0.159
1.2667	0.068	0.034	0.000	0.159
1.3333	0.068	0.036	0.000	0.159
1.4000	0.068	0.038	0.000	0.159
1.4667	0.068	0.040	0.000	0.159
1.5333	0.068	0.042	0.000	0.159

1.6000	0.068	0.044	0.000	0.159
1.6667	0.068	0.045	0.000	0.159
1.7333	0.068	0.047	0.000	0.159
1.8000	0.068	0.049	0.000	0.159
1.8667	0.068	0.051	0.000	0.159
1.9333	0.068	0.053	0.000	0.159
2.0000	0.068	0.055	0.000	0.159
2.0667	0.068	0.056	0.000	0.159
2.1333	0.068	0.058	0.000	0.159
2.2000	0.068	0.060	0.000	0.159
2.2667	0.068	0.062	0.000	0.159
2.3333	0.068	0.064	0.000	0.159
2.4000	0.068	0.066	0.000	0.159
2.4667	0.068	0.068	0.000	0.159
2.5333	0.068	0.069	0.000	0.159
2.6000	0.068	0.071	0.000	0.159
2.6667	0.068	0.073	0.000	0.159
2.7333	0.068	0.075	0.000	0.159
2.8000	0.068	0.077	0.000	0.159
2.8667	0.068	0.079	0.000	0.159
2.9333	0.068	0.080	0.000	0.159
3.0000	0.068	0.082	0.000	0.159
3.0667	0.068	0.084	0.000	0.159
3.1333	0.068	0.086	0.000	0.159
3.2000	0.068	0.088	0.000	0.159
3.2667	0.068	0.090	0.000	0.159
3.3333	0.068	0.091	0.000	0.159
3.4000	0.068	0.093	0.000	0.159
3.4667	0.068	0.095	0.000	0.159
3.5333	0.068	0.097	0.000	0.159
3.6000	0.068	0.099	0.000	0.159
3.6667	0.068	0.101	0.000	0.159
3.7333	0.068	0.102	0.000	0.159
3.8000	0.068	0.104	0.000	0.159
3.8667	0.068	0.106	0.000	0.159
3.9333	0.068	0.108	0.000	0.159
4.0000	0.068	0.110	0.000	0.159
4.0667	0.068	0.112	0.000	0.159
4.1333	0.068	0.113	0.000	0.159
4.2000	0.068	0.115	0.000	0.159
4.2667	0.068	0.117	0.000	0.159
4.3333	0.068	0.119	0.000	0.159
4.4000	0.068	0.121	0.000	0.159
4.4667	0.068	0.123	0.000	0.159
4.5333	0.068	0.124	0.000	0.159
4.6000	0.068	0.126	0.000	0.159
4.6667	0.068	0.128	0.000	0.159
4.7333	0.068	0.130	0.000	0.159
4.8000	0.068	0.132	0.000	0.159
4.8667	0.068	0.134	0.000	0.159
4.9333	0.068	0.135	0.000	0.159
5.0000	0.068	0.137	0.000	0.159
5.0667	0.068	0.139	0.182	0.159
5.1333	0.068	0.141	0.509	0.159
5.2000	0.068	0.143	0.907	0.159
5.2667	0.068	0.145	1.318	0.159
5.3333	0.068	0.146	1.683	0.159
5.4000	0.068	0.148	1.960	0.159

5.4667	0.068	0.150	2.138	0.159
5.5333	0.068	0.152	2.300	0.159
5.6000	0.068	0.154	2.439	0.159
5.6667	0.068	0.156	2.571	0.159
5.7333	0.068	0.157	2.697	0.159
5.8000	0.068	0.159	2.817	0.159
5.8667	0.068	0.161	2.932	0.159
5.9333	0.068	0.163	3.042	0.159
6.0000	0.068	0.165	3.149	0.159

Analysis Results
POC 1





+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 1.52
Total Impervious Area: 0

Mitigated Landuse Totals for POC #1
Total Pervious Area: 0.728
Total Impervious Area: 0.79

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.051073
5 year	0.078347
10 year	0.099382
25 year	0.129476
50 year	0.154541
100 year	0.181952

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	0.051	0.000
1950	0.052	0.000
1951	0.047	0.000
1952	0.037	0.000
1953	0.031	0.000
1954	0.167	0.000
1955	0.066	0.000
1956	0.058	0.000
1957	0.072	0.000
1958	0.052	0.000

1959	0.052	0.000
1960	0.048	0.000
1961	0.091	0.000
1962	0.045	0.000
1963	0.074	0.000
1964	0.053	0.000
1965	0.044	0.000
1966	0.026	0.000
1967	0.053	0.000
1968	0.064	0.000
1969	0.156	0.000
1970	0.037	0.000
1971	0.058	0.000
1972	0.043	0.000
1973	0.040	0.000
1974	0.088	0.000
1975	0.036	0.000
1976	0.037	0.000
1977	0.031	0.000
1978	0.037	0.000
1979	0.102	0.000
1980	0.048	0.000
1981	0.038	0.000
1982	0.049	0.000
1983	0.083	0.000
1984	0.050	0.000
1985	0.061	0.000
1986	0.143	0.000
1987	0.068	0.000
1988	0.035	0.000
1989	0.036	0.000
1990	0.048	0.000
1991	0.049	0.000
1992	0.037	0.000
1993	0.031	0.000
1994	0.034	0.000
1995	0.050	0.000
1996	0.085	0.000
1997	0.169	0.000
1998	0.031	0.000
1999	0.041	0.000
2000	0.031	0.000
2001	0.012	0.000
2002	0.046	0.000
2003	0.036	0.000
2004	0.061	0.000
2005	0.043	0.000
2006	0.113	0.000
2007	0.090	0.000
2008	0.126	0.000
2009	0.038	0.000

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.1692	0.0000
2	0.1668	0.0000
3	0.1557	0.0000

4	0.1426	0.0000
5	0.1258	0.0000
6	0.1132	0.0000
7	0.1022	0.0000
8	0.0907	0.0000
9	0.0896	0.0000
10	0.0876	0.0000
11	0.0851	0.0000
12	0.0830	0.0000
13	0.0738	0.0000
14	0.0719	0.0000
15	0.0681	0.0000
16	0.0657	0.0000
17	0.0640	0.0000
18	0.0611	0.0000
19	0.0607	0.0000
20	0.0580	0.0000
21	0.0580	0.0000
22	0.0531	0.0000
23	0.0526	0.0000
24	0.0522	0.0000
25	0.0520	0.0000
26	0.0515	0.0000
27	0.0510	0.0000
28	0.0501	0.0000
29	0.0499	0.0000
30	0.0490	0.0000
31	0.0487	0.0000
32	0.0480	0.0000
33	0.0479	0.0000
34	0.0476	0.0000
35	0.0466	0.0000
36	0.0464	0.0000
37	0.0448	0.0000
38	0.0443	0.0000
39	0.0428	0.0000
40	0.0425	0.0000
41	0.0407	0.0000
42	0.0405	0.0000
43	0.0383	0.0000
44	0.0375	0.0000
45	0.0374	0.0000
46	0.0368	0.0000
47	0.0367	0.0000
48	0.0367	0.0000
49	0.0367	0.0000
50	0.0363	0.0000
51	0.0359	0.0000
52	0.0356	0.0000
53	0.0352	0.0000
54	0.0340	0.0000
55	0.0311	0.0000
56	0.0310	0.0000
57	0.0309	0.0000
58	0.0308	0.0000
59	0.0305	0.0000
60	0.0260	0.0000
61	0.0123	0.0000

Duration Flows

The Facility PASSED

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0255	19611	0	0	Pass
0.0268	16998	0	0	Pass
0.0281	14668	0	0	Pass
0.0294	12731	0	0	Pass
0.0307	10932	0	0	Pass
0.0321	9437	0	0	Pass
0.0334	8168	0	0	Pass
0.0347	7078	0	0	Pass
0.0360	6126	0	0	Pass
0.0373	5311	0	0	Pass
0.0386	4654	0	0	Pass
0.0399	4066	0	0	Pass
0.0412	3548	0	0	Pass
0.0425	3136	0	0	Pass
0.0438	2761	0	0	Pass
0.0451	2447	0	0	Pass
0.0464	2145	0	0	Pass
0.0477	1894	0	0	Pass
0.0490	1656	0	0	Pass
0.0503	1508	0	0	Pass
0.0516	1370	0	0	Pass
0.0529	1249	0	0	Pass
0.0542	1154	0	0	Pass
0.0555	1069	0	0	Pass
0.0568	1009	0	0	Pass
0.0581	949	0	0	Pass
0.0594	888	0	0	Pass
0.0607	825	0	0	Pass
0.0620	777	0	0	Pass
0.0633	733	0	0	Pass
0.0646	686	0	0	Pass
0.0659	648	0	0	Pass
0.0672	622	0	0	Pass
0.0685	602	0	0	Pass
0.0698	583	0	0	Pass
0.0711	561	0	0	Pass
0.0724	538	0	0	Pass
0.0738	506	0	0	Pass
0.0751	487	0	0	Pass
0.0764	473	0	0	Pass
0.0777	457	0	0	Pass
0.0790	440	0	0	Pass
0.0803	424	0	0	Pass
0.0816	409	0	0	Pass
0.0829	394	0	0	Pass
0.0842	380	0	0	Pass
0.0855	368	0	0	Pass
0.0868	353	0	0	Pass
0.0881	341	0	0	Pass
0.0894	333	0	0	Pass
0.0907	322	0	0	Pass
0.0920	313	0	0	Pass
0.0933	302	0	0	Pass

0.0946	293	0	0	Pass
0.0959	284	0	0	Pass
0.0972	276	0	0	Pass
0.0985	265	0	0	Pass
0.0998	257	0	0	Pass
0.1011	241	0	0	Pass
0.1024	234	0	0	Pass
0.1037	226	0	0	Pass
0.1050	212	0	0	Pass
0.1063	205	0	0	Pass
0.1076	195	0	0	Pass
0.1089	187	0	0	Pass
0.1102	177	0	0	Pass
0.1115	166	0	0	Pass
0.1128	160	0	0	Pass
0.1141	151	0	0	Pass
0.1154	146	0	0	Pass
0.1168	135	0	0	Pass
0.1181	128	0	0	Pass
0.1194	121	0	0	Pass
0.1207	111	0	0	Pass
0.1220	100	0	0	Pass
0.1233	86	0	0	Pass
0.1246	75	0	0	Pass
0.1259	63	0	0	Pass
0.1272	59	0	0	Pass
0.1285	56	0	0	Pass
0.1298	50	0	0	Pass
0.1311	42	0	0	Pass
0.1324	40	0	0	Pass
0.1337	37	0	0	Pass
0.1350	36	0	0	Pass
0.1363	32	0	0	Pass
0.1376	28	0	0	Pass
0.1389	26	0	0	Pass
0.1402	19	0	0	Pass
0.1415	16	0	0	Pass
0.1428	13	0	0	Pass
0.1441	8	0	0	Pass
0.1454	6	0	0	Pass
0.1467	5	0	0	Pass
0.1480	4	0	0	Pass
0.1493	4	0	0	Pass
0.1506	3	0	0	Pass
0.1519	3	0	0	Pass
0.1532	3	0	0	Pass
0.1545	3	0	0	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	☐	195.64			☐	100.00			
Total Volume Infiltrated		195.64	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.

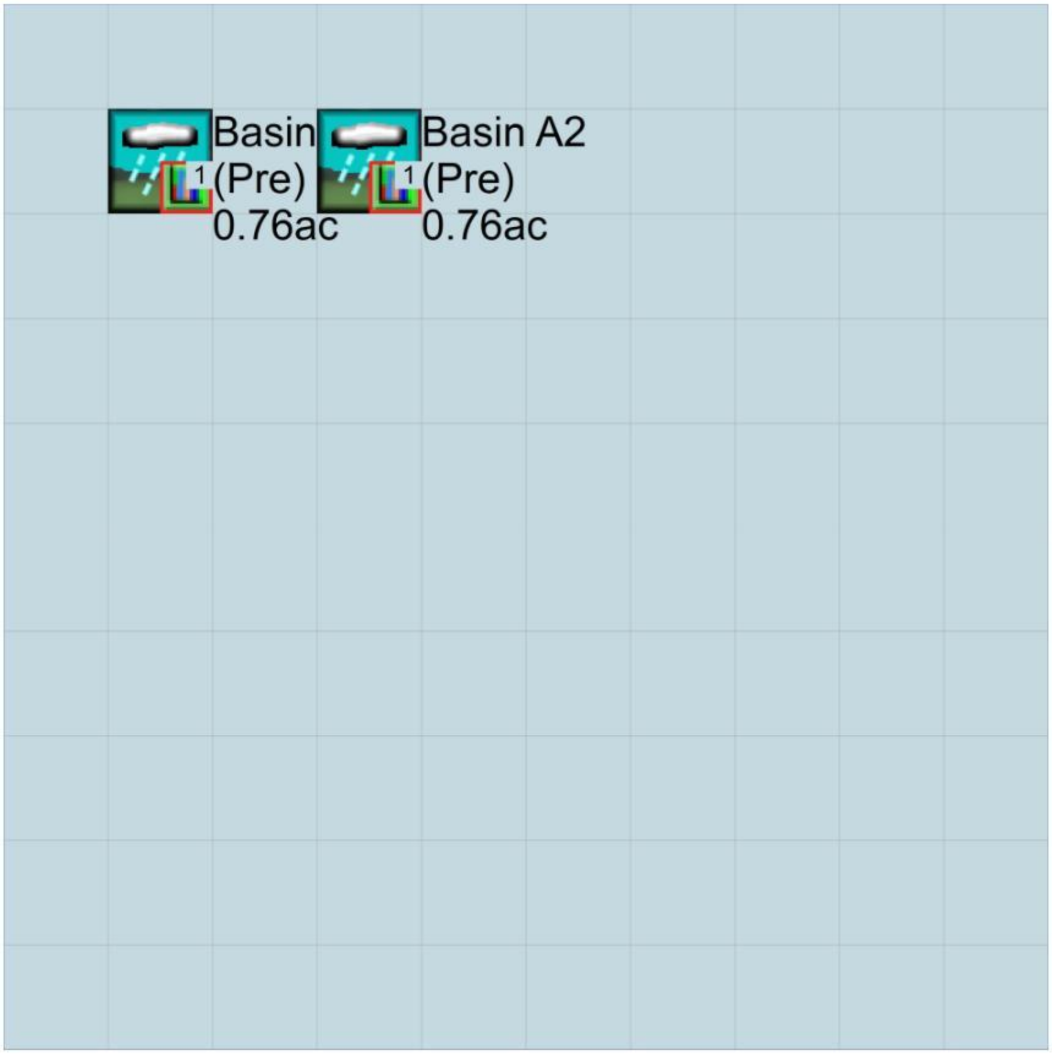
PERLND Changes

No PERLND changes have been made.

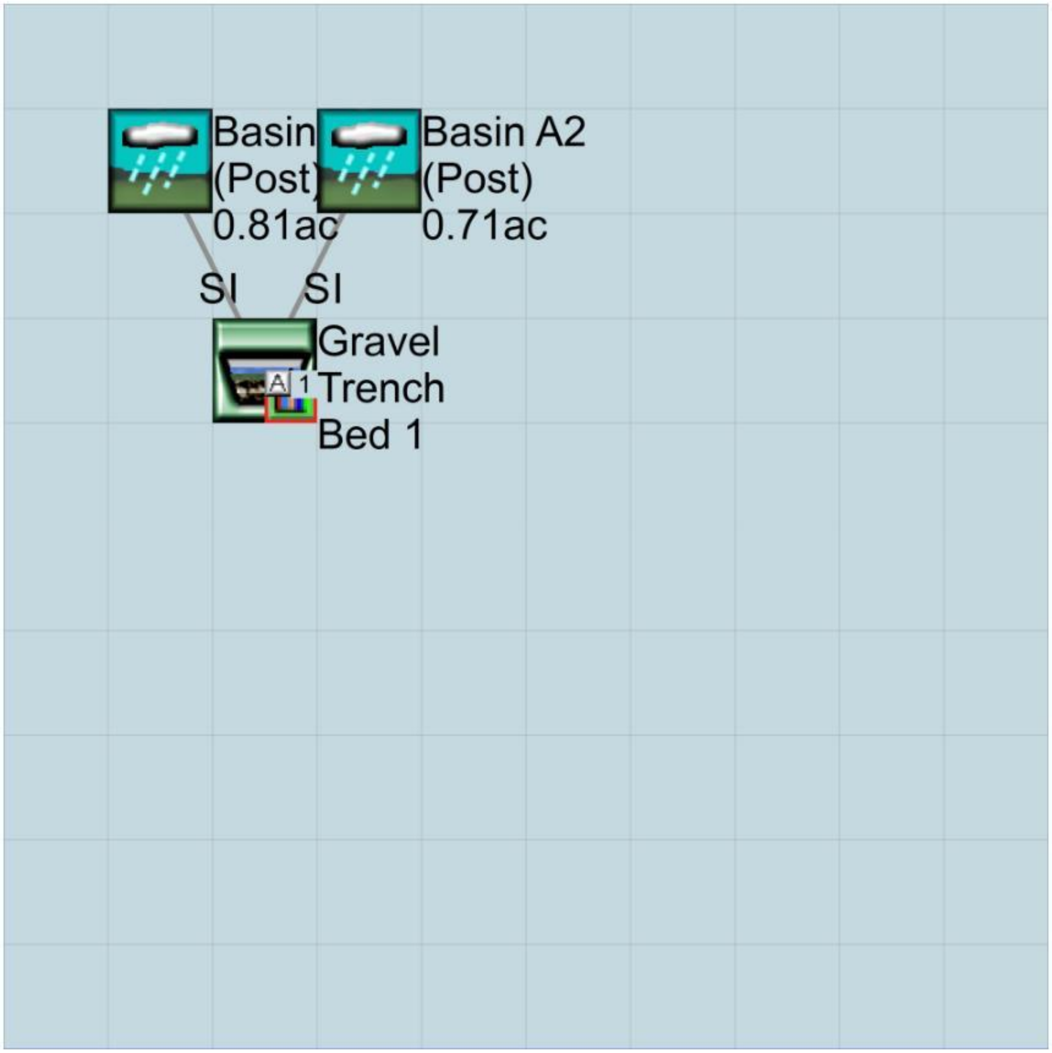
IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic



Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 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   Arlington Wet Rabbit - Flow Control.wdm
MESSU      25   PreArlington Wet Rabbit - Flow Control.MES
           27   PreArlington Wet Rabbit - Flow Control.L61
           28   PreArlington Wet Rabbit - Flow Control.L62
           30   POCArlington Wet Rabbit - Flow Control1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      10
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Basin A1 (Pre)              MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
   10      C, Forest, Flat         1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

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

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

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

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

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

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

END PERLND

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

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

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

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

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

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

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

```
END IMPLND

SCHEMATIC
<-Source->                  <--Area-->     <-Target->   MBLK   ***
<Name>   #                  <-factor->     <Name>   #   Tbl#   ***
Basin A1 (Pre)***
PERLND  10                        0.76     COPY   501     12
PERLND  10                        0.76     COPY   501     13
Basin A2 (Pre)***
PERLND  10                        0.76     COPY   501     12
PERLND  10                        0.76     COPY   501     13

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

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


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

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

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

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

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

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

SPEC-ACTIONS
END SPEC-ACTIONS
FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
```

```
<Name>   # <Name> # tem strg<-factor->strg <Name>   #  #      <Name> # #  ***
WDM      2 PREC    ENGL    1.2            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
  WWHM4 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   Arlington Wet Rabbit - Flow Control.wdm
MESSU      25   MitArlington Wet Rabbit - Flow Control.MES
           27   MitArlington Wet Rabbit - Flow Control.L61
           28   MitArlington Wet Rabbit - Flow Control.L62
           30   POCArlington Wet Rabbit - Flow Control1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND      16
      IMPLND       4
      IMPLND       8
      IMPLND      11
      PERLND      13
      RCHRES       1
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Gravel Trench Bed 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           ***
   16      C, Lawn, Flat           1    1    1    1   27    0
   13      C, Pasture, Flat        1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************* Active Sections *****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
   16         0    0    1    0    0    0    0    0    0    0    0    0
   13         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  *********
   16         0    0    4    0    0    0    0    0    0    0    0    0    1    9
   13         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 ***
   16         0    0    0    0    0    0    0    0    0    0    0
   13         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
   16              0       4.5      0.03       400      0.05       0.5     0.996
   13              0       4.5      0.06       400      0.05       0.5     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
   16              0         0         2         2         0         0         0
   13              0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                                 ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
   16            0.1      0.25      0.25         6       0.5      0.25
   13           0.15       0.4       0.3         6       0.5       0.4
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
             ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS      IFWS       LZS      AGWS      GWVS
   16              0         0         0         0       2.5         1         0
   13              0         0         0         0       2.5         1         0
  END PWAT-STATE1

END PERLND

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

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

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

```
  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      ***
    4         0    0    0    0    0
    8         0    0    0    0    0
   11         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2          ***
    # -  # ***  LSUR      SLSUR      NSUR      RETSC
    4            400       0.01       0.1       0.1
    8            400       0.01       0.1       0.1
   11            400       0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3          ***
    # -  # ***PETMAX    PETMIN
    4             0         0
    8             0         0
   11             0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    4             0         0
    8             0         0
   11             0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                 <--Area-->     <-Target->   MBLK    ***
<Name>   #                 <-factor->     <Name>   #   Tbl#    ***
Basin A1 (Post)***
PERLND  16                      0.218     RCHRES   1      2
PERLND  16                      0.218     RCHRES   1      3
IMPLND   4                      0.142     RCHRES   1      5
IMPLND   8                      0.025     RCHRES   1      5
IMPLND  11                      0.425     RCHRES   1      5
Basin A2 (Post)***
PERLND  13                       0.51     RCHRES   1      2
PERLND  13                       0.51     RCHRES   1      3
IMPLND  11                      0.198     RCHRES   1      5

******Routing******
PERLND  16                      0.218     COPY     1     12
IMPLND   4                      0.142     COPY     1     15
IMPLND   8                      0.025     COPY     1     15
IMPLND  11                      0.425     COPY     1     15
PERLND  16                      0.218     COPY     1     13
PERLND  13                       0.51     COPY     1     12
IMPLND  11                      0.198     COPY     1     15
PERLND  13                       0.51     COPY     1     13
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                                      ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible   exit  *** possible  exit      possible   exit
             *  *  *  *    *  *  *  *  *        *  *  *  *  *         ***
    1        0  1  0  0    4  5  0  0  0        0  0  0  0  0      2  2  2  2  2
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><-------->       ***
    1             1      0.01       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       Area     Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)    (acres)  (acre-ft)     (cfs)     (cfs)  (ft/sec)    (Minutes)***
  0.000000  0.068871  0.000000  0.000000  0.000000
  0.066667  0.068871  0.001837  0.000000  0.159722
  0.133333  0.068871  0.003673  0.000000  0.159722
  0.200000  0.068871  0.005510  0.000000  0.159722
  0.266667  0.068871  0.007346  0.000000  0.159722
  0.333333  0.068871  0.009183  0.000000  0.159722
  0.400000  0.068871  0.011019  0.000000  0.159722
  0.466667  0.068871  0.012856  0.000000  0.159722
  0.533333  0.068871  0.014692  0.000000  0.159722
  0.600000  0.068871  0.016529  0.000000  0.159722
  0.666667  0.068871  0.018365  0.000000  0.159722
  0.733333  0.068871  0.020202  0.000000  0.159722
  0.800000  0.068871  0.022039  0.000000  0.159722
  0.866667  0.068871  0.023875  0.000000  0.159722
  0.933333  0.068871  0.025712  0.000000  0.159722
  1.000000  0.068871  0.027548  0.000000  0.159722
```

1.066667	0.068871	0.029385	0.000000	0.159722
1.133333	0.068871	0.031221	0.000000	0.159722
1.200000	0.068871	0.033058	0.000000	0.159722
1.266667	0.068871	0.034894	0.000000	0.159722
1.333333	0.068871	0.036731	0.000000	0.159722
1.400000	0.068871	0.038567	0.000000	0.159722
1.466667	0.068871	0.040404	0.000000	0.159722
1.533333	0.068871	0.042241	0.000000	0.159722
1.600000	0.068871	0.044077	0.000000	0.159722
1.666667	0.068871	0.045914	0.000000	0.159722
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2.066667	0.068871	0.056933	0.000000	0.159722
2.133333	0.068871	0.058770	0.000000	0.159722
2.200000	0.068871	0.060606	0.000000	0.159722
2.266667	0.068871	0.062443	0.000000	0.159722
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END FTABLES

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

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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

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  MASS-LINK        2
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  END MASS-LINK    2

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

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

  MASS-LINK       12
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  END MASS-LINK   12

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

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

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

END MASS-LINK

END RUN
```

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

Legal Notice

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Appendix C – Geotechnical Report

GEOTECHNICAL ENGINEERING REPORT

ARLINGTON COMMERCIAL DEVELOPMENT
7530 204TH STREET NE
ARLINGTON, WASHINGTON

ZGA Project No. 2760.01
October 30, 2023

DRAFT

Prepared for:
WET RABBIT, LLC

Prepared by:

ZipperGeo
Geoprofessional Consultants

19019 36th Avenue W., Suite E
Lynnwood, WA 98036

ZipperGeo
Geoprofessional Consultants

ZGA Project No. 2760.01
October 30, 2023

Wet Rabbit, LLC
3213 West Wheeler Street, #750
Seattle, Washington 98199

Attention: Mr. Chris McClure

Subject: **Geotechnical Engineering Report - DRAFT**
Arlington Commercial Development
7530 204th Street NE
Arlington, Washington 98223
Parcel Numbers 310514-001-006-00 and 310514-001-010-00

Dear Mr. McClure,

In accordance with your request and written authorization, Zipper Geo Associates, LLC (ZGA) has completed the subsurface evaluation and geotechnical engineering report for the above-referenced project. This report presents the findings of the subsurface evaluation and geotechnical recommendations for the project design and construction. Our services have been completed in general accordance with our *Proposal for Geotechnical Services* (Proposal No. P23120) dated September 22, 2023. Written authorization to proceed was provided by you on September 22, 2023. We appreciate the opportunity to be of service to you on this project. If you have any questions concerning this report, or if we may be of further service, please contact us.

Sincerely,
Zipper Geo Associates, LLC

DRAFT

DRAFT

James P. Georgis, L.E.G.
Principal

Robert A. Ross, P.E.
Principal

19019 36th Avenue West, Suite E Lynnwood, WA 98036 (425) 582-9928

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GEOTECHNICAL ENGINEERING REPORT - DRAFT
ARLINGTON COMMERCIAL DEVELOPMENT
7530 204TH STREET NE
ARLINGTON, WASHINGTON

Project No. 2760.01
October 30, 2023

1.0 INTRODUCTION

This report presents the surface and subsurface conditions encountered at the site and our geotechnical engineering recommendations for the proposed Arlington Commercial Development. Our scope of services included reviewing readily available geologic data, a site reconnaissance, subsurface evaluation, laboratory testing, geotechnical engineering analysis, and preparation of this report. The project description, site conditions, and our geotechnical conclusions and recommendations are presented in the text of this report. Supporting data including detailed exploration logs and field exploration procedures and the results of laboratory testing are presented as appendices.

1.1 Site Description

The site is comprised of two adjoining Snohomish County tax parcels. Tax Parcel 310514-001-006-00 is a developed site with a property address of 7530 204th Street NE in Arlington, Washington. According to Snohomish County Assessor's records, the developed parcel encompasses 0.86 acres of relatively level land with an unoccupied commercial building formerly occupied by Arlington Family Medicine located in the southeastern portion of the parcel. The building is a 3,520 square foot, one-story, wood-framed structure reportedly build in 1984. Asphalt surfaced drive lanes and parking are found to the north, west, and south of the commercial building. The development is services by underground utilities and includes a stormwater system. Vegetation includes ornamental plantings in parking lot islands and around the building, a row of large trees along the west and south property lines which appear to serve as a wind block, and a lawn south of the building. Asphalt pavements near the west and south rows of trees exhibit moderate root damage.

Tax Parcel 310514-001-010-00 is a relatively level, undeveloped site located east of and adjoining the southern portion of the above discussed developed parcel's east property line. The parcel is irregular in shape and according to Snohomish County Assessor's records encompasses 0.81 acres. It appears that some underground utilities may be located near the east property line. Vegetation within the undeveloped parcel primarily consists of well-developed tall grasses with dense blackberry brush along its west and north property lines.

A roughly "L" shaped drainage ditch is located along the northern portion of the developed parcels east property line and along the entire north property line of the undeveloped parcel. Running water of about 3 to 4 inches deep was observed in the drainage ditch during our site reconnaissance. The enclosed *Site and Exploration Plan*, Figure 1, includes an aerial photograph of the subject parcels.

1.2 Project Understanding

We understand that Wet Rabbit, LLC intends to redevelop the currently vacant developed parcel (310514-001-006-00) with a new Wet Rabbit-branded car wash facility. We understand that a layout of the redevelopment has not been finalized, but we expect redevelopment to generally include demolition of the existing structure, minor regrading, construction of a new drive-thru car wash tunnel (potentially along the west side of the site), and reconfiguration and repaving of the parking lot and drive lanes. We understand that development of the currently undeveloped parcel (310514-001-010-00) may include a one-story Quick Service Restaurant (QSR) or similar commercial development. Lightly loaded shallow foundations with slab-on-grade floors are anticipated.

We understand that stormwater management design will be completed in accordance with the 2014 Washington State Department of Ecology (Ecology) Stormwater Management Manual for Western Washington (Stormwater Manual). The type of infiltration system and system location(s) have not been determined. However, given groundwater conditions in this part of Arlington, we anticipate that infiltration systems could include shallow infiltration galleries below parking lot areas.

2.0 SUBSURFACE CONDITIONS

2.1 Published Geologic Information

We assessed the geologic setting of site and the surrounding vicinity by reviewing the *Geologic Map of the Arlington West Quadrangle, Snohomish County, Washington* (US Geological Survey, Map MF-1740, 1985). The published geologic mapping shows the site is underlain by Vashon Recessional Outwash, Marysville Sand Member. The Marysville Sand Member is described as mostly well-drained, stratified to massive outwash sand, with some fine gravel, and some areas of silt and clay. The sediments were deposited by melt water flowing south from the stagnating and receding Vashon glacier. The outwash is reported to have a maximum thickness of about 140 feet. Subsurface conditions disclosed by the explorations advanced for this evaluation are consistent with the published mapping.

2.2 Soil Conditions

The subsurface evaluation completed by ZGA for this project included four borings (B-1 through B-4) and one cone penetrometer test (CPT-01). CPT-01 was completed near the center of the proposed car wash development (currently developed western parcel) and extended to a depth of about 60 feet below grade. The CPT exploration included seismic shear wave velocity measurements. Borings B-1 and B-2 were completed in the north and south portions of the western parcel's existing parking lot, respectively, and extended about 36½ feet below grade. Borings B-3 and B-4 were completed in the undeveloped eastern parcel and extended about 31½ to 36½ feet below grade. Groundwater monitoring wells were installed in borings B-1 through B-3 to evaluate changes in groundwater levels through the wet season. The enclosed *Site and Exploration Plan,* Figure 1, presents the approximate locations of our subsurface explorations completed for this project.

Soil samples recovered from the borings were visually classified in general accordance with the *Explanation of Exploration Logs* enclosed in *Appendix A*. Detailed, descriptive logs of the subsurface explorations and the procedures utilized in the subsurface exploration program are also presented in

Appendix A. In general, our explorations disclosed asphalt pavement and topsoil over recessional glacial outwash deposits interpreted as the Marysville Sand Member. Generalized descriptions of subsurface soil conditions observed at the exploration locations are presented below.

2.2.1 Pavement Section

Borings B-1 and B-2 were completed in the parking lot of the western parcel and encountered about 2 inches of asphalt. The thickness of the pavement at the CPT location could not be accurately determined due to the small diameter of the conical probe used to complete the exploration.

2.2.2 Topsoil

Borings B-3 and B-4 were completed in the undeveloped eastern parcel and encountered about 3 to 4 inches of topsoil. In general, the topsoil consisted of loose, brown sand with silt and abundant fine roots.

2.2.3 Glacial Recessional Outwash

Soil interpreted as glacial recessional outwash deposits of the Marysville Sand Member were encountered below the pavement in the western parcel and below the topsoil in the eastern undeveloped parcel. The glacial outwash deposits extended to the maximum depth explored of 36½ feet in the borings and 60 feet in the CPT.

In general, the upper 5 to 7½ feet of the outwash consists of loose to medium dense sand with variable silt and silt with variable sand content. Soil mottling was observed in some of the samples collected in this depth range. From about 5 to 7½ feet down to about 15 to 17½ feet, the outwash generally consists of medium dense to very dense gravelly sand to sandy gravel with trace to some silt. From about 15 to 17½ feet to the maximum depth explored at 60 feet below grade, the outwash generally consists of loose to medium dense sand with trace to some silt.

2.3 Groundwater Conditions

Groundwater was observed in borings B-1 through B-3 about 25 to 30 feet below grade at the time of drilling. Groundwater monitoring wells were installed in borings B-1 through B-3. Groundwater monitoring well readings are typically more accurate than groundwater depth estimates completed at the time of drilling and are presented in the table below.

Groundwater Monitoring Well Data				
Boring Number	**Approx. Surface Elevation (ft)**	**Date of Groundwater Measurement**	**Approx. Depth to Groundwater (ft)**	**Approx. Groundwater Elevation (ft)**
B-1	127	10-17-2023	25.41	101.59
B-2	129	10-17-2023	27.37	101.63
B-3	130	10-17-2023	28.62	101.38
Ground surface elevations at the exploration locations were obtained from Google Earth Pro imagery and should be considered approximate				

Groundwater levels, flow rates and soil moisture conditions should be expected to vary throughout the year. Fluctuations of the groundwater levels will likely occur due to seasonal variations in the amount of rainfall, runoff and other factors not evident at the time the explorations were performed. Therefore, groundwater levels during construction or at other times in the life of the development should be expected to vary.

3.0 CONCLUSIONS AND RECOMMENDATIONS

3.1 General

Based on the results of our subsurface explorations, laboratory testing, and geotechnical engineering analyses, we conclude that the proposed development is feasible from a geotechnical standpoint, contingent on proper design and construction practices. The explorations completed for our evaluation encountered soils susceptible to seismic induced liquefaction settlements. This condition requires special design considerations, as discussed below.

The liquefaction potential of the development was evaluated in accordance with the 2018 International Building Code (IBC). Based on our analysis, we estimate total seismic settlements of approximately 2½ to 3 inches could occur during the design earthquake. We estimate differential seismic settlements of approximately 1¼ to 1½ inches over a horizontal distance of 40 feet. In our experience, these levels of total and differential seismic settlement are typically considered expectable for most structures from a collapse prevention perspective, but should be evaluated by the owner relative to risk management and the project structural engineer relative to 2018 IBC design requirements and the specific building design being considered. If these levels of potential seismic settlement are not considered acceptable for conventional spread footings, we recommend that a mat foundation be considered. Due to the presence of about 10 to 15 feet of dense to very dense gravelly soils above the potential zone of liquefaction, ground improvement methods, such as stone columns, are not recommended for liquefaction mitigation at this site. This report includes geotechnical design recommendations for both conventional spread and mat foundation options.

Geotechnical engineering recommendations for foundation systems and other earthwork related phases of the project are outlined below. The recommendations contained in this report are based upon the results of field and laboratory testing (which are presented in *Appendices A and B*), engineering analyses, and our current understanding of the proposed project. ASTM and Washington State Department of Transportation (WSDOT) specification codes cited herein respectively refer to the current manual published by the American Society for Testing & Materials and the current edition of the *Standard Specifications for Road, Bridge, and Municipal Construction, (M41-10)*.

3.2 Seismic Design Considerations

The seismic performance of the proposed development was evaluated relative to seismic hazards resulting from ground shaking associated with a design seismic event with a 2,475-year return period determined in accordance with the 2018 International Building Code (IBC). Conformance to the above criteria for seismic excitation does not constitute any kind of guarantee or assurance that significant structural damage or ground failure will not occur if a maximum level earthquake occurs. The primary goal of the IBC seismic design procedure is to protect life and not to avoid all damage, since such design may be economically prohibitive. Following a major earthquake, a building may be damaged beyond repair, yet not collapse.

3.2.1 Ground Fault Rupture

Based on review of the United States Geological Survey *Quaternary Fault and Fold Database of the United States* there are no mapped Quaternary faults within 10 miles of the site. It is our opinion that the risk of ground surface rupture at the site is low.

3.2.2 Landsliding

Based on the relatively level topography of the site and surrounding vicinity, it is our opinion that the risk of earthquake-induced landsliding is low.

3.2.3 Liquefaction

Liquefaction is a phenomenon wherein saturated cohesionless soils build up excess pore water pressures during earthquake loading. Liquefaction typically occurs in loose soils, but may occur in denser soils if the ground shaking is sufficiently strong. ZGA completed a liquefaction analysis in general accordance with the 2018 IBC and ASCE 7-16. Specifically, our analysis used the following primary seismic ground motion parameters.

- A Maximum Considered Earthquake Geometric Mean (MCE_G) Peak Ground Acceleration of 0.441g, based on Figure 22-9 of ASCE 7-16.
- A Modified Peak Ground Acceleration (PGA_M) of 0.511g based on Site Class D, per Section 11.8.3 of ASCE 7-16 (Site Class modification to MCE_G without regard to liquefaction in accordance with Sections 11.4.8 and 20.3.1 of ASCE 7-16).
- A Geometric Mean Magnitude of 6.8 based on 2014 USGS National Seismic Hazard Mapping Project deaggregation data for a seismic event with a 2% probability of exceedance in 50 years (2,475 year return period).

Our liquefaction analysis was completed using the computer program CLiq (Version 3.5.2.10) developed by GeoLogismiki. Our analysis was based on CPT-1 completed to a depth of about 60 feet below existing grade. The approximate exploration location is shown on the enclosed *Site and Exploration Plans,* Figure 1. Our analysis indicates the potential for liquefaction below the groundwater table, which was modeled at depths ranging from 25 to 29 feet below grade in our analysis.

3.2.3.1 Liquefaction Settlement

Based on our analyses, we estimate a total seismic settlement of approximately 2½ to 3 inches. We estimate a differential seismic settlement of approximately 1¼ to 1½ inches over a horizontal distance of 40 feet. If these levels of seismic induced liquefaction settlement are not acceptable for conventional spread footings, we recommend that a mat foundation be considered as discussed in subsequent sections of this report.

3.2.3.2 Lateral Spread

Lateral spreading is a phenomenon in which soil deposits which underlie a site can experience significant lateral displacements associated with the reduction in soil strength caused by soil liquefaction. This phenomenon tends to occur most commonly at sites where the soil deposits can flow toward a "free-face", such as a water body. Given the relatively level nature of the site and lack of a free-face condition, it is our opinion that the potential for distress at the site from lateral spreading is low.

3.2.4 IBC Seismic Design Parameters

Per the 2018 IBC seismic design procedures and ASCE 7-16, the presence of liquefiable soils requires a Site Class definition of F. However, through reference to Sections 11.4.8 and 20.3.1 of ASCE 7-16, the 2018 IBC allows site coefficients F_a and F_v to be determined assuming that liquefaction does not occur for structures with fundamental periods of vibration less than 0.5 seconds. Based on the results of the field evaluation, Site Class D may be used to determine the values of F_a and F_v in accordance with Sections 11.4.8 and 20.3.1 of ASCE 7-16. If exceptions for Site Class D presented in Section 11.4.8 of ASCE 7-16 do not apply, a ground motion hazard analysis may be required.

IBC Seismic Design Criteria

Parameter	Value
2018 International Building Code Site Classification (IBC) [1]	Site Class F [2,3]
Site Latitude/Longitude	48.1803 /-122.1283
Spectral Short-Period Acceleration, S_S	1.038g
Spectral 1-Second Acceleration, S_1	0.371g
Site Coefficient for a Short Period, F_A	1.085
Site Coefficient for a 1-Second Period, F_V	See ASCE Section 11.4.8
Spectral Acceleration for a 0.2-Second Period, S_{MS}	1.126g
Spectral Acceleration for a 1-Second Period, S_{M1}	See ASCE Section 11.4.8
Design Short-Period Spectral Acceleration, S_{DS}	0.751g
Design 1-Second Spectral Acceleration, S_{D1}	See ASCE Section 11.4.8

1. IBC Site Class is based on the average characteristics of the upper 100 feet of the subsurface profile.
2. The explorations completed for this study extended to a maximum depth of about 60 feet below grade. ZGA therefore determined the Site Class assuming that medium dense to dense glacial outwash soils with an average n value greater than 15 extend to 100 feet as suggested by published geologic maps for the project area.
3. Per the *2018 International Building Code* and *ASCE 7-16*, Chapter 20, any profile containing soils vulnerable to potential failure or collapse under seismic loading such as liquefiable soils.

3.3 Site Preparation

3.3.1 Existing Structure Removal

The western parcel is currently developed with an unoccupied commercial building with associated asphalt pavement and concrete flatwork. After the building is removed, we recommend that any remaining foundation elements or other below grade structures, if encountered, be demolished and removed from the proposed development areas. We recommend that the resulting excavation be backfilled with compacted structural fill.

3.3.2 Existing Utility Removal

We recommend that all underground utilities within the prosed building pad be completely removed. Utility pipes outside the building envelope could be abandoned in place, provided they are fully grouted with controlled density fill (CDF) and the trench backfill is density tested to verify that it meets the compaction levels presented in the project specifications. Localized excavations made for removal of utilities or existing unsuitable trench backfill should be backfilled with structural fill as outlined in the following section of this report.

3.3.3 Erosion Control Measures

Stripped surfaces and soil stockpiles are typically a source of runoff sediments. We recommend that silt fences, berms, and/or swales be installed around the downslope side of stripped areas and stockpiles in order to capture runoff water and sediment. If earthwork occurs during wet weather, we recommend that all stripped surfaces be covered with straw to reduce runoff erosion, whereas soil stockpiles should be protected with anchored plastic sheeting.

3.3.4 Temporary Drainage

Stripping, excavation, grading, and subgrade preparation should be performed in a manner and sequence that will provide drainage at all times and provide proper control of erosion. The upper 5 to 7½ feet of the site soils have a moderate fines (silt and clay) content and are therefore susceptible to disturbance and erosion when wet. The site should be graded to prevent water from ponding in construction areas and/or flowing into and/or over excavations. Exposed grades should be crowned, sloped, and smooth-drum rolled at the end of each day to facilitate drainage if inclement weather is forecasted. Accumulated water must be removed from subgrades and work areas immediately and prior to performing further work in the area. Equipment access may be limited, and the amount of soil rendered unfit for use as structural fill may be greatly increased if drainage efforts are not accomplished in a timely manner.

3.3.5 Clearing and Stripping

Vegetation in the western developed parcel includes ornamental plantings in parking lot islands and around the building, a row of large trees along the west and south property lines which appear to serve as a wind block, and a lawn south of the building. Asphalt pavements near the west and south rows of trees exhibit moderate root damage. We anticipate that clearing and stripping depths on the order of 6 to 12 inches may be required in landscaped areas. Deeper excavations may be needed to remove tree roots along the south and west sides of the site. Vegetation within the undeveloped eastern parcel primarily consists of well-developed tall grasses with dense blackberry brush along its west and north property lines. Based on borings B-3 and B-4, we anticipate topsoil stripping depths on the order of 4 to 6 inches in the eastern parcel. Any excavations that extend below finish grades should be backfilled with structural fill as outlined subsequently in this report.

3.3.6 Subgrade Preparation and Protection

Once site preparation is complete, all areas that do not require over-excavation and are at design subgrade elevation or areas that will receive new structural fill should be compacted to a firm and unyielding condition, and to achieve the recommended compaction level within the upper 12 inches of exposed subgrade soil presented in *Section 3.5.6* of this report. Some moisture conditioning of site soils may be required to achieve a moisture content appropriate for compaction. This is generally within ±2 percent of the soil's optimum moisture content determined in accordance with ASTM D 1557 test procedure. Our laboratory testing indicates that, at the time our explorations were completed, in-situ moisture contents collected from the upper 5 feet of the site range from about 5 to 29 percent. As a result, we expect that moisture conditioning of site soils during construction will be required to achieve suitable moisture contents (plus or minus two percent of optimum) for compaction.

Earthwork should be completed during drier periods of the year when soil moisture content can be controlled by aeration and drying if possible. If earthwork or construction activities take place during extended periods of wet weather, it will be difficult to achieve a firm, non-yielding surface and recommended compaction levels. In the event the exposed subgrade becomes unstable, yielding, or unable to be compacted due to high moisture conditions, we recommend that the materials be removed to a sufficient depth in order to develop stable subgrade soils that can be compacted to the minimum recommended levels. The severity of construction problems will be dependent, in part, on the precautions that are taken by the contractor to protect the subgrade soils.

Once compacted, subgrades should be evaluated through density testing and proof rolling with a loaded dump truck or heavy rubber-tired construction equipment weighing at least 20 tons to assess the subgrade adequacy and to detect soft and/or yielding soils. In the event that compaction fails to meet the specified criteria, the upper 12 inches of subgrade should be scarified, and moisture conditioned as necessary to obtain the specified compaction level. Those soils which are soft, yielding, or unable to be compacted to the specified criteria should be over-excavated and replaced with suitable material as recommended in the *Structural Fill* section of this report.

To protect stable subgrades in the wet season, we recommend using crushed rock. The thickness of the protective layer should be determined at the time of construction and be based on the moisture condition of the soil and the amount of anticipated traffic.

3.3.7 Freezing Conditions

If earthwork takes place during freezing conditions, all exposed subgrades should be allowed to thaw and then be compacted prior to placing subsequent lifts of structural fill or pouring foundations. Alternatively, the frozen material could be stripped from the subgrade to expose unfrozen soil prior to placing subsequent lifts of fill or foundation components. The frozen soil should not be reused as structural fill until allowed to thaw and adjusted to the proper moisture content, which may not be possible during winter months.

3.4 Structural Fill

Structural fill includes any material placed below foundations, floor slabs, and pavement sections, within utility trenches, and behind retaining walls. Prior to the placement of structural fill, all surfaces to receive fill should be prepared as previously recommended in the *Site Preparation* section of this report.

3.4.1 Laboratory Testing

Representative samples of on-site and imported soils to be used as structural fill should be submitted for laboratory testing at least four days in advance of its intended use and required density testing in order to complete the necessary Proctor tests.

3.4.2 Re-Use of Site Soils as Structural Fill

It is our opinion that the soils encountered on the site are adequate for reuse as structural fill from a compositional standpoint provided it is placed and compacted in accordance with the recommendations presented in this report. Our laboratory testing indicates that, at the time our explorations were completed, in-situ moisture contents collected from the upper 5 feet of the site range from about 5 to 29 percent. As a result, we expect that some moisture conditioning during construction of site soils will be required to achieve suitable moisture contents (plus or minus two percent of optimum) for compaction. Drying of over-optimum moisture soils may be achieved by scarifying or windrowing surficial materials during extended periods of dry weather. If encountered, soils which are dry of optimum may be moistened through the application of water and thorough blending to facilitate a uniform moisture distribution in the soil prior to compaction.

We recommend that site soils used as structural fill have less than 4 percent organics by weight, have no woody debris greater than ½-inch in diameter, and contain no other deleterious materials. We recommend that all pieces of organic material greater than ½-inch in diameter be picked out of the fill before it is placed and compacted. Deleterious debris includes waste building materials, organics, trash, and asphalt and, if encountered, it should be removed from the soil prior to its reuse as structural fill.

3.4.3 Imported Structural Fill

If additional material is required for grading and fills, the appropriate type of imported structural fill will depend on the weather conditions. During extended periods of dry weather, we recommend imported fill meet the requirements of Common Borrow, Options 1 or 2 as specified in Section 9-03.14(3) of the 2023 Washington State Department of Transportation, *Standard Specifications for Road, Bridge, and Municipal Construction* (WSDOT Standard Specifications). The on-site soils would generally be classified as Common Borrow. During wet weather, higher-quality (lower fines content) structural fill might be required, as Common Borrow may contain sufficient fines to be moisture sensitive. During wet weather we recommend that imported structural fill meet the requirements of Gravel Borrow as specified in Section 9-03.14(1) of the 2023 WSDOT Standard Specifications.

3.4.4 Moisture Content

The suitability of soil for use as structural fill will depend on the prevailing weather at the time of construction, the moisture content of the soil, and the fines content (that portion passing the U.S. No. 200 sieve) of the soil. As the amount of fines increases, the soil becomes increasingly sensitive to small changes in moisture content. Soils containing more than about 5 percent fines (such as most of the on-site soils encountered in the upper 2 feet of the site) cannot be consistently compacted to the appropriate levels when the moisture content is more than approximately 2 percent above or below the optimum moisture content (per ASTM D1557). Optimum moisture content is that moisture content which results in the greatest compacted dry density with a specified compactive effort. The moisture content of fill at the time of placement should be within plus or minus 2 percent of optimum moisture content for compaction as determined by the ASTM D1557 test method.

3.4.5 Fill Placement

We recommend that structural fill be placed in horizontal lifts not exceeding 8 inches in loose thickness and each lift of fill be compacted using compaction equipment suitable for the soil type and lift thickness to the minimum levels recommended below based on the maximum laboratory dry density as determined by the ASTM D1557 Modified Proctor Compaction Test.

3.4.6 Compaction Criteria

Our recommendations for soil compaction are summarized in the following table. We recommend that a geotechnical engineer be present during grading so that an adequate number of density tests may be conducted as structural fill placement occurs.

RECOMMENDED SOIL COMPACTION LEVELS	
Location	**Minimum Percent Compaction***
All fill below building floor slabs and foundations	95
Upper 2 feet of fill below exterior slabs and pavements	95
Pavement and exterior slab fill below two feet	92
Upper two feet of utility trench backfill	95
Utility trenches below two feet	92
Landscape areas	90
* *ASTM D1557 Modified Proctor Maximum Dry Density*	

3.5 Utility Trenching and Backfilling

We recommend that utility trenching conforms to all applicable federal, state, and local regulations, such as OSHA and WISHA, for open excavations. Trench excavation safety guidelines are presented in WAC Chapter 296-155 and WISHA RCW Chapter 49.17.

3.5.1 Trench Dewatering

Groundwater was encountered in borings B-1 through B-3 at depths of about 25 to 30 feet below existing grade at the time of our evaluation. As such, significant construction dewatering associated with utility installations is not anticipated. However, some excavations for utilities and underground structures may encounter zones of perched groundwater that may develop above lower permeability layers in the site outwash soils. The amount of perched groundwater seepage that may be encountered in site excavations will likely be a function of the time of year, the size of the excavation, the excavation depth, and how long the excavation remains open. The type and extent of dewatering measures needed, if any, will be a function of the groundwater conditions at the time of construction. Temporary systems could include pumped sumps, wellpoints, or pumped wells. If dewatering becomes necessary, the appropriate type of dewatering system and means of water disposal should be determined by the contractor based on the conditions encountered.

3.5.2 Utility Subgrade Preparation

We recommend that all utility subgrades be firm and unyielding and free of soils that are loose, disturbed, or pumping. Soils that pump or yield should be removed and replaced. All structural fill used to replace over-excavated soils should be compacted as recommended in the *Structural Fill* section of this report.

3.5.3 Bedding and Initial Backfill

We recommend that a minimum of 4 inches of bedding material be placed above and below all utilities or in general accordance with the utility manufacturer's recommendations and local ordinances. We recommend that pipe bedding consist of Gravel Backfill for Pipe Zone Bedding as specified in Section 9-03.12(3) of the 2023 WSDOT Standard Specifications. All trenches should be wide enough to allow for compaction around the haunches of the pipe, or material such as pea gravel should be used below the spring line of the pipes to eliminate the need for mechanical compaction in this portion of the trenches. If water is encountered in the excavations, it should be removed prior to fill placement.

3.5.4 Trench Backfill

Materials, placement and compaction of utility trench backfill should be in accordance with the recommendations presented in the *Structural Fill* section of this report. In our opinion, the initial lift thickness should not exceed 1 foot unless recommended by the manufacturer to protect utilities from damage by compacting equipment. Light, hand operated compaction equipment may be utilized directly above utilities if damage resulting from heavier compaction equipment is of concern.

3.6 Temporary Shoring

We recommend that temporary shoring systems be used where excavations will be located adjacent to existing foundations, property lines, roadways or utilities, or where ground loss could damage existing facilities. A trench box is one type of support system which might be used. The zone between the trench box and the excavation face should be backfilled as necessary to limit ground movements. As an alternative, braced or unbraced shoring of various types could be considered.

3.7 Temporary and Permanent Slopes

Temporary excavation slope stability is a function of many factors, including:

- The presence and abundance of groundwater;
- The type and density of the various soil strata;
- The depth of cut;
- Surcharge loadings adjacent to the excavation; and
- The length of time the excavation remains open.

It is exceedingly difficult under the variable circumstances to pre-establish a safe and "maintenance-free" temporary cut slope angle. For planning purposes, temporary cuts in loose soils on the order of 1.5H:1V and temporary cuts in medium dense to very dense soils on the order of 1H:1V could be considered. These planning level temporary cut slope inclinations assume a drained condition. Flatter slopes may be needed if groundwater seepage is present. However, it should be the responsibility of the contractor to maintain safe temporary slope configurations since the contractor is continuously at the job site, able to observe the nature and condition of the cut slopes, and able to monitor the subsurface materials and groundwater conditions encountered. Unsupported vertical slopes or cuts deeper than 4 feet are not recommended. The cuts should be adequately sloped, shored, or supported to prevent injury to personnel from local sloughing and spalling. The excavation should conform to applicable Federal, State, and Local regulations.

According to Chapter 296-155 of the Washington Administrative Code (WAC), the contractor should make a determination of excavation side slopes based on classification of soils encountered at the time of excavation. Temporary cuts may need to be constructed at flatter angles based upon the soil moisture, soil density, and groundwater conditions at the time of construction. Adjustments to the slope angles should be determined by the contractor at that time.

We recommend that all permanent cut or fill slopes constructed in native or properly compacted fill soils be designed at a 2H:1V (Horizontal:Vertical) inclination or flatter. All permanent cut and fill slopes should be adequately protected from erosion both temporarily and permanently.

3.8 Corrosion Considerations

Soils in the vicinity of the project site are considered to be very slightly corrosive to concrete and are not typically associated with high sulfate contents. As such, the relative degree of sulfate attack would be considered negligible and ASTM Type I/II Portland cement is suitable for all concrete below and at grade.

3.9 Shallow Foundations

Based on our analyses, it is geotechnically feasible to support the proposed buildings on conventional shallow footings provided that foundation subgrades are properly prepared. We anticipate that foundation subgrade soils will generally consist of loose to medium dense sand with variable silt content.

Our analyses indicate the potential for liquefaction induced settlement due to ground vibrations associated with the 2018 IBC design seismic event with a return period of 2,475 years. The foundation recommendations presented below assume that the levels of potential seismic settlement presented in

Seismic Design Considerations section of this report (total seismic settlement of approximately 2½ to 3 inches and differential seismic settlement of approximately 1¼ to 1½ inches over a horizontal distance of 40 feet) are considered acceptable and meet the Life Safety and Collapse Performance objectives of the 2018 IBC.

If these conditions and levels of seismic settlement are not acceptable for the planned building, we recommend that the mat foundation option presented in this report be utilized to mitigate potential seismic settlements. However, if a mat foundation is utilized for the building, the spread foundation recommendations presented below may be used for ancillary structures determined by the structural engineer and owner to be less sensitive to potential seismic settlements.

3.9.1 Foundation Subgrade Preparation

We recommend that the subgrade exposed at the bottom of foundation excavations be compacted to a firm and non-yielding condition and to at least 95 percent of the modified Proctor maximum dry density determined in accordance with ASTM D 1557. If the exposed subgrade cannot be compacted to the required density, we recommend that it be removed to a depth of 12 inches and be replaced with WSDOT Standard Specification Section 9-03.9(3), Crushed Surfacing Base Course compacted to at least 95 percent of the modified Proctor maximum dry density. We recommend that the over-excavation extend outside the limits of the footings a distance equal to the depth of over-excavation.

3.9.2 Allowable Bearing Pressure

Continuous and isolated column footings bearing on compacted glacial outwash or structural fill placed and compacted in accordance with this report may be designed for a maximum allowable, net, bearing capacity of 2,000 psf. A one-third increase of the bearing pressure may be used for short-term transient loads such as wind and seismic forces. The above-recommended allowable bearing pressure includes a 3.0 factor of safety.

3.9.3 Shallow Foundation Depth and Width

For frost protection, the bottom of all exterior footings should bear at least 18 inches below the lowest adjacent outside grade, whereas the bottoms of interior footings should bear at least 12 inches below the surrounding slab surface level. We recommend that all continuous wall and isolated column footings be at least 12 and 24 inches wide, respectively.

3.9.4 Lateral Resistance

Resistance to lateral loads can be calculated assuming an allowable passive resistance of 300 pcf equivalent fluid pressure (triangular distribution) and an allowable base friction coefficient of 0.35. The allowable passive resistance and friction coefficient include a 1.5 factor of safety. We recommend that passive resistance be neglected in the upper 18 inches of embedment.

3.9.5 Estimated Settlement

Assuming the foundation subgrade soils, and structural fill compaction are completed in accordance with recommendations presented herein, we estimate that total and differential static settlements will be less than 1 inch and ½ inch over 40 feet, respectively.

3.10 On-Grade Concrete Floor Slabs

Our analyses indicate the potential for liquefaction induced settlement due to ground vibrations associated with the 2018 IBC design seismic event with a return period of 2,475 years. The on-grade concrete floor slab recommendations presented below assume that the levels of potential seismic settlement presented in *Seismic Design Considerations* section of this report (total seismic settlement of approximately 2½ to 3 inches and differential seismic settlement of approximately 1¼ to 1½ inches over a horizontal distance of 40 feet) are considered acceptable. If these levels of seismic settlement are not acceptable, we recommend that the mat foundation option presented in this report be utilized to mitigate potential seismic settlements.

3.10.1 Subgrade Preparation

After excavation to subgrade elevation, the base of the excavation is frequently disturbed or altered due to utility excavations, construction traffic, desiccation, or rainfall. As a result, the slab-on-grade subgrade may become unsuitable for floor slab support. We recommend that the slab subgrade be compacted to a firm and non-yielding condition and to at least 95 percent of the modified Proctor maximum dry density determined in accordance with ASTM D 1557. At the time of slab base placement, the subgrade should be evaluated by ZGA to verify a firm and non-yielding condition and adequate compaction.

3.10.2 Slab Base

To provide a capillary break and uniform slab bearing surface, we recommend the on-grade slabs be underlain by a 4-inch thick layer of compacted clean crushed rock. In our opinion, the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction does not include a material well suited for this application below slabs. As such, we recommend that the capillary break conform to the graduation requirements for Type 21 or 22 Crushed Gravel as presented in the 2023 City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction, Section 9-03.14, Mineral Aggregate Chart. Alternative capillary break materials should be submitted to the geotechnical engineer for review and approval before use.

3.10.3 Vapor Barrier

Where potential slab moisture is a concern or where moisture sensitive floor coverings are planned, we recommend using a 15-mil, puncture-resistant proprietary product such as Stego Wrap, or an approved equivalent that is classified as a Class A vapor retarder in accordance with ASTM E 1745. Overlap lengths and the appropriate tape used to seal the laps should be in accordance with the vapor retarder manufacturer's recommendations. When conditions warrant the use of a vapor retarder, the slab designer and slab contractor should refer to ACI 302 and ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder/barrier.

3.11 Mat Foundation Option

Our analyses indicate the potential for liquefaction induced settlement due to ground vibrations associated with the IBC design seismic event with a return period of 2,475 years. As discussed in the *Seismic Design Considerations* section of this report, we estimate a total seismic settlement of approximately 2½ to 3 inches and a differential seismic settlement of approximately 1¼ to 1½ inches over a horizontal distance of 40 feet) for the 2018 IBC design earthquake. A mat foundation could be considered to mitigate this seismic settlement risk. Geotechnical recommendations for a mat foundation are presented below.

3.11.1 Subgrade Preparation

After excavation to subgrade elevation, the base of the excavation is frequently disturbed or altered due to utility excavations, construction traffic, desiccation, or rainfall. As a result, the foundation subgrade may become unsuitable. We recommend that the upper foot of mat foundation subgrade be compacted to a firm and non-yielding condition and to at least 95 percent of the modified Proctor maximum dry density determined in accordance with ASTM D 1557. At the time of slab base placement, the subgrade should be evaluated by ZGA to verify a firm and non-yielding condition and adequate compaction.

3.11.2 Mat Foundation Base

To provide a capillary break and uniform slab bearing surface, we recommend the on-grade slabs be underlain by a 6-inch thick layer of compacted clean crushed rock. In our opinion, the WSDOT Standard Specifications for Road, Bridge, and Municipal Construction does not include a material well suited for this application below slabs. As such, we recommend that the capillary break conform to the graduation requirements for Type 21 or 22 Crushed Gravel as presented in the 2023 City of Seattle Standard Specifications for Road, Bridge, and Municipal Construction, Section 9-03.14, Mineral Aggregate Chart. Alternative capillary break materials should be submitted to the geotechnical engineer for review and approval before use.

3.11.3 Modulus of Subgrade Reaction

For mat foundation design supported on 6 inches of compacted structural fill as described above, we recommend a vertical modulus of subgrade reaction of 200 pounds per cubic inch (pci) be used. This vertical modulus is for a 1-foot by 1-foot loaded area.

3.11.4 Allowable Bearing Pressure and Static Settlement

The soil bearing capacities for mat foundations supported on granular soils are typically very large due to large foundation widths and are therefore typically controlled by allowable settlement. Based on a mat foundation width of about 40 feet, length of about 50 to 70 feet, and embedment depth of about 1.5 feet, we recommend an allowable, net soil bearing capacity of 3,000 psf to limit total static settlement to less than 1 inch and differential static settlement to less than ½ inch. A one-third increase of the bearing pressure may be used for short-term transient loads such as wind and seismic forces. Based on previous projects utilizing a mat foundation to support a structure of this size, we anticipate that actual loads would be substantially less than the allowable load of 3,000 psf. As such, total and differential static settlements are anticipated to be small. Settlements would occur elastically as loads are applied.

3.11.5 Mat Foundation Depth

For frost protection, we recommend that the bottom of the mat foundation around the perimeter of the building bear at least 18 inches below the adjacent outside grade.

3.11.6 Lateral Resistance

Resistance to lateral loads can be calculated assuming an allowable passive resistance of 300 pcf equivalent fluid pressure (triangular distribution) and an allowable base friction coefficient of 0.35. The allowable passive resistance and friction coefficient include a 1.5 factor of safety. We recommend that passive resistance be neglected in the upper 18 inches of embedment.

3.11.7 Vapor Barrier

Where potential slab moisture is a concern or where moisture sensitive floor coverings are planned, we recommend using a 15-mil, puncture-resistant proprietary product such as Stego Wrap, or an approved equivalent that is classified as a Class A vapor retarder in accordance with ASTM E 1745. Overlap lengths and the appropriate tape used to seal the laps should be in accordance with the vapor retarder manufacturer's recommendations. When conditions warrant the use of a vapor retarder, the slab designer and slab contractor should refer to ACI 302 and ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder/barrier.

3.11.8 Estimated Seismic Settlements

As discussed in the *Seismic Considerations* section of this report, our analyses indicate the potential for liquefaction induced settlement during the 2018 IBC design earthquake. Based on our analyses, we estimate a total seismic settlement of the soils beneath the slab of approximately 2½ to 3 inches and a differential seismic settlement of approximately 1¼ to 1½ inches over a horizontal distance of 40 feet.

3.12 Backfilled Walls

We anticipate that the development may include some backfilled, cast-in-place (CIP), concrete, building foundation and/or landscape retaining walls. For recommended bearing capacities and lateral resistance parameters, refer to *Shallow Foundations* (Section 3.9) of this report. Please refer to Section 3.13.3 of this report for wall drainage recommendations. Additional recommendations for CIP retaining walls are provided below.

3.12.1 Lateral Earth Pressures

The lateral soil pressures acting on backfilled retaining walls will depend on the nature and density of the soil behind the wall, and the ability of the wall to yield in response to the earth loads. Yielding walls (i.e., walls that are free to translate or rotate) that are able to displace laterally at least 0.001H, where H is the height of the wall, may be designed for active earth pressures. Non-yielding walls (i.e., walls that are not free to translate or rotate) should be designed for at-rest earth pressures. Non-yielding walls include walls that are braced to another wall or structure, and wall corners.

For backfilled walls, assuming they are backfilled and drained in accordance with Section 3.12.3 of this report, we recommend that yielding walls supporting horizontal backfill be designed using an equivalent fluid density of 35 pcf (active earth pressure). Non-yielding walls should be designed using an equivalent fluid density of 55 pcf (at-rest earth pressure). Surcharge pressures due to sloping backfill, adjacent footings, vehicles, construction equipment, etc. must be added to these lateral earth pressure values. For traffic loads, we recommend using an equivalent two-foot soil surcharge of 250 psf. For retaining walls over 6 feet tall with level backfill conditions, we recommend that a uniformly distributed seismic pressure of 12H psf, where H is the height of the wall, be applied to the walls if required by code. The above equivalent fluid pressures are based on the assumption of no buildup of hydrostatic pressure behind the wall. If groundwater is allowed to saturate the backfill soils, hydrostatic pressures will act against a retaining wall.

3.13 Drainage Considerations

3.13.1 Surface Drainage

Final site grades should be sloped to carry surface water away from buildings and other drainage-sensitive areas. Additionally, site grades should be designed such that concentrated runoff on softscape surfaces is avoided. Any surface runoff directed towards softscaped slopes should be collected at the top of the slope and routed to the bottom of the slope and discharged in a manner that prevents erosion.

3.13.2 Building Perimeter Foundation Drains and Wall Drains

We recommend that the building be provided with a footing drain system to reduce the risk of future moisture problems. The footing drains should consist of a minimum 4-inch diameter, Schedule 40, rigid, perforated PVC pipe placed at the base of the heel of the footing with the perforations facing down. The pipe should be surrounded by a minimum of 6 inches of clean free-draining granular material conforming to 2023 WSDOT Standard Specification 9-03.12(4), Gravel Backfill for Drains. A non-woven filter fabric such as Mirafi 140N, or equivalent, should envelope the free-draining granular material. At appropriate intervals such that water backup does not occur, the drainpipe should be connected to a tightline system leading to a suitable discharge. Cleanouts should be provided for future maintenance. The tightline system must be separate from the roof drain system. Roof drains should be connected to a separate solid wall PVC tightline system and routed to a suitable discharge location.

3.13.2 Backfilled Retaining Wall Drains

Adequate drainage measures must be installed to collect and direct subsurface water away from subgrade walls. All backfilled walls should include a drainage aggregate zone extending 1½ feet from the back of wall for the full height of the wall. The drainage aggregate should consist of material meeting the requirements of 2023 WSDOT 9-03.12(2) Gravel Backfill for Walls. A minimum 4-inch diameter, Schedule 40, rigid, perforated PVC pipe should be provided at the base of backfilled walls with the perforations facing down to collect and direct subsurface water to an appropriate discharge point. The pipe should be surrounded by a minimum of 6 inches of clean free-draining granular material conforming to 2023 WSDOT Standard Specification 9-03.12(4), Gravel Backfill for Drains. A non-woven filter fabric such as Mirafi 140N, or equivalent, should envelope the free-draining granular material. At appropriate intervals such that water backup does not occur, the drainpipe should be connected to a tightline system leading to a suitable discharge. Cleanouts should be provided for future maintenance. The tightline system must be separate from the roof drain system.

3.14 Infiltration Considerations

We understand that stormwater management design will be completed in accordance with the 2014 Washington State Department of Ecology Stormwater Management Manual for Western Washington (2014 DOE Manual). The type of infiltration system and system location(s) have not been determined. However, given the relatively shallow nature of groundwater in this part of Marysville, we anticipate that infiltration systems may include shallow infiltration galleries below the parking lot.

Based on the results of our subsurface exploration and analysis, shallow stormwater infiltration systems appear geotechnically feasible. The following sections provide geotechnical design recommendations regarding stormwater infiltration into the recessional glacial recessional outwash deposits encountered on site.

3.14.1 Design Infiltration Rates

Soil conditions observed in the site explorations are consistent with normally consolidated glacial recessional outwash deposits of the Marysville Sand Member and generally consist of the following.

- Loose to medium dense sand with variable silt and silt with variable sand content in the upper 5 to 7½ feet. Soil mottling was observed in some of the samples collected in this depth range.
- From about 5 to 7½ feet down to about 15 to 17½ feet, the outwash generally consists of medium dense to very dense gravelly sand to sandy gravel with trace to some silt.
- From about 15 to 17½ feet to the maximum depth explored at 60 feet below grade, the outwash generally consists of loose to medium dense sand with trace to some silt.

Volume 3, Section 3.3.6 of the 2014 DOE Manual includes provisions for the determination of initial and design saturated hydraulic conductivities for receptor soils based on 1) Large-Scale Pilot Infiltration Tests, 2) Small-Scale Pilot Infiltration Tests, and 3) by means of the Soil Grain Size Analyses Method. We completed our evaluation of the design infiltration rate using the Soil Grain Size Analysis Method based on test results of soil samples collected in ZGA's explorations. Grain size analysis test results are presented in *Appendix B* of this report. The Design Infiltration Rates presented in the table below include the following correction factors in accordance with Volume 3, Section 3.3.6 of the 2014 DOE Manual.

- Site Variability and number of locations tested (CFv) = 0.5
- Test Method (CFt) = 0.4
- Degree of influent control to prevent siltation and bio-buildup (CFm) = 0.9

Summary of Grain Size Analysis Tests Relative to Stormwater Infiltration					
Exploration	Sample Number	Sample Depth (ft)	Soil Formation	Initial (unfactored) Saturated Hydraulic Conductivity (in/hr)	Design Infiltration Rate[2] (in/hr)
B-1	S-3	7½	Marysville Sand Member	20.2	3.6
B-1	S-4	10	Marysville Sand Member	37.1	6.7
B-1	S-5	10	Marysville Sand Member	19.3	3.5
B-2	S-2	5	Marysville Sand Member	3.8	0.7
B-2	S-3	7½	Marysville Sand Member	12.5	2.3
B-2	S-4	10	Marysville Sand Member	15.6	2.8
B-2	S-5	15	Marysville Sand Member	14.7	2.6
B-3	S-2	5	Marysville Sand Member	39.9	7.2
B-3	S-3	7½	Marysville Sand Member	2.0	0.4
B-3	S-4	10	Marysville Sand Member	4.4	0.8
B-3	S-5	15	Marysville Sand Member	4.5	0.8
B-4	S-2	5	Marysville Sand Member	11.9	2.2
B-4	S-3	7½	Marysville Sand Member	8.3	1.5
B-4	S-5	15	Marysville Sand Member	28.4	5.1
1. Includes Correction Factors: CFv = 0.5, CFt = 0.4, and CFm = 0.9					

The data above indicates that design infiltration rates are generally greater below a depth of about 5 to 7½ feet below grade and that design infiltration rates at boring B-3 located in the eastern portion of the undeveloped parcel are significantly lower than the rest of the study area. Therefore, the selection of an appropriate design infiltration rate will depend on the location and depth of the facility. ZGA is available to assist in the selection of an appropriate design infiltration rate once a system location and depth has been established.

3.14.2 Seasonal High Groundwater

Groundwater was measured at depths of 25.41, 27.37, and 28.62 feet below the ground surface in borings B-1, B-2, and B-3, respectively, on October 17, 2023. Based on the time of year the measurements were taken and our experience with groundwater conditions in this part of Arlington, we recommend a preliminary seasonal high groundwater depth of 20 feet below grade. ZGA will monitor groundwater levels in the on-site wells through the 2023-2024 wet season.

3.14.3 Infiltration System Overflow Considerations

The design of infiltration system is based on a number of design parameters with variable uncertainties. Therefore, we recommend that infiltration systems include an overflow when permitted by code to reduce the potential for water in the system from rising above the top of the system storage aggregate or the bottom of the base course for the parking lot pavement section during periods of unusually high or intense precipitation.

3.14.4 Water Quality Treatment Characteristics of Receptor Soils

Soil requirements for water quality treatment considerations are presented under Site Suitability Criteria (SSC) 4 and 6 in Volume 3, Section 3.3.7 of the 2014 DOE Manual. Laboratory test results relative to water quality treatment characteristics are summarized below. Analytical laboratory test results are presented in *Appendix B* of this report.

3.14.4.1 Organic Content

SSC-6 requires a minimum organic content of 1 percent for treatment facilities. Organic content tests completed on three samples collected from borings B-1, B-2, and B-4 (at depths of about 5, 7½, and 10 feet below grade) had organic contents ranging from 1.1 to 1.6 percent by weight with an average of about 1.4 percent by weight.

3.14.4.2 Cation Exchange Capacity

SSC-6 requires a minimum Cation Exchange Capacity (CEC) of 5 milliequivalents/100grams dry soil for treatment facilities. CEC tests completed on three samples collected from borings B-1, B-2, and B-4 (at depths of about 5, 7½, and 10 feet below grade) had CEC values ranging from 5.8 to 6.5 milliequivalents/100grams dry soil with an average of about 6.2 milliequivalents/100grams dry soil. It should be noted that SSC-6 states that lower CEC (less than 5 milliequivalents/100grams dry soil) may be considered if it is based on a soil loading capacity determination for the target pollutants that is accepted by the local jurisdiction.

3.15 Pavements

3.15.1 Asphalt Pavements

The following pavement sections represent our minimum recommendations for an average level of performance during a 20-year design life; therefore, an average level of maintenance will likely be required. A 20-year pavement life typically assumes that an overlay will be placed after about 12 years. Thicker asphalt, base, and subbase courses would offer better long-term performance, but would cost more initially. Conversely, thinner courses would be more susceptible to "alligator" cracking and other failure modes. As such, pavement design can be considered a compromise between a high initial cost and low maintenance costs versus a low initial cost and higher maintenance costs.

The native subgrade soils are anticipated to consist of a mixture of sand with varying portions of silt. Based on our experience with similar soils, we have estimated a California Bearing Ration (CBR) value of 15 percent for this project. No traffic loading was provided for this project. We have assumed relatively low traffic volumes.

We recommend that the upper 12 inches of pavement subgrades be prepared in accordance with the recommendations presented in the Subgrade Preparation section of this report.

We recommend that the crushed aggregate base course conform to Section 9-03.9(3) of the WSDOT Standard Specifications. All base material should be compacted to at least 95 percent of the maximum dry density determined in accordance with ASTM: D 1557.

3.15.1.1 Asphalt Pavement Recommendations

For light duty pavements (parking stall areas), we recommend 2½ inches of asphalt concrete over 4 inches of crushed rock base course. For heavy duty pavements (main access roads, truck delivery routes, etc.), we recommend 3½ inches of asphalt concrete over 6 inches of crushed rock base course. We recommend that the asphalt concrete conform to Section 9-02.1(4) for PG 58-22 or PG 64-22, Performance Graded Asphalt Binder as presented in the 2022 WSDOT Standard Specifications. We also recommend that the gradation of the asphalt aggregate conform to the aggregate gradation control points for ½-inch mixes as presented in Section 9-03.8(6), HMA Proportions of Materials. We recommend that asphalt be compacted to a minimum of 92 percent and a maximum of 96 percent of the theoretical maximum density.

3.15.2 Concrete Pavements

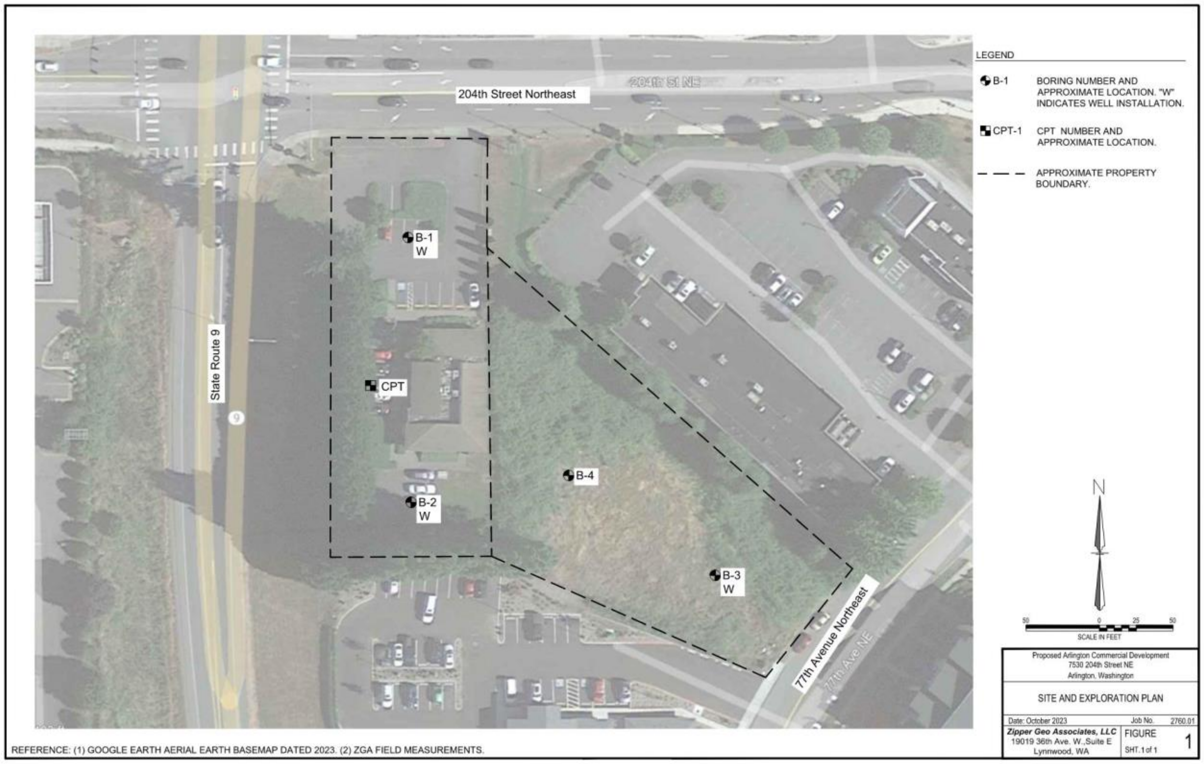
Concrete pavement design recommendations are based on an assumed modulus of rupture of 600 psi and a minimum compressive strength of 4,000 psi for the concrete. For light duty pavements, we recommend 5 inches of concrete over 4 inches of crushed aggregate base. For heavy duty pavements, we recommend 6 inches of concrete over 4 inches of crushed aggregate base. We recommend that concrete pavements be lightly reinforced with 6x6-W2.0xW2.0 welded wire fabric or equivalent to control cracking and have relatively closely spaced control joints on the order of 10 to 12 feet. We recommend that contraction joints be cut before the development of tensile stresses in the concrete. We recommend that the contraction joints be cut to a minimum depth of one inch. We further recommend that loading dock and trash enclosure pavements be reinforced with #4 bars at 15 inches each direction.

4.0 CLOSURE

The analysis and recommendations presented in this report are based, in part, on the explorations completed for this study. The number, location, and depth of the explorations were completed within the constraints of budget and site access so as to yield the information for our environmental scope and to formulate our geotechnical recommendations. Project plans were in the preliminary stage at the time this report was prepared. We therefore recommend that ZGA be provided an opportunity to review the final plans and specifications when they become available in order to assess that the recommendations and design considerations presented in this report have been properly interpreted and implemented into the project design.

The performance of earthwork, structural fill, foundations, and pavements depend greatly on proper site preparation and construction procedures. We recommend that Zipper Geo Associates, LLC be retained to provide geotechnical engineering services during the earthwork-related construction phases of the project. If variations in subsurface conditions are observed at that time, a qualified geotechnical engineer could provide additional geotechnical recommendations to the contractor and design team in a timely manner as the project construction progresses.

This report has been prepared for the exclusive use of Wet Rabbit, LLC, and their agents, for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices. No warranties, either express or implied, are intended or made. Site safety and excavation support are the responsibility of others. In the event that changes in the nature, design, or location of the project as outlined in this report are planned, the conclusions and recommendations contained in this report shall not be considered valid unless Zipper Geo Associates, LLC reviews the changes and either verifies or modifies the conclusions of this report in writing.


204th Street Northeast
204th St NE
State Route 9
B-1
W
CPT
B-2
W
B-4
B-3
W
77th Avenue Northeast
77th Ave NE
LEGEND
B-1 BORING NUMBER AND APPROXIMATE LOCATION. "W" INDICATES WELL INSTALLATION.
CPT-1 CPT NUMBER AND APPROXIMATE LOCATION.
APPROXIMATE PROPERTY BOUNDARY.
N
50 0 25 50
SCALE IN FEET
Proposed Arlington Commercial Development
7530 204th Street NE
Arlington, Washington
SITE AND EXPLORATION PLAN
Date: October 2023
Job No. 2760.01
Zipper Geo Associates, LLC
19019 36th Ave. W.,Suite E
Lynnwood, WA
FIGURE
1
SHT. 1 of 1
REFERENCE: (1) GOOGLE EARTH AERIAL EARTH BASEMAP DATED 2023. (2) ZGA FIELD MEASUREMENTS.

APPENDIX A

SUBSURFACE EXPLORATION PROCEDURES AND LOGS

APPENDIX A
SUBSURFACE EXPLORATION PROCEDURES AND LOGS

Subsurface Exploration Description

Our subsurface evaluation for this project included advancing four borings (B-1 through B-4) and one cone penetrometer test (CPT-1), completed in October 2023. The approximate locations of the explorations are presented on the *Site and Exploration Plan*, Figure 1. The exploration locations were determined by measuring with a fiberglass tape relative to existing site features. Ground surface elevations at the exploration locations were inferred from elevation data available through Google Earth Pro aerial imagery. As such, the exploration locations and elevations should be considered accurate only to the degree implied by the means and methods used to define them.

Soil Borings

The borings were advanced using a track-mounted drill rig operated by a local drilling company (Holocene Drill, Inc.) working under subcontract to ZGA. The borings were advanced using hollow stem auger drilling methods. A geologist from our firm continuously observed the borings, logged the subsurface conditions encountered, and obtained representative soil samples. All samples were stored in moisture-tight containers and transported to our laboratory for further evaluation and testing. Samples were obtained by means of the Standard Penetration Test at 2.5- to 5-foot intervals throughout the drilling operation.

The Standard Penetration Test (ASTM D 1586) procedure consists of driving a standard 2-inch outside diameter steel split spoon sampler 18 inches into the soil with a 140-pound hammer free falling 30 inches. The number of blows required to drive the sampler through each 6-inch interval is recorded, and the total number of blows struck during the final 12 inches is recorded as the Standard Penetration Resistance, or "blow count" (N value). If a total of 50 blows are struck within any 6-inch interval, the driving was stopped, and the blow count is recorded as 50 blows for the actual penetration distance. The resulting Standard Penetration Resistance values indicate the relative density of granular soils and the relative consistency of cohesive soils.

The enclosed boring logs describes the vertical sequence of soils and materials encountered in the borings, based primarily upon our field classifications. Where a soil contact was observed to be gradational, our logs indicate the average contact depth. Where a soil type changed between sample intervals, we inferred the contact depth. Our logs also graphically indicate the blow count, sample type, sample number, and approximate depth of each soil sample obtained from the borings. If groundwater was encountered, the approximate groundwater depth, and date of observation, are depicted on the logs. Groundwater monitoring well installations are also graphically indicated on the logs.

Cone Penetrometer Test (CPT)

One electric cone penetrometer probe was completed using a truck-mounted probe rig operated by an independent firm (In-Situ Engineering, Inc.) working under subcontract to ZGA. An engineer from our firm continuously observed the probes while electronic monitoring equipment in the probe rig automatically logged the subsurface conditions. After the probe was completed, the probe hole was backfilled with a bentonite slurry.

Throughout the probing operation, soil and groundwater properties were measured at 5-centimeter depth intervals by means of the Cone Penetration Test (CPT) in general accordance with ASTM D3441. This testing procedure involves pushing a standard 1.5-inch diameter steel cone penetrometer into the soil with hydraulic rams. A cone penetrometer consists of a conical tip, a cylindrical sleeve, and a pressure transducer. As the penetrometer is pushed downward, the tip resistance, sleeve friction, and porewater pressure are measured electronically and plotted as a function of depth. Through interpretation, the resulting graphs can reveal soil types and groundwater levels, as well as the relative density of granular soils and the relative consistency of cohesive soils. The CPT exploration completed for this project also included measurements of soil shear wave velocity.

The enclosed CPT graph presents the vertical plots of several soil properties and groundwater pressures measured by the cone penetrometer at each probe location. These graphs also depict the Standard Penetration Resistance (N_{60}) corresponding to each test interval, based on published conversion charts.

EXPLANATION OF EXPLORATION LOGS

SOIL DESCRIPTION: Soil descriptions presented on the borings logs are based on visual observations. Soil descriptions include density (coarse-grained soils) or consistency (fine-grained soils), moisture, color, major soil type, and grain size modifiers and should not be interpreted to suggest laboratory or field testing unless indicated on the logs. Soil descriptions include the following: Density/consistency, moisture, color, grain size modifier (adjective implying 31-49 percent), major soil type (CAPITALIZED implying 50+ percent), minor grain size modifier (some implying 6-12 percent, with implying 13-30 percent, and trace implying 0-5 percent), descriptive modifiers (i.e. roots, fill debris, cemented, etc.), and interpreted general geologic description. Descriptions may also include comments describing geologic properties such as dilatancy, toughness, structure, plasticity, and angularity of coarse-grained particles. Additional information regarding geologic properties is presented in the report text as applicable.

DENSITY/CONSISTENCY: Soil density/consistency in borings is related to the blow count number in blows per foot using the sampling method indicated on the logs. Soil density/consistency in test pits is related to a "Field Test" as described below. Soil consistency in test pits or borings may be augmented by field Torvane or Pocket Penetrometer testing.

Coarse-Grained Soils

Density Descriptor	SPT (# blows/ft)	Field Test
Very Loose	0 – 4	Easily penetrated with ½ -inch steel rod pushed by hand.
Loose	5 – 10	Difficult to penetrate with ½ - inch steel rod pushed by hand.
Medium Dense	11 – 30	Easily penetrated a foot with ½-inch steel rod driven with 5-lb hammer.
Dense	31 – 50	Difficult to penetrate a foot with ½-inch steel rod driven with 5-lb hammer.
Very Dense	>50	Penetrated only a few inches with ½-inch steel rod driven with 5-lb hammer.

Fine-Grained Soils

Consistency Descriptor	SPT (# blows/ft)	Torvane	Pocket Penetrometer	Field Test
		Undrained shear strength (tsf)	Unconfined Compressive Strength (tsf)	
Very Soft	0 – 2	<0.125	<0.25	Easily penetrates several inches by thumb.
Soft	3 – 4	0.125 – 0.25	0.25 – 0.5	Easily penetrates one inch by thumb.
Medium Stiff	5 – 8	0.25 – 0.5	0.5 – 1.0	Penetrated over ½ inch by thumb with moderate effort.
Stiff	9 – 15	0.5 – 1.0	1.0 – 2.0	Indented by thumb but penetrated only with great effort.
Very Stiff	16 – 30	1.0 – 2.0	2.0 – 4.0	Readily indented by thumbnail.
Hard	>30	>2.0	>4.0	Indented by thumbnail with difficult effort.

MOISTURE

Descriptor	Field Test
Dry	Absence of moisture, dusty, dry to the touch.
Damp	Too low to achieve compaction
Moist	Appears near optimum moisture content for compaction
Wet	Too wet to achieve compaction
Saturated	Below the groundwater table, visible free moisture.

MAJOR SOIL TYPE: Coarse-grained soils with over 50% of the material retained on the U.S. No. 200 sieve. Coarse-grained soils include boulders, cobbles, gravels and sands. Fine-grained soils with over 50% of the material passing the U.S. No. 200 sieve. Fine-grained soils include silts and clays.

GRAIN SIZE

Descriptor	Sieve Size	Grain Size
Boulder	>12"	>12"
Cobble	3 – 12"	3 – 12"
Gravel	3" – #4	3" – 0.19"
Sand	>#4 – #200	<0.19" – >0.0029"
Silt/Clay	Passing #200	<0.0029"

GRAIN SIZE MODIFIERS

Descriptor	Approximate Percentage
Trace	0 – 5
Some	6 – 12
With	13 – 30
Adjective (silty, clayey, sandy, gravelly)	31 – 50

Boring Location:	See Site and Exploration Plan	Drilling Company:	Holocene	Bore Hole Dia.:	8-inch
Top Elevation:	127 feet above mean sea	Drilling Method:	Hollow Stem Auger	Hammer Type:	Automatic
Date Drilled:	10/12/2023	Drill Rig:	Diedrich D-50	Logged by:	KRN

B-1

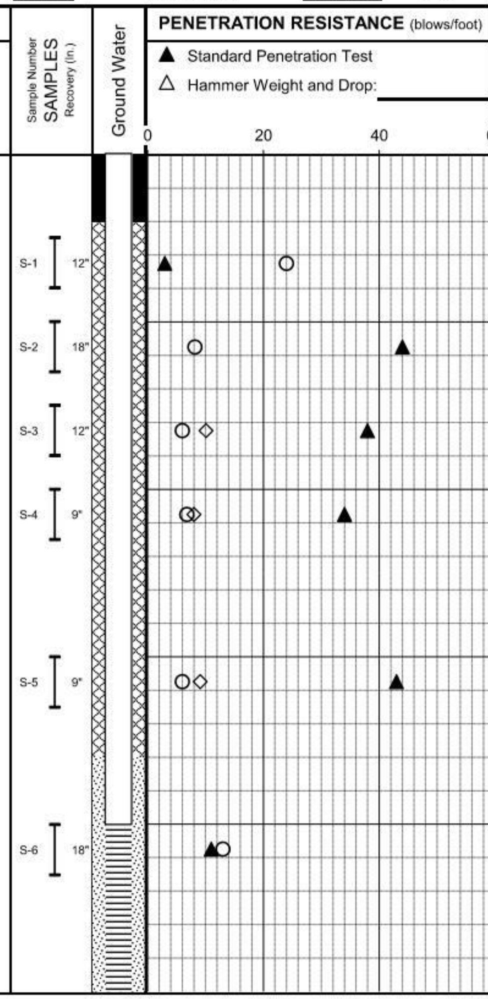
SOIL DESCRIPTION

The stratification lines represent the approximate boundaries between soil types. The transition may be gradual. Refer to report text and appendices for additional information.

PENETRATION RESISTANCE (blows/foot)

▲ Standard Penetration Test

△ Hammer Weight and Drop:



Depth (ft)	Soil Description	Sample Number	Recovery (in.)	Blow Counts	Testing
0	Approximately 2-inches of asphalt over moist, brown, SAND with gravel to gravelly SAND, trace silt. (Marysville Sand Member)				
	Very loose, moist, brown and mottled gray, silty SAND to SILT, some sand. No odors, no staining, PID <1 ppmv.	S-1	12"	3	
5	Dense, moist, gray, mottled, SILT, some sand, some roots. No odors, no staining, PID <1 ppmv. Grades to SAND, some gravel.	S-2	18"	44	CEC ORG
	Dense, moist, brown to gray, gravelly SAND, some silt.	S-3	12"	38	GSA
10	Dense, moist, brown to gray, gravelly SAND, some silt. No odors, no staining, PID <1 ppmv.	S-4	9"	34	GSA
15	Dense, moist, brown to golden brown, gravelly SAND, some silt. No odors, no staining, PID <1 ppmv.	S-5	9"	43	GSA
20	Medium dense, moist, golden brown, SAND, trace to some silt. No odors, no staining, PID <1 ppmv.	S-6	18"	11	
25					

SAMPLE LEGEND

- 2-inch O.D. split spoon sample
- 3-inch I.D. Shelby tube sample

GROUNDWATER LEGEND

- Clean Sand
- Bentonite
- Grout/Concrete
- Screened Casing
- Blank Casing
- ▼ 11/2/12 Groundwater level at time of drilling (ATD) or on date of measurement.

TESTING KEY

GSA = Grain Size Analysis
200W = 200 Wash Analysis
Consol. = Consolidation Test
Att. = Atterberg Limits

◇ % Fines (<0.075 mm)
○ % Water (Moisture) Content
Plastic Limit ├──⊖──┤ Liquid Limit
Natural Water Content

Arlington Commercial Development
7530 204th Street NE
Arlington, WA

Date: October 2023 Project No.: 2760.01

ZipperGeo
Geoprofessional Consultants
19019 36th Ave. W, Suite E
Lynnwood, WA

BORING LOG: B-1

Page 1 of 2

Boring Location: See Site and Exploration Plan	Drilling Company: Holocene	Bore Hole Dia.: 8-inch	**B-1**		
Top Elevation: 127 feet above mean sea	Drilling Method: Hollow Stem Auger	Hammer Type: Automatic			
Date Drilled: 10/12/2023	Drill Rig: Diedrich D-50	Logged by: KRN			

The stratification lines represent the approximate boundaries between soil types. The transition may be gradual. Refer to report text and appendices for additional information.

PENETRATION RESISTANCE (blows/foot): ▲ Standard Penetration Test; △ Hammer Weight and Drop:

Depth (ft)	SOIL DESCRIPTION	Sample Number	Recovery (in.)	Ground Water	Blow Counts	Testing
25	Medium dense, saturated, golden brown, SAND, trace to some silt. No odors, no staining, PID <1 ppmv.	S-7	18"	ATD	16	
30	Loose, saturated, golden brown, SAND, trace to some silt.	S-8	18"		6	
	Boring completed at approximately 31.5 feet. Groundwater was encountered at approximately 25 feet below ground surface at time of drilling. Ecology Well Tag ID BPX 514.					
35						
40						
45						
50						

SAMPLE LEGEND
- 2-inch O.D. split spoon sample
- 3-inch I.D. Shelby tube sample

GROUNDWATER LEGEND
- Clean Sand
- Bentonite
- Grout/Concrete
- Screened Casing
- Blank Casing
- Groundwater level at time of drilling (ATD) or on date of measurement. (11/2/12)

TESTING KEY
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◇ % Fines (<0.075 mm)
○ % Water (Moisture) Content
Plastic Limit ├──⊖──┤ Liquid Limit
Natural Water Content

Arlington Commercial Development
7530 204th Street NE
Arlington, WA

Date: October 2023 Project No.: 2760.01

ZipperGeo Geoprofessional Consultants
19019 36th Ave. W, Suite E
Lynnwood, WA

BORING LOG: B-1

Page 2 of 2

Boring Location: See Site and Exploration Plan	Drilling Company: Holocene	Bore Hole Dia.: 8-inch	**B-2**
Top Elevation: 129 feet above mean sea	Drilling Method: Hollow Stem Auger	Hammer Type: Automatic	
Date Drilled: 10/12/2023	Drill Rig: Diedrich D-50	Logged by: KRN	

SOIL DESCRIPTION

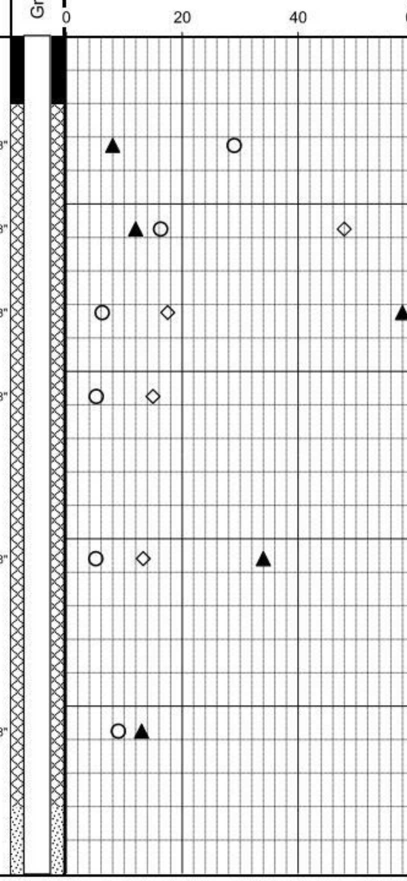
The stratification lines represent the approximate boundaries between soil types. The transition may be gradual. Refer to report text and appendices for additional information.

PENETRATION RESISTANCE (blows/foot)

▲ Standard Penetration Test

△ Hammer Weight and Drop:

Depth (ft)	Soil Description	Sample Number	Recovery (in.)	Blow Counts	Testing
0	Approximately 2-inches of asphalt over moist, brown SAND, with gravel to gravelly SAND, trace silt. (Marysville Sand Member)				
	Loose, moist, dark brown, silty SAND to sandy SILT, some fine roots. No odors, no staining, PID <1 ppmv. Grades to brown, decreasing roots, trace fine gravel.	S-1	18"	8	
5	Medium dense, moist, brown, silty SAND, trace gravel, trace roots. No odors, no staining, PID <1 ppmv.	S-2	18"	12	GSA
	Very dense, moist, light brown to brown, gravelly SAND, with silt. No odors, no staining, PID <1 ppmv.	S-3	18"	58	GSA CEC ORG
10	Very dense, moist, brown to dark brown, GRAVEL, with sand and silt. No odors, no staining, PID <1 ppmv.	S-4	18"	63	GSA
15	Dense, moist, brown, GRAVEL, with sand and silt. No odors, no staining, PID <1 ppmv.	S-5	18"	34	GSA
20	Medium dense, moist, golden brown, SAND with trace to some silt. No odors, no staining, PID <1 ppmv.	S-6	18"	13	
25					



SAMPLE LEGEND

2-inch O.D. split spoon sample

3-inch I.D. Shelby tube sample

GROUNDWATER LEGEND

Clean Sand

Bentonite

Grout/Concrete

Screened Casing

Blank Casing

Groundwater level at time of drilling (ATD) or on date of measurement.

11/2/12

◇ % Fines (<0.075 mm)

○ % Water (Moisture) Content

Plastic Limit ├──⊖──┤ Liquid Limit

Natural Water Content

TESTING KEY

GSA = Grain Size Analysis

200W = 200 Wash Analysis

Consol. = Consolidation Test

Att. = Atterberg Limits

Arlington Commercial Development
7530 204th Street NE
Arlington, WA

Date: October 2023 Project No.: 2760.01

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Lynnwood, WA

BORING LOG: B-2

Page 1 of 2

Boring Location:	See Site and Exploration Plan	Drilling Company:	Holocene	Bore Hole Dia.:	8-inch
Top Elevation:	129 feet above mean sea	Drilling Method:	Hollow Stem Auger	Hammer Type:	Automatic
Date Drilled:	10/12/2023	Drill Rig:	Diedrich D-50	Logged by:	KRN

B-2

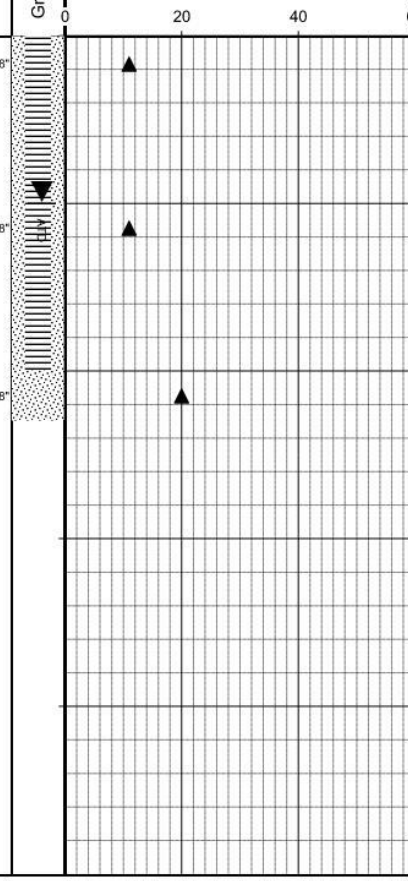
SOIL DESCRIPTION

The stratification lines represent the approximate boundaries between soil types. The transition may be gradual. Refer to report text and appendices for additional information.

PENETRATION RESISTANCE (blows/foot)

▲ Standard Penetration Test
△ Hammer Weight and Drop:

Depth (ft)	Soil Description	Sample Number	Recovery (in.)	Blow Counts	Testing
25	Medium dense, wet to saturated, golden brown, SAND with trace to some silt. No odors, no staining, PID <1 ppmv.	S-7	18"	11	
30	Medium dense, saturated, golden brown, SAND, trace to some silt. No odors, no staining, PID <1 ppmv.	S-8	18"	11	
35	Medium dense, saturated, golden brown, SAND, trace to some silt. No odors, no staining, PID <1 ppmv.	S-9	18"	20	
	Boring completed at approximately 36.5 feet. Groundwater was encountered at approximately 30 feet below ground surface at time of drilling. Ecology Well Tag ID BPX 515.				
40					
45					
50					



SAMPLE LEGEND
- 2-inch O.D. split spoon sample
- 3-inch I.D. Shelby tube sample

GROUNDWATER LEGEND
- Clean Sand
- Bentonite
- Grout/Concrete
- Screened Casing
- Blank Casing
- Groundwater level at time of drilling (ATD) or on date of measurement. 11/2/12

TESTING KEY
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- Consol. = Consolidation Test
- Att. = Atterberg Limits

◇ % Fines (<0.075 mm)
○ % Water (Moisture) Content
Plastic Limit ⊢—⊖—⊣ Liquid Limit
Natural Water Content

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Arlington, WA

Date: October 2023 Project No.: 2760.01

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Lynnwood, WA

BORING LOG: B-2

Page 2 of 2

Boring Location:	See Site and Exploration Plan	Drilling Company:	Holocene	Bore Hole Dia.: 8-inch	**B-3**
Top Elevation:	130 feet above mean sea	Drilling Method:	Hollow Stem Auger	Hammer Type: Automatic	
Date Drilled:	10/12/2023	Drill Rig:	Diedrich D-50	Logged by: KRN	

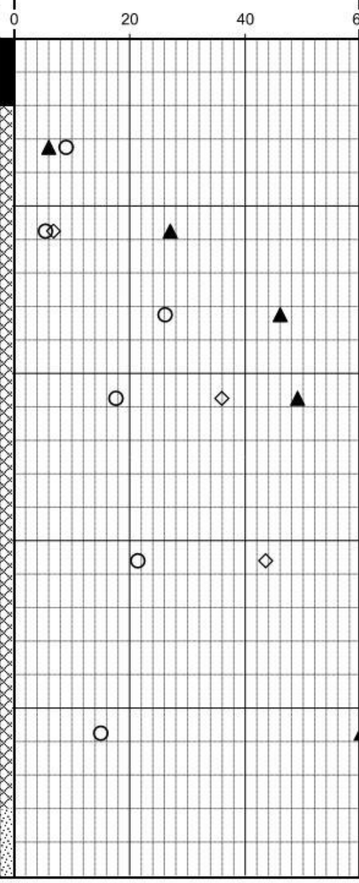
SOIL DESCRIPTION

The stratification lines represent the approximate boundaries between soil types. The transition may be gradual. Refer to report text and appendices for additional information.

PENETRATION RESISTANCE (blows/foot)

▲ Standard Penetration Test
△ Hammer Weight and Drop:

Depth (ft)	Soil Description	Sample Number	Recovery (in.)	Blow Counts	Testing
0	Grass over approximately 3 inches of moist, brown, SAND with silt, abundant grass roots. (Marysville Sand member)				
	Loose, moist, brown, SAND with silt to silty SAND, some fine roots. No odors, no staining, PID <1 ppmv.	S-1	18"	6	
5	Medium dense, moist, dark brown, SAND with gravel, some silt. No odors, no staining, PID <1 ppmv.	S-2	18"	27	GSA
	Dense, moist to wet, brown, sandy SILT, trace gravel. No odors, no staining, PID <1 ppmv.	S-3	6"	46	GSA
10	Dense, moist to wet, brown, silty SAND, with gravel. No odors, no staining, PID <1 ppmv. Grades to gravelly SAND, some silt.	S-4	12"	49	GSA
15	Very dense, wet, brown, silty SAND some gravel. No odors, no staining, PID <1 ppmv.	S-5	9"	82	GSA
20	Very dense, wet, brown, SAND with silt, decreasing fines to some silt. No odors, no staining, PID <1 ppmv.	S-6	18"	91/11"	
25					



SAMPLE LEGEND
- 2-inch O.D. split spoon sample
- 3-inch I.D. Shelby tube sample

GROUNDWATER LEGEND
- Clean Sand
- Bentonite
- Grout/Concrete
- Screened Casing
- Blank Casing
- Groundwater level at time of drilling (ATD) or on date of measurement. 11/2/12

◇ % Fines (<0.075 mm)
○ % Water (Moisture) Content
Plastic Limit ├──⊖──┤ Liquid Limit
Natural Water Content

TESTING KEY
- GSA = Grain Size Analysis
- 200W = 200 Wash Analysis
- Consol. = Consolidation Test
- Att. = Atterberg Limits

Arlington Commercial Development
7530 204th Street NE
Arlington, WA

Date: October 2023 Project No.: 2760.01

ZipperGeo Geoprofessional Consultants
19019 36th Ave. W, Suite E
Lynnwood, WA

BORING LOG: B-3

Page 1 of 2

Boring Location: See Site and Exploration Plan	Drilling Company: Holocene	Bore Hole Dia.: 8-inch	**B-3**
Top Elevation: 130 feet above mean sea	Drilling Method: Hollow Stem Auger	Hammer Type: Automatic	
Date Drilled: 10/12/2023	Drill Rig: Diedrich D-50	Logged by: KRN	

SOIL DESCRIPTION

The stratification lines represent the approximate boundaries between soil types. The transition may be gradual. Refer to report text and appendices for additional information.

PENETRATION RESISTANCE (blows/foot): ▲ Standard Penetration Test; △ Hammer Weight and Drop:

Depth (ft)	Soil Description	Sample Number	Recovery (in.)	Ground Water	Blow Counts	Testing
25	Medium dense, wet, brown, SAND, trace to some silt. No odors, no staining, PID <1 ppmv.	S-7	18"		22	
30	Medium dense, saturated, brown, SAND, trace to some silt. No odors, no staining, PID <1 ppmv.	S-8	18"	▼ ATD	22	
35	Medium dense, saturated, brown, SAND, trace to some silt. No odors, no staining, PID <1 ppmv.	S-9	18"		18	
	Boring completed at approximately 36.5 feet. Groundwater was encountered at approximately 30 feet below ground surface at time of drilling. Ecology Well Tag ID BPX 516.					
40						
45						
50						

SAMPLE LEGEND

- 2-inch O.D. split spoon sample
- 3-inch I.D. Shelby tube sample

GROUNDWATER LEGEND

- Clean Sand
- Bentonite
- Grout/Concrete
- Screened Casing
- Blank Casing
- ▼ Groundwater level at time of drilling (ATD) or on date of measurement. 11/2/12

TESTING KEY

GSA = Grain Size Analysis
200W = 200 Wash Analysis
Consol. = Consolidation Test
Att. = Atterberg Limits

◇ % Fines (<0.075 mm)
○ % Water (Moisture) Content
Plastic Limit —○— Liquid Limit
Natural Water Content

Arlington Commercial Development
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Arlington, WA

Date: October 2023 Project No.: 2760.01

ZipperGeo Geoprofessional Consultants
19019 36th Ave. W, Suite E
Lynnwood, WA

BORING LOG: B-3

Page 2 of 2

B-4

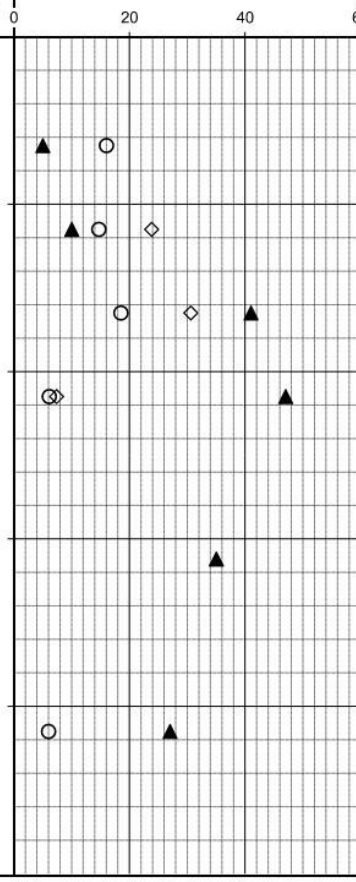
Boring Location: See Site and Exploration Plan	Drilling Company: Holocene	Bore Hole Dia.: 8-inch	B-4
Top Elevation: 130 feet above mean sea	Drilling Method: Hollow Stem Auger	Hammer Type: Automatic	
Date Drilled: 10/12/2023	Drill Rig: Diedrich D-50	Logged by: KRN	

SOIL DESCRIPTION

The stratification lines represent the approximate boundaries between soil types. The transition may be gradual. Refer to report text and appendices for additional information.

PENETRATION RESISTANCE (blows/foot)

▲ Standard Penetration Test
△ Hammer Weight and Drop:



Depth (ft)	Soil Description	Sample Number	Recovery (in.)	Ground Water	Blow Counts	Testing
0	Grass over approximately 4 inches of moist, brown, SAND with silt, abundant roots. (Marysville Sand Member)					
	Loose, moist, brown, SAND, with to some gravel, some silt, trace roots. No odors, no staining, PID <1 ppmv.	S-1	18"		5	
5	Loose, moist, brown, SAND, with silt, trace gravel. No odors, no staining, PID <1 ppmv.	S-2	18"		10	GSA
	Dense, moist, dark brown, silty SAND, trace gravel. No odors, no staining, PID <1 ppmv.	S-3	18"		41	GSA
10	Dense, moist, light brown, gravelly SAND, some silt. No odors, no staining, PID <1 ppmv.	S-4	9"		47	GSA CEC ORG
15	Dense, moist, light brown, gravelly SAND to sandy GRAVEL. No odors, no staining, PID <1 ppmv.	S-5	12"		35	
20	Medium dense, moist, light brown, SAND with gravel, trace silt. No odors, no staining, PID <1 ppmv.	S-6	12"		27	
25						

SAMPLE LEGEND
- 2-inch O.D. split spoon sample
- 3-inch I.D. Shelby tube sample

GROUNDWATER LEGEND
- Clean Sand
- Bentonite
- Grout/Concrete
- Screened Casing
- Blank Casing
- ▼ 11/2/12 Groundwater level at time of drilling (ATD) or on date of measurement.

TESTING KEY
- GSA = Grain Size Analysis
- 200W = 200 Wash Analysis
- Consol. = Consolidation Test
- Att. = Atterberg Limits

◇ % Fines (<0.075 mm)
○ % Water (Moisture) Content
Plastic Limit ├──○──┤ Liquid Limit
Natural Water Content

Arlington Commercial Development
7530 204th Street NE
Arlington, WA

Date: October 2023 Project No.: 2760.01

ZipperGeo Geoprofessional Consultants
19019 36th Ave. W, Suite E
Lynnwood, WA

BORING LOG: B-4

Page 1 of 2

Boring Location: See Site and Exploration Plan	Drilling Company: Holocene	Bore Hole Dia.: 8-inch	**B-4**
Top Elevation: 130 feet above mean sea	Drilling Method: Hollow Stem Auger	Hammer Type: Automatic	
Date Drilled: 10/12/2023	Drill Rig: Diedrich D-50	Logged by: KRN	

The stratification lines represent the approximate boundaries between soil types. The transition may be gradual. Refer to report text and appendices for additional information.

PENETRATION RESISTANCE (blows/foot): ▲ Standard Penetration Test; △ Hammer Weight and Drop:

Depth (ft)	SOIL DESCRIPTION	Sample Number	Recovery (in.)	Ground Water	Blow Counts	Testing
25	Medium dense, moist, light brown, SAND with gravel, trace silt. No odors, no staining, PID <1 ppmv.	S-7	12"		14	
30	Medium dense, moist to wet, light brown, SAND with gravel, trace silt. No odors, no staining, PID <1 ppmv.	S-8	18"		24	
	Boring completed at approximately 31.5 feet. Groundwater was not encountered at time of drilling. Borehole backfilled with bentonite.					
35						
40						
45						
50						

SAMPLE LEGEND
- 2-inch O.D. split spoon sample
- 3-inch I.D. Shelby tube sample

GROUNDWATER LEGEND
- Clean Sand
- Bentonite
- Grout/Concrete
- Screened Casing
- Blank Casing
- Groundwater level at time of drilling (ATD) or on date of measurement. 11/2/12

TESTING KEY
- GSA = Grain Size Analysis
- 200W = 200 Wash Analysis
- Consol. = Consolidation Test
- Att. = Atterberg Limits

◇ % Fines (<0.075 mm)
○ % Water (Moisture) Content
Plastic Limit ├─○─┤ Liquid Limit
Natural Water Content

Arlington Commercial Development
7530 204th Street NE
Arlington, WA

Date: October 2023 Project No.: 2760.01

ZipperGeo Geoprofessional Consultants
19019 36th Ave. W, Suite E
Lynnwood, WA

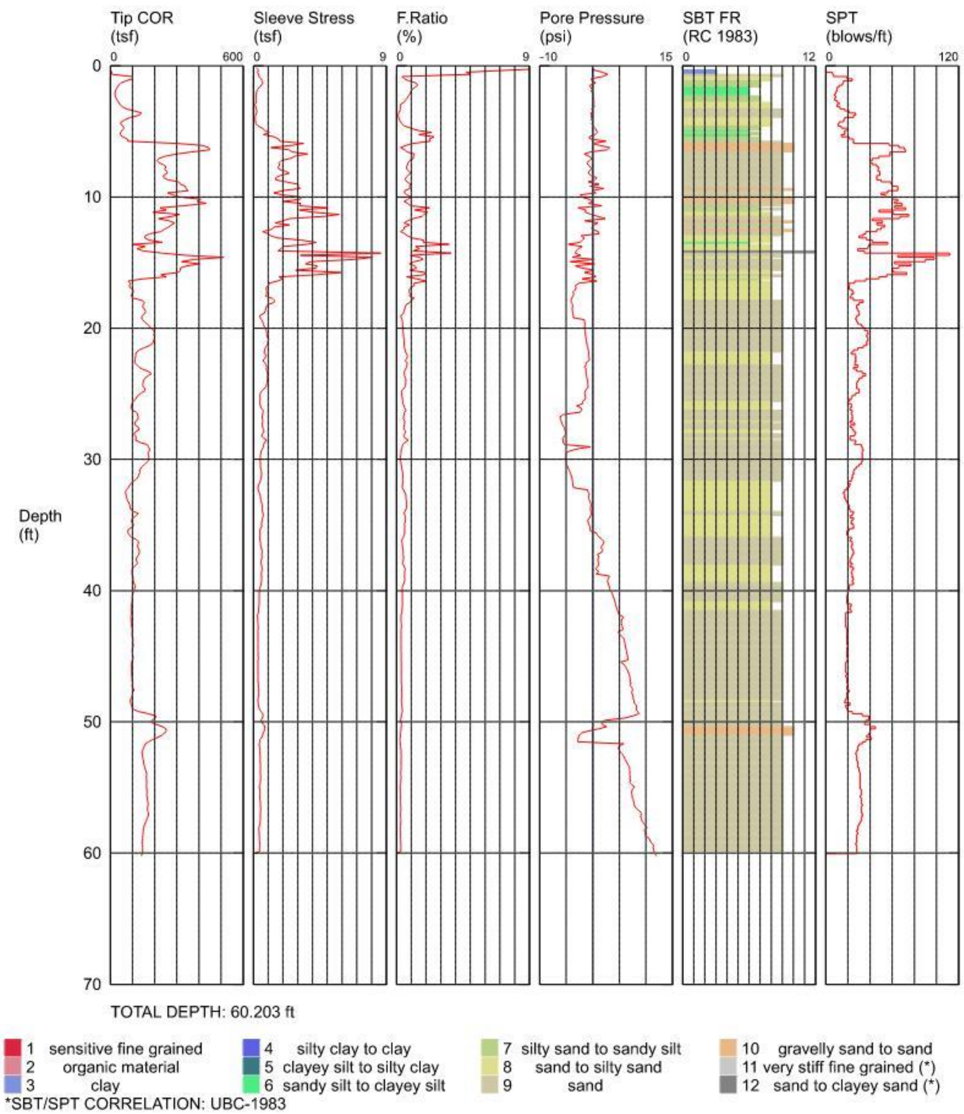
BORING LOG: B-4

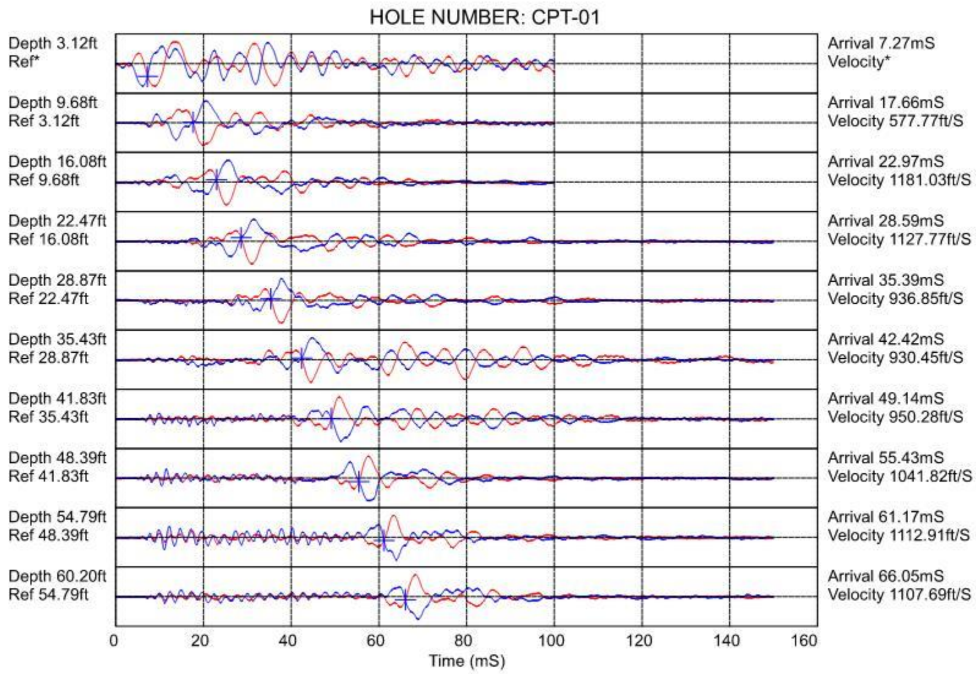
Page 2 of 2

CPT-01

CPT CONTRACTOR: In Situ Engineering
CUSTOMER: Zippergeo
LOCATION: Arlington
JOB NUMBER: 2760.01

OPERATOR: Forinash
CONE ID: DDG1369
TEST DATE: 10/17/2023 9:30:24 AM
PREDRILL: 0ft
BACKFILL: 20% Slurry & Bentonite Chips
SURFACE PATCH: Cold Patch





Hammer to Rod String Distance (ft): 2.49
* = Not Determined

COMMENT:

APPENDIX B
LABORATORY TESTING PROCEDURES AND RESULTS

LABORATORY TESTING PROCEDURES

A series of laboratory tests were performed during the course of this study to evaluate the index and geotechnical engineering properties of the subsurface soils. Descriptions of the types of tests performed are given below.

Visual Classification

Samples recovered from the exploration locations were visually classified in the field during the exploration program. Representative portions of the samples were carefully packaged in moisture tight containers and transported to our laboratory where the field classifications were verified or modified as required. Visual classification was generally done in accordance with ASTM D2488. Visual soil classification includes evaluation of color, relative moisture content, soil type based upon grain size, and accessory soil types included in the sample. Soil classifications are presented on the exploration logs in Appendix A.

Moisture Content Determinations

Moisture content determinations were performed on representative samples obtained from the explorations to aid in identification and correlation of soil types. The determinations were made in general accordance with the test procedures described in ASTM D2216. Moisture contents are presented on the exploration logs in Appendix A.

Grain Size Analysis

A grain size analysis presents the range in diameter of soil particles that comprise a particular sample. Grain size analyses were performed on representative samples in general accordance with ASTM: D6913. The results of the grain size determinations for the samples were used in classification of the soils and are presented in this appendix.

Cation Exchange Capacity

Cation exchange capacity tests were completed on representative samples collected from prospective infiltration receptor soils by an independent analytical laboratory in accordance with the Washington State Department of Ecology SW-846 9081 test method. Test results are presented in this appendix.

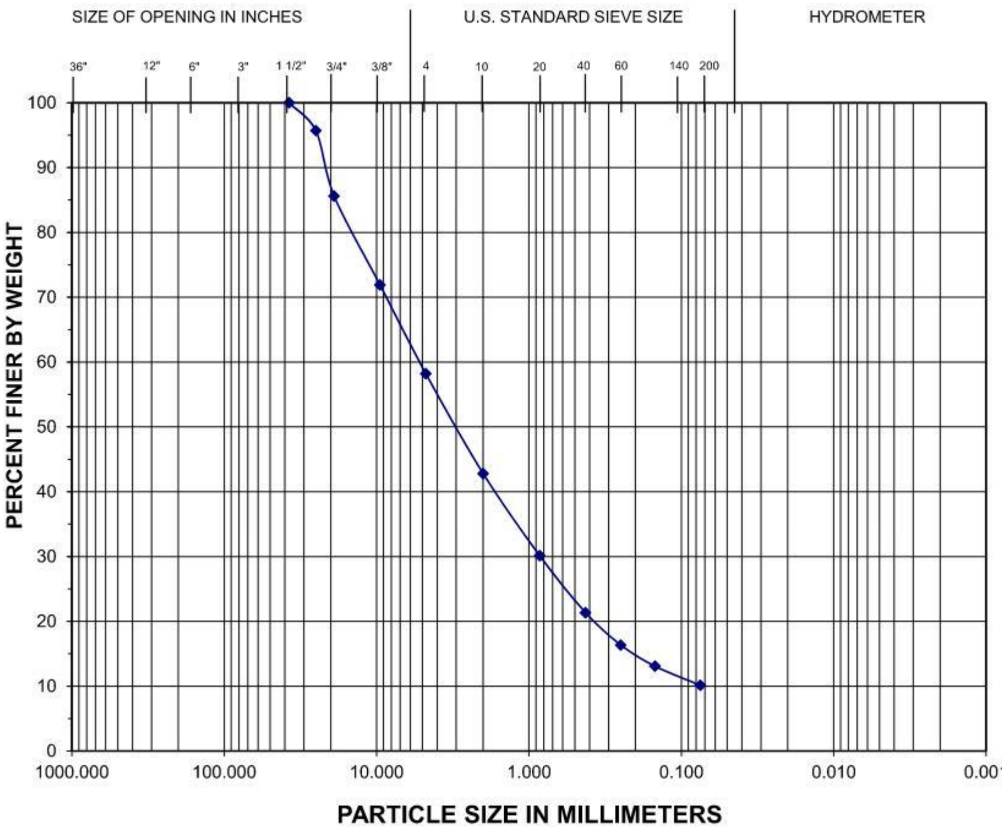
Organic Content Tests

Organic content tests were completed on representative samples collected from prospective infiltration receptor soils by an independent analytical laboratory in accordance with ASTM D2974 test method. Test results are presented in this appendix.

GRAIN SIZE ANALYSIS

Test Results Summary

ASTM D6913



		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
BOULDERS	COBBLES	GRAVEL		SAND			FINE GRAINED	

Comments:

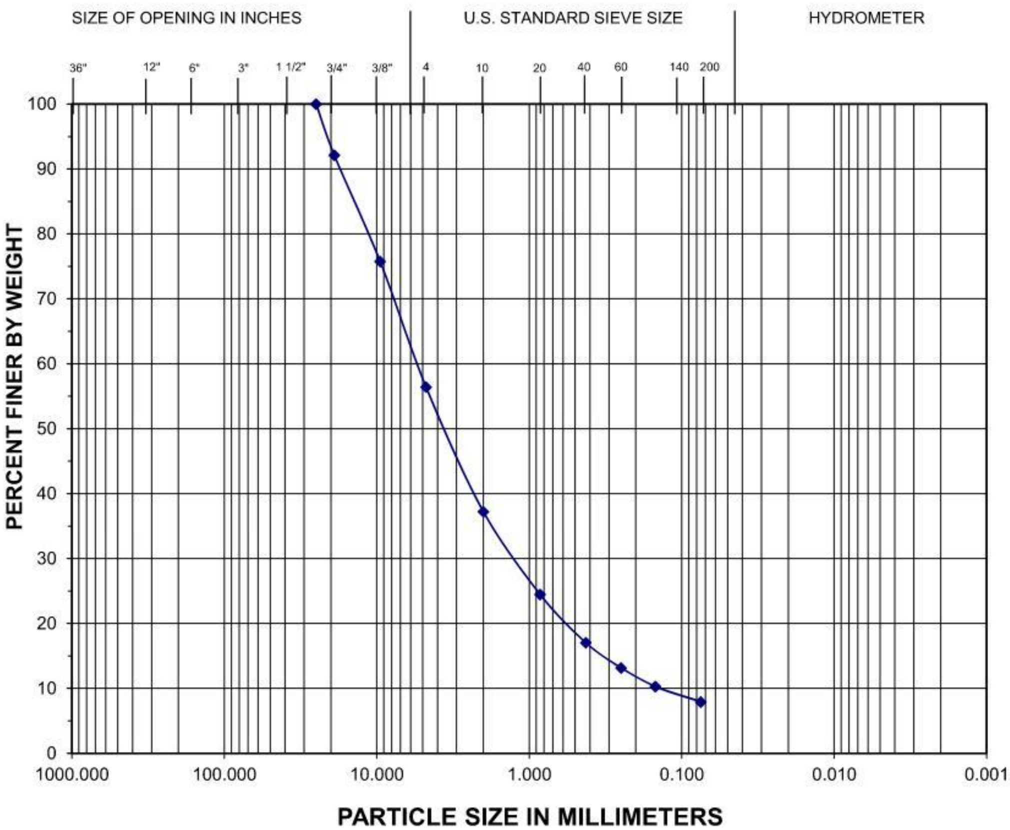
Exploration	Sample	Depth (feet)	Moisture (%)	Fines (%)	Description
B-1	S-3	7.5	5.6	10.1	Gravelly SAND, some silt

Zipper Geo Associates, LLC Geotechnical and Environmental Consultants	PROJECT NO: 2760.01 DATE OF TESTING: 10/16/2023	PROJECT NAME: Arlington Commercial Development

GRAIN SIZE ANALYSIS

Test Results Summary

ASTM D6913



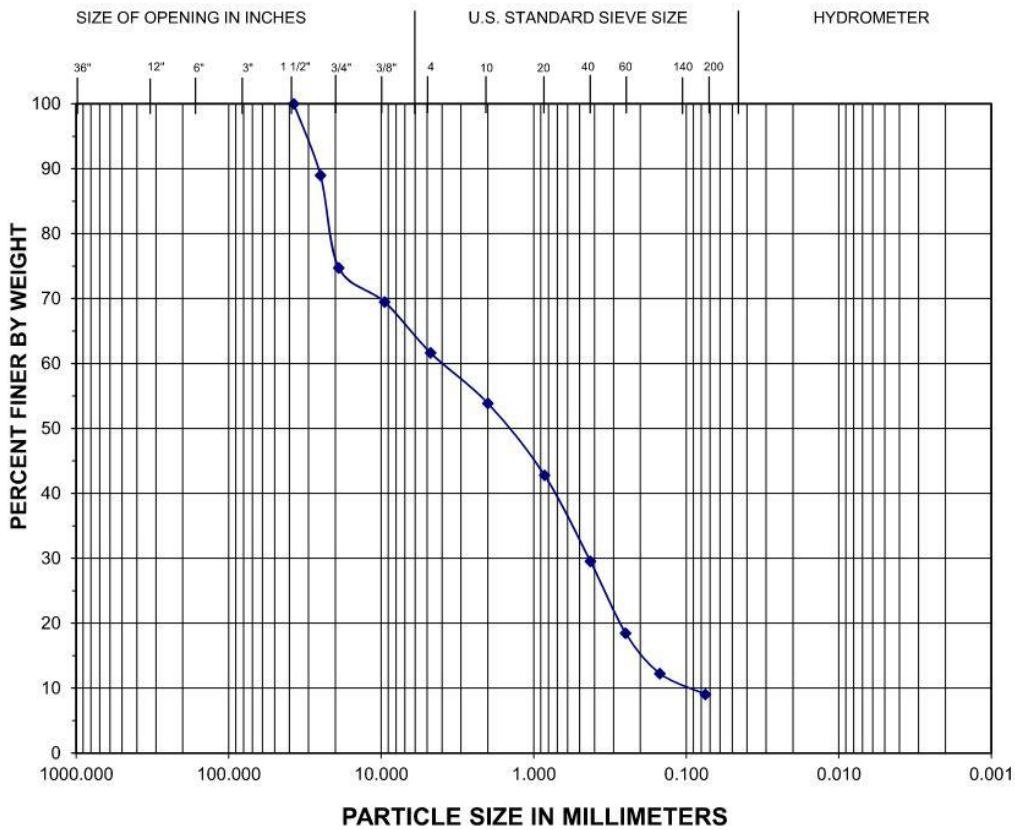
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
BOULDERS	COBBLES	GRAVEL		SAND			FINE GRAINED	

Comments:

Exploration	Sample	Depth (feet)	Moisture (%)	Fines (%)	Description
B-1	S-4	10	6.8	7.9	Gravelly SAND, some silt

Zipper Geo Associates, LLC Geotechnical and Environmental Consultants	PROJECT NO: 2760.01 DATE OF TESTING: 10/16/2023	PROJECT NAME: Arlington Commercial Development

GRAIN SIZE ANALYSIS Test Results Summary ASTM D6913



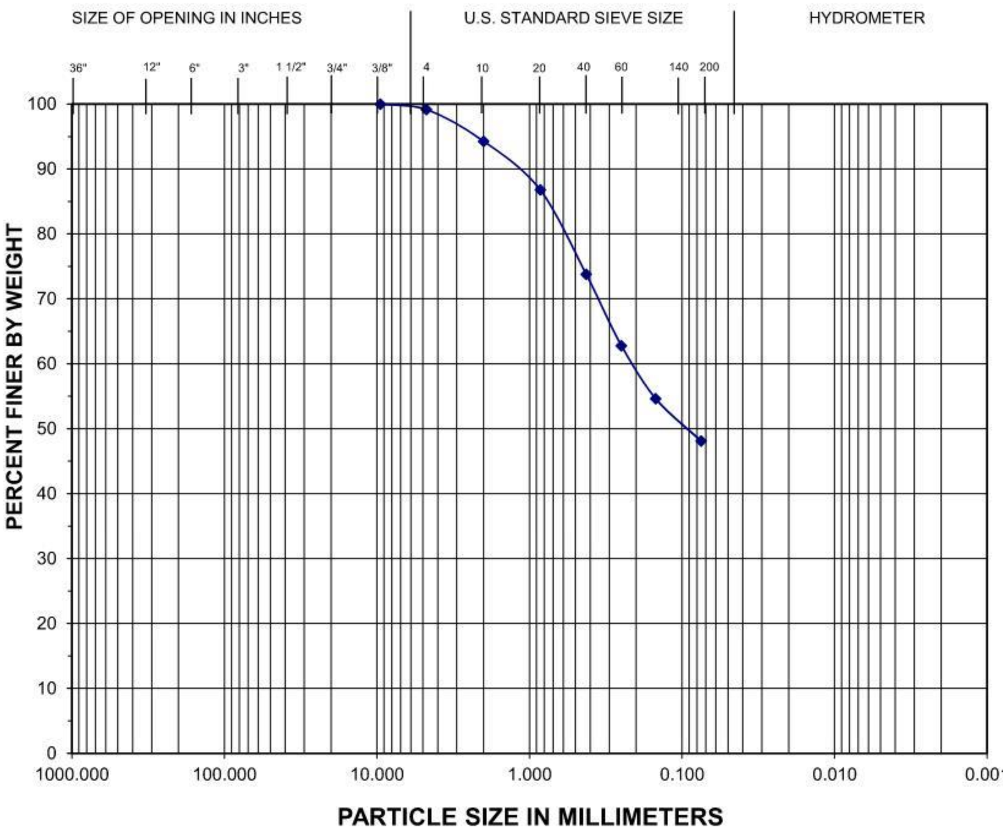
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
BOULDERS	COBBLES	GRAVEL		SAND			FINE GRAINED	

Comments:

Exploration	Sample	Depth (feet)	Moisture (%)	Fines (%)	Description
B-1	S-5	15	6.1	9.1	Gravelly SAND, some silt

Zipper Geo Associates, LLC Geotechnical and Environmental Consultants	PROJECT NO: 2760.01 DATE OF TESTING: 10/16/2023	PROJECT NAME: Arlington Commercial Development

GRAIN SIZE ANALYSIS Test Results Summary ASTM D6913



BOULDERS	COBBLES	GRAVEL		SAND			FINE GRAINED	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay

Comments:

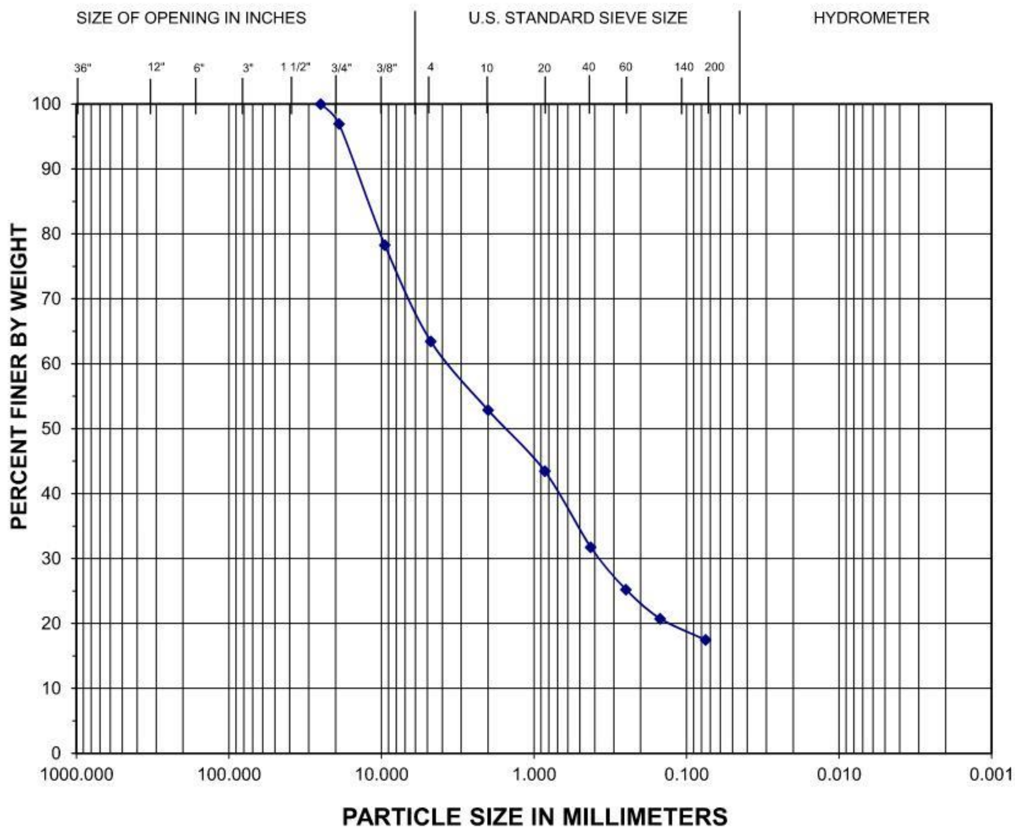
Exploration	Sample	Depth (feet)	Moisture (%)	Fines (%)	Description
B-2	S-2	5	16.3	48.1	Silty SAND, trace grave

Zipper Geo Associates, LLC Geotechnical and Environmental Consultants	PROJECT NO: 2760.01 DATE OF TESTING: 10/16/2023	PROJECT NAME: Arlington Commerical Development

GRAIN SIZE ANALYSIS

Test Results Summary

ASTM D6913



		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
BOULDERS	COBBLES	GRAVEL		SAND			FINE GRAINED	

Comments:

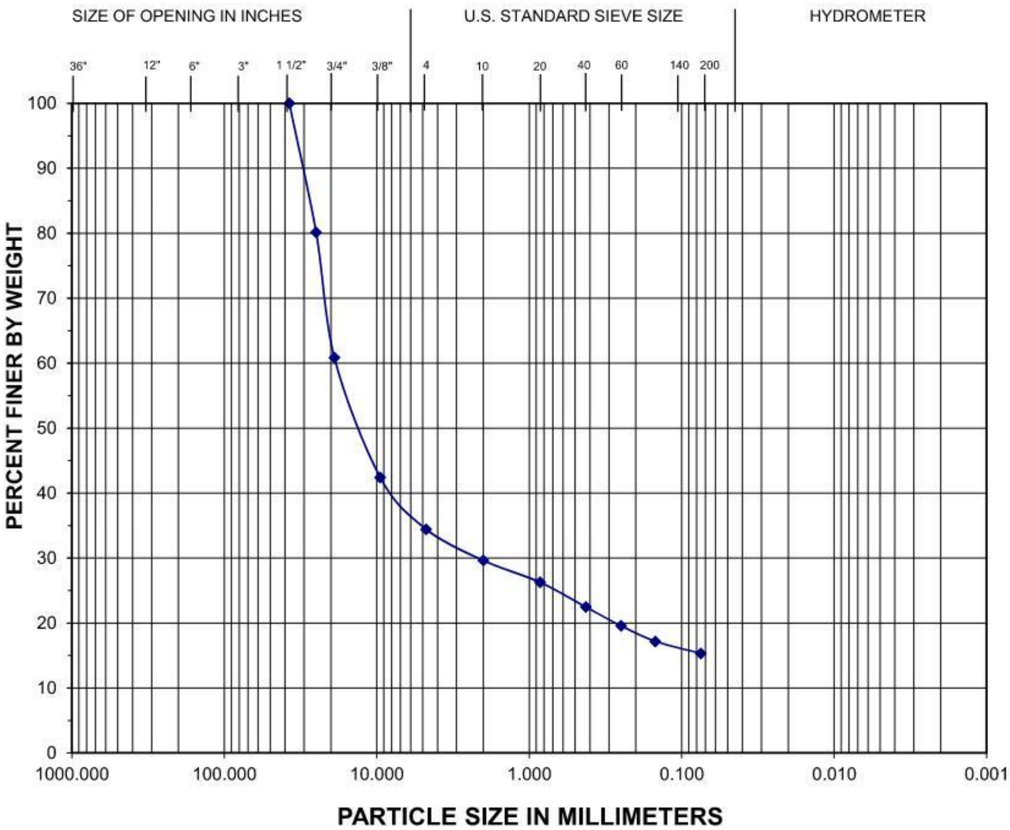
Exploration	Sample	Depth (feet)	Moisture (%)	Fines (%)	Description
B-2	S-3	7.5	6.2	17.5	Gravelly SAND, with silt

Zipper Geo Associates, LLC Geotechnical and Environmental Consultants	PROJECT NO: 2760.01 DATE OF TESTING: 10/16/2023	PROJECT NAME: Arlington Commercial Development

GRAIN SIZE ANALYSIS

Test Results Summary

ASTM D6913



BOULDERS	COBBLES	GRAVEL		SAND			FINE GRAINED	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay

Comments:

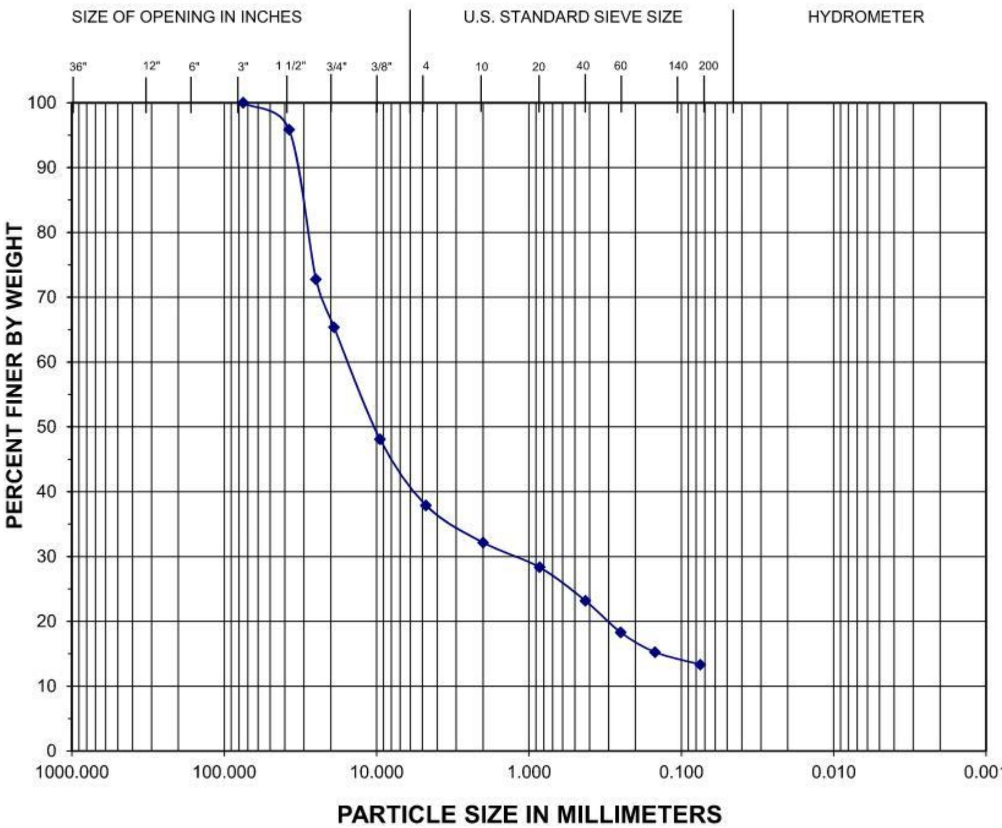
Exploration	Sample	Depth (feet)	Moisture (%)	Fines (%)	Description
B-2	S-4	10	5.2	15.3	GRAVEL, with sand and silt

Zipper Geo Associates, LLC Geotechnical and Environmental Consultants	PROJECT NO: 2760.01 DATE OF TESTING: 10/16/2023	PROJECT NAME: Arlington Commercial Development

GRAIN SIZE ANALYSIS

Test Results Summary

ASTM D6913



		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
BOULDERS	COBBLES	GRAVEL		SAND			FINE GRAINED	

Comments:

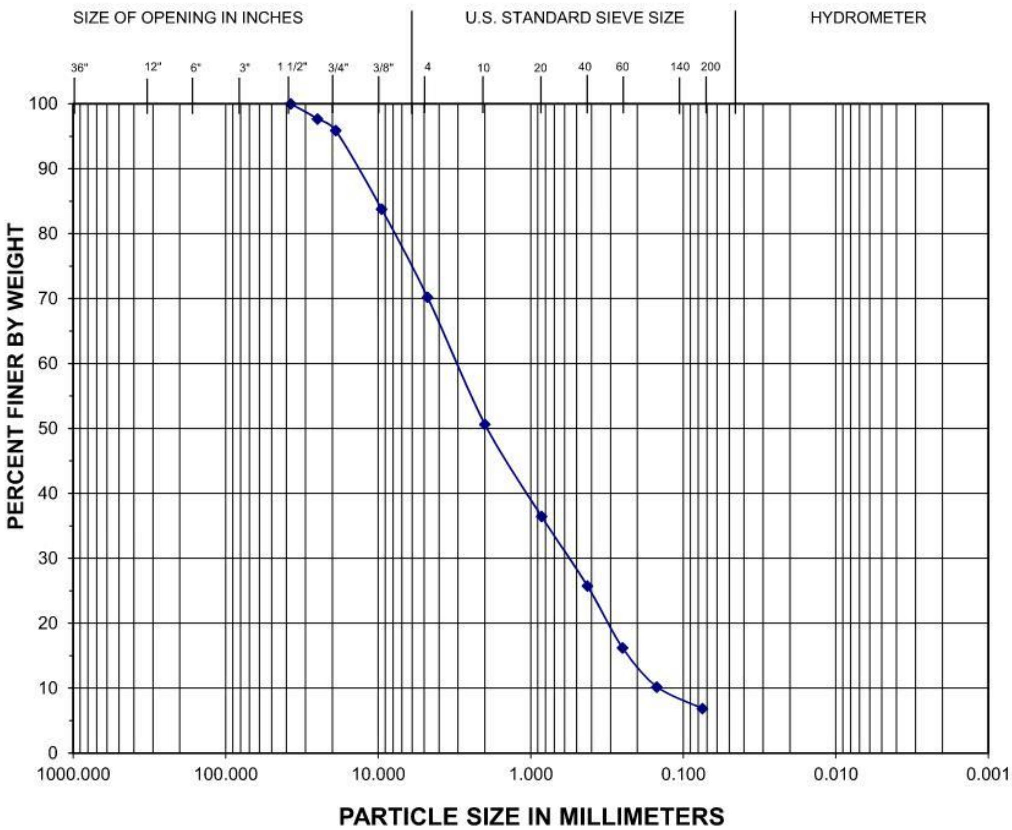
Exploration	Sample	Depth (feet)	Moisture (%)	Fines (%)	Description
B-2	S-5	15	5.1	13.3	GRAVEL, with sand and silt

Zipper Geo Associates, LLC Geotechnical and Environmental Consultants	PROJECT NO: 2760.01 DATE OF TESTING: 10/16/2023	PROJECT NAME: Arlington Commercial Development

GRAIN SIZE ANALYSIS

Test Results Summary

ASTM D6913



		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
BOULDERS	COBBLES	GRAVEL		SAND			FINE GRAINED	

Comments:

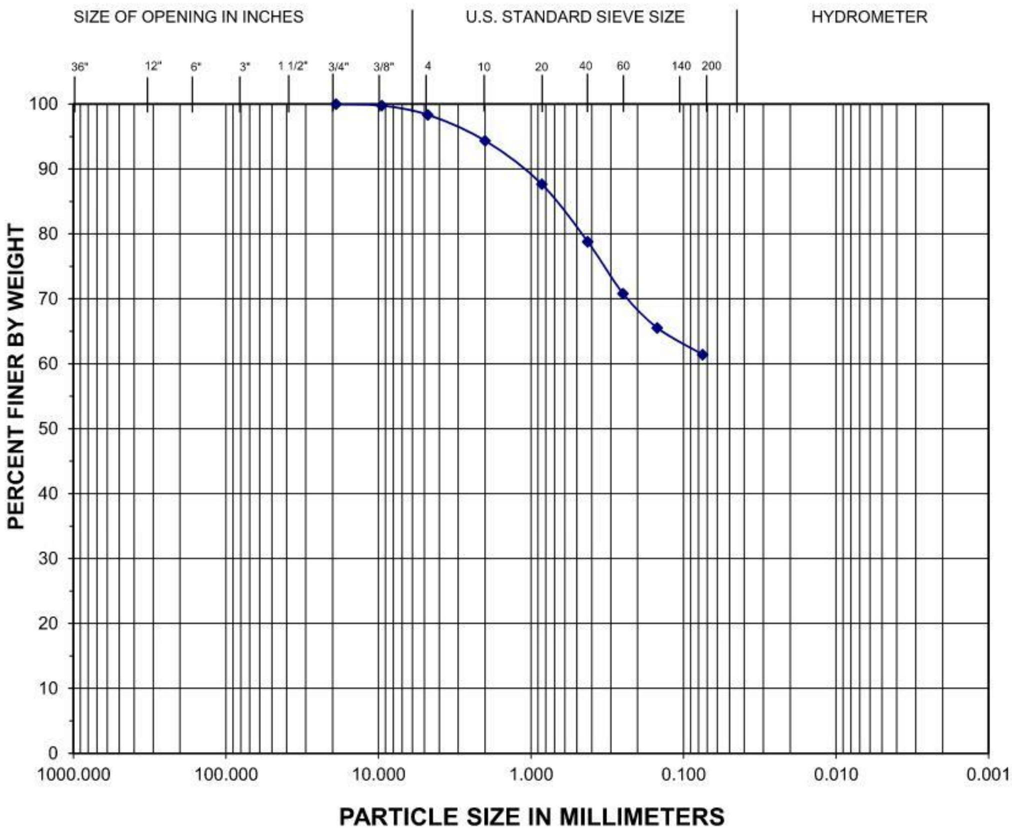
Exploration	Sample	Depth (feet)	Moisture (%)	Fines (%)	Description
B-3	S-2	5	5.4	6.8	SAND, with gravel, some silt

Zipper Geo Associates, LLC Geotechnical and Environmental Consultants	PROJECT NO: 2760.01 DATE OF TESTING: 10/16/2023	PROJECT NAME: Arlington Commercial Development

GRAIN SIZE ANALYSIS

Test Results Summary

ASTM D6913



		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
BOULDERS	COBBLES	GRAVEL		SAND			FINE GRAINED	

Comments:

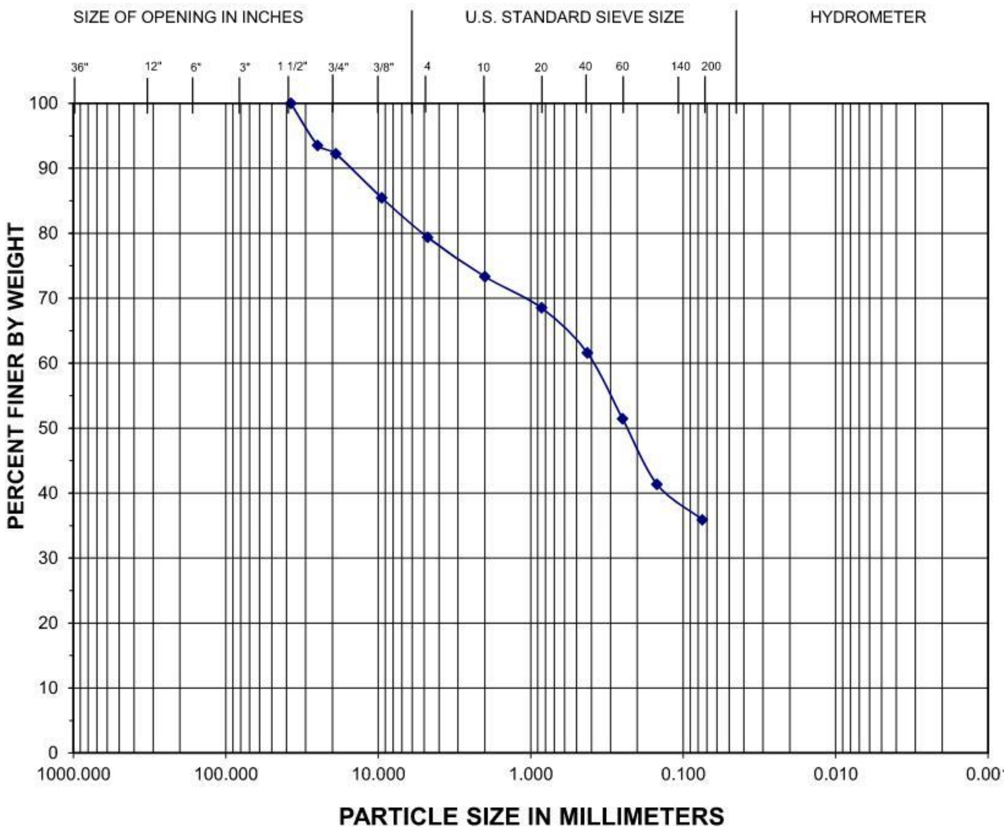
Exploration	Sample	Depth (feet)	Moisture (%)	Fines (%)	Description
B-3	S-3	7.5	26.1	61.4	Sandy SILT, trace gravel

Zipper Geo Associates, LLC Geotechnical and Environmental Consultants	PROJECT NO: 2760.01 DATE OF TESTING: 10/16/2023	PROJECT NAME: Arlington Commercial Development

GRAIN SIZE ANALYSIS

Test Results Summary

ASTM D6913



		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
BOULDERS	COBBLES	GRAVEL		SAND			FINE GRAINED	

Comments:

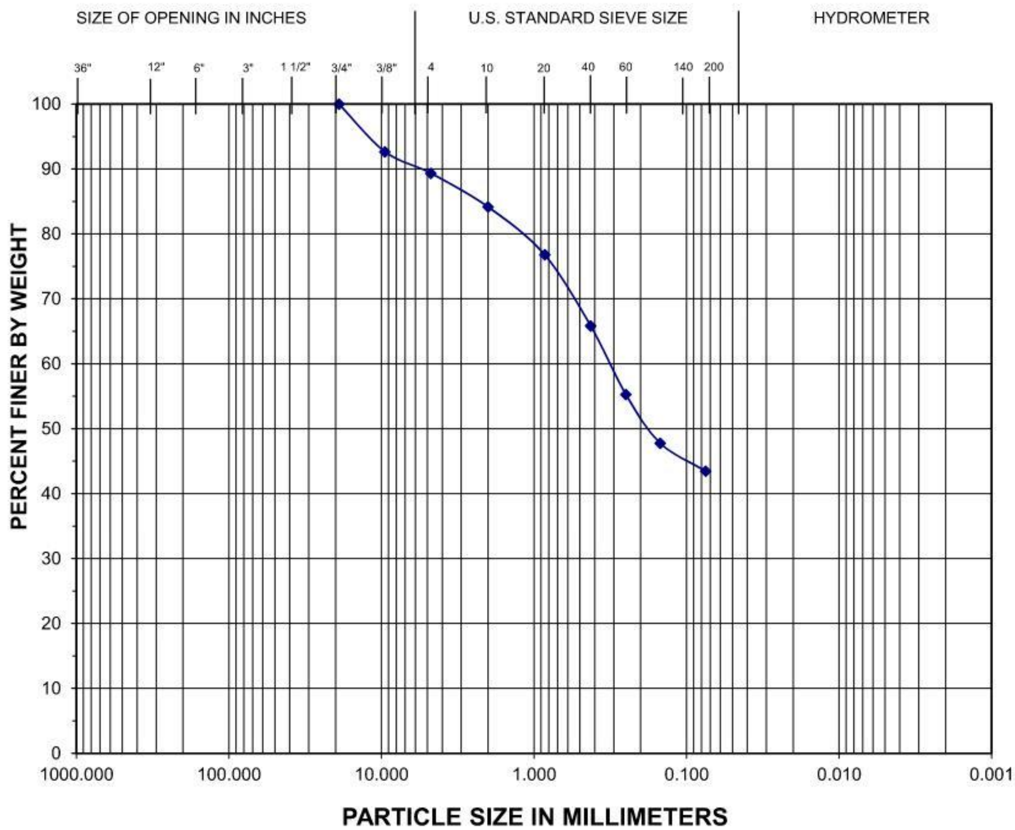
Exploration	Sample	Depth (feet)	Moisture (%)	Fines (%)	Description
B-3	S-4	10	17.6	35.9	Silty SAND, with gravel

Zipper Geo Associates, LLC Geotechnical and Environmental Consultants	PROJECT NO: 2760.01 DATE OF TESTING: 10/16/2023	PROJECT NAME: Arlington Commercial Development

GRAIN SIZE ANALYSIS

Test Results Summary

ASTM D6913



		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
BOULDERS	COBBLES	GRAVEL		SAND			FINE GRAINED	

Comments:

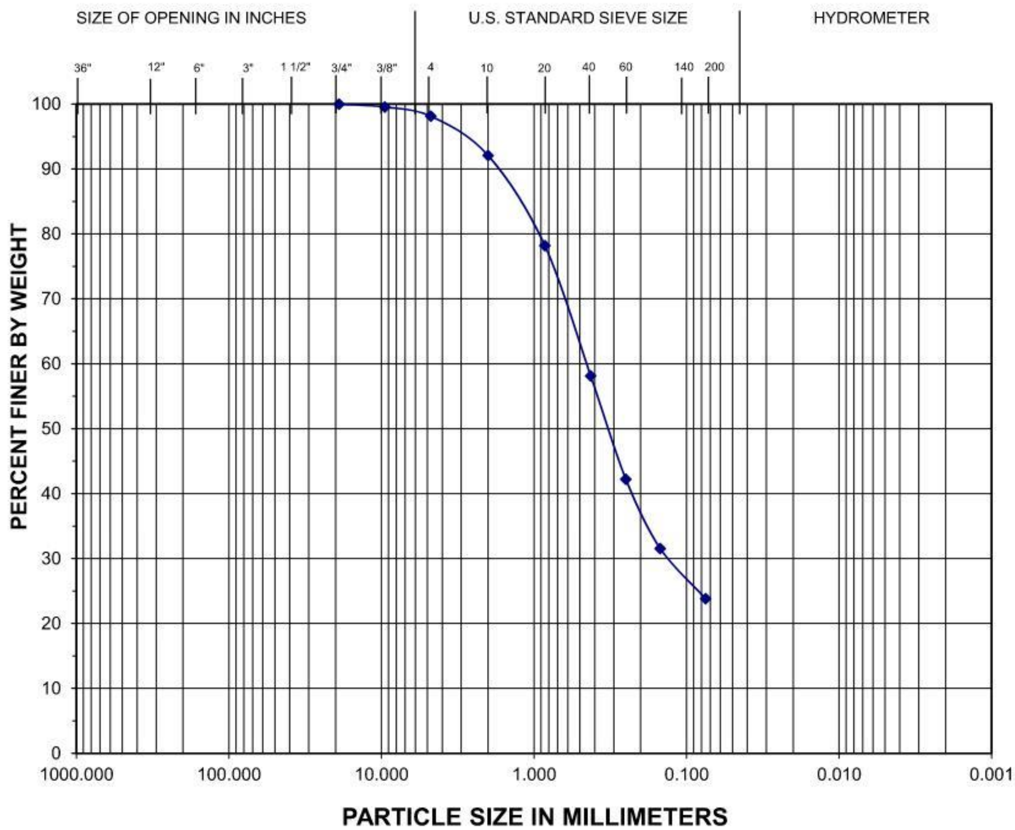
Exploration	Sample	Depth (feet)	Moisture (%)	Fines (%)	Description
B-3	S-5	15	21.4	43.5	Silty SAND, some gravel

Zipper Geo Associates, LLC Geotechnical and Environmental Consultants	PROJECT NO: 2760.01 DATE OF TESTING: 10/16/2023	PROJECT NAME: Arlington Commerical Development

GRAIN SIZE ANALYSIS

Test Results Summary

ASTM D6913



		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
BOULDERS	COBBLES	GRAVEL		SAND			FINE GRAINED	

Comments:

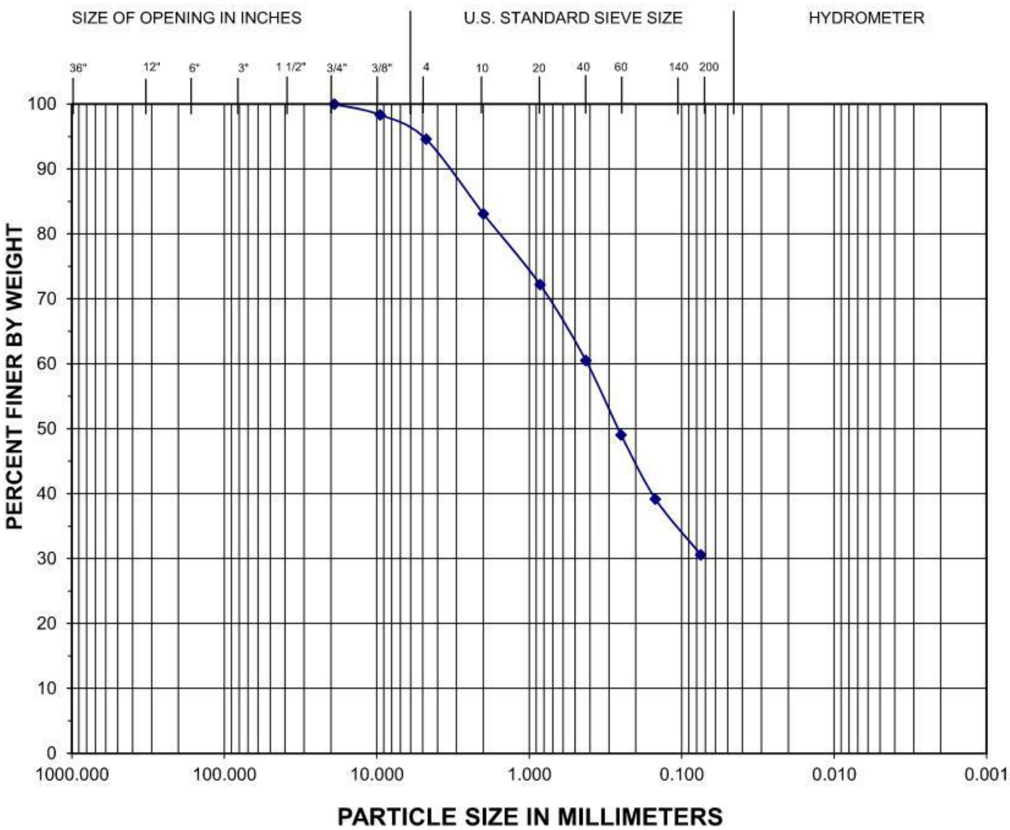
Exploration	Sample	Depth (feet)	Moisture (%)	Fines (%)	Description
B-4	S-2	5	14.7	23.8	SAND, with silt, trace gravel

Zipper Geo Associates, LLC Geotechnical and Environmental Consultants	PROJECT NO: 2760.01 DATE OF TESTING: 10/16/2023	PROJECT NAME: Arlington Commercial Development

GRAIN SIZE ANALYSIS

Test Results Summary

ASTM D6913



		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
BOULDERS	COBBLES	GRAVEL		SAND			FINE GRAINED	

Comments:

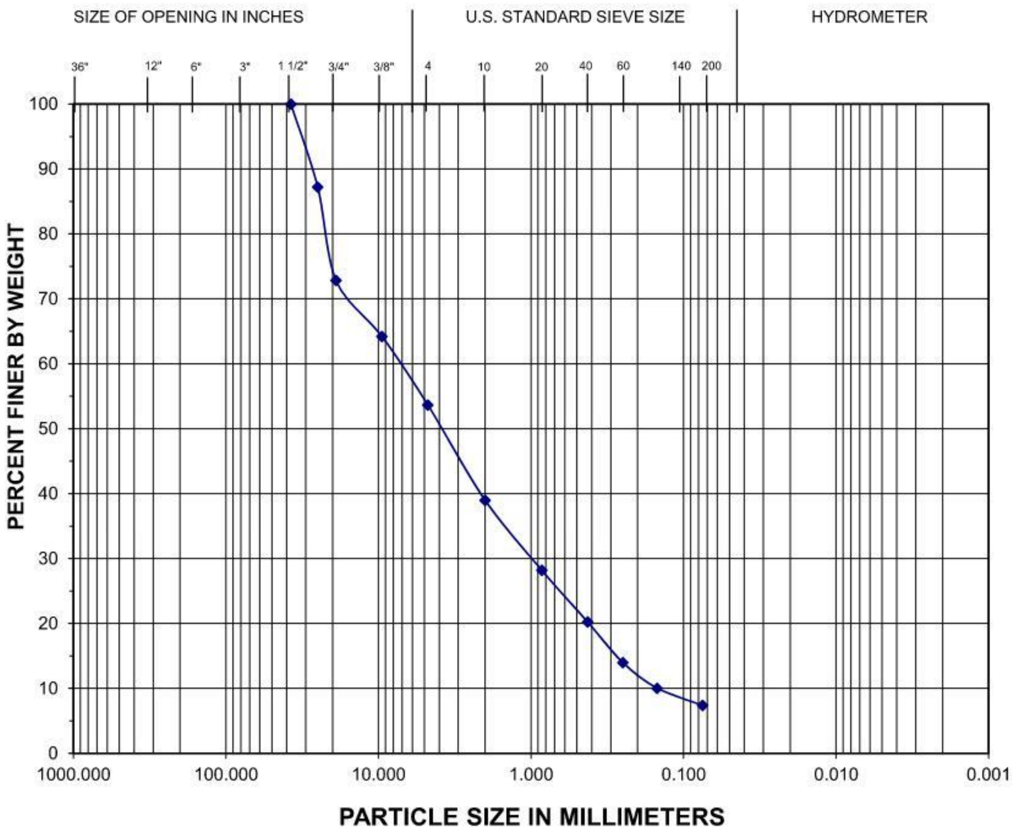
Exploration	Sample	Depth (feet)	Moisture (%)	Fines (%)	Description
B-4	S-3	7.5	18.5	30.6	Silty SAND, trace gravel

Zipper Geo Associates, LLC Geotechnical and Environmental Consultants	PROJECT NO: 2760.01 DATE OF TESTING: 10/16/2023	PROJECT NAME: Arlington Commercial Development

GRAIN SIZE ANALYSIS

Test Results Summary

ASTM D6913



BOULDERS	COBBLES	GRAVEL		SAND			FINE GRAINED	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay

Comments:

Exploration	Sample	Depth (feet)	Moisture (%)	Fines (%)	Description
B-4	S-5	15	6.1	7.4	Gravelly SAND, some silt

Zipper Geo Associates, LLC Geotechnical and Environmental Consultants	PROJECT NO: 2760.01 DATE OF TESTING: 10/16/2023	PROJECT NAME: Arlington Commercial Development

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

Professional Analytical Services

Oct 25 2023
ZIPPER GEO ASSOCIATES, LLC
19019 36TH AVENUE W
SUITE E
LYNNWOOD, WA 98036
Attention: JAMES GEORGIS

Dear JAMES GEORGIS:

Enclosed please find the analytical data for your ARLINGTON COMMERCIAL DEVELOPMENT project.

The following is a cross correlation of client and laboratory identifications for your convenience.

CLIENT ID	MATRIX	AMTEST ID	TEST
B-1 S-2 5'	Soil	23-A018155	CONV
B-2 S-3 7.5'	Soil	23-A018156	CONV
B-4 S-4 10'	Soil	23-A018157	CONV

Your samples were received on Monday, October 16, 2023. At the time of receipt, the samples were logged in and properly maintained prior to the subsequent analysis.

The analytical procedures used at AmTest are well documented and are typically derived from the protocols of the EPA, USDA, FDA or the Army Corps of Engineers.

Following the analytical data you will find the Quality Control (QC) results.

Please note that the detection limits that are listed in the body of the report refer to the Practical Quantitation Limits (PQL's), as opposed to the Method Detection Limits (MDL's).

If you should have any questions pertaining to the data package, please feel free to contact me.

Sincerely,

Aaron W Young

Aaron Young
Vice President

Project #: 2760.01

BACT = Bacteriological
CONV = Conventionals
MET = Metals
ORG = Organics
NUT=Nutrients
DEM=Demand
MIN=Minerals

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

AMTEST LABORATORIES

Professional Analytical Services

ANALYSIS REPORT

ZIPPER GEO ASSOCIATES, LLC
19019 36TH AVENUE W
LYNNWOOD, WA 98036
Attention: JAMES GEORGIS
Project Name: ARLINGTON COMMERCIAL DEVELOPMENT
Project #: 2760.01
All results reported on an as received basis.

Date Received: 10/16/23
Date Reported: 10/25/23

AMTEST Identification Number 23-A018155
Client Identification B-1 S-2 5'
Sampling Date 10/16/23

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Cation Exchange Capacity	5.8	meq/100g		0.5	SW-846 9081	CM	10/19/23

AMTEST Identification Number 23-A018156
Client Identification B-2 S-3 7.5'
Sampling Date 10/16/23

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Cation Exchange Capacity	6.3	meq/100g		0.5	SW-846 9081	CM	10/19/23

P.2

ZIPPER GEO ASSOCIATES, LLC
Project Name: ARLINGTON COMMERCIAL DEVELOPMENT
AmTest ID: 23-A018157

AMTEST Identification Number	**23-A018157**
Client Identification	**B-4 S-4 10'**
Sampling Date	**10/16/23**

Conventionals

PARAMETER	RESULT	UNITS	Q	D.L.	METHOD	ANALYST	DATE
Cation Exchange Capacity	6.5	meq/100g		0.5	SW-846 9081	CM	10/19/23

Aaron Young
Vice President

P.3

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

Professional Analytical Services

QC Summary for sample numbers: 23-A018155 to 23-A018157

DUPLICATES

SAMPLE #	ANALYTE	UNITS	SAMPLE VALUE	DUP VALUE	RPD
23-A017935	Cation Exchange Capacity	meq/100g	2.7	2.9	7.1
23-A018157	Cation Exchange Capacity	meq/100g	6.5	5.1	24.

STANDARD REFERENCE MATERIALS

ANALYTE	UNITS	TRUE VALUE	MEASURED VALUE	RECOVERY
Cation Exchange Capacity	meq/100g	2.0	2.0	100. %
Cation Exchange Capacity	meq/100g	2.0	2.0	100. %

BLANKS

ANALYTE	UNITS	RESULT
Cation Exchange Capacity	meq/100g	< 0.1
Cation Exchange Capacity	meq/100g	< 0.1

EXPLORATION DESIGNATION	TOP DEPTH (feet)	BOTTOM DEPTH (feet)	MOISTURE CONTENT (%)	ORGANIC CONTENT (%)	SPECIFIC GRAVITY	ATTERBERG LIMITS (%)			% GRAVEL	% SAND	% FINES	ASTM SOIL CLASSIFICATION	SAMPLE DESCRIPTION
						LL	PL	PI					
B-1,S-2	5.0	5.0	8.2	1.1								SM	Olive-brown, silty SAND with gravel
B-2,S-3	7.5	7.5	7.3	1.4								SM	Olive-brown, silty SAND with gravel
B-4,S-4	10.0	10.0	11.5	1.6								SM	Dark olive-brown, silty SAND with gravel

Notes:
1. This table summarizes information presented elsewhere in the report and should be used in conjunction with the report test, other graphs and tables, and the exploration logs.
2. The soil classifications in this table are based on ASTM D2487 and D2488 as applicable.

HWA GEOSCIENCES INC.

Laboratory Testing for Zipper Geo Associates, LLC
Arlington Commercial Development
Client Project No.: 2760.01

SUMMARY OF MATERIAL PROPERTIES

PAGE: 1 of 1

PROJECT NO.: 2012-102 T2600 FIGURE: 1

INDEX MATSUM 2 2012-102 T2600.GPJ 10/24/23

Appendix D – Stormwater Operations & Maintenance

Maintain Stormwater Facilities

The owner or operator of the project shall be responsible for maintaining the stormwater facilities in accordance with local requirements. Proper maintenance is important for adequate functioning of the stormwater facilities. The following maintenance program is recommended for this project:

Stormwater Inspection and Maintenance Log

Facility Name		
Address		Checked By
Date	Time	Weather Condition

Date	BMP ID#	BMP Description	Inspected by:	Cause for Inspection	Exceptions Noted	Comments and Actions Taken

Instructions: Record all inspections and maintenance for all treatment BMPs on this form. Use additional log sheets and/or attach extended comments or documentation as necessary. Submit a copy of the completed log with the annual independent inspectors' report to the municipality, and start a new log at that time.

- BMP ID# — Always use ID# from the Operation and Maintenance Manual.
- Inspected by — Note all inspections and maintenance on this form, including the required independent annual inspection.
- Cause for inspection — Note if the inspection is routine, pre-rainy-season, post-storm, annual, or in response to a noted problem or complaint.
- Exceptions noted — Note any condition that requires correction or indicates a need for maintenance.
- Comments and actions taken — Describe any maintenance done and need for follow-up.

Appendix E – Construction SWPPP