



Atonement Church

Drainage Report

Prepared for
Atonement Free Lutheran Church
Contact: Mike Impola
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Arlington, WA 98223

Prepared by



Cooper Powers

Approved by
Tom Abbott, PE



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Job No: 24-0055

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SECTION 1: PROJECT OVERVIEW

The proposed Atonement Church project is an approximately 8.78 acre site. The proposed project is a Residential – low capacity development on two parcels, #31052300301900 and #31052300300900 and addressed at 6905 172nd ST NE Arlington, WA. The proposed project will replace the parking areas for the church as well as construct additions onto the building. Public utilities will be upgraded during this project per request from the City of Arlington.

Existing Site

The parcels are currently occupied by the church with several outbuildings to the southeast of the main church building. There is a city of Arlington water and sewer main on the southern portion of the site. The existing church is connected to a septic system in the southern portion of the site. The project is zoned Residential – low capacity, it was discussed with the City of Arlington that churches are allowed in this designation. Existing ground cover is a combination of trees, grass, gravel and pavement.

The proposed development will exist within the bounds of a single stormwater threshold discharge basin as all site runoff from developed surfaces meets within ¼ mile from the project site downstream. There's a Category IV wetland in the north portion of the site (Wetland A), as well as a Category III wetland on the southeastern corner of the site (Wetland B). There are steep slopes supported by rockery walls throughout the remainder of the site as well. See section 7 for a complete list of reports prepared for the project including a Critical Areas Report, Wetland critical areas, and geotechnical and slope analysis reports.

A preliminary Geotechnical Engineering Design Study has been prepared by GeoTest dated May, 2021 on the site. Please reference the geotechnical report for detailed soils information. Infiltration was confirmed by GeoTest's borings at a rate of 5in/hr.

Proposed Development

The proposed parking lot expansion and church addition project will construct approximately 0.33 acres of new building (which will be proposed at a future date), and 1.47 acres of new parking lot. The infiltration gallery and subsequent drainage system design has been sized to account for the proposed future development footprint of potential building expansion in addition to the proposed parking lot improvements. Emergency and standard access drives along with associated private and public utilities are proposed to serve project development.

Proposed Drainage System

This project is designed to comply with the 2019 Department of Ecology Stormwater Manual for Western Washington (2019 DOE SWMWW). Stormwater will be mitigated via an infiltration gallery that is proposed to be located underneath the southwest corner of the parking lot.

Prior to discharge, a perfilter water quality treatment unit will be used to treat stormwater runoff to water quality treatment requirements. Onsite development will disturb 3.09 AC, 2.86 AC of that will be collected by the infiltration gallery for mitigation and stormwater quality treatment. This area is considered to be within the Onsite Basin for stormwater modeling. The bypass basin along 172nd St NE will drain to the existing stormwater facilities within the respective ROWs, the runoff from these surfaces is approximately 0.23 AC.

Proposed new pollution generating impervious surfaces (PGIS) will exceed the 5,000 SF threshold and thus basic water quality treatment will be required. Onsite soils, per the geotechnical report, are suitable for treatment of infiltrated soils as CEC and organic content testing have been performed on site soils in the vicinity of the proposed infiltration gallery. For pre-treatment, down-turned tees have been proposed to be installed upstream of the infiltration facility. See Section 4.0 for additional discussion regarding proposed stormwater management and water quality treatment measures.

Erosion/Sedimentation Control

Erosion control measures that will be utilized during construction will include a combination of silt fence, storm drain inlet protection, interceptor swales, and sediment pond. See Section 2.0 for discussion of how SWPPP Elements are addressed.

Minimum Requirements

Per the 2019 DOE Manual, Minimum Requirements 1-9 apply to the proposed development.

Minimum Requirement #1: Preparation of Stormwater Site Plans

This report along with the preliminary plans satisfies the minimum requirement.

Minimum Requirement #2: Construction Stormwater Pollution Prevention

See Section 2 of this Report for the SWPPP BMP Elements, and the SWPPP (submitted as a separate document) for a complete discussion of erosion control BMP's and their use specific to the site.

Minimum Requirement #3: Source of Pollution

Permanent source control BMPs are not applicable for the subject site since the associated activities for the new parking lot and church addition do not fall within the types of facilities listed within Volume IV of the DOE Manual (Residential developments are not required to implement source control BMP's). BMPs for erosion and sedimentation control will be specified in the Construction Plans and the CSWPP.

Minimum Requirement #4: Preservation of Natural Drainage Systems and Outfalls

Flow from the site will preserve its natural drainage pattern from the east toward the west. Runoff flows towards Middle Fork Quilceda Creek.

Minimum Requirement #5: On-Site Stormwater Management

The project site will infiltrate collected stormwater runoff onsite within the proposed infiltration gallery. A portion of stormwater runoff will bypass stormwater infiltration facilities, but Minimum Requirement 7 will still be met. BMP T5.13 soils will also be utilized onsite for all disturbed pervious surfaces, See Sections 4.3 & 4.5 for discussion regarding infiltration BMPs and onsite stormwater management measures.

Minimum Requirement #6: Runoff Treatment

As the project will exceed the 5,000 SF threshold of new/replaced PGIS, the project is required to provide basic water quality treatment per the 2019 DOE Manual. Onsite soils, per the geotechnical report, are suitable for treatment of infiltrated soils as CEC and organic content testing have been performed on site soils in the vicinity of the proposed infiltration gallery. For pre-treatment, down-turned tees have been proposed to be installed upstream of the infiltration facility.

Minimum Requirement #7: Flow Control

The project will exceed the 10,000 SF new/replaced impervious threshold and is required to provide flow control. An infiltration gallery will be installed in the southwest corner of the parking lot. Please see Section 4.0 for additional flow control modeling and parameters for detention sizing.

Minimum Requirement #8: Wetlands Protection

Soundview Consultants has prepared a Wetlands Critical Areas Report this section will be updated upon receipt of that report.

Minimum Requirement #9: Operation and Maintenance

See Operations and Maintenance in Section 6 of this report.

SECTION 2: TEMPORARY EROSION AND SEDIMENT CONTROL DESIGN

SWPPP Design Elements

A Construction Stormwater Pollution Prevention Plan (SWPPP) will be provided prior to construction. The SWPPP report is modeled under the guidelines of the 2019 DOE Manual. Construction SWPPP Elements #1 through #13 are addressed below.

Element #1 – Mark Clearing Limits

All clearing limits will be delineated with high visibility plastic fence and/or silt fence. See sheets ER-01 of the construction plans for locations and details.

Element #2 – Establish Construction Access

Stabilized construction accesses will be installed as shown on the construction plans. See sheets ER-01 and ER-02 of the construction plans for locations and details.

Element #3 – Control Flow Rates

Detention of construction period runoff will be provided by means of sediment ponds on the site. See sheets ER-01 of the construction plans for location and details for flow and sediment control BMP's.

Element #4 – Install Sediment Controls

Silt fence, catch basin protection, and the temporary sediment pond will be utilized to contain sediments within the project's clearing limits. See sheets ER-01 and ER-02 of the construction plans for locations and details.

Element #5 – Stabilize Soils

Exposed soils will be stabilized as specified in the Grading and Erosion Control Notes with temporary and permanent seeding, mulching, and plastic covering. See sheet ER-02 of the construction plans for notes.

Element #6 – Protect Slopes

Slopes are minor on the subject site. Slopes shall be protected as specified under Element #5.

Element #7 – Protect Drain Inlets

Storm drain inlet protection will be utilized to contain sediments within the project's clearing limits. See sheets ER-01 and ER-02 of the construction plans for locations and details.

Element #8 – Stabilize Channels and Outlets

Temporary channels, shall be stabilized with check dams. See sheets ER-01 and ER-02 of the construction plans for locations and details.

Element #9 – Control Pollutants

Due to the scope of the site development proposed, there are no anticipated pollutants that would require control.

Element #10 – Control De-Watering

There will be no de-watering as a part of this project. See sheet ER-02 of the construction plans for notes.

Element #11 – Maintain BMPs

Maintenance of the BMPs is specified within the Construction Sequence and Grading and Erosion Control Notes. See sheets ER-01 and ER-02 of the preliminary plans for the Construction Sequence and notes.

Element #12: Manage the Project

The Grading and Erosion Control Notes specify seasonal work limitations. Maintenance of the BMPs is specified within the Construction Sequence and Grading and Erosion Control Notes. See sheets ER-01 and ER-02 of the construction plans for the Construction Sequence and notes.

Element #13: Protect on-site stormwater management BMPs

Infiltration systems proposed onsite will be protected with silt fencing and/or orange construction fencing to prevent overcompaction during construction

SECTION 3: DOWNSTREAM ANALYSIS

Task 1. Study Area Definition and Maps

The Snohomish County Drainage Inventory, survey, and 2022 aerial photography were the best topographical references available for the area containing the site. The limits of the downstream analysis extend roughly 0.25 miles beyond the subject property's natural discharge location.

Task 2. Resource Review

All of the resources below have been reviewed for existing and potential issues near the project site:

Adopted Basin Plans

No Adopted Basin Plans were located that include the project site.

Drainage Basin

This site is in the Puget Sound basin, within the Stillaguamish watershed. Discharge from the proposed development will discharge into Middle Fork Quilceda Creek.

Floodplain / Floodway (FEMA) maps

Per FEMA Floodplain map #53061C0395E the subject property is not within a floodplain.

Critical Areas Map

There's a Category IV wetland in the north portion of the site (Wetland A), as well as a Category III wetland on the southeastern corner of the site (Wetland B). There are steep slopes supported by rockery walls throughout the remainder of the site as well. See section 7 for a complete list of reports prepared for the project including a Critical Areas Report, Wetland critical areas, and geotechnical and slope analysis reports.

Drainage Complaints

No relevant issues were identified near the proposed site.

Road Drainage Problems

No issues were identified near the proposed site.

Soil Survey

Site soils are classified as Everett very gravelly sand loam (8 to 15 percent slopes) which is classified as Hydrologic Soil Group A, Tokul gravelly medial loam (15 to 30 percent) which is classified as Hydrologic Soil Group B, and Norma loam which is classified as Hydrologic Soil Group B/D.

Wetland Inventory Maps

Wetlands are identified to be on, or immediately adjacent to, the project site. Reference the Wetland, Fish, and Wildlife Habitat Assessment Technical Memorandum report completed by Soundview Consultants on September 2nd, 2022, submitted with this report for additional information regarding the wetland areas onsite.

Migrating River Studies

Migrating River Studies are not considered applicable to the proposed development.

Section 303d List of Polluted Waters

Washington State Department of Ecology's Water Quality Assessment for Washington contains no category 5 listings for Edgcomb Creek, and Middle Fork Quilceda Creek which the project flow drains to.

Water Quality Problems

There are no known water quality issues associated with this project site or the tributary waterbodies associated with the project site.

Stormwater Compliance Plans

Not applicable to the proposed project.

Task 3. Field Inspection/Downstream Analysis

On October 30, 2024, a Downstream Analysis was performed at the site. The weather consisted of 49°F and cloudy skies. The following observations were verified during the visit.

The subject property consists of the existing church and its associated outbuildings, and parking lots. The existing ground cover is a combination of trees, grass, gravel and pavement (Image 1).

Two flow paths have been identified leaving the west side of the parcel and converging within one quarter mile of the site, to form one threshold discharge area. Flowpath 1 is formed where runoff from southern portion of the property and the frontage of the property collects into an existing catch basin along the frontage of the property on 172nd St NE (Image 2) and travels to the west through existing culvert (Image 3) before draining into a drainage ditch running along 172nd St NE and continuing west for approximately 380 ft (Image 4). Flowpath 1 then flows into an existing culvert pipe and travels to the south across 172nd St SE releasing into Edgecomb Creek. Edgecomb Creek travels to the southwest approximately 1,650 ft before converging with Middle Fork Quilceda Creek and Flowpath 2.

Flowpath 2 consists of the remainder of the site area. Runoff from the remainder of the site travels from east to west approximately 694 ft onto the adjacent property to the west. Runoff flows into an existing drainage ditch along this property and continues through the stream to the northwest draining into an existing catch basin along 67th Ave NE (Images 5 & 6). Flow then continues through the existing storm system to the north approximately 332 ft crossing Highland View Dr (Image 7). Flow then crosses 67th Ave NE to the west (Image 8) and drains into the wetland to the west (Image 9). Runoff from the wetland travels to the west/southwest following existing topography, eventually entering Middle Fork Quilceda Creek and traveling to the south for approximately 828 ft and converging with Flowpath 1. The combined flow then continues south and west past the ¼-mile boundary of this analysis, eventually joining the Ebey Slough Divergence to the southwest. See Figure 3.0, "Downstream Analysis Map" in Appendix 3 for a visual representation of current discharge.

Task 4. Drainage System Description and Problem Descriptions

Based on the information available and all the resources available including visual inspection of the downstream flow path to the ¼-mile boundary, there is no evidence of existing or anticipated downstream drainage problems. All flows are adequately carried through natural channels to the quarter mile buffer of analysis.

Task 5. Mitigation of Existing or Potential Drainage Problems

No evidence of existing or potential problems with downstream drainage conveyance infrastructure was found. Mitigation is not required.

SECTION 4: DETENTION AND WATER QUALITY TREATMENT DESIGN

4.1 Predeveloped Site Hydrology

The pre-developed and developed conditions were modeled in WWHM for the purpose of matching historic site runoff durations and peak flows. Based on the site location, the WWHM used the Everett Gage with a Precipitation Scale factor of 1.200. For visual representation of the listed basins, see Figure 4.0, "Predeveloped Hydrology Map".

Onsite Basin:

The predeveloped condition applied to the Onsite Basin results in a forested land cover condition. It does not include the wetland buffer area onsite that will not be disturbed for development, nor any other undisturbed areas onsite. The values as modeled in WWHM are as follows:

Table 1: Predeveloped Conditions: Onsite Basin

| Onsite Basin | |
|---------------------|--------------------|
| <u>Ground Cover</u> | <u>Area (acre)</u> |
| Forest, flat | 3.09 |
| Total | 3.09 |

4.2 Developed Site Hydrology

In the developed condition, the proposed project will construct additions to the existing church building and parking lot. Emergency and standard access drives along with associated private and public utilities are proposed to serve project development.

In compliance with the 2019 DOE Manual, all runoff from onsite developed/disturbed surfaces will be collected, treated, and infiltrated or will bypass infiltration and be mitigated within the proposed flow control system.

Onsite Basin:

The developed Onsite Basin is 2.86 acres and includes the majority of the developed site within its boundaries. In the developed condition, the Onsite Basin has been modeled using WWHM with the following areas and ground cover designations:

Table 2: Developed Conditions: Onsite Basin

| Onsite Basin | |
|---------------------|--------------------|
| <u>Ground Cover</u> | <u>Area (acre)</u> |
| Roof, flat | 0.56 |
| Parking, flat | 1.48 |
| Sidewalks, flat | 0.12 |
| Pasture, flat | 0.70 |
| Total | 2.86 |

Onsite Bypass Basin:

The developed Onsite Bypass Basin is 0.23 acres and is comprised of sloped landscape area that cannot be topographically collected into the detention system. The Onsite Bypass Basin was modeled using WWHM with the following areas and ground cover designations:

Table 3: Developed Conditions: Onsite Bypass Basin

| Onsite Bypass Basin | |
|---------------------|-------------|
| Ground Cover | Area (acre) |
| Pasture, flat | 0.14 |
| Parking, flat | 0.09 |
| Total | 0.23 |

4.3 Infiltration Facilities

The project proposes an infiltration gallery to mitigate developed surface runoff produced from the future potential building expansion and the proposed parking lot improvements. A summary of the modeled and provided infiltration facility dimensions can be found below. Porosity of infiltration aggregate is designed to be 0.40. The facility shown below (with dimensions shown as length x width x depth) infiltrates stormwater to the amount noted in the WWHM output (approximately 98%) with an overflow to the existing drainage pipe at the northwest corner of the site. See appendix 4 for WWHM output, volume calculations, and additional facility design details.

| Infiltration Facilities | Dimensions (L x W x D) | Tributary Basin |
|-------------------------|------------------------|-----------------|
| Infiltration Gallery | 225' x 25' x 4' | Onsite Basin |

4.4 Water Quality Treatment

Water Quality Treatment for the Onsite Basin is accomplished through the existing soils within the onsite soil column beneath the proposed infiltration facility. Table 2 on page 16 of the Geotechnical Report indicates that soils within TP-2 (located near the proposed infiltration gallery) have cation exchange capacities and related values suitable for treatment of infiltrated stormwater.

Pre-treatment of stormwater tributary to the infiltration facility is accomplished through down-turned tee catch basins located upstream of the infiltration gallery.

4.5 Onsite Stormwater Management

The project plans to meet the LID performance standard with the proposed infiltration facility and minimum requirements 1-9 are required for the project. As such, no additional requirements to address LID checklist items are necessary.

SECTION 5: CONVEYANCE DESIGN

A fully prepared conveyance capacity analysis of the proposed pipes onsite will be prepared at a future submittal.

SECTION 6: OPERATIONS AND MAINTENANCE MANUAL

The proposed storm drainage system consists of buried pipes, catch basins and an infiltration gallery. These facilities will require periodic maintenance and inspection. Inspection and maintenance procedures are contained on the following pages.

SECTION 7: SPECIAL REPORTS AND STUDIES

The following studies were conducted in preparation of this Report:

- Wetland Critical Areas Report, Atonement Church, Soundview Consultants, November, 2024
- Geotechnical Engineering Report Atonement Parking Lot and Building Improvements, May 28, 2021

Appendix 1: Project Overview

1. Vicinity Map
2. Existing Conditions Map
3. Proposed Development Map

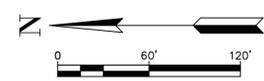
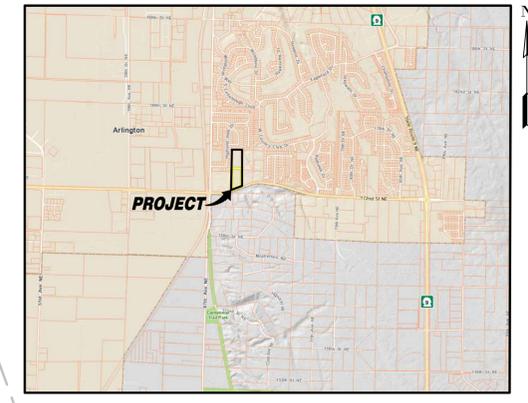
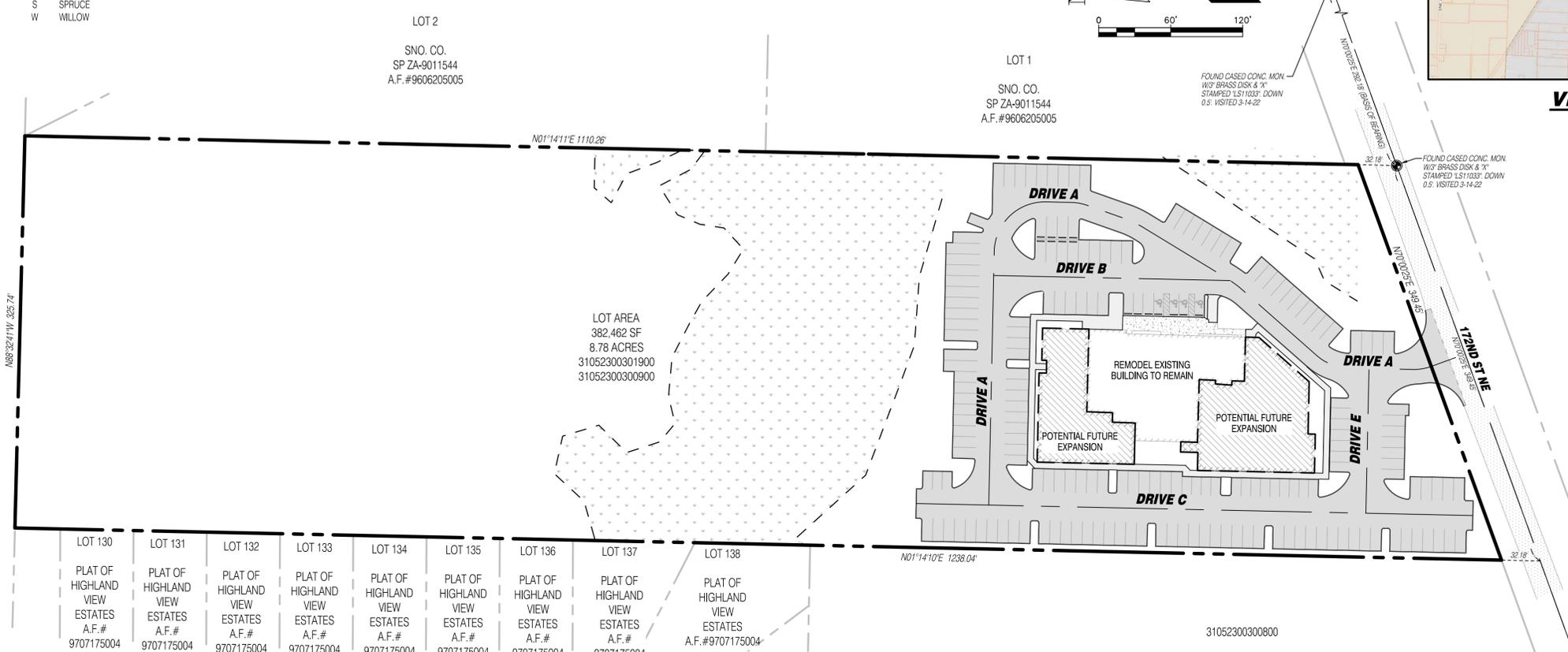
ATONEMENT CHURCH CONSTRUCTION PLANS CITY OF ARLINGTON, WASHINGTON

LEGEND AND ABBREVIATIONS

| EXISTING SYMBOLS | DESCRIPTION | ABBREVIATIONS |
|------------------|-----------------------------------|-----------------------------|
| | MONUMENT IN CASE | CPP CORRUGATED PLASTIC PIPE |
| | SET REBAR W/ CAP | IE INVERT ELEVATION |
| | EXISTING CORNER MONUMENT AS NOTED | INV INVERT ELEVATION |
| | QUARTER SECTION TIE | OHP OVERHEAD POWER LINE |
| | SECTION TIE | TPM TELEPHONE PAINT MARK |
| | AIR VALVE | B BIRCH |
| | BLOW-OFF VALVE | C CEDAR |
| | CATCH BASIN | F FIR |
| | STORM MANHOLE | M MAPLE |
| | CAT RISER | S SPRUCE |
| | CULVERT | W WILLOW |
| | FIRE HYDRANT | |
| | GAS METER | |
| | GAS VALVE | |
| | GUY ANCHOR | |
| | GUY POLE | |
| | JUNCTION BOX | |
| | LIGHT POLE | |
| | LIGHT STANDARD | |
| | POWER TRANSFORMER | |
| | UTILITY MARKER | |
| | METAL COVER | |
| | SEWER CLEANOUT | |
| | SEWER MANHOLE | |
| | SPRINKLER HEAD | |
| | STORM CLEANOUT | |
| | TELCO MANHOLE | |
| | TELCO RISER | |
| | TRAFFIC SWITCH BOX | |
| | UTILITY BOX | |
| | UTILITY POLE | |
| | WATER MANHOLE | |
| | WATER METER | |
| | WATER VALVE | |
| | WELL | |
| | MONITORING WELL | |
| | WATER CAP | |
| | BEEHIVE | |
| | IRRIGATION CONTROL VALVE | |
| | POWER VAULT | |
| | WETLAND FLAG | |
| | CONIFEROUS TREE | |
| | DECIDUOUS TREE | |

| PROPOSED STORM SYMBOLS | | PROPOSED WATER SYMBOLS | |
|------------------------|--------------------------------|------------------------|-------------------|
| SYMBOL | DESCRIPTION | SYMBOL | DESCRIPTION |
| | SD CAP | | WATER CAP |
| | TYPE 1 CATCH BASIN, GRATED LID | | CONCRETE BLOCKING |
| | TYPE 1 CATCH BASIN, SOLID LID | | 11.25° BEND |
| | TYPE 2 CATCH BASIN, GRATED LID | | 22.5° BEND |
| | TYPE 2 CATCH BASIN, SOLID LID | | 45° BEND |
| | BEEHIVE MANHOLE COVER | | 90° BEND |
| | SQUARE YARD DRAIN | | VALVE |
| | ROUND YARD DRAIN | | HYDRANT ASSEMBLY |
| | STORM CLEAN OUT | | BLOW-OFF VALVE |
| | STORM PIPE | | REDUCER |
| | SEWER CAP | | AIR-VAC ASSEMBLY |
| | SEWER CLEANOUT | | WATER METER |
| | SEWER MANHOLE | | WATER PIPE |
| | SEWER PIPE | | |

| PROPOSED SEWER SYMBOLS | | PROPOSED SURVEY SYMBOLS | |
|------------------------|----------------|-------------------------|----------------------------------|
| SYMBOL | DESCRIPTION | SYMBOL | DESCRIPTION |
| | SEWER CAP | | SURVEY MONUMENT IN PROPOSED ROAD |
| | SEWER CLEANOUT | | |
| | SEWER MANHOLE | | |
| | SEWER PIPE | | |



SURVEY INFORMATION

EQUIPMENT & PROCEDURES

METHOD OF SURVEY:
SURVEY PERFORMED BY FIELD TRAVERSE AND REAL TIME KINEMATIC GPS POSITIONING UTILIZING THE HXGN SMARTNET NETWORK

INSTRUMENTATION:
LEICA TS16 ROBOTIC ELECTRONIC TOTAL STATION
LEICA Viva GNSS GS08 RECEIVER
ALL EQUIPMENT HAS BEEN MAINTAINED IN ADJUSTMENT TO MANUFACTURERS SPECIFICATIONS AS REQUIRED BY WAC 332-130-100

PRECISION:
MEETS OR EXCEEDS STATE STANDARDS SET BY WAC 332-130-080 THROUGH 332-130-110

BASIS OF BEARING:
THE MONUMENTED CENTERLINE OF S STILLAGUAMISH AVE NE, AS THE BEARING NORTH 05°21'58" EAST PER GPS OBSERVATIONS.
WASHINGTON STATE PLANE, NORTH ZONE, NAD 83/91

LEGAL DESCRIPTION

LOT 6, THE COLONY, ACCORDING TO THE PLAT THEREOF RECORDED IN VOLUME 47 OF PLATS, PAGES 249 AND 250, RECORDS OF SNOHOMISH COUNTY.

SITuate IN THE CITY OF ARLINGTON, COUNTY OF SNOHOMISH, STATE OF WASHINGTON.

VERTICAL DATUM

NAVD 88 (NAVD88 -3.67' = NGVD29)
FOUND CASED CONC. MON. AT THE INTERSECTION OF E. HIGHLAND DR. & S. STILLAGUAMISH AVE. N.E.
WGS SURVEY DATA WAREHOUSE I.D. #20563

ELEV. = 110.64'

SURVEY REFERENCES

- (R1) PLAT OF THE COLONY - VOL. 47, PG. 249-250.
- (R2) ROSECREEK BSP - AFN 9805285007
- (R3) WESLEY STREET CONDOMINIUMS - AFN 200406085301

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- NOTES AND DETAILS
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- SANITARY SEWER DETAILS
- WATER PLAN
- WATER DETAILS

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EMAIL: case@soundviewconsultants.com

EARTHWORK QUANTITIES

| | |
|-----------------|----------------------|
| STRIPPING: | 5,225 CY |
| CUT: | 1,800 CY |
| FILL: | 600 CY |
| NET: | 1,200 CY (CUT/FILL) |
| DISTURBED AREA: | 116,041 SF (2.66 AC) |

THE ABOVE QUANTITIES ARE FOR PERMITTING PURPOSES. CONTRACTOR TO VERIFY.

PROJECT INFORMATION

| | |
|--------------------|---------------------------------------|
| TAX PARCELS: | 31052300301900 & 31052300300900 |
| SITE ADDRESS: | 6905 172ND ST NE ARLINGTON WA, 98223 |
| SITE AREA: | 382,457 SF (8.78 AC) |
| PROPOSED ZONING: | RLC |
| PROPOSED LAND USE: | RLC |
| FUTURE LAND USE: | RLC |
| WATER: | CITY OF ARLINGTON |
| SEWER: | CITY OF ARLINGTON |
| POWER: | SNOHOMISH PUD |
| GAS: | CASCADE NATURAL GAS |
| TELEPHONE: | COMCAST |
| CABLE: | COMCAST |
| SCHOOL DISTRICT: | ARLINGTON SCHOOL DISTRICT 16 |
| FIRE DISTRICT: | NORTH COUNTRY REGIONAL FIRE AUTHORITY |

PROJECT FILE No. _____

CITY OF ARLINGTON
CONSTRUCTION DRAWING REVIEW APPROVAL

THIS PLAN HAS BEEN REVIEWED AND EVALUATED FOR GENERAL COMPLIANCE WITH THE CITY OF ARLINGTON CODES AND ORDINANCES. CONFORMANCE OF THE DESIGN WITH ALL APPLICABLE LAWS AND REGULATIONS IS THE FULL AND COMPLETE RESPONSIBILITY OF THE LICENSED DESIGN ENGINEER WHOSE STAMP AND SIGNATURE APPEAR ON THIS SHEET. ACKNOWLEDGEMENT OF CONSTRUCTION DRAWING REVIEW DOES NOT IMPLY CITY APPROVAL FOR CONSTRUCTION ACTIVITIES THAT REQUIRE OTHER COUNTY, STATE OR FEDERAL PERMIT REVIEW AND APPROVAL. THE PROPERTY OWNER AND LICENSED DESIGN ENGINEER SHALL BE RESPONSIBLE FOR THE ACQUISITION AND COMPLIANCE OF ALL APPLICABLE PERMITS AND/OR AUTHORIZATION WHICH MAY INCLUDE, BUT ARE NOT LIMITED TO, WSPFW HYDRAULIC PROJECT APPROVAL (HPA), WSDOE NOTICE OF INTENT (NOI), ARMY CORP OF ENGINEERS FILL PERMITS AND THE REQUIREMENTS OF THE ENDANGERED SPECIES ACT.

BY: _____
DEVELOPMENT SERVICES MANAGER

DATE: _____

THESE APPROVED CONSTRUCTION PLANS EXPIRE AFTER 18 MONTHS FROM THE DATE SHOWN ABOVE OR UPON EXPIRATION OF PRELIMINARY PLAT OR SITE PLAN APPROVAL.



ENGINEER'S STAMP

| # | DATE | DESCRIPTION |
|---|------|-------------|
| | | |
| | | |
| | | |
| | | |

COVER SHEET

ATONEMENT FREE LUTHERAN CHURCH
ATONEMENT CHURCH
6905 172ND ST NE ARLINGTON WA, 98223

| | |
|---------------|-------------------|
| DRAWN BY: | KMV |
| CHECKED BY: | TPA |
| DATE: | --- |
| JURISDICTION: | CITY OF ARLINGTON |
| JOB NUMBER: | 24-0055 |

CS-01
1 OF 24



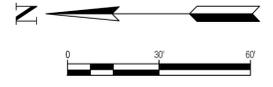
SURVEY DISCLAIMER

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UTILITY NOTE

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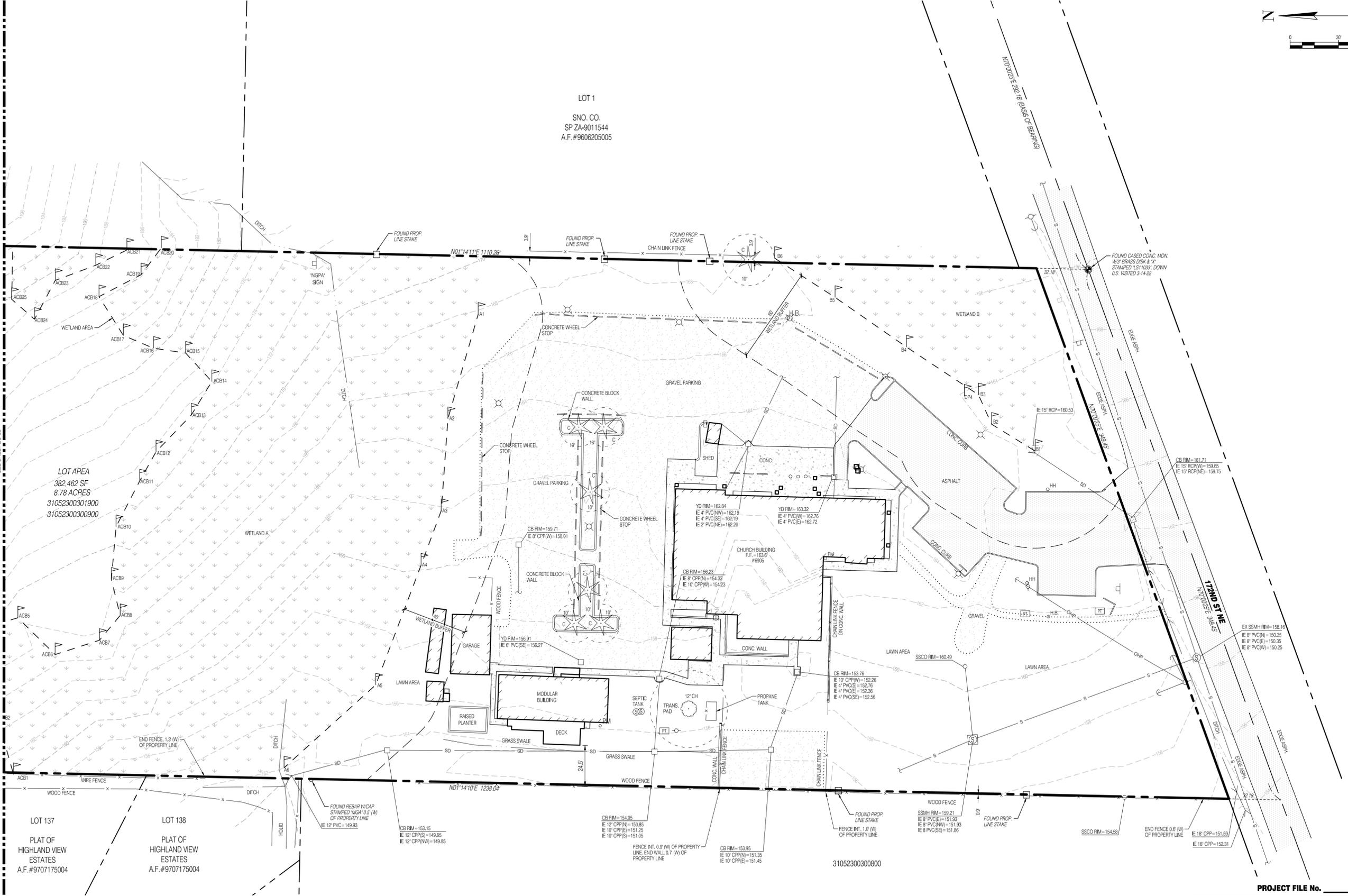
SW 1/4, SW 1/4, SEC 23, T31N, R5E, WM, ARLINGTON, WASHINGTON



LOT 1

SNO. CO.
SP ZA-9011544
A.F.#9606205005

REFERENCE LINE
SEE SHEET EC-02



LOT AREA
382,462 SF
8.78 ACRES
31052300301900
31052300300900

LOT 137
PLAT OF
HIGHLAND VIEW
ESTATES
A.F.#9707175004

LOT 138
PLAT OF
HIGHLAND VIEW
ESTATES
A.F.#9707175004



ENGINEER'S STAMP

| # | DATE | DESCRIPTION |
|---|------|-------------|
| | | |
| | | |
| | | |
| | | |

Solid Ground Engineering
8105 166th Ave NE
Redmond, WA 98052

**EXISTING MAP
CONDITIONS MAP**

**ATONEMENT FREE LUTHERAN
CHURCH**
ATONEMENT CHURCH
**6905 172ND ST NE ARLINGTON
WA.98223**

DRAWN BY: K/MV
CHECKED BY: TPA
DATE: ---
JURISDICTION: CITY OF ARLINGTON
JOB NUMBER: 24-0055

EC-01
2 OF 24

SURVEY DISCLAIMER
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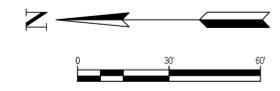
UTILITY NOTE
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PROJECT FILE No. _____
CITY OF ARLINGTON
CONSTRUCTION DRAWING REVIEW APPROVAL
THIS PLAN SHEET HAS BEEN REVIEWED AND APPROVED PER THE CONDITIONS ON THE TITLE SHEET.
BY: _____
DEVELOPMENT SERVICES MANAGER
DATE: _____ THIS APPROVAL VALID FOR 18 MONTHS

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SW 1/4, SW 1/4, SEC 23, T31N, R5E, WM, ARLINGTON, WASHINGTON



LEGEND

| SYMBOLS | DESCRIPTION |
|---------|--|
| • | REMOVABLE BOLLARD |
| + | 'NO PARKING' SIGN UNLESS OTHERWISE NOTED |
| ▬ | RETAINING WALL |
| ▨ | ASPHALT PAVEMENT |
| ▩ | ASPHALT GRIND AND OVERLAY |
| ▧ | CONCRETE PAVEMENT |
| ▭ | FALL PROTECTION FENCING |

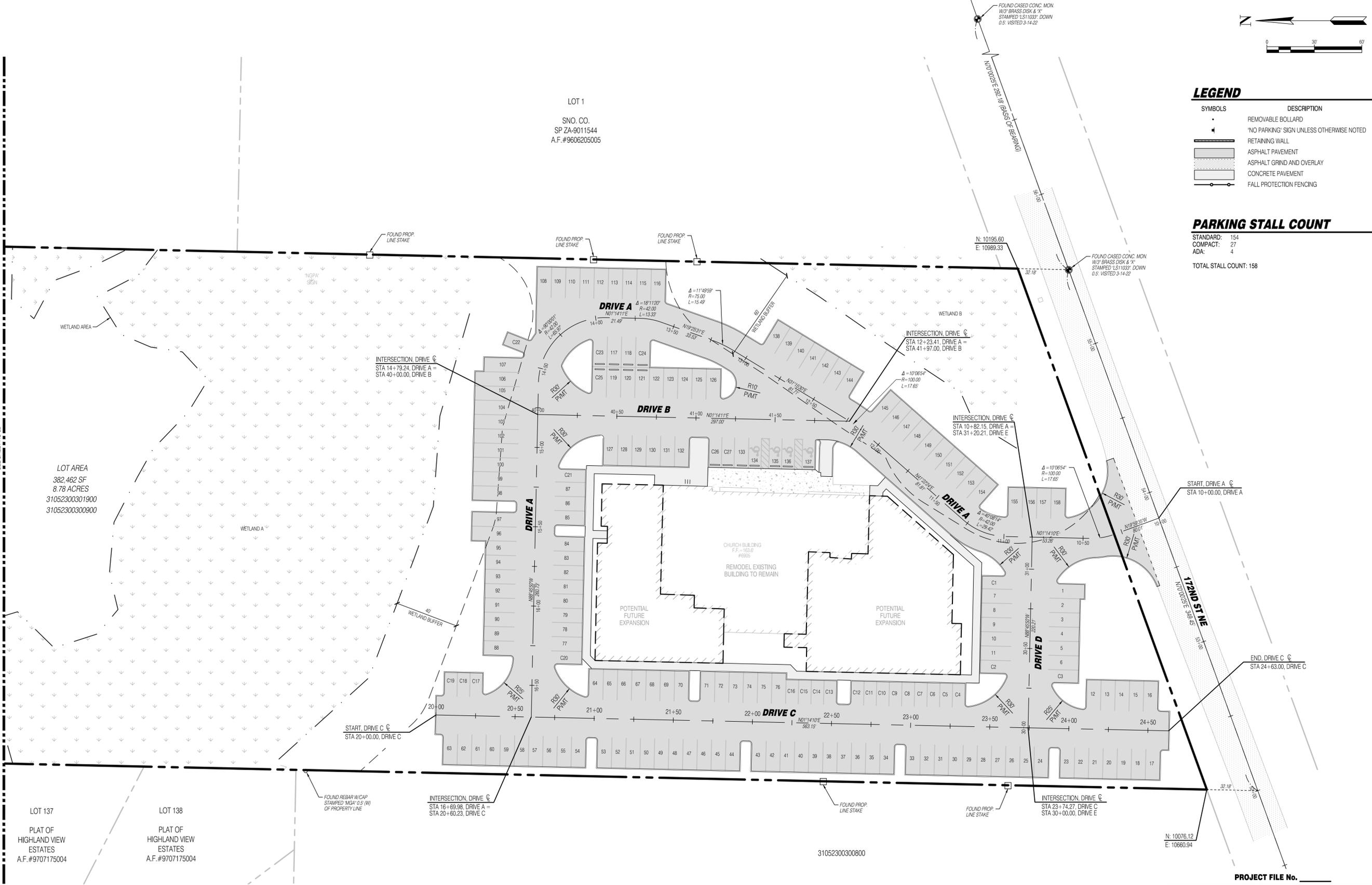
PARKING STALL COUNT

STANDARD: 154
 COMPACT: 27
 ADA: 4
TOTAL STALL COUNT: 158

LOT 1
 SNO. CO.
 SP ZA-9011544
 A.F. #9606205005

LOT AREA
 382,462 SF
 8.78 ACRES
 31052300301900
 31052300300900

REFERENCE LINE
 SEE SHEET HC-02



REVISIONS

| # | DATE | DESCRIPTION |
|---|------|-------------|
| | | |



HORIZONTAL CONTROL AND PAVING PLAN

ATONEMENT FREE LUTHERAN CHURCH
ATONEMENT CHURCH
 6905 172ND ST NE ARLINGTON WA.98223

| | |
|---------------|-------------------|
| DRAWN BY: | KMV |
| CHECKED BY: | TPA |
| DATE: | --- |
| JURISDICTION: | CITY OF ARLINGTON |
| JOB NUMBER: | 24-0055 |

HC-01
6 OF 24

SURVEY DISCLAIMER

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PROJECT FILE No. _____
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 DEVELOPMENT SERVICES MANAGER
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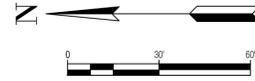
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Appendix 2: Temporary Erosion and Sediment Control Design

1. TESC Plans

CONSTRUCTION SEQUENCE

- PRIOR TO ANY CONSTRUCTION ACTIVITY THE CONTRACTOR SHALL SCHEDULE AND ATTEND A PRE-CONSTRUCTION CONFERENCE WITH THE CITY STAFF. CESL SHALL ATTEND CONFERENCE.
- INSTALL INTERIM CATCH BASIN PROTECTION.
- INSTALL ROCK CONSTRUCTION ENTRANCE.
- STOCKPILE ALL EROSION MATERIALS ON SITE.
- FLAG CLEARING LIMITS.
- ARRANGE FOR CITY TO INSPECT AND APPROVE CLEARING LIMIT FLAGGING PRIOR TO CLEARING.
- INSTALL FILTER FABRIC FENCE AND CONSTRUCTION FENCES AS SHOWN.
- BEGIN CLEARING AND GRADING.
- CLEAR FOR UTILITIES AND INSTALL ALL BURIED UTILITIES.
- INSTALL ALL OTHER UTILITIES.
- FINAL GRADE PAVING AREAS.
- INSTALL FINAL PAVING, CURBING AND SIDEWALK.
- STABILIZE UNPAVED AREAS WITH LANDSCAPING OR HYDROSEEDING AS PERMANENT COVER AND AS REQUIRED PER BMP TS.13.
- CLEAN OUT STORM SYSTEM AND STRUCTURES WHEN CONSTRUCTION IS COMPLETE.
- ALL TEMPORARY EROSION AND SEDIMENT CONTROL MEASURES SHALL BE REMOVED WITHIN 30 DAYS AFTER FINAL SITE STABILIZATION IS ACHIEVED OR AFTER THE TEMPORARY BMP'S ARE NO LONGER NEEDED. TRAPPED SEDIMENT SHALL BE REMOVED OR STABILIZED ON SITE. DISTURBED SOIL AREAS RESULTING FROM REMOVAL SHALL BE PERMANENTLY STABILIZED.

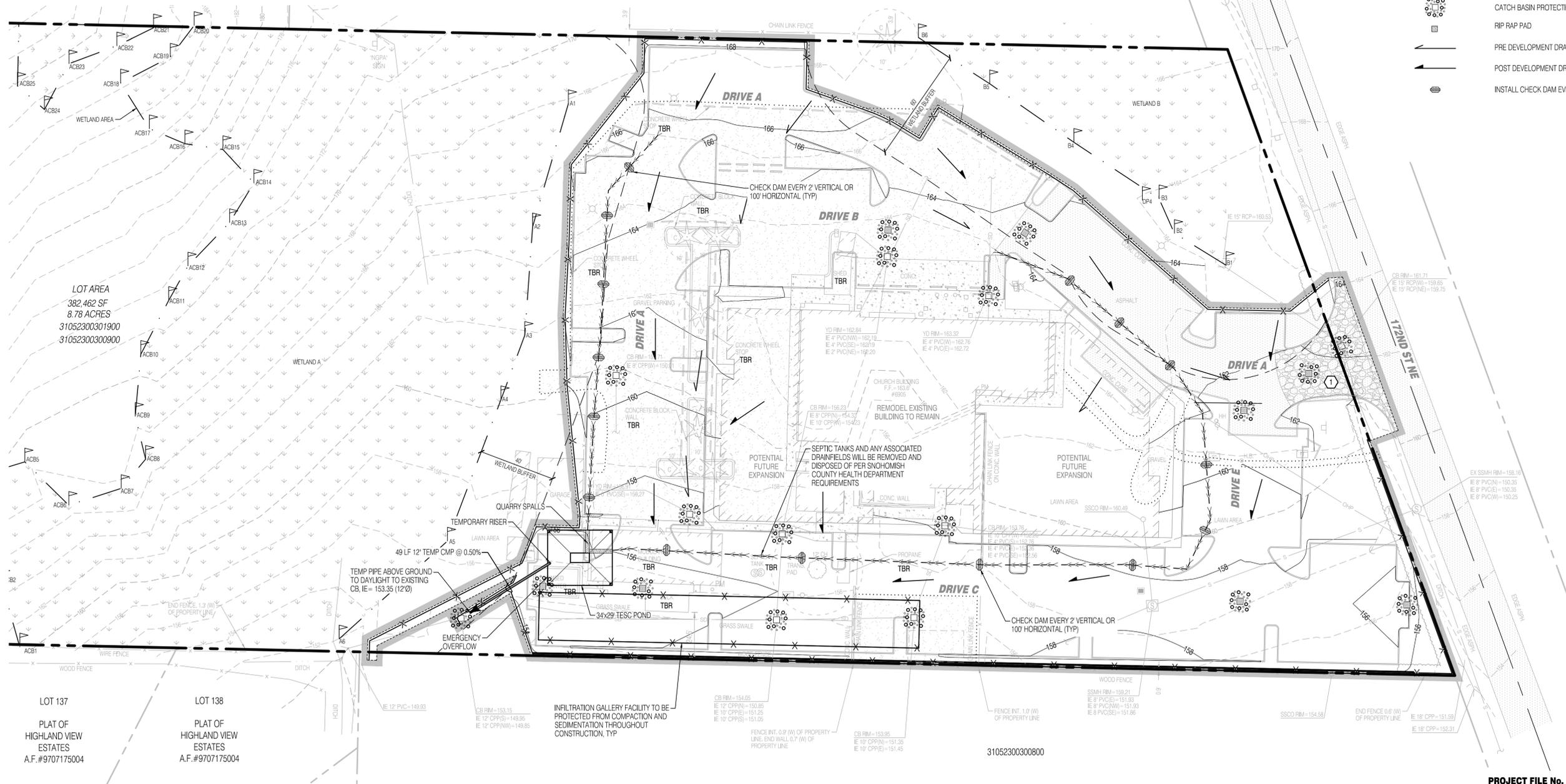


LEGEND

- CLEARING LIMITS
- SILT FENCE
- TREE PROTECTION FENCE
- CONVEYANCE SWALE
- PUMP LINE
- TO BE REMOVED
- ROCK CONSTRUCTION ENTRANCE
- CATCH BASIN PROTECTION
- RIP RAP PAD
- PRE DEVELOPMENT DRAINAGE PATTERN
- POST DEVELOPMENT DRAINAGE PATTERN
- INSTALL CHECK DAM EVERY 100' OR 2' OF ELEVATION CHANGE

| TEMP SEDIMENT POND | |
|-------------------------|--------|
| BOTTOM ELEVATION | 151.00 |
| BOTTOM AREA (SF) | 50 |
| TOP OF RISER ELEVATION | 155.00 |
| TOP AREA (SF) | 986 |
| SIDE SLOPES | 3H:1V |
| SPILLWAY ELEVATION | 155.00 |
| OUTLET INVERT ELEVATION | 151.50 |
| ORIFICE INVERT ELEV. | 151.50 |
| ORIFICE SIZE | 1 1/3' |

2 YEAR DEVELOPED STORM PRIOR TO DETENTION = 0.1038 CFS
 MINIMUM SURFACE AREA AT PONDING = ___ SF



EARTHWORK QUANTITIES

| | |
|-----------------|----------------------|
| STRIPPING: | 5,225 CY |
| CUT: | 1,800 CY |
| FILL: | 600 CY |
| NET: | 1,200 CY (CUT/FILL) |
| DISTURBED AREA: | 116,041 SF (2.66 AC) |

THE ABOVE QUANTITIES ARE FOR PERMITTING PURPOSES. CONTRACTOR TO VERIFY.

SURVEY DISCLAIMER

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PROJECT FILE No. _____

CITY OF ARLINGTON
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BY: _____
 DEVELOPMENT SERVICES MANAGER

DATE: _____ THIS APPROVAL VALID FOR 18 MONTHS



ENGINEER'S STAMP

| # | DATE | DESCRIPTION |
|---|------|-------------|
| | | |
| | | |

Solid Ground Engineering
 8105 166th Ave NE
 Redmond, WA 98052

TESC PLAN

ATONEMENT FREE LUTHERAN CHURCH
ATONEMENT CHURCH
 6905 172ND ST NE ARLINGTON WA.98223

DRAWN BY: K/MV
 CHECKED BY: TPA
 DATE: ---
 JURISDICTION: CITY OF ARLINGTON
 JOB NUMBER: 24-0055

GRADING AND EROSION CONTROL NOTES:

- CITY OF ARLINGTON TESC NOTES:
- APPROVAL OF THE TEMPORARY EROSION/SEDIMENT CONTROL (TESC) PLAN DOES NOT CONSTITUTE AN APPROVAL OF PERMANENT ROAD OR STORM DRAINAGE DESIGN.
 - A TESC PLAN MEETING THE DOE STORM WATER MANAGEMENT MANUAL ADOPTED BY THE CITY SHALL BE SUBMITTED TO THE CITY FOR APPROVAL PRIOR TO ANY WORK ON THE SITE. AN APPROVED COPY MUST BE MAINTAINED ON-SITE AND BE READILY AVAILABLE TO THE CITY INSPECTOR AT THEIR REQUEST.
 - THE TESC BMP'S SHOWN ON THE PLAN MUST BE INSTALLED PRIOR TO ALL OTHER CLEARING AND GRADING ACTIVITIES, AND IN SUCH A MANNER AS TO ENSURE THAT SEDIMENT-ADDED WATER DOES NOT ENTER THE DRAINAGE SYSTEM, LEAVE THE SITE, OR VIOLATE APPLICABLE WATER QUALITY STANDARDS, MAINTENANCE, REPLACEMENT, AND UPGRADE OF THE TESC PLANS IS THE RESPONSIBILITY OF THE CONTRACTOR UNTIL ALL CONSTRUCTION IS COMPLETE AND APPROVED BY THE CITY.
 - THE BOUNDARIES OF THE CLEARING LIMITS, SHOWN ON THE TESC PLAN, SHALL BE CLEARLY FENCED OR FLAGGED IN THE FIELD PRIOR TO STARTING CONSTRUCTION. NO DISTURBANCE BEYOND THE FENCED OR FLAGGED CLEARING LIMITS SHALL BE PERMITTED. THE FENCING AND/OR FLAGGING SHALL BE MAINTAINED BY THE CONTRACTOR FOR THE DURATION OF THE CONSTRUCTION PROJECT.
 - THE TESC FACILITIES SHOWN ON THE PLANS ARE THE MINIMUM REQUIREMENTS FOR THE ANTICIPATED SITE CONSTRUCTION. DURING THE CONSTRUCTION PERIOD, THESE TESC FACILITIES SHALL BE UPGRADED AND ADDED AS NEEDED, FOR UNEXPECTED STORM EVENTS AND TO REFLECT CHANGED CONDITIONS, AS REQUIRED BY THE CITY.
 - THE CONTRACTOR SHALL PROVIDE THE CITY A 24-HOUR EMERGENCY CONTACT PHONE NUMBER OF THE CONTRACTOR'S CERTIFIED EROSION CONTROL SUPERVISOR PRIOR TO STARTING CONSTRUCTION.
 - THE TESC FACILITIES SHALL BE INSPECTED DAILY BY THE CONTRACTOR AND MAINTAINED AS NECESSARY TO ENSURE CONTINUED FUNCTION AND OPERATION.
 - BETWEEN OCTOBER 1 AND APRIL 30, DISTURBED AREAS THAT ARE TO BE LEFT UNWORKED FOR MORE THAN TWO (2) DAYS SHALL BE IMMEDIATELY COVERED BY MULCH, SOIL OR PLASTIC COVERING. BETWEEN MAY 1 AND SEPTEMBER 30, DISTURBED AREAS THAT ARE TO BE LEFT UNWORKED FOR MORE THAN SEVEN (7) DAYS SHALL BE IMMEDIATELY COVERED BY SEEDING OR OTHER APPROVED METHODS.
 - SEDIMENT DEPOSITS SHALL BE REMOVED FROM ALL CATCH BASINS, PRE-TREATMENT SEDIMENT POND, AND SEDIMENT TRAPS UPON REACHING A DEPTH OF 12 INCHES.
 - ANY PERMANENT RETENTION/DETENTION FACILITY USED AS A TEMPORARY SETTLING BASIN SHALL BE MODIFIED WITH THE NECESSARY EROSION CONTROL MEASURES. SHALL PROVIDE ADEQUATE STORAGE CAPACITY AND SHALL BE CLEANED OUT ENTIRELY ONCE THE SITE IS STABILIZED. IF THE PERMANENT FACILITY IS ULTIMATELY FUNCTION AS AN INFILTRATION SYSTEM, THE FACILITY SHALL NOT BE USED AS A TEMPORARY SETTLING BASIN.
 - WHERE SEEDING FOR TEMPORARY EROSION CONTROL IS REQUIRED, FAST GERMINATING GRASSES SHALL BE APPLIED AT AN APPROXIMATE RATE OF 120 LBS PER ACRE.
 - WHERE STRAW MULCH FOR TEMPORARY EROSION CONTROL IS REQUIRED, IT SHALL BE APPLIED AT A MINIMUM THICKNESS OF 3 INCHES, OR 3,000 POUNDS PER ACRE.
 - SOIL STOCKPILES SHALL BE STABILIZED WITHIN 24 HOURS, WHEN ACTIVELY WORKING WITH THE SOIL STOCKPILE. STABILIZATION BY GROUND COVER BMP'S SHALL OCCUR AT THE END OF EACH WORK DAY.
 - STABILIZED CONSTRUCTION ENTRANCES SHALL BE INSTALLED AT THE BEGINNING OF CONSTRUCTION AND MAINTAINED FOR THE DURATION OF THE PROJECT. ADDITIONAL MEASURES MAY BE REQUIRED TO INSURE THAT ALL PAVED AREAS ARE KEPT CLEAN FOR THE DURATION OF THE PROJECT.
 - MAINTENANCE AND REPAIR OF TESC FACILITIES AND STRUCTURES SHALL BE CONDUCTED IMMEDIATELY UPON RECOGNITION OF A PROBLEM OR WHEN THE TESC MEASURES BECOME DAMAGED.
 - UPON COMPLETION OF THE PROJECT, ALL BMP'S SHALL BE REMOVED FROM THE SITE AND RIGHT OF WAY. IF BMP'S ARE REQUIRED TO REMAIN IN PLACE FOR FURTHER PROTECTION, ARRANGEMENTS FOR REMOVAL SHALL BE MADE WITH THE CITY INSPECTOR.
 - THE DUFF LAYER AND NATIVE TOPSOIL SHALL BE RETAINED IN AN UNDISTURBED STATE TO THE MAXIMUM EXTENT PRACTICABLE. ALL AREAS SUBJECT TO CLEARING AND GRADING THAT WILL NOT BE COVERED BY IMPERVIOUS SURFACE, INCORPORATED INTO A DRAINAGE FACILITY OR ENGINEERED AS STRUCTURAL FILL OR SLOPE SHALL, AT THE PROJECT COMPLETION, DEMONSTRATE THE REQUIREMENTS ESTABLISHED IN T5.13 OF THE 2019 SWMMWW. POST CONSTRUCTION SOIL QUALITY AND DEPTH.

SEED OPTIONS MIX

Table 4.1 represents the standard mix for those areas where a temporary vegetative cover is required.

| | % Weight | % Purity | % Germination |
|--|----------|----------|---------------|
| Drawings or annual tall grass Festuca rubra var. communis or poa anna | 40 | 98 | 90 |
| Perennial ryegrass Lolium perenne | 50 | 98 | 90 |
| Redtop or colonial bentgrass Agrostis alba or Agrostis tenuis | 5 | 92 | 85 |
| White Dutch clover Trifolium repens | 5 | 98 | 90 |

This turf seed mix in Table 4.3 is for dry situations where there is no need for much water the advantage is that this mix requires very little maintenance.

| | % Weight | % Purity | % Germination |
|---|----------|----------|---------------|
| Dwarf tall fescue (several varieties) Festuca arundinacea var. | 45 | 98 | 90 |
| Dwarf perennial ryegrass (Barelay) Lolium perenne var. barelay | 30 | 98 | 90 |
| Red fescue Festuca rubra | 20 | 98 | 90 |
| Colonial bentgrass Agrostis tenuis | 5 | 98 | 90 |

Table 4.4 presents a mix recommended for bioswalks and other intermittently wet areas.

| | % Weight | % Purity | % Germination |
|---|----------|----------|---------------|
| Tall or meadow fescue Festuca arundinacea or festuca elatior | 75-80 | 98 | 90 |
| Sesuvia/Creeping bentgrass Agrostis palustris | 10-15 | 92 | 85 |
| Redtop bentgrass Agrostis alba or Agrostis gigantea | 5-10 | 90 | 80 |

THE THIRTEEN ELEMENTS OF A CONSTRUCTION SWPPP:

THE BMP'S REFERENCED BELOW ARE PER THE 2019 STORMWATER MANAGEMENT MANUAL FOR WESTERN WASHINGTON.

- MARK CLEARING LIMITS. THE CLEARING LIMITS ARE INDICATED ON THE PLAN SHEET. CLEARING AND GRADING WILL BE LIMITED TO ONLY AREAS THAT NEED TO BE DISTURBED FOR GRADING, AND PLACING OR STOCK PILING FILL AND TO PRESERVE AS MUCH NATURAL VEGETATION AND THE DUFF LAYER AS POSSIBLE. FIELD MARKING THE CLEARING LIMITS SHALL BE COMPLETED PRIOR TO ANY CLEARING OR DISTURBING THE SITE.
BMP'S:
C103 HIGH VISIBILITY PLASTIC OR METAL FENCE
C233 SILT FENCE
- ESTABLISH CONSTRUCTION ACCESS. ACCESS TO THE CONSTRUCTION SITE SHALL BE LIMITED TO THE ROCK CONSTRUCTION ENTRANCE(S).
BMP'S:
C106 STABILIZED CONSTRUCTION ENTRANCE
- CONTROL FLOW RATES. A SEDIMENT POND WILL BE USED TO COLLECT AND RETAIN RUNOFF ON-SITE TO PROTECT DOWNSTREAM DRAINAGE FEATURES.
C241 SEDIMENT POND
- INSTALL SEDIMENT CONTROLS. SEDIMENT CONTROL WILL BE PROVIDED THROUGH THE USE OF SILT FENCE, INTERCEPTOR SWALE, INLET PROTECTION AND A SEDIMENT POND.
BMP'S:
C200 INTERCEPTOR DIKE AND SWALE
C220 STORM DRAIN INLET PROTECTION
C233 SILT FENCE
C241 SEDIMENT POND
- STABILIZE SOILS. TEMPORARY AND PERMANENT SOIL STABILIZATION WILL BE PROVIDED. TEMPORARY STABILIZATION WILL BE PROVIDED TO EXPOSED WORKED EARTH FROM OCTOBER 1 UNTIL APRIL 30. NO EXPOSED SOIL MAY REMAIN EXPOSED AND UNWORKED FOR MORE THAN TWO DAYS, FROM MAY 1 UNTIL SEPTEMBER 30. NO EXPOSED SOIL MAY REMAIN EXPOSED AND UNWORKED FOR MORE THAN SEVEN DAYS.
BMP'S:
C120 TEMPORARY AND PERMANENT SEEDING
C123 PLASTIC COVERING
C121 MULCHING
- PROTECT SLOPES. SLOPES SHALL BE PROTECTED FROM EROSION THROUGH COVER AND SOIL STABILIZATION.
BMP'S:
C120 TEMPORARY AND PERMANENT SEEDING
C121 MULCHING
C123 PLASTIC COVERING
- PROTECT DRAIN INLETS. INLET PROTECTION SHALL BE INSTALLED FOR EXISTING INLETS PRIOR TO WORK BEGINNING AND ON PROPOSED INLETS AS SOON AS THEY ARE INSTALLED. PROTECTION MEASURES MUST BE MAINTAINED AND CLEANED IN A MANNER THAT COLLECTION SEDIMENT IS NOT ALLOWED TO ENTER THE STORM NETWORK.
BMP'S:
C220 STORM DRAIN INLET PROTECTION
- STABILIZE CHANNELS AND OUTLETS. ALL CHANNEL SLOPES SHALL BE CONSTRUCTED AND PROTECTED AGAINST EROSION.
BMP'S:
C207 CHECK DAMS
- CONTROL POLLUTANTS. POLLUTANTS SHALL BE CONTROLLED PER POLLUTANT CONTROL NOTES. SEE THIS SHEET FOR NOTES.
- CONTROL DE-WATERING. DISPOSAL OPTIONS FOR DE-WATERING WATER ARE AS SPECIFIED IN THE DE-WATERING CONTROL NOTES. SEE THIS SHEET FOR NOTES.
BMP'S:
C151 CONCRETE HANDLING
- MAINTAIN BMP'S. MAINTENANCE OF THE BMP'S IS SPECIFIED IN THE CONSTRUCTION SEQUENCE AND GRADING AND EROSION CONTROL NOTES. SEE SHEET ER-01 AND THIS SHEET.
- PROJECT MANAGEMENT. THE GRADING AND EROSION CONTROL NOTES SPECIFY SEASONAL WORK LIMITATIONS. BMP'S SHALL BE MAINTAINED PER ELEMENT #11.
- PROTECT LID BMP'S. PROTECT THE INFILTRATION AREA WITH ORANGE CONSTRUCTION FENCING SO IT WILL NOT BE OVERCOMPACTED DURING GRADING AND CONSTRUCTION.

DE-WATERING CONTROL NOTES

ALL TURBID DE-WATERING WATER SHALL BE DISPOSED OF USING ONE OF THE FOLLOWING OPTIONS:

- INFILTRATION.
- TRANSPORT OFF-SITE IN A VEHICLE, SUCH AS A VACUUM FLUSH TRUCK, FOR LEGAL DISPOSAL IN A MANNER THAT DOES NOT POLLUTE STATE WATERS.
- ECOLOGICALLY-APPROVED ON-SITE CHEMICAL TREATMENT OR OTHER SUITABLE TREATMENT TECHNOLOGIES.
- SANITARY SEWER DISCHARGE WITH LOCAL SEWER DISTRICT APPROVAL, IF THERE IS NO OTHER OPTION.
- USE OF A SEDIMENTATION BASIN WITH OUTFALL TO A DITCH OR SWALE FOR SMALL VOLUMES OF LOCALIZED DE-WATERING, OR
- FOUNDATION, WALL, AND TRENCH DE-WATERING WATER, WHICH HAVE SIMILAR CHARACTERISTICS TO STORMWATER RUNOFF AT THE SITE, SHALL BE DISPERSED TO NATIVE VEGETATION AND/OR DISCHARGED TO A SEDIMENTATION FACILITY.

POLLUTANT CONTROL NOTES

- ALL POLLUTANTS, INCLUDING WASTE MATERIALS AND DEMOLITION DEBRIS, THAT OCCUR ON-SITE SHALL BE HANDLED AND DISPOSED OF IN A MANNER THAT DOES NOT CAUSE CONTAMINATION OF STORMWATER. WOODY DEBRIS MAY BE CHOPPED AND SPREAD ON SITE.
- COVER, CONTAINMENT AND PROTECTION FROM WINDBLUST SHALL BE PROVIDED FOR ALL CHEMICALS, LIQUID PRODUCTS, PETROLEUM PRODUCTS, AND NON-HAZARDOUS WASTES PRESENT ON THE SITE (SEE CHAPTER 173-300 WAC FOR THE DEFINITION OF HAZARDOUS WASTE). ON-SITE FUELING TANKS SHALL INCLUDE SECONDARY CONTAINMENT.
- ALL MAINTENANCE OF HEAVY EQUIPMENT AND VEHICLES SHALL BE DONE OFF-SITE.
- ACTIVITIES WHICH MAY RESULT IN DISCHARGE OR SPILLAGE OF POLLUTANTS TO THE GROUND OR INTO STORMWATER RUNOFF MUST BE CONDUCTED USING SPILL PREVENTION MEASURES, SUCH AS DRIP PANS, CONTAMINATED SURFACES SHALL BE CLEANED IMMEDIATELY FOLLOWING ANY DISCHARGE OR SPILL INCIDENT. EMERGENCY REPAIRS MAY BE PERFORMED ON-SITE USING TEMPORARY PLASTIC PLACED BENEATH AND, IF RAINING, OVER THE VEHICLE.
- WHEEL WASH OR TIRE BATH WASTEWATER SHALL BE DISCHARGED TO A SEPARATE ON-SITE TREATMENT SYSTEM OR TO THE SANITARY SEWER.
- APPLICATION OF AGRICULTURAL CHEMICALS, INCLUDING FERTILIZERS AND PESTICIDES, SHALL BE CONDUCTED IN A MANNER AND AT APPLICATION RATES THAT WILL NOT RESULT IN LOSS OF CHEMICAL TO STORMWATER. MAXIMUM APPLICATION RATES AND PROCEDURES SHALL BE FOLLOWED.
- BMP'S SHALL BE USED TO PREVENT OR TREAT CONTAMINATION OF STORMWATER RUNOFF BY PH-MODIFYING SOURCES. THESE SOURCES INCLUDE, BUT ARE NOT LIMITED TO, BULK CEMENT, CEMENT KILN DUST, FLY ASH, NEW CONCRETE WASHING AND CURING WATERS, WASTE STREAMS GENERATED FROM CONCRETE GRINDING AND SAWING, EXPOSED AGGREGATE PROCESSES, AND CONCRETE PUMPING AND MIXER WASHOUT WATERS. STORMWATER DISCHARGES SHALL NOT CAUSE OR CONTRIBUTE TO A VIOLATION OF THE WATER QUALITY STANDARD FOR PH IN THE RECEIVING WATER.

BMP T5.13 DESIGN GUIDELINES

SOIL RETENTION:
THE DUFF LAYER AND NATIVE TOPSOIL SHOULD BE RETAINED IN AN UNDISTURBED STATE TO THE MAXIMUM EXTENT PRACTICABLE. IN ANY AREAS REQUIRING GRADING REMOVE AND STOCKPILE THE DUFF LAYER AND TOPSOIL ON SITE IN A DESIGNATED, CONTROLLED AREA, NOT ADJACENT TO PUBLIC RESOURCES AND CRITICAL AREAS, TO BE REAPPLIED TO OTHER PORTIONS OF THE SITE WHERE FEASIBLE.

SOIL QUALITY:
ALL AREAS SUBJECT TO CLEARING AND GRADING THAT HAVE NOT BEEN COVERED BY IMPERVIOUS SURFACE, INCORPORATED INTO A DRAINAGE FACILITY OR ENGINEERED AS STRUCTURAL FILL OR SLOPE SHALL, AT PROJECT COMPLETION, DEMONSTRATE THE FOLLOWING:

- A TOPSOIL LAYER WITH A MINIMUM ORGANIC MATTER CONTENT OF TEN PERCENT DRY WEIGHT IN PLANTING BEDS, AND 5% ORGANIC MATTER CONTENT IN TURF AREAS, AND A PH FROM 6.0 TO 8.0 OR MATCHING THE PH OF THE ORIGINAL UNDISTURBED SOIL. THE TOPSOIL LAYER SHALL HAVE A MINIMUM DEPTH OF EIGHT INCHES EXCEPT WHERE TREE ROOTS LIMIT THE DEPTH OF INCORPORATION OF AMENDMENTS NEEDED TO MEET THE CRITERIA. SUBSOILS BELOW THE TOPSOIL LAYER SHOULD BE SCARIFIED AT LEAST 4 INCHES WITH SOME INCORPORATION OF THE UPPER MATERIAL TO AVOID STRATIFIED LAYERS, WHERE FEASIBLE.
- PLANTING BEDS MUST BE MULCHED WITH 2 INCHES OF ORGANIC MATERIAL.
- QUALITY OF COMPOST AND OTHER MATERIALS USED TO MEET THE ORGANIC CONTENT REQUIREMENTS.
 - THE ORGANIC CONTENT FOR "PRE-APPROVED" AMENDMENT RATES CAN BE MET ONLY USING COMPOST THAT MEETS THE DEFINITION OF "COMPOSTED MATERIALS" IN WAC 173-200-220. THIS CODE IS AVAILABLE ONLINE AT: [HTTP://WWW.ECY.WA.GOV/PROGRAMS/SW/FACILITIES/200.HTML](http://www.ecy.wa.gov/programs/sw/facilities/200.html). THE COMPOST MUST ALSO HAVE AN ORGANIC MATTER CONTENT OF 35% TO 65%, AND A CARBON TO NITROGEN RATIO BELOW 25:1. THE CARBON TO NITROGEN RATIO MAY BE AS HIGH AS 35:1 FOR PLANTINGS COMPOSED ENTIRELY OF PLANTS NATIVE TO THE PUGET SOUND LOWLANDS REGION.
 - CALCULATED AMENDMENT RATES MAY BE MET THROUGH USE OF COMPOSTED MATERIALS AS DEFINED ABOVE, OR OTHER ORGANIC MATERIALS AMENDED TO MEET THE CARBON TO NITROGEN RATIO REQUIREMENTS, AND MEETING THE CONTAMINANT STANDARDS OF GRADE A COMPOST. THE RESULTING SOIL SHOULD BE CONDUCTIVE TO THE TYPE OF VEGETATION TO BE ESTABLISHED.

IMPLEMENTATION OPTIONS:
THE SOIL QUALITY DESIGN GUIDELINES LISTED ABOVE CAN BE MET BY USING ONE OF THE METHODS LISTED BELOW:

- LEAVE UNDISTURBED NATIVE VEGETATION AND SOIL, AND PROTECT FROM COMPACTION DURING CONSTRUCTION.
- AMEND EXISTING SITE TOPSOIL OR SUBSOIL EITHER AT DEFAULT "PRE-APPROVED" RATES, OR AT CUSTOM CALCULATED RATES BASED ON SPECIFIC TESTS OF THE SOIL AND AMENDMENT.
- STOCKPILE EXISTING TOPSOIL DURING GRADING, AND REPLACE IT PRIOR TO PLANTING. STOCKPILED TOPSOIL MUST ALSO BE AMENDED IF NEEDED TO MEET THE ORGANIC MATTER OR DEPTH REQUIREMENTS, EITHER AT A DEFAULT "PRE-APPROVED" RATE OR AT A CUSTOM CALCULATED RATE.
- IMPORT TOPSOIL MIX OF SUFFICIENT ORGANIC CONTENT AND DEPTH TO MEET THE REQUIREMENTS. MORE THAN ONE METHOD MAY BE USED ON DIFFERENT PORTIONS OF THE SAME SITE. SOIL THAT ALREADY MEETS THE DEPTH AND ORGANIC MATTER QUALITY STANDARDS, AND IS NOT COMPACTED, DOES NOT NEED TO BE AMENDED.

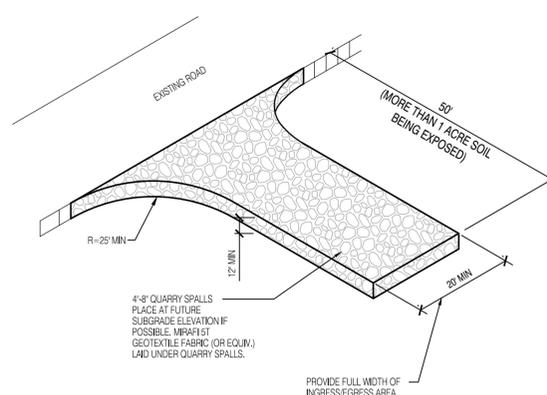
- MAINTENANCE:**
- SOIL QUALITY AND DEPTH SHOULD BE ESTABLISHED TOWARD THE END OF CONSTRUCTION AND ONCE ESTABLISHED, SHOULD BE PROTECTED FROM COMPACTION, SUCH AS FROM LARGE MACHINERY USE, AND FROM EROSION.
 - SOIL SHOULD BE PLANTED AND MULCHED AFTER INSTALLATION.
 - PLANT DEBRIS OR ITS EQUIVALENT SHOULD BE LEFT ON THE SOIL SURFACE TO REPLENISH ORGANIC MATTER.

SURVEY DISCLAIMER

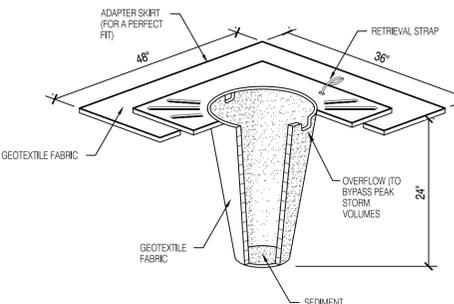
THE TOPOGRAPHIC SURVEY WAS PERFORMED BY PACIFIC COAST SURVEYS. SOLID GROUND ENGINEERING ASSUMES NO LIABILITY AS TO THE ACCURACY AND COMPLETENESS OF THIS DATA. ANY DISCREPANCIES FOUND BETWEEN WHAT IS SHOWN ON THE PLANS AND WHAT IS NOTED IN THE FIELD SHOULD BE BROUGHT IMMEDIATELY TO THE ATTENTION OF THE ENGINEER.

UTILITY NOTE

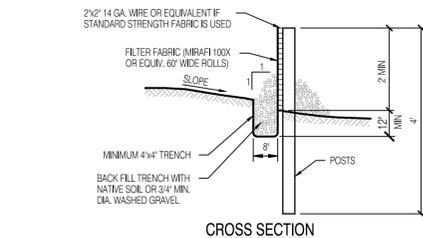
THE CONTRACTOR SHALL VERIFY THE LOCATION OF ALL EXISTING UTILITIES PRIOR TO ANY CONSTRUCTION. AGENCIES INVOLVED SHALL BE NOTIFIED WITHIN A REASONABLE TIME PRIOR TO THE START OF CONSTRUCTION.



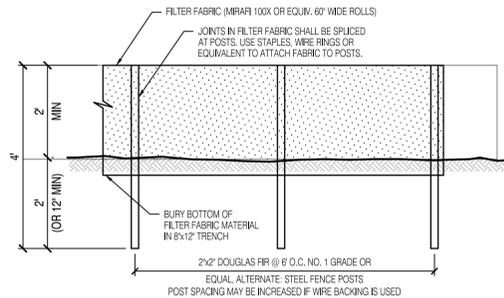
ROCK CONSTRUCTION ENTRANCE
NOT TO SCALE



STORM DRAIN INLET PROTECTION
NOT TO SCALE



CROSS SECTION



NOTES:

- SEDIMENT DEPOSITS SHALL EITHER BE REMOVED WHEN THE DEPOSIT REACHES APPROXIMATELY ONE-THIRD THE HEIGHT OF THE FENCE, OR A SECOND SILT FENCE SHALL BE INSTALLED.

SILT FENCE DETAIL

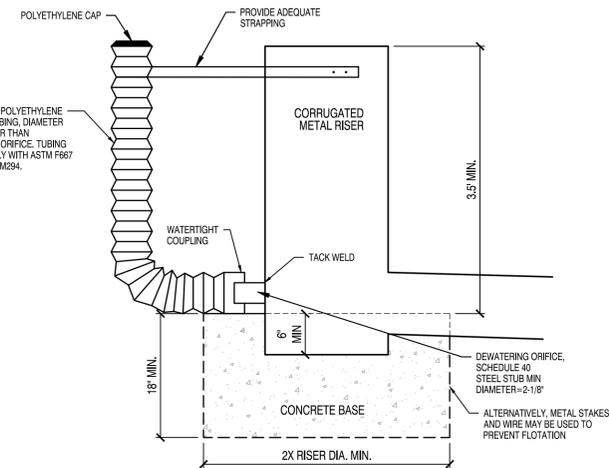
NOT TO SCALE

TEMPORARY GRAVEL CONSTRUCTION ENTRANCE:

- INSTALLATION: THE AREA OF THE ENTRANCE SHOULD BE CLEARED OF ALL VEGETATION, ROOTS AND OTHER OBJECTIONABLE MATERIAL. THE GRAVEL SHALL BE PLACED TO THE SPECIFIED DIMENSIONS. ANY DRAINAGE FACILITIES REQUIRED BECAUSE OF WASHINGS SHOULD BE CONSTRUCTED ACCORDING TO SPECIFICATIONS IN THE PLAN. IF WASH RACKS ARE USED, THEY SHOULD BE INSTALLED ACCORDING TO MANUFACTURER'S SPECIFICATIONS.
- AGGREGATE: 4-8 QUARRY SPALLS.
- ENTRANCE DIMENSIONS: THE AGGREGATE LAYER MUST BE AT LEAST 12 INCHES THICK. IT MUST EXCEED THE FULL WIDTH OF THE VEHICULAR INGRESS AND EGRESS AREA. THE LENGTH OF THE ENTRANCE MUST BE AT LEAST 100 FEET.
- WASHING: IF CONDITIONS ON THE SITE ARE SUCH THAT MOST OF THE MUD IS NOT REMOVED FROM VEHICLE TIRES BY CONTACT WITH THE GRAVEL, THEN THE TIRES MUST BE WASHED BEFORE VEHICLES ENTER A PUBLIC ROAD. WASH WATER MUST BE CARRIED AWAY FROM THE ENTRANCE TO A SETTLING AREA TO REMOVE SEDIMENT. A WASH TRACK MAY ALSO BE USED TO MAKE WASHING MORE CONVENIENT AND EFFECTIVE.
- MAINTENANCE: THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR FLOW OF MUD ONTO PUBLIC RIGHTS-OF-WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH 2-INCH STONE, AS CONDITIONS DEMAND, AND REPAIR AND/OR CLEAN OUT ANY STRUCTURES USED TO TRAP SEDIMENT. ALL MATERIALS SPILLED, DROPPED, WASHED OR TRACKED FROM VEHICLES ONTO ROADWAY OR INTO STORM DRAINS MUST BE REMOVED IMMEDIATELY.

MAINTENANCE STANDARDS:

- QUARRY SPALLS (OR HOG FUEL) SHALL BE ADDED IF THE PAD IS NO LONGER IN ACCORDANCE WITH THE SPECIFICATIONS.
- IF THE ENTRANCE IS NOT PREVENTING SEDIMENT FROM BEING TRACKED ONTO PAVEMENT, THEN ALTERNATIVE MEASURES TO KEEP THE STREETS FREE OF SEDIMENT SHALL BE USED. THIS MAY INCLUDE STREET SWEEPING, AN INCREASE IN THE DIMENSIONS OF THE ENTRANCE, OR THE INSTALLATION OF A WHEEL WASH. IF WASHING IS USED, IT SHALL BE DONE ON AN AREA COVERED WITH CRUSHED ROCK, AND WASH WATER SHALL DRAIN TO A SEDIMENT TRAP OR POND. PROVIDE TIRE WASH FOR ALL WINTER GRADING.
- ANY SEDIMENT THAT IS TRACKED ONTO PAVEMENT SHALL BE REMOVED IMMEDIATELY BY SWEEPING. THE SEDIMENT COLLECTED BY SWEEPING SHALL BE REMOVED OR STABILIZED ON-SITE. THE PAVEMENT SHALL NOT BE CLEANED BY WASHING DOWN THE STREET, EXCEPT WHEN SWEEPING IS INEFFECTIVE AND THERE IS A THREAT TO PUBLIC SAFETY. IF IT IS NECESSARY TO WASH THE STREETS, THE CONSTRUCTION OF A SMALL SUMP SHALL BE CONSIDERED. THE SEDIMENT WOULD THEN BE WASHED INTO THE SUMP.
- ANY ROCK SPALLS THAT ARE LOOSENED FROM THE PAD AND END UP ON THE ROADWAY SHALL BE REMOVED IMMEDIATELY.
- IF VEHICLES ARE ENTERING OR EXITING THE SITE AT POINTS OTHER THAN THE CONSTRUCTION ENTRANCE(S), FENCING (SECTION 5.4.1) SHALL BE INSTALLED TO CONTROL TRAFFIC.



SEDIMENT POND RISER DETAIL

NOT TO SCALE

NOTES:

- SEDIMENT DEPOSITS SHALL EITHER BE REMOVED WHEN THE DEPOSIT REACHES APPROXIMATELY ONE-THIRD THE HEIGHT OF THE FENCE, OR A SECOND SILT FENCE SHALL BE INSTALLED.



ENGINEER'S STAMP

| # | DATE | DESCRIPTION |
|---|------|-------------|
| | | |
| | | |
| | | |
| | | |

SGE
Solid Ground Engineering
8105 166th Ave NE
Redmond, WA 98052

TESC NOTES AND DETAILS

ATONEMENT FREE LUTHERAN CHURCH
ATONEMENT CHURCH
6905 172ND ST NE ARLINGTON WA.98223

| | |
|---------------|-------------------|
| DRAWN BY: | KMV |
| CHECKED BY: | TPA |
| DATE: | --- |
| JURISDICTION: | CITY OF ARLINGTON |
| JOB NUMBER: | 24-0055 |

ER-02
5 OF 24

PROJECT FILE No. _____

CITY OF ARLINGTON
CONSTRUCTION DRAWING REVIEW APPROVAL

THIS PLAN SHEET HAS BEEN REVIEWED AND APPROVED PER THE CONDITIONS ON THE TITLE SHEET.

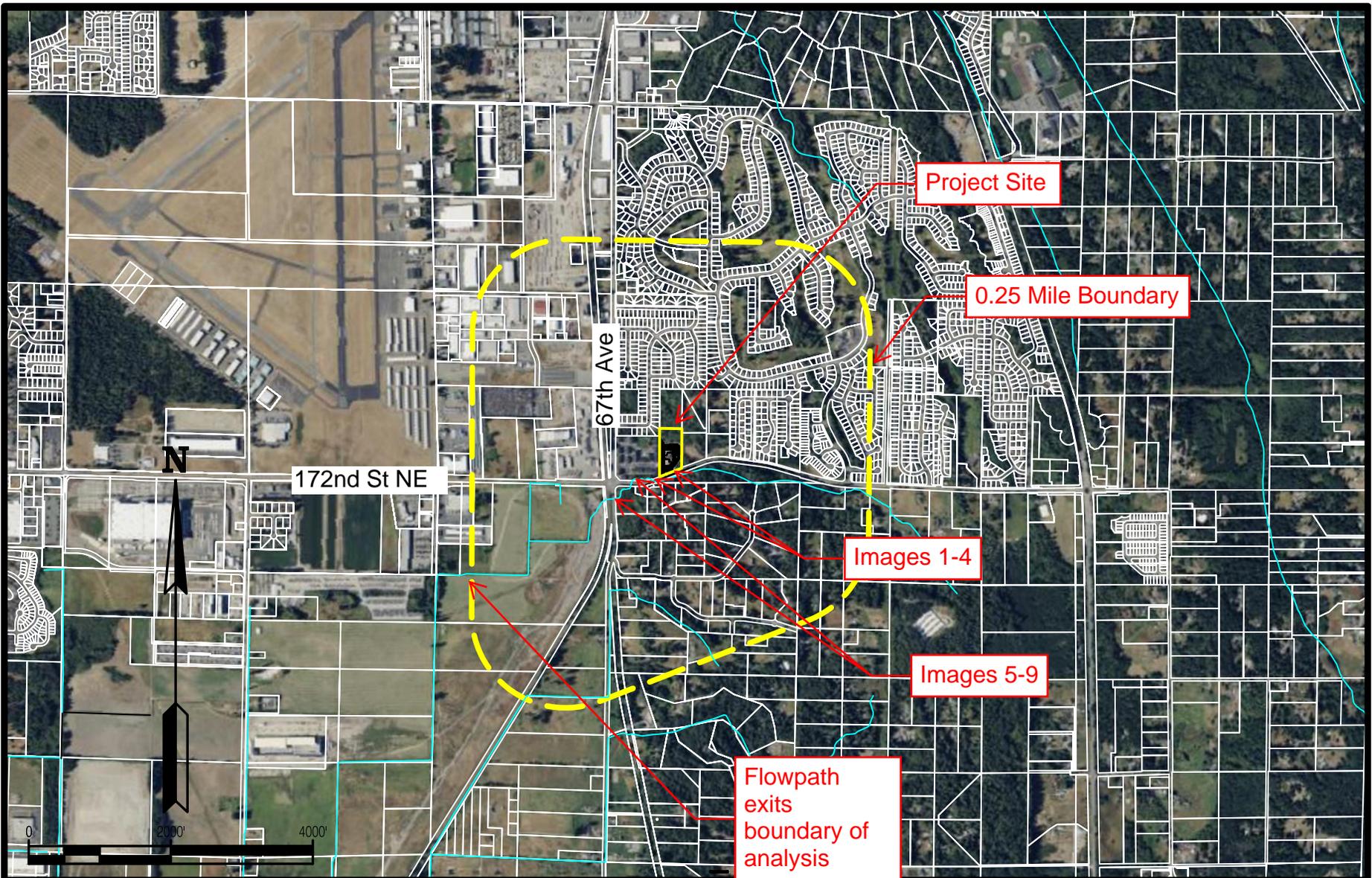
BY: _____
DEVELOPMENT SERVICES MANAGER

DATE: _____ THIS APPROVAL VALID FOR 18 MONTHS



Appendix 3: Downstream Analysis

1. Downstream Analysis Map
2. Downstream Analysis Site Visit Pictures
3. USDA Soils Map & Description



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8105 166th Ave NE
Redmond, WA 98052

ATONEMENT LUTHERAN CHURCH
ATONEMENT PARKING AND BUILDING ADDITIONS
DOWNSTREAM HYDROLOGY MAP

| | | | |
|---------------|-----------|-----------|------------|
| JOB NUMBER: | 24-0055 | DATE: | 10-25-2024 |
| JURISDICTION: | ARLINGTON | DRAWN BY: | CMP |

Downstream Analysis Photographs



Image 1: Front of Property.



Image 2: Flowpath 1 - Existing catch basin along frontage of property, flow travels west into drainage ditch along western portion of the frontage and continues to the west along 172nd St NE.



Image 3: Flowpath 1 travels west through 18" culvert pipes and drainage ditch along western portion of property frontage.



Image 4: Flowpath 1 - Drainage ditch to the west of the property along 172nd St NE, flow travels to the west for approximately 380 ft.



Image 5: Flowpath 2 drains into existing catch basin on neighboring property to the west.



Image 6: Flowpath 2 continues through the existing storm system to the north along 67th Ave NE.



Image 7: Flowpath 2 continues through the existing storm system to the north across Highland View Dr.



Image 8: Flowpath 2 continues through the existing storm system to the west across 67th Ave NE.



Image 9: Flowpath 2 drains into wetland on west side of 67th Ave NE



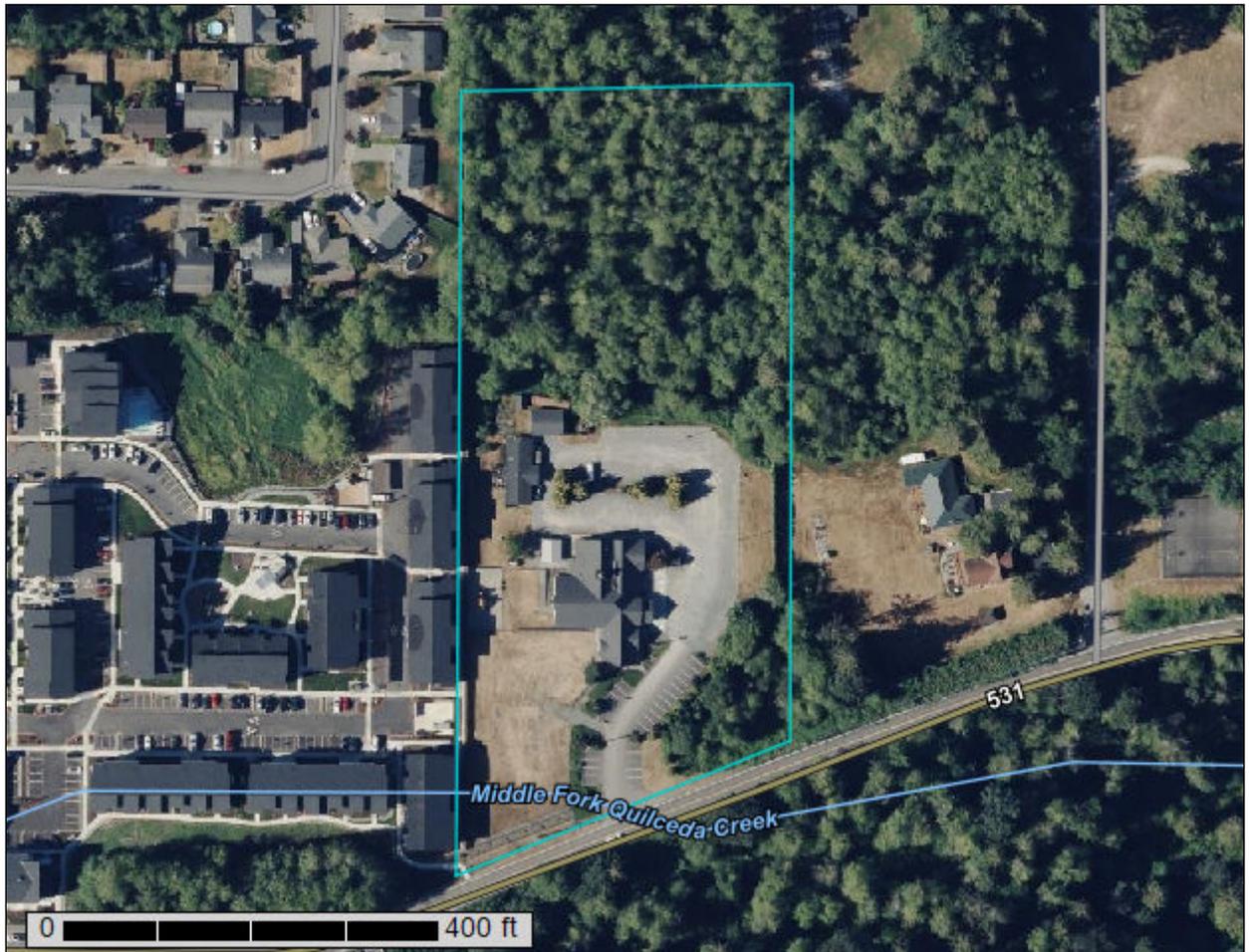
United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for Snohomish County Area, Washington



Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require

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| Map Unit Legend..... | 8 |
| Map Unit Descriptions..... | 8 |
| Snohomish County Area, Washington..... | 10 |
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| 39—Norma loam..... | 11 |
| 74—Tokul gravelly medial loam, 15 to 30 percent slopes..... | 12 |

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features

-  Blowout
-  Borrow Pit
-  Clay Spot
-  Closed Depression
-  Gravel Pit
-  Gravelly Spot
-  Landfill
-  Lava Flow
-  Marsh or swamp
-  Mine or Quarry
-  Miscellaneous Water
-  Perennial Water
-  Rock Outcrop
-  Saline Spot
-  Sandy Spot
-  Severely Eroded Spot
-  Sinkhole
-  Slide or Slip
-  Sodic Spot

-  Spoil Area
-  Stony Spot
-  Very Stony Spot
-  Wet Spot
-  Other
-  Special Line Features

Water Features

 Streams and Canals

Transportation

-  Rails
-  Interstate Highways
-  US Routes
-  Major Roads
-  Local Roads

Background

 Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
 Web Soil Survey URL:
 Coordinate System: Web Mercator (EPSG:3857)

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

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

Soil Survey Area: Snohomish County Area, Washington
 Survey Area Data: Version 26, Aug 27, 2024

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

Date(s) aerial images were photographed: Aug 14, 2022—Sep 1, 2022

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

Map Unit Legend

| Map Unit Symbol | Map Unit Name | Acres in AOI | Percent of AOI |
|------------------------------------|--|--------------|----------------|
| 18 | Everett very gravelly sandy loam, 8 to 15 percent slopes | 1.6 | 25.1% |
| 39 | Norma loam | 2.2 | 35.3% |
| 74 | Tokul gravelly medial loam, 15 to 30 percent slopes | 2.5 | 39.6% |
| Totals for Area of Interest | | 6.3 | 100.0% |

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The

Custom Soil Resource Report

delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Snohomish County Area, Washington

18—Everett very gravelly sandy loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 2t62b

Elevation: 30 to 900 feet

Mean annual precipitation: 35 to 91 inches

Mean annual air temperature: 48 to 52 degrees F

Frost-free period: 180 to 240 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Everett and similar soils: 80 percent

Minor components: 20 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Everett

Setting

Landform: Moraines, eskers, kames

Landform position (two-dimensional): Shoulder, footslope

Landform position (three-dimensional): Base slope, crest

Down-slope shape: Convex

Across-slope shape: Convex

Parent material: Sandy and gravelly glacial outwash

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material

A - 1 to 3 inches: very gravelly sandy loam

Bw - 3 to 24 inches: very gravelly sandy loam

C1 - 24 to 35 inches: very gravelly loamy sand

C2 - 35 to 60 inches: extremely cobbly coarse sand

Properties and qualities

Slope: 8 to 15 percent

Depth to restrictive feature: More than 80 inches

Drainage class: Somewhat excessively drained

Capacity of the most limiting layer to transmit water (Ksat): High (1.98 to 5.95 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Available water supply, 0 to 60 inches: Low (about 3.2 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 4s

Hydrologic Soil Group: A

Ecological site: F002XA004WA - Puget Lowlands Forest

Forage suitability group: Droughty Soils (G002XS401WA), Droughty Soils (G002XF403WA), Droughty Soils (G002XN402WA)

Other vegetative classification: Droughty Soils (G002XS401WA), Droughty Soils (G002XF403WA), Droughty Soils (G002XN402WA)

Hydric soil rating: No

Minor Components

Alderwood

Percent of map unit: 10 percent
Landform: Hills, ridges
Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Nose slope, talus
Down-slope shape: Convex, linear
Across-slope shape: Convex
Hydric soil rating: No

Indianola

Percent of map unit: 10 percent
Landform: Terraces, kames, eskers
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

39—Norma loam

Map Unit Setting

National map unit symbol: 2hyx
Elevation: 0 to 1,000 feet
Mean annual precipitation: 35 to 60 inches
Mean annual air temperature: 48 to 52 degrees F
Frost-free period: 150 to 200 days
Farmland classification: Prime farmland if drained

Map Unit Composition

Norma, undrained, and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Norma, Undrained

Setting

Landform: Drainageways, depressions
Parent material: Alluvium

Typical profile

H1 - 0 to 10 inches: ashy loam
H2 - 10 to 28 inches: sandy loam
H3 - 28 to 60 inches: sandy loam

Properties and qualities

Slope: 0 to 3 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained

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Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high
(0.57 to 1.98 in/hr)

Depth to water table: About 0 inches

Frequency of flooding: None

Frequency of ponding: Frequent

Available water supply, 0 to 60 inches: Moderate (about 9.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 5w

Hydrologic Soil Group: B/D

Ecological site: F002XA007WA - Puget Lowlands Wet Forest

Forage suitability group: Wet Soils (G002XN102WA)

Other vegetative classification: Wet Soils (G002XN102WA)

Hydric soil rating: Yes

Minor Components

Bellingham, undrained

Percent of map unit: 5 percent

Landform: Depressions

Other vegetative classification: Wet Soils (G002XN102WA)

Hydric soil rating: Yes

Norma, drained

Percent of map unit: 5 percent

Landform: Depressions

Other vegetative classification: Seasonally Wet Soils (G002XN202WA)

Hydric soil rating: Yes

Terric medisaprists, undrained

Percent of map unit: 5 percent

Landform: Depressions

Other vegetative classification: Wet Soils (G002XN102WA)

Hydric soil rating: Yes

74—Tokul gravelly medial loam, 15 to 30 percent slopes

Map Unit Setting

National map unit symbol: 2t61m

Elevation: 160 to 1,640 feet

Mean annual precipitation: 45 to 70 inches

Mean annual air temperature: 46 to 52 degrees F

Frost-free period: 140 to 200 days

Farmland classification: Farmland of statewide importance

Map Unit Composition

Tokul and similar soils: 70 percent

Minor components: 30 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Custom Soil Resource Report

Description of Tokul

Setting

Landform: Till plains, hillslopes
Landform position (two-dimensional): Footslope
Landform position (three-dimensional): Side slope, tread
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Volcanic ash mixed with loess over glacial till

Typical profile

Oi - 0 to 1 inches: slightly decomposed plant material
Oa - 1 to 2 inches: highly decomposed plant material
A - 2 to 6 inches: gravelly medial loam
Bs1 - 6 to 9 inches: gravelly medial loam
Bs2 - 9 to 17 inches: gravelly medial loam
Bs3 - 17 to 24 inches: gravelly medial loam
BC - 24 to 33 inches: gravelly medial fine sandy loam
2Bsm - 33 to 62 inches: cemented material

Properties and qualities

Slope: 15 to 30 percent
Depth to restrictive feature: 20 to 39 inches to densic material; 20 to 39 inches to cemented horizon
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Very low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: About 18 to 36 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: B
Ecological site: F002XA005WA - Puget Lowlands Moist Forest
Forage suitability group: Unnamed (G002XN303WA), Limited Depth Soils (G002XF303WA)
Other vegetative classification: Unnamed (G002XN303WA), Limited Depth Soils (G002XF303WA)
Hydric soil rating: No

Minor Components

Rinker

Percent of map unit: 10 percent
Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Vanzandt

Percent of map unit: 5 percent

Custom Soil Resource Report

Landform: Hillslopes
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Concave
Across-slope shape: Linear
Hydric soil rating: No

Barneston

Percent of map unit: 5 percent
Landform: Moraines, eskers, kames
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Convex
Hydric soil rating: No

Pastik

Percent of map unit: 5 percent
Landform: Terraces
Landform position (three-dimensional): Riser
Down-slope shape: Linear
Across-slope shape: Linear
Hydric soil rating: No

Norma

Percent of map unit: 3 percent
Landform: Drainageways, depressions
Landform position (three-dimensional): Dip
Down-slope shape: Linear, concave
Across-slope shape: Concave
Hydric soil rating: Yes

Mckenna

Percent of map unit: 2 percent
Landform: Drainageways, depressions
Landform position (three-dimensional): Dip
Down-slope shape: Linear, concave
Across-slope shape: Concave
Hydric soil rating: Yes

Appendix 4: Detention and Water Quality Design Analysis

1. Predeveloped Hydrology Map
2. Developed Hydrology Map
 3. Perfilter Detail
4. WWHM2012 Output

SW 1/4, SW 1/4, SEC 23, T31N, R5E, WM, ARLINGTON, WASHINGTON



ENGINEER'S STAMP

REVISIONS

DESCRIPTION

DATE

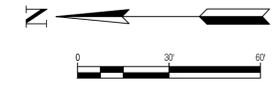


HORIZONTAL CONTROL AND PAVING PLAN

ATONEMENT FREE LUTHERAN CHURCH
ATONEMENT CHURCH
 6905 172ND ST NE ARLINGTON WA, 98223

DRAWN BY: KMV
 CHECKED BY: TPA
 DATE: ---
 JURISDICTION: CITY OF ARLINGTON
 JOB NUMBER: 24-0055

HC-01
6 OF



LEGEND

| SYMBOLS | DESCRIPTION |
|---------|--|
| • | REMOVABLE BOLLARD |
| + | 'NO PARKING' SIGN UNLESS OTHERWISE NOTED |
| ▬ | RETAINING WALL |
| ▨ | ASPHALT PAVEMENT |
| ▩ | ASPHALT GRIND AND OVERLAY |
| ▪ | CONCRETE PAVEMENT |
| ▧ | FALL PROTECTION FENCING |

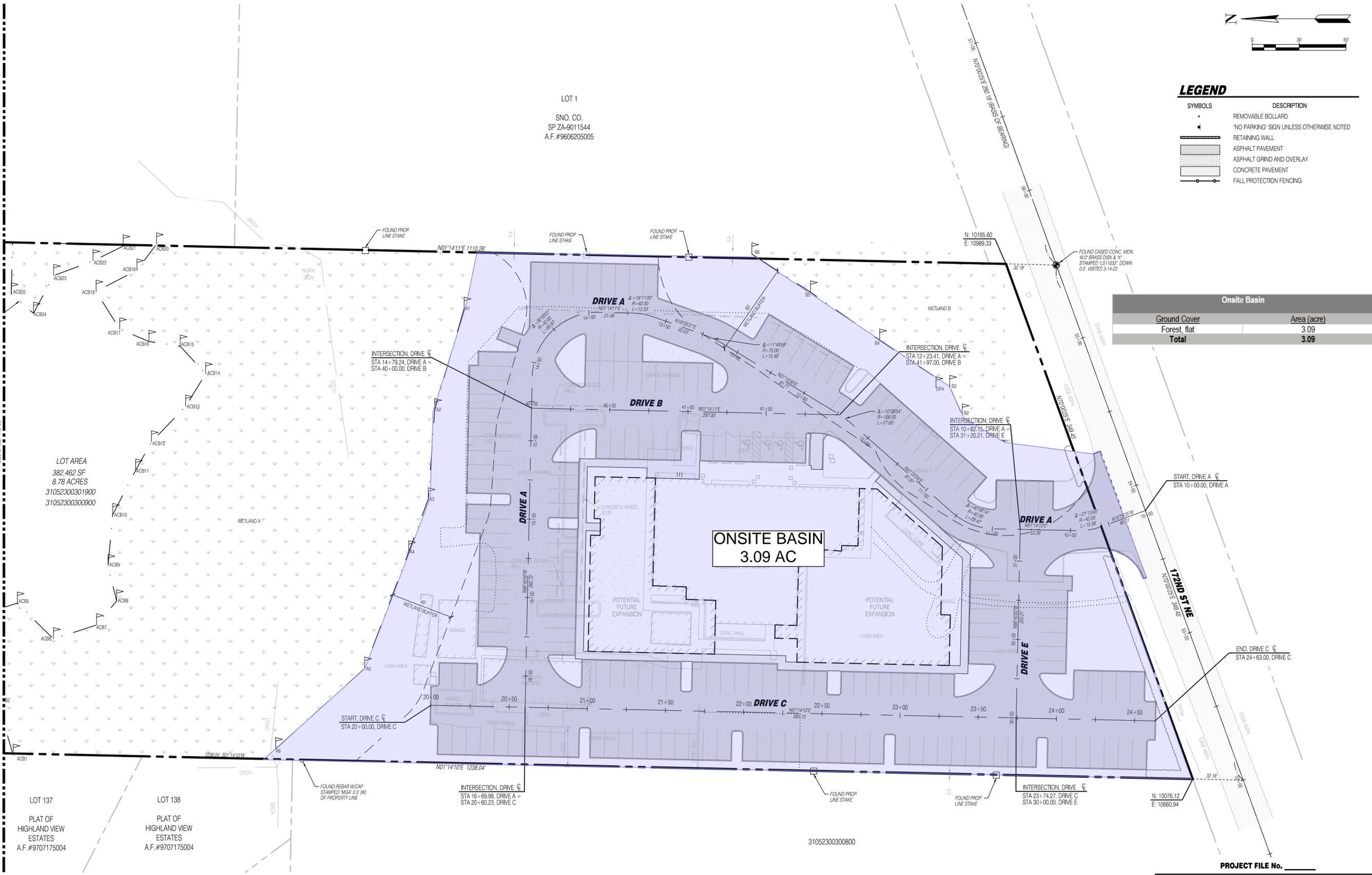
| Onsite Basin | |
|--------------|-------------|
| Ground Cover | Area (acre) |
| Forest, flat | 3.09 |
| Total | 3.09 |

LOT 1
 SNO. CO.
 SP ZA-9011544
 A.F.#9606205005

LOT AREA
 382,462 SF
 8.78 ACRES
 31052300301900
 31052300300900

ONSITE BASIN
 3.09 AC

REFERENCE LINE
 SEE SHEET HC-02



SURVEY DISCLAIMER

THE TOPOGRAPHIC SURVEY WAS PERFORMED BY PACIFIC COAST SURVEYS. SOLID GROUND ENGINEERING ASSUMES NO LIABILITY AS TO THE ACCURACY AND COMPLETENESS OF THIS DATA. ANY DISCREPANCIES FOUND BETWEEN WHAT IS SHOWN ON THE PLANS AND WHAT IS NOTED IN THE FIELD SHOULD BE BROUGHT IMMEDIATELY TO THE ATTENTION OF THE ENGINEER.

UTILITY NOTE

THE CONTRACTOR SHALL VERIFY THE LOCATION OF ALL EXISTING UTILITIES PRIOR TO ANY CONSTRUCTION. AGENCIES INVOLVED SHALL BE NOTIFIED WITHIN A REASONABLE TIME PRIOR TO THE START OF CONSTRUCTION.



PROJECT FILE No. _____
 CITY OF ARLINGTON
 CONSTRUCTION DRAWING REVIEW APPROVAL
 THIS PLAN SHEET HAS BEEN REVIEWED AND APPROVED PER THE CONDITIONS ON THE TITLE SHEET.
 BY: _____
 DEVELOPMENT SERVICES MANAGER
 DATE: _____ THIS APPROVAL VALID FOR 18 MONTHS

C:\Users\jguyman\OneDrive\Solid Ground\Engineering\24-0055\Atonement Church\Project Files\Drawings\24-0055-AC-PA-Long 8/16/2024 12:21:26 PM

SW 1/4, SW 1/4, SEC 23, T31N, R5E, WM, ARLINGTON, WASHINGTON



ENGINEER'S STAMP

REVISIONS

| # | DATE | DESCRIPTION |
|---|------|-------------|
| | | |
| | | |
| | | |

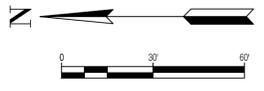
8105 166th Ave NE
Redmond, WA 98052

HORIZONTAL CONTROL AND PAVING PLAN

ATONEMENT FREE LUTHERAN CHURCH
ATONEMENT CHURCH
6905 172ND ST NE ARLINGTON WA, 98223

DRAWN BY: KMV
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DATE: ---
JURISDICTION: CITY OF ARLINGTON
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HC-01
6 OF



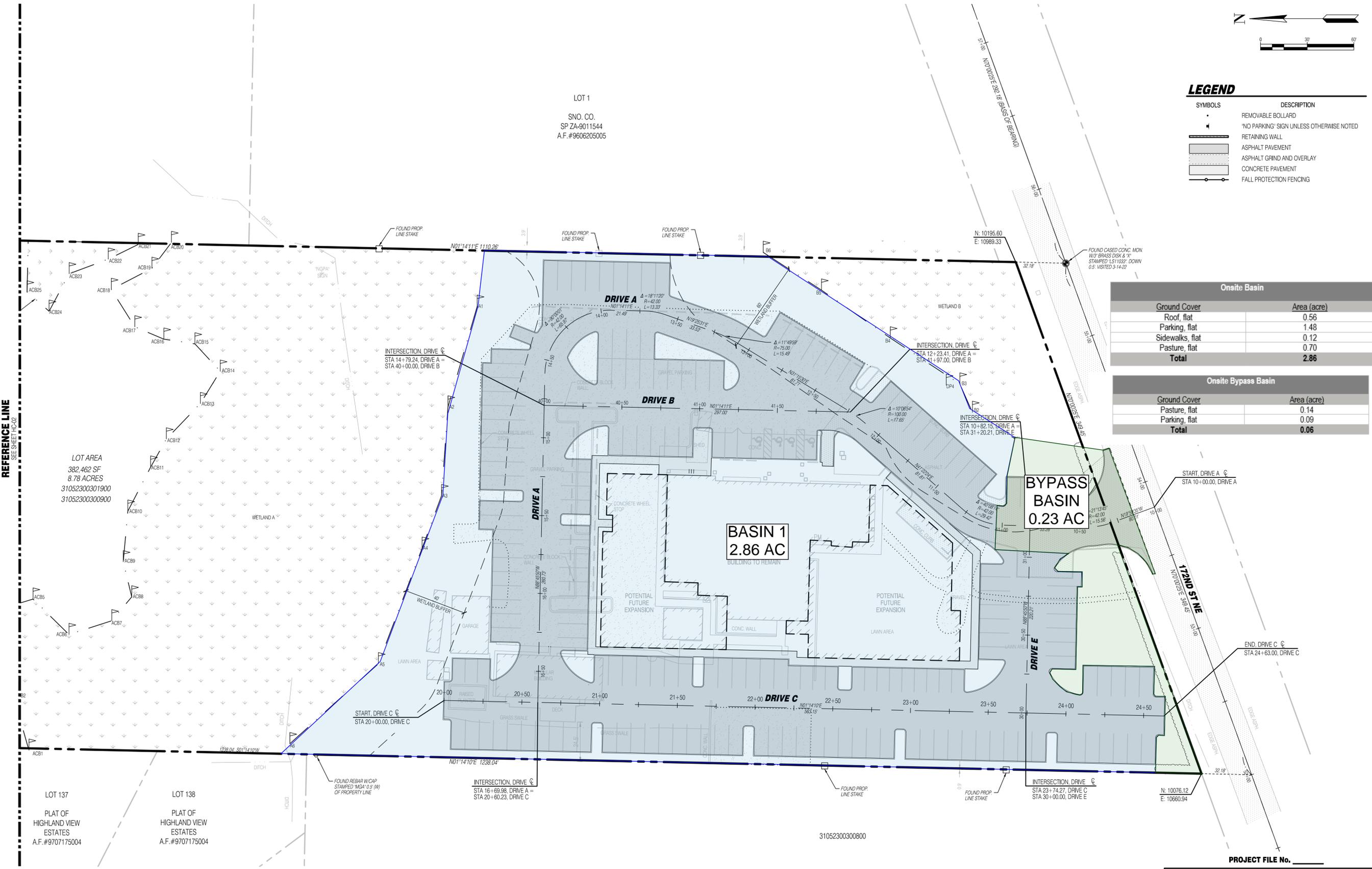
LEGEND

| SYMBOLS | DESCRIPTION |
|---------|--|
| • | REMOVABLE BOLLARD |
| + | 'NO PARKING' SIGN UNLESS OTHERWISE NOTED |
| ▬ | RETAINING WALL |
| ▨ | ASPHALT PAVEMENT |
| ▩ | ASPHALT GRIND AND OVERLAY |
| ▧ | CONCRETE PAVEMENT |
| ▭ | FALL PROTECTION FENCING |

| Onsite Basin | |
|-----------------|-------------|
| Ground Cover | Area (acre) |
| Roof, flat | 0.56 |
| Parking, flat | 1.48 |
| Sidewalks, flat | 0.12 |
| Pasture, flat | 0.70 |
| Total | 2.86 |

| Onsite Bypass Basin | |
|---------------------|-------------|
| Ground Cover | Area (acre) |
| Pasture, flat | 0.14 |
| Parking, flat | 0.09 |
| Total | 0.06 |

REFERENCE LINE
SEE SHEET HC-02



LOT 1
SNO. CO.
SP ZA-9011544
A.F.#9606205005

LOT AREA
382,462 SF
8.78 ACRES
31052300301900
31052300300900

LOT 137
PLAT OF
HIGHLAND VIEW
ESTATES
A.F.#9707175004

LOT 138
PLAT OF
HIGHLAND VIEW
ESTATES
A.F.#9707175004

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UTILITY NOTE

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SAFETY IS IN YOUR HANDS. EVERY DIG. EVERY TIME.

PROJECT FILE No. _____

CITY OF ARLINGTON
CONSTRUCTION DRAWING REVIEW APPROVAL

THIS PLAN SHEET HAS BEEN REVIEWED AND APPROVED PER THE CONDITIONS ON THE TITLE SHEET.

BY: _____
DEVELOPMENT SERVICES MANAGER

DATE: _____ THIS APPROVAL VALID FOR 18 MONTHS

C:\Users\jguyard\OneDrive\Solid Ground Engineering\24-0055\Atonement Church\Project Files\Drawings\24-0055-PC-Plan_81022024_12.21.24.MXD

WWHM2012
PROJECT REPORT

General Model Information

WWHM2012 Project Name: Atonement WWHM_20240418

Site Name:

Site Address:

City:

Report Date: 4/18/2025

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 1

| | |
|--------------------------------------|--------------|
| Bypass: | No |
| GroundWater: | No |
| Pervious Land Use C, Forest, Flat | acre 3.09 |
| Pervious Total | 3.09 |
| Impervious Land Use | acre |
| Impervious Total | 0 |
| Basin Total | 3.09 |

Mitigated Land Use

Onsite Basin

| | |
|---------------------|------|
| Bypass: | No |
| GroundWater: | No |
| Pervious Land Use | acre |
| C, Pasture, Flat | 0.7 |
| Pervious Total | 0.7 |
| Impervious Land Use | acre |
| ROOF TOPS FLAT | 0.56 |
| SIDEWALKS FLAT | 0.12 |
| PARKING FLAT | 1.48 |
| Impervious Total | 2.16 |
| Basin Total | 2.86 |

Bypass Basin

Bypass: Yes

GroundWater: No

Pervious Land Use
C, Pasture, Flat acre
0.14

Pervious Total 0.14

Impervious Land Use
PARKING FLAT acre
0.09

Impervious Total 0.09

Basin Total 0.23

Routing Elements
Predeveloped Routing

Mitigated Routing

Gravel Trench Bed 1

Bottom Length: 225.00 ft.
 Bottom Width: 25.00 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: 2
 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: 5
 Infiltration safety factor: 1
 Wetted surface area On
 Total Volume Infiltrated (ac-ft.): 467.704
 Total Volume Through Riser (ac-ft.): 3.22
 Total Volume Through Facility (ac-ft.): 470.924
 Percent Infiltrated: 99.32
 Total Precip Applied to Facility: 0
 Total Evap From Facility: 0
 Discharge Structure
 Riser Height: 2 ft.
 Riser Diameter: 12 in.
 Orifice 1 Diameter: 1.000 in. Elevation:0 ft.
 Element Flows To:
 Outlet 1 Outlet 2

Gravel Trench Bed Hydraulic Table

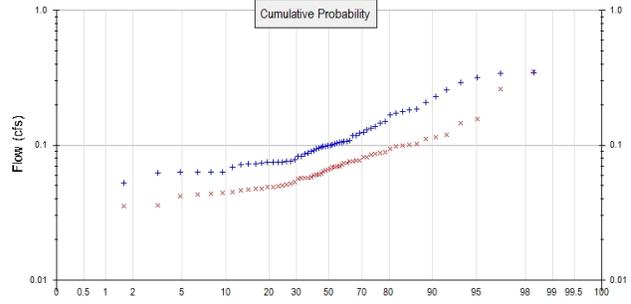
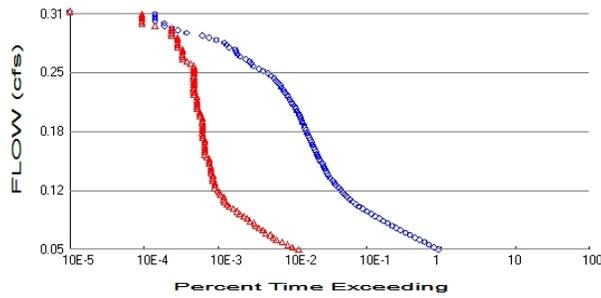
| Stage(feet) | Area(ac.) | Volume(ac-ft.) | Discharge(cfs) | Infilt(cfs) |
|-------------|-----------|----------------|----------------|-------------|
| 0.0000 | 0.129 | 0.000 | 0.000 | 0.000 |
| 0.0222 | 0.129 | 0.001 | 0.004 | 0.651 |
| 0.0444 | 0.129 | 0.002 | 0.005 | 0.651 |
| 0.0667 | 0.129 | 0.003 | 0.007 | 0.651 |
| 0.0889 | 0.129 | 0.004 | 0.008 | 0.651 |
| 0.1111 | 0.129 | 0.005 | 0.009 | 0.651 |
| 0.1333 | 0.129 | 0.006 | 0.009 | 0.651 |
| 0.1556 | 0.129 | 0.008 | 0.010 | 0.651 |
| 0.1778 | 0.129 | 0.009 | 0.011 | 0.651 |
| 0.2000 | 0.129 | 0.010 | 0.012 | 0.651 |
| 0.2222 | 0.129 | 0.011 | 0.012 | 0.651 |
| 0.2444 | 0.129 | 0.012 | 0.013 | 0.651 |
| 0.2667 | 0.129 | 0.013 | 0.014 | 0.651 |
| 0.2889 | 0.129 | 0.014 | 0.014 | 0.651 |
| 0.3111 | 0.129 | 0.016 | 0.015 | 0.651 |
| 0.3333 | 0.129 | 0.017 | 0.015 | 0.651 |
| 0.3556 | 0.129 | 0.018 | 0.016 | 0.651 |
| 0.3778 | 0.129 | 0.019 | 0.016 | 0.651 |
| 0.4000 | 0.129 | 0.020 | 0.017 | 0.651 |
| 0.4222 | 0.129 | 0.021 | 0.017 | 0.651 |
| 0.4444 | 0.129 | 0.023 | 0.018 | 0.651 |
| 0.4667 | 0.129 | 0.024 | 0.018 | 0.651 |

| | | | | |
|--------|-------|-------|-------|-------|
| 0.4889 | 0.129 | 0.025 | 0.019 | 0.651 |
| 0.5111 | 0.129 | 0.026 | 0.019 | 0.651 |
| 0.5333 | 0.129 | 0.027 | 0.019 | 0.651 |
| 0.5556 | 0.129 | 0.028 | 0.020 | 0.651 |
| 0.5778 | 0.129 | 0.029 | 0.020 | 0.651 |
| 0.6000 | 0.129 | 0.031 | 0.021 | 0.651 |
| 0.6222 | 0.129 | 0.032 | 0.021 | 0.651 |
| 0.6444 | 0.129 | 0.033 | 0.021 | 0.651 |
| 0.6667 | 0.129 | 0.034 | 0.022 | 0.651 |
| 0.6889 | 0.129 | 0.035 | 0.022 | 0.651 |
| 0.7111 | 0.129 | 0.036 | 0.022 | 0.651 |
| 0.7333 | 0.129 | 0.037 | 0.023 | 0.651 |
| 0.7556 | 0.129 | 0.039 | 0.023 | 0.651 |
| 0.7778 | 0.129 | 0.040 | 0.023 | 0.651 |
| 0.8000 | 0.129 | 0.041 | 0.024 | 0.651 |
| 0.8222 | 0.129 | 0.042 | 0.024 | 0.651 |
| 0.8444 | 0.129 | 0.043 | 0.024 | 0.651 |
| 0.8667 | 0.129 | 0.044 | 0.025 | 0.651 |
| 0.8889 | 0.129 | 0.045 | 0.025 | 0.651 |
| 0.9111 | 0.129 | 0.047 | 0.025 | 0.651 |
| 0.9333 | 0.129 | 0.048 | 0.026 | 0.651 |
| 0.9556 | 0.129 | 0.049 | 0.026 | 0.651 |
| 0.9778 | 0.129 | 0.050 | 0.026 | 0.651 |
| 1.0000 | 0.129 | 0.051 | 0.027 | 0.651 |
| 1.0222 | 0.129 | 0.052 | 0.027 | 0.651 |
| 1.0444 | 0.129 | 0.053 | 0.027 | 0.651 |
| 1.0667 | 0.129 | 0.055 | 0.028 | 0.651 |
| 1.0889 | 0.129 | 0.056 | 0.028 | 0.651 |
| 1.1111 | 0.129 | 0.057 | 0.028 | 0.651 |
| 1.1333 | 0.129 | 0.058 | 0.028 | 0.651 |
| 1.1556 | 0.129 | 0.059 | 0.029 | 0.651 |
| 1.1778 | 0.129 | 0.060 | 0.029 | 0.651 |
| 1.2000 | 0.129 | 0.062 | 0.029 | 0.651 |
| 1.2222 | 0.129 | 0.063 | 0.030 | 0.651 |
| 1.2444 | 0.129 | 0.064 | 0.030 | 0.651 |
| 1.2667 | 0.129 | 0.065 | 0.030 | 0.651 |
| 1.2889 | 0.129 | 0.066 | 0.030 | 0.651 |
| 1.3111 | 0.129 | 0.067 | 0.031 | 0.651 |
| 1.3333 | 0.129 | 0.068 | 0.031 | 0.651 |
| 1.3556 | 0.129 | 0.070 | 0.031 | 0.651 |
| 1.3778 | 0.129 | 0.071 | 0.031 | 0.651 |
| 1.4000 | 0.129 | 0.072 | 0.032 | 0.651 |
| 1.4222 | 0.129 | 0.073 | 0.032 | 0.651 |
| 1.4444 | 0.129 | 0.074 | 0.032 | 0.651 |
| 1.4667 | 0.129 | 0.075 | 0.032 | 0.651 |
| 1.4889 | 0.129 | 0.076 | 0.033 | 0.651 |
| 1.5111 | 0.129 | 0.078 | 0.033 | 0.651 |
| 1.5333 | 0.129 | 0.079 | 0.033 | 0.651 |
| 1.5556 | 0.129 | 0.080 | 0.033 | 0.651 |
| 1.5778 | 0.129 | 0.081 | 0.034 | 0.651 |
| 1.6000 | 0.129 | 0.082 | 0.034 | 0.651 |
| 1.6222 | 0.129 | 0.083 | 0.034 | 0.651 |
| 1.6444 | 0.129 | 0.084 | 0.034 | 0.651 |
| 1.6667 | 0.129 | 0.086 | 0.035 | 0.651 |
| 1.6889 | 0.129 | 0.087 | 0.035 | 0.651 |
| 1.7111 | 0.129 | 0.088 | 0.035 | 0.651 |
| 1.7333 | 0.129 | 0.089 | 0.035 | 0.651 |
| 1.7556 | 0.129 | 0.090 | 0.036 | 0.651 |

| | | | | |
|--------|-------|-------|-------|-------|
| 1.7778 | 0.129 | 0.091 | 0.036 | 0.651 |
| 1.8000 | 0.129 | 0.093 | 0.036 | 0.651 |
| 1.8222 | 0.129 | 0.094 | 0.036 | 0.651 |
| 1.8444 | 0.129 | 0.095 | 0.036 | 0.651 |
| 1.8667 | 0.129 | 0.096 | 0.037 | 0.651 |
| 1.8889 | 0.129 | 0.097 | 0.037 | 0.651 |
| 1.9111 | 0.129 | 0.098 | 0.037 | 0.651 |
| 1.9333 | 0.129 | 0.099 | 0.037 | 0.651 |
| 1.9556 | 0.129 | 0.101 | 0.037 | 0.651 |
| 1.9778 | 0.129 | 0.102 | 0.038 | 0.651 |
| 2.0000 | 0.129 | 0.103 | 0.038 | 0.651 |

Analysis Results

POC 1



+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1

Total Pervious Area: 3.09
 Total Impervious Area: 0

Mitigated Landuse Totals for POC #1

Total Pervious Area: 0.84
 Total Impervious Area: 2.25

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

| Return Period | Flow(cfs) |
|---------------|-----------|
| 2 year | 0.103825 |
| 5 year | 0.159271 |
| 10 year | 0.202032 |
| 25 year | 0.263212 |
| 50 year | 0.314165 |
| 100 year | 0.369889 |

Flow Frequency Return Periods for Mitigated. POC #1

| Return Period | Flow(cfs) |
|---------------|-----------|
| 2 year | 0.065432 |
| 5 year | 0.097313 |
| 10 year | 0.123451 |
| 25 year | 0.162961 |
| 50 year | 0.197623 |
| 100 year | 0.237233 |

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

| Year | Predeveloped | Mitigated |
|------|--------------|-----------|
| 1949 | 0.104 | 0.077 |
| 1950 | 0.106 | 0.086 |
| 1951 | 0.095 | 0.072 |
| 1952 | 0.075 | 0.057 |
| 1953 | 0.063 | 0.081 |
| 1954 | 0.339 | 0.119 |
| 1955 | 0.134 | 0.081 |
| 1956 | 0.118 | 0.032 |
| 1957 | 0.146 | 0.065 |
| 1958 | 0.106 | 0.262 |

| | | |
|------|-------|-------|
| 1959 | 0.105 | 0.057 |
| 1960 | 0.098 | 0.062 |
| 1961 | 0.184 | 0.351 |
| 1962 | 0.091 | 0.069 |
| 1963 | 0.150 | 0.100 |
| 1964 | 0.108 | 0.045 |
| 1965 | 0.090 | 0.051 |
| 1966 | 0.053 | 0.052 |
| 1967 | 0.107 | 0.145 |
| 1968 | 0.130 | 0.070 |
| 1969 | 0.316 | 0.157 |
| 1970 | 0.075 | 0.049 |
| 1971 | 0.118 | 0.074 |
| 1972 | 0.087 | 0.103 |
| 1973 | 0.082 | 0.076 |
| 1974 | 0.178 | 0.088 |
| 1975 | 0.072 | 0.074 |
| 1976 | 0.075 | 0.047 |
| 1977 | 0.063 | 0.047 |
| 1978 | 0.075 | 0.036 |
| 1979 | 0.208 | 0.099 |
| 1980 | 0.097 | 0.050 |
| 1981 | 0.076 | 0.049 |
| 1982 | 0.099 | 0.047 |
| 1983 | 0.169 | 0.070 |
| 1984 | 0.102 | 0.066 |
| 1985 | 0.123 | 0.086 |
| 1986 | 0.290 | 0.094 |
| 1987 | 0.138 | 0.077 |
| 1988 | 0.072 | 0.057 |
| 1989 | 0.073 | 0.066 |
| 1990 | 0.097 | 0.046 |
| 1991 | 0.100 | 0.061 |
| 1992 | 0.076 | 0.059 |
| 1993 | 0.063 | 0.044 |
| 1994 | 0.069 | 0.050 |
| 1995 | 0.101 | 0.043 |
| 1996 | 0.173 | 0.064 |
| 1997 | 0.344 | 0.098 |
| 1998 | 0.063 | 0.088 |
| 1999 | 0.083 | 0.035 |
| 2000 | 0.062 | 0.114 |
| 2001 | 0.025 | 0.043 |
| 2002 | 0.094 | 0.042 |
| 2003 | 0.074 | 0.058 |
| 2004 | 0.124 | 0.112 |
| 2005 | 0.086 | 0.057 |
| 2006 | 0.230 | 0.076 |
| 2007 | 0.182 | 0.069 |
| 2008 | 0.256 | 0.060 |
| 2009 | 0.078 | 0.053 |

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

| Rank | Predeveloped | Mitigated |
|------|--------------|-----------|
| 1 | 0.3439 | 0.3515 |
| 2 | 0.3392 | 0.2620 |
| 3 | 0.3164 | 0.1572 |

| | | |
|----|--------|--------|
| 4 | 0.2900 | 0.1454 |
| 5 | 0.2556 | 0.1187 |
| 6 | 0.2302 | 0.1142 |
| 7 | 0.2077 | 0.1121 |
| 8 | 0.1844 | 0.1026 |
| 9 | 0.1821 | 0.1001 |
| 10 | 0.1780 | 0.0988 |
| 11 | 0.1730 | 0.0980 |
| 12 | 0.1687 | 0.0942 |
| 13 | 0.1500 | 0.0883 |
| 14 | 0.1461 | 0.0878 |
| 15 | 0.1383 | 0.0863 |
| 16 | 0.1336 | 0.0855 |
| 17 | 0.1302 | 0.0812 |
| 18 | 0.1242 | 0.0809 |
| 19 | 0.1233 | 0.0767 |
| 20 | 0.1180 | 0.0766 |
| 21 | 0.1179 | 0.0759 |
| 22 | 0.1079 | 0.0756 |
| 23 | 0.1070 | 0.0739 |
| 24 | 0.1061 | 0.0739 |
| 25 | 0.1056 | 0.0719 |
| 26 | 0.1047 | 0.0701 |
| 27 | 0.1037 | 0.0700 |
| 28 | 0.1018 | 0.0691 |
| 29 | 0.1013 | 0.0688 |
| 30 | 0.0997 | 0.0665 |
| 31 | 0.0989 | 0.0656 |
| 32 | 0.0976 | 0.0651 |
| 33 | 0.0973 | 0.0642 |
| 34 | 0.0968 | 0.0616 |
| 35 | 0.0948 | 0.0607 |
| 36 | 0.0942 | 0.0601 |
| 37 | 0.0910 | 0.0595 |
| 38 | 0.0901 | 0.0579 |
| 39 | 0.0870 | 0.0572 |
| 40 | 0.0865 | 0.0569 |
| 41 | 0.0827 | 0.0569 |
| 42 | 0.0823 | 0.0565 |
| 43 | 0.0779 | 0.0530 |
| 44 | 0.0763 | 0.0517 |
| 45 | 0.0760 | 0.0510 |
| 46 | 0.0748 | 0.0503 |
| 47 | 0.0746 | 0.0497 |
| 48 | 0.0746 | 0.0486 |
| 49 | 0.0745 | 0.0486 |
| 50 | 0.0738 | 0.0475 |
| 51 | 0.0730 | 0.0472 |
| 52 | 0.0725 | 0.0467 |
| 53 | 0.0717 | 0.0461 |
| 54 | 0.0692 | 0.0451 |
| 55 | 0.0633 | 0.0443 |
| 56 | 0.0629 | 0.0435 |
| 57 | 0.0629 | 0.0433 |
| 58 | 0.0627 | 0.0420 |
| 59 | 0.0621 | 0.0358 |
| 60 | 0.0528 | 0.0352 |
| 61 | 0.0249 | 0.0315 |

Duration Flows

The Facility PASSED

| Flow(cfs) | Predev | Mit | Percentage | Pass/Fail |
|-----------|--------|-----|------------|-----------|
| 0.0519 | 19599 | 256 | 1 | Pass |
| 0.0546 | 16987 | 211 | 1 | Pass |
| 0.0572 | 14662 | 184 | 1 | Pass |
| 0.0599 | 12728 | 155 | 1 | Pass |
| 0.0625 | 10928 | 129 | 1 | Pass |
| 0.0652 | 9437 | 117 | 1 | Pass |
| 0.0678 | 8168 | 107 | 1 | Pass |
| 0.0705 | 7075 | 92 | 1 | Pass |
| 0.0731 | 6126 | 84 | 1 | Pass |
| 0.0758 | 5311 | 75 | 1 | Pass |
| 0.0784 | 4654 | 68 | 1 | Pass |
| 0.0811 | 4066 | 65 | 1 | Pass |
| 0.0837 | 3548 | 57 | 1 | Pass |
| 0.0863 | 3136 | 52 | 1 | Pass |
| 0.0890 | 2759 | 47 | 1 | Pass |
| 0.0916 | 2447 | 41 | 1 | Pass |
| 0.0943 | 2145 | 38 | 1 | Pass |
| 0.0969 | 1892 | 34 | 1 | Pass |
| 0.0996 | 1656 | 30 | 1 | Pass |
| 0.1022 | 1509 | 28 | 1 | Pass |
| 0.1049 | 1374 | 26 | 1 | Pass |
| 0.1075 | 1253 | 25 | 1 | Pass |
| 0.1102 | 1155 | 25 | 2 | Pass |
| 0.1128 | 1071 | 23 | 2 | Pass |
| 0.1155 | 1009 | 22 | 2 | Pass |
| 0.1181 | 950 | 21 | 2 | Pass |
| 0.1208 | 890 | 19 | 2 | Pass |
| 0.1234 | 825 | 19 | 2 | Pass |
| 0.1261 | 779 | 19 | 2 | Pass |
| 0.1287 | 734 | 18 | 2 | Pass |
| 0.1314 | 688 | 18 | 2 | Pass |
| 0.1340 | 648 | 18 | 2 | Pass |
| 0.1367 | 622 | 17 | 2 | Pass |
| 0.1393 | 602 | 17 | 2 | Pass |
| 0.1420 | 583 | 17 | 2 | Pass |
| 0.1446 | 561 | 17 | 3 | Pass |
| 0.1473 | 538 | 16 | 2 | Pass |
| 0.1499 | 507 | 16 | 3 | Pass |
| 0.1526 | 488 | 16 | 3 | Pass |
| 0.1552 | 473 | 15 | 3 | Pass |
| 0.1579 | 457 | 14 | 3 | Pass |
| 0.1605 | 440 | 14 | 3 | Pass |
| 0.1632 | 424 | 14 | 3 | Pass |
| 0.1658 | 409 | 14 | 3 | Pass |
| 0.1685 | 394 | 14 | 3 | Pass |
| 0.1711 | 380 | 14 | 3 | Pass |
| 0.1738 | 368 | 14 | 3 | Pass |
| 0.1764 | 353 | 13 | 3 | Pass |
| 0.1791 | 341 | 13 | 3 | Pass |
| 0.1817 | 333 | 13 | 3 | Pass |
| 0.1844 | 322 | 13 | 4 | Pass |
| 0.1870 | 313 | 13 | 4 | Pass |
| 0.1897 | 304 | 13 | 4 | Pass |

| | | | | |
|--------|-----|----|-----|------|
| 0.1923 | 293 | 13 | 4 | Pass |
| 0.1950 | 284 | 13 | 4 | Pass |
| 0.1976 | 276 | 13 | 4 | Pass |
| 0.2003 | 266 | 12 | 4 | Pass |
| 0.2029 | 257 | 12 | 4 | Pass |
| 0.2056 | 242 | 12 | 4 | Pass |
| 0.2082 | 234 | 11 | 4 | Pass |
| 0.2109 | 226 | 11 | 4 | Pass |
| 0.2135 | 212 | 11 | 5 | Pass |
| 0.2162 | 205 | 11 | 5 | Pass |
| 0.2188 | 195 | 11 | 5 | Pass |
| 0.2214 | 187 | 11 | 5 | Pass |
| 0.2241 | 177 | 10 | 5 | Pass |
| 0.2267 | 166 | 10 | 6 | Pass |
| 0.2294 | 160 | 10 | 6 | Pass |
| 0.2320 | 150 | 10 | 6 | Pass |
| 0.2347 | 146 | 10 | 6 | Pass |
| 0.2373 | 135 | 10 | 7 | Pass |
| 0.2400 | 128 | 10 | 7 | Pass |
| 0.2426 | 120 | 10 | 8 | Pass |
| 0.2453 | 111 | 10 | 9 | Pass |
| 0.2479 | 99 | 10 | 10 | Pass |
| 0.2506 | 85 | 10 | 11 | Pass |
| 0.2532 | 75 | 10 | 13 | Pass |
| 0.2559 | 63 | 10 | 15 | Pass |
| 0.2585 | 59 | 9 | 15 | Pass |
| 0.2612 | 56 | 8 | 14 | Pass |
| 0.2638 | 50 | 7 | 14 | Pass |
| 0.2665 | 42 | 7 | 16 | Pass |
| 0.2691 | 39 | 7 | 17 | Pass |
| 0.2718 | 37 | 7 | 18 | Pass |
| 0.2744 | 36 | 7 | 19 | Pass |
| 0.2771 | 30 | 6 | 20 | Pass |
| 0.2797 | 28 | 6 | 21 | Pass |
| 0.2824 | 26 | 6 | 23 | Pass |
| 0.2850 | 20 | 6 | 30 | Pass |
| 0.2877 | 16 | 6 | 37 | Pass |
| 0.2903 | 13 | 5 | 38 | Pass |
| 0.2930 | 8 | 5 | 62 | Pass |
| 0.2956 | 6 | 5 | 83 | Pass |
| 0.2983 | 5 | 5 | 100 | Pass |
| 0.3009 | 4 | 3 | 75 | Pass |
| 0.3036 | 4 | 2 | 50 | Pass |
| 0.3062 | 3 | 2 | 66 | Pass |
| 0.3089 | 3 | 2 | 66 | Pass |
| 0.3115 | 3 | 2 | 66 | Pass |
| 0.3142 | 3 | 2 | 66 | Pass |

Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume: 0 acre-feet

On-line facility target flow: 0 cfs.

Adjusted for 15 min: 0 cfs.

Off-line facility target flow: 0 cfs.

Adjusted for 15 min: 0 cfs.

LID Report

| LID Technique | Used for Treatment ? | Total Volume Needs Treatment (ac-ft) | Volume Through Facility (ac-ft) | Infiltration Volume (ac-ft) | Cumulative Volume Infiltration Credit | Percent Volume Infiltrated | Water Quality | Percent Water Quality Treated | Comment |
|--|--------------------------|--------------------------------------|---------------------------------|-----------------------------|---------------------------------------|----------------------------|---------------|-------------------------------|-----------------------------------|
| Gravel Trench Bed 1 POC | <input type="checkbox"/> | 428.54 | | | <input type="checkbox"/> | 99.32 | | | |
| Total Volume Infiltrated | | 428.54 | 0.00 | 0.00 | | 99.32 | 0.00 | 0% | No Treat. Credit |
| Compliance with LID Standard 8% of 2-yr to 50% of 2-yr | | | | | | | | | Duration Analysis Result = Passed |
| | | | | | | | | | |

Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Basin 1
3.09ac

Mitigated Schematic



Predeveloped UCI File

Mitigated UCI File

Predeveloped HSPF Message File

Mitigated HSPF Message File

Disclaimer

Legal Notice

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Appendix 5: Conveyance Analysis

Nothing is necessary for this appendix at this time

Appendix 6: Operations and Maintenance Manual

1. Operations and Maintenance Manual

October 30, 2024

City of Arlington Public Works Department
238 N Olympic Ave #1337
Arlington, WA 98223
(360) 403-3421



RE: Operations and Maintenance Manual

Project: Atonement Church (SGE# 24-0055)

Dear City of Arlington,

The proposed stormwater facilities consist of buried pipe networks, catch basins, gravel trench beds, and Perfilter water quality structures. Maintenance instructions for the proprietary structure are included in this Manual. Maintenance of these structures is crucial to their function and to meeting lifespan expectancies. Facility descriptions and maintenance procedures for all proposed facilities have been compiled from Appendix A of the 2019 DOE Manual, Oldcastle documentation for their proprietary structures. Inspection and maintenance procedures can be found on the following pages.

Regards,



Tom Abbott, P.E.
Principal Civil Engineer
Solid Ground Engineering

Appendix V-A: BMP Maintenance Tables

Ecology intends the facility-specific maintenance standards contained in this section to be conditions for determining if maintenance actions are required as identified through inspection. Recognizing that Permittees have limited maintenance funds and time, Ecology does not require that a Permittee perform all these maintenance activities on all their stormwater BMPs. We leave the determination of importance of each maintenance activity and its priority within the stormwater program to the Permittee. We do expect, however, that sufficient maintenance will occur to ensure that the BMPs continue to operate as designed to protect ground and surface waters.

Ecology doesn't intend that these measures identify the facility's required condition at all times between inspections. In other words, exceedance of these conditions at any time between inspections and/or maintenance does not automatically constitute a violation of these standards. However, based upon inspection observations, the Permittee shall adjust inspection and maintenance schedules to minimize the length of time that a facility is in a condition that requires a maintenance action.

Table V-A.1: Maintenance Standards - Detention Ponds

| Maintenance Component | Defect | Conditions When Maintenance Is Needed | Results Expected When Maintenance Is Performed |
|-----------------------|---|--|---|
| General | Trash & Debris | Any trash and debris which exceed 1 cubic feet per 1,000 square feet. In general, there should be no visual evidence of dumping. If less than threshold all trash and debris will be removed as part of next scheduled maintenance. | Trash and debris cleared from site |
| | Poisonous Vegetation and noxious weeds | Any poisonous or nuisance vegetation which may constitute a hazard to maintenance personnel or the public. Any evidence of noxious weeds as defined by State or local regulations. (Apply requirements of adopted IPM policies for the use of herbicides). | No danger of poisonous vegetation where maintenance personnel or the public might normally be. (Coordinate with local health department) Complete eradication of noxious weeds may not be possible. Compliance with State or local eradication policies required |
| | Contaminants and Pollution | Any evidence of oil, gasoline, contaminants or other pollutants (Coordinate removal/cleanup with local water quality response agency). | No contaminants or pollutants present. |
| | Rodent Holes | Any evidence of rodent holes if facility is acting as a dam or berm, or any evidence of water piping through dam or berm via rodent holes. | Rodents destroyed and dam or berm repaired. (Coordinate with local health department; coordinate with Ecology Dam Safety Office if pond exceeds 10 acre-feet.) |
| | Beaver Dams | Dam results in change or function of the facility. | Facility is returned to design function. (Coordinate trapping of beavers and removal of dams with appropriate permitting agencies) |
| | Insects | When insects such as wasps and hornets interfere with maintenance activities. | Insects destroyed or removed from site. Apply insecticides in compliance with adopted IPM policies |
| | Tree Growth and Hazard Trees | Tree growth does not allow maintenance and inspection access or interferes with maintenance activity (i.e., slope mowing, silt removal, vactoring, or equipment movements). If trees are not interfering with access or maintenance, do not remove If dead, diseased, or dying trees are identified (Use a certified Arborist to determine health of tree or removal requirements) | Trees do not hinder maintenance activities. Harvested trees should be recycled into mulch or other beneficial uses (e.g., alders for firewood). Remove hazard Trees |
| Side Slopes of Pond | Erosion Eroded damage over 2 inches deep where cause of damage is still present or where there is potential for continued erosion. Any erosion observed on a compacted berm embankment. | Slopes should be stabilized using appropriate erosion control measure(s); e.g., rock reinforcement, planting of grass, compaction. If erosion is occurring on compacted berms a licensed engineer in the state of Washington should be consulted to resolve source of erosion. | |
| Storage Area | Sediment Accumulated sediment that exceeds 10% of the designed pond depth unless otherwise specified or affects inletting or outletting condition of the facility. | Sediment cleaned out to designed pond shape and depth; pond reseeded if necessary to control erosion. | |

Table V-A.1: Maintenance Standards - Detention Ponds (continued)

| Maintenance Component | Defect | Conditions When Maintenance Is Needed | Results Expected When Maintenance Is Performed |
|---|-----------------------------|--|--|
| | Liner (if Applicable) | Liner is visible and has more than three 1/4-inch holes in it. | Liner repaired or replaced. Liner is fully covered. |
| Ponds Berms (Dikes) | Settlements | Any part of berm which has settled 4 inches lower than the design elevation If settlement is apparent, measure berm to determine amount of settlement Settling can be an indication of more severe problems with the berm or outlet works. A licensed engineer in the state of Washington should be consulted to determine the source of the settlement. | Dike is built back to the design elevation. |
| | Piping | Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.) | Piping eliminated. Erosion potential resolved. |
| Emergency Overflow/Spillway and Berms over 4 feet in height | Tree Growth | Tree growth on emergency spillways creates blockage problems and may cause failure of the berm due to uncontrolled overtopping. Tree growth on berms over 4 feet in height may lead to piping through the berm which could lead to failure of the berm. | Trees should be removed. If root system is small (base less than 4 inches) the root system may be left in place. Otherwise the roots should be removed and the berm restored. A licensed engineer in the state of Washington should be consulted for proper berm/spillway restoration. |
| | Piping | Discernable water flow through pond berm. Ongoing erosion with potential for erosion to continue. (Recommend a Geotechnical engineer be called in to inspect and evaluate condition and recommend repair of condition.) | Piping eliminated. Erosion potential resolved. |
| Emergency Overflow/Spillway | Emergency Overflow/Spillway | Only one layer of rock exists above native soil in area five square feet or larger, or any exposure of native soil at the top of out flow path of spillway. (Rip-rap on inside slopes need not be replaced.) | Rocks and pad depth are restored to design standards. |
| | Erosion | See "Side Slopes of Pond" | |

Table V-A.2: Maintenance Standards - Infiltration

| Maintenance Component | Defect | Conditions When Maintenance Is Needed | Results Expected When Maintenance Is Performed |
|-----------------------|------------------------------|--|---|
| General | Trash & Debris | See Table V-A.1: Maintenance Standards - Detention Ponds | See Table V-A.1: Maintenance Standards - Detention Ponds |
| | Poisonous/Noxious Vegetation | See Table V-A.1: Maintenance Standards - Detention Ponds | See Table V-A.1: Maintenance Standards - Detention Ponds |
| | Contaminants and Pollution | See Table V-A.1: Maintenance Standards - Detention Ponds | See Table V-A.1: Maintenance Standards - Detention Ponds |
| | Rodent Holes | See Table V-A.1: Maintenance Standards - Detention Ponds | See Table V-A.1: Maintenance Standards - Detention Ponds |
| Storage Area | Sediment | Water ponding in infiltration pond after rainfall ceases and appropriate time allowed for infiltration. Treatment basins should infiltrate Water Quality Design Storm Volume within 48 hours, and empty within 24 hours after cessation of most rain events. | Sediment is removed and/or facility is cleaned so that infiltration system works according to design. |

Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults) (continued)

| Maintenance Component | Defect | Conditions When Maintenance is Needed | Results Expected When Maintenance is Performed |
|-----------------------|---|--|---|
| Manhole | Cover Not in Place | Cover is missing or only partially in place. Any open manhole requires maintenance. | Manhole is closed. |
| | Locking Mechanism Not Working | Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread (may not apply to self-locking lids). | Mechanism opens with proper tools. |
| | Cover Difficult to Remove | One maintenance person cannot remove lid after applying normal lifting pressure. Intent is to keep cover from sealing off access to maintenance. | Cover can be removed and reinstalled by one maintenance person. |
| | Ladder Rungs Unsafe | Ladder is unsafe due to missing rungs, misalignment, not securely attached to structure wall, rust, or cracks. | Ladder meets design standards. Allows maintenance person safe access. |
| Catch Basins | See Table V-A.5: Maintenance Standards - Catch Basins | See Table V-A.5: Maintenance Standards - Catch Basins | See Table V-A.5: Maintenance Standards - Catch Basins |

Table V-A.4: Maintenance Standards - Control Structure/Flow Restrictor

| Maintenance Component | Defect | Condition When Maintenance is Needed | Results Expected When Maintenance is Performed |
|-----------------------|--|---|--|
| General | Trash and Debris (Includes Sediment) | Material exceeds 25% of sump depth or 1 foot below orifice plate. | Control structure orifice is not blocked. All trash and debris removed. |
| | Structural Damage | Structure is not securely attached to manhole wall. Structure is not in upright position (allow up to 10% from plumb). Connections to outlet pipe are not watertight and show signs of rust. Any holes - other than designed holes - in the structure. | Structure securely attached to wall and outlet pipe. Structure in correct position. Connections to outlet pipe are water tight; structure repaired or replaced and works as designed. Structure has no holes other than designed holes. |
| Cleanout Gate | Damaged or Missing | Cleanout gate is not watertight or is missing. Gate cannot be moved up and down by one maintenance person. Chain/rod leading to gate is missing or damaged. Gate is rusted over 50% of its surface area. | Gate is watertight and works as designed. Gate moves up and down easily and is watertight. Chain is in place and works as designed. Gate is repaired or replaced to meet design standards. |
| Orifice Plate | Damaged or Missing | Control device is not working properly due to missing, out of place, or bent orifice plate. | Plate is in place and works as designed. |
| | Obstructions | Any trash, debris, sediment, or vegetation blocking the plate. | Plate is free of all obstructions and works as designed. |
| Overflow Pipe | Obstructions | Any trash or debris blocking (or having the potential of blocking) the overflow pipe. | Pipe is free of all obstructions and works as designed. |
| Manhole | See Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults) | See Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults) | See Table V-A.3: Maintenance Standards - Closed Detention Systems (Tanks/Vaults) |
| Catch Basin | See Table V-A.5: Maintenance Standards - Catch Basins | See Table V-A.5: Maintenance Standards - Catch Basins | See Table V-A.5: Maintenance Standards - Catch Basins |

Table V-A.5: Maintenance Standards - Catch Basins

| Maintenance Component | Defect | Conditions When Maintenance is Needed | Results Expected When Maintenance is performed |
|------------------------------|--|---|---|
| General | Trash & Debris | Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%. Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe. Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height. Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane). | No Trash or debris located immediately in front of catch basin or on grate opening. No trash or debris in the catch basin. Inlet and outlet pipes free of trash or debris. No dead animals or vegetation present within the catch basin. |
| | Sediment | Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe. | No sediment in the catch basin |
| | Structure Damage to Frame and/or Top Slab | Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch. (Intent is to make sure no material is running into basin). Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached | Top slab is free of holes and cracks. Frame is sitting flush on the riser rings or top slab and firmly attached. |
| | Fractures or Cracks in Basin Walls/ Bottom | Maintenance person judges that structure is unsound. Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks. | Basin replaced or repaired to design standards. Pipe is regouted and secure at basin wall. |
| | Settlement/ Mis-alignment | If failure of basin has created a safety, function, or design problem. | Basin replaced or repaired to design standards. |
| | Vegetation | Vegetation growing across and blocking more than 10% of the basin opening. Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart. | No vegetation blocking opening to basin. No vegetation or root growth present. |
| | Contamination and Pollution | See Table V-A.1: Maintenance Standards - Detention Ponds | No pollution present. |
| Catch Basin Cover | Cover Not in Place | Cover is missing or only partially in place. Any open catch basin requires maintenance. | Cover/grate is in place, meets design standards, and is secured |
| | Locking Mechanism Not Working | Mechanism cannot be opened by one maintenance person with proper tools. Bolts into frame have less than 1/2 inch of thread. | Mechanism opens with proper tools. |
| | Cover Difficult to Remove | One maintenance person cannot remove lid after applying normal lifting pressure. (Intent is keep cover from sealing off access to maintenance.) | Cover can be removed by one maintenance person. |
| Ladder | Ladder Rungs Unsafe | Ladder is unsafe due to missing rungs, not securely attached to basin wall, misalignment, rust, cracks, or sharp edges. | Ladder meets design standards and allows maintenance person safe access. |
| Metal Grates (If Applicable) | Grate opening Unsafe | Grate with opening wider than 7/8 inch. | Grate opening meets design standards. |
| | Trash and Debris | Trash and debris that is blocking more than 20% of grate surface inletting capacity. | Grate free of trash and debris. |
| | Damaged or Missing. | Grate missing or broken member(s) of the grate. | Grate is in place, meets the design standards, and is installed and aligned with the flow path. |



PERKFILTER™

Inspection and Maintenance Guide



PerkFilter™ Media Filtration System

Description

The PerkFilter is a stormwater treatment device used to remove pollutants from urban runoff. Impervious surfaces and other urban and suburban landscapes generate a variety of contaminants that can enter stormwater and pollute downstream receiving waters. The PerkFilter is a media-filled cartridge filtration device designed to capture and retain sediment, gross solids, metals, nutrients, hydrocarbons, and trash and debris. As with any stormwater treatment system, the PerkFilter requires periodic maintenance to sustain optimum system performance.

Function

The PerkFilter is a water quality treatment system consisting of three chambers: an inlet chamber, a filter cartridge treatment chamber, and an outlet chamber (Figure 1). Stormwater runoff enters the inlet chamber through an inlet pipe, curb opening, or grated inlet. Gross solids are settled out, and floating trash and debris are trapped in the inlet chamber. Pretreated flow is then directed to the treatment chamber through an opening in the baffle wall between the inlet chamber and treatment chamber. The treatment chamber contains media-filled filter cartridges (Figure 2) that use physical and chemical processes to remove pollutants. During a storm event, runoff pools in the treatment chamber before passing radially through the cylindrical cartridges from the outside surface, through the media for treatment, and into the center of the cartridge. At the center of the cartridge is a center tube assembly designed to distribute the hydraulic load evenly across the surface of the filter cartridge and control the treatment flow rate. The center tube assembly discharges treated flow through the false floor and into the outlet chamber. A draindown feature built into each cartridge allows the treatment chamber to dewater between storm events.

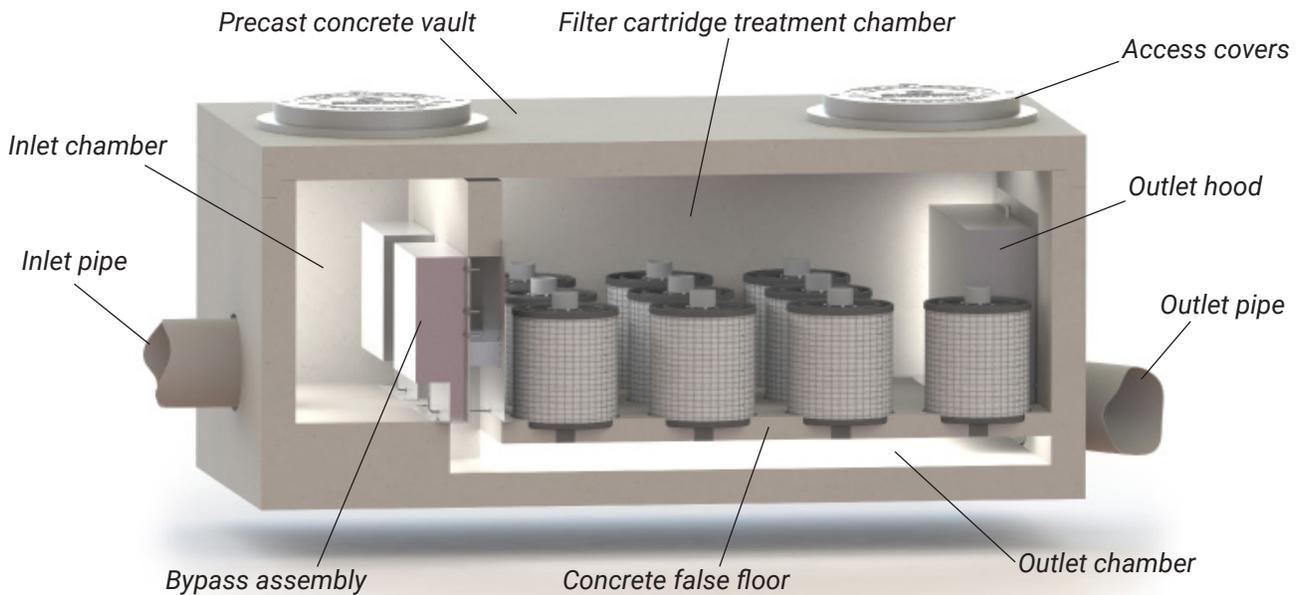


Figure 1. Schematic of the PerkFilter system.

All PerkFilter systems include a high-flow bypass assembly to divert flow exceeding the treatment capacity of the filter cartridges around the treatment chamber. The bypass assembly routes peak flow from the inlet chamber directly to the outlet chamber, bypassing the treatment chamber to prevent sediment and other captured pollutants from being scoured and re-entrained by high flow. Treated flow and bypass flow merge in the outlet chamber for discharge by a single outlet pipe.

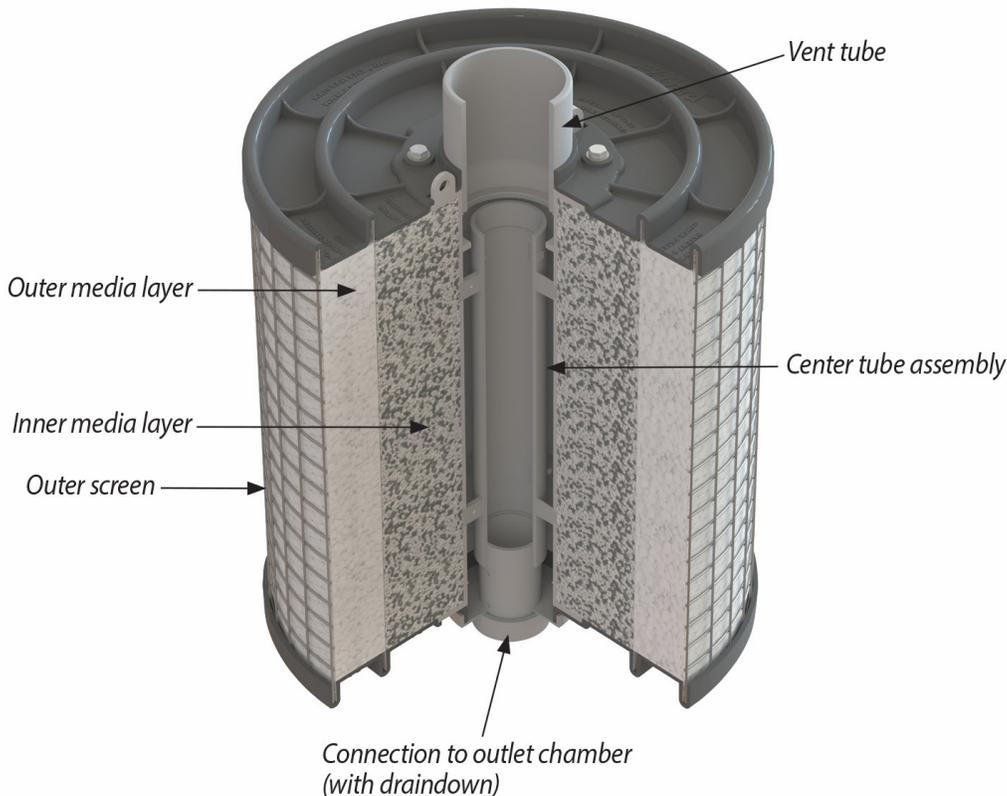


Figure 2. Schematic of PerkFilter cartridge.

Configuration

The PerkFilter structure may consist of a vault, manhole, or catch basin configuration. Catch basin units may be fabricated from concrete or steel. Internal components including the PerkFilter cartridges are manufactured from durable plastic and stainless steel components and hardware. All cartridges are 18 inches in diameter and are available in two heights: 12-inch and 18-inch. Cartridges may be used alone or may be stacked (Figure 3) to provide 24-inch and 30-inch combinations. The capacity of each cartridge or cartridge combination is dictated by the allowable operating rate of the media and the outer surface area of the cartridge. Thus, taller cartridges have greater treatment capacity than shorter cartridges, but they also require more hydraulic drop across the system. Cartridges may be filled with various media depending on the target pollutants and desired treatment rate, among other factors.

Access to an installed PerkFilter system is typically provided by ductile iron castings or hatch covers. The location and number of access appurtenances is dependent on the size and configuration of the system.

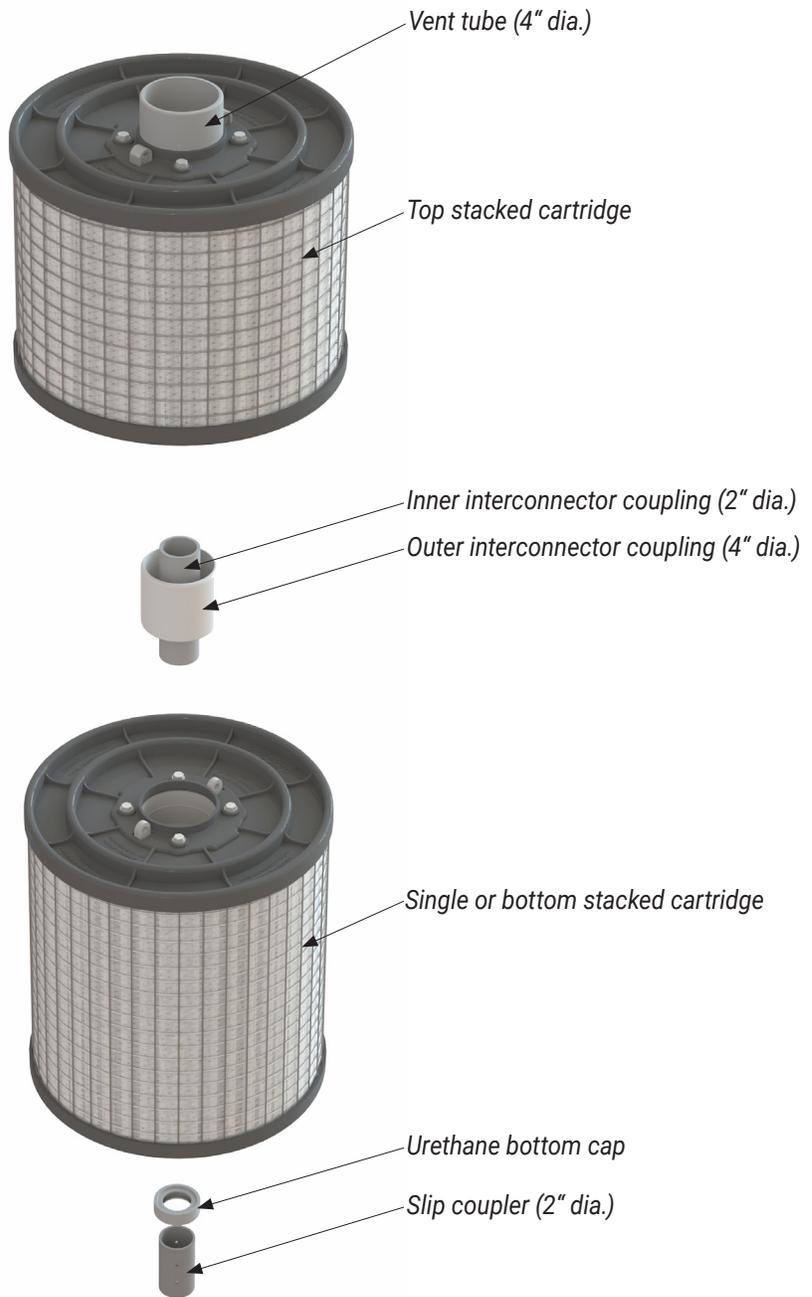


Figure 3. Schematic of stacked cartridges and connector components.

Maintenance Overview

State and local regulations require all stormwater management systems to be inspected on a periodic basis and maintained as necessary to ensure performance and protect downstream receiving waters. Maintenance prevents excessive pollutant buildup that can limit system performance by reducing the operating capacity and increasing the potential for scouring of pollutants during periods of high flow.

Inspection and Maintenance Frequency

The PerkFilter should be inspected on a periodic basis, typically twice per year, and maintained as required. Initially, inspections of a new system should be conducted more frequently to help establish an appropriate site-specific inspection frequency. The maintenance frequency will be driven by the amount of runoff and pollutant loading encountered by a given system. In most cases, the optimum maintenance interval will be one to three years. Inspection and maintenance activities should be performed only during dry weather periods.

Inspection Equipment

The following equipment is helpful when conducting PerkFilter inspections:

- Recording device (pen and paper form, voice recorder, iPad, etc.)
- Suitable clothing (appropriate footwear, gloves, hardhat, safety glasses, etc.)
- Traffic control equipment (cones, barricades, signage, flagging, etc.)
- Socket and wrench for bolt-down access covers
- Manhole hook or pry bar
- Flashlight
- Tape measure
- Measuring stick or sludge sampler
- Long-handled net (optional)

Inspection Procedures

PerkFilter inspections are visual and may be conducted from the ground surface without entering the unit. To complete an inspection, safety measures including traffic control should be deployed before the access covers are removed. Once the covers have been removed, the following items should be checked and recorded (see form provided at the end of this document) to determine whether maintenance is required:

- Inspect the internal components and note whether there are any broken or missing parts. In the unlikely event that internal parts are broken or missing, contact Oldcastle Infrastructure at (800) 579-8819 to determine appropriate corrective action.
- Note whether the inlet pipe is blocked or obstructed. The outlet pipe is covered by a removable outlet hood and cannot be observed without entering the unit.
- Observe, quantify and record the accumulation of floating trash and debris in the inlet chamber. The significance of accumulated floating trash and debris is a matter of judgment. A long-handled net may be used to retrieve the bulk of trash and debris at the time of inspection if full maintenance due to accumulation of floating oils or settled sediment is not yet warranted.

- Observe, quantify and record the accumulation of oils in the inlet chamber. The significance of accumulated floating oils is a matter of judgment. However, if there is evidence of an oil or fuel spill, immediate maintenance by appropriate certified personnel is warranted.
- Observe, quantify and record the average accumulation of sediment in the inlet chamber and treatment chamber. A calibrated dipstick, tape measure, or sludge sampler may be used to determine the amount of accumulated sediment in each chamber. The depth of sediment may be determined by calculating the difference between the measurement from the rim of the PerkFilter to the top of the accumulated sediment, and the measurement from the rim of the PerkFilter to the bottom of the PerkFilter structure. Finding the top of the accumulated sediment below standing water takes some practice and a light touch, but increased resistance as the measuring device is lowered toward the bottom of the unit indicates the top of the accumulated sediment.
- Finally, observe, quantify and record the amount of standing water in the treatment chamber around the cartridges. If standing water is present, do not include the depth of sediment that may have settled out below the standing water in the measurement.

Maintenance Triggers

Maintenance should be scheduled if any of the following conditions are identified during the inspection:

- Internal components are broken or missing.
- Inlet piping is obstructed.
- The accumulation of floating trash and debris that cannot be retrieved with a net and/or oil in the inlet chamber is significant.
- There is more than 6" of accumulated sediment in the inlet chamber.
- There is more than 4" of accumulated sediment in the treatment chamber.
- There is more than 4" of standing water in the treatment chamber more than 24 hours after end of rain event.
- A hazardous material release (e.g. automotive fluids) is observed or reported.
- The system has not been maintained for 3 years (wet climates) to 5 years (dry climates).

Maintenance Equipment

The following equipment is helpful when conducting PerkFilter maintenance:

- Suitable clothing (appropriate footwear, gloves, hardhat, safety glasses, etc.)
- Traffic control equipment (cones, barricades, signage, flagging, etc.)
- Socket and wrench for bolt-down access covers
- Manhole hook or pry bar
- Confined space entry equipment, if needed
- Flashlight
- Tape measure
- 9/16" socket and wrench to remove hold-down struts and filter cartridge tops
- Replacement filter cartridges
- Vacuum truck with water supply and water jet

Contact Oldcastle Infrastructure at (800) 579-8819 for replacement filter cartridges. A lead time of four weeks is recommended.

Maintenance Procedures

Maintenance should be conducted during dry weather when no flow is entering the system. Confined space entry is necessary to maintain vault and manhole PerkFilter configurations. Only personnel that are OSHA Confined Space Entry trained and certified may enter underground structures. Confined space entry is not required for catch basin PerkFilter configurations. Once safety measures such as traffic control are deployed, the access covers may be removed and the following activities may be conducted to complete maintenance:

- Remove floating trash, debris and oils from the water surface in the inlet chamber using the extension nozzle on the end of the boom hose of the vacuum truck. Continue using the vacuum truck to completely dewater the inlet chamber and evacuate all accumulated sediment from the inlet chamber. Some jetting may be required to fully remove sediment. The inlet chamber does not need to be refilled with water after maintenance is complete. The system will fill with water when the next storm event occurs.
- Remove the hold-down strut from each row of filter cartridges and then remove the top of each cartridge (the top is held on by four 9/16" bolts) and use the vacuum truck to evacuate the spent media. When empty, the spent cartridges may be easily lifted off their slip couplers and removed from the vault. The couplers may be left inserted into couplings cast into the false floor to prevent sediment and debris from being washed into the outlet chamber during washdown.
- Once all the spent cartridges have been removed from the structure, the vacuum truck may be used to evacuate all accumulated sediment from the treatment chamber. Some jetting may be required to fully remove sediment. Take care not to wash sediment and debris through the openings in the false floor and into the outlet chamber. All material removed from the PerkFilter during maintenance including the spent media must be disposed of in accordance with local, state, and/or federal regulations. In most cases, the material may be handled in the same manner as disposal of material removed from sumped catch basins or manholes.
- Place a fresh cartridge in each cartridge position using the existing slip couplers and urethane bottom caps. If the vault is equipped with stacked cartridges, the existing outer and inner interconnector couplers must be used between the stacked cartridges to provide hydraulic connection. Transfer the existing vent tubes from the spent cartridges to the fresh cartridges. Finally, refit the struts to hold the fresh cartridges in place.
- Securely replace access covers, as appropriate.
- Make arrangements to return the empty spent cartridges to Oldcastle Infrastructure.

PerkFilter Inspection and Maintenance Log

Location _____

Structure Configuration and Size:

Inspection Date _____

- Vault ____ feet x ____ feet
- Manhole ____ feet diameter
- Catch Basin ____ feet x ____ feet

Number and Height of Cartridge Stacks:

Media Type:

Count ____ each 12" 18" 24" 30"

ZPC Perlite Other _____

Condition of Internal Components

Notes:

- Good Damaged Missing

Inlet or Outlet Blockage or Obstruction

Notes:

- Yes No

Floating Trash and Debris

Notes:

- Significant Not Significant

Floating Oils

Notes:

- Significant Not Significant Spill

Sediment Depth in Inlet Chamber

Notes:

Inches of Sediment: _____

Sediment Depth in Treatment Chamber

Notes:

Inches of Sediment: _____

Standing Water in Treatment Chamber

Notes:

Inches of Standing Water: _____

Maintenance Required

- Yes - Schedule Maintenance No - Inspect Again in _____ Months

PERKFILTER™

OUR MARKETS



**BUILDING
STRUCTURES**



COMMUNICATIONS



WATER



ENERGY



TRANSPORTATION

Appendix 7: Special Reports and Studies

1. N/A

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1. N/A