Bull Run TREATMENT PROJECTS | Pipelines

PORTLAND WATER BUREAU
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Finished Water Intertie Site Stormwater Drainage Report

Bull Run Filtration Pipelines Project

September 2022

Prepared by: Jacobs

In association with EMERIO ENGINEERING • SURVEYING • DESIGN and other firms

Exhibit A.75

FWI Site Stormwater Management Report
Bull Run Filtration Pipelines Project
Multnomah County, Oregon

Emerio Project Number: 0545-006

City of Portland Permit Numbers: TBD

I hereby certify that this Stormwater Management Report for this project has been prepared by me or under my supervision and meets minimum standards of the Multnomah County Design and Construction Manual (MCDCM) and normal standards of engineering practice. I hereby acknowledge and agree that the jurisdiction does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities designed by me.

This report was prepared in support of the City of Portland Water Bureau's Bull Run Filtration Pipelines Project land use applications in Multnomah County and reflects the current status of the project design, which is approximately 60% complete as of the date of this report. This design is subject to change and has been prepared for the specific purpose of addressing conformance of the project to the Multnomah County land use requirements as expressed in the Multnomah County Code.

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1.0 Introduction

1.1 Project Overview and Description

The water supply for the City of Portland includes two sources: the Bull Run Watershed and the Columbia South Shore Wellfield (CSSWF). In addition to the City of Portland, the Water Bureau provides potable water to 19 wholesale customers. The Bull Run Watershed, located east of Portland in the Mount Hood National Forest, is the primary source of water. The 102 square mile, protected watershed is managed by the U.S. Forest Service in cooperation with the Water Bureau. There are two dam structures within the watershed that create two surface water reservoirs with a combined storage capacity of 16.5 billion gallons. This water is transported from the lower dam near the headworks site to the Portland metro area via three large-diameter pipelines.

The Bull Run supply is currently an unfiltered water supply and has consistently met the filtration avoidance criteria under the Surface Water Treatment Rule for source water quality, watershed management, and disinfection. Prior to distribution, the supply is treated with free chlorine for primary disinfection, ammonia to form chloramines as a residual disinfectant, and sodium hydroxide for corrosion control. The Water Bureau supplements the Bull Run source as needed with groundwater withdrawn from the CSSWF. The CSSWF is primarily used as an emergency backup, typically during turbidity events in the Bull Run Watershed and for summer supply augmentation.

In August 2017, the Portland City Council voted to build the Bull Run Filtration Facility to meet the U.S. Environmental Protection Agency (EPA) treatment requirements for Cryptosporidium. As a part of the proposed plan, new raw water pipelines will intersect the existing conduits from the Bull Run Watershed and redirect the flow to the new Filtration Facility. New finished water pipelines will then transmit water from the Filtration Facility and reconnect to the existing conduits. The three conduits currently in operation are referred to as Conduit 2 (C2), Conduit 3 (C3), and Conduit 4 (C4) in order from oldest to newest. Following completion of the Filtration Pipes Project (FPP), much of the approximately 20 miles of existing conduit system from the Bull Run Watershed to the three conduits that deliver drinking water to the Portland Metropolitan Area will remain in service, with about 2.7 linear miles of the existing conduits being replaced with the new raw and finished water pipelines and Filtration Facility.

The Filtration Pipelines Project consists of five primary elements of work:

- Two raw water pipelines - Lusted Raw Water Pipeline North and South (LRWP North and LRWP South)
- Two raw water tunnels and shaft system (Raw Water Tunnel).
- One finished water flow-control Intertie facility (Finished Water Intertie).
- Two finished water pipelines from the Filtration Facility to the Finished Water Intertie (Altman Finished Water Pipeline [AFWP] and Lusted Finished Water Pipeline [LFWP]) and three finished water pipelines from the Finished Water Intertie to the existing

conduits (Conduit 2 Finished Water Pipeline [C2FWP], Conduit 3 Finished Water Pipeline [C3FWP], and Conduit 4 Finished Water Pipeline [C4FWP]). The AFWP and LFWP include a trenchless crossing from the Filtration Facility south of Carpenter Lane to Dodge Park Boulevard.

- A new water distribution pipeline from AFWP and LFWP in SE Dodge Park Boulevard at the intersection of SE Cottrell Road, including a trenchless segment. The northerly terminus of this new Lusted Road Distribution Main connects to the existing SE Lusted Road Distribution Main located east of Lusted Hill Treatment Facility.

The purpose of this report is to evaluate the existing and proposed stormwater conditions at the Finished Water Intertie (FWI) Facility (the project). The FWI Facility is a new development that converts 0.31-acres of pervious agricultural farmland to impervious surfaces. The report includes an analysis and discussion on the following:

- Existing conditions of the site
- Meeting the jurisdictional stormwater requirements (Multnomah County)
- Proposed onsite stormwater quality treatment and flow control management
- Analysis of offsite runoff conditions
- Additional regulatory triggers

1.2 Project Location

The project site is approximately an 0.57-acre site that is located within an existing nursery crop production facility, at 33400 SE Lusted Road, Gresham. Reference the Vicinity Map located in Appendix A for project location. The site is bounded by an existing gravel access road along the east side of the parcel, farm crops along the west and south sides, and SE Lusted Road on the north side. The site's property is zoned MUA-20, Multiple Use Agriculture per Multnomah County WebMap.

1.3 Description of the Existing Conditions

The project is within the Beaver Creek- Sandy River Watershed. The existing topography slopes downhill in the north easterly direction at approximately 5% slope. The site drains to an existing roadside ditch along SE Lusted Road along on the north face of the site. The roadside ditch and site runoff discharge to an area drain and is piped across SE Lusted Road through an existing 18-inch corrugated plastic pipe (CPP) to an unnamed tributary of Beaver Creek.

The existing farm field at this location contains subsurface drain tiles to capture groundwater and stormwater and irrigation runoff, which connects into the existing area drain in the roadside ditch along SE Lusted Road. The existing drain tile piping size and locations are not known, but are shown approximately in the Existing Drainage Exhibit in Appendix A.

1.3.1 Existing Soil Classifications

The existing soils onsite are as follows per National Resource Conservation Service (NRCS) Web Soil Maps:

- Cornelius Silt Loam, 8 to 15 percent slopes, Hydrologic Soil Group C
- Mershon Silt Loam, 8 to 15 percent slopes, Hydrologic Soil Group C

The Cornelius Silt Loam is located predominantly in the north half of the site and is made of silty material over mixed alluvium, resulting in silty clay loam. The Mershon Silt Loam is located predominantly in the south half of the site and is made of loess and medium textured old alluvium that is more of a silt loam. Both soil groups have low capacity to transmit water through the soil column. The Hydraulic Conductivity (K_{sat}) is 4.5 micrometer per second, equating 0.64 inches per hour for the Cornelius silt loam. For the Mershon silt loam, K_{sat} is 3.4 micrometer per second, equating 0.48 inches per hour. Cornelius silt loam soil underlays the location of the proposed bioretention basin. Using the K_{sat} for the Cornelius silt loam with a correction factor of 2, the anticipated infiltration rate would be less than 0.32 in/hr. See Appendix B for NRCS K_{sat} data and more information about these soil groups.

Based on the Geotechnical Engineering Report, "Filtration Pipelines Project – Finished Water Pipeline" dated June 2022 by Jacobs Engineering Group, the soil investigations at soil boring log LFWP-BH08, at the FWI site was consistent with the silty clay loam characteristics as noted in the NRCS Web Soil Maps. The soil boring log shows Fat Clay (CH) for the first 20 feet of investigation, and then transitions to Elastic Silt (EH) for another 5 feet, both soil types have low capability to transmit water through the soil column. Silty sand characteristics are present at 25 feet below ground surface. See Appendix B for excerpt of the soil boring log from the Geotechnical Engineering Report. Infiltration testing was not performed at this site during investigations.

1.3.2 Depth to Groundwater

Depth to the water table was found to be 18.4 feet below ground surface when measured on September 6th, 2021, as noted in June 2022 Geotechnical Engineering Report at soil boring LFWP-BH08. Depth to groundwater was also noted at 19.3 feet below ground surface on December 21, 2021. See Appendix B for an excerpt of the depth to groundwater table from the Geotechnical Engineering Report. A piezometer was installed at this location to monitor groundwater elevation.

1.3.3 Offsite Drainage Analysis

Approximately 31-acres of mixed agricultural and rural residential land drains onto the proposed project site, which then ultimately discharges to the existing area drain along SE Lusted Road and then to an Unnamed Tributary of Beaver Creek, with Beaver Creek approximately ¼-mile downstream of the project site. The existing drain tiles discharge an unknown amount of groundwater, irrigation and stormwater runoff into the area drain to the Unnamed Tributary of Beaver Creek. Of the 31-acres, approximately 2.0-acres discharges on the south face of the project site. Approximately 0.51-acres of runoff from SE Lusted Road

discharges to the same area drain shared with the project site's runoff. See Figure Offsite Drainage Basin Map in Appendix A for offsite drainage basins extents.

1.4 Proposed Improvements

The proposed FWI site consists of a large concrete intertie vault with two incoming pipes and three outgoing pipes. The site will have a new electrical building with a paved parking area. Stormwater will be managed for both stormwater quality and flow control requirements with a lined basin which is located between the concrete intertie vault and SE Lusted Road at the north end of the site. The proposed gravel access road on the east side of the site will sheet flow to a new vegetated conveyance swale between the concrete intertie vault and the gravel access road. This conveyance swale drains northerly to the proposed stormwater basin. Another conveyance swale is also proposed on the west side of the parcel and routed along the outside of the electrical building to the bioretention basin. Discharge from the site will connect to the existing area drain on SE Lusted Road via a new manhole downstream of the proposed stormwater facilities.

An earthen berm on the west side of the parcel will re-route offsite run-on to the SE Lusted Road ditch, preventing the run-on from entering the stormwater treatment and flow control system for the project site. The project will also intercept the existing drain tiles along the south face of the site and re-connect via a new cutoff trench, which re-routes the discharge to a series of manholes and 10" PVC pipe around the east side of the site, and connects to the existing area drain on along SE Lusted Road. Additionally, a new sump pump will occasionally discharge groundwater or clean water spills from the subterrain intertie vault into the outlet of the stormwater treatment and flow control system at a maximum rate of 200 gallons per minute. See proposed site conditions and details in the Proposed Drainage Exhibit and Storm Drainage Details in Appendix A.

1.5 Existing Versus Post-Construction Conditions

The project adds 11,080 square feet of impervious surface to the existing site, which would increase the amount of runoff from the site if no stormwater flow control were provided. The flow control requirements in this stormwater management report are designed to minimize hydromodification impacts to downstream waterbodies particular to the Beaver Creek-Sandy River Watershed. A summary of the existing versus post-construction land use area is show in Table 1-1.

Table 1-1. Existing versus Post-Construction Land Use			
Existing Land Use	**Area (sf)**	**Post-Construction Land Use**	**Area (sf)**
Farmland, Straight Row Crops	22,200	Landscaping	11,420
Gravel Access Road	2,550	Gravel Access Road	2,550
		Roof	1,040
		Pavement	10,040
Total Impervious Area	*2,550*	*Total Impervious Area*	*13,630*
Total Land Area	**24,750**	**Total Land Area**	**24,750**

1.6 Agency Stormwater Criteria and Permitting

Multnomah County is the governing agency for the Bull Run FWI project location. Since the project has over 500 square feet of new or replaced impervious surface, stormwater flow control and stormwater quality treatment are required per Multnomah County Code (MCC) Section 39.6245. The stormwater facilities shall be designed in accordance with Section 5 Drainage of the Multnomah County Design and Construction Manual (MCDCM), which also refers to the City of Portland 2020 Stormwater Management Manual (SWMM) for current stormwater requirements.

In addition to stormwater requirements, the following regulatory district areas were considered that have stormwater impact requirements and may require additional permitting for this project:

- Oregon Department of Environmental Quality (DEQ)
    - 1200-C Construction Stormwater Permit
        - Per Oregon Department of Environmental Quality (DEQ), construction of the FWI site disturbs less than one-acre of land, however it is part of a final project that will disturb over one-acre of land as part of the pipeline infrastructure and will require a 1200-C Construction Stormwater Permit.
    - Wellhead protection
        - The project is not within a wellhead protection area according to DEQ's Webmap and does not require any additional permitting for groundwater discharge
- Oregon Department of State Lands (DSL)
    - Joint Permit Application

        - There are no wetlands within the project site. A Joint Permit Application is not required for the FWI project site.

- Federal Emergency Management Agency (FEMA)
    - Floodplain
        - Project is in an area of minimal flood hazard per FEMA FIRMette Panel 41051C0427J, effective 2/1/2019, and therefore does not have any additional requirements or permitting

2.0 Methodology

This project report follows the guidance of the City of Portland's SWMM stormwater report requirements, which requires analysis and discussion of the infiltration and discharge hierarchy, along with the selection of Best Management Practices (BMP) for stormwater treatment and flow control.

2.1 Infiltration and Discharge Hierarchy

Multnomah County refers to the City of Portland's three Levels of hierarchy for the disposal and conveyance of stormwater required by a project, per the SWMM. The SWMM ranks the use and requirements for stormwater BMPs systems as follows:

Level 1 – Full Onsite infiltration
Level 2 – Offsite Discharge to the Separate Stormwater System
Level 3—Combined sewers that convey water to the wastewater treatment plant

The hierarchy level depends on the site discharge conditions. The preferred discharge condition is Level 1, full onsite infiltration, however, if that is not possible to due subsurface conditions or site constraints, then the next level down is the preference.

Soil infiltration feasibility at the site was reviewed based on the NRCS Web Soil Survey, the Soil Boring data from Geotechnical Investigation Plan for the Filtrations Pipelines Project, and a discussion with a landowner that knows of the existing characteristics of the soil onsite, and the presence of drain tiles used in the fields to move excess water in the soil away from the crop roots

Based on the anticipated saturated soil conditions, no infiltration test was performed onsite for this project as the infiltration rates were anticipated to be less than 2 inches per hour infiltration rate based on the K_{sat} rates. Guidance from the SWMM suggests that infiltration facilities (Level 1 - Full Onsite Infiltration) should not be considered when soils have less than a 2 inch per hour infiltration rate. Thus, the project cannot achieve a Level 1 discharge or full or partial onsite infiltration.

This project shall use Level 2 Offsite Discharges to the Separated Stormwater System, which discharges to the existing roadside stormwater ditch and area drain along SE Lusted Road.

2.2 Stormwater Facility Selection, Sizing and Design

The City of Portland allows the use of three design approaches for stormwater facilities, being:

- Simplified Approach
- Presumptive Approach
- Performance Approach

Both the Presumptive and Performance Approaches are allowed to be used with Hierarchy Level 2. The City of Portland has a Presumptive Analysis Calculator (PAC Tool) which is able to model the discharge rates of the existing and proposed site conditions and show whether the proposed stormwater BMPs (using City of Portland's standard facility details) meet the SWMM requirements for stormwater quality and flow control. The Performance Approach can be used to show how the project meets the stormwater requirements by using other approved hydrologic modelling methods. Multnomah County accepts the use of the PAC Tool as an approved modeling method to show how the project meets stormwater requirements.

2.2.1 Stormwater Quality Treatment

This project proposes a single lined basin with underdrain to achieve both water quality treatment and flow control requirements. Per Multnomah County water quality treatment requirements in Section 5 of the MCDCM and the SWMM, runoff shall be treated to remove 70% of TSS for the water quality design storm, which is considered 90% of the average rainfall with a depth of 1.61-inches.

The basin is designed to filter the site's runoff through a bioengineered soil mix and gravel media, which is then collected by an underdrain and routed to a flow control structure. The flow control structure has an orifice at the outlet structure to regulate the amount of stormwater released to ensure that the water quality storm is detained and treated.

In addition to the water quality rates and TSS removal requirements, discharge from the site eventually enters the waters of Beaver Creek. A pollution reduction facility should be used to treat for impairments listed as a Total Maximum Daily Load (TMDL) or on DEQ's 303(d) list of impaired waters. Per the Oregon 2018/2020 Integrated Report and the 2018/2020 Water Quality Report and List of Water Quality Limited Waters, Beaver Creek has a TMDL and 303(d) listed.

Impairments:

- Bacteria
- Dissolved Oxygen
- Temperature
- DDT 4, 4'; DDD4, 4'; DDE 4,4'
- Dieldrin
- Heptachlor Epoxide

Basins provide water quality treatment through biofiltration media, which filters and treats for many of the listed impairments. Temperature of runoff is cooled down by hyporheic process of discharging through the subsurface media and released via an underdrain.

2.2.2 Stormwater Flow Control

Per the SWMM, the stormwater facility shall provide flow control that matches the pre-developed flowrates for one-half of the 2-year 24-hour storm event up to the 25-year 24-hour storm event. In addition to the flow control requirements, the facility shall be analyzed for the 2, 5, 10, 25, and 100-year storm events for performance and inundation of the site. The following table shows the 24-hour storm event depths were analyzed.

Table 2-1. Design Storm Events

Design Storm Event	24-hr Rainfall Depth (inches)	Requirements by the Receiving System
Water Quality	1.61	Provide volume and flow control for the water quality storm and reduce 70% TSS
½ 2 Year	1.2	Limit 1/2 the 2-year pre-development peak
2 Year	2.4	Do not exceed pre-development peak flows
5 Year	2.9	Do not exceed pre-development peak flows
10 Year	3.4	Do not exceed pre-development peak flows
25 Year	3.8	Do not exceed pre-development peak flows
100 Year	4.7	Must not cause flooding of downstream infrastructure (not calculated by the PAC Tool)

The design storms are based off a Portland-modified NRCS 24-hour Type 1A rainfall distribution, which establishes a given fraction of rainfall for each 10-minute time step over a 24-hour period.

3.0 Analysis

3.1 Hydrologic Model

A hydrologic analysis of the FWI site was conducted using the PAC Tool, along with hydrologic assumptions for the inputs into the PAC Tool using the Santa Barbara Unit Hydrograph (SBUH) Method, see Appendix C for calculations and PAC Report. The SBUH Method is used with the PAC Tool and assumes a rate-based and volume- based approach for sizing facilities to meet the water quality treatment and flow control requirements. The PAC Tool analyzes the amount of impervious area draining to each facility compared to a pre-developed area that was originally forested land. In the PAC Tool for the FWI Site, the lined basin is sized to manage the runoff

from the impervious surfaces (gravel, pavement, and roofs) from the site, compared to the pre-developed condition of those surfaces. The following sections show the inputs used for the project along with results from the PAC Tool.

3.1.1 Area Summary and Curve Numbers

Table 3-1 summarizes the areas used for sizing the basin facility along with the curve number (CN) associated with the land type that is used in the PAC Tool.

Table 3-1: Area Summary and Curve Numbers

Pre-Developed		
Land Type	**Curve Number (CN)**	**Area (sf)**
Woods, Soil Group C	79	24,750
Predeveloped CN	79	24,750
Used in Model for Comparison	***79***	***13,630***
Post-Construction Land Type		
Landscape, Soil Group C	74	11,420
Gravel, Soil Group C	93	2,250
Pavement/Roofs	98	10,040
Total Weighted CN	86	24,750
Used in Model for Total Impervious area	***97***	***13,630***

Per the City of Portland SWMM, the pre-development curve number is 79 for soil type C, which assumes a wooded forest land type. The post-construction weighted curve number for the total impervious surface is 97, and the curve number for the newly landscaped areas is 74 to represent the proposed trees, bushes, and Bermuda grasses. The curve number of 74 is based on the TR-55 Urban Hydrology for Small Watersheds Table 2-2a Runoff Curve Numbers for Urban Areas. See Appendix B for CN references. The PAC Tool only considers the CN of the impervious surfaces, and therefore only a CN that represents the weighted value of the gravel, pavement and roofs is used in the hydrologic modeling.

3.1.2 Time of Concentration

The time of concentration (Tc) used in the PAC Tool for pre-developed and post-construction conditions were based off the SBUH Method, using Worksheet 3 of the MCDCM, as shown in Appendix C, with the minimum time of concentration as 5 minutes for both pre-developed and post-construction conditions. The pre-developed Tc was calculated as 26.8 minutes. The post-construction Tc was calculated as 11.1 minutes, with the longest path of travel from the roof of the electrical building through the vegetated conveyance swale on the west side of the parcel, then to the bioretention basin.

3.2 Facility Design

The stormwater basin is designed in accordance with Section 3.2.2 of the SWMM. No infiltration was accounted for in the design of this facility.

Table 3-2. Stormwater Basin Facility Geometry	
Length	100 feet
Bottom Width	5 feet
Top Width	14.5 feet
Side Slopes	3:1
Running Slope	Flat
Freeboard depth	2 inches
Water Storage Depth	18 inches
Topsoil Depth	18 inches
Rock Storage Depth	12 inches
Orifice	5/8-inch diameter
Surface Storage at Riser	1,490 cubic feet

The lined basin follows the standard detail per City of Portland's Bureau of Environmental Services (BES) standard detail SW-241. The basin is lined with a 30-mil HDPE-liner under the soil and gravel media. The underdrain is a 4-inch slotted PVC pipe and is located 4-inches above the bottom invert of the facility and spans 25 feet from the outlet structure. The soil mix is designed to filter water at 6 inches per hour per the specifications of the 2020 City of Portland Standard Construction Specifications 01040.13(d). A landscape plan is shown in Appendix A, which shows the location and plant types to be used in the stormwater facility. The plant types selected are approved plantings that follow the City of Portland's Bureau of Development Services Tree and Landscaping Manual.

4.0 Engineering Conclusions

4.1 Water Quality and Flow Control Results

The proposed lined basin provides a combination of storage capacity and regulated release of flow that satisfies both the flow control and water quality treatment standards required by the SWMM and the MCDCM. The PAC Tool provides the performance of the proposed facility for the site for the one-half of the 2-year, up to the 25-year storm, with analysis over a 72-hour period. The facility passes the water quality storm volume requirement of 1,266 cubic feet needed for storage, with a detained release through the 5/8-inch orifice after runoff is treated

through the soil media, this satisfies the 70% TSS removal requirement through detention and filtration of the water quality design storm.

The flow control structure reduces post-construction flow rates to the SE Lusted Road area drain for storm events up to 25-year event. See Table 4-1 for a summary of pre-developed, post-construction and mitigated runoff rates, volumes, and flow control results from the PAC Tool.

Table 4-1. Pre-Developed and Post-Construction Flows and Volumes from the PAC Tool Results

Design Storm	Pre-developed		Post-Construction		Mitigated	
	Peak Rate (cfs)	Total Volume (cf)	Peak Rate (cfs)	Total Volume (cf)	Peak Rate (cfs)*	Volume Released (cf)
Pollution Reduction	0.007	354	0.103	1,466	0.015	1,452
½ 2-year	0.015	438	0.082	1,173	0.014	1,159
5-year	0.051	1,268	0.202	2,907	0.018	2,893
10-year	0.075	1,691	0.240	3,470	0.037	3,456
25-year	0.095	2,047	0.270	3,922	0.059	3,908

*The total release rate is the combined underdrain and overflow discharge from the facility

The underdrain provides a maximum discharge of 0.019 cubic feet per second (cfs) at storm events greater than the 5-year storm and provides a discharge rate of 0.014 cfs during the one-half of the 2-year storm, which is less than the pre-developed condition of 0.015 cfs. Note that the mitigated volume released is still comparable to the post-construction volume due to the lined bioretention system—however the volume is released slowly over a 24-hour period to match pre-developed flow rates. The facility drains completely within 46.6 hours after the peak 25-year storm event. See Appendix C for complete PAC Tool results showing the details of the lined bioretention basin performance during each design event.

4.2 Pipe Hydraulic Calculations

The stormwater conveyance pipes shown in Appendix A have been sized using EPA SWMM 5.2 to convey the 25-year storm using the output from the PAC tool, offsite discharge, and potential discharge from the pump discharge from the intertie vault due to groundwater or spills.

Three pipes were analyzed: 8-inch outlet pipe from the stormwater basin flow control structure (BH01) to manhole 03 (MH03), the 10-inch outlet pipe to existing area drain, and the existing offsite 18-inch CPP was verified for capacity. Calculations for the following are in Appendix D.

The peak 25-year post-construction flow rate after stormwater flow control from the basin is approximately 1.9 cfs, which includes site runoff from pervious surfaces onsite that are

unmitigated. The stormwater basin outlet pipe is an 8-inch PVC sloped at 0.5% and discharges into MH03. The capacity of the pipe is approximately 2.5 cfs and is 77% full with a velocity of 5.5 feet per second (fps) during the 25-year event.

The upstream drainage basin was delineated based on LiDAR from the Oregon Department of Geology and Mineral Industries and the 25-year peak flow was determined using the SBUH method, as discussed in Section 3. The peak flow is 0.8 cfs, which is assumed to discharge into the proposed Cutoff Trench on the south face of the site. The Cutoff trench is a drainage collection gravel trench with a perforated 10-inch collection pipe that is routed to manhole 01 (MH01). From MH01 down to MH03, 10-inch PVC pipe system is proposed at 0.5% slope which has a capacity of 2.7 cfs and is 41% full during the 25-year storm with a maximum velocity of 7.9 fps.

The sump pump discharge from the intertie vault is approximately 0.54 cfs (200 gpm), discharging directly into MH03. The pump flow combined with the flow from the stormwater basin and upstream drainage basin is approximately 3.1 cfs. The outlet pipe from MH03 is a 10-inch PVC sloped at 0.5%. The pipe is at maximum capacity with a velocity of 5.7 fps during the 25-year storm.

The existing 18-inch CPP from the area drain has an existing slope of 4.1% and conveys the combined flows from the onsite stormwater, the offsite drainage (including SE Lusted road drainage), and the maximum pump discharge from the intertie vault during the 25-year storm which is a total of 12.5 cfs. The capacity of the 18-inch pipe is approximately 30 cfs and the pipe is 45% full and flowing at a velocity of 8.9 fps during the 25-year storm event.

4.3 Inundation of the 100-Year Storm Event

The stormwater facility has capacity to manage the 25-year storm event, however, in case of the 100-year storm event of 4.7 inches within a 24-hour period the stormwater facility is designed to overflow to the roadside ditch along SE Lusted Ave through an armored overflow weir with riprap. The ditch would likely overtop the road due to the 18-inch existing culvert if flow is over 10.4 cfs at the ditch outlet, but eventually would flow to Beaver Creek, approximately ¼ - mile downstream. There is a recent installation of engineered riprap for energy dissipation at the downstream outlet of the 18-inch culvert and is adequately sized for the 100-year storm flow to minimize downstream impacts to Beaver Creek. No additional offsite infrastructure is proposed.

4.4 Conclusion

The lined bioretention basin with overflow structure manages the stormwater runoff from the proposed project site for the required 25-year stormwater event and water quality treatment standards per the City of Portland SWMM requirements and Multnomah County. The offsite run-on is re-routed around the proposed project site via a Cut-Off trench and raised berm to the original discharge point of the area drain in the ditch on SE Lusted Road. All proposed conveyance structures were sized to convey the 25-year storm. During the 100-year event,

runoff from the site will safely overflow from the bioretention basin to the existing ditch along SE Lusted Road without inundation to other property.

5.0 Operations & Maintenance

The stormwater facility, landscaping and conveyance features will be operated and maintained by the FWI Staff and Portland Water Bureau. The City of Portland maintenance procedures listed in the SWMM will be used for the lined bioretention facility, see Appendix E for City of Portland Operations & Maintenance procedures for the lined bioretention facility and maintenance components.

Conveyance structures such as the cut-off trench and pipes shall be maintained and inspected bi-annually for proper drainage towards the outlets. If structures appear to be plugged or non-operational, then pipe jetting and gravel media replacement may be required. Manholes and area drains shall be inspected and maintained bi-annually, and sediment should be removed by a vacuum truck if inlets and outlets are blocked. Conveyance swales shall be maintained with proper landscaping with erosion and weed inspection of the channel on a bi-annual basis.

Gutters and downspouts from the electrical building shall be inspected bi-annually and cleaned if any debris is found in the gutters.

Appendix A: Figures

Vicinity Map

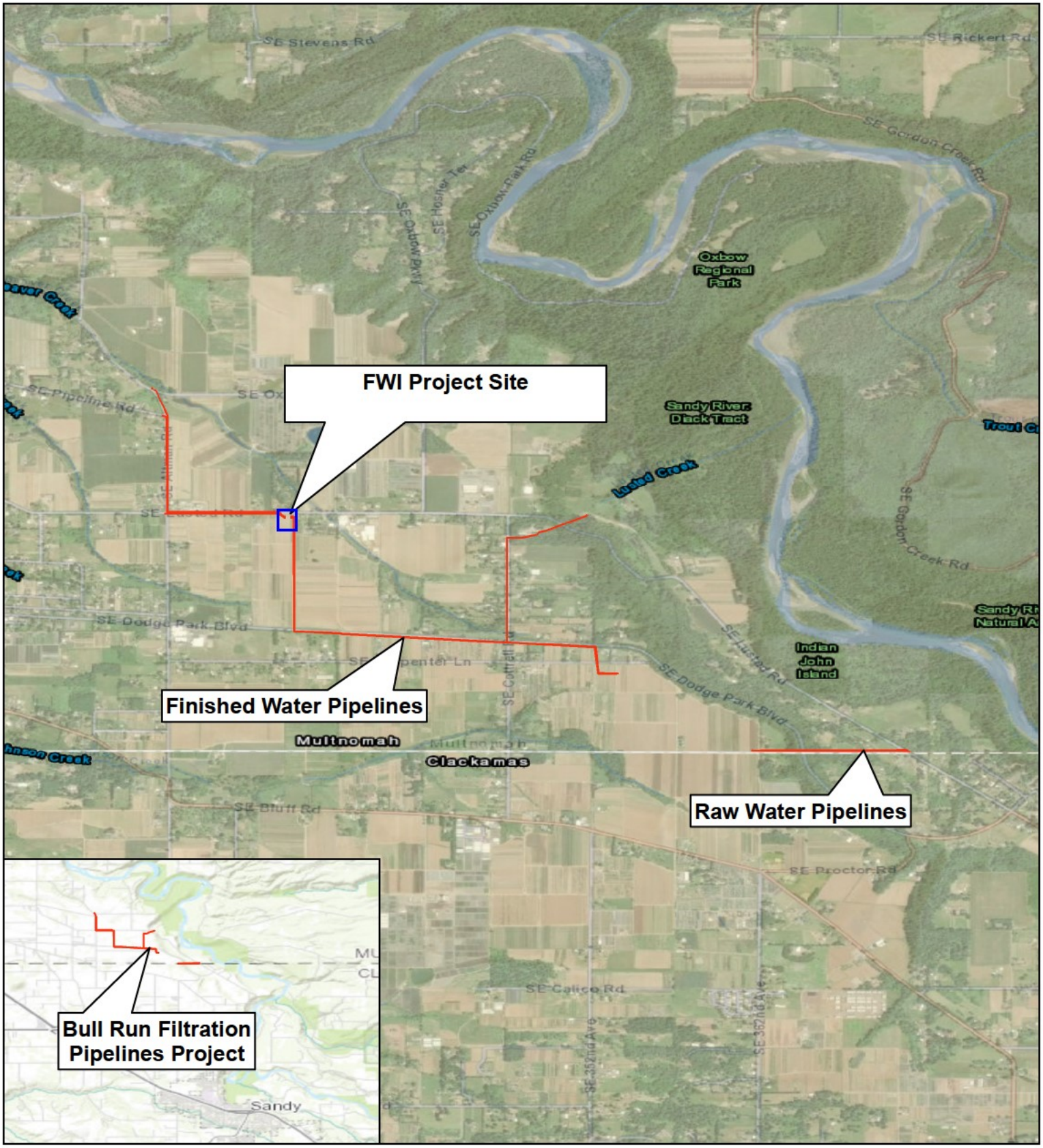
Existing Drainage Exhibit

Drainage Exhibit

Landscape Plan

Storm Drain Details

Offsite Drainage Basins Map



Legend

Pipeline Project Area Extents

Note:
1. Aerial imagery source: ESRI, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, AeroGRID, IGN, and the GIS User Community

Appendix A - Figure 1
Vicinity Map

Bull Run Pipeline Project

Multnomah County

Jacobs

LEGEND

- FLOW DIRECTION
- AREA DRAIN
- STORM MAIN
- EXISTING OUTFALL RIP-RAP
- DRAINAGE BASIN
- EXISTING GRAVEL ROAD

N

0 20 40 60
Scale In Feet

CONFIDENTIAL

No	Date	Description	Appd
		Revision	
Survey			

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PRELIMINARY
NOT FOR
CONSTRUCTION

Designed By	Program Mgr	XXX
Drawn By	Const Mgr	XXX
Checked By	Const Supvr	XXX
Project Mgr	Date 6/30/22	XXX

WARNING
0 1"
If this bar does not measure 1" then the drawing is not to scale

PORTLAND WATER BUREAU
FROM FOREST TO FAUCET

XXX XXX Date

XXX XXX Date

CITY OF PORTLAND OREGON 1851

Bull Run Filtration Pipelines

FINISH WATER INTERTIE CIVIL

EXISTING DRAINAGE EXHIBIT

SAP Project No
W02563
1/4 Section

Sheet No
FWI-C-D1

W02563_FWI-C-D1.dgn
W02563_FWI-C-D1.dgn
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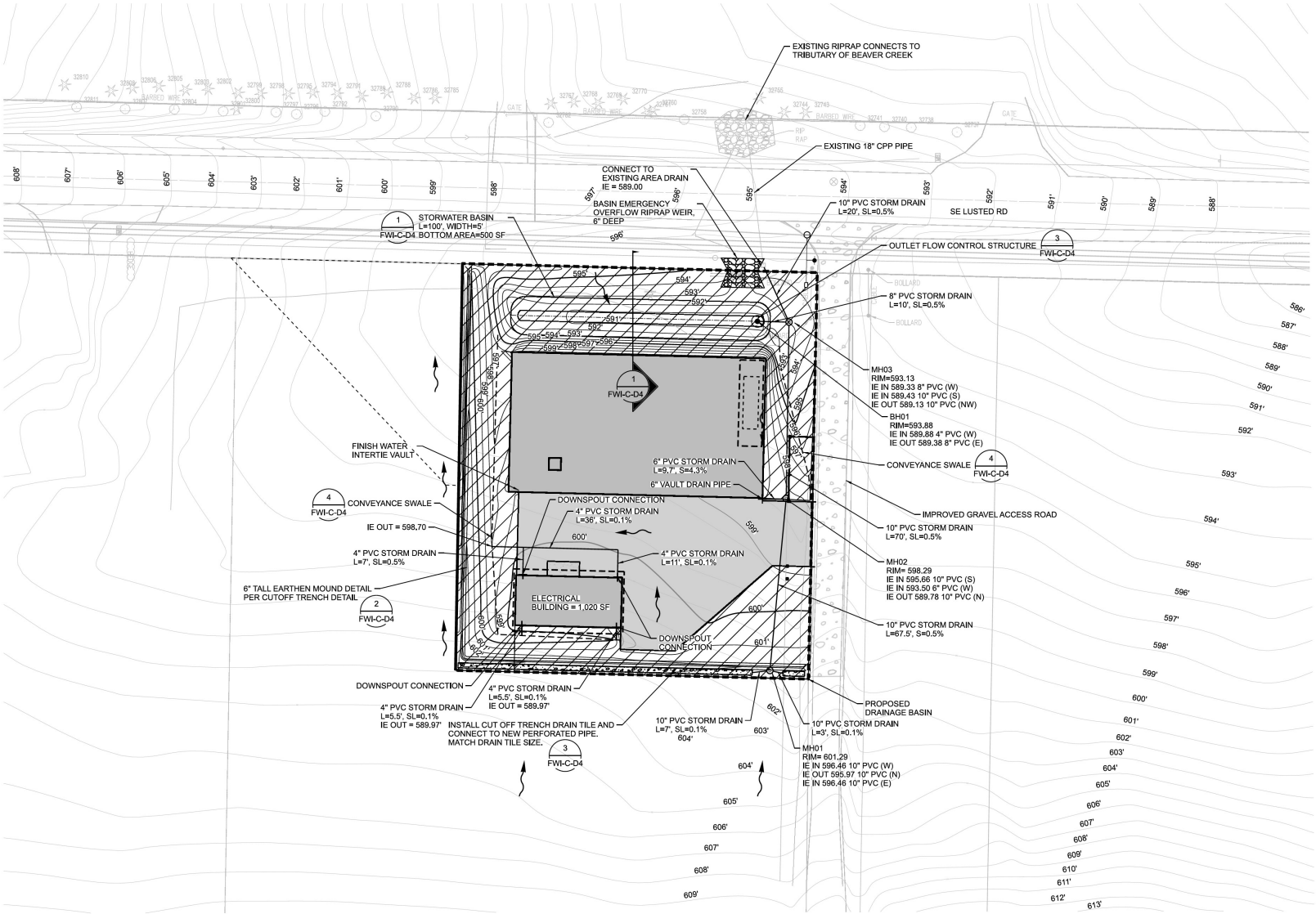

LEGEND

- CONSTRUCTION LIMITS
- IMPERVIOUS AREA
- LANDSCAPE AREA (SEE LANDSCAPE PLANS)
- FLOW DIRECTION
- GRAVEL AREA
- CUTOFF TRENCH
- RIPRAP
- CONVEYANCE SWALE

AREA SUMMARY

TOTAL IMPERVIOUS SURFACE = 13,630 SF

TOTAL PERVIOUS SURFACE = 11,120 SF

TOTAL PROJECT AREA = 24,750 SF

CONFIDENTIAL

No	Date	Description	Appd
		Revision	
Survey			

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Designed By | Drawn By | Checked By | Project Mgr

Program Mgr | Const Mgr | Const Supvr | Date 6/30/22

WARNING

0 1"

If this bar does not measure 1" then the drawing is not to scale

PORTLAND WATER BUREAU

FROM FOREST TO FAUCET

XXX XXX — Date

XXX XXX — Date

CITY OF PORTLAND OREGON 1851

Bull Run Filtration Pipelines

FINISH WATER INTERTIE CIVIL

DRAINAGE BASIN EXHIBIT

SAP Project No W02563

1/4 Section

Sheet No FWI-C-D2

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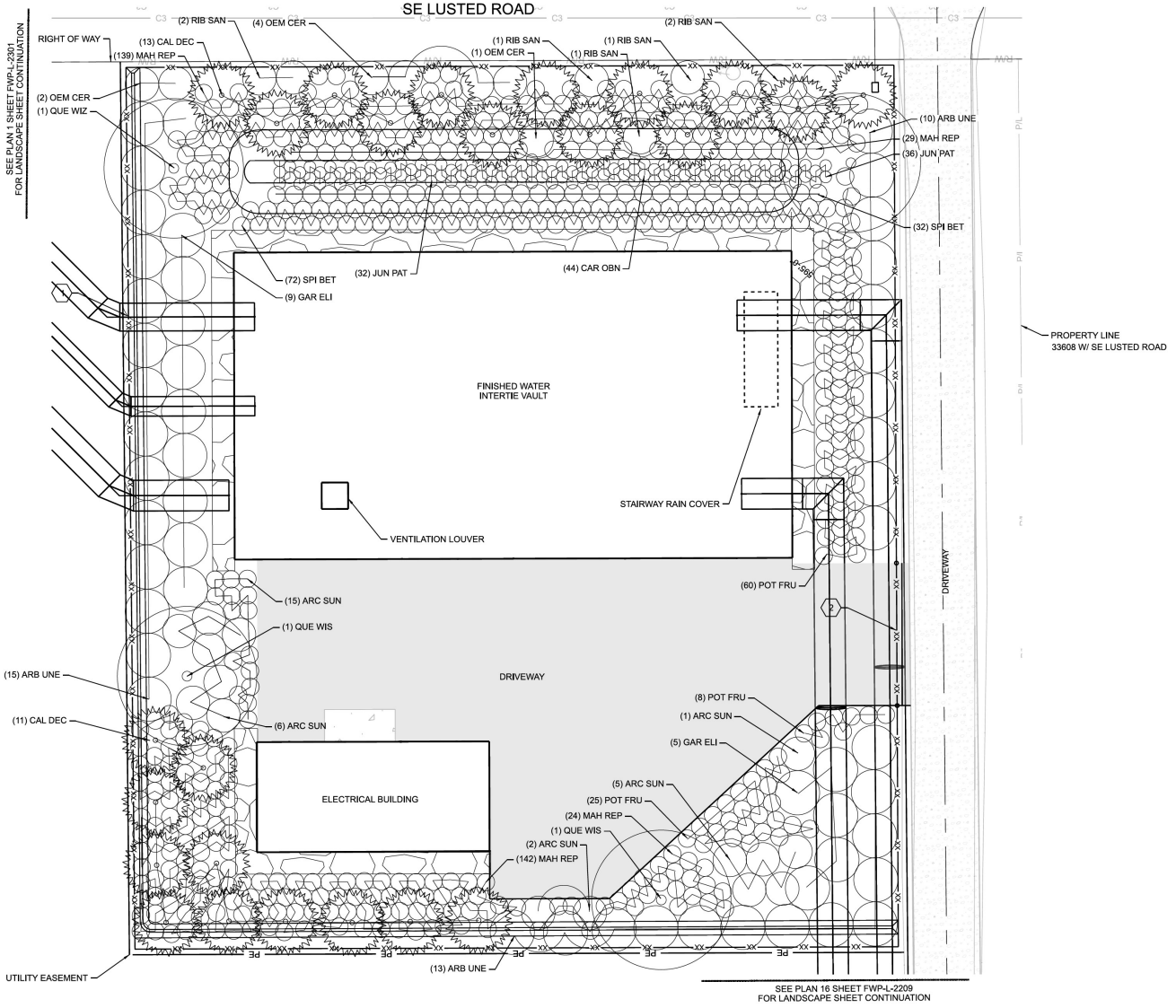
W02563_FWI-C-D2.dgn



33604 SE LUSTED ROAD

GENERAL SHEET NOTES

1. ALL AREAS OUTSIDE THE CONSTRUCTION LIMITS SHALL BE PROTECTED; CONSTRUCTION ACTIVITIES ARE NOT ALLOWED OUTSIDE THE CONSTRUCTION LIMIT FENCE.
2. DO NOT PLANT TREES WITHIN PIPELINE CORRIDOR

SHEET KEYNOTES

1. CHAINLINK FENCE
   SEE DETAIL SHEET STD-L-0004
2. 26' CHAINLINK GATE
   SEE DETAIL SHEET STD-L-0004

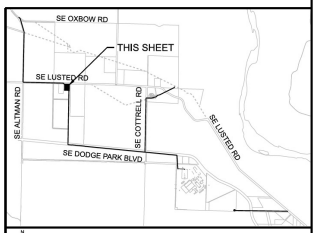
LEGEND

(17) SPI BET
SHRUB PLANTING
WITH COUNT AND SYMBOL
SEE DETAIL SHEET STD-L-0001

(17) CAL DEC
TREE PLANTING
WITH COUNT AND SYMBOL
SEE DETAIL SHEET STD-L-0001

GRAVEL MAINTENANCE STRIP
SEE DETAIL SHEET STD-L-0001

1 10 20 30
Scale In Feet



KEYPLAN

CONFIDENTIAL

No	Date	Description	Appd.
		Revision	
Survey			

NNA Landscape Architecture

PRELIMINARY
NOT FOR
CONSTRUCTION

Designed By		Program Mgr	XXX
Drawn By	XXX	Const Mgr	XXX
Checked By	XXX	Const Supvr	XXX
Project Mgr	XXX	Date	6/30/22

WARNING
0 1"
If this bar does not measure 1" then the drawing is not to scale

PORTLAND WATER BUREAU
FROM FOREST TO FAUCET

XXX XXX Date
XXX XXX Date

Bull Run Filtration Pipelines

FINISHED WATER INTERTIE LANDSCAPE

SAP Project No: W02563
1/4 Section: 3664 / 3764
Sheet No: FWI-C-D3

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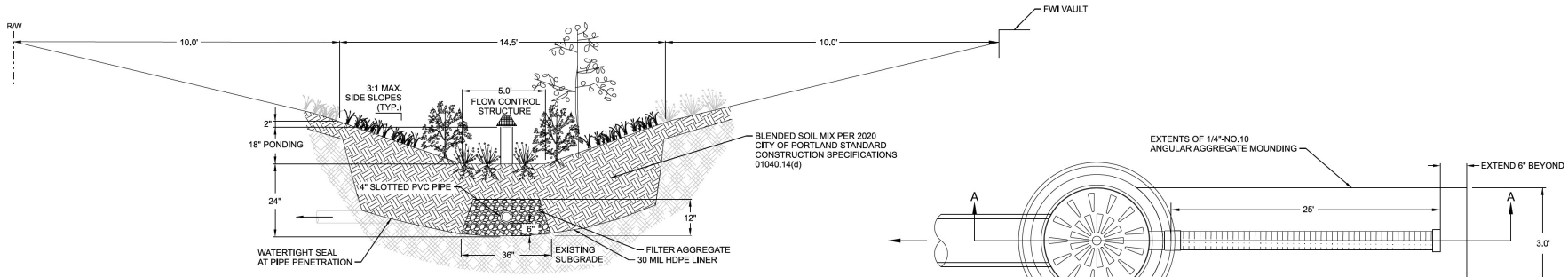
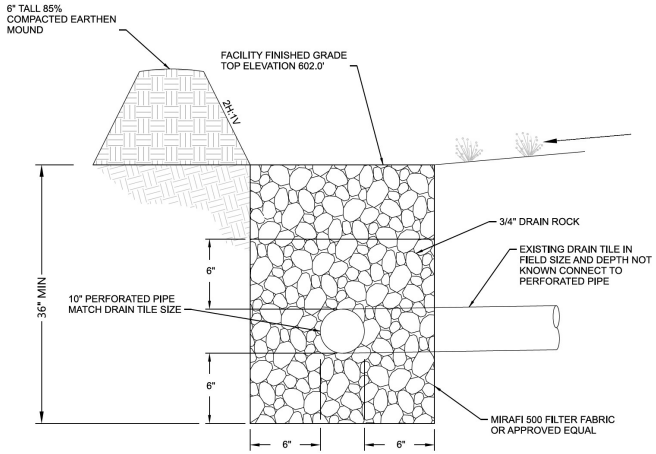
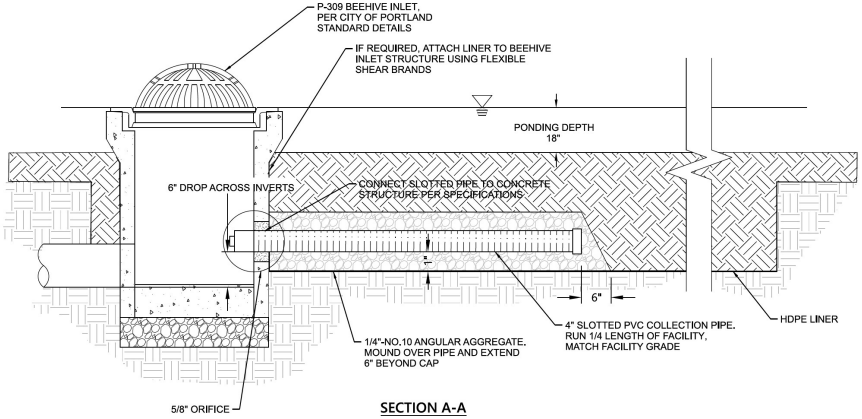


PLAN VIEW

1 FWI-C-D4 BIORETENTION BASIN WITH UNDERDRAIN DETAIL
N.T.S.

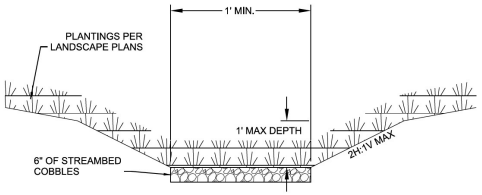


3 FWI-C-D4 CUTOFF TRENCH
N.T.S.



SECTION A-A

2 FWI-C-D4 FLOW CONTROL STRUCTURE
N.T.S.



4 FWI-C-D4 CONVEYANCE SWALE
N.T.S.

CONFIDENTIAL

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No	Date	Description	Appd
		Revision	
Survey			

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PRELIMINARY NOT FOR CONSTRUCTION

Designed By	Program Mgr	XXX
Drawn By	Const Mgr	XXX
Checked By	Const Supvr	XXX
Project Mgr	Date 6/30/22	XXX

WARNING
0 1"
If this bar does not measure 1" then the drawing is not to scale

PORTLAND WATER BUREAU
FROM FOREST TO FAUCET

XXX XXX Date
XXX XXX Date

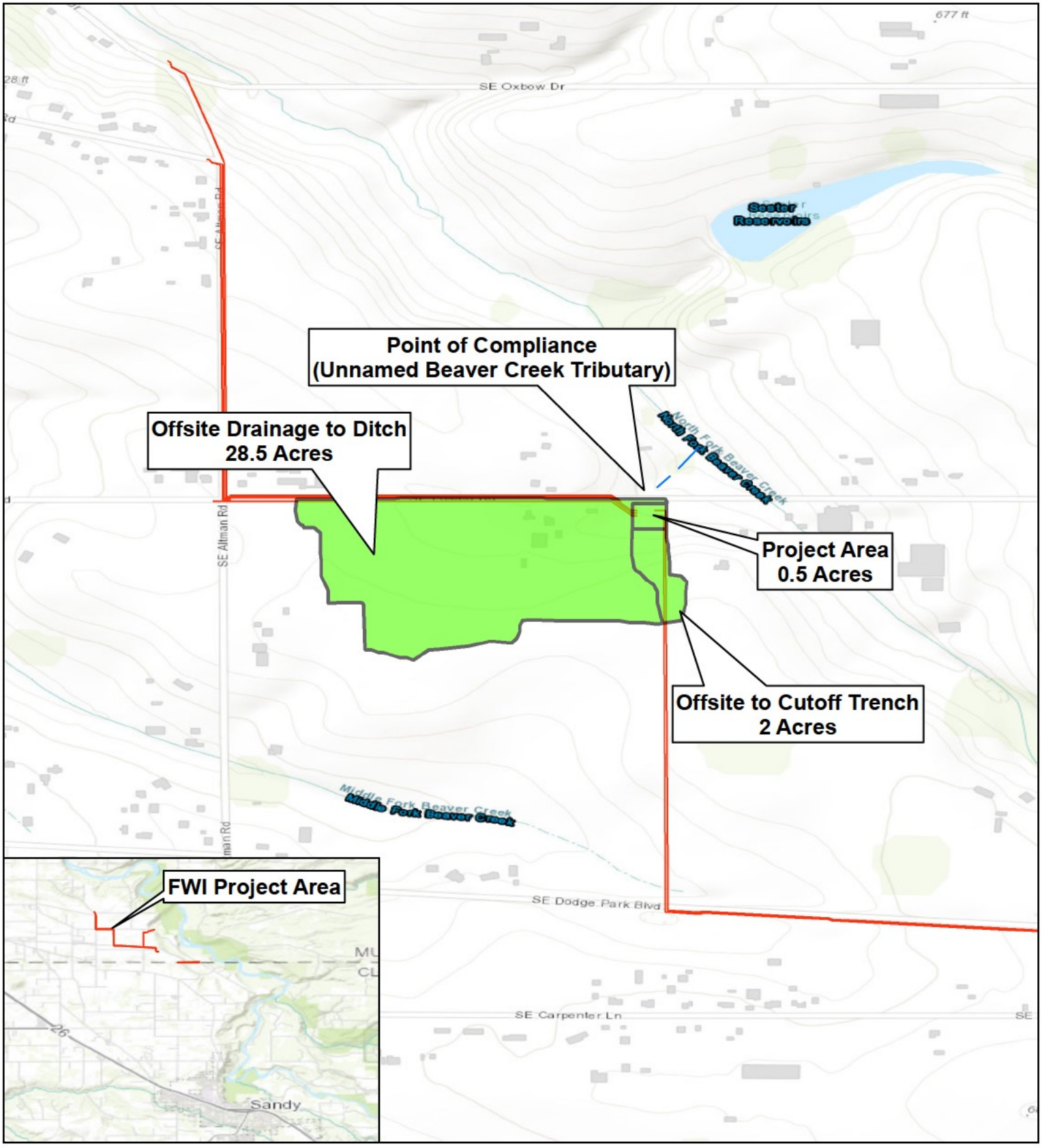
CITY OF PORTLAND OREGON 1851

Bull Run Filtration Pipelines

FINISH WATER INTERTIE CIVIL

STORM DRAINAGE DETAILS

SAP Project No W02563
1/4 Section
Sheet No FWI-C-D4



Legend

- Finished Water Pipeline
- Drainage Areas

Note:
1. Aerial imagery source: ESRI, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, AeroGRID, IGN, and the GIS User Community

0 0.125 0.25 0.5 Miles

N

Appendix A
Offsite Drainage Map
Bull Run Pipeline Project
Multnomah County

Jacobs

Appendix B: References

NRCS Soils Web Map

Excerpts from the 2022 Geotechnical Investigation Report for Bull Run Pipeline Project

City of Portland SWMM Curve Numbers Table A-8

TR-55 Table 2-2a Runoff Curve Numbers for Urban Areas

Soil Map—Multnomah County Area, Oregon
(FWI Site Soils)

Map Scale: 1:517 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 5 10 20 30

Feet
0 25 50 100 150

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 10N WGS84

MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:20,000.

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: Multnomah County Area, Oregon
Survey Area Data: Version 20, Oct 27, 2021

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

Date(s) aerial images were photographed: Jun 22, 2020—Jun 26, 2020

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
10C	Cornelius silt loam, 8 to 15 percent slopes	0.7	68.9%
27C	Mershon silt loam, 8 to 15 percent slopes	0.3	31.1%
Totals for Area of Interest		**1.0**	**100.0%**

Multnomah County Area, Oregon

10C—Cornelius silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 228d
Elevation: 250 to 1,400 feet
Mean annual precipitation: 40 to 70 inches
Mean annual air temperature: 50 to 54 degrees F
Frost-free period: 165 to 210 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Cornelius and similar soils: 90 percent
Minor components: 3 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cornelius

Setting

Landform: Hillslopes
Landform position (two-dimensional): Summit, footslope
Landform position (three-dimensional): Interfluve, base slope
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Silty materials over mixed old alluvium

Typical profile

H1 - 0 to 20 inches: silt loam
H2 - 20 to 33 inches: silty clay loam
H3 - 33 to 60 inches: silt loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 30 to 40 inches to fragipan
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 27 to 37 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.0 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: F002XB005OR - Loess Hill Group
Forage suitability group: Moderately Well Drained < 15% Slopes (G002XY004OR)

Other vegetative classification: Moderately Well Drained < 15% Slopes (G002XY004OR)
Hydric soil rating: No

Minor Components

Delena

Percent of map unit: 3 percent
Landform: Terraces
Landform position (three-dimensional): Riser
Down-slope shape: Concave
Across-slope shape: Linear
Other vegetative classification: Poorly Drained (G002XY006OR)
Hydric soil rating: Yes

Data Source Information

Soil Survey Area: Multnomah County Area, Oregon
Survey Area Data: Version 20, Oct 27, 2021

Multnomah County Area, Oregon

27C—Mershon silt loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: 229f
Elevation: 450 to 1,300 feet
Mean annual precipitation: 60 to 70 inches
Mean annual air temperature: 50 to 52 degrees F
Frost-free period: 165 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Mershon and similar soils: 90 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mershon

Setting

Landform: Hillslopes
Landform position (two-dimensional): Summit
Landform position (three-dimensional): Interfluve
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Loess and medium textured old alluvium

Typical profile

H1 - 0 to 15 inches: silt loam
H2 - 15 to 56 inches: silt loam
H3 - 56 to 60 inches: loam

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.57 in/hr)
Depth to water table: About 36 to 60 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 11.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: F003XC003OR - Glaciated Western Cascades Mesic Udic Forest Group

Hydric soil rating: No

Data Source Information

Soil Survey Area: Multnomah County Area, Oregon
Survey Area Data: Version 20, Oct 27, 2021

At Finished Water Intertie Site

Table 3-1. Groundwater Level Measurements			
Boring [a]	**Date**	**Groundwater Depth (feet, bgs)**	**Groundwater Elevation (feet) [b, c]**
LFWP-BH03	06/24/2021	12.3	623.7
	09/02/2021	33.5	602.5
	12/21/2021	22.8	613.2
	06/06/2022	25.8	610.2
LFWP-BH06	04/15/2021	41.6	577.7
	06/24/2021	> 50.0	< 569.2
	10/06/2021	> 50.0	< 569.2
	06/06/2022	> 50.0	< 569.2
LFWP-BH08	12/21/2021	19.3	576.5
	06/06/2022	18.4	577.4
FWP-PRI-BH01	04/15/2021	60.1	564.7
	06/24/2021	61.5	563.3
	10/06/2021	64.2	560.6
	06/06/2022	60.8	564.0
CRBF-B-05	06/06/2022	9.0	660.2
B-1-FH	05/22/1995	6.2	—
B-2-FH	05/22/1995	13.8	—
WTP-B-06	04/15/2019	27.3	681.0
	05/13/2019	32.5	675.8
	04/15/2021	34.2	674.1
	06/24/2021	35.5	672.8
	10/06/2021	36.2	672.1
	12/09/2021	30.3	678.0
	06/06/2022	32.6	375.7
PL-B-15	04/15/2019	47.4	623.2
	05/13/2019	49.9	620.7
	06/24/2021	16.5	654.1
	10/06/2021	17.6	653.0
	06/06/2022	14.8	655.8
Original AFWP Alignment and Intertie Location			
AFWP-BH13	04/15/2021	46.6	566.6
	06/24/2021	> 50.0	< 563.2
	10/06/2021	> 50.0	< 563.2
	06/06/2022	> 50.0	< 563.2
FWP-LI-BH01	04/15/2021	44.0	568.3
	06/24/2021	44.3	568.0
	10/06/2021	45.3	567.0
	06/06/2022	44.5	567.9

Jacobs

PROJECT NUMBER:	BORING NUMBER:	
D3460500	LFWP-BH08	SHEET 1 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (664904.92 N, 7736258.26 E)

ELEVATION : 595.79 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Dustin Helmig

DRILLING METHOD AND EQUIPMENT : CME-55 Track #2, Mud Rotary, 4-7/8" Tricone Bit, 4-7/8" and 6" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : 18.4 to 20.9 feet bgs START : 9/2/21 08:55 END : 9/2/21 12:10 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
							Ground surface conditions: Farm field, grass, and topsoil consisting of clay and trace sand. Vacuum excavate to 4 ft bgs. Clear of utilities. Start drilling with 4-7/8" drag bit.
5	5.0						
	6.5	1.30	SS-1	WOH-0-1 (1)		**FAT CLAY (CH)** Gray mottled slight orangish-brown, moist, very soft, medium plasticity, trace fine sand, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 0, 0.5, 0.75 tsf WC = 37.3% LL = 52, PL = 23, PI = 29
10	10.0						
	11.5	1.50	SS-2	1-3-3 (6)		Similar to SS-1 except reddish brown, firm, more reddish-brown iron oxide staining, black Mn nodules	PP = 0.5, 0.75, 1.5 tsf
15	15.0						
	16.5	1.50	SS-3	WOH-1-0 (1)		**FAT CLAY (CH)** Gray mottled brown to greenish brown, moist, very soft, high plasticity, 6.5% fine sand, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 0, 0.5, 0.75 tsf WC = 43.7% LL = 64, PL = 24, PI = 40 Fines = 93.5%, Sand = 6.5%, Gravel = 0% Clay collar from 0-12 ft bgs retreived from borehole.
20							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	LFWP-BH08 SHEET 2 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (664904.92 N, 7736258.26 E)

ELEVATION : 595.79 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Dustin Helmig

DRILLING METHOD AND EQUIPMENT : CME-55 Track #2, Mud Rotary, 4-7/8" Tricone Bit, 4-7/8" and 6" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : 18.4 to 20.9 feet bgs START : 9/2/21 08:55 END : 9/2/21 12:10 LOGGER : L. Bhaumik

DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
20.0							
	20.0 - 21.5	1.50	SS-4	2-5-6 (11)		**ELASTIC SILT (MH)** Gray, moist, stiff, medium plasticity, trace fine subrounded gravel, trace reddish-brown iron oxide staining (Residual Soil of the Springwater Formation)	PP = 2.5, 2.5, 1 tsf WC = 44%
21.5							
							23 ft: Use 6" drag bit to re-drill borehole from 0-15 ft bgs, borehole collared up due to plastic soils. Switch back to 4-7/8" drag bit.
25 25.0							
	25.0 - 26.5	1.50	SS-5	4-5-18 (23)		**SANDY SILT (ML)** Gray, moist, very stiff, slight plasticity, ±40% fine to coarse sand, ±5% fine to coarse subrounded to subangular gravel less than 1.25" in diameter (Residual Soil of the Springwater Formation)	WC = 46.4% LL = 48, PL = 44, PI = 4 Top 1" of SS-5 includes soil similar to SS-4 Pumaceous sand 25 ft: Switch to 4-7/8" tricone bit
26.5							
30 30.0							
	30.0 - 31.5	1.50	SS-6	15-42-40 (82)		**SILTY SAND WITH GRAVEL (SM)** Gray with trace red and dark green spots, moist, very dense, ±20% silt, fine to coarse sand, ±15% fine to coarse subangular gravel less than 1.5" in diameter (Less Weathered Springwater Formation)	Lightly cemented sand, disintegrates easily with finger pressure.
31.5							
35 35.0							
	35.0 - 36.3	1.33	SS-7	34-40-50/4" (90/10")		**SILTY SAND (SM)** Similar to SS-6 except 12.2% fine to coarse subangular to subrounded gravel (Less Weathered Springwater Formation)	WC = 20.8% LL = 32, PL = 28, PI = 4 Fines = 29.7%, Sand = 58.1%, Gravel = 12.2% Recovery in SS = 1.5 ft Drill rig chatter after 36 ft
36.3							
40							

Jacobs

PROJECT NUMBER:	BORING NUMBER:
D3460500	LFWP-BH08 SHEET 3 OF 3

SOIL BORING LOG

PROJECT : Bull Run Filtration Pipelines Project - Finished Water Pipeline LOCATION : SE Lusted Road, Gresham, OR (664904.92 N, 7736258.26 E)

ELEVATION : 595.79 ft DRILLING CONTRACTOR : Western States Soil Conservation Inc., Dustin Helmig

DRILLING METHOD AND EQUIPMENT : CME-55 Track #2, Mud Rotary, 4-7/8" Tricone Bit, 4-7/8" and 6" Drag Bit, 2" O.D. Split-Barrel Sampler, 140-lb Auto Trip Hammer

WATER DEPTH : 18.4 to 20.9 feet bgs START : 9/2/21 08:55 END : 9/2/21 12:10 LOGGER : L. Bhaumik

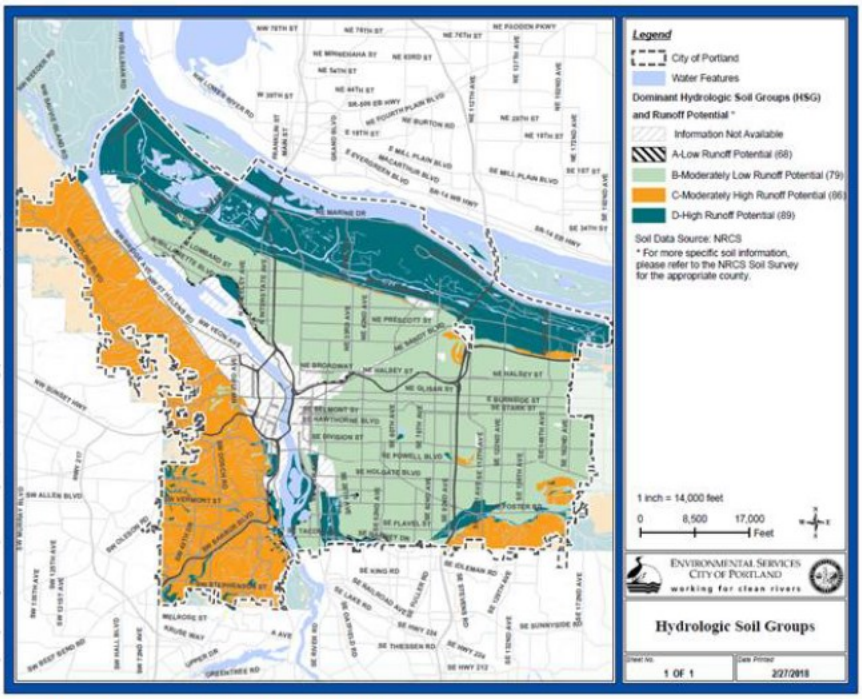
DEPTH BELOW GROUND SURFACE (ft)	INTERVAL (ft)	RECOVERY (ft)	TYPE/ NUMBER	PENETRATION TEST RESULTS 6"-6"-6" (N)	GRAPHIC LOG	SOIL DESCRIPTION: SOIL NAME, USCS GROUP SYMBOL, COLOR, MOISTURE CONTENT, RELATIVE DENSITY OR CONSISTENCY, SOIL STRUCTURE, MINERALOGY	COMMENTS: DEPTH OF CASING, DRILLING RATE, DRILLING FLUID LOSS, TESTS, AND INSTRUMENTATION
40.0							
40.8	0.75	SS-8		24-50/3" (50/3")		Similar to SS-7 except ±10% fine to coarse subangular to subrounded gravel	Recovery in SS = 1.3 ft 40-50 ft: Driller reported similar soil.
45							
50	50.0						
	50.3	0 25	SS-10	50/3" (50/3")		Similar to SS-7 except no greater than 0.25" diameter gravel pieces	
						Bottom of Boring at 50.25 ft below ground surface	Installed 2" dia standpipe piezometer for future installation of VWP
						Geokon VWP 4500S (350 kPa), unvented, serial no. 2146339 Geokon datalogger 8002-WP-2 LC-2, serial no. 2128642	Standpipe piezometer installed immediately after drilling VWP installed on 12/21/2021. 0-1 ft: 12" diameter, 12" deep monument set in concrete 1.5-2 ft: Base gravel 1-37.5 ft: Bentonite chips 37.5-50 ft: Sand 40-50 ft: Screen Start Card # 1053657 Well # L142289 Base of VWP is at 48.45 ft below ground surface. Field VWP Ro (1) 8962.688 (2) 8962.688 (3) 8962.771 (4) 8964.232 Average Ro = 8963.095
55							
60							

Curve Numbers

Use the pre-development curve numbers in Table 2-11 based on the site's soil type. These curve numbers are based on undeveloped, not existing, site conditions. Use post-development curve numbers of 98 for impervious surfaces and 61 for ecoroofs. The design professional may use a different curve number if adequate justification is provided. The Sewer and Drainage Facilities Design Manual provides post-development curve numbers for other surfaces.

Figure 2-7 shows soil types in the City and is for reference only; it is not for site design. For site design, enter an address into Portland Maps and check utilities →environment → stormwater management to find the soil type.

Figure 2-7. Soil Types in the City[1]



1 For reference only; not for site design

Table 2-11 Pre-Development Curve Numbers Based on Soil Type

Soil Type	Curve Number
A	65
B	72
C	79
D	81
Unidentified	81

Table 2-2a Runoff curve numbers for urban areas [1/]

Cover description		Curve numbers for hydrologic soil group			
Cover type and hydrologic condition	Average percent impervious area [2/]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.) [3/]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only) [4/]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation) [5/]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

1 Average runoff condition, and $I_a = 0.2S$.

2 The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.

3 CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

4 Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

5 Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4 based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

Appendix C: Calculation Results

MCDCM Worksheet 3 for Pre-developed and Post-Construction Conditions

PAC Tool Report

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)
SBUH Method Calculation

Project PWB Bull Run Filtration Project By AA Date 8/11/22

Location Finished Water Intertie Site Checked _____ Date _____

Circle one: (Present) Developed _____

Circle one: (T_c) T_t through subarea _____

Notes: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID	1A			
1. Surface description (table III-1.4)			woods			
2. Manning's roughness coeff., n (table III-1.4)			0.4			
3. Flow length, L (total $L \leq 300$ ft)	ft		179.5			
4. Two-yr. 24-hr rainfall, P_2	in		2.4			
5. Land slope, s	ft/ft		0.05			
6. $T_t = \frac{0.42(nL)^{0.8}}{P_2^{0.527} s^{0.4}}$	Compute T_t	min	26.8	+		= 26.8

Shallow concentrated flow		Segment ID				
7. Surface description (table III-1.4)						
8. Time of concentration velocity factor, K (table III-1.4)	ft/s					
9. Watercourse slope, s	ft/ft					
10. $V = K\sqrt{s}$	ft/s					
11. Flow length, L	ft					
12. $T_t = \frac{L}{60V}$	Compute T_t	min		+		=

Channel flow		Segment ID				
13. Surface description (table III-1.4)						
14. Time of concentration velocity factor, K (table III-1.4)	ft/s					
15. Watercourse slope, s	ft/ft					
16. $V = K\sqrt{s}$	ft/s					
17. Flow length, L	ft					
18. $T_t = \frac{L}{60V}$	Compute T_t	min		+		

19. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... min

Worksheet 3: Time of Concentration (T_c) or travel time (T_t)
SBUH Method Calculation

Project PWB Bull Run Filtration Project By AA Date 8/11/22

Location Finished Water Intertie Site Checked _____ Date _____

Circle one: Present (Developed)

Circle one: (T_c) T_t through subarea _____

Notes: Space for as many as two segments per flow type can be used for each worksheet.
Include a map, schematic, or description of flow segments.

Sheet flow (Applicable to T_c only)		Segment ID	A1	A2		
1. Surface description (table III-1.4)			Roof	Vegetated Swale		
2. Manning's roughness coeff., n (table III-1.4)			0.011	0.15		
3. Flow length, L (total $L \leq 300$ ft)	ft		30	150		
4. Two-yr. 24-hr rainfall, P_2	in		2.4	2.4		
5. Land slope, s	ft/ft		0.02	0.05		
6. $T_t = \frac{0.42(nL)^{0.8}}{P_2^{0.527} s^{0.4}}$	Compute T_t	min	0.5	+ 10.5	=	11

Shallow concentrated flow		Segment ID				
7. Surface description (table III-1.4)						
8. Time of concentration velocity factor, K (table III-1.4)	ft/s					
9. Watercourse slope, s	ft/ft					
10. $V = K\sqrt{s}$	ft/s					
11. Flow length, L	ft					
12. $T_t = \frac{L}{60V}$	Compute T_t	min		+	=	

Channel flow		Segment ID				
13. Surface description (table III-1.4)						
14. Time of concentration velocity factor, K (table III-1.4)	ft/s					
15. Watercourse slope, s	ft/ft					
16. $V = K\sqrt{s}$	ft/s					
17. Flow length, L	ft					
18. $T_t = \frac{L}{60V}$	Compute T_t	min		+		

19. Watershed or subarea T_c or T_t (add T_c in steps 6, 11, and 19) ..... min

PAC Report

Project Details

Project Name	Permit No	Created
Bull Run PWB - Finished Water Intertie		8/9/2022 9:04:52 PM
Project Address	**Designer**	**Last Modified**
33304 SE Lusted Road	Annie Alsheimer	8/14/2022 11:23:29 PM
	Company	**Report Generated**
	Jacobs	8/17/2022 3:51:48 PM

Project Summary

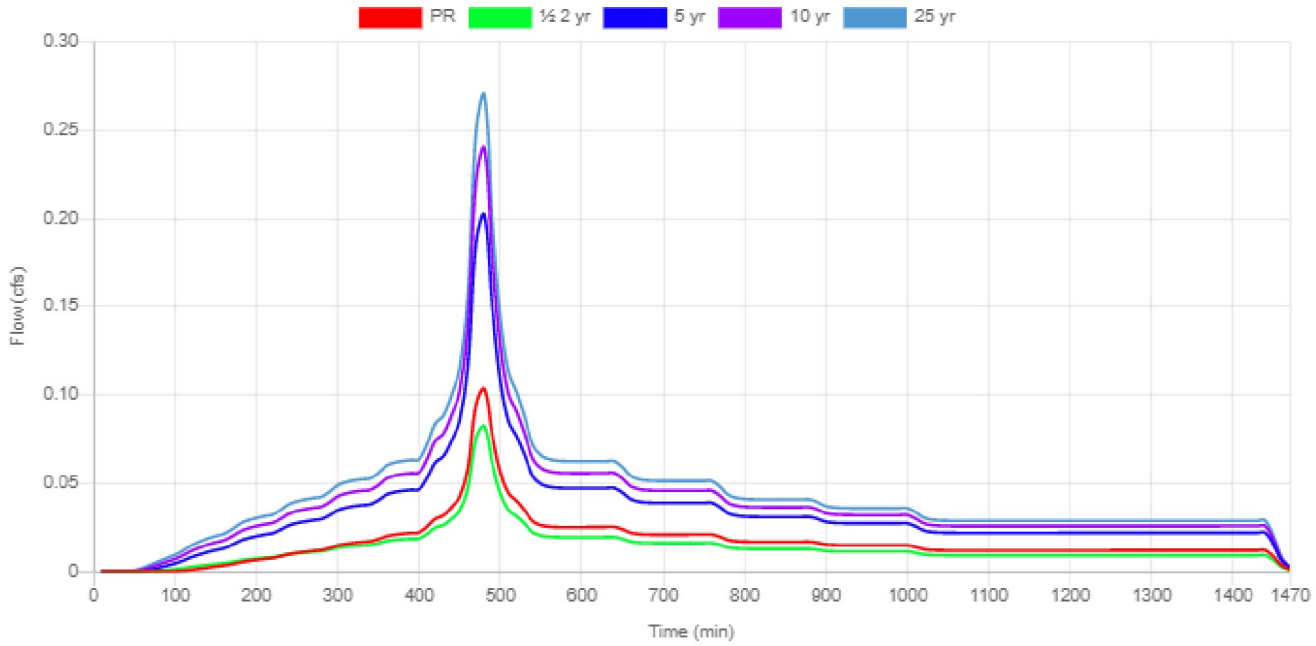
Catchment Name	Imper-vious Area (sq ft)	Native Soil Design Infilt-ration Rate (in/hr)	Level	Category	Config	Facility Area (excl. free board) (sq ft)	Facility Sizing Ratio (%)	PR Results	Infilt-ration Results	Flow Control Results
Impervious Area	13630	0	2B	Basin	D	1508.62	11.07	Pass	NA	Pass

Impervious Area

Site Soils & Infiltration Testing	Infiltration Testing Procedure NA Tested Native Soil Infiltration Rate 0 in/hr
Correction Factor	CF test 2
Design Infiltration Rates	Native Soil 0 in/hr Imported Blended Soil 6 in/hr
Catchment Information	Hierarchy Level 2B Hierarchy Description Discharge to an overland storm drainage system, including streams, drainageways, and ditches, or to a storm-only pipe system that discharges to an overland storm drainage system. Pollution Reduction Requirement Filter the post-development stormwater runoff from the water quality storm event through the blended soil. Infiltration Requirement N/A Flow Control Requirement Limit the ½ the 2-yr, the 5-yr, and the 10-yr post-development peak flows to their respective pre-development peak flows. Unless the facility is a public facility (i.e., in the public right-of-way), also limit the 25-yr post-development peak flow to the 25-year pre-development peak flow. Impervious Area 13630 sq ft 0.313 acre Pre-Development Time of Concentration (Tc pre) 27 min Post-Development Time of Concentration (Tc post) 11 min Pre-Development Curve Number (CN pre) 79 Post-Development Curve Number (CN post) 97

SBUH Results

Post-Development Runoff



	Pre - Development Rate and Volume		Post - Development Rate and Volume	
	Peak Rate (cfs)	**Total Volume (cf)**	**Peak Rate (cfs)**	**Total Volume (cf)**
PR	0.0069	353.5	0.1033	1465.6
½ 2-Year	0.0153	438	0.082	1172.7
5-Year	0.0514	1267.5	0.2021	2906.9
10-Year	0.0746	1690.9	0.2399	3470.1
25-Year	0.0945	2047.2	0.27	3921.5

	Overflow		Underdrain Outflow		Infiltration	
	Peak Rate (cfs)	**Total Volume (cf)**	**Peak Rate (cfs)**	**Total Volume (cf)**	**Peak Rate (cfs)**	**Total Volume (cf)**
PR	0	0	0.015	1451.8	0	0
½ 2-Year	0	0	0.014	1158.9	0	0
5-Year	0	0	0.018	2893.1	0	0
10-Year	0.018	385.3	0.019	3070.9	0	0
25-Year	0.04	809.5	0.019	3098.1	0	0

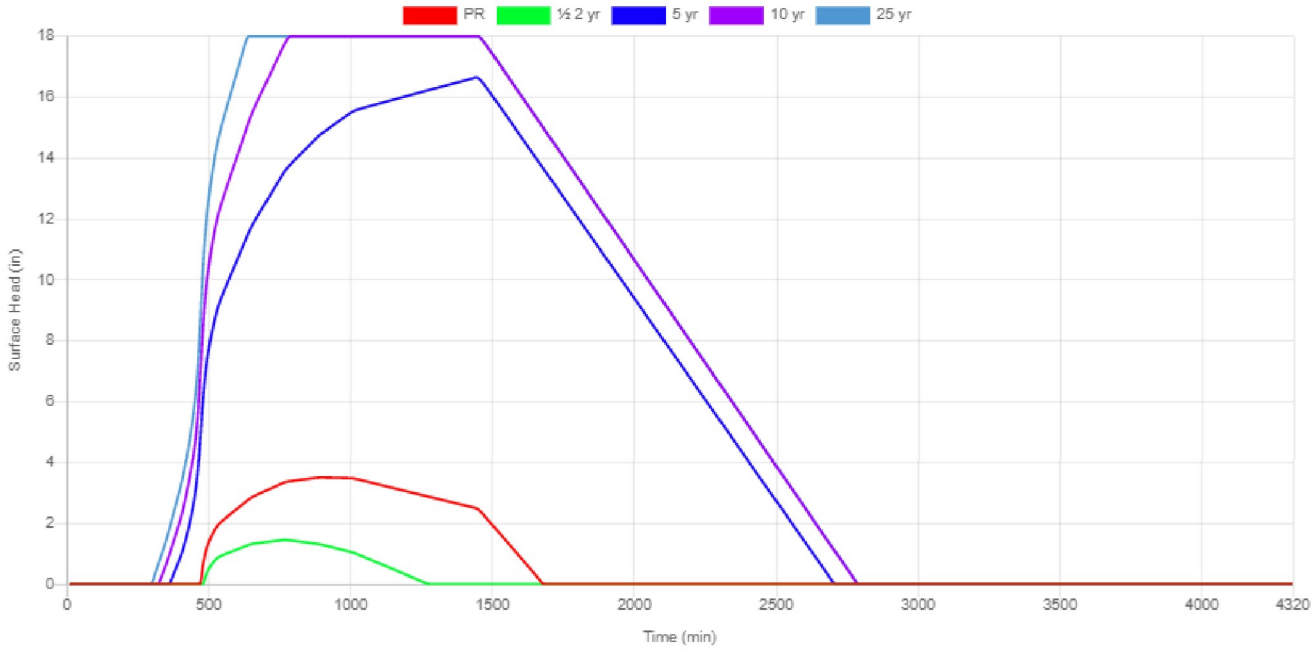
Rect Basin

Site Soils & Infiltration Testing	Category Rect Basin Shape Rectangular Location Parcel Configuration D: Lined Facility with RS and Ud **Above Grade Storage Data** Bottom Area 500 sq ft Bottom Width 5.00 ft Side Slope 3.0 h:1v Freeboard Depth 2.0 in Overflow Height 18.0 in Total Depth of Blended Soil plus Rock 24 in Surface Storage Capacity at Overflow 1490.56 cu ft Design Infiltration Rate to Soil Underlying the Facility 0.000 cfs Design Infiltration Rate for Imported Blended Soil in the Facility 0.173 cfs **Below Grade Storage Data** Catchment is too small for flow control? No Rock Area 75.00 sq ft Rock Width 3.00 ft Rock Storage Depth

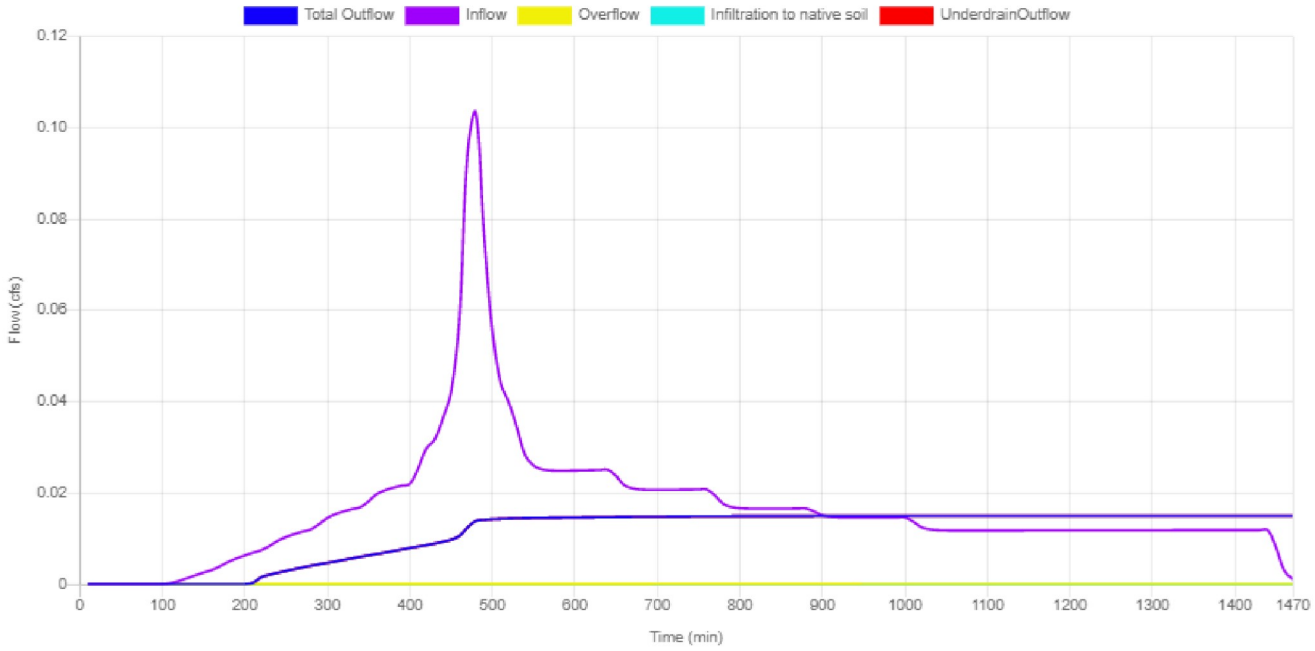
	12.0 in Rock Porosity 0.3 Underdrain Height 1.0 in Percent of Facility Base that Allows Infiltration 0 % Orifice (Y/N)? Yes Orifice Diameter 0.625 in
Facility Facts	Total Facility Area (excluding freeboard) 1508.62 sq ft Sizing Ratio 11.07 %
Pollution Reduction Results	Pollution Reduction Score Pass Overflow Volume 0.00 cf Surface Capacity Used 19.43 %
Flow Control Results	Flow Control Score Pass

	STORMWATER FACILITY OUTFLOW (CFS)		PRE-DEVELOPMENT RUNOFF (CFS)
½ the 2 year	0.0143	<=	0.0153
5 year	0.0183	<=	0.0514
10 year	0.0365	<=	0.0746
25 year	0.0588	<=	0.0945

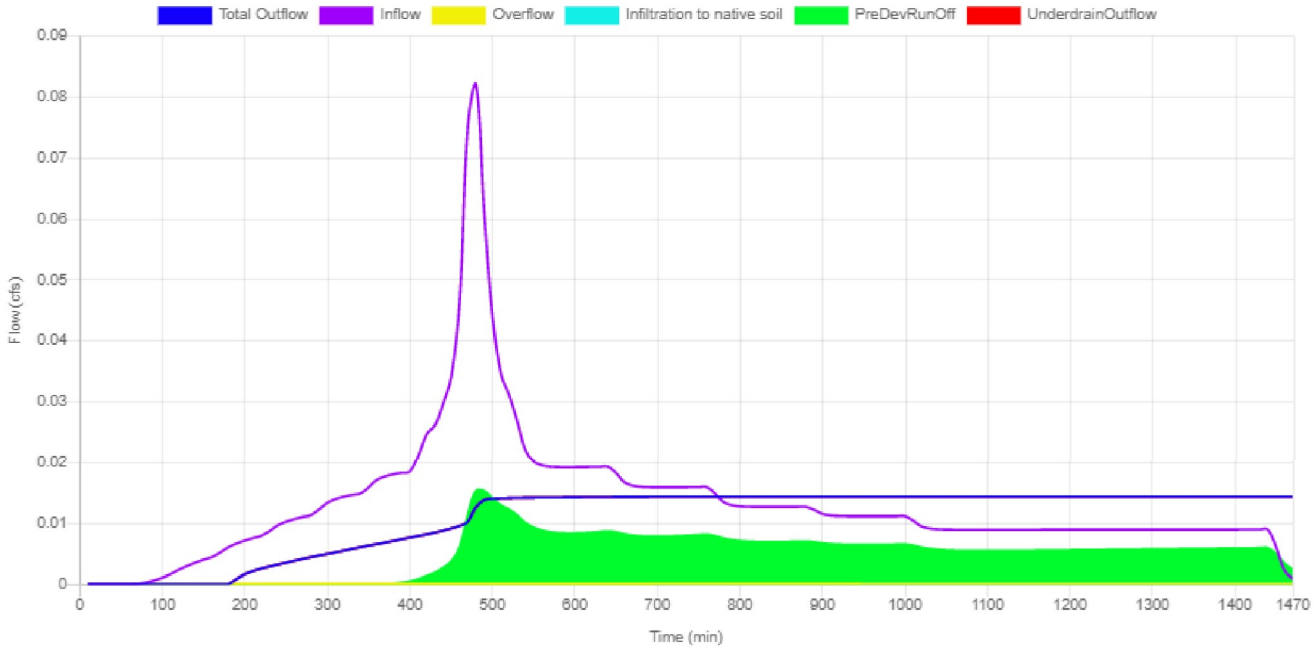
Surface Head



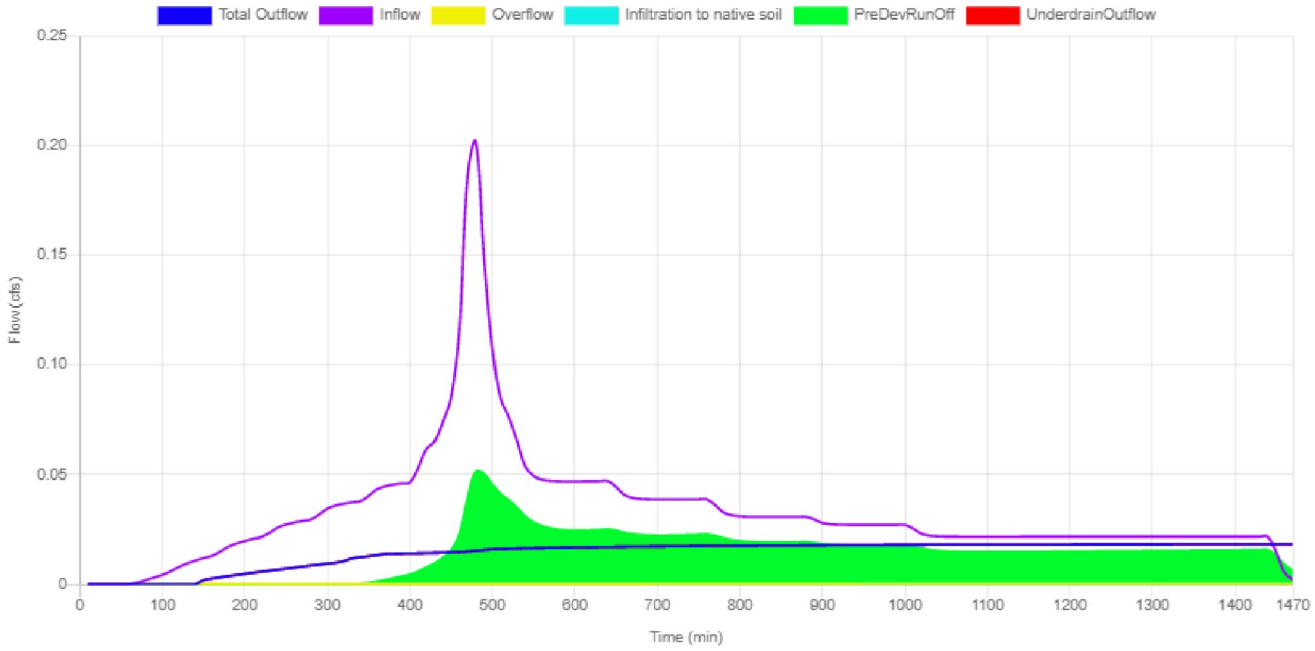
Water Quality



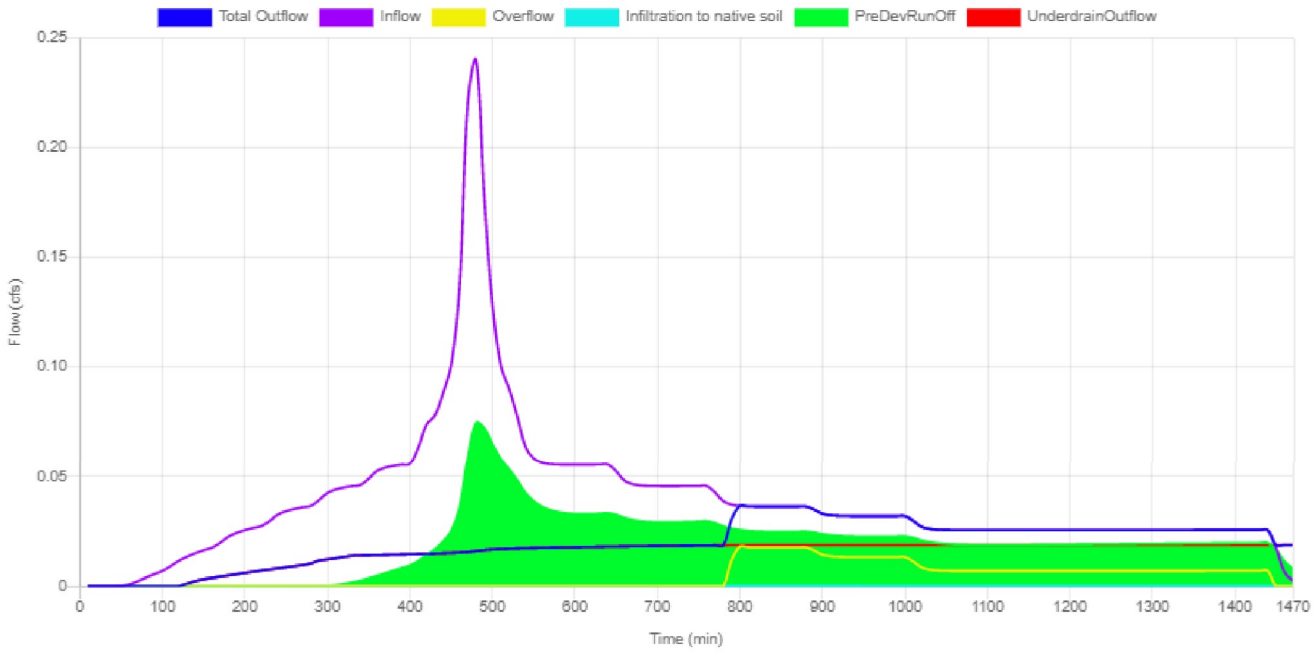
½ 2-Year



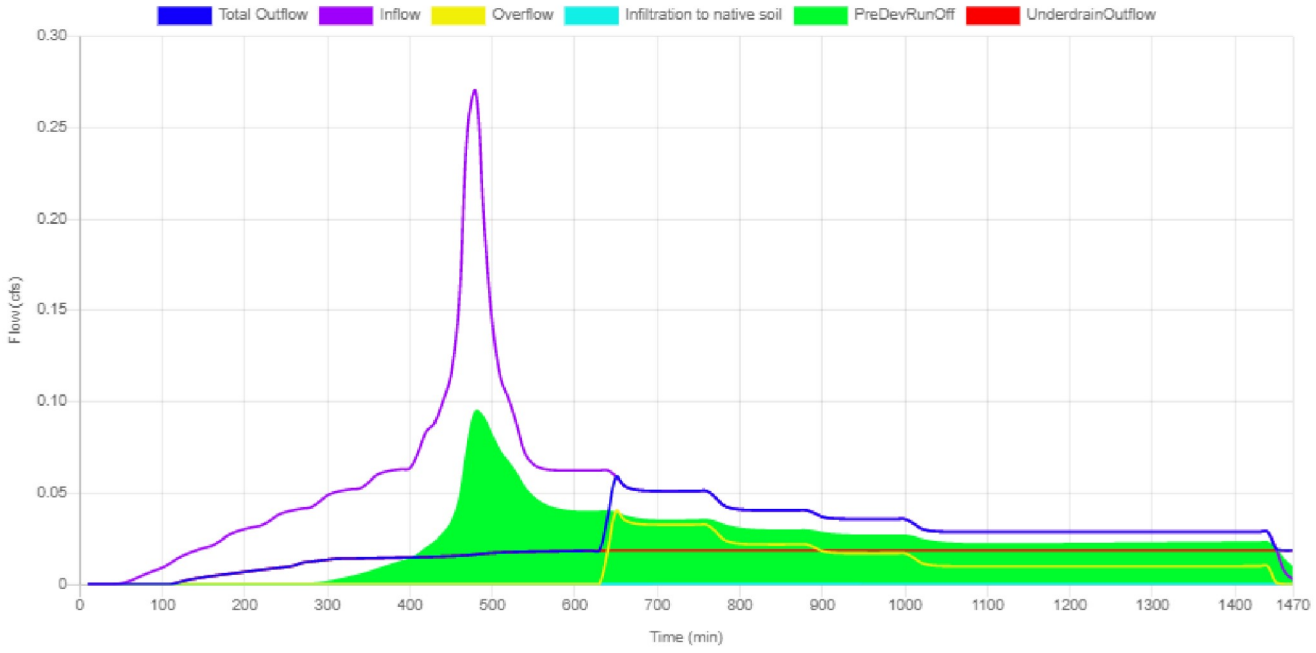
5-Year



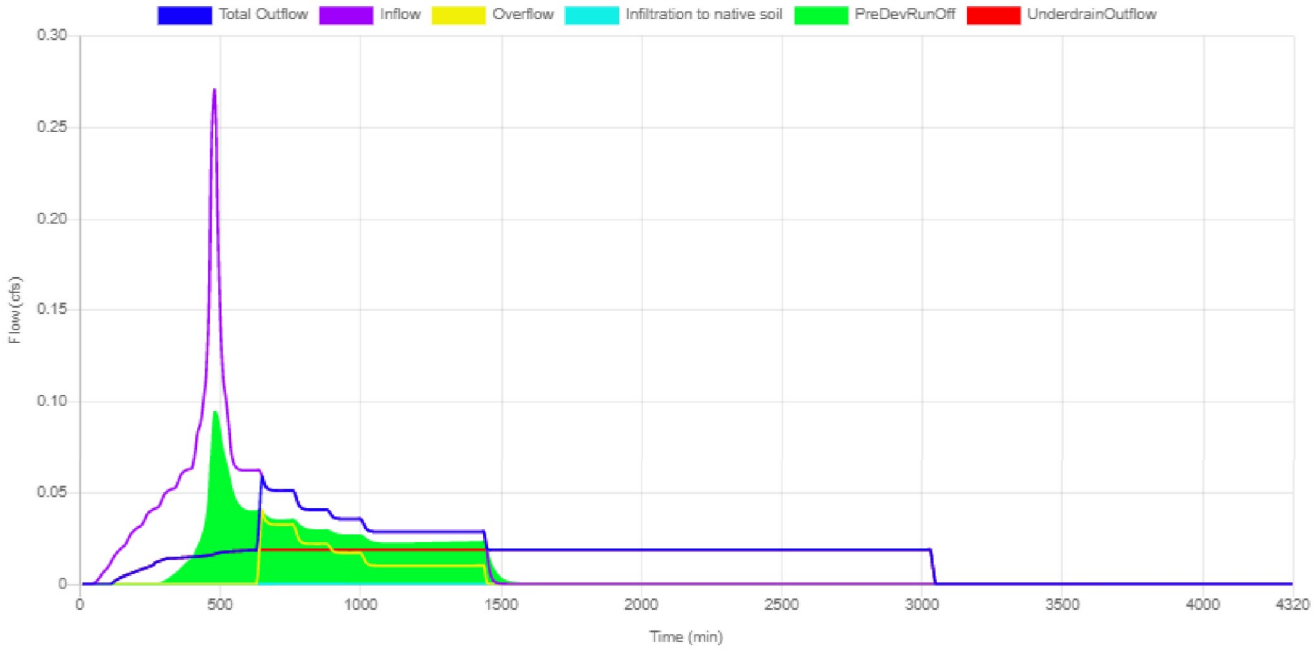
10-Year



25-Year



25-Year


Total Outflow
Inflow
Overflow
Infiltration to native soil
PreDevRunOff
UnderdrainOutflow
0.30
0.25
0.20
0.15
0.10
0.05
0
Flow (cfs)
0
500
1000
1500
2000
2500
3000
3500
4000
4320
Time (min)

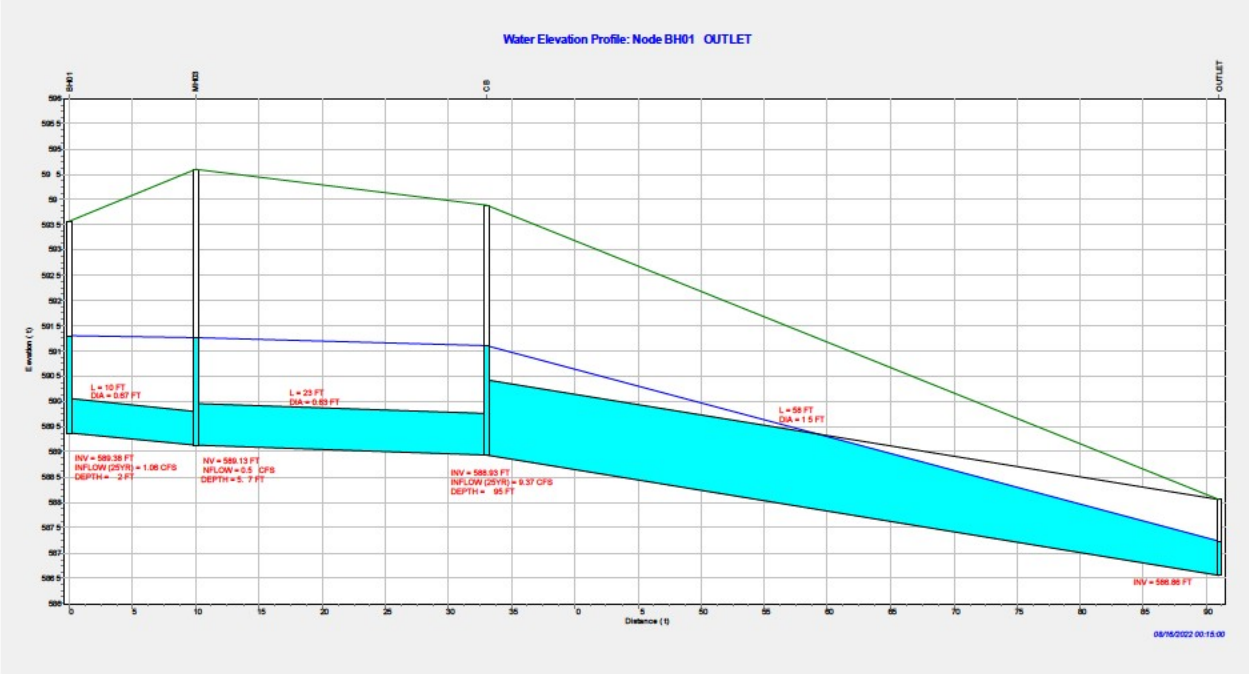
Appendix D: Conveyance Calculations

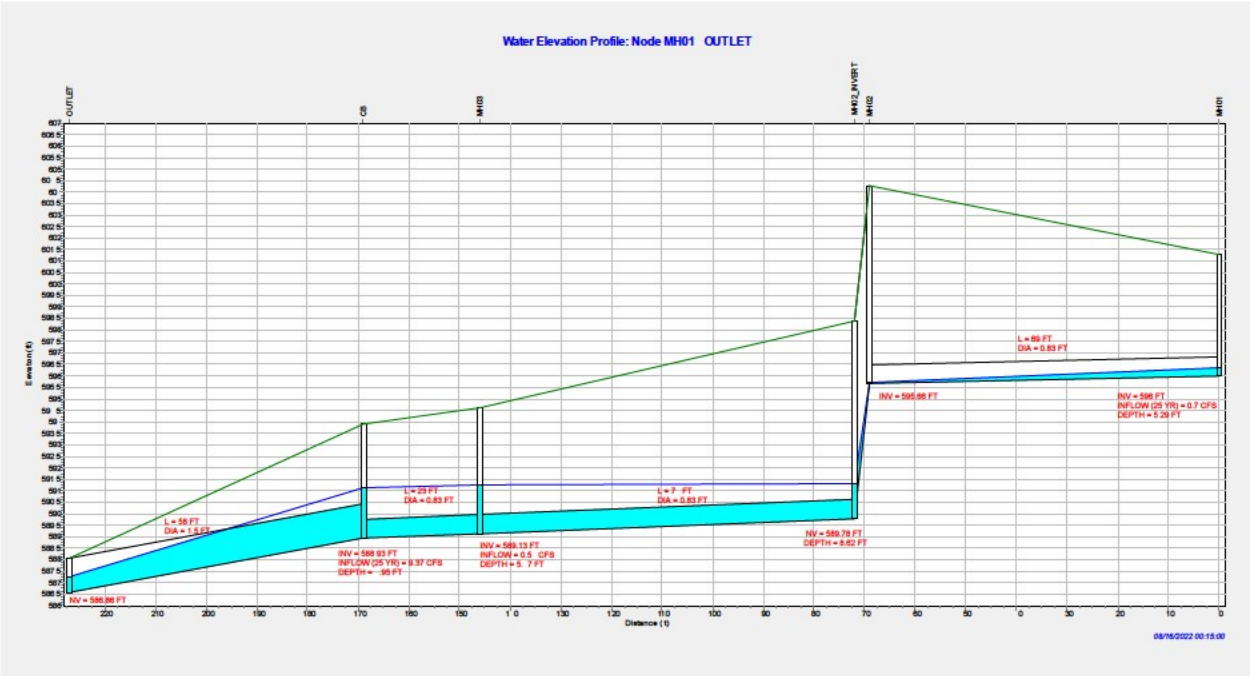
Link Flow Summary

Link	Type	Maximum |Flow| CFS	Day of Maximum Flow	Hour of Maximum Flow	Maximum |Velocity| ft/sec
CB-OUTLET	CONDUIT	12.45	0	00:00	8.94
BH01-MH03	CONDUIT	1.94	0	00:00	5.51
MH01-CB	CONDUIT	3.08	0	00:00	5.70
MH01-MH02	CONDUIT	0.81	0	00:00	7.85
MH02-MH03	CONDUIT	1.86	0	00:00	3.49
MH02STRUC	CONDUIT	0.81	0	00:00	9.36

Link Flow Summary

Link	Max / Full Flow	Max / Full Depth
CB-OUTLET	0.45	0.74
BH01-MH03	0.77	1.00
MH01-CB	1.17	1.00
MH01-MH02	0.41	0.26
MH02-MH03	0.70	1.00
MH02STRUC	0.00	0.13


Water Elevation Profile: Node BH01 OUTLET
BH01
MH03
CB
OUTLET
L = 10 FT
DIA = 0.67 FT
L = 23 FT
DIA = 0.83 FT
L = 58 FT
DIA = 1.5 FT
INV = 589.38 FT
INFLOW (25YR) = 1.06 CFS
DEPTH = .2 FT
INV = 589.13 FT
NFLOW = 0.5 CFS
DEPTH = 5: 7 FT
INV = 588.93 FT
INFLOW (25YR) = 9.37 CFS
DEPTH = .95 FT
INV = 586.86 FT
Distance (t)
08/16/2022 00:15:00


Water Elevation Profile: Node MH01 OUTLET
OUTLET
CB
MH03
MH02_INVERT
MH02
MH01
Elevation(ft)
Distance (ft)
L = 58 FT
DIA = 1.5 FT
INV = 588.86 FT
L = 23 FT
DIA = 0.83 FT
INV = 588.93 FT
INFLOW (25 YR) = 9.37 CFS
DEPTH = .95 FT
L = 7 FT
DIA = 0.83 FT
INV = 589.13 FT
INFLOW = 0.5 CFS
DEPTH = 5 7 FT
L = 89 FT
DIA = 0.83 FT
INV = 595.88 FT
NV = 589.78 FT
DEPTH = 5.62 FT
INV = 596 FT
INFLOW (25 YR) = 0.7 CFS
DEPTH = 5.29 FT
08/16/2022 00:15:00

Appendix E: Operations & Maintenance

STANDARD O&M PLAN FOR THE SIMPLIFIED AND PRESUMPTIVE APPROACHES

Basins

Structural components must be operated and maintained in accordance with the design specifications.		
	MAINTENANCE INDICATOR	**CORRECTIVE ACTION**
	Clogged inlets or outlets	Remove sediment, debris, and blockages from catch basins, trench drains, curb inlets, and pipes to maintain at least 50% conveyance at all times
	Broken inlets or outlets, including grates	Repair or replace broken downspouts, curb cuts, standpipes, and screens as needed.
	Cracked or exposed drain pipes	Repair or seal cracks. Replace when repair is insufficient. Cover with 6 inches of growing medium to prevent freeze/thaw and UV damage.
	Check dams missing/broken	Maintain or replace rock check dams as per design specifications.
	Perforated liner	Replace or repair liner as needed.
Vegetation must cover at least 90% of the facility at maturity.		
	MAINTENANCE INDICATOR	**CORRECTIVE ACTION**
	Dead or stressed vegetation	Replant per original planting plan, or substitute from the plant list in SWMM section 3.5. Irrigate and mulch as needed; prune tall, dry grasses and remove clippings.
	Tall grass and vegetation	Maintain grass height at 6”-9”. Trim to allow sight lines and foot traffic, also to ensure inlets and outlets freely convey stormwater into and/or out of facility.
	Weeds	Manually remove weeds.
Growing medium must sustain healthy plant cover and drain within 48 hours.		
	MAINTENANCE INDICATOR	**CORRECTIVE ACTION**
	Gullies, erosion, exposed soil, sediment accumulation	Fill in and lightly compact areas of erosion with City-approved soil mix (see SWMM section 3.2.2.1). and replant according to planting plan or substitute from the plant list in SWMM section 3.8. Erosion more than 2 inches deep must be addressed. Sediment more than 4 inches deep must be removed.
	Scouring at the inlet(s)	Ensure splash blocks or inlet gravel/rock are placed correctly to prevent erosion.
	Slope slippage	Stabilize 3:1 slopes/banks with plantings from the original planting plan or from the plant list in SWMM section 3.5.
	Ponding	Rake, till, or amend soil surface with City-approved soil mix to restore infiltration rate. Remove sediment at entrance.

Annual Maintenance Schedule

Summer	Make structural repairs; clean gutters and downspouts; remove any build-up of weeds or organic debris.
Fall	Replant exposed soil and replace dead plants. Remove sediment and plant debris.
Winter	Clear gutters and downspouts.
Spring	Remove sediment and plant debris. Replant exposed soil and replace dead plants.
All seasons	Weed as necessary.

Maintenance Records: All facility operators must keep an inspection log. Record date, description, and contractor for all repairs, landscape maintenance, and facility activities. Keep work orders and invoices on file and make available upon request of the City inspector.

Fertilizers: Their use is strongly discouraged because of the potential for negative environmental impacts. Never apply fertilizer before testing the fertility of the growing medium to determine whether fertilizer is needed and appropriate application rates. Use only organic, slow-release fertilizers. See SWMM Section 3.2.2.1 for more information.

Pesticides/Herbicides: Their use is prohibited.

Pollution Prevention: All sites must implement Best Management Practices to prevent the introduction of pollutants to stormwater and/or facility discharge points. In the event of a spill, call 503-823-7180 to report it immediately and document the circumstances and corrective action taken; include the date/time, weather and site conditions. Never wash spills into a stormwater facility.

Vectors (Mosquitoes and Rats): Facilities must not harbor mosquito larvae or rodents. Record the time/date, weather, and site conditions when vector activity is observed. Record when vector abatement started and ended.

Infiltration/Flow Control: Facilities must drain within 48 hours. Record time/date, weather, and conditions when ponding occurs

Access: Maintain ingress/egress per design standards, maintaining access to the entirety of the facility for inspection & maintenance

Operations and Maintenance Log

Date	Work Performed By	Type of Work Performed					Notes	Initials
		Clean inlets and Outlets	Sediment and Trash Removal	Plant Replacement type, location	Structural Repairs – type, location	Other		

Appendix F: Stormwater Certificate Form

Land Use Planning Division
1600 SE 190th Ave.
Portland OR 97233
Phone: 503-988-3043
land.use.planning@multco.us
https://multco.us/landuse/

STORMWATER DRAINAGE CONTROL CERTIFICATE
>500 SQUARE FEET OF NEW / REPLACED IMPERVIOUS SURFACES

NOTE TO PROPERTY OWNER/APPLICANT: Please have an Oregon Licensed Professional Engineer fill out this Certificate and attach a signed site plan, stamped and signed storm water system details, and stamped and signed storm water calculations used to support the conclusion. Please note that replacement of existing structures does not provide a credit to the square footage threshold.

Property Address or Legal Description: 33400 SE Lusted Road, Gresham

Description of Project: Bull Run Filtration - Finished Water Intertie Site

The following stormwater drainage control system will be required:

- ☐ **Use of Gutter, downspout, and splash block drainage control system;**
- ☐ **Natural Infiltration Process; or**
- ☒ **Construction of an on-site storm water drainage control system.**

The rate of stormwater runoff attributed to the new/replaced development for a 10-year/24-hour storm event will be no greater than that which existed prior to any development as measured from the property line or from the point of discharge into a water body with the use of the designated system [MCC 39.6235].

I certify the attached signed site plan showing the areas needed for the chosen system type, stamped and signed storm water system design details, and stamped and signed calculations dated 9/23/2022 **will meet the requirements listed above.**

Signature: _____

Print Name: Patrick Tortora

Business Name: Emerio Design, LLC

Address: 6445 SW Fallbrook Pl., Beaverton, OR 97008

Phone #: 503.746.8812

Date: 9/23/2022

Engineer's Stamp Below:

NOTE TO ENGINEER: Please check one box above. Multnomah County does not use the City of Portland's storm water ordinance. As part of your review, MCC 39.6235 requires that you must consider all new, replaced, and existing structures and impervious areas and determine that the newly generated stormwater from the new or replaced impervious surfaces is in compliance with Multnomah County Code for a 10-year/24-hour storm event. This Storm Water Drainage Control Certificate does not apply to shingle or roof replacement on lawfully established structures.

§ 39.6235 STORMWATER DRAINAGE CONTROL.

(A) Persons creating new or replacing existing impervious surfaces exceeding 500 square feet shall install a stormwater drainage system as provided in this section. This subsection (A) does not apply to shingle or roof replacement on lawful structures.

(B) The provisions of this section are in addition to and not in lieu of any other provision of the code regulating stormwater or its drainage and other impacts and effects, including but not limited to regulation thereof in the SEC overlay.

(C) The provisions of this section are in addition to and not in lieu of stormwater and drainage requirements in the Multnomah County Road Rules and Design and Construction Manual, including those requirements relating to impervious surfaces and proposals to discharge stormwater onto a county right-of-way.

(D) The stormwater drainage system required in subsection (A) shall be designed to ensure that the rate of runoff for the 10-year 24-hour storm event is no greater than that which existed prior to development at the property line or point of discharge into a water body.

(E) At a minimum, to establish satisfaction of the standards in this section and all other applicable stormwater-related regulations in this code, the following information must be provided to the planning director:

(1) A site plan drawn to scale, showing the property line locations, ground topography (contours), boundaries of all ground disturbing activities, roads and driveways, existing and proposed structures and buildings, existing and proposed sanitary tank and drainfields (primary and reserve), location of stormwater disposal, trees and vegetation proposed for both removal and planting and an outline of wooded areas, water bodies and existing drywells;

(2) Documentation establishing approval of any new stormwater surcharges to a sanitary drainfield by the City of Portland Sanitarian and/or any other agency authorized to review waste disposal systems;

(3) Certified statement, and supporting information and documentation, by an Oregon licensed Professional Engineer that the proposed or existing stormwater drainage system satisfies all standards set forth in this section and all other stormwater drainage system standards in this code; and

(4) Any other report, information, plan, certification or documentation necessary to establish satisfaction of all standards set forth in this section and all other applicable stormwater-related regulations in this code, such as, but not limited to, analyses and explanations of soil characteristics, engineering solutions, and proposed stream and upland environmental protection measures.