

**STORMWATER DRAINAGE REPORT FOR  
REECE OFFICE & SCALE HOUSE  
ARLINGTON, WASHINGTON**

APRIL 8, 2021



4/8/21



**CONSTRUCTION DRAWING REVIEW ACKNOWLEDGMENT**

THIS PLAN HAS BEEN REVIEWED AND EVALUATED FOR GENERAL COMPLIANCE WITH THE CITY OF ARLINGTON CODES AND ORDINANCES. CONFORMANCE OF THIS 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. ACKNOWLEDGMENT 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 AUTHORIZATIONS WHICH MAY INCLUDE, BUT ARE NOT LIMITED TO, WSDFW HYDRAULIC PROJECT APPROVAL (HPA), WSDOE NOTICE OF INTENT (NOI), ANY CORP OF ENGINEERS FILL PERMITS AND THE REQUIREMENTS OF THE ENDANGERED SPECIES ACT.

BY: \_\_\_\_\_  
City Engineer

DATE: \_\_\_\_\_  
THIS APPROVAL VALID FOR 18 MONTHS

**SNOHOMISH COUNTY**  
125 E Main Street SE, Suite 104  
Monroe, Washington 98272  
tel: 360. 794.7811 | fax: 360.805.9732

**ISLAND COUNTY**  
840 SE 8<sup>th</sup> Avenue, Suite 102  
Oak Harbor, Washington 98277  
tel: 360. 675.5973 | fax: 360.675.7255

**SKAGIT COUNTY**  
603 South First Street  
Mount Vernon, Washington 98273  
tel: 360. 336.9199 | fax: 360.982.2637

## **TABLE OF CONTENTS**

DRAINAGE INFORMATION SUMMARY FORM	2
MR 1: PROJECT OVERVIEW & EXECUTIVE SUMMARY	3
MR 2: SWPPP NARRATIVE	6
MR 3: WATER POLLUTION SOURCE CONTROL	7
MR 4: PRESERVATION OF NATURAL DRAINAGE	8
MR 5: ONSITE STORMWATER MANAGEMENT	9
MR 6: RUNOFF TREATMENT	10
MR 7: FLOW CONTROL	11
MR 8: WETLANDS PROTECTION	12
MR 9: OPERATION & MAINTENANCE	13
FIGURES & MAPS	14
APPENDIX A: SCS SOILS MAP	20
APPENDIX B: WWHM2012 OUTPUT	23

**DRAINAGE INFORMATION SUMMARY FORM**

Project Name: REECE OFFICE & SCALE HOUSE  
 Project Total Area: 1.75 acres  
 Number of Lots: 1

**SUMMARY TABLE**

Drainage Basin Information	Individual Basin Designation
	A
Area of Impact (acres)	0.84
Existing condition Area (ac)	0.84
Pervious Area (ac)	0.84
Impervious Area (ac)	0.00
Proposed Condition Area (ac)	0.84
Pervious Area (ac)	0.08
Impervious Area (ac)	0.76
Non-pollution Generating (ac)	0.18
Pollution Generating (ac)	0.58
Predeveloped Runoff Rates	
Q (cfs)      2 year	0.0007
10 year	0.003
100 year	0.013
Post-developed Runoff Rates	
Q (cfs)      2 year	0.00
10 year	0.00
100 year	0.00
Offsite Upstream Area	0
Type of Storage Proposed	Infiltration Trench
Approximate Storage Volume (cf)	1,600
Type of Treatment	Filtterra
Low Impact Development	BMP T5.13

## **MR 1: STORMWATER SITE PLAN REPORT**

### **PROJECT OVERVIEW & EXECUTIVE SUMMARY**

#### **DRAINAGE PLAN DESCRIPTION**

This Drainage Report has been prepared for the Reece Office & Scale House project on their property in Arlington WA. The 13.86-acre site is located at 5802 Cemetery Road, Arlington, see Figure 1: Vicinity Map. Currently the site is used as a construction materials storage and aggregate sorting facility. There are also several buildings and parking areas on the site. The site is bounded by Cemetery Road to the north, the property to the west is also owned by Reece, and industrial developments to the east and south. The applicant is proposing to construct a new 2 story office building with associated parking and a scale house building see Figures 3A and 3B.

#### **METHODOLOGY**

The drainage calculations for the site have been prepared based on the requirements of the 2012 DOE Manual as adopted by the City of Arlington. Based on the proposed new plus replaced impervious area of more than 5,000 sf, the site is required to comply with Minimum Requirements 1-9 of the DOE Manual. WWHM2012 by DOE has been used for runoff calculations.

#### **DRAINAGE BASIN**

The site is being development consists of 2 areas. First is the Office Basin consisting of the new office building and associated parking. This basin also includes rebuilding the site access as a roadway extension from Cemetery Road. The Scale House Basin consists of the new scale house.

#### **DRAINAGE SYSTEM SKETCH**

Refer to Figure 3: Developed Conditions for a graphic representation of the proposed drainage system.

#### **DOWNSTREAM ANALYSIS**

See Downstream Analysis on page 4 of this report.

#### **UPSTREAM ANALYSIS**

See Upstream Analysis on page 4 of this report.

#### **CONVEYANCE CALCULATIONS**

Conveyance calculations will be prepared for the project prior to final construction approval.

#### **WATER QUALITY**

With more than 1 acre of disturbance a DOE A Storm Water Pollution Prevention Plan (SWPPP) has been prepared for this project. A copy is included with the building permit submittal package. The plan includes several of the following erosion control Best Management Practices:

BMP C105, Construction Entrance  
BMP C120, Temporary & Permanent Seeding,  
BMP C121, Mulching,  
BMP C123, Plastic Covering,  
BMP C125, Top soiling,  
BMP C220, Storm Drain Inlet Protection  
BMP C233, Silt Fence.

#### OPERATIONS AND MAINTENANCE

An Operations and Maintenance Manual is provided under separate cover.

#### RUNOFF TREATMENT BMP'S

With more than 5,000 sf of new/replaced impervious surface subject to vehicular traffic the project meets the threshold for requiring runoff treatment BMPs. A Filterra bioretention filtration system by Contech is proposed to treat the parking area and access runoff, see MR 6 for more information.

#### STREAM BANK EROSION CONTROL BMP'S

The proposed impervious surface is more than 10,000 sf therefore flow control is required. The following Flow Control BMPs are used on this site. See MRs 5 and 7 for more information.

Infiltration Trench,  
BMP T5.13, Soil Quality and Depth.

### EXISTING CONDITIONS SUMMARY

#### DESCRIPTION

Currently the site is used as a construction materials storage and aggregate sorting facility, see Figure 2 Existing Site. There are also several buildings and parking areas on the site. An existing infiltration pond that serves the site is located on the adjacent property to the southwest of the work areas. A storm collection and conveyance system consisting of catch basins and pipe routes existing site runoff to this pond. The site slopes gently to the south for about 440 feet from Cemetery Road at elevation 123 to a low of about 110. This is where the existing storm catch basins collect the site runoff. The ground then rises to about elevation 115 at the south property line. There are no wetlands, stream, steep slopes or other critical areas on the site.

The site is bounded by Cemetery Road to the north, the property to the west is also owned by Reece and contains additional storage areas and the infiltration pond, and industrial developments lay to the east and south.

#### EXISTING OFFICE BASIN

In the current condition the 0.84 acre basin has the following areas:

Forest	0.84 ac
--------	---------

The existing site flow frequency runoff rates are:

2 year	0.0009 cfs
--------	------------

10 year	0.003 cfs
100 year	0.013 cfs

See WWHM2012 report in Appendix B.

#### SOILS DESCRIPTION

According to the Natural Resources Conservation Service Web Soil Survey Map the soils on-site are classified as Everett Gravelly Sandy Loam. This very deep, somewhat excessively drained soil is found on terraces and outwash plains and is formed in glacial outwash. Typically, the surface layer is dark brown gravelly sandy loam about 6 inches thick. The subsoil is dark brown very gravelly sandy loam about 12 inches thick. The upper part of the substratum is brown very gravelly loamy sand about 5 inches thick. The lower part to a depth of 60 inches or more is dark brown extremely gravelly sand. The DOE Manual defines Everett soil as a hydrologic group A soil. The NRCS Web Soil Survey map is included in Appendix A.

Geotest has prepared a geotechnical study for the site titled *Geotechnical Evaluation Report - Construction Office and Scale Relocation* dated November 25, 2020. The report documented their subsurface findings and provided design recommendations. They evaluated the underlying soils for infiltration and recommended a design infiltration rate of 10"/hr. See their report for more information.

#### UPSTREAM ANALYSIS

There is no significant upstream area that flows onto the site. To the north lays Cemetery Road with roadside ditches that prevent runoff from entering the site. To the east are industrial sites with their own storm systems. To the south is the Arlington Airport and to the west is other property owned by Reece.

#### DOWNSTREAM ANALYSIS

Runoff from the site is collected and flows to an onsite storm system and then to the infiltration pond located on the adjacent property to the west. Runoff from the scale house will be dispersed and flow to the existing storm system and infiltration pond. The proposed office building and parking lot runoff will be collected, treated and infiltrated in a new infiltration trench. As such there is no surface flow discharge from the site.

**MR 2: SWPPP NARRATIVE**

This proposed project will result in greater than 1 acre of disturbed are and will require a Department of Ecology Construction Stormwater General Permit. A Full SWPPP Narrative using the DOE template is provided under separate cover

### **MR 3: WATER POLLUTION SOURCE CONTROL**

#### **CONSTRUCTION STORMWATER BMPs**

A Stormwater Pollution Prevention Plan, SWPPP, is part of the construction drawings prepared for the project, and specifies many of the following erosion control Best Management Practices:

- BMP C102, Buffer Zones
- BMP C103, High Visibility Fence
- BMP C105, Construction Entrance
- BMP C107 Construction Road/Parking Area Stabilization
- BMP C120, Temporary and Permanent Seeding
- BMP C121, Mulching
- BMP C123, Plastic Covering
- BMP C125, Top soiling/Composting
- BMP C130, Surface Roughening
- BMP C140, Dust Control
- BMP C150, Materials on Hand
- BMP C153, Material Storage
- BMP C160, Certified Erosion and Sediment Control Lead
- BMP C200, Interceptor Dike and Swale
- BMP C207, Check Dams
- BMP C209, Outlet Protection
- BMP C220, Storm Inlet Protection
- BMP C233, Silt Fence

#### **PERMANENT SOURCE CONTROL BMPs**

The site is subject to ongoing Source Control BMPs as part of the current site operations DOE NPDES permitting. No additional BMPs will be required as a result of the proposed site improvements. Typical BMPs associated with an office building are:

- Stormwater system maintenance
- Vegetation Management
- Street Sweeping
- Maintenance of dumpsters

#### **MR 4: PRESERVATION OF NATURAL DRAINAGE**

Runoff from the site sheet flows to the central lower area of the site, where several catch basins collect runoff and convey it to an existing infiltration pond located on the adjacent property to the west. In the developed condition runoff from the Office Basin will be collected, treated and infiltrated in a new trench located under the proposed parking lot. Runoff from the Scale Building basin will be brought to splash blocks and then flow to the existing storm system. With infiltration being the existing and proposed methods of controlling stormwater runoff the existing drainage will be preserved. Note that with implementation of the new infiltration facility that the total amount of runoff flowing to the existing infiltration pond will be reduced somewhat.

### **MR 5: ON-SITE STORMWATER MANAGEMENT**

As the site is located in the City of Arlington and will be required to meet MR #1-9, it can achieve MR 5 requirement either through the use of List #2 or by meeting the Low Impact Development Performance Standard. With infiltration of the site runoff, the site meets the Low Impact Development Performance Standard.

Runoff from the different site areas will be managed as follows:

#### **LAWN AND LANDSCAPED AREAS:**

BMP T5.13 Post Construction Soil Quality and Depth will be implemented on disturbed and landscaped areas. It is expected that most disturbed soil will be covered with new impervious. Select site topsoil or imported topsoil will be used for those small areas where pervious surfaces need restoration.

#### **ROOF AREAS:**

##### **Item #1: Full Dispersion or Downspout Full Infiltration**

The site is underlain by sands and gravels. As such the roof runoff will be collected and infiltrated in the trench to be located under the southwest corner of the parking lot.

#### **PAVEMENT AREAS:**

##### **Item #1: Full Dispersion or Full Infiltration**

The site is underlain by sands and gravels. As such the parking lot runoff will be collected, treated and infiltrated in the trench to be located under the southwest corner of the parking lot.

## **MR 6: RUNOFF TREATMENT**

With more than 5,000 sf of pollution generating impervious surface the site requires runoff treatment.

**Oil Control:** The site does not meet the threshold of 100 vehicles per day/1,000 sf of building area.

**Phosphorous Control:** We have reviewed the 303d listing and there are no water bodies listed in the local area. There is no City requirement for Phosphorous Control.

**Enhanced Treatment:** Enhanced treatment is required when a commercial site discharges directly to fresh waters or conveyance systems tributary to fresh waters designated for aquatic life use or that have an existing aquatic life use. Enhanced treatment will be required.

### **OFFICE BASIN TREATMENT FACILITY**

The Filterra Treatment System has been chosen to meet the runoff treatment requirements for the site runoff. The system has Department of Ecology GULD approval for enhanced treatment.

### **FILTERRA OPERATION**

Stormwater runoff enters the Filterra bioretention system from SDCB #4 then filters through a specially designed bioretention filter media mixture contained in a landscaped concrete container. The filter media captures and immobilizes pollutants; those pollutants are then decomposed, volatilized and incorporated into the biomass of the Filterra system's micro/macro fauna and flora. Stormwater runoff flows through the media and into an underdrain system at the bottom of the container, where the treated water is discharged.

### **FILTERRA SIZING**

Treatment facility has been performed using WWHM2012 with the parameters based on Contech's approved media, see output in Appendix B. The facility will be located near the southwest corner of the parking lot and will drain to the infiltration trench. The required Filterra filter bed size, required runoff treatment percentage and actual runoff treatment percentage are listed below. See WWHM2012 report for sizing calculations in Appendix B.

Filterra Size, feet	6'x4'
Required Treatment	91%
Percent Treated	96.0%

## **MR 7: FLOW CONTROL**

The site redevelopment will result in more than 10,000 sf of new and new or replaced impervious surface and will require construction of a flow control facility.

### **OFFICE BASIN FLOW CONTROL FACILITY**

In the developed condition, the basin has the following land uses and areas.

Landscaping	0.08 ac
Asphalt	0.58 ac
Concrete	0.07 ac
Roof	0.11 ac

An infiltration trench will be used to provide flow control. The trench will be located under the southwest corner of the parking area receive flow from the Filterra treatment facility. The infiltration trench will have the following parameters:

#### **Trench Parameters**

Length:	80 feet
Width:	20 feet
Depth:	2.5 feet
Infiltration Rate:	10 inch/hour
% Infiltrated:	100%

For drainage basin input parameters and flow frequency calculations, input parameters and flow duration analysis see WWHM2012 report in Appendix B.

### **GROUNDWATER**

The geotechnical report includes several soil logs to a depth of about 8 feet. No groundwater was noted in the soil logs. The geotechnical report, see page 6, goes on to reference Department of Ecology and other information showing the regional groundwater is 60-70 feet below the ground surface. The bottom of the proposed infiltration trench is elevation 112 and the existing ground at that location is about 117. This provides about 3 feet of separation from the bottom of the trench to the limits of the onsite excavations and likely more than 50 feet to groundwater.

### **SCALE BUILDING BASIN**

The area to contain the scale building and access loop is currently fully impervious and currently flows to existing catch basins, then to an infiltration pond to the northwest. The scale house building is only 820 sf and it is proposed that splash blocks be used to disperse runoff to the adjacent gravel area. Runoff from the paving of the existing access loop will continue to sheet flow to the existing catch basins and infiltration pond.

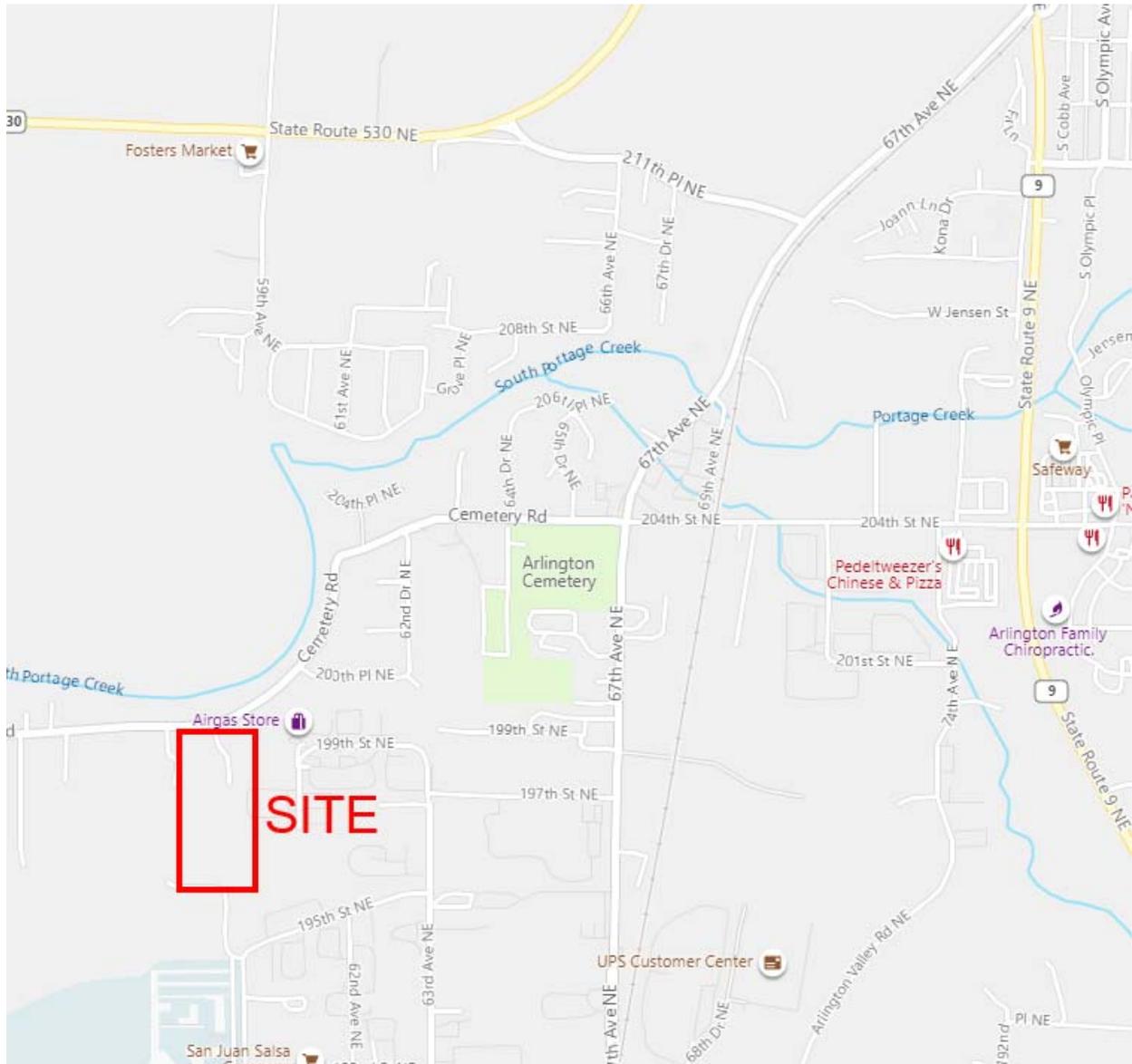
**MR 8: WETLANDS PROTECTION**

There are no known wetlands, streams or other critical areas on the site.

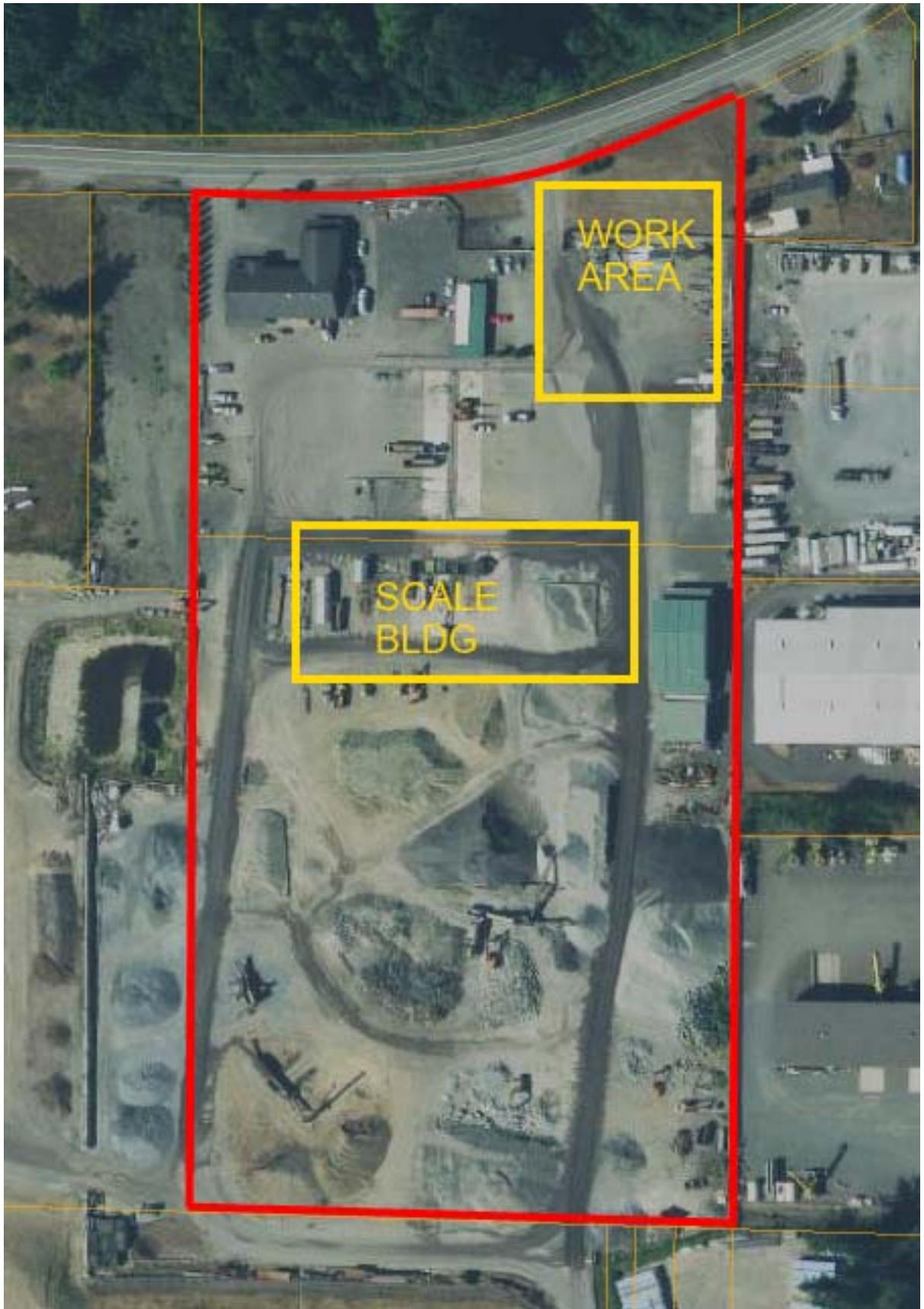
### **MR 9: OPERATION AND MAINTENANCE**

The specific requirements for the ongoing operation and maintenance of the proposed storm water systems is detailed in a separate Operation and Maintenance Manual submitted with the construction drawings, under separate cover.

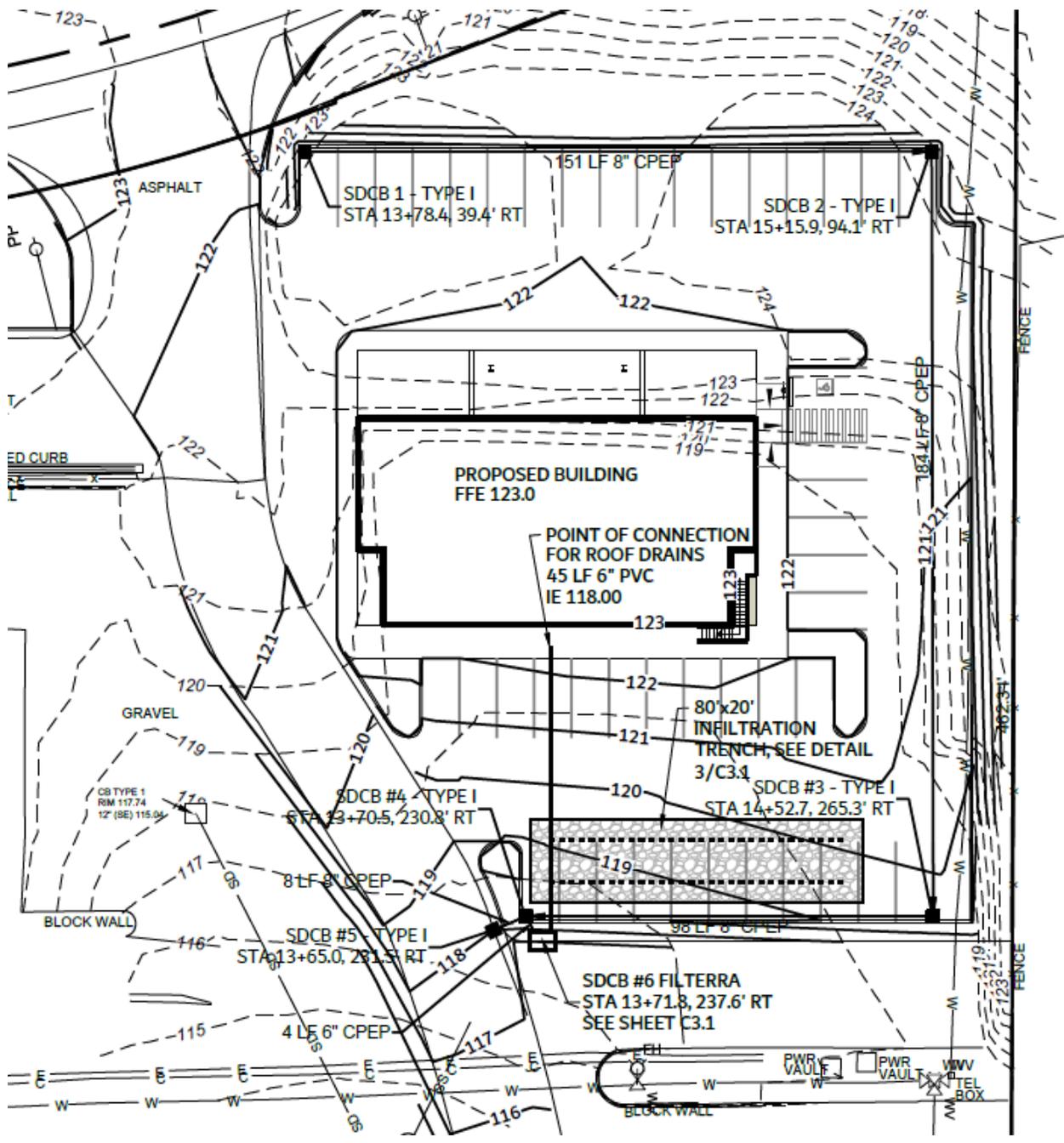
## **FIGURES & BASIN MAPS**



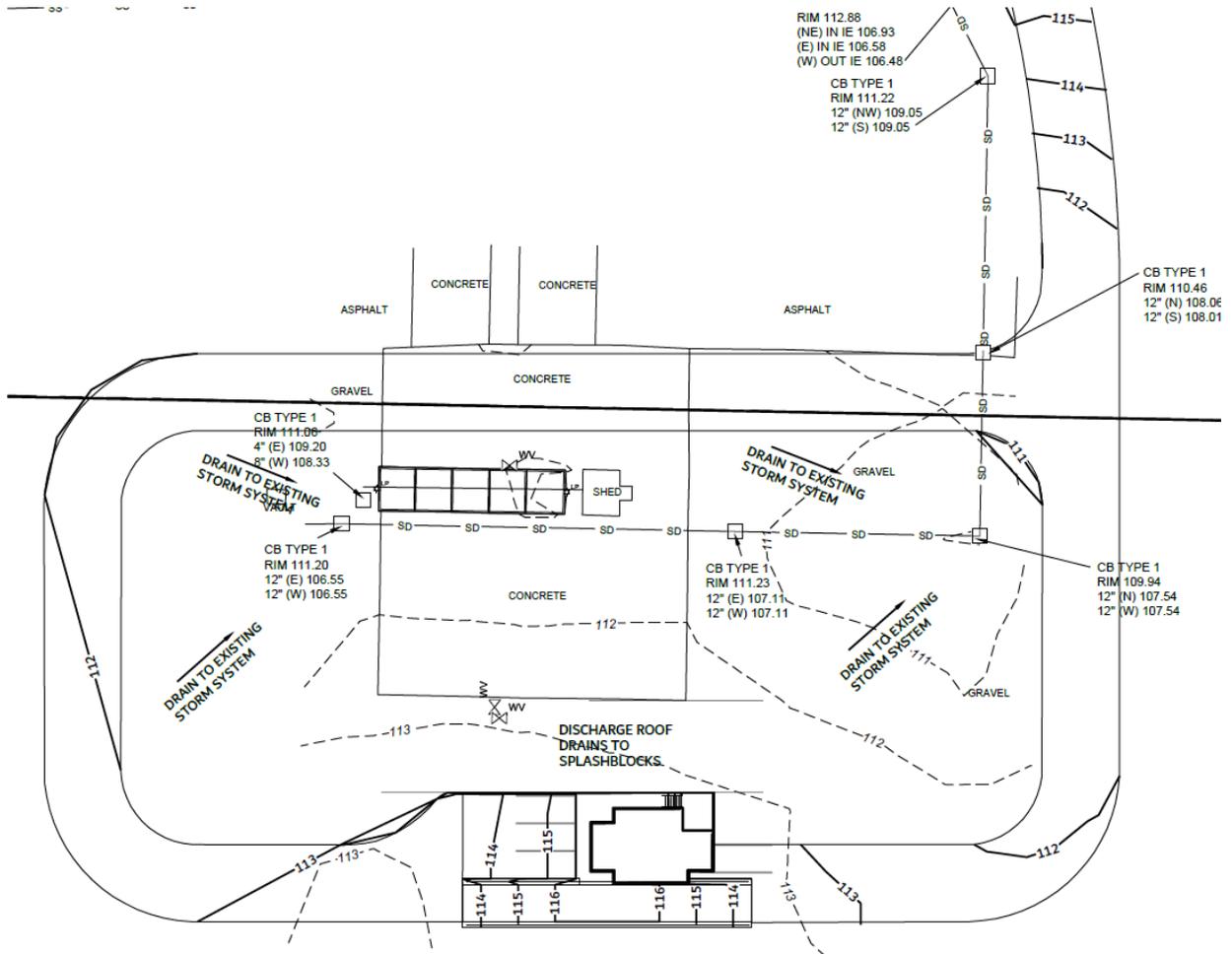
**FIGURE 1: VICINITY MAP**



**FIGURE 2: EXISTING SITE MAP**

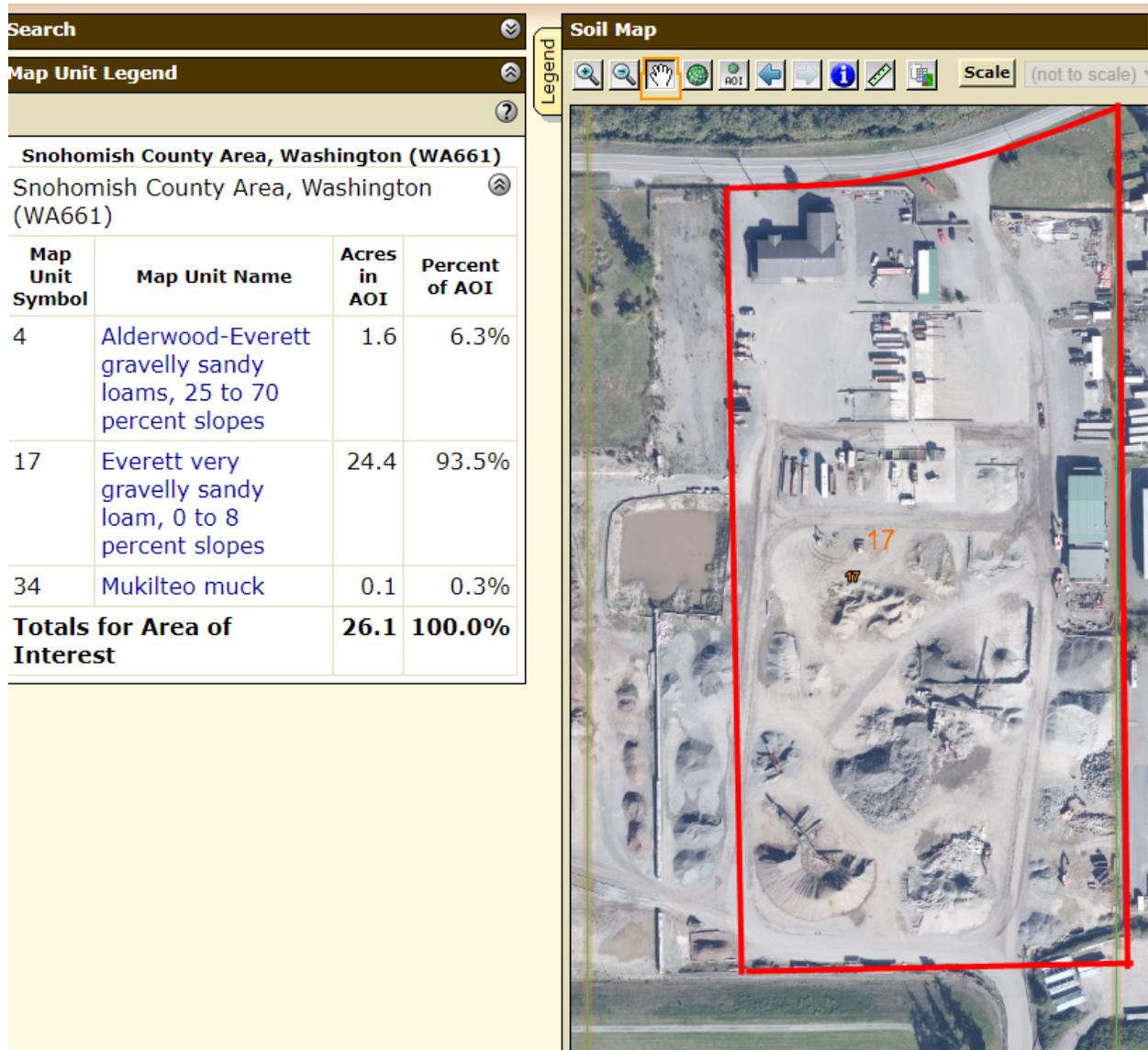


**FIGURE 3A: OFFICE AREA DEVELOPED SITE MAP**



**FIGURE 3B: SCALE HOUSE AREA DEVELOPED SITE MAP**

**APPENDIX A**  
**SCS SOILS MAP & DESCRIPTION**



SCS SOILS MAP

## 17—Everett very gravelly sandy loam, 0 to 8 percent slopes

### Map Unit Setting

*National map unit symbol:* 2t629

*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:* Eskers, moraines, kames

*Landform position (two-dimensional):* Summit, shoulder

*Landform position (three-dimensional):* Crest, interfluvium

*Down-slope shape:* Convex

*Across-slope shape:* Convex

*Parent material:* Sandy and gravelly glacial outwash

#### Typical profile

*O<sub>i</sub> - 0 to 1 inches:* slightly decomposed plant material

*A - 1 to 3 inches:* very gravelly sandy loam

*B<sub>w</sub> - 3 to 24 inches:* very gravelly sandy loam

*C<sub>1</sub> - 24 to 35 inches:* very gravelly loamy sand

*C<sub>2</sub> - 35 to 60 inches:* extremely cobbly coarse sand

#### Properties and qualities

*Slope:* 0 to 8 percent

*Depth to restrictive feature:* More than 80 inches

*Drainage class:* Somewhat excessively drained

*Capacity of the most limiting layer to transmit water (K<sub>sat</sub>):* 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 capacity:* Low (about 3.2 inches)

## SCS SOILS DESCRIPTION

**APPENDIX B**  
**WWHM2012 OUTPUT**

WWHM2012  
PROJECT REPORT

---

Project Name: REECE CONSTRUCTION  
Report Date: 1/27/2021  
Gage : Everett  
Data Start : 1948/10/01  
Data End : 2009/09/30  
Precip Scale: 1.20  
Version Date: 2019/09/13  
Version : 4.2.17

---

Low Flow Threshold for POC 1 : 50 Percent of the 2 Year  
High Flow Threshold for POC 1: 50 year

---

PREDEVELOPED LAND USE

Name : Basin 1  
Bypass: No  
GroundWater: No

<u>Pervious Land Use</u>	<u>acre</u>
A B, Forest, Flat	.84
Pervious Total	0.84
<u>Impervious Land Use</u>	<u>acre</u>
Impervious Total	0
Basin Total	0.84

Element Flows To:  
Surface                      Interflow                      Groundwater

---

MITIGATED LAND USE

Name : Basin 1  
Bypass: No  
GroundWater: No

<u>Pervious Land Use</u>	<u>acre</u>
C, Lawn, Flat	.08
Pervious Total	0.08
<u>Impervious Land Use</u>	<u>acre</u>
ROOF TOPS FLAT	0.11
DRIVEWAYS FLAT	0.58
SIDEWALKS FLAT	0.07
Impervious Total	0.76
Basin Total	0.84

Element Flows To:  
Surface                      Interflow                      Groundwater  
Sand Filter 1                      Sand Filter 1

---

**Name** : Sand Filter 1 (FILTERRA)  
**Bottom Length:** 4.00 ft.  
**Bottom Width:** 6.00 ft.  
**Depth:** 0.85 ft.  
**Side slope 1:** 0 To 1  
**Side slope 2:** 0 To 1  
**Side slope 3:** 0 To 1  
**Side slope 4:** 0 To 1  
**Filtration On**  
**Hydraulic conductivity:** 175  
**Depth of filter medium:** 1.8  
**Total Volume Infiltrated (ac-ft.):** 139.84  
**Total Volume Through Riser (ac-ft.):** 5.832  
**Total Volume Through Facility (ac-ft.):** 145.672  
**Percent Infiltrated:** 96  
**Total Precip Applied to Facility:** 0  
**Total Evap From Facility:** 0  
**Discharge Structure**  
**Riser Height:** 0.7 ft.  
**Riser Diameter:** 100 in.

**Element Flows To:**  
**Outlet 1**                      **Outlet 2**  
 Gravel Trench Bed 1      Gravel Trench Bed 1

**Sand Filter Hydraulic Table**

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.000551	0.000000	0.000	0.000
0.0094	0.000551	0.000005	0.000	0.097
0.0189	0.000551	0.000010	0.000	0.098
0.0283	0.000551	0.000016	0.000	0.098
0.0378	0.000551	0.000021	0.000	0.099
0.0472	0.000551	0.000026	0.000	0.099
0.0567	0.000551	0.000031	0.000	0.100
0.0661	0.000551	0.000036	0.000	0.100
0.0756	0.000551	0.000042	0.000	0.101
0.0850	0.000551	0.000047	0.000	0.101
0.0944	0.000551	0.000052	0.000	0.102
0.1039	0.000551	0.000057	0.000	0.102
0.1133	0.000551	0.000062	0.000	0.103
0.1228	0.000551	0.000068	0.000	0.103
0.1322	0.000551	0.000073	0.000	0.104
0.1417	0.000551	0.000078	0.000	0.104
0.1511	0.000551	0.000083	0.000	0.105
0.1606	0.000551	0.000088	0.000	0.105
0.1700	0.000551	0.000094	0.000	0.106
0.1794	0.000551	0.000099	0.000	0.106
0.1889	0.000551	0.000104	0.000	0.107
0.1983	0.000551	0.000109	0.000	0.107
0.2078	0.000551	0.000114	0.000	0.108
0.2172	0.000551	0.000120	0.000	0.109
0.2267	0.000551	0.000125	0.000	0.109
0.2361	0.000551	0.000130	0.000	0.110
0.2456	0.000551	0.000135	0.000	0.110
0.2550	0.000551	0.000140	0.000	0.111
0.2644	0.000551	0.000146	0.000	0.111
0.2739	0.000551	0.000151	0.000	0.112
0.2833	0.000551	0.000156	0.000	0.112
0.2928	0.000551	0.000161	0.000	0.113
0.3022	0.000551	0.000167	0.000	0.113
0.3117	0.000551	0.000172	0.000	0.114
0.3211	0.000551	0.000177	0.000	0.114

0.3306	0.000551	0.000182	0.000	0.115
0.3400	0.000551	0.000187	0.000	0.115
0.3494	0.000551	0.000193	0.000	0.116
0.3589	0.000551	0.000198	0.000	0.116
0.3683	0.000551	0.000203	0.000	0.117
0.3778	0.000551	0.000208	0.000	0.117
0.3872	0.000551	0.000213	0.000	0.118
0.3967	0.000551	0.000219	0.000	0.118
0.4061	0.000551	0.000224	0.000	0.119
0.4156	0.000551	0.000229	0.000	0.119
0.4250	0.000551	0.000234	0.000	0.120
0.4344	0.000551	0.000239	0.000	0.120
0.4439	0.000551	0.000245	0.000	0.121
0.4533	0.000551	0.000250	0.000	0.121
0.4628	0.000551	0.000255	0.000	0.122
0.4722	0.000551	0.000260	0.000	0.122
0.4817	0.000551	0.000265	0.000	0.123
0.4911	0.000551	0.000271	0.000	0.123
0.5006	0.000551	0.000276	0.000	0.124
0.5100	0.000551	0.000281	0.000	0.124
0.5194	0.000551	0.000286	0.000	0.125
0.5289	0.000551	0.000291	0.000	0.125
0.5383	0.000551	0.000297	0.000	0.126
0.5478	0.000551	0.000302	0.000	0.126
0.5572	0.000551	0.000307	0.000	0.127
0.5667	0.000551	0.000312	0.000	0.127
0.5761	0.000551	0.000317	0.000	0.128
0.5856	0.000551	0.000323	0.000	0.128
0.5950	0.000551	0.000328	0.000	0.129
0.6044	0.000551	0.000333	0.000	0.129
0.6139	0.000551	0.000338	0.000	0.130
0.6233	0.000551	0.000343	0.000	0.130
0.6328	0.000551	0.000349	0.000	0.131
0.6422	0.000551	0.000354	0.000	0.131
0.6517	0.000551	0.000359	0.000	0.132
0.6611	0.000551	0.000364	0.000	0.132
0.6706	0.000551	0.000369	0.000	0.133
0.6800	0.000551	0.000375	0.000	0.134
0.6894	0.000551	0.000380	0.000	0.134
0.6989	0.000551	0.000385	0.000	0.135
0.7083	0.000551	0.000390	0.067	0.135
0.7178	0.000551	0.000395	0.209	0.136
0.7272	0.000551	0.000401	0.397	0.136
0.7367	0.000551	0.000406	0.621	0.137
0.7461	0.000551	0.000411	0.876	0.137
0.7556	0.000551	0.000416	1.158	0.138
0.7650	0.000551	0.000421	1.466	0.138
0.7744	0.000551	0.000427	1.797	0.139
0.7839	0.000551	0.000432	2.149	0.139
0.7933	0.000551	0.000437	2.522	0.140
0.8028	0.000551	0.000442	2.914	0.140
0.8122	0.000551	0.000448	3.325	0.141
0.8217	0.000551	0.000453	3.753	0.141
0.8311	0.000551	0.000458	4.198	0.142
0.8406	0.000551	0.000463	4.660	0.142
0.8500	0.000551	0.000468	5.137	0.143

---

**Name** : Gravel Trench Bed 1  
**Bottom Length:** 80.00 ft.  
**Bottom Width:** 20.00 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:** 2.5  
**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:** 10  
**Infiltration safety factor:** 1  
**Total Volume Infiltrated (ac-ft.):** 145.669  
**Total Volume Through Riser (ac-ft.):** 0.002  
**Total Volume Through Facility (ac-ft.):** 145.67  
**Percent Infiltrated:** 100  
**Total Precip Applied to Facility:** 0  
**Total Evap From Facility:** 0  
**Discharge Structure**  
**Riser Height:** 2.5 ft.  
**Riser Diameter:** 24 in.

**Element Flows To:**  
**Outlet 1**                      **Outlet 2**

---

**Gravel Trench Bed Hydraulic Table**

<u>Stage(feet)</u>	<u>Area(ac.)</u>	<u>Volume(ac-ft.)</u>	<u>Discharge(cfs)</u>	<u>Infilt(cfs)</u>
0.0000	0.036	0.000	0.000	0.000
0.0333	0.036	0.000	0.000	0.370
0.0667	0.036	0.001	0.000	0.370
0.1000	0.036	0.001	0.000	0.370
0.1333	0.036	0.002	0.000	0.370
0.1667	0.036	0.002	0.000	0.370
0.2000	0.036	0.002	0.000	0.370
0.2333	0.036	0.003	0.000	0.370
0.2667	0.036	0.003	0.000	0.370
0.3000	0.036	0.004	0.000	0.370
0.3333	0.036	0.004	0.000	0.370
0.3667	0.036	0.005	0.000	0.370
0.4000	0.036	0.005	0.000	0.370
0.4333	0.036	0.006	0.000	0.370
0.4667	0.036	0.006	0.000	0.370
0.5000	0.036	0.007	0.000	0.370
0.5333	0.036	0.007	0.000	0.370
0.5667	0.036	0.008	0.000	0.370
0.6000	0.036	0.008	0.000	0.370
0.6333	0.036	0.009	0.000	0.370
0.6667	0.036	0.009	0.000	0.370
0.7000	0.036	0.010	0.000	0.370
0.7333	0.036	0.010	0.000	0.370
0.7667	0.036	0.011	0.000	0.370
0.8000	0.036	0.011	0.000	0.370
0.8333	0.036	0.012	0.000	0.370
0.8667	0.036	0.012	0.000	0.370
0.9000	0.036	0.013	0.000	0.370
0.9333	0.036	0.013	0.000	0.370
0.9667	0.036	0.014	0.000	0.370
1.0000	0.036	0.014	0.000	0.370
1.0333	0.036	0.015	0.000	0.370

1.0667	0.036	0.015	0.000	0.370
1.1000	0.036	0.016	0.000	0.370
1.1333	0.036	0.016	0.000	0.370
1.1667	0.036	0.017	0.000	0.370
1.2000	0.036	0.017	0.000	0.370
1.2333	0.036	0.018	0.000	0.370
1.2667	0.036	0.018	0.000	0.370
1.3000	0.036	0.019	0.000	0.370
1.3333	0.036	0.019	0.000	0.370
1.3667	0.036	0.020	0.000	0.370
1.4000	0.036	0.020	0.000	0.370
1.4333	0.036	0.021	0.000	0.370
1.4667	0.036	0.021	0.000	0.370
1.5000	0.036	0.022	0.000	0.370
1.5333	0.036	0.022	0.000	0.370
1.5667	0.036	0.023	0.000	0.370
1.6000	0.036	0.023	0.000	0.370
1.6333	0.036	0.024	0.000	0.370
1.6667	0.036	0.024	0.000	0.370
1.7000	0.036	0.025	0.000	0.370
1.7333	0.036	0.025	0.000	0.370
1.7667	0.036	0.026	0.000	0.370
1.8000	0.036	0.026	0.000	0.370
1.8333	0.036	0.026	0.000	0.370
1.8667	0.036	0.027	0.000	0.370
1.9000	0.036	0.027	0.000	0.370
1.9333	0.036	0.028	0.000	0.370
1.9667	0.036	0.028	0.000	0.370
2.0000	0.036	0.029	0.000	0.370
2.0333	0.036	0.029	0.000	0.370
2.0667	0.036	0.030	0.000	0.370
2.1000	0.036	0.030	0.000	0.370
2.1333	0.036	0.031	0.000	0.370
2.1667	0.036	0.031	0.000	0.370
2.2000	0.036	0.032	0.000	0.370
2.2333	0.036	0.032	0.000	0.370
2.2667	0.036	0.033	0.000	0.370
2.3000	0.036	0.033	0.000	0.370
2.3333	0.036	0.034	0.000	0.370
2.3667	0.036	0.034	0.000	0.370
2.4000	0.036	0.035	0.000	0.370
2.4333	0.036	0.035	0.000	0.370
2.4667	0.036	0.036	0.000	0.370
2.5000	0.036	0.037	0.000	0.370
2.5333	0.036	0.038	0.129	0.370
2.5667	0.036	0.039	0.365	0.370
2.6000	0.036	0.041	0.670	0.370
2.6333	0.036	0.042	1.030	0.370
2.6667	0.036	0.043	1.438	0.370
2.7000	0.036	0.044	1.886	0.370
2.7333	0.036	0.046	2.369	0.370
2.7667	0.036	0.047	2.883	0.370
2.8000	0.036	0.048	3.421	0.370
2.8333	0.036	0.049	3.979	0.370
2.8667	0.036	0.050	4.552	0.370
2.9000	0.036	0.052	5.134	0.370
2.9333	0.036	0.053	5.721	0.370
2.9667	0.036	0.054	6.307	0.370
3.0000	0.036	0.055	6.887	0.370

---

---

ANALYSIS RESULTS

Stream Protection Duration

---

Predeveloped Landuse Totals for POC #1  
Total Pervious Area:0.84  
Total Impervious Area:0

---

Mitigated Landuse Totals for POC #1  
Total Pervious Area:0.08  
Total Impervious Area:0.76

---

Flow Frequency Return Periods for Predeveloped. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0.000964
5 year	0.002091
10 year	0.003354
25 year	0.005858
50 year	0.008657
100 year	0.012557

Flow Frequency Return Periods for Mitigated. POC #1

<u>Return Period</u>	<u>Flow(cfs)</u>
2 year	0
5 year	0
10 year	0
25 year	0
50 year	0
100 year	0

---

Stream Protection Duration

Annual Peaks for Predeveloped and Mitigated. POC #1

<u>Year</u>	<u>Predeveloped</u>	<u>Mitigated</u>
1949	0.001	0.000
1950	0.002	0.000
1951	0.001	0.000
1952	0.001	0.000
1953	0.001	0.000
1954	0.005	0.000
1955	0.004	0.000
1956	0.001	0.000
1957	0.001	0.000
1958	0.001	0.000
1959	0.002	0.000
1960	0.001	0.000
1961	0.003	0.044
1962	0.001	0.000
1963	0.001	0.000
1964	0.002	0.000
1965	0.001	0.000
1966	0.001	0.000
1967	0.001	0.000
1968	0.001	0.000
1969	0.001	0.000
1970	0.001	0.000
1971	0.003	0.000
1972	0.001	0.000
1973	0.001	0.000

1974	0.002	0.000
1975	0.001	0.000
1976	0.002	0.000
1977	0.001	0.000
1978	0.001	0.000
1979	0.001	0.000
1980	0.001	0.000
1981	0.001	0.000
1982	0.001	0.000
1983	0.001	0.000
1984	0.001	0.000
1985	0.001	0.000
1986	0.006	0.000
1987	0.004	0.000
1988	0.001	0.000
1989	0.001	0.000
1990	0.001	0.000
1991	0.001	0.000
1992	0.001	0.000
1993	0.001	0.000
1994	0.001	0.000
1995	0.001	0.000
1996	0.008	0.000
1997	0.021	0.000
1998	0.001	0.000
1999	0.001	0.000
2000	0.001	0.000
2001	0.001	0.000
2002	0.001	0.000
2003	0.000	0.000
2004	0.001	0.000
2005	0.001	0.000
2006	0.022	0.000
2007	0.001	0.000
2008	0.001	0.000
2009	0.001	0.000

---

**Stream Protection Duration**

**Ranked Annual Peaks for Predeveloped and Mitigated. POC #1**

<b>Rank</b>	<b>Predeveloped</b>	<b>Mitigated</b>
1	0.0224	0.0443
2	0.0208	0.0000
3	0.0076	0.0000
4	0.0059	0.0000
5	0.0046	0.0000
6	0.0039	0.0000
7	0.0035	0.0000
8	0.0033	0.0000
9	0.0032	0.0000
10	0.0022	0.0000
11	0.0020	0.0000
12	0.0018	0.0000
13	0.0015	0.0000
14	0.0015	0.0000
15	0.0014	0.0000
16	0.0013	0.0000
17	0.0013	0.0000
18	0.0013	0.0000
19	0.0012	0.0000
20	0.0011	0.0000
21	0.0010	0.0000
22	0.0010	0.0000

23	0.0008	0.0000
24	0.0007	0.0000
25	0.0007	0.0000
26	0.0007	0.0000
27	0.0007	0.0000
28	0.0007	0.0000
29	0.0007	0.0000
30	0.0007	0.0000
31	0.0007	0.0000
32	0.0007	0.0000
33	0.0007	0.0000
34	0.0007	0.0000
35	0.0007	0.0000
36	0.0007	0.0000
37	0.0007	0.0000
38	0.0007	0.0000
39	0.0007	0.0000
40	0.0007	0.0000
41	0.0007	0.0000
42	0.0007	0.0000
43	0.0007	0.0000
44	0.0007	0.0000
45	0.0007	0.0000
46	0.0007	0.0000
47	0.0007	0.0000
48	0.0007	0.0000
49	0.0007	0.0000
50	0.0007	0.0000
51	0.0007	0.0000
52	0.0007	0.0000
53	0.0007	0.0000
54	0.0007	0.0000
55	0.0007	0.0000
56	0.0007	0.0000
57	0.0007	0.0000
58	0.0006	0.0000
59	0.0006	0.0000
60	0.0006	0.0000
61	0.0005	0.0000

**Stream Protection Duration**

**POC #1**

**The Facility PASSED**

**The Facility PASSED.**

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0005	2357	2	0	Pass
0.0006	1333	2	0	Pass
0.0006	434	2	0	Pass
0.0007	112	2	1	Pass
0.0008	103	2	1	Pass
0.0009	89	2	2	Pass
0.0010	77	2	2	Pass
0.0011	66	2	3	Pass
0.0011	61	2	3	Pass
0.0012	58	2	3	Pass
0.0013	54	2	3	Pass
0.0014	50	2	4	Pass
0.0015	49	2	4	Pass
0.0016	47	2	4	Pass
0.0016	43	2	4	Pass

0.0017	40	2	5	Pass
0.0018	36	2	5	Pass
0.0019	36	2	5	Pass
0.0020	32	2	6	Pass
0.0021	31	2	6	Pass
0.0021	31	2	6	Pass
0.0022	29	2	6	Pass
0.0023	29	2	6	Pass
0.0024	27	2	7	Pass
0.0025	26	2	7	Pass
0.0025	26	2	7	Pass
0.0026	26	2	7	Pass
0.0027	25	2	8	Pass
0.0028	23	2	8	Pass
0.0029	23	2	8	Pass
0.0030	23	2	8	Pass
0.0030	23	2	8	Pass
0.0031	23	2	8	Pass
0.0032	21	2	9	Pass
0.0033	19	2	10	Pass
0.0034	18	2	11	Pass
0.0035	17	2	11	Pass
0.0035	16	2	12	Pass
0.0036	16	2	12	Pass
0.0037	15	2	13	Pass
0.0038	15	2	13	Pass
0.0039	14	2	14	Pass
0.0040	13	2	15	Pass
0.0040	13	2	15	Pass
0.0041	13	2	15	Pass
0.0042	13	2	15	Pass
0.0043	13	2	15	Pass
0.0044	13	2	15	Pass
0.0044	13	2	15	Pass
0.0045	13	2	15	Pass
0.0046	13	2	15	Pass
0.0047	11	2	18	Pass
0.0048	11	2	18	Pass
0.0049	11	2	18	Pass
0.0049	11	2	18	Pass
0.0050	11	2	18	Pass
0.0051	11	2	18	Pass
0.0052	11	2	18	Pass
0.0053	11	2	18	Pass
0.0054	11	2	18	Pass
0.0054	11	2	18	Pass
0.0055	11	2	18	Pass
0.0056	11	2	18	Pass
0.0057	11	2	18	Pass
0.0058	10	2	20	Pass
0.0058	10	2	20	Pass
0.0059	9	2	22	Pass
0.0060	9	2	22	Pass
0.0061	8	2	25	Pass
0.0062	8	2	25	Pass
0.0063	8	2	25	Pass
0.0063	8	2	25	Pass
0.0064	8	2	25	Pass
0.0065	8	2	25	Pass
0.0066	8	2	25	Pass
0.0067	8	2	25	Pass
0.0068	8	2	25	Pass
0.0068	8	2	25	Pass

0.0069	8	2	25	Pass
0.0070	8	2	25	Pass
0.0071	8	2	25	Pass
0.0072	8	2	25	Pass
0.0073	8	2	25	Pass
0.0073	7	2	28	Pass
0.0074	7	2	28	Pass
0.0075	7	2	28	Pass
0.0076	7	2	28	Pass
0.0077	6	2	33	Pass
0.0077	6	2	33	Pass
0.0078	6	2	33	Pass
0.0079	6	2	33	Pass
0.0080	6	2	33	Pass
0.0081	6	2	33	Pass
0.0082	6	2	33	Pass
0.0082	6	2	33	Pass
0.0083	6	2	33	Pass
0.0084	6	2	33	Pass
0.0085	6	2	33	Pass
0.0086	5	2	40	Pass
0.0087	5	2	40	Pass

---

---