Stormwater Site Plan

PREPARED FOR:

Larson Automotive Group
1409 Alexander Avenue East
Fife, WA 98424-1109

PROJECT:

Larson River Road Storage
8424 River Road
Puyallup, WA 98371
2160102.10

PREPARED BY:

Dan Osier, PE
Project Engineer

Michael Hager, PE
Project Engineer

REVIEWED BY:

Todd C. Sawin, PE, DBIA, LEED AP
Principal

DATE:

May 2016
Revised June 2021

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Principal

DATE:

May 2016
Revised June 2021

I hereby state that this Stormwater Site Plan for the Larson River Road Storage project has been prepared by me or under my supervision, and meets the standard of care and expertise that is usual and customary in this community for professional engineers. I understand that the City of Puyallup does not and will not assume liability for the sufficiency, suitability, or performance of drainage facilities prepared by me.

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1.0 Project Overview

1.1 Purpose and Scope

This Stormwater Site Plan accompanies the site development plans for the Larson River Road Storage project, located on Tax Parcels 0420204047, 0420204059, 0420204267, 0420204282, 0420204069, 0420204063, 0420208027, 0420208030, 0420208039, 0420208040, 0420213006, 0420213038, . The site is bordered by River Road to the north, a commercial business to the northwest, multi-family housing on the northern half of the western border, land on the southern half of the western border, single-family housing south of the project site, and to the east, 15th Street NW with commercial businesses. The twelve project parcels combine to be approximately 7.47 acres, and almost the entire area is to be disturbed. Refer to Appendix A, Figure A-1 for a Vicinity Map.

This Stormwater Site Plan is for storm drainage approval. This report describes the design and analysis of the basic treatment and storm conveyance facilities proposed as part of the site improvements. This report will demonstrate that the stormwater design for this project will meet the requirements of the 2005 Department of Ecology (DOE) *Stormwater Management Manual for Western Was*

This is a part for stormwater and FH infrastructure. Not to be paved due to zoining issues. SSP expanded to include this information

Still a part?

1.2 Existing Con

1.2.1 Existing Site Features

The existing area is approximately 7.47 acres and is currently developed and undeveloped land cover. Two parcels are in use as a parking lot, these total 1.93 acres. One parcel is undeveloped, grass cover (0.93 acres). Four lots are residential house lots (0.80 acres) with approximately 45% impervious coverage. And the other 5 lots are the commercial businesses fronting River Road and 15th (3.81 acres) with approximately 95% impervious coverage.

There is a slight depression on the undeveloped land in the middle, southern part of the project. The lots used as parking are to the west of this depression and sheet flow towards the depression. There is a conveyance system at the southern property line along these parcels that also collects runoff in several catch basins. The undeveloped and parking lot parcels have existing stormwater conveyance system, but it is in poor condition and the ultimate discharge location of this area is not known, it appears that stormwater likely ponds until it infiltrates onsite. A topographic survey of the project site area was prepared by AHBL that shows existing site conditions and elevations. See Appendix A, Exhibit A-2 for the Existing Conditions Map.

1.2.2 Soils

The Natural Resources Conservation Service (NRCS) classifies the onsite soils as entirely Puyallup fine sandy loam – 31A. Appendix A, Exhibit A-4 provides the NRCS soil map. Puyallup fine sandy loam soils are classified as hydrologic soil Series C, which typically have low erosion and moderate infiltration potential.

In addition to the NRCS information, South Sound Geotechnical Consulting prepared a geotechnical report for the site. On March 30, 2016, four test pits and two infiltration test holes were completed. Based on the results of the infiltration testing, long-term infiltration rates were estimated to be 0.08 to 0.11 inch per hour. Due to the presence of these unfavorable soil conditions and high groundwater (encountered between 4.5 and 5.5 feet below existing grade), infiltration is not a suitable discharge option.

See Appendix B for the Geotechnical Engineering Report.

1.3 Proposed Conditions Summary

The proposed improvements include demolition of existing residential houses and driveways. The commercial buildings will all be kept. Storm Conveyance, grading, paving and striping construction will build a large parking for vehicle storage area. This paved area shall be collected in a new collection system. The system will drain to the southeast of the site into a water quality storm cartridge structure prior to discharging east to the existing storm trunk line located below 15th Street NW. Since this existing trunk line discharges directly to the Puyallup River, no flow control is required per Appendix I-E of Volume I of the *SMMWW*.

See Appendix A, Exhibit A-4, for the Developed Conditions Map.

2.0 Offsite Analysis Report

2.1 Upstream Analysis

There is no proposed upstream basin. The project parcels are bordered by River Road to the north and 15th Street NW to the East. Both of these roads have their own collection system draining away from the project. The bordering commercial and residential areas have their own stormwater management systems and do not discharge onto the project site. Per the topographic survey performed on the existing site, along with field observations, the remaining parcels that border the proposed storage lot do not discharge any significant amount of stormwater onto the project site.

2.2 Downstream Analysis

The commercial properties have onsite storm collection and conveyance systems. There were two storm sump pump stations identified in the northwest parking lot. These systems pumping north to the adjacent city system in River Road. The River Road system has a CB located on the east side of the northwest driveway entrance (STCB#1173), this CB has an 18” CMP culvert that drains north under River Road to an outlet above the Puyallup River.

The eastern parking lot drains south towards likely entering onsite depressions, the onsite storm system to the south, or connecting to the city system in 15th Street. The residential properties drain south to an existing onsite system that is in poor condition. This system draining east to the city system in 15th Street.

The undeveloped parcels and the parcels being used for parking has an existing storm drainage system in poor condition. It is unknown where the site currently discharges its stormwater. No as-built information has been found on the two project parcels, though it appears that stormwater currently ponds until it infiltrates onsite. It appears that the majority of stormwater conveyance facilities within adjacent public rights-of-way discharge north to the Puyallup River. Projects that discharge surface water runoff indirectly to the Puyallup River, through a municipal storm sewer system, are exempt from enhanced treatment and flow control requirements per Appendices I-C and I-E of the *SMMWW*. Refer to Sections 4.6 and 4.7 for information on the proposed water quality and flow control plans.

3.0 Permanent Stormwater Control Plan

This project is a new development project that includes more than 5,000 square feet of impervious surfaces; therefore, all Minimum Requirements (MR) apply to this project. Refer to Appendix A, Exhibit A-5, for the Flow Chart for Determining Requirements for Redevelopment.

The existing stormwater facilities found onsite are to be removed and will not be utilized as part of the permanent stormwater control plan. A new system is proposed to collect all stormwater generated on the project site. These catch basins shall convey runoff south to a 72-inch Contech StormFilter Manhole with seven 18-inch cartridges for water quality treatment. From this proposed manhole, runoff shall be conveyed east toward 15th Street NW, where an existing 60-inch stormwater trunk line runs north, past River Road, and discharges into the Puyallup River. As discussed above in Section 2.2, due to this indirect discharge of stormwater into the Puyallup River through a municipal storm sewer system, no flow control or enhanced treatment is required for the project site, and Basic Treatment (as defined by the *SMMWW*) is proposed. Refer to Sections 4.6 and 4.7 for more information on the proposed water quality and flow control plans.

Refer to the Developed Conditions Map (Appendix A, Exhibit A-4) for the areas used to size the proposed water quality facility, and Appendix D for the WWHM modeling used to size the proposed StormFilter system.

4.0 Summary of Minimum Requirements

4.1 MR 1 – Preparation of Stormwater Site Plans

This report and the project plans represent the Stormwater Site Plan for this project and satisfy MR 1.

4.2 MR 2 - Construction Stormwater Pollution Prevention

A Construction Stormwater Pollution Prevention Plan (CSWPPP) has been prepared to satisfy MR 2 and is included as Appendix E of this report.

4.3 MR 3 – Source Control of Pollution

The proposed project is required to provide source control of pollution. Following are proposed measures to be implemented as part of the civil plans.

- All discharges to the city storm system require City of Puyallup approval.
- All pollutants, including waste materials and demolition debris created onsite during construction, shall be handled and disposed of in a manner that does not cause contamination of surface water.
- Cover, containment, and protection from vandalism shall be provided for all chemicals, liquid products, petroleum products, and non-inert wastes present on the site (see Chapter 173-304 WAC for the definition of inert waste).
- Maintenance and repair of heavy equipment and vehicles that may result in discharge or spillage of pollutants to the ground or into surface water runoff must be conducted using spill prevention measures such as drip pans.
- Concrete Handling (BMP C151) and Sawcutting and Surfacing Pollution (BMP C152) shall be used to prevent or treat contamination of surface water runoff by pH modifying sources.

The CSWPPP provides details on the control of pollution during construction.

4.4 MR 4 – Preservation of Natural Drainage Systems and Outfalls

The existing discharge location of the project parcels is unknown due to the poor condition of the existing stormwater facilities, though it has been assumed that runoff discharges to the Puyallup River. This assumed discharge location shall be maintained under developed conditions. Under proposed conditions, treated runoff is discharged east toward 15th Street NW, where it enters the existing public drainage system. This existing, public stormwater line is a 60-inch trunk line that discharges north directly to the Puyallup River.

4.5 MR 5 – Onsite Stormwater Control

Onsite stormwater management Best Management Practices (BMPs) are not practical for the site due to native site soils, which have low infiltration rates per the attached geotechnical report. Existing trees and vegetation will be retained along the southern boundary of the site. Refer to the landscaping plans for additional information.

A 72-inch Contech StormFilter Manhole is proposed for stormwater treatment. Refer to MR 6 for more information on the proposed runoff treatment facilities. Refer to MR 7 for a narrative describing how the project site is exempt from flow control requirements.

4.6 MR 6 – Runoff Treatment

Over 5,000 square feet of pollution-generating impervious surface (PGIS) will be added as part of these improvements; therefore, water quality treatment shall be provided. Basic water quality treatment is required for this site because it discharges stormwater indirectly, through the existing 60-inch municipal storm sewer system underneath 15th Street NW, to the Puyallup River. Per Appendix I-C of the *SMMWW*, the Puyallup River is a Basic Treatment Receiving Water at the location of the project site, below the Carbon River.

4.7 MR 7 – Flow Control

The proposed stormwater system shall discharge runoff east to an existing 60-inch municipal storm sewer trunk line that runs under 15th Street NW and discharges north to the Puyallup River. Per Appendix I-E of the *SMMWW*, flow control is not required for runoff discharged, directly or indirectly, at least 0.5 mile downstream of the confluence with Kellog Creek. The project site is significantly downstream of this confluence, and therefore flow control is not required for the project site.

4.8 MR 8 – Wetland Protection

No wetlands will be affected by the proposed development. Developed runoff is discharged through a closed conveyance system to an existing municipal piped storm sewer system that runs north and discharges to the Puyallup River.

4.9 MR 9 – Operation and Maintenance

See Appendix C for a copy of the Operations and Maintenance Manual. This manual shall be readily available for inspection by the City of Puyallup. The maintenance and operations shall be the responsibility of the owner of the Larson River Road Storage project.

5.0 Construction Stormwater Pollution Prevention Plan

A Temporary Erosion Control Plan is included with the plan set, and a CSWPPP for the project is included as Appendix E of this report.

6.0 Special Reports and Studies

A geotechnical report was prepared by South Sound Geotechnical Consulting, dated May 5, 2016. Refer to Appendix B.

The project site is not within a 100-year flood plain, as seen in Appendix A, Exhibit A-6.

7.0 Other Permits

A State Environmental Policy Act (SEPA) Checklist has been completed for this project. A grading permit is required for this project by the City of Puyallup. Coverage under DOE's Construction Stormwater General Permit must be obtained.

8.0 Operations and Maintenance Manual

Refer to Appendix C for the Maintenance Standards for the proposed drainage facilities and the Maintenance Checklist for the finished project site.

9.0 Conclusion

Based on our understanding and the attached documentation, we believe the proposed improvements conform to City of Puyallup and Washington State Department of Ecology standards. We conclude that this project, as proposed, will not have adverse impacts to the site or the downstream drainage system.

This analysis is based on data and records either supplied to or obtained by AHBL. These documents are referenced within the text of the analysis. The analysis has been prepared using procedures and practices within the standard accepted practices of the industry.

AHBL, Inc.

Michael Hager, PE
Project Engineer

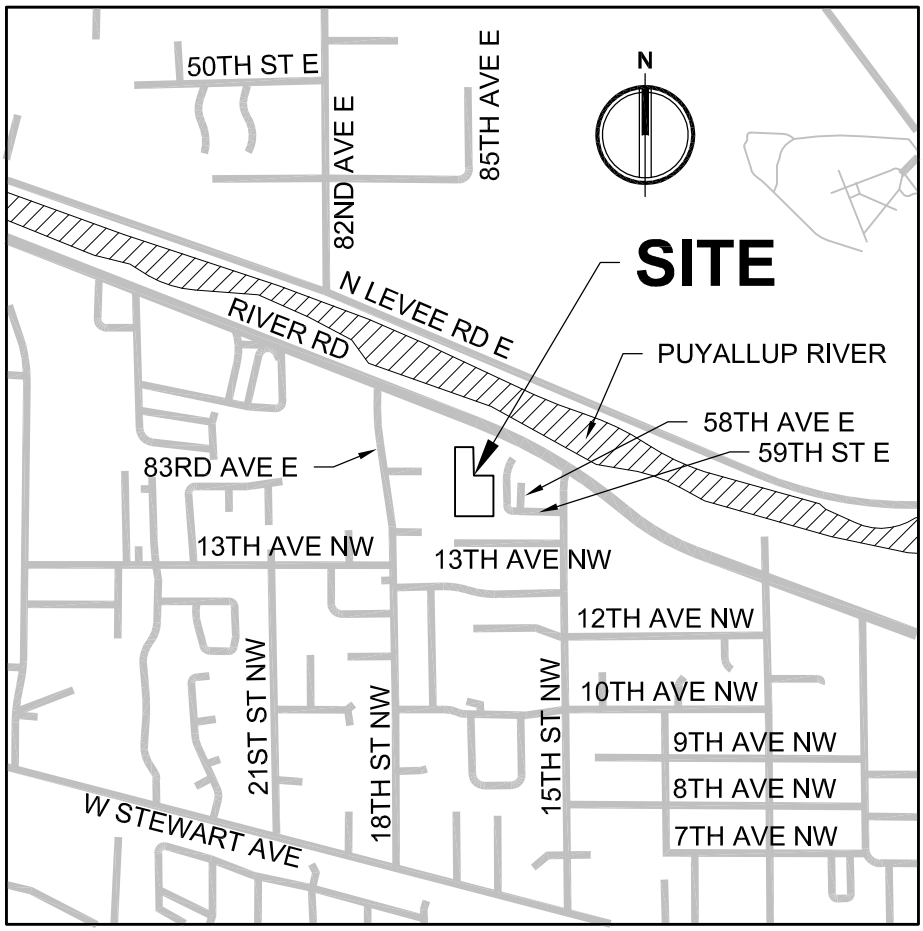
MCH/DJO/lsk

May 2016
Revised June 2021

Q:\2016\2160102\10_CIV\NON_CAD\REPORTS\SSP 20210319\20210319 Rpt (SSP) 2160102.10.docx

Appendix A

Exhibits



VICINITY MAP

SCALE: 1" = 1/4 MILE (1320')

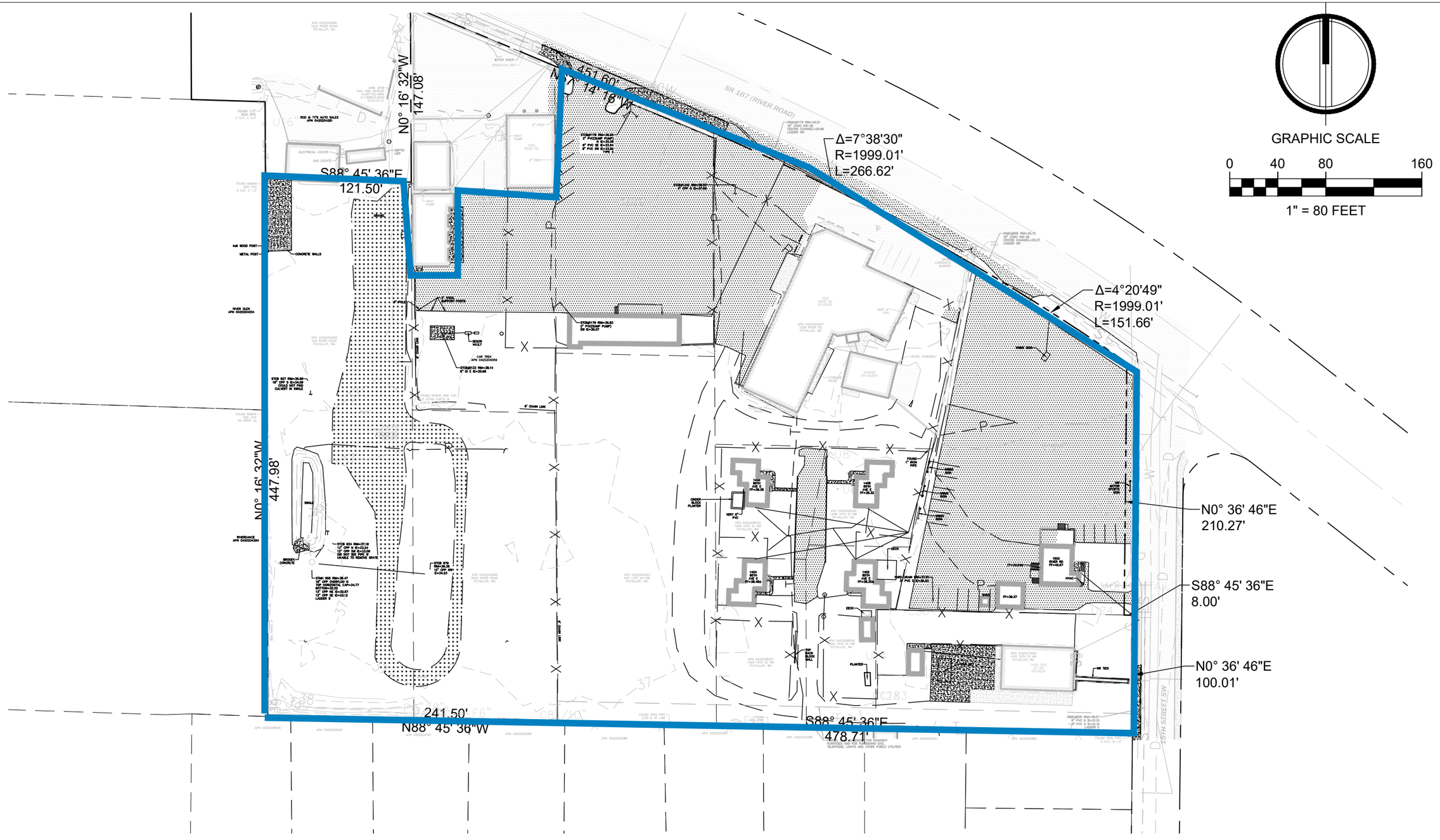
AHBL
TACOMA · SEATTLE
2215 North 30th Street, Suite 300, Tacoma, WA 98403 253.383.2422 TEL
316 Occidental Avenue South, Suite 320, Seattle, WA 98104 206.267.2425 TEL

Civil Engineers
Structural Engineers
Landscape Architects
Community Planners
Land Surveyors
Neighbors

LARSON RIVER ROAD STORATE
2160102.10

VICINITY MAP
05/06/2016

A-1



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316 Occidental Avenue South, Suite 320, Seattle, WA 98104 206.267.2425 TEL

LARSON RIVER ROAD STORAGE
2160102.10

EXISTING CONDITIONS MAP

A-2

Map Scale: 1:1,540 if printed on A landscape (11" x 8.5") sheet.

N

Meters
0 20 40 80 120

Feet
0 50 100 200 300

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

A3

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Pierce County Area, Washington
Survey Area Data: Version 16, Jun 4, 2020

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

Date(s) aerial images were photographed: Jul 29, 2018—Jul 22, 2019

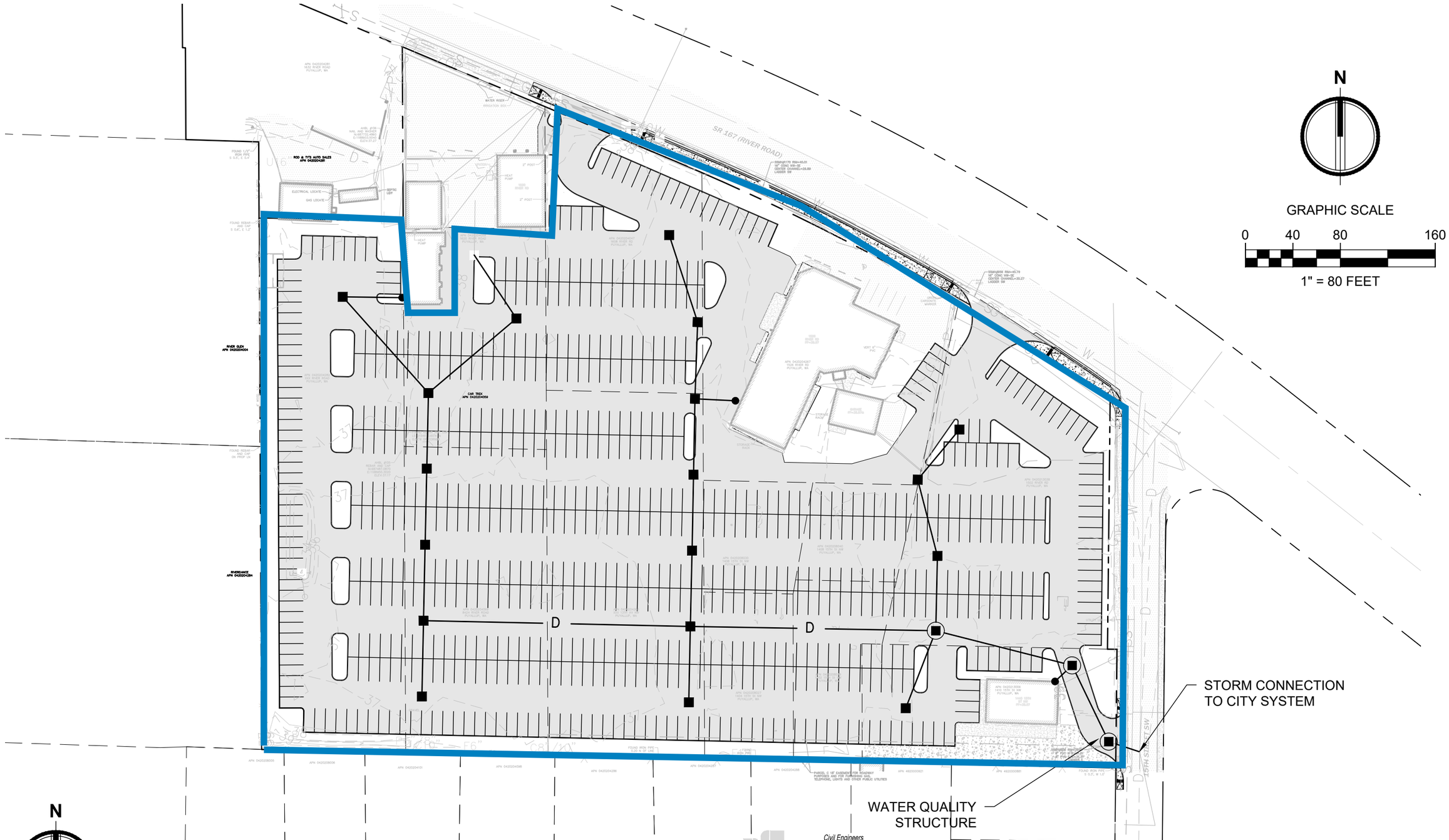
The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

A3

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
31A	Puyallup fine sandy loam	7.6	100.0%
Totals for Area of Interest		**7.6**	**100.0%**

A3



N

GRAPHIC SCALE

0 40 80 160

1" = 80 FEET

N

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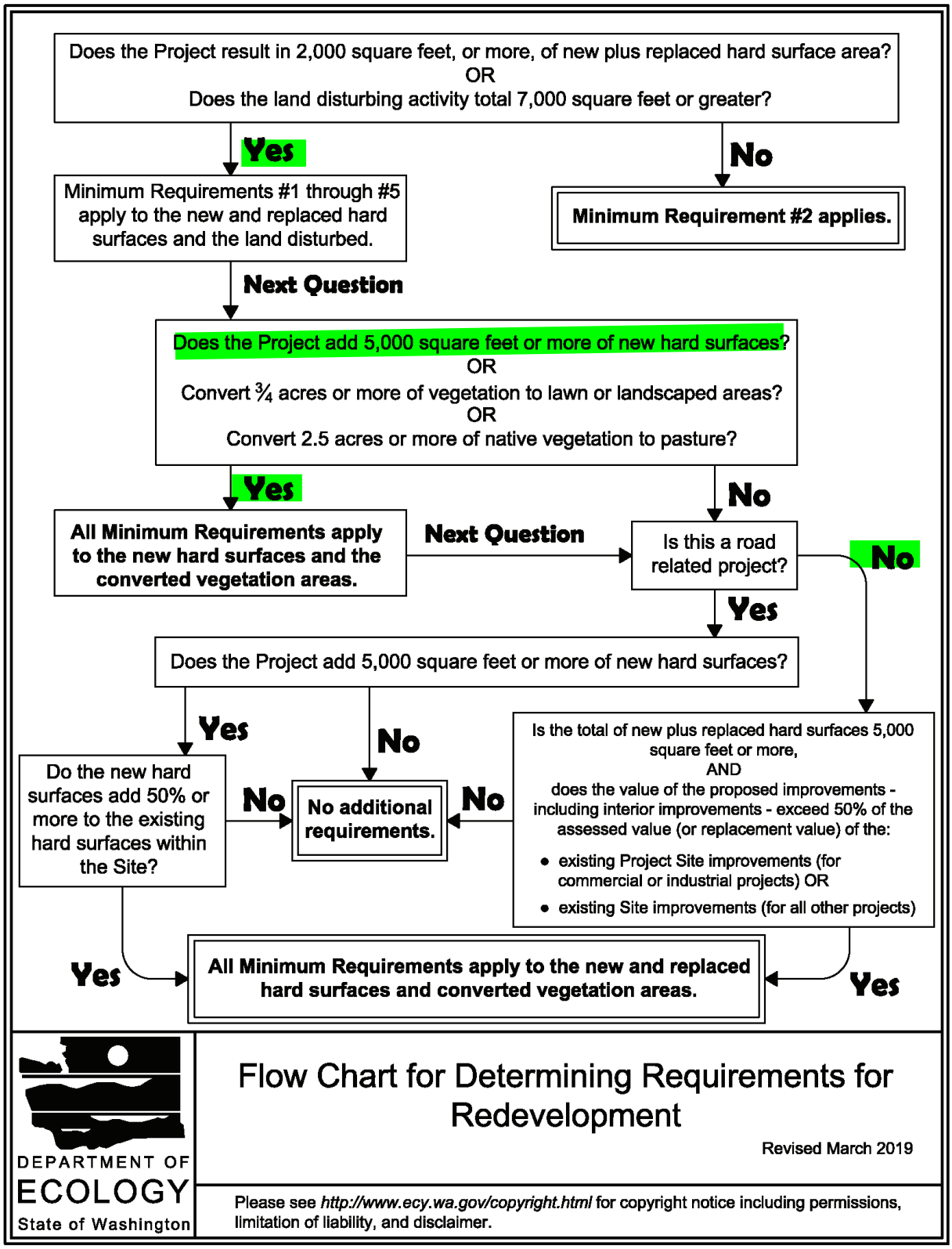
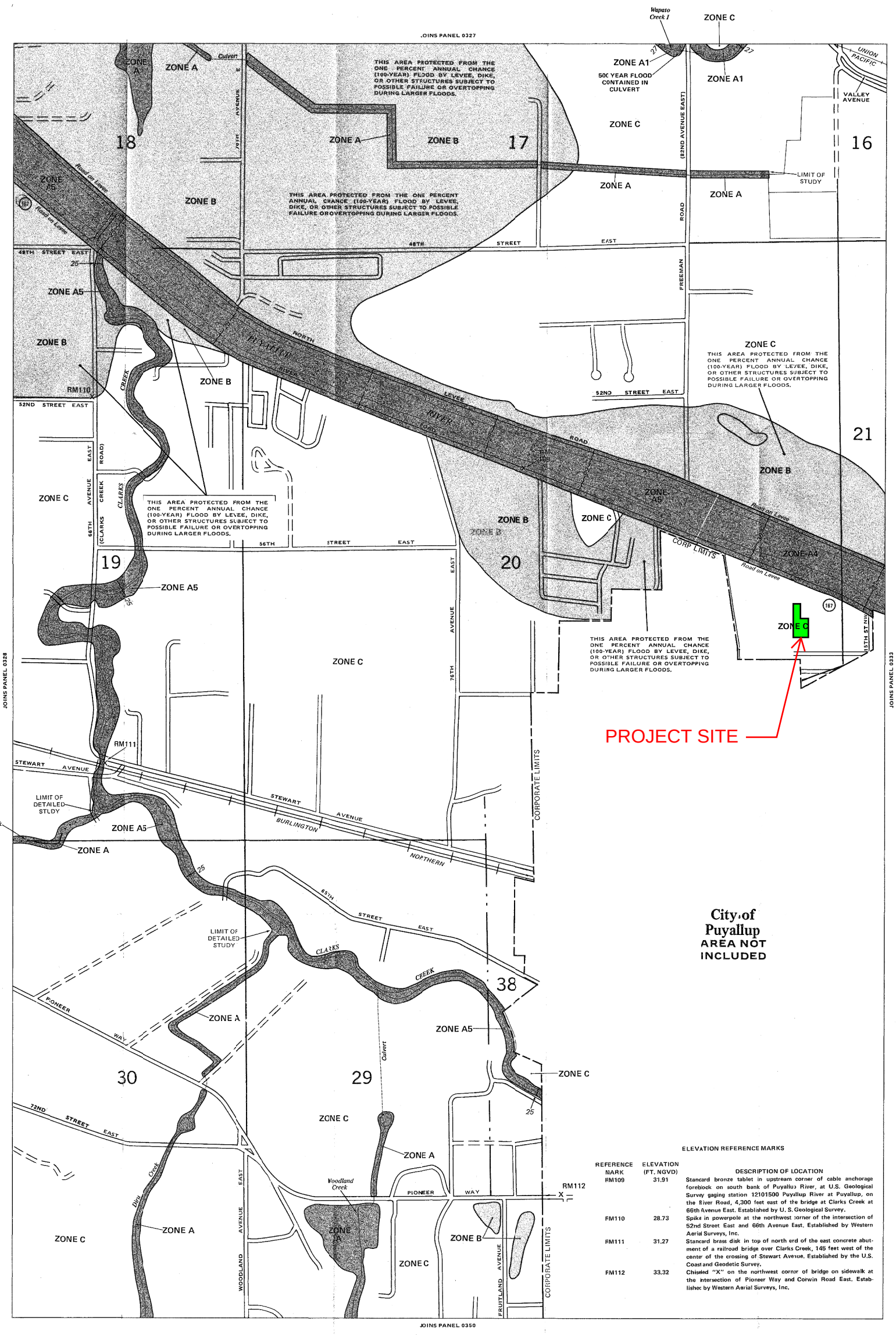
LARSON RIVER ROAD STORAGE
2160102.10

DEVELOPED CONDITIONS

A-4

Figure I-3.2: Flow Chart for Determining Requirements for Redevelopment





KEY TO MAP

500-Year Flood Boundary
100-Year Flood Boundary
Zone Designations
100-Year Flood Boundary
500-Year Flood Boundary

ZONE B
ZONE B

Base Flood Elevation Line With Elevation In Feet** — 513
Base Flood Elevation in Feet Where Uniform Within Zone** — (EL 987)
Elevation Reference Mark — RM7×
Zone E Boundary
River Mile — •M1.5

**Referenced to the National Geodetic Vertical Datum of 1929

EXPLANATION OF ZONE DESIGNATIONS

ZONE	EXPLANATION
A	Areas of 100-year flood; base flood elevations and flood hazard factors not determined.
A0	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; average depths of inundation are shown, but no flood hazard factors are determined.
AH	Areas of 100-year shallow flooding where depths are between one (1) and three (3) feet; base flood elevations are shown, but no flood hazard factors are determined.
A1-A30	Areas of 100-year flood; base flood elevations and flood hazard factors determined.
A99	Areas of 100-year flood to be protected by flood protection system under construction; base flood elevations and flood hazard factors not determined.
B	Areas between limits of the 100-year flood and 500-year flood; or certain areas subject to 100-year flooding with average depths less than one (1) foot or where the contributing drainage area is less than one square mile; or areas protected by levees from the base flood. (Medium shading)
C	Areas of minimal flooding. (No shading)
D	Areas of undetermined, but possible, flood hazards.
V	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors not determined.
V1-V30	Areas of 100-year coastal flood with velocity (wave action); base flood elevations and flood hazard factors determined.

NOTES TO USER

Certain areas not in the special flood hazard areas (zones A and V) may be protected by flood control structures.

This map is for use in administering the National Flood Insurance Program; it does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size, or all planimetric features outside special flood hazard areas.

Coastal base flood elevations apply only landward of the shoreline shown on this map.

For adjoining map panels, see separately printed Index To Map Panels.

INITIAL IDENTIFICATION:
OCTOBER 25, 1977

FLOOD HAZARD BOUNDARY MAP REVISIONS:
APRIL 15, 1980

FLOOD INSURANCE RATE MAP EFFECTIVE:
AUGUST 19, 1987

Refer to the FLOOD INSURANCE RATE MAP EFFECTIVE date shown on this map to determine when actuarial rates apply to structures in the zones where elevations or depths have been established.

To determine if flood insurance is available in this community, contact your insurance agent, or call the National Flood Insurance Program, at (800) 638-6620.

APPROXIMATE SCALE
500 0 500 FEET

ELEVATION REFERENCE MARKS

REFERENCE MARK	ELEVATION (FT. NGVD)	DESCRIPTION OF LOCATION
RM109	31.91	Standard bronze tablet in upstream corner of cable anchorage forebiock on south bank of Puyallup River, at U.S. Geological Survey gaging station 12101500 Puyallup River at Puyallup, on the River Road, 4,300 feet east of the bridge at Clarks Creek at 66th Avenue East. Established by U. S. Geological Survey.
RM110	28.73	Spike in powerpole at the northwest corner of the intersection of 52nd Street East and 66th Avenue East. Established by Western Aerial Surveys, Inc.
RM111	31.27	Standard brass disk in top of north end of the east concrete abutment of a railroad bridge over Clarks Creek, 145 feet west of the center of the crossing of Stewart Avenue. Established by the U.S. Coast and Geodetic Survey.
RM112	33.32	Chiseled "X" on the northwest corner of bridge on sidewalk at the intersection of Pioneer Way and Corwin Road East. Established by Western Aerial Surveys, Inc.

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 20 NORTH, RANGE 4 EAST

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

PIERCE COUNTY, WASHINGTON
(UNINCORPORATED AREAS)

PANEL 329 OF 1375
(SEE MAP INDEX FOR PANELS NOT PRINTED)

COMMUNITY-PANEL NUMBER
530138 0329 C

EFFECTIVE DATE:
AUGUST 19, 1987

Federal Emergency Management Agency

A6

Appendix B

- Geotechnical Engineering Report – South Sound Geotechnical Consulting

South Sound Geotechnical Consulting

May 5, 2016

AHBL
2215 North 30th Street, Suite 200
Tacoma, Washington 98403-3350

Attention: Mr. Lucas Johnson, P.E.

Subject: Geotechnical Engineering Report
Larson River Road Storage
Puyallup, Washington
SSGC Project No. 16025

Mr. Johnson,

South Sound Geotechnical Consulting (SSGC) has completed a geotechnical assessment for planned improvements to the Larson vehicle storage site on River Road in Puyallup, Washington. Our services have been completed in general conformance with our proposal (P16014) dated March 10, 2016 and authorized per AHBL subconsultant agreement dated March 22, 2016. Our scope of services included excavation of four test pits on the site, two infiltration test holes, engineering analyses, and preparation of this report.

PROJECT INFORMATION

The car storage lot is located on the south side of the 1600 block of River Road. Plans include paving the site with conventional HMA asphalt concrete. Stormwater control will include infiltration facilities, if feasible.

SITE CONDITIONS

The site is undeveloped and mostly covered with grass and isolated gravel areas. An existing pond several feet deep is in the center-western portion of the site with a manhole near the southern end of the pond. Overall, the site is generally level with an estimated elevation change of less than 2 feet, with the exception of the pond. Several catch basins are present in the yard area.

SUBSURFACE CONDITIONS

Subsurface conditions were characterized by completing four (4) test pits and two (2) infiltration test holes on March 30, 2016. Approximate location of the test sites are shown on Figure 1, Exploration Plan. A summary description of observed subgrade conditions is provided below.

Soil Conditions

Topsoil was below the surface in test pits TP-1 through TP-3 and extended to depths between about 6 to 8 inches. Loose crushed gravel fill was at the surface in test pit TP-4 and extended to a depth of about 1 foot. Fill consisting of silty sand to sand with silt and gravel was observed in the infiltration test holes and extended to depths between 1 and 2 feet. An approximate 6 inch topsoil layer was below the fill in infiltration test IT-1.

Native silty fine sand was below the topsoil (or fill) in the test pits. This soil was in a loose condition and extended to depths ranging from 1 to 3 feet below the surface. Medium stiff silt with fine sand and clay was observed below the silty sand and continued to the bottom of the test pits at depths between 5.5 to 6.5 feet below the surface. Similar native soils were observed in the infiltration test holes.

Groundwater Conditions

Groundwater or seepage was observed at depths of about 4.5 to 5.5 feet in the test pits at the time of excavation. It should be anticipated that groundwater levels will fluctuate due to seasonal precipitation and on- and off-site drainage patterns.

Geologic Setting

The USDA Soil Conservation Service Soil Map of Pierce County, Washington (1977) shows soils in this part of Eatonville mapped as Puyallup fine sandy loam. This soil reportedly formed in sandy mixed alluvium on natural levees. Native soils in the test holes appear to generally conform to the mapped soil type.

GEOTECHNICAL DESIGN CONSIDERATIONS

Paving of the storage area is considered feasible based on observed soil conditions in the test pits completed. Conventional HMA pavements are suitable over properly prepared subgrades and gravel bases. However, infiltration test results and a relatively high groundwater table suggest infiltration for stormwater control is not feasible at this site.

Recommendations presented in the following sections should be considered general and may require modifications when earthwork and grading occur. They are based upon the subsurface conditions observed in the test pits and our understanding that finish site grades will be similar to existing grades. It should be noted that subsurface conditions across the site may vary from those depicted on the exploration logs and can change with time. Therefore, proper site preparation will depend upon the weather and soil conditions encountered at the time of construction. We recommend that SSGC review final plans and further assess subgrade and slope conditions at the time of construction, as warranted.

General Site Preparation

Site grading and earthwork should include procedures to control surface water runoff. Earthwork without adequate drainage control measures may negatively impact site soils, resulting in increased export of impacted soil and import of fill materials, thereby potentially increasing the cost of the earthwork and subgrade preparation phases of the project.

Site grading should include removal (stripping) of existing fill and topsoil. We anticipate stripping depths to range from about 6 inches to 2 feet based on observed soils in the excavations, but should average less than 1 foot. Pavements subgrades should consist of native firm soils.

General Subgrade Preparation

Following stripping we recommend that exposed subgrades are proofrolled using a large roller, loaded dump truck, or other equipment to assess subgrade conditions. Proofrolling efforts should result in the upper 1 foot of subgrade soils achieving a compaction level of at least 95 percent of the maximum dry density (MDD) per the ASTM D1557 test method. Wet, loose, or soft subgrades that cannot achieve this compaction level should be removed and replaced with structural fill. A representative of SSGC should be present to assess subgrade conditions during proofrolling.

Grading and Drainage

Positive drainage should be provided during construction and maintained throughout the life of the development. Allowing surface water into road subgrades or utility trenches should be prevented.

Structural Fill Materials

The suitability of soil for use as structural fill will depend on the gradation and moisture content of the soil when it is placed. Soils with higher fines content (soil fraction passing the U.S. No. 200 sieve) will become sensitive with higher moisture content. It is often difficult to achieve adequate compaction if soil moisture is outside of optimum condition for soils that contain more than about 5 percent fines.

Site Soils: Site soils will be very difficult to use as structural fill as the amount of fines (silt and clay) observed will make them moisture sensitive. They potentially could be used if allowed to dry to within optimal moisture content. Optimum moisture is considered within about +/- 2 percent of the moisture content required to achieve the maximum density per the ASTM D-1557 test method. If moisture content is higher or lower than optimum, soils would need to be dried or wetted prior to placement as structural fill.

Import Fill Materials: We recommend import structural fill placed during dry weather consist of material which meets the specifications for *Gravel Borrow* as described in Section 9-03.14(1) of the 2014 Washington State Department of Transportation (WSDOT) Specifications for Road,

Bridge, and Municipal Construction (Publication M 41-10). Gravel Borrow should be protected from disturbance if exposed to wet conditions after placement.

During wet weather, or for backfill on wet subgrades, import soil suitable for compaction in wetter conditions should be provided. Imported fill for use in wet conditions should generally conform to specifications for *Select Borrow* as described in Section 9-03.14(2), or *Crushed Surfacing* per Section 9-03.9(3) of the 2014 WSDOT M-41 manual, with the modification that a maximum of 5 percent by weight shall pass the U.S. No. 200 sieve for these soil types.

It should be noted that structural fill placement and compaction is weather-dependent. Delays due to inclement weather are common, even when using select granular fill. We recommend site grading and earthwork be scheduled for the drier months of the year.

Structural Fill Placement

We recommend structural fill is placed in lifts not exceeding about 10 to 12 inches in loose measure. It may be necessary to adjust lift thickness based on site and fill conditions during placement and compaction. Structural fill should be compacted to attain the recommended levels presented in Table 1, Compaction Criteria.

Table 1. Compaction Criteria

Fill Application	Compaction Criteria*
Footing areas (below structures and retaining walls)	95 %
Upper 2 feet in pavement areas, slabs and sidewalks, and utility trenches	95 %
Below 2 feet in pavement areas, slabs and sidewalks, and utility trenches	92 %
Utility trenches or general fill in non-paved or -building areas	90 %

*Per the ASTM D 1557 test method.

Trench backfill within about 2 feet of utility lines should not be over-compacted to reduce the risk of damage to the line. In some instances the top of the utility line may be within 2 feet of the surface. Backfill in these circumstances should be compacted to a firm and unyielding condition.

We recommend fill procedures include maintaining grades that promote drainage and do not allow ponding of water within the fill area. The contractor should protect compacted fill subgrades from disturbance during wet weather. In the event of rain during structural fill placement, the exposed fill surface should be allowed to dry prior to placement of additional fill. Alternatively, the wet soil can be removed. We recommend consideration be given to protecting haul routes and other high traffic areas with free-draining granular fill material (i.e. sand and gravel containing less than 5 percent fines) or

quarry spalls to reduce the potential for disturbance to the subgrade during inclement weather. Structural fill should not consist of frozen material.

Earthwork Procedures

Conventional earthmoving equipment should be suitable for earthwork at this site. Earthwork may be difficult during periods of wet weather or if elevated soil moisture is present as the native fine grained soils will be easily disturbed. Excavated site soils may not be suitable as structural fill depending on the soil moisture content and weather conditions at the time of earthwork. If soils are stockpiled and wet weather is anticipated, the stockpile should be protected with securely anchored plastic sheeting. If stockpiled soils become unusable, it may become necessary to import clean, granular soils to complete wet weather site work.

Wet or disturbed subgrade soils should be over-excavated to expose firm, non-yielding, non-organic soils and backfilled with compacted structural fill. We recommend the earthwork portion of this project be completed during extended periods of dry weather. If earthwork is completed during the wet season (typically late October through May) it may be necessary to take extra measures to protect subgrade soils.

If earthwork takes place during freezing conditions, we recommend the exposed subgrade be allowed to thaw and be re-compacted prior to placing subsequent lifts of structural fill. Alternatively, the frozen soil can be removed to unfrozen soil and replaced with structural fill.

The contractor is responsible for designing and constructing stable, temporary excavations (including utility trenches) as required to maintain stability of both the excavation sides and bottom. Excavations should be sloped or shored in the interest of safety following local and federal regulations, including current OSHA excavation and trench safety standards. Temporary excavation cuts should be sloped at inclinations of 1.5H:1V (Horizontal:Vertical) or flatter, unless the contractor can demonstrate the safety of steeper inclinations. Deeper excavations that extend into the lower wet soils may require shoring to limit caving and loss of ground.

A qualified geotechnical engineer and material testing firm should be retained during the construction phase of the project to observe earthwork operations and to perform necessary tests and observations during subgrade preparation, placement and compaction of structural fill, and backfilling of excavations.

Pavements

We understand concrete asphalt (HMA) pavements will be used. Subgrades for pavement areas should be prepared as described in the site and subgrade preparation, and structural fill sections of this report. Subgrade soils below pavements should be compacted to at least 95 percent of the maximum dry density (ASTM D 1557) within at least one foot of the base of the section. Subgrades below pavement sections should also be graded or crowned to promote drainage and not allow for ponding of water beneath the section. If drainage is not provided and ponding occurs, the subgrade soils could become saturated, lose

strength, and result in premature distress to the pavement. In addition, the pavement surfacing should also be graded to promote drainage and reduce the potential for ponding of water on the pavement surface.

Pavement section design has been prepared and is based on AASHTO design guidelines and the following assumed design parameters:

- 15-year life span;
- Estimated design life Equivalent Single Axle Loads (18 kips) of 50,000;
- Estimated subgrade CBR of 3;
- Terminal serviceability of 2.0; and,
- Level of reliability 85 percent.

Minimum recommended pavement sections for conventional pavement areas include:

Table 2. Minimum Pavement Section

Traffic Area	Minimum Recommended Pavement Section Thickness (inches)			
	Asphalt Concrete Surface[1]	Aggregate Base Course[2]	Subbase Aggregate[3]	Total
Access and General Parking	3	6	6	15

[1] 1/2 –inch nominal aggregate hot-mix asphalt (HMA) per WSDOT 9-03.8(1)
[2] Crushed Surfacing Base Course per WSDOT 9-03.9(3)
[3]Gravel Borrow per WSDOT 9-03.14(1) or Crushed Surfacing Base Course WSDOT 9-03.9(3)

The above recommended pavement section should be considered a minimum. Added life expectancy could be improved by providing a geotextile separation fabric (such as Mirafi 140N) between the prepared subgrade and subbase aggregate fill, or providing a thicker granular fill (subbase or base course) section. The purpose of the separation fabric is to maintain segregation of materials and limit the potential of the coarser fill from migrating into the softer native subgrade which can reduce the structural integrity of the granular fill section. Final pavement sections should conform to applicable City of Puyallup (or Pierce County) pavement standards. The estimated CBR value may not be suitable depending on actual subgrades encountered during construction which could affect the pavement sections.

Pavement Maintenance

The performance and lifespan of pavements can be significantly impacted by future maintenance. The above pavement sections represent minimum recommended thicknesses and, as such, periodic maintenance should be completed. Proper maintenance will slow the rate of pavement deterioration, and will improve pavement performance and life. Preventive maintenance consists of both localized maintenance (crack and joint sealing and patching) and global maintenance (surface

sealing). Added maintenance measures should be anticipated over the lifetime of the pavement section if any existing fill or topsoil is left in-place beneath pavement sections.

Infiltration Characteristics

Two (2) infiltration tests were performed in the proposed storm tract in the southern portion of the site. Tests were completed in general conformance with procedures outlined in the US EPA falling head procedure per the 2012 Pierce County Stormwater Management and Site Development Manual. The approximate locations of the tests are presented on Figure 1, Site Plan. Results of the infiltration tests are presented in Table 2.

Table 2. Infiltration Test Results

Infiltration Test No.	Depth of Test from surface (feet)	Uncorrected (Field) Infiltration Rate (in/hr)	Estimated Long-Term Infiltration Rate (in/hr)	Correction Factors* (Ft/Fg/Fp)
IT-1	3.5	0.51	0.11	(0.5/0.65/0.7)
IT-2	3.75	0.375	0.08	(0.5/0.65/0.7)

*Correction Factors from the 2012 Pierce County Stormwater Management and Site Development Manual.

Results of the tests show native site soils have very low infiltration potential. Additionally, the groundwater table was within 1 to 2 feet of the bottom of the infiltration test sites. As such, it is not considered feasible to utilize infiltration facilities at this site.

REPORT CONDITIONS

This report has been prepared for the exclusive use of Larson Automotive Group and AHBL for specific application to the project discussed and has been prepared in accordance with generally accepted geotechnical engineering practices in the area. No warranties, either express or implied, are intended or made. The analysis and recommendations presented in this report are based on observed soil conditions and test results at the indicated locations, and from other geologic information discussed. This report does not reflect variations that may occur across the site, or due to the modifying effects of construction or weather. The nature and extent of such variations may not become evident until during or after construction. If variations appear, we should be immediately notified so that further evaluation and supplemental recommendations can be provided.

The scope of services for this project does not include any environmental or biological assessment of the site including identification or prevention of pollutants, hazardous materials, or conditions. Other studies should be completed if the owner is concerned about the potential for contamination or pollution.

We appreciate the opportunity to work with you on this project. Please contact us if additional information is required or we can be of further assistance.

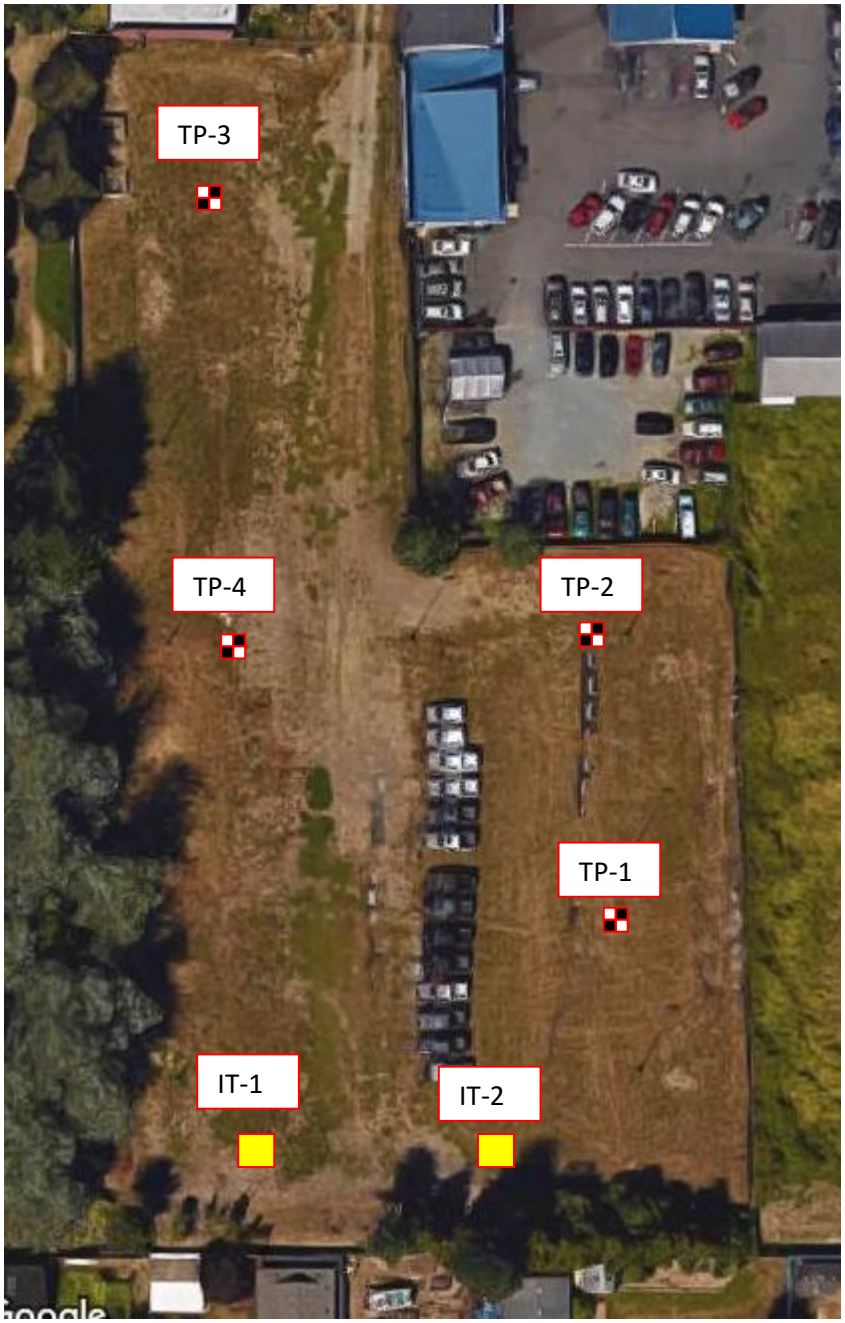
Respectfully,

South Sound Geotechnical Consulting

Timothy H. Roberts, P.E., R.G.
Member/Geotechnical Engineer

Attachments: Figure 1 – Exploration Plan
Appendix A – Field Exploration Procedures
Unified Soil Classification System

N



Legend

TP - 1

Approximate Test Pit Location

IT - 1

Approximate Infiltration Test

Base map from Google Maps.

Scale: NTS

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Lakewood, WA 98496
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Figure 1 – Exploration Plan

Larson River Road Storage
Puyallup, WA

SSGC Project #16025

Test Pit TP-1

Depth (feet)	Material Description
0 – 0.67	**Topsoil:** Sandy SILT with organics: Loose, moist, dark brown.
0.67 – 3	Silty fine SAND: Medium dense, moist, brown. (Sample S-1 @ 2.5 feet)
3 – 6.5	SILT with fine sand and clay: Medium stiff, moist, gray with orange mottling. (Sample S-2 @ 3.5 feet)
	Test pit completed at approximately 6.5 feet on 3/30/16. Groundwater observed at about 4.5 feet at time of excavation. No caving observed at time of excavation. Approximate surface elevation: 37 feet

Test Pit TP-2

Depth (feet)	Material Description
0 – 0.5	**Topsoil:** Sandy SILT with organics: Loose, moist, dark brown.
0.5 – 1	Silty fine SAND: Medium dense, moist, brown.
1 - 6	SILT with fine sand and clay: Medium stiff, moist, gray with orange mottling.
	Test pit completed at approximately 6.5 feet on 3/30/16. Groundwater observed at about 4.5 feet at time of excavation. No caving observed at time of excavation. Approximate surface elevation: 37 feet

Test Pit TP-3

Depth (feet)	Material Description
0 – 0.67	**Topsoil:** Sandy SILT with organics: Loose, moist, dark brown.
0.67 – 2	Silty fine SAND: Medium dense, moist, orange/gray.
2 - 6	SILT with fine sand and clay: Medium stiff, moist, mottled brown/gray. Fine sand seam between 4 and 5 feet. Grades wet at 4 feet.

Test pit completed at approximately 6 feet on 3/30/16.
Groundwater observed at about 5 feet at time of excavation.
No caving observed at time of excavation.
Approximate surface elevation: 37 feet

Test Pit TP-4

Depth (feet)	Material Description
0 – 1	**Fill:** Sandy GRAVEL: Loose, moist, gray.
1 – 2	Silty fine SAND: Medium dense, moist, orange/gray.
2 – 5.5	SILT with fine sand and clay: Medium stiff, moist, mottled brown/gray. Fine sand seam between 4.5 and 5 feet. Grades wet at 4.5 feet.

Test pit completed at approximately 5.5 feet on 3/30/16.
Groundwater observed at about 4.5 feet at time of excavation.
No caving observed at time of excavation.
Approximate surface elevation: 37 feet

Appendix A

Field Exploration Procedures

Field Exploration Procedures

Our field exploration for this project included four (4) test pits and two (2) infiltration test holes completed on March 30, 2016. The approximate locations of the explorations are shown on Figure 1, Exploration Plan. The exploration locations were determined by pacing from site features. Ground surface elevations referenced on the logs were inferred from a site plan figure prepared by AHBL. The locations and elevations should be considered accurate only to the degree implied by the means and methods used.

An excavating contractor subcontracted to SSGC excavated the test pits and infiltration test holes. Soil samples were collected and stored in moisture tight containers for further assessment. Explorations were backfilled with excavated soils and tamped when completed. Please note that backfill in the explorations will likely settle with time. Backfill material in the test pits located in pavement or building areas should be re-excavated and recompacted, or replaced with structural fill.

The following logs indicate the observed lithology of soils and other materials observed in the explorations at the time of excavation. Where a soil contact was observed to be gradational, our log indicates the average contact depth. Our logs also indicate the approximate depth to groundwater (where observed at the time of excavation), along with sample numbers and approximate sample depths. Soil descriptions on the logs are based on the Unified Soil Classification System.

UNIFIED SOIL CLASSIFICATION SYSTEM

Criteria for Assigning Group Symbols and Group Names Using Laboratory Tests[A]					Soil Classification	
					Group Symbol	Group Name[B]
Coarse Grained Soils	Gravels	Clean Gravels	$Cu \geq 4$ and $1 \leq Cc \leq 3$[E]		GW	Well-graded gravel[F]
More than 50% retained	More than 50% of coarse fraction retained on No. 4 sieve	Less than 5% fines[C]	$Cu < 4$ and/or $1 > Cc > 3$[E]		GP	Poorly graded gravel[F]
on No. 200 sieve		Gravels with Fines	Fines classify as ML or MH		GM	Silty gravel[F,G,H]
		More than 12% fines[C]	Fines classify as CL or CH		GC	Clayey gravel[F,G,H]
	Sands	Clean Sands	$Cu \geq 6$ and $1 \leq Cc \leq 3$[E]		SW	Well-graded sand[I]
	50% or more of coarse fraction passes No. 4 sieve	Less than 5% fines[D]	$Cu < 6$ and/or $1 > Cc > 3$[E]		SP	Poorly graded sand[I]
		Sands with Fines	Fines classify as ML or MH		SM	Silty sand[G,H,I]
		More than 12% fines[D]	Fines Classify as CL or CH		SC	Clayey sand[G,H,I]
Fine-Grained Soils	Silts and Clays	inorganic	PI > 7 and plots on or above "A" line[J]		CL	Lean clay[K,L,M]
50% or more passes the No. 200 sieve	Liquid limit less than 50		PI < 4 or plots below "A" line[J]		ML	Silt[K,L,M]
		organic	Liquid limit - oven dried	< 0.75	OL	Organic clay[K,L,M,N]
			Liquid limit - not dried			Organic silt[K,L,M,O]
	Silts and Clays	inorganic	PI plots on or above "A" line		CH	Fat clay[K,L,M]
	Liquid limit 50 or more		PI plots below "A" line		MH	Elastic Silt[K,L,M]
		organic	Liquid limit - oven dried	< 0.75	OH	Organic clay[K,L,M,P]
			Liquid limit - not dried			Organic silt[K,L,M,Q]
Highly organic soils	Primarily organic matter, dark in color, and organic odor				PT	Peat

[A] Based on the material passing the 3-in. (75-mm) sieve

[B] If field sample contained cobbles or boulders, or both, add "with cobbles or boulders, or both" to group name.

[C] Gravels with 5 to 12% fines require dual symbols: GW-GM well-graded gravel with silt, GW-GC well-graded gravel with clay, GP-GM poorly graded gravel with silt, GP-GC poorly graded gravel with clay.

[D] Sands with 5 to 12% fines require dual symbols: SW-SM well-graded sand with silt, SW-SC well-graded sand with clay, SP-SM poorly graded sand with silt, SP-SC poorly graded sand with clay

[E] $Cu = D_{60}/D_{10}$ $\quad Cc = \dfrac{(D_{30})^2}{D_{10} \times D_{60}}$

[F] If soil contains ≥ 15% sand, add "with sand" to group name.

[G] If fines classify as CL-ML, use dual symbol GC-GM, or SC-SM.

[H] If fines are organic, add "with organic fines" to group name.

[I] If soil contains ≥ 15% gravel, add "with gravel" to group name.

[J] If Atterberg limits plot in shaded area, soil is a CL-ML, silty clay.

[K] If soil contains 15 to 29% plus No. 200, add "with sand" or "with gravel," whichever is predominant.

[L] If soil contains ≥ 30% plus No. 200 predominantly sand, add "sandy" to group name.

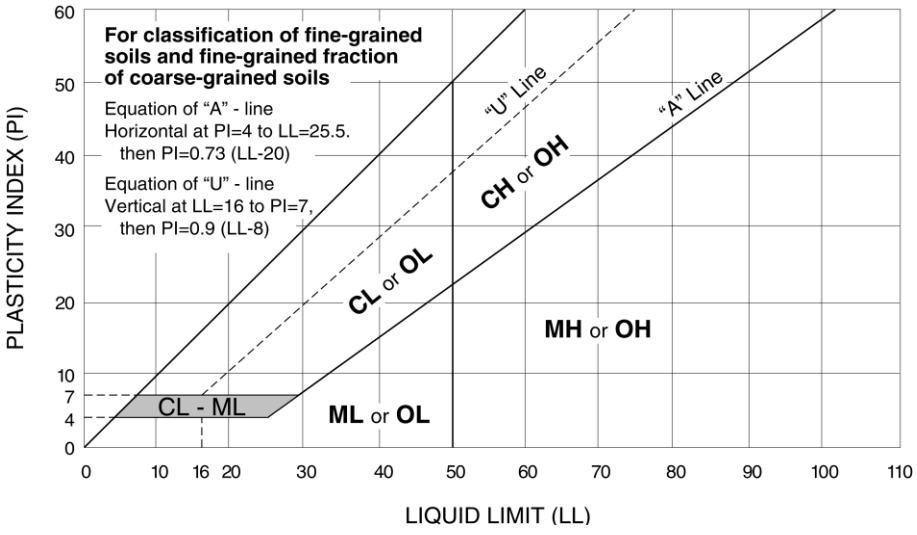
[M] If soil contains ≥ 30% plus No. 200, predominantly gravel, add "gravelly" to group name.

[N] PI ≥ 4 and plots on or above "A" line.

[O] PI < 4 or plots below "A" line.

[P] PI plots on or above "A" line.

[Q] PI plots below "A" line.



Appendix C

Maintenance Report

- Attachment A: Maintenance Checklist
- Attachment B: Source Control BMPs

4.6 Maintenance Standards for Drainage Facilities

The facility-specific maintenance standards contained in this section are intended to be conditions for determining if maintenance actions are required as identified through inspection. They are not intended to be measures of the facility's required condition at all times between inspections. In other words, exceedence of these conditions at any time between inspections and/or maintenance does not automatically constitute a violation of these standards. However, based upon inspection observations, the inspection and maintenance schedules shall be adjusted to minimize the length of time that a facility is in a condition that requires a maintenance action.

Table 4.5 – Maintenance Standards

No. 5 – Catch Basins

Maintenance Component	Defect	Conditions When Maintenance is Needed	Results Expected When Maintenance is performed
General	Trash & Debris	Trash or debris which is located immediately in front of the catch basin opening or is blocking inletting capacity of the basin by more than 10%.	No Trash or debris located immediately in front of catch basin or on grate opening.
		Trash or debris (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of six inches clearance from the debris surface to the invert of the lowest pipe.	No trash or debris in the catch basin.
		Trash or debris in any inlet or outlet pipe blocking more than 1/3 of its height.	Inlet and outlet pipes free of trash or debris.
		Dead animals or vegetation that could generate odors that could cause complaints or dangerous gases (e.g., methane).	No dead animals or vegetation present within the catch basin.
	Sediment	Sediment (in the basin) that exceeds 60 percent of the sump depth as measured from the bottom of basin to invert of the lowest pipe into or out of the basin, but in no case less than a minimum of 6 inches clearance from the sediment surface to the invert of the lowest pipe.	No sediment in the catch basin
	Structure Damage to Frame and/or Top Slab	Top slab has holes larger than 2 square inches or cracks wider than 1/4 inch (Intent is to make sure no material is running into basin).	Top slab is free of holes and cracks.
		Frame not sitting flush on top slab, i.e., separation of more than 3/4 inch of the frame from the top slab. Frame not securely attached	Frame is sitting flush on the riser rings or top slab and firmly attached.
	Fractures or Cracks in Basin Walls/ Bottom	Maintenance person judges that structure is unsound.	Basin replaced or repaired to design standards.
		Grout fillet has separated or cracked wider than 1/2 inch and longer than 1 foot at the joint of any inlet/outlet pipe or any evidence of soil particles entering catch basin through cracks.	Pipe is regrouted and secure at basin wall.
	Settlement/ Misalignment	If failure of basin has created a safety, function, or design problem.	Basin replaced or repaired to design standards.
	Vegetation	Vegetation growing across and blocking more than 10% of the basin opening.	No vegetation blocking opening to basin.
		Vegetation growing in inlet/outlet pipe joints that is more than six inches tall and less than six inches apart.	No vegetation or root growth present.

No. 5 – Catch Basins

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

No. 6 – Debris Barriers (e.g., Trash Racks)

Maintenance Components	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
General	Trash and Debris	Trash or debris that is plugging more than 20% of the openings in the barrier.	Barrier cleared to design flow capacity.
Metal	Damaged/ Missing Bars.	Bars are bent out of shape more than 3 inches.	Bars in place with no bends more than 3/4 inch.
		Bars are missing or entire barrier missing.	Bars in place according to design.
		Bars are loose and rust is causing 50% deterioration to any part of barrier.	Barrier replaced or repaired to design standards.
	Inlet/Outlet Pipe	Debris barrier missing or not attached to pipe	Barrier firmly attached to pipe

No. 15 – Stormfilter™ (leaf compost filter)

Maintenance Component	Defect	Condition When Maintenance is Needed	Results Expected When Maintenance is Performed
Below Ground Vault	Sediment Accumulation on Media.	Sediment depth exceeds 0.25-inches.	No sediment deposits which would impede permeability of the compost media.
	Sediment Accumulation in Vault	Sediment depth exceeds 6-inches in first chamber.	No sediment deposits in vault bottom of first chamber.
	Trash/Debris Accumulation	Trash and debris accumulated on compost filter bed.	Trash and debris removed from the compost filter bed.
	Sediment in Drain Pipes/Clean-Outs	When drain pipes, clean-outs, become full with sediment and/or debris.	Sediment and debris removed.
	Damaged Pipes	Any part of the pipes that are crushed or damaged due to corrosion and/or settlement.	Pipe repaired and/or replaced.
	Access Cover Damaged/Not Working	Cover cannot be opened; one person cannot open the cover using normal lifting pressure, corrosion/deformation of cover.	Cover repaired to proper working specifications or replaced.
	Vault Structure Includes Cracks in Wall, Bottom, Damage to Frame and/or Top Slab	Cracks wider than 1/2-inch or evidence of soil particles entering the structure through the cracks, or maintenance/inspection personnel determine that the vault is not structurally sound.	Vault replaced or repairs made so that vault meets design specifications and is structurally sound.
		Cracks wider than 1/2-inch at the joint of any inlet/outlet pipe or evidence of soil particles entering through the cracks.	Vault repaired so that no cracks exist wider than 1/4-inch at the joint of the inlet/outlet pipe.
	Baffles	Baffles corroding, cracking warping, and/or showing signs of failure as determined by maintenance/inspection person.	Baffles repaired or replaced to specifications.
	Access Ladder Damaged	Ladder is corroded or deteriorated, not functioning properly, not securely attached to structure wall, missing rungs, cracks, and misaligned.	Ladder replaced or repaired and meets specifications, and is safe to use as determined by inspection personnel.
Below Ground Cartridge Type	Compost Media	Drawdown of water through the media takes longer than 1 hour, and/or overflow occurs frequently.	Media cartridges replaced.
	Short Circuiting	Flows do not properly enter filter cartridges.	Filter cartridges replaced.

No. 18 – Catchbasin Inserts

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

BMPs for Dust Control at Disturbed Land Areas and Unpaved Roadways and Parking Lots

Description of Pollutant Sources: Dust can cause air and water pollution problems particularly at demolition sites and in arid areas where reduced rainfall exposes soil particles to transport by air.

Pollutant Control Approach: Minimize dust generation and apply environmentally friendly and government approved dust suppressant chemicals, if necessary.

Applicable Operational BMPs:

- Sprinkle or wet down soil or dust with water as long as it does not result in a wastewater discharge.
- Use only local and/or state government approved dust suppressant chemicals such as those listed in Ecology Publication #96-433, "Techniques for Dust Prevention and Suppression."
- Avoid excessive and repeated applications of dust suppressant chemicals. Time the application of dust suppressants to avoid or minimize their wash-off by rainfall or human activity such as irrigation.
- Apply stormwater containment to prevent the conveyance of stormwater TSS into storm drains or receiving waters.
- The use of motor oil for dust control is prohibited. Care should be taken when using lignin derivatives and other high BOD chemicals in excavations or areas easily accessible to surface water or ground water.
- Consult with the Ecology Regional Office in your area on discharge permit requirements if the dust suppression process results in a wastewater discharge to the ground, ground water, storm drain, or surface water.

Recommended Additional Operational BMPs for Roadways and Other Trafficked Areas:

- Consider limiting use of off-road recreational vehicles on dust generating land.
- Consider paving unpaved permanent roads and other trafficked areas at municipal, commercial, and industrial areas.
- Consider paving or stabilizing shoulders of paved roads with gravel, vegetation, or local government approved chemicals.
- Encourage use of alternate paved routes, if available.
- Vacuum or wet sweep fine dirt and skid control materials from paved roads soon after winter weather ends or when needed.
- Consider using traction sand that is pre-washed to reduce dust emissions.

Additional Recommended Operational BMPs for Dust Generating Areas:

- Prepare a dust control plan. Helpful references include: Control of Open Fugitive Dust Sources (EPA-450/3-88-088), and Fugitive Dust Background Document and Technical Information Document for Best Available Control Measures (EPA-450/2-92-004)
- Limit exposure of soil (dust source) as much as feasible.
- Stabilize dust-generating soil by growing and maintaining vegetation, mulching, topsoiling, and/or applying stone, sand, or gravel.
- Apply windbreaks in the soil such as trees, board fences, tarp curtains, bales of hay, etc.
- Cover dust-generating piles with wind-impervious fabric, or equivalent material.

BMPs for Landscaping and Lawn/ Vegetation Management

Description of Pollutant Sources: Landscaping can include grading, soil transfer, vegetation removal, pesticide and fertilizer applications, and watering. Stormwater contaminants include toxic organic compounds, heavy metals, oils, total suspended solids, coliform bacteria, fertilizers, and pesticides.

Lawn and vegetation management can include control of objectionable weeds, insects, mold, bacteria and other pests with chemical pesticides and is conducted commercially at commercial, industrial, and residential sites. Examples include weed control on golf course lawns, access roads, and utility corridors and during landscaping; sap stain and insect control on lumber and logs; rooftop moss removal; killing nuisance rodents; fungicide application to patio decks, and residential lawn/plant care. Toxic pesticides such as pentachlorophenol, carbamates, and organometallics can be released to the environment by leaching and dripping from treated parts, container leaks, product misuse, and outside storage of pesticide contaminated materials and equipment. Poor management of the vegetation and poor application of pesticides or fertilizers can cause appreciable stormwater contamination.

Pollutant Control Approach: Control of fertilizer and pesticide applications, soil erosion, and site debris to prevent contamination of stormwater.

Develop and implement an Integrated Pest Management Plan (IPM) and use pesticides only as a last resort. If pesticides/herbicides are used they must be carefully applied in accordance with label instructions on U.S. Environmental Protection Agency (EPA) registered materials. Maintain appropriate vegetation, with proper fertilizer application where practicable, to control erosion and the discharge of stormwater pollutants. Where practicable grow plant species appropriate for the site, or adjust the soil properties of the subject site to grow desired plant species.

Applicable Operational BMPs for Landscaping:

- Install engineered soil/landscape systems to improve the infiltration and regulation of stormwater in landscaped areas.
- Do not dispose of collected vegetation into waterways or storm drainage systems.

Recommended Additional Operational BMPs for Landscaping:

- Conduct mulch-mowing whenever practicable
- Dispose of grass clippings, leaves, sticks, or other collected vegetation, by composting, if feasible.

- Use mulch or other erosion control measures when soils are exposed for more than one week during the dry season or two days during the rainy season.
- If oil or other chemicals are handled, store and maintain appropriate oil and chemical spill cleanup materials in readily accessible locations. Ensure that employees are familiar with proper spill cleanup procedures.
- Till fertilizers into the soil rather than dumping or broadcasting onto the surface. Determine the proper fertilizer application for the types of soil and vegetation encountered.
- Till a topsoil mix or composted organic material into the soil to create a well-mixed transition layer that encourages deeper root systems and drought-resistant plants.
- Use manual and/or mechanical methods of vegetation removal rather than applying herbicides, where practical.

Applicable Operational BMPs for the Use of Pesticides:

- Develop and implement an IPM (See section on IPM at end of BMP) and use pesticides only as a last resort.
- Implement a pesticide-use plan and include at a minimum: a list of selected pesticides and their specific uses; brands, formulations, application methods and quantities to be used; equipment use and maintenance procedures; safety, storage, and disposal methods; and monitoring, record keeping, and public notice procedures. All procedures shall conform to the requirements of Chapter 17.21 RCW and Chapter 16-228 WAC (Appendix IV-D R.7).
- Choose the least toxic pesticide available that is capable of reducing the infestation to acceptable levels. The pesticide should readily degrade in the environment and/or have properties that strongly bind it to the soil. Any pest control used should be conducted at the life stage when the pest is most vulnerable. For example, if it is necessary to use a Bacillus thuringiens is application to control tent caterpillars, it must be applied before the caterpillars cocoon or it will be ineffective. Any method used should be site-specific and not used wholesale over a wide area.
- Apply the pesticide according to label directions. Under no conditions shall pesticides be applied in quantities that exceed manufacturer's instructions.
- Mix the pesticides and clean the application equipment in an area where accidental spills will not enter surface or ground waters, and will not contaminate the soil.

- Store pesticides in enclosed areas or in covered impervious containment. Ensure that pesticide contaminated stormwater or spills/leaks of pesticides are not discharged to storm drains. Do not hose down the paved areas to a storm drain or conveyance ditch. Store and maintain appropriate spill cleanup materials in a location known to all near the storage area.
- Clean up any spilled pesticides and ensure that the pesticide contaminated waste materials are kept in designated covered and contained areas.
- The pesticide application equipment must be capable of immediate shutoff in the event of an emergency.
- Do not spray pesticides within 100 feet of open waters including wetlands, ponds, and streams, sloughs and any drainage ditch or channel that leads to open water except when approved by Ecology or the local jurisdiction. All sensitive areas including wells, creeks and wetlands must be flagged prior to spraying.
- As required by the local government or by Ecology, complete public posting of the area to be sprayed prior to the application.
- Spray applications should only be conducted during weather conditions as specified in the label direction and applicable local and state regulations. Do not apply during rain or immediately before expected rain.

Recommended Additional Operational BMPs for the use of pesticides:

- Consider alternatives to the use of pesticides such as covering or harvesting weeds, substitute vegetative growth, and manual weed control/moss removal.
- Consider the use of soil amendments, such as compost, that are known to control some common diseases in plants, such as Pythium root rot, ashy stem blight, and parasitic nematodes. The following are three possible mechanisms for disease control by compost addition (USEPA Publication 530-F-9-044):

    1. Successful competition for nutrients by antibiotic production;
    2. Successful predation against pathogens by beneficial microorganism; and
    3. Activation of disease-resistant genes in plants by composts.

Installing an amended soil/landscape system can preserve both the plant system and the soil system more effectively. This type of approach provides a soil/landscape system with adequate depth, permeability, and organic matter to sustain itself and continue working as an effective stormwater infiltration system and a sustainable nutrient cycle.

- Once a pesticide is applied, its effectiveness should be evaluated for possible improvement. Records should be kept showing the applicability and inapplicability of the pesticides considered.
- An annual evaluation procedure should be developed including a review of the effectiveness of pesticide applications, impact on buffers and sensitive areas (including potable wells), public concerns, and recent toxicological information on pesticides used/proposed for use. If individual or public potable wells are located in the proximity of commercial pesticide applications contact the regional Ecology hydrogeologist to determine if additional pesticide application control measures are necessary.
- Rinseate from equipment cleaning and/or triple-rinsing of pesticide containers should be used as product or recycled into product.
- The application equipment used should be capable of immediate shutoff in the event of an emergency.

For more information, contact the WSU Extension Home-Assist Program, (253) 445-4556, or Bio-Integral Resource Center (BIRC), P.O. Box 7414, Berkeley, CA.94707, or the Washington Department of Ecology to obtain "Hazardous Waste Pesticides" (Publication #89-41); and/or EPA to obtain a publication entitled "Suspended, Canceled and Restricted Pesticides" which lists all restricted pesticides and the specific uses that are allowed. Valuable information from these sources may also be available on the internet.

Applicable Operational BMPs for Vegetation Management:

- Use at least an eight-inch "topsoil" layer with at least 8 percent organic matter to provide a sufficient vegetation-growing medium. Amending existing landscapes and turf systems by increasing the percent organic matter and depth of topsoil can substantially improve the permeability of the soil, the disease and drought resistance of the vegetation, and reduce fertilizer demand. This reduces the demand for fertilizers, herbicides, and pesticides. Organic matter is the least water-soluble form of nutrients that can be added to the soil. Composted organic matter generally releases only between 2 and 10 percent of its total nitrogen annually, and this release corresponds closely to the plant growth cycle. If natural plant debris and mulch are returned to the soil, this system can continue recycling nutrients indefinitely.
- Select the appropriate turfgrass mixture for your climate and soil type. Certain tall fescues and rye grasses resist insect attack because the symbiotic endophytic fungi found naturally in their tissues repel or kill common leaf and stem-eating lawn insects. They do not, however, repel root-feeding lawn pests such as Crane Fly larvae, and are toxic to ruminants such as cattle and sheep. The fungus causes no known

adverse effects to the host plant or to humans. Endophytic grasses are commercially available and can be used in areas such as parks or golf courses where grazing does not occur. The local Cooperative Extension office can offer advice on which types of grass are best suited to the area and soil type.

- Use the following seeding and planting BMPs, or equivalent BMPs to obtain information on grass mixtures, temporary and permanent seeding procedures, maintenance of a recently planted area, and fertilizer application rates: Temporary Seeding, Mulching and Matting, Clear Plastic Covering, Permanent Seeding and Planting, and Sodding as described in Volume II).
- Selection of desired plant species can be made by adjusting the soil properties of the subject site. For example, a constructed wetland can be designed to resist the invasion of reed canary grass by layering specific strata of organic matters (e.g., compost forest product residuals) and creating a mildly acidic pH and carbon-rich soil medium. Consult a soil restoration specialist for site-specific conditions.
- Aerate lawns regularly in areas of heavy use where the soil tends to become compacted. Aeration should be conducted while the grasses in the lawn are growing most vigorously. Remove layers of thatch greater than ¾-inch deep.
- Mowing is a stress-creating activity for turfgrass. When grass is mowed too short its productivity is decreased and there is less growth of roots and rhizomes. The turf becomes less tolerant of environmental stresses, more disease prone and more reliant on outside means such as pesticides, fertilizers and irrigation to remain healthy. Set the mowing height at the highest acceptable level and mow at times and intervals designed to minimize stress on the turf. Generally mowing only 1/3 of the grass blade height will prevent stressing the turf.

Irrigation:

- The depth from which a plant normally extracts water depends on the rooting depth of the plant. Appropriately irrigated lawn grasses normally root in the top 6 to 12 inches of soil; lawns irrigated on a daily basis often root only in the top 1 inch of soil. Improper irrigation can encourage pest problems, leach nutrients, and make a lawn completely dependent on artificial watering. The amount of water applied depends on the normal rooting depth of the turfgrass species used, the available water holding capacity of the soil, and the efficiency of the irrigation system. Consult with the local water utility, Conservation District, or Cooperative Extension office to help determine optimum irrigation practices.

Fertilizer Management:

- Turfgrass is most responsive to nitrogen fertilization, followed by potassium and phosphorus. Fertilization needs vary by site depending on plant, soil and climatic conditions. Evaluation of soil nutrient levels through regular testing ensures the best possible efficiency and economy of fertilization. For details on soils testing, contact the local Conservation District or Cooperative Extension Service.
- Fertilizers should be applied in amounts appropriate for the target vegetation and at the time of year that minimizes losses to surface and ground waters. Do not fertilize during a drought or when the soil is dry. Alternatively, do not apply fertilizers within three days prior to predicted rainfall. The longer the period between fertilizer application and either rainfall or irrigation, the less fertilizer runoff occurs.
- Use slow release fertilizers such as methylene urea, IDBU, or resin coated fertilizers when appropriate, generally in the spring. Use of slow release fertilizers is especially important in areas with sandy or gravelly soils.
- Time the fertilizer application to periods of maximum plant uptake. Generally fall and spring applications are recommended, although WSU turf specialists recommend four fertilizer applications per year.
- Properly trained persons should apply all fertilizers. At commercial and industrial facilities fertilizers should not be applied to grass swales, filter strips, or buffer areas that drain to sensitive water bodies unless approved by the local jurisdiction.

Integrated Pest Management

An IPM program might consist of the following steps:

Step 1: Correctly identify problem pests and understand their life cycle

Step 2: Establish tolerance thresholds for pests.

Step 3: Monitor to detect and prevent pest problems.

Step 4: Modify the maintenance program to promote healthy plants and discourage pests.

Step 5: Use cultural, physical, mechanical, or biological controls first if pests exceed the tolerance thresholds.

Step 6: Evaluate and record the effectiveness of the control and modify maintenance practices to support lawn or landscape recovery and prevent recurrence.

For an elaboration of these steps refer to Appendix IV-F.

BMPs for Maintenance and Repair of Vehicles and Equipment

Description of Pollutant Sources: Pollutant sources include parts/vehicle cleaning, spills/leaks of fuel and other liquids, replacement of liquids, outdoor storage of batteries/liquids/parts, and vehicle parking.

Pollutant Control Approach: Control of leaks and spills of fluids using good housekeeping and cover and containment BMPs.

Applicable Operational BMPs:

- Inspect for leaks all incoming vehicles, parts, and equipment stored temporarily outside.
- Use drip pans or containers under parts or vehicles that drip or that are likely to drip liquids, such as during dismantling of liquid containing parts or removal or transfer of liquids.
- Remove batteries and liquids from vehicles and equipment in designated areas designed to prevent stormwater contamination. Store cracked batteries in a covered non-leaking secondary containment system.
- Empty oil and fuel filters before disposal. Provide for proper disposal of waste oil and fuel.
- Do not pour/convey washwater, liquid waste, or other pollutant into storm drains or to surface water. Check with the local sanitary sewer authority for approval to convey to a sanitary sewer.
- Do not connect maintenance and repair shop floor drains to storm drains or to surface water. To allow for snowmelt during the winter a drainage trench with a sump for particulate collection can be installed and used only for draining the snowmelt and not for discharging any vehicular or shop pollutants.

Applicable Structural Source Control BMPs:

- Conduct all maintenance and repair of vehicles and equipment in a building, or other covered impervious containment area that is sloped to prevent run-on of uncontaminated stormwater and runoff of contaminated stormwater.
- The maintenance of refrigeration engines in refrigerated trailers may be conducted in the parking area with due caution to avoid the release of engine or refrigeration fluids to storm drains or surface water.
- Park large mobile equipment, such as log stackers, in a designated contained area.

For additional applicable BMPs refer to the following BMPs: Fueling at Dedicated Stations; Washing and Steam Cleaning Vehicle/Equipment/Building Structures; Loading and Unloading Areas for Liquid or Solid Material; Storage of Liquids in Permanent Above-Ground Tanks; Storage of Liquid, Food Waste, or Dangerous Waste Containers;

Storage or Transfer (Outside) of Solid Raw Materials, By-Products, or Finished Products; Spills of Oil and Hazardous Substances; Illicit Connections to Storm Drains; and other BMPs provided in this chapter.

Note that a treatment BMP is applicable for contaminated stormwater.

Applicable Treatment BMPs: Contaminated stormwater runoff from vehicle staging and maintenance areas must be conveyed to a sanitary sewer, if allowed by the local sewer authority, or to an API or CP oil and water separator followed by a basic treatment BMP (See Volume V), applicable filter, or other equivalent oil treatment system.

Recommended Additional Operational BMPs:

- Consider storing damaged vehicles inside a building or other covered containment, until all liquids are removed. Remove liquids from vehicles retired for scrap.
- Clean parts with aqueous detergent based solutions or non-chlorinated solvents such as kerosene or high flash mineral spirits, and/or use wire brushing or sand blasting whenever practicable. Avoid using toxic liquid cleaners such as methylene chloride, 1,1,1-trichloroethane, trichloroethylene or similar chlorinated solvents. Choose cleaning agents that can be recycled.
- Inspect all BMPs regularly, particularly after a significant storm. Identify and correct deficiencies to ensure that the BMPs are functioning as intended.
- Avoid hosing down work areas. Use dry methods for cleaning leaked fluids.
- Recycle greases, used oil, oil filters, antifreeze, cleaning solutions, automotive batteries, hydraulic fluids, transmission fluids, and engine oils (see Appendix IV-C).
- Do not mix dissimilar or incompatible waste liquids stored for recycling.

BMPs for Maintenance of Stormwater Drainage and Treatment Systems

Description of Pollutant Sources: Facilities include roadside catch basins on arterials and within residential areas, conveyance systems, detention facilities such as ponds and vaults, oil and water separators, biofilters, settling basins, infiltration systems, and all other types of stormwater treatment systems presented in Volume V. Roadside catch basins can remove from 5 to 15 percent of the pollutants present in stormwater. When catch basins are about 60 percent full of sediment, they cease removing sediments. Oil and grease, hydrocarbons, debris, heavy metals, sediments and contaminated water are found in catch basins, oil and water separators, settling basins, etc.

Pollutant Control Approach: Provide maintenance and cleaning of debris, sediments, and oil from stormwater collection, conveyance, and treatment systems to obtain proper operation.

Applicable Operational BMPs:

Maintain stormwater treatment facilities according to the O & M procedures presented in Section 4.6 of Volume V in addition to the following BMPs:

- Inspect and clean treatment BMPs, conveyance systems, and catch basins as needed, and determine whether improvements in O & M are needed.
- Promptly repair any deterioration threatening the structural integrity of the facilities. These include replacement of clean-out gates, catch basin lids, and rock in emergency spillways.
- Ensure that storm sewer capacities are not exceeded and that heavy sediment discharges to the sewer system are prevented.
- Regularly remove debris and sludge from BMPs used for peak-rate control, treatment, etc. and discharge to a sanitary sewer if approved by the sewer authority, or truck to a local or state government approved disposal site.
- Clean catch basins when the depth of deposits reaches 60 percent of the sump depth as measured from the bottom of basin to the invert of the lowest pipe into or out of the basin. However, in no case should there be less than six inches clearance from the debris surface to the invert of the lowest pipe. Some catch basins (for example, WSDOT Type 1L basins) may have as little as 12 inches sediment storage below the invert. These catch basins will need more frequent inspection and cleaning to prevent scouring. Where these catch basins are part of a stormwater collection and treatment system, the system owner/operator may choose to concentrate maintenance efforts on downstream control devices as part of a systems approach.

- Clean woody debris in a catch basin as frequently as needed to ensure proper operation of the catchbasin.
- Post warning signs; “Dump No Waste - Drains to Ground Water,” “Streams,” “Lakes,” or emboss on or adjacent to all storm drain inlets *where practical*.
- Disposal of sediments and liquids from the catch basins must comply with “Recommendations for Management of Street Wastes” described in Appendix IV-G of this volume.

Additional Applicable BMPs: Select additional applicable BMPs from this chapter depending on the pollutant sources and activities conducted at the facility. Those BMPs include:

- BMPs for Soil Erosion and Sediment Control at Industrial Sites
- BMPs for Storage of Liquid, Food Waste, or Dangerous Waste Containers
- BMPs for Spills of Oil and Hazardous Substances
- BMPs for Illicit Connections to Storm Drains
- BMPs for Urban Streets.

BMPs for Mobile Fueling of Vehicles and Heavy Equipment

Description of Pollutant Sources: Mobile fueling, also known as fleet fueling, wet fueling, or wet hosing, is the practice of filling fuel tanks of vehicles by tank trucks that are driven to the yards or sites where the vehicles to be fueled are located. Mobile fueling is only conducted using diesel fuel, as mobile fueling of gasoline is prohibited. Diesel fuel is considered as a Class II Combustible Liquid, whereas gasoline is considered as a Flammable Liquid.

Historically mobile fueling has been conducted for off-road vehicles that are operated for extended periods of time in remote areas. This includes construction sites, logging operations, and farms. Mobile fueling of on-road vehicles is also conducted commercially in the State of Washington.

Note that some local fire departments may have restrictions on mobile fueling practices.

Pollutant Control Approach: Proper training of the fueling operator, and the use of spill/drip control and reliable fuel transfer equipment with backup shutoff valving are typically needed.

Applicable Operational BMPs:

Organizations and individuals conducting mobile fueling operations must implement the following BMPs. The operating procedures for the driver/operator should be simple, clear, effective and their implementation verified by the organization that will potentially be liable for environmental and third party damage.

- Ensure that all mobile fueling operations are approved by the local fire department and comply with local and Washington State fire codes.
- In fueling locations that are in close proximity to sensitive aquifers, designated wetlands, wetland buffers, or other waters of the State, approval by local jurisdictions is necessary to ensure compliance with additional local requirements.
- Ensure the compliance with all 49 CFR 178 requirements for DOT 406 cargo tanker. Documentation from a Department of Transportation (DOT) Registered Inspector shall be proof of compliance.
- Ensure the presence and the constant observation/monitoring of the driver/operator at the fuel transfer location at all times during fuel transfer and ensure that the following procedures are implemented at the fuel transfer locations:
  - Locating the point of fueling at least 25 feet from the nearest storm drain or inside an impervious containment with a volumetric holding capacity equal to or greater than 110 percent of the fueling tank volume, or covering the storm drain to ensure no inflow of spilled or leaked fuel. Storm drains that convey the inflow to a spill control separator approved by the local jurisdiction and the

fire department need not be covered. Potential spill/leak conveyance surfaces must be impervious and in good repair.

  - Placement of a drip pan, or an absorbent pad under each fueling location prior to and during all dispensing operations. The pan (must be liquid tight) and the absorbent pad must have a capacity of 5 gallons. Spills retained in the drip pan or the pad need not be reported.
  - The handling and operation of fuel transfer hoses and nozzle, drip pan(s), and absorbent pads as needed to prevent spills/leaks of fuel from reaching the ground, storm drains, and receiving waters.
  - Not extending the fueling hoses across a traffic lane without fluorescent traffic cones, or equivalent devices, conspicuously placed so that all traffic is blocked from crossing the fuel hose.
  - Removing the fill nozzle and cessation of filling when the automatic shut-off valve engages. Do not allow automatic shutoff fueling nozzles to be locked in the open position.
  - Not "topping off" the fuel receiving equipment
- Provide the driver/operator of the fueling vehicle with:
  - Adequate flashlights or other mobile lighting to view fill openings with poor accessibility. Consult with local fire department for additional lighting requirements.
  - Two-way communication with his/her home base.
- Train the driver/operator annually in spill prevention and cleanup measures and emergency procedures. Make all employees aware of the significant liability associated with fuel spills.
- The fueling operating procedures should be properly signed and dated by the responsible manager, distributed to the operators, retained in the organization files, and made available in the event an authorized government agency requests a review.
- Ensure that the local fire department (911) and the appropriate regional office of the Department of Ecology are immediately notified in the event of any spill entering the surface or ground waters. Establish a "call down list" to ensure the rapid and proper notification of management and government officials should any significant amount of product be lost off-site. Keep the list in a protected but readily accessible location in the mobile fueling truck. The "call down list" should also pre-identify spill response contractors available in the area to ensure the rapid removal of significant product spillage into the environment.

- Maintain a minimum of the following spill clean-up materials in all fueling vehicles, that are readily available for use:
  - Non-water absorbents capable of absorbing 15 gallons of diesel fuel;
  - A storm drain plug or cover kit;
  - A non-water absorbent containment boom of a minimum 10 feet in length with a 12-gallon absorbent capacity;
  - A non-metallic shovel; and,
  - Two, five-gallon buckets with lids.
- Use automatic shutoff nozzles for dispensing the fuel. Replace automatic shut-off nozzles as recommended by the manufacturer.
- Maintain and replace equipment on fueling vehicles, particularly hoses and nozzles, at established intervals to prevent failures.

Applicable Structural Source Control BMPs: Include the following fuel transfer site components:

- Automatic fuel transfer shut-off nozzles; and,
- An adequate lighting system at the filling point.

BMPs for Parking and Storage of Vehicles and Equipment

Description of Pollutant Sources: Public and commercial parking lots such as retail store, fleet vehicle (including rent-a-car lots and car dealerships), equipment sale and rental parking lots, and parking lot driveways, can be sources of toxic hydrocarbons and other organic compounds, oils and greases, metals, and suspended solids caused by the parked vehicles.

Pollutant Control Approach: If the parking lot is a **high-use site** as defined below, provide appropriate oil removal equipment for the contaminated stormwater runoff.

Applicable Operational BMPs:

- If washing of a parking lot is conducted, discharge the washwater to a sanitary sewer, if allowed by the local sewer authority, or other approved wastewater treatment system, or collect it for off-site disposal.
- Do not hose down the area to a storm drain or to a receiving water. Sweep parking lots, storage areas, and driveways, regularly to collect dirt, waste, and debris.

Applicable Treatment BMPs: An oil removal system such as an API or CP oil and water separator, catch basin filter, or equivalent BMP, approved by the local jurisdiction, is applicable for parking lots meeting the threshold vehicle traffic intensity level of a *high-use site.*

Vehicle High-Use Sites

Establishments subject to a vehicle high-use intensity have been determined to be significant sources of oil contamination of stormwater. Examples of potential high use areas include customer parking lots at fast food stores, grocery stores, taverns, restaurants, large shopping malls, discount warehouse stores, quick-lube shops, and banks. If the PGIS for a high-use site exceeds 5,000 square feet in a threshold discharge area, and oil control BMP from the Oil Control Menu is necessary. A high-use site at a commercial or industrial establishment has one of the following characteristics: (Gaus/King County, 1994)

- Is subject to an expected average daily vehicle traffic (ADT) count equal to or greater than 100 vehicles per 1,000 square feet of gross building area: or
- Is subject to storage of a fleet of 25 or more diesel vehicles that are over 10 tons gross weight (trucks, buses, trains, heavy equipment, etc.).

Appendix D

Drainage Calculations

WWHM2012

PROJECT REPORT

D1

General Model Information

Project Name:	20210319 - WQ (7_437ac 80p imp)
Site Name:	
Site Address:	
City:	
Report Date:	3/19/2021
Gage:	40 IN EAST
Data Start:	10/01/1901
Data End:	09/30/2059
Timestep:	15 Minute
Precip Scale:	1.000
Version Date:	2019/09/13
Version:	4.2.17

POC Thresholds

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

D1

Landuse Basin Data

Predeveloped Land Use

Ex about 60%imp

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Lawn, Flat	2.935
Pervious Total	2.935

Impervious Land Use	acre
PARKING FLAT	4.402
Impervious Total	4.402
Basin Total	7.337

Element Flows To:

Surface	Interflow	Groundwater

D1

Mitigated Land Use

Basin 1

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
C, Lawn, Flat	1.387
Pervious Total	1.387

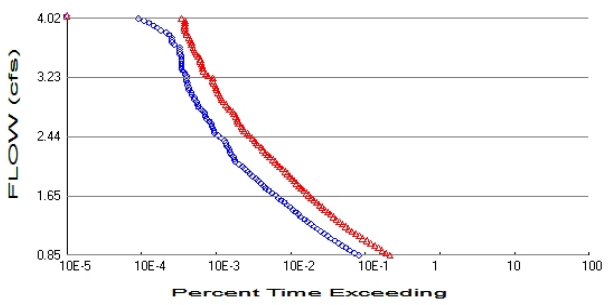
Impervious Land Use	acre
PARKING FLAT	5.95
Impervious Total	5.95
Basin Total	7.337

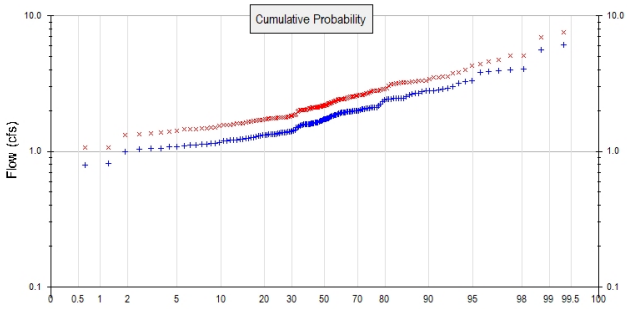
Element Flows To:

Surface	Interflow	Groundwater

Analysis Results

POC 1





\+ Predeveloped x Mitigated

Predeveloped Landuse Totals for POC #1
Total Pervious Area: 2.935
Total Impervious Area: 4.402

Mitigated Landuse Totals for POC #1
Total Pervious Area: 1.387
Total Impervious Area: 5.95

Flow Frequency Method: Log Pearson Type III 17B

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	**Flow(cfs)**
2 year	1.709898
5 year	2.350912
10 year	2.825503
25 year	3.484782
50 year	4.020894
100 year	4.597023

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	**Flow(cfs)**
2 year	2.196103
5 year	2.96862
10 year	3.533137
25 year	4.309126
50 year	4.934306
100 year	5.601221

Annual Peaks

Annual Peaks for Predeveloped and Mitigated. POC #1

Year	**Predeveloped**	**Mitigated**
1902	1.876	2.529
1903	2.091	2.807
1904	2.877	3.415
1905	1.107	1.447
1906	1.206	1.618
1907	1.845	2.251
1908	1.403	1.799
1909	1.595	2.151
1910	1.767	2.107
1911	1.924	2.414

D1

1912	3.916	4.292
1913	1.242	1.665
1914	6.103	7.505
1915	1.142	1.475
1916	2.000	2.688
1917	0.788	1.064
1918	1.582	2.136
1919	1.079	1.382
1920	1.498	1.852
1921	1.256	1.572
1922	2.096	2.523
1923	1.377	1.716
1924	2.322	3.115
1925	1.038	1.341
1926	1.866	2.520
1927	1.610	2.163
1928	1.231	1.575
1929	2.536	3.180
1930	2.454	3.254
1931	1.234	1.590
1932	1.331	1.710
1933	1.320	1.680
1934	2.430	2.887
1935	1.079	1.456
1936	1.588	2.033
1937	1.966	2.589
1938	1.123	1.479
1939	1.345	1.799
1940	2.453	3.255
1941	2.626	3.533
1942	2.059	2.519
1943	1.887	2.424
1944	2.902	3.581
1945	1.994	2.608
1946	1.715	2.115
1947	1.190	1.573
1948	1.684	2.182
1949	2.470	3.310
1950	1.347	1.820
1951	2.082	2.813
1952	3.165	3.542
1953	2.810	3.228
1954	1.380	1.773
1955	1.208	1.627
1956	1.113	1.504
1957	1.346	1.755
1958	1.898	2.289
1959	1.927	2.300
1960	1.330	1.760
1961	4.020	5.043
1962	1.628	2.120
1963	1.144	1.545
1964	3.844	4.711
1965	1.816	2.209
1966	1.318	1.714
1967	2.068	2.513
1968	1.588	2.045
1969	1.444	1.846

D1

1970	1.731	2.126
1971	1.748	2.106
1972	5.614	6.888
1973	2.803	3.770
1974	2.242	2.849
1975	2.770	3.147
1976	2.690	3.231
1977	0.999	1.316
1978	2.041	2.383
1979	1.971	2.475
1980	2.003	2.419
1981	1.685	2.205
1982	1.360	1.774
1983	1.985	2.467
1984	1.960	2.445
1985	2.392	2.861
1986	1.102	1.394
1987	1.841	2.419
1988	1.132	1.449
1989	1.046	1.407
1990	1.415	1.786
1991	2.161	2.709
1992	1.845	2.493
1993	2.050	2.764
1994	1.656	2.008
1995	1.161	1.506
1996	1.682	2.081
1997	1.412	1.817
1998	1.814	2.232
1999	1.809	2.429
2000	1.609	2.063
2001	1.218	1.646
2002	2.813	3.238
2003	1.369	1.752
2004	1.994	2.611
2005	3.872	5.083
2006	1.725	2.314
2007	2.093	2.665
2008	1.641	2.155
2009	1.199	1.618
2010	1.623	2.118
2011	1.597	2.159
2012	1.616	2.084
2013	1.630	2.017
2014	1.389	1.877
2015	2.851	3.339
2016	1.501	2.027
2017	2.421	3.174
2018	1.737	2.032
2019	2.614	3.039
2020	1.950	2.401
2021	1.578	1.987
2022	2.474	3.239
2023	2.983	4.005
2024	3.983	4.569
2025	1.550	2.095
2026	1.764	2.371
2027	1.930	2.585

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2028	0.740	0.999
2029	1.358	1.709
2030	2.664	3.529
2031	0.812	1.062
2032	1.296	1.744
2033	1.631	2.204
2034	1.238	1.673
2035	1.897	2.274
2036	1.286	1.732
2037	1.717	2.320
2038	1.952	2.346
2039	3.270	4.405
2040	1.378	1.774
2041	1.751	2.253
2042	2.012	2.567
2043	2.094	2.818
2044	1.525	1.971
2045	1.262	1.610
2046	1.399	1.787
2047	1.580	2.135
2048	1.302	1.755
2049	1.934	2.604
2050	1.600	2.022
2051	2.434	2.925
2052	1.560	2.108
2053	1.328	1.783
2054	3.315	3.839
2055	1.573	2.045
2056	2.098	2.813
2057	1.053	1.367
2058	1.944	2.627
2059	2.455	3.315

Ranked Annual Peaks

Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	6.1029	7.5051
2	5.6142	6.8879
3	4.0195	5.0829
4	3.9825	5.0431
5	3.9159	4.7113
6	3.8721	4.5689
7	3.8439	4.4046
8	3.3155	4.2917
9	3.2697	4.0046
10	3.1649	3.8393
11	2.9834	3.7698
12	2.9023	3.5814
13	2.8772	3.5418
14	2.8506	3.5334
15	2.8127	3.5286
16	2.8099	3.4154
17	2.8029	3.3386
18	2.7701	3.3147
19	2.6896	3.3097
20	2.6644	3.2553
21	2.6260	3.2539
22	2.6135	3.2390

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23	2.5359	3.2376
24	2.4738	3.2310
25	2.4697	3.2282
26	2.4554	3.1796
27	2.4543	3.1738
28	2.4528	3.1472
29	2.4336	3.1148
30	2.4305	3.0385
31	2.4206	2.9254
32	2.3917	2.8867
33	2.3225	2.8614
34	2.2419	2.8494
35	2.1611	2.8176
36	2.0976	2.8132
37	2.0964	2.8129
38	2.0943	2.8068
39	2.0932	2.7636
40	2.0911	2.7090
41	2.0821	2.6882
42	2.0676	2.6655
43	2.0592	2.6268
44	2.0505	2.6115
45	2.0408	2.6083
46	2.0124	2.6037
47	2.0028	2.5894
48	2.0004	2.5851
49	1.9944	2.5669
50	1.9937	2.5291
51	1.9846	2.5228
52	1.9713	2.5205
53	1.9663	2.5192
54	1.9602	2.5133
55	1.9519	2.4929
56	1.9497	2.4749
57	1.9442	2.4672
58	1.9336	2.4446
59	1.9304	2.4288
60	1.9265	2.4235
61	1.9236	2.4194
62	1.8977	2.4190
63	1.8968	2.4136
64	1.8868	2.4010
65	1.8764	2.3829
66	1.8664	2.3710
67	1.8452	2.3458
68	1.8445	2.3196
69	1.8415	2.3145
70	1.8159	2.3001
71	1.8144	2.2889
72	1.8094	2.2744
73	1.7670	2.2527
74	1.7642	2.2508
75	1.7507	2.2316
76	1.7479	2.2086
77	1.7369	2.2050
78	1.7310	2.2036
79	1.7255	2.1816
80	1.7170	2.1628

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81	1.7151	2.1587
82	1.6848	2.1553
83	1.6835	2.1507
84	1.6818	2.1356
85	1.6559	2.1352
86	1.6409	2.1261
87	1.6306	2.1201
88	1.6302	2.1179
89	1.6282	2.1154
90	1.6235	2.1083
91	1.6155	2.1070
92	1.6104	2.1065
93	1.6094	2.0952
94	1.5998	2.0839
95	1.5974	2.0813
96	1.5945	2.0634
97	1.5883	2.0454
98	1.5879	2.0451
99	1.5824	2.0326
100	1.5802	2.0321
101	1.5779	2.0275
102	1.5732	2.0219
103	1.5602	2.0167
104	1.5505	2.0077
105	1.5250	1.9873
106	1.5007	1.9710
107	1.4982	1.8767
108	1.4438	1.8520
109	1.4147	1.8457
110	1.4120	1.8198
111	1.4029	1.8174
112	1.3990	1.7994
113	1.3889	1.7990
114	1.3798	1.7873
115	1.3782	1.7863
116	1.3773	1.7830
117	1.3686	1.7736
118	1.3604	1.7736
119	1.3580	1.7734
120	1.3469	1.7595
121	1.3460	1.7554
122	1.3448	1.7553
123	1.3311	1.7521
124	1.3300	1.7438
125	1.3276	1.7323
126	1.3197	1.7159
127	1.3181	1.7142
128	1.3017	1.7095
129	1.2956	1.7094
130	1.2864	1.6802
131	1.2617	1.6730
132	1.2563	1.6653
133	1.2422	1.6464
134	1.2383	1.6271
135	1.2339	1.6182
136	1.2309	1.6179
137	1.2183	1.6100
138	1.2083	1.5901

139	1.2059	1.5746
140	1.1986	1.5729
141	1.1897	1.5718
142	1.1610	1.5445
143	1.1441	1.5059
144	1.1419	1.5037
145	1.1324	1.4793
146	1.1232	1.4754
147	1.1128	1.4561
148	1.1073	1.4486
149	1.1024	1.4474
150	1.0794	1.4069
151	1.0789	1.3939
152	1.0529	1.3823
153	1.0463	1.3669
154	1.0383	1.3408
155	0.9988	1.3161
156	0.8119	1.0640
157	0.7878	1.0619
158	0.7403	0.9987

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Duration Flows

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.8549	4572	11872	259	Fail
0.8869	3946	10476	265	Fail
0.9189	3475	9324	268	Fail
0.9509	3061	8260	269	Fail
0.9829	2705	7352	271	Fail
1.0148	2408	6532	271	Fail
1.0468	2154	5778	268	Fail
1.0788	1926	5139	266	Fail
1.1108	1711	4585	267	Fail
1.1428	1540	4109	266	Fail
1.1747	1397	3665	262	Fail
1.2067	1265	3317	262	Fail
1.2387	1128	3019	267	Fail
1.2707	1018	2718	266	Fail
1.3027	919	2481	269	Fail
1.3346	844	2261	267	Fail
1.3666	749	2063	275	Fail
1.3986	701	1902	271	Fail
1.4306	645	1734	268	Fail
1.4626	593	1582	266	Fail
1.4945	547	1451	265	Fail
1.5265	497	1339	269	Fail
1.5585	455	1230	270	Fail
1.5905	413	1125	272	Fail
1.6225	376	1048	278	Fail
1.6544	349	966	276	Fail
1.6864	312	902	289	Fail
1.7184	282	826	292	Fail
1.7504	253	765	302	Fail
1.7823	239	712	297	Fail
1.8143	221	661	299	Fail
1.8463	203	611	300	Fail
1.8783	187	571	305	Fail
1.9103	172	537	312	Fail
1.9422	157	498	317	Fail
1.9742	147	465	316	Fail
2.0062	133	430	323	Fail
2.0382	126	392	311	Fail
2.0702	112	366	326	Fail
2.1021	100	341	341	Fail
2.1341	97	317	326	Fail
2.1661	95	291	306	Fail
2.1981	89	272	305	Fail
2.2301	85	251	295	Fail
2.2620	84	235	279	Fail
2.2940	80	223	278	Fail
2.3260	76	201	264	Fail
2.3580	74	190	256	Fail
2.3900	71	181	254	Fail
2.4219	64	169	264	Fail
2.4539	58	153	263	Fail
2.4859	53	146	275	Fail
2.5179	52	132	253	Fail
2.5498	50	126	252	Fail

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2.5818	48	120	250	Fail
2.6138	47	109	231	Fail
2.6458	45	107	237	Fail
2.6778	41	105	256	Fail
2.7097	40	103	257	Fail
2.7417	39	96	246	Fail
2.7737	37	92	248	Fail
2.8057	35	84	240	Fail
2.8377	32	79	246	Fail
2.8696	31	75	241	Fail
2.9016	30	69	230	Fail
2.9336	28	65	232	Fail
2.9656	28	64	228	Fail
2.9976	26	62	238	Fail
3.0295	26	59	226	Fail
3.0615	24	56	233	Fail
3.0935	24	55	229	Fail
3.1255	23	54	234	Fail
3.1575	23	52	226	Fail
3.1894	22	50	227	Fail
3.2214	22	50	227	Fail
3.2534	22	43	195	Fail
3.2854	21	40	190	Fail
3.3174	20	37	185	Fail
3.3493	19	36	189	Fail
3.3813	19	36	189	Fail
3.4133	19	35	184	Fail
3.4453	19	34	178	Fail
3.4772	19	34	178	Fail
3.5092	19	32	168	Fail
3.5412	18	30	166	Fail
3.5732	18	29	161	Fail
3.6052	18	28	155	Fail
3.6371	18	27	150	Fail
3.6691	15	26	173	Fail
3.7011	14	26	185	Fail
3.7331	14	25	178	Fail
3.7651	14	24	171	Fail
3.7970	13	22	169	Fail
3.8290	12	22	183	Fail
3.8610	10	21	209	Fail
3.8930	9	21	233	Fail
3.9250	8	21	262	Fail
3.9569	7	21	300	Fail
3.9889	6	21	350	Fail
4.0209	5	19	380	Fail

The development has an increase in flow durations from 1/2 Predeveloped 2 year flow to the 2 year flow or more than a 10% increase from the 2 year to the 50 year flow.
The development has an increase in flow durations for more than 50% of the flows for the range of the duration analysis.

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Water Quality

Water Quality BMP Flow and Volume for POC #1

On-line facility volume:	0.6852 acre-feet
On-line facility target flow:	0.8956 cfs.
Adjusted for 15 min:	0.8956 cfs.
Off-line facility target flow:	0.5178 cfs.
Adjusted for 15 min:	0.5178 cfs.

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LID Report

LID Technique	Used for Treatment ?	Total Volume Needs Treatment (ac-ft)	Volume Through Facility (ac-ft)	Infiltration Volume (ac-ft)	Cumulative Volume Infiltration Credit	Percent Volume Infiltrated	Water Quality	Percent Water Quality Treated	Comment
Total Volume Infiltrated		0.00	0.00	0.00		0.00	0.00	0%	No Treat. Credit
Compliance with LID Standard 8% of 2-yr to 50% of 2-yr									Duration Analysis Result = Failed

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Model Default Modifications

Total of 0 changes have been made.

PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

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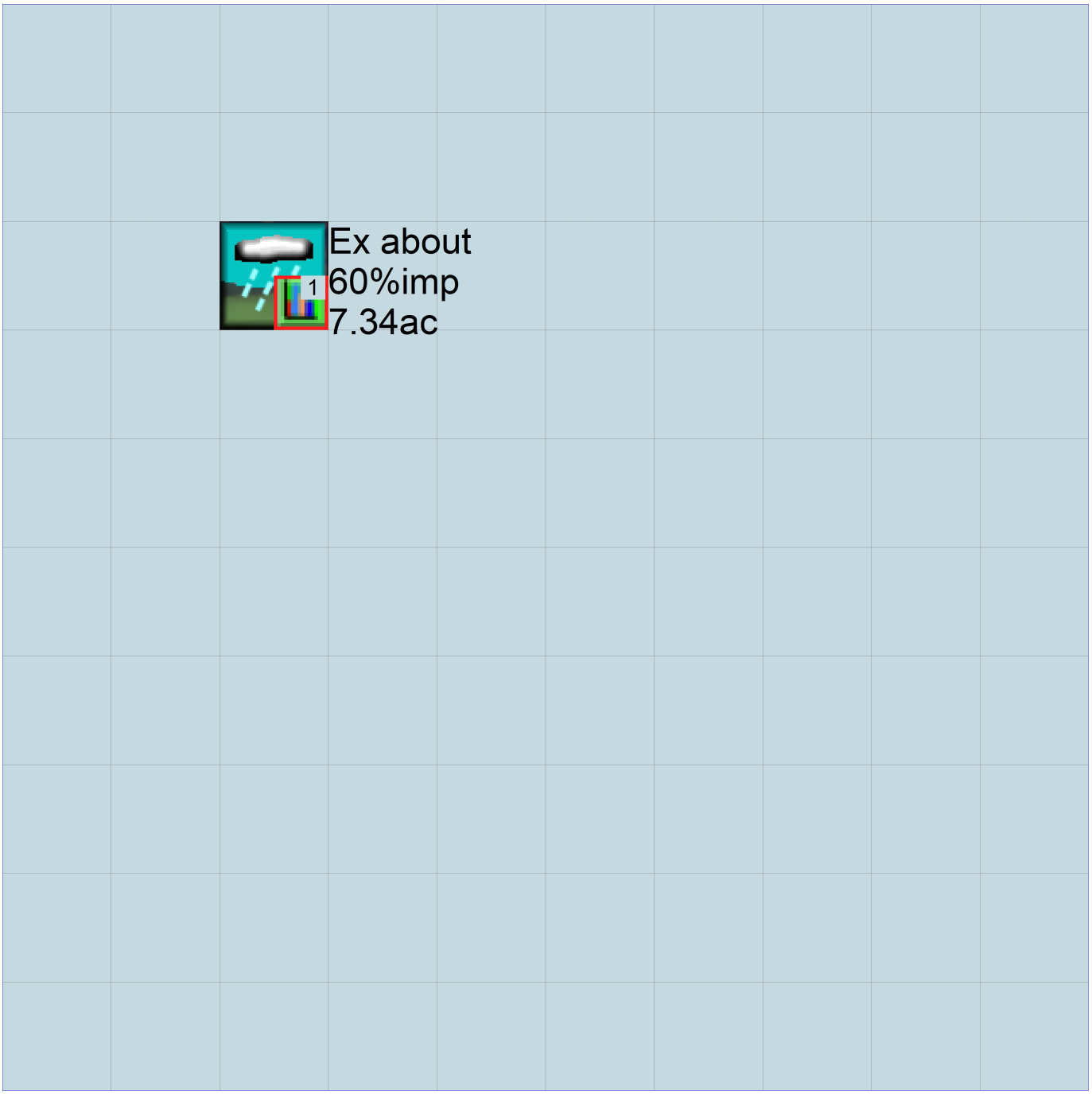
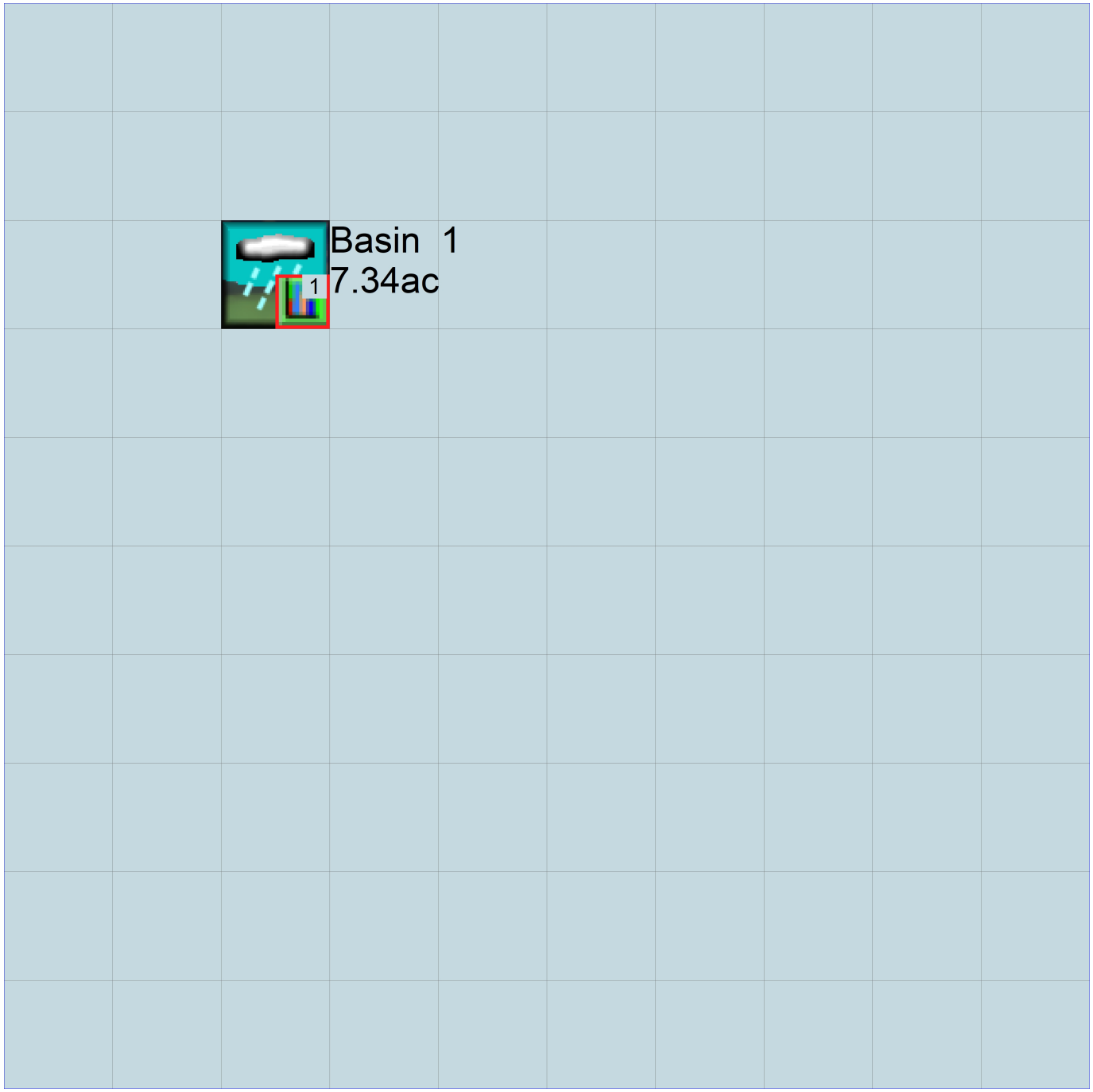
Appendix
Predeveloped Schematic



Mitigated Schematic



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Project Description

File Name	20210616 - LRR Conveyance Caculation Model Upd.SPF
Description	
	Q:\2016\2160102\10_CIV\CAD\EXHIBITS\Storm Report_2160102-Conveyance Basins.dwg

Project Options

Flow Units	CFS
Elevation Type	Elevation
Hydrology Method	Santa Barbara UH
Time of Concentration (TOC) Method	SCS TR-55
Link Routing Method	Hydrodynamic
Enable Overflow Ponding at Nodes	YES
Skip Steady State Analysis Time Periods	YES

Analysis Options

Start Analysis On	Jun 16, 2021	00:00:00
End Analysis On	Jun 17, 2021	00:00:00
Start Reporting On	Jun 16, 2021	00:00:00
Antecedent Dry Days	0	days
Runoff (Dry Weather) Time Step	0 01:00:00	days hh:mm:ss
Runoff (Wet Weather) Time Step	0 00:05:00	days hh:mm:ss
Reporting Time Step	0 00:05:00	days hh:mm:ss
Routing Time Step	30	seconds

Number of Elements

	Qty
Rain Gages	1
Subbasins	27
Nodes	23
Junctions	22
Outfalls	1
Flow Diversions	0
Inlets	0
Storage Nodes	0
Links	22
Channels	0
Pipes	22
Pumps	0
Orifices	0
Weirs	0
Outlets	0
Pollutants	0
Land Uses	0

Rainfall Details

SN	Rain Gage ID	Data Source	Data Source ID	Rainfall Type	Rain Units	State	County	Return Period (years)	Rainfall Depth (inches)	Rainfall Distribution
1	Rain Gage-02	Time Series	TS-02	Cumulative	inches	Washington	Pierce	25	3.45	SCS Type IA 24-hr

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Subbasin Summary

SN	Subbasin ID	Area (ac)	Impervious Area (%)	Impervious Area Curve Number	Pervious Area Curve Number	Total Rainfall (in)	Total Runoff (in)	Total Runoff Volume (ac-in)	Peak Runoff (cfs)	Time of Concentration (days hh:mm:ss)
1	{Site 1}.EX BLDG AND PAVE N	0.16	100.00	98.00	76.00	3.44	3.21	0.52	0.13	0 00:05:00
2	{Site 1}.EX BLDG AND PAVEMENT NW	0.32	98.00	98.00	76.00	3.44	3.17	1.01	0.25	0 00:05:00
3	{Site 1}.EX BLDG N	0.23	100.00	98.00	76.00	3.44	3.21	0.73	0.18	0 00:05:00
4	{Site 1}.EX BLDG NW	0.05	100.00	98.00	76.00	3.44	3.21	0.17	0.04	0 00:05:00
5	{Site 1}.EX BLDG SE	0.06	100.00	98.00	76.00	3.44	3.21	0.19	0.05	0 00:05:00
6	{Site 1}.EX PAVE N	0.14	100.00	98.00	76.00	3.44	3.21	0.44	0.11	0 00:05:00
7	{Site 1}.FR1	0.04	92.00	98.00	76.00	3.44	3.06	0.12	0.03	0 00:05:00
8	{Site 1}.FR2	0.26	97.00	98.00	76.00	3.44	3.15	0.83	0.21	0 00:05:00
9	{Site 1}.L1	0.34	97.00	98.00	76.00	3.44	3.15	1.06	0.27	0 00:05:00
10	{Site 1}.L2	0.34	96.00	98.00	76.00	3.44	3.13	1.05	0.26	0 00:05:00
11	{Site 1}.L3	0.34	96.00	98.00	76.00	3.44	3.13	1.06	0.27	0 00:05:00
12	{Site 1}.L4	0.34	96.00	98.00	76.00	3.44	3.13	1.07	0.27	0 00:05:00
13	{Site 1}.L5	0.45	96.00	98.00	76.00	3.44	3.13	1.42	0.36	0 00:05:00
14	{Site 1}.L6	0.21	95.00	98.00	76.00	3.44	3.11	0.65	0.16	0 00:05:00
15	{Site 1}.L7	0.26	95.00	98.00	76.00	3.44	3.11	0.82	0.21	0 00:05:00
16	{Site 1}.M1	0.34	100.00	98.00	76.00	3.44	3.21	1.10	0.28	0 00:05:00
17	{Site 1}.M3	0.34	100.00	98.00	76.00	3.44	3.21	1.10	0.28	0 00:05:00
18	{Site 1}.M4	0.34	98.00	98.00	76.00	3.44	3.17	1.07	0.27	0 00:05:00
19	{Site 1}.M5	0.17	93.00	98.00	76.00	3.44	3.08	0.52	0.13	0 00:05:00
20	{Site 1}.M6	0.26	95.00	98.00	76.00	3.44	3.11	0.81	0.20	0 00:05:00
21	{Site 1}.M7	0.43	97.00	98.00	76.00	3.44	3.15	1.35	0.34	0 00:05:00
22	{Site 1}.MR1	0.19	98.00	98.00	76.00	3.44	3.17	0.61	0.15	0 00:05:00
23	{Site 1}.MR2	0.28	98.00	98.00	76.00	3.44	3.17	0.88	0.22	0 00:05:00
24	{Site 1}.MR3	0.27	98.00	98.00	76.00	3.44	3.17	0.86	0.22	0 00:05:00
25	{Site 1}.MR4	0.45	98.00	98.00	76.00	3.44	3.17	1.42	0.36	0 00:05:00
26	{Site 1}.MR5	0.05	98.00	98.00	76.00	3.44	3.17	0.16	0.04	0 00:05:00
27	M2	0.28	100.00	98.00	76.00	3.44	3.21	0.90	0.23	0 00:05:00

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Node Summary

SN	Element ID	Element Type	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Initial Water Elevation (ft)	Surcharge Elevation (ft)	Ponded Area (ft²)	Peak Inflow (cfs)	Max HGL Elevation Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	CB 1	Junction	25.17	38.25	25.17	38.25	0.00	5.47	26.52	0.00	11.73	0 00:00	0.00	0.00
2	CB 11	Junction	32.36	36.89	32.36	36.89	0.00	1.23	33.04	0.00	3.86	0 00:00	0.00	0.00
3	CB 12	Junction	32.68	37.33	32.68	37.33	0.00	0.96	33.26	0.00	4.07	0 00:00	0.00	0.00
4	CB 13	Junction	33.00	37.27	33.00	37.27	0.00	0.65	33.39	0.00	3.88	0 00:00	0.00	0.00
5	CB 14	Junction	33.39	36.44	33.39	36.44	0.00	0.34	33.66	0.00	2.78	0 00:00	0.00	0.00
6	CB 15	Junction	31.83	35.86	31.83	35.86	0.00	2.08	32.77	0.00	3.09	0 00:00	0.00	0.00
7	CB 16	Junction	33.33	36.38	33.33	36.38	0.00	0.27	33.60	0.00	2.78	0 00:00	0.00	0.00
8	CB 17	Junction	32.15	35.72	32.15	35.72	0.00	1.55	32.93	0.00	2.79	0 00:00	0.00	0.00
9	CB 18	Junction	32.47	35.72	32.47	35.72	0.00	1.29	33.17	0.00	2.55	0 00:00	0.00	0.00
10	CB 19	Junction	32.79	35.88	32.79	35.88	0.00	1.09	33.39	0.00	2.49	0 00:00	0.00	0.00
11	CB 2	Junction	28.58	38.40	28.58	38.40	0.00	5.44	29.94	0.00	8.46	0 00:00	0.00	0.00
12	CB 20	Junction	33.44	36.48	33.44	36.48	0.00	0.21	33.69	0.00	2.80	0 00:00	0.00	0.00
13	CB 21	Junction	34.00	37.05	34.00	37.05	0.00	0.46	34.32	0.00	2.73	0 00:00	0.00	0.00
14	CB 3	Junction	29.17	37.23	29.17	37.23	0.00	5.19	30.49	0.00	6.74	0 00:00	0.00	0.00
15	CB 4	Junction	34.20	37.25	34.20	37.25	0.00	0.15	34.40	0.00	2.85	0 00:00	0.00	0.00
16	CB 5	Junction	34.33	37.38	34.33	37.38	0.00	0.74	34.94	0.00	2.44	0 00:00	0.00	0.00
17	CB 6	Junction	34.76	37.81	34.76	37.81	0.00	0.53	35.26	0.00	2.55	0 00:00	0.00	0.00
18	CB 7	Junction	36.78	39.88	36.78	39.88	0.00	0.04	36.92	0.00	2.96	0 00:00	0.00	0.00
19	CB 8	Junction	30.20	35.84	30.20	35.84	0.00	4.08	31.34	0.00	4.50	0 00:00	0.00	0.00
20	CB 9	Junction	33.12	36.17	33.12	36.17	0.00	0.28	33.40	0.00	2.77	0 00:00	0.00	0.00
21	CB_10	Junction	32.04	36.20	32.04	36.20	0.00	1.51	32.80	0.00	3.40	0 00:00	0.00	0.00
22	CONNECT TO EX CB2	Junction	35.21	35.73	35.21	35.73	0.00	0.25	35.48	0.00	0.40	0 00:00	0.00	0.00
23	Out-1P - (25)	Outfall	24.40					5.48	24.95					

D2

Link Summary

SN	Element ID	Element Type	From (Inlet) Node	To (Outlet) Node	Length	Inlet Invert Elevation	Outlet Invert Elevation	Average Slope	Diameter or Height	Manning's Roughness	Peak Flow	Design Flow Capacity	Peak Flow/ Design Flow Ratio	Peak Flow Velocity	Peak Flow Depth	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged	Reported Condition
					(ft)	(ft)	(ft)	(%)	(in)		(cfs)	(cfs)		(ft/sec)	(ft)		(min)	
1	.5	Pipe	CB 11	CB_10	64.00	32.36	32.04	0.5000	12.000	0.0120	1.23	2.73	0.45	2.14	0.72	0.72	0.00	Calculated
2	P - (10)	Pipe	CB 2	CB 1	71.30	28.58	28.22	0.5000	18.000	0.0120	5.44	8.05	0.68	3.82	1.13	0.75	0.00	Calculated
3	P - (11)	Pipe	CB 16	CB 15	64.00	33.33	31.33	3.1300	8.000	0.0120	0.27	2.00	0.13	1.01	0.47	0.70	0.00	Calculated
4	P - (12)	Pipe	CB 17	CB 15	64.02	32.15	31.83	0.5000	12.000	0.0120	1.55	2.73	0.57	2.15	0.86	0.86	0.00	Calculated
5	P - (13)	Pipe	CB 9	CB 8	64.00	33.12	30.53	4.0500	8.000	0.0120	0.28	2.63	0.11	2.16	0.47	0.71	0.00	Calculated
6	P - (14)	Pipe	CB 8	CB_10	64.00	30.20	32.04	-2.8700	12.000	0.0120	1.51	6.54	0.23	2.06	0.88	0.88	0.00	Calculated
7	P - (15)	Pipe	CB 14	CB 13	77.23	33.39	33.00	0.5000	12.000	0.0120	0.34	2.73	0.12	1.54	0.33	0.33	0.00	Calculated
8	P - (16)	Pipe	CB 13	CB 12	64.68	33.00	32.68	0.5000	12.000	0.0120	0.65	2.71	0.24	1.86	0.48	0.48	0.00	Calculated
9	P - (17)	Pipe	CB 12	CB 11	64.00	32.68	32.36	0.5000	12.000	0.0120	0.96	2.73	0.35	2.05	0.63	0.63	0.00	Calculated
10	P - (19)	Pipe	CB 7	CB 6	55.02	36.78	34.76	3.6700	8.000	0.0120	0.04	2.51	0.02	0.38	0.32	0.48	0.00	Calculated
11	P - (20)	Pipe	CB 6	CB 5	66.44	34.76	33.79	1.4600	8.000	0.0120	0.53	1.58	0.33	1.83	0.55	0.83	0.00	Calculated
12	P - (21)	Pipe	CONNECT TO EX CB2	CB 21	64.31	35.21	34.33	1.3600	8.000	0.0120	0.25	1.53	0.17	2.44	0.23	0.34	0.00	Calculated
13	P - (25)	Pipe	CB 1	Out-1P - (25)	26.74	25.17	24.40	2.8800	18.000	0.0120	5.48	19.31	0.28	4.66	0.95	0.63	0.00	Calculated
14	P - (26)	Pipe	CB 4	CB 3	70.08	34.20	30.00	5.9900	8.000	0.0120	0.15	3.21	0.05	2.41	0.34	0.51	0.00	Calculated
15	P - (27)	Pipe	CB 21	CB 19	97.22	34.00	32.79	1.2400	12.000	0.0120	0.46	4.30	0.11	1.51	0.46	0.46	0.00	Calculated
16	P - (3)	Pipe	CB 20	CB 19	108.58	33.44	32.79	0.6000	12.000	0.0120	0.27	2.99	0.09	0.88	0.42	0.42	0.00	Calculated
17	P - (4)	Pipe	CB 19	CB 18	63.74	32.79	32.47	0.5000	12.000	0.0120	1.02	2.72	0.37	2.12	0.65	0.65	0.00	Calculated
18	P - (5)	Pipe	CB 18	CB 17	64.25	32.47	32.15	0.5000	12.000	0.0120	1.28	2.73	0.47	2.12	0.74	0.74	0.00	Calculated
19	P - (6)	Pipe	CB 15	CB 8	225.00	31.83	30.20	0.7200	12.000	0.0120	2.07	3.28	0.63	2.66	0.97	0.97	0.00	Calculated
20	P - (7)	Pipe	CB 8	CB 3	206.99	30.20	29.17	0.5000	18.000	0.0120	4.08	8.03	0.51	2.63	1.23	0.82	0.00	Calculated
21	P - (8)	Pipe	CB 5	CB 3	63.11	33.79	30.00	6.0100	8.000	0.0120	0.74	3.43	0.22	3.33	0.55	0.82	0.00	Calculated
22	P - (9)	Pipe	CB 3	CB 2	118.56	29.17	28.58	0.5000	18.000	0.0120	5.19	8.03	0.65	3.12	1.34	0.89	0.00	Calculated

D2

Subbasin Hydrology

Subbasin : {Site 1}.EX BLDG AND PAVE N

Input Data

Area (ac) 0.16
Impervious Area (%) 100.00
Impervious Area Curve Number 98.00
Pervious Area Curve Number 76.00
Rain Gage ID ..... Rain Gage-02

Composite Curve Number

Soil/Surface Description	Area (acres)	Soil Group	Curve Number
Composite Area & Weighted CN	0.16		98

Time of Concentration

TOC Method : SCS TR-55

Sheet Flow Equation :

Tc = (0.007 * ((n * Lf)^0.8)) / ((P^0.5) * (Sf^0.4))

Where :

Tc = Time of Concentration (hr)
n = Manning's roughness
Lf = Flow Length (ft)
P = 2 yr, 24 hr Rainfall (inches)
Sf = Slope (ft/ft)

Shallow Concentrated Flow Equation :

V = 16.1345 * (Sf^0.5) (unpaved surface)
V = 20.3282 * (Sf^0.5) (paved surface)
V = 15.0 * (Sf^0.5) (grassed waterway surface)
V = 10.0 * (Sf^0.5) (nearly bare & untilled surface)
V = 9.0 * (Sf^0.5) (cultivated straight rows surface)
V = 7.0 * (Sf^0.5) (short grass pasture surface)
V = 5.0 * (Sf^0.5) (woodland surface)
V = 2.5 * (Sf^0.5) (forest w/heavy litter surface)
Tc = (Lf / V) / (3600 sec/hr)

Where:

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)

Channel Flow Equation :

V = (1.49 * (R^(2/3)) * (Sf^0.5)) / n
R = Aq / Wp
Tc = (Lf / V) / (3600 sec/hr)

Where :

Tc = Time of Concentration (hr)
Lf = Flow Length (ft)
R = Hydraulic Radius (ft)
Aq = Flow Area (ft²)
Wp = Wetted Perimeter (ft)
V = Velocity (ft/sec)
Sf = Slope (ft/ft)
n = Manning's roughness

User-Defined TOC override (minutes): 5.00

Subbasin Runoff Results

Total Rainfall (in) 3.44
Total Runoff (in) 3.21
Peak Runoff (cfs) 0.13
Weighted Curve Number 98.00
Time of Concentration (days hh:mm:ss) 0 00:05:00

D2

Junction Input

SN	Element ID	Invert Elevation (ft)	Ground/Rim (Max) Elevation (ft)	Ground/Rim (Max) Offset (ft)	Initial Water Elevation (ft)	Initial Water Depth (ft)	Surcharge Elevation (ft)	Surcharge Depth (ft)	Ponded Area (ft^2)	Minimum Pipe Cover (in)
1	CB 1	25.17	38.25	13.08	25.17	0.00	38.25	0.00	0.00	102.35
2	CB 11	32.36	36.89	4.53	32.36	0.00	36.89	0.00	0.00	42.40
3	CB 12	32.68	37.33	4.65	32.68	0.00	37.33	0.00	0.00	43.78
4	CB 13	33.00	37.27	4.27	33.00	0.00	37.27	0.00	0.00	39.15
5	CB 14	33.39	36.44	3.05	33.39	0.00	36.44	0.00	0.00	24.60
6	CB 15	31.83	35.86	4.03	31.83	0.00	35.86	0.00	0.00	36.36
7	CB 16	33.33	36.38	3.05	33.33	0.00	36.38	0.00	0.00	28.64
8	CB 17	32.15	35.72	3.57	32.15	0.00	35.72	0.00	0.00	30.85
9	CB 18	32.47	35.72	3.25	32.47	0.00	35.72	0.00	0.00	26.99
10	CB 19	32.79	35.88	3.09	32.79	0.00	35.88	0.00	0.00	25.08
11	CB 2	28.58	38.40	9.82	28.58	0.00	38.40	0.00	0.00	99.84
12	CB 20	33.44	36.48	3.04	33.44	0.00	36.48	0.00	0.00	24.53
13	CB 21	34.00	37.05	3.05	34.00	0.00	37.05	0.00	0.00	24.55
14	CB 3	29.17	37.23	8.06	29.17	0.00	37.23	0.00	0.00	78.75
15	CB 4	34.20	37.25	3.05	34.20	0.00	37.25	0.00	0.00	28.60
16	CB 5	34.33	37.38	3.05	34.33	0.00	37.38	0.00	0.00	35.05
17	CB 6	34.76	37.81	3.05	34.76	0.00	37.81	0.00	0.00	28.64
18	CB 7	36.78	39.88	3.10	36.78	0.00	39.88	0.00	0.00	29.16
19	CB 8	30.20	35.84	5.64	30.20	0.00	35.84	0.00	0.00	49.68
20	CB 9	33.12	36.17	3.05	33.12	0.00	36.17	0.00	0.00	28.62
21	CB_10	32.04	36.20	4.16	32.04	0.00	36.20	0.00	0.00	37.92
22	CONNECT TO EX CB2	35.21	35.73	0.52	35.21	0.00	35.73	0.00	0.00	0.00

D2

Junction Results

SN	Element ID	Peak Inflow (cfs)	Peak Lateral Inflow (cfs)	Max HGL Elevation Attained (ft)	Max HGL Depth Attained (ft)	Max Surcharge Depth Attained (ft)	Min Freeboard Attained (ft)	Average HGL Elevation Attained (ft)	Average HGL Depth Attained (ft)	Time of Max HGL Occurrence (days hh:mm)	Time of Peak Flooding Occurrence (days hh:mm)	Total Flooded Volume (ac-in)	Total Time Flooded (min)
1	CB 1	5.47	0.03	26.52	1.35	0.00	11.73	25.68	0.51	0 07:55	0 00:00	0.00	0.00
2	CB 11	1.23	0.27	33.04	0.68	0.00	3.86	32.64	0.28	0 07:55	0 00:00	0.00	0.00
3	CB 12	0.96	0.31	33.26	0.58	0.00	4.07	32.93	0.25	0 07:55	0 00:00	0.00	0.00
4	CB 13	0.65	0.31	33.39	0.39	0.00	3.88	33.22	0.22	0 07:54	0 00:00	0.00	0.00
5	CB 14	0.34	0.34	33.66	0.27	0.00	2.78	33.55	0.16	0 07:54	0 00:00	0.00	0.00
6	CB 15	2.08	0.26	32.77	0.94	0.00	3.09	32.18	0.35	0 07:54	0 00:00	0.00	0.00
7	CB 16	0.27	0.27	33.60	0.27	0.00	2.78	33.48	0.15	0 07:54	0 00:00	0.00	0.00
8	CB 17	1.55	0.27	32.93	0.78	0.00	2.79	32.45	0.30	0 07:56	0 00:00	0.00	0.00
9	CB 18	1.29	0.27	33.17	0.70	0.00	2.55	32.75	0.28	0 07:56	0 00:00	0.00	0.00
10	CB 19	1.09	0.36	33.39	0.60	0.00	2.49	33.05	0.26	0 07:55	0 00:00	0.00	0.00
11	CB 2	5.44	0.26	29.94	1.36	0.00	8.46	29.09	0.51	0 07:57	0 00:00	0.00	0.00
12	CB 20	0.21	0.21	33.69	0.25	0.00	2.80	33.57	0.13	0 07:54	0 00:00	0.00	0.00
13	CB 21	0.46	0.21	34.32	0.32	0.00	2.73	34.18	0.18	0 07:55	0 00:00	0.00	0.00
14	CB 3	5.19	0.22	30.49	1.32	0.00	6.74	29.67	0.50	0 07:57	0 00:00	0.00	0.00
15	CB 4	0.15	0.15	34.40	0.20	0.00	2.85	34.31	0.11	0 07:54	0 00:00	0.00	0.00
16	CB 5	0.74	0.22	34.94	0.61	0.00	2.44	34.55	0.22	0 07:55	0 00:00	0.00	0.00
17	CB 6	0.53	0.49	35.26	0.50	0.00	2.55	34.96	0.20	0 07:54	0 00:00	0.00	0.00
18	CB 7	0.04	0.04	36.92	0.14	0.00	2.96	36.84	0.06	0 07:55	0 00:00	0.00	0.00
19	CB 8	4.08	0.23	31.34	1.14	0.00	4.50	30.65	0.45	0 07:56	0 00:00	0.00	0.00
20	CB 9	0.28	0.28	33.40	0.28	0.00	2.77	33.27	0.15	0 07:54	0 00:00	0.00	0.00
21	CB_10	1.51	0.28	32.80	0.76	0.00	3.40	32.34	0.30	0 07:55	0 00:00	0.00	0.00
22	CONNECT TO EX CB2	0.25	0.25	35.48	0.27	0.00	0.40	35.36	0.15	0 07:54	0 00:00	0.00	0.00

Pipe Input

SN	Element ID	Length (ft)	Inlet Invert Elevation (ft)	Inlet Invert Offset (ft)	Outlet Invert Elevation (ft)	Outlet Invert Offset (ft)	Total Drop (ft)	Average Slope (%)	Pipe Shape	Pipe Diameter or Height (in)	Pipe Width (in)	Manning's Roughness	Entrance Losses	Exit/Bend Losses	Additional Losses	Initial Flow (cfs)	Flap Gate	No. of Barrels
1	.5	64.00	32.36	0.00	32.04	0.00	0.32	0.5000	CIRCULAR	12.000	12.000	0.0120	0.5000	0.5000	0.0000	0.00	No	1
2	P - (10)	71.30	28.58	0.00	28.22	3.05	0.36	0.5000	CIRCULAR	18.000	18.000	0.0120	0.5000	0.5000	0.0000	0.00	No	1
3	P - (11)	64.00	33.33	0.00	31.33	-0.50	2.00	3.1300	CIRCULAR	8.040	8.040	0.0120	0.5000	0.5000	0.0000	0.00	No	1
4	P - (12)	64.02	32.15	0.00	31.83	0.00	0.32	0.5000	CIRCULAR	12.000	12.000	0.0120	0.5000	0.5000	0.0000	0.00	No	1
5	P - (13)	64.00	33.12	0.00	30.53	0.33	2.59	4.0500	CIRCULAR	8.040	8.040	0.0120	0.5000	0.5000	0.0000	0.00	No	1
6	P - (14)	64.00	30.20	0.00	32.04	0.00	-1.84	-2.8700	CIRCULAR	12.000	12.000	0.0120	0.5000	0.5000	0.0000	0.00	No	1
7	P - (15)	77.23	33.39	0.00	33.00	0.00	0.39	0.5000	CIRCULAR	12.000	12.000	0.0120	0.5000	0.5000	0.0000	0.00	No	1
8	P - (16)	64.68	33.00	0.00	32.68	0.00	0.32	0.5000	CIRCULAR	12.000	12.000	0.0120	0.5000	0.5000	0.0000	0.00	No	1
9	P - (17)	64.00	32.68	0.00	32.36	0.00	0.32	0.5000	CIRCULAR	12.000	12.000	0.0120	0.5000	0.5000	0.0000	0.00	No	1
10	P - (19)	55.02	36.78	0.00	34.76	0.00	2.02	3.6700	CIRCULAR	8.040	8.040	0.0120	0.5000	0.5000	0.0000	0.00	No	1
11	P - (20)	66.44	34.76	0.00	33.79	-0.54	0.97	1.4600	CIRCULAR	8.040	8.040	0.0120	0.5000	0.5000	0.0000	0.00	No	1
12	P - (21)	64.31	35.21	0.00	34.33	0.34	0.88	1.3600	CIRCULAR	8.040	8.040	0.0120	0.5000	0.5000	0.0000	0.00	No	1
13	P - (25)	26.74	25.17	0.00	24.40	0.00	0.77	2.8800	CIRCULAR	18.000	18.000	0.0120	0.5000	0.5000	0.0000	0.00	No	1
14	P - (26)	70.08	34.20	0.00	30.00	0.83	4.20	5.9900	CIRCULAR	8.040	8.040	0.0120	0.5000	0.5000	0.0000	0.00	No	1
15	P - (27)	97.22	34.00	0.00	32.79	0.00	1.21	1.2400	CIRCULAR	12.000	12.000	0.0120	0.5000	0.5000	0.0000	0.00	No	1
16	P - (3)	108.58	33.44	0.00	32.79	0.00	0.65	0.6000	CIRCULAR	12.000	12.000	0.0120	0.5000	0.5000	0.0000	0.00	No	1
17	P - (4)	63.74	32.79	0.00	32.47	0.00	0.32	0.5000	CIRCULAR	12.000	12.000	0.0120	0.5000	0.5000	0.0000	0.00	No	1
18	P - (5)	64.25	32.47	0.00	32.15	0.00	0.32	0.5000	CIRCULAR	12.000	12.000	0.0120	0.5000	0.5000	0.0000	0.00	No	1
19	P - (6)	225.00	31.83	0.00	30.20	0.00	1.63	0.7200	CIRCULAR	12.000	12.000	0.0120	0.5000	0.5000	0.0000	0.00	No	1
20	P - (7)	206.99	30.20	0.00	29.17	0.00	1.03	0.5000	CIRCULAR	18.000	18.000	0.0120	0.5000	0.5000	0.0000	0.00	No	1
21	P - (8)	63.11	33.79	-0.54	30.00	0.83	3.79	6.0100	CIRCULAR	8.040	8.040	0.0120	0.5000	0.5000	0.0000	0.00	No	1
22	P - (9)	118.56	29.17	0.00	28.58	0.00	0.59	0.5000	CIRCULAR	18.000	18.000	0.0120	0.5000	0.5000	0.0000	0.00	No	1

D2

Pipe Results

SN	Element ID	Peak Flow (cfs)	Time of Peak Flow Occurrence (days hh:mm)	Design Flow Capacity (cfs)	Peak Flow/ Design Flow Ratio	Peak Flow Velocity (ft/sec)	Travel Time (min)	Peak Flow Depth (ft)	Peak Flow Depth/ Total Depth Ratio	Total Time Surcharged (min)	Froude Number	Reported Condition
1	.5	1.23	0 07:55	2.73	0.45	2.14	0.50	0.72	0.72	0.00		Calculated
2	P - (10)	5.44	0 07:57	8.05	0.68	3.82	0.31	1.13	0.75	0.00		Calculated
3	P - (11)	0.27	0 07:54	2.00	0.13	1.01	1.06	0.47	0.70	0.00		Calculated
4	P - (12)	1.55	0 07:56	2.73	0.57	2.15	0.50	0.86	0.86	0.00		Calculated
5	P - (13)	0.28	0 07:54	2.63	0.11	2.16	0.49	0.47	0.71	0.00		Calculated
6	P - (14)	1.51	0 07:55	6.54	0.23	2.06	0.52	0.88	0.88	0.00		Calculated
7	P - (15)	0.34	0 07:54	2.73	0.12	1.54	0.84	0.33	0.33	0.00		Calculated
8	P - (16)	0.65	0 07:55	2.71	0.24	1.86	0.58	0.48	0.48	0.00		Calculated
9	P - (17)	0.96	0 07:55	2.73	0.35	2.05	0.52	0.63	0.63	0.00		Calculated
10	P - (19)	0.04	0 07:55	2.51	0.02	0.38	2.41	0.32	0.48	0.00		Calculated
11	P - (20)	0.53	0 07:54	1.05	0.50	1.83	0.61	0.55	0.83	0.00		Calculated
12	P - (21)	0.25	0 07:54	1.53	0.17	2.44	0.44	0.23	0.34	0.00		Calculated
13	P - (25)	5.48	0 07:55	19.31	0.28	4.66	0.10	0.95	0.63	0.00		Calculated
14	P - (26)	0.15	0 07:54	3.21	0.05	2.41	0.48	0.34	0.51	0.00		Calculated
15	P - (27)	0.46	0 07:55	4.30	0.11	1.51	1.07	0.46	0.46	0.00		Calculated
16	P - (3)	0.27	0 07:52	2.99	0.09	0.88	2.06	0.42	0.42	0.00		Calculated
17	P - (4)	1.02	0 07:56	2.72	0.37	2.12	0.50	0.65	0.65	0.00		Calculated
18	P - (5)	1.28	0 07:56	2.73	0.47	2.12	0.51	0.74	0.74	0.00		Calculated
19	P - (6)	2.07	0 07:54	3.28	0.63	2.66	1.41	0.97	0.97	0.00		Calculated
20	P - (7)	4.08	0 07:56	8.03	0.51	2.63	1.31	1.23	0.82	0.00		Calculated
21	P - (8)	0.74	0 07:55	3.43	0.22	3.33	0.32	0.55	0.82	0.00		Calculated
22	P - (9)	5.19	0 07:57	8.03	0.65	3.12	0.63	1.34	0.89	0.00		Calculated

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Appendix E

- Construction Stormwater Pollution Prevention Plan (CSWPPP)