Exhibit 15

Crestview Village II

Drainage Report

Prepared For:

Crestview II, LLC
15 Lake Bellevue Dr., #102
Bellevue, WA 98005

September 25, 2019

Prepared By:

PACE Engineers, Inc.
1724 W. Marine View Dr.
#140
Everett, WA 98201
p. 425.486.6533

CRESTVIEW VILLAGE II

DRAINAGE REPORT

Prepared For:

Crestview II, LLC
15 Lake Bellevue Dr. #102
Bellevue, WA 98005

September 25, 2019

Prepared By:

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PACE Project No. 19462

PROJECT CERTIFICATION

The technical material and data contained in this report was prepared by PACE Engineers, Inc., under the supervision of the below listed individuals. Those responsible staff members who are registered professional engineers are licensed in the State of Washington.

09-25-19

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1. PROJECT OVERVIEW

Crestview Village II proposes the subdivision of three existing parcels into 25 single-family residential lots, along with the associated roadways and utilities. The project site is located within the NW ¼ of Section 32, Township 28 North, Range 5 East, W.M. More specifically, the project is located within the City of Mill Creek, occupying the Snohomish County Tax Parcels listed below:

Table 1: Property Summary

Snohomish County Tax Lot #	Size
28053200201000	1.04 acres
28053200202300	0.51 acres
28053200200800	1.68 acres

The project site has frontage on 132nd St. SE, which is classified as a state highway. Full frontage improvements currently exist along the entire frontage, and access to the site will be via a road connection that currently serves a neighboring parcel which was recently developed.

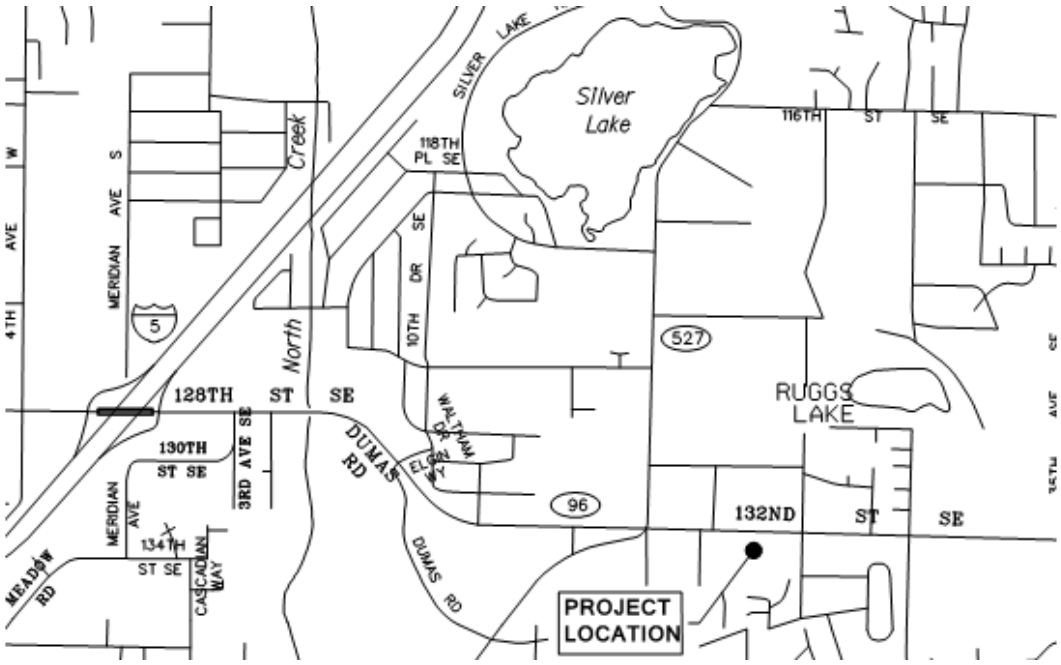


Figure 1: Vicinity Map

The NRCS web soil survey identifies the underlying soil unit as a "till" variety of soil. This type of soil is often referred to as "hardpan", and typically does not support infiltration of surface runoff as a stormwater management technique. With that in mind, the project is proposing a conventional stormwater detention system. The project site is located within a single drainage basin, which generally falls to the north.

The project is located within the City of Mill Creek's "MDR" (Medium Density Residential) zone, and is subject to the provisions of the Mill Creek Municipal Code. The City has adopted the 2014 edition of the WA State Dept. of Ecology's Stormwater Management Manual for Western Washington (SWMMM) for stormwater regulations. A discussion of the minimum stormwater management requirements from that manual is provided in the following section of this report, and the remainder of the report provides supporting information to demonstrate how those minimum requirements are met.

2. MINIMUM REQUIREMENTS

The project is a new development which proposes more than 5,000 sq.ft. of new/replaced hard surface area, and therefore is required to satisfy all nine of the minimum requirements stipulated by the SWMWW.

2.1 MINIMUM REQUIREMENT #1: PREPARATION OF STORMWATER SITE PLANS

This report, along with the accompanying plans are intended to satisfy the stormwater site plan requirements. This requirement includes research of applicable site information, evaluation of any upstream tributary drainage basins and the downstream flowpath. These items are addressed in Chapter 3 of this report.

2.2 MINIMUM REQUIREMENT #2: CONSTRUCTION STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

A temporary erosion & sediment control plan will be provided with the final engineering drawings, and a separate SWPPP report will also be provided. A preliminary stormwater pollution prevention discussion is provided in Section 4 of this report.

2.3 MINIMUM REQUIREMENT #3: SOURCE CONTROL OF POLLUTION

The project is not a high-use site and is not expected to have significant point-sources of pollution requiring source control methods.

2.4 MINIMUM REQUIREMENT #4: PRESERVATION OF NATURAL DRAINAGE SYSTEMS AND OUTFALLS

The topography of the site generally falls to the north-northeast, and the project is ultimately tributary to the public drainage system within the 132nd St SE right-of-way. The project intends to maintain this flowpath. A more detailed discussion is provided in Section 6 of this report.

2.5 MINIMUM REQUIREMENT #5: ONSITE STORMWATER MANAGEMENT

The project is required to either meet the low-impact flow control standard, or evaluate a series of low-impact stormwater management features, as outlined in the SWMMWW. This project is electing to evaluate the low-impact stormwater management features, and that evaluation is provided in Section 7 of this report.

2.6 MINIMUM REQUIREMENT #6: RUNOFF TREATMENT

The project is subject to "basic" treatment requirements, as outlined in the SWMMWW. A more detailed discussion of stormwater treatment is provided in Section 8 of this report.

2.7 MINIMUM REQUIREMENT #7: FLOW CONTROL

The project is subject to the flow control requirements outlined in the SWMMWW. A detailed discussion of the proposed flow control measures is provided in Section 9 of this report.

2.8 MINIMUM REQUIREMENT #8: WETLANDS PROTECTION

The SWMMWW requests an evaluation of wetland hydrology to minimize the effects of urbanization. A critical areas study and mitigation plan is provided separate from this document, which discusses the likely history of this particular wetland and the measures being taken to mitigate disturbance proposed within the existing wetland buffer areas. Wetland protection is also discussed in further detail in Section 10 of this report.

2.9 MINIMUM REQUIREMENT #9: OPERATIONS AND MAINTENANCE

General operations and maintenance recommendations are provided in Section 11 of this report.

3. PREPARATION OF STORMWATER SITE PLANS

This section of the report is intended to address Minimum Requirement #1, as outlined in the SWMMWW.

3.1 RESOURCE REVIEW SUMMARY

The NRCS Web Soil Survey classifies the underlying soil at the project site as Alderwood-Urban Land Complex. Alderwood soils are generally described as a glacially consolidated till, with a hardpan layer. Urban Land Complex describes soil that has been previously disturbed and compacted during previous urban land development activity. Both soil types are typically considered to have moderate runoff rates with little capacity for infiltration.

The Federal Emergency Management Agency (FEMA) identifies the project site on Flood Insurance Rate Map (FIRM) panel #53061C1040F, and is not shown to be in a flood hazard area. A FEMA map has been provided in **Appendix A** of this report for reference.

A critical areas study was prepared for the site by Soundview Consultants and issued in February, 2019. The critical areas study provides mitigation recommendations for the onsite wetland and is submitted separately from this report.

The WA State Dept. of Ecology's Water Quality Assessment map was consulted to determine if the project may contribute to a 303(d) assessed waterway. There are no 303(d) -listed waterways in the ¼-mile downstream flowpath required to be evaluated for the project. The project site is ultimately tributary to Penny Creek, which lies roughly ¾-mile to the east. The Water Quality Atlas indicates that Penny Creek is a fresh water body with existing aquatic life uses, but not assessed as a 303(d) waterway requiring special mitigation measures. A print from the Water Quality Assessment map is provided in **Appendix A** of this report.

3.2 UPSTREAM BASIN ANALYSIS

The project site is bounded on the north by 132nd St SE. A public storm drainage network within the right-of-way conveys runoff from the north away from the site. The site is bounded on the west, south, and southeast by existing residential developments which are expected to collect and convey runoff away from the project site. The site is bounded on the northeast by a small green-belt that lies lower than the project site. Considering the site conditions surrounding the project site, it does not appear that there is any upstream flow tributary to the site.

3.3 DOWNSTREAM FLOWPATH ANALYSIS

A downstream investigation of the site was conducted on June 19, 2019. The conditions at the time of the visit were moderate and clear, with some rainfall having occurred the previous day. No surface runoff was observed onsite or in the downstream flowpath during the investigation.

The existing topography of the site falls gently toward the northeast corner of the site. Runoff from the site is currently collected and routed to the public storm drainage system

within the 132nd St SE right-of-way. The project intends to maintain this flowpath, providing a storm drainage connection directly to the existing 132nd St. storm drainage system.

The storm drainage system within the 132nd St. SE right-of-way is conveyed easterly through a closed pipe network for a distance exceeding the ¼-mile analysis distance. A Snohomish County Drainage Inventory map is provided in Appendix B of this report, showing the downstream flowpath from the site.

The entire downstream investigation area is contained within a closed pipe network within an arterial/collector right-of-way, so safe access to the structures was limited, and only surface-visible features could be observed. No significant issues were identified during the limited downstream investigation that could be conducted.

4. STORMWATER POLLUTION PREVENTION PLAN (SWPPP)

A formal stormwater pollution prevention plan (SWPPP) report will be submitted during the final phase of the project, but the discussion below is intended to provide a preliminary-level discussion of how the 13 required SWPPP elements are intended to be addressed.

4.1 ELEMENT 1 – PRESERVE VEGETATION/MARK CLEARING LIMITS

The project will identify the intended clearing limits and mark them in the field with high-visibility construction fencing or silt-fencing. Critical areas and buffers will also be clearly identified in the field, and the project will retain and stockpile the duff-layer, and replace it on the completed site to the greatest practical extent.

4.2 ELEMENT 2 – ESTABLISH CONSTRUCTION ACCESS

A rock-stabilized construction access will be provided at the entrance to the site. Sediment that is tracked off-site shall be swept at the end of each day, or as determined necessary by the project's erosion/sediment control lead.

4.3 ELEMENT 3 – CONTROL FLOW RATES

A temporary sediment pond will be constructed for the project, and site runoff will be routed to that facility until the permanent stormwater management facility is constructed.

4.4 ELEMENT 4 – INSTALL SEDIMENT CONTROLS

Sediment control is expected to be provided via a temporary sedimentation pond near the entrance of the site. A series of interceptor trenches will be proposed to route site runoff to this facility. Perimeter silt-fencing will also be installed on the downhill portions of the site, and adjacent to the existing wetland.

4.5 ELEMENT 5 – STABILIZE SOILS

Exposed soils which are expected to remain unworked for an extended period will be stabilized with mulch, seed, or other measures. Soil stockpiles are expected to be covered with plastic or will implement other sediment-trapping measures.

4.6 ELEMENT 6 – PROTECT SLOPES

The project is not expected to construct or expose any steep slopes, so no slope-protection is expected to be warranted.

4.7 ELEMENT 7 – PROTECT DRAIN INLETS

Catch basin inlet protection devices will be placed in all nearby downstream catch basins. These will be identified in the TESC plan of the final engineering drawings.

4.8 ELEMENT 8 – STABILIZE CHANNELS & OUTLETS

All temporary channels proposed for the project shall be stabilized with rock or vegetation if signs of erosion are observed by the project's erosion/sediment control lead. There are not free-outlets proposed that warrant stabilization measures.

4.9 ELEMENT 9 – CONTROL POLLUTANTS

The project is relatively small and is not expected to store contaminants on-site for an extended period of time. Any contaminants that are stored on-site should be protected from vandalism or theft. Maintenance, fueling, and repair of construction equipment should be conducted off-site to the greatest possible extent. A concrete washout area shall be provided to keep concrete wash-water from entering the public storm drainage system.

4.10 ELEMENT 10 – CONTROL DE-WATERING

No significant de-watering is expected to be needed on this project.

4.11 ELEMENT 11 – MAINTAIN BMPS

The project shall identify personnel to serve as an erosion/sediment control lead, who can monitor all BMPs at the site and recommend revisions and new BMPs as needed.

4.12 ELEMENT 12 – MANAGE THE PROJECT

The project shall identify personnel to serve as an erosion/sediment control lead, who can monitor site conditions & BMP performance, and recommend revisions as site conditions change.

4.13 ELEMENT 13 – PROTECT LOW-IMPACT DEVELOPMENT BMPS

The project does not appear to be well-suited to the implementation of low-impact BMPs. This element is primarily intended to protect areas where infiltration-based BMPs from compaction during construction activities. Due to the underlying soil conditions, no infiltration-based BMPs are proposed on this project.

5. SOURCE CONTROL OF POLLUTION

The project is not an industrial or high-use site, and no significant point-sources of pollution are expected to be present. No specific structural source-control measures are proposed.

6. PRESERVATION OF NATURAL DRAINAGE SYSTEMS AND OUTFALLS

The topography of the site generally falls to the north-northeast. Runoff collects in a small existing wetland area which appears to have been created as a result of the frontage grade having been raised during the original construction of 132nd St SE. The wetland area appears to be drained by a small ditch which is tributary to the public drainage system in 132nd St. SE. The project intends to connect the proposed storm drainage system to the public drainage system in 132nd St. SE, in order to maintain the current downstream flowpath.

7. ON-SITE STORMWATER MANAGEMENT

7.1 SITE HYDROLOGY

7.1.1 Existing Hydrologic Conditions

The site is currently occupied by a couple of homes and detached out-buildings. All existing buildings and driveways are expected to be removed as part of the project.

The underlying topography of the site falls gently to the north. Based on field-observation and historical testimony provided in the critical areas study, it appears that the fronting road (132nd St SE) was raised at some point in the past, which has resulted in the impoundment of water near the northeast corner of the site, creating a small wetland area. A small ditch currently drains this area and discharges it to the public storm drainage network in the 132nd St SE right-of-way.

Once runoff reaches the public storm drainage system, it is conveyed easterly toward Penny Creek. A basin map depicting the existing site conditions is provided in **Appendix C**.

7.1.2 Developed Hydrologic Conditions

The project is proposing the construction of an internal roadway and a number of new residential lots. A stormwater conveyance network will be provided beneath the interior roadway to collect and convey the roadway runoff. Roof/footing drains will be provided for each individual lot, which will also tie-in to the roadway drainage network. Project drainage will generally be routed to an underground stormwater management facility prior to release from the site. A small portion of roadway at the north end of the site lies too low low to be collected and routed to the proposed facility, so it will be considered as bypass flow in the stormwater model. A basin map depicting the developed site conditions is provided in Appendix C.

There is a small area immediately west of the existing wetland which will be utilized as an open-space area. This area lies at an elevation that is too low to be reasonably collected and conveyed to the proposed detention facility. There is an existing building at this location which will be removed as part of the development. This area would typically need to be considered as bypass flow, but since the building will be replaced with landscaping, it is expected to reduce the runoff response from this area. With that in mind, the project proposes to consider this are to already be mitigated. This area will also continue to drain to the on-site wetland area, in order to maintain some surface recharge. Routing this runoff through the wetland is expected to provide a small level of attenuation, further mitigating the effects downstream.

7.1.3 Hydrologic Modeling

Hydrologic modeling was performed for the project, in order to design the proposed detention and treatment facility. Hydrologic modeling was performed using WWHM2012, which is a continuous-runoff simulation model approved for

use by the WA State Dept. of Ecology. The calculations demonstrate that the project is in compliance with the applicable flow-control regulations, and also calculates the appropriate water quality design parameters.

Hydrologic modeling calculations are provided in Appendix D of this report. Input parameters for the hydrologic model are summarized on the basin maps provided in **Appendix C**.

7.2 LOW IMPACT DEVELOPMENT

The proposed project occupies less than 5-acres and is located within the urban growth area. The project is also required to satisfy all nine minimum requirements outlined in the SWMMWW. Therefore, the project is required to either meet the Low Impact Development Performance Standard, or evaluate the low-impact stormwater BMPs contained within List 2. The SWMMWW outlines the Low Impact Development Performance Standard and BMP lists in detail.

This project is electing to evaluate the low-impact BMP options contained within List #2. Minimum Requirement #5 requires evaluation of those BMP options, and implementation to the greatest feasible extent. The required evaluation is provided below:

Lawn & Landscape Areas	
Post-Construction Soil Quality & Depth (BMP T5.13)	Feasible – The project intends to strip the duff layer, stockpile it, and re-use it on the completed site.

Roofs	
Full Dispersion (BMP T5.30)	Not Feasible – Most of the project was previously cleared of native vegetation, and there are no suitable dispersal flowpaths meeting the applicable requirements.
Biretention (Vol. 5, Ch. 7)	Not Feasible – The geotechnical report identifies the underlying soil as being a till variety of soil that is not likely to be conducive to infiltration. Section 4.4 of the geotechnical report encountered groundwater as shallow as 5.2-ft below the existing ground surface during the dry season, which would not provide the required 3-ft of separation from a large bioretention facility. The report also suggests that groundwater may become perched during winter months with depths as shallow as 2-ft. This would not provide the required separation for small bioretention facilities on each individual lot.
Downspout Dispersion (BMP T5.10B)	Not Feasible – Most of the project was previously cleared of native vegetation, and there are no suitable dispersal flowpaths meeting the applicable requirements.

Perforated Stub-out Connections (BMP T5.10C)	Feasible – Perforated stub-out connections will be specified on the final design plans for the project.

Other Hard Surfaces	
Full Dispersion (BMP T5.30)	Not Feasible – Most of the project was previously cleared of native vegetation, and there are no suitable dispersal flowpaths meeting the applicable requirements.
Permeable Pavement (BMP T5.15)	Not Feasible – The underlying soil conditions are not conducive to infiltration and permeable pavements would require an underdrain system to keep from becoming inundated with water. There is no significant flow control benefit to permeable pavement containing underdrain systems.
Bioretention (Vol. 5, Ch. 7)	Not Feasible – The geotechnical report identifies the underlying soil as being a till variety of soil that is not likely to be conducive to infiltration. Section 4.4 of the geotechnical report encountered groundwater as shallow as 5.2-ft below the existing ground surface during the dry season, which would not provide the required 3-ft of separation from a large bioretention facility. The report also suggests that groundwater may become perched during winter months with depths as shallow as 2-ft. This would not provide the required separation for small bioretention facilities on each individual lot.
Flow Dispersion (BMPs T5.11 / T5.12)	Not Feasible – Most of the project was previously cleared of native vegetation, and there are no suitable dispersal flowpaths meeting the applicable requirements.

8. RUNOFF TREATMENT

Volume V, Chapter 2 of the SWMMWW provides a step-by-step selection process for determining the required level of treatment for the project site. That step-by-step process is provided below:

- Step 1 – Determine the receiving waters and pollutants of concern

  The project site is ultimately tributary to Penny Creek. There does not appear to be a specific basin plan or TMDL clean-up plan for Penny Creek, and the WA State Dept. of Ecology does not identify a 303(d) or 305(b) assessment for Penny Creek.

- Step 2 – Determine if an oil control facility/device is required

  Oil control is required when a site has "high-use" characteristics, such as a commercial/industrial area, heavy vehicle storage, or arterial roadways with a high traffic count. This project does not meet the high-use criteria, so oil control is not required.

- Step 3 – Determine if infiltration for pollutant removal is practicable

  The project is underlain by till soils which are not expected to be conducive to infiltration, and the geotechnical report indicates a likelihood of a shallow perched groundwater layer during the winter months, so infiltration is not expected to be practical at this site.

- Step 4 – Determine if control of phosphorus is required

  The project is ultimately tributary to Penny Creek. The WA State Dept. of Ecology does not identify a 305(b) or 319(a) designation for Penny Creek for nutrients or phosphorus control.

- Step 5 – Determine if enhanced treatment is required

  Step 5 provides several criteria where enhanced treatment is typically required, but specifically exempts projects which qualify for basic treatment under Step 6. This project qualifies for basic treatment under Step 6 (see below).

- Step 6 – Select a basic treatment facility

  Step 6 indicates that basic treatment is required for "Residential projects not otherwise needing phosphorus control in Step 4 as designated by USEPA, Ecology, or a local government". Since this is a single-family residential project which does not require phosphorus control, the project is subject to "basic" treatment, and is exempt from the "enhanced" treatment requirement specified in Step 5.

Subject to the evaluation above, the project will implement a water quality facility from the basic treatment menu. The goal of basic water quality treatment is primarily to remove suspended sediment from the runoff prior to discharging the site. This will be achieved on this project

through the use of permanent wetpool storage in the lower portion of the underground stormwater management facility.

Wetpool storage consists of a permanent pool of water, which provides sufficient residence time for suspended sediment to settle to the bottom of the facility. The facility is periodically cleaned-out to remove the sediment accumulations. Wetpool storage sizing calculations are included in the hydrologic modeling calculations provided in **Appendix D**.

9. FLOW CONTROL

The project is required to satisfy the flow control requirement outlined in Minimum Requirement #7 of the SWMMWW. This involves evaluating the site using a continuous runoff simulation model, and verifying that the developed discharge durations match the historic discharge durations for the range of pre-developed discharge rates from 50% of the 2-year peak flow up to the full 50-year peak flow. For this analysis, the historic runoff conditions should be assumed to have a forested land cover.

Existing and developed basin maps are provided in **Appendix C**, which tabulate the historic and anticipated land cover conditions. Those tabulated values are used as input for the hydrologic model provided in **Appendix D**. The calculations demonstrate that the flow control requirement is met with the installation of an underground stormwater detention vault.

10. WETLANDS PROTECTION

A critical areas assessment report has been prepared for the project, and the on-site wetland appears to have been artificially created through the impoundment of water resulting from the construction of 132nd St SE. With this in mind, the existing wetland likely did not exist historically. The critical areas report includes a mitigation plan to manage encroachments into the existing wetland buffer.

Minimum Requirement #8 in the SWMMWW provides guide-sheets with recommendations for maintaining a suitable hydrologic response within the wetland areas. However, the discussion in the guide-sheets indicates that the stormwater modeling methods currently available are not suitable for modeling of most types of wetland areas. The guide-sheets also provide recommendations for maintaining the hydroperiod in the wetland areas. However, the recommendations are typically in conflict with the flow control requirement (Minimum Requirement #5). For example, when runoff is restricted by an onsite flow control facility prior to discharge into the wetland area, it does not provide sufficient flow into the wetland area to meet the hydroperiod recommendations outlined in the guide-sheets. Conversely, if a portion of the site is allowed to discharge to the wetland undetained, the hydroperiod recommendations may be met, but the flow-control requirement will not be met.

Given that the on-site wetland essentially consists of a small, artificial closed-depression, the project is proposing to simply utilize the mitigation measures recommended in the critical areas report. Since very little infiltration of runoff is expected, rainfall that enters the wetland will likely remain perched in the wetland area until it evaporates or reaches the existing discharge route, so the effective hydrology of the wetland is not expected to be substantially altered. There is also a small open space area which will be allowed to discharge to the wetland, in order to maintain a small amount of surface recharge to the wetland.

11. OPERATIONS & MAINTENANCE

Operations & maintenance recommendations will be added to the report at the final design stage.

APPENDIX A
Resource Review Documents

National Flood Hazard Layer FIRMette

FEMA

Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS
- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD
- 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee. See Notes. *Zone X*
- Area with Flood Risk due to Levee *Zone D*

OTHER AREAS
- NO SCREEN Area of Minimal Flood Hazard *Zone X*
- Effective LOMRs
- Area of Undetermined Flood Hazard *Zone D*

GENERAL STRUCTURES
- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES
- 20.2 / 17.5 Cross Sections with 1% Annual Chance Water Surface Elevation
- Coastal Transect
- 513 Base Flood Elevation Line (BFE)
- Limit of Study
- Jurisdiction Boundary
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature

MAP PANELS
- Digital Data Available
- No Digital Data Available
- Unmapped

N

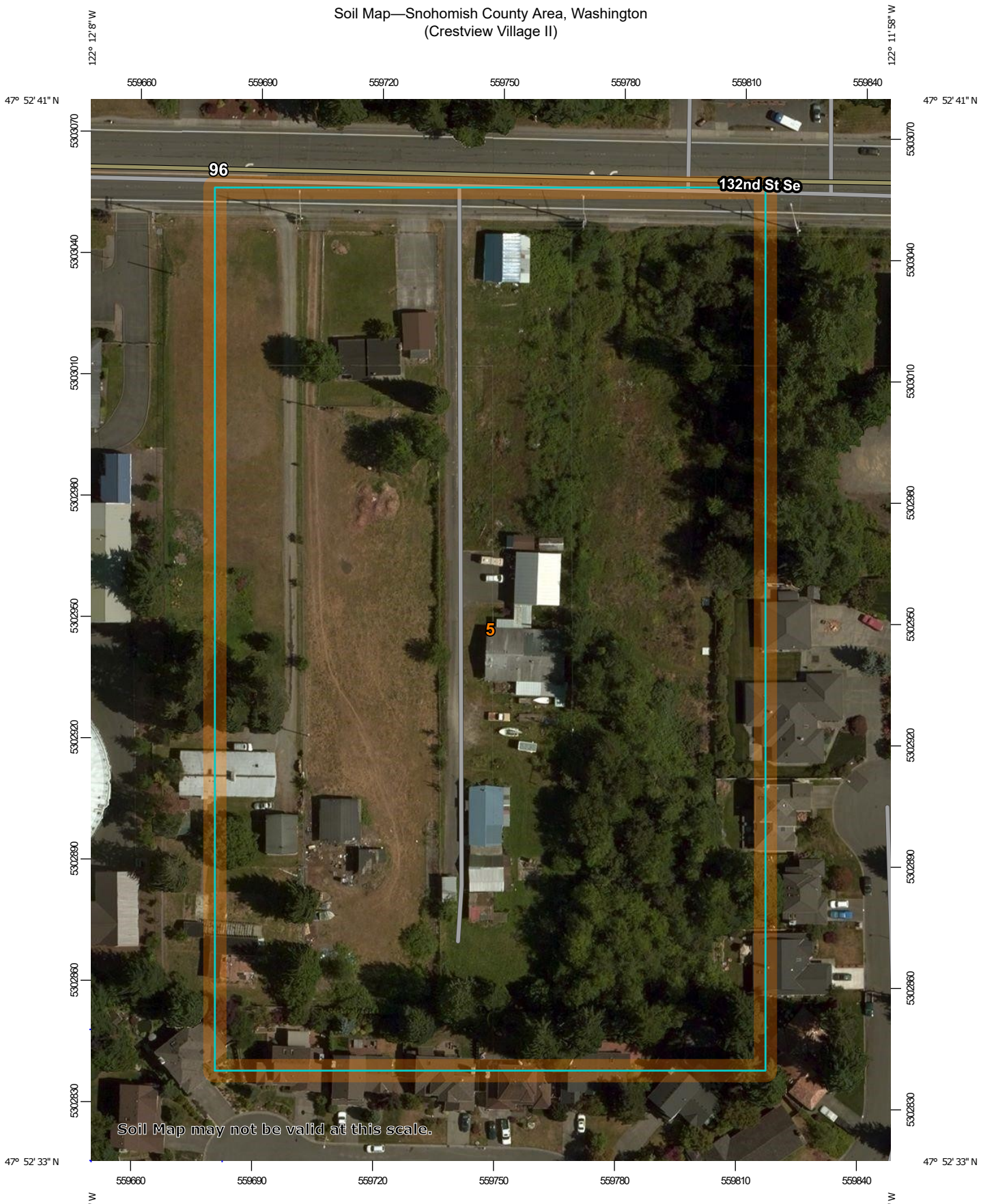
The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 6/19/2019 at 11:46:10 AM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.

Soil Map—Snohomish County Area, Washington
(Crestview Village II)



Map Scale: 1:1,280 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 15 30 60 90

Feet
0 50 100 200 300

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

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

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

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

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

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

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

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

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

Soil Survey Area: Snohomish County Area, Washington
Survey Area Data: Version 20, Sep 10, 2018

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

Date(s) aerial images were photographed: Jul 7, 2014—Jul 8, 2014

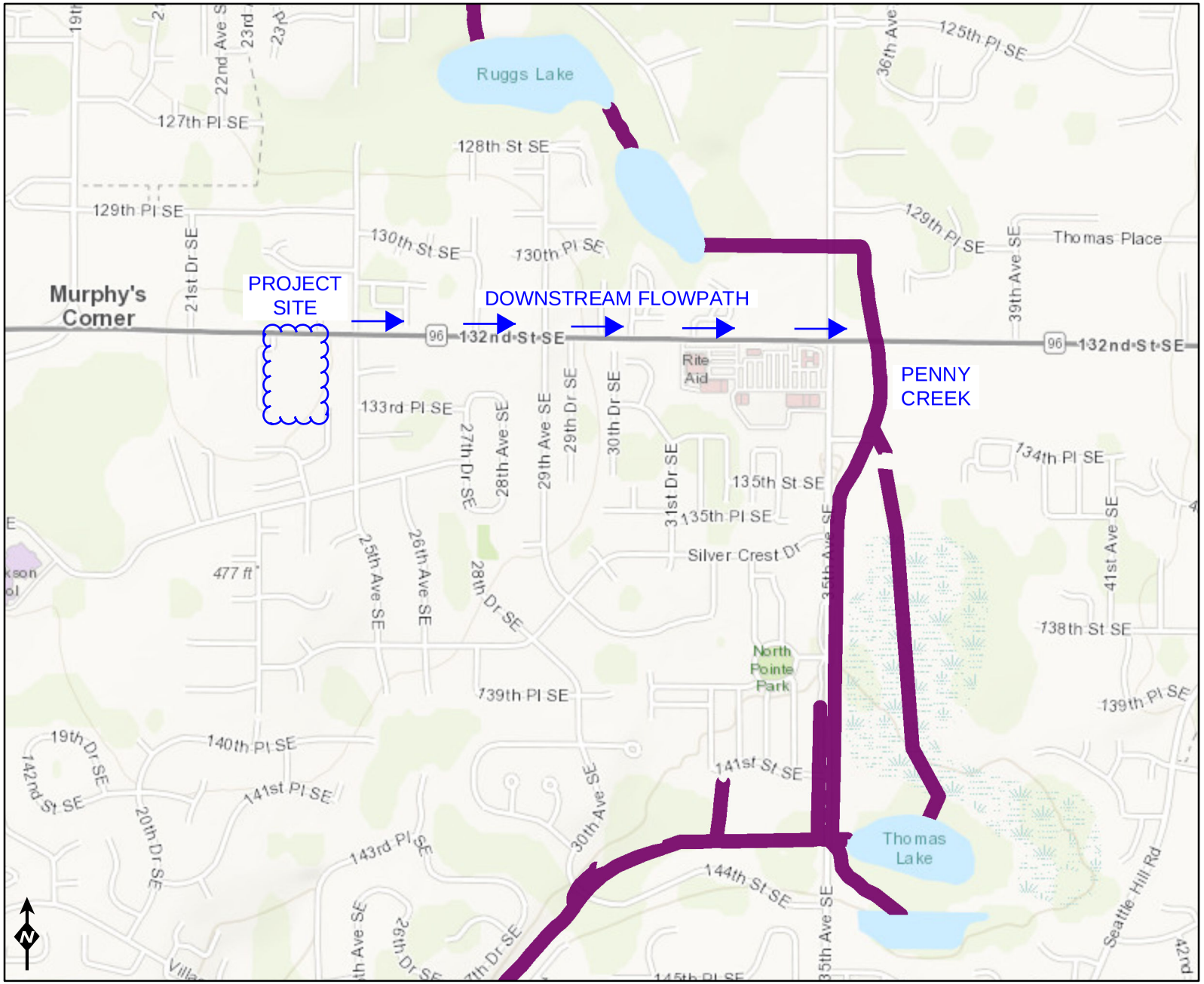
The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
5	Alderwood-Urban land complex, 2 to 8 percent slopes	7.4	100.0%
Totals for Area of Interest		**7.4**	**100.0%**

September 17, 2019

Crestview II



Map Source:
WA State Dept. of Ecology
Water Quality Atlas

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and

Miles
0 0.125 0.25 0.5

DEPARTMENT OF ECOLOGY
State of Washington

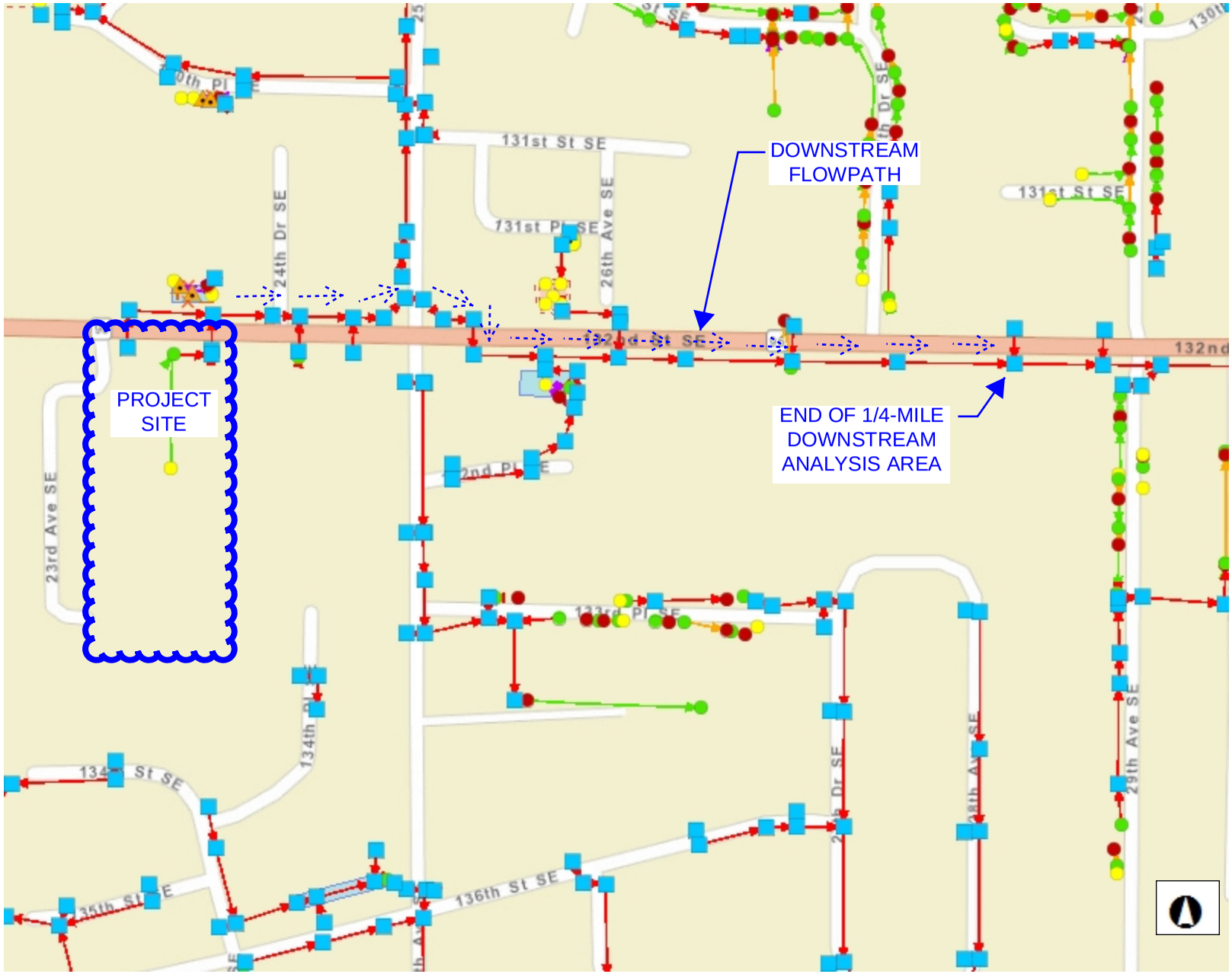
APPENDIX B
Downstream Flowpath Map

Snohomish County
Public Works

Snohomish County Drainage Inventory Online Mapping Tool

Surface Water Management

9/17/2019



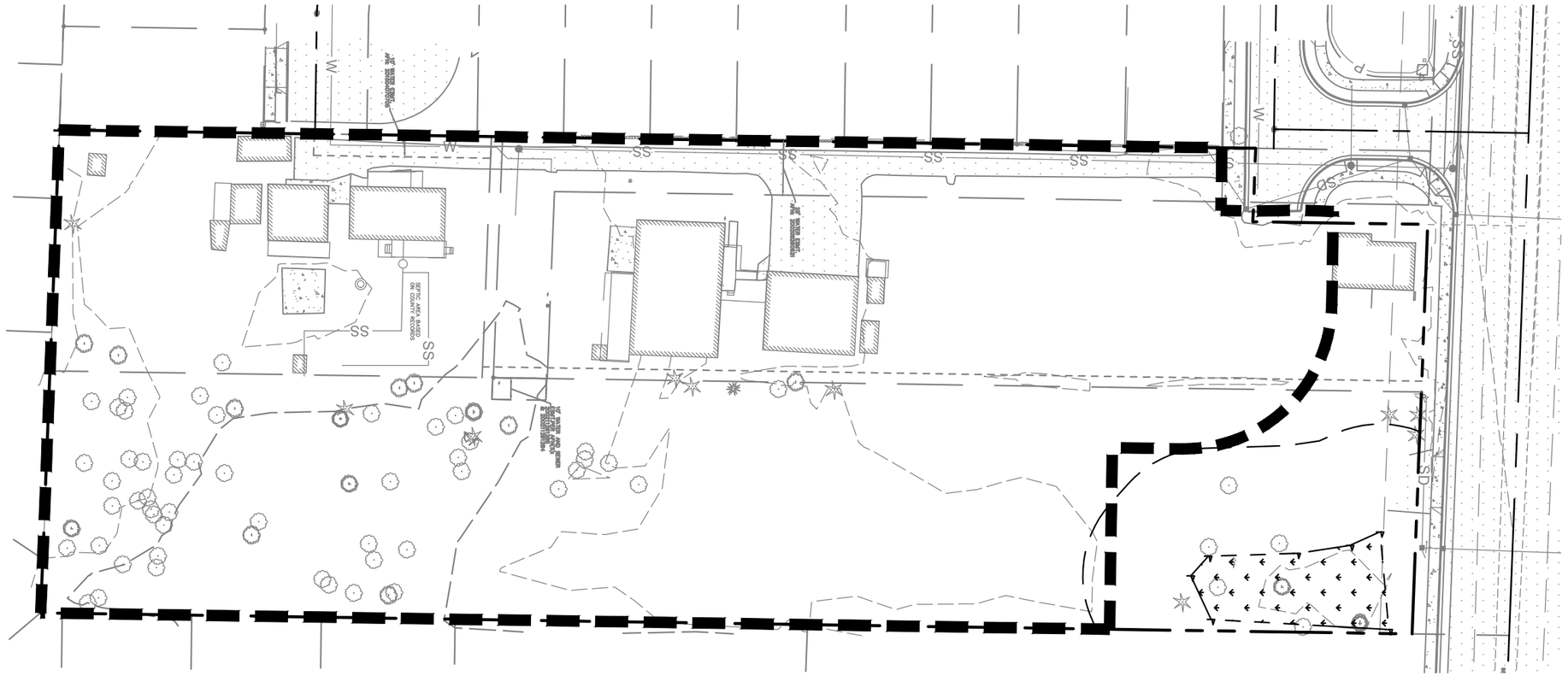
Legend

- Catch Basin
- Media Filter Structure
- Energy Dissipator
- Overflow Control
- Auxiliary Point
  - Pipe In
  - Pipe Out
  - Pipe Invert
  - Other Auxiliary Point
- Culvert
- Enclosed Pipe
- Open Channel
- Other Flow Network
- Fence
- Facility Access
- Closed Detention
- Permeable Pavement
- Pond
- Water Quality Feature
- Watercourse
- County Boundary
- DOWNSTREAM FLOWPATH

0.1 0 0.07 0.1 Miles

WGS_1984_Web_Mercator_Auxiliary_Sphere
Surface Water Management, Snohomish County Public Works

APPENDIX C
Basin Mapping



PROJECT BASIN

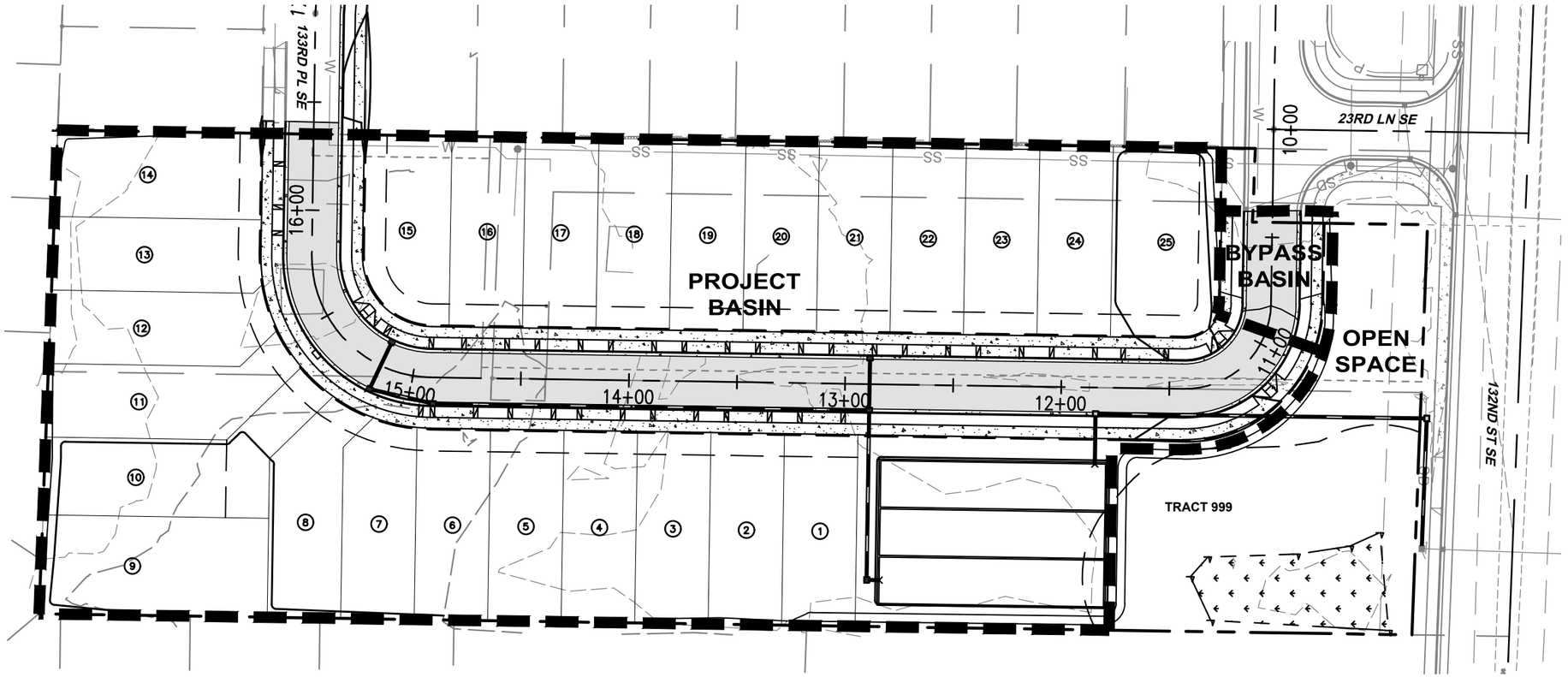
TOTAL BASIN AREA = 2.79 AC.
(ASSUMED FULLY FORESTED)

HORIZ. 0 30 60 120
Scale In Feet

N

DESIGNED _____ DRAWN _____ CHECKED _____	PACE An Engineering Services Company 1724 W Marine View Drive, Suite 140 Everett, WA 98201 *p.* 425.486.6533 | *f.* 425.486.6593 Civil | Structural | Planning | Survey www. paceengrs.com	DATE SCALE AS SHOWN	**CRESTVIEW VILLAGE II** **EXISTING HYDROLOGY**	PACE PROJECT NO. **19462** SHEET NAME LAYOUT1

FILE NAME: P:\P19\19462 CRESTVIEW II\CAD\ENGINEERING\FIGURES\SHEETS\F19462-EX-HYDROLOGY.DWG
SAVE TIME: 6/20/2019 10:57:06 AM PLOT TIME: 6/20/2019 2:52 PM
USER NAME:KEN MCINTYRE
XREF FILES: X19462-11X17-TBLOCK.dwg X19462_BASE.dwg X19462_SITE.dwg X19462_HATCH.dwg



PROJECT BASIN

TOTAL LOT AREA =	1.88 AC.
(MEASURED FROM DRAWING)	
IMPERVIOUS LOT AREA =	0.75 AC.
(ASSUME 40% – MAX ALLOWED PER MCMC 17.12.090)	
IMPERVIOUS R/W AREA =	0.57 AC.
(MEASURED FROM DRAWING)	
TOTAL IMPERVIOUS AREA =	1.32 AC.
LANDSCAPE/LAWN AREA =	1.40 AC.
TOTAL BASIN AREA =	2.72 AC.

BYPASS BASIN

IMPERVIOUS R/W AREA =	0.05 AC.
(MEASURED FROM DRAWING)	
TOTAL IMPERVIOUS AREA =	0.05 AC.
LANDSCAPE/LAWN AREA =	0.02 AC.
TOTAL BASIN AREA =	0.07 AC.

N

HORIZ. 0 30 60 120

Scale In Feet

DESIGNED _____

DRAWN _____

CHECKED _____

PACE
An Engineering Services Company

1724 W Marine View Drive, Suite 140
Everett, WA 98201
p. 425.486.6533 | *f.* 425.486.6593
Civil | Structural | Planning | Survey
www. paceengrs.com

DATE

SCALE
AS SHOWN

CRESTVIEW VILLAGE II

DEVELOPED HYDROLOGY

PACE PROJECT NO.
19462

SHEET NAME LAYOUT1

FILE NAME: P:\P19\19462 CRESTVIEW II\CAD\ENGINEERING\FIGURES\SHEETS\F19462-DV-HYDROLOGY.DWG
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USER NAME:KEN MCINTYRE
XREF FILES: X19462-11X17-TBLOCK.dwg X19462_BASE.dwg X19462_SITE.dwg X19462_HATCH.dwg X19462_FG.dwg X19462_SD.dwg

Crestview Village II
City of Mill Creek, WA

APPENDIX D
Hydrologic Modeling Calculations

PACE

WWHM2012
PROJECT REPORT

Project Name: 2019-06-20 Vault Calcs
Site Name: Crestview II
Site Address:
City :
Report Date: 7/12/2019
Gage : Everett
Data Start : 1948/10/01
Data End : 2009/09/30
Precip Scale: 1.00
Version Date: 2018/10/10
Version : 4.2.16

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

High Flow Threshold for POC 1: 50 year

PREDEVELOPED LAND USE

Name : ONSITE
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Forest, Flat	2.79
Pervious Total	2.79

Impervious Land Use	acre
Impervious Total	0
Basin Total	2.79

Element Flows To:

Surface	Interflow	Groundwater

MITIGATED LAND USE

Name : ON-SITE
Bypass: No

GroundWater: No

Pervious Land Use	acre
C, Lawn, Flat	1.4
Pervious Total	**1.4**

Impervious Land Use	acre
ROADS FLAT	1.32
Impervious Total	**1.32**
Basin Total	**2.72**

Element Flows To:

Surface	Interflow	Groundwater
Vault 1	Vault 1	

Name : Vault 1
Width : 64.5 ft.
Length : 104 ft.
Depth: 4.05 ft.
Discharge Structure
Riser Height: 3.55 ft.
Riser Diameter: 12 in.
Notch Type: Rectangular
Notch Width: 0.063 ft.
Notch Height: 0.438 ft.
Orifice 1 Diameter: 0.8125 in. **Elevation:** 0 ft.
Orifice 2 Diameter: 0.875 in. **Elevation:** 2.6 ft.

Element Flows To:

Outlet 1	Outlet 2

Vault Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.154	0.000	0.000	0.000
0.0450	0.154	0.006	0.003	0.000
0.0900	0.154	0.013	0.005	0.000
0.1350	0.154	0.020	0.006	0.000
0.1800	0.154	0.027	0.007	0.000
0.2250	0.154	0.034	0.008	0.000
0.2700	0.154	0.041	0.009	0.000
0.3150	0.154	0.048	0.010	0.000
0.3600	0.154	0.055	0.010	0.000
0.4050	0.154	0.062	0.011	0.000
0.4500	0.154	0.069	0.012	0.000
0.4950	0.154	0.076	0.012	0.000
0.5400	0.154	0.083	0.013	0.000

0.5850	0.154	0.090	0.013	0.000
0.6300	0.154	0.097	0.014	0.000
0.6750	0.154	0.103	0.014	0.000
0.7200	0.154	0.110	0.015	0.000
0.7650	0.154	0.117	0.015	0.000
0.8100	0.154	0.124	0.016	0.000
0.8550	0.154	0.131	0.016	0.000
0.9000	0.154	0.138	0.017	0.000
0.9450	0.154	0.145	0.017	0.000
0.9900	0.154	0.152	0.017	0.000
1.0350	0.154	0.159	0.018	0.000
1.0800	0.154	0.166	0.018	0.000
1.1250	0.154	0.173	0.019	0.000
1.1700	0.154	0.180	0.019	0.000
1.2150	0.154	0.187	0.019	0.000
1.2600	0.154	0.194	0.020	0.000
1.3050	0.154	0.201	0.020	0.000
1.3500	0.154	0.207	0.020	0.000
1.3950	0.154	0.214	0.021	0.000
1.4400	0.154	0.221	0.021	0.000
1.4850	0.154	0.228	0.021	0.000
1.5300	0.154	0.235	0.022	0.000
1.5750	0.154	0.242	0.022	0.000
1.6200	0.154	0.249	0.022	0.000
1.6650	0.154	0.256	0.023	0.000
1.7100	0.154	0.263	0.023	0.000
1.7550	0.154	0.270	0.023	0.000
1.8000	0.154	0.277	0.024	0.000
1.8450	0.154	0.284	0.024	0.000
1.8900	0.154	0.291	0.024	0.000
1.9350	0.154	0.298	0.024	0.000
1.9800	0.154	0.304	0.025	0.000
2.0250	0.154	0.311	0.025	0.000
2.0700	0.154	0.318	0.025	0.000
2.1150	0.154	0.325	0.026	0.000
2.1600	0.154	0.332	0.026	0.000
2.2050	0.154	0.339	0.026	0.000
2.2500	0.154	0.346	0.026	0.000
2.2950	0.154	0.353	0.027	0.000
2.3400	0.154	0.360	0.027	0.000
2.3850	0.154	0.367	0.027	0.000
2.4300	0.154	0.374	0.027	0.000
2.4750	0.154	0.381	0.028	0.000
2.5200	0.154	0.388	0.028	0.000
2.5650	0.154	0.395	0.028	0.000
2.6100	0.154	0.401	0.031	0.000
2.6550	0.154	0.408	0.034	0.000
2.7000	0.154	0.415	0.036	0.000
2.7450	0.154	0.422	0.037	0.000
2.7900	0.154	0.429	0.039	0.000
2.8350	0.154	0.436	0.040	0.000
2.8800	0.154	0.443	0.041	0.000
2.9250	0.154	0.450	0.042	0.000
2.9700	0.154	0.457	0.043	0.000
3.0150	0.154	0.464	0.044	0.000
3.0600	0.154	0.471	0.045	0.000
3.1050	0.154	0.478	0.046	0.000

3.1500	0.154	0.485	0.048	0.000
3.1950	0.154	0.492	0.052	0.000
3.2400	0.154	0.498	0.058	0.000
3.2850	0.154	0.505	0.064	0.000
3.3300	0.154	0.512	0.070	0.000
3.3750	0.154	0.519	0.077	0.000
3.4200	0.154	0.526	0.085	0.000
3.4650	0.154	0.533	0.093	0.000
3.5100	0.154	0.540	0.101	0.000
3.5550	0.154	0.547	0.112	0.000
3.6000	0.154	0.554	0.228	0.000
3.6450	0.154	0.561	0.419	0.000
3.6900	0.154	0.568	0.658	0.000
3.7350	0.154	0.575	0.926	0.000
3.7800	0.154	0.582	1.206	0.000
3.8250	0.154	0.589	1.480	0.000
3.8700	0.154	0.596	1.730	0.000
3.9150	0.154	0.602	1.941	0.000
3.9600	0.154	0.609	2.107	0.000
4.0050	0.154	0.616	2.228	0.000
4.0500	0.154	0.623	2.319	0.000
4.0950	0.154	0.630	2.441	0.000
4.1400	0.000	0.000	2.536	0.000

Name : BYPASS
Bypass: Yes

GroundWater: No

Pervious Land Use	**acre**
C, Lawn, Flat	**.02**
Pervious Total	**0.02**

Impervious Land Use	**acre**
ROADS FLAT	**0.05**
Impervious Total	**0.05**
Basin Total	**0.07**

Element Flows To:

Surface	**Interflow**	**Groundwater**

ANALYSIS RESULTS

Stream Protection Duration

Predeveloped Landuse Totals for POC #1
Total Pervious Area:2.79
Total Impervious Area:0

Mitigated Landuse Totals for POC #1
Total Pervious Area:1.42
Total Impervious Area:1.37

Flow Frequency Return Periods for Predeveloped. POC #1

Return Period	Flow(cfs)
2 year	0.059807
5 year	0.088522
10 year	0.108182
25 year	0.133539
50 year	0.152722
100 year	0.172113

Flow Frequency Return Periods for Mitigated. POC #1

Return Period	Flow(cfs)
2 year	0.050061
5 year	0.090482
10 year	0.129857
25 year	0.198886
50 year	0.268072
100 year	0.356238

Stream Protection Duration
Annual Peaks for Predeveloped and Mitigated. POC #1

Year	Predeveloped	Mitigated
1949	0.034	0.038
1950	0.066	0.046
1951	0.054	0.032
1952	0.043	0.040
1953	0.035	0.037
1954	0.132	0.053
1955	0.090	0.089
1956	0.079	0.099
1957	0.088	0.047
1958	0.059	0.066
1959	0.064	0.036
1960	0.057	0.040
1961	0.059	0.087
1962	0.052	0.036
1963	0.062	0.046
1964	0.053	0.032
1965	0.059	0.042
1966	0.032	0.034
1967	0.073	0.055
1968	0.085	0.042
1969	0.064	0.070
1970	0.047	0.036

1971	0.066	0.106
1972	0.058	0.055
1973	0.047	0.047
1974	0.082	0.046
1975	0.047	0.040
1976	0.045	0.037
1977	0.038	0.035
1978	0.047	0.037
1979	0.084	0.051
1980	0.053	0.037
1981	0.043	0.031
1982	0.057	0.049
1983	0.080	0.041
1984	0.059	0.152
1985	0.078	0.075
1986	0.191	0.494
1987	0.085	0.224
1988	0.047	0.048
1989	0.040	0.040
1990	0.062	0.047
1991	0.066	0.044
1992	0.050	0.046
1993	0.033	0.027
1994	0.031	0.049
1995	0.063	0.060
1996	0.109	0.053
1997	0.209	0.841
1998	0.040	0.041
1999	0.057	0.039
2000	0.032	0.066
2001	0.010	0.028
2002	0.060	0.053
2003	0.044	0.033
2004	0.069	0.055
2005	0.051	0.036
2006	0.118	0.069
2007	0.101	0.058
2008	0.160	0.334
2009	0.050	0.044

Stream Protection Duration
Ranked Annual Peaks for Predeveloped and Mitigated. POC #1

Rank	Predeveloped	Mitigated
1	0.2090	0.8414
2	0.1913	0.4942
3	0.1601	0.3336
4	0.1324	0.2237
5	0.1181	0.1525
6	0.1095	0.1055
7	0.1006	0.0991
8	0.0897	0.0891
9	0.0880	0.0869
10	0.0855	0.0754
11	0.0851	0.0698
12	0.0842	0.0688

13	0.0818	0.0658
14	0.0800	0.0656
15	0.0793	0.0599
16	0.0776	0.0580
17	0.0730	0.0555
18	0.0692	0.0551
19	0.0661	0.0546
20	0.0659	0.0533
21	0.0656	0.0532
22	0.0642	0.0528
23	0.0640	0.0508
24	0.0630	0.0493
25	0.0624	0.0492
26	0.0619	0.0483
27	0.0604	0.0469
28	0.0595	0.0467
29	0.0594	0.0465
30	0.0592	0.0465
31	0.0588	0.0460
32	0.0583	0.0455
33	0.0575	0.0455
34	0.0569	0.0438
35	0.0566	0.0436
36	0.0535	0.0425
37	0.0528	0.0418
38	0.0527	0.0413
39	0.0517	0.0411
40	0.0509	0.0400
41	0.0503	0.0399
42	0.0502	0.0396
43	0.0471	0.0395
44	0.0470	0.0390
45	0.0468	0.0378
46	0.0467	0.0371
47	0.0466	0.0367
48	0.0448	0.0366
49	0.0440	0.0366
50	0.0430	0.0359
51	0.0426	0.0358
52	0.0398	0.0358
53	0.0396	0.0356
54	0.0376	0.0353
55	0.0351	0.0343
56	0.0338	0.0332
57	0.0328	0.0324
58	0.0323	0.0317
59	0.0317	0.0311
60	0.0306	0.0281
61	0.0104	0.0272

Stream Protection Duration
POC #1
The Facility PASSED

The Facility PASSED.

Flow(cfs)	Predev	Mit	Percentage	Pass/Fail
0.0299	22651	20961	92	Pass
0.0311	20533	18548	90	Pass
0.0324	18585	17085	91	Pass
0.0336	16805	15913	94	Pass
0.0349	15154	14837	97	Pass
0.0361	13708	13486	98	Pass
0.0373	12459	12145	97	Pass
0.0386	11298	10928	96	Pass
0.0398	10243	9856	96	Pass
0.0411	9308	8707	93	Pass
0.0423	8455	7666	90	Pass
0.0436	7676	6746	87	Pass
0.0448	6936	5653	81	Pass
0.0460	6310	4584	72	Pass
0.0473	5771	3867	67	Pass
0.0485	5281	3418	64	Pass
0.0498	4851	3039	62	Pass
0.0510	4438	2776	62	Pass
0.0522	4092	2502	61	Pass
0.0535	3700	2220	60	Pass
0.0547	3375	2087	61	Pass
0.0560	3054	1965	64	Pass
0.0572	2748	1849	67	Pass
0.0584	2505	1745	69	Pass
0.0597	2301	1650	71	Pass
0.0609	2108	1564	74	Pass
0.0622	1949	1497	76	Pass
0.0634	1821	1434	78	Pass
0.0646	1698	1380	81	Pass
0.0659	1580	1304	82	Pass
0.0671	1479	1254	84	Pass
0.0684	1398	1215	86	Pass
0.0696	1329	1164	87	Pass
0.0708	1260	1112	88	Pass
0.0721	1197	1058	88	Pass
0.0733	1138	1016	89	Pass
0.0746	1081	975	90	Pass
0.0758	1024	929	90	Pass
0.0770	952	904	94	Pass
0.0783	915	875	95	Pass
0.0795	879	854	97	Pass
0.0808	845	833	98	Pass
0.0820	808	811	100	Pass
0.0832	767	784	102	Pass
0.0845	731	758	103	Pass
0.0857	700	731	104	Pass
0.0870	676	702	103	Pass
0.0882	655	673	102	Pass
0.0895	639	639	100	Pass
0.0907	620	621	100	Pass
0.0919	604	594	98	Pass
0.0932	587	577	98	Pass
0.0944	573	559	97	Pass
0.0957	560	539	96	Pass
0.0969	551	513	93	Pass

0.0981	539	491	91	Pass
0.0994	523	469	89	Pass
0.1006	511	452	88	Pass
0.1019	497	436	87	Pass
0.1031	473	418	88	Pass
0.1043	458	401	87	Pass
0.1056	448	378	84	Pass
0.1068	438	366	83	Pass
0.1081	428	354	82	Pass
0.1093	417	341	81	Pass
0.1105	402	330	82	Pass
0.1118	396	318	80	Pass
0.1130	385	298	77	Pass
0.1143	375	273	72	Pass
0.1155	362	254	70	Pass
0.1167	355	244	68	Pass
0.1180	349	241	69	Pass
0.1192	338	236	69	Pass
0.1205	329	232	70	Pass
0.1217	320	226	70	Pass
0.1229	310	224	72	Pass
0.1242	306	222	72	Pass
0.1254	300	216	72	Pass
0.1267	296	214	72	Pass
0.1279	288	210	72	Pass
0.1292	283	206	72	Pass
0.1304	278	201	72	Pass
0.1316	270	199	73	Pass
0.1329	260	195	75	Pass
0.1341	252	194	76	Pass
0.1354	246	192	78	Pass
0.1366	239	186	77	Pass
0.1378	234	184	78	Pass
0.1391	227	181	79	Pass
0.1403	215	178	82	Pass
0.1416	205	176	85	Pass
0.1428	200	173	86	Pass
0.1440	194	172	88	Pass
0.1453	188	171	90	Pass
0.1465	184	171	92	Pass
0.1478	176	168	95	Pass
0.1490	170	166	97	Pass
0.1502	165	163	98	Pass
0.1515	159	160	100	Pass
0.1527	152	158	103	Pass

Required Wetpool Vol = **0.0808 ac-ft (3,520 sq.ft.)**

Provided Wetpool Vol = **64.5’ x 104’ x 4’ (26,832 sq.ft.)**

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0.0808 **acre-feet**
On-line facility target flow: 0.0447 **cfs.**
Adjusted for 15 min: 0.0447 **cfs.**
Off-line facility target flow: 0.0256 **cfs.**
Adjusted for 15 min: 0.0256 **cfs.**

LID Report

LID Technique	Used for Water Quality	Total Volume Percent Treatment?	Volume Needs Treatment (ac-ft)	Infiltration Through Facility (ac-ft)	Volume (ac-ft.)	Cumulative Volume Infiltration Credit	Comment
Vault 1 POC	N	283.54				N	
0.00							
Total Volume Infiltrated		283.54	0.00	0.00			
0.00	0.00	0%	No Treat. Credit				

Compliance with LID Standard 8
Duration Analysis Result = Failed

Perlnd and Implnd Changes

No changes have been made.

more than 50% of the flows for the range of the duration analysis.

Water Quality BMP Flow and Volume for POC #1
On-line facility volume: 0.0808 **acre-feet**
On-line facility target flow: 0.0447 **cfs.**
Adjusted for 15 min: 0.0447 **cfs.**
Off-line facility target flow: 0.0256 **cfs.**
Adjusted for 15 min: 0.0256 **cfs.**

LID Report

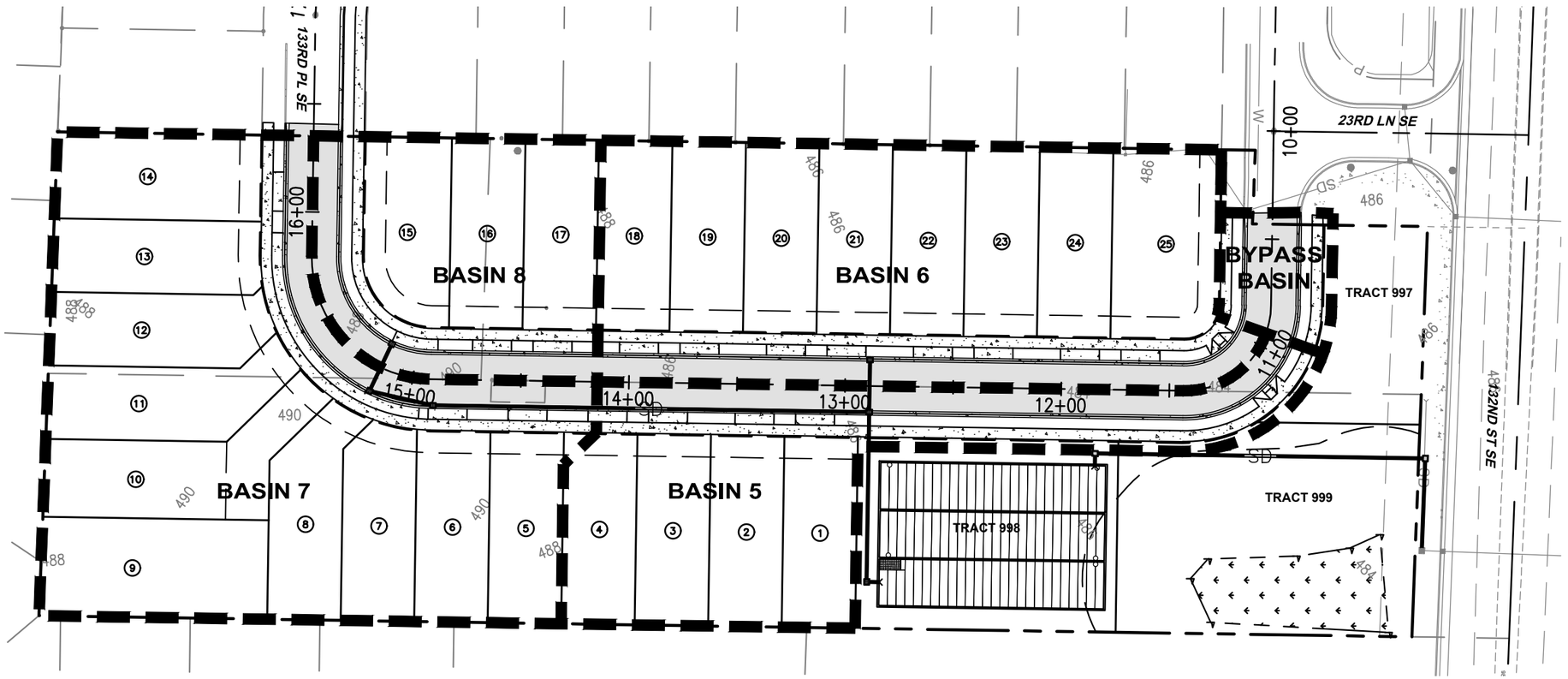
LID Technique	Used for Water Quality	Total Volume Percent Treatment?	Volume Needs Treatment (ac-ft)	Infiltration Through Facility (ac-ft)	Volume (ac-ft.)	Cumulative Infiltration Volume	Percent Infiltrated	Water Quality Treated	Comment
Vault 1 POC	N	283.54				N	0.00		
Total Volume Infiltrated		283.54	0.00	0.00	0.00	0.00	0%	No Treat. Credit	

Compliance with LID Standard 8
Duration Analysis Result = Failed

Perlnd and Implnd Changes

No changes have been made.

APPENDIX E
Conveyance Calculations



BASIN 5		BASIN 6		BASIN 7		BASIN 8	
TOTAL LOT AREA = *(MEASURED FROM DRAWING)*	0.27 AC.	TOTAL LOT AREA = *(MEASURED FROM DRAWING)*	0.58 AC.	TOTAL LOT AREA = *(MEASURED FROM DRAWING)*	0.82 AC.	TOTAL LOT AREA = *(MEASURED FROM DRAWING)*	0.21 AC.
IMPERVIOUS LOT AREA = *(ASSUME 40%)*	0.11 AC.	IMPERVIOUS LOT AREA = *(ASSUME 40%)*	0.23 AC.	IMPERVIOUS LOT AREA = *(ASSUME 40%)*	0.33 AC.	IMPERVIOUS LOT AREA = *(ASSUME 40%)*	0.08 AC.
IMPERVIOUS R/W AREA = *(MEASURED FROM DRAWING)*	0.18 AC.	IMPERVIOUS R/W AREA = *(MEASURED FROM DRAWING)*	0.17 AC.	IMPERVIOUS R/W AREA = *(MEASURED FROM DRAWING)*	0.13 AC.	IMPERVIOUS R/W AREA = *(MEASURED FROM DRAWING)*	0.11 AC.
TOTAL IMPERVIOUS AREA =	0.29 AC.	TOTAL IMPERVIOUS AREA =	0.40 AC.	TOTAL IMPERVIOUS AREA =	0.46 AC.	TOTAL IMPERVIOUS AREA =	0.19 AC.
LANDSCAPE/LAWN AREA =	0.19 AC.	LANDSCAPE/LAWN AREA =	0.35 AC.	LANDSCAPE/LAWN AREA =	0.49 AC.	LANDSCAPE/LAWN AREA =	0.14 AC.
TOTAL BASIN AREA =	0.48 AC.	TOTAL BASIN AREA =	0.75 AC.	TOTAL BASIN AREA =	0.95 AC.	TOTAL BASIN AREA =	0.33 AC.

N

HORIZ. 0 30 60 120

Scale In Feet

FILE NAME: P:\P19\19462 CRESTVIEW II\CAD\ENGINEERING\FIGURES\SHEETS\F19462-CONVEYANCE.DWG
SAVE TIME: 9/17/2019 8:19:31 AM PLOT TIME: 9/17/2019 8:46 AM
USER NAME: KEN MCINTYRE
XREF FILES: X19462-11X17-TBLOCK.dwg X19462_BASE.dwg X19462_SITE.dwg X19462_SD.dwg X19462_HATCH.dwg X19462_FG.dwg X19462_SD.dwg

DESIGNED _____
DRAWN _____
CHECKED _____

PACE
An Engineering Services Company

1724 W Marine View Drive, Suite 140
Everett, WA 98201
p. 425.486.6533 | *f*. 425.486.6593
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DATE

SCALE
AS SHOWN

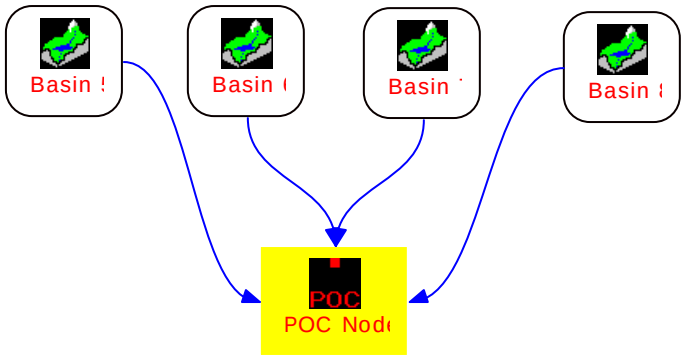
CRESTVIEW VILLAGE II

CONVEYANCE EXHIBIT

PACE PROJECT NO.
19462
SHEET NAME LAYOUT1

PREDEVELOPED SCHEMATIC

DEVELOPED CONVEYANCE SCHEMATIC



BASIN SUMMARY

MGS FLOOD
PROJECT REPORT

Program Version: MGSFlood 4.46
Program License Number: 201110001
Project Simulation Performed on: 09/17/2019 8:27 AM
Report Generation Date: 09/17/2019 8:27 AM

Input File Name: 2019-09-16 Conveyance.fld
Project Name: Crestview Div. 2
Analysis Title: Conveyance Analysis
Comments:

PRECIPITATION INPUT

Computational Time Step (Minutes): 15

Extended Precipitation Time Series Selected
Climatic Region Number: 15

Full Period of Record Available used for Routing
Precipitation Station : 96004005 Puget East 40 in_5min 10/01/1939-10/01/2097
Evaporation Station : 961040 Puget East 40 in MAP
Evaporation Scale Factor : 0.750

HSPF Parameter Region Number: 1
HSPF Parameter Region Name : USGS Default

********** Default HSPF Parameters Used (Not Modified by User) **********

********** WATERSHED DEFINITION **********

Predevelopment/Post Development Tributary Area Summary

	Predeveloped	Post Developed
Total Subbasin Area (acres)	2.510	2.510
Area of Links that Include Precip/Evap (acres)	0.000	0.000
Total (acres)	2.510	2.510

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1

---------- Subbasin : Total Basin ----------

	-------Area (Acres) --------
Till Forest	2.510
Subbasin Total	2.510

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 4

---------- Subbasin : Basin 5 ----------

	-------Area (Acres) --------
Till Grass	0.190
Impervious	0.290
Subbasin Total	0.480

---------- Subbasin : Basin 6 ----------

	-------Area (Acres) --------
Till Grass	0.350
Impervious	0.400
Subbasin Total	0.750

---------- Subbasin : Basin 7 ----------

	-------Area (Acres) --------
Till Grass	0.490
Impervious	0.460
Subbasin Total	0.950

---------- Subbasin : Basin 8 ----------

	-------Area (Acres) --------
Till Grass	0.140
Impervious	0.190
Subbasin Total	0.330

********** **LINK DATA** **********

----------SCENARIO: PREDEVELOPED
Number of Links: 0

********** **LINK DATA** **********

----------SCENARIO: POSTDEVELOPED
Number of Links: 1

Link Name: POC Node
Link Type: Copy
Downstream Link: None

**********FLOOD FREQUENCY AND DURATION STATISTICS**********

----------SCENARIO: PREDEVELOPED
Number of Subbasins: 1
Number of Links: 0

----------SCENARIO: POSTDEVELOPED
Number of Subbasins: 4
Number of Links: 1

********** Subbasin: Basin 5 **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.125
5-Year	0.159
10-Year	0.200
25-Year	0.269
50-Year	0.323
100-Year	0.401
200-Year	0.403

********** Subbasin: Basin 6 **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.180
5-Year	0.235
10-Year	0.290

25-Year	0.390
50-Year	0.486
100-Year	0.596
200-Year	0.605

********** **Subbasin: Basin 7** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.214
5-Year	0.282
10-Year	0.346
25-Year	0.467
50-Year	0.600
100-Year	0.728
200-Year	0.744

********** **Subbasin: Basin 8** **********

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	8.335E-02
5-Year	0.107
10-Year	0.133
25-Year	0.179
50-Year	0.219
100-Year	0.270
200-Year	0.273

********** Link: POC Node ********** Link Outflow 1 Frequency Stats

Flood Frequency Data(cfs)
(Recurrence Interval Computed Using Gringorten Plotting Position)

Tr (yrs)	Flood Peak (cfs)
2-Year	0.603
5-Year	0.787
10-Year	0.972
25-Year	1.304
50-Year	1.628
100-Year	1.996
200-Year	2.026

**********Groundwater Recharge Summary **********

Recharge is computed as input to Perlnd Groundwater Plus Infiltration in Structures

Model Element	Total Predeveloped Recharge During Simulation Recharge Amount (ac-ft)
Subbasin: Total Basin	432.797
Total:	432.797

Total Post Developed Recharge During Simulation

Model Element	Recharge Amount (ac-ft)
Subbasin: Basin 5	23.220
Subbasin: Basin 6	42.774
Subbasin: Basin 7	59.883
Subbasin: Basin 8	17.109
Link: POC Node	0.000
Total:	142.987

Total Predevelopment Recharge is Greater than Post Developed
Average Recharge Per Year, (Number of Years= 158)
Predeveloped: 2.739 ac-ft/year, Post Developed: 0.905 ac-ft/year

************Water Quality Facility Data **************

----------SCENARIO: PREDEVELOPED

Number of Links: 0

----------SCENARIO: POSTDEVELOPED

Number of Links: 1

********** Link: POC Node **********

Infiltration/Filtration Statistics----------
Inflow Volume (ac-ft): 836.08
Inflow Volume Including PPT-Evap (ac-ft): 836.08
Total Runoff Infiltrated (ac-ft): 0.00, 0.00%
Total Runoff Filtered (ac-ft): 0.00, 0.00%
Primary Outflow To Downstream System (ac-ft): 836.08
Secondary Outflow To Downstream System (ac-ft): 0.00
Percent Treated (Infiltrated+Filtered)/Total Volume: 0.00%

************Compliance Point Results **************

Scenario Predeveloped Compliance Subbasin: Total Basin

Scenario Postdeveloped Compliance Link: POC Node

***** Point of Compliance Flow Frequency Data *****
Recurrence Interval Computed Using Gringorten Plotting Position

Predevelopment Runoff		Postdevelopment Runoff	
Tr (Years)	Discharge (cfs)	Tr (Years)	Discharge (cfs)
2-Year	5.349E-02	2-Year	0.603
5-Year	8.717E-02	5-Year	0.787
10-Year	0.117	10-Year	0.972
25-Year	0.149	25-Year	1.304
50-Year	0.190	50-Year	1.628
100-Year	0.206	100-Year	1.996
200-Year	0.321	200-Year	2.026

** Record too Short to Compute Peak Discharge for These Recurrence Intervals

(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)	(20)	(21)	(22)
Pipe Segment		Pipe Flow	Pipe Length	Pipe Size	Manning's n'	Outlet Elev.	Inlet Elev.	Upstream Rim Elev.	Upstream Bend Angle	Tail-water Elev	Barrel Area	Barrel Vel Head	Friction Loss	Entr HGL Elev	Entr Head Loss	Outlet Cntrl Elev	Inlet Cntrl Elev	Appr Vel Head	Bend Head Loss	Junc Head Loss	HW Elev	Free-board Depth
From CB	To CB	(cfs)	(ft)	(in)		(ft)	(ft)	(ft)	(°)	(ft)	(ft^2)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)	(ft)
Vault	*4*	*2.00*	*6*	*18*	*0.012*	*482.97*	*483.00*	*490.50*	*90*	*488.00*	1.77	0.02	0.00	488.00	0.01	488.03	483.74	0.02	0.03	0.00	**488.04**	**2.46**
4	*5*	*2.00*	*79*	*18*	*0.012*	*483.00*	*483.47*	*488.52*	*0*	*488.04*	1.77	0.02	0.02	488.06	0.01	488.09	484.21	0.00	0.00	0.01	**488.10**	**0.42**
5	*6*	*0.60*	*24*	*12*	*0.012*	*483.97*	*485.50*	*488.52*	*0*	*488.10*	0.79	0.01	0.01	488.11	0.00	488.12	485.91	0.00	0.00	0.00	**488.12**	**0.40**
5	*7A*	*1.00*	*202*	*12*	*0.012*	*483.97*	*485.18*	*488.64*	*12*	*488.10*	0.79	0.03	0.13	488.23	0.01	488.27	485.77	0.03	0.00	0.00	**488.25**	**0.39**
7A	*7*	*1.00*	*30*	*12*	*0.012*	*485.18*	*485.36*	*488.51*	*90*	*488.25*	0.79	0.03	0.02	488.27	0.01	488.31	485.95	0.00	0.00	0.00	**488.31**	**0.20**
7	*8*	*0.27*	*25*	*12*	*0.012*	*485.36*	*485.51*	*488.51*	*0*	*488.31*	0.79	0.00	0.00	488.31	0.00	488.31	485.80	0.00	0.00	0.00	**488.31**	**0.20**

Crestview II

Direct-Step Backwater

Conveyance Analysis

Made by: **KJM**	Date: **9/17/2019**	
Checked by: **KJM**	Date:	
Backchecked by: **KJM**	Date:	

PACE