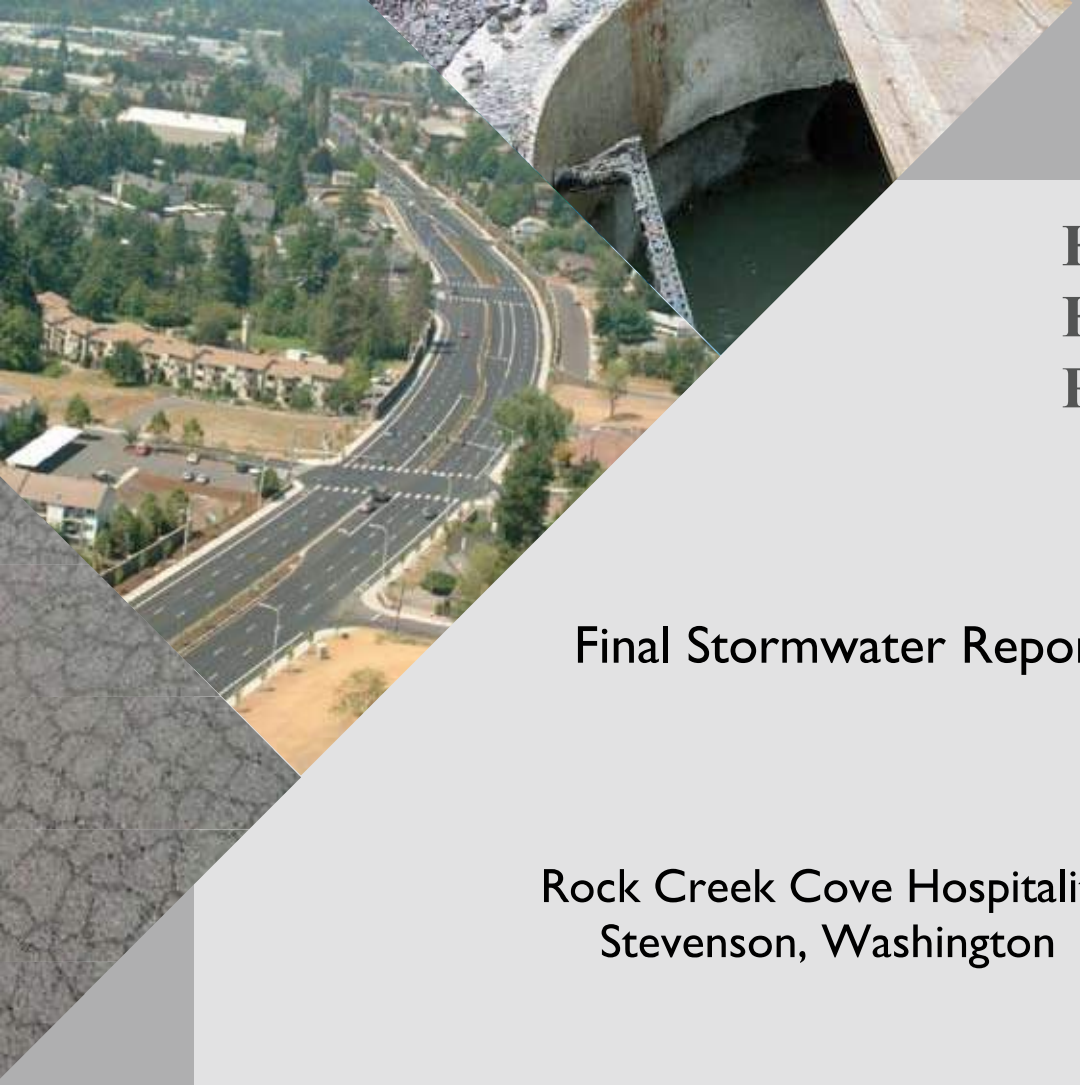

Harper
Houf Peterson
Righellis Inc.

Final Stormwater Report

Rock Creek Cove Hospitality
Stevenson, Washington

May 18, 2023

Prepared For:

FDM Development Inc.
5453 Ridgeline Drive
Suite 160
Kennewick, WA 99338

FDM-01

Prepared By:

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Laura Haunreiter, PE

HHPR

ENGINEERS ◆ PLANNERS
LANDSCAPE ARCHITECTS ◆ SURVEYORS

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TECHNICAL APPENDICES

1. Maps
2. Project Plans
3. Stormwater Calculations and Design Information
4. Geotechnical Report
5. Critical Areas Assessment
6. Operations and Maintenance Manual

REFERENCES

1. Department of Ecology Stormwater Management Manual for the Puget Sound Basin, 1992
2. GN Northern, Inc. *Geotechnical Site Investigation Report. Proposed Rock Creek Cove Development*. Stevenson, Washington. January 2020.
3. Ecological Land Services. *Rock Cove Preliminary Critical Areas Assessment*. Stevenson, Washington. January 21, 2020.

SECTION A – PROJECT OVERVIEW

Site Location and Description

FDM Development, Inc. (FDM) proposes to develop a vacant lot located at Rock Creek Cove into a resort that would include 19 vacation rental units, event space, a massage hut, associated utilities and paved parking areas.

The 6.4-acre site is in the town of Stevenson in Skamania County, Section 1, Township 2 North, Range 7 East, Willamette Meridian. The site consists of three contiguous parcels (02070100130300, 02070100130400, and 02070100130200), on an irregularly shaped peninsula projecting into Rock Creek Cove on the northern bank of the Columbia River. It is bordered on the west by Rock Creek Drive, and by the cove on the north, east and south. Historically, the site was developed as an industrial lumber mill facility, the Hegewald Veneer Mill.

Topography

The subject site is generally characterized as an irregular shaped peninsula with several fingers extending east from Rock Creek Drive into Rock Cove. The elevation of the site is approximately 102 ft above mean sea level. Most of the upper surface of the site is relatively flat, while the irregular shaped peninsula fingers typically include steep slopes along the perimeter down to the shoreline. Surface conditions across the site include a variety of gravel covered and paved areas (asphalt and concrete), as well as areas with a dense growth of mature Douglas-fir, red alder, and maple trees, grasses and Himalayan blackberry, with selected areas across shoreline slope faces that include riprap.

The surface contains artificial fill likely related to the development of the Hegewald Veneer Mill in the early 1950s. Two concrete pads remain onsite (28,982 sf and 2,655 sf) marking the former location of the mill buildings.

Critical Areas

A Critical Areas Assessment of the site was completed by Ecological Land Services. ELS and Ecology identified one unnamed tributary north of the study area identified as a Type F (fish-bearing) water by Washington Department of Natural Resources (DNR). Rock Creek is east of the study area and is designated as Type S, a shoreline of the state. Rock Cove surrounds the study area on three sides. The Columbia River is designated Type S and is a shoreline of statewide significance. There were no wetlands or other surface waters in the study area, and no priority habitat for terrestrial wildlife. Additionally, portions of the study area are exempt from the designation as a fish and wildlife habitat conservation area (FWHCA) for Rock Cove due to areas of maintained vegetation and the presence of riprap which is both structural and vertical separation from Rock Cove. (See attached Critical Areas Assessment in Appendix 5)

Existing Stormwater System

No stormwater system presently exists on-site. Stormwater either infiltrates on-site or flows overland to Rock Cove.

Site Soils

The National Resources Conservation Service (NRCS) map identifies the site soils as Arents (0 to 5 percent slopes) with typical profile described as gravelly sandy loam grading to extremely gravelly sandy loam; units generally consisting of well drained materials. The geotechnical investigation of the site determined that the soils include a variably thick layer of artificial fill soils likely associated with historic site development, atop the native silty gravel with sand stratum

(mass wasting deposits). Fill soils were generally classified as silty gravel with sand and variable amounts of cobbles and boulders, and with some areas also including organics, wood debris and miscellaneous trash. The fill soils at the site are likely to be related to the previous historic development at the site. The apparent native underlying soils were classified as Silty Gravel with Sand and included varying amounts of cobbles and boulders. The native soil stratum typically appeared medium dense.

The Geotechnical Engineer tested the infiltration rate at one location near the site entrance. At a depth of 5.5 feet below ground surface (bgs), the infiltration test pit yielded a result of 4 in/hour. The infiltration rate will be confirmed during construction. (See attached Geotechnical Report in Appendix 4.)

Drainage to and from Adjacent Properties
The site is relatively flat, with steep slopes along the perimeter of the peninsula down to the shoreline. No stormwater flows onto the site from adjacent parcels.

Compliance with Standards
This project is designed to meet the requirements of the City of Stevenson, the Department of Ecology's 1992 Stormwater Management Manual for the Puget Sound Basin (portions adopted by the City of Stevenson), and the Uniform Plumbing Code.

SECTION B – MINIMUM REQUIREMENTS

There is an existing gravel driveway (pervious) and existing concrete building pads (impervious) on-site. A summary of the project's surface impacts to the site is provided in the table below.

TABLE B-1. PROJECT IMPACT AREA VALUES

Existing Impervious (acres)	Replaced Impervious (acres)	New Impervious (acres)	Total Land-Disturbing Activity (acres)
0.72	0.72	0.51	2.00

This project is considered a "New Development" project for stormwater thresholds, as the development is greater than 5000 square feet, with greater than 1 acre of land disturbing activity. Minimum Requirements 1-11 apply.

A summary of how the project meets each of the minimum requirements is described below. See additional sections of this report for more detailed information. See the project plans in Appendix 2 for grading, stormwater and erosion control information.

MR#1 – Erosion and Sediment Control
See the project plans in Appendix 2 for temporary erosion control information. The contractor is responsible for conforming to the City of Stevenson and Department of Ecology (DOE) erosion control standards. A Construction Stormwater Pollution Prevention Plan (SWPPP) will be prepared prior to construction.

MR#2 – Preservation of Natural Drainage Systems
The majority of the upper surface of the site is relatively flat, while the irregular shaped peninsula fingers typically include steep slopes along the perimeter down to the shoreline. No stormwater flows onto the site from adjacent parcels. Stormwater collected on site will be conveyed to proposed bioretention facilities, and then discharged to Rock Cove. The proposed

outfall will be placed above the Ordinary High Water Mark (OHWM) and stabilized with a riprap dispersion pad.

MR#3 – Source Control of Pollution
The primary source of pollutants for this project will be vehicle traffic. The main permanent structural BMPs incorporated on this project will be:

1. Sumped catch basins.
2. Bioretention facilities located in the north, south and east portions of the site.

The operational BMP will be the continual maintenance of the storm system by the property owner.

MR#4 – Runoff Treatment BMPs
Three bioretention facilities designed using WWHM2012 are proposed to treat the collected runoff from the new pollution generating and non-pollution generating impervious surfaces. See attached WWHM Report in Appendix 3.

MR#5 – Streambank Erosion Control
Stormwater runoff treated by the proposed bioretention facilities will be discharged to Rock Cove through a proposed outfall, placed above the OHWM and stabilized with a riprap dispersion pad.

MR#6 – Wetlands
There are no existing wetlands on the project site.

MR#7 – Water Quality Sensitive Areas
There are no known sensitive areas on or immediately downstream of the project site where stormwater will flow, and therefore, this minimum requirement does not apply.

MR#8 – Off-Site Analysis and Mitigation
The proposed bioretention facilities will treat stormwater runoff, which will be discharged to Rock Cove, a large water body along the north shore of the Columbia River. There are no negative water quality impacts anticipated downstream of the project site.

MR#9 – Basin Planning
There are no impacts to any regional drainage basins or watersheds associated with this development, nor are there any known regional plans that would affect the minimum requirements for this project.

MR#10 – Operation and Maintenance
The new stormwater facilities associated with this project will be maintained by the property owner.

MR#11 – Financial Liability
These facilities will be constructed by the property owner, and financial guarantee is not necessary.

SECTION C – OFFSITE ANALYSIS

This project will provide water quality treatment to all proposed runoff from the project site prior to discharge into Rock Cove, and ultimately the Columbia River. See Appendix 2 for project plans and Appendix 3 for all stormwater calculations.

SECTION D – FLOW CONTROL ANALYSIS AND DESIGN

The stormwater runoff from this site will discharge directly to Rock Cove and the Columbia River. Per the 2019 Stormwater Management Manual for Western Washington, flow control is not required for Threshold Discharge Areas that discharge to a Flow Control Exempt Receiving waterbody. Table I-A.1 in Appendix I-A of the SWMMWW lists the Columbia River downstream of the Canadian border as a Flow Control Exempt Receiving Waters. Therefore, the project is exempt from the requirement to control the off-site flow to match the existing conditions for the 2-year, 10-year and 100-year 24-hour design storms. (A design exemption memo is attached.) Stormwater runoff from the site will be collected and conveyed to proposed bioretention facilities, and discharged to Rock Cove through proposed outfalls, placed above the OHWM and stabilized with a riprap dispersion pad.
See project plans in Appendix 2.

SECTION E – CONVEYANCE SYSTEMS ANALYSIS AND DESIGN

For conveyance calculations, the capacity of the pipe based on size, slope and pipe type was calculated using the Rational Method and a 25-year storm event. The flow was calculated for the immediate and upstream basins conveyed to each pipe segment. The actual flow for each pipe was then compared to the capacity of the pipe to ensure that the pipe was free flowing.

1. The conveyance system for the project consists of overland flow, inlets and underground pipes to convey stormwater to the bioretention facilities and the proposed outfalls.
2. The conveyance system has not been significantly adjusted since the preliminary plan set.
3. Refer to Appendix 3 – Stormwater Calculations where peak flows and pipe capacities are tabulated.
4. The existing site consisted of onsite infiltration and overland flow to Rock Creek Cove. The design has kept this same flow regime.
5. The assumptions utilized in the conveyance system design are:
    a. The rainfall data in the storm calculations accurately reflects the rainfall.
    b. The proposed conveyance system will be well maintained by the owner.
6. Refer to Appendix 2 - Project Plans for details regarding the stormwater piping and outfall protection.
7. Refer to Appendix 3 – Stormwater Calculations where peak flows and pipe capacities are tabulated and verified.

SECTION F – WATER QUALITY DESIGN

The proposed BMPs, bioretention facilities, were designed using WWHM2012 per the DOE Stormwater Manual. They are designed to infiltrate at least 91% of the runoff through the treatment soil. The infiltration rate utilized for design of the bioretention facility soil was 12 in/hour with a factor of safety of four (design rate = 3 in/hour). Infiltration tests conducted onsite in the vicinity of the proposed bioretention facilities yielded results of 4 in/hour (5.5 feet bgs). The non-pollution generating roof drain runoff will flow to roof drain dispersion systems. See Appendix 3 for all stormwater calculations and Appendix 4 for the Geotechnical Report.

TABLE F-1. Pollution Generating Surface Summary
Post-Developed

Pollution Generating Impervious Surface (acre)	Pollution Generating Pervious Surface (acre)
0.78	0

The asphalt parking area and the drive aisles are considered pollution generating. The roof areas and pedestrian pathways are considered non-pollution generating. The runoff from the pollution generating and the non-pollution generating pedestrian areas will be treated in bioretention facilities and discharged to proposed outfalls with riprap dispersion pads located above the OHWM of Rock Cove. As shown in the WWHM printouts, the bioretention facilities treat at least 91% of the water quality runoff through the treatment soils. There are three bioretention facilities within the project:

Bioretention Facility 1 (North): The northern bioretention facility is located north of the north parking area and will treat pollution generating runoff from the Basin A parking area and drive aisles. The facility has a bottom area of approximately 24 sf, 3:1 side slopes, 6 inches of storage volume, 18 inches BSM depth, and 12 inches of drain rock below the BSM.

Bioretention Facility 2 (South): The southern bioretention facility is located southwest of the south parking area and will treat pollution generating runoff from the Basin B parking area and drive aisles. The facility has a bottom area of approximately 24 sf, 3:1 side slopes, 6 inches of storage volume, 18 inches BSM depth, and 12 inches of drain rock below the BSM.

Bioretention Facility 3 (East): The eastern bioretention facility is located east of the east parking area and will treat pollution generating runoff from the Basin C parking area and drive aisles, as well as non-pollution generating roof drain runoff from the event center. The facility has a bottom area of approximately 12 sf, 3:1 side slopes, 6 inches of storage volume, 18 inches BSM depth, and 12 inches of drain rock below the BSM.

1. The water quality will be mitigated by sumped catch basins and bioretention facilities.
2. The water quality system has not been significantly adjusted since the preliminary plan set.
3. Refer to Appendix 4 for the geotechnical report.
4. The Best Management Practices (BMPs) utilized in design are bioretention facilities. BMP T5.13 Post-Construction Soil Quality and Depth will be completed on all disturbed soils.
5. Groundwater was found on-site ranging from 12’ – 14’ below existing ground surface in the month of December. See Geotechnical Report, Appendix 4.
6. The assumptions utilized in the water quality system design are:
    a. The rainfall data in WWHM2012 accurately reflects the rainfall.
    b. The proposed bioretention facilities will be well maintained by the owner.
7. Refer to the project plans for details regarding the stormwater piping, outfall protection, and bioretention facilities.
8. Refer to Appendix 3 – Stormwater Calculations for all storm water treatment calculations.

SECTION G – SOILS EVALUATION

1. The National Resources Conservation Service (NRCS) map identifies the site soils as Arents (0 to 5 percent slopes) with typical profile described as gravelly sandy loam grading to extremely gravelly sandy loam; units generally consisting of well drained materials. The geotechnical investigation of the site determined that the soils include a variably thick layer of artificial fill soils likely associated with historic site development, atop the native silty gravel with sand stratum (mass wasting deposits). Fill soils were generally classified as silty gravel with sand and variable amounts of cobbles and boulders, and with some areas also including organics, wood debris and miscellaneous trash. The fill soils at the site are likely to be related to the previous historic development at the site. The apparent native underlying soils were classified as Silty Gravel with Sand and included varying amounts of cobbles and boulders. The native soil stratum typically appeared medium dense. (See attached Geotechnical Report in Appendix 4.)
2. The Geotechnical Engineer tested the infiltration rate at one location near the site entrance. At a depth of 5.5 feet below ground surface (bgs), the infiltration test pit yielded a result of 4 in/hour. The infiltration rate will be confirmed during construction. (See attached Geotechnical Report in Appendix 4.)
3. The soil parameters that affected the stormwater design are the infiltration rates, as well as the proximity to a large receiving water body.

SECTION H – SPECIAL REPORTS AND STUDIES

1. Geotechnical Report – See Appendix 4.
2. Critical Areas Assessment – See Appendix 5.

SECTION I – OTHER PERMITS

1. N/A

SECTION J – GROUNDWATER MONITORING PROGRAM

1. N/A

SECTION K – MAINTENANCE AND OPERATIONS MANUAL

1. An Operations and Maintenance manual is provided in Appendix 6.

SECTION L – TECHNICAL APPENDIX

The Technical Appendices include all computations, drawings, maps, referenced data, software printouts, specials studies, and all other information used in the preparation of this report.

1. Maps
2. Project Plans
3. Stormwater Calculations and Design Information
4. Geotechnical Report
5. Critical Areas Assessment
6. Operations and Maintenance Manuals

APPENDIX 1 – Maps

Figure 2
Property Vicinity

Former Hegewald Timber Site
Stevenson, Washington

0 400 800
Feet

Source: Aerial photograph obtained from Esri ArcGIS Online

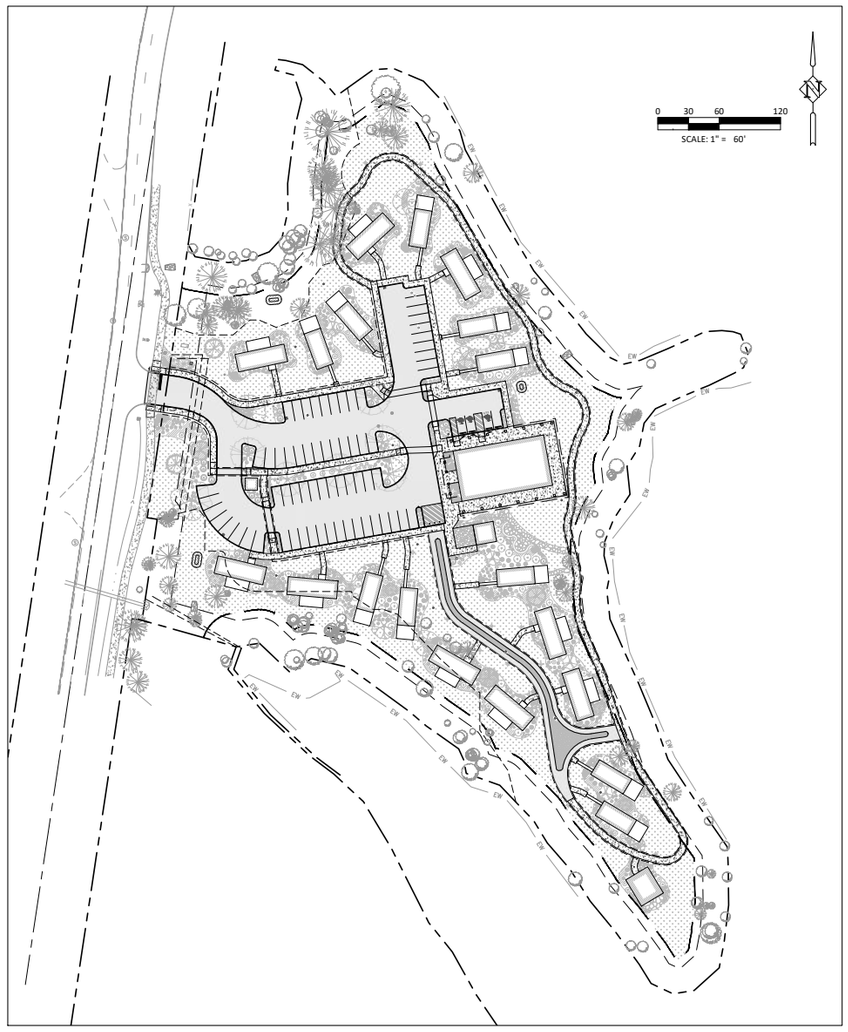
MAUL FOSTER ALONGI
p. 971 544 2139 | www.maulfoster.com

Path: X:\1200.01\Fig2_Property Vicinity.mxd
Print Date: 11/3/2015
Approved By: sotto
Produced By: jschane
Project: 1200.01

APPENDIX 2 – Project Plans

ROCK CREEK COVE HOSPITALITY

STEVENSON, WASHINGTON



SITE MAP
SCALE: 1" = 60'

VICINITY MAP
N.T.S.

PROJECT TEAM

OWNER / DEVELOPER:

FDM DEVELOPMENT, INC.
CONTACT: ZACHARY PYLE, PE
(210) 849-5592

CIVIL ENGINEER:

HARPER HOUF PETERSON RIGHELLIS INC.
1220 MAIN STREET, SUITE 150
VANCOUVER, WASHINGTON 98660
(360) 750-1131
CONTACT: BRUCE HAUNREITER, PE

SURVEYOR:

S&F LAND SERVICES
1725 N ROOSEVELT DR,
STE B, SEASIDE, OR 97138
(503) 738-3425

SITE INFORMATION:

LOTS 2, 3, AND 4 OF ROCK CREEK COVE
A PORTION OF TAX LOT 02-07-01-1300
SECTION 1, TOWNSHIP 4 NORTH, RANGE 7 EAST
WILLAMETTE MERIDIAN
SKAMANIA COUNTY, WASHINGTON

HORIZONTAL DATUM (BASIS OF BEARINGS)
PROJECT IS WASHINGTON STATE PLANE COORDINATE SYSTEM, SOUTH ZONE, SCALED TO GROUND AROUND CONTROL POINT #1 WITH A COMBINED SCALE FACTOR OF 1.00003427467. THE HORIZONTAL DATUM IS NAD83(2011) EPOCH 2010.00 BASED ON STATIC GPS OBSERVATIONS ON CONTROL POINT #1, PROCESSED THROUGH OPUS. UNITS ARE IN US SURVEY FEET.

VERTICAL DATUM
NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88) BASED ON STATIC GPS OBSERVATIONS ON POINT #1 PROCESSED THROUGH OPUS, USING GEOID 18.

SHEET LIST TABLE

Sheet Number	Sheet Title
C1.00	COVER
C1.01	GENERAL NOTES
C2.00	OVERALL EXISTING CONDITIONS & DEMO PLAN
C3.00	OVERALL SITE PLAN
C4.00	OVERALL GRADING, DRAINAGE & EROSION CONTROL PLAN
C5.00	OVERALL UTILITY PLAN
C6.00	DETAILS
C6.01	DETAILS
C6.02	DETAILS

LEGEND:

PROPOSED

- RIGHT-OF-WAY
- EASEMENT
- SAWCUT
- CURB
- SAN — SANITARY LINE
- W — WATER LINE
- F — FIRE LINE
- STM — STORM LINE
- 101 — PROPOSED CONTOUR
- UTILITY DEMOLTION
- CLEANOUT
- PORTLAND CEMENT CONCRETE
- ASPHALT CONCRETE RESURFACING
- LANDSCAPING

XX.XX TC
XX.XX BC

TC = TOP OF CURB
BC = BOTTOM OF CURB
FS = FINISH SURFACE
FG = FINISH GRADE
TW = TOP OF WALL
BW = BOTTOM OF WALL
FF = FINISHED FLOOR
TG = TOP OF GRATE

EXISTING

- BUILDING
- BUILDING OVERHANG
- BUILDING DECK
- PARKING STRIPES
- FLOW LINE CURB
- EXTRUDED CURB
- STANDARD CURB
- EDGE OF PAVEMENT
- EDGE OF CONCRETE
- EDGE OF GRAVEL
- GUARD RAIL
- WALL–TOP
- WALL–TOE
- TV — COMMUNICATIONS – CABLE TV
- W — WATER
- SD — STORM SEWER
- G — GAS
- E — ELECTRIC
- OHP — OVERHEAD POWER
- SS — SANITARY SEWER
- PS — SANITARY SEWER–PRESSURE
- FO — FIBER OPTIC
- TS — TRAFFIC SIGNAL
- T — TELEPHONE
- COMM — COMMUNICATION
- IRR — IRRIGATION
- UGU — UNKNOWN UNDERGROUND UTILITY
- EDGE OF LANDSCAPING
- EW — EDGE OF WATER
- FENCE – MISC***
- FENCE – BARBED WIRE
- FENCE – WOOD
- FENCE – CHAINLINK
- CENTERLINE
- RIGHT OF WAY
- BOUNDARY LINE
- EASEMENT
- LOT/PARCEL LINE
- SETBACK
- TREELINE
- DONATION LAND CLAIM
- SECTION LINE
- OHW — ORDINARY HIGH WATER LINE
- NATURAL GAS LINE
- BUILDING HATCH
- CONCRETE HATCH
- GRAVEL HATCH
- MAJOR CONTOUR
- MINOR CONTOUR

- BREAKLINE
- SET MONUMENT
- SET BERNSTEN BRASS DISC
- CALCULATED POSITION
- FOUND MONUMENT–ALUMINUM CAP
- FOUND MONUMENT–BRASS CAP
- FOUND MONUMENT–IRON PIPE
- XXXX — FOUND MONUMENT NO.
- FOUND MONUMENT – 1/2" IRON ROD
- FOUND MONUMENT – MAG NAIL
- FOUND MONUMENT – 5/8" IRON ROD
- FOUND MONUMENT – SCREW
- BENCHMARK
- CONTROL ALUM CAP/BRASS CAP
- CONTROL HUB & TACK
- CONTROL MAGNAIL/PK NAIL
- CONTROL 5/8" IR W/ RPC
- CONTROL RR SPIKE
- CONTROL SCRIBE
- CONTROL NAIL & WASHER
- CONTROL POINT
- HANDICAP PARKING
- SIGN
- FP — FLAG POLE
- MB — MAILBOX
- ROCK–BOULDER
- SIGN–WARNING UNDERGROUND UTILITY
- XX — TEST PIT / BOREHOLE
- AC — A/C UNIT
- STOP SIGN
- MW — MONITORING WELL
- BOLLARD
- BUILDING COLUMN
- RAILROAD X–ING
- FENCE GATE POST
- XX — WETLAND FLAG
- TREE – STUMP
- SCHRUB/BUSH
- TREE – DECIDUOUS
- TREE – CONIFER

- POWER METER
- POWER POLE
- POWER TRANSFORMER
- POWER POLE W/ LIGHT
- PR — POWER RISER
- P — POWER VAULT
- POWER JUNCTION BOX
- GROUND LIGHT
- LIGHT–LAMP POST
- GUY ANCHOR
- POWER CABINET
- POWER MANHOLE
- POWER GUY POLE
- SANITARY SEWER CLEANOUT
- S — SANITARY SEWER MANHOLE
- STORM AREA DRAIN
- STORM CATCH BASIN
- D — STORM MANHOLE
- DR — STORM ROOF DRAIN
- DCO — STORM CLEANOUT
- STORM CULVERT
- STORM DITCH INLET/SLANTED CATCH BASIN
- DW — STORM DRY WELL
- STORM TRAPPED INLET
- STORM CATCH BASIN – ROUND
- STORM CURB INLET
- STORM COMBINATION CURB INLET
- W — WATER MANHOLE
- WATER AIR RELEASE VALVE
- WATER FIRE DEPT. CONNECT
- PIV — WATER POST INDICATOR VALVE
- WATER SPIGOT – SHUTOFF
- W — WATER VAULT
- FIRE HYDRANT
- WATER METER
- WATER VALVE
- WATER STANDPIPE
- W — WELL
- GAS VALVE
- GAS METER
- GR — GAS RISER
- GAS FINK
- TRAFFIC SIGNAL CROSSWALK
- TRAFFIC SIGNAL JUNCTION BOX
- TRAFFIC SIGNAL POLE
- TRAFFIC SIGNAL POLE W/ LIGHT
- TELEPHONE RISER
- T — TELEPHONE MANHOLE
- T — TELEPHONE VAULT
- C — COMMUNICATION MANHOLE
- C — COMMUNICATION VAULT
- SPRINKLER HEAD
- IRV — IRRIGATION CONTROL VALVE
- CATV RISER
- U — UNKNOWN VAULT
- UR — UNKNOWN RISER
- UJ — UNKNOWN JUNCTION BOX
- UM — UNKNOWN MANHOLE

LIST OF ABBREVIATIONS

EL	ELEVATION
LT	LEFT
RT	RIGHT
CB	CATCH BASIN
MH	MANHOLE
EP	EDGE OF PAVEMENT
CL, C/L	CENTERLINE
R.O.W., R/W	RIGHT-OF-WAY
PL, P/L	PROPERTY LINE
ESMT	EASMENT
DED.	RIGHT-OF-WAY DEDICATION
STD	STANDARD
AC	ASPHALT CONCRETE
STM	STORM
SAN	SANITARY
WTR	WATER
BC	BEGIN CURVE
EC	END CURVE
PRC	POINT OF REVERSE CURVATURE
PCC	POINT OF COMPOUND CURVATURE
PCC	PORTLAND CEMENT CONCRETE
STA	STREET STATION
CR	CURB RETURN
FL	FLOWLINE ELEVATION
GUT	GUTTER ELEVATION
FFE	FINISHED FLOOR ELEVATION
TC	TOP OF CURB
BC	BOTTOM OF CURB
FG	FINISHED GRADE
FS	FINISHED SURFACE
TW	TOP OF WALL
BW	BOTTOM OF WALL
EX	EXISTING
PROP	PROPOSED

COVER
ROCK CREEK COVE HOSPITALITY
STEVENSON, WASHINGTON

Harper Houf Peterson Righellis Inc.
ENGINEERS PLANNERS LANDSCAPE ARCHITECTS SURVEYORS
205 SE Spokane Street, Suite 200, Portland, OR 97202
phone: 503.221.1131 www.hhpr.com fax: 503.221.1171

NOT FOR CONSTRUCTION

DESIGNED:	DRAWN:	CHECKED:	DATE:
HHPR	HHPR	HHPR	05/18/2023

NO.	DESCRIPTION	DATE
	REVISIONS	

SHEET NO.
C1.00

JOB NO. FDM-01A

FDM DEVELOPMENT INC.

W:\022\acc\cove\FDM.FDM.Development\FDM-01.Rock Creek Cove\FDM01-2\WGS\Sheets\FDM01-C1.00 COVER.dwg

GENERAL NOTES:

1. WORK SHALL CONFORM WITH CITY OF STEVENSON STANDARDS, THE INTERNATIONAL BUILDING CODE AND THE LATEST EDITION OF THE "STANDARD SPECIFICATIONS FOR ROAD, BRIDGE, AND MUNICIPAL CONSTRUCTION" AS PREPARED BY WSDOT AND APWA.
2. AS-BUILT INFORMATION SHOULD BE FIELD VERIFIED PRIOR TO CONSTRUCTION. THIS INCLUDES POTHOLING EXISTING UTILITIES AT PROPOSED CONNECTION POINTS PRIOR TO CONSTRUCTION TO ENSURE LOCATIONS AND ELEVATIONS ARE ACCURATE. NOTIFY ENGINEER IMMEDIATELY WITH POTHOLE RESULTS FOR DISCREPANCIES.
3. PROVISIONS SHALL BE MADE BY THE CONTRACTOR TO KEEP ALL EXISTING UTILITIES NOT SHOWN FOR REMOVAL IN SERVICE AND PROTECT THEM DURING CONSTRUCTION.
4. EXISTING MONUMENTS, PROPERTY CORNERS, AND SURVEY MARKERS SHALL BE PROTECTED. REPLACEMENT SHALL BE AT THE CONTRACTOR'S EXPENSE.
5. CONSTRUCTION STAGING IS NOT PERMITTED IN THE PUBLIC RIGHT-OF-WAY.
6. EXISTING UTILITIES SHOWN ON THE PLANS ARE PER SURFACE LOCATIONS AND AS-BUILT DRAWINGS. ADDITIONAL UNDERGROUND UTILITIES MAY EXIST. THE CONTRACTOR SHALL VERIFY LOCATIONS OF ALL EXISTING UTILITIES PRIOR TO CONSTRUCTION AND REPORT ANY CONFLICTS TO THE ENGINEER. THE CONTRACTOR SHALL COORDINATE THE RELOCATION OF ANY UTILITY IN CONFLICT WITH THE PROPOSED CONSTRUCTION.
7. CONTRACTOR SHALL CONFIRM ALL REQUIRED PERMITS AND LICENSES HAVE BEEN ISSUED BEFORE STARTING CONSTRUCTION.
8. CONTRACTOR SHALL NOTIFY THE PROJECT ENGINEER AND THE CITY OF STEVENSON INSPECTOR 48 HOURS BEFORE INSPECTION.
9. CONSTRUCTION VEHICLES ARE NOT ALLOWED TO BE STAGED IN THE PUBLIC RIGHT-OF-WAY WITHOUT PRIOR APPROVAL.
10. CONTRACTOR SHALL KEEP AND MAINTAIN A CURRENT SET OF DRAWINGS FOR THE PROJECT ENGINEER SHOWING AS-CONSTRUCTED DATA. CONTRACTOR SHALL KEEP AN APPROVED SET OF PLANS ON THE PROJECT SITE AT ALL TIMES.
11. CONTRACTOR SHALL PERFORM ALL WORK NECESSARY TO COMPLETE THIS PROJECT IN ACCORDANCE WITH THE PLANS INCLUDING SUCH INCIDENTALS AS MAY BE NECESSARY TO MEET APPLICABLE AGENCY REQUIREMENTS AND OTHERS AS NECESSARY TO PROVIDE A COMPLETE PROJECT.
12. ANY ALTERATION OR VARIANCE FROM THESE PLANS, EXCEPT MINOR FIELD ADJUSTMENTS NEEDED TO MEET EXISTING FIELD CONDITIONS, SHALL FIRST BE APPROVED BY THE APPLICABLE AGENCY REPRESENTATIVE. ANY ALTERATION OR VARIANCE FROM THESE PLANS SHALL BE DOCUMENTED ON CONSTRUCTION FIELD PRINTS AND TRANSMITTED TO THE PROJECT ENGINEER.
13. CONTRACTOR SHALL PROVIDE THE NECESSARY EROSION PROTECTION TO MINIMIZE EROSION AND IMPACT TO ADJACENT PROPERTIES.
14. OPEN TRENCHES SHALL BE STRICTLY LIMITED TO A MAXIMUM OF 100 FEET UNLESS LIMITED TO A LESSER AMOUNT BY PERMIT. NO TRENCHES WILL BE ALLOWED TO REMAIN OPEN AT NIGHT.
15. AT THE END OF EACH WORK DAY THE CONTRACTOR SHALL CLEAN UP THE PROJECT AREA AND LEAVE IT IN A NEAT AND SECURED MANNER. UPON COMPLETION, THE CONTRACTOR SHALL LEAVE THE PROJECT AREA FREE OF DEBRIS AND UNUSED MATERIAL.
16. THE CONTRACTOR SHALL PRUNE ALL VEGETATION, AS NECESSARY, AWAY AND UP FROM THE AREA OF WORK. THE CONTRACTOR SHALL PROTECT ALL EXISTING LANDSCAPING THAT IS TO REMAIN. ARBORIST SHALL BE CONTACTED IF SIGNIFICANT ROOTS ARE UNCOVERED.
17. ALL MATERIAL SUPPLIERS SHALL SUBMIT TO THE ENGINEER PROOF OF MATERIAL(S) TESTED IN ACCORDANCE WITH SPECIFICATIONS. BY ACCEPTANCE OF THE CONTRACT WITH THE OWNER/DEVELOPER, THE CONTRACTOR CERTIFIES THAT ALL MATERIALS DELIVERED TO THE JOB SITE WILL MEET OR EXCEED THOSE SPECIFICATIONS. ANY MATERIAL NOT CONFORMING SHALL BE REMOVED FROM THE SITE AT NO ADDITIONAL COST TO THE OWNER.

TRAFFIC CONTROL:

1. TRAFFIC CONTROL TO BE PERFORMED IN ACCORDANCE WITH THE MANUAL FOR UNIFORM TRAFFIC CONTROL DEVICES. THE CITY OR COUNTY CAN REQUIRE ADDITIONAL TRAFFIC CONTROL MEASURES AS NEEDED TO PROVIDE FOR PUBLIC SAFETY.
2. A TRAFFIC CONTROL PLAN SHALL BE PREPARED AND SUBMITTED FOR REVIEW BY CITY, FOR BOTH CONSTRUCTION OPERATIONS AND AFTER-HOUR SITUATIONS.
3. ALL TRAFFIC CONTROL MEASURES NEED TO BE SUBMITTED TO THE CITY FOR REVIEW AND APPROVAL.

PRIVATE UTILITIES NOTES:

STORM DRAINAGE

1. PRIVATE STORM DRAINAGE CONSTRUCTION SHALL BE IN ACCORDANCE WITH CITY OF STEVENSON, THE INTERNATIONAL BUILDING CODE (IBC) AND THE UNIFORM PLUMBING CODE (UPC).
2. STORM SEWER PIPE MATERIAL SHALL BE HDPE (ADS N-12), PVC ASTM D-3034, OR ENGINEER APPROVED EQUAL.
3. THE CONTRACTOR SHALL FLUSH THE ENTIRE STORM SYSTEM AT PROJECT COMPLETION.
4. CATCH BASINS SHALL BE INSTALLED TO FINISH GRADE.
5. ADJUST MANHOLES, CLEAN OUT AND AREA DRAIN RIMS TO FINISH GRADE.
6. HORIZONTAL LINES CONNECTING WITH OTHER HORIZONTAL LINES SHALL ENTER THROUGH 45 DEGREE WYE BRANCH. TEE BRANCH IS NOT ALLOWED.
7. ALL RAIN DRAIN PIPING INSTALLED WITHIN 5.0 FEET OF A BUILDING TO BE SCHEDULE 40 PVC-D.W.V. PIPING OR APPROVED EQUAL. COORDINATE LOCATION OF RAIN DRAINS WITH PLUMBING PLANS.
8. FOUNDATION DRAIN PIPE SHALL BE COORDINATED WITH STRUCTURAL AND ARCHITECTURAL PLANS AND DETAILS. AT FOUNDATION DRAIN CONNECTION INSTALL CLEANOUT AND ACCESSIBLE FLAPPER TYPE BACKWATER VALVE. SET RIM TO FINISH GRADE. COORDINATE FOUNDATION DRAIN CONNECTION POINTS WITH ARCHITECTURAL AND STRUCTURAL PLANS.
9. TRACER WIRE - 12-GAUGE STRANDED OR SOLID COPPER INSULATED HIGH MOLECULAR WEIGHT POLYETHYLENE (HMW-PE) TRACER WIRE. THE HMW-PE INSULATED COVER SHALL BE GREEN AND A MINIMUM 45 MIL THICK. THE WIRE SHALL BE RATED FOR 140 DEGREES FAHRENHEIT. INSTALL TRACER WIRE IN ALL TRENCHES FOR STORM SEWERS. PLACE THE TRACER WIRE DIRECTLY OVER THE PIPE CENTERLINE AND ON TOP OF THE PIPE ZONE MATERIAL, PARALLEL TO, AND ALONG THE ENTIRE LENGTH OF ALL NONMETALLIC PIPE.
10. ALL STORMWATER FACILITIES SHALL REMAIN IN PRIVATE OWNERSHIP AND SHALL BE PRIVATELY MAINTAINED IN ACCORDANCE WITH THE O&M MANUAL AND THE PROJECT TIR.

SANITARY SEWER

11. ALL SANITARY SEWER CONSTRUCTION TO WITHIN THREE (3) FEET OF THE BUILDING SHALL BE PVC ASTM D3034 SDR 35 AND PVC C900 WHERE PIPE COVER IS LESS THAN 3' IN VEHICULAR AREAS AND IN ACCORDANCE WITH CITY OF STEVENSON, THE INTERNATIONAL BUILDING CODE (IBC) AND UNIFORM PLUMBING CODE (UPC).
12. PRIVATE SANITARY SEWER PIPE WITHIN THREE (3) FEET OF THE BUILDING SHALL BE DRAIN WASTE VENT (DWV), IN ACCORDANCE WITH INTERNATIONAL BUILDING CODE (IBC) AND UNIFORM PLUMBING CODE (UPC).
13. HORIZONTAL LINES CONNECTING WITH OTHER HORIZONTAL LINES SHALL ENTER THROUGH 45 DEGREE WYE BRANCH. TEE BRANCH IS NOT ALLOWED.
14. WHERE SANITARY LINES CROSS WATER LINES, THE SYSTEMS NEED TO BE CONSTRUCTED SUCH THAT THE CROSSING WILL OCCUR AT THE CENTER OF A PIPE SEGMENT FOR BOTH LINES.
15. PRIOR TO TESTING AND INSPECTION OF THE SANITARY PIPELINE, ALL PARTS OF THE SYSTEM SHALL BE CLEANED OF ALL DEBRIS.
16. TESTING OF PRIVATE SANITARY PIPELINE SHALL BE IN ACCORDANCE WITH INTERNATIONAL BUILDING CODE AND UNIFORM PLUMBING CODE.
17. TRACER WIRE - 12-GAUGE STRANDED OR SOLID COPPER INSULATED HIGH MOLECULAR WEIGHT POLYETHYLENE (HMW-PE) TRACER WIRE. THE HMW-PE INSULATED COVER SHALL BE GREEN AND A MINIMUM 45 MIL THICK. THE WIRE SHALL BE RATED FOR 140 DEGREES FAHRENHEIT. INSTALL TRACER WIRE IN ALL TRENCHES FOR SANITARY SEWERS. PLACE THE TRACER WIRE DIRECTLY OVER THE PIPE CENTERLINE AND ON TOP OF THE PIPE ZONE MATERIAL, PARALLEL TO, AND ALONG THE ENTIRE LENGTH OF ALL NONMETALLIC PIPE.

WATER SERVICE

18. ALL PIPE SHALL HAVE A MINIMUM OF 36" OF COVER MEASURED FROM FINISH GRADE.
19. WATER PIPE MATERIAL SHALL BE SCHEDULE 80 PVC OR ENGINEER APPROVED EQUAL.
20. FIRE SERVICE PIPE MATERIAL SHALL BE C900, D.I.P. OR ENGINEER APPROVED EQUAL.
21. THE CONTRACTOR SHALL CALL FOR ALL INSPECTIONS AND PERFORM THE NECESSARY TESTING REQUIRED BY THE SPECIFICATIONS AND THE PRIVATE UTILITIES PERMIT. UPON COMPLETION OF THE INSTALLATION OF THE WATER SYSTEM ALL LINES SHALL BE FLUSHED AND DISINFECTED IN CONFORMANCE WITH HEALTH DIVISION GUIDELINES.
22. ALL WATERLINES, JOINTS, TEES, BENDS (HORIZ. & VERT.), REDUCERS AND VALVES SHALL BE MECHANICALLY RESTRAINED.
23. ALL WATER PIPE SHALL COMPLY WITH AWWA STANDARDS AND UL APPROVED.
24. TRACER WIRE - 12-GAUGE STRANDED OR SOLID COPPER INSULATED HIGH MOLECULAR WEIGHT POLYETHYLENE (HMW-PE) TRACER WIRE. THE HMW-PE INSULATED COVER SHALL BE GREEN AND A MINIMUM 45 MIL THICK. THE WIRE SHALL BE RATED FOR 140 DEGREES FAHRENHEIT. INSTALL TRACER WIRE IN ALL TRENCHES FOR WATER LINE. PLACE THE TRACER WIRE DIRECTLY OVER THE PIPE CENTERLINE AND ON TOP OF THE PIPE ZONE MATERIAL, PARALLEL TO, AND ALONG THE ENTIRE LENGTH OF ALL NONMETALLIC PIPE.

MISC. UTILITIES

23. ELECTRICAL, TELEPHONE, GAS, AND TV INSTALLATION SHALL BE COORDINATED BY THE CONTRACTOR WITH THE APPROPRIATE UTILITY COMPANY INCLUDING REQUIREMENTS FOR UTILITY CROSSING SLEEVES.
24. ALL PROPOSED POWER, TELEPHONE, GAS, AND TV SERVICES ON SITE SHALL BE PLACED UNDERGROUND.
25. TRENCH BACKFILL WITHIN THE PUBLIC RIGHT OF WAY TO BE CRUSHED ROCK PER CITY OF STEVENSON STANDARDS. THIS APPLIES TO ALL UTILITY INSTALLATIONS: STORM, SANITARY, WATER, IRRIGATION CROSSINGS, PRIVATE UTILITIES.
26. PLACE DETECTABLE MARKING TAPE AND TRACER WIRE IN THE TRENCH DIRECTLY ABOVE, PARALLEL TO, AND ALONG THE ENTIRE LENGTH OF ALL NONMETALLIC PIPE AND CONDUIT.

SITE GRADING, PREPARATION AND FILL NOTES:

1. REFER TO FINAL GEOTECHNICAL REPORT FOR ADDITIONAL EARTHWORK AND GEOTECHNICAL RECOMMENDATIONS.
2. BUILDING SLAB AND FOUNDATION DESIGN SHALL BE PER STRUCTURAL DRAWINGS AND GEOTECHNICAL ENGINEERING REPORT.
3. THE PERIMETER GROUND SURFACE AND HARDSCAPE SHOULD BE SLOPED TO DRAIN AWAY FROM ALL STRUCTURES AND AWAY FROM ADJACENT SLOPES.
4. CONSTRUCTION OF THE PROPOSED DEVELOPMENT WILL INVOLVE CLEARING AND GRUBBING OF THE EXISTING VEGETATION AND DEMOLITION OF EXISTING STRUCTURES. DEMOLITION SHALL INCLUDE REMOVAL OF EXISTING PAVEMENT, SLABS, UTILITIES, ETC., THROUGHOUT THE PROPOSED NEW DEVELOPMENT. VEGETATION, ROOTS, ORGANIC LADEN SOILS, AND ANY OTHER DELETERIOUS SOILS SHALL BE REMOVED. UNDERGROUND UTILITY LINES OR OTHER ABANDONED STRUCTURAL ELEMENTS SHALL BE REMOVED. THE VOIDS RESULTING FROM REMOVAL OF FOUNDATIONS OR LOOSE SOIL IN UTILITY LINES SHALL BE BACKFILLED WITH COMPACTED STRUCTURAL FILL. THE BASE OF THESE EXCAVATIONS SHOULD BE EXCAVATED TO FIRM NATIVE SUBGRADE BEFORE FILLING, WITH SIDES SLOPED AT A MINIMUM OF 1H:1V TO ALLOW FOR UNIFORM COMPACTION. MATERIALS GENERATED DURING DEMOLITION SHOULD BE TRANSPORTED OFF SITE OR STOCKPILED IN AREAS DESIGNATED BY THE OWNER'S REPRESENTATIVE. A REPRESENTATIVE OF THE GEOTECHNICAL ENGINEER SHOULD DETERMINE THE DEPTH OF REMOVAL AT THE TIME OF CONSTRUCTION.
5. FILL SHOULD BE PLACED IN RELATIVELY UNIFORM HORIZONTAL LIFTS ON THE PREPARED SUBGRADE. EACH LOOSE LIFT SHOULD BE ABOUT 10 INCHES THICK. THE TYPE OF COMPACTION EQUIPMENT USED WILL ULTIMATELY DETERMINE THE MAXIMUM LIFT THICKNESS. STRUCTURAL FILL SHALL BE COMPACTED TO AT LEAST 92 PERCENT OF MODIFIED PROCTOR MAXIMUM DRY DENSITY AS DETERMINED BY ASTM DESIGNATION D 1557 (MODIFIED PROCTOR).
6. ANY STRUCTURAL FILL PLACED ON SLOPES AT OR GREATER THAN 5H:1V SHOULD BE PROPERLY BENCHED. LEVEL BENCHES EXCAVATED INTO THE EXISTING SLOPE SHOULD BE A MINIMUM OF 10 FEET WIDE LATERALLY, AND SHOULD BE CUT INTO THE SLOPE FOR EVERY FIVE FEET OF MAXIMUM VERTICAL RISE. THE PLACEMENT OF FILL SHOULD BEGIN AT THE BASE OF THE FILL. ALL BENCHES SHOULD BE INSPECTED BY A REPRESENTATIVE OF THE GEOTECHNICAL ENGINEER AND APPROVED PRIOR TO PLACEMENT OF STRUCTURAL FILL LIFTS. IF EVIDENCE OF SEEPAGE IS OBSERVED IN THE BENCH EXCAVATIONS, A SUPPLEMENTAL DRAINAGE SYSTEM MAY NEED TO BE DESIGNED AND INSTALLED TO PREVENT HYDROSTATIC PRESSURE BUILDUP BEHIND THE FILL. FINAL FILL AND/OR CUT SLOPES SHOULD BE KEPT AT OR BELOW 2H:1V.
7. EACH LIFT OF COMPACTED ENGINEERED FILL SHOULD BE TESTED BY A REPRESENTATIVE OF THE GEOTECHNICAL ENGINEER PRIOR TO PLACEMENT OF SUBSEQUENT LIFTS.
8. FOLLOWING SITE PREPARATION AND PRIOR TO PLACING AGGREGATE BASE FOR SHALLOW FOUNDATIONS, BUILDING PAD, SLAB SUBGRADE SECTIONS, OR PAVEMENT SECTIONS, THE EXPOSED SUBGRADE SHOULD BE EVALUATED EITHER BY PROOFROLLING OR ANOTHER METHOD OF SUBGRADE VERIFICATION. THE SUBGRADE SHOULD BE PROOFROLLED WITH A FULLY LOADED DUMP TRUCK OR SIMILAR HEAVY, RUBBER-TIRE CONSTRUCTION EQUIPMENT TO IDENTIFY UNSUITABLE AREAS. IF EVALUATION OF THE SUBGRADES OCCURS DURING WET CONDITIONS, OR IF PROOFROLLING THE SUBGRADES WILL RESULT IN DISTURBANCE, THEY SHOULD BE EVALUATED BY THE GEOTECHNICAL ENGINEER.
9. SITE EARTHWORK AND SUBGRADE PREPARATION SHOULD NOT BE COMPLETED DURING FREEZING CONDITIONS, EXCEPT FOR MASS EXCAVATION TO THE SUBGRADE DESIGN ELEVATIONS.
10. ALL EXCAVATIONS SHOULD BE MADE IN ACCORDANCE WITH APPLICABLE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND STATE REGULATION.
11. IF DEWATERING IS REQUIRED, THE TYPE AND DESIGN OF THE DEWATERING SYSTEM SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.
12. CUT AND FILL SLOPES SHALL BE PROTECTED FROM EROSION. SUCH CONTROL MAY CONSIST OF APPROPRIATE REVEGETATION OR OTHER ACCEPTABLE MEANS AND METHODS. EROSION CONTROL MEASURES SHALL BE IN PLACE PRIOR TO EARTHWORK OR SITE STRIPPING.

EROSION AND SEDIMENT CONTROL NOTES:

1. THE ESCP MEASURES SHOWN ON THIS PLAN ARE MINIMUM REQUIREMENTS FOR ANTICIPATED SITE CONDITIONS. DURING THE CONSTRUCTION PERIOD, UPGRADE THESE MEASURES AS NEEDED TO COMPLY WITH ALL APPLICABLE LOCAL, STATE, AND FEDERAL EROSION AND SEDIMENT CONTROL REGULATIONS.
2. SUBMISSION OF ALL ESCP REVISIONS IS NOT REQUIRED. SUBMITTAL OF THE ESCP REVISIONS IS ONLY UNDER SPECIFIC CONDITIONS.
3. PHASE CLEARING AND GRADING TO THE MAXIMUM EXTENT PRACTICAL TO PREVENT EXPOSED INACTIVE AREAS FROM BECOMING A SOURCE OF EROSION.
4. IDENTIFY, MARK, AND PROTECT (BY FENCING OFF OR OTHER MEANS) CRITICAL RIPARIAN AREAS AND VEGETATION INCLUDING IMPORTANT TREES AND ASSOCIATED ROOTING ZONES, AND VEGETATION AREAS TO BE PRESERVED. IDENTIFY VEGETATIVE BUFFER ZONES BETWEEN THE SITE AND SENSITIVE AREAS (E.G., WETLANDS), AND OTHER AREAS TO BE PRESERVED, ESPECIALLY IN PERIMETER AREAS.
5. PRESERVE EXISTING VEGETATION WHEN PRACTICAL AND RE-VEGETATE OPEN AREAS. RE-VEGETATE OPEN AREAS WHEN PRACTICABLE BEFORE AND AFTER GRADING OR CONSTRUCTION. IDENTIFY THE TYPE OF VEGETATIVE SEED MIX USED.
6. EROSION AND SEDIMENT CONTROL MEASURES INCLUDING PERIMETER SEDIMENT CONTROL MUST BE IN PLACE BEFORE VEGETATION IS DISTURBED AND MUST REMAIN IN PLACE AND BE MAINTAINED, REPAIRED, AND PROMPTLY IMPLEMENTED FOLLOWING PROCEDURES ESTABLISHED FOR THE DURATION OF CONSTRUCTION, INCLUDING PROTECTION FOR ACTIVE STORM DRAIN INLETS AND CATCH BASINS AND APPROPRIATE NON-STORMWATER POLLUTION CONTROLS.
7. ESTABLISH CONCRETE TRUCK AND OTHER CONCRETE EQUIPMENT WASHOUT AREAS BEFORE BEGINNING CONCRETE WORK. DIRECT ALL WASH WATER INTO A PIT OR LEAK-PROOF CONTAINER. HANDLE WASH WATER AS WASTE, CONCRETE DISCHARGE TO WATER OF THE STATE IS PROHIBITED.
8. APPLY TEMPORARY AND/OR PERMANENT SOIL STABILIZATION MEASURES IMMEDIATELY ON ALL DISTURBED AREAS AS GRADING PROGRESSES AND FOR ALL ROADWAYS INCLUDING GRAVEL ROADWAYS.
9. ESTABLISH MATERIAL AND WASTE STORAGE AREAS, AND OTHER NON-STORMWATER CONTROLS.
10. PREVENT TRACKING OF SEDIMENT ONTO PUBLIC OR PRIVATE ROADS USING BMPS SUCH AS: GRAVELED (OR PAVED) EXITS AND PARKING AREAS, GRAVEL ALL UNPAVED ROADS LOCATED ONSITE, OR USE AN EXIT TIRE WASH. THESE BMPS MUST BE IN PLACE PRIOR TO LAND-DISTURBING ACTIVITIES.
11. WHEN TRUCKING SATURATED SOILS FROM THE SITE, EITHER USE WATER-TIGHT TRUCKS OR DRAIN LOADS ON SITE.
12. USE BMPS TO PREVENT OR MINIMIZE STORMWATER EXPOSURE TO POLLUTANTS FROM SPILLS; VEHICLE AND EQUIPMENT FUELING, MAINTENANCE, AND STORAGE; OTHER CLEANING AND MAINTENANCE ACTIVITIES; AND WASTE HANDLING ACTIVITIES. THESE POLLUTANTS INCLUDE FUEL, HYDRAULIC FLUID, AND OTHER OILS FROM VEHICLES AND MACHINERY, AS WELL AS DEBRIS, LEFTOVER PAINTS, SOLVENTS, AND GLUES FROM CONSTRUCTION OPERATIONS.
13. IMPLEMENT THE FOLLOWING BMPS WHEN APPLICABLE: WRITTEN SPILL PREVENTION AND RESPONSE PROCEDURES, EMPLOYEE TRAINING ON SPILL PREVENTION AND PROPER DISPOSAL PROCEDURES, SPILL KITS IN ALL VEHICLES, REGULAR MAINTENANCE SCHEDULE FOR VEHICLES AND MACHINERY, MATERIAL DELIVERY AND STORAGE CONTROLS, TRAINING AND SIGNAGE, AND COVERED STORAGE AREAS FOR WASTE AND SUPPLIES.
14. USE WATER, SOIL-BINDING AGENT OR OTHER DUST CONTROL TECHNIQUE AS NEEDED TO AVOID WIND-BLOWN SOIL.
15. THE APPLICATION RATE OF FERTILIZERS USED TO REESTABLISH VEGETATION MUST FOLLOW MANUFACTURER'S RECOMMENDATIONS TO MINIMIZE NUTRIENT RELEASES TO SURFACE WATERS. EXERCISE CAUTION WHEN USING TIME-RELEASE FERTILIZERS WITHIN ANY WATERWAY RIPARIAN ZONE.
16. AT THE END OF EACH WORKDAY SOIL STOCKPILES MUST BE STABILIZED OR COVERED, OR OTHER BMPS MUST BE IMPLEMENTED TO PREVENT DISCHARGES TO SURFACE WATERS OR CONVEYANCE SYSTEMS LEADING TO SURFACE WATERS.
17. CONSTRUCTION ACTIVITIES MUST AVOID OR MINIMIZE EXCAVATION AND CREATION OF BARE GROUND DURING WET WEATHER OCTOBER 01 - MAY 31.
18. SEDIMENT FENCE: REMOVE TRAPPED SEDIMENT BEFORE IT REACHES ONE THIRD OF THE ABOVE GROUND FENCE HEIGHT AND BEFORE FENCE REMOVAL.
19. OTHER SEDIMENT BARRIERS (SUCH AS BIOBAGS): REMOVE SEDIMENT BEFORE IT REACHES TWO INCHES DEPTH ABOVE GROUND HEIGHT. AND BEFORE BMP REMOVAL.
20. CATCH BASINS: CLEAN BEFORE RETENTION CAPACITY HAS BEEN REDUCED BY FIFTY PERCENT. SEDIMENT BASINS AND SEDIMENT TRAPS: REMOVE TRAPPED SEDIMENTS BEFORE DESIGN CAPACITY HAS BEEN REDUCED BY FIFTY PERCENT AND AT COMPLETION OF PROJECT.
21. WITHIN 24 HOURS, SIGNIFICANT SEDIMENT THAT HAS LEFT THE CONSTRUCTION SITE, MUST BE REMEDIATED. INVESTIGATE THE CAUSE OF THE SEDIMENT RELEASE AND IMPLEMENT STEPS TO PREVENT A RECURRENCE OF THE DISCHARGE WITHIN THE SAME 24 HOURS.
22. THE INTENTIONAL WASHING OF SEDIMENT INTO STORM SEWERS OR DRAINAGE WAYS MUST NOT OCCUR. VACUUMING OR DRY SWEEPING AND MATERIAL PICKUP MUST BE USED TO CLEANUP RELEASED SEDIMENTS.
23. PROVIDE PERMANENT EROSION CONTROL MEASURES ON ALL EXPOSED AREAS. DO NOT REMOVE TEMPORARY SEDIMENT CONTROL PRACTICES UNTIL PERMANENT VEGETATION OR OTHER COVER OF EXPOSED AREAS IS ESTABLISHED. HOWEVER, DO REMOVE ALL TEMPORARY EROSION CONTROL MEASURES AS EXPOSED AREAS BECOME STABILIZED, UNLESS DOING SO CONFLICTS WITH LOCAL REQUIREMENTS. PROPERLY DISPOSE OF CONSTRUCTION MATERIALS AND WASTE, INCLUDING SEDIMENT RETAINED BY TEMPORARY BMPS.
24. IF VEGETATIVE SEED MIXES ARE SPECIFIED, SEEDING MUST TAKE PLACE NO LATER THAT SEPTEMBER 1; THE TYPE AND PERCENTAGES OF SEED IN THE MIX MUST BE IDENTIFIED ON THE PLANS.
25. ALL PUMPING OF SEDIMENT LADEN WATER SHALL BE DISCHARGED OVER AN UNDISTURBED, PREFERABLY VEGETATED AREA, AND THROUGH A SEDIMENT CONTROL BMP I.E. (FILTER BAG).
26. ALL EXPOSED SOILS MUST BE COVERED DURING THE WET WEATHER PERIOD, OCTOBER 01 - MAY 31.
27. IF WATERS OF THE STATE IS WITHIN THE PROJECT SITE OR WITHIN 50 FEET OF THE PROJECT BOUNDARY, MAINTAIN THE EXISTING NATURAL BUFFER WITHIN THE 50-FOOT ZONE FOR THE DURATION OF THE PERMIT COVERAGE, OR MAINTAIN LESS THAN THE ENTIRE EXISTING NATURAL BUFFER AND PROVIDE ADDITIONAL EROSION AND SEDIMENT CONTROL BMPS.
28. DISCHARGE OF SEDIMENT LADEN WATER FROM SITE TO PUBLIC STORM SYSTEM IS NOT ALLOWED. TREATMENT REQUIRED PRIOR TO DISCHARGE.
29. ALL LAND AREA PROPOSED FOR EXCAVATION, VEGETATION REMOVAL, SOIL STOCKPILING, OR WHICH WILL HAVE EXPOSED SOIL SHALL BE CONSIDERED PART OF THE DEVELOPMENT SITE.
30. MAY 1 THROUGH SEPTEMBER 30, THE DURATION OF SOIL EXPOSURE SHALL BE KEPT TO A MAXIMUM OF 21 DAYS. ALL DISTURBED SOIL THAT REMAINS EXPOSED FOR 21 DAYS OR MORE DURING CONSTRUCTION SHALL BE TREATED WITH AN EROSION CONTROL COVER (I.E., PLASTIC, SEEDING OR MULCHING), FOLLOWING GRADING OR CONSTRUCTION, UNTIL SOILS ARE RE-VEGETATED OR OTHERWISE STABILIZED.
31. OCTOBER 1 THROUGH APRIL 30, THE DURATION OF SOIL EXPOSURE SHALL BE KEPT TO A MAXIMUM OF 7 DAYS. ALL DISTURBED SOIL THAT REMAINS EXPOSED FOR 7 DAYS OR MORE DURING CONSTRUCTION SHALL BE TREATED WITH AN EROSION CONTROL COVER (I.E., PLASTIC, SEEDING OR MULCHING), FOLLOWING GRADING OR CONSTRUCTION, UNTIL SOILS ARE REVEGETATED OR OTHERWISE STABILIZED.
32. DURING CONSTRUCTION, RUNOFF FROM THE DEVELOPMENT SITE SHALL BE CONTROLLED, AND RUNOFF AND SEDIMENT RESULTING THEREFROM SHALL BE RETAINED ON SITE.
33. A STABILIZED PAD OF GRAVEL SHALL BE LAID AND MAINTAINED AT ALL ENTRANCES AND EXITS TO ANY DEVELOPMENT SITE FROM WHICH VEHICULAR TRAFFIC MAY TRACK SOIL OR DEBRIS ONTO PUBLIC RIGHT-OF-WAY. THE GRAVEL PAD(S) SHALL BE INSTALLED AND INSPECTED BY CITY STAFF PRIOR TO ANY DEVELOPMENT OR SITE PREPARATION. NO OTHER VEHICULAR ENTRANCE OR EXIT BY USED TO ACCESS THE DEVELOPMENT SITE.
34. GRAVEL PADS SHALL BE MAINTAINED TO FUNCTION PROPERLY. IF THE GRAVEL PAD DOES NOT ADEQUATELY REMOVE DIRT AND MUD FROM THE VEHICLE WHEELS, SUCH THAT MUD TRACKING IS EVIDENT OFF SITE, ADDITIONAL MEASURES MUST BE TAKEN.
35. TOPSOIL REMOVED FOR DEVELOPMENT SHALL BE STOCKPILED AND REUSED TO THE DEGREE NECESSARY TO RESTORE DISTURBED AREAS TO THEIR ORIGINAL OR ENHANCED CONDITION, OR TO ASSURE A MINIMUM OF SIX INCHES OF STABLE TOPSOIL FOR REVEGETATION.
36. THE OWNER SHALL BE RESPONSIBLE FOR THE PROMPT CLEAN-UP OF ALL SEDIMENTS THAT ARE CARRIED ONTO ANY PUBLIC OR PRIVATE STREETS, OR ONTO ADJACENT PROPERTY AS SOON AS THE OWNER BECOMES AWARE OF SUCH PROBLEMS OR WITHIN THE TIME REQUIRED BY THE CITY. THE OWNER SHALL BE RESPONSIBLE FOR CLEANING AND REPAIRING STREETS, CATCH BASINS, DRAINAGE WAYS, STORM WATER DRAINAGE FACILITIES, AND ADJACENT PROPERTIES CONTAMINATED OR DAMAGED BY SEDIMENT. FAILURE TO DO SO WILL BE IN VIOLATION OF THIS CODE.

GENERAL NOTES

ROCK CREEK COVE HOSPITALITY

STEVENSON, WASHINGTON

Harper Houf Peterson Righellis Inc.
ENGINEERS • PLANNERS • LANDSCAPE ARCHITECTS • SURVEYORS
205 SE Spokane Street, Suite 200, Portland, OR 97202
phone: 503.221.1131 www.hhpr.com fax: 503.221.1171

NOT FOR CONSTRUCTION

DESIGNED:	HHPR
DRAWN:	HHPR
CHECKED:	HHPR
DATE:	05/18/2023

REVISIONS

NO.	DESCRIPTION	DATE

SHEET NO.
C1.01

JOB NO. FDM-01A

FDM DEVELOPMENT INC.

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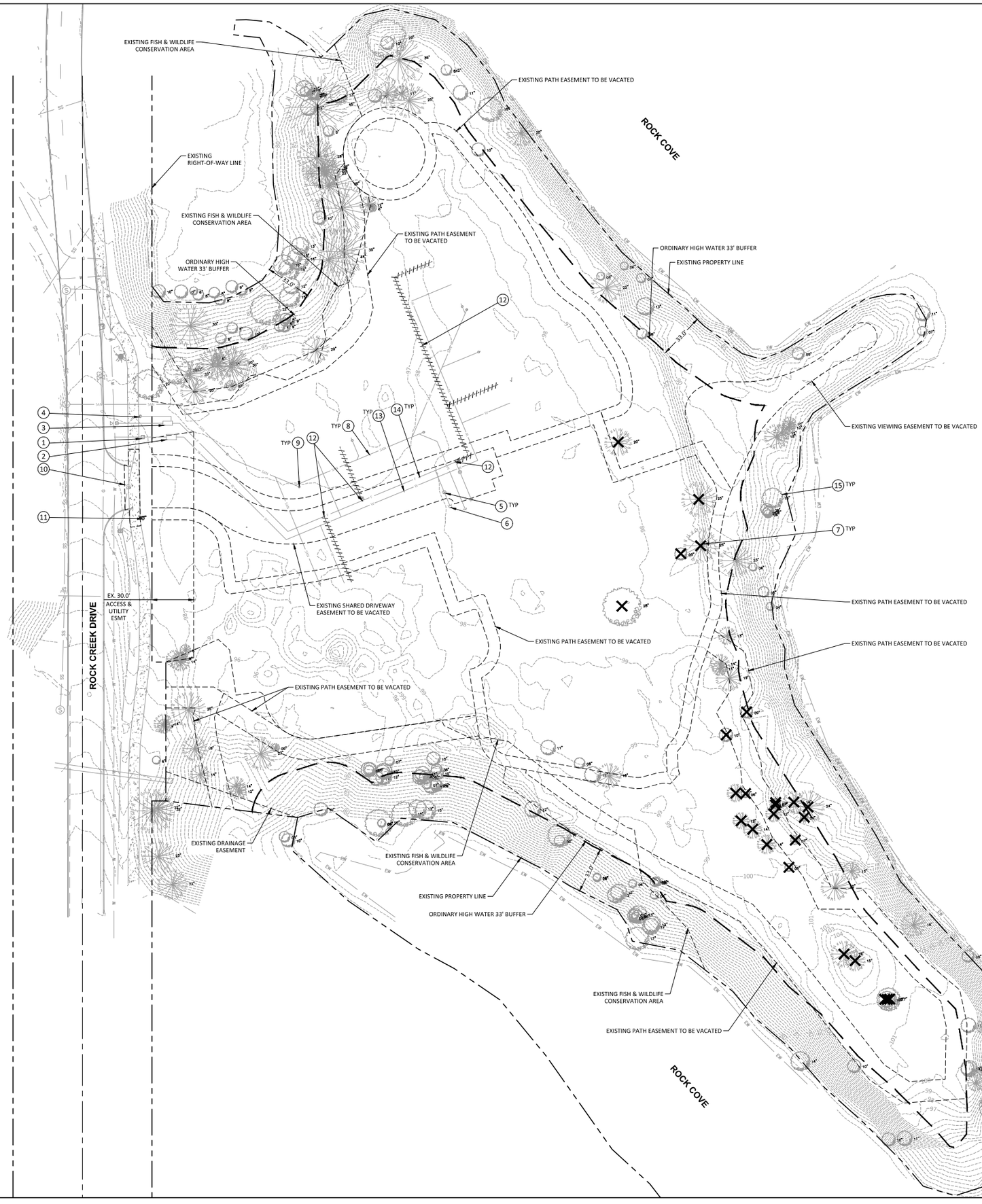

CONSTRUCTION NOTES:

1. EXISTING WATER METER AND SERVICE TO REMAIN. PROTECT IN PLACE.
2. EXISTING WATER DCVA TO REMAIN. PROTECT IN PLACE.
3. EXISTING FIRE SERVICE AND DCDA TO REMAIN. PROTECT IN PLACE.
4. EXISTING FDC TO REMAIN. PROTECT IN PLACE.
5. EXISTING WATER VALVE TO REMAIN AND BE PROTECTED. LID TO BE ADJUSTED TO FINISH GRADE AS NECESSARY.
6. EXISTING PRIVATE FIRE HYDRANT TO REMAIN. PROTECT IN PLACE.
7. EXISTING TREE TO BE REMOVED.
8. EXISTING SANITARY SEWER LINE TO REMAIN. PROTECT IN PLACE.
9. EXISTING SANITARY CLEANOUT TO REMAIN AND BE PROTECTED. LID TO BE ADJUSTED TO FINISH GRADE AS NECESSARY.
10. SAWCUT AND REMOVE EXISTING CURB AND PAVEMENT AS SHOWN ON PLANS. SIDEWALK TO BE REMOVED AT NEAREST JOINT.
11. REMOVE EXISTING SIGN AND POST.
12. EXISTING FIRE SERVICE TO BE CAPPED AT EXISTING TEE AND REMOVED OR ABANDONED.
13. EXISTING PRIVATE WATER LINE TO REMAIN. PROTECT IN PLACE.
14. EXISTING PRIVATE FIRE LINE TO REMAIN. PROTECT IN PLACE.
15. EXISTING TREE TO REMAIN AND BE PROTECTED.

OVERALL EXISTING CONDITIONS & DEMO PLAN

ROCK CREEK COVE HOSPITALITY

STEVENSON, WASHINGTON

Harper Houf Peterson Righellis Inc.
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NOT FOR CONSTRUCTION

DESIGNED:	HHPR
DRAWN:	HHPR
CHECKED:	HHPR
DATE:	05/18/2023

NO.	DESCRIPTION	DATE

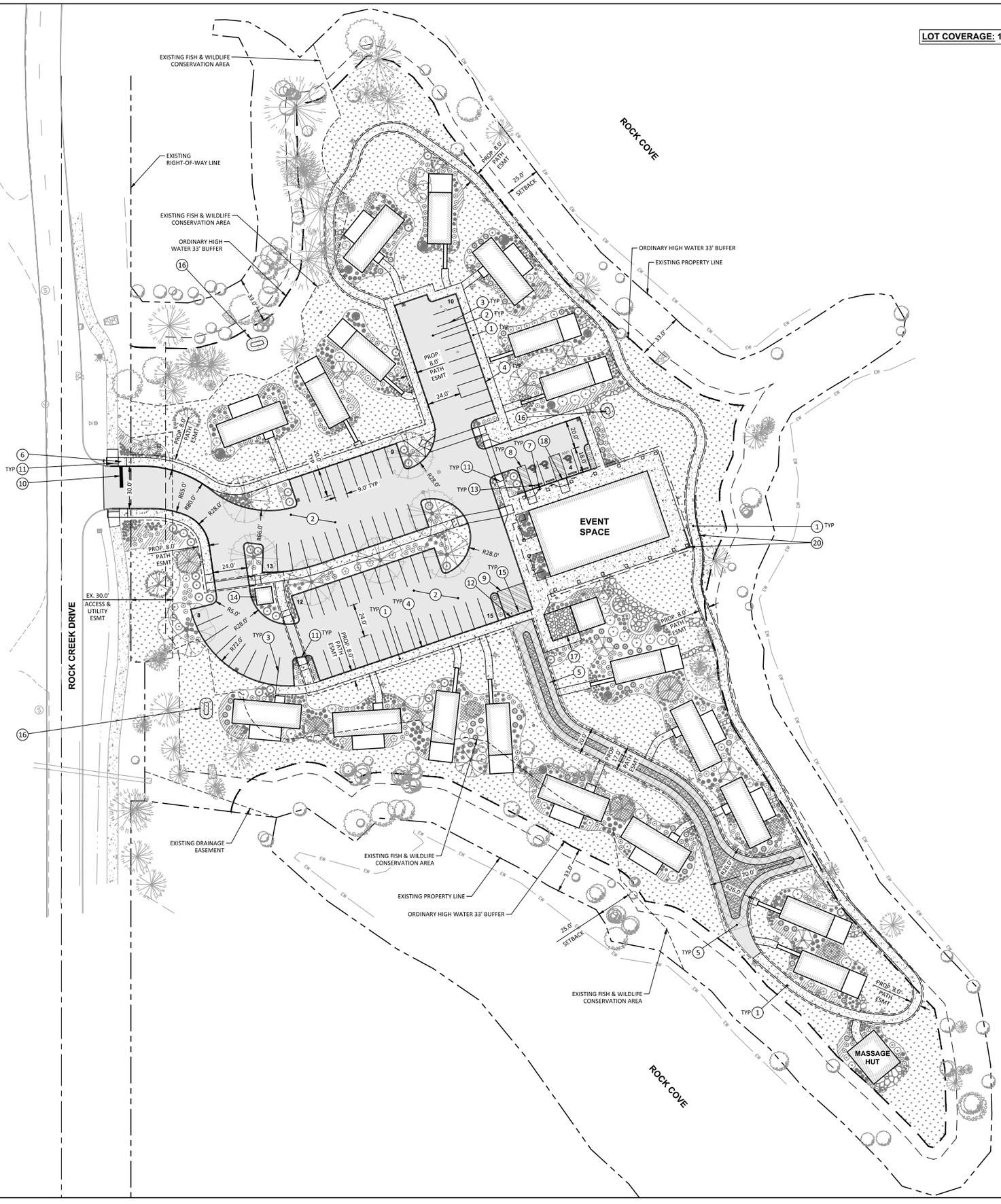
REVISIONS

SHEET NO.
C2.00

JOB NO. FDM-01A

FDM DEVELOPMENT INC.

W:\02-Vancouver\FDM (FDM Development\FDM-01 (Rock Creek Cove\(FDM01+2\WGS\Sheets\ FDM01-C1.02 OVERALL EXISTING CONDITIONS.dwg



LOT COVERAGE: 10.6% (27,983 SF/262,834 SF)

CONSTRUCTION NOTES:

1. CONSTRUCT CONCRETE SIDEWALK PER DETAIL ON SHEET C6.00.
2. CONSTRUCT AC PAVEMENT PER SECTIONS ON SHEET C6.00.
3. PAINT 4" WHITE PARKING STRIPE PER DETAILS ON SHEET C6.00.
4. CONSTRUCT STANDARD CONCRETE 6" CURB PER DETAIL ON SHEET C6.00.
5. CONSTRUCT FIRE ACCESS AND PEDESTRIAN PATH PER SECTION ON SHEET C6.00.
6. INSTALL STOP SIGN AND POST PER DETAIL ON SHEET C6.00.
7. INSTALL ACCESSIBLE PARKING SIGN PER DETAILS ON SHEET C6.00. VAN ACCESSIBLE SIGN TO BE INSTALLED WHERE SHOWN ON PLANS.
8. PAINT LOADING ZONE STRIPING AND ACCESSIBLE PARKING SYMBOL PER DETAILS ON SHEET C6.00.
9. PAINT "NO PARKING" STRIPING PER DETAIL ON SHEET C6.00.
10. PAINT STOP BAR PER DETAIL ON SHEET C6.00.
11. INSTALL PERPENDICULAR SIDEWALK RAMP PER DETAIL ON SHEET C6.00.
12. INSTALL MOUNTABLE CURB PER DETAIL ON SHEET 6.00. INSTALL CONSTRUCTION JOINT ON EITHER END.
13. INSTALL CONCRETE WHEELSTOP PER DETAIL ON SHEET C6.00.
14. PROPOSED COVERED TRASH ENCLOSURE.
15. INSTALL REMOVABLE BOLLARD WITH KNOX PADLOCK PER DETAIL ON SHEET C6.00.
16. PROPOSED STORMWATER FACILITY. REFER TO UTILITY PLANS FOR INFORMATION.
17. PROPOSED STORAGE AREA AND GAZEBO. REFER TO ARCHITECTURAL PLANS FOR INFORMATION.
18. CONSTRUCT FLUSH CURB PER DETAIL ON SHEET C6.00.
20. PROPOSED SIDEWALK THICKENED EDGE PER DETAIL ON SHEET C6.00.

OVERALL SITE PLAN
ROCK CREEK COVE HOSPITALITY
STEVENSON, WASHINGTON

Harper Houf Peterson Righellis Inc.
ENGINEERS ■ PLANNERS
LANDSCAPE ARCHITECTS ■ SURVEYORS
205 SE Spokane Street, Suite 200, Portland, OR 97202
phone: 503.221.1131 www.hhpr.com fax: 503.221.1171

NOT FOR CONSTRUCTION

DESIGNED:	HHPR	05/18/2023
DRAWN:	HHPR	
CHECKED:	HHPR	

NO.	DESCRIPTION	DATE

REVISIONS

SHEET NO.
C3.00

JOB NO. FDM-01A

FDM DEVELOPMENT INC.

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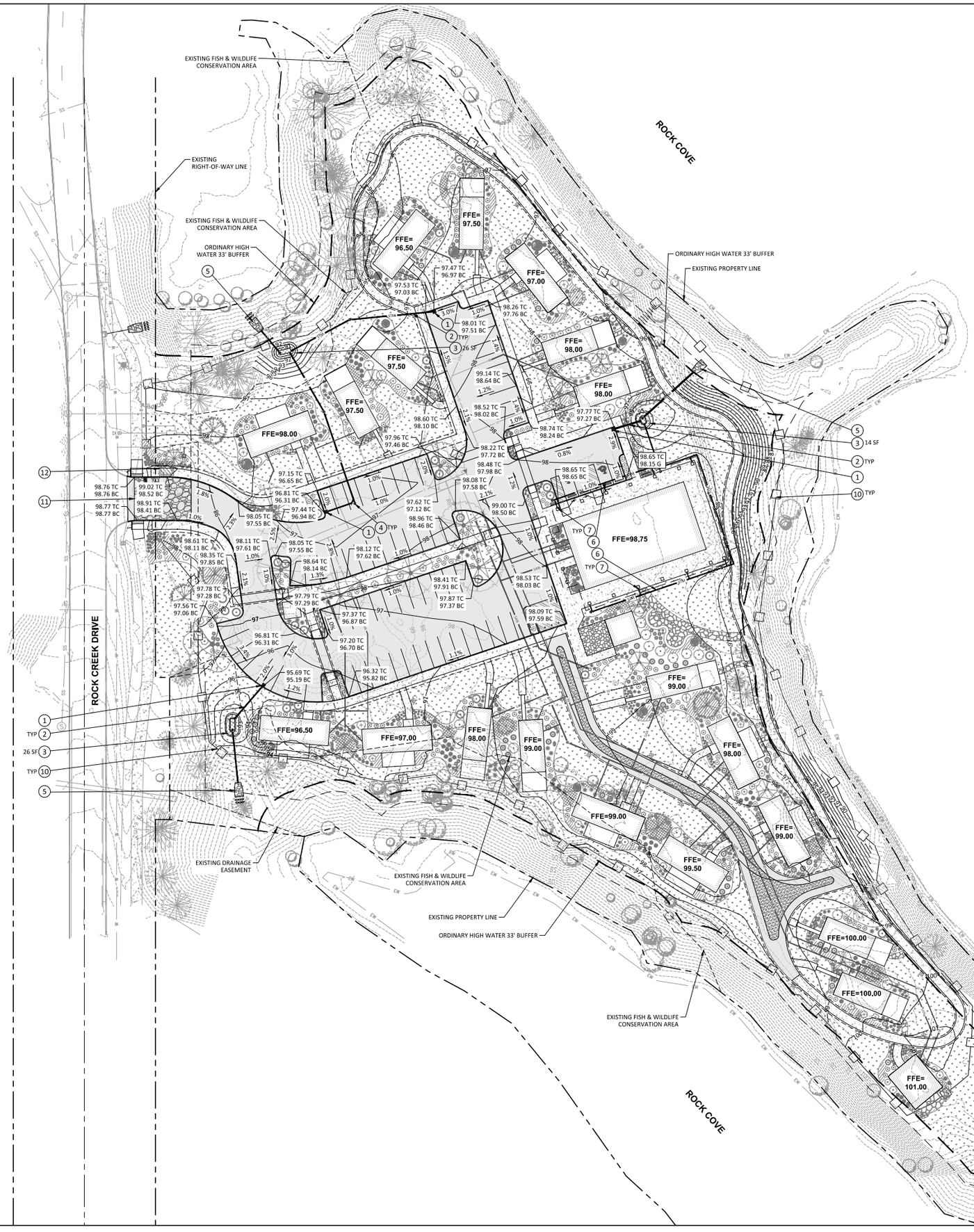

CONSTRUCTION NOTES:

1. INSTALL CATCHBASIN PER DETAIL ON SHEET C6.01. INLET TO BE PROTECTED WITH 'SILT SACK' PER DETAIL ON SHEET C6.02 FOR ENTIRE COURSE OF CONSTRUCTION.
2. INSTALL 12" PVC STORM LINE. SLOPE AT 0.5% MIN.
3. CONSTRUCT STORMWATER FACILITY PER DETAIL ON SHEET C6.01. BEEHIVE INLET TO BE PROTECTED WITH 'SILT SACK' PER DETAIL ON SHEET C6.02 FOR ENTIRE COURSE OF CONSTRUCTION.
4. INSTALL STORM CLEANOUT PER DETAIL ON SHEET C6.01.
5. CONSTRUCT STORMWATER ROCK OUTFALL PER DETAIL ON SHEET C6.01.
6. INSTALL 6" PVC STORM LINE. SLOPE AT 0.5% MIN.
7. PROPOSED DOWNSPOUT CONNECTION.
10. INSTALL SEDIMENT FENCE FOR EROSION CONTROL PER DETAIL ON SHEET C6.02.
11. INSTALL CONSTRUCTION ENTRANCE PER DETAIL SHEET C6.02.
12. INSTALL CONCRETE WASHOUT PER DETAIL ON SHEET C6.02

OVERALL GRADING, DRAINAGE & EROSION CONTROL PLAN

ROCK CREEK COVE HOSPITALITY

STEVENSON, WASHINGTON

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NO.	DESCRIPTION	DATE
	REVISIONS	

SHEET NO.

C4.00

JOB NO. FDM-01A

SCALE: 1" = 30'

FDM DEVELOPMENT INC.

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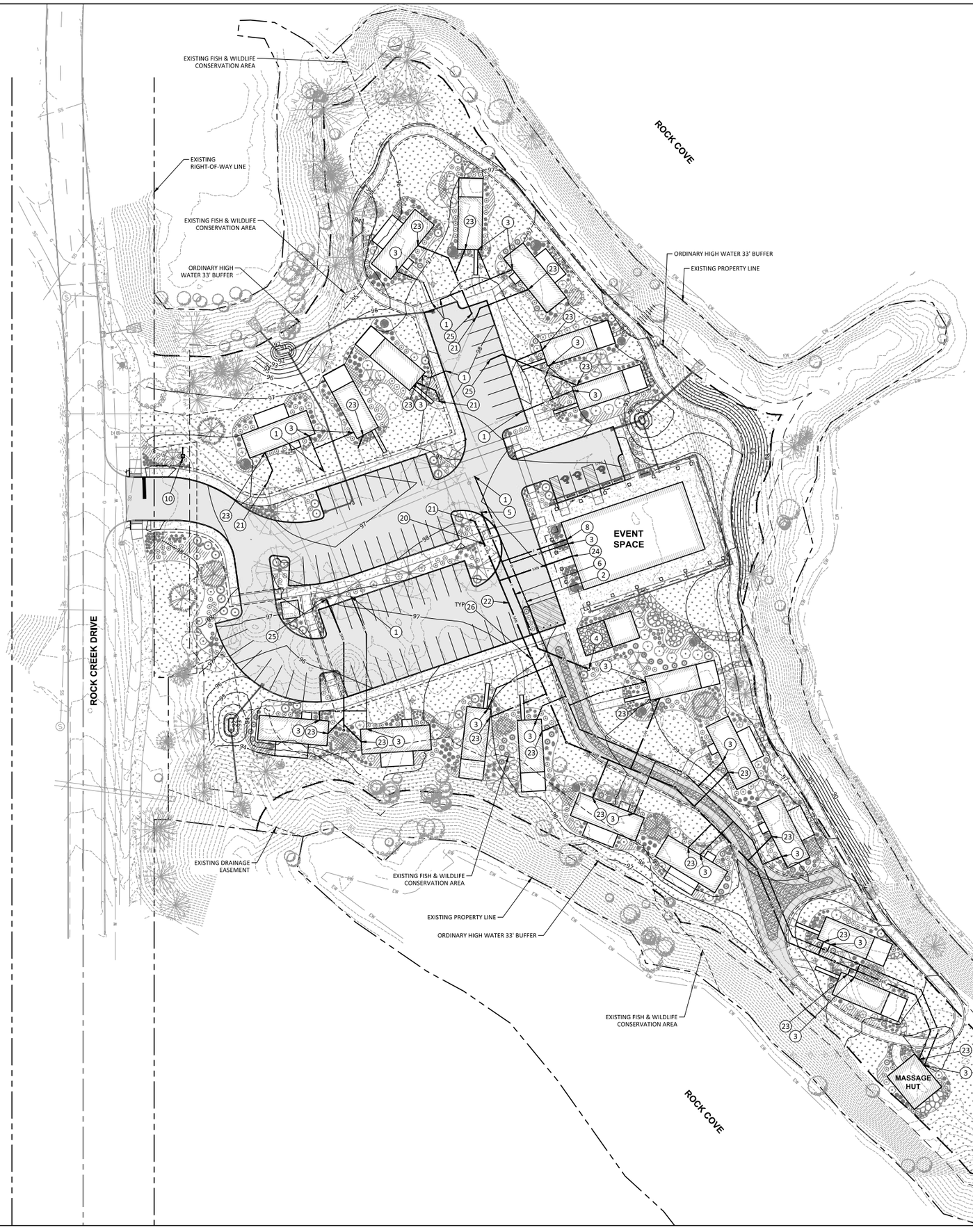

CONSTRUCTION NOTES:

1. CONNECT TO EXISTING 1.5" WATER SERVICE.
2. INSTALL 1.5" SCH. 80 PVC WATER SERVICE.
3. DOMESTIC WATER SERVICE CONNECTION POINT. VERIFY SIZE AND LOCATION WITH BUILDING PLUMBING DESIGNER. INSTALL APPROVED PRESSURE REDUCING VALVE (PRV) PER PLUMBING CODE AND SET PRESSURE TO 70 PSI.
4. INSTALL FIRE HYDRANT ASSEMBLY INCLUDING 6" X 6" TEE, FLG. AND 6" G.V., FLG. X M.J. PER DETAIL, SHEET C6.02 INCLUDING:
   1 - 6" ADAPTER, FLG. X M.J.
   1 - 6" BLIND FLANGE, 2" TAPPED I.P.T.
5. CONNECT TO EXISTING 6" D.I. FIRE SERVICE LINE.
6. INSTALL 6" D.I. CLASS 52 FIRE SERVICE LINE.
8. FIRE SERVICE CONNECTION POINT. VERIFY SIZE AND LOCATION WITH BLDG SPRINKLER DESIGNER.
10. IRRIGATION SERVICE CONNECTION POINT AND DEDUCT METER. REFER TO LANDSCAPE PLANS.
20. INSTALL 8" C900 SANITARY PIPE. SLOPE AT 0.5% MIN.
21. CONNECT TO EXISTING 8" SANITARY LINE.
22. INSTALL 6" C900 SANITARY PIPE. SLOPE AT 0.5% MIN.
23. 4" SANITARY SEWER BUILDING CONNECTION.
24. 6" SANITARY SEWER BUILDING CONNECTION.
25. CONNECT TO EXISTING 6" SANITARY LINE.
26. INSTALL SANITARY SEWER CLEANOUT PER DETAIL ON SHEET C6.01.

OVERALL UTILITY PLAN

ROCK CREEK COVE HOSPITALITY

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NO.	DESCRIPTION	DATE
	REVISIONS	

SHEET NO.

C5.00

JOB NO. FDM-01A

0 15 30 60

SCALE: 1" = 30'

FDM DEVELOPMENT INC.

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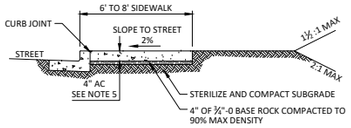
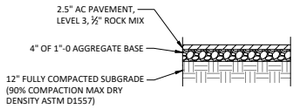


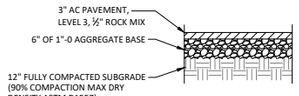
NOTES:

1. CONCRETE SHALL BE COMMERCIAL MIX, MIN. COMPRESSIVE STRENGTH OF 3300 PSI @ 28 DAYS, WITH A SLUMP RANGE OF 1½" MIN. TO 3" MAX.
2. SIDEWALK PANELS TO BE SQUARE (5' LONG x 5' WIDE TYP.).
3. EXPANSION JOINTS TO BE PLACED AT SIDES OF DRIVEWAY APPROACHES, UTILITY VAULTS, CURB RAMPS, AND/OR POINTS OF TANGENCY IN CURB AS SHOWN ON THE STANDARD DRAWINGS FOR SIDEWALK RAMPS, AND AT SPACING NOT TO EXCEED 45'.
4. FOR SIDEWALKS ADJACENT TO THE CURB AND POURED AT THE SAME TIME AS THE CURB, THE JOINT BETWEEN THEM SHALL BE A TROWELED JOINT WITH A MINIMUM ½" RADIUS.
5. SIDEWALKS SHALL HAVE A MINIMUM THICKNESS OF 4". IF MOUNTABLE CURB IS USED, OR IF SIDEWALK IS INTENDED AS PORTION OF A RESIDENTIAL DRIVEWAY IT SHALL HAVE A 6" MINIMUM THICKNESS, COMMERCIAL 8".
6. CONCRETE SHALL HAVE A BROOM FINISH, ALL JOINTS SHALL BE EDGED WITH 3" SHINE.
7. WIDTH OF PLANTER STRIP AND SIDEWALK IS MEASURED FROM FACE OF CURB.
8. IF DRAIN BLOCKOUTS IN CURBS ARE APPROVED, THEY SHALL BE EXTENDED PERPENDICULAR TO CURB TO 1' PAST BACK OF SIDEWALK WITH A 3" DIAMETER ADS PIPE. CONTRACTION JOINT SHALL BE PLACE OVER PIPE.

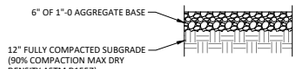
STANDARD SIDEWALK
NTS



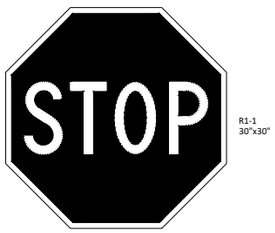
AC PAVEMENT SECTION FOR PARKING LOT STALLS
NTS



AC PAVEMENT SECTION FOR PARKING LOT AISLES
NTS

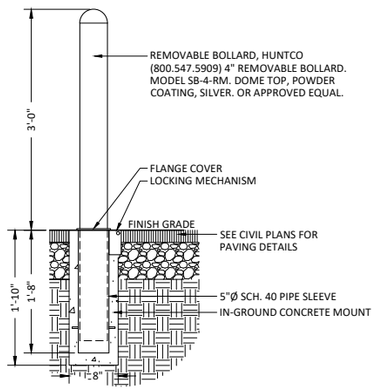


GRAVEL FIRE TURNAROUND SECTION
NTS

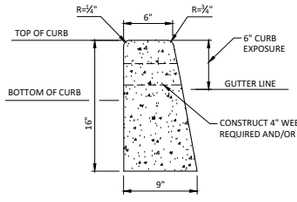


R1-1
30"x30"

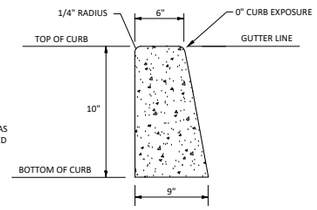
SIGN LEGEND
N.T.S.



REMOVABLE BOLLARD DETAIL
NTS



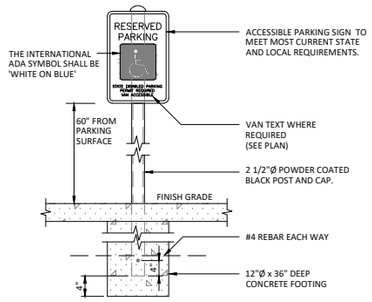
STANDARD CURB
NTS



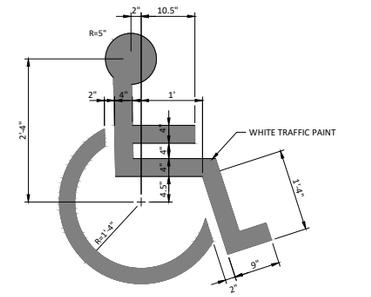
FLUSH CURB
NTS

CURB NOTES:

1. CONCRETE SHALL BE 4000 PSI MIN. 3-1/2: SLUMP (MAX).
2. CURBS ADJACENT TO PAVEMENT OR SIDEWALK TO HAVE EXPANSION AND/OR CONTRACTION JOINTS TO MATCH EXISTING PATTERNS.
3. EXPANSION JOINTS TO BE PROVIDED AT EACH; POINT OF TANGENCY, COLD JOINT, SIDE OF INLET STRUCTURE, SIDE OF DRIVEWAYS.
4. EXPANSION JOINT MATERIAL TO BE PRE-MOLDED, ASPHALT IMPREGNATED, NON-EXTRUDING, WITH A THICKNESS OF ½ INCH.
5. CONTRACTION JOINTS SHALL HAVE; SPACING OF NOT MORE THAN 15FEET, DEPTH OF JOINT OF AT LEAST 1 ½ INCHES.
6. BASE ROCK SHALL BE ¾"-0, COMPACTED TO 95% ASTM D 1557. BASE ROCK SHALL BE TO SUBGRADE OF STREET STRUCTURE OR 4 INCHES, WHICHEVER IS GREATER, AND SHALL EXTEND 12" BEHIND THE CURB.



ACCESSIBLE PARKING SIGN
N.T.S.

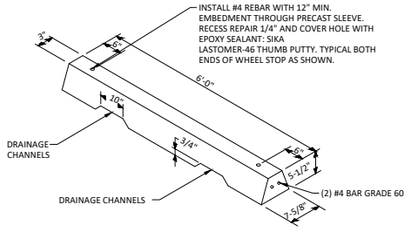


NOTES:

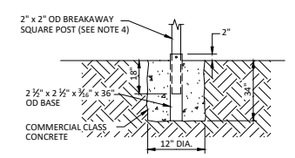
1. SYMBOL AND PAINT SHALL MEET CURRENT A.D.A. ACCESSIBILITY GUIDELINE REQUIREMENTS.

ACCESSIBLE PARKING SYMBOL
N.T.S.

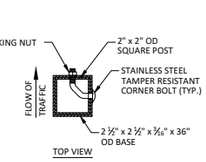
STOP BAR
N.T.S.



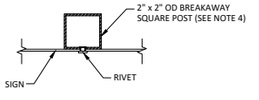
PRECAST CONCRETE WHEEL STOP
NTS



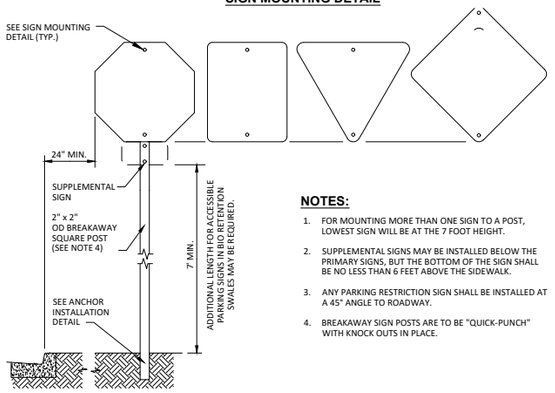
ANCHOR INSTALLATION DETAIL



ANCHOR DETAIL



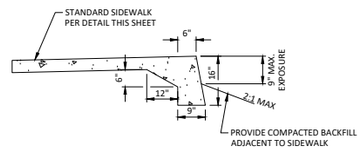
SIGN MOUNTING DETAIL



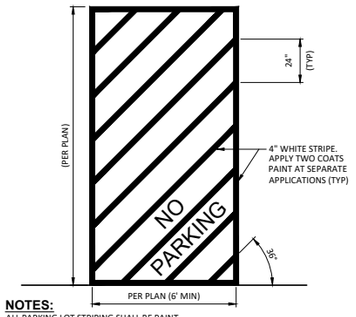
NOTES:

1. FOR MOUNTING MORE THAN ONE SIGN TO A POST, LOWEST SIGN WILL BE AT THE 7 FOOT HEIGHT.
2. SUPPLEMENTAL SIGNS MAY BE INSTALLED BELOW THE PRIMARY SIGNS, BUT THE BOTTOM OF THE SIGN SHALL BE NO LESS THAN 6 FEET ABOVE THE SIDEWALK.
3. ANY PARKING RESTRICTION SIGN SHALL BE INSTALLED AT A 45° ANGLE TO ROADWAY.
4. BREAKAWAY SIGN POSTS ARE TO BE "QUICK-PUNCH" WITH KNOCK OUTS IN PLACE.

GROUND MOUNTED SIGN DETAILS
N.T.S.



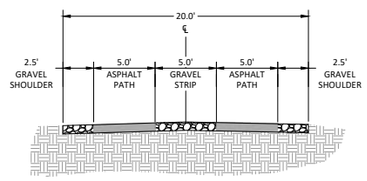
SIDEWALK THICKENED EDGE
NTS



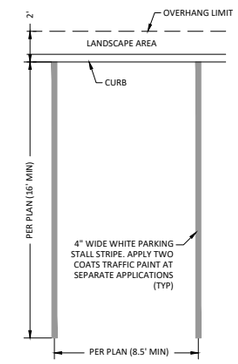
NOTES:
ALL PARKING LOT STRIPING SHALL BE PAINT.
TRAFFIC MARKING PAINT SHALL BE INDUSTRY STANDARD: AASHTO M-24B, TYPE 3F

ACCEPTABLE TRAFFIC PAINTS:
FULLER O'BRIEN: TRAFFIC LINE PAINT, 382-12
GENERAL: TRU-TEST SUPREME ZONE MARKING PAINT, 1010 WHITE AND 1012 YELLOW
PPG INDUSTRIES: PITTSBURGH TRAFFIC AND ZONE MARKING PAINT 22 LINE, WHITE AND YELLOW
RODDA: TRAFFIC PAINT, WHITE 671 AND YELLOW 870
SHERWIN WILLIAMS: WHITE 829 W1 AND YELLOW B29 Y2

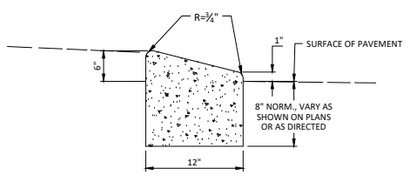
ACCESSIBLE AISLE & NO PARKING AREA STRIPING
NTS



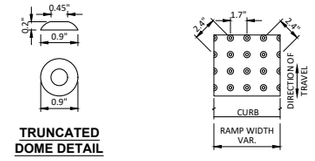
ASPHALT TRAIL/FIRE ACCESS LANE SECTION
SCALE: 1" = 5'

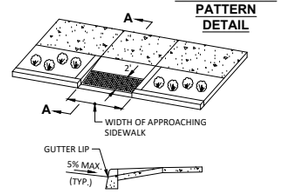


STANDARD PARKING STALL STRIPING
NTS



LOW PROFILE MOUNTABLE CONCRETE CURB
NTS





SECTION A-A

GENERAL NOTES:

1. PLACE TRUNCATED DOME DETECTABLE WARNING TEXTURE IN THE LOWER 2' OF THROAT OF RAMP ONLY. ARRANGE DOMES USING IN-LINE PATTERN AS SHOWN IN DETAIL BELOW. COLOR OF TEXTURE TO BE SAFETY YELLOW. FOR CONSTRUCTION OF SIDEWALK RAMPS OUTSIDE OF PUBLIC RIGHT-OF-WAY, CHECK STATE BUILDING CODE REQUIREMENTS.
2. SIDEWALK CURB RAMP SLOPES SHOWN ARE RELATIVE TO THE TRUE LEVEL HORIZON (ZERO BUBBLE).
3. IN ALTERATIONS, CURB RAMP SLOPE(S) MAY BE 10% FOR A MAX. RISE OF 6" OR 12.5% FOR A MAX RISE OF 3". CURB RAMPS, IN ALTERATIONS, NEED NOT EXCEED 6' IN LENGTH.
4. SIDE FLARES THAT ARE NOT PART OF THE PATH OF TRAVEL MAY BE ANY SLOPE.
5. RAMPS FOR PATHS INTERSECTING A ROADWAY SHOULD BE FULL WIDTH OF PATH. WHEN A RAMP IS USED TO PROVIDE BICYCLE ACCESS FROM A ROADWAY TO A SIDEWALK, THE RAMP SHOULD BE 8' WIDE WITH NO TEXTURING.
6. SIDEWALK RAMP DETAILS ARE BASED ON ORS 447.310 AND PROWAAC FINAL REPORT.
7. FOR THE PURPOSE OF THIS DRAWING, A CURB RAMP IS CONSIDERED "PERPENDICULAR" IF THE ANGLE BETWEEN THE LONGITUDINAL AXIS OF THE RAMP AND A TANGENT TO THE CURB AT THE RAMP CENTER IS 75° OR GREATER.
8. TOOLED JOINTS ARE REQUIRED AT ALL SIDEWALK RAMP SLOPE BREAK LINES.
9. SIDEWALK FLARE IS NOT NECESSARY WHERE THE RAMP IS PROTECTED FROM PEDESTRIAN CROSS-TRAVEL.

SIDEWALK RAMP
N.T.S.

DETAILS

ROCK CREEK COVE HOSPITALITY

STEVENSON, WASHINGTON

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ENGINEERS PLANNERS LANDSCAPE ARCHITECTS SURVEYORS
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DESIGNED:	HHPR		
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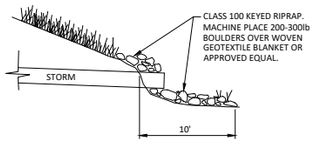
NO.	DATE	DESCRIPTION
		REVISIONS

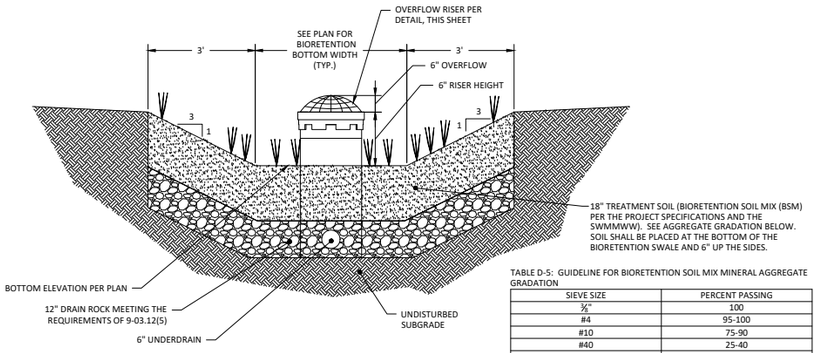
SHEET NO.
C6.00

JOB NO. FDM-01A

FDM DEVELOPMENT INC.



ROCK OUTFALL
NTS



BIOFILTRATION SWALE
N.T.S.

TABLE D-5: GUIDELINE FOR BIORETENTION SOIL MIX MINERAL AGGREGATE GRADATION

SIEVE SIZE	PERCENT PASSING
¾"	100
#4	95-100
#10	75-90
#40	25-40
#100	4-10
#200	2-5

BIORETENTION SOIL MIXES MUST CONTAIN 35% - 40% COMPOST BY VOLUME

NOTES:

DO NOT EXCAVATE THE BIORETENTION FACILITY DURING WET OR SATURATED CONDITIONS.

EXCAVATION SHOULD BE PERFORMED BY MACHINERY OPERATING ADJACENT TO THE BIORETENTION FACILITY AND NO HEAVY EQUIPMENT WITH NARROW TRACKS, NARROW TIRES, OR LARGE LUGGED, HIGH PRESSURE TIRES SHOULD BE ALLOWED ON THE BOTTOM OF THE BIORETENTION FACILITY.

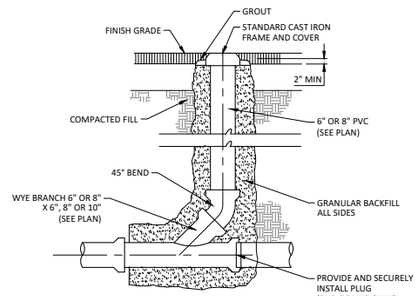
PRIOR TO PLACEMENT OF THE BSM, THE FINISHED SUBGRADE SHALL:
- BE SCARIFIED TO A MINIMUM DEPTH OF 3 INCHES.
- HAVE ANY SEDIMENT DEPOSITED FROM CONSTRUCTION RUNOFF REMOVED. TO REMOVE ALL INTRODUCED SEDIMENT, SUBGRADE SOIL SHOULD BE REMOVED TO A DEPTH OF 3-6 INCHES AND REPLACED WITH BSM.
- BE INSPECTED BY THE RESPONSIBLE ENGINEER TO VERIFY REQUIRED SUBGRADE CONDITIONS.
- EXPOSED SIDEWALLS OF THE COMPLETED BIORETENTION AREA WITH BSM IN PLACE SHOULD BE NO STEEPER THAN 3H:1V. THE BOTTOM OF THE FACILITY SHOULD BE FLAT.

THE SOIL MIXTURE SHALL BE PLACED IN HORIZONTAL LAYERS NOT TO EXCEED 6 INCHES PER LIFT FOR THE ENTIRE AREA OF THE BIORETENTIUON FACILITY.

COMPACT THE BIORETENTION SOIL MIX TO A RELATIVE COMPACTION OF 85 PERCENT OF MODIFIED MAXIMUM DRY DENSITY (ASTM D 1557). COMPACTION CAN BE ACHIEVED BY BOOT PACKING (SIMPLY WALKING OVER ALL AREAS OF EACH LIFT), AND THEN APPLY 0.2 INCHES (0.5 CM) OF WATER PER 1 INCH (2.5 CM) OF BIORETENTION SOIL MIX DEPTH. WATER FOR SETTLING SHOULD BE APPLIED BY SRAYING OR SPRINKLING.

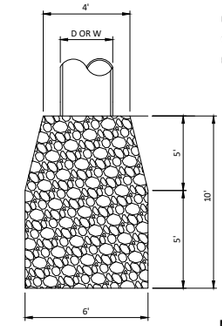
BIORETENTION FACILITIES SHOULD NOT BE USED AS SEDIMENT CONTROL FACILITIES AND ALL DRAINAGE SHOULD BE DIRECTED AWAY FROM BIORETENTION FACILITIES AFTER INITIAL ROUGH GRADING.

CONSTRUCTION ON BIORETENTION FACILITIES SHOULD NOT BEGIN UNTIL ALL CONTRIBUTING DRAINAGE AREAS ARE STABILIZED ACCORDING TO EROSION AND SEDIMENT CONTROL BMP'S AND TO THE SATISFACTION OF THE ENGINEER.

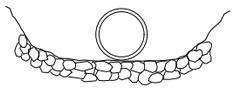


NOTE:
NOTE: CAST IRON FRAME AND COVER SHALL BE VALLEY IRON & STEEL CO. NO.'S 202 (6") OR 203 (8") OR APPROVED EQUAL.

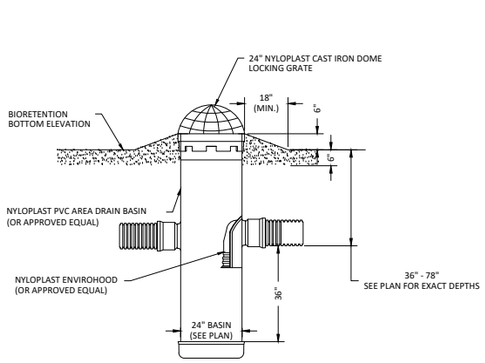
STANDARD CLEANOUT
NTS



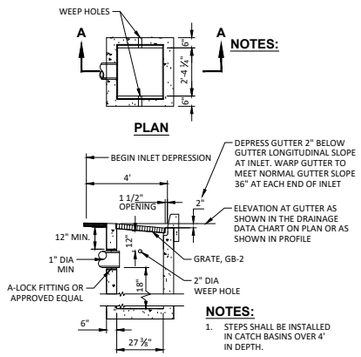
NOTES:
1. SEE PLAN FOR CLASS OF RIP RAP REQUIRED AT OUTLET.
2. MINIMUM DEPTH OF RIP RAP SHALL BE 1 1/2 TIMES AVERAGE STONE SIZE.
3. ROCKS SHALL BE PLACED TO PROVIDE A MINIMUM OF VOIDS.
4. SURFACE ROCKS SHALL PROTRUDE AT LEAST 1/2 THEIR VERTICAL DIMENSION.
5. RIP RAP SHALL BE PLACED OVER A GEOTEXTILE FABRIC ON A NATURAL BEDDING, OR IT MAY GROUTED OR PLACED OVER A GRAVEL BEDDING AS REQUIRED BY THE ENGINEER.



RIPRAP AT STORM PIPE OUTLET
NTS

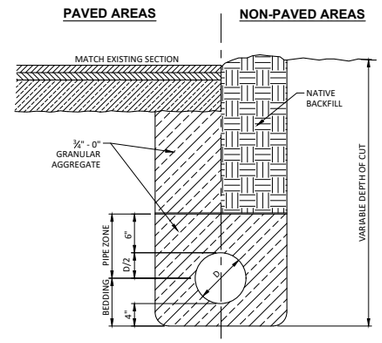


BEEHIVE OVERFLOW INLET DETAIL
NTS

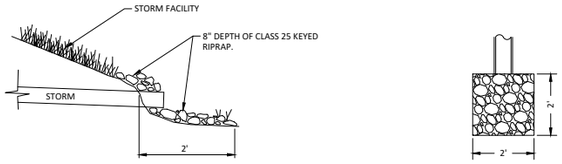


NOTES:
1. STEPS SHALL BE INSTALLED IN CATCH BASINS OVER 4' IN DEPTH.

CONCRETE CATCH BASIN GB-2
NTS



PIPE BEDDING AND BACKFILL TYPICAL SECTION
NTS



PROFILE **PLAN**

BIOFILTRATION SWALE INLET PIPE OUTFALL
NTS

DETAILS
ROCK CREEK COVE HOSPITALITY
STEVENSON, WASHINGTON

Harper Houf Peterson Righellis Inc.
ENGINEERS PLANNERS LANDSCAPE ARCHITECTS SURVEYORS
205 SE Spokane Street, Suite 200, Portland, OR 97202
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www.hhpr.com

NOT FOR CONSTRUCTION

DESIGNED:	HHPR
DRAWN:	HHPR
CHECKED:	HHPR
DATE:	05/18/2023

REVISIONS

NO.	DESCRIPTION	DATE

SHEET NO.
C6.01
JOB NO. FDM-01A

FDM DEVELOPMENT INC.

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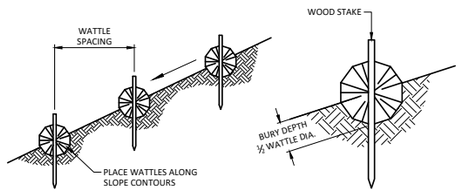
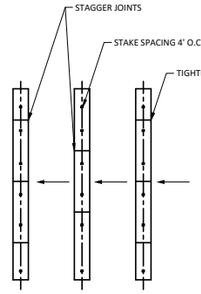


PROFILE **SECTION**



PLAN VIEW

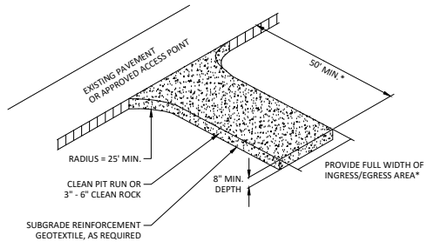
NOTES

1. WATTLES TO BE MADE FROM RICE STRAW, WOOD, COCONUT FIBER, OR EXCELSIOR PLACED WITHIN A PLASTIC NETTING.
2. WATTLES BURIED ½ WATTLE DIAMETER.
3. USE 1"x 2" STAKES EVERY 4' O.C.
4. WHEN SPACED ON CONTOUR, STAGGER JOINTS ON EACH UPHILL INSTALLATION.
5. WATTLE INSTALLATION SPACING PER TABLE BELOW.
6. ADDITIONAL STAKES MAY BE REQUIRED ON DOWNHILL SIDE OF WATTLES ON STEEP SLOPES OR HIGHLY EROSIVE SOILS.

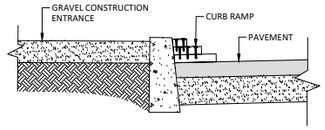
WATTLE INSTALLATION SPACING TABLE

% SLOPE	SPACING SLOPE	(MAX)
<10%	<10:1	300'
10%>X<15%	10:1>X<7.5:1	150'
15%>X<20%	7.5:1>X<5:1	100'
20%>X<30%	5:1>X<3.5:1	50'
30%>X<50%	3.5:1>X<2:1	25'

EROSION AND SEDIMENT CONTROL WATTLE DETAIL
NTS



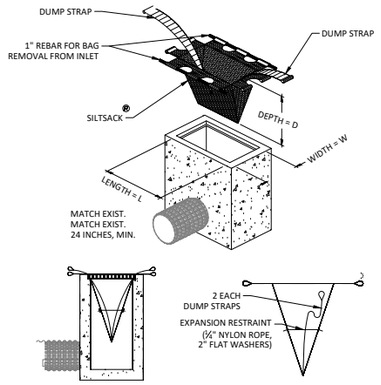
*20' MIN. FOR SINGLE FAMILY AND DUPLEX RESIDENTIAL



NOTES:

1. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION THAT WILL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHT-OF-WAYS. THIS MAY REQUIRE TOP DRESSING, REPAIR AND/OR CLEAN OUT OF ANY MEASURES USED TO TRAP SEDIMENT.
2. WHEN NECESSARY, WHEELS SHALL BE CLEANED PRIOR TO ENTRANCE ONTO PUBLIC RIGHT-OF-WAY.
3. WHEN WASHING IS REQUIRED, IT SHALL BE DONE ON AN AREA STABILIZED WITH CRUSHED STONE THAT DRAINS INTO AN APPROVED SEDIMENT TRAP OR SEDIMENT BASIN.
4. WHERE RUNOFF CONTAINING SEDIMENT LADEN WATER IS LEAVING THE SITE VIA THE CONSTRUCTION ENTRANCE, OTHER MEASURES SHALL BE IMPLEMENTED TO DIVERT RUNOFF THROUGH AN APPROVED FILTERING SYSTEM.
5. DIMENSIONS
   SINGLE FAMILY
   20' LONG BY 20' WIDE 8" DEEP OF ¾" MINUS CLEAN ROCK.
   COMMERCIAL
   50' LONG BY 20' WIDE 3-6" CLEAN ROCK, GOVERNING AUTHORITY MAY REQUIRE GEOTEXTILE FABRIC TO PREVENT SUB-SOIL PUMPING.

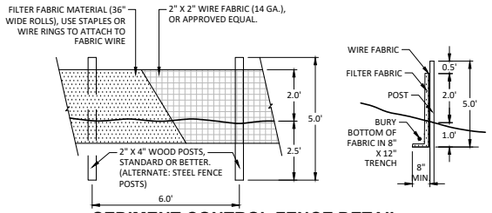
CONSTRUCTION ENTRANCE DETAIL
NTS



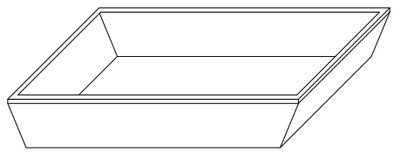
INSTALLATION DETAIL **BAG DETAIL**

NOTE:
INSTALL SILTSACK AND ACCESSORIES AS SUPPLIED BY ACF WEST, INC., PH. 771-5115, OR APPROVED EQUAL.

"SILT SACK" INLET PROTECTION
NTS



SEDIMENT CONTROL FENCE DETAIL
NTS



NOTES:

1. COLLECT AND RETAIN ALL THE CONCRETE WASHOUT WATER AND SOLIDS IN A LEAK PROOF BASIN.
2. INSPECT FREQUENTLY. DO NOT OVERFILL BASIN.
3. RECYCLE MATERIALS.
   A. WASHWATER RECYCLING: WASHWATER SHOULD BE PASSED THROUGH A FILTER AND TREATMENT SYSTEM TO REMOVE SOLIDS REDUCE PH. WASHWATER MAY BE REUSED FOR CONCRETE WASHOUT WATER. DISPOSAL OF WASHWATER SHALL BE AT AN APPROVED DISPOSAL FACILITY. DO NOT DRAIN TO STORM OR SANITARY SYSTEM.
   B. SOLIDS RECYCLING: COURSE AGGREGATE MATERIALS THAT ARE SEPARATED FROM WASHWATER MAY BE RETURN TO READY MIX PLANT. COORDINATE WITH READY MIX PLANT PRIOR TO CONSTRUCTION.
   C. HARDENED CONCRETE RECYCLING: ALLOW CONCRETE WASHOUT TO HARDEN IN BASIN. THE HARDEN CONCRETE MAY BE DELIVERED TO RECYCLING PLANTS.

CONCRETE TRUCK WASHOUT BASIN
NTS

DETAILS
ROCK CREEK COVE HOSPITALITY
STEVENSON, WASHINGTON

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ENGINEERS PLANNERS LANDSCAPE ARCHITECTS SURVEYORS
205 SE Spokane Street, Suite 200, Portland, OR 97202
phone: 503.221.1131 www.hhpr.com fax: 503.221.1171

NOT FOR CONSTRUCTION

DESIGNED:	DRAWN:	CHECKED:	DATE:
HHPR	HHPR	HHPR	05/18/2023

NO.	DATE	DESCRIPTION

REVISIONS

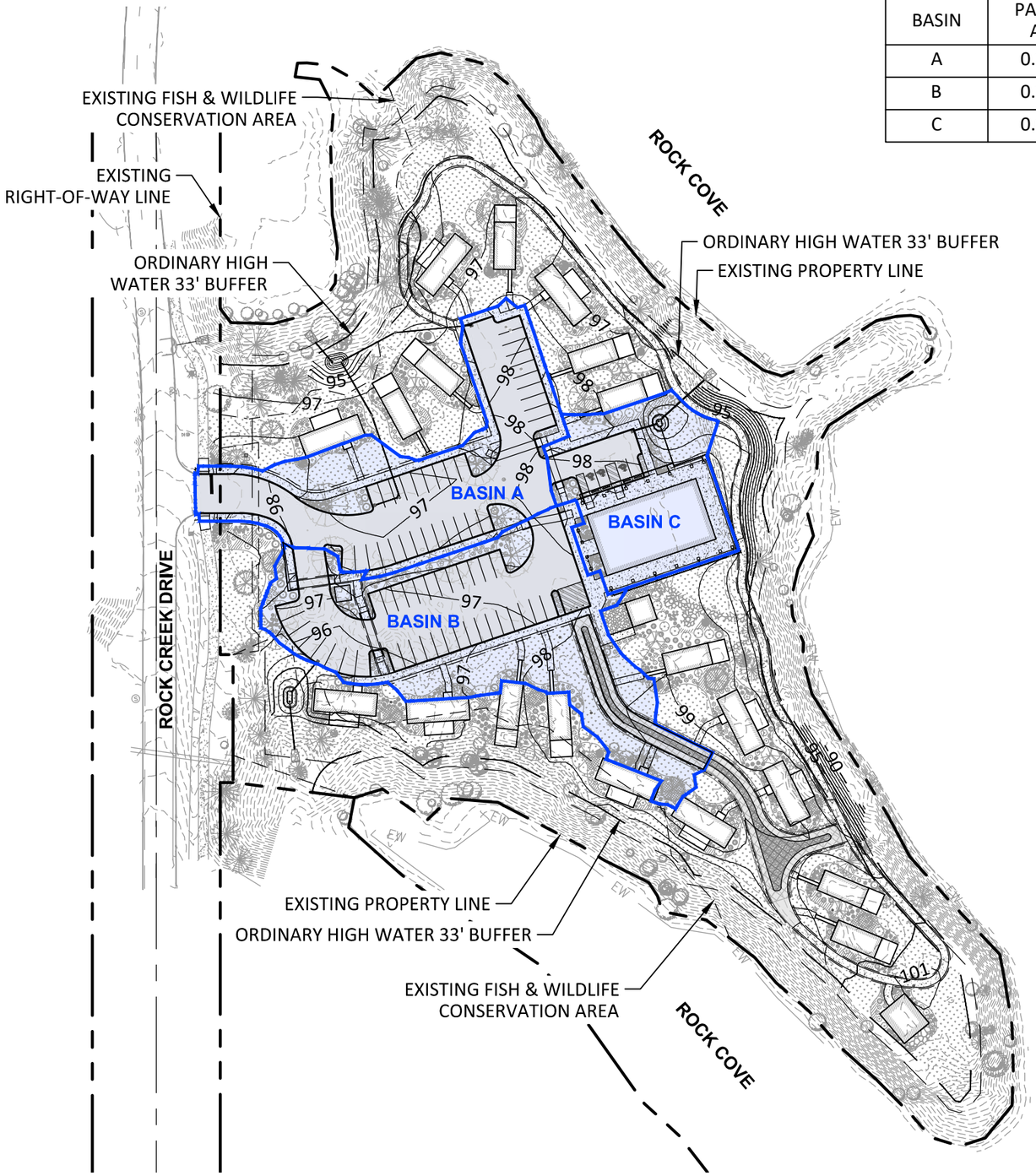
SHEET NO.
C6.02

JOB NO. FDM-01A

FDM DEVELOPMENT INC.

APPENDIX 3 – Stormwater Calculations and Design Information

BASIN AREA TABLE					
BASIN	PARKING AREA	PEDESTRIAN AREA	ROOF AREA	PERVIOUS AREA	TOTAL
A	0.39 AC	0.10 AC	--	0.11 AC	0.60 AC
B	0.33 AC	0.13 AC	--	0.32 AC	0.78 AC
C	0.06 AC	0.02 AC	0.20 AC	0.08 AC	0.36 AC



STORMWATER BASIN MAP

ROCK CREEK COVE HOSPITALITY

STEVENSON, WASHINGTON

Harper Houf Peterson Righellis Inc.
HHPR
ENGINEERS ♦ PLANNERS
LANDSCAPE ARCHITECTS ♦ SURVEYORS
205 SE Spokane Street, Suite 200, Portland, OR 97202
phone: 503.221.1131 www.hhpr.com fax: 503.221.1171

DESIGNED:	HHPR	DATE:	05/18/2023
DRAWN:	HHPR		
CHECKED:	HHPR		

REVISIONS			
NO.	DESCRIPTION		DATE

SHEET NO.

1

JOB NO.

FDM-01A

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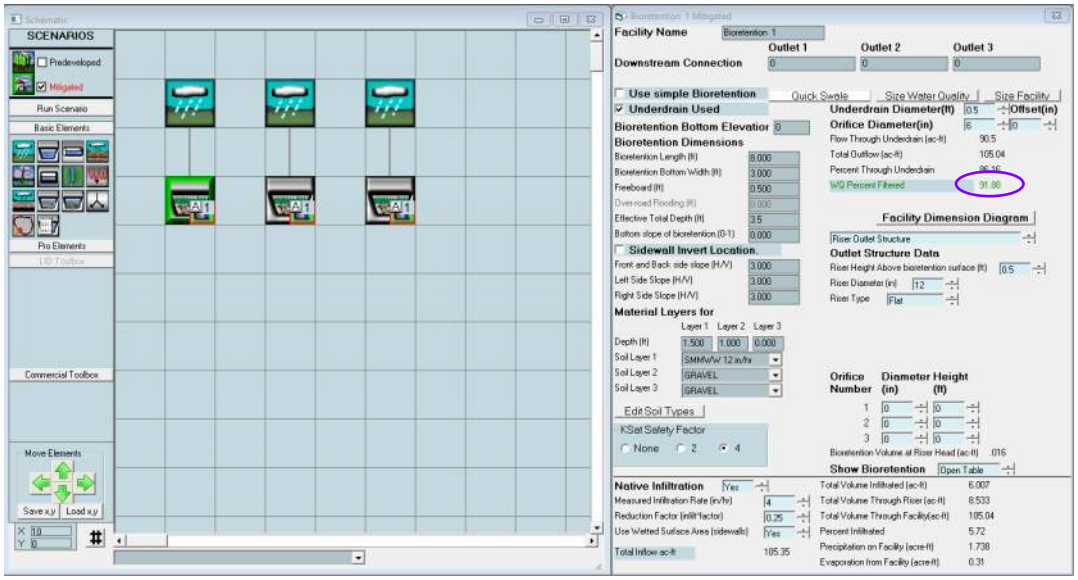
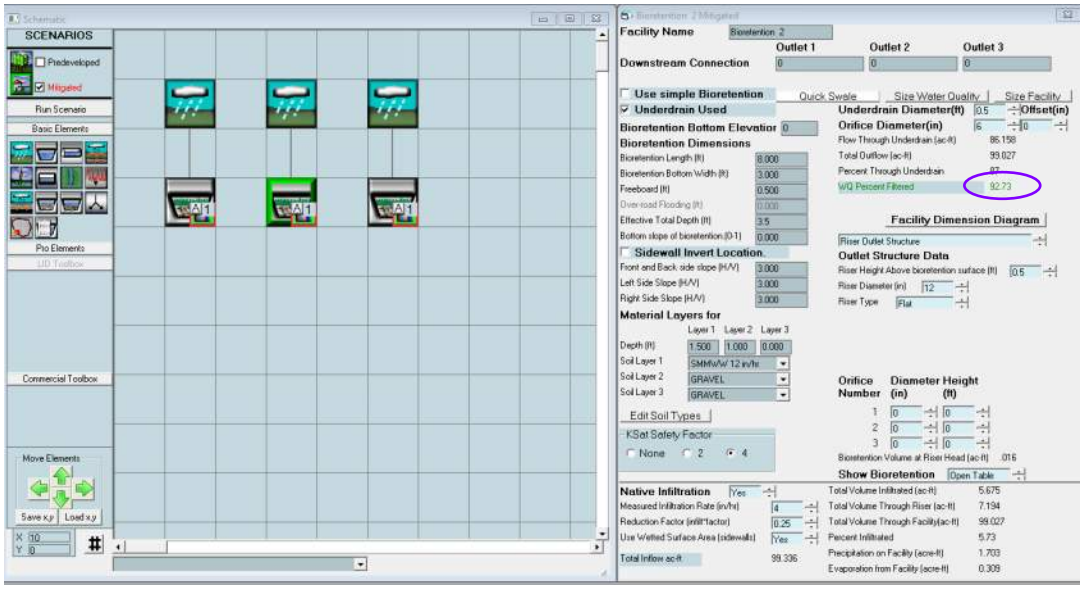
WWHM2012

PROJECT REPORT


SCENARIOS
Predeveloped
Mitigated
Run Scenario
Basic Elements
Pro Elements
Commercial Toolbox
Move Elements
Save x,y
Load x,y
Facility Name
Bioretention 1
Outlet 1
Outlet 2
Outlet 3
Downstream Connection
Use simple Bioretention
Quick Swale
Size Water Quality
Size Facility
Underdrain Used
Underdrain Diameter(ft)
Offset(in)
Bioretention Bottom Elevation
Orifice Diameter(in)
Bioretention Dimensions
Flow Through Underdrain (ac-ft)
Total Outflow (ac-ft)
Percent Through Underdrain
WQ Percent Filtered
Facility Dimension Diagram
Sidewall Invert Location
Outlet Structure Data
Riser Height Above bioretention surface (ft)
Riser Diameter (in)
Riser Type
Material Layers for
Layer 1
Layer 2
Layer 3
Depth (ft)
Soil Layer 1
Soil Layer 2
Soil Layer 3
Edit Soil Types
KSat Safety Factor
None
2
4
Orifice Number
Diameter (in)
Height (ft)
Bioretention Volume at Riser Head (ac-ft)
Show Bioretention
Native Infiltration
Measured Infiltration Rate (in/hr)
Reduction Factor (infiltFactor)
Use Wetted Surface Area (sidewalls)
Total Inflow ac-ft
Total Volume Infiltrated (ac-ft)
Total Volume Through Riser (ac-ft)
Total Volume Through Facility(ac-ft)
Percent Infiltrated
Precipitation on Facility (acre-ft)
Evaporation from Facility (acre-ft)


SCENARIOS
Predeveloped
Mitigated
Run Scenario
Basic Elements
Pro Elements
Commercial Toolbox
Move Elements
Save x,y
Load x,y
Facility Name
Bioretention 2
Outlet 1
Outlet 2
Outlet 3
Downstream Connection
Use simple Bioretention
Quick Swale
Size Water Quality
Size Facility
Underdrain Used
Underdrain Diameter(ft)
Offset(in)
Bioretention Bottom Elevation
Orifice Diameter(in)
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Percent Infiltrated
Precipitation on Facility (acre-ft)
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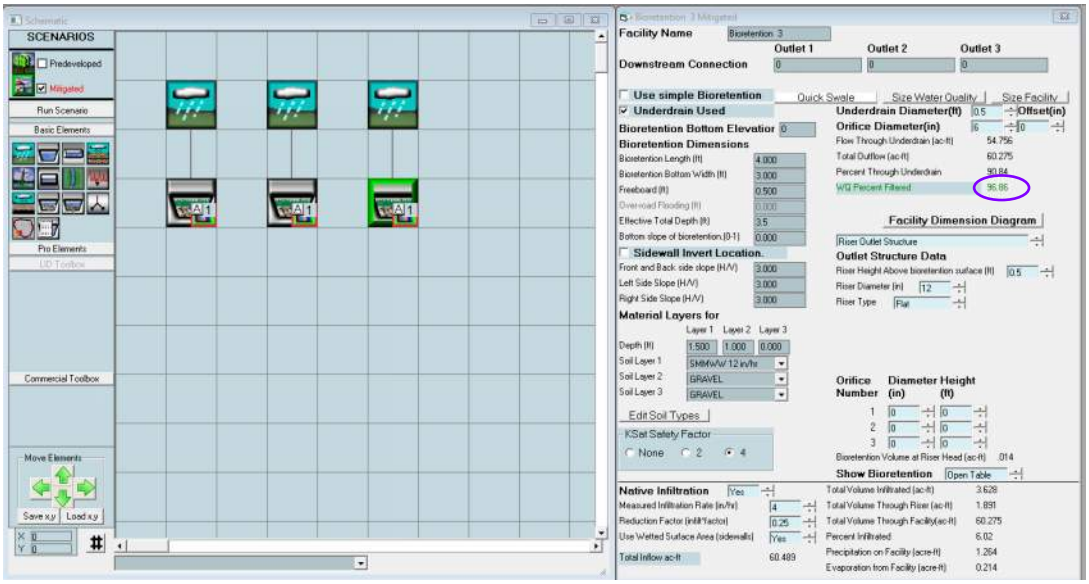
SCENARIOS
Predeveloped
Mitigated
Run Scenario
Basic Elements
Pro Elements
Commercial Toolbox
Move Elements
Save x,y
Load x,y
Facility Name
Bioretention 3
Outlet 1
Outlet 2
Outlet 3
Downstream Connection
Use simple Bioretention
Quick Swale
Size Water Quality
Size Facility
Underdrain Used
Underdrain Diameter(ft)
Offset(in)
Bioretention Bottom Elevation
Orifice Diameter(in)
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Layer 3
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Soil Layer 1
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4
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Reduction Factor (infiltFactor)
Use Wetted Surface Area (sidewalls)
Total Inflow ac-ft
Total Volume Infiltrated (ac-ft)
Total Volume Through Riser (ac-ft)
Total Volume Through Facility(ac-ft)
Percent Infiltrated
Precipitation on Facility (acre-ft)
Evaporation from Facility (acre-ft)

General Model Information

Project Name:	FDM-01 Rock Creek WWHM
Site Name:	Rock Ck Cove
Site Address:	
City:	Steveson
Report Date:	5/18/2023
Gage:	Portland
Data Start:	1948/10/01
Data End:	2009/09/30
Timestep:	15 Minute
Precip Scale:	0.000 (adjusted)
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

Landuse Basin Data
Predeveloped Land Use

Mitigated Land Use

Basin A

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Lawn, Flat	0.11
Pervious Total	0.11

Impervious Land Use	acre
SIDEWALKS FLAT	0.1
PARKING FLAT	0.39
Impervious Total	0.49
Basin Total	0.6

Element Flows To:

Surface	Interflow	Groundwater
Surface retention 1	Surface retention 1	

Basin B

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Lawn, Flat	0.32
Pervious Total	0.32

Impervious Land Use	acre
SIDEWALKS FLAT	0.13
PARKING FLAT	0.33
Impervious Total	0.46
Basin Total	0.78

Element Flows To:

Surface	Interflow	Groundwater
Surface retention 2	Surface retention 2	

Basin 3

Bypass:	No
GroundWater:	No

Pervious Land Use	acre
A B, Lawn, Flat	0.08
Pervious Total	0.08

Impervious Land Use	acre
ROOF TOPS FLAT	0.2
SIDEWALKS FLAT	0.02
PARKING FLAT	0.06
Impervious Total	0.28
Basin Total	0.36

Element Flows To:

Surface	Interflow	Groundwater
Surface retention 3	Surface retention 3	

Routing Elements
Predeveloped Routing

Mitigated Routing

Bioretention 1

Bottom Length:	8.00 ft.
Bottom Width:	3.00 ft.
Material thickness of first layer:	1.5
Material type for first layer:	SMMWW 12 in/hr
Material thickness of second layer:	1
Material type for second layer:	GRAVEL
Material thickness of third layer:	0
Material type for third layer:	GRAVEL
Infiltration On	
Infiltration rate:	4
Infiltration safety factor:	0.25
Wetted surface area On	
Total Volume Infiltrated (ac-ft.):	6.007
Total Volume Through Riser (ac-ft.):	8.533
Total Volume Through Facility (ac-ft.):	105.04
Percent Infiltrated:	5.72
Total Precip Applied to Facility:	1.738
Total Evap From Facility:	0.31
Underdrain used	
Underdrain Diameter (feet):	0.5
Orifice Diameter (in.):	6
Offset (in.):	0
Flow Through Underdrain (ac-ft.):	90.5
Total Outflow (ac-ft.):	105.04
Percent Through Underdrain:	86.16
Discharge Structure	
Riser Height:	0.5 ft.
Riser Diameter:	12 in.
Element Flows To:	
Outlet 1	Outlet 2

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0095	0.0000	0.0000	0.0000
0.0385	0.0095	0.0000	0.0000	0.0000
0.0769	0.0093	0.0000	0.0000	0.0000
0.1154	0.0091	0.0000	0.0000	0.0000
0.1538	0.0089	0.0000	0.0000	0.0000
0.1923	0.0087	0.0001	0.0000	0.0000
0.2308	0.0084	0.0001	0.0000	0.0000
0.2692	0.0082	0.0001	0.0000	0.0000
0.3077	0.0080	0.0001	0.0000	0.0000
0.3462	0.0078	0.0001	0.0001	0.0000
0.3846	0.0076	0.0002	0.0001	0.0000
0.4231	0.0075	0.0002	0.0001	0.0000
0.4615	0.0073	0.0002	0.0002	0.0000
0.5000	0.0071	0.0002	0.0002	0.0000
0.5385	0.0069	0.0003	0.0003	0.0000
0.5769	0.0067	0.0003	0.0004	0.0000
0.6154	0.0065	0.0003	0.0005	0.0000
0.6538	0.0063	0.0003	0.0006	0.0000
0.6923	0.0062	0.0004	0.0006	0.0000

0.7308	0.0060	0.0004	0.0007	0.0000
0.7692	0.0058	0.0005	0.0009	0.0000
0.8077	0.0056	0.0005	0.0011	0.0000
0.8462	0.0055	0.0005	0.0013	0.0000
0.8846	0.0053	0.0006	0.0015	0.0000
0.9231	0.0052	0.0006	0.0018	0.0000
0.9615	0.0050	0.0007	0.0021	0.0000
1.0000	0.0048	0.0007	0.0022	0.0000
1.0385	0.0047	0.0008	0.0025	0.0000
1.0769	0.0045	0.0008	0.0029	0.0000
1.1154	0.0044	0.0009	0.0033	0.0000
1.1538	0.0042	0.0009	0.0038	0.0000
1.1923	0.0041	0.0010	0.0043	0.0000
1.2308	0.0039	0.0011	0.0049	0.0001
1.2692	0.0038	0.0011	0.0055	0.0001
1.3077	0.0037	0.0012	0.0058	0.0001
1.3462	0.0035	0.0013	0.0065	0.0001
1.3846	0.0034	0.0013	0.0073	0.0001
1.4231	0.0033	0.0014	0.0081	0.0001
1.4615	0.0031	0.0015	0.0091	0.0001
1.5000	0.0030	0.0016	0.0101	0.0001
1.5385	0.0029	0.0017	0.0112	0.0001
1.5769	0.0028	0.0017	0.0120	0.0001
1.6154	0.0027	0.0018	0.0128	0.0002
1.6538	0.0025	0.0019	0.0141	0.0002
1.6923	0.0024	0.0020	0.0155	0.0002
1.7308	0.0023	0.0021	0.0225	0.0003
1.7692	0.0022	0.0022	0.0232	0.0003
1.8077	0.0021	0.0023	0.0238	0.0003
1.8462	0.0020	0.0024	0.0245	0.0004
1.8846	0.0019	0.0025	0.0252	0.0004
1.9231	0.0018	0.0026	0.0259	0.0004
1.9615	0.0017	0.0027	0.0266	0.0004
2.0000	0.0016	0.0028	0.0273	0.0004
2.0385	0.0015	0.0029	0.0281	0.0005
2.0769	0.0014	0.0030	0.0288	0.0005
2.1154	0.0013	0.0031	0.0295	0.0005
2.1538	0.0013	0.0032	0.0303	0.0005
2.1923	0.0012	0.0034	0.0311	0.0006
2.2308	0.0011	0.0035	0.0318	0.0006
2.2692	0.0010	0.0036	0.0326	0.0006
2.3077	0.0009	0.0037	0.0334	0.0007
2.3462	0.0009	0.0039	0.0342	0.0007
2.3846	0.0008	0.0040	0.0350	0.0007
2.4231	0.0007	0.0042	0.0358	0.0008
2.4615	0.0007	0.0043	0.0367	0.0008
2.5000	0.0006	0.0045	0.0375	0.0008
2.5000	0.0006	0.0045	0.0375	0.0008

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infilt(cfs)
2.5000	0.009504	0.004462	0.0000	0.0294	0.0002
2.5385	0.009723	0.004832	0.0000	0.0294	0.0004
2.5769	0.009943	0.005210	0.0000	0.0316	0.0007
2.6154	0.010167	0.005597	0.0000	0.0331	0.0009
2.6538	0.010393	0.005992	0.0000	0.0347	0.0011
2.6923	0.010621	0.006396	0.0000	0.0362	0.0014
2.7308	0.010851	0.006809	0.0000	0.0379	0.0016

2.7692	0.011084	0.007231	0.0000	0.0395	0.0018
2.8077	0.011320	0.007662	0.0000	0.0413	0.0021
2.8462	0.011558	0.008102	0.0000	0.0430	0.0023
2.8846	0.011798	0.008551	0.0000	0.0448	0.0026
2.9231	0.012041	0.009009	0.0000	0.0467	0.0028
2.9615	0.012287	0.009477	0.0000	0.0486	0.0031
3.0000	0.012534	0.009955	0.0000	0.0506	0.0033
3.0385	0.012785	0.010441	0.0800	0.0526	0.0036
3.0769	0.013037	0.010938	0.2257	0.0546	0.0038
3.1154	0.013292	0.011444	0.4122	0.0567	0.0041
3.1538	0.013550	0.011961	0.6273	0.0589	0.0043
3.1923	0.013810	0.012487	0.8600	0.0611	0.0046
3.2308	0.014072	0.013023	1.0991	0.0633	0.0049
3.2692	0.014337	0.013569	1.3333	0.0656	0.0051
3.3077	0.014605	0.014126	1.5516	0.0680	0.0054
3.3462	0.014874	0.014693	1.7445	0.0704	0.0057
3.3846	0.015147	0.015270	1.9054	0.0728	0.0060
3.4231	0.015421	0.015858	2.0318	0.0754	0.0062
3.4615	0.015698	0.016456	2.1274	0.0779	0.0065
3.5000	0.015978	0.017066	2.2033	0.0806	0.0065

Surface retention 1

Element Flows To:

Outlet 1	Outlet 2
	Bioretention 1

Bioretention 2

Bottom Length:	8.00 ft.
Bottom Width:	3.00 ft.
Material thickness of first layer:	1.5
Material type for first layer:	SMMWW 12 in/hr
Material thickness of second layer:	1
Material type for second layer:	GRAVEL
Material thickness of third layer:	0
Material type for third layer:	GRAVEL
Infiltration On	
Infiltration rate:	4
Infiltration safety factor:	0.25
Wetted surface area On	
Total Volume Infiltrated (ac-ft.):	5.675
Total Volume Through Riser (ac-ft.):	7.194
Total Volume Through Facility (ac-ft.):	99.027
Percent Infiltrated:	5.73
Total Precip Applied to Facility:	1.703
Total Evap From Facility:	0.309
Underdrain used	
Underdrain Diameter (feet):	0.5
Orifice Diameter (in.):	6
Offset (in.):	0
Flow Through Underdrain (ac-ft.):	86.158
Total Outflow (ac-ft.):	99.027
Percent Through Underdrain:	87
Discharge Structure	
Riser Height:	0.5 ft.
Riser Diameter:	12 in.
Element Flows To:	
Outlet 1	Outlet 2

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0095	0.0000	0.0000	0.0000
0.0385	0.0095	0.0000	0.0000	0.0000
0.0769	0.0093	0.0000	0.0000	0.0000
0.1154	0.0091	0.0000	0.0000	0.0000
0.1538	0.0089	0.0000	0.0000	0.0000
0.1923	0.0087	0.0001	0.0000	0.0000
0.2308	0.0084	0.0001	0.0000	0.0000
0.2692	0.0082	0.0001	0.0000	0.0000
0.3077	0.0080	0.0001	0.0000	0.0000
0.3462	0.0078	0.0001	0.0001	0.0000
0.3846	0.0076	0.0002	0.0001	0.0000
0.4231	0.0075	0.0002	0.0001	0.0000
0.4615	0.0073	0.0002	0.0002	0.0000
0.5000	0.0071	0.0002	0.0002	0.0000
0.5385	0.0069	0.0003	0.0003	0.0000
0.5769	0.0067	0.0003	0.0004	0.0000
0.6154	0.0065	0.0003	0.0005	0.0000
0.6538	0.0063	0.0003	0.0006	0.0000
0.6923	0.0062	0.0004	0.0006	0.0000
0.7308	0.0060	0.0004	0.0007	0.0000
0.7692	0.0058	0.0005	0.0009	0.0000

0.8077	0.0056	0.0005	0.0011	0.0000
0.8462	0.0055	0.0005	0.0013	0.0000
0.8846	0.0053	0.0006	0.0015	0.0000
0.9231	0.0052	0.0006	0.0018	0.0000
0.9615	0.0050	0.0007	0.0021	0.0000
1.0000	0.0048	0.0007	0.0022	0.0000
1.0385	0.0047	0.0008	0.0025	0.0000
1.0769	0.0045	0.0008	0.0029	0.0000
1.1154	0.0044	0.0009	0.0033	0.0000
1.1538	0.0042	0.0009	0.0038	0.0000
1.1923	0.0041	0.0010	0.0043	0.0000
1.2308	0.0039	0.0011	0.0049	0.0001
1.2692	0.0038	0.0011	0.0055	0.0001
1.3077	0.0037	0.0012	0.0058	0.0001
1.3462	0.0035	0.0013	0.0065	0.0001
1.3846	0.0034	0.0013	0.0073	0.0001
1.4231	0.0033	0.0014	0.0081	0.0001
1.4615	0.0031	0.0015	0.0091	0.0001
1.5000	0.0030	0.0016	0.0101	0.0001
1.5385	0.0029	0.0017	0.0112	0.0001
1.5769	0.0028	0.0017	0.0120	0.0001
1.6154	0.0027	0.0018	0.0128	0.0002
1.6538	0.0025	0.0019	0.0141	0.0002
1.6923	0.0024	0.0020	0.0155	0.0002
1.7308	0.0023	0.0021	0.0225	0.0003
1.7692	0.0022	0.0022	0.0232	0.0003
1.8077	0.0021	0.0023	0.0238	0.0003
1.8462	0.0020	0.0024	0.0245	0.0004
1.8846	0.0019	0.0025	0.0252	0.0004
1.9231	0.0018	0.0026	0.0259	0.0004
1.9615	0.0017	0.0027	0.0266	0.0004
2.0000	0.0016	0.0028	0.0273	0.0004
2.0385	0.0015	0.0029	0.0281	0.0005
2.0769	0.0014	0.0030	0.0288	0.0005
2.1154	0.0013	0.0031	0.0295	0.0005
2.1538	0.0013	0.0032	0.0303	0.0005
2.1923	0.0012	0.0034	0.0311	0.0006
2.2308	0.0011	0.0035	0.0318	0.0006
2.2692	0.0010	0.0036	0.0326	0.0006
2.3077	0.0009	0.0037	0.0334	0.0007
2.3462	0.0009	0.0039	0.0342	0.0007
2.3846	0.0008	0.0040	0.0350	0.0007
2.4231	0.0007	0.0042	0.0358	0.0008
2.4615	0.0007	0.0043	0.0367	0.0008
2.5000	0.0006	0.0045	0.0375	0.0008
2.5000	0.0006	0.0045	0.0375	0.0008

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infilt(cfs)
2.5000	0.009504	0.004462	0.0000	0.0294	0.0002
2.5385	0.009723	0.004832	0.0000	0.0294	0.0004
2.5769	0.009943	0.005210	0.0000	0.0316	0.0007
2.6154	0.010167	0.005597	0.0000	0.0331	0.0009
2.6538	0.010393	0.005992	0.0000	0.0347	0.0011
2.6923	0.010621	0.006396	0.0000	0.0362	0.0014
2.7308	0.010851	0.006809	0.0000	0.0379	0.0016
2.7692	0.011084	0.007231	0.0000	0.0395	0.0018
2.8077	0.011320	0.007662	0.0000	0.0413	0.0021

2.8462	0.011558	0.008102	0.0000	0.0430	0.0023
2.8846	0.011798	0.008551	0.0000	0.0448	0.0026
2.9231	0.012041	0.009009	0.0000	0.0467	0.0028
2.9615	0.012287	0.009477	0.0000	0.0486	0.0031
3.0000	0.012534	0.009955	0.0000	0.0506	0.0033
3.0385	0.012785	0.010441	0.0800	0.0526	0.0036
3.0769	0.013037	0.010938	0.2257	0.0546	0.0038
3.1154	0.013292	0.011444	0.4122	0.0567	0.0041
3.1538	0.013550	0.011961	0.6273	0.0589	0.0043
3.1923	0.013810	0.012487	0.8600	0.0611	0.0046
3.2308	0.014072	0.013023	1.0991	0.0633	0.0049
3.2692	0.014337	0.013569	1.3333	0.0656	0.0051
3.3077	0.014605	0.014126	1.5516	0.0680	0.0054
3.3462	0.014874	0.014693	1.7445	0.0704	0.0057
3.3846	0.015147	0.015270	1.9054	0.0728	0.0060
3.4231	0.015421	0.015858	2.0318	0.0754	0.0062
3.4615	0.015698	0.016456	2.1274	0.0779	0.0065
3.5000	0.015978	0.017066	2.2033	0.0806	0.0065

Surface retention 2

Element Flows To:

Outlet 1	Outlet 2
	Bioretention 2

Bioretention 3

Bottom Length:	4.00 ft.
Bottom Width:	3.00 ft.
Material thickness of first layer:	1.5
Material type for first layer:	SMMWW 12 in/hr
Material thickness of second layer:	1
Material type for second layer:	GRAVEL
Material thickness of third layer:	0
Material type for third layer:	GRAVEL
Infiltration On	
Infiltration rate:	4
Infiltration safety factor:	0.25
Wetted surface area On	
Total Volume Infiltrated (ac-ft.):	3.628
Total Volume Through Riser (ac-ft.):	1.891
Total Volume Through Facility (ac-ft.):	60.275
Percent Infiltrated:	6.02
Total Precip Applied to Facility:	1.264
Total Evap From Facility:	0.214
Underdrain used	
Underdrain Diameter (feet):	0.5
Orifice Diameter (in.):	6
Offset (in.):	0
Flow Through Underdrain (ac-ft.):	54.756
Total Outflow (ac-ft.):	60.275
Percent Through Underdrain:	90.84
Discharge Structure	
Riser Height:	0.5 ft.
Riser Diameter:	12 in.
Element Flows To:	
Outlet 1	Outlet 2

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	Infilt(cfs)
0.0000	0.0079	0.0000	0.0000	0.0000
0.0385	0.0079	0.0000	0.0000	0.0000
0.0769	0.0077	0.0000	0.0000	0.0000
0.1154	0.0075	0.0000	0.0000	0.0000
0.1538	0.0073	0.0000	0.0000	0.0000
0.1923	0.0071	0.0000	0.0000	0.0000
0.2308	0.0069	0.0000	0.0000	0.0000
0.2692	0.0067	0.0001	0.0000	0.0000
0.3077	0.0065	0.0001	0.0000	0.0000
0.3462	0.0064	0.0001	0.0000	0.0000
0.3846	0.0062	0.0001	0.0001	0.0000
0.4231	0.0060	0.0001	0.0001	0.0000
0.4615	0.0058	0.0001	0.0001	0.0000
0.5000	0.0057	0.0001	0.0001	0.0000
0.5385	0.0055	0.0002	0.0002	0.0000
0.5769	0.0053	0.0002	0.0002	0.0000
0.6154	0.0052	0.0002	0.0003	0.0000
0.6538	0.0050	0.0002	0.0004	0.0000
0.6923	0.0049	0.0002	0.0004	0.0000
0.7308	0.0047	0.0003	0.0005	0.0000
0.7692	0.0046	0.0003	0.0006	0.0000

0.8077	0.0044	0.0003	0.0007	0.0000
0.8462	0.0043	0.0003	0.0009	0.0000
0.8846	0.0041	0.0004	0.0011	0.0000
0.9231	0.0040	0.0004	0.0013	0.0000
0.9615	0.0039	0.0004	0.0015	0.0000
1.0000	0.0037	0.0005	0.0016	0.0000
1.0385	0.0036	0.0005	0.0018	0.0000
1.0769	0.0035	0.0005	0.0021	0.0000
1.1154	0.0033	0.0006	0.0024	0.0000
1.1538	0.0032	0.0006	0.0028	0.0000
1.1923	0.0031	0.0007	0.0032	0.0000
1.2308	0.0029	0.0007	0.0037	0.0000
1.2692	0.0028	0.0008	0.0041	0.0000
1.3077	0.0027	0.0008	0.0043	0.0000
1.3462	0.0026	0.0009	0.0049	0.0000
1.3846	0.0025	0.0009	0.0055	0.0000
1.4231	0.0024	0.0010	0.0062	0.0001
1.4615	0.0023	0.0010	0.0069	0.0001
1.5000	0.0022	0.0011	0.0077	0.0001
1.5385	0.0021	0.0012	0.0086	0.0001
1.5769	0.0020	0.0012	0.0093	0.0001
1.6154	0.0019	0.0013	0.0099	0.0001
1.6538	0.0018	0.0014	0.0110	0.0001
1.6923	0.0017	0.0014	0.0121	0.0001
1.7308	0.0016	0.0015	0.0176	0.0002
1.7692	0.0015	0.0016	0.0182	0.0002
1.8077	0.0014	0.0016	0.0188	0.0002
1.8462	0.0013	0.0017	0.0194	0.0002
1.8846	0.0013	0.0018	0.0200	0.0002
1.9231	0.0012	0.0019	0.0207	0.0003
1.9615	0.0011	0.0020	0.0213	0.0003
2.0000	0.0010	0.0020	0.0219	0.0003
2.0385	0.0010	0.0021	0.0226	0.0003
2.0769	0.0009	0.0022	0.0232	0.0003
2.1154	0.0008	0.0023	0.0239	0.0003
2.1538	0.0008	0.0024	0.0246	0.0004
2.1923	0.0007	0.0025	0.0253	0.0004
2.2308	0.0007	0.0026	0.0260	0.0004
2.2692	0.0006	0.0027	0.0267	0.0004
2.3077	0.0005	0.0028	0.0274	0.0004
2.3462	0.0005	0.0029	0.0281	0.0005
2.3846	0.0004	0.0031	0.0288	0.0005
2.4231	0.0004	0.0032	0.0296	0.0005
2.4615	0.0004	0.0033	0.0303	0.0005
2.5000	0.0003	0.0034	0.0311	0.0006
2.5000	0.0003	0.0034	0.0311	0.0006

Bioretention Hydraulic Table

Stage(feet)	Area(ac.)	Volume(ac-ft.)	Discharge(cfs)	To Amended(cfs)	Infilt(cfs)
2.5000	0.007851	0.003420	0.0000	0.0243	0.0002
2.5385	0.008048	0.003726	0.0000	0.0243	0.0004
2.5769	0.008248	0.004039	0.0000	0.0262	0.0006
2.6154	0.008450	0.004360	0.0000	0.0275	0.0008
2.6538	0.008655	0.004689	0.0000	0.0289	0.0010
2.6923	0.008862	0.005026	0.0000	0.0302	0.0012
2.7308	0.009071	0.005371	0.0000	0.0317	0.0014
2.7692	0.009283	0.005724	0.0000	0.0331	0.0017
2.8077	0.009498	0.006085	0.0000	0.0346	0.0019

2.8462	0.009714	0.006454	0.0000	0.0362	0.0021
2.8846	0.009934	0.006832	0.0000	0.0378	0.0023
2.9231	0.010155	0.007219	0.0000	0.0394	0.0025
2.9615	0.010379	0.007613	0.0000	0.0411	0.0028
3.0000	0.010606	0.008017	0.0000	0.0428	0.0030
3.0385	0.010835	0.008429	0.0800	0.0445	0.0032
3.0769	0.011067	0.008850	0.2257	0.0464	0.0035
3.1154	0.011300	0.009281	0.4122	0.0482	0.0037
3.1538	0.011537	0.009720	0.6273	0.0501	0.0040
3.1923	0.011776	0.010168	0.8600	0.0521	0.0042
3.2308	0.012017	0.010626	1.0991	0.0541	0.0044
3.2692	0.012261	0.011093	1.3333	0.0561	0.0047
3.3077	0.012507	0.011569	1.5516	0.0582	0.0049
3.3462	0.012755	0.012055	1.7445	0.0604	0.0052
3.3846	0.013006	0.012550	1.9054	0.0625	0.0055
3.4231	0.013260	0.013055	2.0318	0.0648	0.0057
3.4615	0.013516	0.013570	2.1274	0.0671	0.0060
3.5000	0.013774	0.014095	2.2033	0.0694	0.0060

Surface retention 3

Element Flows To:

Outlet 1	Outlet 2
	Bioretention 3

Analysis Results

POC 1

POC #1 was not reported because POC must exist in both scenarios and both scenarios must have been run.

Model Default Modifications

Total of 0 changes have been made.

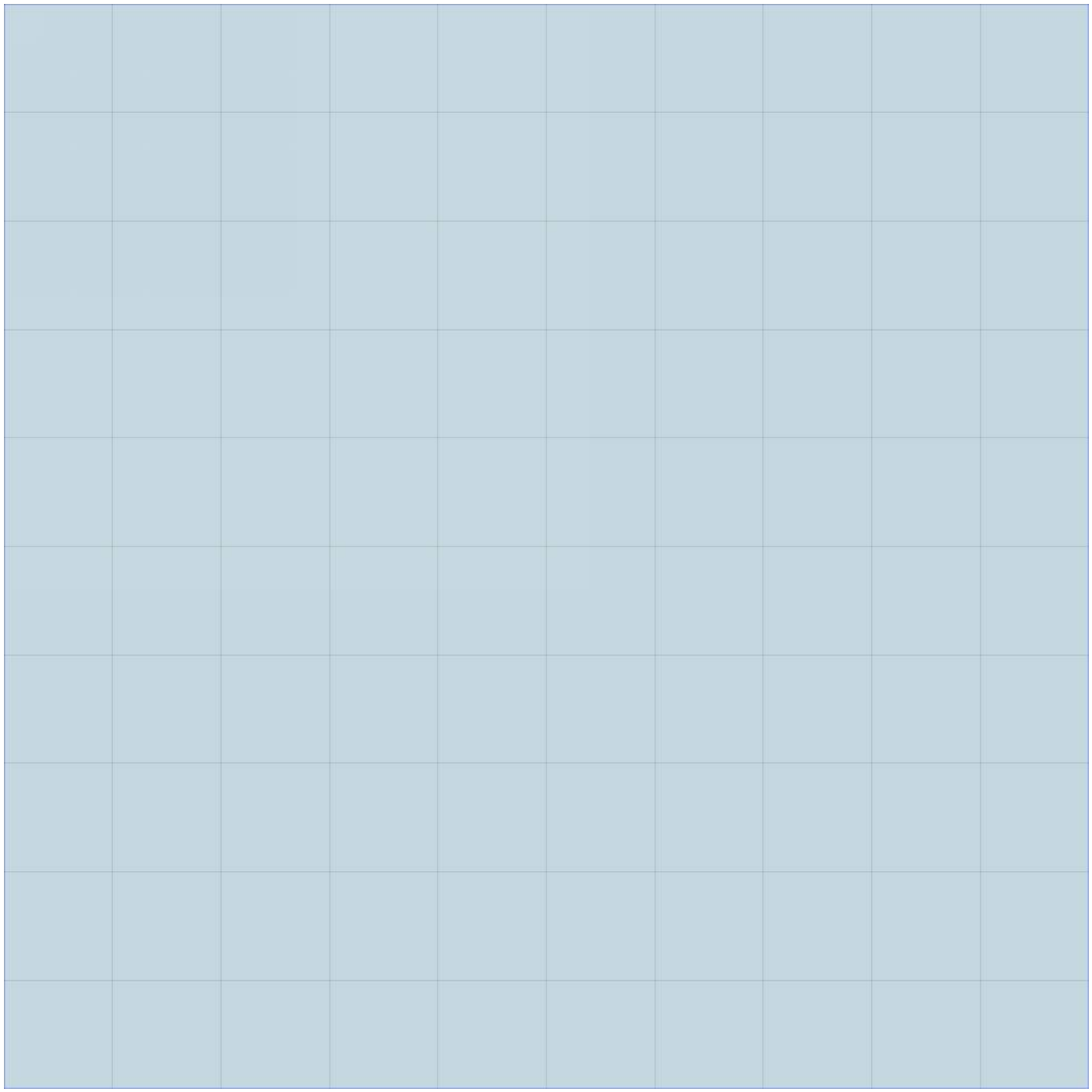
PERLND Changes

No PERLND changes have been made.

IMPLND Changes

No IMPLND changes have been made.

Appendix
Predeveloped Schematic



Mitigated Schematic

Predeveloped UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   FDM-01 Rock Creek WWHM.wdm
MESSU       25   PreFDM-01 Rock Creek WWHM.MES
            27   PreFDM-01 Rock Creek WWHM.L61
            28   PreFDM-01 Rock Creek WWHM.L62
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title---------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
  END OPCODE
  PARM
    #    #         K ***
  END PARM
END GENER
PERLND
  GEN-INFO
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                          User  t-series Engl Metr ***
                                          in  out           ***
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ***************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
  END PWAT-PARM2
```

```
  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
               ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS       IFWS       LZS       AGWS      GWVS
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                     User  t-series Engl Metr ***
                                      in  out           ***
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************* Active Sections ****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
  END ACTIVITY

  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                 <--Area-->     <-Target->   MBLK   ***
<Name>   #                 <-factor->     <Name>   #   Tbl#   ***

******Routing******
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
```

```
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<----------------><---> User T-series  Engl Metr LKFG             ***
                                      in  out                               ***
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ****************** PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                   ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
            FG FG FG FG  possible  exit  *** possible  exit      possible  exit
             *  *  *  *    *  *  *  *  *       *  *  *  *  *        ***
  END HYDR-PARM1

  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><--------><--------> ***
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                      ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
  END HYDR-INIT
END RCHRES

FTABLES
END FTABLES

EXT SOURCES
<-Volume-> <Member> SsysSgap<--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   # <Name> # tem strg<-factor->strg <Name>   #   #        <Name> # #  ***
WDM      2 PREC     ENGL    1.333          PERLND   1 999 EXTNL  PREC
WDM      2 PREC     ENGL    1.333          IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP

END EXT SOURCES

EXT TARGETS
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Volume-> <Member> Tsys Tgap Amd ***
<Name>   #        <Name> # #<-factor->strg <Name>   # <Name>    tem strg strg***
END EXT TARGETS

MASS-LINK
<Volume>   <-Grp> <-Member-><--Mult-->     <Target>       <-Grp> <-Member->***
<Name>            <Name> # #<-factor->     <Name>                <Name> # #***

END MASS-LINK

END RUN
```

Mitigated UCI File

```
RUN

GLOBAL
  WWHM4 model simulation
  START       1948 10 01        END    2009 09 30
  RUN INTERP OUTPUT LEVEL    3    0
  RESUME     0 RUN     1                    UNIT SYSTEM     1
END GLOBAL

FILES
<File>  <Un#>   <-----------File Name------------------------------>***
<-ID->                                                              ***
WDM         26   FDM-01 Rock Creek WWHM.wdm
MESSU       25   MitFDM-01 Rock Creek WWHM.MES
            27   MitFDM-01 Rock Creek WWHM.L61
            28   MitFDM-01 Rock Creek WWHM.L62
            30   POCFDM-01 Rock Creek WWHM1.dat
END FILES

OPN SEQUENCE
    INGRP              INDELT 00:15
      PERLND       7
      IMPLND       8
      IMPLND      11
      IMPLND       4
      GENER        2
      RCHRES       1
      RCHRES       2
      GENER        4
      RCHRES       3
      RCHRES       4
      GENER        6
      RCHRES       5
      RCHRES       6
      COPY         1
      COPY       501
      DISPLY       1
    END INGRP
END OPN SEQUENCE
DISPLY
  DISPLY-INFO1
    # -  #<----------Title----------->***TRAN PIVL DIG1 FIL1  PYR DIG2 FIL2 YRND
    1        Surface retention  1        MAX                    1    2   30    9
  END DISPLY-INFO1
END DISPLY
COPY
  TIMESERIES
    # -  #  NPT  NMN ***
    1         1    1
  501         1    1
  END TIMESERIES
END COPY
GENER
  OPCODE
    #    # OPCD ***
    2        24
    4        24
    6        24
  END OPCODE
  PARM
    #    #         K ***
    2             0.
    4             0.
    6             0.
  END PARM
END GENER
PERLND
  GEN-INFO
```

```
    <PLS ><-------Name------->NBLKS   Unit-systems   Printer ***
    # -  #                        User  t-series Engl Metr ***
                                       in  out           ***
    7     A/B, Lawn, Flat         1    1    1    1   27    0
  END GEN-INFO
  *** Section PWATER***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC ***
    7         0    0    1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags **************************** PIVL  PYR
    # -  # ATMP SNOW PWAT  SED  PST  PWG PQAL MSTL PEST NITR PHOS TRAC  *********
    7         0    0    4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  PWAT-PARM1
    <PLS >  PWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP UZFG  VCS  VUZ  VNN VIFW VIRC  VLE INFC  HWT ***
    7         0    0    0    0    0    0    0    0    0    0    0
  END PWAT-PARM1

  PWAT-PARM2
    <PLS >      PWATER input info: Part 2         ***
    # -  # ***FOREST      LZSN    INFILT      LSUR     SLSUR     KVARY     AGWRC
    7               0         5       0.8       400      0.05       0.3     0.996
  END PWAT-PARM2

  PWAT-PARM3
    <PLS >      PWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN    INFEXP    INFILD    DEEPFR    BASETP    AGWETP
    7               0         0         2         2         0         0         0
  END PWAT-PARM3
  PWAT-PARM4
    <PLS >     PWATER input info: Part 4                              ***
    # -  #     CEPSC      UZSN      NSUR     INTFW       IRC     LZETP ***
    7          0.1       0.5      0.25         0       0.7      0.25
  END PWAT-PARM4

  PWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
             ran from 1990 to end of 1992 (pat 1-11-95) RUN 21 ***
    # -  # ***  CEPS      SURS       UZS       IFWS       LZS       AGWS      GWVS
    7               0         0         0         0         3          1         0
  END PWAT-STATE1

END PERLND

IMPLND
  GEN-INFO
    <PLS ><-------Name------->   Unit-systems   Printer ***
    # -  #                      User  t-series Engl Metr ***
                                      in  out           ***
    8      SIDEWALKS/FLAT         1    1    1   27    0
   11      PARKING/FLAT           1    1    1   27    0
    4      ROOF TOPS/FLAT         1    1    1   27    0
  END GEN-INFO
  *** Section IWATER***

  ACTIVITY
    <PLS > ************ Active Sections ****************************
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL   ***
    8         0    0    1    0    0    0
   11         0    0    1    0    0    0
    4         0    0    1    0    0    0
  END ACTIVITY
```

```
  PRINT-INFO
    <ILS > ******** Print-flags ******** PIVL  PYR
    # -  # ATMP SNOW IWAT  SLD  IWG IQAL    *********
    8         0    0    4    0    0    0    1    9
   11         0    0    4    0    0    0    1    9
    4         0    0    4    0    0    0    1    9
  END PRINT-INFO

  IWAT-PARM1
    <PLS >  IWATER variable monthly parameter value flags  ***
    # -  # CSNO RTOP  VRS  VNN RTLI     ***
    8         0    0    0    0    0
   11         0    0    0    0    0
    4         0    0    0    0    0
  END IWAT-PARM1

  IWAT-PARM2
    <PLS >      IWATER input info: Part 2         ***
    # -  # ***  LSUR     SLSUR      NSUR     RETSC
    8            400      0.01       0.1       0.1
   11            400      0.01       0.1       0.1
    4            400      0.01       0.1       0.1
  END IWAT-PARM2

  IWAT-PARM3
    <PLS >      IWATER input info: Part 3         ***
    # -  # ***PETMAX    PETMIN
    8              0         0
   11              0         0
    4              0         0
  END IWAT-PARM3

  IWAT-STATE1
    <PLS > *** Initial conditions at start of simulation
    # -  # ***  RETS      SURS
    8              0         0
   11              0         0
    4              0         0
  END IWAT-STATE1

END IMPLND

SCHEMATIC
<-Source->                 <--Area-->     <-Target->   MBLK   ***
<Name>   #                 <-factor->     <Name>   #   Tbl#   ***
Basin  A***
PERLND   7                      0.11     RCHRES   1      2
PERLND   7                      0.11     RCHRES   1      3
IMPLND   8                       0.1     RCHRES   1      5
IMPLND  11                      0.39     RCHRES   1      5
Basin  B***
PERLND   7                      0.32     RCHRES   3      2
PERLND   7                      0.32     RCHRES   3      3
IMPLND   8                      0.13     RCHRES   3      5
IMPLND  11                      0.33     RCHRES   3      5
Basin  3***
PERLND   7                      0.08     RCHRES   5      2
PERLND   7                      0.08     RCHRES   5      3
IMPLND   4                       0.2     RCHRES   5      5
IMPLND   8                      0.02     RCHRES   5      5
IMPLND  11                      0.06     RCHRES   5      5

******Routing******
PERLND   7                      0.11     COPY     1     12
IMPLND   8                       0.1     COPY     1     15
IMPLND  11                      0.39     COPY     1     15
PERLND   7                      0.11     COPY     1     13
RCHRES   1                         1     RCHRES   2      8
RCHRES   3                         1     RCHRES   4      8
RCHRES   3                               COPY     1     18
```

```
RCHRES   5                              1     RCHRES   6      8
RCHRES   5                                    COPY     1     18
RCHRES   2                              1     COPY   501     17
RCHRES   1                              1     COPY   501     17
RCHRES   4                              1     COPY   501     17
RCHRES   6                              1     COPY   501     17
END SCHEMATIC

NETWORK
<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
COPY   501 OUTPUT MEAN   1 1   48.4        DISPLY   1     INPUT  TIMSER 1
GENER    2 OUTPUT TIMSER      .0011111     RCHRES   1     EXTNL  OUTDGT 1
GENER    4 OUTPUT TIMSER      .0011111     RCHRES   3     EXTNL  OUTDGT 1
GENER    6 OUTPUT TIMSER      .0011111     RCHRES   5     EXTNL  OUTDGT 1



<-Volume-> <-Grp> <-Member-><--Mult-->Tran <-Target vols> <-Grp> <-Member->  ***
<Name>   #        <Name> # #<-factor->strg <Name>   #   #        <Name> # #  ***
END NETWORK

RCHRES
  GEN-INFO
    RCHRES       Name        Nexits   Unit Systems   Printer                ***
    # -  #<------------------><---> User T-series  Engl Metr LKFG           ***
                                       in  out                              ***
    1     Surface retentio-007    3    1    1    1   28    0    1
    2     Bioretention  1         2    1    1    1   28    0    1
    3     Surface retentio-011    3    1    1    1   28    0    1
    4     Bioretention  2         2    1    1    1   28    0    1
    5     Surface retentio-015    3    1    1    1   28    0    1
    6     Bioretention  3         2    1    1    1   28    0    1
  END GEN-INFO
  *** Section RCHRES***

  ACTIVITY
    <PLS > ************ Active Sections ******************************
    # -  # HYFG ADFG CNFG HTFG SDFG GQFG OXFG NUFG PKFG PHFG ***
    1         1    0    0    0    0    0    0    0    0    0
    2         1    0    0    0    0    0    0    0    0    0
    3         1    0    0    0    0    0    0    0    0    0
    4         1    0    0    0    0    0    0    0    0    0
    5         1    0    0    0    0    0    0    0    0    0
    6         1    0    0    0    0    0    0    0    0    0
  END ACTIVITY

  PRINT-INFO
    <PLS > ***************** Print-flags ******************* PIVL  PYR
    # -  # HYDR ADCA CONS HEAT  SED  GQL OXRX NUTR PLNK PHCB PIVL  PYR  *********
    1         4    0    0    0    0    0    0    0    0    0    1    9
    2         4    0    0    0    0    0    0    0    0    0    1    9
    3         4    0    0    0    0    0    0    0    0    0    1    9
    4         4    0    0    0    0    0    0    0    0    0    1    9
    5         4    0    0    0    0    0    0    0    0    0    1    9
    6         4    0    0    0    0    0    0    0    0    0    1    9
  END PRINT-INFO

  HYDR-PARM1
    RCHRES  Flags for each HYDR Section                                   ***
    # -  #  VC A1 A2 A3  ODFVFG for each *** ODGTFG for each     FUNCT  for each
           FG FG FG FG  possible  exit  *** possible  exit      possible  exit
            *  *  *  *    *  *  *  *  *       *  *  *  *  *        ***
    1       0  1  0  0    4  5  6  0  0       0  1  0  0  0       2  1  2  2  2
    2       0  1  0  0    4  5  0  0  0       0  0  0  0  0       2  2  2  2  2
    3       0  1  0  0    4  5  6  0  0       0  1  0  0  0       2  1  2  2  2
    4       0  1  0  0    4  5  0  0  0       0  0  0  0  0       2  2  2  2  2
    5       0  1  0  0    4  5  6  0  0       0  1  0  0  0       2  1  2  2  2
    6       0  1  0  0    4  5  0  0  0       0  0  0  0  0       2  2  2  2  2
  END HYDR-PARM1
```

```
  HYDR-PARM2
    # -  #    FTABNO       LEN     DELTH     STCOR        KS      DB50       ***
  <------><--------><--------><--------><--------><--------><--------><-------->       ***
    1              1      0.01       0.0       0.0       0.0       0.0
    2              2      0.01       0.0       0.0       0.0       0.0
    3              3      0.01       0.0       0.0       0.0       0.0
    4              4      0.01       0.0       0.0       0.0       0.0
    5              5      0.01       0.0       0.0       0.0       0.0
    6              6      0.01       0.0       0.0       0.0       0.0
  END HYDR-PARM2
  HYDR-INIT
    RCHRES  Initial conditions for each HYDR section                          ***
    # -  # ***   VOL     Initial  value  of COLIND     Initial  value  of OUTDGT
          *** ac-ft     for each possible exit        for each possible exit
  <------><-------->     <---><---><---><---><---> *** <---><---><---><---><--->
    1            0         4.0  5.0  6.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    2            0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    3            0         4.0  5.0  6.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    4            0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    5            0         4.0  5.0  6.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
    6            0         4.0  5.0  0.0  0.0  0.0       0.0  0.0  0.0  0.0  0.0
  END HYDR-INIT
END RCHRES

SPEC-ACTIONS
*** User-Defined Variable Quantity Lines
***                          addr
***                         <------>
*** kwd  varnam optyp  opn  vari  s1 s2 s3 tp multiply  lc ls ac as agfn ***
  <****> <----> <----> <-> <----><-><-><-><-><--------> <><-> <><-> <--> ***
  UVQUAN vol2   RCHRES   2 VOL              4
  UVQUAN v2m2   GLOBAL     WORKSP  1        3
  UVQUAN vpo2   GLOBAL     WORKSP  2        3
  UVQUAN v2d2   GENER    2 K       1        3
*** User-Defined Variable Quantity Lines
***                          addr
***                         <------>
*** kwd  varnam optyp  opn  vari  s1 s2 s3 tp multiply  lc ls ac as agfn ***
  <****> <----> <----> <-> <----><-><-><-><-><--------> <><-> <><-> <--> ***
  UVQUAN vol4   RCHRES   4 VOL              4
  UVQUAN v2m4   GLOBAL     WORKSP  3        3
  UVQUAN vpo4   GLOBAL     WORKSP  4        3
  UVQUAN v2d4   GENER    4 K       1        3
*** User-Defined Variable Quantity Lines
***                          addr
***                         <------>
*** kwd  varnam optyp  opn  vari  s1 s2 s3 tp multiply  lc ls ac as agfn ***
  <****> <----> <----> <-> <----><-><-><-><-><--------> <><-> <><-> <--> ***
  UVQUAN vol6   RCHRES   6 VOL              4
  UVQUAN v2m6   GLOBAL     WORKSP  5        3
  UVQUAN vpo6   GLOBAL     WORKSP  6        3
  UVQUAN v2d6   GENER    6 K       1        3
*** User-Defined Target Variable Names
***                  addr or                        addr or
***                 <------>                       <------>
*** kwd   varnam ct  vari  s1 s2 s3  frac oper     vari  s1 s2 s3  frac oper
  <****>  <----><-> <----><-><-><-> <---> <-->    <----><-><-><-> <---> <-->
  UVNAME  v2m2    1 WORKSP  1         1.0 QUAN
  UVNAME  vpo2    1 WORKSP  2         1.0 QUAN
  UVNAME  v2d2    1 K       1         1.0 QUAN
*** User-Defined Target Variable Names
***                  addr or                        addr or
***                 <------>                       <------>
*** kwd   varnam ct  vari  s1 s2 s3  frac oper     vari  s1 s2 s3  frac oper
  <****>  <----><-> <----><-><-><-> <---> <-->    <----><-><-><-> <---> <-->
  UVNAME  v2m4    1 WORKSP  3         1.0 QUAN
  UVNAME  vpo4    1 WORKSP  4         1.0 QUAN
  UVNAME  v2d4    1 K       1         1.0 QUAN
*** User-Defined Target Variable Names
```

```
***                  addr or                      addr or
***                 <------>                     <------>
*** kwd   varnam ct  vari  s1 s2 s3  frac oper     vari  s1 s2 s3  frac oper
  <****>  <----><-> <----><-><-><-> <---> <-->    <----><-><-><-> <---> <-->
  UVNAME  v2m6    1 WORKSP  5         1.0 QUAN
  UVNAME  vpo6    1 WORKSP  6         1.0 QUAN
  UVNAME  v2d6    1 K       1         1.0 QUAN
*** opt foplop dcdts  yr mo dy hr mn d t   vnam  s1 s2 s3 ac quantity  tc  ts rp
  <****><-><--><><-><--> <> <> <> <><><>  <----><-><-><-><-><--------> <> <-><->
  GENER   2                               v2m2            =  228.87
*** Compute remaining available pore space
  GENER   2                               vpo2            =  v2m2
  GENER   2                               vpo2           -=  vol2
*** Check to see if VPORA goes negative; if so set VPORA = 0.0
IF (vpo2 < 0.0) THEN
  GENER   2                               vpo2            =  0.0
END IF
*** Infiltration volume
  GENER   2                               v2d2            =  vpo2
*** opt foplop dcdts  yr mo dy hr mn d t   vnam  s1 s2 s3 ac quantity  tc  ts rp
  <****><-><--><><-><--> <> <> <> <><><>  <----><-><-><-><-><--------> <> <-><->
  GENER   4                               v2m4            =  228.87
*** Compute remaining available pore space
  GENER   4                               vpo4            =  v2m4
  GENER   4                               vpo4           -=  vol4
*** Check to see if VPORA goes negative; if so set VPORA = 0.0
IF (vpo4 < 0.0) THEN
  GENER   4                               vpo4            =  0.0
END IF
*** Infiltration volume
  GENER   4                               v2d4            =  vpo4
*** opt foplop dcdts  yr mo dy hr mn d t   vnam  s1 s2 s3 ac quantity  tc  ts rp
  <****><-><--><><-><--> <> <> <> <><><>  <----><-><-><-><-><--------> <> <-><->
  GENER   6                               v2m6            =  177.47
*** Compute remaining available pore space
  GENER   6                               vpo6            =  v2m6
  GENER   6                               vpo6           -=  vol6
*** Check to see if VPORA goes negative; if so set VPORA = 0.0
IF (vpo6 < 0.0) THEN
  GENER   6                               vpo6            =  0.0
END IF
*** Infiltration volume
  GENER   6                               v2d6            =  vpo6
END SPEC-ACTIONS
FTABLES
  FTABLE      2
   67    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)     (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.009504  0.000000  0.000000  0.000000
  0.038462  0.009504  0.000010  0.000000  0.000000
  0.076923  0.009288  0.000021  0.000000  0.000000
  0.115385  0.009075  0.000034  0.000000  0.000000
  0.153846  0.008864  0.000047  0.000000  0.000000
  0.192308  0.008655  0.000062  0.000000  0.000000
  0.230769  0.008449  0.000078  0.000017  0.000000
  0.269231  0.008245  0.000095  0.000028  0.000000
  0.307692  0.008044  0.000114  0.000043  0.000000
  0.346154  0.007845  0.000134  0.000063  0.000000
  0.384615  0.007648  0.000155  0.000090  0.000001
  0.423077  0.007454  0.000178  0.000125  0.000001
  0.461538  0.007263  0.000203  0.000168  0.000001
  0.500000  0.007074  0.000228  0.000221  0.000002
  0.538462  0.006887  0.000256  0.000286  0.000003
  0.576923  0.006703  0.000285  0.000364  0.000003
  0.615385  0.006521  0.000316  0.000457  0.000005
  0.653846  0.006342  0.000348  0.000567  0.000006
  0.692308  0.006165  0.000382  0.000635  0.000006
  0.730769  0.005991  0.000418  0.000733  0.000006
  0.769231  0.005819  0.000456  0.000890  0.000007
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  0.807692  0.005649  0.000496  0.001069  0.000009
  0.846154  0.005482  0.000538  0.001275  0.000012
  0.884615  0.005317  0.000581  0.001509  0.000015
  0.923077  0.005155  0.000627  0.001773  0.000018
  0.961538  0.004995  0.000675  0.002071  0.000022
  1.000000  0.004838  0.000724  0.002200  0.000022
  1.038462  0.004683  0.000776  0.002513  0.000023
  1.076923  0.004531  0.000831  0.002900  0.000028
  1.115385  0.004381  0.000887  0.003332  0.000033
  1.153846  0.004233  0.000946  0.003810  0.000040
  1.192308  0.004088  0.001007  0.004338  0.000047
  1.230769  0.003946  0.001070  0.004919  0.000055
  1.269231  0.003805  0.001136  0.005507  0.000055
  1.307692  0.003668  0.001204  0.005769  0.000060
  1.346154  0.003532  0.001274  0.006491  0.000070
  1.384615  0.003400  0.001348  0.007279  0.000081
  1.423077  0.003269  0.001423  0.008137  0.000094
  1.461538  0.003141  0.001502  0.009069  0.000108
  1.500000  0.003016  0.001575  0.010079  0.000124
  1.538462  0.002893  0.001651  0.011171  0.000142
  1.576923  0.002772  0.001730  0.012028  0.000142
  1.615385  0.002654  0.001811  0.012757  0.000155
  1.653846  0.002538  0.001894  0.014059  0.000176
  1.692308  0.002425  0.001980  0.015451  0.000199
  1.730769  0.002314  0.002069  0.022486  0.000298
  1.769231  0.002205  0.002161  0.023152  0.000316
  1.807692  0.002100  0.002255  0.023826  0.000335
  1.846154  0.001996  0.002352  0.024510  0.000355
  1.884615  0.001895  0.002452  0.025203  0.000376
  1.923077  0.001796  0.002555  0.025905  0.000397
  1.961538  0.001700  0.002660  0.026616  0.000419
  2.000000  0.001606  0.002769  0.027335  0.000442
  2.038462  0.001515  0.002880  0.028064  0.000466
  2.076923  0.001426  0.002994  0.028802  0.000491
  2.115385  0.001340  0.003112  0.029548  0.000518
  2.153846  0.001256  0.003232  0.030304  0.000545
  2.192308  0.001174  0.003356  0.031068  0.000573
  2.230769  0.001095  0.003483  0.031841  0.000602
  2.269231  0.001019  0.003613  0.032622  0.000632
  2.307692  0.000945  0.003746  0.033413  0.000663
  2.346154  0.000873  0.003883  0.034212  0.000696
  2.384615  0.000804  0.004022  0.035020  0.000729
  2.423077  0.000737  0.004166  0.035837  0.000764
  2.461538  0.000672  0.004312  0.036662  0.000800
  2.500000  0.000610  0.004462  0.037496  0.000837
  2.500000  0.000551  0.005254  0.037496  0.000837
  END FTABLE  2
  FTABLE      1
   27    6
     Depth      Area    Volume  Outflow1  Outflow2  Outflow3  Velocity  Travel
Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)     (cfs)   (ft/sec)
(Minutes)***
  0.000000  0.000551  0.000000  0.000000  0.000000  0.000220
  0.038462  0.009723  0.000370  0.000000  0.029411  0.000220
  0.076923  0.009943  0.000748  0.000000  0.031621  0.000443
  0.115385  0.010167  0.001135  0.000000  0.033120  0.000668
  0.153846  0.010393  0.001530  0.000000  0.034662  0.000896
  0.192308  0.010621  0.001934  0.000000  0.036247  0.001126
  0.230769  0.010851  0.002347  0.000000  0.037876  0.001358
  0.269231  0.011084  0.002769  0.000000  0.039549  0.001594
  0.307692  0.011320  0.003200  0.000000  0.041267  0.001831
  0.346154  0.011558  0.003640  0.000000  0.043031  0.002071
  0.384615  0.011798  0.004089  0.000000  0.044842  0.002313
  0.423077  0.012041  0.004547  0.000000  0.046699  0.002558
  0.461538  0.012287  0.005015  0.000000  0.048603  0.002806
  0.500000  0.012534  0.005493  0.000000  0.050556  0.003056
  0.538462  0.012785  0.005979  0.079976  0.052556  0.003308
  0.576923  0.013037  0.006476  0.225672  0.054606  0.003563
  0.615385  0.013292  0.006982  0.412175  0.056706  0.003820
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0.653846  0.013550  0.007499  0.627270  0.058856  0.004080
0.692308  0.013810  0.008025  0.859995  0.061056  0.004342
0.730769  0.014072  0.008561  1.099144  0.063308  0.004606
0.769231  0.014337  0.009107  1.333311  0.065612  0.004873
0.807692  0.014605  0.009664  1.551565  0.067968  0.005143
0.846154  0.014874  0.010231  1.744468  0.070377  0.005415
0.884615  0.015147  0.010808  1.905359  0.072840  0.005690
0.923077  0.015421  0.011396  2.031838  0.075357  0.005966
0.961538  0.015698  0.011994  2.127417  0.077929  0.006246
1.000000  0.015978  0.012604  2.203335  0.080556  0.006528
END FTABLE  1
FTABLE      4
 67    5
   Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
    (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
0.000000  0.009504  0.000000  0.000000  0.000000
0.038462  0.009504  0.000010  0.000000  0.000000
0.076923  0.009288  0.000021  0.000000  0.000000
0.115385  0.009075  0.000034  0.000000  0.000000
0.153846  0.008864  0.000047  0.000000  0.000000
0.192308  0.008655  0.000062  0.000000  0.000000
0.230769  0.008449  0.000078  0.000017  0.000000
0.269231  0.008245  0.000095  0.000028  0.000000
0.307692  0.008044  0.000114  0.000043  0.000000
0.346154  0.007845  0.000134  0.000063  0.000000
0.384615  0.007648  0.000155  0.000090  0.000001
0.423077  0.007454  0.000178  0.000125  0.000001
0.461538  0.007263  0.000203  0.000168  0.000001
0.500000  0.007074  0.000228  0.000221  0.000002
0.538462  0.006887  0.000256  0.000286  0.000003
0.576923  0.006703  0.000285  0.000364  0.000003
0.615385  0.006521  0.000316  0.000457  0.000005
0.653846  0.006342  0.000348  0.000567  0.000006
0.692308  0.006165  0.000382  0.000635  0.000006
0.730769  0.005991  0.000418  0.000733  0.000006
0.769231  0.005819  0.000456  0.000890  0.000007
0.807692  0.005649  0.000496  0.001069  0.000009
0.846154  0.005482  0.000538  0.001275  0.000012
0.884615  0.005317  0.000581  0.001509  0.000015
0.923077  0.005155  0.000627  0.001773  0.000018
0.961538  0.004995  0.000675  0.002071  0.000022
1.000000  0.004838  0.000724  0.002200  0.000022
1.038462  0.004683  0.000776  0.002513  0.000023
1.076923  0.004531  0.000831  0.002900  0.000028
1.115385  0.004381  0.000887  0.003332  0.000033
1.153846  0.004233  0.000946  0.003810  0.000040
1.192308  0.004088  0.001007  0.004338  0.000047
1.230769  0.003946  0.001070  0.004919  0.000055
1.269231  0.003805  0.001136  0.005507  0.000055
1.307692  0.003668  0.001204  0.005769  0.000060
1.346154  0.003532  0.001274  0.006491  0.000070
1.384615  0.003400  0.001348  0.007279  0.000081
1.423077  0.003269  0.001423  0.008137  0.000094
1.461538  0.003141  0.001502  0.009069  0.000108
1.500000  0.003016  0.001575  0.010079  0.000124
1.538462  0.002893  0.001651  0.011171  0.000142
1.576923  0.002772  0.001730  0.012028  0.000142
1.615385  0.002654  0.001811  0.012757  0.000155
1.653846  0.002538  0.001894  0.014059  0.000176
1.692308  0.002425  0.001980  0.015451  0.000199
1.730769  0.002314  0.002069  0.022486  0.000298
1.769231  0.002205  0.002161  0.023152  0.000316
1.807692  0.002100  0.002255  0.023826  0.000335
1.846154  0.001996  0.002352  0.024510  0.000355
1.884615  0.001895  0.002452  0.025203  0.000376
1.923077  0.001796  0.002555  0.025905  0.000397
1.961538  0.001700  0.002660  0.026616  0.000419
2.000000  0.001606  0.002769  0.027335  0.000442
2.038462  0.001515  0.002880  0.028064  0.000466
2.076923  0.001426  0.002994  0.028802  0.000491
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  2.115385  0.001340  0.003112  0.029548  0.000518
  2.153846  0.001256  0.003232  0.030304  0.000545
  2.192308  0.001174  0.003356  0.031068  0.000573
  2.230769  0.001095  0.003483  0.031841  0.000602
  2.269231  0.001019  0.003613  0.032622  0.000632
  2.307692  0.000945  0.003746  0.033413  0.000663
  2.346154  0.000873  0.003883  0.034212  0.000696
  2.384615  0.000804  0.004022  0.035020  0.000729
  2.423077  0.000737  0.004166  0.035837  0.000764
  2.461538  0.000672  0.004312  0.036662  0.000800
  2.500000  0.000610  0.004462  0.037496  0.000837
  2.500000  0.000551  0.005254  0.037496  0.000837
  END FTABLE  4
  FTABLE      3
   27    6
     Depth      Area    Volume  Outflow1  Outflow2  Outflow3  Velocity  Travel
Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)     (cfs)   (ft/sec)
(Minutes)***
  0.000000  0.000551  0.000000  0.000000  0.000000  0.000220
  0.038462  0.009723  0.000370  0.000000  0.029411  0.000220
  0.076923  0.009943  0.000748  0.000000  0.031621  0.000443
  0.115385  0.010167  0.001135  0.000000  0.033120  0.000668
  0.153846  0.010393  0.001530  0.000000  0.034662  0.000896
  0.192308  0.010621  0.001934  0.000000  0.036247  0.001126
  0.230769  0.010851  0.002347  0.000000  0.037876  0.001358
  0.269231  0.011084  0.002769  0.000000  0.039549  0.001594
  0.307692  0.011320  0.003200  0.000000  0.041267  0.001831
  0.346154  0.011558  0.003640  0.000000  0.043031  0.002071
  0.384615  0.011798  0.004089  0.000000  0.044842  0.002313
  0.423077  0.012041  0.004547  0.000000  0.046699  0.002558
  0.461538  0.012287  0.005015  0.000000  0.048603  0.002806
  0.500000  0.012534  0.005493  0.000000  0.050556  0.003056
  0.538462  0.012785  0.005979  0.079976  0.052556  0.003308
  0.576923  0.013037  0.006476  0.225672  0.054606  0.003563
  0.615385  0.013292  0.006982  0.412175  0.056706  0.003820
  0.653846  0.013550  0.007499  0.627270  0.058856  0.004080
  0.692308  0.013810  0.008025  0.859995  0.061056  0.004342
  0.730769  0.014072  0.008561  1.099144  0.063308  0.004606
  0.769231  0.014337  0.009107  1.333311  0.065612  0.004873
  0.807692  0.014605  0.009664  1.551565  0.067968  0.005143
  0.846154  0.014874  0.010231  1.744468  0.070377  0.005415
  0.884615  0.015147  0.010808  1.905359  0.072840  0.005690
  0.923077  0.015421  0.011396  2.031838  0.075357  0.005966
  0.961538  0.015698  0.011994  2.127417  0.077929  0.006246
  1.000000  0.015978  0.012604  2.203335  0.080556  0.006528
  END FTABLE  3
  FTABLE      6
   67    5
     Depth      Area    Volume  Outflow1  Outflow2  Velocity  Travel Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)   (ft/sec)    (Minutes)***
  0.000000  0.007851  0.000000  0.000000  0.000000
  0.038462  0.007851  0.000005  0.000000  0.000000
  0.076923  0.007656  0.000011  0.000000  0.000000
  0.115385  0.007464  0.000018  0.000000  0.000000
  0.153846  0.007274  0.000025  0.000000  0.000000
  0.192308  0.007087  0.000033  0.000000  0.000000
  0.230769  0.006902  0.000042  0.000010  0.000000
  0.269231  0.006719  0.000052  0.000016  0.000000
  0.307692  0.006539  0.000063  0.000026  0.000000
  0.346154  0.006361  0.000075  0.000038  0.000000
  0.384615  0.006186  0.000088  0.000055  0.000000
  0.423077  0.006013  0.000102  0.000078  0.000000
  0.461538  0.005843  0.000118  0.000106  0.000001
  0.500000  0.005675  0.000134  0.000141  0.000001
  0.538462  0.005510  0.000151  0.000185  0.000001
  0.576923  0.005347  0.000170  0.000238  0.000001
  0.615385  0.005186  0.000190  0.000302  0.000002
  0.653846  0.005028  0.000212  0.000378  0.000003
  0.692308  0.004872  0.000235  0.000427  0.000003
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  0.730769  0.004719  0.000259  0.000498  0.000003
  0.769231  0.004568  0.000285  0.000609  0.000003
  0.807692  0.004420  0.000312  0.000738  0.000004
  0.846154  0.004274  0.000341  0.000887  0.000006
  0.884615  0.004131  0.000371  0.001058  0.000007
  0.923077  0.003990  0.000403  0.001253  0.000009
  0.961538  0.003851  0.000437  0.001474  0.000011
  1.000000  0.003715  0.000473  0.001576  0.000011
  1.038462  0.003581  0.000510  0.001811  0.000012
  1.076923  0.003450  0.000549  0.002104  0.000015
  1.115385  0.003321  0.000590  0.002431  0.000018
  1.153846  0.003195  0.000633  0.002796  0.000021
  1.192308  0.003071  0.000677  0.003202  0.000025
  1.230769  0.002950  0.000724  0.003651  0.000030
  1.269231  0.002831  0.000773  0.004107  0.000031
  1.307692  0.002714  0.000824  0.004324  0.000034
  1.346154  0.002600  0.000877  0.004889  0.000040
  1.384615  0.002488  0.000932  0.005508  0.000046
  1.423077  0.002379  0.000989  0.006186  0.000054
  1.461538  0.002272  0.001048  0.006925  0.000063
  1.500000  0.002168  0.001105  0.007730  0.000073
  1.538462  0.002066  0.001163  0.008603  0.000084
  1.576923  0.001967  0.001223  0.009298  0.000084
  1.615385  0.001870  0.001286  0.009900  0.000093
  1.653846  0.001775  0.001351  0.010952  0.000106
  1.692308  0.001683  0.001418  0.012080  0.000121
  1.730769  0.001593  0.001487  0.017644  0.000183
  1.769231  0.001506  0.001559  0.018230  0.000196
  1.807692  0.001421  0.001633  0.018825  0.000209
  1.846154  0.001339  0.001709  0.019429  0.000222
  1.884615  0.001259  0.001788  0.020043  0.000237
  1.923077  0.001182  0.001870  0.020665  0.000252
  1.961538  0.001107  0.001954  0.021297  0.000268
  2.000000  0.001034  0.002041  0.021938  0.000284
  2.038462  0.000964  0.002130  0.022588  0.000301
  2.076923  0.000897  0.002222  0.023248  0.000319
  2.115385  0.000831  0.002316  0.023916  0.000338
  2.153846  0.000769  0.002414  0.024593  0.000357
  2.192308  0.000708  0.002514  0.025280  0.000378
  2.230769  0.000650  0.002617  0.025975  0.000399
  2.269231  0.000595  0.002723  0.026679  0.000421
  2.307692  0.000542  0.002831  0.027393  0.000444
  2.346154  0.000491  0.002943  0.028115  0.000468
  2.384615  0.000443  0.003058  0.028846  0.000493
  2.423077  0.000398  0.003175  0.029586  0.000519
  2.461538  0.000355  0.003296  0.030335  0.000546
  2.500000  0.000314  0.003420  0.031093  0.000574
  2.500000  0.000275  0.004074  0.031093  0.000574
  END FTABLE  6
  FTABLE      5
   27    6
     Depth      Area    Volume  Outflow1  Outflow2  Outflow3  Velocity  Travel
Time***
      (ft)   (acres) (acre-ft)   (cfs)      (cfs)     (cfs)   (ft/sec)
(Minutes)***
  0.000000  0.000275  0.000000  0.000000  0.000000  0.000199
  0.038462  0.008048  0.000306  0.000000  0.024347  0.000199
  0.076923  0.008248  0.000619  0.000000  0.026230  0.000400
  0.115385  0.008450  0.000940  0.000000  0.027528  0.000604
  0.153846  0.008655  0.001269  0.000000  0.028866  0.000810
  0.192308  0.008862  0.001606  0.000000  0.030244  0.001019
  0.230769  0.009071  0.001951  0.000000  0.031663  0.001230
  0.269231  0.009283  0.002304  0.000000  0.033122  0.001444
  0.307692  0.009498  0.002665  0.000000  0.034624  0.001660
  0.346154  0.009714  0.003035  0.000000  0.036168  0.001879
  0.384615  0.009934  0.003412  0.000000  0.037754  0.002100
  0.423077  0.010155  0.003799  0.000000  0.039385  0.002323
  0.461538  0.010379  0.004194  0.000000  0.041059  0.002549
  0.500000  0.010606  0.004597  0.000000  0.042778  0.002778
  0.538462  0.010835  0.005010  0.079976  0.044542  0.003009
```

```
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  0.653846  0.011537  0.006300  0.627270  0.050111  0.003716
  0.692308  0.011776  0.006748  0.859995  0.052062  0.003957
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  0.807692  0.012507  0.008149  1.551565  0.058204  0.004694
  0.846154  0.012755  0.008635  1.744468  0.060351  0.004945
  0.884615  0.013006  0.009130  1.905359  0.062547  0.005198
  0.923077  0.013260  0.009635  2.031838  0.064795  0.005454
  0.961538  0.013516  0.010150  2.127417  0.067094  0.005712
  1.000000  0.013774  0.010675  2.203335  0.069444  0.005972
  END FTABLE  5
END FTABLES

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WDM      2 PREC     ENGL    1.333          IMPLND   1 999 EXTNL  PREC
WDM      1 EVAP     ENGL    0.76           PERLND   1 999 EXTNL  PETINP
WDM      1 EVAP     ENGL    0.76           IMPLND   1 999 EXTNL  PETINP
WDM      2 PREC     ENGL    1.333          RCHRES   1     EXTNL  PREC
WDM      2 PREC     ENGL    1.333          RCHRES   3     EXTNL  PREC
WDM      2 PREC     ENGL    1.333          RCHRES   5     EXTNL  PREC
WDM      1 EVAP     ENGL    0.5            RCHRES   1     EXTNL  POTEV
WDM      1 EVAP     ENGL    0.76           RCHRES   2     EXTNL  POTEV
WDM      1 EVAP     ENGL    0.5            RCHRES   3     EXTNL  POTEV
WDM      1 EVAP     ENGL    0.76           RCHRES   4     EXTNL  POTEV
WDM      1 EVAP     ENGL    0.5            RCHRES   5     EXTNL  POTEV
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END EXT SOURCES

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RCHRES   2 HYDR   O      1 1        1      WDM   1001 FLOW     ENGL       REPL
RCHRES   2 HYDR   O      2 1        1      WDM   1002 FLOW     ENGL       REPL
RCHRES   2 HYDR   STAGE  1 1        1      WDM   1003 STAG     ENGL       REPL
RCHRES   1 HYDR   STAGE  1 1        1      WDM   1004 STAG     ENGL       REPL
RCHRES   1 HYDR   O      1 1        1      WDM   1005 FLOW     ENGL       REPL
COPY     1 OUTPUT MEAN   1 1     48.4      WDM    701 FLOW     ENGL       REPL
COPY   501 OUTPUT MEAN   1 1     48.4      WDM    801 FLOW     ENGL       REPL
RCHRES   4 HYDR   RO     1 1        1      WDM   1006 FLOW     ENGL       REPL
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RCHRES   6 HYDR   STAGE  1 1        1      WDM   1015 STAG     ENGL       REPL
RCHRES   5 HYDR   STAGE  1 1        1      WDM   1016 STAG     ENGL       REPL
RCHRES   5 HYDR   O      1 1        1      WDM   1017 FLOW     ENGL       REPL
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  MASS-LINK        5
IMPLND     IWATER SURO       0.083333      RCHRES         INFLOW IVOL
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  MASS-LINK       13
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  END MASS-LINK   13

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  END MASS-LINK   18


END MASS-LINK

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entire ingroup is ignored.

ERROR/WARNING ID: 211 4

END EXGRP was explicitly or implicitly specified but, since exgroup
contains no operations, entire exgroup is ignored.

Mitigated HSPF Message File

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APPENDIX 4 – Geotechnical Report

Northern, Inc.

Consulting Engineers Environmental Scientists Geologists
Construction Materials Testing Geophysical Services

GEOTECHNICAL SITE INVESTIGATION REPORT

PROPOSED ROCK CREEK COVE DEVELOPMENT

PARCEL # 02070100130200, 02070100130300 & 02070100130400

ROCK CREEK DRIVE, STEVENSON, WASHINGTON

GNN PROJECT NO. 219-1183

JANUARY 2020

Prepared for

FDM DEVELOPMENT INC.
5101 NE 82ND AVENUE, SUITE 200
VANCOUVER, WA 98662

FDM DEVELOPMENT INC.

Prepared by

GN NORTHERN, INC.
CONSULTING GEOTECHNICAL ENGINEERS
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Common Sense Approach to Earth and Engineering
Since 1995

GN Northern, Inc.

At GN Northern our mission is to serve our clients in the most efficient, cost effective way using the best resources and tools available while maintaining professionalism on every level. Our philosophy is to satisfy our clients through hard work, dedication and extraordinary efforts from all of our valued employees working as an extension of the design and construction team.

Northern, Inc.

January 13, 2020

FDM Development Inc.
5101 NE 82nd Ave, Suite 200
Vancouver, WA 98662

Attn: Zachary Pyle, PE, Development Manager

CC: F. Dean Maldonado, Principal

Subject: Geotechnical Site Investigation Report
Proposed Rock Creek Cove Development
Parcel # 02070100130200, 02070100130300 & 02070100130400
Rock Creek Drive, Stevenson, Washington

GNN Project No. 219-1183

Gentlemen,

As requested, GN Northern (GNN) has completed a geotechnical site investigation for the proposed Rock Creek Cove vacation homes project to be constructed at the vacant site located on Rock Creek Drive, east of the intersection with Attwell Road, in the City of Stevenson, Washington.

Based on the findings of our subsurface study, we conclude that the site is suitable for the proposed construction provided that our geotechnical recommendations presented in this report are followed during the design and construction phases of the project.

This report describes in detail the results of our investigation, summarizes our findings and presents our recommendations concerning earthwork and the design and construction of foundation for the proposed project. It is important that GN Northern provide consultation during the design phase as well as field compaction testing and geotechnical monitoring services during the earthwork phase to ensure implementation of the geotechnical recommendations.

If you have any questions regarding this report, please contact us at 509-248-9798 or 541-387-3387.

Respectfully submitted,

GN Northern, Inc.

Karl A. Harmon, LEG, PE
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APPENDICES

1.0 PURPOSE AND SCOPE OF SERVICES

This report has been prepared for the proposed Rock Creek Cove vacation homes project to be constructed at the vacant site located on Rock Creek Drive, east of the intersection with Attwell Road, in the City of Stevenson, Washington; site location is shown on the *Vicinity Map* (Figure 1, Appendix I). Our investigation was conducted to collect information regarding subsurface conditions and present recommendations for suitability of the subsurface materials to support the proposed building structures and allowable bearing capacity for the proposed construction.

GN Northern, Inc. has prepared this report for use by the client and their design consultants in the design of the proposed development. Do not use or rely upon this report for other locations or purposes without the written consent of GN Northern, Inc.

Our study was conducted in general accordance with our *Proposal for Geotechnical Engineering Services* dated October 29, 2019. Notice to proceed was provided in the form of a signed/authorized copy of our proposal via email on November 19, 2019.

A conceptual site plan (*Concept D*, prepared by FDM Development, dated 10/28/2019), along with a topographic survey of the project site (Lots 2, 3, and 4 of Rock Creek Cove, prepared by S&F Land Services, dated 12/11/2019), were provided by Mr. Pyle via email on December 17, 2019. Field exploration, consisting of twelve (12) test-pits and one (1) infiltration test, was completed on December 23, 2019. Locations of the exploratory test-pits and infiltration test are shown on the *Site Exploration Map* (Figure 2, Appendix I), and detailed test-pit logs are presented in Appendix II.

This report has been prepared to summarize the data obtained during this study and to present our recommendations based on the proposed construction and the subsurface conditions encountered at the site. Results of the field exploration were analyzed to develop recommendations for site development, earthwork, pavements, and foundation bearing capacity. Design parameters and a discussion of the geotechnical engineering considerations related to construction are included in this report.

2.0 PROPOSED CONSTRUCTION

Based on the preliminary information presented on the conceptual site plan and communication with your office, we understand that the proposed development will likely include approximately 15 to 25 structures. The various vacation rental structures are anticipated to consist of 6 to 8 single-room studio units along with 8 to 16 multi-story 3-bedroom units. Based on the current site layout, the studio units are planned across the southern finger, while the multi-story units are planned across the northern and western portions of the site. Proposed development will also include a 3-story central building with upstairs suite, central floor reception area, and lower floor kitchen and bar. Site development will also include associated infrastructure elements consisting of underground utilities, stormwater facilities, parking areas, and drive lanes. While the current site plan calls for a proposed wedding chapel/shelter on the eastern finger, we understand that development across this portion of the site may not be permitted.

Structural loading information was not available at the time of this report. Based on our experience with similar projects, we expect maximum wall loads to be on the order of 2,500 plf and maximum column loads to be less than 80 kips. It shall be noted that assumed loading is based on limited preliminary information provided at the time of this report. If loading conditions differ from those described herein, GNN should be given an opportunity to perform re-analysis. Settlement tolerances for structures are assumed to be limited to 1 inch, with differential settlement limited to ½ inch.

3.0 FIELD EXPLORATION & LABORATORY TESTING

The field exploration was completed on December 23, 2019. A local public utility clearance was obtained prior to the field exploration. Twelve (12) exploratory test-pits were completed at various locations within the footprint of the proposed development. Test-pits were excavated by Riley Materials using a Link-Belt 145x4 excavator to depths of approximately 8 to 14.5 feet below existing ground surface (BGS) and logged by a GNN field geologist/engineer. Additionally, an infiltration test was performed on the north side of the entrance driveway. Upon completion, all excavations were loosely backfilled with excavation spoils. Test-hole locations are shown on *Site Exploration Map* (Figure 2)

The soils observed during our field exploration were classified according to the Unified Soil Classification System (USCS), utilizing the field classification procedures as outlined in ASTM D2488. A copy of the USCS Classification Chart is included in Appendix II. Photographs of the site and exploration are presented in Appendix IV. Depths referred to in this report are relative to the existing ground surface elevation at the time of our investigation. The surface and subsurface conditions described in this report are as observed at the time of our field investigation.

Representative samples of the subsurface soils obtained from the field exploration were selected for testing to determine the index properties of the soils in general accordance with ASTM procedures. The following laboratory tests were performed:

Table 1: Laboratory Tests Performed

Test	To determine
Particle Size Distribution (ASTM D6913)	Soil classification based on proportion of sand, silt, and clay-sized particles
Natural Moisture Content (ASTM D2216)	Soil moisture content indicative of in-situ condition at the time samples were taken

Results of the laboratory test are included on the test-pit logs and are also presented in graphic form in Appendix III attached to the end of the report.

4.0 SITE CONDITIONS

The project site is located east of the intersection of Rock Creek Drive and Attwell Road, approximately ½-mile north of State Highway 14, in the City of Stevenson, Washington. The 6.4-acre project site is currently comprised of three separate parcels identified by the Skamania County Assessor as Parcel Numbers: 020701001302000 (Lot 2), 020701001303000 (Lot 3), and 020701001304000 (Lot 4) located within the SW ¼ of the NW ¼ of Section 1, Township 2 North and Range 7 East, Willamette Meridian.

The subject site is generally characterized as an irregular shaped peninsula with several fingers extending east from Rock Creek Drive into Rock Cove. The majority of the upper surface of the site is relatively flat, while the irregular shaped peninsula fingers typically include steep slopes along the perimeter down to the shoreline. Surface conditions across the site include a variety of gravel covered and paved areas (asphalt and concrete), as well as areas with a dense growth of mature trees and vegetation, with selected areas across slope faces that include a veneer of angular

rock (apparent rip-rap). Recently placed stockpiles of apparent landscape clippings are present across an area located south of the existing entrance driveway.

Surface topography across the subject site has been historically altered by previous grading activity related to the preexisting use. The upper historically graded portions of the site are relatively flat at elevations ranging from approximately 95' to 101' across a majority of the site. Site grades step down towards that eastern finger with surface elevations ranging from approximately 87' to 90'. The surrounding edges of the various peninsula fingers typically include relatively steep slopes, with gradients as steep as 1H:1V, from the upper flat portions descending down to the shoreline.

The history of past use and development of the property was not investigated as part of our scope of services for this geotechnical site investigation. Based on our cursory review of available historic aerial photos (Appendix V) and topographic maps, along with a previously completed phase II environmental site assessment (Maul Foster Alongi, 2017), the site is known to have been historically developed with an industrial lumber mill facility. Scattered buried remnants related to the noted previous development and operations at the site including concrete foundation and slabs, miscellaneous utilities, trash and debris should be anticipated. Additionally, the eastern finger extending into Rock Cove appears to have been created by historic filling of the area between the main portion of the site and a preexisting island toward the eastern tip. The 1935 aerial photograph taken prior to historic site development of the site shows the site vicinity at the time when the Rock Cove had not been flooded by construction of the Bonneville Dam.

5.0 SITE & REGIONAL GEOLOGY

The City of Stevenson and Skamania County are located in the South Cascades physiographic province that extends from the Columbia River to the south to Interstate 90 to the north, and is dominated by three massive stratovolcanoes. The current day volcanoes are the most recent installments of a 40-million-year-old volcanic complex called the Cascades Volcanic Arc. The bedrock geology of the western Columbia Gorge is dominated by Oligocene to early Miocene volcaniclastic rocks and minor interbedded lava flows of the ancestral Cascade Volcanic Arc. At many locations, the ancestral arc rocks are unconformably overlain by lava flows of the middle Miocene Columbia River Basalt Group, late Miocene to Pliocene fluvial deposits, or Quaternary olivine-phyric mafic lavas (Pierson et al., 2016).

The western part of the Columbia River Gorge is characterized by massive landslides on the Washington side, and the instability of these land masses is associated with abundant rainfall, high relief, composition and structure of the underlying rocks, tectonic uplift associated with the structural evolution of the Cascade Range and Yakima Fold Belt, and valley-side erosion by the incising Columbia River, which flows across the uplifting terrains (Pierson et al., 2016). The Cascade landslide complex is one such landslide feature that spans from the town of North Bonneville to the western portion of Stevenson. The Cascade landslide complex is subdivided into four individual landslides: the Carpenters Lake, Bonneville, and Red Bluffs landslides, as well as a reactivated part of the Red Bluffs landslide body known as the Crescent Lake landslide. Immediately east of the Cascade landslide complex is the newly recognized Stevenson landslide which is occupied by the City of Stevenson.

The project site is located near the eastern toe of the Red Bluffs landslide, approximately 1-mile east of the reactivated Crescent Lake landslide. The head scarp of the Red Bluffs landslide is located approximately 3½ miles northwest of the site. Surface geology at the site is mapped as Quaternary landslide deposits [Qls] of the Red Bluffs landslide (mass wasting deposits), consisting of poorly sorted blocks, boulders, gravels, and fines sediments produced by the gravitational failure and rotational-translational slide of bedrock and/or unconsolidated sediments above the bedrock (Korosec, 1987).

6.0 SUBSURFACE CONDITIONS

Based on the findings of our field exploration, subsurface soils at the project site include a variably-thick layer of artificial fill soils likely associated with historic site development, atop the native silty gravel with sand stratum (mass wasting deposits). The undocumented artificial fill soils were noted to depths of approximately 3 to 8 feet across the upper portion of the site. Test-pit TP-9 excavated on the lower eastern finger encountered fill to the full depth of exploration (~8 feet) that is believed to represent historic fill placed to create new land. Fill soils were generally classified as silty gravel with sand and variable amounts of cobbles and boulders, and with some areas also including organics, wood debris and miscellaneous trash. The fill soils at the site are likely to be related to the previous historic development at the site. The apparent native underlying soils were classified as Silty Gravel with Sand (GM) and included varying amounts of cobbles and boulders. The native soil stratum typically appeared medium dense. Due to similar soil condition between

the upper fills and the underlaying native stratum, the fill/native transition was typically ambiguous and therefore not clearly discernable within the test-pits. Test-pit logs in Appendix II show detailed descriptions and stratification of the soils encountered.

6.1 NRCS Soil Survey

Although altered at the surface, the soil survey map of the site prepared by the Natural Resources Conservation Service (NRCS) identifies the site soils as *Arents* with typical profile described as *gravelly sandy loam* grading to *extremely gravelly sandy loam*. Based on the NRCS map (Appendix VII), these units generally consist of *well drained* materials.

6.2 Groundwater

Groundwater was encountered within two of the exploratory test-pits at depths ranging from approximately 12 to 14 feet BGS at the time of our exploration in late December. Approximate correlating groundwater elevations ranged from approximately 83' in TP-3 in the western portion, down to 78' in TP-8 near the eastern portion. A review of the Washington Department of Ecology's online water well log database revealed a lack of nearby water wells in the site vicinity. Water levels within the adjacent Rock Cove portion of the Columbia River, controlled by the down-river Bonneville Dam, are typically noted at an elevation approximately 20 to 25 feet below the upper leveled-off site elevation. Therefore, we believe groundwater at the site is not directly affected by pool elevations in the Columbia River, and is likely controlled by the complex hydrogeological conditions of the up-gradient mass-wasting landslide deposits, as well as regional precipitation and snowmelt. Groundwater levels will fluctuate with irrigation, precipitation, drainage, and regional pumping from wells.

7.0 SOIL INFILTRATION TESTING

A single infiltration test was performed on the north side of the existing entrance drive at a depth of approximately 5.5 feet BGS using a small-scale Pilot Infiltration Test (PIT). To the degree possible, care was exercised during excavation to attempt to maintain relatively uniform side walls, and the resulting size and geometry of the finished test-pit was carefully recorded in the field. Water was introduced into the test-pit using a garden hose connected to a nearby fire hydrant. The water flow into the test-pit was continued until the soils with the test-pit were saturated and a

constant flow rate was established. The stabilized inflow rate was measured and recorded, and the resulting un-factored infiltration rates are presented in the table below:

Table 2: Infiltration Test Results

Test ID	Approximate Location (GPS Coordinates)	Soil Tested	Field Infiltration Rate
P-1	45°41'20.69"N, 121°53'56.06"W	Silty Gravel	**4 inches/hour**

The infiltration rate presented herein represents the un-factored field soil infiltration rate. An appropriate factor of safety should be applied to the field infiltration rate to determine long-term design infiltration rate. Determination of safety factors for long-term design infiltration should consider the following: pretreatment, potential for bio-fouling, system maintainability, horizontal and vertical variability of soils, and type of infiltration testing. Typical factors of safety for these soils generally range from 2 to 3. If stormwater management facilities are selected at other locations, additional site-specific infiltration testing shall be performed.

8.0 GEOLOGIC HAZARDS

Potential geologic hazards that may affect the proposed development include: [i] landslides & slope instability, [ii] seismic hazards (ground shaking, surface fault rupture, soil liquefaction, and other secondary earthquake-related hazards), and [iii] flooding & erosion. The perimeter/shoreline edges of the subject property are generally all mapped by the City of Stevenson's Critical Areas & Geologic Hazards Map as 'Potentially Unstable Slope' which refers to an area with slopes of 25% or greater per Stevenson Municipal Code (SMC), Chapter 18.13, Section 18.13.090, Critical Area - Geologically Hazardous Areas. A discussion follows on the specific hazards to this site:

8.1 Landslides

As discussed above in Section 5.0, the project site lies within the Cascade landslide complex that is subdivided into four individual landslides (Carpenters Lake, Bonneville, Red Bluffs, & Crescent Lake landslide). The Bonneville landslide has been dated to have occurred from 1416-1452 A.D. by a combination of dating methods. The Red Bluffs landslide has crosscutting morphologic features suggesting a younger age than that of the Bonneville landslide, with an age range of 1760-1770 A.D. The Crescent Lake landslide has reactivated within the last few decades and currently is moving downslope at an average rate of 11–18 cm/year and possibly as fast as 25 cm/year (Pierson et al., 2016). Results of another recent study (Hu et al., 2015) showed that the central upper part of

the Crescent Lake landslide moved a total of 700 mm downslope during a 4-year observation period from 2007 to 2011, and that the movement was seasonal and showed a strong correlation with winter precipitation. In contrast to the Crescent Lake landslide, coherent parts of Red Bluffs, Bonneville and Stevenson landslides were observed to remain stable during the observation period.

Although considered a recent landslide (< 1,000 years old), the Red Bluffs landslide is not considered an active landslide (movement in last 20 years). Based on Table 18.13.090-1, Landslide Hazard Classification, of the Stevenson Municipal Code (SMC), the landslide hazard for the site classifies as 'Moderate Hazard'.

8.2 Regional Faulting & Surface Fault Rupture

The nearest regional faulting with Quaternary displacement (< 130,000 years) consists of the Faults near The Dalles located approximately 12 miles east of the project site (Czajkowski, 2014). Published slip rates for these faults are listed at less than 0.2 mm/year. For the purposes of this report, an active fault is defined as a fault that has had displacement within the Holocene epoch or last 11,700 years. Due to the lack of any known active fault traces in the immediate site vicinity, surface fault rupture is unlikely to occur at the subject property. While future fault rupture could occur at other locations, rupture would most likely occur along previously established fault traces.

8.3 Earthquakes & Seismic Conditions

Earthquakes caused by movements along crustal faults, generally in the upper 10 to 15 miles, occur on the crust of the North America tectonic plate when built-up stresses near the surface are released. The two largest crustal earthquakes felt in the state of Washington included the 1872, M 6.8 quake near Lake Chelan and the 1936, M 6.0 Walla Walla earthquake. Noteworthy to the City of Stevenson, the Mount Saint Helens Seismic Zone is located approximately 30 miles towards the north-northwest. The following list provides information gathered from the online USGS database regarding historic earthquakes (≥4.0 M) within the past 50 years for epicenters within 100 kilometers of project site, sorted by magnitude (largest to smallest):

Table 3: Earthquakes within 100-kilometers of project site

Date(s) of Event	Magnitude(s)	Nearby Faults / Seismic Zone	Approx. Distance from Site (miles)
March to May, 1980	4.0 - 5.7	Mt. Saint Helens Seismic Zone	33 – 47
March 25, 1993	5.6	Mt. Angel Fault Zone	57
February 14, 1981	5.2	Mt. Saint Helens Seismic Zone	48

May 13, 1981	4.5	Mt. Saint Helens Seismic Zone	50
June 29, 2002	4.5	Faults near The Dalles	26
March 1, 1982	4.4	Mt. Saint Helens Seismic Zone	48
February 14, 2011	4.3	Mt. Saint Helens Seismic Zone	44
July 14, 2008	4.2	*Unknown*	60
December 13, 1974	4.1	Faults near The Dalles	33
February 2, 1981	4.0	Toppenish Ridge Fault Zone	59

Based on seismic scenarios published by the Washington State Department of Natural Resources (DNR), M 7.0 Mount Saint Helens and M 7.1 Mill Creek earthquake events would result in a shaking intensity of 'V' (moderate shaking) on the Modified Mercalli Intensity (MMI) scale. We further used the USGS deaggregation tool which provides the relative contributions of hazard for each seismic source based on Probabilistic Seismic Hazard Analysis (PSHA). Based on the deaggregation, it appears that about 23% of the contribution to the probabilistic hazard at the site comes from the Cascadia Subduction Zone, with the remaining contribution primarily from the shallower sources.

8.4 Soil Liquefaction

Liquefaction is the loss of soil strength from sudden shock (usually earthquake shaking), causing the soil to become a fluid mass. In general, for the effects of liquefaction to be manifested at the surface, groundwater levels must be within 50 feet of the ground surface and the soils within the saturated zone must also be susceptible to liquefaction. Based on the published Liquefaction Susceptibility Map of of Skamania County, Washington (Palmer et al., 2004a), the site is mapped with a 'low to moderate' relative suceptibility for seismically-induced liquefaction to occur. A detailed assessment of the liquefaction potential at the site, including liquefaction-induced settlement and the effects of lateral spreading, is beyond the scope of this investigation.

8.5 Secondary Seismic Hazards

Additional secondary seismic hazards related to ground shaking include ground subsidence, tsunamis, and seiches. The site is far inland, so the hazard from tsunamis is non-existent. The potential hazard of seiches from a significant seismic event is relatively low for development on the upper portion of the project site that is elevated approximately 20 to 25 feet above Rock Cove.

8.6 Site Slopes

Surface topography across the subject site has been historically altered by previous grading activity related to the preexisting lumber mill facility. The upper historically graded portions of the site are relatively flat at elevations ranging from approximately 95' to 101'. The surrounding edges of the various peninsula fingers typically include relatively steep slopes, with gradients as great as 1H:1V, from the upper flat portions descending down to the shoreline. A field reconnaissance of the subject property was performed to observe site conditions and look for common geomorphic features of landslides as well as indications of possible signs demonstrating recent activity and instability of slide masses. While several areas across the site include a relatively dense cover of vegetation, no apparent indications of recent failures or significant slope instability were observed. Section 9.0 presents results of a preliminary slope stability analysis completed at the site and Section 12.0 provides recommendations for appropriate structure setbacks.

8.7 Flooding and Erosion

The subject property is mapped by Federal Emergency Management Agency (FEMA) as Zone 'C' which translates to areas of minimal flooding. Portions of the subject property are however situated in areas where sheet flow and erosion may occur. Soil erodibility is only one of several factors affecting the erosion susceptibility. Soil erosion by water also increases with the length and steepness of the site slopes due to the increased velocity of runoff and resulting greater degree of scour and sediment transport. The need for and design of erosion protection measures is within the purview of the design Civil Engineer. Appropriate erosion and sediment control plan(s) and a drainage plan shall be prepared by the project civil engineer with the final construction drawings. Erosion should be mitigated with appropriate BMPs consisting of proper drainage design including collecting and disposal (conveyance) of water to approved points of discharge in a non-erosive manner. Appropriate project design, construction, and maintenance will be necessary to mitigate the site erosion hazards.

9.0 SLOPE STABILITY ANALYSIS

A preliminary slope stability analysis was conducted for a critical slope section across the southern finger as shown on Figure 2. The analysis was conducted using a generalized geologic cross-section model developed from the existing site topography and data obtained from our subsurface exploration. An output of our slope stability analysis is attached in Appendix VI.

The slope stability analysis was conducted by a two-dimensional limit equilibrium stability analysis of selected trial failure surfaces using the computer program *SLIDE (Version 7)*. Potential circular-arc failure surfaces were evaluated using the Spencer method under static conditions. The computer program searched for critical potential failure surfaces with low computed factors of safety. The computed factor of safety (FS) against slope failure is simply the ratio of total resisting forces or moments (strength of the slope) to the total driving forces or moments for planar or circular failure surfaces respectively. A slope with a factor of safety of 1.0 is in equilibrium, indicating that the disturbing forces driving the slope down are equal to its strength to resist failure. Simply put slope-failure result when the strength of the slope is overcome by gravity.

The selection of unit weight and shear strength parameters for the various earth materials were based on judgment and data obtained during our field investigation, laboratory testing, review of previous studies, research and previous experience with similar materials in similar geotechnical and geologic settings. Engineering and geologic judgment must be applied to the estimated shear strength parameters in order to consider lateral and vertical variations in the subsurface conditions, such as degree of cementation, fracturing, planes of weakness, and gradational characteristics. The following geotechnical strength parameters were used in our stability calculations:

Table 4: Estimated Strength Parameters

Material	Shear Strength Parameters		Unit Weight (pcf)
	Friction Angle: ϕ	Cohesion: c (psf)	
Fill/Disturbed Soil	33	25	120
Native Silty Gravel w/ Sand	35	50	130 (moist) 138 (saturated)

GN Northern recommends that any existing or reconfigured slopes should meet or be designed and constructed to meet a minimum factor of safety of 1.5 for the static condition and 1.1 under seismic loading. Based on the results of our slope stability analysis, we conclude that the steep perimeter slopes do not meet minimum recommended safety factors. Consequently, the currently proposed layout with future structures sited at/over the edge of slopes is generally considered unfeasible, and remedial grading and/or other appropriate mitigation measures will be required to increase slope safety factors and provide adequate subgrade support for the proposed structures.

In lieu of appropriate remediation of the slope stability concerns, in order to provide sufficient vertical and lateral support for the proposed foundations without significant risk of detrimental settlement, appropriate increased setbacks/embedment for the new building foundations should be maintained. It should be understood however that while the proposed structures may not be at significant risk from slope instability, the existing slopes will remain at risk for some future failure if not appropriately remediated.

10.0 SEISMIC DESIGN PARAMETERS

Based on subsurface data obtained during or field exploration, along with our review of the published NEHRP Site Class Map of Skamania County, Washington (Palmer et al., 2004b), a site class 'D' as defined by 2015 International Building Code (IBC) is applicable. According to Mapped Spectral Acceleration obtained from the USGS Seismic Design Maps using the 2015 IBC, the following site-specific design values may be used:

Table 5: IBC Design Response Spectra Parameters

Seismic Design Parameter	Value (unit)
S_s	0.657 (g)
S_1	0.292 (g)
F_a	1.274 (unitless)
F_v	1.816 (unitless)
SM_s	0.837 (g)
SM_1	0.530 (g)
SD_s	0.558 (g)
SD_1	0.354 (g)

S_S = MCE spectral response acceleration at short periods
S_1 = MCE spectral response acceleration at 1-second period
F_a = Site coefficient for short periods
F_v = Site coefficient for 1-second period
SM_S = MCE spectral response acceleration at short periods as adjusted for site effects
SM_1 = MCE spectral response acceleration at 1-second period as adjusted for site effects
SD_S = Design spectral response acceleration at short periods
SD_1 = Design spectral response acceleration at 1-second period

It shall be noted that determination of an appropriate site class requires shear wave velocity, soil undrained shear strength, or standard penetration resistance (N-value) data in the upper 100 feet of the subsurface profile, which was beyond the scope of this investigation.

11.0 SUMMARY OF FINDINGS & CONCLUSIONS

Conditions imposed by the proposed development have been evaluated on the basis of assumed elevations and engineering characteristics of the subsurface materials encountered in the exploratory test-pits, and their anticipated behavior both during and after construction. The following is a summary of our findings, conclusions and professional opinions based on the data obtained from a review of selected technical literature and the site evaluation.

- Based on the findings of this geotechnical evaluation and our understanding of the proposed development, from a geotechnical perspective, it is our opinion that the site is suitable for the proposed development, provided the soil design parameters and site-specific recommendations in this report are followed in the design and construction of the project.
- Final design plans for the proposed development, including grading, drainage and finished elevations, were not provided at the time of this report**.** Once the plans are finalized, GNN **must** be provided an opportunity to review final design plans to provide revised recommendations if/as necessary.
- Site soils include a variably-thick layer of artificial fill soils believed to be related to historic site development, atop the native silty gravels with sand. The undocumented artificial fill soils, largely made-up of similar soils that were apparently derived from onsite and/or near sources, extend to depths ranging from 3 to 8 feet and include some areas with miscellaneous trash and debris. Our estimation of the depth of fill materials is based on selected, localized points of exploration, and cannot quantify the full extent of the onsite fill. Additional undocumented fill soils with trash/debris, buried within the subsurface profile, may extend to greater depths at isolated locations across the site.
- Groundwater was encountered within the two of our test-pits at depths ranging from approximately 12 to 14 feet BGS at the time of our exploration in late December. Approximate correlating groundwater elevations ranged from approximately 83' in TP-3 in the western portion, down to 78' in TP-8 near the eastern portion. We believe groundwater at the site is not directly affected by pool elevations in the Columbia River, and is likely controlled by the complex hydrogeological conditions of the up-gradient mass-wasting landslide deposits, as well as regional precipitation and snowmelt.

- The onsite silty gravel soils, screened and processed to be free of oversize rocks (>5 inches) and any deleterious materials including trash and debris, are generally suitable for reuse as engineered fill and utility trench backfill.
- The proposed building structures may be supported on conventional shallow foundations bearing on a layer of crushed rock atop the recompacted native subgrade in accordance with the recommendations of this report. However, due to presence of artificial fill soils across future building footprints, over-excavation of the existing fill soils to a competent native stratum and replacement with engineered fill will be required.
- Due to ecological constraints, it appears that remedial grading of the onsite slopes to improve long-term stability is not considered feasible. Therefore, deeper embedment of the building foundations will be required in order to meet the minimum setback requirements while ignoring the stability of the onsite slopes.
- Appropriate slope setbacks for future structures should be incorporated in the final planning and design of the project. Slopes setbacks shall adhere to IBC 2015 Section 1808.7 *Foundations on or Adjacent to Slopes*, as well as the recommendations of this report.
- Site grading shall incorporate the requirements of IBC 2015, Appendix J *Grading*.
- Upon completion, all test-pit excavations were loosely backfilled with excavation spoils. The contractor is responsible to locate the test-pits to re-excavate the loose soils and re-place as compacted engineered fill.
- The underlying geologic condition for seismic design is site class 'D'. The *minimum* seismic design should comply with the 2015 International Building Code (IBC) and ASCE 07-10, Minimum Design Loads for Buildings and Other Structures.
- The near-surface site soils are susceptible to wind and water erosion when exposed during grading operations. Preventative measures and appropriate BMPs to control runoff and reduce erosion should be incorporated into site grading plans.
- Based on our evaluation, the risk for liquefaction at the project site is considered low to moderate. A site-specific liquefaction analysis to assess the risk of soil liquefaction and liquefaction-induced settlement was beyond the scope of this geotechnical evaluation and would require additional exploration including a 50-foot deep boring with continuous penetration testing.

12.0 GEOTECHNICAL RECOMMENDATIONS

The following geotechnical recommendations are based on our current understanding of the proposed project as shown on the conceptual site plan (Concept D, prepared by FDM Development, dated 10/28/2019), and as described in Section 2.0 of this report. The report is prepared to comply with the 2015 International Building Code Section 1803, Geotechnical Investigations, and as required by Subsection 1803.2, Investigations Required. Please note that Soil Design Parameters and Recommendations presented in this report are predicated upon appropriate geotechnical monitoring and testing of the site preparation and foundation and building pad construction by a representative of GNN's Geotechnical-Engineer-of-Record (GER). Any deviation and nonconformity from this requirement may invalidate, partially or in whole, the following recommendations. We recommend that we be engaged to review grading and foundation plans in order to provide revised, augmented, and/or additional geotechnical recommendations as required.

12.1 Site Development – Grading

Site grading shall incorporate the requirements of IBC 2015 Appendix J. The project GER or a representative of the GER should observe site clearing, grading, and the bottoms of excavations before placing fills. Local variations in soil conditions may warrant increasing the depth of over-excavation and recompaction. Seasonal weather conditions may adversely affect grading operations. To improve compaction efforts and prevent potential pumping and unstable ground conditions, we suggest performing site grading during dryer periods of the year.

Soil conditions shall be evaluated by in-place density testing, visual evaluation, probing, and proof-rolling of the imported fill and re-compacted on-site soil as it is prepared to check for compliance with recommendations of this report. A moisture-density curve shall be established in accordance with the ASTM D1557 method for all onsite soils and imported fill materials used as structural fill.

12.2 Clearing and Grubbing

At the start of site grading, any vegetation, large roots, non-engineered/artificial fill, including trash and debris, and any abandoned underground utilities shall be removed from the proposed building and structural areas. The surface shall be stripped of all topsoil and/or organic growth

(vegetation) that may exist within the proposed structural areas. The topsoil and organic rich soils shall either be stockpiled on-site separately for future use or be removed from the construction area. Depth of stripping can be minimized with real-time onsite observation of sufficient removals. Areas disturbed during clearing shall be properly backfilled and compacted as described below.

12.3 Suitability of the Onsite Soils as Engineered Fill

The onsite silty gravel with sand soils, screened and processed to be free of oversize rocks (>5 inches) and deleterious materials including trash and debris, are generally suitable for reuse as engineered fill and utility trench backfill. Suitable onsite soils shall be placed in maximum 8-inch lifts (loose) and compacted to at least 95% relative compaction (ASTM D1557) near its optimum moisture content. Compaction of these soils shall be performed within a range of ±2% of optimum moisture to achieve the proper degree of compaction.

12.4 Temporary Excavations

It shall be the responsibility of the contractor to maintain safe temporary slope configurations since the contractor is at the job site, able to observe the nature and conditions of the slopes and be able to monitor the subsurface conditions encountered. Unsupported vertical cuts deeper than 4 feet are not recommended if worker access is necessary. The cuts shall be adequately sloped, shored or supported to prevent injury to personnel from caving and sloughing. The contractor and subcontractors shall be aware of and familiar with applicable local, state and federal safety regulation including the current OSHA Excavation and Trench Safety Standards, and OSHA Health and Safety Standards for Excavations, 29 CFR Part 1929, or successor regulations.

According to chapter 296-155 of the Washington Administrative Code (WAC), it is our opinion that the soil encountered at the site is classified as Type C soils. We recommend that temporary, unsupported, open cut slopes shall be no steeper than 1.5 feet horizontal to 1.0 feet vertical (1.5H:1V) in Type C soils. No heavy equipment should be allowed near the top of temporary cut slopes unless the cut slopes are adequately braced. Final (permanent) fill slopes should be graded to an angle of 2H:1V or flatter. Where unstable soils are encountered, flatter slopes may be required.

12.5 Utility Excavation, Pipe Bedding and Trench Backfill

To provide suitable support and bedding for the pipe, we recommend the utilities be founded on suitable bedding material consisting of clean sand and/or sand & gravel mixture. To minimize trench subgrade disturbance during excavation, the excavator should use a smooth-edged bucket rather than a toothed bucket.

Pipe bedding and pipe zone materials shall conform to Section 9-03.12(3) of the *WSDOT Standard Specifications.* Pipe bedding should provide a firm uniform cradle for support of the pipes. A minimum 4-inch thickness of bedding material beneath the pipe should be provided. Prior to installation of the pipe, the pipe bedding should be shaped to fit the lower part of the pipe exterior with reasonable closeness to provide uniform support along the pipe. Pipe bedding material should be used as pipe zone backfill and placed in layers and tamped around the pipes to obtain complete contact. To protect the pipe, bedding material should extend at least 6 inches above the top of the pipe.

Placement of bedding material is particularly critical where maintenance of precise grades is essential. Backfill placed within the first 12 inches above utility lines should be compacted to at least 90% of the maximum dry density (ASTM D1557), such that the utility lines are not damaged during backfill placement and compaction. In addition, rock fragments greater than 1 inch in maximum dimension should be excluded from this first lift. The remainder of the utility excavations should be backfilled and compacted to 95% of the maximum dry density as determined by ASTM D1557.

Onsite soils are considered suitable for utility trench backfill provided they are free of oversize material and trash/debris and can be adequately compacted. All excavations should be wide enough to allow for compaction around the haunches of pipes and underground tanks. We recommend that utility trenching, installation, and backfilling conform to all applicable federal, state, and local regulations such as OSHA and WISHA for open excavations.

Compaction of backfill material should be accomplished with soils within ±2% of their optimum moisture content in order to achieve the minimum specified compaction levels recommended in this report. However, initial lift thickness could be increased to levels recommended by the

12.6 Imported Crushed Rock Structural Fill

Imported structural fill shall consist of well-graded, crushed aggregate material meeting the grading requirements of Washington State Department of Transportation (WSDOT) Standard Specification 9-03.9(3) (1-1/4 inch minus Base Course Material) presented here:

Table 6: WSDOT Standard Spec. 9-03.9(3)

Sieve Size	Percent Passing (by Weight)
1¼ Inch Square	99 - 100
1 Inch Square	80 - 100
5/8 Inch Square	50 – 80
U.S. No. 4	25 - 45
U.S. No. 40	3 – 18
U.S. No. 200	Less than 7.5

A fifty (50) pound sample of each imported fill material shall be collected by GNN personnel prior to placement to ensure proper gradation and establish the moisture-density relationship (proctor curve).

12.7 Compaction Requirements for Engineered Fill

All fill or backfill shall be approved by a representative of the GER, placed in uniform lifts, and compacted to a minimum 95% of the maximum dry density as determined by ASTM D1557. The compaction effort must be verified by a representative of the GER in the field using a nuclear density gauge in accordance with ASTM D6938. The thickness of the loose, non-compacted, lift of structural fill shall not exceed 8 inches for heavy-duty compactors or 4 inches for hand operated compactors.

12.8 Building Pad & Foundation Subgrade Preparation

Building structures may be supported on conventional shallow foundations bearing on subgrade prepared in accordance with the recommendations of this report. We recommend that all building foundations, including all exterior footings, interior footings and isolated column footings for any over-hang patio roof/decks, be supported on uniform improved native subgrade support conditions. The minimum footing depth shall be 24 inches below adjacent grades for frost protection and bearing capacity considerations. Interior footings may be supported at nominal depths below the floor. All footings shall be protected against weather and water damage during/after construction.

Following completion of site clearing and grubbing operations, all foundation areas shall be over-excavated to expose the native silty gravels. We anticipate the native soils in the vicinity of the currently proposed building footprints will range from depths of approximately 3 to 8 feet BGS. In order to reduce the risk of differential settlement, we recommend the differential in depth of foundation over-excavation (thickness of fill) be limited to 50%; i.e. if the deepest required foundation over-ex is 6 feet, then no portion of the foundation excavation shall be less than 3 feet below footing elevation. The exposed native gravelly stratum shall be moisture-conditioned (as necessary) and proof-compacted to a dense and non-yielding surface. Any soft spots encountered during compaction shall be over-excavated an additional 12 inches and replaced as compacted fill. Although not anticipated, deeper foundation over-excavations may extend into groundwater; consequently, employment of appropriate means of dewatering by the contractor may be required.

Foundation backfill shall consist of suitable screened/processed onsite soils (see *Suitability of Onsite Soils as Engineered Fill*) and/or imported 2-inch minus Gravel Borrow material (meeting the grading and quality requirements of WSDOT Standard Spec. Sec. 9-03.14(1)). The upper 12 inches of backfill directly below the foundations shall consist of imported 1¼"-minus crushed rock structural fill placed as engineered fill, moisture-conditioned and compacted to at least 95% of the maximum dry density as determined by the ASTM D1557. Crushed rock structural fill shall extend minimum 12 inches beyond the edges of the footings.

Where future buildings are proposed near or on the existing slopes, building foundations will be required to be constructed with appropriate setbacks in accordance with IBC 2015 Section 1808.7 (see *Slope Setbacks* section below). In general, if buildings are constructed with the current proposed layout, deeper embedment of the foundations will be required in order to meet the minimum setback, such that a minimum distance of 10 feet from the exterior face of the footings to a projected 2H:1V slope face from the toe of the existing slope is maintained. These recommendations may require the need for stepped foundations across the building structure, or deeper foundations such as taller stem-walls or columns.

Footings constructed in accordance with the above recommendations may be designed for an allowable bearing capacity of **2,500 pounds per square foot (psf)**. The allowable bearing pressure may be increased by 1/3 for short-term transient loading conditions. The estimated total settlement

for footings is approximately 1-inch with differential settlement less than half that magnitude. The weight of the foundation concrete below grade may be neglected in dead load computations.

Lateral forces on foundations from short term wind and seismic loading would be resisted by friction at the base of foundations and passive earth pressure against the buried portions. We recommend an allowable passive earth pressure for the compacted onsite soil of **220 pcf**. This lateral foundation resistance value includes a factor of safety of 1.5. We recommend a coefficient of friction of **0.45** be used between cast-in-place concrete and imported crushed rock fill. An appropriate factor of safety should be used to calculate sliding resistance at the base of footings.

12.9 Slab-on-Grade Floors

We recommend placing a minimum 6-inch layer of crushed aggregate fill beneath all slabs. The material shall meet the WSDOT Specification 9-03.9 (3), "Crushed Surfacing Top Course". The crushed rock material shall be compacted to at least 95% of the maximum dry density as determined by the ASTM D1557 method. Prior to placement of crushed aggregate fill, the building pad shall be prepared as described above in the *Building Pad & Foundation Subgrade Preparation* section. We recommend a modulus of subgrade reaction equal to 120 pounds per cubic inch (pci) based on a value for gravel presented in the Portland Cement Association publication No. EB075.01D. Slab thickness, reinforcement and joint spacing shall be determined by a licensed engineer based on the intended use and loading.

An appropriate vapor retarder (15-mil polyethylene liner) shall be used (ASTM E1745/E1643) beneath areas receiving moisture sensitive resilient flooring/VCT where prevention of moisture migration through slab is essential. The slab designer should refer to ACI 302 and/or ACI 360 for procedures and cautions regarding the use and placement of a vapor retarder. The architect shall determine the need and use of a vapor retarder.

12.10 Retaining Walls

The following table presents recommendations for lateral earth pressures for use in retaining wall design. The values are given in terms of equivalent fluid pressures without surcharge loads and are based on the assumption that proper drainage is provided behind the wall, the backfill is horizontal and that no-buildup of hydrostatic pressure occurs.

Table 7: Lateral Earth Pressures

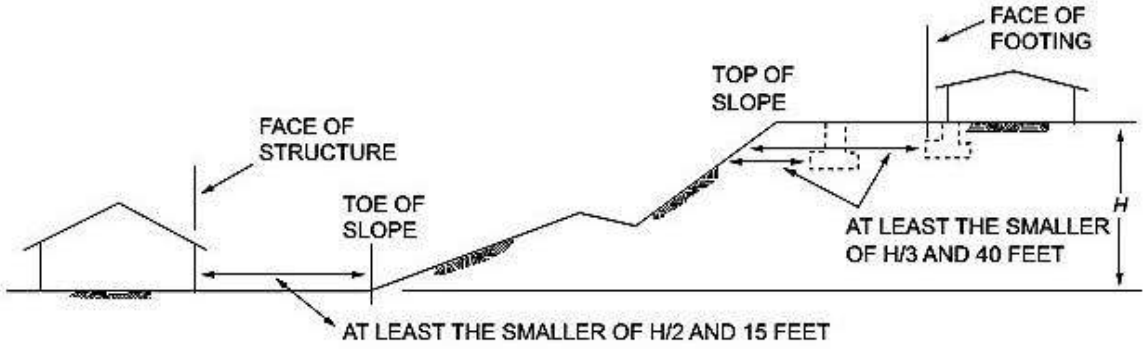
Lateral Pressures	Suitable Onsite Soils
Active Pressure Use when wall is permitted to rotate 0.1 to 0.2% of wall height for granular backfill	38 pcf - level ground
At-Rest Pressure	56 pcf - level ground

Drainage: Retaining structures should include adequate back drainage to avoid build-up of hydrostatic pressures. Positive drainage for retaining walls should consist of a vertical layer of permeable material (chimney drain), such as a pea gravel or crushed rock (typically ¼- to ¾-inch crushed), at least 18 inches thick, positioned between the retaining wall and the backfill. We recommend installing a non-woven filter fabric such as Mirafi 140N between the drainage material and the general backfill to prevent fines from migrating into the drainage material. A 4-inch diameter perforated or slotted drain-pipe, wrapped or socked in filter fabric, shall be installed at the bottom of the chimney drain.

Backfill and Subgrade Compaction: Compaction on the retained side of the wall within a horizontal distance equal to one wall height should be performed by hand-operated or other lightweight compaction equipment. This is intended to reduce potential locked-in lateral pressures caused by compaction with heavy grading equipment. Retaining wall foundations and subgrade improvements shall be constructed in accordance with the recommendations of this report.

12.11 Slope Setbacks

In accordance with IBC 2015 Section 1808.7 *Foundations on or Adjacent to Slopes*: "foundations on or adjacent to slope surfaces shall be founded in firm material with an embedment and setback from the slope surface sufficient to provide vertical and lateral support for the foundation without detrimental settlement." IBC Figure 1808.7.1 (presented below) defines the appropriate minimum setbacks from ascending and descending slope surfaces:



Appropriate setbacks can be accommodated by lateral offset and/or increased embedment. The long-term performance of the structure near slopes is dependent on the protection of slopes from erosion or over steepening from subsequent slope grading. Slopes should be maintained to prevent erosion or undermining of the toe.

12.12 Flexible Pavement

Due to the presence of undocumented fills throughout the project site, remedial grading will be required to minimize the risk of pavement distress. We recommend that the new pavement section be constructed on an improved subgrade. Due to the presence of artificial fills soils that include some miscellaneous trash and debris, the pavement subgrade over-excavation be completed in accordance with one of the following two options:

(1) Pavement areas shall be fully over-excavated to remove the artificial fill soils. Based on our site exploration, we anticipate that the maximum depth of excavation could be as great as approximately 8 feet.

(2) Excavate the proposed pavement areas to a minimum depth of 12 inches BGS. We recommend installing a Mirafi 600X geotextile fabric at the bottom of the over-ex. It must be understood that if this option is selected, the owner must accept some risks related to future distresses to the pavements including the potential for settlement and cracking.

After appropriate over-excavation is complete and confirmed by a representative of the GER, the exposed native subgrade shall be moisture-conditioned and compacted to a dense and non-yielding surface. After a suitable subgrade is confirmed by a representative of the GER, the over-excavation shall be backfilled with engineered structural fill soil consisting of suitable/screened onsite soil (see Section 12.3) and/or imported 2-inch minus Gravel Borrow material (meeting the grading and quality requirements of WSDOT Standard Spec. Sec. 9-03.14(1)). Engineered structural fill soils shall be placed in max. 8-inch thick loose lifts and each lift compacted to 95% of ASTM D1557. The following table presents recommended light duty and heavy-duty asphalt pavement sections for proposed project to constructed atop the prepared subgrade:

Table 8: Recommended Asphalt Concrete Paving Sections

Traffic	Asphalt Thickness (inches)	Crushed Aggregate Base Course (inches)
Heavy Duty†	4.0	10*
Standard Duty ††	3.0	6

†Heavy duty applies to pavements subjected to truck traffic and drive lanes
††Standard duty applies to general parking areas
*The upper 2" of crushed rock should be top course rock placed over the base course layer

Pavement section recommendations assume proper drainage and construction monitoring. Pavement shall be constructed on a dense and non-yielding surface. All fills used to raise low areas must be compacted structural fills and shall be placed under engineering control conditions.

Soils containing roots or organic materials shall be completely removed from the proposed paved areas prior to subgrade construction. The upper 12 inches of subgrade soils beneath the pavement section shall be moisture conditioned and proof-compacted to a dense and non-yielding condition. All fills used to raise low areas must be compacted onsite soils or structural gravel fill and shall be placed under engineering control conditions. The finished surface shall be smooth, uniform and free of localized weak/soft spots. All subgrade deficiency corrections and drainage provisions shall be made prior to placing the aggregate base course. All underground utilities shall be protected prior to grading.

The HMAC utilized for the project should be designed and produced in accordance with Section 5-04 Hot Mix Asphalt of the *Washington Department of Transportation 2014 Standard Specifications for Road and Bridge Construction* (WSDOT Specifications). Aggregate Base material shall comply with Section 9-03.9(3) Crushed Surfacing of the *WSDOT Specifications*. Aggregate base or pavement materials should not be placed when the surface is wet.

12.13 Subgrade Protection

The degree to which construction grading problems develop is expected to be dependent, in part, on the time of year that construction proceeds and the precautions which are taken by the contractor to protect the subgrade. The fine-grained soils currently present on site are considered to be moisture and disturbance sensitive due to their fines content and may become unstable (pumping) if allowed to increase in moisture content and are disturbed (rutted) by construction traffic if wet. If necessary, the construction access road should be covered with a layer of gravel or

quarry spalls course. The soils are also susceptible to erosion in the presence of moving water. The soils shall be stabilized to minimize the potential of erosion into the foundation excavation. The site shall be graded to prevent water from ponding within construction areas and/or flowing into excavations. Accumulated water must be removed immediately along with any unstable soil. Foundation concrete shall be placed and excavations backfilled as soon as possible to protect the bearing grade. We further recommend that soils that become unstable are to be either:

- Removed and replaced with structural compacted gravel fill, or
- Mechanically stabilized with a coarse crushed aggregate (possibly underlain with a geotextile) and compacted into the subgrade.

12.14 Surface Drainage

With respect to surface water drainage, we recommend that the ground surface be sloped to drain away from the structure. Final exterior site grades shall promote free and positive drainage from the building areas. Water shall not be allowed to pond or to collect adjacent to foundations or within the immediate building area. We recommend that a gradient of at least 5% for a minimum distance of 10 feet from the building perimeter be provided, except in paved locations. In paved areas, a minimum gradient of 1% should be provided unless provisions are included for collection/disposal of surface water adjacent to the structure. Catch basins, drainage swales, or other drainage facilities should be aptly located. All surface water such as that coming from roof downspouts and catch basins be collected in tight drain lines and carried to a suitable discharge point, such as a storm drain system. Surface water and downspout water should not discharge into a perforated or slotted subdrain, nor should such water discharge onto the ground surface adjacent to the building. Cleanouts should be provided at convenient locations along all drain lines.

12.15 Wet Weather Conditions

The project site soils are fine-grained and sensitive to moisture during handling and compaction. Proceeding with site earthwork operations using these soils during wet weather could add project costs and/or delays. The stability of exposed soils may rapidly deteriorate due to a change in moisture content. Therefore, if possible, complete site clearing, preparation, and earthwork during periods of warm, dry weather when soil moisture can be controlled by aeration. During/subsequent to wet weather, drying or compacting the on-site soils will be difficult. It may be necessary to

amend the on-site soils or import granular materials for use as structural fill. If earthwork takes place in wet weather/conditions, the following recommendations should be followed:

- Fill material should consist of clean, granular soil, and not more than 3% fines (by weight) should pass the No. 200 sieve. Fines should be non-plastic. These soils would have to be imported to the site.
- Earthwork should be accomplished in small sections and carried through to completion to reduce exposure to wet weather. Soils that becomes too wet for compaction should be removed and replaced with clean, granular material.
- The construction area ground surface should be sloped and sealed to reduce water infiltration, to promote rapid runoff, and to prevent water ponding.
- To prevent soil disturbance, the size or type of equipment may have to be limited.
- Work areas and stockpiles should be covered with plastic. Straw bales, straw wattles, geotextile silt fences, and other measures should be used as appropriate to control soil erosion.
- Excavation and fill placement should be observed on a full-time basis by a representative of GER to determine that unsuitable materials are removed and that suitable compaction and site drainage is achieved.

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14.0 CONTINUING GEOTECHNICAL SERVICES

GNN recommends that the Client should maintain an adequate program of geotechnical consultation, construction monitoring, and soils testing during the final design and construction phases to monitor compliance with GNN's geotechnical recommendations. Maintaining GNN as the geotechnical consultant from beginning to end of the project will provide continuity of services. If GN Northern, Inc. is not retained by the owner/developer and/or the contractor to provide the recommended geotechnical inspections/observations and testing services, the geotechnical engineering firm or testing/inspection firm providing tests and observations shall assume the role and responsibilities of Geotechnical Engineer-of-Record.

GNN can provide construction monitoring and testing as additional services. The costs of these services are not included in our present fee arrangement, but can be obtained from our office. The recommended construction monitoring and testing includes, but is not necessarily limited to, the following:

- Consultation during the design stages of the project.
- Review of the grading and drainage plans to monitor compliance and proper implementation of the recommendations in GNN's Report.
- Observation and quality control testing during site preparation, grading, and placement of engineered fill as required by the local building ordinances.
- Geotechnical engineering consultation as needed during construction

15.0 LIMITATIONS OF THE GEOTECHNICAL SITE INVESTIGATION REPORT

This GEOTECHNICAL SITE INVESTIGATION REPORT ("Report") was prepared for the exclusive use of the Client. GN Northern, Inc.'s (GNN) findings, conclusions and recommendations in this Report are based on selected points of field exploration, and GNN's understanding of the proposed project at the time the Report is prepared. Furthermore, GNN's findings and recommendations are based on the assumption that soil, rock and/or groundwater conditions do not vary significantly from those found at specific exploratory locations at the project site. Variations in soil, bedrock and/or groundwater conditions could exist between and beyond the exploration points. The nature and extent of these variations may not become evident until during or after construction. Variations in soil, bedrock and groundwater may require additional studies, consultation, and revisions to GNN's recommendations in the Report.

In many cases the scope of geotechnical exploration and the test locations are selected by others without consultation from the geotechnical engineer/consultant. GNN assumes no responsibility and, by preparing this Report, does not impliedly or expressly validate the scope of exploration and the test locations selected by others.

This Report's findings are valid as of the issued date of this Report. However, changes in conditions of the subject property or adjoining properties can occur due to passage of time, natural processes, or works of man. In addition, applicable building standards/codes may change over time. Accordingly, findings, conclusions, and recommendations of this Report may be invalidated, wholly or partially, by changes outside of GNN's control. Therefore, this Report is subject to review and shall not be relied upon after a period of **one (1) year** from the issued date of the Report.

In the event that any changes in the nature, design, or location of structures are planned, the findings, conclusions and recommendations contained in this Report shall not be considered valid unless the changes are reviewed by GNN and the findings, conclusions, and recommendations of this Report are modified or verified in writing.

This Report is issued with the understanding that the owner or the owner's representative has the responsibility to bring the findings, conclusions, and recommendations contained herein to the attention of the architect and design professional(s) for the project so that they are incorporated

into the plans and construction specifications, and any follow-up addendum for the project. The owner or the owner's representative also has the responsibility to verify that the general contractor and all subcontractors follow such recommendations during construction. It is further understood that the owner or the owner's representative is responsible for submittal of this Report to the appropriate governing agencies. The foregoing notwithstanding, no party other than the Client shall have any right to rely on this Report and GNN shall have no liability to any third party who claims injury due to reliance upon this Report, which is prepared exclusively for Client's use and reliance.

GNN has provided geotechnical services in accordance with generally accepted geotechnical engineering practices in this locality at this time. GNN expressly disclaims all warranties and guarantees, express or implied.

Client shall provide GNN an opportunity to review the final design and specifications so that earthwork, drainage and foundation recommendations may be properly interpreted and implemented in the design and specifications. If GNN is not accorded the review opportunity, GNN shall have no responsibility for misinterpretation of GNN's recommendations.

Although GNN can provide environmental assessment and investigation services for an additional cost, the current scope of GNN's services does not include an environmental assessment or an investigation for the presence or absence of wetlands, hazardous or toxic materials in the soil, surface water, groundwater, or air on, below, or adjacent to the subject property.

APPENDICES

Appendix I

Vicinity Map (Figure 1)

Site Exploration Map (Figure 2)

Critical Areas Map (Figure 3)

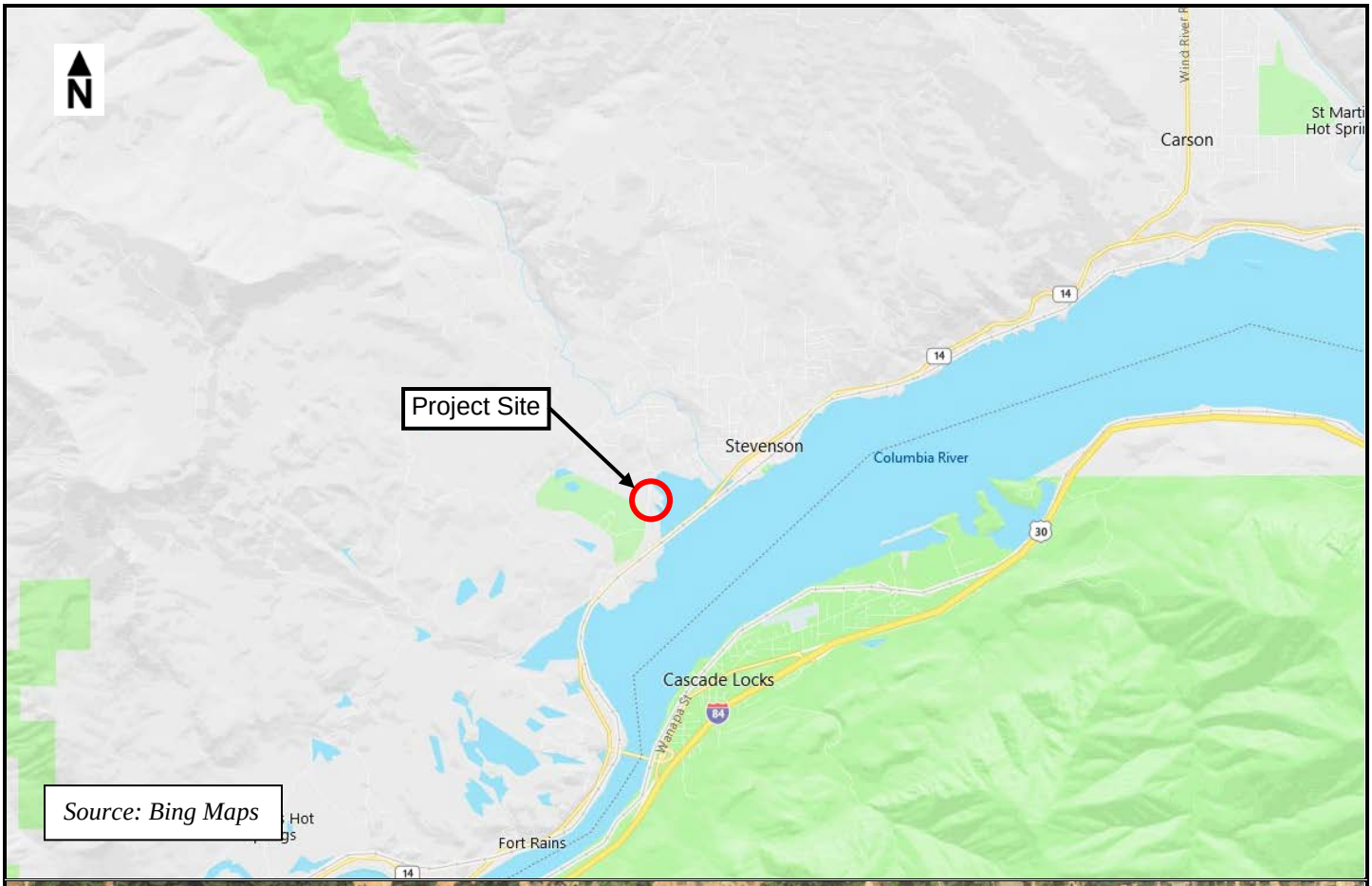

FIGURE 1: VICINITY MAP **PROJECT NO. 219-1183**

FIGURE 2: SITE EXPLORATION MAP **PROJECT NO. 219-1183**

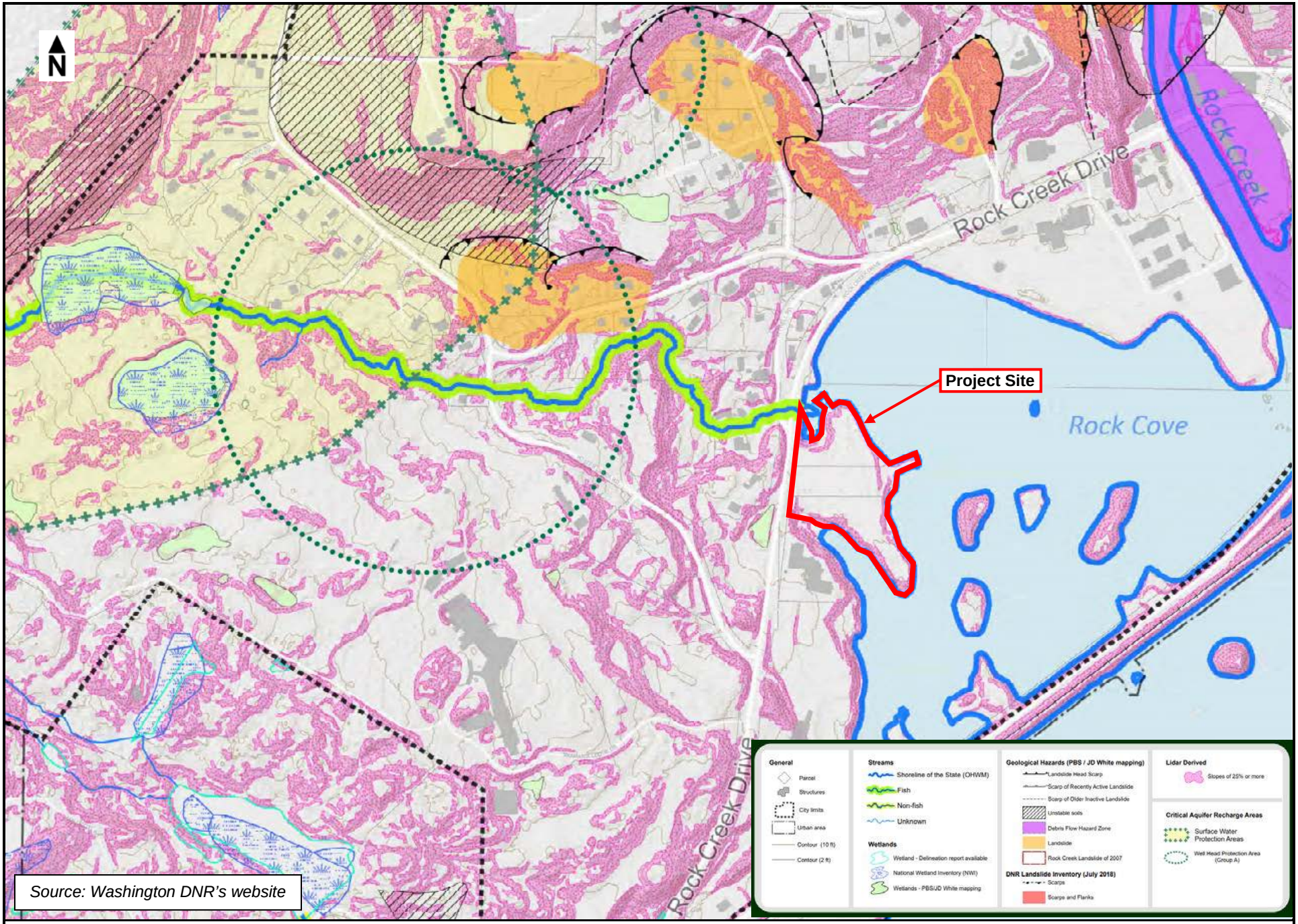

FIGURE 3: CRITICAL AREAS MAP **PROJECT NO. 219-1183**

Appendix II
Exploratory Test-Pit Logs
Key Chart (for Soil Classification)

GN Northern Inc.
11115 E. Montgomery, Suite C
Spokane Valley, WA, 99206
Telephone: (509) 248-9798
Fax: (509) 248-4220

TEST PIT NUMBER TP-1

CLIENT FDM Development
PROJECT NAME Proposed Rock Creek Cove Development
PROJECT NUMBER 219-1183
PROJECT LOCATION Rock Creek Drive, Stevenson, WA
DATE STARTED 12/23/19 **COMPLETED** 12/23/19
GROUND ELEVATION 98 ft **TEST PIT SIZE** 36 x 96 inches
EXCAVATION CONTRACTOR Riley Materials
GROUND WATER LEVELS:
EXCAVATION METHOD Link-Belt 145x4 Excavator
AT TIME OF EXCAVATION ---
LOGGED BY KAH **CHECKED BY** MYM
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 45°41'19.59"N, 121°53'55.44"W
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					~6" to 18" LANDSCAPE CUTTINGS / ORGANIC DEBRIS
					1.5 — 96.5
2.5			GP-GM		FILL: POORLY GRADED GRAVEL WITH SILT AND SAND, (GP-GM) gray, moist to wet, appears loose to medium dense, with cobbles, with wood and organic debris - pipe at ~3' BGS
					4.5 — 93.5
5.0	GB	MC = 22% Fines = 18%			CLAYEY GRAVEL WITH SAND, (GC) brown, wet, appears loose to medium dense, with organics and roots (APPARENT NATIVE)
7.5					- becomes blueish gray, moist, appears medium dense (NATIVE)
10.0			GC		- with boulders from 10' to 11'
12.5					
					14.5 — 83.5

- Significant amount of surface water flowing into test-pit excavation
- Referenced elevations are approximate and based on Survey Topography for Lots 2, 3, and 4 of Rock Creek Cove dated December 11, 2019 prepared by S&F Land Services

Bottom of test pit at 14.5 feet.

GN Northern Inc.
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TEST PIT NUMBER TP-2

CLIENT FDM Development
PROJECT NAME Proposed Rock Creek Cove Development
PROJECT NUMBER 219-1183
PROJECT LOCATION Rock Creek Drive, Stevenson, WA
DATE STARTED 12/23/19 **COMPLETED** 12/23/19
GROUND ELEVATION 98 ft **TEST PIT SIZE** 36 x 96 inches
EXCAVATION CONTRACTOR Riley Materials
GROUND WATER LEVELS:
EXCAVATION METHOD Link-Belt 145x4 Excavator
AT TIME OF EXCAVATION ---
LOGGED BY KAH **CHECKED BY** MYM
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 45°41'18.75"N, 121°53'55.09"W
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					FILL: SILTY GRAVEL WITH SAND, (GM) brown, angular, moist, appears loose, with cobbles, with roots
2.5					- becomes orange brown, appears loose to medium dense, some cobbles
	GB	MC = 28% Fines = 47%	GM		
5.0					- with a significant amount of woody debris, organics, roots
7.5					8.0 90.0
					SILTY GRAVEL WITH SAND, (GM) brown, subrounded, moist, appears medium dense to dense, with cobbles and boulders (APPARENT NATIVE)
10.0			GM		
12.5					14.0 84.0

- Groundwater not encountered at time of excavation
- Referenced elevations are approximate and based on Google Earth topography

Bottom of test pit at 14.0 feet.

GN Northern Inc.
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TEST PIT NUMBER TP-3

CLIENT FDM Development
PROJECT NAME Proposed Rock Creek Cove Development
PROJECT NUMBER 219-1183
PROJECT LOCATION Rock Creek Drive, Stevenson, WA
DATE STARTED 12/23/19 **COMPLETED** 12/23/19
GROUND ELEVATION 97 ft **TEST PIT SIZE** 36 x 96 inches
EXCAVATION CONTRACTOR Riley Materials
GROUND WATER LEVELS:
EXCAVATION METHOD Link-Belt 145x4 Excavator
▽ **AT TIME OF EXCAVATION** 14.00 ft / Elev 83.00 ft
LOGGED BY KAH **CHECKED BY** MYM
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 45°41'20.75"N, 121°53'55.36"W
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0			GP-GM		FILL: POORLY GRADED GRAVEL WITH SILT AND SAND, (GP-GM) gray brown, angular, wet, appears loose to medium dense, with cobbles
3.0					94.0
			GM		SILTY GRAVEL WITH SAND, (GM) brown, subrounded, moist, appears medium dense, trace cobbles (APPARENT NATIVE)
10.0	GB	MC = 29% Fines = 28%			- becomes blueish gray
14.5					82.5

- Groundwater encountered at ~14' BGS at time of excavation
- Referenced elevations are approximate and based on Google Earth topography

Bottom of test pit at 14.5 feet.

GN Northern Inc.
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TEST PIT NUMBER TP-4

CLIENT FDM Development
PROJECT NAME Proposed Rock Creek Cove Development
PROJECT NUMBER 219-1183
PROJECT LOCATION Rock Creek Drive, Stevenson, WA
DATE STARTED 12/23/19 **COMPLETED** 12/23/19
GROUND ELEVATION 94.9 ft **TEST PIT SIZE** 36 x 96 inches
EXCAVATION CONTRACTOR Riley Materials
GROUND WATER LEVELS:
EXCAVATION METHOD Link-Belt 145x4 Excavator
AT TIME OF EXCAVATION ---
LOGGED BY KAH **CHECKED BY** MYM
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 45°41'23.09"N, 121°53'53.97"W
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0.0				TOPSOIL/DUFF	
1.0					93.9
2.5		GM		FILL: SILTY GRAVEL WITH SAND, (GM) brown, moist, appears loose to medium dense, some cobbles, trace boulders	
5.0					
6.0				- chainsaw blade	88.9
7.5		GM		SILTY GRAVEL WITH SAND, (GM) light brown, damp, appears medium dense, some cobbles (APPARENT NATIVE)	
10.0					
12.5					
13.0					81.9

- Groundwater not encountered at time of excavation
- Referenced elevations are approximate and based on Google Earth topography

Bottom of test pit at 13.0 feet.

GN Northern Inc.
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TEST PIT NUMBER TP-5

CLIENT FDM Development
PROJECT NAME Proposed Rock Creek Cove Development
PROJECT NUMBER 219-1183
PROJECT LOCATION Rock Creek Drive, Stevenson, WA
DATE STARTED 12/23/19 **COMPLETED** 12/23/19
GROUND ELEVATION 96.9 ft **TEST PIT SIZE** 36 x 96 inches
EXCAVATION CONTRACTOR Riley Materials
GROUND WATER LEVELS:
EXCAVATION METHOD Link-Belt 145x4 Excavator
AT TIME OF EXCAVATION ---
LOGGED BY KAH **CHECKED BY** MYM
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 45°41'22.14"N, 121°53'53.51"W
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0.0				TOPSOIL/SLASH/DUFF	
				1.0	95.9
		GM		APPARENT FILL: SILTY GRAVEL WITH SAND, (GM) brown, moist, appears loose to medium dense, some cobbles, trace boulders	
2.5					
5.0				5.0	91.9
		GM		SILTY GRAVEL WITH SAND, (GM) light brown, damp to moist, appears medium dense, some cobbles (APPARENT NATIVE)	
7.5					
10.0					
				12.0	84.9

- Groundwater not encountered at time of excavation
- Referenced elevations are approximate and based on Google Earth topography

Bottom of test pit at 12.0 feet.

GN Northern Inc.
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TEST PIT NUMBER TP-6

CLIENT FDM Development
PROJECT NAME Proposed Rock Creek Cove Development
PROJECT NUMBER 219-1183
PROJECT LOCATION Rock Creek Drive, Stevenson, WA
DATE STARTED 12/23/19 **COMPLETED** 12/23/19
GROUND ELEVATION 98 ft **TEST PIT SIZE** 36 x 96 inches
EXCAVATION CONTRACTOR Riley Materials
GROUND WATER LEVELS:
EXCAVATION METHOD Link-Belt 145x4 Excavator
AT TIME OF EXCAVATION ---
LOGGED BY KAH **CHECKED BY** MYM
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 45°41'21.16"N, 121°53'53.95"W
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0.0				~12" CONCRETE SLAB	
				1.0	97.0
				FILL: BASALTIC GRAVEL/COBBLES, angular, some silty/sandy soil matrix	
				2.0	96.0
2.5		SM		FILL: SILTY SAND, (SM) gray, fine grained, damp to moist, appears medium dense	
				3.0	95.0
5.0		GM		SILTY GRAVEL WITH SAND, (GM) brown, rounded to subrounded, damp to moist, appears medium dense to dense, with cobbles and boulders (APPARENT NATIVE)	
7.5					
10.0					
				12.0	86.0

- Groundwater not encountered at time of excavation
- Referenced elevations are approximate and based on Google Earth topography

Bottom of test pit at 12.0 feet.

GN Northern Inc.
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TEST PIT NUMBER TP-7

CLIENT FDM Development
PROJECT NAME Proposed Rock Creek Cove Development
PROJECT NUMBER 219-1183
PROJECT LOCATION Rock Creek Drive, Stevenson, WA
DATE STARTED 12/23/19 **COMPLETED** 12/23/19
GROUND ELEVATION 97.6 ft **TEST PIT SIZE** 36 x 96 inches
EXCAVATION CONTRACTOR Riley Materials
GROUND WATER LEVELS:
EXCAVATION METHOD Link-Belt 145x4 Excavator
AT TIME OF EXCAVATION ---
LOGGED BY KAH **CHECKED BY** MYM
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 45°41'19.86"N, 121°53'52.14"W
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0.0				~6" TOPSOIL	97.1
0.5		GM		FILL: SILTY GRAVEL WITH SAND, (GM) brown, moist, appears loose to medium dense, some cobbles, trace boulders	
3.0		GM		SILTY GRAVEL WITH SAND, (GM) light brown, damp to moist, appears medium dense, some cobbles (APPARENT NATIVE)	94.6
13.0					84.6

- Groundwater not encountered at time of excavation
- Referenced elevations are approximate and based on Google Earth topography

Bottom of test pit at 13.0 feet.

GN Northern Inc.
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TEST PIT NUMBER TP-8

CLIENT FDM Development
PROJECT NAME Proposed Rock Creek Cove Development
PROJECT NUMBER 219-1183
PROJECT LOCATION Rock Creek Drive, Stevenson, WA
DATE STARTED 12/23/19 **COMPLETED** 12/23/19
GROUND ELEVATION 89.5 ft **TEST PIT SIZE** 36 x 96 inches
EXCAVATION CONTRACTOR Riley Materials
GROUND WATER LEVELS:
EXCAVATION METHOD Link-Belt 145x4 Excavator
▽ **AT TIME OF EXCAVATION** 12.00 ft / Elev 77.50 ft
LOGGED BY KAH **CHECKED BY** MYM
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 45°41'20.44"N, 121°53'51.63"W
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0		GM		FILL: SILTY GRAVEL WITH SAND, (GM) brown, moist, appears loose, some cobbles
2.0 / 87.5				
2.5		GM		SILTY GRAVEL WITH SAND, (GM) brown, damp to moist, appears medium dense, some cobbles (APPARENT NATIVE)
5.0				
7.5				
10.0				- becomes moist to wet
12.5				▽
14.5 / 75.0				

- Groundwater encountered at ~12' BGS at time of excavation
- Referenced elevations are approximate and based on Google Earth topography

Bottom of test pit at 14.5 feet.

GN Northern Inc.
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TEST PIT NUMBER TP-9

CLIENT FDM Development
PROJECT NAME Proposed Rock Creek Cove Development
PROJECT NUMBER 219-1183
PROJECT LOCATION Rock Creek Drive, Stevenson, WA
DATE STARTED 12/23/19 **COMPLETED** 12/23/19
GROUND ELEVATION 87 ft **TEST PIT SIZE** 36 x 96 inches
EXCAVATION CONTRACTOR Riley Materials
GROUND WATER LEVELS:
EXCAVATION METHOD Link-Belt 145x4 Excavator
AT TIME OF EXCAVATION ---
LOGGED BY KAH **CHECKED BY** MYM
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 45°41'20.74"N, 121°53'49.97"W
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0				~6" to 12" TOPSOIL/ORGANICS
1.0				86.0
		GM		FILL: SILTY GRAVEL WITH SAND, (GM) brown, moist, appears loose to medium dense, some cobbles, trace boulders (APPARENT FILL)
2.5				
5.0				
7.5				
8.0				79.0

- Groundwater not encountered at time of excavation
- Referenced elevations are approximate and based on Google Earth topography

Bottom of test pit at 8.0 feet.

GN Northern Inc.
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TEST PIT NUMBER TP-10

CLIENT FDM Development
PROJECT NAME Proposed Rock Creek Cove Development
PROJECT NUMBER 219-1183
PROJECT LOCATION Rock Creek Drive, Stevenson, WA
DATE STARTED 12/23/19 **COMPLETED** 12/23/19
GROUND ELEVATION 100.3 ft **TEST PIT SIZE** 36 x 96 inches
EXCAVATION CONTRACTOR Riley Materials
GROUND WATER LEVELS:
EXCAVATION METHOD Link-Belt 145x4 Excavator
AT TIME OF EXCAVATION ---
LOGGED BY KAH **CHECKED BY** MYM
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 45°41'15.46"N, 121°53'49.93"W
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0		GM		APPARENT FILL: SILTY GRAVEL WITH SAND, (GM) brown, moist, appears loose to medium dense, some cobbles
4.0				96.3
		GM		SILTY GRAVEL WITH SAND, (GM) light brown, damp to moist, appears medium dense, some roots in upper ~6", some cobbles (APPARENT NATIVE)
				- becomes orange brown, damp to moist (NATIVE)
13.0				87.3

- Groundwater not encountered at time of excavation
- Referenced elevations are approximate and based on Google Earth topography

Bottom of test pit at 13.0 feet.

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TEST PIT NUMBER TP-11

CLIENT FDM Development
PROJECT NAME Proposed Rock Creek Cove Development
PROJECT NUMBER 219-1183
PROJECT LOCATION Rock Creek Drive, Stevenson, WA
DATE STARTED 12/23/19 **COMPLETED** 12/23/19
GROUND ELEVATION 104 ft **TEST PIT SIZE** 36 x 96 inches
EXCAVATION CONTRACTOR Riley Materials
GROUND WATER LEVELS:
EXCAVATION METHOD Link-Belt 145x4 Excavator
AT TIME OF EXCAVATION ---
LOGGED BY KAH **CHECKED BY** MYM
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 45°41'16.39"N, 121°53'50.59"W
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	TESTS	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION
0.0					FILL: SILTY SAND WITH GRAVEL, (SM) dark gray brown, fine grained, damp to moist, appears loose to medium dense, with misc. trash/metal debris
2.5			SM		- becomes cemented, very dense
3.5					100.5
	GB	MC = 17% Fines = 12%			APPARENT FILL: SILTY SAND, (SM) reddish brown, fine grained, damp, appears medium dense, some gravel
5.0			SM		
6.0					98.0
7.5			GM		SILTY GRAVEL WITH SAND, (GM) light brown, damp to moist, appears medium dense, with cobbles, with boulders (APPARENT NATIVE)
10.0				10.0	94.0

- Groundwater not encountered at time of excavation
- Referenced elevations are approximate and based on Google Earth topography

Bottom of test pit at 10.0 feet.

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TEST PIT NUMBER TP-12

CLIENT FDM Development
PROJECT NAME Proposed Rock Creek Cove Development
PROJECT NUMBER 219-1183
PROJECT LOCATION Rock Creek Drive, Stevenson, WA
DATE STARTED 12/23/19 **COMPLETED** 12/23/19
GROUND ELEVATION 99.5 ft **TEST PIT SIZE** 36 x 96 inches
EXCAVATION CONTRACTOR Riley Materials
GROUND WATER LEVELS:
EXCAVATION METHOD Link-Belt 145x4 Excavator
AT TIME OF EXCAVATION ---
LOGGED BY KAH **CHECKED BY** MYM
AT END OF EXCAVATION ---
NOTES Approx. GPS Coords.: 45°41'17.30"N, 121°53'51.73"W
AFTER EXCAVATION ---

DEPTH (ft)	SAMPLE TYPE NUMBER	U.S.C.S.	GRAPHIC LOG	MATERIAL DESCRIPTION	
0.0				~12" TOPSOIL/DUFF	
				1.0	98.5
				APPARENT FILL: SILTY GRAVEL WITH SAND, (GM) brown, damp, appears medium dense, some roots	
2.5		GM			
5.0				6.0	93.5
				SILTY GRAVEL WITH SAND, (GM) light brown, damp, appears medium dense, some cobbles (APPARENT NATIVE)	
7.5		GM			
10.0				11.0	88.5

- Groundwater not encountered at time of excavation
- Referenced elevations are approximate and based on Google Earth topography

Bottom of test pit at 11.0 feet.

Northern, Inc.
Kennewick, Yakima, Spokane, Hermiston (OR)

KEY CHART

RELATIVE DENSITY OR CONSISTENCY VERSUS SPT N-VALUE

COARSE-GRAINED SOILS			FINE-GRAINED SOILS		
DENSITY	N (BLOWS/FT)	FIELD TEST	CONSISTENCY	N (BLOWS/FT)	FIELD TEST
Very Loose	0 – 4	Easily penetrated with ½-inch reinforcing rod pushed by hand	Very Soft	0 – 2	Easily penetrated several inches by thumb
Loose	4 – 10	Difficult to penetrate with ½-inch reinforcing rod pushed by hand	Soft	2 – 4	Easily penetrated one inch by thumb
Medium -Dense	10 – 30	Easily penetrated with ½-inch rod driven with a 5-lb hammer	Medium-Stiff	4 – 8	Penetrated over ½-inch by thumb with moderate effort
Dense	30 – 50	Difficult to penetrate with ½-inch rod driven with a 5-lb hammer	Stiff	8 – 15	Indented about ½-inch by thumb but penetrated with great effort
Very Dense	> 50	penetrated only a few inches with ½-inch rod driven with a 5-lb hammer	Very Stiff	15 – 30	Readily indented by thumb
			Hard	> 30	Indented with difficulty by thumbnail

USCS SOIL CLASSIFICATION

MAJOR DIVISIONS				GROUP DESCRIPTION
Coarse-Grained Soils <50% passes #200 sieve	**Gravel** and **Gravelly Soils** <50% coarse fraction passes #4 sieve	**Gravel** (with little or no fines)	GW	Well-graded **Gravel**
			GP	Poorly Graded **Gravel**
		Gravel (with >12% fines)	GM	Silty **Gravel**
			GC	Clayey **Gravel**
	Sand and **Sandy Soils** >50% coarse fraction passes #4 sieve	**Sand** (with little or no fines)	SW	Well-graded **Sand**
			SP	Poorly graded **Sand**
		Sand (with >12% fines)	SM	Silty **Sand**
			SC	Clayey **Sand**
Fine-Grained Soils >50% passes #200 sieve	**Silt** and **Clay** Liquid Limit < 50		ML	**Silt**
			CL	Lean **Clay**
			OL	Organic **Silt** and C**lay** (low plasticity)
	Silt and **Clay** Liquid Limit > 50		MH	Inorganic **Silt**
			CH	Inorganic **Clay**
			OH	Organic **Clay** and **Silt** (med. to high plasticity)
Highly Organic Soils			PT	**Peat**
				Top Soil

LOG SYMBOLS

	2S	2" OD Split Spoon (SPT)
	3S	3" OD Split Spoon
	NS	Non-Standard Split Spoon
	ST	Shelby Tube
	CR	Core Run
	BG	Bag Sample
	TV	Torvane Reading
	PP	Penetrometer Reading
	NR	No Recovery
	GW	Groundwater Table

MODIFIERS

DESCRIPTION	RANGE
Trace	<5%
Little	5% – 12%
Some	>12%

MOISTURE CONTENT

DESCRIPTION	FIELD OBSERVATION
Dry	Absence of moisture, dusty, dry to the touch
Moist	Damp but not visible water
Wet	Visible free water

SOIL CLASSIFICATION INCLUDES

1. Group Name
2. Group Symbol
3. Color
4. Moisture content
5. Density / consistency
6. Cementation
7. Particle size (if applicable)
8. Odor (if present)
9. Comments

MAJOR DIVISIONS WITH GRAIN SIZE

SIEVE SIZE						
12"	3"	3/4"	4	10	40	200
GRAIN SIZE (INCHES)						
12	3	0.75	0.19	0.079	0.0171	0.0029

Boulders	Cobbles	Gravel		Sand			Silt and Clay
		Coarse	Fine	Coarse	Medium	Fine	

Conditions shown on boring and testpit logs represent our observations at the time and location of the fieldwork, modifications based on lab test, analysis, and geological and engineering judgment. These conditions may not exist at other times and locations, even in close proximity thereof. This information was gathered as part of our investigation, and we are not responsible for any use or interpretation of the information by others.

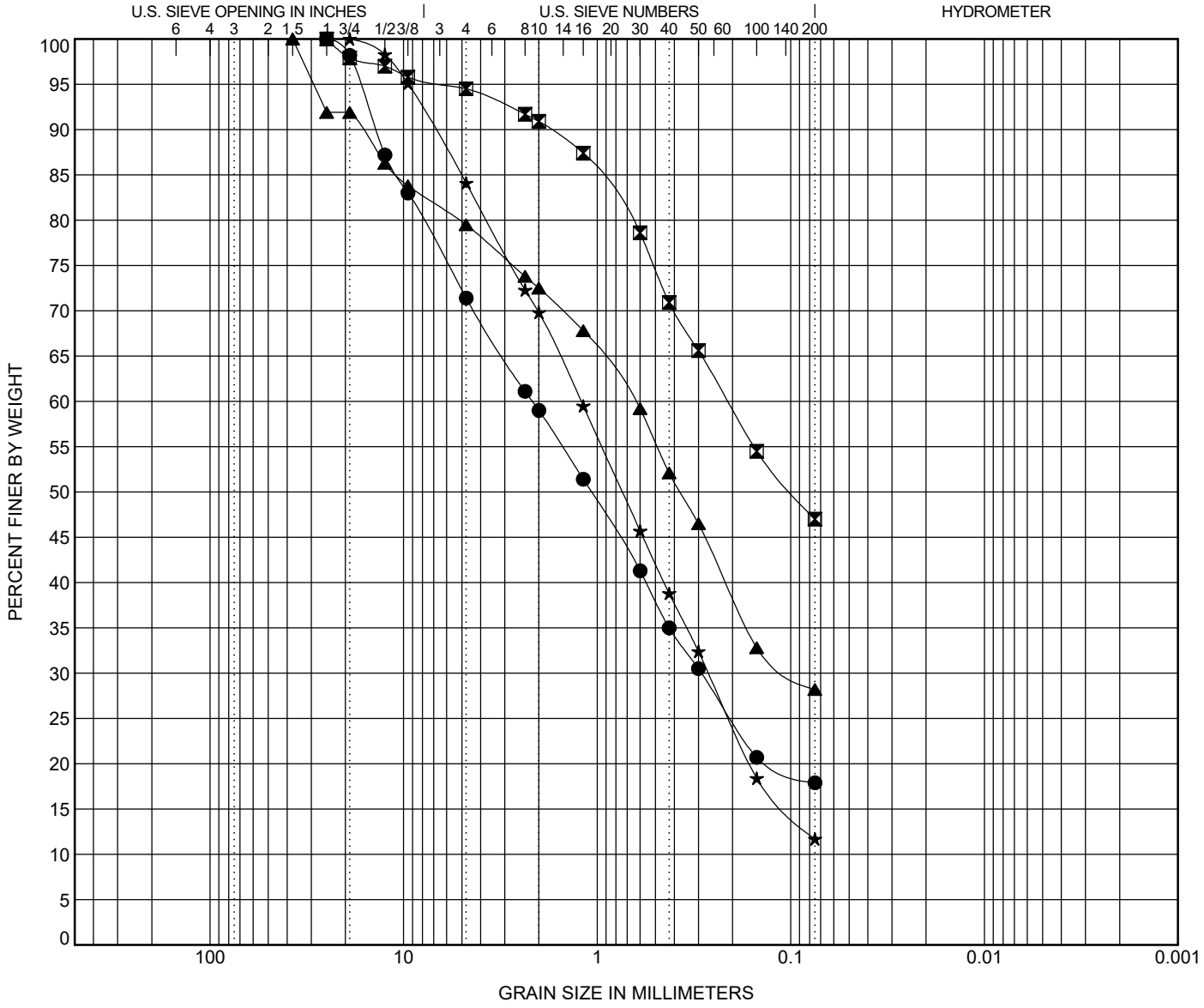
Appendix III
Laboratory Testing Results

GN Northern Inc.
11115 E. Montgomery, Suite C
Spokane Valley, WA, 99206
Telephone: (509) 248-9798
Fax: (509) 248-4220

GRAIN SIZE DISTRIBUTION

CLIENT FDM Development **PROJECT NAME** Proposed Rock Creek Cove Development

PROJECT NUMBER 219-1183 **PROJECT LOCATION** Rock Creek Drive, Stevenson, WA



COBBLES	GRAVEL		SAND			SILT OR CLAY
	coarse	fine	coarse	medium	fine	

	BOREHOLE	DEPTH	Classification	LL	PL	PI	Cc	Cu
●	TP-1	5.0	SILTY SAND WITH GRAVEL (SM)					
⊠	TP-2	3.5	SILTY SAND (SM)					
▲	TP-3	11.0	SILTY SAND WITH GRAVEL (SM)					
★	TP-11	4.0	SILTY SAND WITH GRAVEL (SM)				0.93	19.25

	BOREHOLE	DEPTH	D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	TP-1	5.0	25	2.164	0.29		28.6	53.5	17.9	
⊠	TP-2	3.5	25	0.211			5.5	47.5	47.0	
▲	TP-3	11.0	37.5	0.639	0.098		20.5	51.3	28.2	
★	TP-11	4.0	19	1.211	0.266		15.9	72.4	11.7	

Appendix IV
Site & Exploration Photographs

Excavation of test-pit TP-1, looking west

Exposed subsurface soil profile within test-pit TP-1

Excavation of test-pit TP-2, looking southwest

Exposed subsurface soil profile within test-pit TP-2

Excavation of test-pit TP-3, looking west

Exposed subsurface soil profile within test-pit TP-3

PLATE 1: SITE & EXPLORATION PHOTOGRAPHS **PROJECT NO. 219-1183**

View of site conditions near test-pit TP-4

Exposed subsurface soil profile within test-pit TP-4

Excavation of test-pit TP-5, looking east

Exposed subsurface soil profile within test-pit TP-5

Excavation of test-pit TP-6, looking north

Exposed subsurface soil profile within test-pit TP-6

PLATE 2: SITE & EXPLORATION PHOTOGRAPHS **PROJECT NO. 219-1183**

View of site conditions near test-pit TP-7, looking north

View of site conditions

View of site conditions near test-pit TP-8, looking west

Exposed subsurface soil profile within test-pit TP-8

Exposed subsurface soil profile within test-pit TP-9

Exposed subsurface soil profile within test-pit TP-10

PLATE 3: SITE & EXPLORATION PHOTOGRAPHS **PROJECT NO. 219-1183**

Exposed subsurface soil profile within test-pit TP-11

Exposed subsurface soil profile within test-pit TP-11

Excavation of test-pit TP-12, looking southwest

Exposed subsurface soil profile within test-pit TP-12

View of site conditions near test-pit TP-12, looking northwest

Infiltration test setup at test-pit P-1

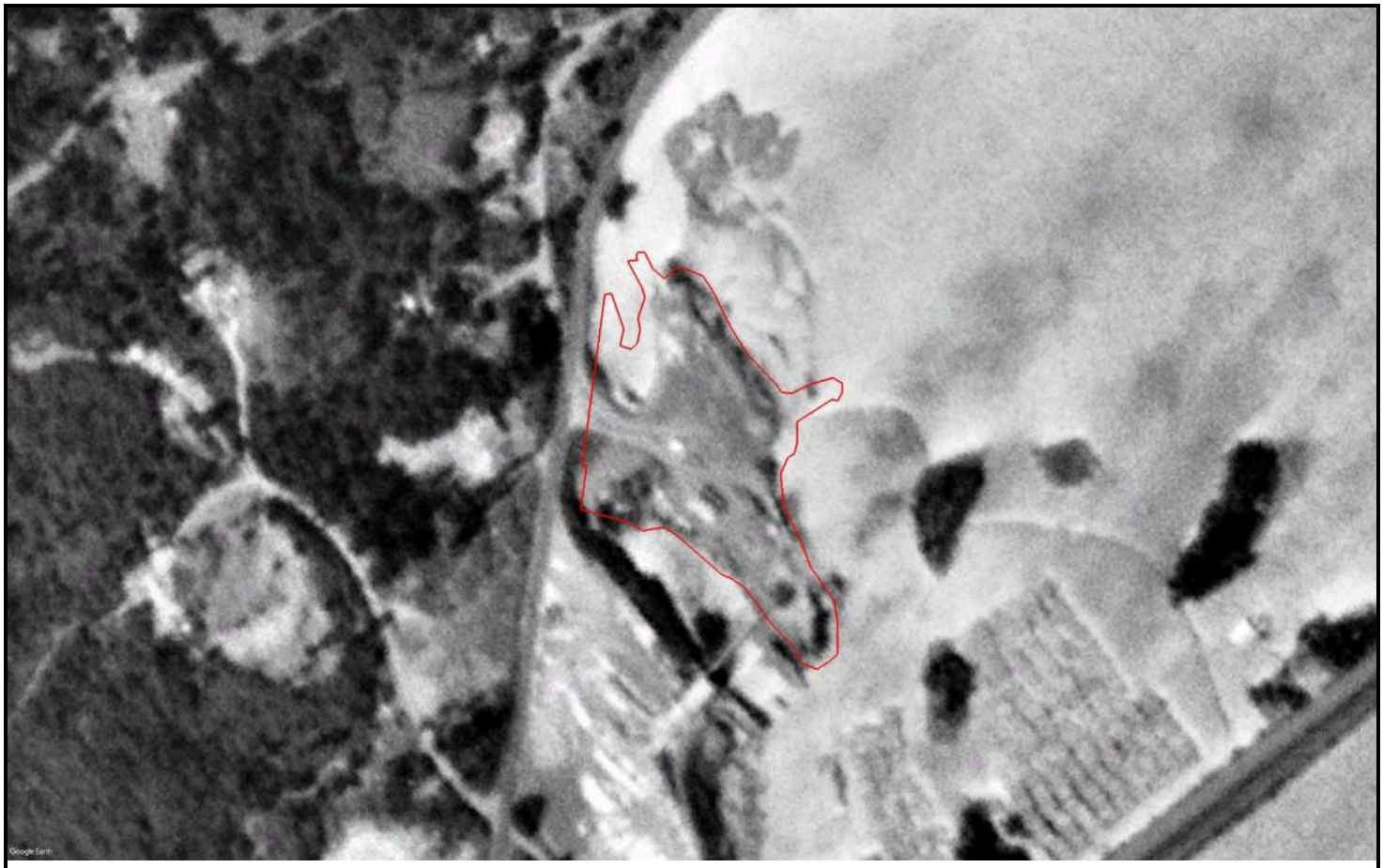
PLATE 4: SITE & EXPLORATION PHOTOGRAPHS **PROJECT NO. 219-1183**

Appendix V
Historic Aerial Photographs

1935 Historic USGS Aerial

1952 Historic USGS Aerial

PLATE 1: HISTORIC AERIAL PHOTOGRAPHS **PROJECT NO. 119-1183**

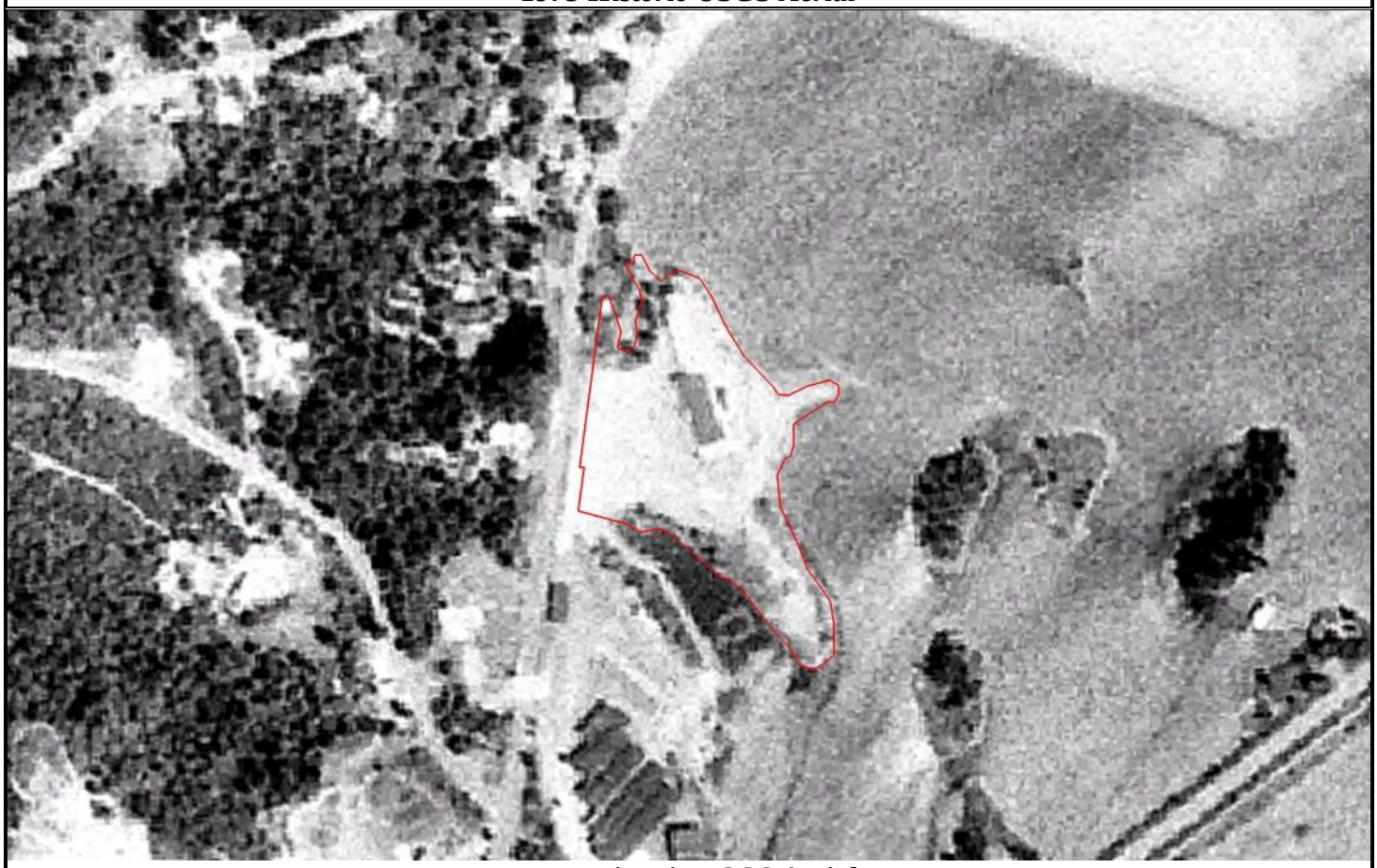


1955 Historic USGS Aerial

1973 Historic USGS Aerial

PLATE 2: HISTORIC AERIAL PHOTOGRAPHS **PROJECT NO. 119-1183**

1975 Historic USGS Aerial



1979 Historic USGS Aerial

PLATE 3: HISTORIC AERIAL PHOTOGRAPHS **PROJECT NO. 119-1183**

1981 Historic USGS Aerial

1984 Historic USGS Aerial

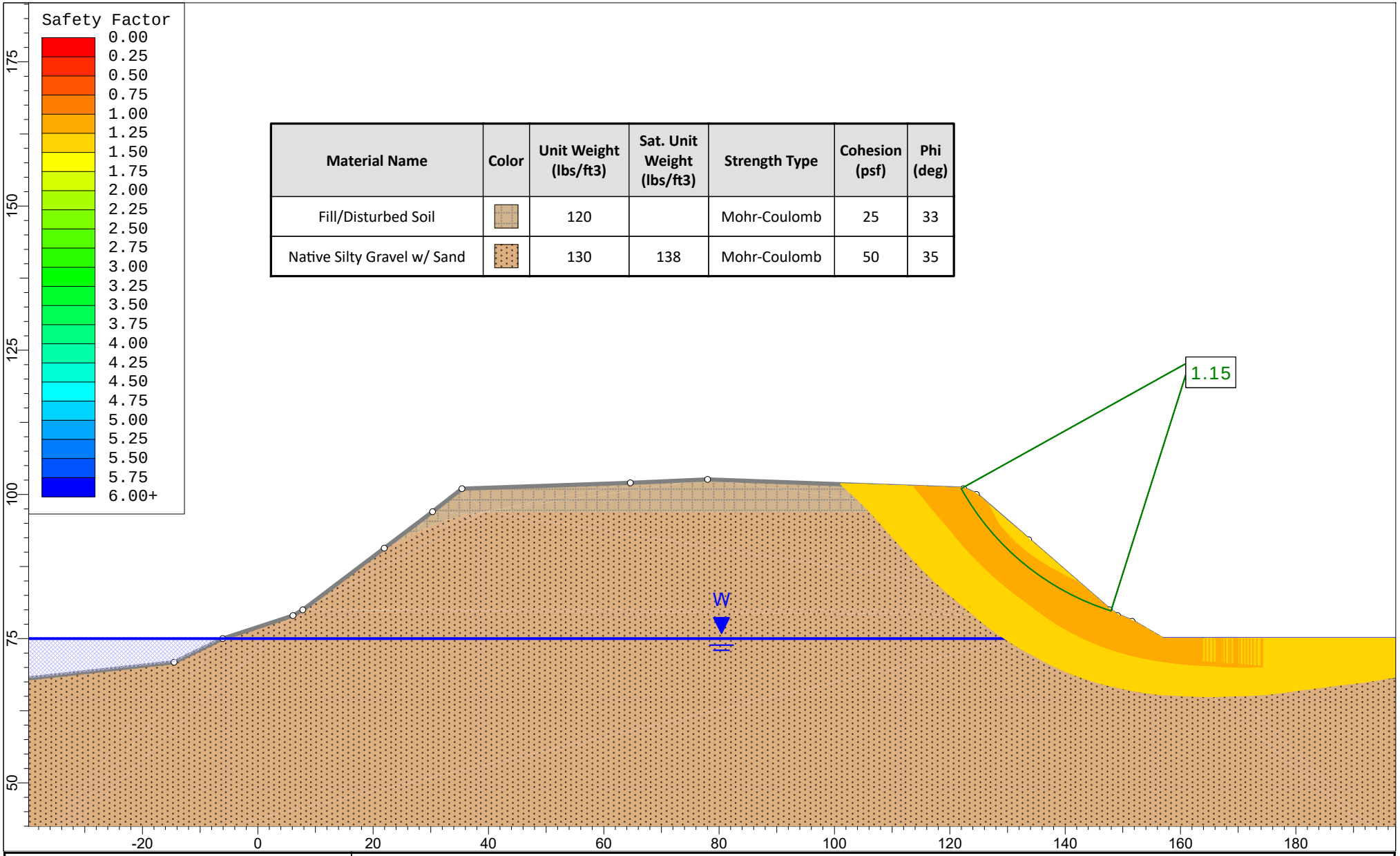
PLATE 4: HISTORIC AERIAL PHOTOGRAPHS **PROJECT NO. 119-1183**

1993 Historic USGS Aerial

2007 Historic USGS Aerial

PLATE 5: HISTORIC AERIAL PHOTOGRAPHS **PROJECT NO. 119-1183**

Appendix VI
Slope Stability Analysis



Material Name	Color	Unit Weight (lbs/ft3)	Sat. Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)
Fill/Disturbed Soil		120		Mohr-Coulomb	25	33
Native Silty Gravel w/ Sand		130	138	Mohr-Coulomb	50	35

Northern, Inc.
Consulting Engineers Environmental Scientists Geologists
Construction Materials Testing Geophysical Services

SLIDEINTERPRET 7.037

Project	Rock Creek Cove Vacation Homes Project		
Analysis Description	Existing Slopes Across Southern Peninsula - Spencer Method - Static		
Drawn By	MYM	*Scale* 1:276	*Company* GN Northern, Inc,
Date			*File Name* Slide1.slim

Appendix VII
NRCS Soil Survey

United States Department of Agriculture

NRCS

Natural Resources Conservation Service

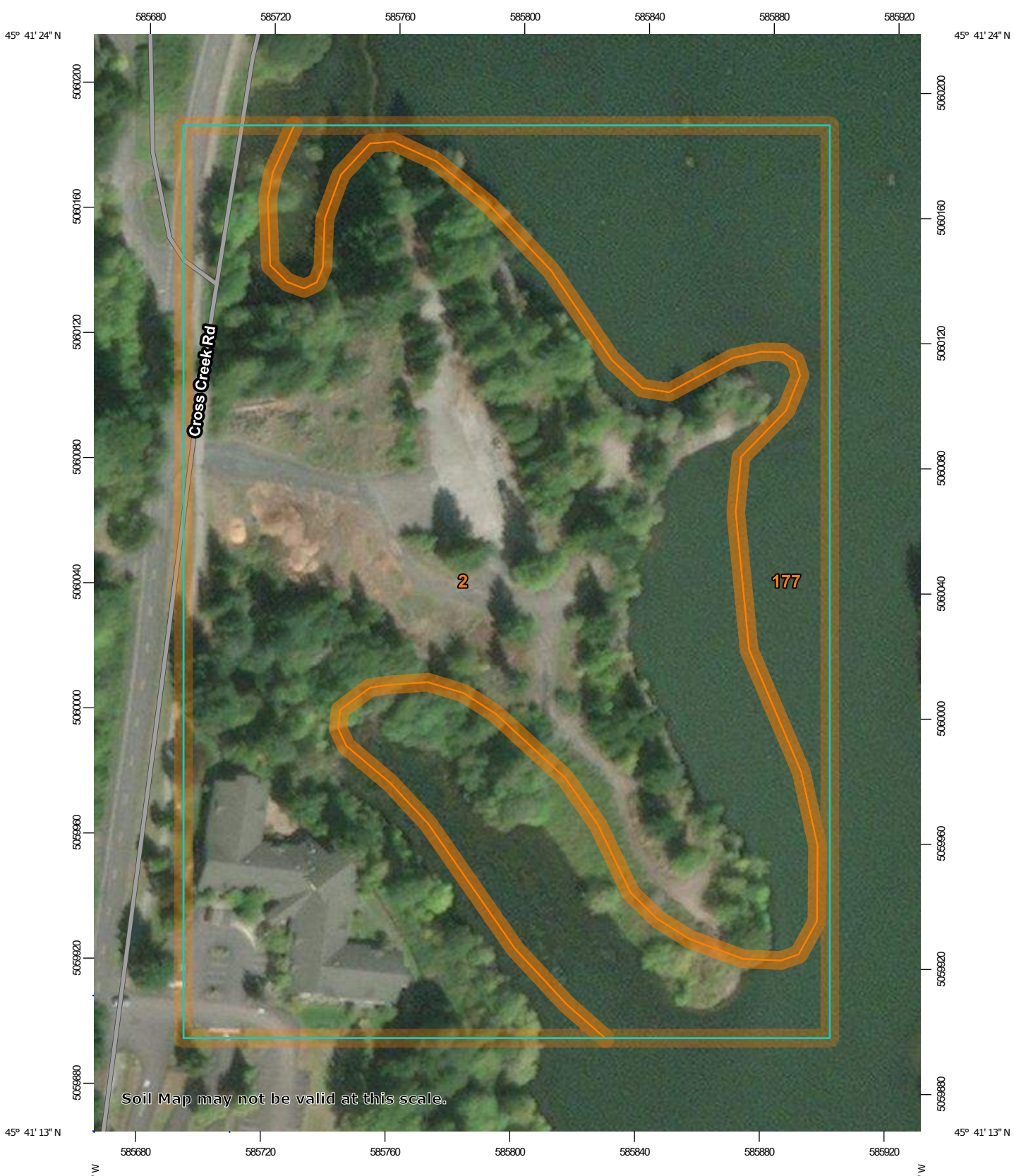
A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Skamania County Area, Washington

Rock Creek Cove Vacation Homes Project

January 9, 2020

Custom Soil Resource Report
Soil Map



Map Scale: 1:1,710 if printed on A portrait (8.5" x 11") sheet.

N

Meters: 0 25 50 100 150

Feet: 0 50 100 200 300

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

Skamania County Area, Washington

2—Arents, 0 to 5 percent slopes

Map Unit Setting

National map unit symbol: 1hhrw
Elevation: 0 to 200 feet
Mean annual precipitation: 40 to 80 inches
Mean annual air temperature: 45 to 52 degrees F
Frost-free period: 90 to 200 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Arents and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Arents

Setting

Landform: Terraces

Typical profile

H1 - 0 to 24 inches: gravelly sandy loam
H2 - 24 to 60 inches: extremely gravelly sandy loam

Properties and qualities

Slope: 0 to 5 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water storage in profile: Moderate (about 6.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: A
Hydric soil rating: No

177—Water

Map Unit Composition

Water: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

APPENDIX 5 – Critical Areas Assessment

Ecological Land Services

January 21, 2020

Zachary Pyle, PE
Development Manager
FDM Development, Inc.
5453 Ridgeline Dr #160
Kennewick, WA 99338
zpyle@fdmdevelopment.com
(210) 849-5592

Re: Rock Cove Preliminary Critical Areas Assessment

Zach,

Ecological Land Services (ELS) completed a field assessment for FDM Development to determine whether wetlands or fish and wildlife habitat conservation areas (hereafter collectively termed critical areas) are located on or adjacent to parcels 02070100130300, 02070100130400, and 02070100130200 (hereafter referred to as the study area) in the City of Stevenson, Skamania County, Washington. The study area is in the SW ¼ of the NW ¼ of Section 1, Township 2 N, and Range 7 East of the Willamette Meridian, coordinates 45.6890, -121.8992, and accessed from Rock Cove Drive (Figure 1). City of Stevenson zoning is "Commercial Recreation" (CR).

ELS completed fieldwork for a critical areas determination on December 30, 2019 in collaboration with Washington Department of Ecology (Ecology) staff. This letter provides a description of the study area's existing conditions as observed on December 30th and a summary of critical areas findings in accordance with Stevenson Municipal Code (SMC), Title 18 "Environmental Protection", Chapters 18.08 "Shoreline Management" and 18.13 "Critical Areas and Natural Resource Lands", and Stevenson's Shoreline Master Programs (SMP) dated 1977 (approved) and 2018 (in review).

Site Description

The study area consists of three parcels that form a peninsula in Rock Cove; Rock Cove is a side channel of the Columbia River formed by the berm for Lewis and Clark Hwy (WA 14) and an adjacent railroad. An unnamed tributary enters Rock Cove north of the study area and Rock Creek enters Rock Cove to the east (Figure 3). An open connection between Rock Cove and the Columbia River is present at its confluence with Rock Creek, southeast of the study area. The study area is currently undeveloped (there are no buildings) but it retains improvements from prior industrial land uses that include concrete and gravel surfaces, gravel roads accessing various points within the study area, a graveled boat launch, and riprap embankments that span the majority of shoreline. A line of abandoned wooden pilings is located just offshore northeast.

Dominant vegetation in the study area included Douglas fir (*Pseudotsuga menziesii*) and red alder (*Alnus rubra*) with Himalayan blackberry (*Rubus armeniacus*) in the understory and rooted in riprap along the

shoreline, and clusters of reed canarygrass (*Phalaris arundinacea*) and soft rush (*Juncus effuses*) rooted in places along the water's edge, at the head of sediment bars and mudflats, and along the river's ordinary high water mark (OHWM).

Methods

ELS followed the U.S. Army Corps of Engineers (Corps) Routine Determination Method described in the "Wetland Delineation Manual" (Environmental Laboratory 1987) and the "Regional Supplement to the Corps of Engineers Wetland Delineation Manual: Western Mountains, Valleys, and Coast Region (Version 2.0)" (Corps 2010). To make determinations about the presence of wetland in the study area. For regulatory purposes under the Clean Water Act (Section 404) the Environmental Protection Agency (EPA) defines wetlands as "those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions" (EPA 2014). Wetlands are regulated as "Waters of the United States" by the Corps, as "Waters of the State" by Ecology, and locally by the City of Stevenson.

The Revised Code of Washington (RCW) 90.58.030(2)(b) and Washington Administrative Code (WAC) 173-22-030(11), defines ordinary high water mark as the action of water "so common and usual and so long continued in all ordinary years as to mark upon the soil a character distinct from that of the abutting upland." In collaboration with Ecology staff, ELS used principles in this guidance to identify transitions in vegetation, wrack lines, scouring under trees and exposed roots, and breaks in topography to distinguish the OHWM of the Columbia River along the study area boundary. Ecology and ELS flagged the OHWM with consecutively numbered orange tape flagging. The flag locations were professionally surveyed by S&F Land Services.

Critical areas findings

ELS and Ecology identified one unnamed tributary north of the study area (Figures 2 and 3). The tributary is identified as a Type F (fish-bearing) water by Washington Department of Natural Resources (DNR) (Figure 4). Rock Creek is east of the study area and is designated as Type S, a shoreline of the state. Rock Cove surrounds the study area on three sides. The Columbia River is designated Type S and is a shoreline of statewide significance. There were no wetlands or other surface waters in the study area, and no priority habitat for terrestrial wildlife. According to SMC 18.13.095(D), the area designated as a fish and wildlife habitat conservation area (FWHCA) for Type F waters is 100 feet and for Type S waters, 150 feet.[1] SMC 18.13.095(D)(3) addresses functionally isolated buffers, indicating areas that "do not protect the FWHCA from adverse impacts due to features such as "lawns, pre-existing roads, structures, or vertical separation" are exempt from buffer criteria. Accordingly, portions of the study area are exempt from the FWHCA for Rock Cove due to areas of maintained vegetation and the presence of riprap which is both structural and vertical separation from Rock Cove (Figure 2).

SMC 18.13.095(D)(6) outlines provisions for buffer averaging or riparian habitat buffer reduction with mitigation to allow reasonable use of a parcel.

[1] Table 18.13.095-1 - Fish & Wildlife Habitat Conservation Area Protective Buffer Widths

Averaged buffers must meet the following conditions:

a. There are no feasible alternatives to the site design
b. The averaged buffer will not result in degradation of the FWHCA's functions and values.
c. The total buffer area after averaging is equal to the area required without averaging.
d. The buffer at its narrowest point is never less than 75% of the required base buffer width.

Reduced buffers must meet the following conditions:

a. mitigation involves restoration or enhancement of all remaining buffers.
b. Conservation covenants shall--and performance bonds may--be required.
c. Reduced buffers do not result in a net loss of existing buffer functions.

December 2018 SMP requirements

The standard shoreline management area (or shoreline setback) for all designated shorelines is 200 feet, measured landward from the OHWM. The study area is zoned "active waterfront"; according to the 2018 SMP, setbacks for development proposed in active waterfront is typically 50 feet.[2]

Regarding improvements from prior industrial land uses including concrete and gravel surfaces, gravel roads, the graveled boat launch, and riprap embankments, the following condition applies:

> A shoreline use that was lawfully constructed prior to the effective date of the SMA or the December 2018 SMP and that does not conform to the current SMP standards is considered a nonconforming use. For the purposes of the December 2018 SMP, existing roads (whether asphalt, gravel, or dirt) are considered nonconforming uses and do not need a Shoreline Conditional Use Permit to be retained or improved (SMP 2018).

Thank you for the opportunity to provide this information. The findings in this letter are intended for FDM Development's planning strategy and should be considered preliminary until they're reviewed and approved in writing by the City of Stevenson and Washington Department of Ecology. If you have any questions, please contact me by phone (360) 578-1371 or email andrew@eco-land.com.

Sincerely,

Andrew R. Allison
Wetland Scientist, Principal

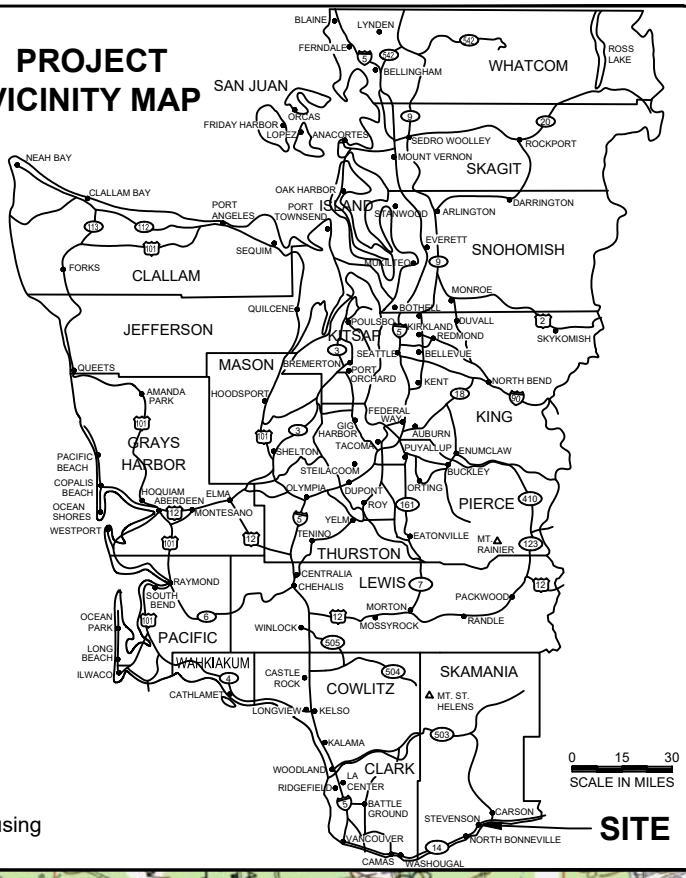
Attachments:
Figures 1-4
Photoplates 1-4
City of Stevenson 2018 SMP "Table 5.1 Shoreline Use & Setback Standards"

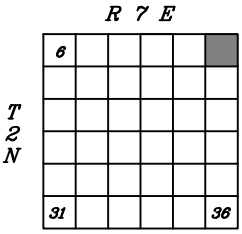
[2] Tables identifying setback distances per development type are attached to this letter for reference.

Latitude: 45.6886°
Longitude: -121.8981°

LOCATION MAP

PROJECT VICINITY MAP





NOTE:
USGS topographic quadrangle map reproduced using MAPTECH Inc., Terrain Navigator Pro software.

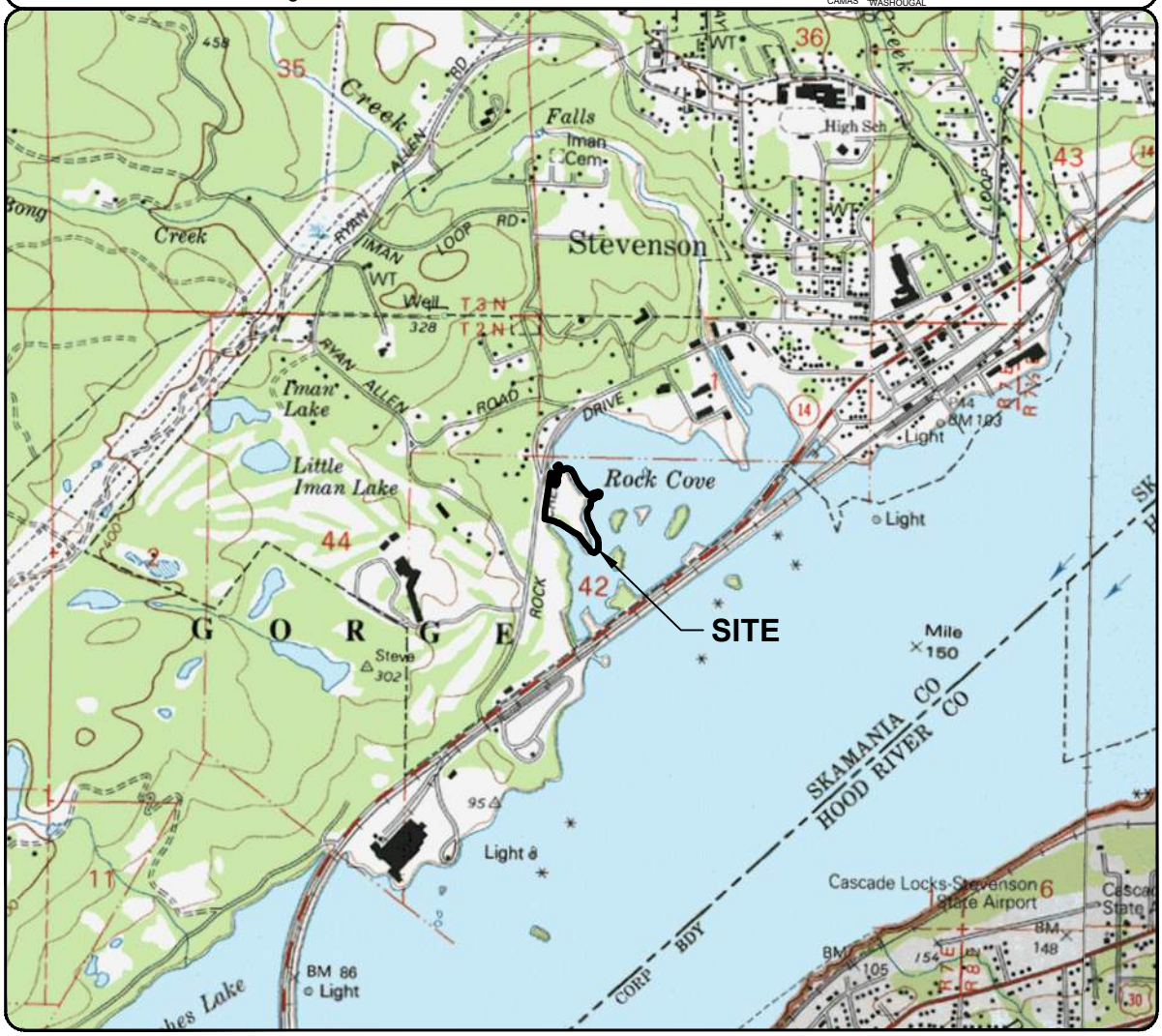


Figure 1
VICINITY MAP
Rock Cove CAR
FDM Development
City of Stevenson, Skamania County, Washington
Section 1, Township 2N, Range 3E, W.M.

DATE: 1/17/20
DWN: EF
REQ. BY: AA
PRJ. MGR: AA
CHK: AA
PROJECT NO: 2682.02

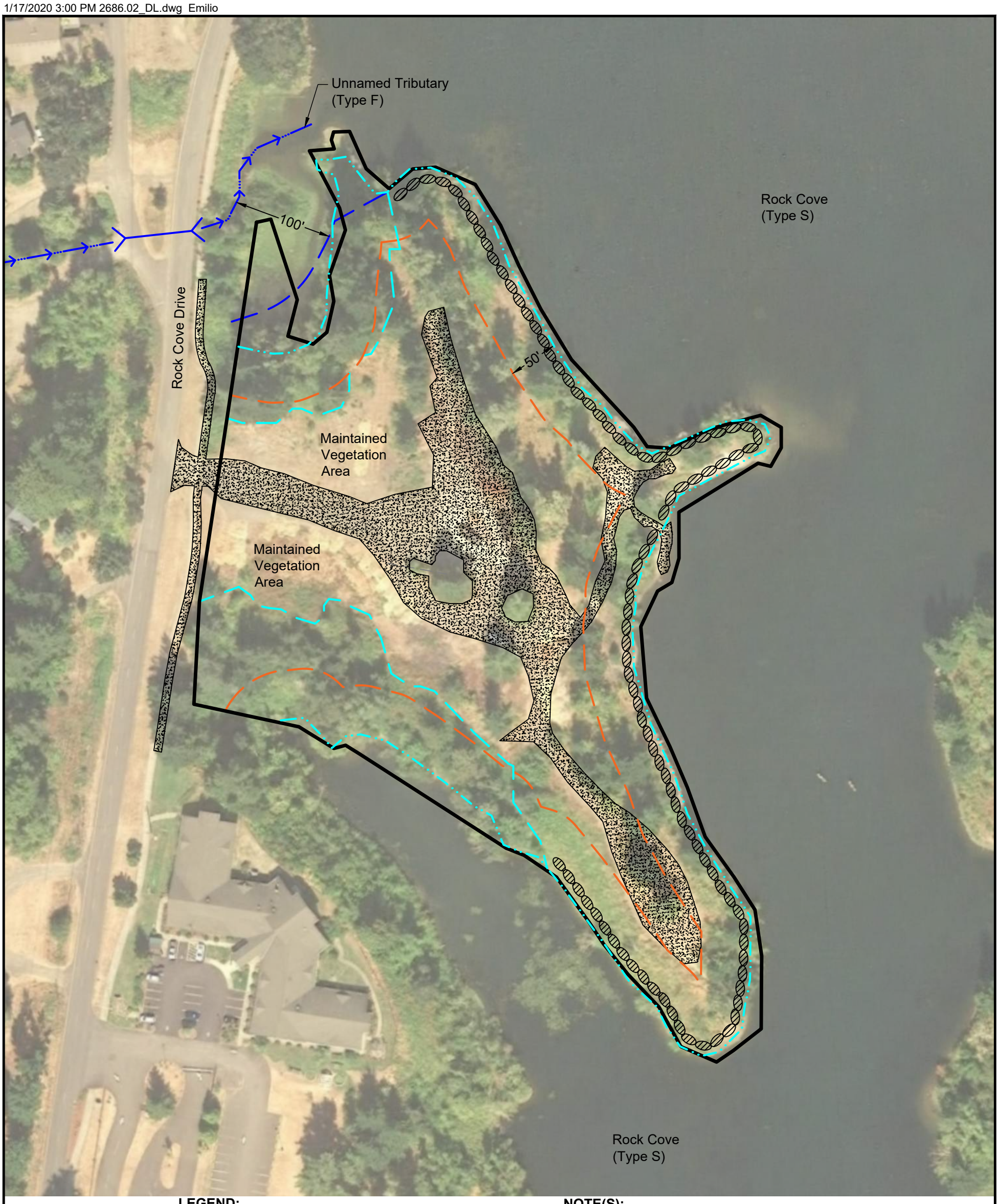
1157 3rd Ave., Suite 220A
Longview, WA 98632
Phone: (360) 578-1371
Fax: (360) 414-9305
www.eco-land.com
Ecological Land Services

0 2000 4000
SCALE IN FEET

N
W E
S

1/17/2020 3:00 PM 2686.02_DL.dwg Emilio

1/17/2020 3:00 PM 2686.02_DL.dwg Emilio



LEGEND:

- Site Boundary
- OHWM
- Stream with Flow Direction
- FWHCA Buffer for Type F
- FWHCA Buffer for Type S
- Shoreline Management Plan Setback
- Culvert
- Existing Graveled or Concrete Surfacing
- Existing Rip Rap

NOTE(S):

1. Aerial from Google Earth™.
2. OHWM line was determined through a joint effort by Ecological Land Services and Washington Department of Ecology on December 30, 2019. OHWM flags were professionally surveyed by S&F Land Services December 30-31, 2019.
3. FWHCA buffer is functionally isolated along existing riprap and existing graveled or concrete surfacing.

N W E S

0 100 200
SCALE IN FEET

Ecological Land Services
1157 3rd Ave., Suite 220A
Longview, WA 98632
Phone: (360) 578-1371
Fax: (360) 414-9305
www.eco-land.com

DATE: 1/17/20
DWN: EF
REQ. BY: AA
PRJ. MGR: AA
CHK: AA
PROJECT NO: 2682.02

Figure 2
SITE MAP
Rock Cove CAR
FDM Development
City of Stevenson, Skamania County, Washington
Section 1, Township 2N, Range 3E, W.M.

1/17/2020 3:00 PM 2686.02_DL.dwg Emilio

LEGEND:

- Site Boundary
- OHWM
- Stream with Flow Direction

NOTE(S):

1. Aerial from Google Earth™.

N W E S

0 400 800

SCALE IN FEET

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DATE: 1/17/20
DWN: EF
REQ. BY: AA
PRJ. MGR: AA
CHK: AA
PROJECT NO: 2682.02

Figure 3
SITE OVERVIEW MAP
Rock Cove CAR
FDM Development
City of Stevenson, Skamania County, Washington
Section 1, Township 2N, Range 3E, W.M.

No mapped streams indicated onsite by the Washington State Department of Natural Resources (DNR).

LEGEND:

Streams

Streams

- Type S
- Type F
- Type N, Np, Ns
- U, unknown
- X, non-typed per WAC 222-16

NOTE: Map provided online by Washington State Department of Natural Resources at web address: *https://fortress.wa.gov/dnr/protectiongis/fpamt/index.html*

Figure 4
DNR STREAM TYPE MAP
Rock Cove CAR
FDM Development
City of Stevenson, Skamania County, Washington
Section 1, Township 2N, Range 3E, W.M.

DATE: 1/17/20
DWN: EF
REQ. BY: AA
PRJ. MGR: AA
CHK: AA
PROJECT NO: 2682.02

1157 3rd Ave., Suite 220A
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Fax: (360) 414-9305
www.eco-land.com

Ecological Land Services

3000
1500
0
SCALE IN FEET

N
W
E
S

Photo 1. Inflow point of the unnamed tributary via concrete culvert.

Photo 2. Unnamed tributary flowing toward Rock Cove.

Photo 3. Overview of unnamed tributary's confluence with Rock Cove.

Photo 4. Mud flat adjoining Rock Cove.

Ecological Land Services

1157 3rd Ave., Suite 220A
Longview, WA 98632
Phone: (360) 578-1371
Fax: (360) 414-9305

DATE: 1/17/20
DWN: ARBA
MGR: ARBA
PR#: 2682.02

Photoplate 1
Site Photos
Rock Cove Preliminary Critical Areas Assessment
FDM Development, Inc.
City of Stevenson, Washington

Photo 1. Vegetated shoreline on the north end of the study area.

Photo 2. Vegetated shoreline extending toward the unnamed tributary.

Photo 3. Riprap on the eastern shoreline, facing north.

Photo 4. Riprap on the eastern shoreline, facing south.

Ecological Land Services

1157 3rd Ave., Suite 220A
Longview, WA 98632
Phone: (360) 578-1371
Fax: (360) 414-9305

DATE: 1/17/20
DWN: ARBA
MGR: ARBA
PR#: 2682.02

Photoplate 2
Site Photos
Rock Cove Preliminary Critical Areas Assessment
FDM Development, Inc.
City of Stevenson, Washington

Photo 1. Graveled boat launch on the east side of the study area.

Photo 2. Vegetated shoreline on the west side, facing south.

Photo 3. Vegetated shoreline and mud flat in the southwest portion of the study area, facing south.

Photo 4. Groomed vegetation in the center of the study area.

Ecological Land Services

1157 3rd Ave., Suite 220A
Longview, WA 98632
Phone: (360) 578-1371
Fax: (360) 414-9305

DATE: 1/17/20
DWN: ARBA
MGR: ARBA
PR#: 2682.02

Photoplate 3
Site Photos
Rock Cove Preliminary Critical Areas Assessment
FDM Development, Inc.
City of Stevenson, Washington

Photo 1. Existing concrete and gravel surfacing.

Photo 2. Existing concrete and gravel surfacing.

Photo 3. Groomed vegetation in the center of the study area.

Photo 4. Existing gravel road.

Ecological Land Services

1157 3rd Ave., Suite 220A
Longview, WA 98632
Phone: (360) 578-1371
Fax: (360) 414-9305

DATE: 1/17/20
DWN: ARBA
MGR: ARBA
PR#: 2682.02

Photoplate 4
Site Photos
Rock Cove Preliminary Critical Areas Assessment
FDM Development, Inc.
City of Stevenson, Washington

TABLE 5.1 – SHORELINE USE & SETBACK STANDARDS

	Shoreline Environment Designation									
	Most Restrictive to Least Restrictive									
	AQUATIC		NATURAL		SHORELINE RESIDENTIAL		URBAN CONSERVANCY		ACTIVE WATERFRONT	
	Allowance	Setbacks (ft)	Allowance	Setbacks (ft)	Allowance	Setbacks (ft)	Allowance	Setbacks (ft)	Allowance	Setbacks (ft)
P= Permitted, C=Conditional Use, X= Not Permitted, n/a= Not Applicable										
Agriculture & Mining										
Agriculture	X	n/a	X	n/a	X	n/a	X	n/a	X	n/a
Mining	X	n/a	X	n/a	X	n/a	X	n/a	X	n/a
Aquaculture										
Water-Oriented	C	n/a	X	n/a	X	n/a	C	0	C	0
Non-Water Oriented	X						X	n/a	C	150
Boating Facilities & Overwater Structures										
Non-motorized Boat Launch	See Adjacent Upland Environment		C		P		P		P	
Motorized Boat Launch			X		C		C		P	
Mooring Buoy			C		C		P		P	
Float			X		C		C		P	
Private Leisure Deck			X	n/a	C	n/a	C	n/a	P	n/a
Public Leisure Pier			X		C		P		P	
Single-User Residential Dock			X		C		C		P	
Joint-Use Moorage			X		P		P		P	
Marina			X		X		C		P	
Commercial & Industrial										
Water-Dependent	P	n/a	X	n/a	X[1]	0	P	0	P	0
Water-Related, Water Enjoyment	C				X[1]	75	P	50	P	33
Non-Water-Oriented	X				X	-	C[2]	150	C[2]	100
Forest Practices										
All	X	n/a	C	50	P	50	P	50	P	25
Institutional										
Water-Dependent	C	n/a	C	0	C	0	P	0	P	0
Water-Related	X		X	n/a	C	100	P	75	P	50
Non-Water-Oriented	X		X	n/a	C	100	C	100	P	100
Cemetery	X		X	n/a	C	50	P	50	C	50
Instream Structures										
All	C	n/a	C	0	C	0	C	0	C	0

TABLE 5.1 – SHORELINE USE & SETBACK STANDARDS, CONT.

	Shoreline Environment Designation									
	Most Restrictive to Least Restrictive									
	AQUATIC		NATURAL		SHORELINE RESIDENTIAL		URBAN CONSERVANCY		ACTIVE WATERFRONT	
	Allowance	Setbacks (ft)	Allowance	Setbacks (ft)	Allowance	Setbacks (ft)	Allowance	Setbacks (ft)	Allowance	Setbacks (ft)
P= Permitted, C=Conditional Use, X= Not Permitted, n/a= Not Applicable										
Land Division										
All	C	n/a	C	n/a	P	n/a	P	n/a	P	n/a
Recreational										
Water-Dependent	P		P	0	P	0	P	0	P	0
Water-Related/Water-Enjoyment	X		C	100	P	50	P	50	P	50
Trail Parallel to the Shoreline, View Platform	C	n/a	P	50	P	50	P	33	P	25
Dirt or Gravel Public Access Trail to the Water	X		P	0	P	0	P	0	P	0
Non-Water-Oriented (golf course, sports field)	X		X	n/a	X	n/a	C	150	C	100
Residential										
Single-Family	X		X		P	50	C	50	X	N/A
Multi-Family	X	n/a	X	n/a	P	50	P	50	P	50
Over-Water Residence	X		X		X	n/a	X	n/a	X	n/a
Transportation & Parking Facilities										
Highway/Arterial Road	C		X	n/a	C	100	P	50	P	50
Access & Collector Road	X		C	100	P	100	P	50	P	50
Private Road	X		C	100	P	50	C	50	C	50
Bridge	C	n/a	C	0	C	0	P	0	P	0
Railroad	C		C	100	C	100	P	50	P	50
Airport	X		X	n/a	X	n/a	C	150	C	150
Primary Parking Facility	X		X	n/a	X	n/a	X	n/a	X	n/a
Accessory Parking (On-Site Parking Serving another Use, Including Recreation/Vista Uses)	X		P	100	P	100	P	50	P	33

TABLE 5.1 – SHORELINE USE & SETBACK STANDARDS, CONT.

	Shoreline Environment Designation									
	Most Restrictive to Least Restrictive									
	AQUATIC		NATURAL		SHORELINE RESIDENTIAL		URBAN CONSERVANCY		ACTIVE WATERFRONT	
	Allowance	Setbacks (ft)	Allowance	Setbacks (ft)	Allowance	Setbacks (ft)	Allowance	Setbacks (ft)	Allowance	Setbacks (ft)
P= Permitted, C=Conditional Use, X= Not Permitted, n/a= Not Applicable										
Utilities										
Water-Oriented	P	n/a	C	0	C	0	P	0	P	0
Non-Water-Oriented (Parallel)	X	n/a	C	100	C	50	P	50	P	33
Non-water-Oriented (Perpendicular)	C	n/a	C	0	C	0	C	0	P	0

1 – All Industrial uses are prohibited, however, a Water-Oriented Commercial use may be allowed as a conditional use in the Shoreline Residential SED.

2 – Conditionally allowed only when a) the project provides a significant public benefit with respect to SMA objectives (e.g., providing public access and ecological restoration) and i) is part of a mixed-use project that includes water-dependent uses or ii) navigability is severely limited or b) the site is physically separated from the shoreline by another property or public right-of-way.

APPENDIX 6 – Operation and Maintenance Manuals

STORMWATER FACILITIES OPERATIONS AND MAINTENANCE PLAN

Owner: FDM Development

Project Name: Rock Creek Cove Hospitality

Engineer: Harper Houf Peterson Righellis Inc.
1220 Main Street, Suite 150
Vancouver, WA 98660

Date: May 2023

The following Operations and Maintenance (O&M) outlines the necessary requirements for stormwater conveyance and water quality facilities for Rock Creek Cove Hospitality.

This manual is provided in addition to the City of Stevenson's General Requirements.

Water Quality facilities on this project will be owned and maintained by FDM Development.

Summary:

The facilities to be maintained under this plan consist of inlets, pipes, manholes, and bioretention facilities. These facilities are shown on the civil improvement plans for the project.

General O&M Requirements and Performance Measures

O&M Activity

System Component	Remove Sediment, Trash, Debris, and Vegetation	Clean Out/ Control pollution	Manage Vegetation
Structural Storm Sewer Devices Sedimentation Compartment/ Catch Basin	Sediment Accumulation does Not exceed 1 foot deep or exceed design specifications for sediment storage.	No flammable Chemicals or vapors are present in amounts that would present a fire hazard, exceed pollution control requirements presented in this table, or produce vapors that exceed 10% of the lower explosive limit for that chemical.	
Inlets/Outlets	No trash/debris/ Sediment obstructs more than 25% of the inlet/outlet structure. Flow is not restricted or impounded.		

Maintenance and Inspection Procedures

Catch Basin and Inlet Inspection/Cleaning

Inspection of catch basins and ditch inlets to be performed no less than annually or in the event of system failure.

	Action	Response/Remark
1.	Check the amount of trash, debris, and other material at the catch basin/ditch inlet.	Make note of the amount of trash and other material at the catch basin. Measure the sediment (in inches) in the catch basin or ditch inlet. Note significant evidence of pollution (oil, grease, foam, odors, etc.)
2.	Remove accessible trash, debris, sediment, etc. from the catch basin/ditch inlet.	Place the debris on a truck so that it can be hauled to disposal.
3.	Inspect the catch basin/ditch inlet, checking that the grate and cover are in place and in good condition.	Check that: • The frame is even with the curb and the top slab is free of holes and cracks. • The frame is sitting flush on the top slab. • The inlet grate is in place and is undamaged.
4.	Check for cracks in the catch basin/ditch inlet structure	Check the basin walls, bottom, and at the joints of the inlet/outlet pipes. Look for dirt entering the catch basin or ditch inlet through cracks.
5.	Check for settling and/or misalignment of the catch basin/ditch inlet.	Check if: • The frame has settled more than 1 inch. • The frame has rotated more than 2 inches out of alignment.
6.	Make notes for machine cleaning, major repair, or replacement of the catch basin/ditch inlet.	Note any particular problems at the catch basin.

Drywells/Manholes Inspection/Cleaning

Inspection of manholes to be performed no less that annually or in the event of system failure.

Inspection

	Action	Response/Remark
1.	Test the manholes or flow structure for a hazardous atmosphere.	
2.	Inspect the manhole or flow structure frame and cover.	Check that: • The cover is accessible. • The manhole cover is in place and in good working condition. • All bolts and locks are in place. • The cover locks properly. • The cover is not difficult to remove.
3.	Check the amount of sediment in the manhole or structure.	Measure the depth of sediment. Record the depth of sediment. Remove sediment when depths exceeds 1/3 the sump depth.
4.	Check for plugging of the manhole or control structure inlet.	
5.	Make notes for cleaning and repair of the manhole or flow structure.	Note any particular structural problems at the manhole or flow structure. Note visual evidence of pollution or unusual odors. Report all problems immediately for follow-up action.
6.	Report the work completed.	Record: • Quantity of debris removed. • Significant evidence of pollution. • Types of defects observed.

Cleaning

	Action	Response/Remark
1.	Test the manhole or flow structure manhole for a hazardous atmosphere.	
2.	Follow vactor manufacturer guidelines to pump water and debris from the manhole or flow structure. Closely monitor the level of accumulation material.	Note any significant signs of pollution, such as oil and grease, foam and unusual odors.
3.	Make notes for repairs to manhole or flow structure.	The manhole cover or flow control frame should be in place and in good condition.
4.	Report the work completed	Record: • Amount of debris removed in CY. • Significant signs of pollution.

Operation and Maintenance Plan

Stormwater Bioretention Facilities Operation and Maintenance

The stormwater bioretention facilities are designed to trap pollutants by filtering and slowing flows, allowing particles to settle out. All facility components, vegetation, and source controls shall be inspected for proper operations and structural stability, at a minimum, quarterly for the first 2 years from the date of installation, 2 times per year thereafter, and within 48 hours after each major storm event. The maintenance staff must keep a log, recording all inspection dates, observations, and maintenance activities. The following items shall be inspected and maintained as stated:

Bioretention Inlet (pipe) shall maintain a calm flow of water entering the planter.
• Source of erosion shall be identified and controlled when native soil is exposed or erosion channels are forming.
• Sediment accumulation shall be hand-removed with minimum damage to vegetation using proper erosion control measures. Sediment shall be removed if it is more than 4" thick or so thick as to damage or kill vegetation.
• Inlet shall be cleared when conveyance capacity is plugged. Sources of sediment and debris shall be identified and corrected.
• Splash blocks shall be inspected and any deficiencies in structure such as cracking, rotting, and failure shall be repaired.

Bioretention Soil Media (BSM) shall allow stormwater to percolate uniformly through the planter/swale. If it does not drain within 48 hours, it shall be tilled and replanted according to design specifications.

• Annual or semi-annual tilling shall be implemented if compaction or clogging continues.
• Debris in quantities that inhibit operation shall be removed routinely (e.g., no less than quarterly), or upon discovery.

Bioretention Outlet shall maintain sheet flow of water exiting the planter/swale unless a catch basin is installed. Source of erosion damage shall be identified and controlled when native soil is exposed or erosion channels are forming.
• Outlets shall be cleared when 50% of the conveyance capacity is plugged.
• Sources of sediment and debris shall be identified and corrected.

Vegetation shall be healthy and dense enough to provide filtering while protecting underlying soils from erosion.
Mulch shall be replenished as needed to ensure survival of vegetation.
• Vegetation, large shrubs or trees that interfere with planter/swale operation shall be pruned.
• Fallen leaves and debris from deciduous plant foliage shall be removed.
• Nuisance vegetation (such as blackberries and English Ivy) shall be removed when discovered. Invasive vegetation contributing up to 25% of vegetation of all species shall be removed and replaced.
• Dead vegetation and woody material shall be removed to maintain less than 10% of area coverage or when planter/swale function is impaired. Vegetation shall be replaced within 3 months, or immediately if required to maintain cover density and control erosion where soils are exposed.

Spill Prevention measures shall be exercised when handling substances that contaminate stormwater. Releases of pollutants shall be corrected as soon as identified.

Insects & Rodents shall not be harbored in the planter/swale. Pest control measures shall be taken when insects/rodents are found to be present.
• If sprays are considered, then a mosquito larvicide, such as Bacillus thurendensis or Altoside formulations can be applied only if absolutely necessary, and only by a licensed individual or contractor.

Operation and Maintenance Plan

• Holes in the ground located in and around the planter/swale shall be filled.

Check Dams shall control and distribute flow.
• Causes for altered water flow shall be identified, and obstructions cleared upon discovery.
• Causes for channelization shall be identified and repaired.