North Woodbridge
Mobility Improvements

Prince William County, Virginia

Drainage & Stormwater Management Narrative

(RW Submission)

May 2022

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SECTION 1

INTRODUCTION

Project Description

This project involves the completing the extension of Annapolis Way connecting Route 1 to Route 123. The extension is designed as a 2-lane facility, transitioning to match the existing 4-lane section on each end. Turn lanes are provided where necessary. A 10-foot shared use path is provided on the north side of Annapolis Way and a 5-foot sidewalk is proposed on the south side of Annapolis Way. The project is approximately 0.65 miles. Annapolis Way is classified as a local street with a 30 mile per hour design speed. This project is adjacent to and will utilize the design prepared by others of the Annapolis Way Public Improvement Plan, SPR2018-00412S04. This plan proposed a Stormwater Management facility to meet the water quantity requirement. This facility will be expanded to meet the water quantity requirements. This project will comply with the applicable Virginia Stormwater Management Program's (VSMP) Laws and Regulations.

Site Description

Topography for this project is mostly steep with open ground cover and existing roadway. Areas adjacent to the project limits are residential. Sites adjacent to the project site are under construction. A stormwater management facility is proposed as part of the Annapolis Way Public Improvement Plan, SPR 2018-0041S04. This facility is proposed to be expanded to accommodate the additional runoff from the extension

The project is within the limits of a single watershed of the Prince William County – Occoquan River – Belmont Bay (HUC12 #020700100803, VAHU6 – PL48), which flows to the Occoquan River.

Wetland Impacts

Wetlands have been identified within the project limits. Roadway design has been limited to the area necessary to construct the Annapolis Way Extension. All necessary permits will be obtained prior to commencing construction.

Stormwater Management Overview

Stormwater management (SWM) and Best Management Practices (BMP) requirements will be assessed in accordance with VDOT and DEQ (Part II-B) criteria for existing versus post-project conditions at outfalls within the receiving drainage basins. The overall BMP Site Area is 4.25 acres with a total proposed impervious area of 1.62 acres. The existing project impervious area is 0.16 acres. The new impervious area ratio for the project site area is 38.1%. These numbers are provided in the Virginia Runoff Reduction Method Calculations located in this report. Based upon these calculations, it is anticipated that pollutant removal requirements (WQL) will be addressed through offsite BMP credit purchase. Water quantity (WQN) shall be addressed through the utilization of existing stormwater management pond that will be expanded to incorporate runoff from the Annapolis Way Extension (Detention Facility 4-1).

- The storm sewer and inlet layout provided as part of the construction plans is intended to drain the roadway in conformance with VDM Chapter 9 and convey the project runoff to the SWM basins and/or an adequate outfall.

- All ditch lining specifications shall be based on the 2-year storm event. A soils map with data table will be provided in this section for verification of allowable shear stress.

- Compliance with the VESCH MS-19 shall be verified by outfall analysis through design of receiving channels and the analysis of existing downstream systems as required.

- It is anticipated that all other structural E&S measures will be contained within Existing/Proposed Right of way and Easements.

Floodplain

The construction of the Annapolis Way Extension will require a new crossing of the unnamed tributary to the Occoquan River. This area is delineated in FEMA mapping as Zone A floodplain (See FEMA Flood Insurance Rate Map on pg 13). There is no detailed study available for this tributary. A FEMA firmette has been provided for information. H&HA is not required, as there are no structures within the floodplain expected to exceed 500 cfs, no significant lateral encroachments.

SECTION 2

DRAINAGE DESIGN CRITERIA AND METHODOLOGY

Drainage Design Criteria and Methodology:

General:

This document summarizes our understanding of the design criteria and method of analysis employed in the design of the Annapolis Way Extension drainage systems and stormwater management facilities. The criteria as defined in the latest edition of the VDOT Drainage Manual, including all its Technical Supplements, and I&IM are generally applied. A list of computer software utilized for this project is also enclosed.

Hydrology:

The Rational method has been utilized to calculate flow rates to all structures, inlets, and culverts (in cubic feet per second) for drainage areas less than 200 acres. In the rational method, the following runoff coefficients have been used:

Ultimate Land Use	Coefficient
Paved (Asphalt or concrete)	0.90
Business Park / Retail	0.85
Steep Grass, Established (2:1)	0.40
Steep Grass, Unestablished (2:1)	0.70
Ditch Areas / Unpaved Shoulders	0.50
Subdivisions	0.45
Wooded Areas	0.30

Runoff coefficients for land uses not listed above have been taken from appendix 6E-1 of the VDM.

SCS method has been utilized to calculate flow rates to all outfalls and stormwater management. TR-55 calculations shall be provided as part of final design.

Rainfall Intensity:

Rainfall intensities used for rational method design of facilities are based upon the NOAA "Atlas 14" Rainfall Precipitation Frequency Data and assigned B, D & E factors. The following rainfall intensities are developed from chart #76 B, D & E factors for Manassas, Virginia.

RAINFALL INTENSITY (INCHES PER HOUR)

Duration (Tc - Minutes) Recurrence Interval (yr)	5	10	15	30
2	4.85	3.88	3.25	2.25
10	6.47	5.19	4.36	3.16
25	7.34	5.87	4.95	3.66
100	8.70	6.90	5.81	4.44

The correction factors of 1.1 and 1.25 shall be applied to 25-yr and 100-yr storm intensities respectively.

Storm Sewer Design:

All storm sewer pipes have been designed to convey the appropriate design storm based upon Tables 9-1 & 2 of VDM Chapter 9.3.1. Annapolis Way Extension requires a 10-year design event. A 0.1-foot drop between the lowest incoming storm sewer pipe through a manhole or inlet and the outgoing storm sewer pipe invert will be specified where possible. Hydraulic Grade Line have been analyzed for all storm sewer systems with more than two links utilizing Ensoftec PipeSoftVA 2.1 computer program. Specified storm sewer pipe materials shall comply with HDA 08-01 for "Allowable Pipe Material for Storm Sewer Systems" dated 01/22/08.

Inlet Design: Detailed inlet reports have been provided for inlet design computations. They have be generated using the Ensoftec InletSoftVA 2.1 computer program, which utilizes HEC-22 methodology to calculate the spread and depth for roadway inlets on grade and in sump.

Roadway Inlets on Grade: Drop inlets on grade have been designed for four (4) inches per hour for Annapolis Way Extension. The maximum allowable spread for curb inlets is 8.0 feet (1/2 travel lane + gutter panel) from the face of curb for Annapolis Way Extension.

A minimum of ninety percent capture efficiency will be been attempted to maximize inlet efficiency. At super- elevation reversals, curb returns and intersections, we will make every attempt to provide 100% interception.

Roadway Inlets At Sumps: In order to correctly evaluate the performance of sump inlets, overflow from upstream inlets have been accounted for. The maximum allowable spread for Annapolis Way Extension is the same as for inlets on grade. Annapolis Way Extension sag inlets will be designed assuming to 50% clogged, and will use a 4.0 in/hr rainfall intensity, as it has been determined that no downstream properties will be negatively impacted by overtopping the sump inlet. Locations of 0.10% longitudinal slope approaching sumps will be checked to assure that the allowable maximum spread is not exceeded. Flanking inlets shall be located where the edge of pavement elevation is no higher than 0.3 feet above the edge of pavement elevation at the sag point.

Culvert Design:

The allowable pipe types for culverts shall be in accordance with I&IM LD-97 (D)121.15 (except extensions, which will be same type as existing). Headwater over depth ratio shall be between 1 and 1.5. A minimum freeboard of 18 inches below the edge of shoulder shall be maintained for the design storm. The CulvertsoftVA 2.1 computer program has been utilized.

Outfall Protection:

Outfall protection for both the storm sewer networks and culverts is based on the 2-year storm velocity and follows the procedure set forth in the VDM. A detailed report of the outlet protection is provided in this report.

End Treatments

Max. Velocity (fps)	End Sections	Outlet Protection Material
8	EC-1 Class A1	Class AI Dry Riprap
14	EC-1 Class I	Class I Dry Riprap
19	EC-1 Class II	Class II Dry Riprap
>19	Special Design	Special Design

Riprap quantities shall be based upon dimensions specified in the Hydraulic Design Advisory HDA 06-03.1 [Date: September 01, 2007 – Subject: Culvert Outlet Protection Road and Bridge Standards EC-1].

Ditch Design:

Tractive Force Method was used for the ditch design. Ditches have been designed to convey the 10-year storm without overtopping. Ditch linings will be determined by an evaluation of the shear stress of the 2-yr storm according to inferred soil type as follows:

Type of Lining	Mannings 'n' Value	Maximum Allowable Velocity (fps)	Maximum Allowable Shear Stress (lb/ft^2)
Bare Earth	0.02	Varies*	Varies**
VDOT EC-2 Type 1	0.037	4.0	1.5
VDOT EC-2 Type 2	0.037	4.0	1.75
VDOT EC-2 Type 3	0.037	4.0	2.00
VDOT EC-2 Type 4	0.037	4.0	2.25
VDOT EC-3 Type 1	0.03	7.0	6.00
VDOT EC-3 Type 2	0.03	10.0	8.00
VDOT EC-3 Type 3	0.03	NA	10.00
Concrete	0.013	NA	NA

**The Tractive Force (Permissible Shear) Method considers the physical factors of bed material, channel geometry, depth, and velocity of flow. Geotech borings from locations nearby individual ditch locations have been analyzed to determine the maximum allowable shear stress of bare earth. Refer to Section 5 of this report.

Soil borings will be utilized, when available, to perform the tractive force ditch computations. The following assumptions will be utilized for the ditch design, as applicable:

- The second layer of soil below the topsoil will be utilized as the soil classification.
- All soils are medium compaction.
- The first particle size was chosen from each grouping in the Unified Soil Classification System.

Underdrain:

Types of underdrains and usage as described in the VDOT Drainage Manual (VDM 9.4.3.9, Dated July 14, 2017) will be applied for the underdrain design.

Drainage for Pavement Subbase:

STANDARD	USAGE AND PURPOSES
UD-1	As recommended by Materials Division to lower ground water table in cuts
UD-2	Drains raised grass median strips as recommended by Materials Division
CD-1 & 2	Drains subsurface water from cuts and fills according to road and bridge standards and as recommended by Materials Division
UD-3	Drains area under sidewalk
UD-4	Provides drainage for pavement structure as recommended by Materials Division
UD-5	Same as UD-4; more easily added to previously constructed projects
UD-7	Provides pavement structure drainage as recommended by Material Division for existing pavements
EW-12	Used at outlet ends of all underdrains which do not tie to other drainage structures (inlets, manholes, etc.)

Non-perforated pipe will be used between the limits of the curb returns when a standard underdrain UD-3, UD-4, or UD-7 passed through a commercial entrance.
The following criteria will apply to spacing of outlet pipes:

- UD-1 – Variable spacing
- UD-2 – 500ft maximum spacing
- UD-3 – 1000ft maximum spacing
- UD-4 – 350ft maximum spacing
- UD-5 – 350ft maximum spacing
- UD-7 – 350ft maximum spacing

Hydrology/Hydraulics Software To Be Utilized In Drainage Computations:

1. CulvertsoftVA, Version 2.1 - Virginia Edition
2. InletsoftVA, Version 2.1 - Virginia Edition
3. Haestad Methods FlowMaster PE, Version V8i
4. Haestad Methods Pondpack, Version V8i
5. PipesoftVA, Version 2.1 – Virginia Edition

SECTION 3

FIRMETTE

JOINS PANEL 0217

6930000 FT

Occoquan River

ZONE AE

ZONE A

FLOOD HAZARD INFORMATION IS NOT SHOWN ON THIS PANEL IN AREAS OUTSIDE OF PRINCE WILLIAM COUNTY

LIMIT OF MODERATE WAVE ACTION

RIVERGATE PLACE

MARINA WAY

ANNAPOLIS WAY

Prince William County
Unincorporated Areas
510119

COLCHESTER FERRY PLACE

FERRY LANDING LANE

DOGUES TRAIL

POTOMAC PATH DRIVE

GORDON BOULEVARD

RAILROAD

HERONS VIEW WAY

CHATSFORD COURT

TRETHAWAY DRIVE

BELMONT

HV2373

ZONE AE
(EL 9)

Occoquan River

12 12 95 B 11 10 9 A 1 123

the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 500'

250 0 500 1000 FEET

150 0 150 300 M

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0236E

FIRM

FLOOD INSURANCE RATE MAP

PRINCE WILLIAM COUNTY, VIRGINIA
AND INCORPORATED AREAS

PANEL 236 OF 328

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
PRINCE WILLIAM COUNTY	510119	0236	E

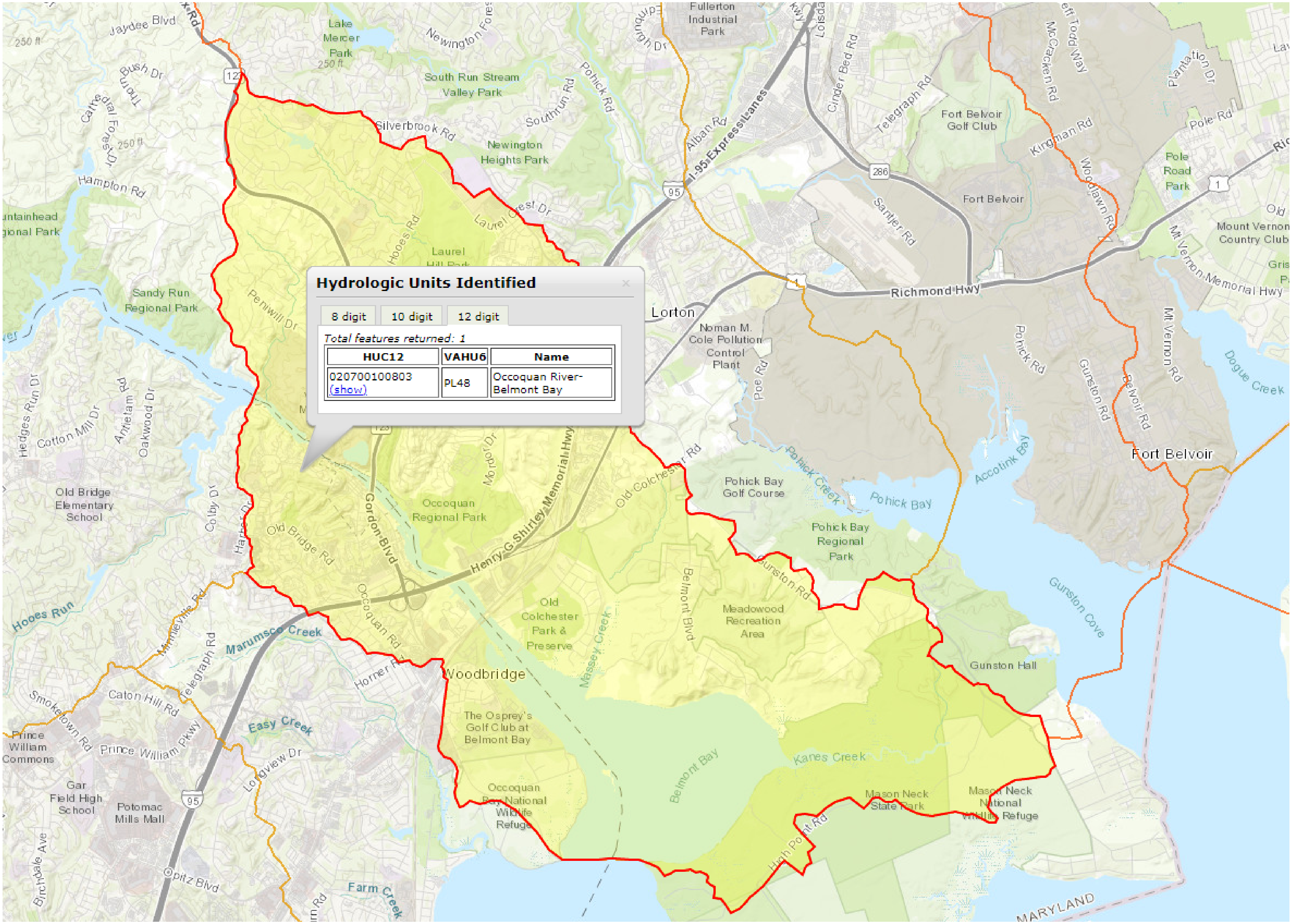
Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
51153C0236E

MAP REVISED
AUGUST 3, 2015

Federal Emergency Management Agency

HUC MAP (PL48)


Hydrologic Units Identified
8 digit
10 digit
12 digit
Total features returned: 1
HUC12
VAHU6
Name
020700100803
(show)
PL48
Occoquan River-Belmont Bay
Lake Mercer Park
South Run Stream Valley Park
Newington Heights Park
Fullerton Industrial Park
Fort Belvoir Golf Club
Fort Belvoir
Pole Road Park
Mount Vernon Country Club
Laurel Hill Park
Sandy Run Regional Park
Lorton
Noman M. Cole Pollution Control Plant
Pohick Bay Golf Course
Pohick Bay
Pohick Bay Regional Park
Accotink Bay
Dogue Creek
Gunston Cove
Gunston Hall
Meadowood Recreation Area
Occoquan Regional Park
Old Colchester Park & Preserve
Old Bridge Elementary School
Woodbridge
The Osprey's Golf Club at Belmont Bay
Occoquan Bay National Wildlife Refuge
Belmont Bay
Kanes Creek
Mason Neck State Park
Mason Neck National Wildlife Refuge
Marumsco Creek
Hooes Run
Easy Creek
Farm Creek
Prince William Commons
Gar Field High School
Potomac Mills Mall
Richmond Hwy
Henry G Shirley Memorial Hwy
Gordon Blvd
Belmont Blvd
Old Colchester Rd
Gunston Rd
High Point Rd
Prince William Pkwy
Mt Vernon Memorial Hwy
MARYLAND

Soils Map

Soil Type	Description
20B	Elsinboro sandy loam
27A	Hatboro-Codorus complex
42B	Neabsco-Quantico complex
47B	Quantico sandy loam
54B	Urban land-Udorthents complex
18D	Dumfries sandy loam
18E	Dumfries sandy loam

SCALE
0 80' 160'

SECTION 4

STORMWATER MANAGEMENT

Stormwater Management & Best Management Practice Narrative

Stormwater Management

This project involves the completing the extension of Annapolis Way connecting Route 1 to Route 123.

For the purposes of determining compliance with Part IIB Requirements, 2 Outfalls have been identified for the Project Area. Compliance with Channel Protection and Flood Protection requirements will be provided at all outfalls. A brief description of outfalls is provided below. Please refer to the Outfall Map located in this report for locations of Outfalls.

Impacts to Existing Stormwater Management

Private Facility – Annapolis Way– Station 30+50 Left

This facility was previously constructed as part of the Annapolis Way Public Improvement Plan, SPR2018-00412S04. It was designed as an Extended Detention Facility (Quantity only). This existing facility will be expanded in a plan revision to accommodate the increase in runoff from the extension of Annapolis Way, named Detention Facility 4-1 in the current plans. This existing facility will remain as a water quantity only. As the outfall from this facility is to a natural channel, the energy balance method will be used at this outfall to demonstrate adequate release rates from Detention Facility 4-1.

Private Facility – Annapolis Way– Station 39+50 Right

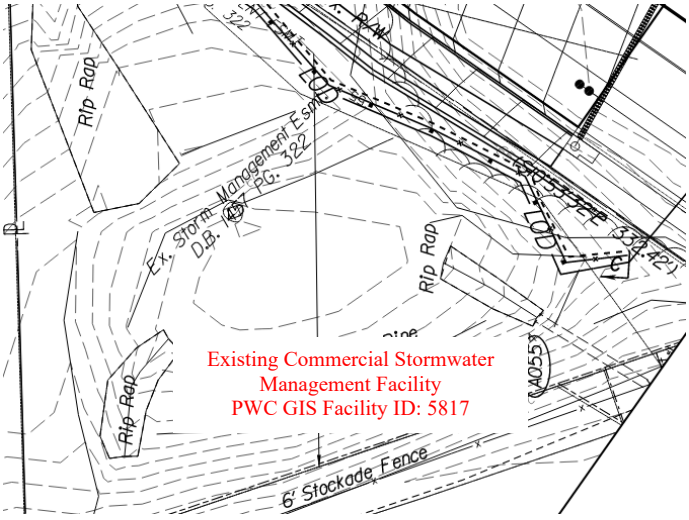


Exhibit - NTS

The construction of Annapolis Way will not impact the volume available in this facility, nor will it disturb or relocate its dam, principle spillway or emergency spillway.

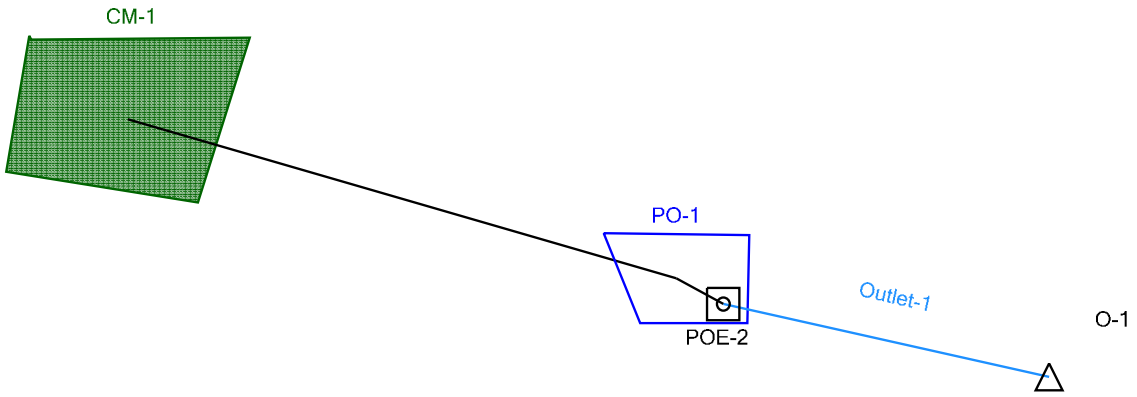
No water quality provided in this pond is being credited to the Annapolis Way project. It is therefore our opinion that this project does not adversely impact this facility.

Best Management Practice

Best Management Practice requirements were calculated using the Virginia Runoff Reduction calculations (Part IIB) required by VDOT IIM 195.9.

The supporting calculations can be found in this report. The Annapolis Way Extension project has a total site area of 4.25 acres, post-developed impervious cover of 1.62 acres, and pre-developed impervious cover of 0.16 acres. The calculated Pollutant Removal requirement is 3.23 lb/yr. as this is classified as a Linear Project. The removal requirement will be met through the purchase of nutrient credits per IIM 251.4. BMP maps have been attached, showing the locations of site area as well as the pre and post impervious conditions.

Scenario: 1-yr



Subsection: Master Network Summary

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
CM-1	1-yr	1	0.790	12.000	12.90
CM-1	2-yr	2	1.095	12.000	18.00
CM-1	10-yr	10	2.245	12.000	36.62
CM-1	100-yr	100	4.700	12.000	74.24

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
O-1	1-yr	1	0.789	12.200	4.07
O-1	2-yr	2	1.093	12.200	6.73
O-1	10-yr	10	2.241	12.100	21.93
O-1	100-yr	100	4.687	12.000	74.00

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
PO-1 (IN)	1-yr	1	0.790	12.000	12.90	(N/A)	(N/A)
PO-1 (OUT)	1-yr	1	0.789	12.200	4.07	10.66	0.227
PO-1 (IN)	2-yr	2	1.095	12.000	18.00	(N/A)	(N/A)
PO-1 (OUT)	2-yr	2	1.093	12.200	6.73	11.15	0.323
PO-1 (IN)	10-yr	10	2.245	12.000	36.62	(N/A)	(N/A)
PO-1 (OUT)	10-yr	10	2.241	12.100	21.93	12.34	0.588
PO-1 (IN)	100-yr	100	4.700	12.000	74.24	(N/A)	(N/A)
PO-1 (OUT)	100-yr	100	4.687	12.000	74.00	12.87	0.721

CN Area Collection - CM-1 (Catchment)

Description	CN	Area (acres)	Percent Connected Impervious Area (%)	Percent Unconnected Impervious Area (%)
Impervious Areas - Paved; curbs and storm sewers - Soil D	98.000	5.660	100.0	0.0
Open space (Lawns,parks etc.) - Good condition; grass cover > 75% - Soil A	39.000	1.180	0.0	0.0
Open space (Lawns,parks etc.) - Good condition; grass cover > 75% - Soil B	61.000	1.970	0.0	0.0
Open space (Lawns,parks etc.) - Good condition; grass cover > 75% - Soil D	80.000	0.900	0.0	0.0

Storm Event	1
Return Event	1 years
Duration	24.000 hours
Depth	2.5 in
Time of Concentration (Composite)	0.165 hours
Area (User Defined)	9.710 acres

Computational Time Increment	0.022 hours
Time to Peak (Computed)	12.012 hours
Flow (Peak, Computed)	12.91 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.000 hours
Flow (Peak Interpolated Output)	12.90 ft³/s

Drainage Area	
SCS CN (Composite)	81.655
Area (User Defined)	9.710 acres
Maximum Retention (Pervious)	2.2 in
Maximum Retention (Pervious, 20 percent)	0.4 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	1.0 in
Runoff Volume (Pervious)	0.792 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	0.790 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.165 hours
Computational Time Increment	0.022 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	66.68 ft³/s

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.110 hours
Unit receding limb, Tr	0.440 hours
Total unit time, Tb	0.550 hours

Storm Event	2
Return Event	2 years
Duration	24.000 hours
Depth	3.0 in
Time of Concentration (Composite)	0.165 hours
Area (User Defined)	9.710 acres

Computational Time Increment	0.022 hours
Time to Peak (Computed)	11.990 hours
Flow (Peak, Computed)	18.04 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.000 hours
Flow (Peak Interpolated Output)	18.00 ft³/s

Drainage Area	
SCS CN (Composite)	81.655
Area (User Defined)	9.710 acres
Maximum Retention (Pervious)	2.2 in
Maximum Retention (Pervious, 20 percent)	0.4 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	1.4 in
Runoff Volume (Pervious)	1.097 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	1.095 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.165 hours
Computational Time Increment	0.022 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	66.68 ft³/s

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.110 hours
Unit receding limb, Tr	0.440 hours
Total unit time, Tb	0.550 hours

Storm Event	10
Return Event	10 years
Duration	24.000 hours
Depth	4.7 in
Time of Concentration (Composite)	0.165 hours
Area (User Defined)	9.710 acres

Computational Time Increment	0.022 hours
Time to Peak (Computed)	11.990 hours
Flow (Peak, Computed)	36.89 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.000 hours
Flow (Peak Interpolated Output)	36.62 ft³/s

Drainage Area	
SCS CN (Composite)	81.655
Area (User Defined)	9.710 acres
Maximum Retention (Pervious)	2.2 in
Maximum Retention (Pervious, 20 percent)	0.4 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	2.8 in
Runoff Volume (Pervious)	2.250 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	2.245 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.165 hours
Computational Time Increment	0.022 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	66.68 ft³/s

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.110 hours
Unit receding limb, Tr	0.440 hours
Total unit time, Tb	0.550 hours

Storm Event	100
Return Event	100 years
Duration	24.000 hours
Depth	8.0 in
Time of Concentration (Composite)	0.165 hours
Area (User Defined)	9.710 acres

Computational Time Increment	0.022 hours
Time to Peak (Computed)	11.968 hours
Flow (Peak, Computed)	75.17 ft³/s
Output Increment	0.050 hours
Time to Flow (Peak Interpolated Output)	12.000 hours
Flow (Peak Interpolated Output)	74.24 ft³/s

Drainage Area	
SCS CN (Composite)	81.655
Area (User Defined)	9.710 acres
Maximum Retention (Pervious)	2.2 in
Maximum Retention (Pervious, 20 percent)	0.4 in

Cumulative Runoff	
Cumulative Runoff Depth (Pervious)	5.8 in
Runoff Volume (Pervious)	4.709 ac-ft

Hydrograph Volume (Area under Hydrograph curve)	
Volume	4.700 ac-ft

SCS Unit Hydrograph Parameters	
Time of Concentration (Composite)	0.165 hours
Computational Time Increment	0.022 hours
Unit Hydrograph Shape Factor	483.432
K Factor	0.749
Receding/Rising, Tr/Tp	1.670
Unit peak, qp	66.68 ft³/s

SCS Unit Hydrograph Parameters	
Unit peak time, Tp	0.110 hours
Unit receding limb, Tr	0.440 hours
Total unit time, Tb	0.550 hours

Subsection: Elevation-Area Volume Curve
Label: PO-1
Scenario: 1-yr

Return Event: 1 years
Storm Event: 1

Elevation (ft)	Planimeter (ft²)	Area (acres)	A1+A2+sqr (A1*A2) (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
8.00	0.0	0.000	0.000	0.000	0.000
10.00	0.0	0.166	0.166	0.111	0.111
12.00	0.0	0.232	0.594	0.396	0.507
14.00	0.0	0.306	0.804	0.536	1.043

Requested Pond Water Surface Elevations	
Minimum (Headwater)	8.00 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	14.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Irregular Weir	Weir - 1	Forward	TW	8.00	14.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Weir - 1
Structure Type: Irregular Weir

Station (ft)	Elevation (ft)
0.00	14.00
0.01	12.60
56.65	12.60
56.66	10.80
57.85	10.80
57.86	8.00
58.15	8.00
58.16	10.80
59.34	10.80
59.35	12.60
79.99	12.60
80.00	14.00

Lowest Elevation	8.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: TW
Structure Type: TW Setup, DS Channel

Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

Subsection: Individual Outlet Curves
Label: Composite Outlet Structure - 1
Scenario: 1-yr

Return Event: 1 years
Storm Event: 1

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Weir - 1 (Irregular Weir)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
8.00	0.00	(N/A)	0.00
8.50	0.31	(N/A)	0.00
9.00	0.88	(N/A)	0.00
9.50	1.62	(N/A)	0.00
10.00	2.50	(N/A)	0.00
10.50	3.51	(N/A)	0.00
11.00	5.28	(N/A)	0.00
11.50	10.05	(N/A)	0.00
12.00	16.58	(N/A)	0.00
12.50	24.44	(N/A)	0.00
13.00	92.08	(N/A)	0.00
13.50	241.37	(N/A)	0.00
14.00	438.37	(N/A)	0.00

Computation Messages
E = Y min=8.00
Max.H=.50; Max.Htw=free out;; W(ft) =.29
Max.H=1.00; Max.Htw=free out;; W(ft) =.30
Max.H=1.50; Max.Htw=free out;; W(ft) =.30
Max.H=2.00; Max.Htw=free out;; W(ft) =.30
Max.H=2.50; Max.Htw=free out;; W(ft) =.31
Max.H=3.00; Max.Htw=free out;; W(ft) =2.68
Max.H=3.50; Max.Htw=free out;; W(ft) =2.69
Max.H=4.00; Max.Htw=free out;; W(ft) =2.69

Subsection: Individual Outlet Curves
Label: Composite Outlet Structure - 1
Scenario: 1-yr

Return Event: 1 years
Storm Event: 1

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = Weir - 1 (Irregular Weir)

Upstream ID = (Pond Water Surface)
Downstream ID = Tailwater (Pond Outfall)

Computation Messages
Max.H=4.50; Max.Htw=free out;; W(ft) =2.70
Max.H=5.00; Max.Htw=free out;; W(ft) =79.99
Max.H=5.50; Max.Htw=free out;; W(ft) =79.99
Max.H=6.00; Max.Htw=free out;; W(ft) =80.00

Subsection: Composite Rating Curve
Label: Composite Outlet Structure - 1
Scenario: 1-yr

Return Event: 1 years
Storm Event: 1

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)
8.00	0.00	(N/A)	0.00
8.50	0.31	(N/A)	0.00
9.00	0.88	(N/A)	0.00
9.50	1.62	(N/A)	0.00
10.00	2.50	(N/A)	0.00
10.50	3.51	(N/A)	0.00
11.00	5.28	(N/A)	0.00
11.50	10.05	(N/A)	0.00
12.00	16.58	(N/A)	0.00
12.50	24.44	(N/A)	0.00
13.00	92.08	(N/A)	0.00
13.50	241.37	(N/A)	0.00
14.00	438.37	(N/A)	0.00

Contributing Structures
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1

Requested Pond Water Surface Elevations	
Minimum (Headwater)	8.00 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	14.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Irregular Weir	Weir - 1	Forward	TW	8.00	14.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Weir - 1
Structure Type: Irregular Weir

Station (ft)	Elevation (ft)
0.00	14.00
0.01	12.60
56.65	12.60
56.66	10.80
57.85	10.80
57.86	8.00
58.15	8.00
58.16	10.80
59.34	10.80
59.35	12.60
79.99	12.60
80.00	14.00

Lowest Elevation	8.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: TW
Structure Type: TW Setup, DS Channel

Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = ()

Upstream ID =
Downstream ID =

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
Contributing Structures			

Subsection: Composite Rating Curve
Label: Composite Outlet Structure - 1
Scenario: 2-yr

Return Event: 2 years
Storm Event: 2

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)
8.00	0.00	(N/A)	0.00
8.50	0.31	(N/A)	0.00
9.00	0.88	(N/A)	0.00
9.50	1.62	(N/A)	0.00
10.00	2.50	(N/A)	0.00
10.50	3.51	(N/A)	0.00
11.00	5.28	(N/A)	0.00
11.50	10.05	(N/A)	0.00
12.00	16.58	(N/A)	0.00
12.50	24.44	(N/A)	0.00
13.00	92.08	(N/A)	0.00
13.50	241.37	(N/A)	0.00
14.00	438.37	(N/A)	0.00

Contributing Structures
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1

Requested Pond Water Surface Elevations	
Minimum (Headwater)	8.00 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	14.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Irregular Weir	Weir - 1	Forward	TW	8.00	14.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Weir - 1
Structure Type: Irregular Weir

Station (ft)	Elevation (ft)
0.00	14.00
0.01	12.60
56.65	12.60
56.66	10.80
57.85	10.80
57.86	8.00
58.15	8.00
58.16	10.80
59.34	10.80
59.35	12.60
79.99	12.60
80.00	14.00

Lowest Elevation	8.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: TW
Structure Type: TW Setup, DS Channel

Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

Subsection: Individual Outlet Curves
Label: Composite Outlet Structure - 1
Scenario: 10-yr

Return Event: 10 years
Storm Event: 10

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = ()

Upstream ID =
Downstream ID =

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
Contributing Structures			

Subsection: Composite Rating Curve
Label: Composite Outlet Structure - 1
Scenario: 10-yr

Return Event: 10 years
Storm Event: 10

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)
8.00	0.00	(N/A)	0.00
8.50	0.31	(N/A)	0.00
9.00	0.88	(N/A)	0.00
9.50	1.62	(N/A)	0.00
10.00	2.50	(N/A)	0.00
10.50	3.51	(N/A)	0.00
11.00	5.28	(N/A)	0.00
11.50	10.05	(N/A)	0.00
12.00	16.58	(N/A)	0.00
12.50	24.44	(N/A)	0.00
13.00	92.08	(N/A)	0.00
13.50	241.37	(N/A)	0.00
14.00	438.37	(N/A)	0.00

Contributing Structures
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1

Requested Pond Water Surface Elevations	
Minimum (Headwater)	8.00 ft
Increment (Headwater)	0.50 ft
Maximum (Headwater)	14.00 ft

Outlet Connectivity

Structure Type	Outlet ID	Direction	Outfall	E1 (ft)	E2 (ft)
Irregular Weir	Weir - 1	Forward	TW	8.00	14.00
Tailwater Settings	Tailwater			(N/A)	(N/A)

Structure ID: Weir - 1
Structure Type: Irregular Weir

Station (ft)	Elevation (ft)
0.00	14.00
0.01	12.60
56.65	12.60
56.66	10.80
57.85	10.80
57.86	8.00
58.15	8.00
58.16	10.80
59.34	10.80
59.35	12.60
79.99	12.60
80.00	14.00

Lowest Elevation	8.00 ft
Weir Coefficient	3.00 (ft^0.5)/s

Structure ID: TW
Structure Type: TW Setup, DS Channel

Tailwater Type	Free Outfall

Convergence Tolerances	
Maximum Iterations	30
Tailwater Tolerance (Minimum)	0.01 ft
Tailwater Tolerance (Maximum)	0.50 ft
Headwater Tolerance (Minimum)	0.01 ft
Headwater Tolerance (Maximum)	0.50 ft
Flow Tolerance (Minimum)	0.001 ft³/s
Flow Tolerance (Maximum)	10.000 ft³/s

Subsection: Individual Outlet Curves
Label: Composite Outlet Structure - 1
Scenario: 100-yr

Return Event: 100 years
Storm Event: 100

RATING TABLE FOR ONE OUTLET TYPE
Structure ID = ()

Upstream ID =
Downstream ID =

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
Contributing Structures			

Subsection: Composite Rating Curve
Label: Composite Outlet Structure - 1
Scenario: 100-yr

Return Event: 100 years
Storm Event: 100

Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft^3/s)	Tailwater Elevation (ft)	Convergence Error (ft)
8.00	0.00	(N/A)	0.00
8.50	0.31	(N/A)	0.00
9.00	0.88	(N/A)	0.00
9.50	1.62	(N/A)	0.00
10.00	2.50	(N/A)	0.00
10.50	3.51	(N/A)	0.00
11.00	5.28	(N/A)	0.00
11.50	10.05	(N/A)	0.00
12.00	16.58	(N/A)	0.00
12.50	24.44	(N/A)	0.00
13.00	92.08	(N/A)	0.00
13.50	241.37	(N/A)	0.00
14.00	438.37	(N/A)	0.00

Contributing Structures
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1
Weir - 1

Subsection: Level Pool Pond Routing Summary
Label: PO-1 (IN)
Scenario: 1-yr

Return Event: 1 years
Storm Event: 1

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	8.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	12.90 ft³/s	Time to Peak (Flow, In)	12.000 hours
Flow (Peak Outlet)	4.07 ft³/s	Time to Peak (Flow, Outlet)	12.200 hours

Elevation (Water Surface, Peak)	10.66 ft
Volume (Peak)	0.227 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	0.790 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	0.789 ac-ft
Volume (Retained)	0.000 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.1 %

Subsection: Level Pool Pond Routing Summary
Label: PO-1 (IN)
Scenario: 2-yr

Return Event: 2 years
Storm Event: 2

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	8.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	18.00 ft³/s	Time to Peak (Flow, In)	12.000 hours
Flow (Peak Outlet)	6.73 ft³/s	Time to Peak (Flow, Outlet)	12.200 hours

Elevation (Water Surface, Peak)	11.15 ft
Volume (Peak)	0.323 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	1.095 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	1.093 ac-ft
Volume (Retained)	0.000 ac-ft
Volume (Unrouted)	-0.001 ac-ft
Error (Mass Balance)	0.1 %

Subsection: Level Pool Pond Routing Summary
Label: PO-1 (IN)
Scenario: 10-yr

Return Event: 10 years
Storm Event: 10

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	8.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	36.62 ft³/s	Time to Peak (Flow, In)	12.000 hours
Flow (Peak Outlet)	21.93 ft³/s	Time to Peak (Flow, Outlet)	12.100 hours

Elevation (Water Surface, Peak)	12.34 ft
Volume (Peak)	0.588 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	2.245 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	2.241 ac-ft
Volume (Retained)	0.002 ac-ft
Volume (Unrouted)	-0.002 ac-ft
Error (Mass Balance)	0.1 %

Subsection: Level Pool Pond Routing Summary
Label: PO-1 (IN)
Scenario: 100-yr

Return Event: 100 years
Storm Event: 100

Infiltration	
Infiltration Method (Computed)	No Infiltration

Initial Conditions	
Elevation (Water Surface, Initial)	8.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Inflow/Outflow Hydrograph Summary			
Flow (Peak In)	74.24 ft³/s	Time to Peak (Flow, In)	12.000 hours
Flow (Peak Outlet)	74.00 ft³/s	Time to Peak (Flow, Outlet)	12.000 hours

Elevation (Water Surface, Peak)	12.87 ft
Volume (Peak)	0.721 ac-ft

Mass Balance (ac-ft)	
Volume (Initial)	0.000 ac-ft
Volume (Total Inflow)	4.700 ac-ft
Volume (Total Infiltration)	0.000 ac-ft
Volume (Total Outlet Outflow)	4.687 ac-ft
Volume (Retained)	0.008 ac-ft
Volume (Unrouted)	-0.005 ac-ft
Error (Mass Balance)	0.1 %

Subsection: Pond Routed Hydrograph (total out) Return Event: 1 years
Label: PO-1 (OUT) Storm Event: 1
Scenario: 1-yr

Peak Discharge	4.07 ft³/s
Time to Peak	12.200 hours
Hydrograph Volume	0.789 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
10.100	0.00	0.00	0.01	0.01	0.01
10.350	0.02	0.02	0.03	0.04	0.04
10.600	0.05	0.06	0.07	0.08	0.09
10.850	0.10	0.11	0.12	0.14	0.15
11.100	0.17	0.19	0.21	0.23	0.26
11.350	0.29	0.31	0.33	0.35	0.37
11.600	0.42	0.52	0.69	0.92	1.14
11.850	1.49	1.87	2.35	2.85	3.30
12.100	3.71	3.99	4.07	4.05	3.97
12.350	3.86	3.74	3.61	3.49	3.41
12.600	3.32	3.23	3.14	3.05	2.97
12.850	2.88	2.80	2.72	2.65	2.57
13.100	2.49	2.41	2.33	2.25	2.17
13.350	2.10	2.03	1.97	1.90	1.84
13.600	1.78	1.72	1.67	1.61	1.53
13.850	1.46	1.39	1.32	1.26	1.21
14.100	1.15	1.11	1.06	1.02	0.98
14.350	0.94	0.91	0.88	0.83	0.78
14.600	0.74	0.70	0.68	0.65	0.63
14.850	0.61	0.60	0.58	0.57	0.56
15.100	0.55	0.54	0.53	0.52	0.51
15.350	0.51	0.50	0.49	0.49	0.48
15.600	0.47	0.47	0.46	0.46	0.45
15.850	0.45	0.44	0.43	0.43	0.42
16.100	0.42	0.41	0.41	0.40	0.40
16.350	0.40	0.39	0.39	0.39	0.38
16.600	0.38	0.38	0.38	0.37	0.37
16.850	0.37	0.37	0.37	0.36	0.36
17.100	0.36	0.36	0.36	0.35	0.35
17.350	0.35	0.35	0.35	0.34	0.34
17.600	0.34	0.34	0.34	0.33	0.33
17.850	0.33	0.33	0.33	0.32	0.32
18.100	0.32	0.32	0.32	0.31	0.31
18.350	0.31	0.31	0.30	0.30	0.29
18.600	0.29	0.29	0.29	0.29	0.28
18.850	0.28	0.28	0.28	0.28	0.27
19.100	0.27	0.27	0.27	0.27	0.26
19.350	0.26	0.26	0.26	0.26	0.25
19.600	0.25	0.25	0.25	0.24	0.24

Subsection: Pond Routed Hydrograph (total out) Return Event: 1 years
Label: PO-1 (OUT) Storm Event: 1
Scenario: 1-yr

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
19.850	0.24	0.24	0.24	0.23	0.23
20.100	0.23	0.23	0.23	0.23	0.23
20.350	0.23	0.22	0.22	0.22	0.22
20.600	0.22	0.22	0.22	0.22	0.22
20.850	0.22	0.22	0.22	0.22	0.22
21.100	0.22	0.22	0.22	0.22	0.22
21.350	0.22	0.22	0.22	0.22	0.22
21.600	0.22	0.22	0.21	0.21	0.21
21.850	0.21	0.21	0.21	0.21	0.21
22.100	0.21	0.21	0.21	0.21	0.21
22.350	0.21	0.21	0.21	0.21	0.21
22.600	0.21	0.21	0.21	0.21	0.21
22.850	0.21	0.21	0.21	0.21	0.20
23.100	0.20	0.20	0.20	0.20	0.20
23.350	0.20	0.20	0.20	0.20	0.20
23.600	0.20	0.20	0.20	0.20	0.20
23.850	0.20	0.20	0.20	0.20	(N/A)

Subsection: Pond Routed Hydrograph (total out)
Label: PO-1 (OUT)
Scenario: 2-yr

Return Event: 2 years
Storm Event: 2

Peak Discharge	6.73 ft³/s
Time to Peak	12.200 hours
Hydrograph Volume	1.093 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
9.200	0.00	0.00	0.00	0.01	0.01
9.450	0.01	0.02	0.02	0.02	0.03
9.700	0.03	0.04	0.04	0.05	0.05
9.950	0.06	0.07	0.07	0.08	0.09
10.200	0.09	0.10	0.11	0.12	0.13
10.450	0.14	0.15	0.16	0.18	0.19
10.700	0.20	0.22	0.24	0.26	0.27
10.950	0.30	0.31	0.32	0.33	0.35
11.200	0.37	0.39	0.42	0.45	0.49
11.450	0.53	0.57	0.63	0.72	0.88
11.700	1.02	1.25	1.61	1.94	2.44
11.950	3.05	3.84	4.84	5.93	6.69
12.200	6.73	6.42	6.00	5.55	5.20
12.450	5.02	4.83	4.64	4.44	4.25
12.700	4.07	3.89	3.73	3.57	3.45
12.950	3.36	3.27	3.18	3.09	3.00
13.200	2.92	2.84	2.76	2.69	2.61
13.450	2.54	2.47	2.39	2.31	2.24
13.700	2.17	2.10	2.04	1.97	1.91
13.950	1.86	1.80	1.75	1.69	1.64
14.200	1.58	1.51	1.44	1.38	1.33
14.450	1.27	1.23	1.18	1.14	1.10
14.700	1.07	1.04	1.01	0.98	0.95
14.950	0.93	0.90	0.88	0.85	0.81
15.200	0.78	0.76	0.73	0.71	0.69
15.450	0.68	0.66	0.65	0.64	0.63
15.700	0.62	0.61	0.60	0.59	0.58
15.950	0.57	0.56	0.56	0.55	0.54
16.200	0.53	0.53	0.52	0.52	0.51
16.450	0.51	0.50	0.50	0.50	0.49
16.700	0.49	0.49	0.48	0.48	0.48
16.950	0.48	0.47	0.47	0.47	0.46
17.200	0.46	0.46	0.46	0.45	0.45
17.450	0.45	0.45	0.44	0.44	0.44
17.700	0.44	0.43	0.43	0.43	0.43
17.950	0.42	0.42	0.42	0.42	0.41
18.200	0.41	0.41	0.40	0.40	0.40
18.450	0.40	0.39	0.39	0.39	0.39
18.700	0.38	0.38	0.38	0.38	0.37

Subsection: Pond Routed Hydrograph (total out) Return Event: 2 years
Label: PO-1 (OUT) Storm Event: 2
Scenario: 2-yr

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
18.950	0.37	0.37	0.37	0.36	0.36
19.200	0.36	0.35	0.35	0.35	0.35
19.450	0.34	0.34	0.34	0.34	0.33
19.700	0.33	0.33	0.32	0.32	0.32
19.950	0.32	0.31	0.31	0.31	0.30
20.200	0.30	0.29	0.29	0.29	0.29
20.450	0.29	0.29	0.29	0.29	0.29
20.700	0.29	0.29	0.29	0.29	0.29
20.950	0.29	0.28	0.28	0.28	0.28
21.200	0.28	0.28	0.28	0.28	0.28
21.450	0.28	0.28	0.28	0.28	0.28
21.700	0.28	0.28	0.28	0.28	0.28
21.950	0.28	0.27	0.27	0.27	0.27
22.200	0.27	0.27	0.27	0.27	0.27
22.450	0.27	0.27	0.27	0.27	0.27
22.700	0.27	0.27	0.27	0.27	0.27
22.950	0.27	0.26	0.26	0.26	0.26
23.200	0.26	0.26	0.26	0.26	0.26
23.450	0.26	0.26	0.26	0.26	0.26
23.700	0.26	0.26	0.26	0.26	0.26
23.950	0.25	0.25	(N/A)	(N/A)	(N/A)

Subsection: Pond Routed Hydrograph (total out)
Label: PO-1 (OUT)
Scenario: 10-yr

Return Event: 10 years
Storm Event: 10

Peak Discharge	21.93 ft³/s
Time to Peak	12.100 hours
Hydrograph Volume	2.241 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
6.950	0.00	0.00	0.00	0.01	0.01
7.200	0.01	0.02	0.02	0.02	0.03
7.450	0.03	0.04	0.04	0.04	0.05
7.700	0.05	0.06	0.06	0.07	0.07
7.950	0.07	0.08	0.08	0.09	0.09
8.200	0.10	0.10	0.11	0.12	0.12
8.450	0.13	0.14	0.15	0.15	0.16
8.700	0.17	0.18	0.19	0.20	0.21
8.950	0.22	0.23	0.24	0.25	0.26
9.200	0.27	0.28	0.29	0.29	0.30
9.450	0.31	0.31	0.31	0.32	0.32
9.700	0.33	0.34	0.35	0.36	0.37
9.950	0.38	0.39	0.41	0.42	0.44
10.200	0.46	0.48	0.50	0.52	0.54
10.450	0.57	0.59	0.62	0.64	0.67
10.700	0.70	0.74	0.77	0.81	0.85
10.950	0.89	0.91	0.94	0.97	1.00
11.200	1.04	1.09	1.14	1.20	1.26
11.450	1.34	1.41	1.51	1.64	1.79
11.700	2.04	2.43	2.92	3.64	5.18
11.950	9.72	15.32	19.82	21.93	21.51
12.200	19.59	17.22	15.09	13.23	11.61
12.450	10.21	9.20	8.32	7.54	6.83
12.700	6.22	5.68	5.25	5.08	4.91
12.950	4.75	4.59	4.44	4.29	4.15
13.200	4.01	3.88	3.75	3.63	3.52
13.450	3.45	3.38	3.31	3.24	3.18
13.700	3.11	3.05	2.98	2.92	2.86
13.950	2.80	2.74	2.68	2.63	2.57
14.200	2.52	2.46	2.40	2.34	2.29
14.450	2.24	2.19	2.14	2.10	2.05
14.700	2.01	1.97	1.93	1.89	1.86
14.950	1.82	1.79	1.76	1.72	1.69
15.200	1.66	1.64	1.60	1.56	1.52
15.450	1.48	1.45	1.41	1.38	1.35
15.700	1.32	1.29	1.27	1.24	1.22
15.950	1.20	1.17	1.15	1.13	1.11
16.200	1.09	1.08	1.06	1.05	1.03
16.450	1.02	1.00	0.99	0.98	0.97

Subsection: Pond Routed Hydrograph (total out) Return Event: 10 years
Label: PO-1 (OUT) Storm Event: 10
Scenario: 10-yr

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
16.700	0.96	0.95	0.94	0.93	0.92
16.950	0.92	0.91	0.90	0.89	0.89
17.200	0.88	0.87	0.85	0.84	0.83
17.450	0.83	0.82	0.81	0.80	0.80
17.700	0.79	0.78	0.78	0.77	0.77
17.950	0.76	0.76	0.75	0.75	0.74
18.200	0.74	0.73	0.73	0.72	0.72
18.450	0.71	0.71	0.70	0.70	0.69
18.700	0.69	0.68	0.68	0.67	0.67
18.950	0.66	0.66	0.65	0.65	0.64
19.200	0.64	0.63	0.63	0.62	0.62
19.450	0.61	0.61	0.60	0.60	0.59
19.700	0.59	0.58	0.58	0.57	0.57
19.950	0.56	0.56	0.55	0.55	0.55
20.200	0.54	0.54	0.53	0.53	0.53
20.450	0.53	0.52	0.52	0.52	0.52
20.700	0.52	0.52	0.52	0.51	0.51
20.950	0.51	0.51	0.51	0.51	0.51
21.200	0.51	0.51	0.50	0.50	0.50
21.450	0.50	0.50	0.50	0.50	0.50
21.700	0.50	0.50	0.50	0.49	0.49
21.950	0.49	0.49	0.49	0.49	0.49
22.200	0.49	0.49	0.49	0.48	0.48
22.450	0.48	0.48	0.48	0.48	0.48
22.700	0.48	0.48	0.48	0.48	0.47
22.950	0.47	0.47	0.47	0.47	0.47
23.200	0.47	0.47	0.47	0.47	0.46
23.450	0.46	0.46	0.46	0.46	0.46
23.700	0.46	0.46	0.46	0.46	0.46
23.950	0.45	0.45	(N/A)	(N/A)	(N/A)

Subsection: Pond Routed Hydrograph (total out)
Label: PO-1 (OUT)
Scenario: 100-yr

Return Event: 100 years
Storm Event: 100

Peak Discharge	74.00 ft³/s
Time to Peak	12.000 hours
Hydrograph Volume	4.687 ac-ft

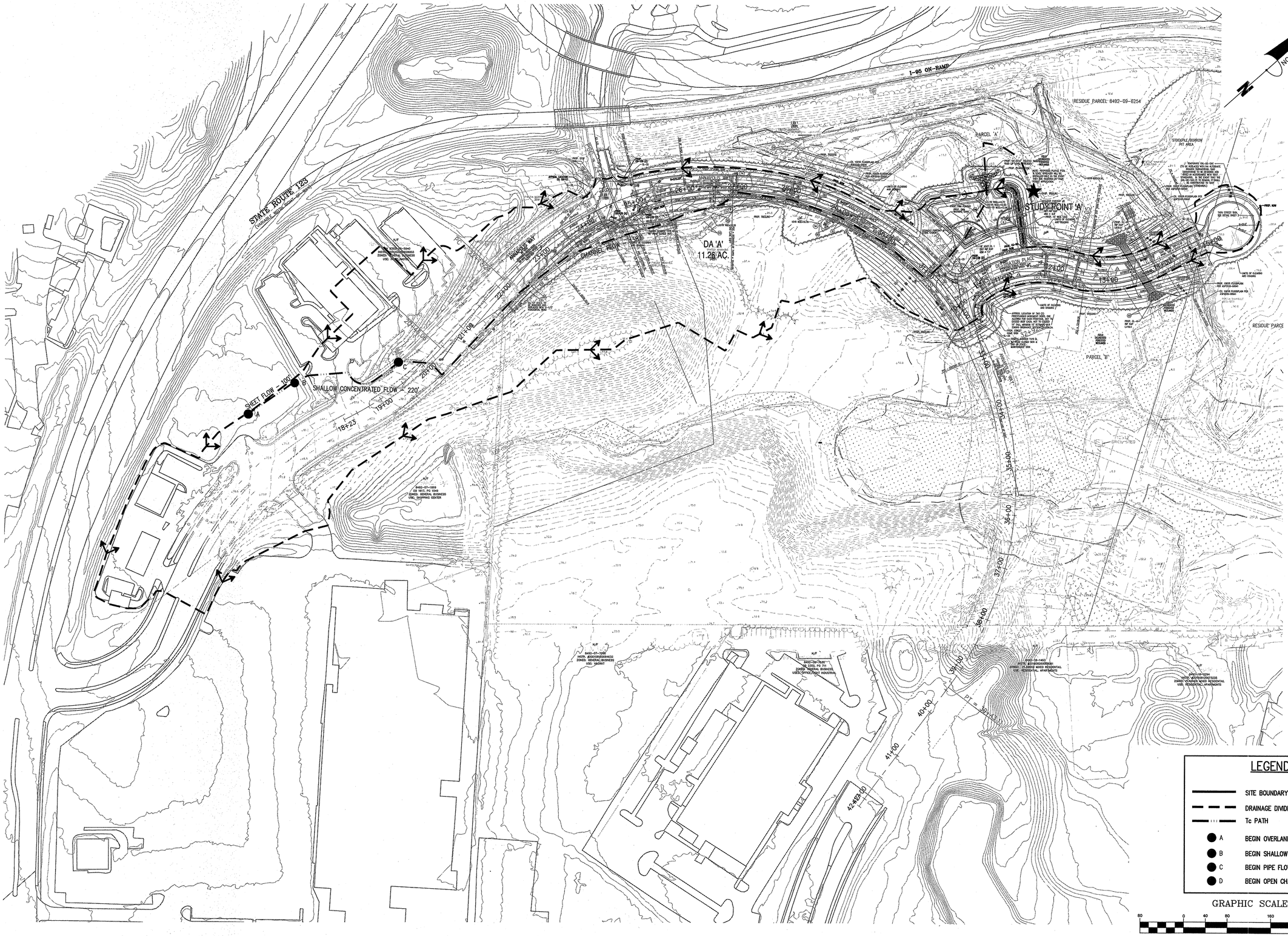
HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
4.650	0.00	0.00	0.00	0.01	0.01
4.900	0.02	0.03	0.03	0.04	0.05
5.150	0.05	0.06	0.07	0.07	0.08
5.400	0.09	0.10	0.10	0.11	0.12
5.650	0.12	0.13	0.14	0.15	0.16
5.900	0.16	0.17	0.18	0.19	0.20
6.150	0.20	0.21	0.22	0.23	0.24
6.400	0.25	0.25	0.26	0.27	0.28
6.650	0.29	0.30	0.31	0.31	0.31
6.900	0.32	0.32	0.33	0.34	0.34
7.150	0.35	0.36	0.37	0.38	0.38
7.400	0.39	0.40	0.41	0.42	0.43
7.650	0.44	0.45	0.46	0.47	0.48
7.900	0.48	0.49	0.50	0.51	0.52
8.150	0.53	0.55	0.56	0.57	0.59
8.400	0.61	0.62	0.64	0.66	0.68
8.650	0.70	0.73	0.75	0.77	0.80
8.900	0.82	0.84	0.87	0.89	0.90
9.150	0.91	0.93	0.94	0.96	0.97
9.400	0.99	1.00	1.02	1.03	1.04
9.650	1.06	1.07	1.09	1.11	1.13
9.900	1.16	1.18	1.21	1.24	1.27
10.150	1.30	1.34	1.37	1.41	1.46
10.400	1.50	1.55	1.60	1.64	1.67
10.650	1.71	1.75	1.79	1.84	1.89
10.900	1.95	2.01	2.07	2.14	2.21
11.150	2.29	2.37	2.47	2.56	2.66
11.400	2.77	2.88	3.01	3.15	3.36
11.650	3.81	4.63	6.60	10.53	16.54
11.900	26.94	68.41	74.00	69.87	56.55
12.150	39.14	25.80	23.08	21.11	19.05
12.400	17.12	15.49	14.05	12.74	11.57
12.650	10.52	9.69	9.05	8.47	7.96
12.900	7.51	7.10	6.73	6.39	6.08
13.150	5.80	5.55	5.32	5.21	5.12
13.400	5.03	4.94	4.85	4.76	4.67
13.650	4.57	4.48	4.39	4.31	4.22
13.900	4.13	4.05	3.96	3.88	3.80
14.150	3.72	3.64	3.57	3.50	3.46

Subsection: Pond Routed Hydrograph (total out) Return Event: 100 years
Label: PO-1 (OUT) Storm Event: 100
Scenario: 100-yr

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
14.400	3.42	3.38	3.34	3.30	3.26
14.650	3.22	3.18	3.15	3.11	3.07
14.900	3.04	3.00	2.97	2.94	2.90
15.150	2.87	2.84	2.80	2.77	2.74
15.400	2.71	2.68	2.65	2.61	2.58
15.650	2.55	2.52	2.49	2.46	2.42
15.900	2.39	2.36	2.32	2.29	2.26
16.150	2.23	2.20	2.17	2.14	2.11
16.400	2.09	2.06	2.04	2.01	1.99
16.650	1.97	1.95	1.93	1.91	1.89
16.900	1.87	1.85	1.83	1.82	1.80
17.150	1.78	1.77	1.75	1.74	1.72
17.400	1.71	1.69	1.68	1.67	1.65
17.650	1.64	1.63	1.61	1.59	1.57
17.900	1.55	1.54	1.52	1.51	1.49
18.150	1.48	1.46	1.45	1.43	1.42
18.400	1.41	1.40	1.38	1.37	1.36
18.650	1.35	1.34	1.33	1.32	1.31
18.900	1.30	1.29	1.28	1.27	1.26
19.150	1.25	1.24	1.23	1.22	1.21
19.400	1.20	1.19	1.18	1.17	1.16
19.650	1.15	1.14	1.13	1.12	1.11
19.900	1.10	1.09	1.08	1.07	1.07
20.150	1.06	1.05	1.04	1.03	1.03
20.400	1.02	1.01	1.01	1.00	1.00
20.650	0.99	0.99	0.98	0.98	0.97
20.900	0.97	0.97	0.96	0.96	0.96
21.150	0.96	0.95	0.95	0.95	0.94
21.400	0.94	0.94	0.94	0.93	0.93
21.650	0.93	0.93	0.93	0.92	0.92
21.900	0.92	0.92	0.92	0.91	0.91
22.150	0.91	0.91	0.91	0.90	0.90
22.400	0.90	0.90	0.90	0.89	0.89
22.650	0.89	0.89	0.89	0.88	0.88
22.900	0.88	0.88	0.88	0.87	0.87
23.150	0.87	0.86	0.86	0.86	0.86
23.400	0.85	0.85	0.85	0.85	0.85
23.650	0.84	0.84	0.84	0.84	0.84
23.900	0.83	0.83	0.83	(N/A)	(N/A)



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POST-DEVELOPED DRAINAGE DIVIDES MAP

ANNAPOLIS WAY
PUBLIC IMPROVEMENT PLAN
WOODBRIDGE MAGISTERIAL DISTRICT - PRINCE WILLIAM COUNTY

SPR-2018-000412
COUNTY PLAN NUMBER

COMMONWEALTH OF VIRGINIA
CHARLES V. FITZGERALD JR
Lic. No.050113
6-6-2019
PROFESSIONAL ENGINEER

PLAN STATUS	
05/24/18	1ST SUBMISSION
03/24/19	2ND SUBMISSION
06/14/19	3RD SUBMISSION
09/06/19	ISSUED TO CLIENT

DATE	DESCRIPTION

CVF	JLD	CVF
DESIGN	DRAWN	CHKD

SCALE H: 1"=80'
V: N/A

JOB No. 100065-02-001

DATE : SEPTEMBER 2019

FILE No. 100065-D-PIP-001

SHEET 26 OF 34

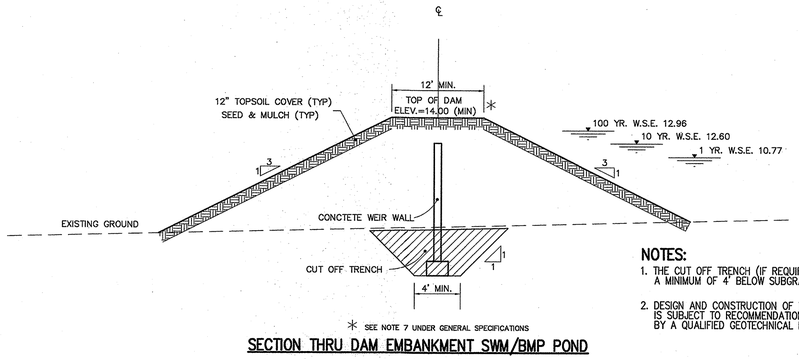
11A	0.22					0.04			0.02		0.28	0.28	0.22	0.00	0.06	0.00	93	0.78	11A
11B	0.19					0.04			0.10		0.33	0.33	0.19	0.00	0.14	0.00	90	0.67	11B
12B	0.20		0.04								0.24	0.24	0.20	0.00	0.04	0.00	92	0.81	12B

PRE/POST-	RUNOFF					OVERALL RUNOFF TO STRUCTURE	PRE/POST-
	IMPERVIOUS	B SOILS	C SOILS	D SOILS	TOTAL		

Tc PATH CALCULATIONS

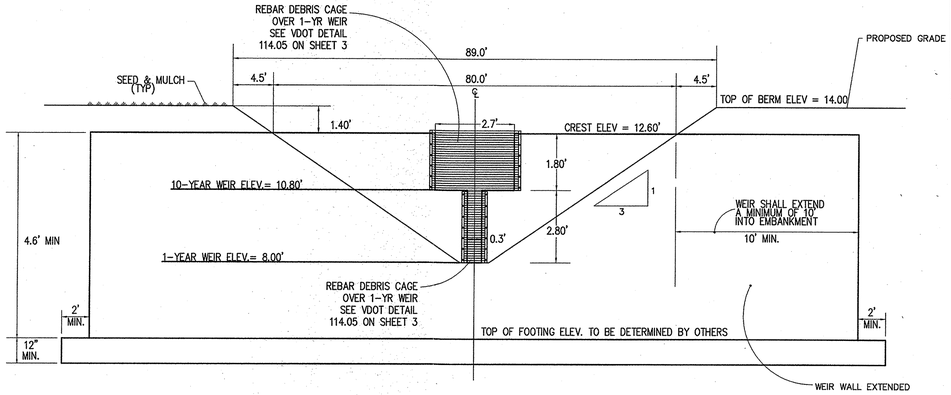
DA #	OVERLAND FLOW				SHALLOW CONCENTRATED FLOW				PIPE FLOW			CHANNEL FLOW			TOTAL
	LENGTH (FT)	SLOPE (FT/FT)	C-FACTOR	Tt (MIN)	LENGTH (FT)	AVG. SLOPE	AVG. VELOCITY	Tt (MIN)	LENGTH (FT)	DELTA H (FT)	Tt (MIN)	LENGTH (FT)	DELTA H (FT)	Tt (MIN)	Tc (MIN)
PRE DEV DA	100	2.200	0.2	**6.70**	220	9	6.0	**0.61**				471	2.40	**5.90**	**16.17**
PRE DEV DA					496	3	2.8	**2.95**							
POST DEV DA	100	2.200	0.2	**6.70**	514	6	4.0	**2.14**	500	4.69	**1.07**				**9.91**

Study Point	Pre-Developed						Post-Developed						Channel Protection Energy Balance Calc.			Flood Protection		
	Drainage Area (ac.)	CN	Tc (hrs.)	Q1 (cfs)	1yr hyd. vol. (ac-ft)	Q10 (cfs)	Drainage Area (ac.)	CN	Tc (hrs.)	Q1 (cfs)	1yr hyd. vol. (ac-ft)	Q10 (cfs)	Pre-Dev Q1 x hyd. Vol. x I.F.	Post-Dev Q1 x hyd. Vol.	Greater Product?	Q10 diff. (cfs)	Q10 diff. (%increase)	Proposed BMP
Study Point 'A'	11.26	74	0.2695	7.21	0.573	27.59	11.26	79	0.16	4.11	0.789	26.16	3.305064	3.24279	Pre-Developed	-1.43	-5.2%	Ext. Detention Pond



SECTION THRU DAM EMBANKMENT SWM/BMP POND

SCALE: NONE



SECTION THRU COMBINATION PRINCIPAL & EMERGENCY SPILLWAY S.W.M. FACILITY

SCALE: NONE

NOTE: CONCRETE WEIR STRUCTURAL DESIGN BY OTHERS

NOTES:

1. THE CUT OFF TRENCH (IF REQUIRED) SHALL EXTEND A MINIMUM OF 4' BELOW SUBGRADE OR TO REFUSAL.
2. DESIGN AND CONSTRUCTION OF THE PROPOSED DAM IS SUBJECT TO RECOMMENDATIONS AND INSPECTION BY A QUALIFIED GEOTECHNICAL ENGINEER.

COMPOSITE RATING CURVE

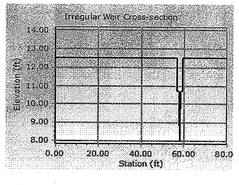
Composite Outflow Summary

Water Surface Elevation (ft)	Flow (ft³/s)	Tailwater Elevation (ft)	Convergence Error (ft)	Contributing Structures
8.00	0.00	(N/A)	0.00	Weir - 1
8.25	0.11	(N/A)	0.00	Weir - 1
8.50	0.31	(N/A)	0.00	Weir - 1
8.75	0.57	(N/A)	0.00	Weir - 1
9.00	0.88	(N/A)	0.00	Weir - 1
9.25	1.23	(N/A)	0.00	Weir - 1
9.50	1.62	(N/A)	0.00	Weir - 1
9.75	2.04	(N/A)	0.00	Weir - 1
10.00	2.5	(N/A)	0.00	Weir - 1
10.25	2.99	(N/A)	0.00	Weir - 1
10.50	3.51	(N/A)	0.00	Weir - 1
10.75	4.06	(N/A)	0.00	Weir - 1
11.00	5.28	(N/A)	0.00	Weir - 1
11.25	7.4	(N/A)	0.00	Weir - 1
11.50	10.05	(N/A)	0.00	Weir - 1
11.75	13.13	(N/A)	0.00	Weir - 1
12.00	16.58	(N/A)	0.00	Weir - 1
12.25	20.36	(N/A)	0.00	Weir - 1
12.50	24.44	(N/A)	0.00	Weir - 1
12.75	42.27	(N/A)	0.00	Weir - 1
13.00	92.08	(N/A)	0.00	Weir - 1
13.25	159.8	(N/A)	0.00	Weir - 1
13.50	241.37	(N/A)	0.00	Weir - 1
13.75	334.68	(N/A)	0.00	Weir - 1
14.00	438.37	(N/A)	0.00	Weir - 1

POND OUTLET INFORMATION

Irregular Weir Cross-section

Station (ft)	Elevation (ft)
0.00	14.00
0.01	12.6
56.65	12.6
56.66	10.8
57.85	10.8
57.86	8.00
58.15	8.00
58.16	10.8
59.34	10.8
59.35	12.6
79.99	12.6
80.00	14.00



SEDIMENT TRAP CALCULATIONS

SEDIMENT TRAP CAPACITY CALCULATIONS - PHASE 1

PROJECT: SPRING ARBOR II

SEDIMENT TRAP CAPACITY CALCULATIONS - PHASE 1

TRAP NO.	DRAIN AREA (AC)	TOTAL REQUIRED STORAGE (134 C.Y./ AC)	REQUIRED WET STORAGE (67 C.Y.)	REQUIRED DRY STORAGE (67 C.Y.)	WET STORAGE VOLUME CALC. L (FT)	W (FT)	D (FT)	VOL. (C.Y.)	DRY STORAGE VOLUME CALC. L (FT)	W (FT)	D (FT)	VOL. (C.Y.)	TOTAL VOLUME PROVIDED (C.Y.)	LENGTH AT BOTTOM OF TRAP	WIDTH AT BOTTOM OF TRAP	ELEVATION AT BOTTOM OF TRAP	BOTTOM OF WEIR ELEVATION	OUTLET ELEVATION	DAM ELEVATION	LENGTH OF RIP RAP WEIR	HEIGHT OF EMBANKMENT	WIDTH OF EMBANKMENT
1	1.25	168	84	84	37.0	27.0	3.00	94.4	45.0	35.0	2.00	95.3	189.7	31.0	21.0	5.0	8.0	10.0	11.0	7.5	3.0	2.5
2	1.75	235	117	117	41.0	28.0	3.25	117.5	50.0	37.0	2.25	124.9	242.4	34.5	21.5	8.8	12.0	14.3	15.3	10.5	3.3	2.5
3	1.07	143	72	72	37.0	22.0	3.00	76.9	45.0	30.0	2.00	80.1	157.0	31.0	16.0	4.5	7.5	9.5	10.5	6.4	3.0	2.5
4	1.13	151	76	76	37.0	22.0	3.00	76.9	45.0	30.0	2.00	80.1	157.0	31.0	16.0	4.5	7.5	17.0	19.0	20.0	6.8	3.0	2.5

SEDIMENT TRAP CAPACITY CALCULATIONS - PHASE 2

PROJECT: SPRING ARBOR II

SEDIMENT TRAP CAPACITY CALCULATIONS - PHASE 2

TRAP NO.	DRAIN AREA (AC)	TOTAL REQUIRED STORAGE (134 C.Y./ AC)	REQUIRED WET STORAGE (67 C.Y.)	REQUIRED DRY STORAGE (67 C.Y.)	WET STORAGE VOLUME CALC. L (FT)	W (FT)	D (FT)	VOL. (C.Y.)	DRY STORAGE VOLUME CALC. L (FT)	W (FT)	D (FT)	VOL. (C.Y.)	TOTAL VOLUME PROVIDED (C.Y.)	LENGTH AT BOTTOM OF TRAP	WIDTH AT BOTTOM OF TRAP	ELEVATION AT BOTTOM OF TRAP	BOTTOM OF WEIR ELEVATION	OUTLET ELEVATION	DAM ELEVATION	LENGTH OF RIP RAP WEIR	HEIGHT OF EMBANKMENT	WIDTH OF EMBANKMENT
1	TRAP TO BE PHASED OUT AS FILL OPERATIONS PROCEED																					
3	TRAP TO BE PHASED OUT AS FILL OPERATIONS PROCEED																					

EVQ TABLE

Infiltration	
Infiltration Method (Computed)	No Infiltration
Initial Conditions	
Elevation (Water Surface, Initial)	8.00 ft
Volume (Initial)	0.000 ac-ft
Flow (Initial Outlet)	0.00 ft³/s
Flow (Initial Infiltration)	0.00 ft³/s
Flow (Initial, Total)	0.00 ft³/s
Time Increment	0.050 hours

Elevation (ft)	Outflow (ft³/s)	Storage (ac-ft)	Area (acres)	Infiltration (ft³/s)	Flow (Total) (ft³/s)	2S/t + O (ft³/s)
8.00	0.00	0.000	0.000	0.00	0.00	0.00
8.25	0.11	0.000	0.002	0.00	0.11	0.20
8.50	0.31	0.001	0.009	0.00	0.31	1.02
8.75	0.57	0.005	0.020	0.00	0.57	2.98
9.00	0.88	0.012	0.035	0.00	0.88	6.60
9.25	1.23	0.023	0.055	0.00	1.23	12.42
9.50	1.62	0.040	0.080	0.00	1.62	20.95
9.75	2.04	0.063	0.109	0.00	2.04	32.74
10.00	2.50	0.095	0.142	0.00	2.50	48.32
10.25	2.99	0.131	0.148	0.00	2.99	66.37
10.50	3.51	0.169	0.155	0.00	3.51	85.22
10.75	4.06	0.208	0.161	0.00	4.06	104.88
11.00	5.28	0.249	0.168	0.00	5.28	126.01
11.25	7.40	0.292	0.175	0.00	7.40	148.86
11.50	10.05	0.337	0.182	0.00	10.05	173.07
11.75	13.13	0.383	0.189	0.00	13.13	198.56
12.00	16.58	0.431	0.196	0.00	16.58	225.29
12.25	20.36	0.481	0.201	0.00	20.36	253.11
12.50	24.44	0.532	0.207	0.00	24.44	281.88
12.75	42.27	0.584	0.212	0.00	42.27	325.07
13.00	92.08	0.638	0.218	0.00	92.08	400.91
13.25	159.80	0.693	0.224	0.00	159.80	495.34
13.50	241.37	0.750	0.229	0.00	241.37	604.31
13.75	334.68	0.808	0.235	0.00	334.68	725.72
14.00	438.37	0.867	0.241	0.00	438.37	858.21

10-YEAR HYDROGRAPH TABLE

Peak Discharge	26.16 ft³/s
Time to Peak	12.100 hours
Hydrograph Volume	2.355 ac-ft

HYDROGRAPH ORDINATES (ft³/s)
Output Time Increment = 0.050 hours
Time on left represents time for first value in each row.

Time (hours)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)	Flow (ft³/s)
7.800	0.00	0.00	0.00	0.01	0.01
8.050	0.02	0.02	0.02	0.03	0.04
8.300	0.04	0.05	0.05	0.06	0.07
8.550	0.07	0.08	0.09	0.10	0.10
8.800	0.11	0.12	0.13	0.14	0.15
9.050	0.15	0.16	0.17	0.18	0.19
9.300	0.20	0.20	0.21	0.22	0.23
9.550	0.23	0.24	0.25	0.26	0.27
9.800	0.28	0.30	0.31	0.32	0.34
10.050	0.35	0.37	0.39	0.40	0.42
10.300	0.44	0.46	0.49	0.51	0.53
10.550	0.55	0.58	0.61	0.63	0.66
10.800	0.69	0.73	0.76	0.80	0.84
11.050	0.88	0.92	0.96	1.01	1.07
11.300	1.12	1.19	1.25	1.33	1.40
11.550	1.49	1.62	1.82	2.12	2.52
11.800	3.07	3.88	6.61	12.64	19.32
12.050	24.33	26.16	24.74	21.70	18.52
12.300	15.75	13.49	11.67	10.20	9.02
12.550	8.04	7.23	6.56	6.01	5.55
12.800	5.18	4.88	4.62	4.42	4.25
13.050	4.14	4.06	3.98	3.90	3.81
13.300	3.73	3.66	3.58	3.50	3.43
13.550	3.35	3.28	3.21	3.14	3.07
13.800	3.01	2.94	2.88	2.82	2.76
14.050	2.70	2.64	2.58	2.53	2.47
14.300	2.42	2.37	2.32	2.27	2.23
14.550	2.18	2.13	2.09	2.05	2.00
14.800	1.96	1.92	1.88	1.85	1.81
15.050	1.77	1.74	1.70	1.67	1.64
15.300	1.61	1.58	1.55	1.52	1.49
15.550	1.46	1.43	1.41	1.38	1.36
15.800	1.33	1.31	1.28	1.26	1.24
16.050	1.22	1.20	1.18	1.16	1.14
16.300	1.12	1.10	1.09	1.07	1.06
16.550	1.05	1.04	1.03	1.02	1.01
16.800	1.00	0.99	0.98	0.97	0.96
17.050	0.96	0.95	0.94	0.93	0.93
17.300	0.92	0.92	0.91	0.90	0.90
17.550	0.89	0.89	0.88	0.87	0.87
17.800	0.86	0.86	0.85	0.85	0.84
18.050	0.83	0.83	0.82	0.82	0.81
18.300	0.81	0.80	0.80	0.79	0.78
18.550	0.78	0.77	0.77	0.76	0.76
18.800	0.75	0.75	0.74	0.73	0.73
19.050	0.72	0.72	0.71	0.71	0.70
19.300	0.70	0.69	0.68	0.68	0.67
19.550	0.67	0.66	0.66	0.65	0.64
19.800	0.64	0.63	0.63	0.62	0.62
20.050	0.61	0.61	0.60	0.60	0.59
20.300	0.59	0.58	0.58	0.58	0.58
20.550	0.58	0.57	0.57	0.57	0.57
20.800	0.57	0.57	0.57	0.56	0.56
21.050	0.56	0.56	0.56	0.56	0.56
21.300	0.56	0.56	0.56	0.55	0.55
21.550	0.55	0.55	0.55	0.55	0.55
21.800	0.55	0.55	0.54	0.54	0.54
22.050	0.54	0.54	0.54	0.54	0.54
22.300	0.54	0.54	0.53	0.53	0.53
22.550	0.53	0.53	0.53	0.53	0.53
22.800	0.53	0.52	0.52	0.52	0.52
23.050	0.52	0.52	0.52	0.52	0.52
23.300	0.52	0.51	0.51	0.51	0.51
23.550	0.51	0.51	0.51	0.51	0.51
23.800	0.50	0.50	0.50	0.50	0.50

ELEVATION-AREA TABLE

Subsection: Elevation-Area Volume Curve
Label: SWM Pond

Return Event: 10 years
Storm Event: 10-YR

Elevation (ft)	Perimeter (ft)	Area (acres)	A1+A2+sqr(A1*A2) / 3 (acres)	Volume (ac-ft)	Volume (Total) (ac-ft)
8.00	0.0	0.000	0.000	0.000	0.000
10.00	0.0	0.142	0.142	0.095	0.095
12.00	0.0	0.196	0.505	0.337	0.431
14.00	0.0	0.241	0.654	0.436	0.867

STORM WATER MANAGMENT NARRATIVE

THE PROPOSED STORM DRAIANGE SYSTEM FOR THE ANNAPOLIS WAY PUBLIC IMPROVEMENT PLAN CONSISTS OF CURB INLETS CONNECTED TO AN UNDERGROUND PIPE NETWORK, COLLECTING RUNOFF AND CONVEYING IT TO AN EXTENDED DETENTION FACILITY.
THERE IS ONE LOCATION WHERE CONCENTRATED RUNOFF LEAVES THE SUBJECT SITE. STUDY POINT 'A' HAS BEEN PLACED AT THIS LOCATION. A PROPOSED EXTENDED DETENTION FACILITY STORES RUNOFF LEAVING THE SITE AND RELEASES IT SLOWLY OVER AN EXTENDED AMOUNT OF TIME. THE CALCULATIONS ON THIS SHEET SHOW HOW THE PROPOSED EXTENDED DETENTION FACILITY CONTROLS THE RUNOFF FROM THE 1-YR (CHANNEL PROTECTION), 2-YR, AND 10-YR (FLOOD PROTECTION) STORM EVENTS AT STUDY POINT 'A'.

THE PRE-DEVELOPED 1-YR FLOW IS 7.21 CFS AND THE POST-DEVELOPED FLOW IS 4.11 CFS. THE PRE-DEVELOPED 2-YR FLOW IS 11.59 CFS AND THE POST-DEVELOPED FLOW IS 8.35 CFS. THE PRE-DEVELOPED 10-YR FLOW IS 27.59 CFS AND THE POST-DEVELOPED FLOW IS 26.16 CFS. THE REDUCTION IN POST-DEVELOPED FLOWS ARE ACCOMPLISHED BY THE TEMPORARY STORAGE OF RUNOFF IN THE EXTENDED DETENTION FACILITY. A SUMMARY OF THE PRE-DEVELOPED AND POST-DEVELOPED FLOWS & HYDROGRAPH VOLUMES ARE PROVIDED ON THIS SHEET.
AT STUDY POINT 'A', THE EXTENDED DETENTION FACILITY OUTFALLS INTO A NATURAL CHANNEL. RUNOFF FROM ALL OTHER PORTIONS OF THE DISTURBED 'SITE AREA' LEAVES THE SITE VIA SHEET FLOW.

1-YEAR FLOW SUMMARY

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
Post-Dev DA	1-YR	1	0.79	12.000	12.8
Pre-Dev DA	1-YR	1	0.573	12.100	7.21

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
Post-Dev SP 'A'	1-YR	1	0.789	12.200	4.11
Pre-Dev SP 'A'	1-YR	1	0.573	12.100	7.21

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
SWM Pond (IN)	1-YR	1	0.79	12.000	12.8	(N/A)	(N/A)
SWM Pond (OUT)	1-YR	1	0.789	12.200	4.11	10.77	0.212

2-YEAR FLOW SUMMARY

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
Post-Dev DA	2-YR	2	1.140	12.000	18.77
Pre-Dev DA	2-YR	2	0.872	12.050	11.59

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
Post-Dev SP 'A'	2-YR	2	1.138	12.150	8.35
Pre-Dev SP 'A'	2-YR	2	0.872	12.050	11.59

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
SWM Pond (IN)	2-YR	2	1.140	12.000	18.77	(N/A)	(N/A)
SWM Pond (OUT)	2-YR	2	1.138	12.150	8.35	11.35	0.309

10-YEAR FLOW SUMMARY

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
Post-Dev DA	10-YR	10	2.359	12.000	38.94
Pre-Dev DA	10-YR	10	1.966	12.050	27.59

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
Post-Dev SP 'A'	10-YR	10	2.355	12.100	26.16
Pre-Dev SP 'A'	10-YR	10	1.966	12.050	27.59

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
SWM Pond (IN)	10-YR	10	2.359	12.000	38.94	(N/A)	(N/A)
SWM Pond (OUT)	10-YR	10	2.355	12.100	26.16	12.6	0.553

100-YEAR FLOW SUMMARY

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
Post-Dev DA	100-YR	100	5.184	12.000	83.25
Pre-Dev DA	100-YR	100	4.631	12.050	65.09

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)
Post-Dev SP 'A'	100-YR	100	5.17	12.000	82.5
Pre-Dev SP 'A'	100-YR	100	4.631	12.050	65.09

Pond Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (hours)	Peak Flow (ft³/s)	Maximum Water Surface Elevation (ft)	Maximum Pond Storage (ac-ft)
SWM Pond (IN)	100-YR	100	5.184	12.000	83.25	(N/A)	(N/A)
SWM Pond (OUT)	100-YR	100	5.17	12.000	82.5	12.96	0.629

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SWM CALCULATIONS

ANNAPOLIS WAY
PUBLIC IMPROVEMENT PLAN
WOODBRIDGE MAGISTERIAL DISTRICT - PRINCE WILLIAM COUNTY

SPR-2018-000412
COUNTY PLAN NUMBER

COMMONWEALTH OF VIRGINIA
CHARLES V. FITZGERALD IV
Lic. No.050113
9-6-2019
PROFESSIONAL ENGINEER

PLAN STATUS	
05/24/18	1ST SUBMISSION
03/24/19	2ND SUBMISSION
06/14/19	3RD SUBMISSION
09/06/19	ISSUED TO CLIENT

DATE	DESCRIPTION

CVF	JLD	CVF
DESIGN	DRAWN	CHKD

SCALE H: N/A V: N/A

JOB No. 100065-02-001

DATE : SEPTEMBER 2019

FILE No. 100065-D-PIP-001

SHEET 27 OF 34

Cad file name : P:\100065 - Annapolis Way\100065-02-001 (ENG)\Engineering\Engineering Plans\100065-D-PIP-001 Public Improvement Plan\027-029-100065-D-PIP-001-SWM-BMP.dwg

NOTES FOR CONCRETE USED IN CONSTRUCTION OF DAMS

1. UNLESS OTHERWISE SPECIFIED IN THE APPROVED SITE OR CONSTRUCTION PLAN, THE FOLLOWING APPLY TO ALL CONCRETE. MINIMUM STRENGTH IS 3,000 POUNDS. MINIMUM SLUMP IS 1" AND MAXIMUM SLUMP IS 3". CEMENT SHALL BE TYPE I; IF SOIL IS FOUND TO BE HIGH IN SOLUBLE SULFATES, TYPE V SHOULD BE USED AFTER CONSULTING WITH THE DESIGN ENGINEER (OR THE ENGINEER WHO IS TO CERTIFY THE STRUCTURE). EXPOSED CONCRETE WILL BE WATER CURED OR COVERED WITH CLEAR OR WHITE POLYETHYLENE FILM. ALL MATERIALS SHALL CONFORM TO APPROPRIATE ASTMS. FORMS SHALL BE CLEAR OF SOIL AND OTHER MATERIALS. CHAMFER STRIPS SHALL BE PLACED IN THE CORNERS OF THE FORMS AND AT THE TOPS OF WALL PLACEMENTS TO PRODUCE BEVELED EDGES ON PERMANENTLY EXPOSED CONCRETE SURFACES. SHARP EDGES OF CONSTRUCTION JOINTS SHALL NOT BE BEVELED EXCEPT WHERE INDICATED ON THE DRAWINGS. CONSOLIDATION OF ALL CONCRETE SHALL BE BY IMMERSION-TYPE VIBRATORS OPERATED IN A NEARLY VERTICAL POSITION. CONCRETE SHALL BE PLACED ACCORDING TO AMERICAN CONCRETE INSTITUTE (ACI) PROCEDURES FOR HOT AND COLD WEATHER CONCRETE.
2. UNLESS IT HAS BEEN SHOWN THAT THE ENTRAINED AIR CONTENT OF THE CONCRETE IS AT LEAST 4%, BY VOLUME, AS DISCHARGED AT PLACEMENT, AN AIR ENTRAINING ADMIXTURE SHALL BE USED IN THE CONCRETE. THE ADMIXTURE SHALL CONFORM TO ASTM C 260; ANY AIRENTRAINING ADMIXTURE USED WITH TYPE F OR G CHEMICAL ADMIXTURE SHALL BE NEUTRALIZED VINSOL RESIN FORMULATION. ALL ADMIXTURES WILL BE USED AS SPECIFIED IN THE DESIGN OR AS APPROVED BY THE DESIGN OR CERTIFYING ENGINEER. ANY ADMIXTURE, SUCH AS CALCIUM CHLORIDE, OR COMBINATION OF ADMIXTURES WHICH WILL INTRODUCE MORE THAN 0.1% CHLORIDE (TO CEMENT, BY WEIGHT) SHALL NOT BE USED IN CONCRETE IN WHICH ALUMINUM GALVANIZED METALWORK OR PRESTRESSING STEEL IS TO BE EMBEDDED.
3. NOTE REBAR SCHEDULE IN DRAWINGS. LUBRICATION OF FORMS IS REQUIRED UNLESS OTHERWISE SPECIFIED. FORMS SHALL BE REMOVED WITHIN 24 HOURS AFTER THE CONCRETE HAS HARDENED SUFFICIENTLY TO PREVENT DAMAGE BY CAREFUL FORM REMOVAL AND SPECIFIED REPAIR AND CURING WILL BE COMMENCED IMMEDIATELY THEREAFTER.
4. ALL MATERIALS TO BE WITHIN THE CONCRETE SHALL BE APPROPRIATE METAL REBAR, ELECTRICALLY WELDED WIRE FABRIC, MESH, TIES, METAL SUPPORTS, ETC. INTERIOR WOODEN BRACES ARE NOT ACCEPTABLE. BEFORE REINFORCEMENT IS EMBEDDED IN THE CONCRETE, THE SURFACES OF THE BARS, FABRIC AND SUPPORTS SHALL BE CLEANED OF HEAVY FLAKY RUST, LOOSE MILL SCALE, DIRT, GREASE OR OTHER FOREIGN SUBSTANCES WHICH ARE OBJECTIONABLE. HEAVY FLAKE RUST WHICH CAN BE REMOVED BY FIRM RUBBING WITH BURLAP, OR EQUIVALENT TREATMENT, IS CONSIDERED OBJECTIONABLE. PLASTIC FORM SPACERS ARE ACCEPTABLE. WHERE APPLICABLE, FIBER REINFORCEMENT IS ACCEPTABLE. EMBEDDED TIES FOR HOLDING FORMS SHALL REMAIN EMBEDDED AND EXCEPT WHERE F1 FINISH IS PERMITTED, SHALL TERMINATE NOT LESS THAN TWO DIAMETERS OR TWICE THE MINIMUM DIMENSION OF THE TIE, WHICHEVER IS GREATER, FROM THE FORMED SURFACES OF THE CONCRETE. RECESSES SHALL BE FILLED WITH APPROPRIATE MATERIAL.
5. ALL CONCRETE SHALL BE VIBRATED OR SUPER-PLASTICIZED IT SHALL NOT BE "WATERED DOWN" TO MAKE IT FLOW.
6. WHERE CONCRETE IS USED TO BED PIPE LARGER THAN 12 INCHES IN DIAMETER, IT SHALL BE VIBRATED OR SUPER-PLASTICIZED
7. POND RISERS SHALL BE PROPERLY SUPPORTED BY METAL OR CONCRETE BLOCKS PRIOR TO POURING THE BASE. AN ALTERNATIVE WOULD BE TO POUR THE BASE TO THE ELEVATION OF THE BOTTOM OF THE RISER, SET THE BOTTOM UNIT OF THE RISER IN PLACE AND THEN FINISH POURING THE BASE.
8. CONCRETE SURFACES LIKELY TO BE WALKED UPON, SUCH AS CHANNEL TYPE SPILLWAYS, SHALL HAVE A ROUGH SURFACE TO IMPROVE TRACTION.
9. CONCRETE SHALL BE DEPOSITED AS NEARLY AS PRACTICAL IN ITS FINAL POSITION AND SHALL NOT BE ALLOWED TO FLOW IN SUCH A MANNER THAT THE LATERAL MOVEMENT WILL CAUSE SEGREGATION OF THE COARSE AGGREGATE FROM THE CONCRETE MASS. METHODS AND EQUIPMENT EMPLOYED IN DEPOSITING CONCRETE IN FORMS SHALL MINIMIZE CLUSTERS OF COARSE AGGREGATE. CLUSTERS THAT OCCUR SHALL BE SCATTERED BEFORE THE CONCRETE IS VIBRATED. PLACING OF ADDITIONAL CONCRETE IN FORMS SHALL NOT BE DELAYED SO LONG THAT THE CONCRETE PLACED BEFORE THE DELAY IS NOT READILY PENETRATED BY VIBRATORS. IT IS ESPECIALLY IMPORTANT THAT ADEQUATE CONSOLIDATION BE ACHIEVED IN THE CONCRETE AT THE INTERFACE OF THE FRESH CONCRETE AND THE UNDERLYING CONCRETE. THE VIBRATOR SHALL REPEATEDLY PENETRATE AND THOROUGHLY RECONSOLIDATE THE UPPER PORTION OF THE UNDERLYING CONCRETE WHICH WAS PLACED BEFORE THE DELAY.
10. WHERE LIFT HOLES ARE PERMITTED IN CONCRETE PIPE, THEY SHALL BE FULLY GROUTED AND THE SURFACE OF THE GROUT ON THE INSIDE OF THE PIPE SHALL BE UNIFORM WITH THE INSIDE WALL OF THE PIPE. PIPE IN WHICH THE SMALLEST DIMENSION (DIAMETER IN ROUND PIPE) IS LESS THAN 36 INCHES SHALL NOT CONTAIN LIFT HOLES. LIFT HOLES ARE NOT PERMITTED IN POND BARRELS. WHERE PIPES ENTER RISERS, JUNCTION BOXES, MANHOLES, ETC., THE SPACE BETWEEN THE OUTSIDE WALL OF THE PIPE AND THE WALL OF THE OPENING SHALL BE FILLED WITH APPROPRIATE NON-SHRINKING CEMENT PASTE OR CEMENT MORTAR. WHERE THE OPENINGS ARE LARGE, CONCRETE BRICKS MAY ALSO BE USED. OTHER TYPES (CLAY, CINDERBLOCK) OF BRICK ARE NOTACCEPTABLE. ALL SURFACES OF THE BRICKS MUST BE COVERED WITH CEMENT. THE FINISHED SURFACES OF THE CEMENT MUST BE UNIFORM WITH THE INSIDE AND OUTSIDE WALLS OF THE STRUCTURE. THE SURFACES SHALL BE SMOOTH TO MINIMIZE ADVERSE EFFECTS OF FREEZING AND THAWING AND BRICKS SHALL NOT BE VISIBLE. O-RINGS SHALL BE PROPERLY LUBRICATED AND PROPERLY INSTALLED. ALL OTHER TYPES OF JOINTS SHALL BE PROPERLY SEALED. CONCRETE RISER SEGMENTS SHALL BE CONNECTED BY BOLTING FOUR GALVANIZED OR STAINLESS STEEL PLATES (6" X 18" X 1/4" MIN.), UNIFORMLY SPACED, TO EACH PAIR OF ADJOINING SEGMENTS.
11. THE BOTTOMS OF ALL RISERS, MANHOLES, JUNCTION BOXES, ETC. SHALL BE SHAPED IN ACCORDANCE WITH VDOT'S IS-1.

MAINTENANCE PLAN FOR STORMWATER DETENTION PONDS

1. THIS STRUCTURE IS A STORMWATER DETENTION POND; IT WILL STORE WATER DURING PERIODS OF HIGH INTENSITY RAINFALL. WITHIN SEVERAL HOURS MOST OF THE WATER WILL DRAIN OUT OF THE POND. THE DEVELOPMENT OF THE SITE INCREASED THE AMOUNT OF RAINFALL WATER WHICH LEAVES THE SITE BECAUSE ABSORBENT SOIL WAS COVERED WITH IMPERVIOUS SURFACES SUCH AS BUILDINGS AND ROADS. THE PURPOSE OF THIS TEMPORARY STORAGE IS TO ENSURE THAT THE PEAK RATE/VOLUME OF FLOW TO THE CHANNEL BELOW THE SITE AREA WERE NOT INCREASED. SUCH INCREASES CAUSE FLOODING AND CHANNEL EROSION DOWNSTREAM FROM THE POND.
2. MOWING. ALL GRASSES SHOULD BE MOWED AT LEAST TWICE EACH YEAR. GRASSES SUCH AS TALL FESCUE SHOULD BE MOWED IN EARLY SUMMER AFTER EMERGENCE OF THE HEADS ON COOL SEASON GRASSES. THEY SHOULD BE MOWED AGAIN IN THE EARLY FALL TO PREVENT SEEDS OF ANNUAL WEEDS FROM MATURING. MOWING OF LEGUMES SUCH AS SERICEA LESPEDEZA AND CROWN VETCH CAN BE PERMITTED TO GROW ON THE DAM OR IN ANY PART OF THE EMERGENCY SPILLWAY.
3. LIMING AND FERTILIZING. THE SOIL SHOULD BE SAMPLED ACCORDING TO RECOMMENDED PROCEDURES AT LEAST ONCE EVERY 4 YEARS. THE SAMPLE SHOULD BE TESTED AT A QUALIFIED SOIL TESTING LABORATORY (SUCH AS THE ONE AT VPI&SU). LIME AND FERTILIZER SHOULD BE APPLIED IN ACCORDANCE WITH RECOMMENDATIONS BASED ON THE TESTS.
4. REPLANTING AND OVERSEEDING. IF VEGETATION COVERS LESS THAN 40% OF THE SOIL SURFACE, LIME, FERTILIZE AND SEED IN ACCORDANCE WITH CURRENT RECOMMENDATIONS FOR NEW SEEDINGS. IF VEGETATION COVERS MOST THAN 40% BUT LESS THAN 70% OF THE SOIL SURFACE, LIME FERTILIZE AND OVERSEED IN ACCORDANCE WITH CURRENT RECOMMENDATIONS.
5. REMOVING TRASH AND DEBRIS. TRASH, LITTER AND VEGETATION WILL BE REMOVED AS NEEDED TO PREVENT OBSTRUCTION TO THE FLOW OF WATER, TO PREVENT MOVEMENT OF TRASH AND LITTER TO DOWNSTREAM PROPERTIES, TO MAINTAIN THE INTEGRITY OF THE STRUCTURE, TO PROVIDE AN ATTRACTIVE APPEARANCE AND TO MINIMIZE WATER POLLUTION.
6. REMOVING SEDIMENT. SOIL MATERIALS (INCLUDING CLAY,SILT, SAND AND GRAVEL) WILL BE REMOVED BEFORE THE PERMANENT POOL OR THE BMP POOL LOSES 10% OF THE DESIGNED STORAGE CAPACITY. IF FOREBAYS ARE INCLUDED IN THE DESIGN, SEDIMENT SHOULD BE REMOVED BEFORE THE FOREBAY LOSES 10% OF THE DESIGN CAPACITY OF THE FOREBAY.
7. SEDIMENT DISPOSAL. SEDIMENT DISPOSAL SHOULD BE IN ACCORDANCE WITH CURRENT PROCEDURES FOR DISPOSAL OF SEDIMENT. WHERE DEEMED NECESSARY OR DESIRABLE, THE SEDIMENT WILL BE TESTED FOR APPROPRIATE POLLUTANTS BEFORE IT IS REMOVED FROM THE POND.
8. REPAIRS, REPAIR SLIDES, SLUMPS AND ERODED AREAS PROMPTLY AND IN A WORKMANLIKE MANNER TRASH RACKS, PIPES, HEADWALLS, ETC. WILL BE MAINTAINED, REPAIRED AND/OR REPLACED AS NEEDED TO MAINTAIN THE INTEGRITY OF THE STRUCTURE. EXPOSED METAL SURFACES WILL BE PAINTED TO MINIMIZE DAMAGE DUE TO RUST.
9. MAINTENANCE INSPECTIONS. THE FEE TITLE OWNER SHALL BE RESPONSIBLE FOR THE MAINTENANCE OF ALL DRAINAGE, STORM WATER MANAGEMENT, AND BEST MANAGEMENT PRACTICES FACILITIES AND SYSTEMS IN ACCORDANCE WITH THE MAINTENANCE AGREEMENT TO ENSURE THAT THEY FUNCTION PROPERLY. SUBJECT TO OTHER LIMITATIONS, THE FEE TITLE OWNER MAY LANDSCAPE THE EASEMENT TO INCLUDE VEGETATION, SIGNS AND FENCES, PROVIDED THAT DRAINAGE AND THE COUNTY'S OR THE OWNER'S ABILITY TO ACCESS THE EASEMENT IS NOT COMPROMISED AND THAT THE COUNTY IS NOT IN ANY WAY RESPONSIBLE FOR THE REPAIRS OF THESE LANDSCAPE ITEMS EVEN IF DAMAGED BY COUNTY FORCES.
10. THE LANDOWNER SHALL PROVIDE AN ANNUAL INSPECTION TO BE PERFORMED BY A VIRGINIA REGISTERED PROFESSIONAL ENGINEER. THE REPORT OF INSPECTIONS, ALONG WITH A SCHEDULE FOR REPAIR WHEN NEEDED, WILL BE FURNISHED TO THE DEPARTMENT OF PUBLIC WORKS, WATERSHED MANAGEMENT DIVISION BY JUNE 30TH EACH YEAR.
11. THE DETENTION POND SHALL NOT BE MODIFIED IN ANY WAY WITHOUT PRIOR APPROVAL BY PRINCE WILLIAM COUNTY.

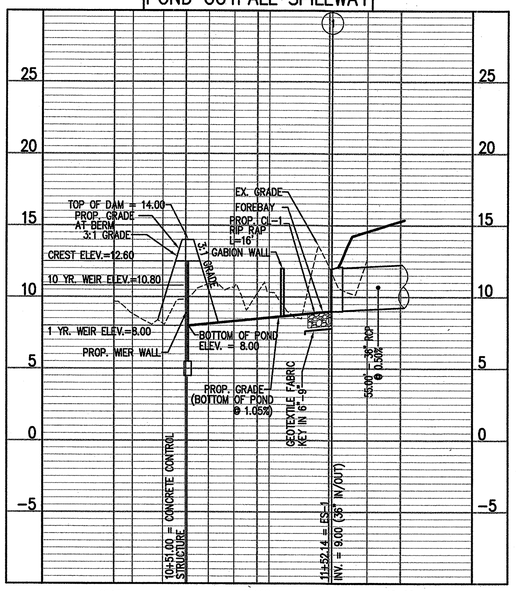
GENERAL SPECIFICATIONS FOR SWM DAM AND FACILITY

1. AREAS UNDER THE EMBANKMENT AND ANY STRUCTURAL WORKS SHALL BE CLEARED, GRUBBED, AND STRIPPED OF TOPSOIL, ROOTS OR OTHER OBJECTIONABLE MATERIAL. WOODY STEMMED SPECIES, PROPOSED OR EXISTING SHALL NOT BE PERMITTED WITHIN 25 FT OF EMBANKMENT FILL
2. THE SUITABILITY AND ACCEPTABILITY OF ALL FILL MATERIAL WILL BE DETERMINED BY REGULAR PERIODIC SOIL ANALYSIS AND COMPACTION TESTS, WHICH SHALL BE MADE BY A QUALIFIED GEOTECHNICAL ENGINEER.
3. TESTS FOR SOIL ANALYSIS, MOISTURE CONTENT, AND COMPACTION ARE TO BE CONDUCTED IN ACCORDANCE WITH THE LATEST APPLICABLE ASTM STANDARDS AND SPECIFICATIONS.
4. THE EMBANKMENT MAY BE CONSTRUCTED AS A HOMOGENOUS EMBANKMENT DAM FILL MATERIAL SHALL BE TAKEN FROM AN APPROVED, DESIGNATED BORROW AREA. IT SHALL BE FREE OF ROOTS, STUMPS, WOOD, RUBBISH, STONES GREATER THAN 6 INCHES, AND FROZEN OR OTHER OBJECTIONABLE MATERIALS. FILL MATERIAL FOR CENTER OF THE EMBANKMENT AND THE CUTOFF TRENCH SHALL CONFORM TO UNIFIED SOIL CLASSIFICATION GC, SC, OR CL. CONSIDERATION MAY BE GIVEN TO THE USE OF OTHER MATERIALS IN THE EMBANKMENT BASED ON THE RECOMMENDATIONS OF A GEOTECHNICAL ENGINEER SUPERVISING THE DESIGN AND CONSTRUCTION.
5. THE MINIMUM REQUIRED DENSITY IS 95% MAXIMUM OF DRY DENSITY WITH A MOISTURE CONTENT WITHIN 2% OF THE OPTIMUM, UNLESS OTHERWISE SPECIFIED BY THE GEOTECHNICAL ENGINEER. EACH LAYER OF THE FILL SHALL BE COMPACTED AS NECESSARY TO OBTAIN MINIMUM DENSITY AND THE ENGINEER SHALL CERTIFY, AT THE TIME OF CONSTRUCTION, THAT EACH FILL LATER MEETS THE MINIMUM DENSITY REQUIREMENT. ALL COMPACTION IS TO BE DETERMINED BY EITHER STANDARD PROCTOR TEST (ASTM D698) OR THE MODIFIED PROCTOR TEST (ASTM D1557) AS DIRECTED BY THE GEOTECHNICAL ENGINEER BASED ON SITE AND SOIL CONDITIONS AND THE SIZE AND TYPE OF STRUCTURE BEING BUILT.
6. THE FILL SHALL BE CONSTRUCTED AS DIRECTED BY THE GEOTECHNICAL ENGINEER.
7. THE EMBANKMENT SHALL BE CONSTRUCTED TO A MINIMUM ELEVATION 10% HIGHER THAN THE DESIGNED HEIGHT, OR BASED ON GEOTECHNICAL REPORT, TO ALLOW FOR SETTLEMENT WHEN MECHANICAL COMPACTORS ARE USED FOR CONSTRUCTION.
8. IF SUFFICIENT ACCEPTABLE MATERIAL IS NOT AVAILABLE ON THE SITE TO PROPERLY COMPLETE THE FILL, THE CONTRACTOR IS RESPONSIBLE FOR ACQUIRING ACCEPTABLE BORROW MATERIAL.
9. AREAS ON WHICH FILL IS TO BE PLACED SHALL BE SCARIFIED BEFORE ITS PLACEMENT. FILL MATERIAL SHALL BE PLACED IN LAYERS A MAXIMUM OF 8 INCHES THICK (BEFORE COMPACTION), WHICH SHALL BE CONTINUOUS OVER THE ENTIRE LENGTH OF FILL. THE MOST PERMEABLE BORROW MATERIAL SHALL BE PLACED IN THE DOWNSTREAM PORTIONS OF THE EMBANKMENT. THE PRINCIPLE SPILLWAY MUST BE INSTALLED CONCURRENTLY WITH FILL PLACEMENT AND NOT EXCAVATED INTO THE EMBANKMENT.
10. CUTOFF TRENCH SHALL BE EXCAVATED INTO IMPERVIOUS MATERIAL ALONG OR PARALLEL TO THE CENTERLINE OF THE EMBANKMENT AS SHOWN ON THE PLANS. THE EQUIPMENT USED FOR EXCAVATION SHOULD GOVERN THE BOTTOM WIDTH OF THE TRENCH, WITH THE MINIMUM WIDTH BEING 4'. THE DEPTH SHALL BE AT LEAST 4' BELOW THE EXISTING GRADE OR AS SHOWN ON THE PLANS. THE SIDE SLOPES OF THE TRENCH SHALL BE 1H:1V OR FLATTER. THE BACKFILL SHALL BE COMPACTED ACCORDING TO NOTE 5.
11. THE SURFACE LAYER OF COMPACTED FILL SHALL BE SCARIFIED PRIOR TO PLACEMENT OF AT LEAST 6 INCHES OF TOPSOIL. THE TOPSOIL SHALL BE STABILIZED IN ACCORDANCE WITH THE VESCH, LATEST EDITION.

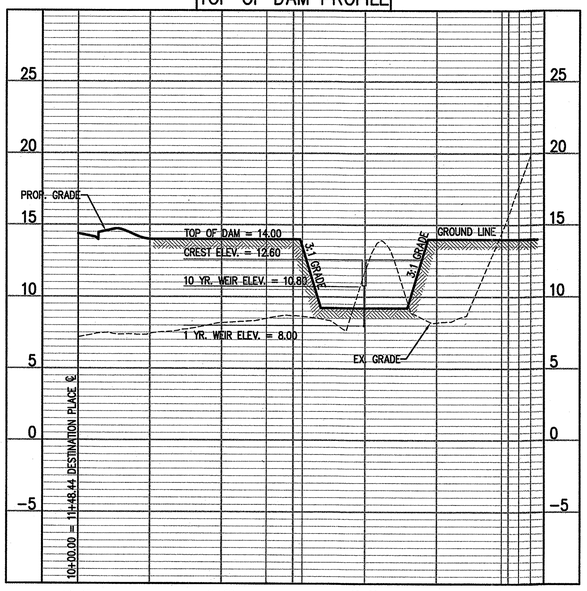
DAM CONSTRUCTION NOTES

1. STAKE OUT THE ENTIRE AREA TO BE COVERED BY THE DAM AND RELATED STRUCTURES.
2. REMOVE ALL TOPSOIL, ORGANIC MATTER AND STONES FROM THE AREA. INSTALL A COFFER DAM OR SOME OTHER APPROPRIATE STRUCTURE TO DIVERT RUNOFF AWAY FROM THE WORK AREA DURING CONSTRUCTION.
3. THE GEOTECHNICAL ENGINEER SHOULD PERFORM TEST PITS ALONG THE CENTERLINE OF THE EMBANKMENT DURING CONSTRUCTION TO EVALUATE THAT THE ACTUAL SUBSURFACE CONDITIONS ARE CONSISTENT WITH THE BORINGS AND PROVIDE RECOMMENDATIONS WITH RESPECT TO REQUIRED CUT-OFF TRENCH.
4. EXCAVATE FOR CUT-OFF TRENCH AND BEGIN FILLING. THE CUT-OFF TRENCH SHALL BE A MINIMUM 4' BELOW THE EXISTING GRADE. SEE DAM EMBANKMENT PROFILE ON SHEET 30.
5. INSTALL THE POND BARREL AND THE RISER. THE UPSTREAM 2/3 OF THE POND BARREL WILL BE BEDDED IN CONCRETE; THE CONCRETE MUST BE PLASTICIZED OR VIBRATED TO ENSURE THAT THERE WILL BE NO VOIDS. THE DOWNSTREAM 1/3 OF THE BARREL WILL BE SURROUNDED IN GRAVEL WRAPPED IN FILTER FABRIC. IF THE PLAN INCLUDES TOE DRAINS, THEY MAY BE CONNECTED TO THE GRAVEL BEDDING. FILL ADJACENT TO AND OVER THE CULVERT ARE TO BE COMPACTED BY MANUALLY OPERATED EQUIPMENT (NOT PULLED BY OR MOUNTED ON TRACK-TYPE OR WHEEL-TYPE EQUIPMENT). TAMPERS MOUNTED ON BACKHOES ARE NOT ACCEPTABLE. AFTER THE DEPTH OF FILL OVER THE WALL HAS REACHED A DEPTH OF AT LEAST 2 FEET, LARGE EQUIPMENT, BUT NOT VIBRATORY ROLLERS, MAY BE USED. VIBRATORY ROLLERS MAY BE USED AFTER THE DEPTH OF FILL OVER THE PIPE EXCEEDS 3 FEET.
6. PLACE FILL AS DIRECTED BY THE GEOTECHNICAL ENGINEER.
7. SIDE SLOPES SHALL BE AS FLAT AS THOSE SHOWN ON THE APPROVED PLANS.
8. A SETTLING ALLOWANCE OF AT LEAST 10%, OR AS DICTATED BY THE GEOTECHNICAL ENGINEER, IS REQUIRED.
9. DURING THE BACKFILLING OPERATION, EQUIPMENT SHOULD NOT BE DRIVEN CLOSER THAN 4 FEET, AS MEASURED HORIZONTALLY, TO ANY PART OF A STRUCTURE. ALSO, EQUIPMENT SHOULD NEVER BE DRIVEN OVER ANY PART OF A STRUCTURE OR PIPE, UNLESS COMPACTED FILL HAS BEEN PLACED TO A DEPTH SPECIFIED BY THE STRUCTURAL LIVE LOAD CAPACITY OF THE STRUCTURE OR PIPE IN ORDER TO ADEQUATELY DISTRIBUTE THE LOAD. BACKFILL THAT IS BESIDE THE PIPE OR STRUCTURES SHALL BE OF THE SAME TYPE AND QUALITY OF THE ADJOINING FILL MATERIAL. THE FILL SHALL BE PLACED IN HORIZONTAL LAYERS NOT TO EXCEED 4 INCHES IN THICKNESS (BEFORE COMPACTION) AND COMPACTED BY HAND TAMPERS, OR OTHER MANUALLY DIRECTED COMPACTION EQUIPMENT. THE MATERIAL SHALL COMPLETELY FILL ALL SPACES UNDER AND BESIDE THE PIPE AND STRUCTURES.
10. DURING THE BACKFILLING OPERATION, EQUIPMENT SHOULD NOT BE DRIVEN CLOSER THAN 4 FEET, AS MEASURED HORIZONTALLY, TO ANY PART OF A STRUCTURE. ALSO, EQUIPMENT SHOULD NEVER BE DRIVEN OVER ANY PART OF A STRUCTURE OR PIPE, UNLESS COMPACTED FILL HAS BEEN PLACED TO A DEPTH SPECIFIED BY THE STRUCTURAL LIVE LOAD CAPACITY OF THE STRUCTURE OR PIPE IN ORDER TO ADEQUATELY DISTRIBUTE THE LOAD.

POND OUTFALL SPILLWAY



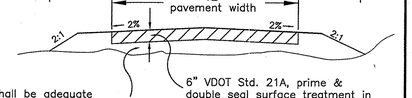
TOP OF DAM PROFILE



MAINTENANCE RESPONSIBILITY:

THE PROPOSED STORMWATER MANAGEMENT FACILITY APPURTENANT TO ANNAPOLIS WAY AND DESTINATION PLACE SERVES ONLY THESE PUBLIC ROAD IMPROVEMENTS, SO LONG TERM FACILITY MAINTENANCE RESPONSIBILITY BY THE DEVELOPER WILL NOT BE REQUIRED AND THE APPROPRIATE POLITICAL SUBDIVISION (VDOT OR PWCDOT) WILL ASSUME RESPONSIBILITY.

Typical Access Road Section

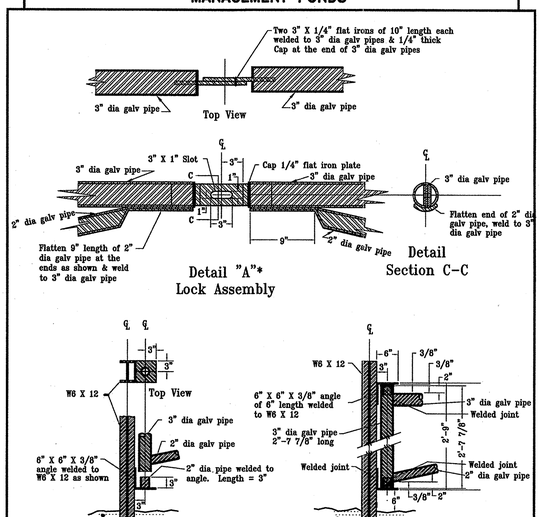


Subbase shall be adequate to support H20 wheel loading.

6" VDOT Std. 21A, prime & double seal surface treatment in accordance with VDOT Std. is recommended.

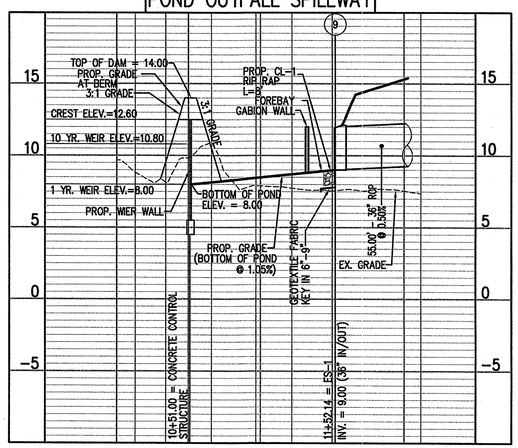
Note: Where maintenance access is located between or near residential lots, approved geoblock pavement alternative should be considered.

STANDARD MAINTENANCE ACCESS ROAD DETAILS FOR STORMWATER MANAGEMENT PONDS



STANDARD ACCESS ROAD GATE DESIGN

POND OUTFALL SPILLWAY



GRAPHIC SCALE

50 0 25 50 100 200

(IN FEET)
1 inch = 50 ft.

Bowman
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POND PROFILES & DETAILS

ANNAPOLIS WAY
PUBLIC IMPROVEMENT PLAN
WOODBRIDGE MAGISTERIAL DISTRICT - PRINCE WILLIAM COUNTY

SPR-2018-000412
COUNTY PLAN NUMBER

COMMONWEALTH OF VIRGINIA
CHARLES V. FITZGERALD III
Lic. No.050113
9-6-2019
PROFESSIONAL ENGINEER

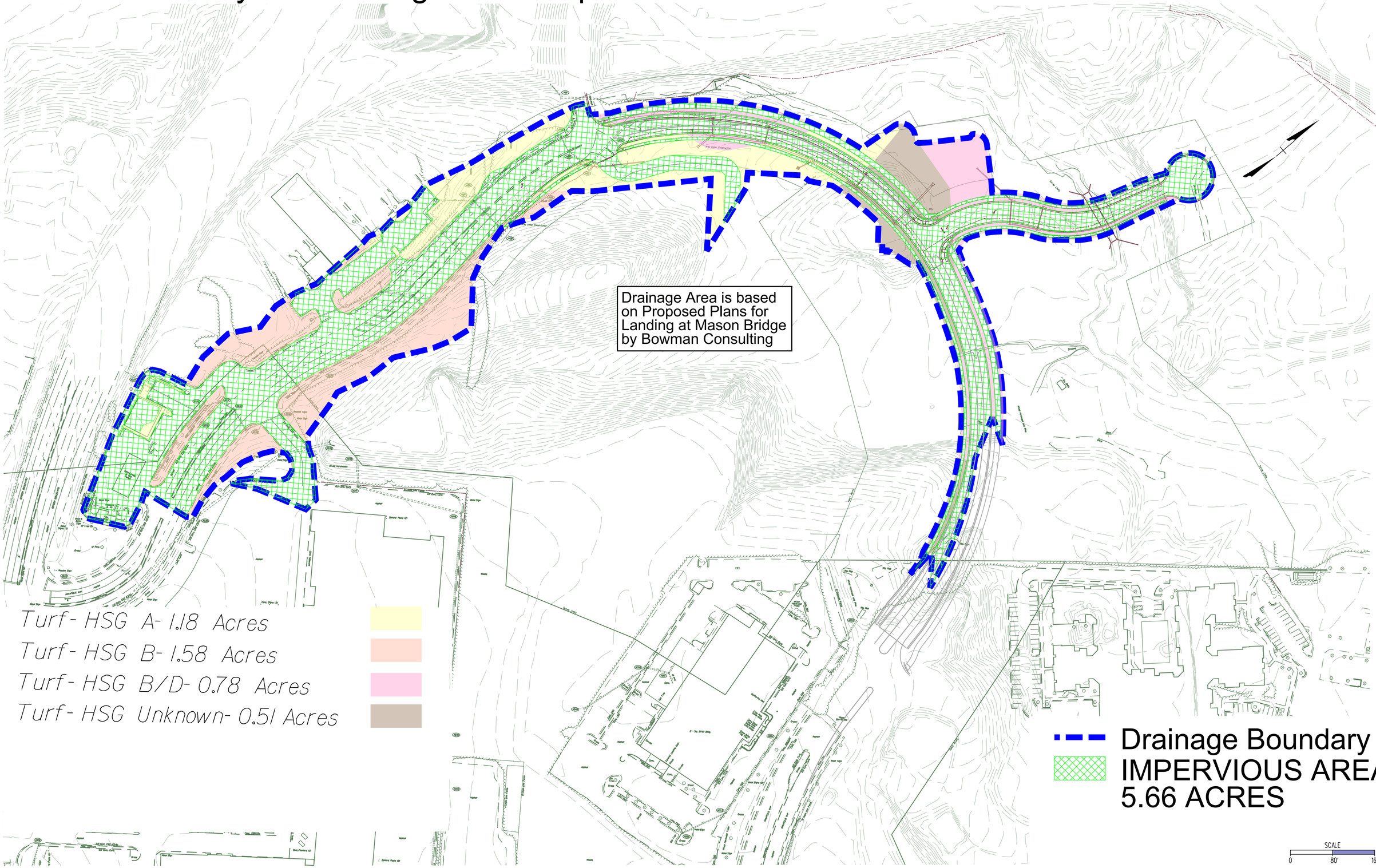
PLAN STATUS	
05/24/18	1ST SUBMISSION
03/24/19	2ND SUBMISSION
06/14/19	3RD SUBMISSION
09/06/19	ISSUED TO CLIENT

DATE	DESCRIPTION

CVF DESIGN	JLD DRAWN	CVF CHKD
SCALE	H: 1"=50' V: 1"=5'	
JOB No.	100065-02-001	
DATE :	SEPTEMBER 2019	
FILE No.	100065-D-PIP-001	
SHEET	29 OF 34	

Cad file name : P:\100065 - Annapolis Way\100065-02-001 (ENG)\Engineering\Engineering Plans\100065-D-PIP-001 Public Improvement Plan\027-029-100065-D-PIP-001-SWM-BMP.dwg

Detention Facility 4-1 Drainage Area Map



DEQ Virginia Runoff Reduction Method Re-Development Compliance Spreadsheet - **Version 3.0**

☒ 2011 BMP Standards and Specifications ☐ 2013 Draft BMP Standards and Specifications

Project Name:	**Annapolis Way Public Improvement Plan**
Date:	**4/21/2022**
Linear Development Project?	**Yes**

CLEAR ALL

data input cells
constant values
calculation cells
final results

Site Information

Post-Development Project (Treatment Volume and Loads)

Enter Total Disturbed Area *(acres)* → 4.25

Check:

BMP Design Specifications List: 2011 Stds & Specs

Maximum reduction required:	*20%*	*Linear project?*	No
The site's net increase in impervious cover (acres) is:	*1.46*	*Land cover areas entered correctly?*	✓
Post-Development TP Load Reduction for Site (lb/yr):	*3.23*	*Total disturbed area entered?*	✓

Pre-ReDevelopment Land Cover (acres)

	A Soils	B Soils	C Soils	D Soils	Totals
Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land				2.20	2.20
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed	0.21			1.68	1.89
Impervious Cover (acres)	0.03			0.13	0.16
					4.25

Post-Development Land Cover (acres)

	A Soils	B Soils	C Soils	D Soils	Totals
Forest/Open Space (acres) -- undisturbed, protected forest/open space or reforested land					0.00
Managed Turf (acres) -- disturbed, graded for yards or other turf to be mowed/managed	0.16			2.47	2.63
Impervious Cover (acres)	0.08			1.54	1.62
Area Check	**OK.**	**OK.**	**OK.**	**OK.**	4.25

Constants

Annual Rainfall (inches)	43
Target Rainfall Event (inches)	1.00
Total Phosphorus (TP) EMC (mg/L)	0.26
Total Nitrogen (TN) EMC (mg/L)	1.86
Target TP Load (lb/acre/yr)	0.41
Pj (unitless correction factor)	0.90

Runoff Coefficients (Rv)

	A Soils	B Soils	C Soils	D Soils
Forest/Open Space	0.02	0.03	0.04	0.05
Managed Turf	0.15	0.20	0.22	0.25
Impervious Cover	0.95	0.95	0.95	0.95

LAND COVER SUMMARY -- PRE-REDEVELOPMENT

Land Cover Summary-Pre

Pre-ReDevelopment	Listed	Adjusted[1]
Forest/Open Space Cover (acres)	2.20	0.79
Weighted Rv(forest)	0.05	0.05
% Forest	52%	28%
Managed Turf Cover (acres)	1.89	1.84
Weighted Rv(turf)	0.24	0.24
% Managed Turf	44%	66%
Impervious Cover (acres)	0.16	0.16
Rv(impervious)	0.95	0.95
% Impervious	4%	6%
Total Site Area (acres)	**4.25**	**2.79**
Site Rv	**0.17**	**0.23**

LAND COVER SUMMARY -- POST DEVELOPMENT

Land Cover Summary-Post (Final)

Post ReDev. & New Impervious	
Forest/Open Space Cover (acres)	0.00
Weighted Rv(forest)	0.00
% Forest	0%
Managed Turf Cover (acres)	2.63
Weighted Rv (turf)	0.24
% Managed Turf	62%
Impervious Cover (acres)	1.62
Rv(impervious)	0.95
% Impervious	38%
Final Site Area (acres)	**4.25**
Final Post Dev Site Rv	**0.51**

Land Cover Summary-Post

Post-ReDevelopment	
Forest/Open Space Cover (acres)	0.00
Weighted Rv(forest)	0.00
% Forest	0%
Managed Turf Cover (acres)	2.63
Weighted Rv (turf)	0.24
% Managed Turf	94%
ReDev. Impervious Cover (acres)	0.16
Rv(impervious)	0.95
% Impervious	6%
Total ReDev. Site Area (acres)	**2.79**
ReDev Site Rv	**0.28**

Land Cover Summary-Post

Post-Development New Impervious	
New Impervious Cover (acres)	1.46
Rv(impervious)	0.95

Treatment Volume and Nutrient Load

Pre-ReDevelopment Treatment Volume (acre-ft)	0.0595	0.0530
Pre-ReDevelopment Treatment Volume (cubic feet)	2,590	2,307
Pre-ReDevelopment TP Load (lb/yr)	**1.63**	**1.45**
Pre-ReDevelopment TP Load per acre (lb/acre/yr)	0.38	0.52
Baseline TP Load (lb/yr) (**0.41 lbs/acre/yr** applied to pre-redevelopment area excluding pervious land proposed for new impervious cover)		*1.14*

Final Post-Development Treatment Volume (acre-ft)	0.1817
Final Post-Development Treatment Volume (cubic feet)	7,915
Final Post-Development TP Load (lb/yr)	**4.97**
Final Post-Development TP Load per acre (lb/acre/yr)	1.17

Treatment Volume and Nutrient Load

Post-ReDevelopment Treatment Volume (acre-ft)	0.0661
Post-ReDevelopment Treatment Volume (cubic feet)	2,880
Post-ReDevelopment Load (TP) (lb/yr)*	**1.81**
Post-ReDevelopment TP Load per acre (lb/acre/yr)	0.65
Max. Reduction Required (Below Pre-ReDevelopment Load)	**20%**
TP Load Reduction Required for Redeveloped Area (lb/yr)	**0.65**

Post-Development Treatment Volume (acre-ft)	0.1156
Post-Development Treatment Volume (cubic feet)	5,035
Post-Development TP Load (lb/yr)	**3.16**
TP Load Reduction Required for New Impervious Area (lb/yr)	**2.56**

[1] *Adjusted Land Cover Summary:*
Pre ReDevelopment land cover minus pervious land cover (forest/open space or managed turf) acreage proposed for new impervious cover.

Adjusted total acreage is consistent with Post-ReDevelopment acreage (minus acreage of new impervious cover).

Column I shows load reduction requriement for new impervious cover (based on new development load limit, 0.41 lbs/acre/year).

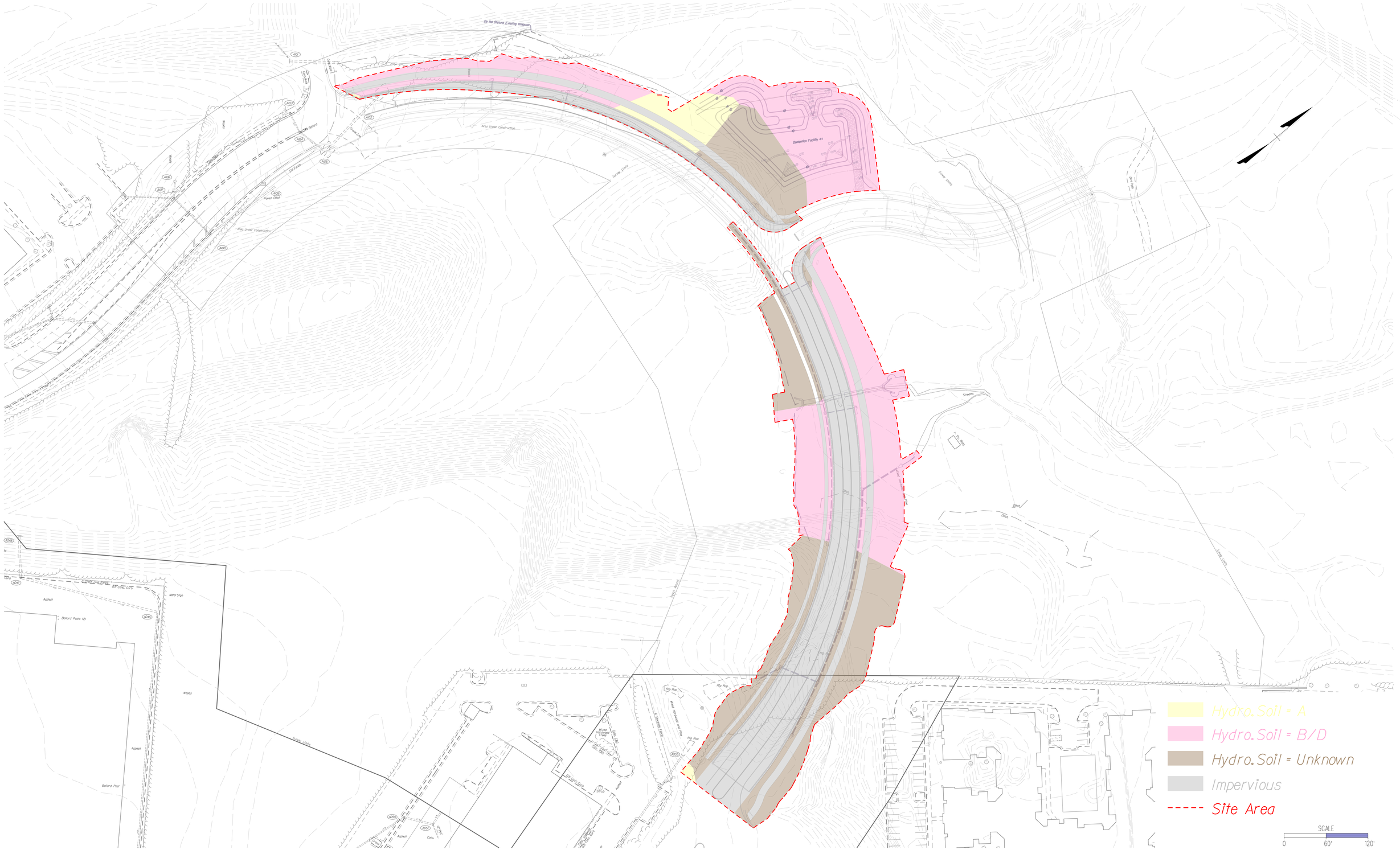
Post-Development Requirement for Site Area

TP Load Reduction Required (lb/yr)	**3.21**
Linear Project TP Load Reduction Required (lb/yr):	**3.23**

Nitrogen Loads (Informational Purposes Only)

Pre-ReDevelopment TN Load (lb/yr)	11.64
Final Post-Development TN Load (Post-ReDevelopment & New Impervious) (lb/yr)	35.58

Site Area Map



SECTION 5

STORM DRAIN COMPUTATIONS

ROUTE Annapolis Way **PROJECT** North Woodbridge **DESIGNER:** IDL **DATE** 5/2/2022
CHECKED: NVD **UNITS:** ENGLISH

INLET																										Sag Inlets Only					
NUMBER	TYPE	LENGTH (FT; M)	STATION	DRAINAGE AREA (AC; HA)	C	CA	ΣCA	I (IN/HR; mm/HR)	Q INCR. (CFS; CMS)	Qc CARRYOVER (CFS; CMS)	QT GUTTER FLOW (CFS; CMS)	S GUTTER SLOPE (FT/FT; M/M)	Sx CROSS SLOPE (FT/FT; M/M)	T (SPREAD) (FT; M)	W (GUTTER WIDTH) (FT; M)	W/T	Sw (GUTTER SLOPE) (FT/FT; M/M)	Sw/Sx	Eo (App. 9C-8)	a	Sw	Se	COMPUTED LENGTH L_T (FT; M)	L, SPECIFIED LENGTH (FT; M)	L/LT	E (App. 9C-18)	Q INTERCEPTED (CFS; CMS) or d/h	Qb CARRYOVER (CFS; CMS)	Depth at Curb (IN; MM)	Allowable Ponding Depth d (FT; M)	Height of Curb Opening h (FT; M)	d/h	Depth at Inlet (IN; MM)	T SPREAD @ SAG (FT; M)	REMARKS
4-10	DI-3B	4.000	30+00.00	0.060	0.90	0.054																												
			-27.980'LEF	0.067	0.35	0.0235																												
							0.077	4	0.308	0	0.308	0.0100	0.0200	1.859	2.000	1.0758	0.0833	4.165	1.000	3.52	0.1466	0.1666	3.347	4.000	1.195	1.000	0.308	0.000	1.858						
4-12	DI-4C	8.000	31+02.83	0.068	0.90	0.0612																												Back/Lt.
			-28.890'LEF	0.023	0.35	0.0081																												Back/Lt.
							0.069	4	0.276	0		0.0100	0.0200	1.784	2.000	1.1211	0.0833	4.165		3.52														Back/Lt.
				0.068	0.90	0.0612																												Ahead/Rt.
				0.023	0.35	0.0081																												Ahead/Rt.
							0.069	4	0.276	0																								Ahead/Rt.
											0.552	0.0100												8			0.552		0.903	0.160	0.333	0.48048	2.903	3.763	Weir Flow
4-14	DI-3B	8.000	32+29.88	0.220	0.90	0.198																												
			16.010'RIGH	0.050	0.35	0.0175																												
							0.216	4	0.864	0	0.864	0.0300	0.0200	2.922	2.000	0.6845	0.0833	4.165	0.991	3.52	0.1466	0.1653	7.210	8.000	1.110	1.000	0.864	0.000	2.221						
4-15	DI-3B	6.000	32+29.97	0.056	0.90	0.0504																												
			-28.020'LEF	0.058	0.35	0.0203																												
							0.071	4	0.284	0	0.284	0.0300	0.0200	1.468	2.000	1.3624	0.0833	4.165	1.000	3.52	0.1466	0.1666	4.497	6.000	1.334	1.000	0.284	0.000	1.467						
4-3	DI-3B	4.000	26+95.59	0.060	0.90	0.054																												
			-27.890'LEF	0.065	0.35	0.0228																												
							0.077	4	0.308	0	0.308	0.0100	0.0200	1.859	2.000	1.0758	0.0833	4.165	1.000	3.52	0.1466	0.1666	3.347	4.000	1.195	1.000	0.308	0.000	1.858						
4-5	DI-3B	4.000	28+00	0.030	0.90	0.027																												
			-27.970'LEF	0.035	0.35	0.0123																												
							0.039	4	0.156	0	0.156	0.0100	0.0200	1.441	2.000	1.3879	0.0833	4.165	1.000	3.52	0.1466	0.1666	2.515	4.000	1.590	1.000	0.156	0.000	1.440						
5-1	DI-3B	6.000	34+12.9	0.080	0.90	0.072																												
			16.030'RIGH	0.050	0.35	0.0175																												
							0.09	4	0.36	0	0.360	0.0500	0.0200	1.458	2.000	1.3717	0.0833	4.165	1.000	3.52	0.1466	0.1666	5.791	6.000	1.036	1.000	0.360	0.000	1.457						
5-10	DI-3BB	10.000	36+82.60	0.180	0.90	0.162																												
			-66.480'LEF	0.060	0.35	0.021																												
							0.183	4	0.732	0	0.732	0.0600	0.0200	1.838	2.000	1.0881	0.0833	4.165	1.000	3.52	0.1466	0.1666	8.241	10.000	1.213	1.000	0.732	0.000	1.837						
5-2	DI-3B	10.000	34+12.98	0.077	0.90	0.0693																												
			-27.970'LEF	0.040	0.35	0.014																												

ROUTE Annapolis Way **PROJECT** North Woodbridge **DESIGNER:** IDL **DATE** 5/2/2022
CHECKED: NVD **UNITS:** ENGLISH

INLET																										Sag Inlets Only					
NUMBER	TYPE	LENGTH (FT; M)	STATION	DRAINAGE AREA (AC; HA)	C	CA	ΣCA	I (IN/HR; mm/HR)	Q INCR. (CFS; CMS)	Qc CARRYOVER (CFS; CMS)	QT GUTTER FLOW (CFS; CMS)	S GUTTER SLOPE (FT/FT; M/M)	Sx CROSS SLOPE (FT/FT; M/M)	T (SPREAD) (FT; M)	W (GUTTER WIDTH) (FT; M)	W/T	Sw (GUTTER SLOPE) (FT/FT; M/M)	Sw/Sx	Eo (App. 9C-8)	a	Sw	Se	COMPUTED LENGTH L_T (FT; M)	L, SPECIFIED LENGTH (FT; M)	L/LT	E (App. 9C-18)	Q INTERCEPTED (CFS; CMS) or d/h	Qb CARRYOVER (CFS; CMS)	Depth at Curb (IN; MM)	Allowable Ponding Depth d (FT; M)	Height of Curb Opening h (FT; M)	d/h	Depth at Inlet (IN; MM)	T SPREAD @ SAG (FT; M)	REMARKS
							0.083	4	0.332	0	0.332	0.0600	0.0100	1.367	2.000	1.4631	0.0833	8.33	1.000	3.76	0.1566	0.1666	5.912	10.000	1.691	1.000	0.332	0.000	1.366						
5-3	DI-3B	8.000	36+01.35	0.130	0.90	0.117																												
			16.140'RIGH	0.040	0.35	0.014																												
							0.131	4	0.524	0	0.524	0.0800	0.0300	1.537	2.000	1.3012	0.0833	2.7767	1.000	3.28	0.1366	0.1666	7.807	8.000	1.025	1.000	0.524	0.000	1.536						
5-5	DI-3B	10.000	38+02.29	0.170	0.90	0.153																												
			29.300'RIGH	0.040	0.35	0.014																												
							0.167	4	0.668	0	0.668	0.0800	0.0200	1.683	2.000	1.1884	0.0833	4.165	1.000	3.52	0.1466	0.1666	8.645	10.000	1.157	1.000	0.668	0.000	1.682						
5-6	DI-3BB	8.000	37+98.68	0.086	0.90	0.0774																												
			-28.050'LEF	0.110	0.35	0.0385																												
							0.116	4	0.464	0	0.464	0.0800	0.0200	1.468	2.000	1.3624	0.0833	4.165	1.000	3.52	0.1466	0.1666	7.418	8.000	1.078	1.000	0.464	0.000	1.468						
5-7	DI-3BB	6.000	38+78.58	0.180	0.90	0.162																												
			-32.900'LEF	0.070	0.35	0.0245																												
							0.187	4	0.748	0	0.748	0.0100	0.0200	4.264	2.000	0.469	0.0833	4.165	0.936	3.52	0.1466	0.1572	5.031	6.000	1.193	1.000	0.748	0.000	2.543						
5-9	DI-3BB	6.000	37+22.34	0.060	0.90	0.054																												
			-27.990'LEF	0.027	0.35	0.0095																												
							0.063	4	0.252	0	0.252	0.0700	0.0200	1.198	2.000	1.6694	0.0833	4.165	1.000	3.52	0.1466	0.1666	5.515	6.000	1.088	1.000	0.252	0.000	1.197						
Ex3	DI-3B	6.000	31+03.52	0.230	0.90	0.207																												
			16.920'RIGH	0.260	0.35	0.091																												
							0.298	4	1.192	0	1.192	0.0140	0.0320	4.171	2.000	0.4795	0.0833	2.6031	0.906	3.23	0.1346	0.1540	6.852	6.000	0.876	0.977	1.164	0.028	2.833						
Ex4	DI-3B	6.000	30+00.00	0.090	0.90	0.081																												
			16.920'RIGH	0.090	0.35	0.0315																												
							0.113	4	0.452	0	0.452	0.0140	0.0320	2.039	2.000	0.9809	0.0833	2.6031	1.000	3.23	0.1346	0.1666	4.349	6.000	1.380	1.000	0.452	0.000	2.014						
Ex5	DI-3B	12.000	29+00.00	0.080	0.90	0.072																												
			16.920'RIGH	0.010	0.35	0.0035																												
							0.076	4	0.304	0	0.304	0.0140	0.0320	1.737	2.000	1.1514	0.0833	2.6031	1.000	3.23	0.1346	0.1666	3.682	12.000	3.259	1.000	0.304	0.000	1.736						
Ex5A	DI-7	3.200	28+79.86				0	0	3.77	0	3.770	0.0100			3.200									3.200		1.000	3.770	0.000	0.5555						BHt.=0.211'
			40.110'RIGHT																															
Ex6	DI-3B	6.000	28+00.00	0.070	0.90	0.063																												

ROUTE Annapolis Way **PROJECT** North Woodbridge **DESIGNER:** IDL **DATE** 5/2/2022
CHECKED: NVD **UNITS:** ENGLISH

INLET																											Sag Inlets Only					
NUMBER	TYPE	LENGTH (FT; M)	STATION	DRAINAGE AREA (AC; HA)	C	CA	ΣCA	I (IN/HR; mm/HR)	Q INCR. (CFS; CMS)	Qc CARRYOVER (CFS; CMS)	QT GUTTER FLOW (CFS; CMS)	S GUTTER SLOPE (FT/FT; M/M)	Sx CROSS SLOPE (FT/FT; M/M)	T (SPREAD) (FT; M)	W (GUTTER WIDTH) (FT; M)	W/T	Sw (GUTTER SLOPE) (FT/FT; M/M)	Sw/Sx	Eo (App. 9C-8)	a	Siw	Se	COMPUTED LENGTH L_T (FT; M)	L, SPECIFIED LENGTH (FT; M)	L/LT	E (App. 9C-18)	Q INTERCEPTED (CFS; CMS) or d/h	Qb CARRYOVER (CFS; CMS)	Depth at Curb (IN; MM)	Allowable Ponding Depth d (FT; M)	Height of Curb Opening h (FT; M)	d/h	Depth at Inlet (IN; MM)	T SPREAD @ SAG (FT; M)	REMARKS
			16.920'RIGH	0.020	0.35	0.007																												
							0.07	4	0.28	0	0.280	0.0140	0.0320	1.684	2.000	1.1876	0.0833	2.6031	1.000	3.23	0.1346	0.1666	3.557	6.000	1.687	1.000	0.280	0.000	1.684						
Ex7	DI-3B	4.000	26+95.65	0.340	0.90	0.306																												
			16.940'RIGH	0.030	0.35	0.0105																												
							0.317	4	1.268	0	1.268	0.0140	0.0320	4.322	2.000	0.4627	0.0833	2.6031	0.895	3.23	0.1346	0.1525	7.076	4.000	0.565	0.777	0.985	0.283	2.891						

LD-229
STORM SEWER DESIGN COMPUTATIONS

STORM FREQUENCY **10**

PROJECT: Annapolis Way
LOCATION: North Woodbridge
COUNTY: Quantico 1 S

Designed by: IDL

Checked by: NVD

UNITS **ENGLISH**

PIPE NO.	FROM POINT		TO POINT		DRAIN. AREA "A" Acre	RUNOFF COEFF. "C"	CA		INLET TIME Minutes	RAIN FALL In/Hr	RUNOFF		INVERT ELEVATIONS		LENGTH of Pipe Ft.	SLOPE Ft./Ft.	SIZE (Dia. Or Span/Rise) In.	SHAPE	Number of Pipes	Capacity CFS	Friction Slope Ft./Ft.	NORMAL FLOW					FLOW TIME		REMARKS
	REFERENCE	STA.	REFERENCE	STA.			INCRE-MENT	ACCUM-ULATED			Lateral	Total Q	UPPER END	LOWER END								Depth of Flow, dn Ft.	Area of Flow, An SqFt	Hrn Ft.	Vn Ft/Sec	En Ft.	INCRE-MENT Minutes	ACCUMU-LATED Minutes	
	(1)		(2)		(3)	(4)	(5)	(6)	(7)	(8)	CFS	(9)	(10)	(11)	(12)	(13)	(14)			(15)					(16)		(17)	(17)	(18)
4-10toEx4	4-10	30+00.00	Ex4	30+00.00	0.13	0.61	0.08	0.08	5.00	6.78	0.00	0.52	12.30	12.08	45.00	0.00489	15	Circular	1	4.52	0.00010	0.29	0.21	0.17	2.46	0.38	0.31	5.31	
4-12toEx1	4-12	31+02.83	Ex1	30+98.13	0.18	0.76	0.14	1.91	6.65	6.28	0.00	37.98	9.28	9.00	50.38	0.00556	36	Circular	1	49.73	0.00340	1.96	4.90	0.87	7.75	2.90	0.11	6.76	
4-14toEx3	4-14	32+29.88	Ex3	31+03.52	0.27	0.80	0.22	0.70	6.06	6.45	0.00	4.53	10.20	9.73	120.20	0.00391	24	Circular	1	14.15	0.00040	0.78	1.13	0.42	4.01	1.03	0.50	6.56	
4-15to4-14	4-15	32+29.97	4-14	32+29.88	0.11	0.62	0.07	0.07	5.00	6.78	0.00	0.48	10.52	10.30	43.91	0.00501	15	Circular	1	4.57	0.00010	0.27	0.20	0.16	2.42	0.37	0.30	5.30	
4-3toEx7	4-3	26+95.59	Ex7	26+95.65	0.13	0.62	0.08	0.08	5.00	6.78	0.00	0.52	14.95	14.74	42.00	0.00500	15	Circular	1	4.57	0.00010	0.29	0.21	0.17	2.48	0.38	0.28	5.28	
4-5toEx6	4-5	28+00	Ex6	28+00.00	0.07	0.60	0.04	0.04	5.00	6.78	0.00	0.26	13.95	13.73	44.00	0.00500	15	Circular	1	4.57	0.00000	0.20	0.13	0.13	2.03	0.27	0.36	5.36	
5-10to5-12	5-10	36+82.60	5-12	35+70.90	0.24	0.76	0.18	3.41	13.06	4.94	0.00	25.09	7.75	7.00	61.23	0.01225	30	Circular	1	45.40	0.00390	1.33	2.65	0.65	9.48	2.72	0.11	13.17	
5-1to4-14	5-1	34+12.9	4-14	32+29.88	0.13	0.69	0.09	0.42	5.62	6.58	0.00	2.73	14.00	10.30	175.58	0.02107	18	Circular	1	15.25	0.00070	0.43	0.42	0.25	6.53	1.09	0.45	6.06	
5-2to5-1	5-2	34+12.98	5-1	34+12.9	0.26	0.76	0.19	0.19	5.00	6.78	0.00	1.32	16.75	16.50	41.32	0.00605	15	Circular	1	5.03	0.00040	0.44	0.38	0.24	3.45	0.62	0.20	5.20	
5-3to5-1	5-3	36+01.35	5-1	34+12.9	0.17	0.77	0.13	0.13	5.00	6.78	0.00	0.89	26.00	16.25	180.75	0.05394	15	Circular	1	15.00	0.00020	0.21	0.13	0.13	6.70	0.90	0.45	5.45	
5-5to5-6	5-5	38+02.29	5-6	37+98.68	0.21	0.80	0.17	2.86	12.48	5.03	0.00	14.41	40.50	39.50	54.85	0.01823	24	Circular	1	30.54	0.00420	0.97	1.50	0.49	9.58	2.39	0.10	12.57	
5-6to5-9	5-6	37+98.68	5-9	37+22.34	0.20	0.59	0.12	3.16	12.57	5.02	0.00	23.87	34.30	33.30	77.31	0.01293	30	Circular	1	46.64	0.00350	1.27	2.50	0.63	9.56	2.69	0.14	12.71	
5-7to5-6	5-7	38+78.58	5-6	37+98.68	0.25	0.75	0.19	0.19	5.01	6.78	0.00	15.68	41.50	40.00	81.31	0.01845	24	Circular	1	30.73	0.00500	1.01	1.60	0.50	9.83	2.51	0.14	5.14	
5-8to5-5	5-8	38+19.91	5-5	38+02.29	4.72	0.57	2.69	2.69	12.43	5.04	0.00	13.57	41.00	40.60	24.00	0.01667	24	Circular	1	29.21	0.00370	0.96	1.49	0.49	9.13	2.25	0.04	12.48	
5-9to5-10	5-9	37+22.34	5-10	36+82.60	0.09	0.72	0.06	3.22	12.71	5.00	0.00	24.18	23.00	20.50	202.91	0.01232	30	Circular	1	45.53	0.00360	1.30	2.57	0.64	9.42	2.67	0.36	13.06	
EX31to5-7	Ex31	38+77.84	5-7	38+78.58	0.00		0.00	0.00	5.00	0.00		14.41	35.20	35.10	3.87	0.02584	24	Circular	1	36.37	0.00420	0.88	1.32	0.46	10.90	2.72	0.01	5.01	
Ex3to4-12	Ex3	31+03.52	4-12	31+02.83	0.49	0.61	0.30	1.77	6.56	6.31	0.00	37.12	9.63	9.30	44.89	0.00735	36	Circular	1	57.18	0.00320	1.76	4.31	0.82	8.61	2.91	0.09	6.65	
Ex4toEx3	Ex4	30+00.00	Ex3	31+03.52	0.18	0.63	0.11	0.77	5.87	6.51	0.00	31.13	10.23	9.73	99.98	0.00500	36	Circular	1	47.16	0.00230	1.78	4.37	0.83	7.13	2.57	0.23	6.11	
Ex5AtoEx5	Ex5A	28+79.86	Ex5	29+00.00	0.00		0.00	0.00	5.00	0.00	0.00	3.50	12.81	12.66	30.00	0.00500	15	Circular	1	4.57	0.00310	0.82	0.85	0.36	4.10	1.08	0.12	5.12	
Ex5toEx4	Ex5	29+00.00	Ex4	30+00.00	0.09	0.84	0.08	0.58	5.64	6.57	0.00	29.90	10.81	10.33	96.59	0.00497	36	Circular	1	47.02	0.00210	1.74	4.24	0.82	7.05	2.51	0.23	5.87	
Ex6toEx5	Ex6	28+00.00	Ex5	29+00.00	0.09	0.78	0.07	0.50	5.47	6.63	0.00	29.40	11.88	10.91	96.59	0.01004	36	Circular	1	66.83	0.00200	1.39	3.21	0.71	9.15	2.69	0.18	5.64	
Ex7toEx6	Ex7	26+95.65	Ex6	28+00.00	0.37	0.86	0.32	0.39	5.28	6.69	0.00	28.67	12.99	11.98	100.77	0.01002	36	Circular	1	66.77	0.00190	1.37	3.16	0.71	9.09	2.66	0.19	5.47	
Ex8toEx7	Ex8	26+66.44	Ex7	26+95.65	0.00		0.00	0.00	5.00	0.00		26.13	15.30	13.49	36.21	0.04999	30	Circular	1	91.71	0.00420	0.91	1.62	0.50	16.10	4.94	0.04	5.04	Flow from Rivergate Plan#SPR2019-00023

LD-347
HYDRAULIC GRADE LINE ANALYSIS

PROJECT: Annapolis Way

DESIGNED BY: IDL

Checked: NVD

INCIDENCE PROBABILITY **10** **Year**

INLET OR JUNCTION	STA.	INVERT EL. OUTFLOW PIPE	DEPTH OF FLOW OUTFLOW PIPE	OUTLET WATER SURFACE ELEV.	DIA. PIPE Do (In/mm)	DESIGN DISCH. Qo (CFS/CMS)	LENGTH PIPE Lo (Ft/M)	FRICTION SLOPE, Sfo (FT/FT) (M/M)	FRICTION LOSS Hf (Ft/M)	JUNCTION LOSS									SURFACE FLOW	Adj. Ht 1.3 Ht (Ft/M)	Inlet Shaping? Y/N	0.5 Ht (Ft/M)	FINAL H (Ft/M)	Inlet Water Surface Elevation	Top of MH Top of Inlet Elev. APPROX.	Adjustment?
										Vo	Contr. Ho (Ft/M)	Vi	Vi*2/2g	Hi (Expn) 0.35*MAX. (Vi2/2g)	SKEW Angle	K	Bend H (Ft/M)	Sum HL (Ft/M)								
(1)	(2)			(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)		(12)	(13)		(14)	(15)		(16)		(16)	(17)	(18)	(19)	
5-12																								9.000		
5-10	36+82.60	7.000	2.50	9.000	30	25.087	61.23	0.00391	0.239	9.478	0.349	9.415	1.376	0.482	0.0	0.00	0.000	0.830	0.903	0.830	YES	0.415	0.655	9.655	25.880	O.K.
5-9	37+22.34	20.500	2.50	22.500	30	24.183	202.91	0.00363	0.737	9.415	0.344	9.556	1.418	0.496	0.0	0.00	0.000	0.840	0.315	0.840	YES	0.420	1.157	24.296	38.870	O.K.
5-6	37+98.68	33.300	2.50	35.300	30	23.868	77.31	0.00354	0.274	9.556	0.354	9.830	1.500	0.525	0.0	0.00	0.000	0.880	0.582	0.880	YES	0.440	0.713	36.013	45.000	O.K.
5-5	38+02.29	39.500	2.00	41.100	24	14.409	54.85	0.00424	0.233	9.580	0.356	9.126	1.293	0.453	0.0	0.00	0.000	0.809	0.841	0.809	YES	0.404	0.637	41.737	45.250	O.K.
5-8	38+19.91	40.600	2.00	42.200	24	13.568	24.00	0.00376	0.090	9.126	0.323	0.000	0.000	0.000	0.0	0.00	0.000	0.323	13.568	0.420	NO	0.420	0.511	42.711	45.250	O.K.
5-7	38+78.58	40.000	2.00	41.600	24	15.677	81.31	0.00502	0.408	9.830	0.375	10.903	1.846	0.646	0.0	0.00	0.000	1.021	1.267	1.021	YES	0.511	0.919	42.519	51.290	O.K.
Ex31	38+77.84	35.100	2.00	42.519	24	14.410	3.87	0.00424	0.016	10.903	0.461	0.000	0.000	0.000	0.0	0.00	0.000	0.461	0.000	0.461	YES	0.231	0.247	42.766	51.430	O.K.

LD-347
HYDRAULIC GRADE LINE ANALYSIS

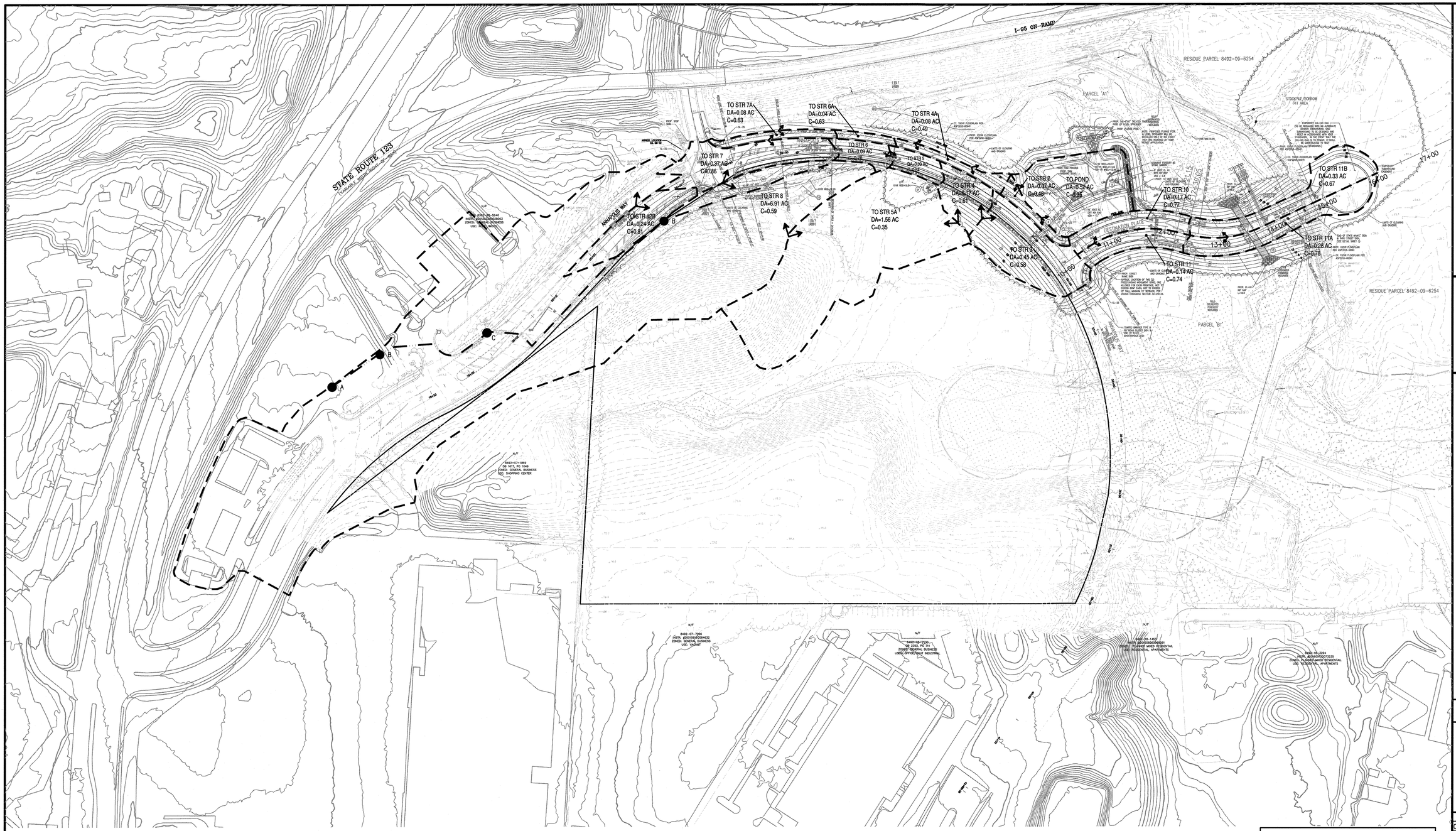
PROJECT: Annapolis Way

DESIGNED BY: IDL

Checked: NVD

INCIDENCE PROBABILITY **10** **Year**

INLET OR JUNCTION	STA.	INVERT EL. OUTFLOW PIPE	DEPTH OF FLOW OUTFLOW PIPE	OUTLET WATER SURFACE ELEV.	DIA. PIPE Do (In/mm)	DESIGN DISCH. Qo (CFS/CMS)	LENGTH PIPE Lo (Ft/M)	FRICTION SLOPE, Sfo (FT/FT) (M/M)	FRICTION LOSS Hf (Ft/M)	JUNCTION LOSS									SURFACE FLOW	Adj. Ht 1.3 Ht (Ft/M)	Inlet Shaping? Y/N	0.5 Ht (Ft/M)	FINAL H (Ft/M)	Inlet Water Surface Elevation	Top of MH Top of Inlet Elev. APPROX.	Adjustment?
										Vo	Contr. Ho (Ft/M)	Vi	Vi*2/2g	Hi (Expn) 0.35*MAX. (Vi2/2g)	SKEW Angle	K	Bend H (Ft/M)	Sum HL (Ft/M)								
(1)	(2)			(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)		(12)	(13)		(14)	(15)		(16)		(16)	(17)	(18)	(19)	
Ex1																								12.340		
4-12	31+02.83	9.000	3.00	12.340	36	37.289	50.38	0.00327	0.165	7.721	0.231	8.598	1.148	0.402	0.0	0.00	0.000	0.633	0.389	0.633	YES	0.317	0.481	12.821	15.510	O.K.
Ex3	31+03.52	9.300	3.00	12.821	36	36.900	44.89	0.00320	0.144	8.598	0.287	7.128	0.789	0.276	0.0	0.00	0.000	0.563	1.652	0.563	YES	0.282	0.425	13.246	14.580	O.K.
Ex4	30+00.00	9.730	3.00	13.246	36	31.131	99.98	0.00228	0.228	7.128	0.197	7.046	0.771	0.270	0.0	0.00	0.000	0.467	0.735	0.467	YES	0.234	0.461	13.708	15.260	O.K.
Ex5	29+00.00	10.330	3.00	13.708	36	29.895	96.59	0.00210	0.203	7.046	0.193	9.151	1.300	0.455	0.0	0.00	0.000	0.648	0.500	0.648	YES	0.324	0.527	14.234	16.650	O.K.
Ex6	28+00.00	10.910	3.00	14.234	36	29.395	96.59	0.00203	0.196	9.151	0.325	9.086	1.282	0.449	0.0	0.00	0.000	0.774	0.464	0.774	YES	0.387	0.583	14.817	18.050	O.K.
Ex7	26+95.65	11.980	3.00	14.817	36	28.673	100.77	0.00193	0.195	9.086	0.320	16.101	4.026	1.409	0.0	0.00	0.000	1.729	2.120	1.729	YES	0.865	1.059	15.877	19.510	O.K.
Ex8	26+66.44	13.490	2.50	15.877	30	26.130	36.21	0.00424	0.154	16.101	1.006	0.000	0.000	0.000	0.0	0.00	0.000	1.006	0.000	1.006	YES	0.503	0.657	16.533	17.300	O.K.
4-14	32+29.88	9.730	2.00	13.246	24	4.527	120.20	0.00042	0.050	4.006	0.062	6.531	0.662	0.232	0.0	0.00	0.000	0.294	1.393	0.382	YES	0.191	0.241	13.488	15.810	O.K.
5-1	34+12.9	10.300	1.50	13.488	18	2.732	175.58	0.00071	0.124	6.531	0.166	6.699	0.697	0.244	0.0	0.00	0.000	0.409	0.592	0.532	YES	0.266	0.390	14.430	20.870	O.K.
5-3	36+01.35	16.250	1.25	17.250	15	0.888	180.75	0.00020	0.036	6.699	0.174	0.000	0.000	0.000	0.0	0.00	0.000	0.174	0.888	0.226	NO	0.226	0.262	26.206	30.540	O.K.
4-10	30+00.00	12.080	1.25	13.708	15	0.522	45.00	0.00007	0.003	2.458	0.023	0.000	0.000	0.000	0.0	0.00	0.000	0.023	0.522	0.030	NO	0.030	0.034	13.741	16.230	O.K.
Ex5A	28+79.86	12.660	1.25	14.234	15	3.500	30.00	0.00307	0.092	4.103	0.065	0.000	0.000	0.000	0.0	0.00	0.000	0.065	0.000	0.065	YES	0.033	0.125	14.359	16.500	O.K.
4-5	28+00	13.730	1.25	14.817	15	0.264	44.00	0.00002	0.001	2.030	0.016	0.000	0.000	0.000	0.0	0.00	0.000	0.016	0.264	0.021	NO	0.021	0.022	14.839	18.690	O.K.
4-3	26+95.59	14.740	1.25	15.877	15	0.522	42.00	0.00007	0.003	2.477	0.024	0.000	0.000	0.000	0.0	0.00	0.000	0.024	0.522	0.031	NO	0.031	0.034	15.911	20.700	O.K.
4-15	32+29.97	10.300	1.25	13.488	15	0.481	43.91	0.00006	0.003	2.420	0.023	0.000	0.000	0.000	0.0	0.00	0.000	0.023	0.481	0.030	NO	0.030	0.032	13.520	16.530	O.K.
5-2	34+12.98	16.500	1.25	17.500	15	1.315	41.32	0.00043	0.018	3.448	0.046	0.000	0.000	0.000	0.0	0.00	0.000	0.046	1.315	0.060	NO	0.060	0.078	17.578	21.560	O.K.



LEGEND

- DRAINAGE DIVIDE
- Tc PATH
- A — BEGIN OVERLAND FLOW
- B — BEGIN SHALLOW CONCENTRATED FLOW
- C — BEGIN OPEN CHANNEL FLOW

NORTH

GRAPHIC SCALE

80 0 40 80 160 320

(IN FEET)
1 inch = 80 ft.

Bowman CONSULTING

Bowman Consulting Group, Ltd.
550A Nelms Circle
Fredericksburg, Virginia 22406

Phone: (540) 371-0268
Fax: (540) 371-3479
www.bowmanconsulting.com

DRAINAGE DIVIDES MAP

ANNAPOLIS WAY
PUBLIC IMPROVEMENT PLAN
WOODBRIDGE MAGISTERIAL DISTRICT - PRINCE WILLIAM COUNTY

SPR-2018-000412
COUNTY PLAN NUMBER

COMMONWEALTH OF VIRGINIA
CHARLES V. FITZGERALD JR
Lic. No.050113
2-18-2020
PROFESSIONAL ENGINEER

PLAN STATUS	
05/24/18	1ST SUBMISSION
03/24/19	2ND SUBMISSION
06/14/19	3RD SUBMISSION
09/06/19	4TH SUBMISSION
11/27/19	5TH SUBMISSION
02/18/20	SIG. SUBMISSION

DATE	DESCRIPTION	
CVF DESIGN	JLD DRAWN	CVF CHKD
SCALE	H: 1"=80' V: N/A	
JOB No.	100065-02-001	
DATE :	FEBRUARY 2020	
FILE No.	100065-D-PIP-001	
SHEET	16 OF 34	

Cad file name : P:\100065 - Annapolis Way\100065-02-001 (ENG)\Engineering\Engineering Plans\100065-D-PIP-001 Public Improvement Plan\016-100065-D-PIP-001-DDM.dwg

DGN $REF001 $REF002 $REF003 $REF004 $REF005 $REF006
$DGNLEV $LEV001 $LEV002 $LEV003 $LEV004 $LEV005 $LEV006

PROJECT MANAGER PWC DEPT. OF TRANSPORTATION: SHERRY DJOUHARIAN (703) 792-6822
SURVEYED BY, DATE RINKER DESIGN ASSOCIATES P.C. (703) 368-7373 JAN. 2020 & DEC. 2021
DESIGN BY RINKER DESIGN ASSOCIATES P.C. (703) 368-7373
SUBSURFACE UTILITY BY, DATE ACCUMARK INC. DECEMBER 2019

REVISED	STATE	ROUTE	PROJECT	SHEET NO.
	VA.	76-673		3

Rinker Design Associates, P.C.
Virginia Beach, Virginia
Hydraulics Engineer

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

SCALE	PROJECT	SHEET NO.
0 25' 50'	0234-076-323	3

$TIME$STAMP$

THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY.

DGN $REF001 $REF002 $REF003 $REF004 $REF005 $REF006

$DGNLEV $LEV001 $LEV002 $LEV003 $LEV004 $LEV005 $LEV006

PROJECT MANAGER PWC DEPT OF TRANSPORTATION: SHERRY DJOUHARIAN (703) 792-6822
SURVEYED BY, DATE RINKER DESIGN ASSOCIATES, P.C. (703) 368-7373, JAN. 2020 & DEC. 2021
DESIGN BY RINKER DESIGN ASSOCIATES, P.C. (703) 368-7373
SUBSURFACE UTILITY BY, DATE ACCUMARK, INC., DECEMBER 2019

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	673		4

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Rinker Design Associates, P.C.
Virginia Beach, Virginia
Hydraulics Engineer

Match Line Sheet 3 - Annapolis Way C.B.L Sta.26+75.00

Match Line Sheet 7 - Destination Place C.B.L Sta.12+75.00

Match Line Sheet 5 - Annapolis Way C.B.L Sta.33+25.00

Do Not Disturb Existing Wingwall

WINGWALL

PWCSA MANHOLE #291135

EX 300

4-3
DA=0.13 ac
C=0.62

4-5
DA=0.07 ac
C=0.60

4-10
DA=0.13 ac
C=0.61

4-12
DA=0.18 ac
C=0.76

EX 3
DA=0.49 ac
C=0.61

4-14
DA=0.27 ac
C=0.80

4-15
DA=0.11 ac
C=0.62

Detention Facility 4-1

THE LANDING AT MASON'S BRIDGE, LP
Instr. #202107300089458
TM #8492-09-1636
3.13021 Ac.

THE LANDING AT MASON'S BRIDGE, LP
Instr. #202107300089458
TM #8492-08-2272
1.80726 Ac.

THE LANDING AT MASON'S BRIDGE, LP
Instr. #202107300089458
TM #8492-09-5925
2.70003 Ac.

Ex. Prince William County Service Authority Facility Esmt. D.B. 1762 Pg. 1152

Ex. Sanitary Sewer Esmt. Instr.#202012160121631-2

Ex. 25' Drainage Esmt. D.B. 2190 Pg. 1338

Ex. Drainage Esmt. Instr. 202012160121631-2

Ex. Storm Distribution Easement Instr. 202012160121631-2

D.B. 2190 Pg. 1338 and P.B. 158 Pg. 59-65 Depict Additional Easements for which Is Incomplete or Illegible.

Ex. Water Management Esmt. Instr. #202012160121631-2

Ex. R/W

Ditch 1

PC12+39.05

PT12+21.15

N 55° 36' 36" E

S 55° 36' 36" W (R=239.00' L=25.36')

(R=167.00' L=135.06')

PC10+46.58

N 5° 35' 58" E

PT 10+84.52

S 77° 41' 35" E

33

32

12

SCALE 0 25' 50'

PROJECT 0234-076-323

SHEET NO. 4

THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY.

RW PLAN

$TIME$STAMP$

DGN $REF001 $REF002 $REF003 $REF004 $REF005 $REF006
$DGNLEV $LEV001 $LEV002 $LEV003 $LEV004 $LEV005 $LEV006

PROJECT MANAGER PWC DEPT. OF TRANSPORTATION: SHERRY DJOUHARIAN (703) 792-6822
SURVEYED BY, DATE RINKER DESIGN ASSOCIATES, P.C. (703) 368-7373, JAN. 2020 & DEC. 2021
DESIGN BY RINKER DESIGN ASSOCIATES, P.C. (703) 368-7373
SUBSURFACE UTILITY BY, DATE ACCUMARK, INC., DECEMBER 2019

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	673		5

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Rinker Design Associates, P.C.
Virginia Beach, Virginia
Hydraulics Engineer

SCALE	PROJECT	SHEET NO.
0 25' 50'	0234-076-323	5

THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY.

RW PLAN

$TIME$STAMP$

DGN $REF001 $REF002 $REF003 $REF004 $REF005 $REF006
$DGNLEV $LEV001 $LEV002 $LEV003 $LEV004 $LEV005 $LEV006

PROJECT MANAGER PWC DEPT. OF TRANSPORTATION: SHERRY DJOUHARIAN (703) 792-6822
SURVEYED BY, DATE RINKER DESIGN ASSOCIATES, P.C. (703) 368-7373, JAN. 2020 & DEC. 2021
DESIGN BY RINKER DESIGN ASSOCIATES, P.C. (703) 368-7373
SUBSURFACE UTILITY BY, DATE ACCUMARK, INC., DECEMBER 2019

FOR INFORMATION ONLY

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	673		6

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Rinker Design Associates, P.C.
Virginia Beach, Virginia
Hydraulics Engineer

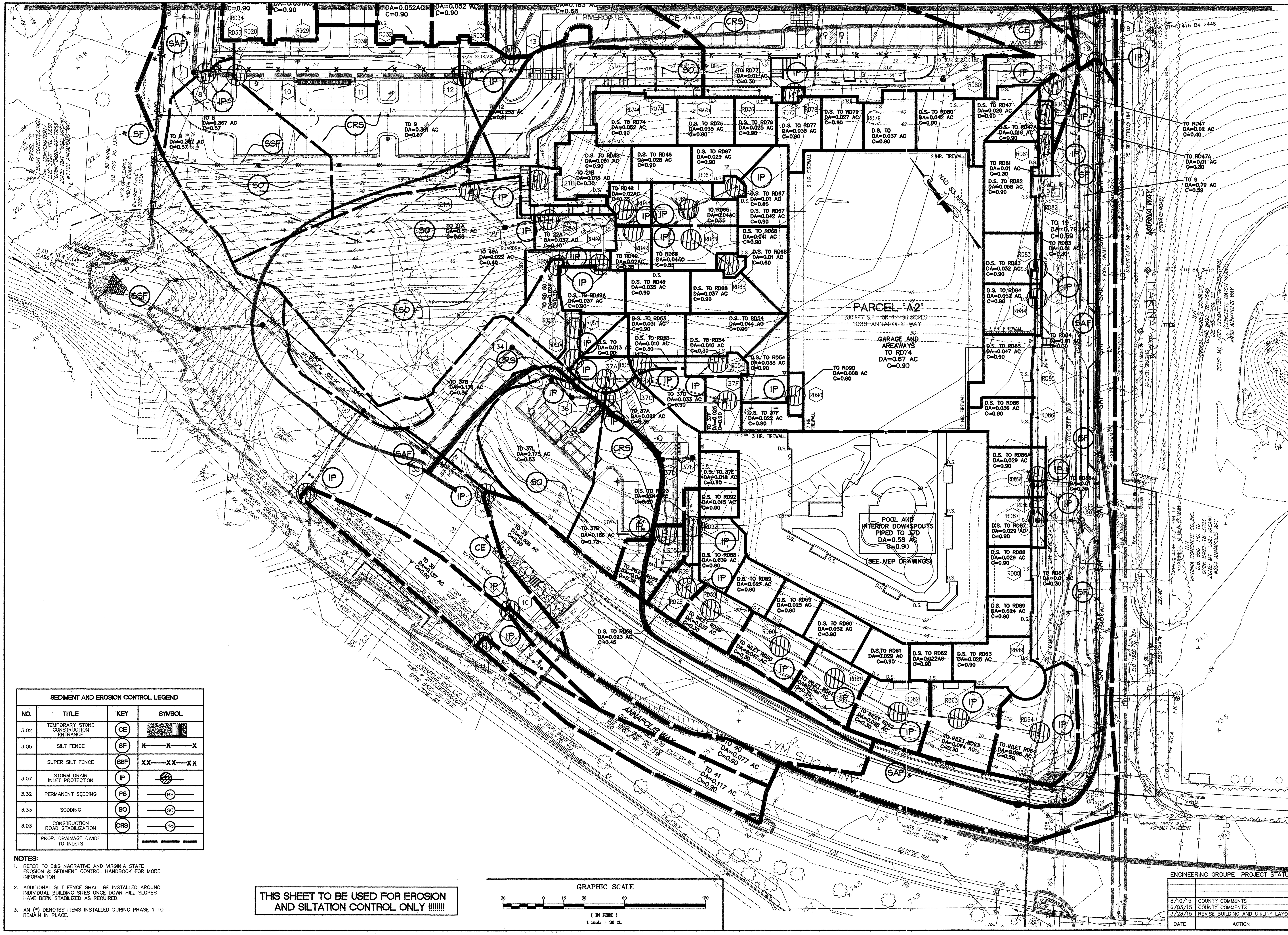
Rinker Design Associates, P.C.
Virginia Beach, Virginia
Roadway Engineer

SCALE	PROJECT	SHEET NO.
0 25' 50'		6

$TIME$STAMP$

THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY.

RW PLAN



SEDIMENT AND EROSION CONTROL LEGEND			
NO.	TITLE	KEY	SYMBOL
3.02	TEMPORARY STONE CONSTRUCTION ENTRANCE	CE	
3.05	SILT FENCE	SF	—X—X—X
	SUPER SILT FENCE	SSF	XX—XX—XX
3.07	STORM DRAIN INLET PROTECTION	IP	
3.32	PERMANENT SEEDING	PS	—PS—
3.33	SODDING	SO	—SO—
3.03	CONSTRUCTION ROAD STABILIZATION	CRS	—CRS—
	PROP. DRAINAGE DIVIDE TO INLETS		— — —

NOTES:

1. REFER TO E&S NARRATIVE AND VIRGINIA STATE EROSION & SEDIMENT CONTROL HANDBOOK FOR MORE INFORMATION.
2. ADDITIONAL SILT FENCE SHALL BE INSTALLED AROUND INDIVIDUAL BUILDING SITES ONCE DOWN HILL SLOPES HAVE BEEN STABILIZED AS REQUIRED.
3. AN (*) DENOTES ITEMS INSTALLED DURING PHASE 1 TO REMAIN IN PLACE.

THIS SHEET TO BE USED FOR EROSION AND SILTATION CONTROL ONLY !!!!!!!

GRAPHIC SCALE
30 0 15 30 60 120
(IN FEET)
1 inch = 30 ft.

ENGINEERING GROUPE PROJECT STATUS	
8/10/15	COUNTY COMMENTS
6/03/15	COUNTY COMMENTS
3/23/15	REVISE BUILDING AND UTILITY LAYOUT
DATE	ACTION

NO.	DATE	COUNTY REVISIONS
2	11/12/19	REVISED E&S, REVISED BUILDING 2 LAYOUT
1	3/23/15	REVISE BUILDING AND UTILITY LAYOUT

The Engineering Groupe Inc.
Engineers | Surveyors | Planners
Central Office: 13580 Groupe Drive, Suite 200, Woodbridge, VA 22192, PH 703.670.0985
South Office: 10333 Southpoint Landing Blvd, Suite 121, Fredericksburg, VA 22407, PH 703.670.0985
West Office: 21001 Sycolin Road, Suite 200, Ashburn, VA 20147, PH 703.670.0985

EROSION AND SEDIMENT CONTROL – PHASE II
RIVERGATE
WOODBRIDGE MAGISTERIAL DISTRICT
PRINCE WILLIAM COUNTY, VIRGINIA

COMMONWEALTH OF VIRGINIA
ROBERT A. POLINS
Lic. No. 9641
12/03/19
PROFESSIONAL ENGINEER

DATE: MARCH 23, 2015
SCALE: 1"=30'
DESIGNER: RAP, VF
DRAFTSMAN: YQ, VF
FILE NO. SP-381
SHEET 22 OF 36

G:\PROJECT\RIVERGATE\ENG\DWG\PHASE 2\01-K5000-E&S PH2.dwg, 00-K5001, 12/4/2019 10:18:36 AM, Victorf

PROJECT: Annapolis Way
LOCATION: North Woodbridge

OUTLET PROTECTION

Designed IDL

UNITS ENGLISH

PIPE OUTFALL & TAILWATER DATA

Pipe No:	**4-12**		2-Year Outlet Velocity:	4.97	Ft/Sec.
Pipe Dia. / Rise:	3.00	Ft.	Tailwater Channel Flow Depth:	2.50	Ft.
Design Discharge:	36.90	CFS.			
Depth of Flow @ Outlet:	2.01	Ft.	Natural Channel Bed Material:	Medium Gravel	
Outlet Velocity:	7.32	Ft/Sec.	Mean Particle size of Bed Material:	0.0525 - 0.0262	
Froude No.:	0.91		Non-scour Velocity for Soil Type:	3.44	Ft/Sec.

OUTLET PROTECTION **REQUIRED!**

SCOUR HOLE SIZE

D_{16} Stone Size	0.01	Ft.	Depth:	0.91	Ft.
D_{84} Stone Size	0.10	Ft.	Width:	2.77	Ft.
Plasticity Index	5.00		Length:	6.38	Ft.
			Location of Max. Scour:	2.55	Ft.

VDOT METHOD

Outlet Protection Type	Class A1	Length of Apron:	15.00	Ft.
(See VDOT Design Standards for Details)		Width of Apron:	15.00	Ft.
		Thickness of Apron:	1.50	Ft.

PROJECT: Annapolis Way
LOCATION: North Woodbridge

Designed IDL

OUTLET PROTECTION

UNITS ENGLISH

PIPE OUTFALL & TAILWATER DATA

Pipe No:	**5-12**		2-Year Outlet Velocity:	10.71	Ft/Sec.
Pipe Dia. / Rise:	2.50	Ft.	Tailwater Channel Flow Depth:	2.00	Ft.
Design Discharge:	25.09	CFS.			
Depth of Flow @ Outlet:	1.04	Ft.	Natural Channel Bed Material:	Sandy Loam (Light)	
Outlet Velocity:	12.99	Ft/Sec.	Mean Particle size of Bed Material:	-	
Froude No.:	2.25		Non-scour Velocity for Soil Type:	3.00	Ft/Sec.

OUTLET PROTECTION **REQUIRED!**

SCOUR HOLE SIZE

D_{16} Stone Size	0.01	Ft.	Depth:	0.91	Ft.
D_{84} Stone Size	0.10	Ft.	Width:	2.77	Ft.
Plasticity Index	5.00		Length:	6.38	Ft.
			Location of Max. Scour:	2.55	Ft.

VDOT METHOD

Outlet Protection Type	Class I	Length of Apron:	7.50	Ft.
(See VDOT Design Standards for Details)		Width of Apron:	7.50	Ft.
		Thickness of Apron:	2.00	Ft.

SECTION 6

DITCH COMPUTATIONS

Rinker Design Associates, PC

PROJECT NO: 19096-8 **PROJECT PHASE** RW Submission
DATE 05/05/22 **REGION** Quantico 1 S

ROADSIDE DITCHES
DESIGNED BY: IDL
CHECKED BY: NVD

Roadway: Annapolis Way
Ditch Identifier: Ditch 1

Allowable Shear Stress Calculations

Station Range			Boring Number	Soil Group	USC	Cohesive /Non Cohesive	Cohesive Soils				Non-Cohesive Soils	
							PI	N	Compact/Medium Compact/Loose	$\tau_{permissible}$	Particle Size	$\tau_{permissible}$
32+00	to	34+00	n/a	54B	RBAN LAN	Cohesive	0	n/a	Medium Compact	0.049 lb/sqft	n/a	n/a
34+01		36+00	n/a	27A	ML	Cohesive	7	n/a	Medium Compact	0.033 lb/sqft	n/a	n/a

STA. TO STA.	SIDE	% SLOPE	DIST (ft)	C = 0.90 / C = 0.50 / C = 0.30 INCREMENT AREA	INCREMENT CA	Tc (min)	Tt (min)	'i' (2 YR) (in/hr)	'i' (10 YR) (in/hr)	CA	Q (2 YR) (cfs)	Q (10 YR) (cfs)	DITCH SECTION F.S. (: 1)	B.W. (ft)	B.S. (: 1)	'n'	'd' (2 YR) (ft)	'd' (10 YR) (ft)	VEL (2 YR) (fps)	VEL (10 YR) (fps)	R_h (2 YR) (ft)	R_h (10 YR) (ft)	τ_p (lb/ft^2)	τ_o (2 YR) (lb/ft^2)	τ_o (10 YR) (lb/ft^2)	DITCH LINING
32+26				0.000	0.000																					
TO				0.210	0.105																					Pick From Drop Down List
33+25	RT	0.516	93	0.000	0.000	5.0	0.0	0.4	0.6	0.11	0.04	0.07	2.00	0.00	2.00	0.020	0.15	0.18	0.89	1.01	0.07	0.08	0.049	0.02	0.03	Bare Earth
33+25				0.000	0.000																					
TO				0.120	0.060																					Pick From Drop Down List
33+89	LT	0.500	64	0.000	0.000	5.0	1.0	0.4	0.6	0.17	0.06	0.10	2.00	0.00	2.00	0.020	0.18	0.21	0.97	1.10	0.08	0.10	0.049	0.02	0.03	Bare Earth

Rinker Design Associates, PC

PROJECT NO: 19096-8 **PROJECT PHASE** RW Submission
DATE 05/05/22 **REGION** Quantico 1 S

ROADSIDE DITCHES
DESIGNED BY: IDL
CHECKED BY: NVD

Roadway: Annapolis Way
Ditch Identifier: Ditch 2

Allowable Shear Stress Calculations

Station Range			Boring Number	Soil Group	USC	Cohesive /Non Cohesive	Cohesive Soils				Non-Cohesive Soils	
							PI	N	Compact/Medium Compact/Loose	$\tau_{permissible}$	Particle Size	$\tau_{permissible}$
32+00	to	34+00	n/a	54B	RBAN LAN	Cohesive	0	n/a	Medium Compact	0.049 lb/sqft	n/a	n/a
34+01		38+00	n/a	27A	ML	Cohesive	7	n/a	Medium Compact	0.033 lb/sqft	n/a	n/a

STA. TO STA.	SIDE	% SLOPE	DIST (ft)	C = 0.90 / C = 0.50 / C = 0.30 INCREMENT AREA	INCREMENT CA	Tc (min)	Tt (min)	'i' (2 YR) (in/hr)	'i' (10 YR) (in/hr)	CA	Q (2 YR) (cfs)	Q (10 YR) (cfs)	DITCH SECTION F.S. (: 1)	B.W. (ft)	B.S. (: 1)	'n'	'd' (2 YR) (ft)	'd' (10 YR) (ft)	VEL (2 YR) (fps)	VEL (10 YR) (fps)	R_h (2 YR) (ft)	R_h (10 YR) (ft)	τ_p (lb/ft^2)	τ_o (2 YR) (lb/ft^2)	τ_o (10 YR) (lb/ft^2)	DITCH LINING
36+25				0.000	0.000																					Pick From Drop Down List
TO				0.090	0.045																					
36+00	RT	2.065	93	0.000	0.000	5.0	0.0	0.4	0.6	0.05	0.02	0.03	2.00	0.00	2.00	0.037	0.11	0.13	0.76	0.87	0.05	0.06	1.500	0.06	0.08	EC-2 Type 1
36+00				0.000	0.000																					Pick From Drop Down List
TO				0.017	0.009																					
35+75	LT	33.240	25	0.000	0.000	5.0	0.2	0.4	0.6	0.05	0.02	0.03	2.00	0.00	2.00	0.037	0.07	0.08	2.26	2.56	0.03	0.04	1.500	0.63	0.76	EC-2 Type 1
35+75				0.000	0.000																					Pick From Drop Down List
TO				0.015	0.008																					
35+50	RT	24.560	25	0.000	0.000	5.2	0.2	0.4	0.6	0.06	0.02	0.04	2.00	0.00	2.00	0.037	0.08	0.09	2.08	2.36	0.03	0.04	1.500	0.52	0.63	EC-2 Type 1
35+50				0.000	0.000																					Pick From Drop Down List
TO				0.019	0.010																					
35+25	RT	8.320	25	0.000	0.000	5.3	0.3	0.4	0.6	0.07	0.03	0.04	2.00	0.00	2.00	0.037	0.10	0.12	1.43	1.62	0.04	0.05	1.500	0.23	0.27	EC-2 Type 1
35+25				0.000	0.000																					Pick From Drop Down List
TO				0.023	0.012																					
35+00	RT	1.880	25	0.000	0.000	5.6	0.4	0.4	0.6	0.08	0.03	0.05	2.00	0.00	2.00	0.037	0.13	0.16	0.85	0.96	0.06	0.07	1.500	0.07	0.09	EC-2 Type 1
35+00				0.000	0.000																					Pick From Drop Down List
TO				0.067	0.034																					
34+25	RT	0.507	75	0.000	0.000	6.0	2.0	0.3	0.5	0.12	0.04	0.06	2.00	0.00	2.00	0.037	0.19	0.23	0.55	0.62	0.08	0.10	1.500	0.03	0.03	EC-2 Type 1
34+25				0.000	0.000																					Pick From Drop Down List
TO				0.025	0.013																					
33+89	RT	1.167	36	0.000	0.000	8.0	0.7	0.3	0.5	0.13	0.04	0.07	2.00	0.00	2.00	0.037	0.16	0.20	0.76	0.86	0.07	0.09	1.500	0.05	0.06	EC-2 Type 1

Rinker Design Associates, PC

PROJECT NO: 19096-8 **PROJECT PHASE** RW Submission
DATE 05/05/22 **REGION** Quantico 1 S

ROADSIDE DITCHES
DESIGNED BY: IDL
CHECKED BY: NVD

Roadway: Annapolis Way
Ditch Identifier: Ditch 3

Allowable Shear Stress Calculations

Station Range			Boring Number	Soil Group	USC	Cohesive /Non Cohesive	Cohesive Soils				Non-Cohesive Soils	
							PI	N	Compact/Medium Compact/Loose	$\tau_{permissible}$	Particle Size	$\tau_{permissible}$
0+00	to	20+00	n/a	27A	ML	Cohesive	7	n/a	Medium Compact	0.033 lb/sqft	n/a	n/a

STA. TO STA.	SIDE	% SLOPE	DIST (ft)	C = 0.90 / C = 0.50 / C = 0.30 INCREMENT AREA	INCREMENT CA	Tc (min)	Tt (min)	'i' (2 YR) (in/hr)	'i' (10 YR) (in/hr)	CA	Q (2 YR) (cfs)	Q (10 YR) (cfs)	DITCH SECTION F.S. (: 1)	B.W. (ft)	B.S. (: 1)	'n'	'd' (2 YR) (ft)	'd' (10 YR) (ft)	VEL (2 YR) (fps)	VEL (10 YR) (fps)	R_h (2 YR) (ft)	R_h (10 YR) (ft)	τ_p (lb/ft^2)	τ_o (2 YR) (lb/ft^2)	τ_o (10 YR) (lb/ft^2)	DITCH LINING
10+00				0.000	0.000																					
TO				0.021	0.011																					Pick From Drop Down List
10+26	RT	1.237	93	0.000	0.000	5.0	0.0	0.4	0.6	0.01	18.82	25.09	2.00	0.00	2.00	0.037	1.62	1.80	3.60	3.87	0.72	0.81	1.500	0.56	0.62	EC-2 Type 1

DGN $REF001 $REF002 $REF003 $REF004 $REF005 $REF006

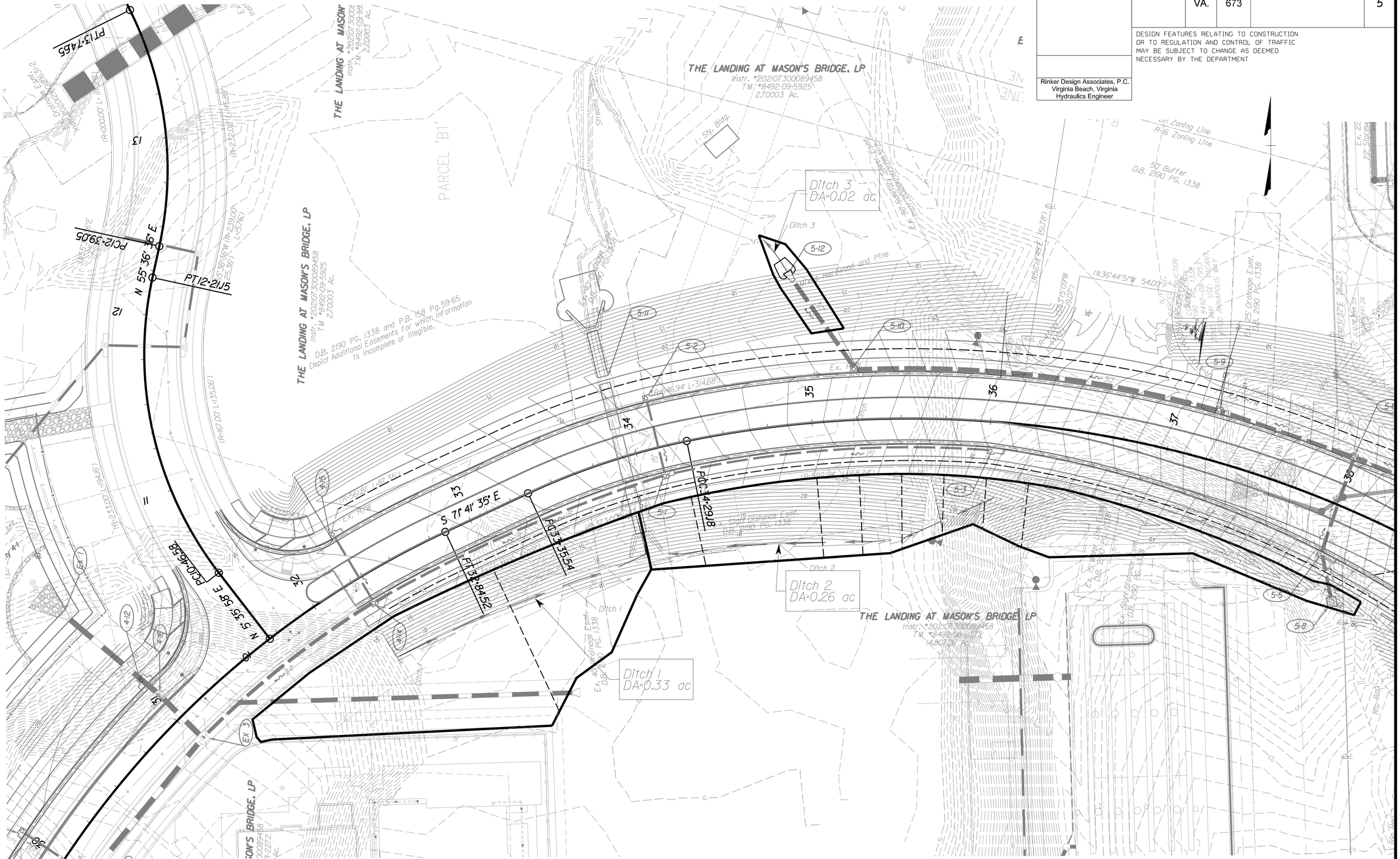
$DGNLEV $LEV001 $LEV002 $LEV003 $LEV004 $LEV005 $LEV006

PROJECT MANAGER PWC DEPT OF TRANSPORTATION: SHERRY DJOUHARIAN (703) 792-6822
SURVEYED BY, DATE RINKER DESIGN ASSOCIATES, P.C. (703) 368-7373, JAN. 2020 & DEC. 2021
DESIGN BY RINKER DESIGN ASSOCIATES, P.C. (703) 368-7373 _ _ _ _ _
SUBSURFACE UTILITY BY, DATE ACCUMARK, INC. DECEMBER 2019 _ _ _ _

REVISED	STATE	STATE ROUTE	STATE PROJECT	SHEET NO.
	VA.	673		5

DESIGN FEATURES RELATING TO CONSTRUCTION OR TO REGULATION AND CONTROL OF TRAFFIC MAY BE SUBJECT TO CHANGE AS DEEMED NECESSARY BY THE DEPARTMENT

Rinker Design Associates, P.C.
Virginia Beach, Virginia
Hydraulics Engineer



SCALE	PROJECT	SHEET NO.
0 25' 50'	0234-076-323	5

$TIME$ST AMP$

THESE PLANS ARE UNFINISHED AND UNAPPROVED AND ARE NOT TO BE USED FOR ANY TYPE OF CONSTRUCTION OR THE ACQUISITION OF RIGHT OF WAY.

RW PLAN

SECTION 7

CULVERT COMPUTATIONS

PROJECT	**Annapolis Way**			**CULVERT DESIGN FORM LD-269**	
ROAD	**Annapolis Way**	**COUNTY**	Prince William	SHEET	OF
CULVERT	5-11		VA	UNITS	**ENGLISH**
NOAA Station	33+93.10 Quantico 1 S	0		DESIGNER: IDL	DATE: 5/3/2022
				REVIEWER: NVD	DATE: 5/3/2022

HYDROLOGICAL DATA

Method: RATIONAL

Drainage Area: 35.62 Acres

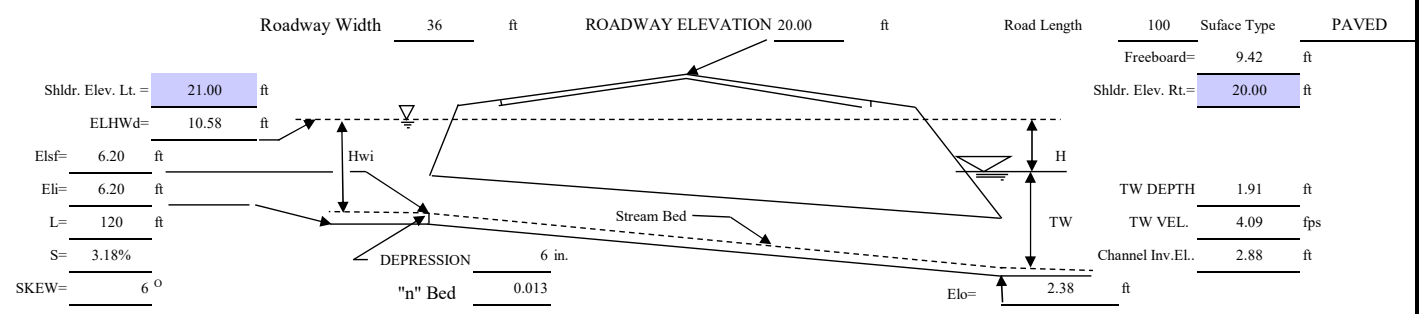
Time of Concentration 18.6 Minutes

DESIGN FLOWS

R.I. (years)	FLOW (cfs)	
10	Design	97.24
2	Check	71.54
100	Max.	161.49

CULVERT DESCRIPTION:

TYPE: **Single/Multiple Conforming**



Inlet Edge Description:

Square edge w/headwall

Single / Multiple Conforming / Broken Back Culverts

MATERIAL	SHAPE	Size (in)	N	Mannings n	TOTAL FLOW Q cfs	FLOW PER BARREL Q/N cfs	HEADWATER CALCULATIONS: INLET CONTROL HWi/D	HWi ft	FALL ft	ELHWi ft	OUTLET CONTROL TW ft	dc ft	(dc+D)/2 ft	ho ft	ke	H ft	ELHWo ft	CONTROL HEADWATER ELEV ft	OUTLET VEL fps	MINIMUM SHOULDER ELEV. ft	COMMENTS
Concrete	Circular	72	1	0.01	97.24	97.2	0.73	3.88	0.00	10.08	1.91	2.34	4.17	3.92	0.50	0.37	7.67	10.58	17.99		
					71.54	71.5	0.63	3.26	0.00	9.46	1.70	1.96	3.98	3.73	0.50	0.20	7.31	9.96	16.37		
					161.49	161.5	0.97	5.32	0.00	11.52	2.31	3.14	4.57	4.32	0.50	1.02	8.72	12.02	20.94		

Broken Back Culvert

LENGTH	Elev.	SKEW O

TAILWATER DATA:

Channel Shape	Triangular	
Bottom Width, ft	0.00	"n" = 0.035
Side Slope Lt: (H:1V)	6.61	
Side Slope Rt: (H:1V)	6.39	
Channel Slope, ft/ft	0.0100	

Distance						
Elevation						
"n" =						

TAILWATER RESULTS:

	Discharge cfs	Elevation ft	Flow depth ft	Velocity fps	Shear force PSF
Design	4.79	1.91	4.09	1.19	
Check	4.58	1.70	3.79	1.06	
Max.	5.19	2.31	4.64	1.44	

ROADWAY DATA:

Roadway Width, ft	36
Surface Type	PAVED
Top of Road Elevation, ft	20
Length of Road, ft	100

ROADWAY OVERTOPPING:

	Discharge cfs	Overtopping Discharge cfs	Overtopping Elevation ft
Design	0		0.00
Check	0		0.00
Max.	0		0.00

TECHNICAL FOOTNOTES:

(1) USE Q/NB FOR BOX CULVERTS

(2) HWi/D = HW/D OR HWi/D FROM DESIGN CHARTS

(3) FALL = HWI - (ELHWd - ELsf); FALL IS ZERO FOR CULVERTS ON GRADE

(4) ELhi = HWi + ELi (INVERT OF INLET CONTROL SECTION)

(5) TW BASED ON DOWNSTREAM CONTROL OR FLOW DEPTH IN CHANNEL

(6) ho = TW or (dc + D/2) (WHICHEVER IS GREATER)

(7) $H = [1 + ke + (29n^2L)/R^{1.33}]v^2/2g$

SUBSCRIPT DEFINITIONS:

HWd	DESIGN HEADWATER	i	INLET
HWi	HW IN INLET CONTROL	o	OUTLET
HWo	HW IN OUTLET CONTROL	sf	Streambed @ culvert face

COMMENTS / DISCUSSION:

CULVERT BARREL SELECTED

SIZE: n:

SHAPE: MATERIAL:

ENTRANCE:

Name of Project:	Annapolis Way			Designed By:	IDL
State:	VA	**County:**	Prince William	Date:	05/03/22
Name of Culvert:	11-May			Checked By:	NVD
NOAA Station:	Quantico 1 S			Date:	05/03/22
LOCATION:	Prince William County				
				UNITS	**ENGLISH**

RATIONAL METHOD - DATA:

DRAINAGE BASIN

SUBSHED #	Land Use Description	Area Acres	C	C A
	Business: Industrial and Commercial (0.80-0.90)			
	Apartments and Townhomes (0.65-0.75)	35.62	0.65	23.15
	Schools (0.50-0.60)			
	Residential - lots 10,000 sq. ft. (0.40-0.50)			
	- lots 12,000 sq. ft. (0.40-0.45)			
	- lots 17,000 sq. ft. (0.35-0.45)			
	- lots ½ acre or more (0.30-0.40)			
	Parks, Cemeteries and Unimproved Areas (0.20-0.35)			
	Paved and Roof Areas (0.90)			
	Cultivated Areas (0.50-0.70)			
	Pasture (0.35-0.45)			
	Lawns (0.25-0.35)			
	Forest (0.20-0.30)			
	Steep Grass (2:1) (0.40-0.70)			
	Shoulder and Ditch Areas (0.35-0.50)			
	Totals =	**35.62**	**Acres**	**23.15**

Time of Concentration (Tc)

Reach	Soil / Surface Type/Land Cover	Flow Distance Ft.	Upper Elev. Ft.	Lower Elev. Ft.	Slope Ft./Ft	Rational C		Tc (Minutes)
Overland Flow (E.E. Seelye - VDOT Modified)								
		120.00	78.00	75.43	0.021	0.65		5.40
Channel Flow (Kirpich Method)		Height Ft.	Length Ft.			Surface Factor		
Shallow Concentrated Flow		Flow Distance Ft.	Upper Elev. Ft.	Lower Elev. Ft.	Slope (%)	Intercept Coeff.		
		360.00	58.50	36.20	0.062			2.30
Channel / Pipe Flow					Slope Ft./Ft	Mannings 'n'	Velocity FPS	
		1100.00	75.43	58.50	0.015	0.015	2.10	8.80
		170.00	9.12	6.20	0.017	0.015	1.40	2.10
							Total Tc (Minutes) =	**18.60**

	2-Year	5-Year	10-Year	25-Year	50-Year	100-Year
Rainfall Intensity Inches / Hour.	**2.97**	**3.66**	**4.05**	**4.63**	**5.02**	**5.40**
Aosorption Coefficient / Ground Saturation Correction Coefficient Cf	1.00	1.00	1.00	1.10	1.20	1.25
Peak Discharge CFS.	**71.54**	**84.74**	**97.24**	**117.92**	**139.47**	**161.49**

PROJECT: Annapolis Way
LOCATION: Prince William County

Designed IDL

OUTLET PROTECTION

UNITS ENGLISH

CULVERT & TAILWATER DATA

Culvert No:	**5-11**		2-Year Outlet Velocity:	16.17	Ft/Sec.
Culvert Dia. / Rise:	6.00	Ft.	Tailwater Channel Flow Depth:	1.89	Ft.
Design Discharge:	97.24	CFS.			
Depth of Flow @ Outlet:	1.16	Ft.	Natural Channel Bed Material:	Boulders	
Brink Velocity:	17.80	Ft/Sec.	Mean Particle size of Bed Material:	> 0.84	
Froude No.:	2.91		Non-scour Velocity for Soil Type:	14.94	Ft/Sec.

OUTLET PROTECTION **REQUIRED!**

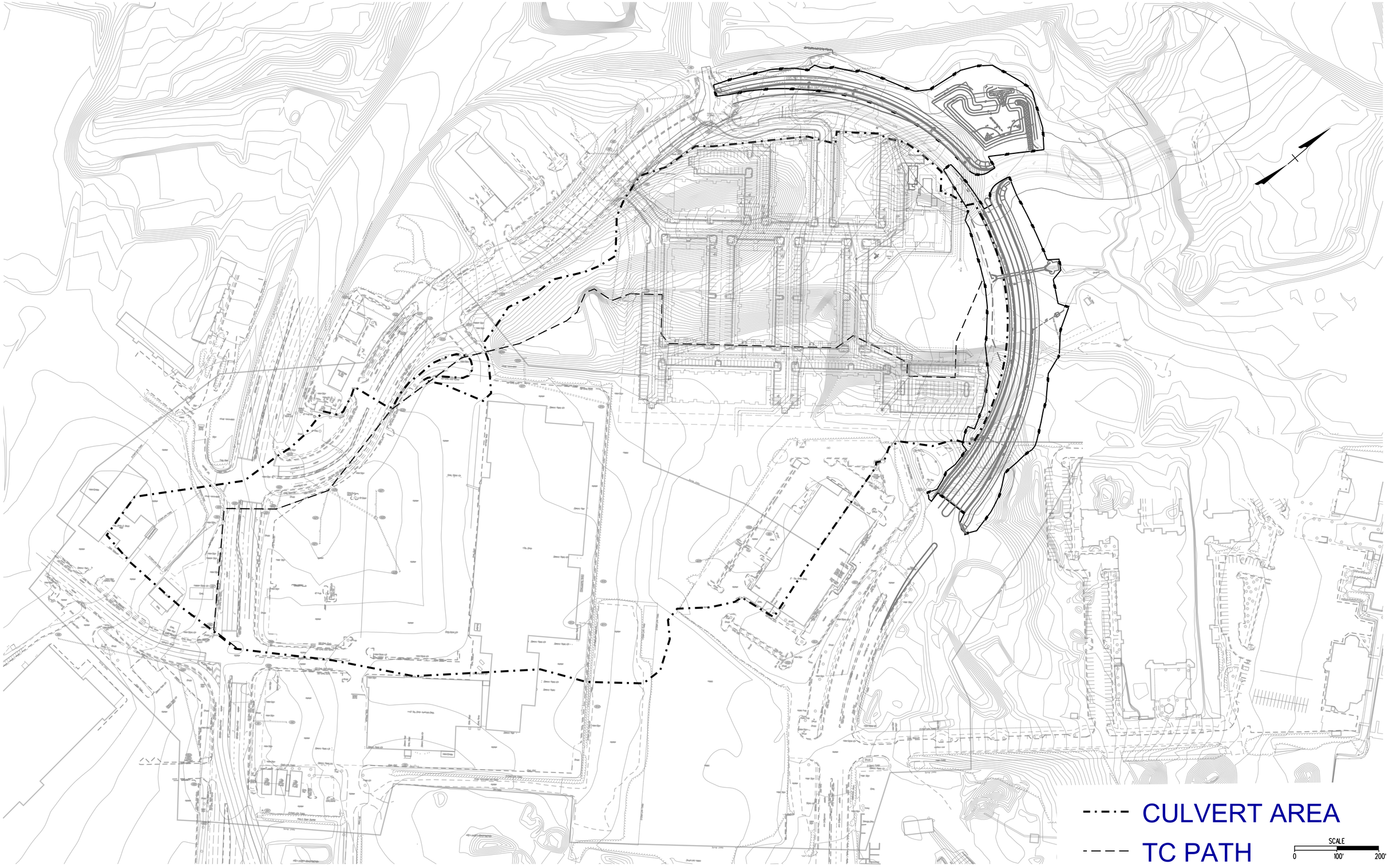
SCOUR HOLE SIZE

			Depth:	1.24	Ft.
D_{16} Stone Size	0.01	Ft.	Width:	4.31	Ft.
D_{84} Stone Size	0.10	Ft.	Length:	9.38	Ft.
Plasticity Index	5.00		Location of Max. Scour:	3.75	Ft.

VDOT METHOD

Outlet Protection Type	Class II	Length of Apron:	30.00	Ft.
(See VDOT Design Standards for Details)		Width of Apron:	30.00	Ft.
		Thickness of Apron:	3.00	Ft.

CULVERT 5-11 MAP



SECTION 8

OUTFALL ANALYSIS

Outfall 1

Outfall 1 is an existing outfall downstream of the existing pond. The outfall consists of a natural stormwater conveyance system. In existing conditions, flow is conveyed through the existing storm sewer system to the pond. Discharge from the pond is conveyed through a short manmade channel to the bed and banks of an Unnamed Tributary to the Occoquan River. The project area prior to development is 2.10 acres.

Development of this area will result in an increased impervious area to this outfall, due to the installation of a storm sewer system and roadway widening. The pond has been designed to accommodate the flow from this additional impervious area.

Drainage Area:

The drainage areas and resulting changes are summarized in the table below:

Outfall 1			
Drainage Area	Total Area	Onsite area	% of Total Watershed
Existing	576 ac	2.10 ac	0.036%
Proposed		3.10 ac	0.054%

Limits of Study:

The location of the outfall is shown in the included outfall drainage map. The point of analysis is at the location where the discharge from the pond enters the Unnamed Tributary to the Occoquan River.

Easement Requirements:

No additional easements are required.

Runoff Reduction Practices

There are no runoff reduction practices located within this outfall.

Channel and Flood Protection:

The existing stormwater management facility was designed using the energy balance equation to demonstrate that the post development flow was adequately below the predevelopment flow. Upgrades to the facility will be proposed with the Annapolis Way Extension plan to provide additional storage volume. Computations can be found in the Annapolis Way PIP Plan Revision SPR2018-00412.

Under Section 11.4.2.1.4.a and 11.4.2.2.3.a of the VDOT drainage manual, channel and flood protection for an outfall must be analyzed to a point where the contributing site drainage area for the outfall is less than or equal to one percent of the total watershed area at that point. Outfall 1 is located where the contributing site area is 3.10 acres of the total watershed (576 acres) at the outfall limit, which represents 0.036% of the watershed. As this is less than one percent no further analysis is required.

ENERGY BALANCE EQUATION

Outfall 1

$$Q_{1post} \leq Q_{1pre}\left(\frac{Vol_{1pre}}{Vol_{1post}}\right)(IF)$$

Where:

A_{pre}	=	11.26 ac
CN_{pre}	=	74
i_{1pre}	=	2.50 in
Q_{1pre}	=	7.21 cfs
$Rv1_{pre}$	=	0.573 ac-ft
A_{post}	=	9.71 ac
CN_{post}	=	82
i_{1post}	=	2.50 in
Q_{1post}	=	4.07 cfs
$Rv1_{post}$	=	0.789 ac-ft
IF	=	0.8
4.07 ≤		4.20 cfs

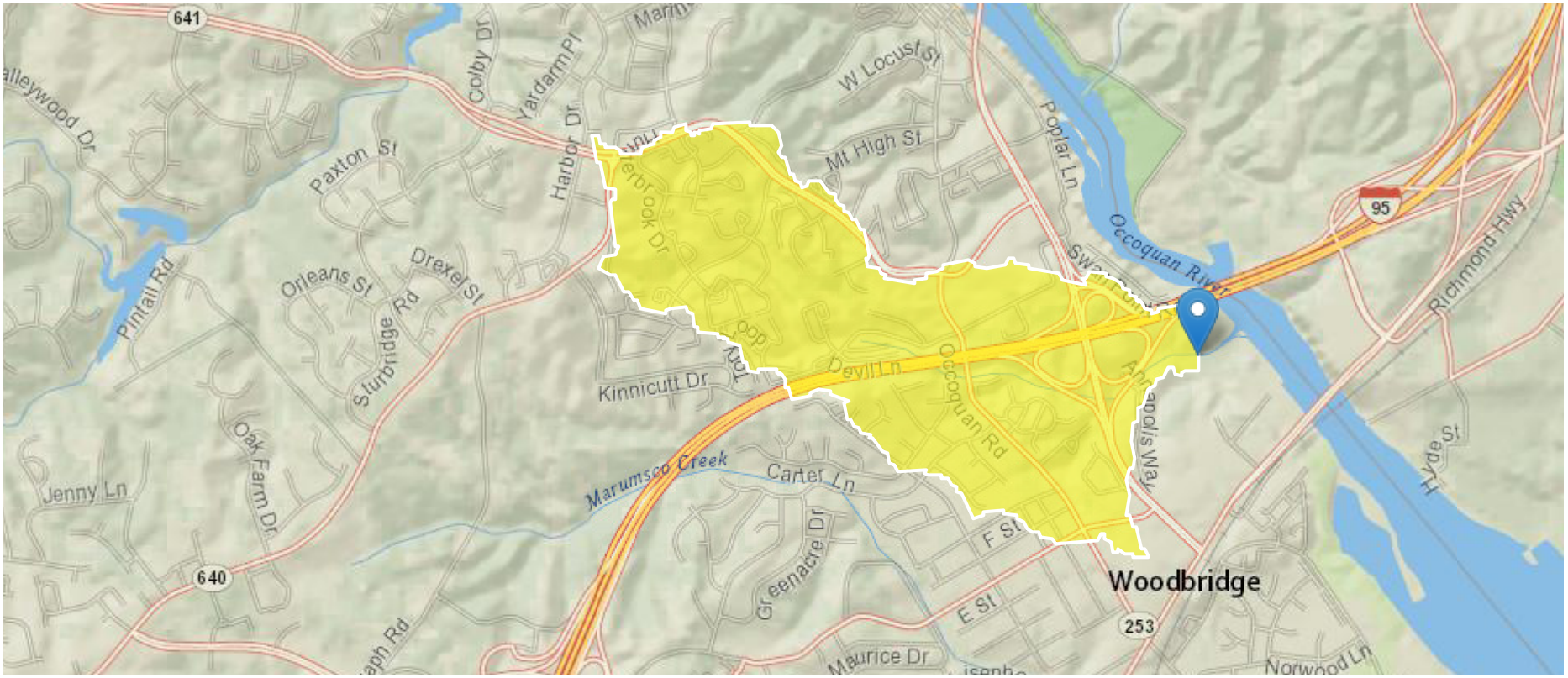
ENERGY BALANCE EQUATION IS SATISFIED

Final Opinion:

This outfall is a natural stormwater conveyance system. We have shown compliance with the channel and flood protection criteria, by analyzing the system to the 1% point. As the contributing site area is less than 1% of the total watershed area, it is our opinion that this outfall is adequate.

StreamStats Report

Region ID: VA
Workspace ID: VA20220302024345528000
Clicked Point (Latitude, Longitude): 38.66956, -77.24715
Time: 2022-03-01 21:44:06 -0500



Basin Characteristics

Parameter Code	Parameter Description	Value	Unit

Parameter Code	Parameter Description	Value	Unit
DRNAREA	Area that drains to a point on a stream	0.9	square miles

Peak-Flow Statistics Parameters [Coastal Plain 2011 5144]

Parameter Code	Parameter Name	Value	Units	Min Limit	Max Limit
DRNAREA	Drainage Area	0.9	square miles	0.06	7866

Peak-Flow Statistics Flow Report [Coastal Plain 2011 5144]

PII: Prediction Interval-Lower, PIu: Prediction Interval-Upper, ASEp: Average Standard Error of Prediction, SE: Standard Error (other -- see report)

Statistic	Value	Unit	ASEp
20-percent AEP flood	77.4	ft^3/s	44
10-percent AEP flood	120	ft^3/s	47
4-percent AEP flood	194	ft^3/s	51
2-percent AEP flood	269	ft^3/s	55
1-percent AEP flood	358	ft^3/s	58
0.5-percent AEP flood	470	ft^3/s	64

Peak-Flow Statistics Citations

Austin, S.H., Krstolic, J.L., and Wiegand, Ute,2011, Peak-flow characteristics of Virginia streams: U.S. Geological Survey Scientific Investigations Report 2011–5144, 106 p. + 3 tables and 2 appendixes on CD. (http://pubs.usgs.gov/sir/2011/5144/)

Application Version: 4.7.0
StreamStats Services Version: 1.2.22
NSS Services Version: 2.1.2

Outfall 2

Outfall 2 is located to the north of Annapolis Way (Station 34+00 Left). This outfall is a natural conveyance system. In existing Conditions, flow is conveyed by overland flow and storm sewer to the unnamed tributary to Occoquan River. The project area prior to development is 1.32 acres.

Development of this area will result in a reduction in area to this outfall, due to installation of storm sewer, as well as the Annapolis Way roadway extension. The resulting area to the outfall will be 45.88 acres.

Drainage Area:

The drainage areas and resulting changes are summarized in the table below:

Outfall 2			
Drainage Area	Total Area	Onsite Area	% of Total Watershed
Existing	46.59 ac.	1.32	2.83%
Proposed	45.88 ac.	0.38	0.83%

Limits of Study:

The location of the outfall is shown in the included outfall drainage map. The point of analysis is the main channel of a mapped floodplain.

Easement Requirements:

No additional easements are required.

Outfall Discharge:

All discharges will be calculated using the Rational Method

Runoff Reduction Practices

There are no runoff reduction practices located within this outfall. The outfall is to the main channel of a mapped floodplain

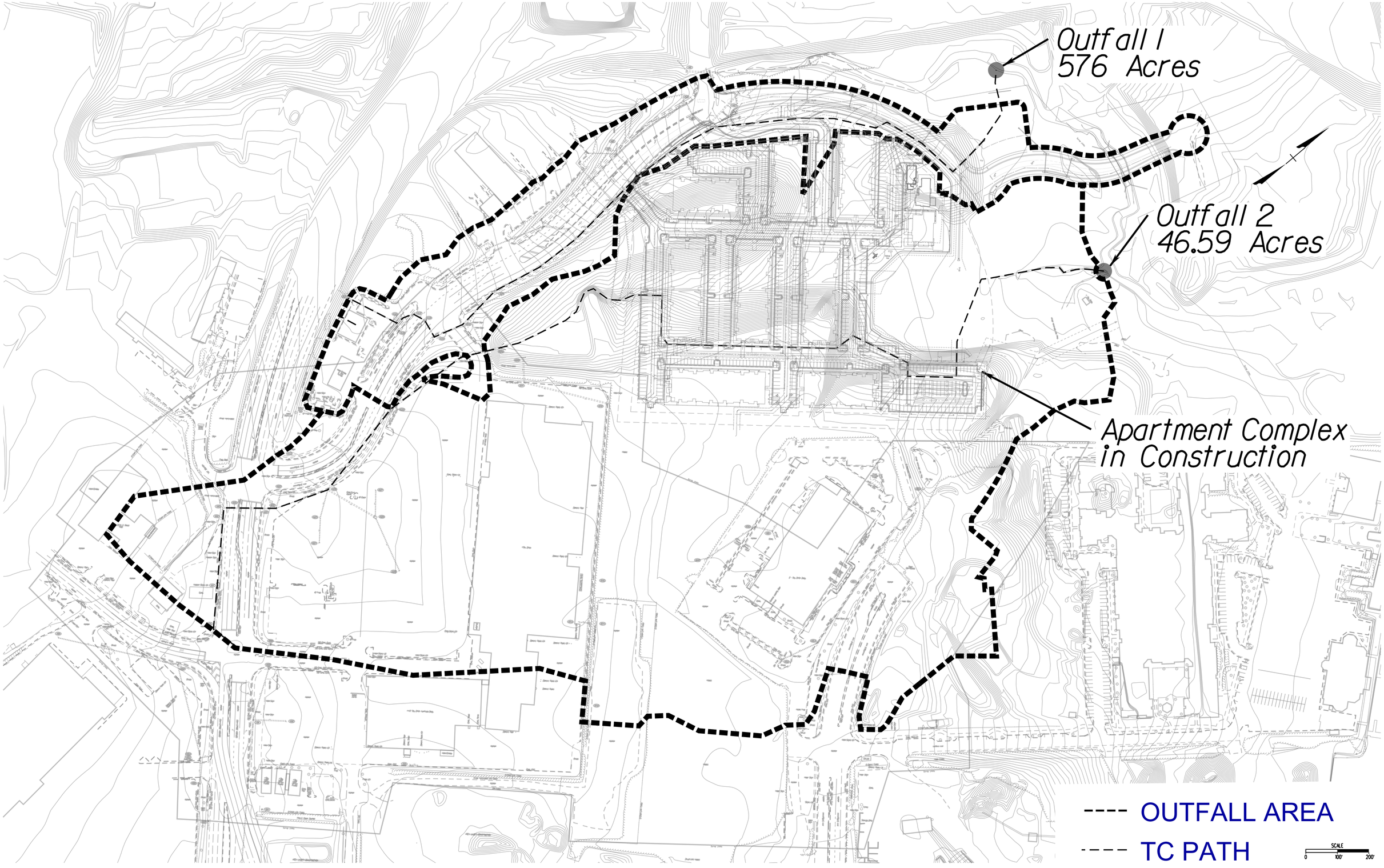
Channel and Flood Protection:

Under Section 11.4.2.1.4.a and 11.4.2.2.3.a of the VDOT drainage manual, channel and flood protection for an outfall must be analyzed to a point where the contributing site drainage area for the outfall is less than or equal to one percent of the total watershed area at that point. Outfall 2 is located where the proposed contributing site area is 0.38 acres of the total watershed (45.88 acres) at the outfall limit, which represents 0.83% of the watershed. As this is less than one percent no further analysis is required.

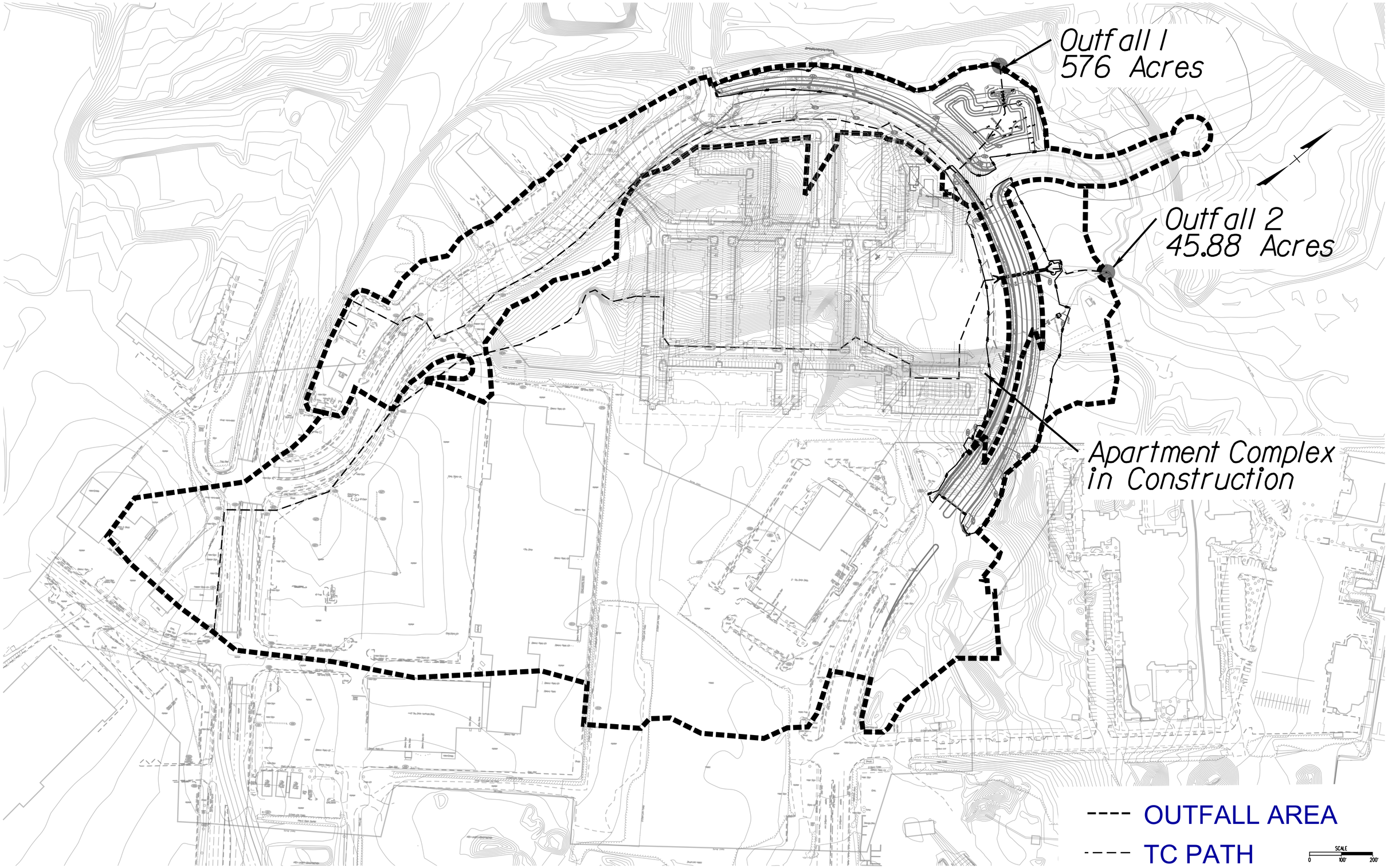
Final Opinion:

This outfall is a natural stormwater conveyance system. We have shown compliance with the channel and flood protection criteria, by analyzing the system to the 1% point. As the contributing site area is less than 1% of the total watershed area, it is our opinion that this outfall is adequate

EXISTING OUTFALL MAP



PROPOSED OUTFALL MAP



SECTION 9

EROSION AND SEDIMENT CONTROL CALCULATIONS

PROJECT	**Annapolis Way**			**CULVERT DESIGN FORM LD-269**	
ROAD	**Annapolis Way**	**COUNTY**	Prince William	SHEET	OF
CULVERT	T-5-1		VA	UNITS	**ENGLISH**
NOAA Station	33+95.88 Quantico 1 S	0		DESIGNER: IDL	DATE: 4/29/2022
				REVIEWER: NVD	DATE: 4/29/2022

HYDROLOGICAL DATA

Method: RATIONAL

Drainage Area: 35.62 Acres

Time of Concentration 20 Minutes

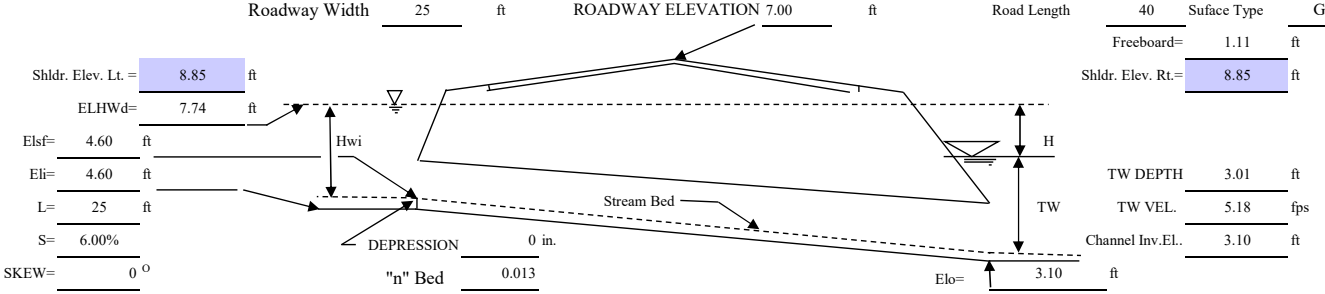
DESIGN FLOWS

R.I. (years)	FLOW (cfs)	
10	Design	93.77
2	Check	68.76
100	Max.	156.28

CULVERT DESCRIPTION:

TYPE: Single/Multiple Conforming

Roadway Width 25 ft ROADWAY ELEVATION 7.00 ft Road Length 40 Suface Type GRAVEL



Inlet Edge Description:

Square edge w/headwall

Single / Multiple Conforming / Broken Back Culverts

HEADWATER CALCULATIONS

MATERIAL	SHAPE	Size (in)	N	Mannings n	TOTAL FLOW Q cfs	FLOW PER BARREL Q/N cfs	INLET CONTROL HWi/D	HWi ft	FALL ft	ELHWi ft	OUTLET CONTROL TW ft	dc ft	(dc+D)/2 ft	ho ft	ke	H ft	ELHWo ft	CONTROL HEADWATER ELEV ft	OUTLET VEL fps	MINIMUM SHOULDER ELEV. ft	COMMENTS
Concrete	Circular	30	1	0.01	93.77	93.8	1.26	3.14	0.00	7.74	3.01	2.48	2.49	3.01	0.50	2.40	8.51	7.74	6.20		
					68.76	68.8	1.18	2.95	0.00	7.55	2.68	2.44	2.47	2.68	0.50	2.40	8.18	7.55	5.80		
					156.28	156.3	1.42	3.54	0.00	8.14	3.65	2.50	2.50	3.65	0.50	2.40	9.15	8.14	6.97		

Broken Back Culvert

LENGTH	Elev.	SKEW O

TAILWATER DATA:

Channel Shape	Triangular	
Bottom Width, ft	0.00	"n" = 0.035
Side Slope Lt: (H:1V)	2.00	
Side Slope Rt: (H:1V)	2.00	
Channel Slope, ft/ft	0.0100	

Distance											
Elevation											
"n" =											

TAILWATER RESULTS:

	Discharge cfs	Elevation ft	Flow depth ft	Velocity fps	Shear force PSF
Design	6.11	3.01	5.18	1.88	
Check	5.78	2.68	4.79	1.67	
Max.	6.75	3.65	5.88	2.28	

ROADWAY DATA:

Roadway Width, ft	25
Surface Type	GRAVEL
Top of Road Elevation, ft	7
Length of Road, ft	40

ROADWAY OVERTOPPING:

	Discharge cfs	Overtopping Discharge cfs	Overtopping Elevation ft
Design	63		7.74
Check	40		7.55
Max.	122		8.14

TECHNICAL FOOTNOTES:

(1) USE Q/NB FOR BOX CULVERTS

(2) HWi/D = HW/D OR HWi/D FROM DESIGN CHARTS

(3) FALL = HWI - (ELHWd - ELsf); FALL IS ZERO FOR CULVERTS ON GRADE

(4) ELhi = HWi + ELi (INVERT OF INLET CONTROL SECTION)

(5) TW BASED ON DOWNSTREAM CONTROL OR FLOW DEPTH IN CHANNEL

(6) ho = TW or (dc + D/2) (WHICHEVER IS GREATER)

(7) $H = [1 + ke + (29n^2L)/R^{1.33}]v^2/2g$

SUBSCRIPT DEFINITIONS:

HWd	DESIGN HEADWATER	i	INLET
HWi	HW IN INLET CONTROL	o	OUTLET
HWo	HW IN OUTLET CONTROL	sf	Streambed @ culvert face

COMMENTS / DISCUSSION:

Temporary Stream Crossing Standards Apply

CULVERT BARREL SELECTED

SIZE: n:

SHAPE: MATERIAL:

ENTRANCE: