STREAM RESTORATION DESIGN REPORT

for

WEST WINDS STREAM RESTORATION

NEW MARKET
FREDERICK COUNTY, MARYLAND

TCH
Job #: 2024-0317
Date: SEPTEMBER 2025
Rev: NOVEMBER 2025

Prepared by:

FREDERICK, SEIBERT & ASSOCIATES, INC.
Civil Engineering
Land Surveying
Landscape Architecture

11/11/2025

Professional Certification
I hereby certify that this document was prepared or approved by me, and that I am a duly licensed professional engineer under the laws of the State of Maryland, License No. 20945. Expiration Date: 2027-08-23.

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Narrative:

Existing Conditions:

West Winds Stream Restoration is located within the West Winds subdivision of the Lake Linganore Association of Frederick County, MD. The project reach is located at the pond east of Country Club Road, south of Pond Fountain Court. The project lies within parcel 29 of grid 22 on tax map 69 in the Land Records of Frederick County. This parcel encompasses 75.51 acres of land that has previously been used as a golf course up until approximately 2018. The existing pond has inputs from an unnamed stream, groundwater springs, and general runoff from uphill drainage patterns. The pond outlet structure collapsed in 2023, causing the pond to fully drain. As a result of this collapse, the downstream outlet failed and created a sinkhole capturing all water from the pond until it overflows into an unnamed tributary of Ben's Branch. The sinkhole remains inundated, and its depth is currently unknown. Downstream of the sinkhole, the unnamed tributary flows through a 6'x8' box culvert running under Country Club Road. The reach between the sinkhole and the road culvert details an overwide stream with severely eroded banks. Within the pond embankment, wetlands have formed as a result of the continuous flow from the unnamed stream and groundwater springs. A wetland delineation was conducted for the site and noted strong hydrophytic vegetation, presence of wetland hydrology, as well as hydric soils within the existing pond bottom. Due to the existing stream being piped, MDE has determined the project to be exempt from Section 6.A.1 in the newest Stream Restoration Authorization Checklist. To fulfill Section 6.A.2 of this checklist, a HEC-RAS model was created to model existing and proposed conditions. Please see the associated H&H Report for details on this model. See Appendix A for site photos documenting the project's existing conditions.

The existing watershed for this project has a study point at the upstream end of the road culvert under County Club Road. The full watershed is broken into three different sections combining for a total of 62.71 Ac. Watershed 'A' encompasses 30.05 Ac and represents the drainage that bypasses the existing pond via drainage patterns north of the pond. Watershed 'B' includes 25.09 Ac of land that drains directly into the existing pond. Watershed 'C' describes all stormwater south of the existing pond, contributing to 7.57 Ac of flow from roadside storm drains.

Geology/Soils:

This project lies within the Piedmont physiographic province of Maryland. The Piedmont Plateau Province is composed of hard, crystalline igneous and metamorphic rocks. The province extends from the inner edge of the Coastal Plain westward to the Catoctin Mountains - the eastern boundary of the Blue Ridge Province. The Piedmont Province is an area of rolling uplands with elevations ranging from 100 to 500 feet above sea level. Soils of the Piedmont were derived from granite rock and consist of loams and clays with rock fragments and gravel. The soil in the watershed consists of 38.8% MeC (Mt. Airy channery loam, 8-15% slopes, HSG C), 31.0% GmB (Glenelg – Mt. Airy channery loams, 3-8% slopes, HSG B), 19.5% GvA (Glenville – Codorus complex, 0-3% slopes, HSG C), 6.0% BkD (Brinklow – Blocktown channery loams, 15-25% slopes, HSG C), 4.6% MeB (Mt. Airy channery loam, 3-8 % slopes, HSG C), and 0.1% MeD Mt. Airy channery loam, 15-25% slopes, HSG C). See Appendix C for the USDA Soil Map and more information on the soils within this watershed.

Proposed Design:

Through field surveys and aerial surveys supplemented with LIDAR data, the necessary data has been gathered to design a stable channel aimed at restoring the upstream unnamed stream to the downstream unnamed tributary to Ben's Branch. Connecting these streams will require a section of the

existing pond berm to be removed. This restoration will incorporate a combination of riffles, runs, pools, and glides based on calculations from both the field survey stream geometry and the USFWS Piedmont Regional Curve. Along the upstream end of some riffles, rock clusters have been designed to maintain streambed grades and prevent excessive scouring within the channel. In addition to this, the proposed design includes the relocation of a section of the existing golf cart/walking path with the implementation of a 18LF 57”x38” CMPA providing a stable stream crossing. On the downstream end of the restoration reach, step pool conveyances have been designed to allow for stable grade changes in order to tie into the unnamed tributary. This step pool design follows Anne Arundel County’s Design Guidelines for Step Pool Stormwater Conveyance Systems. This project’s proposed design will have approximately 12,182 sq ft of wetland impacts. These impacts will be restored with a 1:1 square footage ratio of construction impacts to wetland seeding mix within the existing pond embankment. Existing wetland soils will be stripped and salvaged for proper wetland plant seed germination.

Channel Geometry:

To ensure proper channel geometrics, various surveys were conducted. The upstream unnamed stream was field surveyed with thalweg data and multiple cross sections data being collected to accurately model the inputs to the restoration reach. Downstream, a combination of field survey data and pebble count data was collected to provide a precise description of what the restoration reach is flowing into. Both the upstream and downstream reach flow calculations included data from the watershed delineations mentioned above. Having both the upstream and downstream reaches defined, regional curves within Maryland’s Piedmont physiographic province were compared to provide stream design goals for the project. With geometric goals understood, a multi-stage channel design approach was used to effectively meet the design goals and ensure a stable stream channel fit for this project. The final channel design includes a bankfull width of 8 feet, bankfull depth of 0.67 feet, and a bankfull channel area of 4.46 square feet. To see more information on the selected regional curve and multi-stage channel design, see Appendix B.

With this design, there will be a more natural pathway for all ecological life interacting with the stream. Daylighting the water from the existing outfall pipe will allow for ecological uplift at a rate far above the existing conditions.

Riparian Areas:

Based on the findings from the approved Forest Stand Delineation (FSD) conducted for the project, no specimen trees were located within 25ft of the proposed limit of disturbance. Knowing this, the stream restoration was designed to avoid as much forest clearing area as possible. The site entrance road was designed such that no tree removal will be necessary. This road is only wide enough to fit construction equipment and necessary erosion and sediment controls. Due to grading for the step pools and sections of the floodplain, there will be approximately 0.11 Ac of tree clearing. As mentioned above, none of this clearing will impact any specimen trees. This tree clearing area will be mitigated through live stake plantings along the stream banks of the entire restoration reach. Long term, the property owner plans to convert the entire parcel to forested area, thus increasing the naturality of the stream and the ecosystem surrounding it.

Since the entire existing pond area is a wetland, the design could not avoid wetland impacts. As guided by MDE, this project will restore all wetland impacts with a 1:1 ratio. In other words, for every 1 sq ft of wetlands impacted by the stream restoration, there will be 1 sq ft of wetland mitigation in the form of wetland plant seeding within the existing pond berm.

Functional Uplift, Resource Improvement, and Co-Benefits:

Daylighting a piped stream comes with a variety of resource improvements. Reconnecting the stream and its floodplain provides a much more natural habitat for all aquatic life with the implementation of boulder clusters in the stream bed. The implementation of live stakes along the stream will create a more stable stream while also remediating the 0.11 Ac of tree clearing associated with construction. With natural flow of water restored, there will be a general water quality increase as the water will no longer sit within the pond berm and erode the pond outlet structure ultimately collecting sediments and other unnatural particles before releasing them downstream. During construction, clean water diversions and dewatering practices through filter bags have been designed such that construction will not temporarily degrade water quality. The proposed wetland seeding will invite native wetland plant species that are not currently in the wetland; however, this will help diversify the vegetation and assist in the overall ecological uplift of the project. Apart from the previously mentioned co-benefits of the project, this project will also increase recreational opportunities and public access to Maryland's waterways and natural habitats. The project lies within a previously used golf course with paved cart paths. These cart paths are actively used as walking paths by the local residents. With the reconnection of the stream and relocation of the walking path, the public is able to directly witness and enjoy the natural aspects of Maryland's waterways. Over time, as the live stakes grow, the walking path will provide exceptional exposure to natural habitats outside of the stream itself.

Summary:

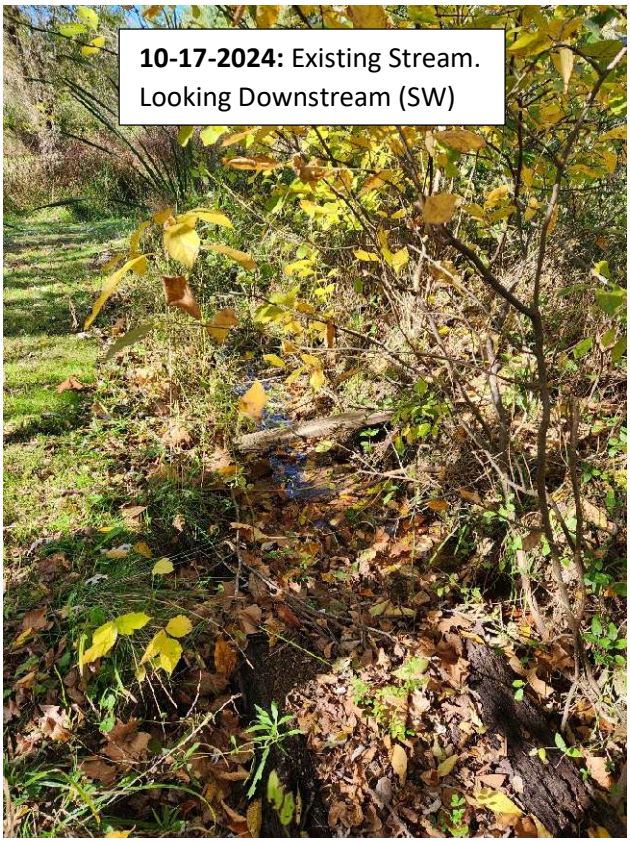
This project is based in the West Winds subdivision of the Lake Linganore Association within Frederick County, MD. Existing conditions describe an unnamed stream flowing into a drained pond with a collapsed outlet structure. This water flows through the outlet pipe into a sinkhole where it spills into an unnamed tributary to Ben's Branch. The project proposes to connect these streams by removing a section of pond berm, creating a stream channel through the existing natural valley, and matching downstream grades with a series of converging step pools. This stream was designed using multiple forms of data collection, such as field and aerial surveys in conjunction with regional curves and a multi-stage channel design to ensure stability. All wetland impacts for the project will be mitigated with a 1:1 square footage ratio via wetland seeding mix. Any tree clearing areas will be mitigated through both planted live stakes along the stream banks, and future forestation planting by the property owner. There are no negative hydrologic or hydraulic impacts identified on any adjacent properties. See the associated H&H Report and Alternative Analysis for additional discussions on all aspects of the project.

Appendix A – Existing Conditions Site Photos

West Winds Stream Restoration

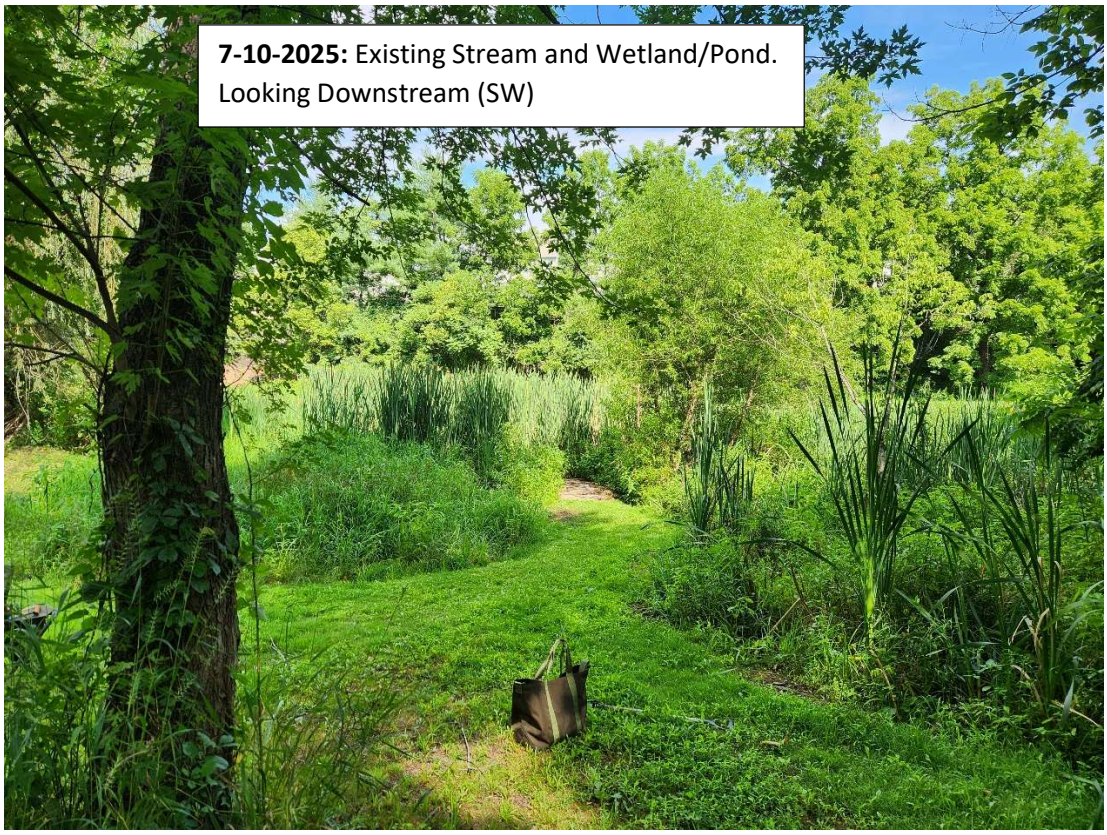
Existing Conditions Site Photos

10-17-2024: Existing Stream. Looking Downstream (SW)



10-17-2024: Existing Stream. Looking Downstream (SW)

10-30-2024: Existing Outlet Structure.



7-10-2025: Existing Stream and Wetland/Pond. Looking Downstream (SW)

7-10-2025: Existing Wetland/Pond. Looking Upstream (NE)

7-10-2025: Existing Wetland/Pond. Looking Downstream (S)

7-10-2025: Existing Sinkhole. Looking Upstream (S)

10-17-2024: Existing Downstream Stream. Looking Downstream (SW)

Appendix B – Stream Channel Design Calculations

Project	2024-0317 West Winds Stream Restoration
Stream	UNT
Drainage Area (sqmi)	0.08 mi²

Regional Curve	Q_{bf}(cfs)	A_{bf}(sqft)	W_{bf}(ft)	D_{bf}(ft)	
USFWS Piedmont Curve	12.18	2.71	5.47	0.50	←
USGS VA Piedmont Curve	3.92	1.52	4.34	0.35	
USGS PA MD Piedmont Curve	6.21	1.57	4.11	0.38	
USGS PA MD Non-Carbonate Curve	4.74	1.58	4.66	0.38	
USGS PA MD Carbonate Curve	8.80	1.33	3.13	0.43	
USGS PA NY Non-Carbonate Curve	5.33	1.63	4.43	0.40	
USGS PA NY Carbonate Curve	0.27	0.17	1.09	0.17	
USFWS AP/VR Curve	3.10	1.95	4.52	0.43	
USGS MD VA WV AP/VR Curve	5.77	2.01	4.06	0.48	
USFWS Eastern Coastplain Curve	2.11	1.74	3.91	0.45	
USFWS Western Coastplain Curve	4.87	1.74	3.91	0.45	
USGS VA MD Coastplain Curve	6.13	2.35	4.07	0.58	
Coastalplain Urban Curve (Powell)	25.36	6.74	5.66	1.09	

Selected Regional Curve		←
Applicable Regional Curves		

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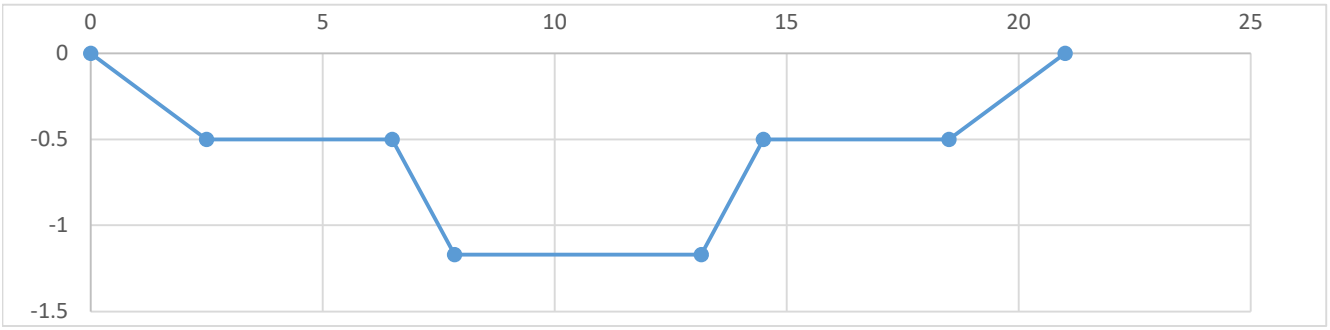
Date: 10/25/24
FSA Job: 2024 0317
Project: West Wind
Stream: UNT to Ben's Creek
Designer: KDM, TCH

Multi-Stage Channel Design

Stage1 - Bankfull						**Stream Type F, B or C**	
W=	5.32 ft	dmax/d	A1=	4.46 sf	2.5 sf	w/d=	14.3
dmax=	0.67 ft	1.2	Wp1=	8.32 ft		d=	0.56 ft
SS:1=	2.0 ft		Wbkf=	8.00 ft	5.0 ft		0.50 ft
			R1=	0.54 ft			
n=	0.040						
S=	0.0190 ft/ft		V1=	3.4 fps			
			Q1=	15.1 cfs	8.8 cfs Qbkf		
Stage 2 - Floodprone							
W2=	4.00 ft		A2=	5.3 sf			
D=	0.50 ft		Wp2=	13.10 ft		**Stream Type E or C**	
SS:1=	5.0 ft		Wfp=	21.00 ft		E/R=	2.6
n=	0.060		Q2=	9.7 cfs	1.9 fps		
Total							
			A=	13.71 sf			
Inputs			Wp=	21.42 ft			
Results			W=	21.00 ft			
Targets			R=	0.64 ft			
			V=	2.45 fps			
			Q=	33.6 cfs	Qfp		



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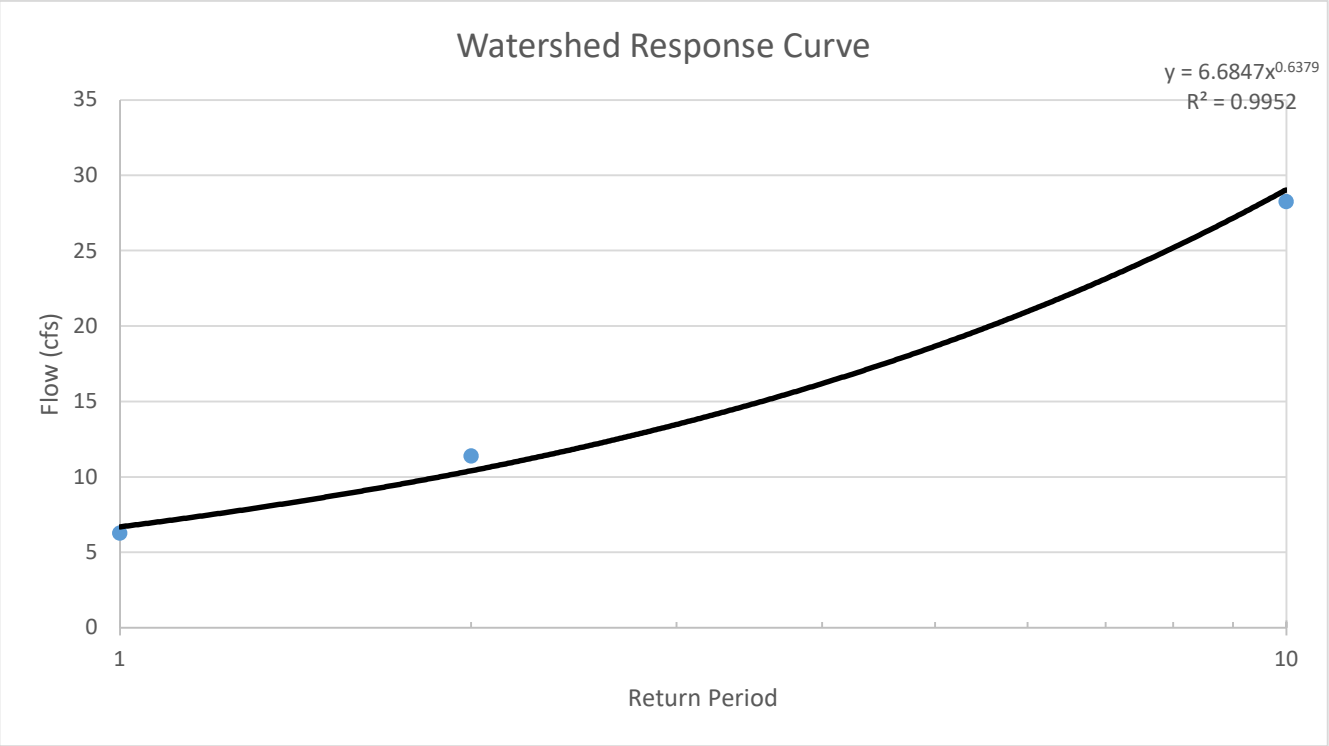
Date: 10/25/24
FSA Job: #VALUE!
Project: West Wind
Stream: UNT to Ben's Creek
Designer: KDM, TCH

Storm	RI (yr)	Q	Prob.
Qbkf			
Q1	1	6.27	100%
Q2	2	11.4	50%
Q5	5		20%
Q10	10	28.25	10%
Q25	25		4%
Q50	50		2%
Q100	100	181	1%
Q500	500		0.2%

Prediction EQ		
	Q	RI (yr)
	11.4	2.31
RI(yr)	Q	
	2	10.4

Trendline values

base	exp
6.6847	0.6379



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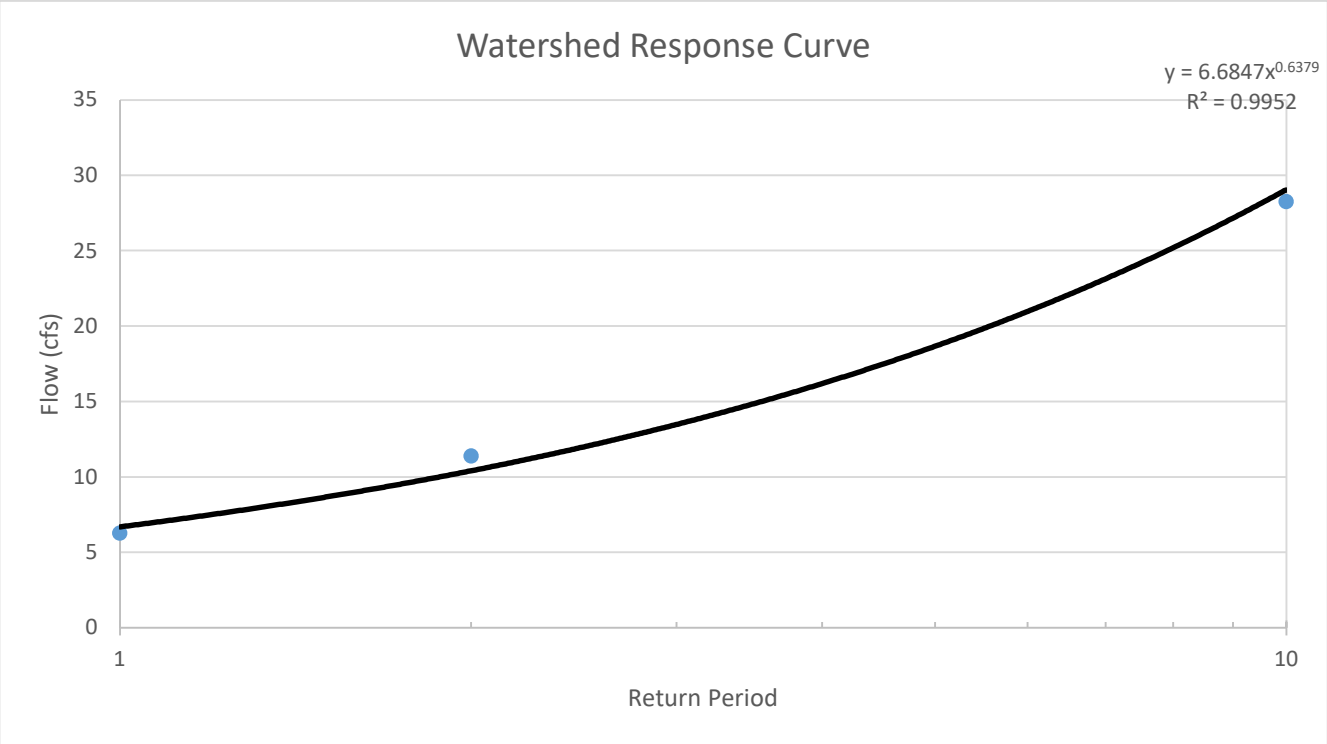
Qbkf			
Q1	1	6.27	100%
Q2	2	11.4	50%
Q5	5		20%
Q10	10	28.25	10%
Q25	25		4%
Q50	50		2%
Q100	100	181	1%
Q500	500		0.2%

Prediction EQ		
	Q	RI (yr)
	11.4	2.31
	RI(yr)	Q
	2	10.4

Trendline values

base	exp
6.6847	0.6379



Appendix C – USDA Soil Map and Descriptions

Soil Map—Frederick County, Maryland
(Unknown(Polygon))

Map Scale: 1:5,180 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 250 500 1000 1500

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 18N WGS84

MAP LEGEND

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

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

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

Water Features
- Streams and Canals

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

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:12,000.

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

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

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

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

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

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

Soil Survey Area: Frederick County, Maryland
Survey Area Data: Version 21, Sep 6, 2024

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

Date(s) aerial images were photographed: May 9, 2022—Aug 15, 2022

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
BkD	Brinklow-Blocktown channery loams, 15 to 25 percent slopes	3.7	6.0%
GmB	Glenelg-Mt. Airy channery loams, 3 to 8 percent slopes	19.5	31.0%
GvA	Glenville-Codorus complex, 0 to 3 percent slopes	12.2	19.5%
MeB	Mt. Airy channery loam, 3 to 8 percent slopes	2.9	4.6%
MeC	Mt. Airy channery loam, 8 to 15 percent slopes	24.3	38.8%
MeD	Mt. Airy channery loam, 15 to 25 percent slopes	0.1	0.1%
Totals for Area of Interest		**62.7**	**100.0%**

Frederick County, Maryland

MeC—Mt. Airy channery loam, 8 to 15 percent slopes

Map Unit Setting

National map unit symbol: kyr2
Elevation: 300 to 2,000 feet
Mean annual precipitation: 35 to 55 inches
Mean annual air temperature: 45 to 61 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Mt. airy and similar soils: 85 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Mt. Airy

Typical profile

H1 - 0 to 7 inches: channery loam
H2 - 7 to 22 inches: channery silt loam
H3 - 22 to 80 inches: bedrock

Properties and qualities

Slope: 8 to 15 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 1.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: C
Ecological site: F148XY021PA - Dry, Piedmont - felsic, Upland, Mixed Oak Heath / Oak-Pine Woodland
Hydric soil rating: No

Minor Components

Brinklow

Percent of map unit: 10 percent
Hydric soil rating: No

Glenelg

Percent of map unit: 5 percent

Hydric soil rating: No

Data Source Information

Soil Survey Area: Frederick County, Maryland
Survey Area Data: Version 21, Sep 6, 2024

Frederick County, Maryland

GmB—Glenelg-Mt. Airy channery loams, 3 to 8 percent slopes

Map Unit Setting

National map unit symbol: kypb
Elevation: 200 to 1,050 feet
Mean annual precipitation: 35 to 55 inches
Mean annual air temperature: 48 to 61 degrees F
Frost-free period: 110 to 240 days
Farmland classification: Farmland of statewide importance

Map Unit Composition

Glenelg, , and similar soils: 45 percent
Mt. airy and similar soils: 35 percent
Minor components: 20 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Glenelg,

Setting

Landform: Interfluves, hillslopes
Landform position (two-dimensional): Summit, shoulder, backslope
Landform position (three-dimensional): Side slope
Down-slope shape: Convex
Across-slope shape: Linear
Parent material: Loamy residuum weathered from phyllite

Typical profile

Ap - 0 to 10 inches: channery loam
Bt1,Bt2,BCt1 - 10 to 30 inches: clay loam
BCt2, CBt - 30 to 54 inches: loam
C - 54 to 76 inches: very channery sandy loam

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 1.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: High (about 10.7 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 2e
Hydrologic Soil Group: B

Ecological site: F148XY024PA - Moist, Piedmont - felsic, Upland, Mixed Oak - Hardwood - Conifer Forest
Hydric soil rating: No

Description of Mt. Airy

Typical profile

H1 - 0 to 7 inches: channery loam
H2 - 7 to 22 inches: very channery loam
H3 - 22 to 80 inches: bedrock

Properties and qualities

Slope: 3 to 8 percent
Depth to restrictive feature: 20 to 40 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 1.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 3s
Hydrologic Soil Group: C
Ecological site: F148XY021PA - Dry, Piedmont - felsic, Upland, Mixed Oak Heath / Oak-Pine Woodland
Hydric soil rating: No

Minor Components

Brinklow

Percent of map unit: 10 percent
Hydric soil rating: No

Glenville

Percent of map unit: 10 percent
Hydric soil rating: No

Data Source Information

Soil Survey Area: Frederick County, Maryland
Survey Area Data: Version 21, Sep 6, 2024