APPENDIX L: PRIVATE PHASE I MITIGATION DESIGN PLANS

RFP-1: INDIAN CREEK & TRIBUTARIES AT KONTERRA

Ecosystem Investment Partners

SUMMARY

Location Information

Project:	Indian Creek and Tributaries at Konterra Wetland and Stream Mitigation
County:	Prince George's
Federal HUC-8 Watershed:	Middle Potomac-Anacostia-Occoquan Watershed (02060010)
MDE 8-digit Watershed:	Anacostia River (02140205)
Coordinates:	39°5'5"N 76°54'37"W
Location:	Interstate 95 and Inter County Connector, Route 200 (ICC)
Property Ownership:	Konterra Associates, LLC

Site Conditions

Parcel Area:	1,419 acres
Stream Use Class:	I
Drainage Area:	1,155 acres
Existing Land Use:	Former sand and gravel mining
Adjacent Land Use:	Residential and Commercial

The Konterra site is a former sand and gravel mine located at the interchange of Interstate 95 and the Intercounty Connector (ICC). Most of the natural geomorphic conditions and materials have been altered or removed from the previous mining activities. The wetland mitigation will include extensive work to create and enhance an existing wetland network that has established within abandoned settling ponds. The stream restoration designs will establish a stable cross section, planform, and profile and re-establish a floodplain connection. Geomorphic structures will be utilized to provide grade control and energy dissipation. In addition, a robust native revegetation plan and incorporation of woody material will be developed and implemented to provide long-term vegetative stability and habitat enhancement for terrestrial and aquatic organisms.

Summary of Opportunities

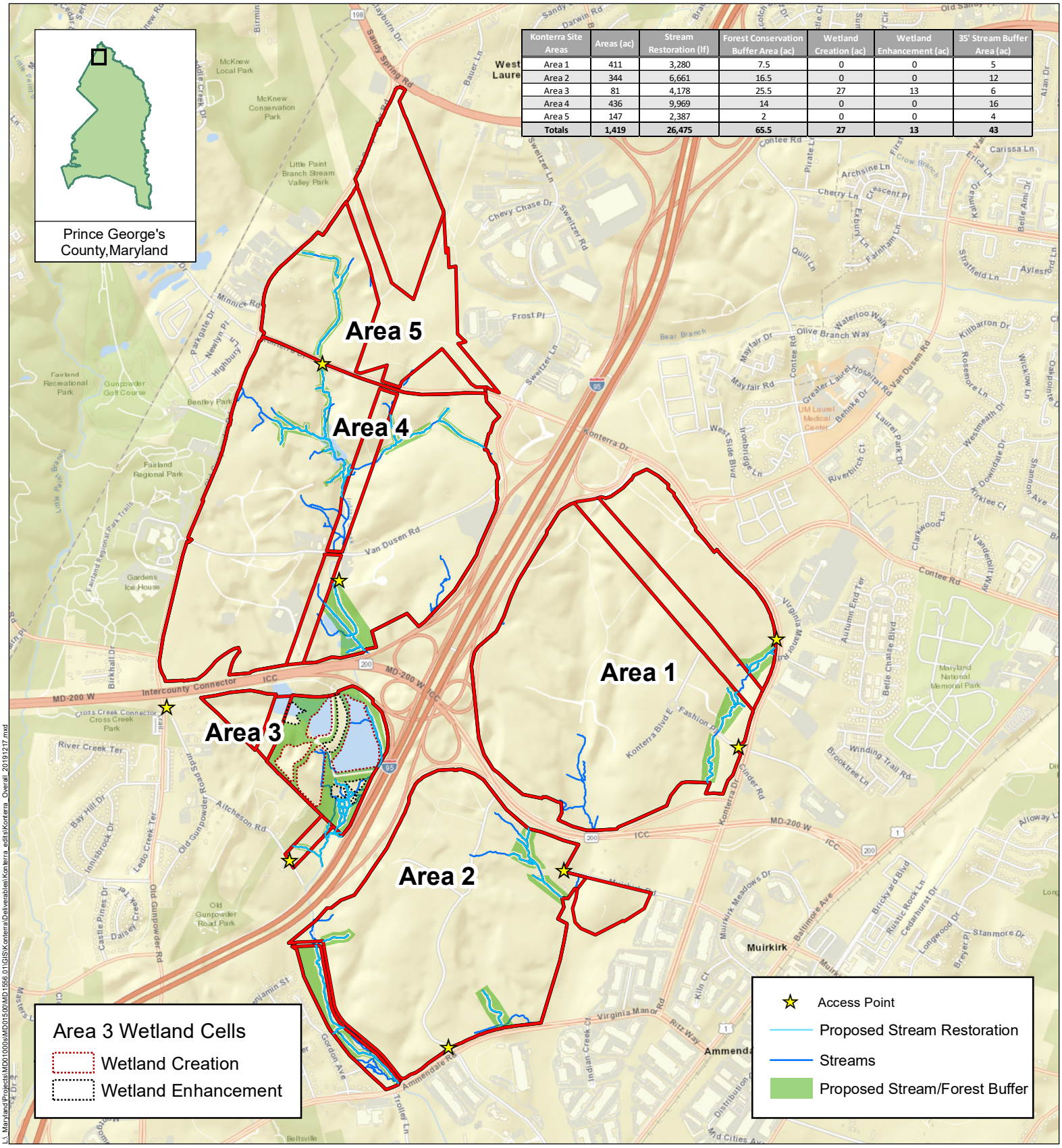
- Stream Restoration: 26,475 linear feet
- Wetland Restoration: 27 ac creation, 6.5 ac enhancement, and 10.5 ac buffer enhancement

Restoration Objectives

- Bed and bank stabilization
- Floodplain reconnection
- In-stream and riparian habitat improvements
- Invasive species control
- Improve hydrologic and ecologic function of wetlands

Restoration Concept

- Create and enhance wetlands with tiered wetland system connected by weirs and streams
- Improve floodplain reconnection raising the channel and creating floodplain benches
- Install instream structures to reduce erosion and create a stable cross section, pattern, and profile
- Establish a forested riparian buffer with invasive species control and seeding/planting native species



Konterra Site Areas	Areas (ac)	Stream Restoration (lf)	Forest Conservation Buffer Area (ac)	Wetland Creation (ac)	Wetland Enhancement (ac)	35' Stream Buffer Area (ac)
Area 1	411	3,280	7.5	0	0	5
Area 2	344	6,661	16.5	0	0	12
Area 3	81	4,178	25.5	27	13	6
Area 4	436	9,969	14	0	0	16
Area 5	147	2,387	2	0	0	4
Totals	**1,419**	**26,475**	**65.5**	**27**	**13**	**43**

Konterra Site: ± 1,419 acres

Project Overview Map
Indian Creek Tributaries at
Konterra Wetland and Stream Restoration

NORTH

0 2,000

Feet

Original Scale:
1 " = 2,000 '

Jurisdiction: Prince George's County, MD
MD Congressional District: 05, 04
*Area is based on GIS data, and does not reflect the legal acreage of the site.
Base Source: Prince George's County GIS, ESRI streetmap

Wetland Studies and Solutions, Inc.
a DAVEY company

Exhibit 3

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Project Overview Map
Indian Creek Tributaries at Konterra Wetland and Stream Restoration Area 1

NORTH

0 600

Feet

Original Scale: 1 " = 600 '

- Konterra Site: ± 411 acres
- Forest Conservation Buffer Area: ± 7.5 acres
- 35' Buffer Area: ± 5 acres
- Stream for Restoration: ± 3,280 linear feet
- Access Point

Wetland Studies and Solutions, Inc.
a DAVEY company

Data Source: Prince George's County Digital Data,
Photo Source: DoIT, MD iMAP, Spring 2017.

Exhibit 3a

L:_Maryland\Projects\MD01000s\MD01500\MD1556.01\GIS\Konterra\Deliverables\Access\03b_Konterra_Area2.mxd

Project Overview Map
Indian Creek Tributaries at Konterra Wetland and Stream Restoration Area 2

NORTH

0 600

Feet

Original Scale: 1 " = 600 '

- Konterra Site: ± 344 acres
- Forest Conservation Buffer Area: ± 16.5 acres
- 35' Buffer Area: ± 12 acres
- Stream for Restoration: ± 6,661 linear feet
- SHA Easement Area
- Access Point
- Access Routes

Wetland Studies and Solutions, Inc.
a DAVEY company

Data Source: Prince George's County Digital Data,
Photo Source: DoIT, MD iMAP, Spring 2017.

Exhibit 3b

Project Overview Map
Indian Creek Tributaries at Konterra Wetland and Stream Restoration Area 3

NORTH

0 350

Feet

Original Scale: 1 " = 350 '

- Konterra Site: ± 81 acres
- Forest Conservation Buffer Area: ± 25.5 acres (*see note)
- 35' Buffer Area: ± 6 acres
- Wetland Creation: ± 27 ac.
- Wetland Enhancement: ± 6.5 ac.
- Stream for Restoration: ± 4,178 lf
- Potential Future Stream Restorations: ± 1,313 lf
- Potential Future Stream Restoration Buffer: ± 3 acres
- Downstream Parcels
- Dam
- Dam Removal for Stream Restoration: ± 674 lf
- Access Point
- Access Routes

*Note: Approximately, 10.5 acres of the Forest Conservation Buffer Area within Area 3 will be used for Wetland Buffer Enhancement Credit.

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Wetland Studies and Solutions, Inc.
a DAVEY company

Data Source: Prince George's County Digital Data
Photo Source: DoIT, MD iMAP, Spring 2017.

Exhibit 3c

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Project Overview Map
Indian Creek Tributaries at Konterra Wetland and Stream Restoration Area 4

NORTH

0 600

Feet

Original Scale: 1 " = 600 '

- Konterra Site: ± 436 acres
- Forest Conservation Buffer Area: ± 14 acres
- 35' Buffer Area: ± 16 acres
- Stream for Restoration: ± 9,969 linear feet
- Access Point

Wetland Studies and Solutions, Inc.

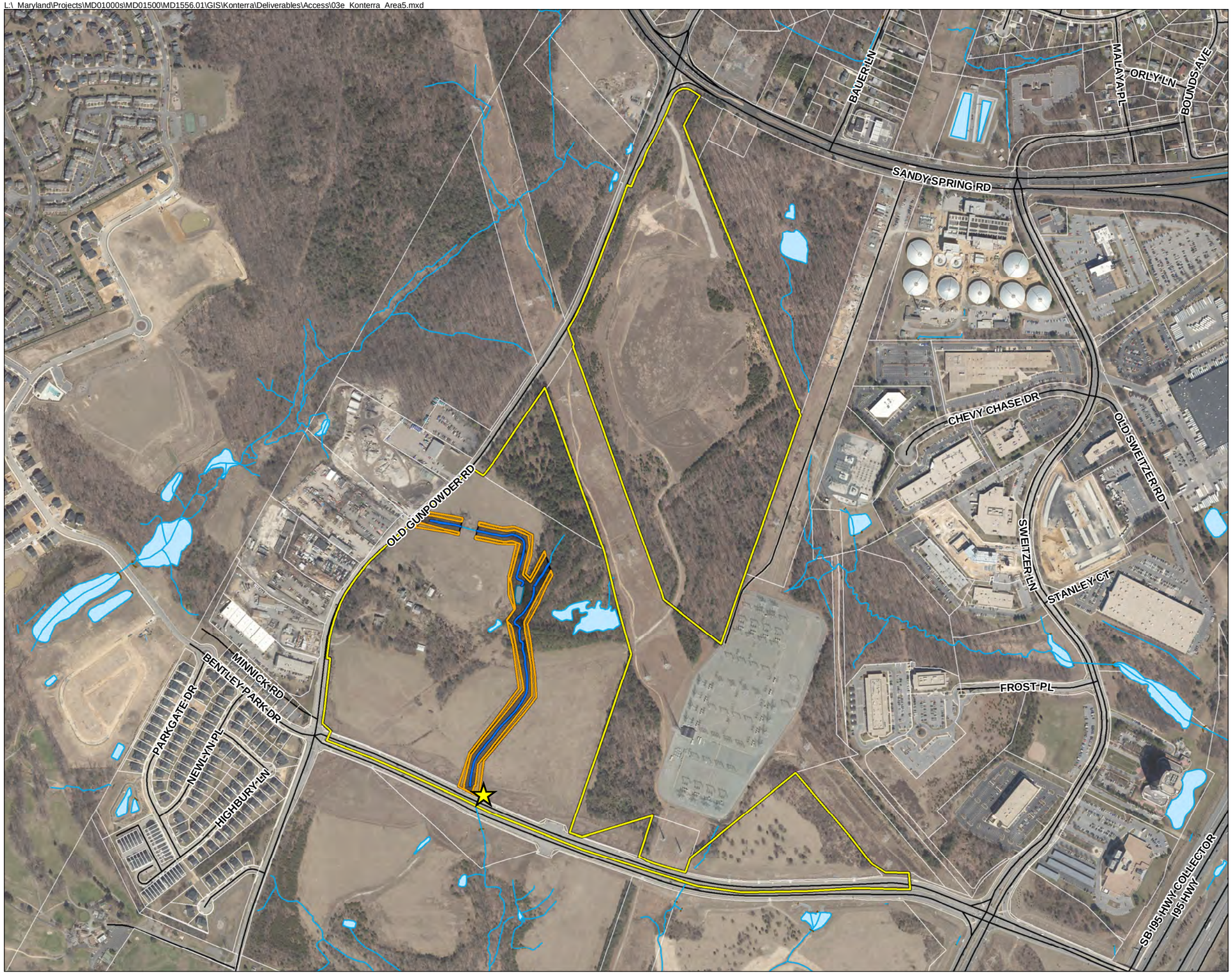
a DAVEY company

Data Source: Prince George's County Digital Data
Photo Source: DoIT, MD iMAP, Spring 2017.

Exhibit 3d

L:\ Maryland\Projects\MD01000s\MD01500\MD1556.01\GIS\Konterra\Deliverables\Access\03e_Konterra_Area5.mxd

Project Overview Map
Indian Creek Tributaries at Konterra Wetland and Stream Restoration Area 5



NORTH

0 600

Feet

Original Scale: 1 " = 600 '

- Konterra Site: ± 147 acres
- Forest Conservation Buffer Area: ± 2 acres
- 35' Buffer Area: ± 4 acres
- Stream for Restoration: ± 2,387 linear feet
- Access Point

Wetland Studies and Solutions, Inc.
a DAVEY company

Data Source: Prince George's County Digital Data
Photo Source: DoIT, MD iMAP, Spring 2017.

Exhibit 3e

RFP-2: CABIN BRANCH

I-495 & I-270 Managed Lanes Study
Cabin Branch Stream and Wetland Mitigation
RES (HGS, LLC)

Existing Conditions Summary

Location Information
County: Montgomery
Federal HUC-8 Watershed: Middle Potomac-Catoctin (02070008)
MDE 8-digit Watershed: Seneca Creek (02140208)
Coordinates: 39.1789, -77.2042
Location: 19550 Montgomery Village Avenue, Montgomery Village, MD 20886
Property Ownership: Private

Site Conditions
Project Area: 36.3 acres
Drainage Area: 4.4 sq miles
Existing Land Use: Open/Historic Golf Course
Constraints: None
Stream Use Class: I-P
Adjacent Land Use: Residential/Open

The Cabin Branch restoration project will restore approximately 6,700 linear feet of Cabin Branch and associated tributaries. In addition, the project will create approximately 4.6 acres of floodplain wetland and associated wetland/stream buffer enhancement. The site is located on a former golf course located off Montgomery Village Avenue. The adjacent land use is primarily open and presents optimal site access with minimal tree impacts required to complete the proposed restoration.

Impacts associated with the historic golf course has directly led to channel modifications and impairments. The presence of channelization, unnatural historic floodplain grading, stream incision, bank armoring, channel blockages, and resultant stream/floodplain perturbation is evident throughout the proposed project area. These impairments are illustrated by multiple non-functioning ecological categories that will be restored or enhanced by the proposed project. Overall the project goals are to establish a functioning stream/wetland/riparian interaction in an urban setting by remediation of adjacent land use impacts and establishment of functioning floodplain connectivity.

Summary of Opportunities

- Stream Restoration: Approximately 6,680 Linear Feet
- Wetland Restoration: Approximately 4.61 Acres
- Wetland Buffer Enhancement: Approximately 3.01 Acres
- Stream Riparian Buffer Enhancement: Approximately 36.3 Acres

Restoration Objectives

- Bed and Bank Stabilization
- Floodplain Reconnection
- In-Stream Habitat (Habitat Structures and Bed Form Diversity)
- Ecological Uplift (4 Functional Categories)
- Wetland Creation

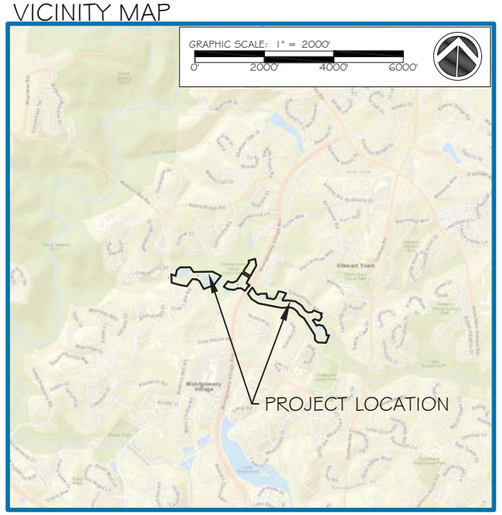
Restoration Concept

- Natural Channel Design and Wetland Restoration
- Combination of raising channel profile for restored floodplain connectivity and excavating banks to establish new floodplain function. Practical location of Priority II Restoration may include transitions to Priority I activities where Project constraints limit the application of Priority I.
- Enhance hydraulic functions (floodplain connectivity, hydraulic stability, and sediment transport) and improve geomorphic functions throughout the entire reach.
- Placement of various instream structures (i.e. Constructed Riffles, Toe Wood, J-Hooks, Log Vanes, Cross Vanes) to address bank erosion, provide vertical bed stabilization, increase bedform diversity and supplement corresponding hydraulic and habitat properties.
- Establishment of stable hydraulic geometry (dimension, pattern and profile) throughout the entire restoration reach.
- Wetland creation through conversion of existing amenity ponds to floodplain wetlands.

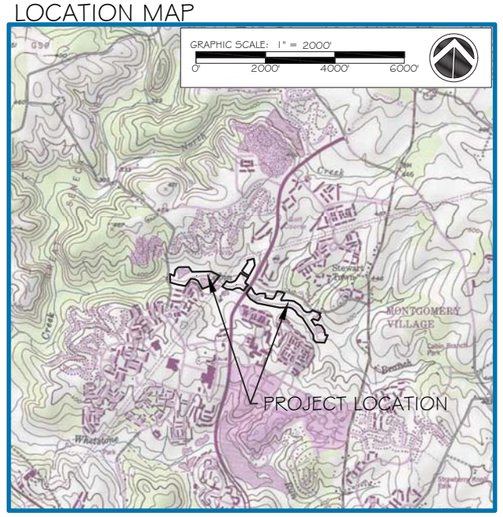
CABIN BRANCH PHASE I MITIGATION PLAN

MONTGOMERY COUNTY, MARYLAND

VICINITY MAP

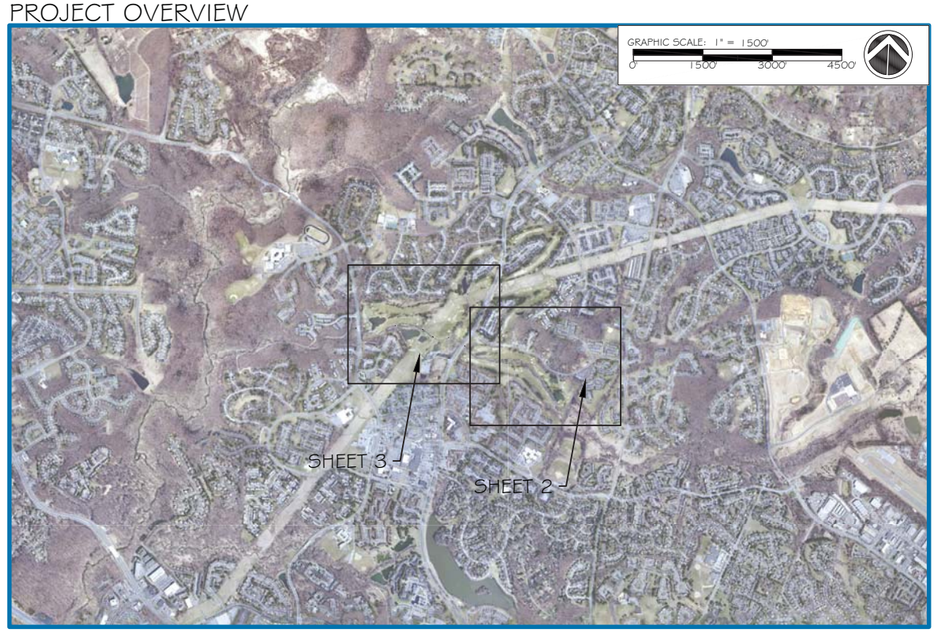


LOCATION MAP



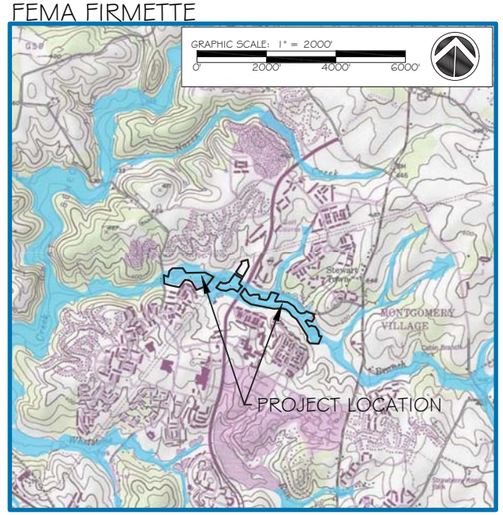
LATITUDE: N 39° 10' 43"
LONGITUDE: W 77° 12' 08"

PROJECT OVERVIEW



SHEET INDEX:

FEMA FIRMETTE



REFERENCE FEMA MAP: 24031C0187D

PROJECT STATUS	
DATE	DESCRIPTION
7/15/2019	CONCEPT PLAN

JOB NUMBER: 0456

CABIN BRANCH PHASE I MITIGATION PLAN

CABIN BRANCH PHASE I MITIGATION PLAN

PROJECT MANAGER: RC	JOB NUMBER: 0456
DESIGNED: KH	DESIGN TYPE: STREAM PLAN
DRAWN: KH	INITIAL PLAN DATE: 7/15/2019

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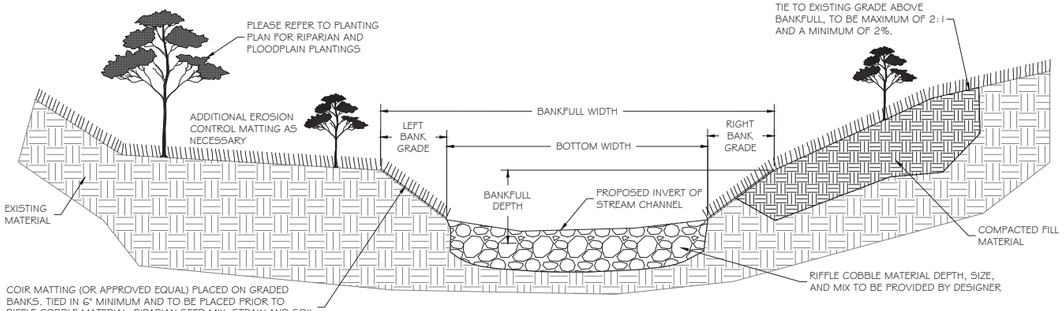

RIFFLE CROSS SECTION ORIENTATION LOOKING DOWNSTREAM
NOT TO SCALE

WATERSHED CHARACTERISTICS - CABIN BRANCH	
DRAINAGE AREA	4.36 SQ MI
IMPERVIOUS AREA	21.3%
URBAN AREA	78.3%
FOREST COVER	11.5%
BANKFULL DISCHARGE (CFS)	207.19
BANKFULL WIDTH	25 FT
BANKFULL DEPTH	2 FT
BANKFULL AREA	48 SQ FT
*APPROXIMATE BANKFULL CHARACTERISTICS ARRIVED FROM MARYLAND PIEDMONT REGIONAL CURVE	

WATERSHED CHARACTERISTICS - TRIB 1	
DRAINAGE AREA	0.14 SQ MI
IMPERVIOUS AREA	18.9%
URBAN AREA	79.2%
FOREST COVER	0.0%
BANKFULL DISCHARGE (CFS)	15.18
BANKFULL WIDTH	6.46 FT
BANKFULL DEPTH	0.69 FT
BANKFULL AREA	4.37 SQ FT
*APPROXIMATE BANKFULL CHARACTERISTICS ARRIVED FROM MARYLAND PIEDMONT REGIONAL CURVE	

WATERSHED CHARACTERISTICS - TRIB 2	
DRAINAGE AREA	0.16 SQ MI
IMPERVIOUS AREA	13.9%
URBAN AREA	95.0%
FOREST COVER	3.6%
BANKFULL DISCHARGE (CFS)	16.75
BANKFULL WIDTH	6.8 FT
BANKFULL DEPTH	0.72 FT
BANKFULL AREA	4.79 FT
*APPROXIMATE BANKFULL CHARACTERISTICS ARRIVED FROM MARYLAND PIEDMONT REGIONAL CURVE	

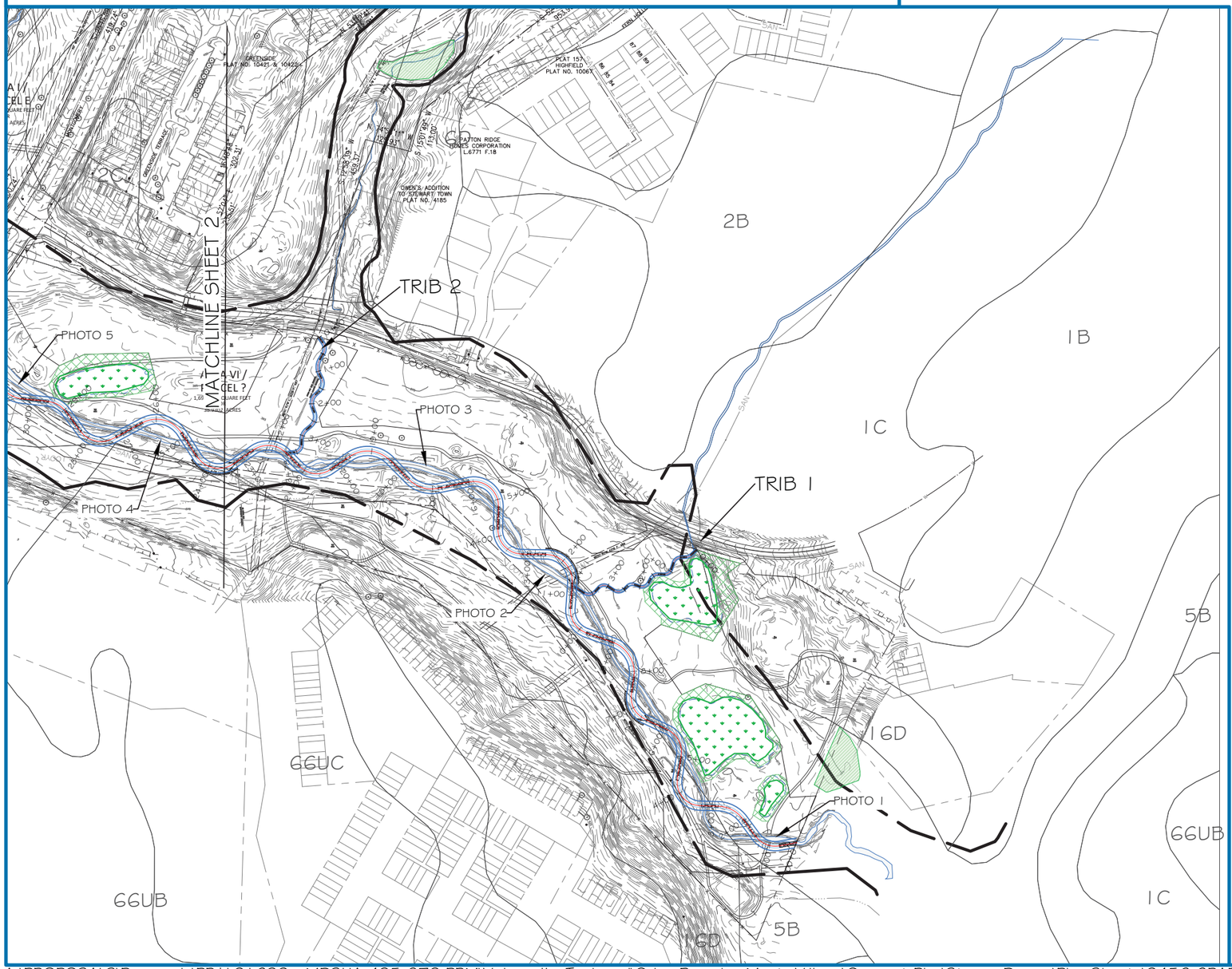


PHOTO LOCATION 1


PHOTO LOCATION 2


PHOTO LOCATION 3

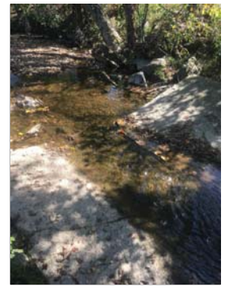
PHOTO LOCATION 4

SOILS LEGEND				
MAP UNIT SYMBOL	MAP UNIT NAME	RATING	ACRES IN AOI	PERCENT OF AOI
1B	Gaila silt loam, 3 to 8 percent slopes	B	25.9	2.00%
1C	Gaila silt loam, 8 to 15 percent slopes	B	118.2	9.00%
2B	Glenelg silt loam, 3 to 8 percent slopes	B	184.8	14.10%
2C	Glenelg silt loam, 8 to 15 percent slopes	B	3	0.20%
5B	Glenville silt loam, 3 to 8 percent slopes	C/D	2.1	0.20%
6A	Baile silt loam, 0 to 3 percent slopes	C/D	37.9	2.90%
16B	Brinklow-Blocktown channery silt loams, 3 to 8 percent slopes	C	10.8	0.80%
16C	Brinklow-Blocktown channery silt loams, 8 to 15 percent slopes	C	31.5	2.40%
16D	Brinklow-Blocktown channery silt loams, 15 to 25 percent slopes	C	93.8	7.10%
17B	Occoquan loam, 3 to 8 percent slopes	B	9.6	0.70%
17C	Occoquan loam, 8 to 15 percent slopes	B	22.3	1.70%
54A	Hatboro silt loam, 0 to 3 percent slopes, frequently flooded	B/D	122.2	9.30%
65B	Wheaton silt loam, 0 to 8 percent slopes	B	11.9	0.90%
66UB	Wheaton-Urban land complex, 0 to 8 percent slopes	B	253.2	19.30%
66UC	Wheaton-Urban land complex, 8 to 15 percent slopes	B	265.3	20.20%
67UB	Urban land-Wheaton complex, 0 to 8 percent slopes	D	19.4	1.50%
116D	Blocktown channery silt loam, 15 to 25 percent slopes, very rocky	D	63.3	4.80%
116E	Blocktown channery silt loam, 25 to 45 percent slopes, very rocky	D	12.4	0.90%
400	Urban land	D	16.1	1.20%
W	Census water		8.3	0.60%
Totals for Area of Interest			1,312.00	100.00%

NOTES:
1. ALL TOPOGRAPHY, PROPERTY LINES AND OTHER DATA WAS ACQUIRED FROM MONTGOMERY COUNTY DATA.

GRAPHIC SCALE: 1" = 150'
0 150' 300' 450'

LEGEND:
- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
- EX. ROAD CENTERLINE
- OHU — EX. OVERHEAD UTILITY
- OHE — EX. OVERHEAD ELECTRIC
- SAN — EX. SANITARY SEWER
- EX. STORM UTILITY
- GAS — GAS — EX. GAS
- EX. BUILDING
- EX. CURB
- EX. 100 YR WSE
- EX. FLOODPLAIN
- EX. STREAM CENTERLINE
- EX. POND
- EX. STREAM
- EX. WETLAND
- PR. EASEMENT
- PR. BOTTOM OF BANK
- PR. BANKFULL
- PR. WETLAND CREATION
- PR. WETLAND BUFFER
- PR. WOOD TOE
- PR. RIFFLE
- PR. ROCK STRUCTURE

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PROJECT: CABIN BRANCH PHASE I MITIGATION PLAN

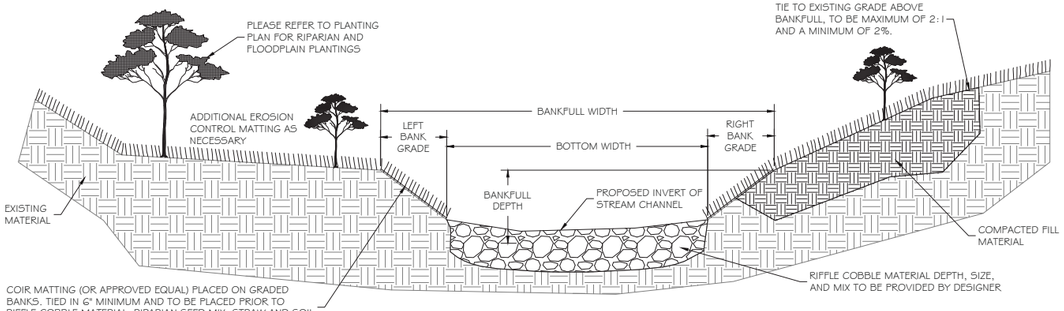
CABIN BRANCH AND TRIBUTARY 1 #2

MONTGOMERY COUNTY, MARYLAND

REVISIONS:
1

PROJECT STATUS:
7/15/2019 CONCEPT PLAN

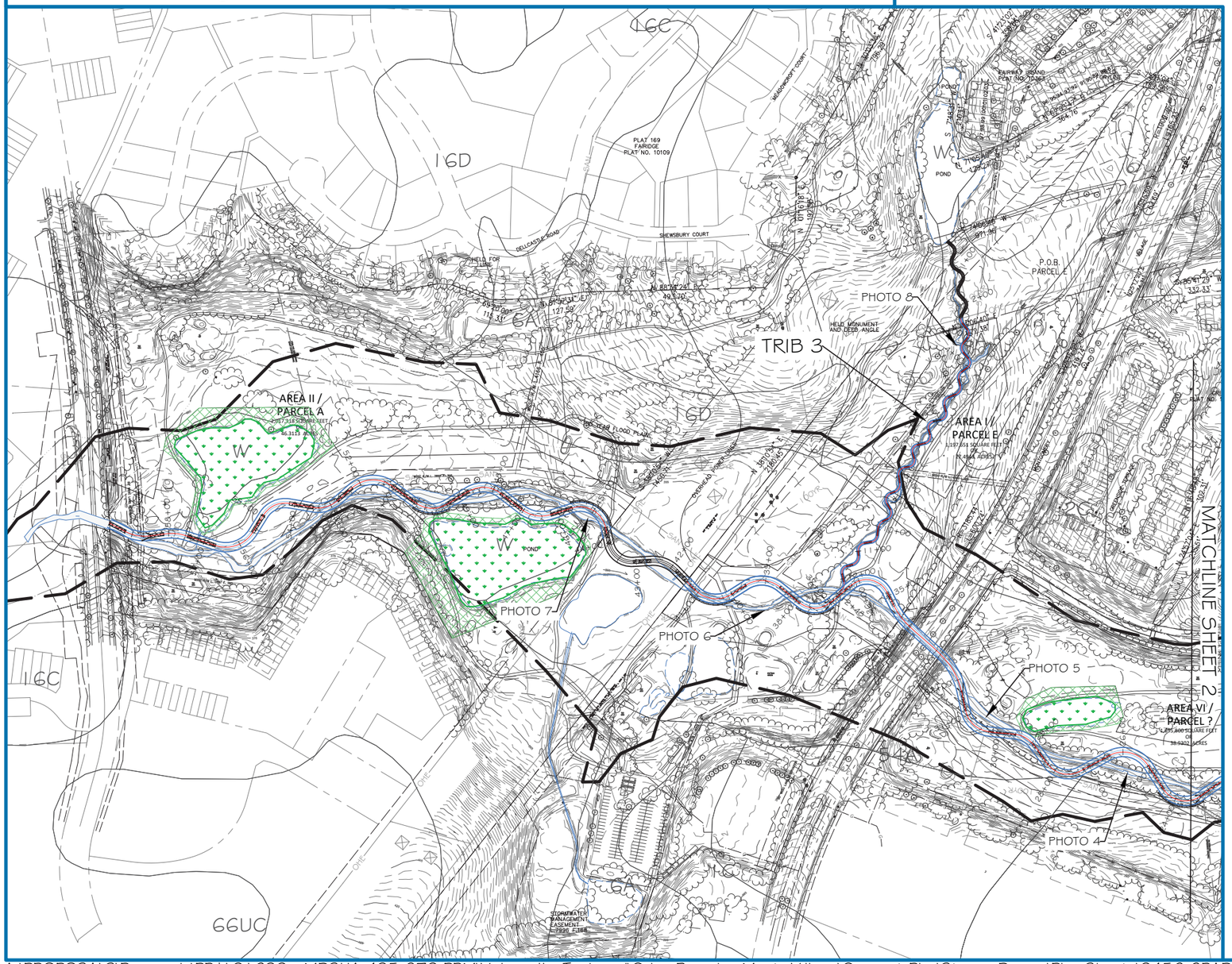
PROJECT MANAGER:	RC
DESIGNED:	RC
DRAWN:	KH
JOB NUMBER:	0456
DESIGN TYPE:	CONCEPT PLAN
DATE:	7/15/2019
SHEET NO:	2 OF 5



RIFFLE CROSS SECTION ORIENTATION LOOKING DOWNSTREAM
NOT TO SCALE

WATERSHED CHARACTERISTICS - CABIN BRANCH	
DRAINAGE AREA	4.36 SQ MI
IMPERVIOUS AREA	21.3%
URBAN AREA	78.3%
FOREST COVER	11.5%
BANKFULL DISCHARGE (CFS)	207.19
BANKFULL WIDTH	25 FT
BANKFULL DEPTH	2 FT
BANKFULL AREA	48 SQ FT
*APPROXIMATE BANKFULL CHARACTERISTICS ARRIVED FROM MARYLAND PIEDMONT REGIONAL CURVE	

WATERSHED CHARACTERISTICS - TRIB 3	
DRAINAGE AREA	0.13 SQ MI
IMPERVIOUS AREA	100.0%
URBAN AREA	14.8%
FOREST COVER	0.0%
BANKFULL DISCHARGE (CFS)	14.38
BANKFULL WIDTH	6.27 FT
BANKFULL DEPTH	0.68 FT
BANKFULL AREA	4.15 SQ FT
*APPROXIMATE BANKFULL CHARACTERISTICS ARRIVED FROM MARYLAND PIEDMONT REGIONAL CURVE	



GRAPHIC SCALE: 1" = 150'
0 150' 300' 450'

LEGEND:

- EX. PROPERTY LINE
- EX. PROPERTY ADJACENT
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
- EX. ROAD CENTERLINE
- OHU — EX. OVERHEAD UTILITY
- OHE — EX. OVERHEAD ELECTRIC
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- EX. STORM UTILITY
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- EX. CURB
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- PR. EASEMENT
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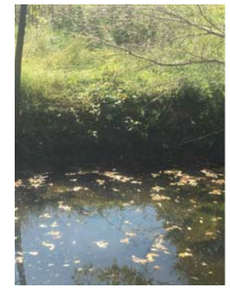
- PR. WETLAND BUFFER
- PR. WOOD TOE
- PR. RIFFLE
- PR. ROCK STRUCTURE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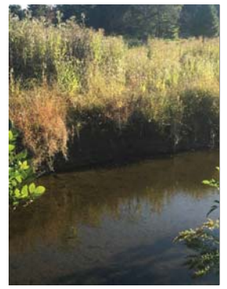
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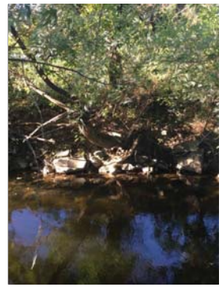
PHOTO LOCATION 7


PHOTO LOCATION 8

SOILS LEGEND				
MAP UNIT SYMBOL	MAP UNIT NAME	RATING	ACRES IN AOI	PERCENT OF AOI
1B	Gaila silt loam, 3 to 8 percent slopes	B	25.9	2.00%
1C	Gaila silt loam, 8 to 15 percent slopes	B	118.2	9.00%
2B	Glenelg silt loam, 3 to 8 percent slopes	B	184.8	14.10%
2C	Glenelg silt loam, 8 to 15 percent slopes	B	3	0.20%
5B	Glenville silt loam, 3 to 8 percent slopes	C/D	2.1	0.20%
6A	Baile silt loam, 0 to 3 percent slopes	C/D	37.9	2.90%
16B	Brinklow-Blocktown channery silt loams, 3 to 8 percent slopes	C	10.8	0.80%
16C	Brinklow-Blocktown channery silt loams, 8 to 15 percent slopes	C	31.5	2.40%
16D	Brinklow-Blocktown channery silt loams, 15 to 25 percent slopes	C	93.8	7.10%
17B	Occoquan loam, 3 to 8 percent slopes	B	9.6	0.70%
17C	Occoquan loam, 8 to 15 percent slopes	B	22.3	1.70%
54A	Hatboro silt loam, 0 to 3 percent slopes, frequently flooded	B/D	122.2	9.30%
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66UB	Wheaton-Urban land complex, 0 to 8 percent slopes	B	253.2	19.30%
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NOTES:
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PROJECT: CABIN BRANCH PHASE I MITIGATION PLAN

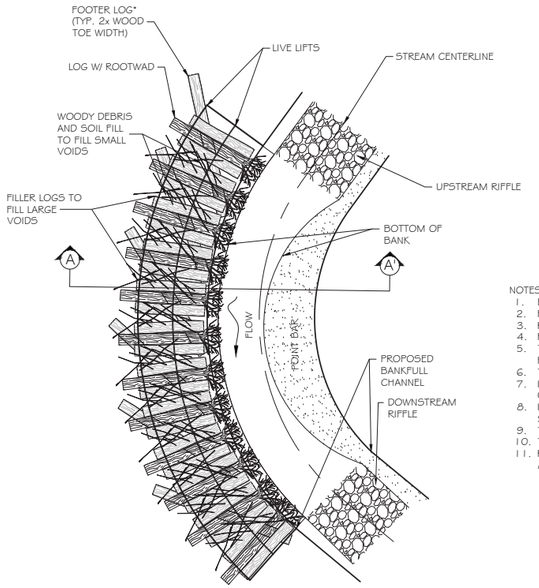
CABIN BRANCH AND TRIBUTARY 3

MONTGOMERY COUNTY, MARYLAND

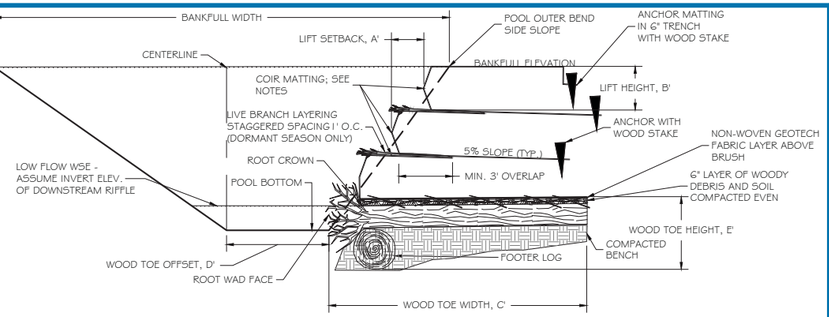
REVISIONS:
1

PROJECT STATUS:
7/15/2019 CONCEPT PLAN

PROJECT MANAGER:	RC
DESIGNED:	RC
DRAWN:	KH
JOB NUMBER:	0456
DESIGN TYPE:	CONCEPT PLAN
DATE:	7/15/2019
SHEET NO:	3 OF 5



PLAN VIEW
NOT TO SCALE

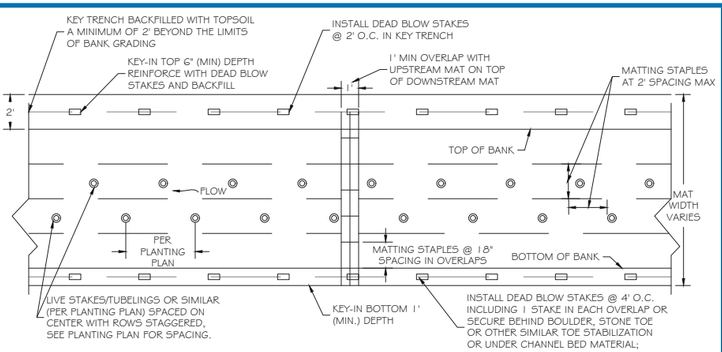


SECTION A - A'
NOT TO SCALE

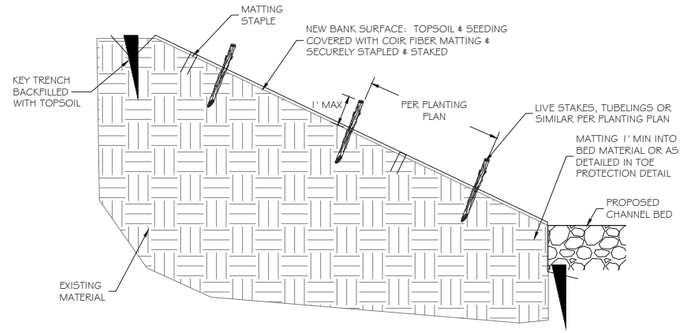
NOTES:
1. BASE OF STRUCTURE SHOULD BE A COMPACTED SOIL BENCH THAT THE TRENCHES FOR EACH LOG CAN BE CUT INTO.
2. FOOTER AND ROOTWAD LOGS SHOULD BE ROUGHLY HALF OF THE WOOD TOE HEIGHT TO ADD UP TO A MINIMUM OF THE VALUE SHOWN IN TABLE.
3. ROOTWADS SHALL BE TOUCHING OR OVERLAPPING SO THAT THERE ARE NO GAPS ALONG THE FACE OF THE REVETMENT.
4. FILLER LOGS SHALL BE ANY SCRAP LOGS NOT USED FOR ROOTWADS AND TIGHTLY FITTED IN TO HOLD THE ROOTWADS IN PLACE. USE WOODY DEBRIS AND SOIL TO FILL SMALLER VOID SPACES.
5. THE WOODY DEBRIS AND SOIL FILL SHALL BE COMPACTED WITH EXCAVATOR BUCKET IN THE VOIDS AROUND THE LOGS AND ON TOP OF THE WOOD TOE LAYER TO PROVIDE AN EVEN SURFACE FOR THE BOTTOM SOIL LIFT.
6. THE SOIL USED FOR LIVE LIFTS SHALL BE FREE OF STICKS, ROOTS, AND ROCKS LARGER THAN GRAVEL. THIS SOIL SHALL CONTAIN NO LESS THAN 50% TOPSOIL.
7. IF ONLY ONE (1) LIFT IS SPECIFIED PER REVETMENT, COIR 700 MAY BE USED AND LIFT SHOULD MATCH CHANNEL GEOMETRY. IF MULTIPLE LIFTS ARE SPECIFIED ALL LIFTS SHALL USE COIR 1000 OR ALTERNATIVE MATERIAL AS APPROVED BY ENGINEER.
8. IF LIFTS ARE COMPLETED DURING GROWING SEASON WHEN LIVE BRANCHES ARE NOT AVAILABLE, USE HIGH DENSITY LIVE STAKING DURING THE FOLLOWING DORMANT SEASON. LIVE BRANCHES SHALL BE OF THE SAME SPECIES SPECIFIED FOR LIVE STAKES OR ALTERNATIVE AS APPROVED BY THE ONSITE ENGINEER. FOLLOW SEEDING AND PLANTING SCHEDULE PROVIDED IN THE PLANS.
9. THE OVERALL SLOPE CREATED BY THE WOOD TOE AND LIVE LIFTS SHALL MATCH THE PROPOSED CROSS SECTION SHAPE FOR THE OUTER BANK OF THE PROPOSED POOL.
10. THE SURFACE SHALL BE FINISHED TO A SMOOTH AND COMPACT SURFACE IN ACCORDANCE WITH THE ELEVATIONS, GRADES, AND/OR CROSS-SECTIONS SHOWN IN THE PLANS.
11. REDRESSING OF CHANNEL, BENCHES, AND FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF THIS STRUCTURE AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION. ADDITIONAL ROOTWADS OR RIPRAP MAY BE USED TO ADDRESS AREAS OF CONCERN FOR EROSION, ESPECIALLY AT THE ENDS OF THIS STRUCTURE.

1 WOOD TOE REVETMENT
NOT TO SCALE

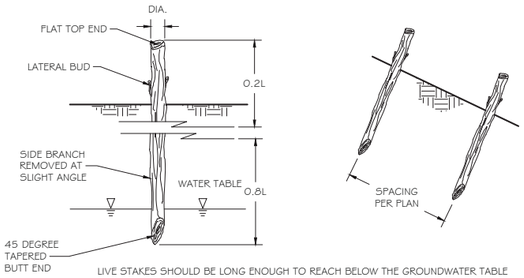
^ OFFSET FROM THE CENTERLINE APPLIES ONLY AT THE DMAX/MIDPOINT OF THE POOL. WOOD TOE REVETMENT SHOULD TRANSITION TO AND FROM THE RIFFLE CROSS-SECTION FROM THAT POINT.



2 COIR FIBER MATTING DETAIL IN-CHANNEL INSTALLATION
NOT TO SCALE

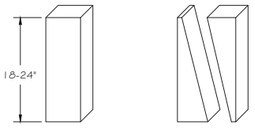


5 COIR FIBER MATTING WITH LIVE STAKES
NOT TO SCALE

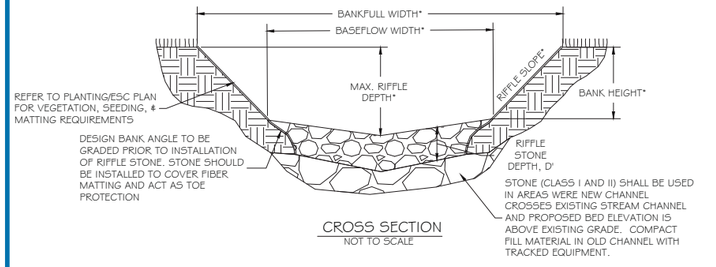


LIVE STAKES SHOULD BE LONG ENOUGH TO REACH BELOW THE GROUNDWATER TABLE (LENGTH OF 2 TO 3 FEET). ADDITIONALLY, THE STAKES SHOULD HAVE A DIAMETER IN THE RANGE OF 0.75 TO 1.5 INCHES.

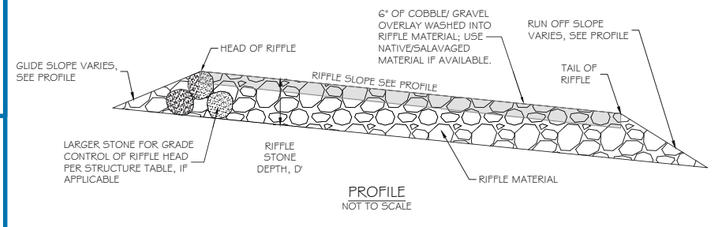
3 LIVE STAKES
NOT TO SCALE



4 DEAD BLOW STAKE
NOT TO SCALE



CROSS SECTION
NOT TO SCALE



PROFILE
NOT TO SCALE

STRUCTURE TABLE

	RIFFLE STONE DEPTH, ^	ROCK HEIGHT (A)	ROCK DEPTH (D)	ROCK LENGTH (C)
NA				

SEE FINAL PLAN

RIFFLE MATERIAL

MATERIAL	PERCENT
CLASS I	10%
	20%
VDOT #1	30%
GABION	30%
FINES	10%

6 CONSTRUCTED RIFFLE
NOT TO SCALE

*NOTE: SEE CROSS-SECTION GEOMETRY TABLE FOR CHANNEL DIMENSIONS AND SLOPES.

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PROJECT: CABIN BRANCH PHASE I MITIGATION PLAN

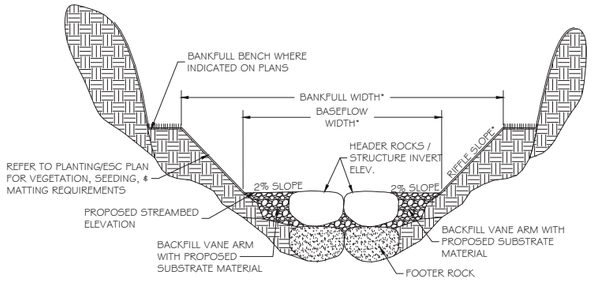
STREAM DETAILS

MONTGOMERY COUNTY, MARYLAND

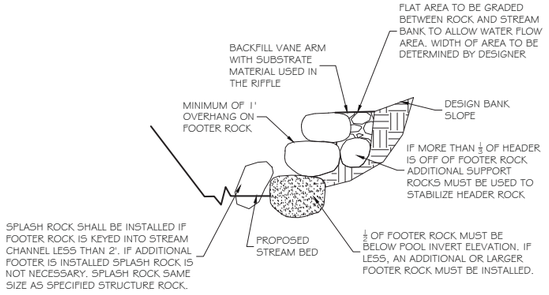
REVISIONS:
1

PROJECT STATUS:
7/15/2019 CONCEPT PLAN

PROJECT MANAGER:	RC
DESIGNED:	RC
DRAWN:	KH
JOB NUMBER:	0456
DESIGN TYPE:	CONCEPT PLAN
DATE:	7/15/2019
SHEET NO:	4 OF 5



SECTION A - A'
NOT TO SCALE



SECTION E - E'
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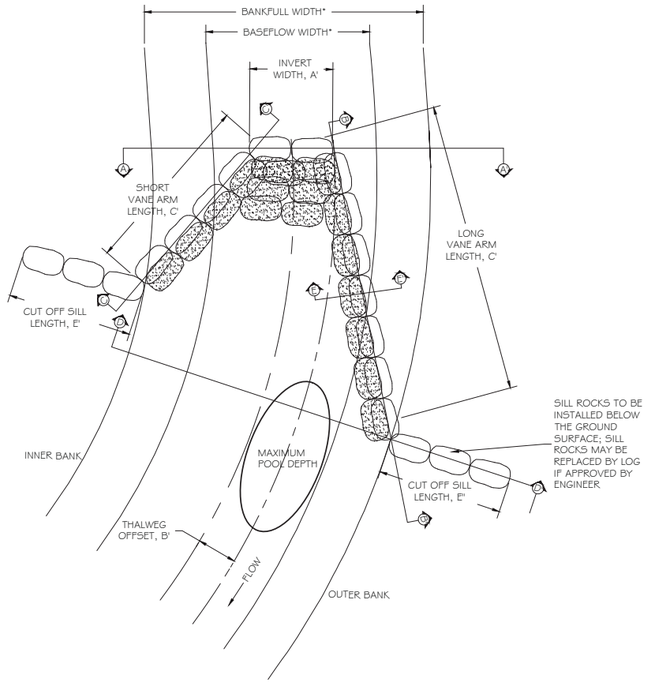
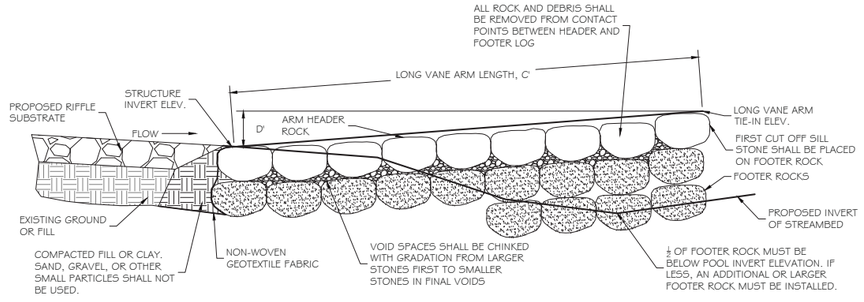


PLAN VIEW
NOT TO SCALE



SECTION B - B'
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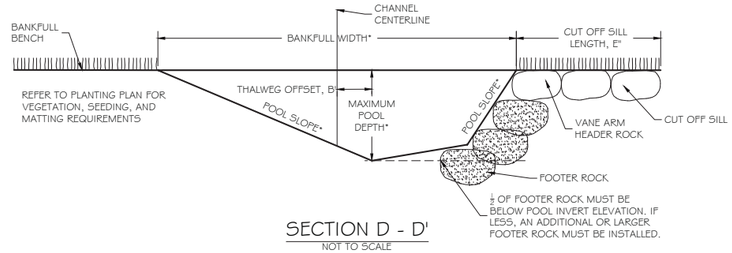
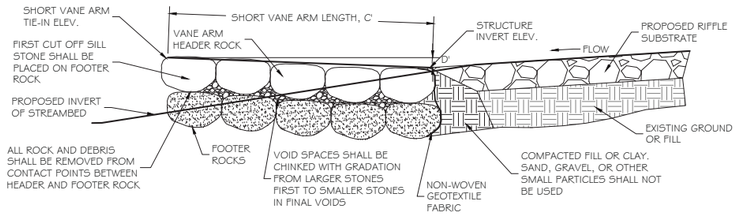


SECTION D - D'
NOT TO SCALE

*NOTE: SEE CROSS-SECTION GEOMETRY TABLE FOR CHANNEL DIMENSIONS AND SLOPES.



SECTION C - C'
NOT TO SCALE

7 OFFSET CROSS VANE/STEP POOL
NOT TO SCALE

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PROJECT: CABIN BRANCH PHASE I MITIGATION PLAN

STREAM DETAILS

MONTGOMERY COUNTY, MARYLAND

REVISIONS:
1

PROJECT STATUS:
7/15/2019 CONCEPT PLAN

PROJECT MANAGER:	RC
DESIGNED:	RC
DRAWN:	KH
JOB NUMBER:	0456
DESIGN TYPE:	CONCEPT PLAN
DATE:	7/15/2019
SHEET NO:	5 OF 5

RFP-3: TUSCARORA CREEK

Tuscarora Creek Stream and Wetland Mitigation

The Tuscarora Creek project will restore approximately 5,096 linear feet of stream, create approximately 4.88 acres of forested non-tidal wetlands, preserve approximately 1.6 acres of non-tidal forested wetlands, and preserve/enhance approximately 22 acres of non-tidal wetland buffer and riparian habitat. The project is within the Middle Potomac-Catoctin watershed (Federal 8-Digit HUC 02070008) and located at 5515B Mountville Road, Adamstown, MD, 21710. The wetland, stream, and buffer components will be fully integrated to provide the greatest functional uplift while generating compensatory mitigation credits as outlined below.

Tuscarora Creek Proposed Compensatory Mitigation Credit

ACTIVITY	LINEAR FEET (LF)/ACREAGE (AC)	RATIO	CREDITS
Stream Restoration	5,096 LF	1:1	5,096
Wetland Restoration	4.88 AC	1:1	4.88
Wetland Preservation	1.62 AC	10:1	0.16
Wetland Buffer Enhancement	0.31 AC	15:1	0.02
Wetland Buffer Preservation	1.00 AC	20:1	0.05
Total Wetland Credits			5.11
Riparian Buffer	20.52 AC	-	-

The proposed restoration reach currently exhibits incised banks, disconnection from the floodplain, and accelerated bank erosion. There is evidence of channel migration including abandoned oxbows, tortuous meander patterns, active bank erosion, and compromised stream side trees. Concrete and other debris illustrates evidence of historic channel alterations that have further compromised channel stability. In addition, the lower portion of the channel appears to have been straightened which is most likely a result of historic agricultural practices. Tuscarora Creek is classified as a use I-P stream, “Water Contact Recreation, Protection of Aquatic Life, and Public Water Supply” (COMAR 26.08.02.08) and is part of the 303(d) Upper Monocacy River TMDL.

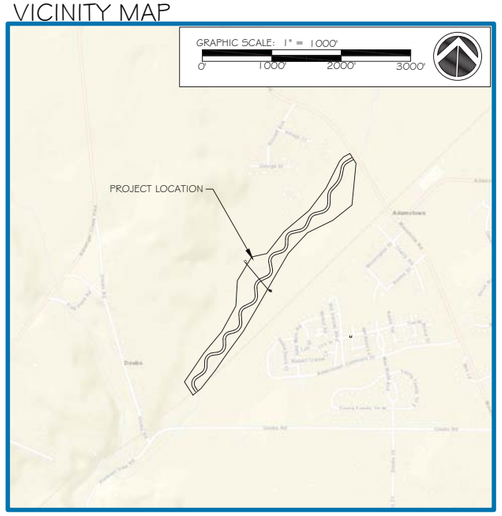
Design objectives include restoration of stream channel hydraulics and geomorphology to create ecological uplift and landscape connectivity along the entire reach of Tuscarora Creek. The current design approach will include Priority I/II restoration that include channel relocation combined with raising the channel profile and excavation of lower floodplain elevations to ensure bank height ratios of ≤ 1.2 and functional dimension and pattern. Another important restoration component is addition of woody material within the channel. This will include installation of wood toe structures to promote channel stability and habitat creation. In addition, log vanes and wood enhanced riffle structures may be used to further promote stabilization, bed form complexity, and enhanced hyporheic exchange that will result in further ecological uplift. The riparian corridor will be reforested and enhanced with native woody species to promote long-term diversity and structure within the project area. While not a specific project objective, the current design approach will result in significant nutrient reductions and other important co-benefits to the site and Upper Monocacy TMDL.

Wetland creation will be achieved through connection with existing wetlands and an increased groundwater table as a result of the proposed stream design. Greater floodplain connection will further enhance wetland hydrology by increasing the likelihood of overbank flows into proposed wetland areas. Wetland elevations will be determined based on a ground water analysis and final stream channel elevations. An important component of wetland creation will be incorporating the abandoned stream after channel relocation. This will provide the opportunity for complex wetland features without significant additional site disturbance. With the integration of wetland, stream, and riparian features, the Tuscarora Creek project will provide compensatory

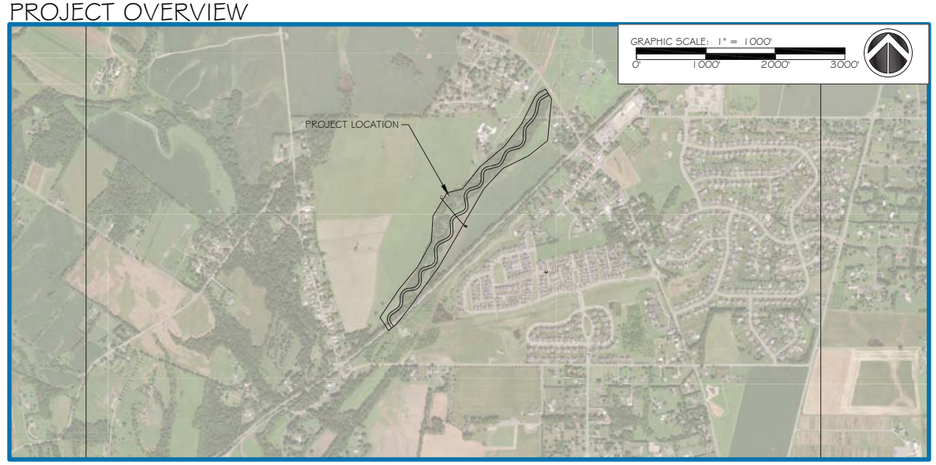
mitigation and significant ecological uplift in support of the Maryland State Highway Administration I-495 & I-270 Managed Lanes Study.

TUSCARORA CREEK PHASE I
MITIGATION PLAN
FREDERICK COUNTY, MARYLAND

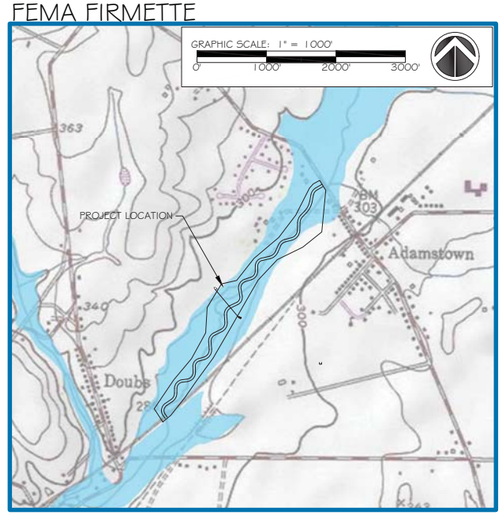
VICINITY MAP



PROJECT OVERVIEW

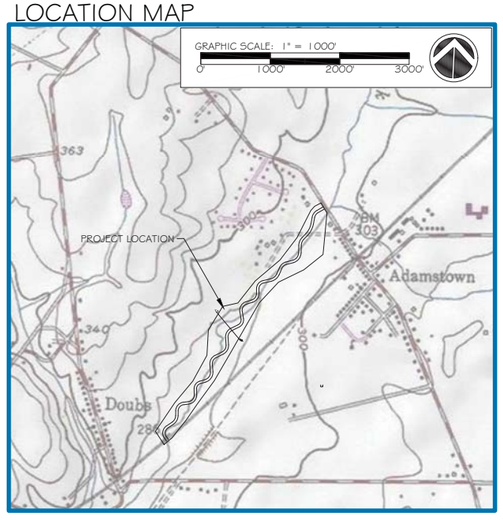


FEMA FIRMETTE



REFERENCE FEMA MAP: 24021C0430D

LOCATION MAP



LATITUDE: N 39° 18' 19"
LONGITUDE: W 77° 29' 04"

PROJECT SUMMARY

Tuscarora Creek Stream and Wetland Mitigation

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SHEET INDEX:

An accounting of the proposed stream and wetlands credits from the restoration activities outlined in the Project Summary are detailed in the table below.

ACTIVITY	LINEAR FEET (LF) ACREAGE (AC)	RATIO	CREDITS
STREAM RESTORATION	5,096 LF	1:1	5,096
WETLAND RESTORATION	4.88 AC	1:1	4.88
WETLAND PRESERVATION	1.62	10:1	0.16
WETLAND BUFFER ENHANCEMENT	0.31	15:1	0.02
WETLAND BUFFER PRESERVATION	1	15:1	0.05
		TOTAL WETLAND CREDITS	5.11
RIPARIAN BUFFER PRESERVTION AND ENHANCEMENT	20.52	-	-

PROJECT STATUS	
DATE	DESCRIPTION
2/17/2020	CONCEPT PLAN

JOB NUMBER: 102055
TUSCARORA CREEK PHASE I MITIGATION PLAN

TUSCARORA CREEK PHASE I MITIGATION PLAN

PROJECT MANAGER: RC	JOB NUMBER: 102055
DESIGNED: KH	DESIGN TYPE: STREAM PLAN
DRAWN: KH	INITIAL PLAN DATE: 02/17/2020

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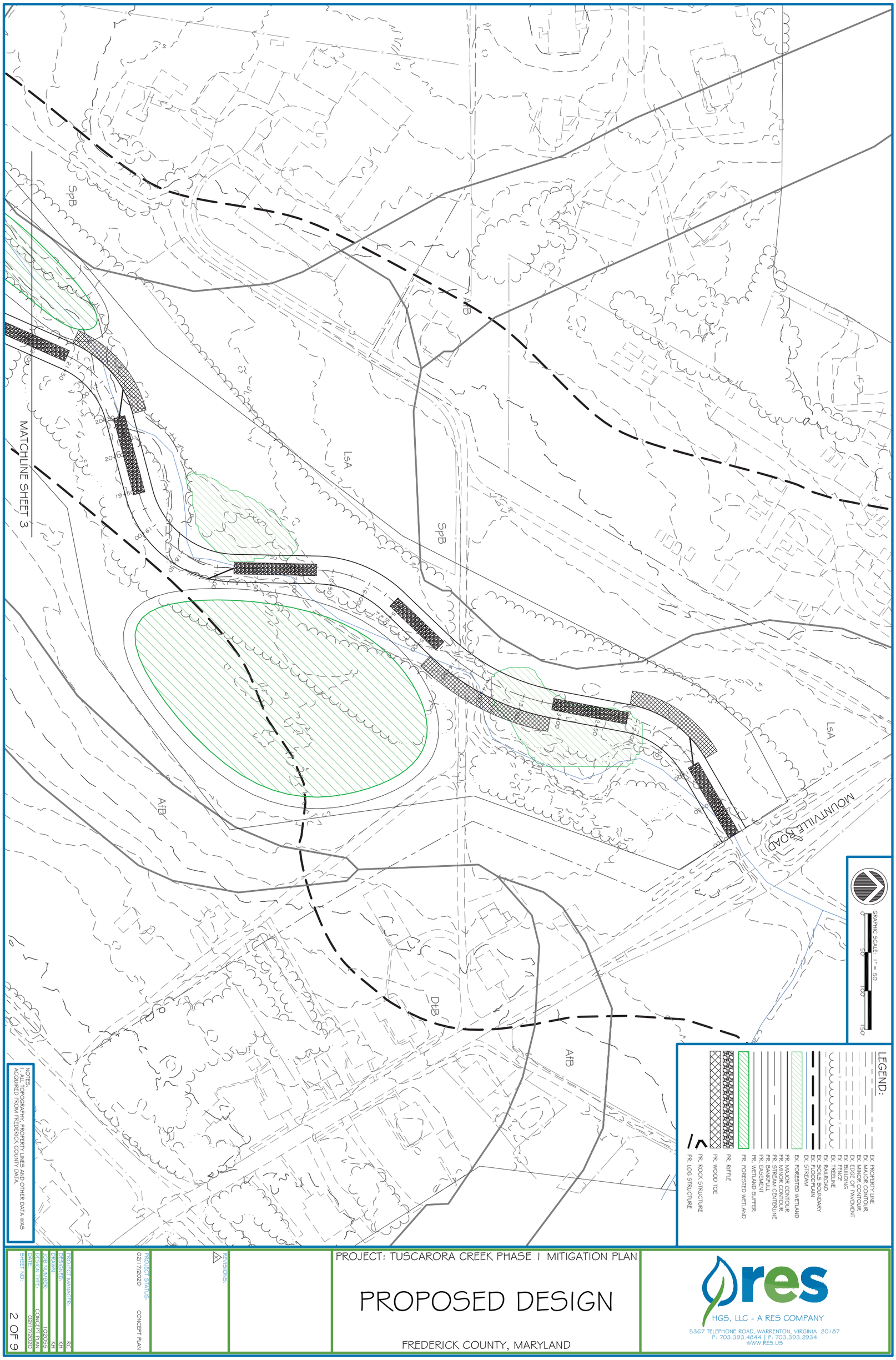

NOTES:
1. ALL TOPOGRAPHY, PROPERTY LINES AND OTHER DATA WAS ACQUIRED FROM FREDERICK COUNTY DATA.

PROJECT: TUSCARORA CREEK PHASE I MITIGATION PLAN

PROPOSED DESIGN

FREDERICK COUNTY, MARYLAND

PROJECT MANAGER:	KC
DESIGNED:	KM
DRAWN:	KM
DESIGN NUMBER:	102055
DESIGN TYPE:	CONCEPT PLAN
DATE:	02/17/2020
SHEET NO:	2 OF 9

PROJECT STATUS:
02/17/2020 CONCEPT PLAN

REVISIONS

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GRAPHIC SCALE: 1" = 50'
0 50' 100' 150'

MATCHLINE SHEET 2

MATCHLINE SHEET 4

LEGEND:

- EX. PROPERTY LINE
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
- EX. BUILDING
- EX. FENCE
- EX. TREELINE
- EX. RAILROAD
- EX. SOILS BOUNDARY
- EX. FLOODPLAIN
- EX. STREAM
- EX. FORESTED WETLAND
- PR. MAJOR CONTOUR
- PR. MINOR CONTOUR
- PR. STREAM CENTERLINE
- PR. BANKFULL
- PR. EASEMENT
- PR. WETLAND BUFFER
- PR. FORESTED WETLAND
- PR. RIFFLE
- PR. WOOD TOE
- PR. ROCK STRUCTURE
- PR. LOG STRUCTURE

NOTES:
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PROPOSED DESIGN

PROJECT: TUSCARORA CREEK PHASE I MITIGATION PLAN
FREDERICK COUNTY, MARYLAND

REVISIONS:
1

PROJECT STATUS:	
02/17/2020	CONCEPT PLAN
PROJECT MANAGER:	RC
DESIGNED:	KH
DRAWN:	KH
JOB NUMBER:	102055
DESIGN TYPE:	CONCEPT PLAN
DATE:	02/17/2020
SHEET NO:	3 OF 9

GRAPHIC SCALE: 1" = 50'
0 50 100 150

LEGEND:

- EX. PROPERTY LINE
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
- EX. BUILDING
- EX. FENCE
- EX. TREELINE
- EX. RAILROAD
- EX. SOILS BOUNDARY
- EX. FLOODPLAIN
- EX. STREAM
- EX. FORESTED WETLAND
- PR. MAJOR CONTOUR
- PR. MINOR CONTOUR
- PR. STREAM CENTERLINE
- PR. BANKFULL
- PR. EASEMENT
- PR. WETLAND BUFFER
- PR. FORESTED WETLAND
- PR. RIFFLE
- PR. WOOD TOE
- PR. ROCK STRUCTURE
- PR. LOG STRUCTURE

MATCHLINE SHEET 3

MATCHLINE SHEET 5

NOTES:
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P: 703.393.4844 | F: 703.393.2934
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PROPOSED DESIGN

PROJECT: TUSCARORA CREEK PHASE I MITIGATION PLAN
FREDERICK COUNTY, MARYLAND

REVISIONS:
1

PROJECT STATUS:
02/17/2020 CONCEPT PLAN

PROJECT MANAGER:	RC
DESIGNED:	KH
DRAWN:	KH
JOB NUMBER:	102055
DESIGN TYPE:	CONCEPT PLAN
DATE:	02/17/2020
SHEET NO:	4 OF 9

GRAPHIC SCALE: 1" = 50'
0 50' 100' 150'

LEGEND:
- EX. PROPERTY LINE
- EX. MAJOR CONTOUR
- EX. MINOR CONTOUR
- EX. EDGE OF PAVEMENT
- EX. BUILDING
- EX. FENCE
- EX. TREELINE
- EX. RAILROAD
- EX. SOILS BOUNDARY
- EX. FLOODPLAIN
- EX. STREAM
- EX. FORESTED WETLAND
- PR. MAJOR CONTOUR
- PR. MINOR CONTOUR
- PR. STREAM CENTERLINE
- PR. BANKFULL
- PR. EASEMENT
- PR. WETLAND BUFFER
- PR. FORESTED WETLAND
- PR. RIFFLE
- PR. WOOD TOE
- PR. ROCK STRUCTURE
- PR. LOG STRUCTURE

MATCHLINE SHEET 4

BgB
BgB
LsA
DtB
KeC
PfB
AfB
LsA
DtB

NOTES:
1. ALL TOPOGRAPHY, PROPERTY LINES AND OTHER DATA WAS ACQUIRED FROM FREDERICK COUNTY DATA.

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PROJECT: TUSCARORA CREEK PHASE I MITIGATION PLAN

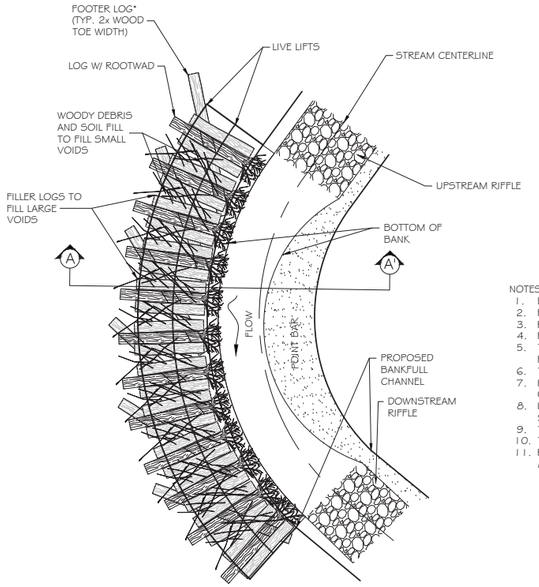
PROPOSED DESIGN

FREDERICK COUNTY, MARYLAND

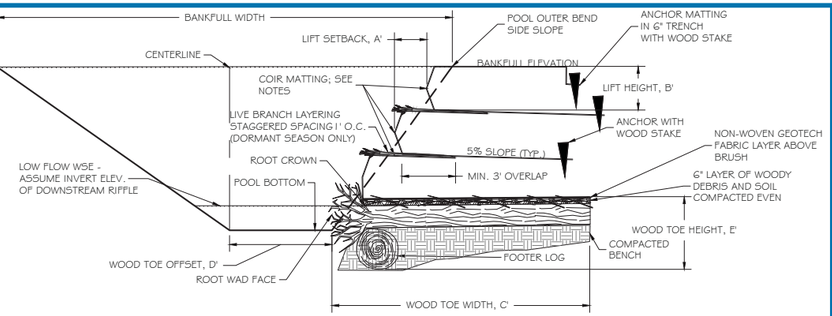
REVISIONS:
1

PROJECT STATUS:
02/17/2020 CONCEPT PLAN

PROJECT MANAGER:	RC
DESIGNED:	KH
DRAWN:	KH
JOB NUMBER:	102055
DESIGN TYPE:	CONCEPT PLAN
DATE:	02/17/2020
SHEET NO:	5 OF 9



PLAN VIEW
NOT TO SCALE

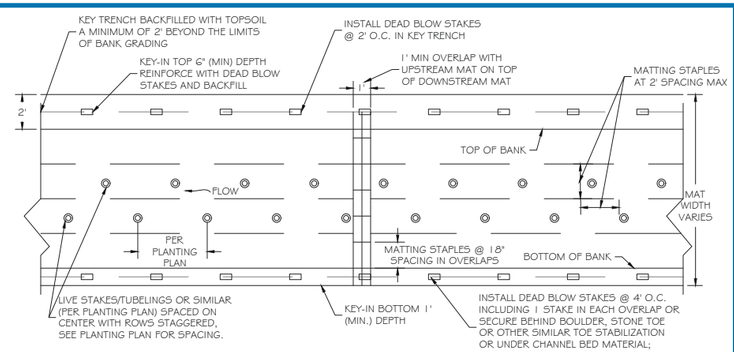


SECTION A - A'
NOT TO SCALE

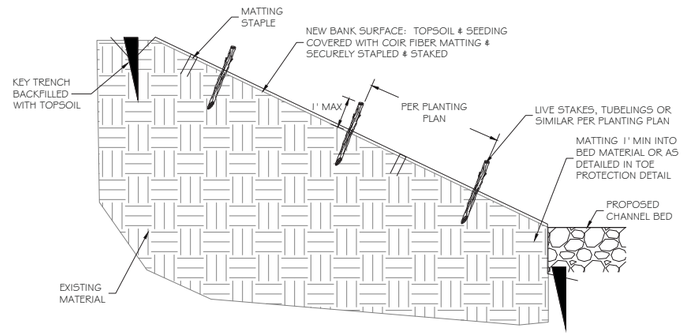
NOTES:
1. BASE OF STRUCTURE SHOULD BE A COMPACTED SOIL BENCH THAT THE TRENCHES FOR EACH LOG CAN BE CUT INTO.
2. FOOTER AND ROOTWAD LOGS SHOULD BE ROUGHLY HALF OF THE WOOD TOE HEIGHT TO ADD UP TO A MINIMUM OF THE VALUE SHOWN IN TABLE.
3. ROOTWADS SHALL BE TOUCHING OR OVERLAPPING SO THAT THERE ARE NO GAPS ALONG THE FACE OF THE REVETMENT.
4. FILLER LOGS SHALL BE ANY SCRAP LOGS NOT USED FOR ROOTWADS AND TIGHTLY FITTED IN TO HOLD THE ROOTWADS IN PLACE. USE WOODY DEBRIS AND SOIL TO FILL SMALLER VOID SPACES.
5. THE WOODY DEBRIS AND SOIL FILL SHALL BE COMPACTED WITH EXCAVATOR BUCKET IN THE VOIDS AROUND THE LOGS AND ON TOP OF THE WOOD TOE LAYER TO PROVIDE AN EVEN SURFACE FOR THE BOTTOM SOIL LIFT.
6. THE SOIL USED FOR LIVE LIFTS SHALL BE FREE OF STICKS, ROOTS, AND ROCKS LARGER THAN GRAVEL. THIS SOIL SHALL CONTAIN NO LESS THAN 50% TOPSOIL.
7. IF ONLY ONE (1) LIFT IS SPECIFIED PER REVETMENT, COIR 700 MAY BE USED AND LIFT SHOULD MATCH CHANNEL GEOMETRY. IF MULTIPLE LIFTS ARE SPECIFIED ALL LIFTS SHALL USE COIR 1000 OR ALTERNATIVE MATERIAL AS APPROVED BY ENGINEER.
8. IF LIFTS ARE COMPLETED DURING GROWING SEASON WHEN LIVE BRANCHES ARE NOT AVAILABLE, USE HIGH DENSITY LIVE STAKING DURING THE FOLLOWING DORMANT SEASON. LIVE BRANCHES SHALL BE OF THE SAME SPECIES SPECIFIED FOR LIVE STAKES OR ALTERNATIVE AS APPROVED BY THE ONSITE ENGINEER. FOLLOW SEEDING AND PLANTING SCHEDULE PROVIDED IN THE PLANS.
9. THE OVERALL SLOPE CREATED BY THE WOOD TOE AND LIVE LIFTS SHALL MATCH THE PROPOSED CROSS SECTION SHAPE FOR THE OUTER BANK OF THE PROPOSED POOL.
10. THE SURFACE SHALL BE FINISHED TO A SMOOTH AND COMPACT SURFACE IN ACCORDANCE WITH THE ELEVATIONS, GRADES, AND/OR CROSS-SECTIONS SHOWN IN THE PLANS.
11. REDRESSING OF CHANNEL, BENCHES, AND FLOODPLAIN WILL LIKELY BE REQUIRED FOLLOWING INSTALLATION OF THIS STRUCTURE AND SHALL BE CONSIDERED INCIDENTAL TO CONSTRUCTION. ADDITIONAL ROOTWADS OR RIPRAP MAY BE USED TO ADDRESS AREAS OF CONCERN FOR EROSION, ESPECIALLY AT THE ENDS OF THIS STRUCTURE.

1 WOOD TOE REVETMENT
NOT TO SCALE

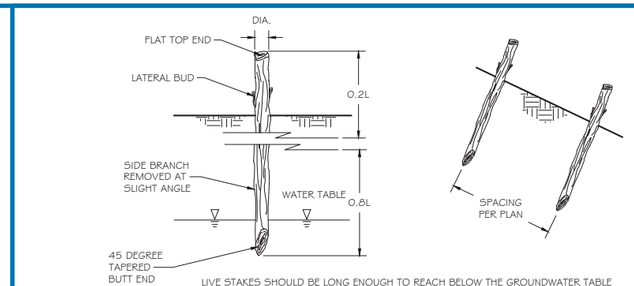
^OFFSET FROM THE CENTERLINE APPLIES ONLY AT THE DMAX/MIDPOINT OF THE POOL. WOOD TOE REVETMENT SHOULD TRANSITION TO AND FROM THE RIFFLE CROSS-SECTION FROM THAT POINT.



2 COIR FIBER MATTING DETAIL IN-CHANNEL INSTALLATION
NOT TO SCALE

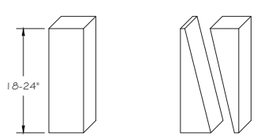


3 COIR FIBER MATTING WITH LIVE STAKES
NOT TO SCALE



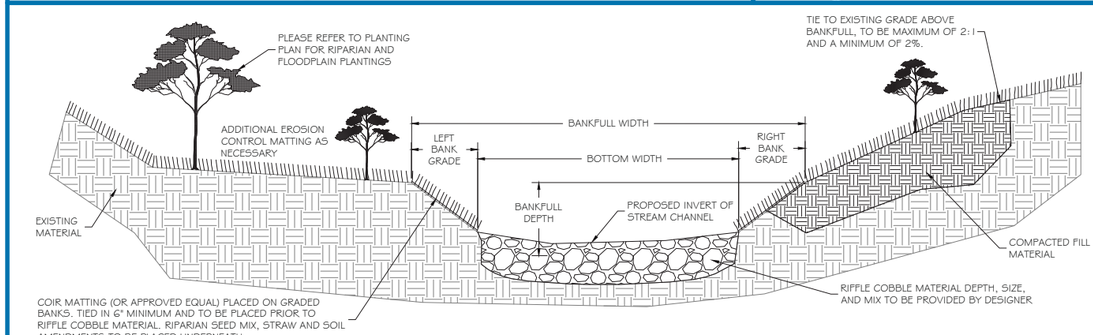
LIVE STAKES SHOULD BE LONG ENOUGH TO REACH BELOW THE GROUNDWATER TABLE (LENGTH OF 2 TO 3 FEET). ADDITIONALLY, THE STAKES SHOULD HAVE A DIAMETER IN THE RANGE OF 0.75 TO 1.5 INCHES.

4 LIVE STAKES
NOT TO SCALE

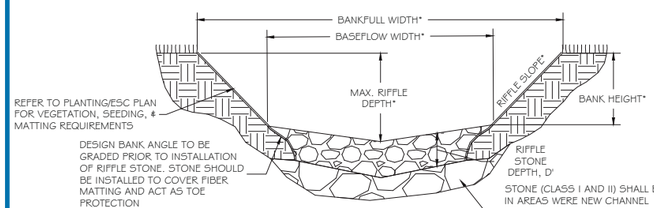


SAW A 2X3 DIAGONALLY TO PRODUCE (2) DEAD BLOW STAKES

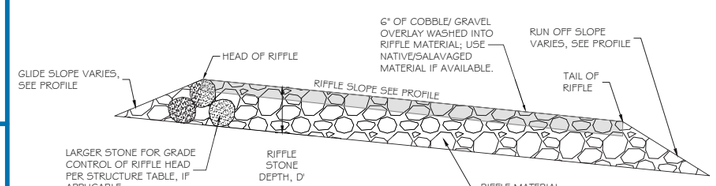
5 DEAD BLOW STAKE
NOT TO SCALE



6 RIFFLE CROSS SECTION ORIENTATION LOOKING DOWNSTREAM
NOT TO SCALE



CROSS SECTION
NOT TO SCALE



PROFILE
NOT TO SCALE

STRUCTURE TABLE

	RIFFLE STONE DEPTH, D	ROCK HEIGHT (A)	ROCK DEPTH (B)	ROCK LENGTH (C)
NA				

SEE FINAL PLAN

RIFFLE MATERIAL

MATERIAL	PERCENT
CLASS I	10%
3S A1	20%
VDOT #1	30%
GABION	30%
FINES	10%

7 CONSTRUCTED RIFFLE
NOT TO SCALE

*NOTE: SEE CROSS-SECTION GEOMETRY TABLE FOR CHANNEL DIMENSIONS AND SLOPES.

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PROJECT: TUSCARORA CREEK PHASE I MITIGATION PLAN

STREAM DETAILS

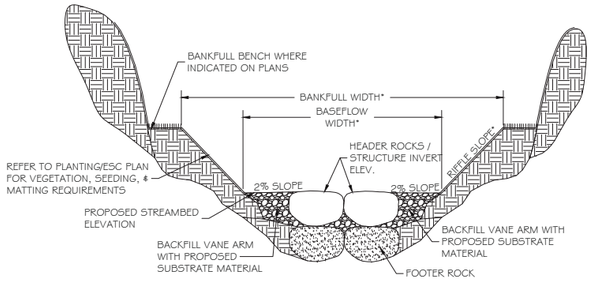
FREDERICK COUNTY, MARYLAND

REVISIONS:
1

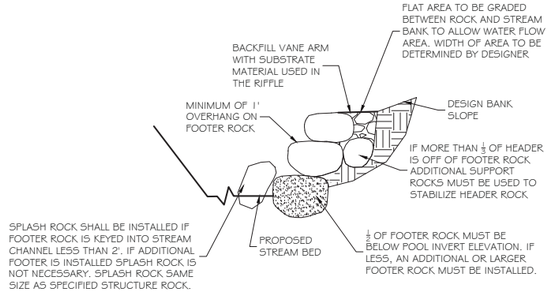
PROJECT STATUS:
02/17/2020 CONCEPT PLAN

PROJECT MANAGER:	RC
DESIGNED:	KH
DRAWN:	KH
JOB NUMBER:	102055
DESIGN TYPE:	CONCEPT PLAN
DATE:	02/17/2020
SHEET NO:	6 OF 9

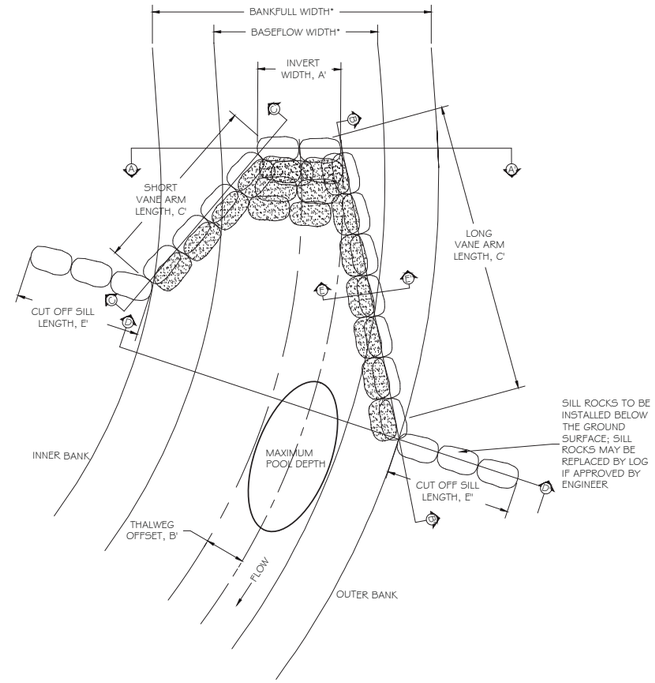
A:\Active Jobfiles\102055 MDSHA Tuscarora Creek\Engineering\Graphics\CONCEPT PLAN\Plan Sheets\102055-STREAM DETAILS.dwg, 2/17/2020 2:00:15 PM, khenneke, 1:1



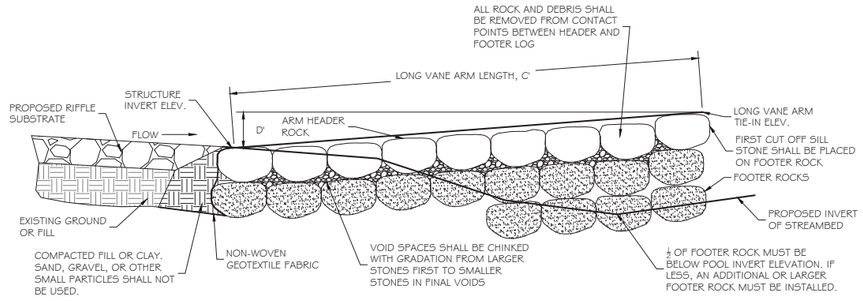
SECTION A - A'
NOT TO SCALE



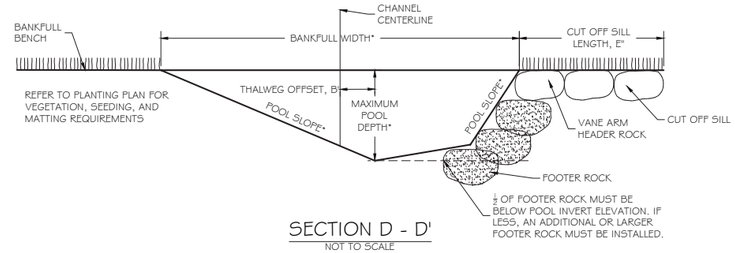
SECTION E - E'
NOT TO SCALE



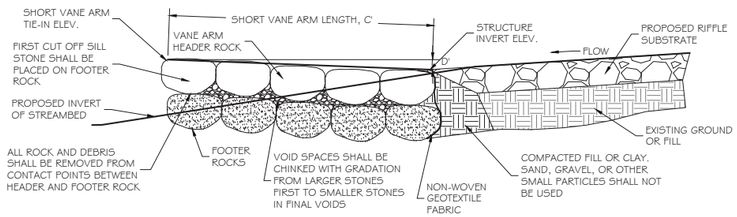
PLAN VIEW
NOT TO SCALE



SECTION B - B'
NOT TO SCALE



SECTION D - D'
NOT TO SCALE
*NOTE: SEE CROSS-SECTION GEOMETRY TABLE FOR CHANNEL DIMENSIONS AND SLOPES.



SECTION C - C'
NOT TO SCALE

8 OFFSET CROSS VANE/STEP POOL
NOT TO SCALE

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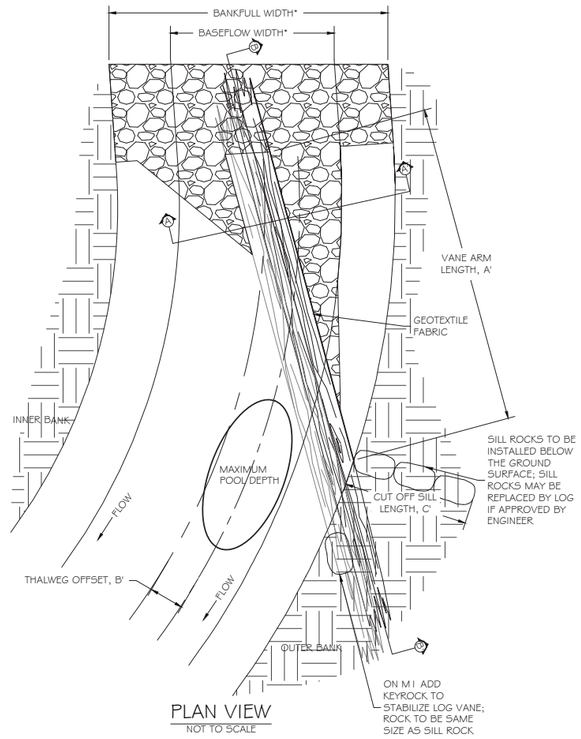
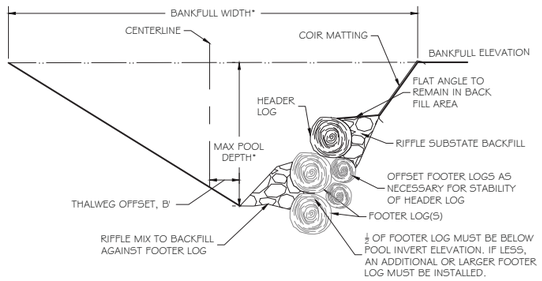
SHEET NO:	7 OF 9

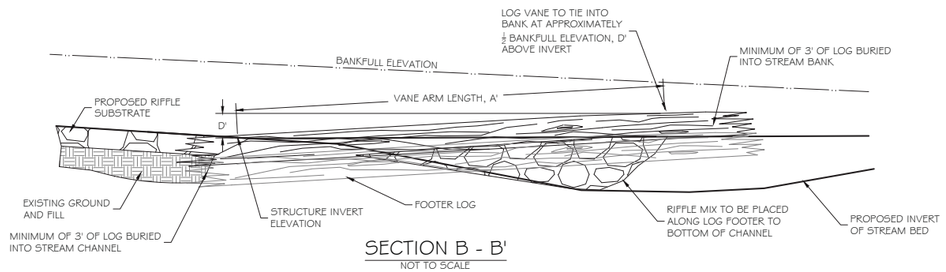
SOIL CHARACTERISTICS				
MAP UNIT SYMBOL	MAP UNIT NAME	ERODABILITY K FACTOR	HYDROLOGIC SOIL GROUP	HIGHLY ERODABLE SOIL
AdA	ADAMSTOWN SILT LOAM, 0 TO 3 PERCENT SLOPES	0.37	C	YES
AfB	ADAMSTOWN-FUNKSTOWN COMPLEX, 0 TO 8 PERCENT SLOPES	0.37	C	YES
BgB	BIRDSBORO SILT LOAM, 3 TO 8 PERCENT SLOPES	0.37	B	YES
CrB	CROTON-ABBOTTSTOWN SILT LOAMS, 3 TO 8 PERCENT SLOPES	0.37	D	YES
DeB	DUFFIELD-RYDER SILT LOAMS, 3 TO 8 PERCENT SLOPES	0.37	B	YES
HcB	HAGERSTOWN-OPEQUON SILTY CLAY LOAMS, 3 TO 8 PERCENT SLOPES, ROCKY	0.37	B	YES
KeC	KLINESVILLE VERY CHANNERY LOAM, 8 TO 15 PERCENT SLOPES	0.2	D	NO
KeD	KLINESVILLE VERY CHANNERY LOAM, 15 TO 25 PERCENT SLOPES	0.2	D	NO
KrF	KLINESVILLE-ROCK OUTCROP COMPLEX, 25 TO 65 PERCENT SLOPES	0.2	D	NO
LsA	LINDSIDE SILT LOAM, 0 TO 3 PERCENT SLOPES	0.37	C	YES
PaB	PENN LOAM, 3 TO 8 PERCENT SLOPES	0.32	B	NO
PrB	PENN-REAVILLE SILT LOAMS, 3 TO 8 PERCENT SLOPES	0.32	B	NO
RgB	READINGTON SILT LOAM, 3 TO 8 PERCENT SLOPES	0.37	C	YES
RwA	ROWLAND SILT LOAM, 0 TO 3 PERCENT SLOPES	0.37	C	YES
SpB	SPRINGWOOD GRAVELLY LOAM, 3 TO 8 PERCENT SLOPES	0.24	C	NO



PLAN VIEW
NOT TO SCALE



SECTION A - A'
NOT TO SCALE



SECTION B - B'
NOT TO SCALE

9 LOG VANE
NOT TO SCALE

*NOTE: SEE CROSS-SECTION GEOMETRY TABLE FOR CHANNEL DIMENSIONS AND SLOPES.

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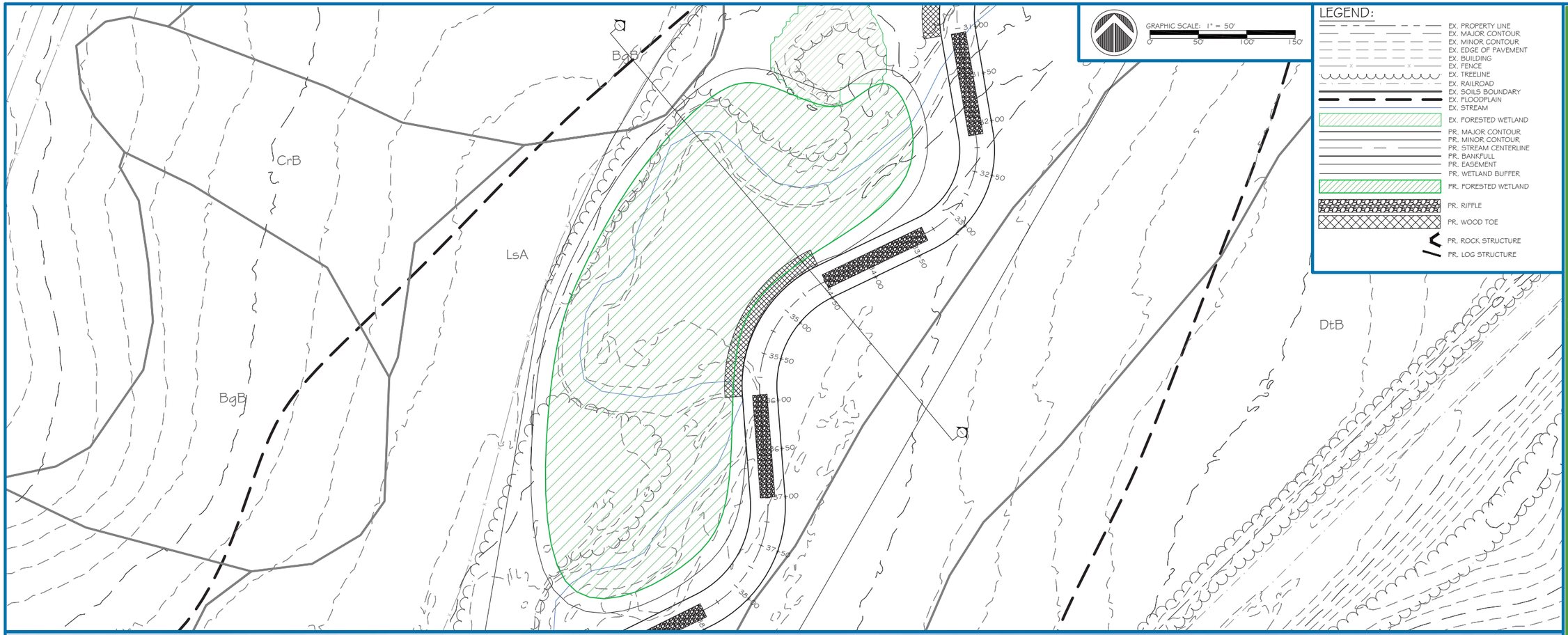

XS 1-1

GRAPHIC SCALE: 1" = 10'
0
20
30
40

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PROJECT: TUSCARORA CREEK PHASE I MITIGATION PLAN

STREAM DETAILS

FREDERICK COUNTY, MARYLAND

REVISIONS:
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PROJECT STATUS:
02/17/2020 CONCEPT PLAN

PROJECT MANAGER:	RC
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DRAWN:	KH
JOB NUMBER:	102055
DESIGN TYPE:	CONCEPT PLAN
DATE:	02/17/2020
SHEET NO:	9 OF 9

RFP-4: CABIN BRANCH

I-495 & I-270 Managed Lanes Study Wetland & Stream Mitigation - Cabin Branch
MDOT SHA Contract# AZ0485172-A

The following is a summarized PHASE I Mitigation Plan for the Cabin Branch Stream and Wetland Mitigation Site. This summary includes project areas detailed in GreenVest 404's July 17, 2019 Volume II -Technical Proposal submitted in response to RFP Full Delivery Stream and Wetland Mitigation Services, Solicitation No. AZ0485172 as well as supplemental mitigation areas requested by MDOT|SHA.

Existing Conditions Summary

Location Information

County: Anne Arundel

Federal HUC-8 Watershed: Patuxent (0206006)

MDE 8-digit Watershed: Patuxent River Middle watershed (02131102)

Coordinates: 38.810642, -76.645949

Location: Greenock Road, Lothian, MD 20711

Property Ownership: The proposed restoration reaches within the Wilson Owens Branch and Cabin Branch are contiguous reaches on one "site" that traverses several adjacent parcels. The project area contains 10 parcels under private ownership located near a watershed divide (Greenock Road) and includes stream and wetland creation within two 12-digit subwatersheds, Wilson Owens Branch-Patuxent River (020600060403) and Lyons Creek (hereafter referred to as Cabin Branch – 020600060501).

Parcel Areas:

Map ID	Total Acres	Map ID	Total Acres
3	98.89	11	31.20
6	12.69	13	25.31
8	10.36	20	14.68
10a	24.50	21	86.03
10b	3.10	31	182.09

Drainage Area: Wilson Owens Branch 0.88 square miles
Cabin Branch 1.27 square miles

Stream Use Class: I

Existing Land Use: Historic and present land use within a half mile of the project area is a mix of forest and agriculture, primarily horse pasture (Maryland Department of Planning 1973). Current land use now consists of very low and low-density residential, forest, agricultural areas, and a golf course. Cabin Branch and Wilson Owens Branch and their tributaries and related floodplains are not protected from stormwater runoff and have been manipulated over the years (including ditching and draining), resulting in significant bed/bank form alteration and functional impairment.

Constraints: None

I-495 & I-270 Managed Lanes Study Wetland & Stream Mitigation - Cabin Branch
MDOT SHA Contract# AZ0485172-A

Mapped Soils:

Soil	*Soil Description*	*Drainage Class*	*Hydric Rating*	*K-factor*	*Parent Material*
DfB	Dodon very fine sandy loam, 2-5% slopes	Moderately well drained	Non-hydric	0.32	loamy fluviomarine deposits
DfC	Dodon very fine sandy loam, 5-10% slopes	Moderately well drained	Non-Hydric	0.32	loamy fluviomarine deposits
MaB	Marr-Dodon complex, 2-5% slopes	Well drained	Non-Hydric	0.20	loamy fluviomarine deposits
MaC	Marr-Dodon complex, 5-10% slopes	Well drained	Non-Hydric	0.20	loamy fluviomarine deposits
MaD	Marr-Dodon complex 10-15% slopes	Well drained	Non-Hydric	0.20	loamy fluviomarine deposits
MDE	Marr and Dodon soils, 15-25% slopes	Well drained	Non-Hydric	0.20	loamy fluviomarine deposits
MDF	Marr and Dodon soils, 25-40% slopes	Well drained	Non-Hydric	0.20	loamy fluviomarine deposits
WBA	Widewater and Issue soils, 0-2% slopes, frequently flooded	Poorly drained	Partially Hydric	0.37	loamy alluvium

Description:

The Cabin Branch Stream and Wetland Mitigation Project contains several degraded stream reaches and non-tidal wetlands that have been altered over time as Wilson Owens Branch and Cabin Branch have downcut. The incised channels have disconnected the stream reaches from their respective floodplains and have lowered the seasonal high groundwater table within the stream's zone of influence, negatively affecting the hydroperiod in the adjacent wetlands. The alterations in hydroperiod and hydrology have negatively impacted the structure, composition, and functions of these floodplain wetlands. Headcuts are actively migrating upstream and laterally along the length of the proposed restoration project. If these channels are not restored and stabilized, it will result in further impairment and degradation in the existing forested wetlands and agricultural fields.

No Tier II waters were identified in the study area; however, Cabin Branch and Wilson Owens Branch are located within a Tier II catchment basin. According to the Maryland 303(d) list of impaired waterways, the Patuxent River Middle watershed is listed as Category 5 – impaired for sulfates and total suspended solids downstream of the project area.

According to the Water Resources Registry, the CBSWMP site has been identified as:

- Riparian Preservation and Restoration,
- Stormwater Natural Infrastructure Preservation,
- Stormwater Compromised Infrastructure Restoration,
- Upland Preservation and Restoration,
- Wetland Preservation and Restoration, and
- Part of the Biodiversity Conservation Network.

The Cabin Branch portion of the project area is a Targeted Ecological Area, includes Preservation and Gaps in the Green Infrastructure plan, is a Maryland Tier II Catchment, and is included under Anne Arundel County's MS4 Phase I permit.

The existing riparian buffer along the streams targeted for restoration are narrow and, in some places, non-existent with agricultural land or fairways adjoining the channels. In general, trees within the forested areas of the site are in good to fair condition. The understory within these areas is a combination of woody shrubs and herbaceous vegetation, including varying degrees of invasive species cover.

Please note that the CBSWMP project contains two distinct contiguous reaches; contiguous reaches being preferred by MDE and the ACOE for mitigation. Other desirable characteristics of these projects include:

- The stream restoration, wetland creation, and preservation will re-integrate these aquatic system components resulting in significant functional uplift;
- The site possesses excellent accessibility and constructability with direct access from Greenock Road and Mt. Zion Marlboro Road;
- Sufficient open space is available for efficient staging and stockpiling of material;
- The site's current context and watershed conditions support technically feasibility and self-maintaining restoration; and
- The site meets specific objectives of the MDE's Prioritizing Sites for Wetland Restoration, Mitigation and Preservation in Maryland.

The CBSWMP possesses the necessary chemical, physical, and biological composition; lacks ecological, cultural and historic constraints; and complies with the site selection criteria of the Federal Rules on Compensatory Mitigation at 33 CFR 332 as overseen and regulated by the U.S. Army Corps of Engineers and the rules, policy and guidance authorized under the Maryland Nontidal Wetlands Protection Act as overseen and regulated by MDE, as well as Section 106 of the National Historic Preservation Act, Federal Aviation Administration (FAA) Advisory Circular (No. 150/5200-33B) and the State/Federal Endangered Species Acts.

I-495 & I-270 Managed Lanes Study Wetland & Stream Mitigation - Cabin Branch
MDOT SHA Contract# AZ0485172-A

Summary of Opportunities

Proposed Mitigation Type	*Proposed Area/Length*	*Mitigation Credit Ratio*	*Units*
Wetland (PFO) Enhancement	14.23	5:1	2.85
Wetland Creation	4.00	1:1	4.00
Wetland Preservation	18.19	10:1	1.82
Wetland Buffer Enhancement	7.60	15:1	0.51
Wetland Mitigation Total	**44.03**		**9.18**
Stream Mitigation			
Wilson Owens - Upstream	4,683	2:1	2,342
Wilson Owens - Downstream	1,408	1:1	1,408
Cabin Branch	8,221	1:1	8,221
Stream Mitigation Total	**14,312**		**11,971**

Restoration Objectives

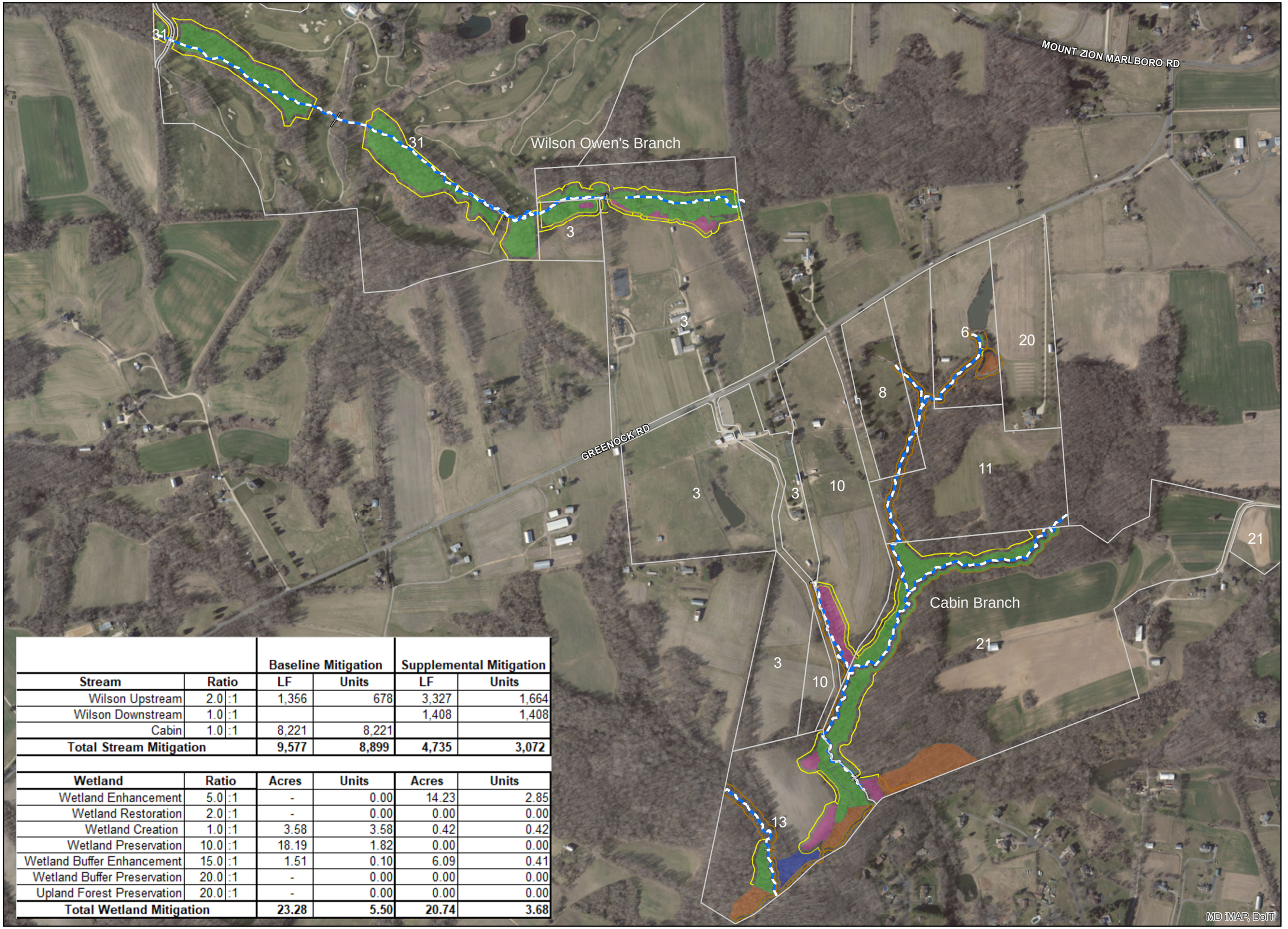
- The proposed CBSWMP includes:
  - The enhancement of 14.23 acres of non-tidal wetland;
  - The creation of 4.0 acres of non-tidal wetlands;
  - The preservation of 18.19 acres of non-tidal, forested wetlands;
  - The enhancement of 7.60 acres of non-tidal wetland buffer; and
  - 14,312 linear feet of stream restoration.
- This project as proposed will yield up to 11,971 stream and 9.18 wetland mitigation units.
- The wetland, stream, plus their respective buffer elements will be fully integrated to yield significant ecological and functional uplift.
- Additional credits may be generated during the course of the design and construction through preservation of upland forests and non-tidal, forested wetland buffers.

Restoration Concept

- The proposed design utilizes on-site materials and will iterate to find the ideal balance of impacts required to restore more frequent floodplain access.
  - Create a bank height ratio of 1.2 or less along the restored reaches to reduce shear stresses and velocities for peak flow events and allow for more frequent access to the floodplain.
  - Increase the floodplain inundation area for high frequency storm events, including a bankfull discharge (e.g. 1.25-yr recurrence interval); by increasing the entrenchment ratio to greater than 2.
  - Create stable woody debris structures that will provide habitat and mimic natural processes where it will serve to reduce channel cross sectional area through the formation of depositional features such as inside meander bars and benches. Self-sustaining depositional channel features will increase sinuosity and reduce shear stress on the channel bed and banks.

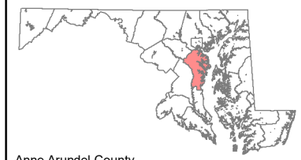
- Riparian buffers will be maintained, new wetlands will be supported by overbank flows, and invasive species will be controlled.
- Wetland enhancement will be accomplished by re-hydrating remnant hydric soils by increasing the riparian groundwater elevation and floodplain storage.
- Wetland preservation will be requested in high quality areas adjacent to proposed restoration and enhancement practices.
- If, during the course of design, borrow materials are needed during the restoration of either Cabin Branch or Wilson Owen's Branch to balance cut/fill on-site, the excavated areas create an opportunity for additional wetland creation.
- Forested floodplain habitats will be restored/enhanced through invasive species treatment and planting native trees and shrubs.

Confidential, Pre-Decisional, and Deliberative



		Baseline Mitigation		Supplemental Mitigation	
Stream	**Ratio**	**LF**	**Units**	**LF**	**Units**
Wilson Upstream	2.0 :1	1,356	678	3,327	1,664
Wilson Downstream	1.0 :1			1,408	1,408
Cabin	1.0 :1	8,221	8,221		
Total Stream Mitigation		**9,577**	**8,899**	**4,735**	**3,072**

Wetland	**Ratio**	**Acres**	**Units**	**Acres**	**Units**
Wetland Enhancement	5.0 :1	-	0.00	14.23	2.85
Wetland Restoration	2.0 :1	-	0.00	0.00	0.00
Wetland Creation	1.0 :1	3.58	3.58	0.42	0.42
Wetland Preservation	10.0 :1	18.19	1.82	0.00	0.00
Wetland Buffer Enhancement	15.0 :1	1.51	0.10	6.09	0.41
Wetland Buffer Preservation	20.0 :1	-	0.00	0.00	0.00
Upland Forest Preservation	20.0 :1	-	0.00	0.00	0.00
Total Wetland Mitigation		**23.28**	**5.50**	**20.74**	**3.68**



MDOT / SHA
Stream and Wetland Mitigation Services

Overall Mitigation Plan
Cabin Branch Stream
& Wetland Mitigation Project
Patuxent Watershed

Legend:

- Parcels
- Stream Mitigation
- Riparian Buffer
- Wetland Buffer
- Wetland Creation
- Wetland Enhancement
- Wetland Preservation
- Upland Forest Preservation

N

Feet
0 400

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Document Path: X:\Planning_Design\PROJECTS\MDOT_FD\Cabin_Branch\GIS Work\Cabin Branch Mitigation Plan w GC_Rev1.mxd

Date Figure Created: 3/12/2020

RFP-5: HENSON CREEK

I-495 & I-270 Managed Lanes Study Wetland & Stream Mitigation - Henson Creek
MDOT SHA Contract# AZ0485172-D

The following is a summary of the PHASE I Mitigation Plan submitted to MDOT SHA for the Henson Creek Stream and Wetland Mitigation Project (HSWMP). A full PHASE I Mitigation Plan is available in Volume II -Technical Proposal of GreenVest 404's response to RFP Full Delivery Stream and Wetland Mitigation Services, Solicitation No. AS0485172, dated July 17th, 2019.

Existing Conditions Summary

Location Information

County:	Prince George's
Federal HUC-8 Watershed:	Middle Potomac-Anacostia-Occoquan Federal 8-digit watershed (02070010)
MDE 8-digit Watershed:	Potomac River Upper Tidal 8-Digit Watershed (02140201)
Coordinates:	38.764802, -76.995271
Location:	9013 Livingston Rd, Fort Washington, MD 20744
Property Ownership:	The Henson Creek Stream and Wetland Mitigation Site is currently owned by Susan N. Hovermale and Carl W. Hovermale.
Parcel Areas:	The entire parcel owned by Susan and Carl Hovermale is 17.88 acres. A conservation easement will be placed on 16.36 acres.
Drainage Area:	Henson Creek Tributary, approximately 8 acres Henson Creek 21.4 square miles
Stream Use Class:	I
Existing Land Use:	Historic land use cover within a half mile of the project area was predominantly forested land, with agricultural and commercial areas (Maryland Department of Planning 1973). Today land use cover within a half mile of this site is dominated by major transportation networks, commercial, industrial, and residential development.
Constraints:	Washington Sanitary Sewer Commission easements run north to south along the western bank of Henson Creek and west to east through the parcel along the southern bank of the Henson Creek Tributary.

I-495 & I-270 Managed Lanes Study Wetland & Stream Mitigation - Henson Creek
MDOT SHA Contract# AZ0485172-D

Mapped Soils:

Soil	*Soil Description*	*Drainage Class*	*Hydric Rating*	*K-factor*	*Parent Material*
Ada	Adelphia-Holmdel complex, 0 to 2 percent slopes	Moderately well drained	Predominantly Non-Hydric (5)	0.37	Glauconite bearing loamy fluviomarine deposits
CnB	Collington-Wist complex, 2 to 5 percent slopes	Well drained	Non-Hydric (0)	0.17	Glauconite bearing loamy fluviomarine deposits
Iu	Issue-Urban land complex, occasionally flooded	Somewhat poorly drained	Predominantly Non-Hydric (10)	0.37	Loamy alluvium
SrA	Shrewsbury loam, 0 to 2 percent slopes	Poorly drained	Predominantly Hydric (85)	0.24	Glauconite bearing loamy fluviomarine deposits
UrdB	Urban land-Collington-Wist complex, 0 to 5 percent slopes	N/A	Non-Hydric (0)	N/A	N/A
WE	Widewater and Issue soils, frequently flooded	Poorly drained	Predominantly Hydric (60)	0.37	Loamy alluvium

Description:

The HSWMP will create/restore 5.03 acres of palustrine forested (PFO) wetlands, enhance 0.34 acres of existing PEM wetlands to PFO, and preserve an additional 7.07 acres of adjacent forested wetland/upland habitat. Created/restored wetlands will be integrated with the Henson Creek Mainstem, the unnamed channelized tributary (HT), and existing forested wetlands/uplands into a contiguous 14.16-acre habitat restoration/preservation project via surface water and groundwater connection. The main objective of the project's wetland elements is to restore wetland hydrology/hydroperiod, topography, vegetative structure and overall function. Function will be enhanced by integrating the wetland creation/restoration element with the stream restoration and existing forested habitat. The restoration will be accomplished by excavating to targeted wetland elevations such that groundwater will substantially contribute to the proposed hydroperiod. The proposed excavation, evaluation of current drainage area, and the contribution of more frequent bankfull discharge will support wetland hydrology and formation and/or re-establishment of hydric soils. The GVT has laid out a native planting plan to restore a forested wetland system that will meet the hydrophytic and diversity composition required under the standard IRT monitoring protocols for forested wetland sites. The planted areas will be completely enclosed in deer exclusion fencing to allow for proper establishment while promoting the maximum structural development and diversity. A proactive approach to maintenance will ensure that the restored wetlands stay on a trajectory to reaching self-maintaining equilibrium. The GVT will also implement an aggressive invasive species management program where any recolonization of invasive/non-native species will be the threshold for action.

No Tier II waters were identified in the study area. According to the Maryland 303(d) list of impaired waterways, the Potomac River Upper Tidal watershed is listed as Category 5 – impaired for chlorides, sulfates, and total suspended solids.

Please note that the HSWMP is located on one single site, which is preferred by MDE along with these other desirable characteristics:

- Portions of the site were formerly wetland and are connected to existing degraded wetlands all of which will be restored or enhanced as part of this project.
- The entire site is located within the 100-year floodplain. One of the project's objectives is to reconnect Henson Creek with this portion of its floodplain during higher frequency events by removing a levee spoil bank.
- The site possesses excellent accessibility and constructability with direct access from Livingston Road, a parking lot and open areas for efficient staging and stockpiling of material.

According to information available from the Water Resources Registry, the HSWMP site:

- Has been identified for:
  - Riparian Preservation and Restoration,
  - Stormwater Natural Infrastructure Preservation,
  - Upland Preservation and Restoration, and
  - Wetland Preservation.
- The site immediately abuts Protected Natural Areas, and
- Has been identified as a gap in the existing Green Infrastructure Plan and Biodiversity Conservation Network.

The required 25' wetland buffer will be established around the proposed creation, restoration, and enhancement areas as proposed. This site contains areas of existing forested upland and wetland all of which will be preserved as part of this project. Thus, the buffer will be comprised of enhancement and preservation. The additional preservation proposed on this highly urban site will connect the project to protected open space that flanks to the north, south and west thus extending the buffer and totality of restored/preserved habitat. The additional preservation will put the proposed restoration/creation into a more "interior" location, thus increasing its probability of reaching a self-maintain equilibrium plus increasing the function and value of the entire system. The invasive species management program discussed above shall apply to the buffer and all preserved areas on the subject site and will continue throughout the entire maintenance/monitoring period.

This site meets specific objectives of the MDE's Prioritizing Sites for Wetland Restoration, Mitigation and Preservation in Maryland. This site is located in an MDE Priority Restoration Watershed and it will specifically restore and preserve gaps in existing green infrastructure, specifically the Henson Creek Greenway Corridor which flanks the site on three sides. According to the MDE Prioritizing Sites for Wetland Restoration and Preservation, based on DNR mapping in 2006 only 602 acres of forested and 22 acres of scrub-shrub wetlands remained in this watershed. The HSWMP specifically targets restoration of forested non-tidal wetlands with a scrub-shrub component. Further, the State's Clean

Water Action Plan classifies this watershed as Category I for not meeting clean water and other natural resource goals, and it is therefore in need of restoration. Stormwater management is a specific objective set for this watershed, and among other functions this project will provide functional uplift in nutrient cycling, and sediment trapping/sequestration.

The HSWMP site possesses the necessary chemical, physical and biological composition; lacks ecological, cultural and historic constraints; and complies with the site selection criteria of the Federal Rules on Compensatory Mitigation at 33 CFR 332 as overseen and regulated by the USACE and the rules, policy and guidance authorized under the Maryland Non-Tidal Wetlands Protection Act as overseen and regulated by MDE, as well as Section 106 of the National Historic Preservation Act, Federal Aviation Administration (FAA) Advisory Circular (No. 150/5200-33B) and the State/Federal Endangered Species Acts.

Summary of Opportunities

Proposed Mitigation Type	*Proposed Area/Length*	*Mitigation Type to Mitigation Credit Ratio*	*Credits*	*Units*
Wetland Restoration/Creation (PFO)	5.03	1:1	5.03	Acres
Wetland Enhancement (PFO) Resulting in Significant Functional Uplift	0.34	1.5:1	0.23	Acres
Wetland Preservation (PFO)	4.05	10:1	0.41	Acres
Wetland Buffer Enhancement	0.50	15:1	0.03	Acres
Wetland Buffer Preservation	0.44	20:1	0.02	Acres
Upland Preservation	2.58	20:1	0.13	Acres
		Sub-total Wetland	**5.85**	**Acres**
Stream Restoration (Trib)	558	1:1	558.0	Linear Feet
Stream Restoration (Henson Creek)	1,066	2:1	533.0	Linear Feet
		Sub-Total Stream	**1,091**	**Linear Feet**

Restoration Objectives

- The main objective of the project's wetland elements is to restore wetland hydrology/hydroperiod, topography, vegetative structure and overall function. Function will be enhanced by integrating the wetland creation/restoration element with the stream restoration and existing forested habitat.

Restoration Concept

- The proposed design for the Henson Creek Tributary realigns and integrates the channel with the proposed wetland creation/restoration providing an additional source of hydrology where each element will then add habitat complexity for the other.

- Restoration work along the main stem of Henson Creek involves removal of the left bank levee to allow for reconnection of the channel at frequent storm events to the left floodplain and proposed wetland restoration/creation.
- Create a bank height ratio of 1.2 or less along the restored reaches to reduce shear stresses and velocities for peak flow events and allow for more frequent access to the floodplain.
- Increase the floodplain inundation area for high frequency storm events, including a bankfull discharge (e.g. 1.25-yr recurrence interval); by increasing the entrenchment ratio to greater than 2.
- Wetland creation will be accomplished through excavation of fill material to establish, reestablish, and enhance targeted wetland hydroperiod approximating both historic conditions and those of surrounding reference wetlands. Specifically, the large area currently mowed for the driving range will be excavated between 1' and 2'+/-. Microtopographic variation (hummock/hollow) will be created along with a shallow topographic depression design to hold shallow water after storm events to augment hydrology as well as habitat diversity. Proposed elevations will be within one foot of the proposed ground surface elevations for a portion of the growing season (at least 14 consecutive days).
- Riparian buffers will be maintained, new wetlands will be supported by overbank flows, and invasive species will be controlled.
- Wetland preservation may be requested in high quality areas adjacent to proposed restoration and enhancement practices.
- Wetland enhancement may be requested in currently margin areas if functional uplift can be documented either hydrologically or through invasive species control and supplemental planting.
- Restore forested floodplain habitat by invasive species treatment and planting native trees and shrubs.

Confidential, Pre-Decisional, and Deliberative

RFP FULL DELIVERY STREAM & WETLAND MITIGATION SERVICES
Solicitation No. AZ0485172
HENSON CREEK STREAM & WETLAND MITIGATION PROJECT

GENERAL NOTES

1. ELEVATIONS AND EXISTING CONDITIONS ARE BASED ON AVAILABLE GIS, FIELD OBSERVATIONS, AND MINOR NON-DATUM SURVEY.
2. NO WETLAND DELINEATION, FOREST STAND DELINEATION, OR TOPOGRAPHIC SURVEY HAS BEEN PERFORMED.

MITIGATION SUMMARY

STREAM ENHANCEMENT: 1,066 LF.

STREAM RESTORATION: 558 LF.

STREAM BUFFER: 1.20 AC.

UPLAND / WETLAND PRESERVATION: 2.58 AC.

WETLAND BUFFER ENHANCEMENT: 0.50 AC.

WETLAND CREATION: 5.03 AC.

WETLAND ENHANCEMENT: 0.34 AC.

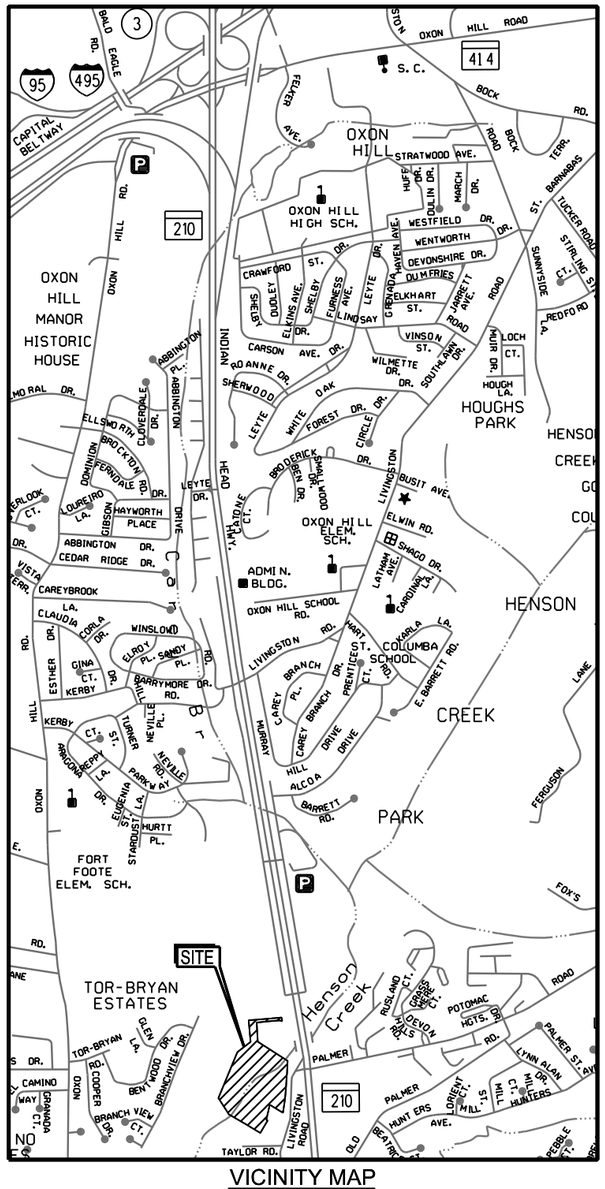
WETLAND PRESERVATION : 4.05 AC.

WETLAND PRESERVATION BUFFER : 0.44 AC.

TOTAL ACRES: 14.16

LEGEND

- EX. CONTOUR
- EX. STORM DRAIN
- EX. SANITARY SEWER
- EX. MANHOLE
- EX. STREAM CENTERLINE
- EX. WOODS LINE
- PROPERTY LINE
- SUBJECT PROPERTY LINE
- EASEMENT LINE
- EX. NON-TIDAL WETLAND
- WUS — WATERS OF THE U.S.
- FP — EX. 100-YR FLOODPLAIN
- LOD — LIMIT OF DISTURBANCE
- PROP. EASEMENT
- 20 — PROP. CONTOUR
- PROP. WETLAND CREATION
- PROP. WETLAND BUFFER ENHANCEMENT
- PROP. WETLAND ENHANCEMENT
- PROP. WETLAND PRESERVATION
- PROP. WETLAND PRESERVATION BUFFER
- PROP. UPLAND / WETLAND PRESERVATION
- PROP. STREAM RESTORATION
- PROP. STREAM BUFFER



VICINITY MAP
SCALE: 1" = 2000'

SHEET INDEX

BEST MANAGEMENT PRACTICES FOR WORKING IN NONTIDAL WETLANDS, WETLAND BUFFERS, WATERWAYS, AND 100-YEAR FLOODPLAINS

1. NO EXCESS FILL, CONSTRUCTION MATERIAL, OR DEBRIS SHALL BE STOCKPILED OR STORED IN NONTIDAL WETLANDS, NONTIDAL WETLAND BUFFERS, WATERWAYS, OR THE 100-YEAR FLOODPLAIN.
2. PLACE MATERIALS IN A LOCATION AND MANNER WHICH DOES NOT ADVERSELY IMPACT SURFACE OR SUBSURFACE WATER FLOW INTO OR OUT OF NONTIDAL WETLANDS, NONTIDAL WETLAND BUFFERS, WATERWAYS, OR THE 100-YEAR FLOODPLAIN.
3. DO NOT USE THE EXCAVATED MATERIAL AS BACKFILL IF IT CONTAINS WASTE METAL PRODUCTS, UNSIGHTLY DEBRIS, TOXIC MATERIAL, OR ANY OTHER DELETERIOUS SUBSTANCE. IF ADDITIONAL BACKFILL IS REQUIRED, USE CLEAN MATERIAL FREE OF WASTE METAL PRODUCTS, UNSIGHTLY DEBRIS, TOXIC MATERIAL, OR ANY OTHER DELETERIOUS SUBSTANCE.
4. PLACE HEAVY EQUIPMENT ON MATS OR SUITABLY OPERATE THE EQUIPMENT TO PREVENT DAMAGE TO NONTIDAL WETLANDS, NONTIDAL WETLAND BUFFERS, WATERWAYS, OR THE 100-YEAR FLOODPLAIN.
5. REPAIR AND MAINTAIN ANY SERVICEABLE STRUCTURE OR FILL SO THERE IS NO PERMANENT LOSS OF NONTIDAL WETLANDS, NONTIDAL WETLAND BUFFERS, OR WATERWAYS, OR PERMANENT MODIFICATION OF THE 100-YEAR FLOODPLAIN IN EXCESS OF THAT LOST UNDER THE ORIGINALLY AUTHORIZED STRUCTURE OR FILL.
6. RECTIFY ANY NONTIDAL WETLANDS, WETLAND BUFFERS, WATERWAYS, OR 100-YEAR FLOODPLAIN TEMPORARILY IMPACTED BY ANY CONSTRUCTION.
7. ALL STABILIZATION IN THE NONTIDAL WETLAND AND NONTIDAL WETLAND BUFFER SHALL CONSIST OF THE FOLLOWING SPECIES: ANNUAL RYEGRASS (LOLIUM MULTIFLORUM), MILLET (SETARIA ITALICA), BARLEY (HORDEUM SP.), OATS (UNIOLA SP.), AND/OR RYE (SECALE CEREALE). THESE SPECIES WILL ALLOW FOR THE STABILIZATION OF THE SITE WHILE ALSO ALLOWING FOR THE VOLUNTARY REVEGETATION OF NATURAL WETLAND SPECIES. OTHER NON-PERSISTENT VEGETATION MAY BE ACCEPTABLE, BUT MUST BE APPROVED BY THE NONTIDAL WETLANDS AND WATERWAYS DIVISION. KENTUCKY 31 FESCUE SHALL NOT BE UTILIZED IN WETLAND OR BUFFER AREAS. THE AREA SHOULD BE SEEDED AND MULCHED TO REDUCE EROSION AFTER CONSTRUCTION ACTIVITIES HAVE BEEN COMPLETED.
8. AFTER INSTALLATION HAS BEEN COMPLETED, MAKE POST-CONSTRUCTION GRADES AND ELEVATIONS THE SAME AS THE ORIGINAL GRADES AND ELEVATIONS IN TEMPORARILY IMPACTED AREAS.
9. TO PROTECT AQUATIC SPECIES, IN-STREAM WORK IS PROHIBITED AS DETERMINED BY THE CLASSIFICATION OF THE STREAM:

   USE I WATERS: IN-STREAM WORK SHALL NOT BE CONDUCTED DURING THE PERIOD MARCH 1 THROUGH JUNE 15, INCLUSIVE, DURING ANY YEAR.

10. STORMWATER RUNOFF FROM IMPERVIOUS SURFACES SHALL BE CONTROLLED TO PREVENT THE WASHING OF DEBRIS INTO THE WATERWAY.
11. CULVERTS SHALL BE CONSTRUCTED AND ANY RIPRAP PLACED SO AS NOT TO OBSTRUCT THE MOVEMENT OF AQUATIC SPECIES, UNLESS THE PURPOSE OF THE ACTIVITY IS TO IMPOUND WATER.

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DATE	JULY 2019
SCALE	AS SHOWN
DESIGNED BY	SL
DRAWN BY	CD

RFP FULL DELIVERY STREAM & WETLAND MITIGATION SERVICES
Solicitation No. AZ0485172
HENSON CREEK STREAM & WETLAND MITIGATION PROJECT
TITLE SHEET
PRINCE GEORGE'S COUNTY, MARYLAND

DRAWING NO. TI-01
SHEET 1 OF 9
KCI JOB NUMBER xxxxxxxx.xx

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HENSON CREEK

HENSON TRIBUTARY

E 1,312,950
N 399,650

E 1,312,950
N 400,950

20' WIDE RIGHT OF WAY

LEVEE +22'

21.8
22.3
20.9
21.9
20.1

GW2
GROUND
20.1

WSEL
16.6

20.1
WSEL
17.8

40' WIDE RIGHT OF WAY

EX. 42" SAN.

22.4

GW3
GROUND 19.7
GROUNDWATER 18.3

N 399,650
E 1,313,400

EX. 60" DIA. CMP

23.9
INV.
18.1

GW1
GROUND
21.0

HOVERMALE'S TASTES BEST ICE CREAM

DRIVING RANGE

20' WIDE RIGHT OF WAY

EX. 10" SAN.

LIVINGSTON RD.

0 50 100
SCALE: 1" = 100'

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SCALE	1" = 100'
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HENSON CREEK STREAM & WETLAND MITIGATION PROJECT
EXISTING CONDITIONS
PRINCE GEORGE'S COUNTY, MARYLAND

DRAWING NO.
EX-01
SHEET 2 OF 9
KCI JOB NUMBER
xxxxxxxx.xx

GRADE LEVEE DOWN FROM 22' TO 20-21'-BF.

HENSON CREEK

STEAM BUFFER 1.20 AC.

OVERFLOW AT LESS THAN BF-19.5' ELEV.

E 1,312,950

N 399,650

20' WIDE RIGHT OF WAY

WETLAND PRESERVATION BUFFER 0.44 AC.

WETLAND ENHANCEMENT 0.34 AC.

EXCAVATE WITH MICROGRADING FROM 20' TO ELEV. -18.5' TO 19'

WETLAND CREATION 5.03 AC.

E 1,312,950

N 400,950

40' WIDE RIGHT OF WAY

TRIBUTARY

N 399,650

EX. 60" DIA. CMP

E 1,313,400

234 LF BANK GRADING AND WOODY TOE STABILIZATION

HENSON TRIBUTARY

WETLAND PRESERVATION 4.05 AC.

600 LF STREAM RESTORATION: REMOVE CMP CULVERT; REALIGN AND GRADE IN BENCHES FOR TRIB. WBF=8: RC=24; INV. 17 TO 18; BF= 18.5 TO 19.5

WETLAND BUFFER ENHANCEMENT 0.50 AC.

UPLAND/WETLAND PRESERVATION 2.58 AC.

PROPOSED EASEMENT

LIVINGSTON RD.

ACCESS AND STAGING AREA

0 50 100

SCALE: 1" = 100'

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DATE: JULY 2019
SCALE: 1" = 100'
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RFP FULL DELIVERY STREAM & WETLAND MITIGATION SERVICES
Solicitation No. AZ0485172
HENSON CREEK STREAM & WETLAND MITIGATION PROJECT
SITE PLAN
PRINCE GEORGE'S COUNTY, MARYLAND

DRAWING NO. SP-01
SHEET 3 OF 9
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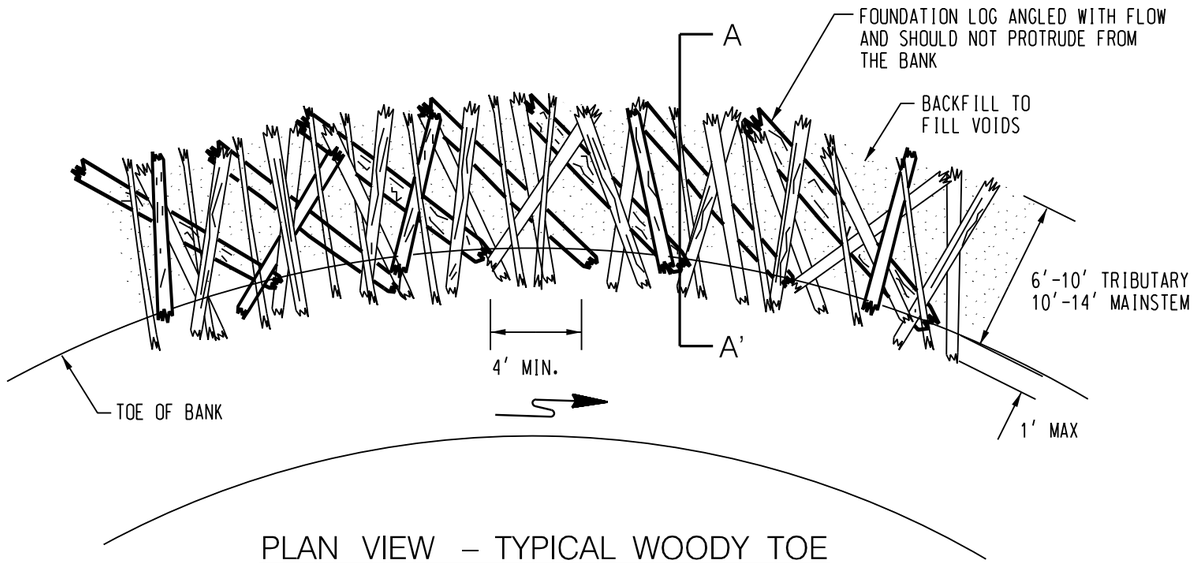

PLAN VIEW – TYPICAL WOODY TOE

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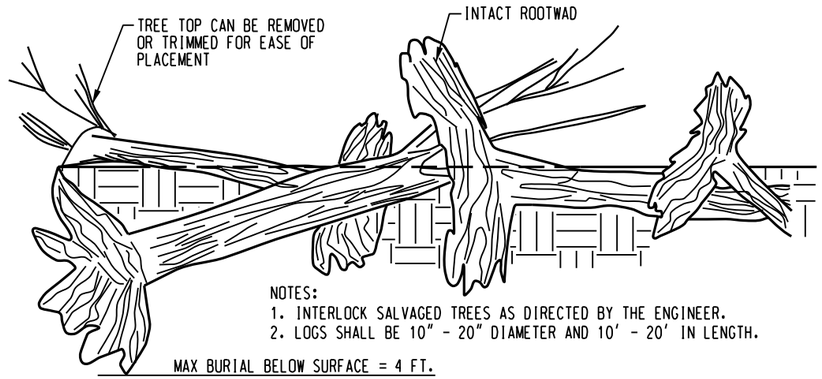

WOODY DEBRIS PLUG

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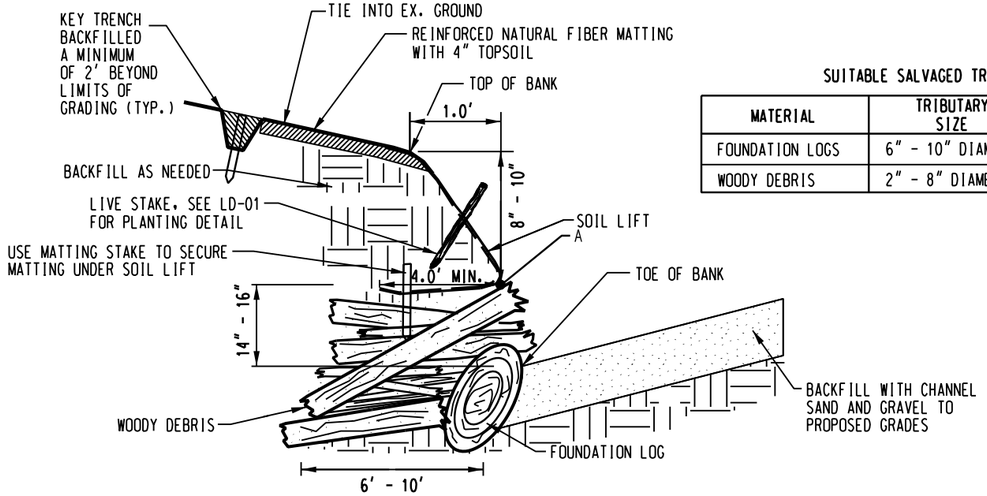


SUITABLE SALVAGED TREE MATERIALS

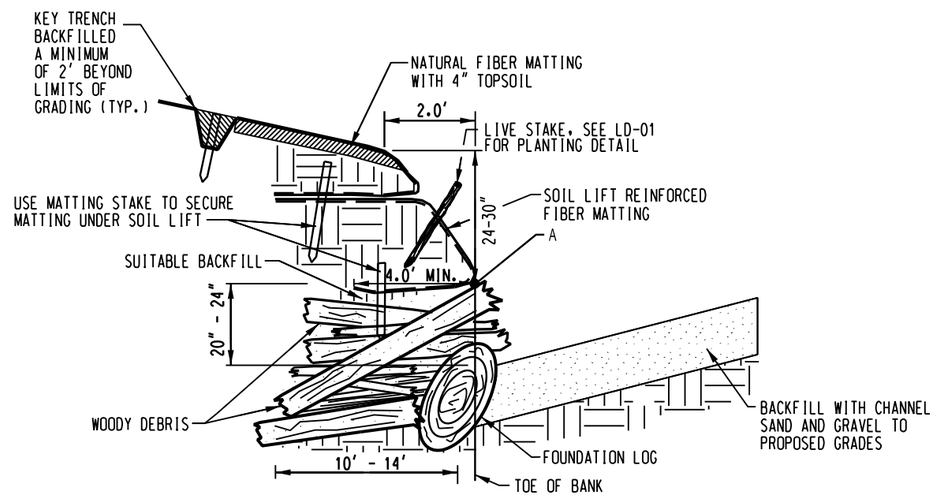
MATERIAL	TRIBUTARY SIZE	MAINSTEM SIZE
FOUNDATION LOGS	6" - 10" DIAMETER	10" - 14" DIAMETER
WOODY DEBRIS	2" - 8" DIAMETER	2" - 8" DIAMETER

CROSS SECTION A–A' TYPICAL WOODY TOE TRIBUTARY

NOT TO SCALE

NOTES:

1. SUITABLE TREE MATERIALS INCLUDING TRUNKS, TOPS, AND LIMBS, SHALL BE SALVAGED FOR USE IN TOE WOOD APPLICATIONS AS APPROVED BY THE ENGINEER.
2. FOUNDATION LOGS SHALL BE ANGLED WITH THE FLOW TO THE BANK AND EXTEND THE FULL WIDTH OF THE FILL SECTION. ORIENT FOUNDATION LOG SLIGHTLY DOWNSTREAM APPROXIMATELY 30 DEGREES FROM TANGENT TO THE BASELINE. ANGLE VARIES WITH BASELINE CURVATURE.
3. WOODY DEBRIS MATERIAL SHALL BE PLACED RANDOMLY ON FOUNDATION LOGS AND PRESSED FLAT WITH THE BUCKET UNTIL THE FINAL DEPTH OF MATERIAL IS REACHED (SEE SECTION A-A').
4. FILL VOIDS WITH SUITABLE BACKFILL MATERIAL. ENSURE THAT VOIDS ARE FILLED BEFORE PLACING SOIL LIFT.
5. INSTALL SOIL LIFT WITH REINFORCED NATURAL FIBER MATTING.



CROSS SECTION A–A' TYPICAL WOODY TOE MAINSTEM

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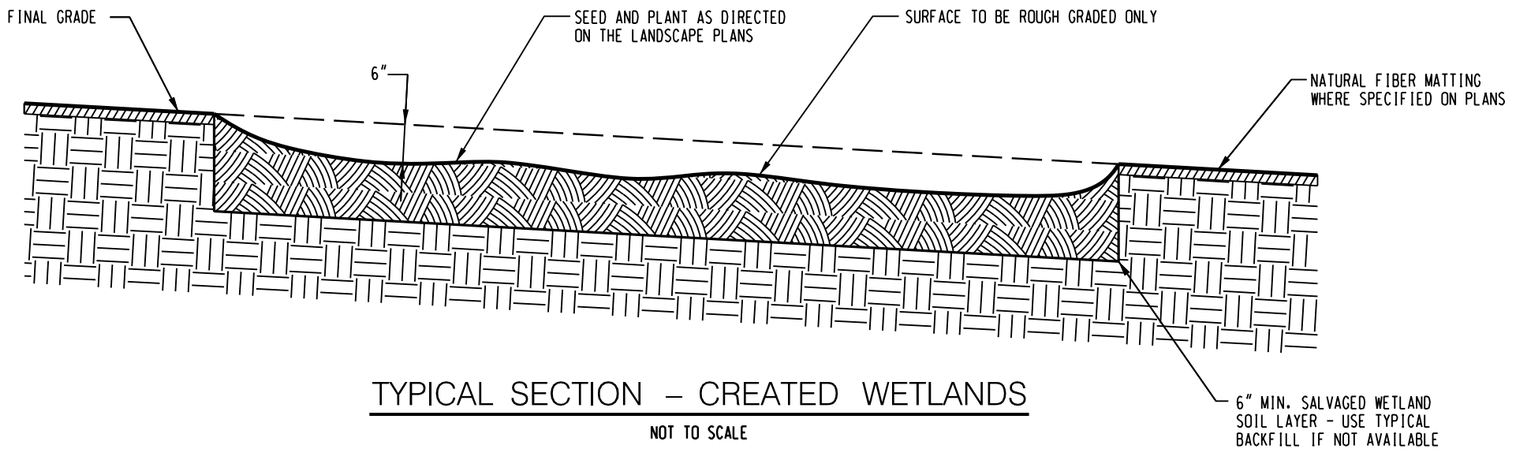
RFP FULL DELIVERY STREAM & WETLAND MITIGATION SERVICES
Solicitation No. AZ0485172
HENSON CREEK STREAM & WETLAND MITIGATION PROJECT
DETAILS
PRINCE GEORGE'S COUNTY, MARYLAND

DRAWING NO. DE-01
SHEET 4 OF 9
KCI JOB NUMBER xxxxxxxx.xx



TYPICAL SECTION – CREATED WETLANDS

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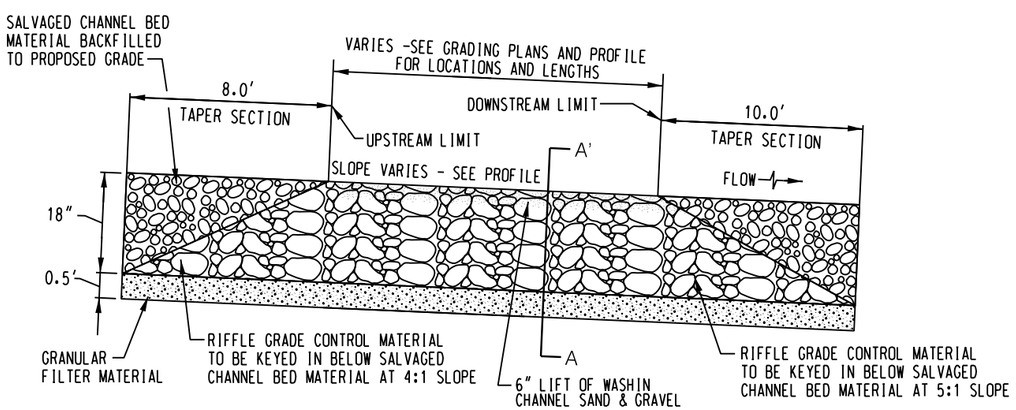
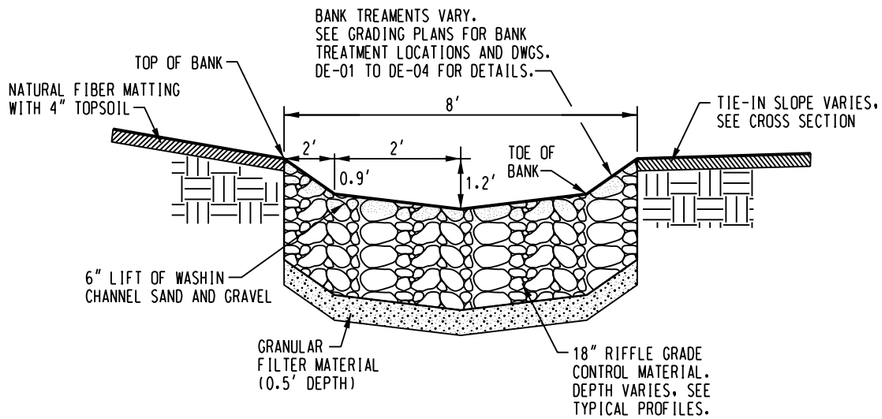


TYPICAL RIFFLE GRADE CONTROL MAINSTEM – PROFILE

NOT TO SCALE



TYPICAL RIFFLE CROSS SECTION A–A'

NOT TO SCALE

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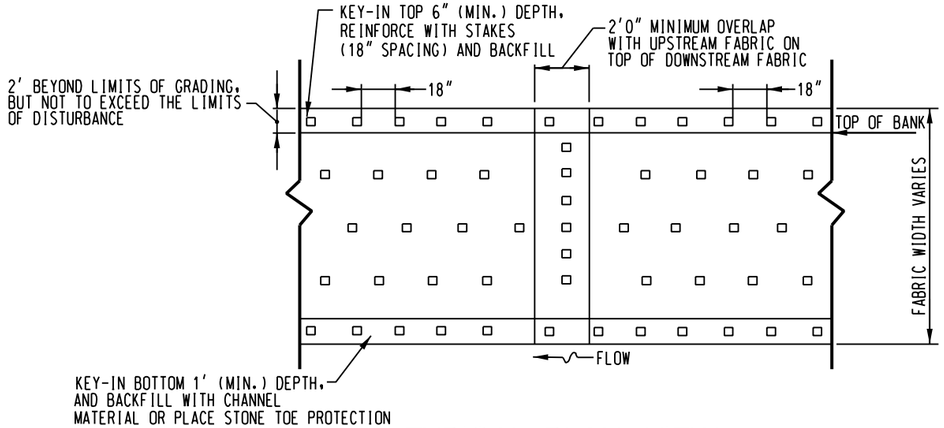
DATE: JULY 2019
SCALE: NOT TO SCALE
DESIGNED BY: SL
DRAWN BY: CD

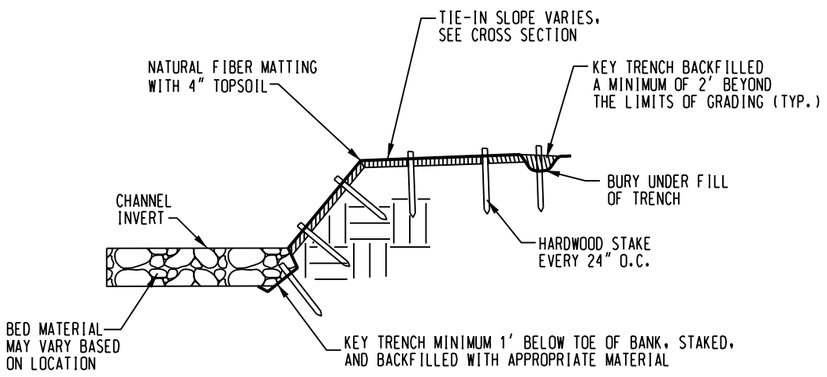
RFP FULL DELIVERY STREAM & WETLAND MITIGATION SERVICES
Solicitation No. AZ0485172
HENSON CREEK STREAM & WETLAND MITIGATION PROJECT
DETAILS
PRINCE GEORGE'S COUNTY, MARYLAND

DRAWING NO. DE-02
SHEET 5 OF 9
KCI JOB NUMBER xxxxxxxx.xx



TYPICAL PLAN VIEW NATURAL FIBER MATTING AND REINFORCED NATURAL FIBER MATTING

NOT TO SCALE



NATURAL FIBER MATTING CROSS SECTION

NOT TO SCALE

NOTES FOR NATURAL AND REINFORCED NATURAL FIBER MATTING:

1. NATURAL FIBER MATTING TO BE ROLLED LENGTHWISE ALONG STREAMBANK EXTENDING TO THE BOTTOM OF TOE PROTECTION AND A MINIMUM OF TWO FEET PAST THE LIMITS OF GRADING. IF MORE THAN ONE ROLL IS REQUIRED, MID-BANK OVERLAP SHOULD BE A MINIMUM OF ONE FOOT AND SECURELY FASTENED WITH STAKES. AT TRANSITION BETWEEN NATURAL FIBER MATTING AND REINFORCED NATURAL FIBER MATTING, MATTING SHOULD BE OVERLAPPED TWO FEET AND SECURELY FASTENED WITH STAKES.

2. NATURAL FIBER MATTING IS TO BE INSTALLED ON ALL GRADED SLOPES, HIGHLY ERODIBLE SOILS (SEE SHEET 2), AND WETLAND AREAS.

3. NATURAL FIBER MATTING. MATTING FOR THE BANK TREATMENT AREAS SHALL CONSIST OF A MACHINE PRODUCED MAT OF DEGRADABLE NATURAL FIBERS AND SHALL MEET THE FOLLOWING MINIMUM SPECIFICATIONS:

   MATERIAL: WOVEN COIR FIBER YARN OR TWINE
   THICKNESS: 0.25 IN.
   ELONGATION (DRY/WET): 29%/35%
   WEIGHT: 20 OZ/SY
   OPEN AREA: 50%
   SIZE: 6 FT. WIDE X 150 FT IN LENGTH (100 SY PER ROLL)
   SHEAR STRESS: 2.0 LBS/SQ FT
   FLOW VELOCITY: 8 FT./SEC.
   LIFE EXPECTANCY: 3 YEARS

4. REINFORCED NATURAL FIBER MATTING. MATTING FOR ALTERNATING ROUGHNESS AND WOODY TOE SHALL CONSIST OF A DOUBLE-LAYERED BIODEGRADABLE FABRIC: A BOTTOM LAYER OF JUTE FABRIC AND A TOP LAYER OF HIGH STRENGTH COIR MATTING, CONNECTED TOGETHER. REINFORCED NATURAL FIBER MATTING SHALL MEET THE FOLLOWING MINIMUM SPECIFICATIONS:

   MATERIALS: WOVEN COIR FIBER (TOP LAYER) AND JUTE FABRIC (BOTTOM LAYER)
   THICKNESS: 0.35 IN.
   ELONGATION (DRY/WET): 30%/26% (TOP LAYER) AND 8%/9% (BOTTOM LAYER)
   WEIGHT: 33.3 OZ/SY
   PERMEABILITY: 1.03 IN/SEC
   SHEAR STRESS: 4.5 LBS/SQ FT
   FLOW VELOCITY: 12 FT/SEC

5. REINFORCED NATURAL FIBER MATTING SHOULD BE PLACED AS INDICATED ABOVE IN #1.

6. MATTING STAKES. STAKES FOR SECURING THE MATTING ALONG OTHER PORTIONS OF THE MATTING MATERIAL ABOVE THE TOE TRENCH AND FOR THE KEY-IN TRENCH AT THE TOP OF THE SLOPE SHALL CONSIST OF 1-1/2" X 1-1/2" HARDWOOD STAKES, 18-INCHES IN LENGTH, TAPERED AT THE BOTTOM END FOR EASY INSERTION INTO THE SOIL AND FLAT AT THE TOP END FOR HAMMERING.

   SHEAR STRESS: 4.5 LBS/SQ FT
   FLOW VELOCITY: 12 FT./SEC.
   LIFE EXPECTANCY: 3 YEARS IN REINFORCED NATURAL FIBER MATTING

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DETAILS
PRINCE GEORGE'S COUNTY, MARYLAND

DRAWING NO. DE-03
SHEET 6 OF 9
KCI JOB NUMBER xxxxxxxx.xx

MASTER PLANT SCHEDULE

WETLAND CREATION & WETLAND ENHANCEMENT ZONE

(230,088 SQ FT /5.28 AC)

Qty	Botanical Name	Common Name	Size / Form	Spacing/Rate
TREES				
125	Betula nigra	River Birch	#1 Container	10' O.C.
125	Platanus occidentalis	Sycamore	#1 Container	10' O.C.
125	Quercus bicolor	Swamp White Oak	#1 Container	10' O.C.
125	Quercus palustris	Pin Oak	#1 Container	10' O.C.
125	Quercus phellos	Willow Oak	#1 Container	10' O.C.
125	Salix nigra	Black Willow	#1 Container	10' O.C.
125	Betula nigra	River Birch	Bare root	10' O.C.
125	Platanus occidentalis	Sycamore	Bare root	10' O.C.
125	Quercus bicolor	Swamp White Oak	Bare root	10' O.C.
125	Quercus palustris	Pin Oak	Bare root	10' O.C.
125	Quercus phellos	Willow Oak	Bare root	10' O.C.
125	Salix nigra	Black Willow	Bare root	10' O.C.
SHRUBS				
206	Cephalanthus occidentalis	Common Buttonbush	#1 Container	6'-8' O.C.
206	Ilex verticillata	Winterberry	#1 Container	6'-8' O.C.
206	Magnolia virginiana	Sweetbay magnolia	#1 Container	6'-8' O.C.
206	Sambucus nigra 'canadensis'	Common elderberry	#1 Container	6'-8' O.C.
206	Cephalanthus occidentalis	Common Buttonbush	Bare root	6'-8' O.C.
206	Ilex verticillata	Winterberry	Bare root	6'-8' O.C.
206	Magnolia virginiana	Sweetbay magnolia	Bare root	6'-8' O.C.
206	Sambucus nigra 'canadensis'	Common elderberry	Bare root	6'-8' O.C.

CREATED WETLAND BUFFER ZONE

(37,145 SQ FT /0.85 AC)

Qty	Botanical Name	Common Name	Size / Form	Spacing/Rate
TREES				
31	Acer saccharinum	Silver Maple	#1 Container	10' O.C.
31	Asimina triloba	Pawpaw	#1 Container	10' O.C.
31	Liquidambar styraciflua	Sweet Gum	#1 Container	10' O.C.
31	Nyssa sylvatica	Black Gum	#1 Container	10' O.C.
31	Acer saccharinum	Silver Maple	Bare root	10' O.C.
31	Asimina triloba	Pawpaw	Bare root	10' O.C.
31	Liquidambar styraciflua	Sweet Gum	Bare root	10' O.C.
31	Nyssa sylvatica	Black Gum	Bare root	10' O.C.
SHRUBS				
45	Amelanchier canadensis	Serviceberry	#1 Container	6'-8' O.C.
45	Ilex opaca	American Holly	#1 Container	6'-8' O.C.
45	Viburnum dentatum	Southern Arrowwood	#1 Container	6'-8' O.C.
45	Amelanchier canadensis	Serviceberry	Bare root	6'-8' O.C.
45	Ilex opaca	American Holly	Bare root	6'-8' O.C.
45	Viburnum dentatum	Southern Arrowwood	Bare root	6'-8' O.C.

UPLAND BUFFER ENHANCEMENT ZONE

(6,012 SQ FT /0.14 AC)

Qty	Botanical Name	Common Name	Size / Form	Spacing/Rate
TREES				
4	Carya glabra	Pignut Hickory	#1 Container	10' O.C.
4	Liquidambar styraciflua	Sweet Gum	#1 Container	10' O.C.
4	Sassafrass albidum	Sassafras	#1 Container	10' O.C.
4	Quercus alba	White Oak	#1 Container	10' O.C.
4	Quercus rubra	Red Oak	#1 Container	10' O.C.
4	Carya glabra	Pignut Hickory	Bare root	10' O.C.
4	Liquidambar styraciflua	Sweet Gum	Bare root	10' O.C.
4	Sassafrass albidum	Sassafras	Bare root	10' O.C.
4	Quercus alba	White Oak	Bare root	10' O.C.
4	Quercus rubra	Red Oak	Bare root	10' O.C.
SHRUBS				
8	Cercis canadensis	Eastern Redbud	#1 Container	6'-8' O.C.
8	Cornus florida	Flowering Dogwood	#1 Container	6'-8' O.C.
8	Hamamelis virginiana	Witch Hazel	#1 Container	6'-8' O.C.
8	Cercis canadensis	Eastern Redbud	Bare root	6'-8' O.C.
8	Cornus florida	Flowering Dogwood	Bare root	6'-8' O.C.
8	Hamamelis virginiana	Witch Hazel	Bare root	6'-8' O.C.

PERMANENT SEEDING FOR WETLAND CREATION, WETLAND ENHANCEMENT, AND CREATED WETLAND BUFFER ZONE

(267,232 SQ FT /6.13 AC)

Botanical Name	Common Name	% of Mix	Quantity (lbs)
Elymus virginicus	Virginia Wildrye	20	18.39
Carex vulpinoidea	Fox Sedge	15	13.79
Panicum anceps	Beaked Panicgrass	15	13.79
Panicum clandestinum	Deertounge	10	9.2
Carex scoparia	Blunt Broom Sedge	8	7.36
Panicum rigidulum	Redtop Panicgrass	7	6.44
Carex lupulina	Hop Sedge	5.5	5.06
Carex lurida	Shallow Sedge	5.5	5.06
Juncus effusus	Soft Rush	3	2.76
Asclepias incarnata	Swamp Milkweed	2.3	2.11
Carex grayi	Gray's Sedge	2	1.84
Carex intumescens	Star Sedge	2	1.84
Eupatorium perfoliatum	Boneset	1	0.92
Iris versicolor	Blueflag	1	0.92
Vernonia noveboracensis	New York Ironweed	0.9	0.83
Chelone glabra	Turtlehead	0.5	0.46
Lobelia siphilitca	Great Blue Lobelia	0.5	0.46
Scirpus cyperinus	Woolgrass	0.5	0.46
Penthorum sedoides	Ditch Stonecrop	0.3	0.28
		SEED TOTAL	91.5

Application Rate of 15 lb / ac
ERNST MIX # 723: MD LOWER MIDLAND FACW MIX
OR SIMILAR MIX AS APPROVED BY ENGINEER.

PERMANENT SEEDING FOR UPLAND BUFFER ENHANCEMENT ZONE

(6,012 SQ FT/0.14 AC)

Botanical Name	Common Name	% of Mix	Quantity (lbs)
Elymus virginicus	Virginia Wildrye	20	0.42
Panicum anceps	Beaked panicgrass	17	0.36
Panicum clandestinum	Deertounge	15	0.32
Sorghastrum nutans	Indiangrass	15	0.32
Andropogon gerardii	Big Bluestem	9	0.19
Carex vulpinoidea	Fox sedge	8	0.17
Panicum rigidulum	Redtop panicgrass	7	0.15
Chamaecrista fasciculata	Patridge pea	4	0.08
Asclepias incarnata	Swamp milkweed	2	0.04
Eupatorium perfoliatum	Boneset	1.5	0.03
Vernonia noveboracensis	New York Ironweed	1	0.02
Mondarda fistulosa	Wild bergamot	0.5	0.01
		SEED TOTAL	2.1

Application Rate of 15 lb / ac
ERNST MIX # 722: LOWER MIDLAND RIPARIAN MIX
OR SIMILAR MIX AS APPROVED BY ENGINEER.

LIVE STAKES

(837 LF)

Qty	Botanical Name	Common Name	Size	Form	Spacing/Rate
105	Cornus amomum	Silky Dogwood	3' Length 0.5"-1.5" dia.	Dormant Stems	2' O.C.
104	Cornus sericea	Red Osier Dogwood	3' Length 0.5"-1.5" dia.	Dormant Stems	2' O.C.
105	Salix lucida	Shinning willow	3' Length 0.5"-1.5" dia.	Dormant Stems	2' O.C.
105	Salix sericea	Silky willow	3' Length 0.5"-1.5" dia.	Dormant Stems	2' O.C.

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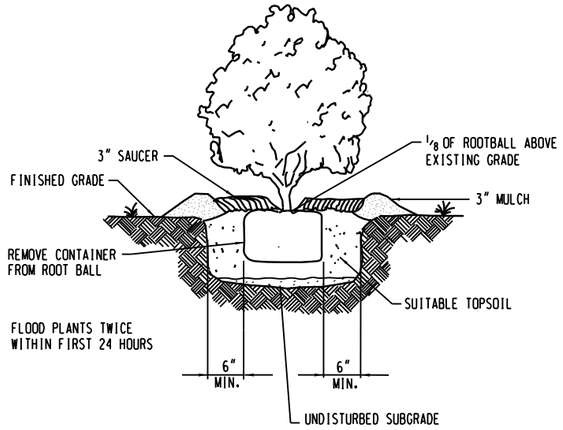
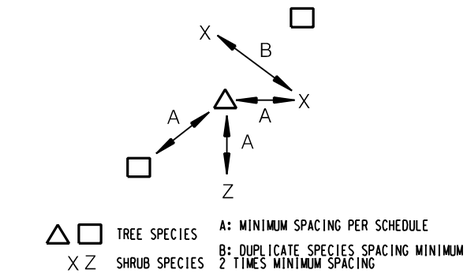
LANDSCAPE PLANTING SCHEDULE
PRINCE GEORGE'S COUNTY, MARYLAND

DRAWING NO. LD-01
SHEET 7 OF 9
KCI JOB NUMBER xxxxxxxx.xx



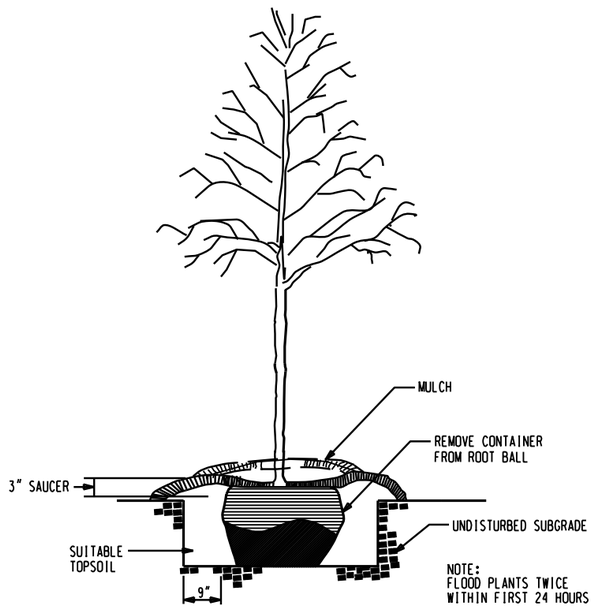
SHRUB PLANTING DETAIL

NOT TO SCALE



TREE AND SHRUB RANDOM SPACING

NOT TO SCALE



TREE PLANTING DETAIL

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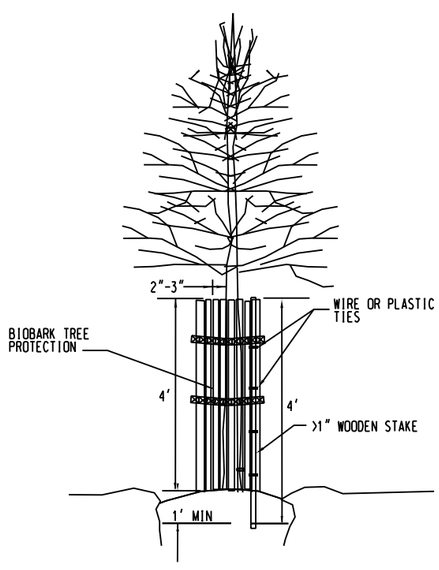

TREE SHELTER DETAIL

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LANDSCAPE DETAILS
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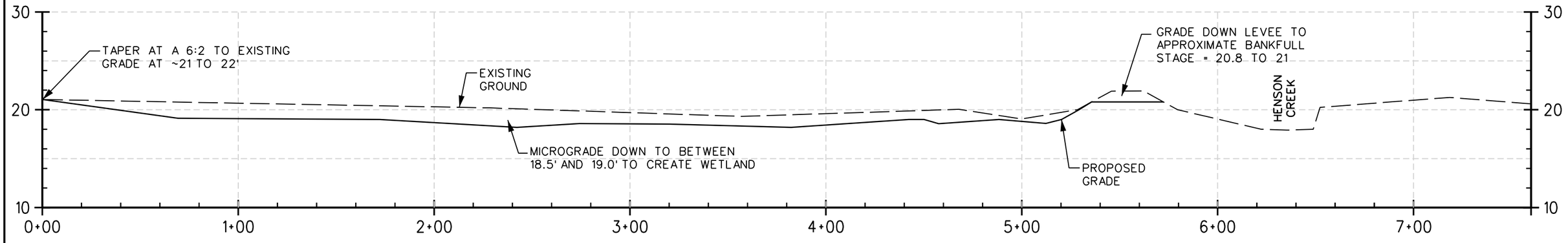
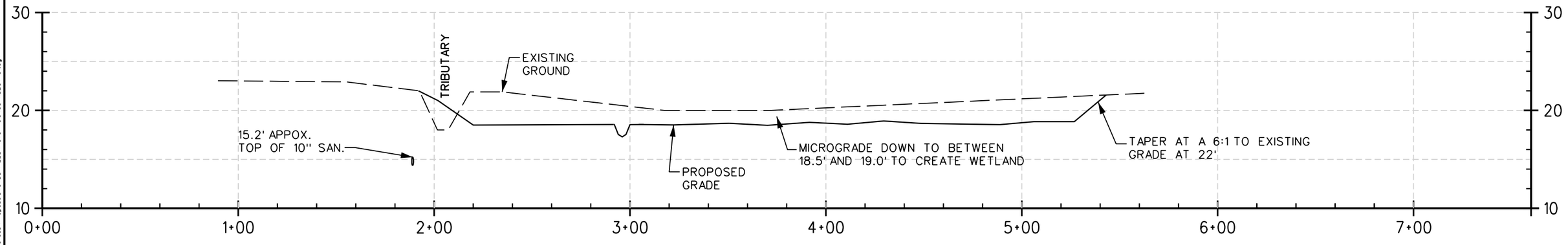
DRAWING NO.: LD-02
SHEET 8 OF 9
KCI JOB NUMBER: xxxxxxxx.xx



PROPOSED LEVEE REMOVAL AND WETLAND GRADING SECTION A-A'



PROPOSED TRIBUTARY AND WETLAND GRADING SECTION B-B'

PLOTTED: 11:08 AM on Tuesday, July 02, 2019"
FILE: V:_RESOURCE_MANAGEMENT\Greater_Md._Atlantic\Natural_Resources\Proposals\CADD-FILES\Havermole\09-XSECT-01.dgn

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DATE: JULY 2019
SCALE: HORZ. 1" = 50' VERT. 1" = 10'
DESIGNED BY: SL
DRAWN BY: CD

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CROSS SECTIONS
PRINCE GEORGE'S COUNTY, MARYLAND

DRAWING NO. XS-01
SHEET 9 OF 9
KCI JOB NUMBER xxxxxxx.xx

RFP- 6: Mill Swamp Creek

I-495 & I-270 Managed Lanes Study Wetland & Stream Mitigation - Mill Swamp Creek
MDOT SHA Contract# AZ0485172

The following is a summarized PHASE I Mitigation Plan for the Mill Swamp Creek Stream and Wetland Mitigation Site (MSWMP). This summary includes project areas detailed in GreenVest 404's July 17, 2019 Volume II -Technical Proposal submitted in response to RFP Full Delivery Stream and Wetland Mitigation Services, Solicitation No. AZ0485172.

Existing Conditions Summary

Location Information

County: Charles

Federal HUC-8 Watershed: Middle Potomac-Anacostia-Occoquan (02070010)

MDE 8-digit Watershed: Potomac River Middle Tidal drainage watershed (02140102)

Coordinates: 38.652836, -77.086043

Location: Ward Place, Bryans Road, MD 20616

Property Ownership: The proposed stream and wetland restoration project is located within three separate private parcels which contain the Mill Swamp Creek mainstem and the unnamed tributary to Mill Swamp Creek (MST). The majority of the MST reach is included in two contiguous parcels north of Ward Place. A third parcel spans both sides of Ward Place. The north section of the parcel contains the confluence of Mill Swamp Creek and its tributary. Mill Swamp Creek flows from north to south on this parcel before crossing underneath Ward Place and continuing onto the southern section of the parcel.

Parcel Areas:

Map ID	Total Acres
1	23.98
2	7.00
3	5.01

Drainage Area: Mill Swamp Creek Mainstem 5.57 square miles
Mill Swamp Creek Tributary (MST) 3.05 square miles

Stream Use Class: I

Existing Land Use: Historic and present land use within a half mile of the project area is a mix of forest, wetlands, and agriculture. The subject parcels are located within Charles County's Rural Conservation Zone and have been used for intensive agricultural purposes for at least 70 years based on historic aerials. Mill Swamp Creek, its tributary (MST), and the related floodplains are not protected from stormwater runoff and have been manipulated over the years from agriculture-related use (channelization and drainage) and development within the drainage areas, resulting in significant bed/bank form alteration and functional impairment.

I-495 & I-270 Managed Lanes Study Wetland & Stream Mitigation - Mill Swamp Creek
MDOT SHA Contract# AZ0485172

Constraints: None

Mapped Soils:

Soil	*Soil Description*	*Drainage Class*	*Hydric Rating*	*K-factor*	*Parent Material*
CmD	Croom-Marr complex, 10-15% slopes	Well drained	Non-hydric	0.15	Gravelly fluviomarine deposits
CmE	Croom-Marr complex, 15-25% slopes	Well drained	Non-Hydric	0.15	Gravelly fluviomarine deposits
GcB	Galestown-Hammonton complex, 0-5% slopes	Somewhat excessively drained to moderately well drained	Non-Hydric	0.02	Sandy eolian deposits and/or fluviomarine sediments
LxD	Liverpool-Piccowaxen complex, 5-15% slopes	Moderately well drained to somewhat poorly drained	Non-Hydric	0.43	Silty and loamy fluviomarine deposits
MnD	Marr-Dodon complex 10-15% slopes	Well drained to moderately well drained	Non-Hydric	0.20	loamy fluviomarine deposits
MT	Mispillion and Transquaking soils, tidally flooded	Very poorly drained	Hydric	N/A	Herbaceous organic material over silty estuarine sediments
NG	Nanticoke and Mannington soils, frequently flooded	Very poorly drained	Hydric	0.43	Silty and loamy alluvium
PcA	Piccowaxen loam, 0-2% slopes	Somewhat poorly drained	Partially Hydric	0.37	Silty and loamy fluviomarine deposits
PcB	Piccowaxen loam, 2-5% slopes	Somewhat poorly drained	Partially Hydric	0.37	Silty and loamy fluviomarine deposits
Pu	Potobac-Issue, 2-5% slopes	Poorly drained to somewhat poorly drained	Hydric	0.28	Loamy alluvium

Description:

The Mill Swamp Creek Stream and Wetland Mitigation Project contains two degraded stream reaches and several non-tidal wetlands that have been altered over time from continued agriculture and regional development. The incised channels have disconnected the stream reaches from their respective floodplains and have lowered the seasonal high groundwater table within the stream's zone of influence,

negatively affecting the hydroperiod in the adjacent wetlands. The alterations in hydroperiod and hydrology have negatively impacted the structure, composition, and functions of these floodplain wetlands. If these channels are not restored and stabilized, it will result in further impairment and degradation in the existing forested wetlands and agricultural fields.

No Tier II waters were identified in the study area and Mill Swamp Creek is not located within a Tier II catchment basin. According to the Maryland 303(d) list of impaired waterways, the Potomac River Middle watershed is listed as Category 5 – impaired for high levels of nutrients resulting in poor levels of dissolved oxygen.

According to the Water Resources Registry, the MSWMP site is currently a gap in the Maryland Biological Stream Survey's monitored stream network and has been identified as:

- Riparian Preservation and Restoration,
- Stormwater Natural Infrastructure Preservation,
- Upland Preservation and Restoration,
- Wetland Preservation and Restoration,
- Part of the Biodiversity Conservation Network, and
- Sea Level Rise Vulnerability.

The MSWMP site is also contiguous with Priority Conservation Areas such as Targeted Ecological Areas, Green Infrastructure, and Maryland Critical Areas. The site also meets specific objectives of the MDE's Prioritizing Sites for Wetland Restoration, Mitigation, and Preservation in Maryland. This site is located in an MDE Priority Restoration Watershed and will specifically restore and preserve gaps in existing green infrastructure corridors, create an additional green infrastructure hub, and restore/protect headwater wetland and streams.

The existing riparian buffers along the streams targeted for restoration are narrow and, in some places, non-existent with degraded wetlands that transition to upland hay/pasture fields. In general, trees within the forested areas of the site are in good to fair condition. The understory within these areas is a combination of woody shrubs and herbaceous vegetation, including varying degrees of invasive species cover.

Please note that the MSWMP project contains two distinct contiguous reaches; contiguous reaches being preferred by MDE and the ACOE for mitigation. Other desirable characteristics of these projects include:

- The stream restoration, wetland creation, and preservation will re-integrate these aquatic system components resulting in significant functional uplift;
- The site possesses excellent accessibility and constructability with direct access from Ward Place and Fenwick Road;

- Sufficient open space is available for efficient staging and stockpiling of material;
- The site's current context and watershed conditions support technically feasibility and self-maintaining restoration; and
- The site meets specific objectives of the MDE's Prioritizing Sites for Wetland Restoration, Mitigation and Preservation in Maryland.

The MSWMP site possesses the necessary chemical, physical, and biological composition; lacks ecological, cultural and historic constraints; and complies with the site selection criteria of the Federal Rules on Compensatory Mitigation at 33 CFR 332 as overseen and regulated by USACE and the rules, policy, and guidance authorized under the Maryland Non-Tidal Wetlands Protection Act as overseen and regulated by MDE, as well as Section 106 of the National Historic Preservation Act, Federal Aviation Administration (FAA) Advisory Circular (No. 150/5200-33B) and the State/Federal Endangered Species Acts.

Summary of Opportunities

Proposed Mitigation Type	***Proposed Area/Length***	***Mitigation Credit Ratio***	***Units***
Wetland (PFO) Enhancement	6.53	1.5:1	4.353
Wetland Creation	4.97	1:1	4.970
Wetland Preservation	5.86	10:1	0.586
Wetland Buffer Enhancement	3.24	15:1	0.216
Wetland Buffer Preservation	2.27	20:1	0.114
Upland & Upland Buffer Preservation	2.23	20:1	0.112
Wetland Mitigation Total	**25.1**		**10.35**
Stream Mitigation			
Stream Restoration (MST)	789	1:1	789
Stream Restoration (Mainstem)	1,738	2:1	869
Stream Mitigation Total	**2,527**		**1,658**

Restoration Objectives

- The proposed MSWMP includes:
  - The enhancement of 6.53 acres of non-tidal wetland (farmed wetland conversion to forested wetland);
  - The creation of 4.97 acres of non-tidal wetlands;
  - The preservation of 5.86 acres of non-tidal, forested wetlands;
  - The enhancement of 3.24 acres of non-tidal wetland buffer;
  - The preservation of 2.27 acres of non-tidal wetland buffer;
  - The preservation of 2.23 acres of upland and upland buffer; and
  - 2,527 linear feet of stream restoration.
- This project as proposed will yield up to 1,658 stream and 10.35 wetland mitigation units.

- The wetland, stream, plus their respective buffer elements will be fully integrated to yield significant ecological and functional uplift.
- Additional credits may be generated during the course of the design and construction through Creation or enhancement of additional wetlands, preservation of upland forests and non-tidal, forested wetland buffers.

Restoration Concept

- The proposed design utilizes on-site materials and will iterate to find the ideal balance of impacts required to restore more frequent floodplain access.
    - Create a bank height ratio of 1.2 or less along the restored reaches to reduce shear stresses and velocities for peak flow events and allow for more frequent access to the floodplain.
    - Increase the floodplain inundation area for high frequency storm events, including a bankfull discharge (e.g. 1.25-yr recurrence interval), by increasing the entrenchment ratio to greater than 2.2.
    - Create stable woody debris structures that will provide habitat and mimic natural processes where it will serve to reduce channel cross sectional area through the formation of depositional features such as inside meander bars and benches. Self-sustaining depositional channel features will increase sinuosity and reduce shear stress on the channel bed and banks.
- Riparian buffers will be maintained, new wetlands will be supported by overbank flows, and invasive species will be controlled.
- Wetland enhancement will be accomplished by re-hydrating remnant hydric soils by increasing the riparian groundwater elevation and floodplain storage.
- Wetland preservation will be requested in high quality areas adjacent to proposed restoration and enhancement practices.
- If, during the course of design, borrow materials are needed during the restoration of either Mill Swamp Creek or MST to balance cut/fill associated with stream restoration, the excavated areas create an opportunity for additional wetland creation.
- Forested floodplain habitats will be restored/enhanced through invasive species treatment and planting native trees and shrubs.

Confidential, Pre-Decisional, and Deliberative

Proposed Mitigation Type	Proposed Area/Length	Mitigation Credit Ratio	Units
Wetland (PFO) Enhancement	6.53	1.5:1	4.353
Wetland Creation	4.97	1:1	4.970
Wetland Preservation	5.86	10:1	0.586
Wetland Buffer Enhancement	3.24	15:1	0.216
Wetland Buffer Preservation	2.27	20:1	0.114
Upland & Upland Buffer Preservation	2.23	20:1	0.112
Wetland Mitigation Total	**25.1**		**10.35**
Stream Mitigation			
Stream Restoration (MST)	789	1:1	789
Stream Restoration (Mainstem)	1,738	2:1	869
Stream Mitigation Total	**2,527**		**1,658**

Mitigation Plan

Proposal:
SHA Full Delivery
Charles County, MD

Mill Swamp

Legend

Wetland Crediting

- Creation
- Enhancement
- Preservation
- Upland Preservation

25' Wetland Buffer

- Enhancement
- Preservation
- Upland Preservation
- Proposed Stream Work
- 2 FT Contours
- Easements
- DNR Wetlands
- NWI Wetlands

Adjacent Parcels Ownership

- Private

0 125 250
Feet

N

Biohabitats

June, 2019

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