



APPENDIX K: PUBLIC PHASE I MITIGATION DESIGN PLANS



AN-1: CRABBS BRANCH

**I-495 & I-270 Managed Lanes Study
Wetland & Stream Mitigation - Crabbs Branch
Site AN-1**



Existing Conditions Summary

Location Information

County: Montgomery
Federal HUC-8 Watershed: Middle-Potomac-Anacostia-Occoquan (02070010)
MDE 8-digit Watershed: Rock Creek (02140206)
Coordinates: 39.115535, -77.145948
Location: East of Redland Rd. & north of Oskaloosa Dr.
Property Ownership: M-NCPPC

Site Conditions

Parcel Area:	<u>98.5 Ac</u>	Park Name: <u>Crabbs Branch SVP</u>
Drainage Area:	<u>1.89 square miles</u>	Stream Use Class: <u>IV</u>
Existing Land Use:	<u>Forest</u>	Adjacent Land Use: Residential
Mapped Soils:	<u>Hatboro silt loam & Baile silt loam</u>	
Constraints:	<u>Sewer line in floodplain</u>	

AN-1 is a stream and wetland restoration site located along Crabbs Branch, just east of the intersection of Redland Road and Crabbs Branch Way. The site was recommended by M-NCPPC and consists of an incised channel surrounded by a mid-successional forest in the upper reach and an open meadow with scattered trees in the lower reach. The stream is highly unstable with torturous meanders and severe erosion along 3-8 foot tall vertical banks. The hydrology and morphology of the site have been influenced by anthropogenic influences such as the upstream online Crabbs Branch Regional Stormwater Pond, residential development encroachment on the floodplain, and buried infrastructure that crosses the channel. The lower floodplain consists of wetlands dominated by invasive reed canary grass that is preventing forest regeneration. There is potential access at the upstream end of the site off of Crabbs Branch Way and through an HOA road off of Oskaloosa Drive at the downstream end of the site.

Summary of Opportunities

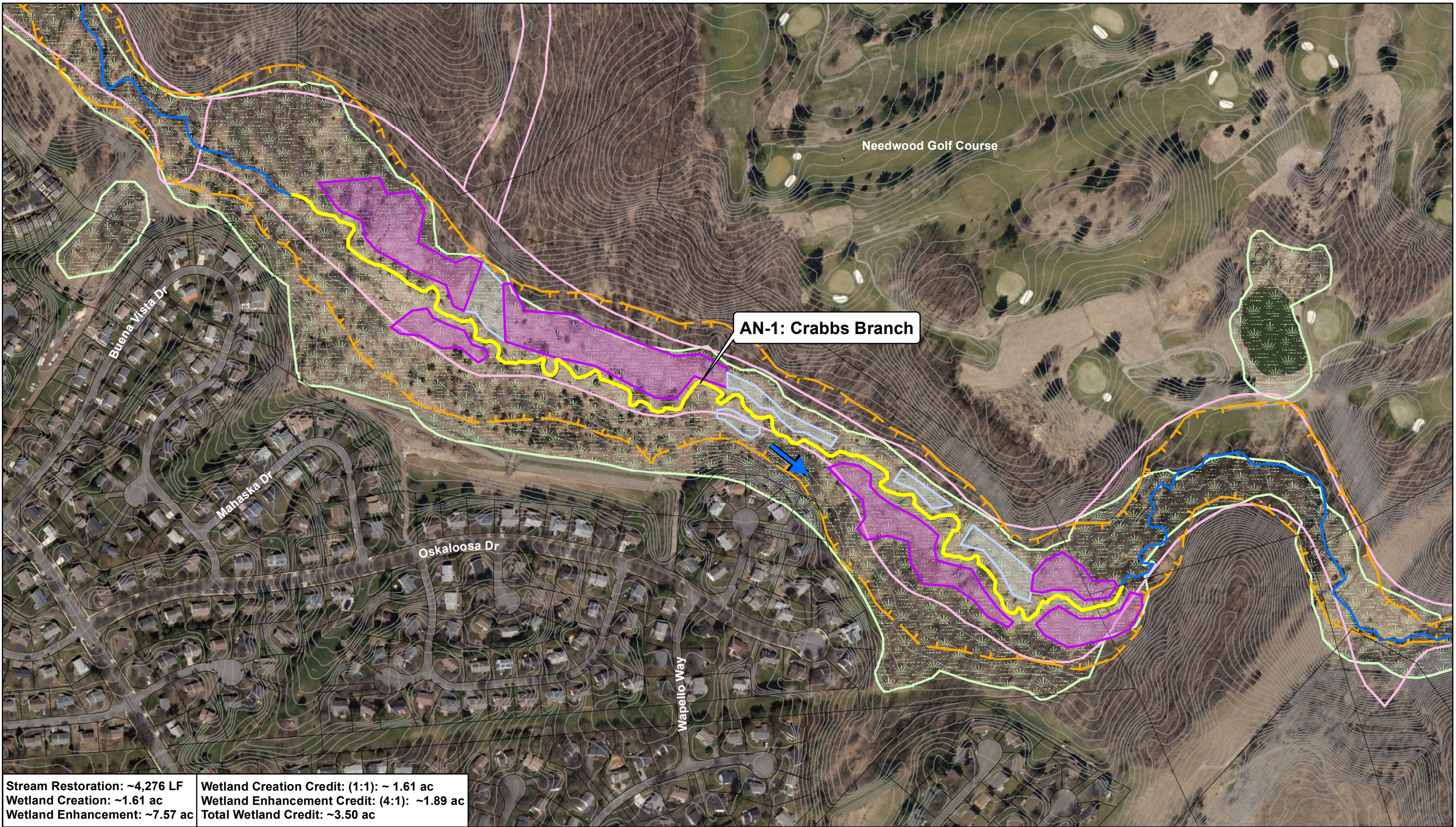
- Stream Restoration – Approximately 4,276 linear feet
- Wetland Restoration – Approximately 1.61 acres of Creation (~1.61 acres credit) & 7.57 acres of Enhancement (~1.89 acres credit)

Restoration Objectives

- | | |
|--------------------------------------|----------------------------------|
| • Bed & bank stabilization | • Wetland creation & enhancement |
| • Floodplain connection improvements | • Floodplain reforestation |
| • In-stream habitat improvements | • Invasive species control |

Restoration Concept

- Improve floodplain connection by lowering the floodplain in the downstream reach to provide more-frequent floodplain access to mitigate damage from erosive flood flows.
- Grade back and vegetate vertical banks to reduce erosion and instream sedimentation
- Installation of instream structures to provide channel stability and habitat diversity
- Minor floodplain grading to expand existing wetlands and restore groundwater hydrology
- Restore forested floodplain habitat by invasive species treatment and planting native trees and shrubs



Stream Site	Streams	Parcel Boundaries
Wetland Creation	NWI/DNR Wetlands	Hydric Soils
Wetland Enhancement	FEMA Floodplain	2' Contours

1 inch = 300 feet

I-495 & I-270 Managed Lanes Study
Phase I Mitigation Design Plan
Wetland/Stream Site AN-1
Crabbs Branch



AN-3: PEBBLESTONE DR. TRIBUTARY

**I-495 & I-270 Managed Lanes Study
Stream Mitigation – Pebblestone Dr. Tributary
Site AN-3**



Existing Conditions Summary

Location Information

County:	<u>Montgomery</u>
Federal HUC-8 Watershed:	<u>Middle-Potomac-Anacostia-Occoquan (02070010)</u>
MDE 8-digit Watershed:	<u>Anacostia River (02140205)</u>
Coordinates:	<u>39.092946, -77.016077</u>
Location:	<u>South of Bonifant Rd. & east of Pebblestone Dr.</u>
Property Ownership:	<u>M-NCPPC & South Stonegate HOA</u>

Site Conditions

Parcel Area:	<u>28.7 Ac</u>	Park Name: <u>Northwest Branch SVU 5</u>
Drainage Area:	<u>1.05 square miles</u>	Stream Use Class: <u>IV</u>
Existing Land Use:	<u>Forest</u>	Adjacent Land Use: <u>Medium density residential</u>
Constraints:	<u>Forest Conservation Easement & Sewer line in floodplain</u>	

AN-3 is a stream restoration site located along an unnamed tributary to Northwest Branch, just east of Pebble Stone Drive. The site was recommended by M-NCPPC and consists of a deeply incised channel surrounded by a mid-successional forest with extensive herbaceous invasives. The majority of the reach is highly unstable with severe erosion along 3-8 foot tall vertical banks and extensive deposition bars within the channel. A 1-2 foot tall fish blockage over rip-rap and an exposed sewer line were observed at the upstream and downstream ends of the site. There is potential access, which would require minimal tree impacts, through open canopy areas dominated by invasives and along an old route that was used for a previous ICC stream restoration project (NW-4) located within the same stream valley.

Summary of Opportunities

- Stream restoration – Approximately 2,162 linear feet

Restoration Objectives

- Bed & bank stabilization
- Floodplain connection improvements
- In-stream & riparian habitat improvements
- Fish blockage removal

Restoration Concept

- Grade and vegetate vertical banks to reduce erosion and instream sedimentation
- Install instream structures to reduce channel incision and improve fish and benthic habitat
- Improve floodplain connection by raising the stream bed and/or creating floodplain benches to provide more-frequent floodplain access to mitigate damage from erosive flood flows
- Provide fish passage over existing rip-rap by raising the stream bed to allow access to 0.59 miles of potential upstream habitat
- Installation of instream structures to protect exposed utilities
- Riparian habitat enhancements by invasive species treatment and seeding/planting native species
- Improve plan and profile of existing stream to enhance stream functions



Stream Restoration: ~2,162 LF

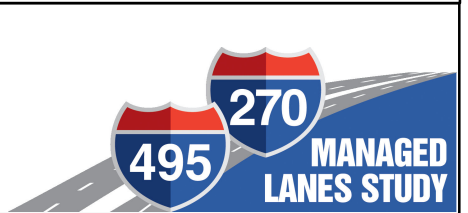
Stream Site	Hydric Soils	Parcel Boundaries
Streams	FEMA Floodplain	
NWI/DNR Wetlands	2' Contours	

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Feet

1 inch = 200 feet

I-495 & I-270 Managed Lanes Study
Phase I Mitigation Design Plan
Stream Site AN-3
Pebblestone Dr. Tributary





AN-6: PAINT BRANCH FISH PASSAGE

**I-495 & I-270 Managed Lanes Study
Stream Mitigation – Paint Branch Fish Passage
Site AN-6**



Existing Conditions Summary

Location Information

County:	<u>Prince George's</u>
Federal HUC-8 Watershed:	<u>Middle-Potomac-Anacostia-Occoquan (02070010)</u>
MDE 8-digit Watershed:	<u>Anacostia River (02140205)</u>
Coordinates:	<u>39.021078, -76.945642</u>
Location:	<u>I-495/I-95 Interchange</u>
Property Ownership:	<u>USDA BARC & SHA</u>

Site Conditions

Parcel Area:	<u>362.0 Ac (BARC)</u>	Parcel Name: <u>South Farm</u>
Drainage Area:	<u>16.4 square miles</u>	Stream Use Class: <u>III</u>
Existing Land Use:	<u>Roadway & agriculture</u>	Adjacent Land Use: Residential & forest
Constraints:	<u>Sewer line in eastern floodplain</u>	

AN-6 is a fish passage site located along Paint Branch, within the southeast portion of the I-495/I-95 Interchange. The site was originally investigated and designed to 90% for the Greenbelt Metro Access Project, before the project was canceled in 2017. The site consists of two quadruple cell box culverts (10' X 14') under I-495 that have created one-foot tall fish blockages. Fish ladders were installed just downstream of the culverts in the 1990's, but have failed since. During preliminary field investigations, a debris jam was observed at the upstream culvert that has created an additional 14-inch-tall temporary blockage. Removing these fish blockages would allow complete upstream access to 0.45 miles of high-quality habitat below a partial blockage at the I-95 northbound ramp culvert, and partial upstream access to an additional 13.84 miles of Paint Branch and its tributaries (2nd Order and greater). There is potential access to the site from the BARC property and SHA ROW that would require minimal tree impacts.

Summary of Opportunities

- Stream Restoration & Fish Blockage Removal – Approximately 1,544 linear feet (5,258 LF of potential credit)

Restoration Objectives

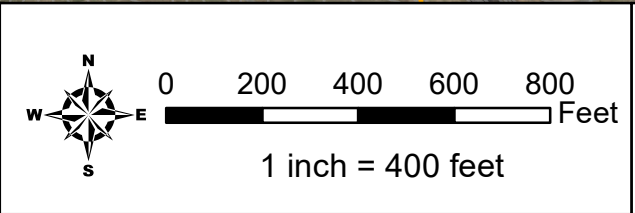
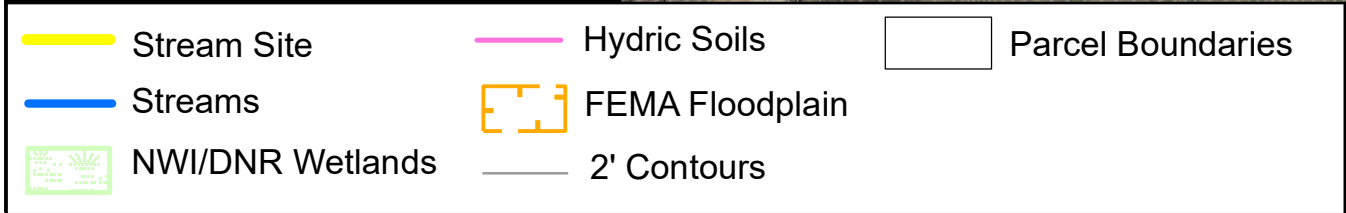
- Removal of three fish blockages
- Provide passage for a wide range of native fish and other aquatic organisms
- Avoid impacting the hydraulic function of the culverts

Restoration Concept

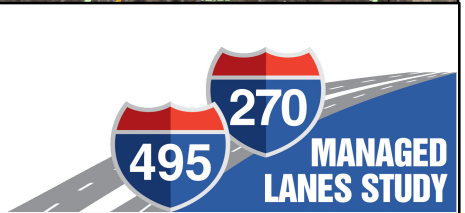
- Demolition of failed fish passages and removal of upstream debris jam
- Incrementally raise the stream elevation through a series of constructed riffles placed downstream of the culverts
- Backwater both culverts to allow passage, while maintaining hydraulic capacity of the culverts during high flow events
- Riparian habitat enhancements by planting native tree and shrub species



Fish Passage Limit of Work: ~1,544 LF
Potential Credit: ~5,258 LF



I-495 & I-270 Managed Lanes Study
Phase I Mitigation Design Plan
Stream Site AN-6
Paint Branch Fish Passage



I-495 & I-270 Managed Lanes Study
Phase I Fish Passage Credits
Stream Site AN-6
Paint Branch Fish Passage

Legend
The Nature Conservancy (TNC)
Fish Blockages

- Full Blockage
- ◐ Partial Blockage
- Removed after field assessment

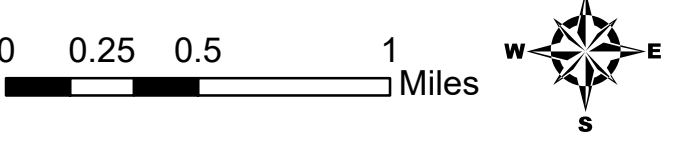
Credit Ratio

- 20:1 Partial Blockage Removal
- 10:1 Full Blockage Removal
- 1:1 Full Restoration

Strahler Stream Order

- Not Assigned
- 1
- 2
- 3
- 4
- MDE-12 Digit Watershed

Note:
The entire stream channel has not been assessed for fish blockages. Only blockages within the TNC source have been included.



Full Restoration Length: 1,544 LF
Full Restoration Credit: 1,544 LF

Full Blockage Removal Length: 969 LF
Full Blockage Removal Credit: 97 LF

Partial Blockage Removal Length: 72,340 LF
Partial Blockage Removal Credit: 3,617 LF

Total Credit: 5,258 LF

Project Site: Paint Branch Fish Blockages to be removed

MD iMAP, DoIT



AN-7: PAINT BRANCH SOUTH FARM TRIBUTARIES

**I-495 & I-270 Managed Lanes Study
Stream Mitigation – Paint Branch South Farm Tributaries
Site AN-7**



Existing Conditions Summary

Location Information

County: Prince George's
Federal HUC-8 Watershed: Middle-Potomac-Anacostia-Occoquan (02070010)
MDE 8-digit Watershed: Anacostia River (02140205)
Coordinates: 39.018526 -76.949208 and 39.012977 -76.945156
Location: Southeast of I-495/I-95 Interchange
Property Ownership: USDA BARC & SHA

Site Conditions

Parcel Area:	<u>361.9 Ac</u>	Parcel Name:	<u>South Farm</u>
Drainage Area:	<u>0.17 & 0.11 sq. mi.</u>	Stream Use Class:	<u>I</u>
Existing Land Use:	<u>Agriculture</u>	Adjacent Land Use:	<u>Roadway</u>
Constraints:	<u>Exposed sewer line, gas line in floodplain, adjacent ag. fields</u>		

AN-7 is a stream restoration site located along two headwater streams that drain into Paint Branch, just southeast of the I-495/I-95 interchange. The site was recommended by BARC and consists of deeply incised channels surrounded by forest and agricultural fields. The northern tributary (Tributary 1) consists of a concrete lined channel and highly unstable natural channel that flows into a moderately stabilized section with localized erosion areas. There is a two-foot-tall fish blockage and exposed sewer line just downstream of where the concrete lined channel ends. The southern tributary (Tributary 2) is a small, incised channel with a failed culvert and culvert outfall channel that are creating fish blockages to an upstream reach that appears stable. There is direct access to the site from existing roads and fields, however access to the upstream end of Tributary 1 would require some forest impacts.

Summary of Opportunities

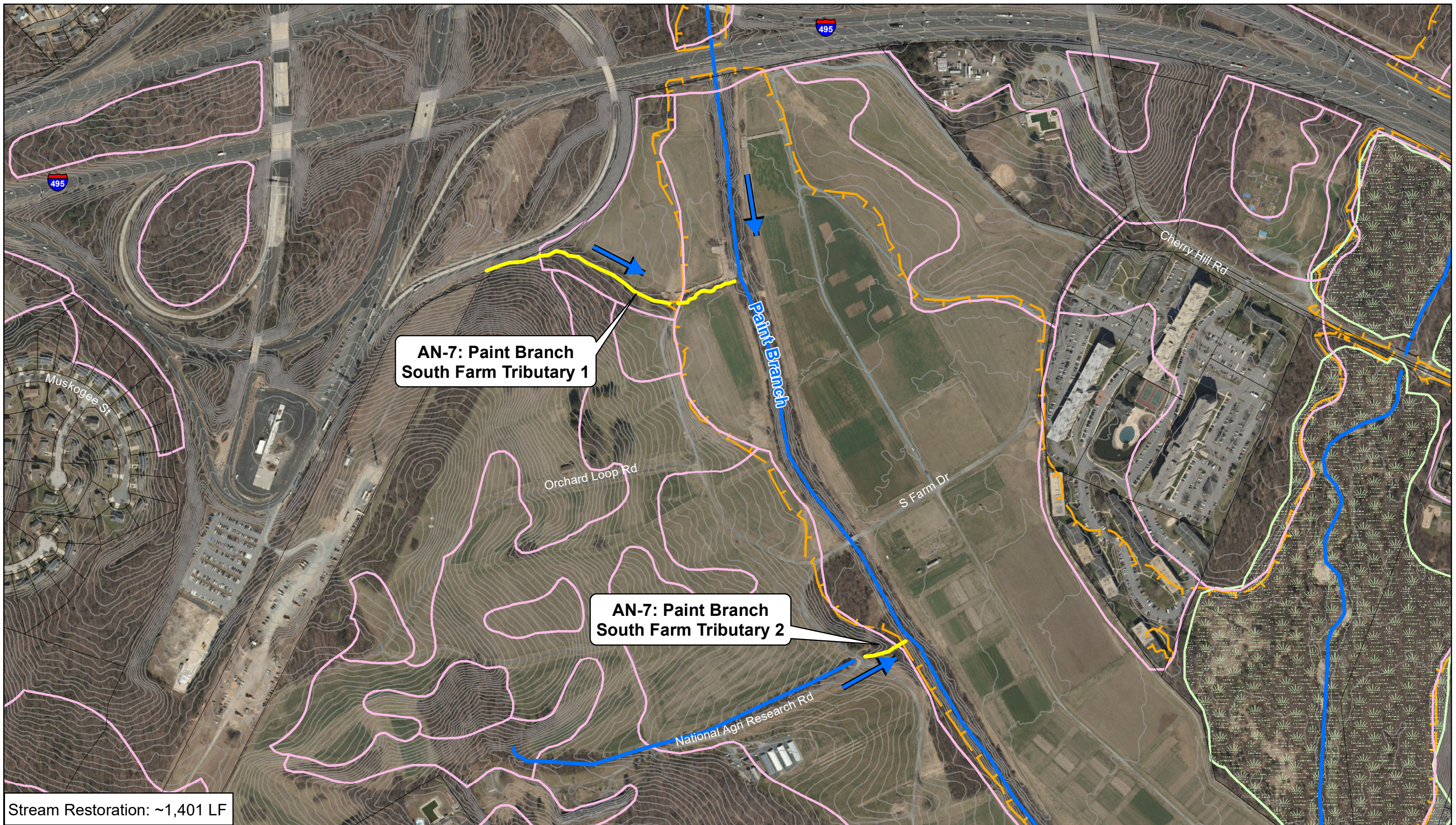
- Stream restoration & fish blockage removals – Approximately 1,401 linear feet

Restoration Objectives

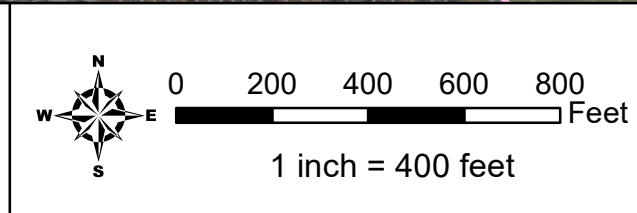
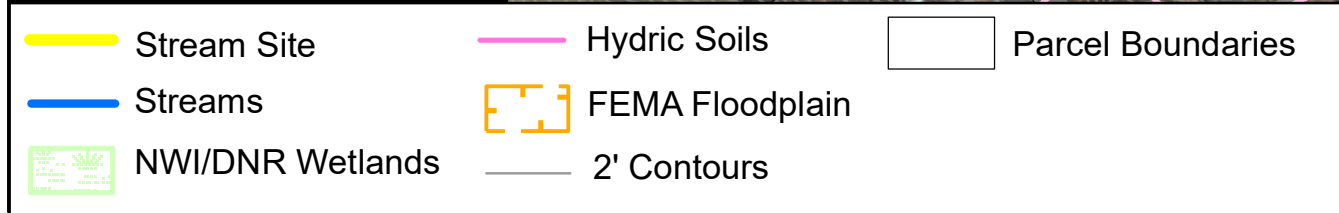
- Bed & bank stabilization
- In-stream and riparian habitat improvements
- Fish blockage removals

Restoration Concept

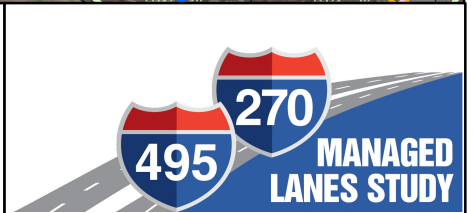
- Install instream structures to stabilize the stream bed, protect exposed utilities, and improve fish and benthic habitat
- Grade and vegetate banks to reduce erosion and instream sedimentation
- Provide fish passage at three blockages by raising the stream bed and/or removing failed culverts
- Riparian habitat enhancements by planting native trees and shrubs



Stream Restoration: ~1,401 LF



I-495 & I-270 Managed Lanes Study
Phase I Mitigation Design Plan
Stream Site AN-7
Paint Branch South Farm Tributaries





CA-2: LOWER MAGRUDER BRANCH

**I-495 & I-270 Managed Lanes Study
Wetland & Stream Mitigation Site – Lower Magruder Branch
Site – CA-2**



Existing Conditions Summary

Location Information

County: Montgomery
Federal HUC-8 Watershed: Middle-Potomac-Catoctin (02070008)
MDE 8-digit Watershed: Seneca Creek (02140208)
Coordinates: 39.232782, -77.188321
Location: South of Watkins Road
Property Ownership: M-NCPPC

Site Conditions

Parcel Area:	<u>66.4 Ac</u>	Park Name: <u>Great Seneca SVU 4</u>
Drainage Area:	<u>3.48 square miles</u>	Stream Use Class: <u>I-P</u>
Existing Land Use:	<u>Agriculture</u>	Adjacent Land Use: <u>Barren land & Forest</u>
Mapped Soils:	<u>Hatboro silt loam</u>	
Constraints:	<u>None</u>	

CA-2 is a stream and wetland restoration site located along Magruder Branch, just south of Watkins Road. The stream is highly unstable throughout the site with torturous meanders and moderate to severe erosion along 3-4 foot tall banks. There is a one foot tall fish blockage at the upstream end of the site where the stream flows under Watkins Road. The upper stream reach is surrounded by a broad floodplain dominated by invasive reed canary grass that is preventing forest regeneration, while the lower floodplain consists of sparse early successional forest dominated by black walnut. In the upper western floodplain, there are two large PEM wetlands dominated by cattail and reed canary grass, while the eastern floodplain is mostly dry reed canary meadow. Groundwater was observed in the eastern floodplain at 2.5 feet below the ground surface in November 2018. No utilities were observed in the floodplain during preliminary site investigations. There is potential access off of Watkins Road that would require minimal tree impacts.

Summary of Opportunities

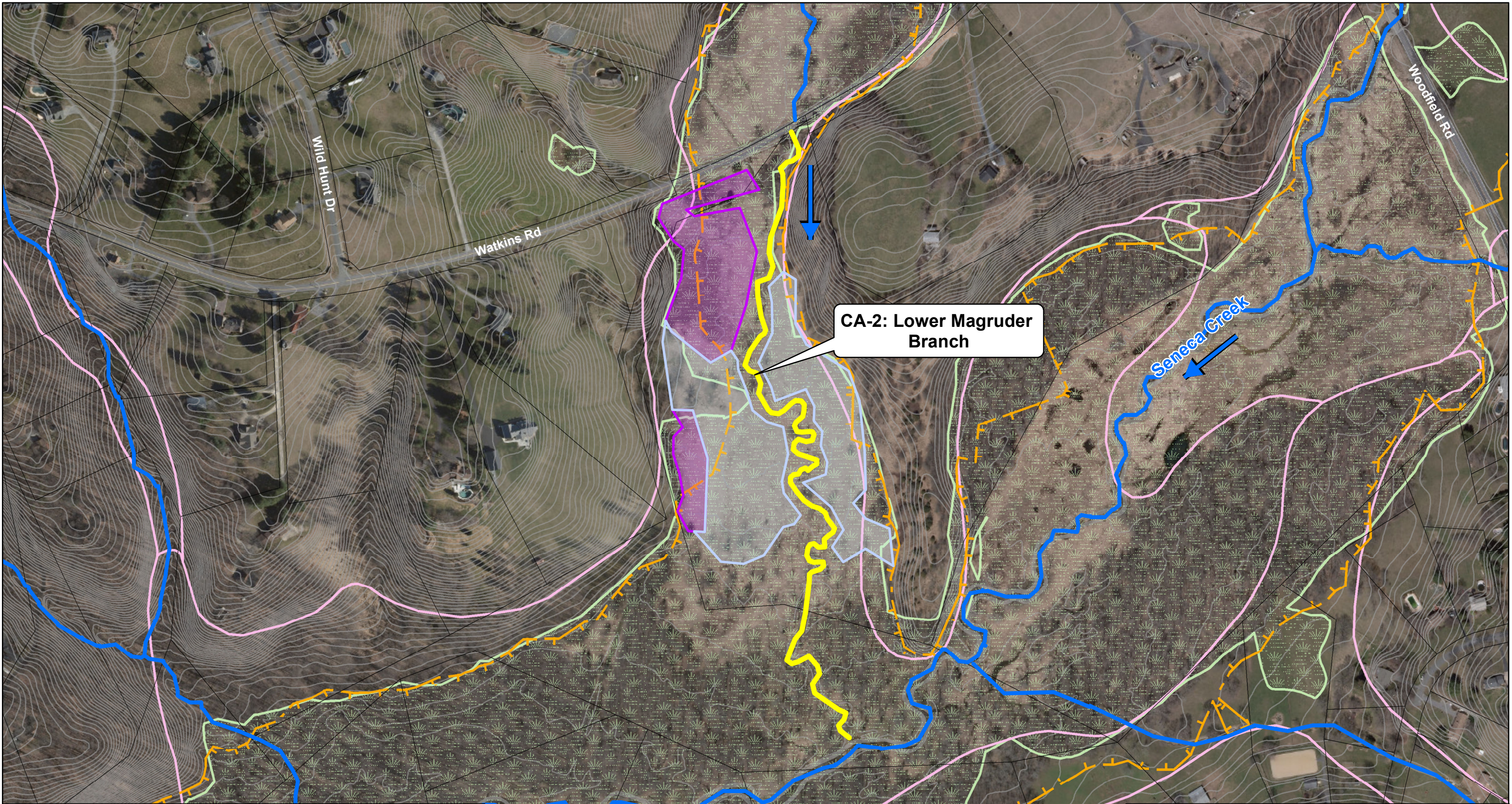
- Stream Restoration – Approximately 2,934 linear feet
- Wetland Creation – Approximately 7.07 acres (~7.07 acres credit)
- Wetland Enhancement – Approximately 3.63 acres (~0.91 acres credit)

Restoration Objectives

- | | |
|---------------------------------------|----------------------------------|
| • Bed & bank stabilization | • Wetland creation & enhancement |
| • Floodplain reconnection | • Floodplain reforestation |
| • Fish passage & habitat improvements | • Invasive species treatment |

Restoration Concept

- Restore floodplain connection by relocating the channel, raising the stream bed, and/or excavating floodplain sediment to provide more-frequent floodplain access to mitigate damage from erosive flood flows.
- Installation of instream structures to provide channel stability, fish passage and habitat diversity
- Floodplain grading to expand existing wetlands and restore groundwater hydrology
- Restore forested floodplain habitat by invasive species treatment and planting native trees and shrubs



Stream Restoration: ~2,934 LF
Wetland Creation: ~7.07 ac
Wetland Enhancement: ~3.63 ac

Wetland Creation Credit: (1:1): ~7.07 ac
Wetland Enhancement Credit: (4:1): ~0.91 ac
Total Wetland Credit: ~7.98 ac

Note: NWI/DNR Wetlands layer overestimates the extent of wetlands observed during preliminary field investigations. The majority of the site consists of dry floodplain

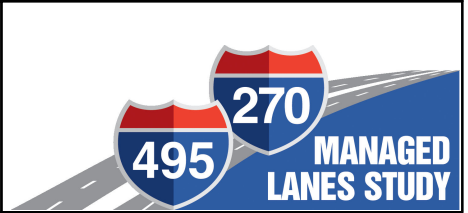
Stream Site	Streams	Parcel Boundaries
Wetland Creation	NWI/DNR Wetlands	Hydric Soils
Wetland Enhancement	FEMA Floodplain	2' Contours

0150300450600

Feet

1 inch = 300 feet

I-495 & I-270 Managed Lanes Study
Phase I Mitigation Design Plan
Wetland/Stream Site CA-2
Lower Magruder Branch





CA-3: UPPER MAGRUDER BRANCH

I-495 & I-270 Managed Lanes Study
Wetland & Stream Mitigation Site – Upper Magruder Branch
Site – CA-3



Existing Conditions Summary

Location Information

County: Montgomery
Federal HUC-8 Watershed: Middle-Potomac-Catoctin (02070008)
MDE 8-digit Watershed: Seneca Creek (02140208)
Coordinates: 39.235212, -77.187785
Location: North of Watkins Road
Property Ownership: M-NCPPC

Site Conditions

Parcel Area:	<u>41.0 Ac</u>	Park Name: <u>Magruder Branch SVU 1</u>
Existing Land Use:	<u>Agriculture & Forest</u>	Adjacent Land Use: <u>Low density residential</u>
Drainage Area:	<u>3.35 square miles</u>	Stream Use Class: <u>I-P</u>
Mapped Soils:	<u>Hatboro silt loam</u>	
Constraints:	<u>None</u>	

CA-3 is a stream and wetland restoration site located along Magruder Branch, just north of Watkins Road and Site CA-2. The stream is unstable throughout the site with torturous meanders and moderate erosion along 2-4 foot tall banks. The surrounding floodplain is dominated by invasive reed canary grass with scattered trees and several PEM wetlands. There is a high quality scrub-shrub wetland in the south-eastern floodplain dominated by button bush and smooth alder. The large reed canary wetland in the western floodplain drains under Watkins Road through two 21 inch corrugated metal pipes (CMPs), before flowing into Magruder Branch within the CA-2 site. Groundwater was observed in the dry reed canary floodplain areas of the site at 2-3 feet below the ground surface in November. No utilities were observed in the floodplain during preliminary site investigations. There is potential access off of Watkins Road that would require no tree impacts.

Summary of Opportunities

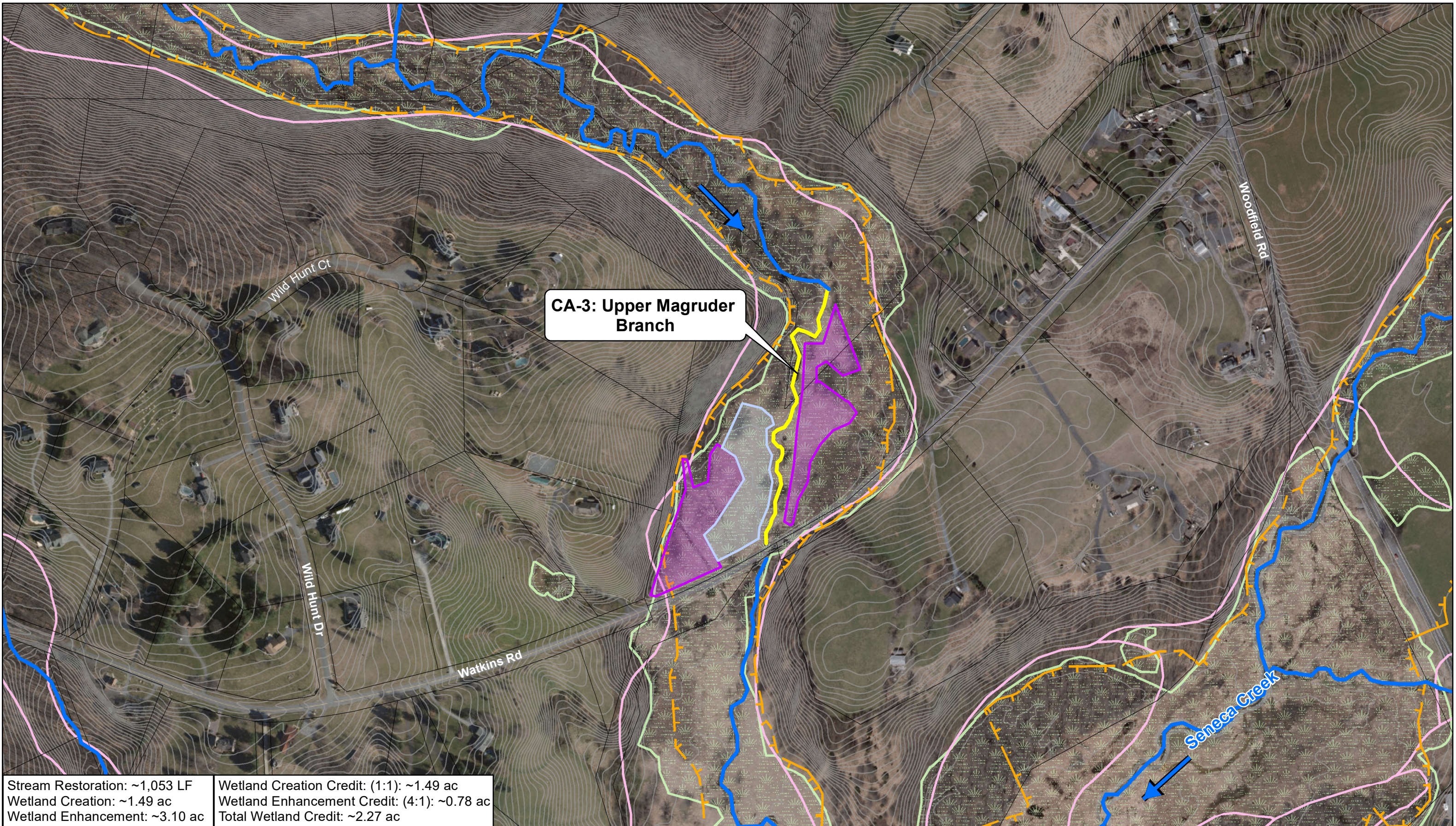
- Stream Restoration – Approximately 1,053 linear feet
- Wetland Creation – Approximately 1.49 acres (~1.49 acres credit)
- Wetland Enhancement – Approximately 3.10 acres (~ 0.78 acres credit)

Restoration Objectives

- | | |
|---------------------------------|----------------------------------|
| • Bed & bank stabilization | • Wetland creation & enhancement |
| • Floodplain reconnection | • Floodplain reforestation |
| • Instream habitat improvements | • Invasive species treatment |

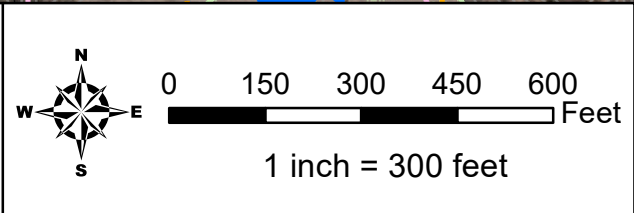
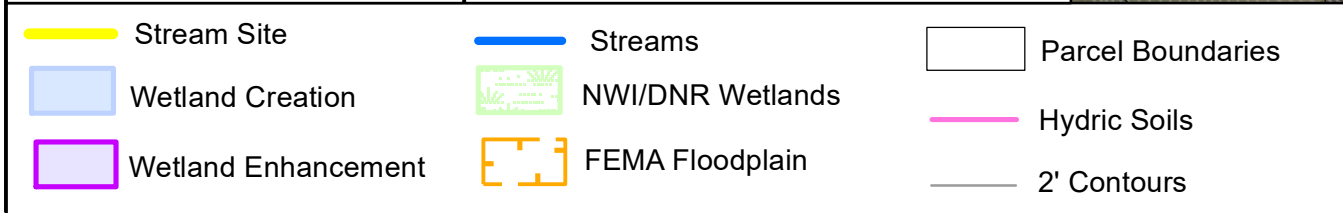
Restoration Concept

- Restore floodplain connection by relocating the channel, raising the stream bed, and/or excavating floodplain to provide more-frequent floodplain access to mitigate damage from erosive flood flows.
- Installation of instream structures to provide channel stability and in-stream habitat
- Floodplain grading to expand existing wetlands and restore groundwater hydrology
- Restore forested floodplain habitat by invasive species treatment and planting native trees and shrubs

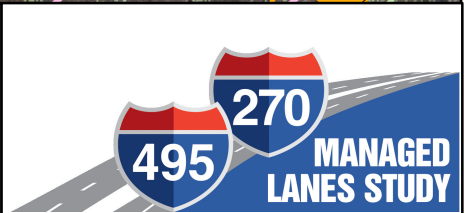


Stream Restoration: ~1,053 LF
Wetland Creation: ~1.49 ac
Wetland Enhancement: ~3.10 ac

Wetland Creation Credit: (1:1): ~1.49 ac
Wetland Enhancement Credit: (4:1): ~0.78 ac
Total Wetland Credit: ~2.27 ac



I-495 & I-270 Managed Lanes Study
Phase I Mitigation Design Plan
Wetland/Stream Site CA-3
Upper Magruder Branch





CA-5: SENECA CREEK TRIBUTARY

**I-495 & I-270 Managed Lanes Study
Stream Mitigation – Seneca Creek Tributary
Site CA-5**



Existing Conditions Summary

Location Information

County: Montgomery
Federal HUC-8 Watershed: Middle Potomac-Catoctin (02070008)
MDE 8-digit Watershed: Seneca Creek (02140208)
Coordinates: 39.13030063, --77.25646132
Location: South of Bradbury Dr. & Suffolk Terrace
Property Ownership: M-NCPPC

Site Conditions

Parcel Area: 2 parcels - 16.4 & 9.3 Ac
Drainage Area: 0.24 square miles **Stream Use Class:** I
Existing Land Use: Forested
Adjacent Land Use: Forested and residential
Constraints: Sewer line runs parallel to stream and crosses the stream in a couple locations. Manhole observed in center of channel

CA-5 is a stream restoration site located along a tributary to Seneca Creek, south of Bradbury Drive & Suffolk Terrace. The stream corridor has steep valley walls and a narrow, forested floodplain with adjacent residential development. The reach contains a sewer line that runs parallel to stream and crosses the stream in a couple locations as well as a manhole observed in center of channel. There is a man-made pond along the left bank at the downstream end of the site. The stream is eroding the pond embankment and there are headcuts forming from the stream to the pond. The majority of the reach is highly unstable with 3-6 feet tall vertical eroded banks. There is potential access, requiring minimal tree impacts, along existing sewer line access throughout most of the site. May require clearing some smaller trees and stream crossings. Potential access for the upstream portion is located at Suffolk Terrace.

Summary of Opportunities

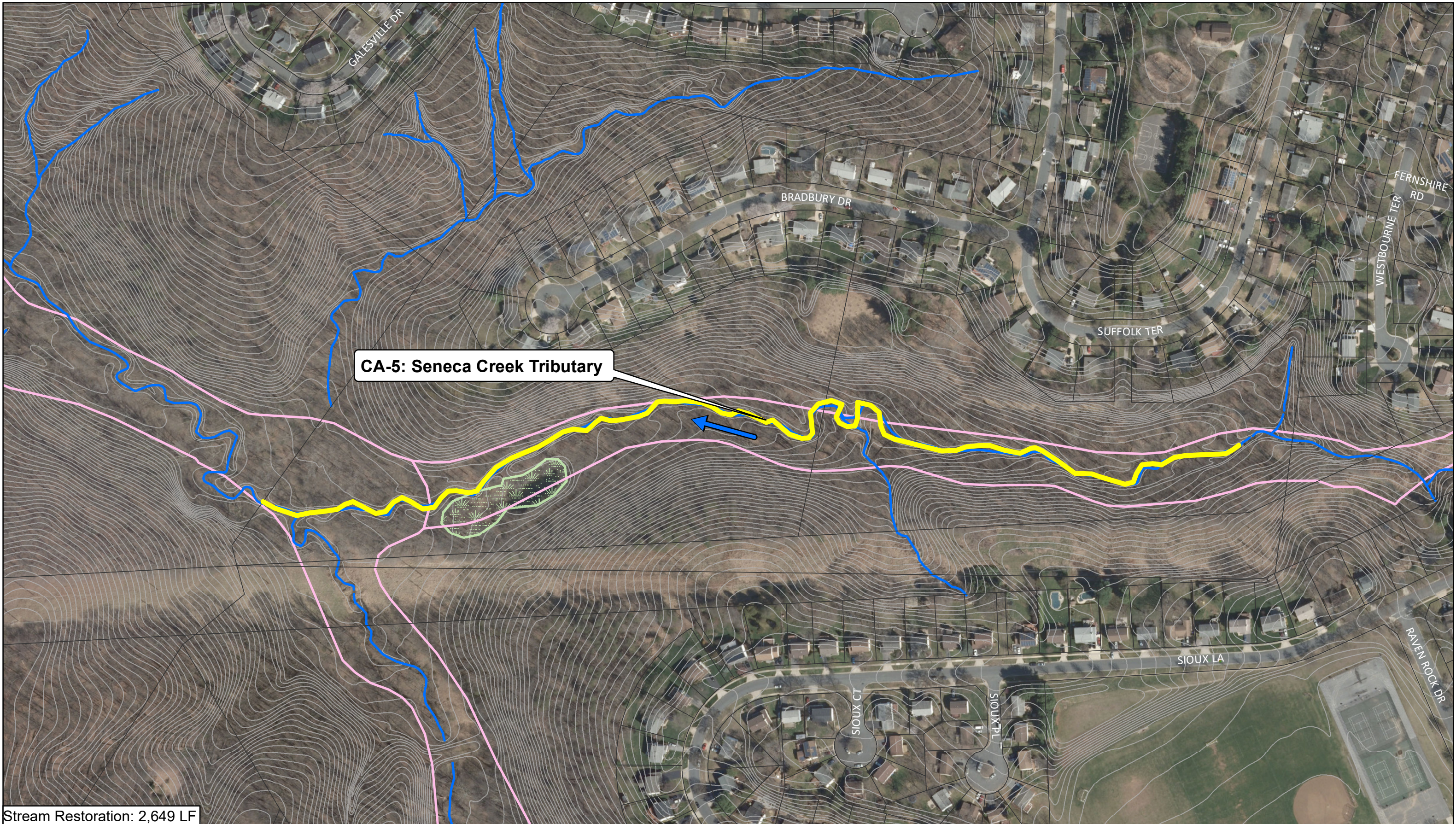
- Stream restoration – Approximately 2,649 linear feet

Restoration Objectives

- Bed & bank stabilization
- Floodplain connection improvements
- In-stream & riparian habitat improvements
- Protection of utilities

Restoration Concept

- Lay back and vegetate vertical banks to improve channel stability, reduce sediment loading, and provide floodplain connection where feasible.
- Install in-stream structures to provide grade control, protect exposed utilities, and enhance habitat
- Improve floodplain connection by raising the stream bed and/or creating floodplain benches to provide more-frequent floodplain access to mitigate damage from erosive flood flows
- Riparian habitat enhancements by invasive species treatment and seeding/planting native species
- Improve planform and profile of existing stream to enhance stream functions



Stream Restoration: 2,649 LF

Stream Site	Hydric Soils	Parcel Boundaries
Streams	FEMA Floodplain	
NWI/DNR Wetlands	2' Contours	

1 inch = 200 feet

I-495 & I-270 Managed Lanes Study
Phase I Mitigation Design Plan
Stream Site CA-5
Seneca Creek Tributary



PA-1: BACK BRANCH

**I-495 & I-270 Managed Lanes Study
Stream Mitigation - Back Branch
Site PA-1**



Existing Conditions Summary

Location Information

County: Prince George's
Federal HUC-8 Watershed: Patuxent (02060006)
MDE 8-digit Watershed: Western Branch (02131103)
Coordinates: 38.837228, -76.786687
Location: West of Brown Station Rd. & Brooke Ln. Intersection
Property Ownership: PG County DOE, PG County BOE, 2 private landowners

Site Conditions

Parcel Area: 413.4 Ac **Landfill Name:** Brown Station Rd. Sanitary Landfill
Drainage Area: 2.67 square miles **Stream Use Class:** I
Existing Land Use: Forest & very low density residential
Adjacent Land Use: Agriculture & educational
Constraints: Sewer line in floodplain & Forest Conservation Easements

PA-1 is a stream restoration site located along Back Branch, just west of the intersection of Brown Station Road and Brooke Lane. The site consists of an incised channel surrounded by a mid-successional forest with several scattered forest conservation easements. The majority of the reach is highly unstable with torturous meanders and moderate to severe erosion along 3-5 foot tall vertical banks. Portions of the northern floodplain have been filled in the past by landfill operations. The stream appears to be disconnected from the floodplain with no evidence of out-of-bank flows and a sewer line runs parallel to the stream in the floodplain. There are potential access entry points from the adjacent landfill roads, however access through the floodplain and to the stream would require tree clearing.

Summary of Opportunities

- Stream Restoration – Approximately 6,742 linear feet

Restoration Objectives

- Bed & bank stabilization
- Floodplain connection improvements
- Fish & benthic habitat improvements

Restoration Concept

- Improve floodplain connection by raising the stream bed and/or creating floodplain benches to provide more-frequent floodplain access to mitigate damage from erosive flood flows
- Grade and vegetate vertical banks to reduce erosion and instream sedimentation
- Install instream structures to reduce channel incision and improve fish and benthic habitat
- Improve plan and profile of existing stream to enhance stream functions



Stream Restoration: ~6,742 LF

Stream Site	Hydric Soils	Parcel Boundaries
Streams	FEMA Floodplain	
NWI/DNR Wetlands	2' Contours	

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Feet

1 inch = 300 feet

I-495 & I-270 Managed Lanes Study
Phase I Mitigation Design Plan
Stream Site PA-1
Back Branch

