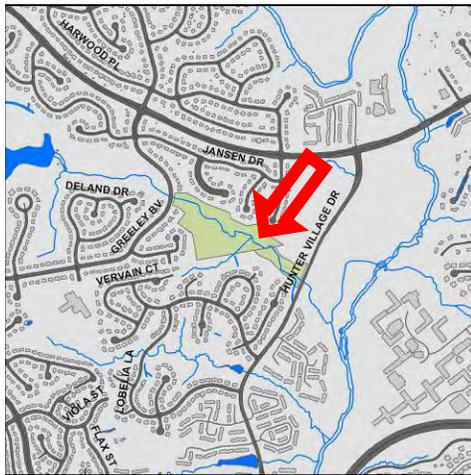


AC9200 – Stream Restoration



| | |
|-------------------------|---|
| Address: | Between 7823 and 7829 Greeley Boulevard |
| Location: | Downstream from Greeley Boulevard / Hunter Village Park |
| Land Owner: | Private / County - FCPA |
| PIN: | 0892 14 0006A, 0892 14 0030C |
| Control Type | Water Quality |
| Drainage Area | N/A |
| Receiving Waters | Unknown Tributary of Accotink Creek |

Description: This project proposes to restore an eroded section of stream channel located in both private and public areas. Severe erosion is occurring along this channel where the floodplain is constricted by the valley walls. Within this channel concrete slabs are found lying along the banks. In addition, what appears to be an abandoned sanitary sewer vault or junction is also present on the left bank facing downstream. Erosion is also evident from a storm drain outfall that drains Harwood Place and in a tributary channel that drains along Bluecurl Circle. Any restoration should also address these small areas.

Restoration of this channel will focus on regrading and stabilizing eroded stream banks through the use of armor-in-place techniques on outer meander bends and bioengineering techniques on the inside meander bends and any straight portions of the channel. Redirecting future flows away from the currently eroded banks in addition to the use of grade controls or stone-toe protection will prevent future bank instability.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: The goal of this project is to stabilize an eroded section of stream channel that has discharged a large amount of sediment in this channel and watershed. Channel armoring and redirection of flow will help to reduce sediment transport within this channel. Sediment load reductions may also be achieved by preventing bank scour, meander bend migration, and over-widening conditions. It is estimated that a total of 33,371 lbs of sediment, 27 lbs of total nitrogen and 10 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Access to this project will be difficult and will most likely need to occur from Hunter Village Drive. Access from this point is relatively far from the project site and steep slopes will need to be accounted for. This stream is buffered by forest, so access along the channel and grading of the existing channel and floodplain will require tree removal. The amount of forest impacts due to access and construction may counteract some of the restoration benefits. This project will also require environmental permitting due to modifications to a perennial stream channel. There are a number of Native American sites above the stream channel. Depending on the amount of disturbance to the terrain, this project may require Phase I archaeological survey, and subsequent archaeological work if sites are found.

Removal of several large concrete slabs from the channel will be necessary for this restoration. Several sanitary sewer utilities were found within the project limits including a large concrete vault area that may constrain design and construction.

Costs:

| ITEM | QUANTITY | UNITS | UNIT COST | TOTAL |
|-------------------------------|----------|-------|---|------------------|
| Construct New Channel | 604 | LF | \$200 | \$120,800 |
| Clear and Grub | 2.08 | AC | \$10,000 | \$20,799 |
| Plantings | 2.08 | AC | \$25,000 | \$51,997 |
| Additional Cost, First 500 LF | 500 | LF | \$200 | \$100,000 |
| | | | Initial Project Cost | \$293,596 |
| Ancillary Items | 1 | LS | 5% of project | \$14,680 |
| Erosion and Sediment Control | 1 | LS | 10% of project | \$29,360 |
| | | | Base Construction Cost | \$337,636 |
| | | | Mobilization (5%) | \$16,882 |
| | | | Subtotal 1 | \$354,518 |
| | | | Contingency (25%) | \$88,630 |
| | | | Subtotal 2 | \$443,148 |
| | | | Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%) | \$199,417 |
| | | | Estimated Project Cost | \$643,000 |



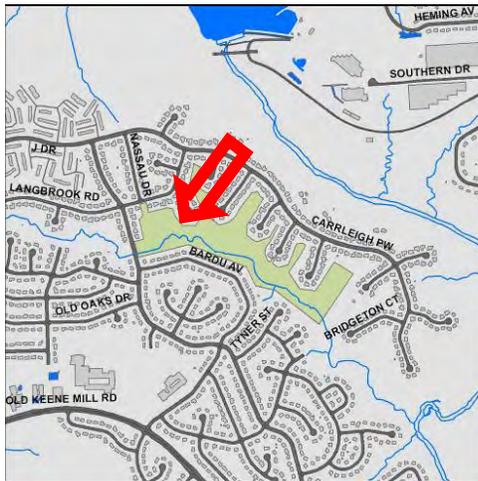
Site Photo: Severe bank erosion



Site Photo: Over-widened channel with moderate erosion

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AC9201 - Stream Restoration



| | |
|-------------------------|-------------------------------------|
| Address: | 6100 Block Bardu Ave |
| Location: | Accotink Stream Valley Park |
| Land Owner: | County-FCPA |
| PIN: | 0794 07 0013P |
| Control Type | Water Quality |
| Drainage Area | N/A |
| Receiving Waters | Unknown Tributary of Accotink Creek |

Description: This project parallels Bardu Avenue, between the culvert under Greeley Boulevard and Lamont Court in the Accotink Stream Valley Park. The upstream portion of the channel is relatively stable except for minor to moderate erosion occurring in isolated areas, and the downstream portion is very sinuous with moderate to severe erosion and over-widening evident. A partially exposed sanitary sewer crossing is present in the downstream portion of the project site.

Restoration of this channel will focus on changing the current channel dimensions to reconnect the original floodplain; redirecting flows away from eroded meanders, and installing grade controls to dissipate stream energy. Armor-in-place or bioengineering stabilization techniques and stone toe protection may be needed on outer meander bends and at the sewer crossing, depending on peak flows and velocities.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This project will help to stabilize the channel at the location of an existing sanitary sewer crossing and promote the use of the original floodplain, thus reducing sediment loads currently being transported downstream in this watershed. By reducing sedimentation within this channel and providing stable habitat along restored banks, overall instream water quality and habitat may be also be improved. It is estimated that a total of over 37,902 lbs of sediment, 30 lbs of total nitrogen and 12 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: A partially exposed sanitary sewer pipe and another buried sewer pipe may constrain design and construction along this project. Since access to the floodplain will need to occur from Greeley Boulevard, steep slopes will need to be addressed. This stream is buffered by forest, so access along the channel and grading of the existing channel and floodplain will require significant tree removal. However, in this case, experience has shown that restoration benefits will outweigh overall construction impacts and impacted forest will be replanted. This project will require environmental permitting due to construction and modifications to a perennial stream channel.

Costs:

| ITEM | QUANTITY | UNITS | UNIT COST | TOTAL |
|-------------------------------|----------|-------|---|------------------|
| Construct New Channel | 795 | LF | \$200 | \$159,000 |
| Clear and Grub | 1.83 | AC | \$10,000 | \$18,251 |
| Plantings | 1.83 | AC | \$25,000 | \$45,627 |
| Additional Cost, First 500 LF | 500 | LF | \$200 | \$100,000 |
| | | | Initial Project Cost | \$322,878 |
| Ancillary Items | 1 | LS | 5% of project | \$16,144 |
| Erosion and Sediment Control | 1 | LS | 10% of project | \$32,288 |
| | | | Base Construction Cost | \$371,310 |
| | | | Mobilization (5%) | \$18,566 |
| | | | Subtotal 1 | \$389,876 |
| | | | Contingency (25%) | \$97,469 |
| | | | Subtotal 2 | \$487,345 |
| | | | Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%) | \$219,305 |
| | | | Estimated Project Cost | \$707,000 |



Site Photo: Moderate to severe erosion on outside meander bends



Site Photo: Sinuous and over-widened channel with moderate erosion on outside meanders

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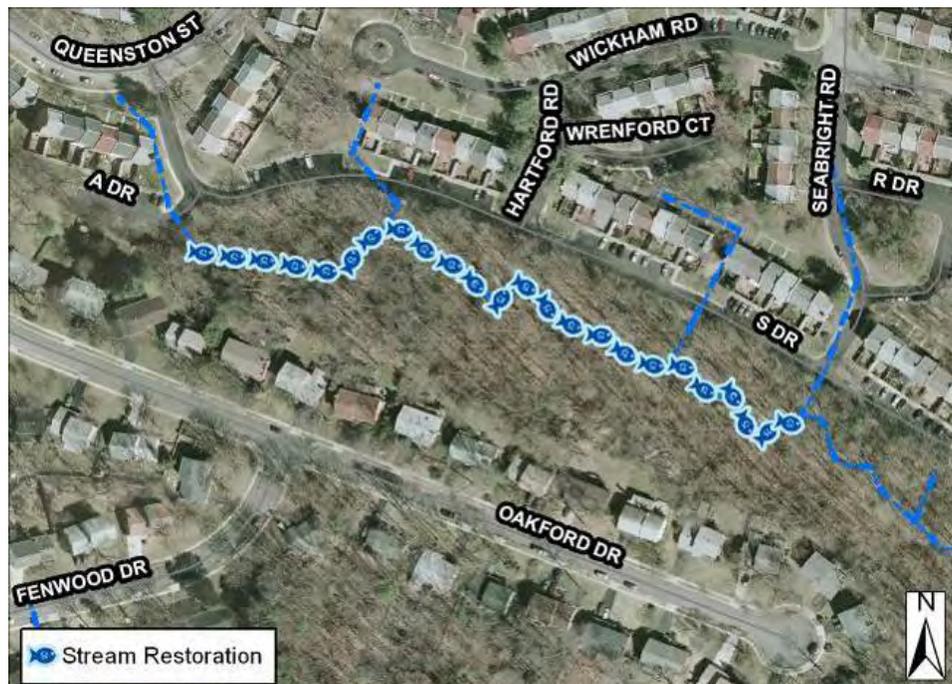
AC9202 - Stream Restoration



| | |
|-------------------------|--|
| Address: | Between A Drive, S Drive and Oakford Drive |
| Location: | Charlestowne neighborhood |
| Land Owner: | Private - Residential |
| PIN: | 0793 14 0012, 0793 14 A3, 0793 14 A1 |
| Control Type | Water Quality |
| Drainage Area | N/A |
| Receiving Waters | Unknown Tributary of Accotink Creek |

Description: This project is located between Oakford Drive and S Drive from the intersection of A and S Drives to the intersection of Seabright Road and S Drive. The upstream portion of this project is severely eroded and incised with very tall unstable banks. The downstream portion of the project is also incised, but experiencing only moderate erosion. Bank heights and overall incision gradually dissipate further downstream along the floodplain.

Restoration of the upstream portion of this project will focus on raising the channel bed elevation as well as regrading and stabilizing stream banks. Since the upstream portion of this project is located in an area with tall streambanks, reconnecting this portion of the channel to the floodplain is not feasible. Reconnection the downstream channel to the floodplain is feasible by reducing channel dimensions and raising the bed elevation. Lastly, all storm drain outfalls to this channel should be restored and stabilized with this project.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This restoration will be designed to withstand large, flashy flows that are discharged from the outfall at the headwaters, along with the other stormwater inputs. Implementation of this project will help to dissipate energy and erosion by restoring the function of the floodplain. This project will also include grade controls to address bank instability and scour, bed incision, and over-widening, which all result in excessive sediment loads being discharged to downstream channels. Reduced sediment loads and new channel creation with a stable habitat along restored banks will also help to improve instream water quality and increase aquatic habitat. It is estimated that a total of over 75,104 lbs of sediment, 60 lbs of total nitrogen and 23 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: This project is entirely contained within private HOA property and will require significant coordination with property owners for access and construction. It will require environmental permitting due to construction and modifications to a perennial stream channel. This stream is buffered by forest, so tree loss is expected to accommodate construction activities. However, in similar projects, experience has shown that restoration benefits will outweigh overall construction impacts. Access most likely will need to occur off of S Drive. Utility impacts are not anticipated with this restoration.

Costs:

| ITEM | QUANTITY | UNITS | UNIT COST | TOTAL |
|---|----------|-------|-------------------------------|------------------|
| Construct New Channel | 983 | LF | \$200 | \$196,600 |
| Clear and Grub | 2.26 | AC | \$10,000 | \$22,567 |
| Plantings | 2.26 | AC | \$25,000 | \$56,416 |
| Additional Cost, First 500 LF | 500 | LF | \$200 | \$100,000 |
| | | | Initial Project Cost | \$375,583 |
| Ancillary Items | 1 | LS | 5% of project | \$18,779 |
| Erosion and Sediment Control | 1 | LS | 10% of project | \$37,558 |
| | | | Base Construction Cost | \$431,920 |
| | | | Mobilization (5%) | \$21,596 |
| | | | Subtotal 1 | \$453,516 |
| | | | Contingency (25%) | \$113,379 |
| | | | Subtotal 2 | \$566,895 |
| Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%) | | | | \$255,103 |
| | | | Estimated Project Cost | \$822,000 |



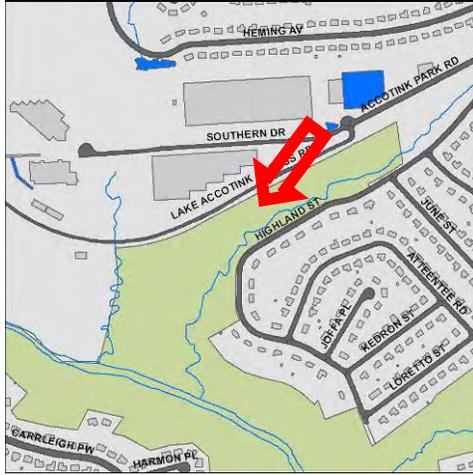
Site Photo: Incised channel with severe meander bend erosion



Site Photo: Incised and over-widened channel with unstable banks

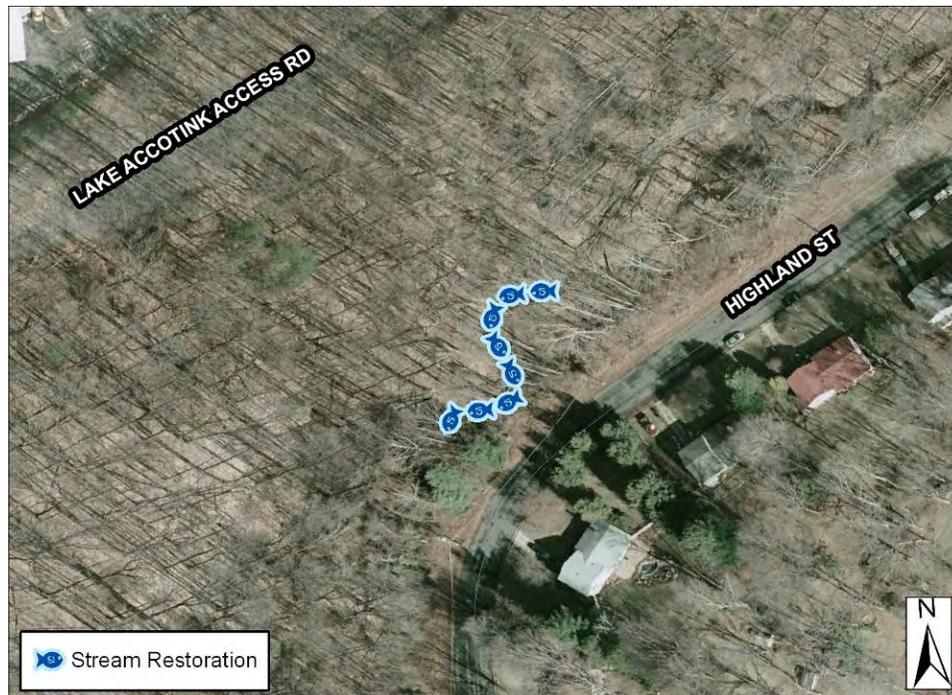
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AC9203 - Stream Restoration



Address: Across from 7600 block of Highland Street
Location: Lake Accotink Park
Land Owner: County - FCPA
PIN: 0803 01 0001A
Control Type: Water Quality
Drainage Area: N/A
Receiving Waters: Unknown Tributary of Accotink Creek

Description: This project is entirely contained within Lake Accotink Park between Highland Street and Lake Accotink Access Road. This project involves a short section of existing stream channel that parallels Highland Street. The existing stream channel is incised and over-widened with severe erosion occurring on both banks. Restoring this channel will focus on reducing the current channel dimensions, redirecting flows away from eroded meanders, and installing grade controls to dissipate stream energy and prevent further overwidening. Armor-in-place or bioengineering stabilization techniques or stone toe protection may be needed on outer meander bends to prevent erosion.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This project will help to decrease sediment loads to downstream portions of the watershed by stabilizing the channel bed and banks, especially on outer meanders. By reducing sedimentation within the channel and providing stable habitat along restored banks, overall instream water quality and habitat may be improved. It is estimated that a total of 26,630 lbs of sediment, 23 lbs of total nitrogen and eight lbs of total phosphorus would be reduced annually by this project.

Project Design Considerations: Existing utility impacts are possible with this restoration due to a sanitary sewer easement within the vicinity of the existing stream channel. This utility may impact access as well as design or construction. Access to this project could occur from Highland Street, but would require significant tree removal and manipulation of steep slopes. Although tree loss is expected, restoration benefits will outweigh overall construction impacts. This project will require environmental permitting to allow for construction and modifications to a perennial stream channel and for forest impacts.

Costs:

| ITEM | QUANTITY | UNITS | UNIT COST | TOTAL |
|-------------------------------|----------|-------|---|------------------|
| Construct New Channel | 194 | LF | \$200 | \$38,800 |
| Clear and Grub | 0.30 | AC | \$10,000 | \$3,000 |
| Plantings | 0.30 | AC | \$25,000 | \$7,500 |
| Additional Cost, First 500 LF | 194 | LF | \$200 | \$38,800 |
| | | | Initial Project Cost | \$88,100 |
| Ancillary Items | 1 | LS | 5% of project | \$4,405 |
| Erosion and Sediment Control | 1 | LS | 10% of project | \$8,810 |
| | | | Base Construction Cost | \$101,315 |
| | | | Mobilization (5%) | \$5,066 |
| | | | Subtotal 1 | \$106,381 |
| | | | Contingency (25%) | \$26,595 |
| | | | Subtotal 2 | \$132,976 |
| | | | Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%) | \$59,839 |
| | | | Estimated Project Cost | \$193,000 |



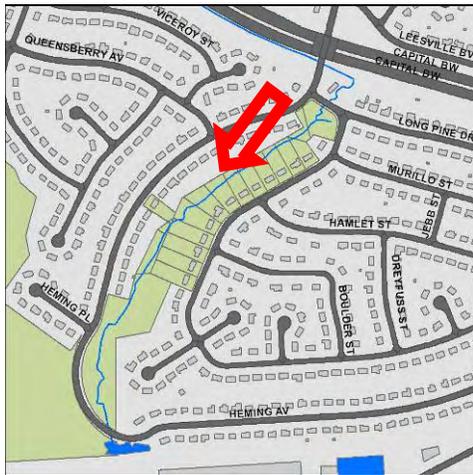
Figure 1: Eroded banks along Highland Street



Figure 2: Eroded banks with large depositional features in the channel

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AC9204 - Stream Restoration



Address: Behind 6500 block of Heming Ave and behind 7600 block of Long Pine Drive

Location: Lake Accotink Park

Land Owner: Public - FCPA

PIN: 0792 01 0001A, 0792 0268 B1, 0792 02630011, 10, 9, 8, 7, 6, 5, 4, 3, 2, 0801 0268 A, 0801 0263 B

Control Type Water Quality

Drainage Area N/A

Receiving Waters Unknown Tributary of Accotink Creek

Description: This project is located between Long Pine Drive and Heming Place in Lake Accotink Park. The upper channel is confined in a narrow valley where the stream banks have been stabilized with concrete that is failing. The downstream portions of the stream section include storm drain outfalls that are also failing. The channel is currently incised and overwidened.

Restoration efforts should focus on removing the failed concrete bank stabilization measures in the upper reaches of the stream channel and replacing it with armor-in-place and bioengineering techniques. The channel should be stabilized by installing grade controls to dissipate energy and some stone toe protection to ensure future bank stability. Restoration efforts in the lower reaches should include redirecting flows away from eroding banks and reconnecting the channel to the floodplain. Storm outfalls will need scour protection to reduce the potential for further erosive forces and headcuts.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: Restoring this channel will help to protect storm drain and utility infrastructure as well as private residential property. Creating a new channel geometry and reconnecting the channel to the floodplain will allow for reduced sediment loads to downstream channels. Reductions in sedimentation and the creation of stable habitat may provide improved instream water quality and habitat conditions. Removing of the concrete in the channel will alleviate erosion of the stream banks It is estimated that a total load of 274,031 lbs of sediment, 354 lbs of total nitrogen and 137 lbs of total phosphorus would be reduced annually by this project.

Project Design Considerations: Since this restoration is located on mostly private residential properties, coordination with these property owners will be necessary for access and construction. Access for this project will need to occur off of Heming Avenue and Long Pine Drive. Steep slopes, tree removal, and confined areas of movement especially in the upstream portion of this restoration will be encountered with this access. This project will require environmental permitting to allow for construction and modifications to a perennial stream channel. Since this stream is buffered by forest on both banks, access and construction for this project will cause a significant amount of tree loss; however, restoration benefits will outweigh overall construction impacts.

Costs:

| ITEM | QUANTITY | UNITS | UNIT COST | TOTAL |
|-------------------------------|----------|-------|---|--------------------|
| Construct New Channel | 2161 | LF | \$200 | \$432,200 |
| Clear and Grub | 1.98 | AC | \$10,000 | \$19,800 |
| Plantings | 1.98 | AC | \$25,000 | \$49,500 |
| Additional Cost, First 500 LF | 500 | LF | \$200 | \$100,000 |
| | | | Initial Project Cost | \$601,500 |
| Ancillary Items | 1 | LS | 5% of project | \$30,075 |
| Erosion and Sediment Control | 1 | LS | 10% of project | \$60,150 |
| | | | Base Construction Cost | \$691,725 |
| | | | Mobilization (5%) | \$34,586 |
| | | | Subtotal 1 | \$726,311 |
| | | | Contingency (25%) | \$181,578 |
| | | | Subtotal 2 | \$907,889 |
| | | | Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%) | \$408,550 |
| | | | Estimated Project Cost | \$1,317,000 |



Figure 1: Severe meander bend erosion



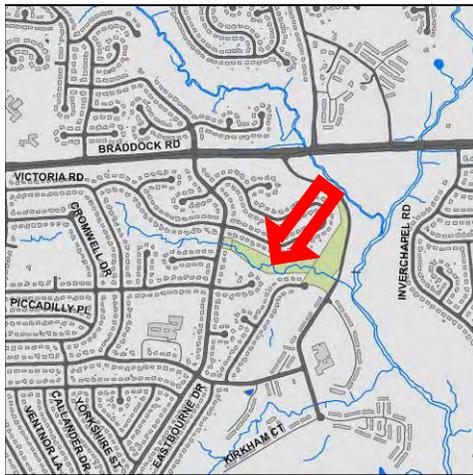
Figure 2: Existing concrete lined channel breaking up



Figure 3: Severe erosion and stormdrain outfall damage

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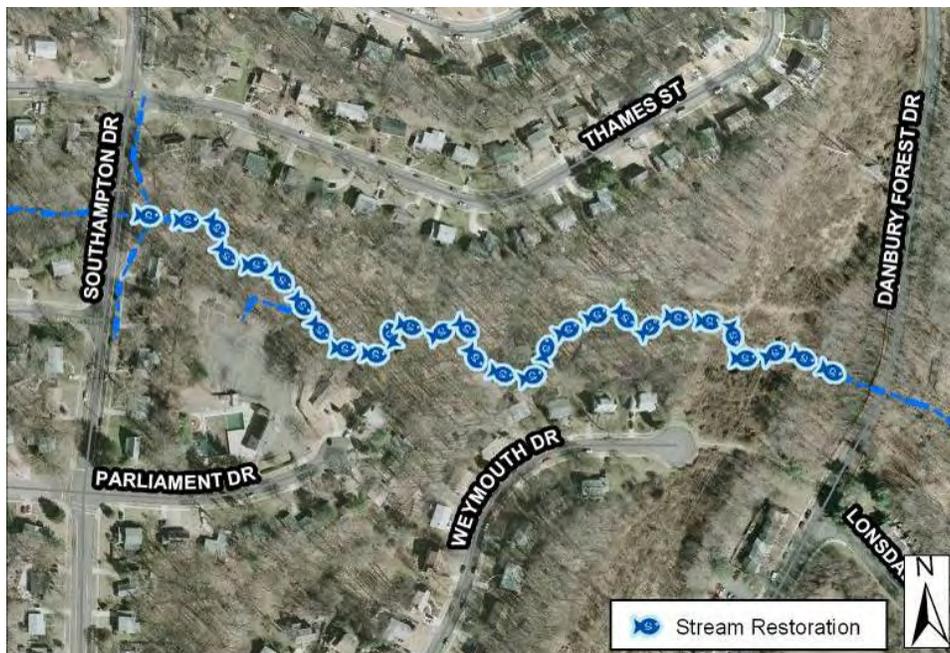
AC9205 - Stream Restoration



| | |
|-------------------------|--|
| Address: | Behind 8400/8500 Blocks Thames St |
| Location: | Lake Accotink Park |
| Land Owner: | County - FCPA |
| PIN: | 0703 04 B1, 0703 12 J, 0703 04 B |
| Control Type | Water Quality |
| Drainage Area | N/A |
| Receiving Waters | Unknown Tributary of Accotink Creek |

Description: This project is designed to restore an existing stream channel located within Lake Accotink Park from Southampton Drive to Danbury Forest Drive. This channel is experiencing moderate erosion on outside meander bends and has become over-widened. The conditions in the channel become worse moving downstream. In many cases, the ephemeral channels created by storm drain outfalls that drain to this project are also eroded and unstable.

Restoration will focus on reconnecting this channel to the floodplain by reducing channel dimensions and raising the bed elevation. Reconnection to the floodplain, along with installing grade controls, will help to prevent further incision and over-widening. In areas where the existing channel will be maintained, regrading and stabilization may need to occur with armor-in-place or bioengineering techniques. In particular, these techniques may be required where a sanitary sewer utility is within close proximity or where the channel is eroding the valley walls.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This project will help to reduce sediment loads that could be transported downstream toward Lake Accotink. Sediment loads to those downstream channels will be reduced through the creation of new channel geometry as well as through the stabilization of existing banks. Reconnecting the channel to the floodplain will also reduce downstream sediment loads by depositing suspended sediment on the floodplain. It is estimated that a total of 266,730 lbs of sediment, 213 lbs of total nitrogen and 83 lbs of total phosphorus would be reduced by this project. This project will also protect a sanitary sewer utility line that runs parallel to this channel on the floodplain.

Project Design Considerations: Access for this project will most likely need to occur from Southampton Drive. An existing sanitary sewer utility clearing can be used from this access point to travel along the floodplain; however, the utility also has the potential to constrain design or construction. Overhead power transmission lines are present in the downstream portion of this project; however, no construction impacts are anticipated. Since this stream is buffered by forest on both banks, construction for this project will likely result in loss of trees. However, as in similar situations, experience has shown that restoration benefits will outweigh overall construction impacts. This project will require environmental permitting due to construction and modifications to a perennial stream channel. Steep slopes, especially where the channel meanders along the valley wall, will require special attention.. This project should also be designed with reference to AC9403 and AC9402, which occur at the upstream and downstream culverts along this stream channel.

Costs:

| ITEM | QUANTITY | UNITS | UNIT COST | TOTAL |
|-------------------------------|----------|-------|---|--------------------|
| Construct New Channel | 1831 | LF | \$200 | \$366,200 |
| Clear and Grub | 4.20 | AC | \$10,000 | \$42,034 |
| Plantings | 4.20 | AC | \$25,000 | \$105,085 |
| Additional Cost, First 500 LF | 500 | LF | \$200 | \$100,000 |
| | | | Initial Project Cost | \$613,319 |
| Ancillary Items | 1 | LS | 5% of project | \$30,666 |
| Erosion and Sediment Control | 1 | LS | 10% of project | \$61,332 |
| | | | Base Construction Cost | \$705,317 |
| | | | Mobilization (5%) | \$35,266 |
| | | | Subtotal 1 | \$740,583 |
| | | | Contingency (25%) | \$185,146 |
| | | | Subtotal 2 | \$925,729 |
| | | | Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%) | \$416,578 |
| | | | Estimated Project Cost | \$1,343,000 |



Site Photo: Upstream end with moderate erosion and adjacent sanitary sewer



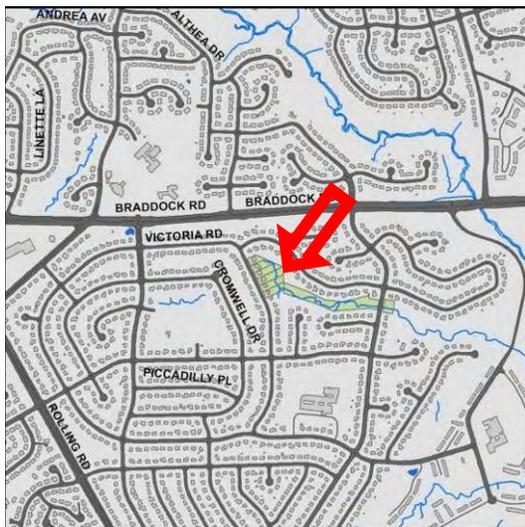
Site Photo: Over-widened channel with moderate meander bend erosion



Site Photo: Downstream end with moderate to severe meander erosion

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AC9206 - Stream Restoration



Address: Behind 8500-8600 Block of Thames Street
Location: Kings Park neighborhood
Land Owner: Private – Residential
PIN: 0703 03 0065, 0703 03 0066, 0703 03 0067, 0703 03 0068, 0703 0069, 0703 04 B
Control Type Water Quality
Drainage Area N/A
Receiving Waters Unknown Tributary of Accotink Creek

Description: This project is located on private residential properties and is located between Thames Street, Victoria Street and Perth Court. The stream channel is experiencing moderate incision and bank erosion with over-widened conditions.

Restoration efforts should focus on reconnecting this channel to the floodplain, which, along with installing grade controls, will help prevent further downcutting and over-widening. As an option, channel relocation could be considered in this situation, to help redirect flows away from existing infrastructure. Several storm drain outfalls drain to this project and should be stabilized in conjunction with channel restoration using armor-in-place or bioengineering techniques. In addition, protection of an existing sanitary sewer crossing and an exposed sewer manhole standpipe should also be addressed with the channel restoration.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This project will help to stabilize conditions at an existing sanitary sewer manhole and crossing. It will also promote the use of the floodplain, which can reduce sediment loads being transported to downstream portions of this watershed. By reducing sedimentation within this channel and providing stable habitat along restored banks, overall instream water quality and habitat may also be improved with this project. It is estimated that a total of over 181,645 lbs of sediment, 145 lbs of total nitrogen and 56 lbs of total phosphorus would be reduced by this project.

Project Design Considerations: Coordination with private residential property owners for access and construction will be necessary with this project, as the existing stream channel is partially located on many of these privately owned parcels. A partially exposed sanitary sewer pipe and manhole may constrain design and construction along this project, in that it may be more advantageous to redirect stream flow away from the manhole standpipe by relocating those stream segments. Access to the floodplain will require the use of the floodplain upstream adjacent to Southampton Drive, while access might be possible along storm drain easements at the end of Perth Court or Durham Court and along Thames Street and Victoria Road. However, all of these access points will be adjacent to private residential properties and will require construction access approval. This stream is buffered by forest, so access along the channel and grading of the existing channel and floodplain will likely require tree removal. However, in similar projects, experience has shown that restoration benefits will outweigh overall construction impacts. This project will require environmental permitting due to construction and modifications to a perennial stream channel.

Costs:

| ITEM | QUANTITY | UNITS | UNIT COST | TOTAL |
|-------------------------------|----------|-------|---|------------------|
| Construct New Channel | 1068 | LF | \$200 | \$213,600 |
| Clear and Grub | 2.45 | AC | \$10,000 | \$24,518 |
| Plantings | 2.45 | AC | \$25,000 | \$61,295 |
| Additional Cost, First 500 LF | 500 | LF | \$200 | \$100,000 |
| | | | Initial Project Cost | \$399,413 |
| Ancillary Items | 1 | LS | 5% of project | \$19,971 |
| Erosion and Sediment Control | 1 | LS | 10% of project | \$39,941 |
| | | | Base Construction Cost | \$459,325 |
| | | | Mobilization (5%) | \$22,966 |
| | | | Subtotal 1 | \$482,291 |
| | | | Contingency (25%) | \$120,573 |
| | | | Subtotal 2 | \$602,864 |
| | | | Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%) | \$271,289 |
| | | | Estimated Project Cost | \$875,000 |



Site Photo: Moderate erosion on meander banks



Site Photo: Over-widened with moderate erosion



Site Photo: Sanitary sewer manhole in eroded channel

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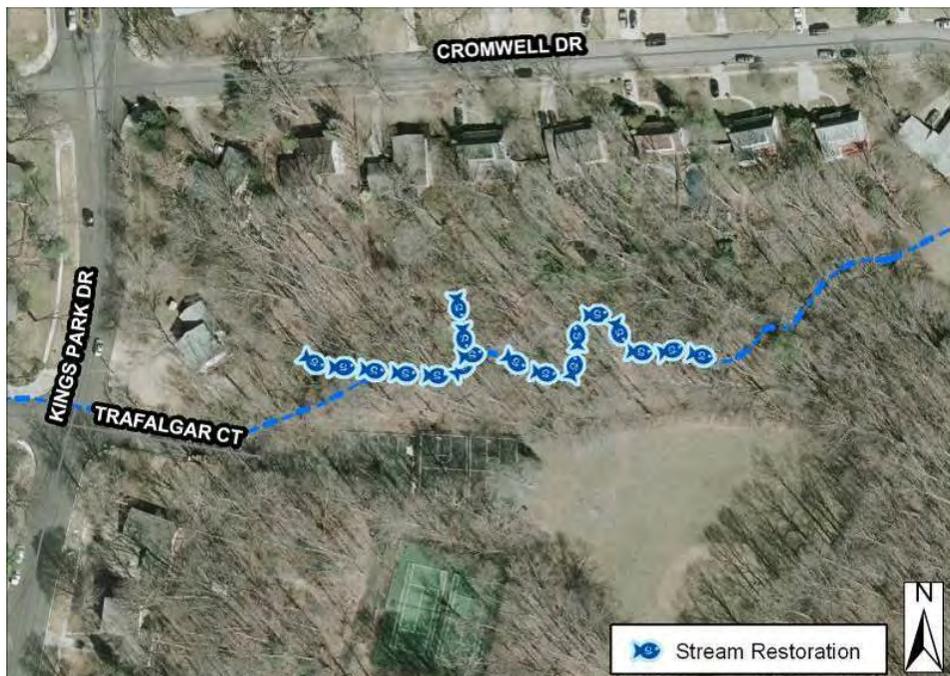
AC9207 - Stream Restoration



| | |
|-------------------------|-------------------------------------|
| Address: | 8717 Trafalgar Ct |
| Location: | Kings Park |
| Land Owner: | County - FCPA |
| PIN: | 0703 01 0027 |
| Control Type | Water Quality |
| Drainage Area | N/A |
| Receiving Waters | Unknown Tributary of Accotink Creek |

Description: This project is located entirely within Kings Park and extends from the end of Trafalgar Court to a culvert under Cromwell Drive. The current sinuous, incised, and over-widened stream channel is eroding on the outside of meander bends as well as along straight segments of the stream. A small tributary channel originating from an outfall off of Cromwell Drive is also eroding and should be restored in conjunction with this project.

Restoration of the channel will focus on creating a nested channel, in which the floodplain and banks of the current channel will be regraded to allow for creation of a new floodplain at an elevation lower than the original. Restoration will include reducing the existing channel dimensions and installing grade controls to dissipate streamflow energy, thus avoiding further incision and over-widening. Armor-in-place stabilization techniques or stone toe protection may also be needed near the 42" outfall or on outer meander bends.



Project Area Map: Conceptual plan showing potential project location

Project Benefits: This restoration will be designed to withstand large, flashy flows that may originate from the 42" outfall. Implementation of the project will effectively provide for a reduction in sediment loads to downstream channels by reducing bank scour and meander bend migration, while also providing a floodplain to dissipate energy and encourage sediment deposition. By providing for a more stable flow regime, instream water quality and habitat may be improved with this project. It is estimated that a total of 246,009 lbs of sediment, 197 lbs of total nitrogen and 76 lbs of total phosphorus would be reduced by this project.

The project will also stabilize several storm drain outfalls and conveyances that drain to this channel. This project is within park property, so it may provide an environmental education or stewardship opportunity for residents of this community and park patrons.

Project Design Considerations: This project will require environmental permitting due to construction and modifications to a perennial stream channel. This stream is buffered by forest, so access along the channel and grading of the existing channel and floodplain will require tree removal. However, in similar projects, experience has shown that restoration benefits will outweigh overall construction impacts.

The project area contains two Native American quarry sites. Both are south of the proposed area of stream restoration and associated with the athletic facilities in the park. It is recommended that those sites be avoided by staging and access activities. Therefore, access for this project will need to occur from the parking lot within Kings Park at the end of Trafalgar Court. Impacts to existing utilities are not anticipated.

Costs:

| ITEM | QUANTITY | UNITS | UNIT COST | TOTAL |
|-------------------------------|----------|-------|---|------------------|
| Construct New Channel | 501 | LF | \$200 | \$100,200 |
| Clear and Grub | 1.15 | AC | \$10,000 | \$11,501 |
| Plantings | 1.15 | AC | \$25,000 | \$28,753 |
| Additional Cost, First 500 LF | 500 | LF | \$200 | \$100,000 |
| | | | Initial Project Cost | \$240,454 |
| Ancillary Items | 1 | LS | 5% of project | \$12,023 |
| Erosion and Sediment Control | 1 | LS | 10% of project | \$24,045 |
| | | | Base Construction Cost | \$276,522 |
| | | | Mobilization (5%) | \$13,826 |
| | | | Subtotal 1 | \$290,348 |
| | | | Contingency (25%) | \$72,587 |
| | | | Subtotal 2 | \$362,935 |
| | | | Engineering Design, Surveys, Land Acquisition, Utility Relocations, and Permits (45%) | \$163,321 |
| | | | Estimated Project Cost | \$527,000 |



Site Photo: Incised and over-widened with moderate to severe erosion



Site Photo: Over-widened with moderate to severe erosion on meander bends

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