

I-495 Culvert Outfall and Wetland Evaluation - April 2017

Introduction

In February 2016 the Virginia Department of Transportation (VDOT) asked the Northern Virginia Soil and Water Conservation District (NVSWCD) to evaluate the impact of an existing I-495 culvert on its receiving channel and an adjacent small wetland. VDOT asked NVSWCD to provide options on how to remediate the impacts.

The NVSWCD staff have visited the location on several different occasions and sought input from VDOT, Fairfax County Park Authority (FCPA), Friends of Accotink Creek (FACC), and Fairfax County Stormwater Planning Division staff. Their input has been incorporated throughout this report.

Overall, the culvert, its immediate outfall, and its downstream receiving channel have been assessed and the culvert impact has been evaluated. Attempts have been made to determine whether the existing small wetland close to the culvert outfall has been impacted by the culvert or construction activities during I-495 Express Lane project.

Stakeholders

- Virginia Department of Transportation (VDOT) - The culvert, its immediate outfall, and the adjacent wetland are partially located within the VDOT right of way.
- Fairfax County Park Authority (FCPA) - A portion of the outfall and the entire receiving channel are located within FCPA's Accotink Creek Stream Valley Park.
- Friends of Accotink Creek (FACC) - FACC is a volunteer organization concerned with preservation and restoration of the Accotink Creek and its stream valley corridor.
- Fairfax County DPWES-Stormwater Planning Division (SWPD) - There is potential for Fairfax County Stormwater Planning Division of the Department of Public Works and Environmental Services to participate.
- Northern Virginia Soil and Water Conservation District (NVSWCD) - The NVSWCD has been assigned to assess the downstream impact of the culvert and provide stabilization options.

Location

The culvert is located approximately 2,600 feet north of the Americana Park along the Cross Country Trail. The distance between the edge of the trail and culvert is approximately 500 linear feet. Approximately 450 linear feet of the receiving channel is located within the Accotink Creek Stream Valley Park and partially located within the Accotink Creek Resource Protected Area (RPA). The remaining outfall is located within the VDOT right of way. The attached location map shows the culvert outfall, receiving channel, limits of RPA, FCPA property line, the paved trail, and culvert proximity to Americana Park.

Existing Conditions

Culvert outfall and the receiving channel: The culvert is a 24.0-inch corrugated plastic pipe. The hydraulic and hydrology data for this specific culvert has not been available. The culvert is not shown on Fairfax County GIS, and no information on its drainage area is available.

However, observations in the field suggest that the culvert drainage area is limited to I-495 impervious surface only and that the original culvert appears to have been extended while the I-495 Express lane was constructed.

A rock apron consisting of Class I rip rap protects the culvert outlet. The rip rap apron is approximately 12.0 feet wide and 20.0 feet long. The outlet invert drops in elevation at the end of rip rap apron. The drop is also lined with Class I rip rap. The elevation difference between the end of the outlet protection apron and the invert of receiving channel is approximately seven feet.

The outfall protection has been impacted by the discharge from the culvert. Some of the rocks have been moved. Portions of the apron is covered with sediment transported through the culvert. A portion of the existing rip rapped drop has collapsed. The outfall protection seems to be inadequate in protecting the downstream receiving channel.

A blockage exists at the beginning of the receiving channel. The blockage has been caused by the existing VDOT right of way (ROW) fence partially blocking the stream. The receiving channel starting at the end of the rip rap apron extends approximately 175 feet before the channel ties into the floodplain and disappears.

A culvert under the Cross County Trail connects the floodplain with the Accotink Creek. A portion of the receiving channel is located within the Accotink Creek RPA boundary. The first 90.0 feet reach starting at the end of the culvert outlet apron is highly incised. Channel banks are vertical and in some places undercut. The channel width varies between 2.0 and 4.0 feet. The average channel depth is approximately 3.0 to 4.0 feet. This reach is highly impacted by the discharge from the culvert and continues to erode.

Downstream from this reach the channel becomes wider with an increase in width-to-depth ratio. The channel becomes more stable with gentler slopes compared with the upstream reach. This section contains two major natural blockages, which have resulted in a significant rise in stream invert immediately upstream from the blockage. At the end of this section the stream gradually ties into the floodplain where no defined bed and bank is present.

Wetlands: The wetlands along the outfall channel can be divided into 3 regions.

1. Emergent Wetland: Approximately 800 square feet (20' x 40'). It is dominated by cattails (*Typha* sp.) and sedges (*Carex* spp.). It is located between the existing ROW fence and the I-495 embankment. The wetland is within the VDOT right of way. An existing silt fence, presumably installed during I-495 Express Lane construction, acts as a berm and helps to retain the wetland on the lower side. Field indicators including the obvious recent earth disturbance at the toe of the road fill slope, sedimentation and age and type of vegetation as well as later review of Fairfax County aerial imagery confirm that the current emergent wetland was created as a result of the I-495 Express Lane construction. It is unknown whether a previous forested wetland existed at this location. The remaining silt fence has helped the creation of the wetland.

2. Channel-side Palustrine Forested Wetland: Approximately 700 to 800 square feet along both banks of receiving channel just below the riprap outfall. This is an old wetland and vegetation consists of mostly skunk cabbage (*Symplocarpus foetidus*), sedges (*Carex* spp.), maleberry (*Lyonia ligustrina*), black highbush blueberry (*Vaccinium fuscum*), greenbriar (*Smilax rotundifolia*), iron wood (*Carpinus caroliniana*), red maple (*Acer rubrum*), black gum (*Nyssa sylvatica*), sweet gum (*Liquidambar styraciflua*), and green ash (*Fraxinus pennsylvanica*).
3. Accotink Creek Palustrine Forested Wetland: The largest among the 3 regions. Located at the end of the receiving channel and borders the Cross County Trail. The receiving channel flows into this wetland. This wetland has been impacted by deer browse and likely by increased flow and sedimentation. The dominant species include sweet woodreed (*Cinna arundinacea*), wild rye (*Elymus* sp.), skunk cabbage (*Symplocarpus foetidus*), spicebush (*Lindera benzoin*), ironwood (*Carpinus caroliniana*), red maple (*Acer rubrum*), sweet gum (*Liquidambar styraciflua*) and green ash (*Fraxinus pennsylvanica*).

Comments and Recommendations

Culvert outfall and receiving channel.

Although the culvert outlet and receiving channel have been impacted by culvert discharge, the NVSWCD does not recommend full-scale channel restoration/stabilization for the following reasons:

1. *Environmental impact.* Any restoration that requires readjustment of the existing channel dimension, pattern, and profile will have negative environmental impact that will well exceed the benefit of restoring the channel. Construction activities including building an access path, staging area, stockpile, and implementing the needed grading will require disturbing a large area including the main wetland and removing existing vegetation and mature trees.
2. *Insignificant impact of the existing channel on Accotink creek and its riparian buffer.* Sediment produced by stream erosion within the upper reach of the channel spreads over the floodplain and rarely reaches Accotink Creek. The distance between the culvert outfall and Accotink Creek is approximately 600 linear feet. The receiving channel is approximately 170 feet, and afterward the stream ties into the floodplain (no bed and banks). Sediment load coming from the receiving channel is deposited over a large area of the floodplain. There is no sign of significant sediment deposition where the channel discharge spreads over the floodplain.
3. *Site accessibility:* The only path for the material and equipment to reach the outfall is through the existing paved Cross County Trail. The trail length from Americana Park to restoration site is approximately 2,600 linear feet. The trail is paved and is not suitable for use by heavy machinery. If used, the trail might require significant repair when restoration is ended. The trail is also widely used by the general public. During the restoration, access to the trail by the general public will be restricted. The impact of trail closure, public reaction, and repair cost will make it difficult to justify restoration of such a small outfall.
4. *Permit requirements.* The receiving channel is partly located within a 100-year floodplain, RPA, FCPA land, and VDOT right of way. Federal, state, and county permits will be required. In addition, possible easement and other permits from FCPA and VDOT

to work within their properties will be needed. Compliance with these obligations will be costly and time consuming.

5. *Final costs.* The total restoration cost will exceed the usual stream restoration cost of \$800 to \$1000 per linear feet. The final cost cannot be justified for such a small-scale restoration project.

The NVSWCD recommends:

1. Spot stabilization of the receiving channel using measures that require minimum land disturbance and can be constructed manually, with a concentration on the first 90-foot reach of the culvert outfall. The recommended spot stabilization measures include:
 - a. Rearrangement of the existing rocks to protect the culvert's immediate outfall. The existing rocks could be rearranged to build a shallow plunge pool at the culvert outfall. Existing rocks can be used to repair the damaged drop and turn the drop into two or three step-pools. All the activities could be performed manually. For step pools additional rocks might be needed.
 - b. Removal of an existing blockage caused by the existing ROW fence that crosses the stream. This can be done manually. The ROW fence should be reinstalled correctly to prevent future blockage.
 - c. Spot stabilization of the remaining reach where the channel is incised and active erosion is in progress. This could be done with little need for re-grading the channel banks. The land disturbance activities will be limited. Needed material can be partly harvested from within the surrounding forest. These include logs that can be salvaged from the existing fallen trees. Stabilization could include installing man-made blockages within the channel to slow velocity and allow the rise in stream invert through sediment accumulation behind the blockage. The NVSWCD has built such man-made blockages as part of a demonstration project in Huntley Meadows Park. A variety of techniques can be implemented manually to slow the erosion and reduce erosion-induced sediment transport¹.
 - d. Undercut bank areas within the stabilized channel sections would cut off with hand tools to remove cantilevered sediment and establish a stable bank profile. This sediment would be sequestered within the channel upstream of the blockages and stabilized with native plants.

The emergent wetland

1. It is the NVSWCD understanding that this emergent wetland is the subject of concerns regarding the impact of Express Lane construction on its health and performance.
2. Fairfax County aerial photography confirms that there was no emergent wetland in this location in 1997. The NVSWCD is unable to verify whether construction activities during construction of I-494 Express Lane disturbed a pre-existing forested wetland in this location. At present, a sign in the area where the wetland is located confirms the presence of the wetland. This is an indication that VDOT or the contractor responsible for the Express Lane construction was aware of the presence of a wetland during

¹ Reference: Let Water do the Work, Induced Meandering, An Evolving Method for Restoring Incised Channels, By Bill Zeedyk and Van Clothier 2009, Chelsea Green Publishing.

construction activities. The remaining silt fence might be an indication that the wetland has been identified and silt fence was installed as a wetland perimeter control.

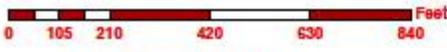
3. During several site visits, the NVSWCD has been able to verify that an area approximately 20x40 exists as wetland. Soil cores taken during a site visit verified the presence of hydric soil. Vegetation mostly consists of wetland plants, primarily cattail. During the November 2016 and January-February 2017 visits, NVSWCD observed clear signs of groundwater seepage into the area designated as the wetland.

To enhance quality and performance of the existing wetland, the NVSWCD recommends:

1. Removing the existing silt fence at the lower side of the wetland. The silt fence presently acts as a berm. Its removal will require an alternative structure to act as the berm. The least intrusive alternative would be large-diameter biologs. It might be possible to expand the wetland footprint by relocating the berm. Doing this will require further study by a wetland specialist. Removing the silt fence and installing a new berm can be done manually.
2. Removing and reinstalling the existing ROW fence. This can be done manually.
3. Introducing new and/or additional wetland plants to enhance biodiversity inside the wetland. All can be done manually.

The proposed recommendations attempt to minimize the environmental impact of stabilizing the outfall channel and enhancing the existing wetland. Nevertheless, the use of small machinery and import of outside material might be needed. The use of a Bobcat to transport small rocks, biologs, and plants might become necessary. Since the trail is the only path through which the site could be accessed, the use of Cross County Trail for a limited time and its closure should be considered in any future planning. Certain permits including a water quality impact assessment report (WQIA), permit to work within RPA, permit to use the trail, and permit for land disturbance activities within VDOT right of way might be required, along with appropriate permissions from FCPA.

I-495 Culvert Outfall and Wetland Evaluation



1 inch = 300 feet

I-495 Culvert Outfall
Accotank Creek Stream Valley Park

Prepared by the NVSWCD
March 2017





The 24.0" culvert



Culvert outlet protection and drop



Blockage caused by the RW fence



The upper incised reach



The end of upper incised reach



Channel ties into the floodplain (looking upstream)



Channel ties into the floodplain (looking downstream)



The emergent wetland. Stakes hold the silt fence



Manmade blockage during construction
Designed and built by the NVSWCD, Huntley Meadows Park



Manmade blockage following construction
Designed and built by the NVSWCD, Huntley Meadows Park



Manmade blockage one year later construction
Designed and built by the NVSWCD, Huntley Meadows Park