TOWN OF
VIENNA
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Bear Branch Tributary Phase II – Southside Park Stream Restoration Grant Proposal

Stormwater Local Assistance Fund Fiscal Year 2020

Town of Vienna, Virginia - Grant Proposal for a Stream Restoration Project to the 2020 Stormwater Local Assistance Fund

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A. Background

The Town of Vienna, Virginia is located approximately fifteen miles west of Washington, D.C., and called home by approximately 16,000 residents. With a geographic area of slightly over four square miles, it is one of a handful of incorporated areas within Fairfax County. The Town of Vienna was primarily developed during the 1950s and 1960s without the environmental benefits of stormwater management and water quality treatment. Further subdivision development in the 1980s increased impervious areas, enclosed tributaries, straightened streams, removed riparian buffers, and steepened stream banks to build more homes. More recently, the Town of Vienna has experienced a redevelopment boom leading to a further increase in its impervious surfaces and a further burden on the receiving watercourses. Predictably, the receiving streams and channels have experienced incision, erosion and widening in response to the increase in water quantity resulting from fifty plus years of development. Within the Town of Vienna's four plus square miles is the watershed for the Bear Branch Tributary section of the Accotink Creek watershed and the subject of this application.

The portion of Bear Branch Tributary impacted by this proposed project is unassessed and categorized as a 3A in the Virginia 2016 and 2018 Impaired Waters – 303(d) category list; however, other downstream assessed sections are listed as type 5 (the most severe impairments). The proposed restoration section shares many of the same issues of assessed sections. Additionally, Bear Branch Tributary flows to Accotink Creek, the Potomac River, and the Chesapeake Bay, which are all under a Total Maximum Daily Load (TMDL).

Municipal maintenance funds are only available for occasional dredging of sediment, but not for corrective action to prevent the erosion and naturally stabilize the stream. Over the years, stream bank armoring and dredging have been the standard repair method used by the Town of Vienna stream maintenance crews. Funding is tight; therefore, problems are addressed in a reactive, as opposed to a preventive, manner. This project will show local staff and residents the practical aspects of correcting the problem of stream bank erosion before sediment must be dredged from the stream. As it ages, the stabilization of the problem area will demonstrate how carefully preparing for natural restoration is cheaper in the long run with the elimination of costly dredging. This project will extend closer to the ultimate headwaters and additional action on this stream will help maintain downstream sections by reducing the sediment load.

In 2014, additional regulations in response to the continuing challenges faced by the Chesapeake Bay went into effect and the Town of Vienna, as a MS4 permittee, experienced additional requirements relating to the water quality in its streams. The Town has executed a cooperative agreement with Fairfax County to share responsibility for implementing a joint Chesapeake Bay TMDL Action Plan. As a function of these requirements and the cooperative agreement with Fairfax County, the amount of Phosphorus, Nitrogen and Total Suspended Solids will need to be reduced. The Town, in conjunction with Fairfax County, has a role and responsibility in meeting these requirements. Formal correspondence with Fairfax County has indicated available design and construction funding for the restoration to constitute the matching funds required for the grant (refer to Appendix F).

This application also makes multiple references to Fairfax County's *Accotink Creek Watershed Management Plan*. This plan describes the needs and requirements for the future of the watershed, and a

path to meeting the requirements of the updated regulations. Further, Accotink Creek is identified as an impaired waterbody in the following categories: PCB found in fish tissue and impaired benthic communities caused by excess sediment flow, both of which are benefited by restoring the proposed stream sections.

B. Environmental Benefit

The primary aim and quantified requirement in meeting the grant application standards is establishing the amount of Total Phosphorus (TP) to be removed as a result of the proposed project. This project proposes to stabilize approximately 2,300 feet of stream bank within the borders of the Town of Vienna (refer to Figure 1). The Bear Branch Tributary section proposed for this restoration is in the Accotink Creek watershed and is close to the headwater of the stream. As a result of being situated in the headwaters, all downstream sections will benefit from stabilization and restoration that takes place in the upper reaches. The total drainage area for the proposed restoration is 0.62 square mile. A Bear Branch Tributary Drainage Area Map is attached (refer to Appendix A).

The erosion of stream banks causes suspended solids, which may be laden with phosphorus, to be suspended in runoff. Additionally, the restoration of stream banks provides a means of pretreatment for runoff and removal of phosphorus prior to reaching the stream. As outlined in the grant application, the Protocols defined in the *Recommendations of the Expert Panel to Define Removal Rate for Individual Stream Restoration Projects (September 2014)* were used to determine a total phosphorus reduction of **618.88 lb TP per year**. The Bear Branch Tributary Methodology for Calculating Total Phosphorus Reduction including the Bank Assessment of Non-point source Consequences of Sediment (BANCS) model using Protocol I is attached (refer to Appendix B).

Figure 1 – Location Map and Extents of Proposed Project

C. Statement of Need

Condition of the Stream Sections

The current condition of the stream sections have been evaluated onsite and photographed as shown in Figure 2, additional photographs are included in Appendix E. As shown on the Bear Branch Tributary Stream Erosion Evaluation Map included in Appendix C, there are multiple portions of the stream rated extreme for both bank hazard erosion index (BEHI) and near-bank stress risk (NBS). In addition to the site visits and photographs taken, the *Accotink Creek Watershed Management Plan* was reviewed for insight into the phosphorus loads arising from the drainage areas. Figure 2 shows the degree of incision and erosion along the banks. While walking the stream, several areas of 3 feet to 13 feet high, eroded banks are clearly visible. Details for each field-investigated bank can be found in Appendix C. In many of these areas, existing trees have been undermined and overturned. The condition of the stream appears to be a Type III, as described by Figure 3 and indicated in Figure 4 from the *Accotink Creek Watershed Management Plan, Appendix A, Stream Condition Map*.

Figure 2. BEHI #8 showing 13' of eroded bank

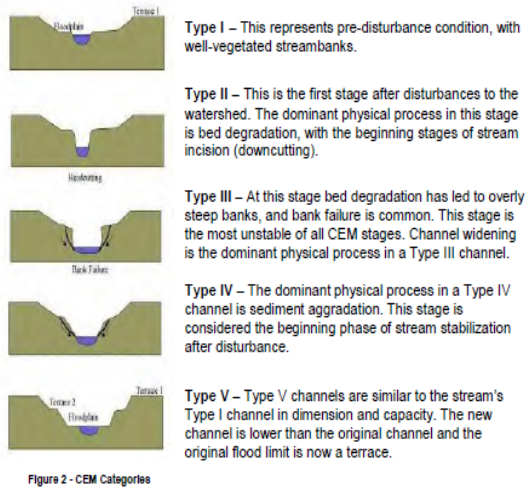


Figure 3. Stream Condition Types

Figure 4. Accotink Creek Channel Evolution Model Map

The A*ccotink Creek Watershed Management Plan* also outlines this stretch of Bear Branch Tributary as a potential project to help restore and protect the watershed. A project description, benefits, and considerations per the watershed's plan can be found in this SLAF application's Section J, Attachment - Section F. A conceptual plan showing the limits of the County's recommendation can be seen in Figure 5.

Figure 5. Conceptual Plan showing the limits of Fairfax County's recommendation

Total Phosphorus (TP)

In reviewing the *Accotink Creek Watershed Management Plan*, several items reference the condition of the streams in the Bear Branch portion of Accotink Creek. As shown in Table 3-3, Figure 6, the Bear Branch section of Accotink Creek is rated as very poor for a composite site condition rating. This score is consistent with the heavily urbanized watershed and eroded state of the stream. In addition, the Bear Branch region is considered very high as seen in Figure 7 for total phosphorus loading. This very high rating for phosphorus further supports the need for stream mitigation.

The field investigated stream condition and completed BANCS model indicates a significant need for restoration and stabilization. The watershed's plan finding that Bear Branch Tributary is inundated with high levels of total phosphorus in conjunction with the significant drainage area, this restoration presents a prime opportunity to achieve the total phosphorus reduction goal of the SLAF grant.

Table 3-3: Stream Protection Strategy Baseline Data Summary

Site Code and Stream Name	Composite	Environmental Variables		
	Site Condition Rating	Index of Biotic Integrity	Habitat Score	Fish Taxa Richness
ACAC01- Accotink Creek 1	Very Poor	Poor	Very Poor	Low
ACDR01- Daniels Run	Very Poor	Very Poor	Poor	Very Low
ACAC02- Accotink Creek 2	Very Poor	Fair	Very Poor	Moderate
ACBB01- Bear Branch	Very Poor	Very Poor	Poor	Low
ACLC01- Long Branch North	Very Poor	Very Poor	Poor	Low
ACAC03- Accotink Creek 3	Very Poor	Poor	Poor	Moderate
ACAC04- Accotink Creek 4	Poor	Poor	Poor	Moderate
ACLB01- Long Branch Central	Poor	Poor	Fair	Moderate
ACAC05- Accotink Creek 5	Poor	Very Poor	Good	Moderate
ACAC06- Accotink Creek 6	Poor	Poor	Good	Moderate
ACLA01- Long Branch South	Poor	Poor	Good	Low
ACAC07- Accotink Creek 7	Poor	Poor	Poor	Moderate

Source: SPS Baseline Study Report, 2001. Sites are generally ordered from upstream to downstream.

Figure 6. *Accotink Creek Watershed Management Plan, Stream Protection Strategy Baseline Data Summary*

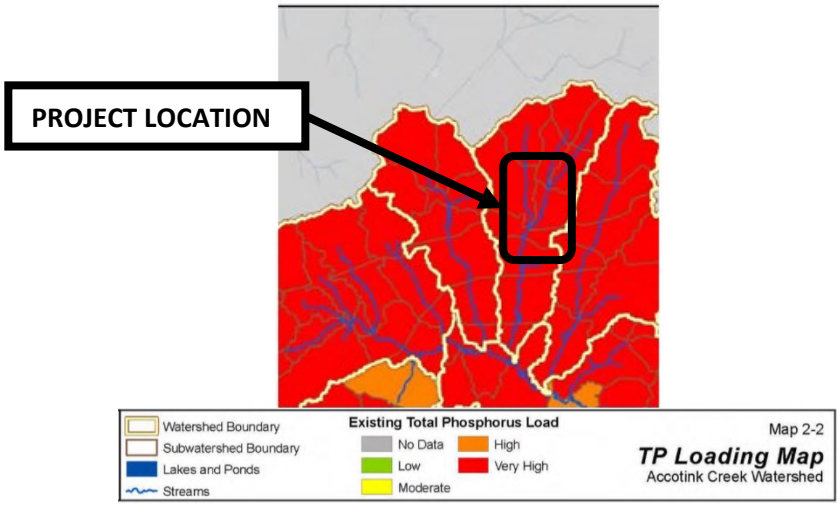


Figure 7. *Accotink Creek Watershed Management Plan, TP Loading Map*

Stream Restoration Description

The goal of stream restoration is to return the stream to a stable state in which it neither significantly erodes or fills with sediment, is connected to its floodplain and has an improved habitat condition. When a connection to the floodplain is restored, the total phosphorus discharge lessens and future erosion is prevented.

For incised urban channels, such as this one, there are several options available depending on the severity of the section and the extent of adjacent land. The most extensive restoration portions may move the stream itself, creating a new channel on a new alignment at the original floodplain elevation. Other sections could involve adjusting the cross-section, reducing bank slopes, or creating a new floodplain bench within an over-widened channel. For portions with restricted availability of adjacent land where there is limited room to increase meander width, the restoration design will use grade controls to flatten the slope of the stream and dissipate stream energy. In the small sections where it is infeasible to recreate a natural channel, less extensive restoration approaches will be completed. Such measures include armoring stream banks with rock or bioengineering materials to prevent further erosion and grading to lay back over-steepened banks to create a more stable cross-section.

Maintenance

Provisions for the long-term maintenance responsibility of the restored stream, including an inspection and maintenance schedule, will be included in the project. Project documents will indicate the specific maintenance requirements for the project, as well as the duration and ongoing requirements and responsibilities.

The entirety of Bear Branch Tributary impacted by this proposed project is located on the Town-owned property of Southside Park.

D. Grant Application Summary

I. POLLUTION REDUCTION

"Points will be based on the calculated reduction of total phosphorus (TP) as a result of the proposed project. TP is the representative pollutant for stormwater in the Commonwealth and serves as a surrogate for other pollutants of concern. The established methodology for calculating the TP reduction for stormwater management projects is outlined in Attachment A. For the purchase of non-point source nutrient credits, the number of pounds of TP proposed for purchase will be the pollutant reduction amount."

The project proposes a total of 2,300 linear feet of stream restoration with a total of **618.88 lb TP of removed phosphorus**. Bear Branch Tributary methodology for calculating TP reduction per Protocol 1 of the *Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects (September 2014)* is attached in Appendix B.

II. COST EFFECTIVENESS

"Points will be based on the projected cost of the project divided by the calculated amount of TP reduction or the proposed pounds of TP to be purchased for non-point source nutrient credits."

Project Cost as included on the Grant Application	=	**$2,520,000**
Total Phosphorus Removed	=	**618.88 lb TP**
Cost Effectiveness Ratio	**=**	**$4,072 / lb TP**

III. IMPAIRED WATER BODIES

"Points will be based on the location and impact of the proposed project in relation to priority water bodies in the state. Note: These categories (a – b) are additive.

a. Project is directly related to the requirements of the Chesapeake Bay TMDL 60 pts.
b. Project is directly related to requirements of a local impaired stream TMDL 40 pts.
or
Project is directly related to a local impaired stream without a TMDL 20 pts."

The project is directly related to the Chesapeake Bay TMDL and is within the Local Accotink Creek TMDL.

IV. FISCAL STRESS

"50 of the points for county and city applicants will be based on the latest available Commission on Local Government composite fiscal stress index. Town applicants will be assigned the points of the surrounding county. Any applicant with a project serving more than one jurisdiction (such as public service authorities or towns located in two counties) will be assigned a weighted average from the component scores. An additional 25 points will be awarded to applicants that have established a dedicated local funding/revenue mechanism for stormwater capital projects."

The Town of Vienna has a dedicated local funding/revenue mechanism. The Stormwater Tax is collected via Fairfax County and portions thereof are then passed onto Vienna for use in implementing The Town of Vienna's responsibilities.

V. READINESS TO PROCEED

"Because it is important that grant recipients proceed quickly with their proposed projects, applicants that can proceed immediately with their proposed projects, or demonstrate an advanced state of readiness, will be given the highest points under this category.

Final design plans approved by the locality	*75 pts.*
Design plans submitted and under review by the locality	*70 pts.*
Preliminary / Concept engineering completed	*55 pts.*
Executed engineering contract with approved task order and notice to proceed issued for this project	*40 pts.*
Project included in current year Capital Improvement Plan	*25 pts.*
Project identified in Comprehensive Stormwater Management plan, Watershed Management Plan, or TMDL Action Plan	*15 pts.*

An additional 15 points will be awarded if all funding is in place for the local match and another 10 points will be awarded if land and easements necessary for the project have already been acquired or if land and easement acquisitions are not required."

The proposed project is in the beginning stages of coordination. Fairfax County has committed to providing the local matching funds for this restoration (see letter of commitment from Fairfax County in Appendix F). The project will be administered by the Town. Upon notice of award of the grant, the Town will immediately acquire a design engineer and begin the project. It can be expected that an engineer could be under contract within four (4) months of the notice of grant award. A project description, benefits, and considerations per the *Accotink Creek Watershed Management Plan* can be found in this SLAF application's Section J, Attachment - Section F.

No acquisition of property is required for this project. All of the Bear Branch Tributary impacted by this proposed project is located on the Town-owned property of Southside Park.

VI. PHASE II (SMALL) MS4

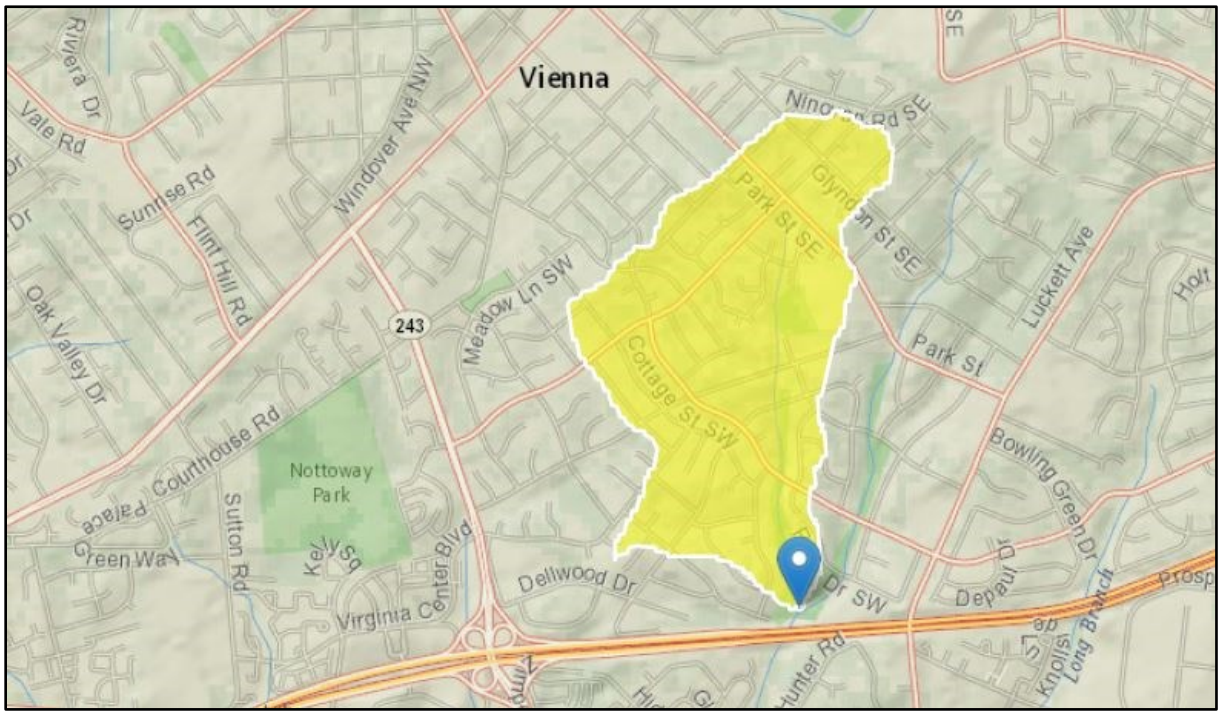
"Applicants that are regulated under the General Permit for the Discharge of Stormwater from Small Municipal Separate Storm Sewer Systems will receive 25 points."

The Town of Vienna is regulated under a General Permit for the Discharge of Stormwater from Small Municipal Separate Storm Sewer systems.

E. Closing

In closing, the Town of Vienna appreciates the opportunity to apply for grant match funds for a critical and sorely needed Stormwater management project that will benefit the Commonwealth of Virginia, Fairfax County, the Chesapeake Bay, and the Town, while meeting its MS4 responsibilities.

Appendix A – Bear Branch Tributary Drainage Area Map



Bear Branch Tributary Drainage Area Map – 0.62 square miles

Appendix B – Bear Branch Tributary Methodology for Calculating Total Phosphorus Reduction

Per the Stormwater Local Assistance Fund program guidelines dated September 2019, the pollutant removal computations provided are based on the guidance in the *Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects* (prepared by Chesapeake Stormwater Network and Center for Watershed Protection), accepted by the WQGIT on September 8, 2014.

In accordance with the SLAF guidelines, Urban Stream Restoration Protocol 1: Credit for Prevented Sediment during Storm Flow was used to compute the expected reduction in Total Phosphorus. This Protocol provides an annual mass nutrient and sediment reduction credit for qualifying stream restoration practices that prevent channel or bank erosion that would otherwise be delivered downstream from an actively enlarging or incising urban stream. The drainage map (drainage area = 0.62 square mile) can be found in the previous section, or Appendix A, and computations are provided below.

The process is as follows:

1. Estimate stream sediment erosion rates (using the BANCS method)
2. Convert erosion rates to phosphorus loadings
3. Estimate reduction efficiency attributed to restoration

The "Bank Assessment for Non-point Source Consequences of Sediment" (BANCS method) was used to predict streambank erosion. The BANCS method evaluates bank characteristics and flow distribution along river reaches and maps Bank Erosion Hazard Index (BEHI) and Near-Bank Stress (NBS) risk ratings commensurate with streambank and channel changes. A field investigation was performed on October 29 and 30, 2019, by Wood Environment & Infrastructure Solutions to determine the bank locations exhibiting erosion throughout the length of the project reach. The BEHI model was used to determine the erosion susceptibility at each bank location, based on parameters such as bank height, root depth, bank angle, surface protection, bank material composition, etc. Since the project reach is out of equilibrium and bankfull indicators were not readily apparent, rural regional curve data was used to determine bankfull width and depth where comparison to bankfull values is required. The NBS assessment was based on field observations to quantify the associated energy against streambanks. Level I: Reconnaissance assessment methods were used to estimate the NBS. The results from the BANCS assessment (worksheets and maps) are included at the end of this section, or Appendix C.

BEHI and NBS rating pairs were used to determine the annual lateral bank erosion rate for each section of streambank using the District of Columbia Bank Erosion Curves (USFWS 2005), see Figure E1. The District of Columbia Curves are based on analysis of Hickey Run, a tributary stream of the Anacostia River in Washington, D.C. Hickey Run is in a highly urbanized area and its watershed consists of a large amount of impervious surfaces and piped tributaries similar to the Bear Branch watershed.

In order to convert erosion rates from feet per year to tons per year, soil bulk density needs to be determined. For this project reach, three (3) in-situ bank samples were taken using a soil probe. The

samples were weighed, volume determined, and the moist density was computed to be. Moist density varied between 91 and 113 lb/ft^3. A representative sample from the upstream, middle, and downstream portions of the reach was selected and sent to a materials testing lab where the moisture content (18.9 – 20.1%) was determined and the average bulk density was computed to be 84 lb/ ft^3. This bulk density was used with the results of the BANCS analysis to determine a sediment loading in tons. Based on the expert panel, the median nutrient concentration in streambank sediments is 1.05 pounds of TP per ton (Walter et. al, 2007). A summary of the TP reduction calculation, as described above, is provided below.

Total Reduction (TP) based on BANCS Method:

$$Sediment\ Load = \left[\left(28{,}067\ \frac{ft^3}{yr}\right) \times \left(84 \frac{lb}{ft^3}\right)\right] \div 2{,}000 \frac{lb}{ton} = 1{,}178.81 \frac{ton}{yr}$$

Using conservative 50% reduction efficiency:

$$\boldsymbol{Sediment\ Load} = 50\% \times 1{,}178.81\ \frac{ton}{yr} = \boldsymbol{589.41\ \frac{ton}{yr}}$$

$$\boldsymbol{Total\ Phosphorous\ Reduction} = 1.05\ \frac{lb\ TP}{ton} \times 589.41\ \frac{ton}{yr} = \boldsymbol{618.88\ \frac{lb\ TP}{yr}}$$

Using an estimated design, permitting, and construction cost of $2,520,000:

$$\boldsymbol{Cost\ per\ lb\ of\ TP\ Removal} = \frac{\$2{,}520{,}000}{618.88\ lb\ TP} = \boldsymbol{\$4{,}071.87\ per\ lb\ TP}$$

In summary:

- Pollutant Reduction = 618.88 lb TP
- Cost Effectiveness = $4,072 / lb TP

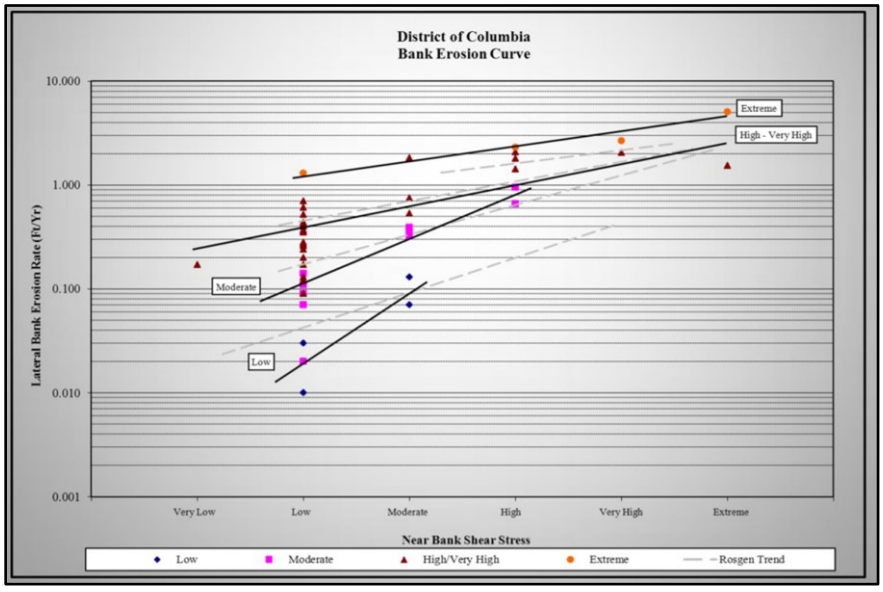
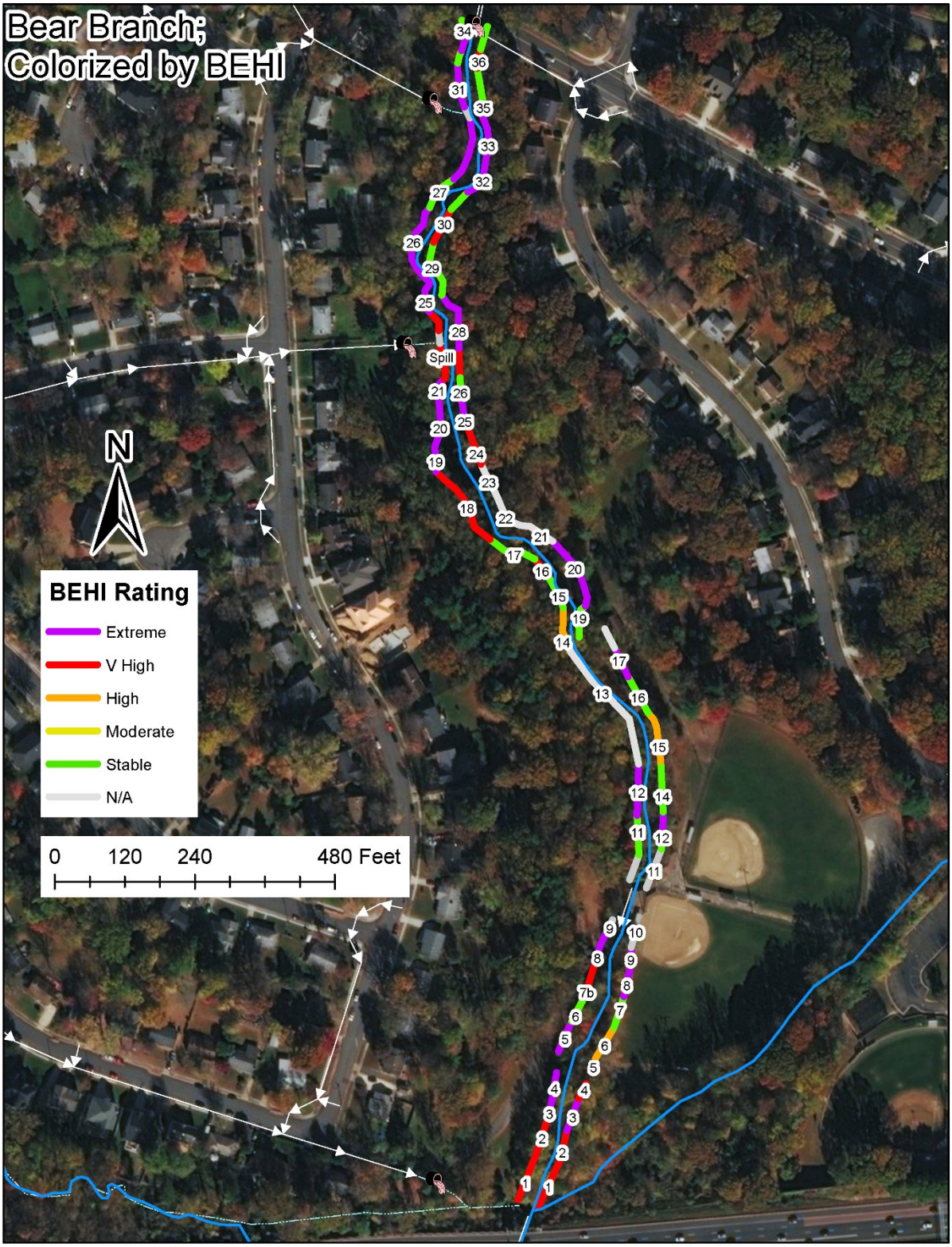


Figure E1 - Bank Erosion Rate Curve Developed by the USFWS

Appendix C – Erosion Evaluation Map and BEHI / NBS Worksheets



Appendix D – Bulk Density Computations

Bear Branch Tributary Sampling

Sites Sampled – RB-1, LB-17, & RB-31

Average streambank bulk density was determined from core samples, taken at the banks above, as summarized in the table below. Sample lengths and soil weights were used to determine the wet soil density. Lab tested moisture content was then used to compute the bulk density of the streambank material. The average value was then taken and applied to the sediment and nutrient reduction calculations.

Sample	**RB-1**	**LB-17**	**RB-31**
Sample Length (ft)	1.16	1.30	0.80
Sample Volume (ft^3)	0.0025	0.0028	0.0017
Soil Weight (g)	109	114	87
Moist Density (lb/ft^3)	97	91	113
Moisture Content (%)	20.1	18.9	19.7
Bulk Density (lb/ft^3)	81	76	94
	Average Bulk Density = 84 lb/ft^3		

Appendix E –Site Photographs

Appendix F – Letter from Fairfax County

County of Fairfax, Virginia

To protect and enrich the quality of life for the people, neighborhoods and diverse communities of Fairfax County

October 25, 2019

Michael J. Gallagher, PE
Director of Public Works
Town of Vienna
127 Center St. S.
Vienna, VA 22180

Reference: Bear Branch Tributary Phase II – Southside Park Stream Restoration Project/ Stormwater Local Assistance Fund Grant

Dear Mr. Gallagher:

In conjunction with our letter dated March 13, 2019, and as we have discussed, we will take the necessary steps to obtain approval to fund the local share for the Bear Branch Tributary Phase II – Southside Park Stream Restoration Project. This will provide the local match of Stormwater Local Assistance Fund grant funds, if awarded, to the town.

This is in accordance with Paragraph 25 of the Cooperative Agreement between Fairfax County Board of Supervisors, the Town of Herndon, and the Town of Vienna. The nutrient and sediment removal credits will be shared, in accordance with Paragraph 27 of the Agreement.

This is an exciting project and we will provide any support we can.

Should you have any questions, I can reached at 703-324-5500 or email Craig.Carinci@fairfaxcounty.gov.

Sincerely,

Craig Carinci
Director, Stormwater Planning Division

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