December 2021

Kimley»Horn

Wetland Studies and Solutions, Inc.
a DAVEY company

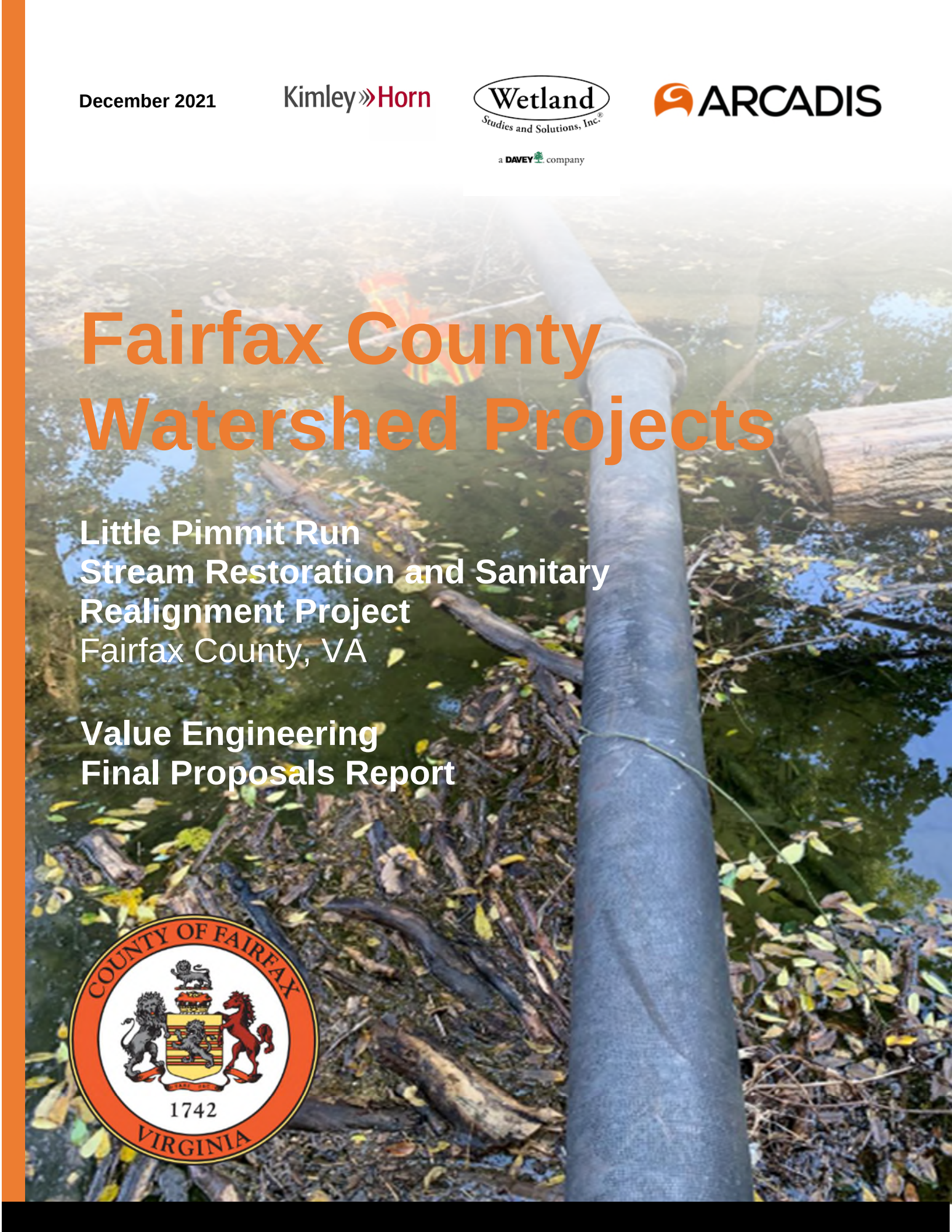
ARCADIS

Fairfax County Watershed Projects

Little Pimmit Run Stream Restoration and Sanitary Realignment Project

Fairfax County, VA

Value Engineering Final Proposals Report



Fred Wilkins, Engineer IV
Stormwater Planning Division WPIB
Fairfax County Dept of Public Works and Environmental Services
Sent via email to fred.wilkins@fairfaxcounty.gov

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Date: December 21, 2021
Our Ref: 30110947
Subject: Final Value Engineering Proposals Report for Little Pimmit Run – Stream Restoration and Sewer Realignment Improvements

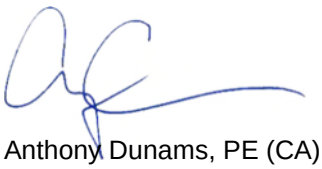
Dear Mr. Wilkins:

Arcadis U.S., Inc. is pleased to submit the attached Final Value Engineering (VE) report to highlight findings from the VE workshop held from November 15th to the 18th, 2021. The alternatives presented provide solutions addressing the basic project functions and focusing on CONVEYING WASTEWATER, IMPROVING HABITAT, and PROTECTING STREAM, among other functions, in this corridor. Functional solutions that also provide cost savings include keeping and protecting shallow crossings; reducing the size of the west bank sewer project; optimizing timber matting usage; options to address floodplain structure; and increasing the use of wood in low stress areas.

Please do not hesitate to contact me regarding the content of this report. I am sending the full report and will also send you another report removing the baseline concept drawings so that it is easier/alleviates layers so that this document can be put on the Fairfax County website.

Sincerely,

Arcadis U.S., Inc.



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CC. Suzy Harding

Enclosures:
Value Engineering Proposals Final Report

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EXECUTIVE SUMMARY

VALUE ENGINEERING STUDY OBJECTIVES

Arcadis U.S., Inc. conducted a Value Engineering (VE) study for the Fairfax County Department of Public Works and Environmental Services (Fairfax County) on the Little Pimmit Run at Chesterbrook Road Stream Restoration and Sewer Realignment Projects in Fairfax County, VA via remote video conference November 15-18, 2021. During this workshop, the VE team was tasked with applying the SAVE International® eight phase Value Methodology Job Plan (six phases during the workshop) to evaluate the 35% Stream Restoration Design Submission prepared by Wetland Studies and Solutions, Inc. (WSSI) dated August 2021, and the Sewer Realignment Preliminary Engineering Report prepared by Kimley-Horn (KH), dated October 2021, hereinafter referred together as the "baseline concept." The objective of the study was to identify value-improving alternatives to the baseline concept that may reduce project costs, project schedule, project risks, and improve project performance.

BASELINE CONCEPT

The Little Pimmit Run Segment consists of the restoration of the stream between Franklin Park Road, past Chesterbrook Road, ending near the Laburnum Street cul-de-sac in Fairfax County, VA. The stream restoration work is in a tight corridor with six sanitary sewer crossings. The goal of the sanitary sewer realignment project is to eliminate the majority of those six sanitary sewer stream crossings along the Little Pimmit Run stream corridor in conjunction with the ongoing stream restoration project near Chesterbrook Road. In general, the stream restoration project is improving or eliminating erosion concerns while the sewer project is connecting and conveying wastewater flows from the west-side of Little Pimmit Run to the sewer system located north and east of that location.

The estimated construction cost presented was $13.1M (including a 30-percent contingency) – this is split between the $8.5M stream restoration cost and $4.5M for the sewer realignment cost. The contractor's notice to proceed for the sewer work is expected to be granted in the first quarter of 2023 and take 12-13 months to complete and the stream restoration notice to proceed is planned for late 2023 (Phase 1) with subsequent work staring in 2024 to complete Reach 2.

PROJECT DRIVERS AND CONSTRAINTS

Fairfax County and the two project design teams identified several project challenges and constraints during the pre-workshop call and during the morning in-brief on the first day of the VE study. The following are the two key constraints/drivers identified:

- Easement concerns delaying stream restoration work and
- Synchronizing construction between the stream restoration work and the sewer realignment work.

FUNCTION ANALYSIS

The cornerstone of a VE study is the Function Analysis which evaluates the baseline concept to identify the required functions of the overall project and the functions provided by the major cost drivers. The

functions identified are then used by the VE team to underpin all later VE team activities, including the brainstorming of creative ideas to identify better ways to accomplish the same desired functionality at a lower cost or a shorter project duration, lower risk, and/or improved performance. The following are the key project functions identified during this phase of the Job Plan (the complete list of functions is presented later in this report):

- **Improve Water Quality** (Need or Higher Order Function)
- **Stabilize Bed** (Purpose or Basic Function) – Stream Restoration
- **Convey Wastewater** (Purpose or Basic Function) – Sewer Realignment

STUDY RESULTS

Focusing on the project's intended functions, nearly 30 ideas were generated and evaluated to address the key project functions (some noted above and more in the main text of this report). Ultimately, the VE team developed nine proposals with quantifiable value savings and nine design suggestions/proposals increasing cost but providing qualitative value impacts. The following table summarizes the proposals/ suggestions generated by the VE team:

Table ES-1: Recommended Proposals

PRO. NO.	ALTERNATIVE DESCRIPTION	LIFE-CYCLE COST SAVINGS (PRESENT WORTH)	SCHEDULE CHANGE	FUNCTIONAL BENEFIT *
CW-2	For creek crossings 1, 2, and 3 raise proposed stream bed elevation at existing sanitary sewer crossings and leave the other crossings in lieu of installing 6500 LF of west bank sewer	$3,210,000	Reduces schedule by 6 months	C
CW-6	Modify proposed sewer along west bank to only include ~3400 LF of sanitary sewer and only eliminate crossings X3 and X2	$1,789,000	Reduces schedule by months	C
CW-6A	Modify proposed sewer along west bank to only include ~1200 LF of sanitary sewer and only eliminate crossing X3	$2,910,000	Reduces schedule by months	C
GL-1	Merge stormwater restoration and sanitary sewer work into one construction project over a 2-year period	DESIGN SUGGESTION	Reduces schedule by months	C
GL-2	Replace welded wire fence where applicable with orange safety fence (away from residential and trail areas)	$22,000	No impact	C

PRO. NO.	ALTERNATIVE DESCRIPTION	LIFE-CYCLE COST SAVINGS (PRESENT WORTH)	SCHEDULE CHANGE	FUNCTIONAL BENEFIT *
GL-3	Install chain link fence at all trail access areas (any residential areas)	($92,000)	No impact	S/E
GL-7	Cover or bury gabion baskets to preserve functionality but improve aesthetics of this structure located near station 29+00 to 30+25 (Phase I)	DESIGN SUGGESTION	No impact	S/O
GL-8	Increase use of salvage material employing vortex or other harvesting device for collecting sediment and cobble	DESIGN SUGGESTION	Extends schedule 2-4 months	O/E
GL-11	Decrease/eliminate timber matting at staging/stockpile areas	$249,000	Minor reduction	O/C
GL-12	Expand community outreach on topic of stream restoration through signage	DESIGN SUGGESTION	No impact	S/E
GL-13	Replace gabion wall at STA 49+00 (offset) with a permanent retaining wall structure	($280,000)	Extends schedule by a month	S/E
IH-1	Provide additional woody debris for improved habitat	DESIGN SUGGESTION	No impact	E
IH-2	Replace rock sills at downstream ends of boulder pools with log sills	$23,000	No impact	C
IH-3	Add more woody debris to reduce RBM in multiple locations such as areas with slopes lower than 1-percent or area with low stresses	$45,000	No impact	E/C
IH-4	Utilize Newbury Riffle design to increase quality of habitat and floodplain connection	DESIGN SUGGESTION	Minor reduction	E
SI-1	Replace imbricated rock wall with concrete blocks	$46,000	No impact	C
SI-3	Adjust alignment around meander at STA 71+90 to remove imbricated wall	$79,000	Slight reduction of a few weeks	E/C
SI-4	Utilize clay plug or instream structure to prevent proposed stream from re-entering the abandoned channel	DESIGN SUGGESTION	No impact	O/E

** In addition to cost implications, funding and regulatory agencies require an evaluation on each approved recommendation in terms of the project feature or features that the recommendation benefits. If a specific recommendation can be shown to provide benefit to more than one feature described below, count the recommendation in each category that is applicable.*

Safety (S): *Recommendations that mitigate or reduce hazards on the facility.*

Operations (O)*: Recommendations that improve real-time service and/or local or regional levels of service of the facility.*

Environment (E)*: Recommendations that successfully avoid or mitigate impacts to natural and or cultural resources.*

Construction (C)*: Recommendations that improve work conditions or expedite the project delivery.*

The most significant cost saving and value-inducing proposals target the reduction or elimination of the amount of sewer installed and either leaving all crossings in place and protecting them (Alt. Pro. No. CW-2) or including a reduced amount of new sewer with some reduction in crossings to provide both the sewer and stream improvements desired (Alt. Pro. Nos. CW-6 and CW-6A). Other impactful proposals include reductions in timber matting (Alt. Pro. No. GL-11) and combining the two projects into one sequenced construction effort with a stream restoration contractor hiring a sewer contractor that will reduce the impact to neighbors along Little Pimmit Run and should lead to further cost reductions and streamlined construction addressing tree removal, site access and other elements supporting the construction process.

CONSIDERATIONS AND ASSUMPTIONS

In the preparation of this report, and during the development of the recommended proposals and design suggestions, the VE team made some assumptions with respect to conditions that may occur in the future. In addition, the VE team reviewed the project documentation, relying solely upon the information provided by the designer(s), and relying on that information as being true, complete, and accurate. This summary of considerations and assumptions should be reviewed in connection with this entire report:

- The alternatives and design suggestions rendered herein are as of the date of this report. Arcadis U.S., Inc. assumes no duty to monitor events after the date, nor have a duty to advise or incorporate any new, or previously unknown technology into the proposals or design suggestions.
- Arcadis' report is based upon the presumption that there are no material documents affecting the design or construction costs that the VE team has not seen. The existence of any such documents may alter the proposals and design suggestions contained herein.
- Arcadis is not warranting and expressly disclaims all warranties and liabilities for the feasibility of these alternatives and design suggestions, as well as the advisability of their implementation. It is Fairfax County Stormwater Planning Division and Wastewater Design and Construction Division and their design consultants sole responsibility to explore the technical feasibility of the proposals and design suggestions, and to make final determination of implementation.

SECTION ONE INFORMATION PHASE

INTRODUCTION

Arcadis US, Inc. conducted a 4-day value engineering (VE) study on the Pimmit Run Watershed addressing the Little Pimmit Run at Chesterbrook Road Stream Restoration Project for the Fairfax County Stormwater Planning Division (SWPD) and the Little Pimmit Run Sanitary Sewer Realignment for the Wastewater Design and Construction Division (WDCD) for Fairfax County Department of Public Works and Environmental Services. These two projects are being developed by:

- Wetland Studies and Solutions, Inc. (WSSI) targeting the stream restoration efforts with design documents at a 35% Conceptual Plan Basis of Design level of completion, and
- Kimley-Horn (KH) targeting the sanitary sewer realignment efforts with design document at a Preliminary Engineering report level of completion.

The workshop was conducted remotely using Microsoft Teams Video Conferencing from November 15-18, 2021. An agenda for the workshop is provided in Appendix A. Participants in the VE study and report development include the following:

PARTICIPANT	DISCIPLINE	AFFILIATION
Dionna Bucci	Ecologist	Fairfax Co SWPD
Scott Funk, PE, ENV SP	Wastewater Engineer	Kimley-Horn
Susie Hoopes, PE, CFM	Senior Stream Engineer	Wetland Studies and Solutions, Inc.
Sajan Pokharel	Project Engineer/Manager	Fairfax Co SWPD
Jasdeep Saini	Project Engineer/Manager	Fairfax Co SWPD
Jon Sanford	Cost Estimator	Fairfax Co UDCD
Brendan Schillo, PE	Construction Engineer	Fairfax Co UDCD
Anthony Dunams, PE, CVS	Facilitator / VE Project Manager	Arcadis U.S., Inc.
Howard Greenfield, CVS-Life, FSAVE	QA/QC Editor	Arcadis U.S., Inc.

The VE study was carried out following the standard SAVE International® VE Job plan consisting of eight phases (with six phases completed during the workshop) as promulgated in the United States Environmental Protection Agency and Fairfax County SWPD Guidelines for conducting a VE study, noted below:

- Information Phase (including pre-workshop document review, a presentation by the design teams, and a pre-workshop site visit by Fairfax County SWPD and WDCD staff)
- Function Phase
- Creativity Phase
- Evaluation Phase
- Development Phase

- Presentation Phase (VE team's out-brief presentation and this final report)

This VE study report documents the execution of the VE Job Plan during the workshop.

INFORMATION GATHERING PHASE

The first phase of the VE Job Plan is for the VE team to become familiar with the project. Prior to the workshop, the VE Facilitator/PM coordinated a call with WSSI, KH and Fairfax County project managers to review the goals of the study and project criteria – this call was held on November 12, 2021, and the following key items about the project were conveyed:

- Removing five of six sanitary sewer crossings and conveying sanitary flow on the west side of Little Pimmit Run via a new sewer line
- Addressing if anything can be done to remove the last sanitary sewer crossing
- Easements are holding up the stream restoration aspects of the project
- Syncing construction which could be 3 years long with the first year being the sewer work and years 2 and 3 addressing the stream restoration (also looking into easements, construction access, tree protection, etc. regarding the two projects)

The VE workshop team also prepared by reviewing the following background documents prior to the first day of the workshop:

- Pimmit Run Watershed, Little Pimmit Run at Chesterbrook Road – Conceptual Stream Restoration Plan, prepared by WSSI, dated August 2021
- Little Pimmit at Chesterbrook - Concept Cost Estimate Form, prepared by WSSI, dated August 24, 2021
- Little Pimmit Run Sanitary Sewer Realignment Preliminary Engineering Report, prepared by Kimley-Horn, dated October 2021
- Little Pimmit Run Sanitary Realignment Project Overview for the VE Study, prepared by KH, dated November 15, 2021

As part of the preparation for the workshop, the facilitator used the current Cost Estimate of $13.1M (including a 35% design contingency with a breakout of $8.5M for the stream restoration part of the project and $4.5M for the sewer realignment part of the project) to prepare two cost models reflective of the current Conceptual Plans showing how the costs of these two projects were allotted to the various project elements. The cost models are described in Section Two of this report.

The workshop was then kicked off with a presentation of the project by KH, WSSI and Fairfax County representatives via teleconference. The purpose of the presentation was to expand on the information contained in the provided documents and share additional project information. This was an interactive session that allowed VE team members to ask questions of the WSSI and KH design teams and the Fairfax County Project Managers to enhance understanding of the project. Those attending the kick-off meeting are listed on the sign-in sheet in Appendix B.

PROJECT DESCRIPTION

Both the stream restoration work and the sewer realignment work described below are based on information excerpted from the Conceptual Plan sheets regarding the stream restoration effort proposed (Design Narrative, sheet 66 of 89):

Site Description and Constraints

Site Description

Restoration is proposed for approximately 6,300 linear feet of Little Pimmit Run. Additional smaller tributaries totaling approximately 1,200 linear feet will be restored as part of the project. Located in the Pimmit Run watershed of Fairfax County, the total drainage area for the project is 1,759 acres (spanning Arlington and Fairfax counties) and is 35% impervious. The watershed assessment for Little Pimmit Run determined the watershed is in poor condition. The reach assessment for both streams was determined to be "functioning at risk." The existing channels exhibit multiple shear vertical banks, moderate sinuosity, and poor ecological habitat. Little Pimmit Run also has multiple locations where it is actively threatening sanitary infrastructure and needs to be directed away from these areas before further damage occurs.

For assessment and restoration purposes, Little Pimmit Run has been divided into two reaches.

Constraints

Site constraints limit the restoration potential and design decisions in places. In general, Reach 1 (R1) is more constrained than Reach 2 (R2). The majority of R1 is constrained on both sides by private property, which limits re-alignment options, except for a Fairfax Park Authority property on the left bank slightly upstream of Chesterbrook Road. Additionally, there are three sanitary crossings in R1 (X6, X5, and a place where the meander exposes the 21-inch line twice) further constraining design. R1 is bounded upstream by the Franklin Park Road bridge crossing, and downstream by four 10-foot x 10-foot box culverts under Chesterbrook Road.

Reach R2, starting at the outflow of the box culverts under Chesterbrook Road, is less confined by private property, particularly the downstream two-thirds of the reach where there are several large Park Authority parcels. Private parcels in R2 tend to be significantly larger than those in R1, and dwellings are not in close proximity to the stream. The channel scar in R2 is larger than R1, which gives more leeway for added sinuosity. Lastly, there are four sanitary crossings in R2 (X4, X3, X2 and X1), three of which are exposed and will constrain design in nearby areas, the most upstream (in close proximity to Chesterbrook Road) has previously been stabilized by a two-step cross vane.

Impervious Area and Future Watershed Conditions

Studies show that streams exhibit signs of instability and habitat degradation once the contributing watershed exceeds ten percent imperviousness. Channel instability is a result of the stream's response to increased runoff from a developing watershed; resulting in more frequent and severe runoff events.

The contributing watershed of Little Pimmit Run has been fully developed and is currently at approximately 35% impervious area overall. The stream is currently experiencing instability and portions of the stream are threatening sanitary infrastructure and privately owned properties. Erosion and downcutting along these sections of stream will further endanger sanitary crossings and homeowner properties, which has the potential to create costly maintenance problems in the future. There are eroding banks throughout the project area, and bed material is transported and dropped out in massive bars,

observable at various locations. In most places the bank height limits floodplain access, further exacerbating erosion.

The Fairfax County Zoning Districts and Comprehensive Plan were reviewed to determine areas where future development, and associated increases in imperviousness, may occur. These plans agree, indicating that the Fairfax County portion of the drainage area is fully developed. While only zoning data was available for the Arlington County portion of the watershed, designated zoning and the density of existing single-family dwellings and public facilities indicates that little development is possible.

However, if significant additional development within the watershed occurs, resulting in increased imperviousness, state and county regulations are in-place to require that stormwater management be provided to offset any increases in stormwater runoff. In addition, adequate outfall regulations require that the downstream receiving conveyance systems be able to withstand any increase in runoff rate or volume. Thus, any development project will be required to abide by these regulations and not adversely impact the proposed restoration

Restoration Potential

Restoration potential is the highest level of restoration or functional uplift that can be achieved given the watershed health, reach-level function-based condition, stressors, and constraints (Harman et al., 2012). The highest restoration potential for Little Pimmit Run is to the level of "Functioning." Levels 2-Hydraulics and 3-Geomorphology of the Stream Functions will be directly improved by re-grading of the channel cross-section, and realignment to the planform and profile. Uplift will be seen in Level 1-hydrology and level 4-physiochemical, as a direct impact of the Level 2 and 3 changes. As a result of the Levels 2, 3 and 4 uplift, some uplift may also be seen in Level 5 - Biology. However, the urban nature of the watershed will not change, and thus success will be limited by hydrology and biology constraints that are associated with an urban watershed.

Design Objectives

Measurable, site-specific design objectives have been established for Little Pimmit Run based on project goals and site constraints (see below). Continued discussion of these objectives throughout the design process is important to ensure the evolving design is effective. The primary goals for this restoration include improving stability to reduce erosion/nutrient transport, re-alignment/stabilization of the channel to prevent damage to existing sanitary crossings and private property, reconnection of the stream with its floodplain, and increased flood storage. These are achieved by grading of an appropriately sized channel with floodplain access and reduced bank height (thus increasing entrenchment ratio), and placement of appropriately sized reinforced bed mix (supplemented by salvaged existing bed material). Secondary goals for Little Pimmit Run are to increase channel sinuosity with appropriate radii of curvature, improve riparian buffer vegetation, introduce wood, roots, and bedform diversity within the channel for habitat improvement, and dissipate concentrated flows from storm drain outfalls.

Scoping Meeting
Client's Goals/Targets (CGT)

Goals/Targets	Goal Rank	Problem or Issue
Flow Regime Management	2	No existing SWM upstream of project site and channel disconnected from floodplain which is producing extremely erosive conditions
Stormwater Management	2	Concentrated flows draining into existing channel
Channel reconfiguration	1	Severe bank erosion, which jeopardizes existing infrastructure including sanitary lines in seven locations.
Floodplain Reconnection	1	Channel disconnected from floodplain
Lateral and Vertical Stability	1	Disconnected floodplain contributing to channel incision.
Frequent floodplain inundation and increased attenuation	2	Channel disconnected from floodplain
Raise Groundwater	3	Groundwater in floodplain lowered due to incised channel
Bank Stabilization	1	Severe bank erosion
In-stream Habitat Improvement	3	Overal lack of in-stream habitat throughout main stem and tributaries
In-stream Habitat Improvement	4	Overal lack of in-stream habitat throughout main stem and tributaries
Water Quality Management	5	Eroding bed and banks contributing to sediment and nutrient pollution
Water Quality Management		
In-stream Species Management	6	Overal lack of in-stream habitat throughout main stem and tributaries
In-stream Habitat Improvement	7	Overal lack of in-stream habitat throughout main stem and tributaries
Riparian Management	2	Poor diversity and invasive species

Scoping Meeting
Parameter Assesment (PA)

Functional Pyramid Level	Assessment Parameter	Notes on Existing Conditions
Hydrology	Flow regime/hydrograph	Main channel maximum bank height of 10-12 ft, tributary maximum bank height of 4-6 ft
Hydrology	Concentrated flow paths	Several concentrated flow paths, most tributaries originate at outfalls
Hydraulics	Stream Routing and Conveyance	Existing channel is very straight leading to increased channel slope and subsequently erosion. Multiple Sanitary crossings are imperiled.
Hydraulics	Floodplain Connectivity	Incision present through main stem and tributaries preventing frequent floodplain access
Hydraulics	Flow Dynamics (velocity, shear stress, power)	Large flows with high power causing erosion. Storms larger than bankfull are being contained within the existing channel.
Hydraulics	Floodplain Storage and Attenuation	Stream is disconnected from floodplain
Hydraulics	Raise Groundwater	Floodplain is not currently accessed by stream. Vegetation dominated by FACU and FAC species
Geomorphology	Bank migration/lateral stability	Stream is very straight, providing little planform dissipation of energy.
Geomorphology	Bedform Diversity	Limited aquatic species habitat because bed features have been scoured away by erosive forces
Geomorphology	Large woody debris transport and storage	Limited large woody debris in channel due to erosive flows.
Physicochemical	Sediment load and suspended solids	Erosion of bed and banks contributes to sediment pollution.
Physicochemical	Phosphorus	Phosphorus readily sorbs to sediment. Therefore, erosion of bed and banks contributes to phosphorus pollution
Biology	Benthic Macroinvertebrate Communities	Low presence of macroinvertebrates
Biology	Fish Communities	Low presence of fish
Biology	Riparian vegetation	Forested buffer is as small as 20 feet in places, and is heavily managed, this lacking a robust understory. Invasive cover is as much as 95% in places - including english ivy, amur honeysuckle, winter creeper, japanese stiltgrass, and bamboo.

[1] *Goals based on Bernhardt et al. "Synthesizing U. S. river restoration efforts." Science Magazine 308.5722 (2005): 636-637.*

[2] *Matrix concepts and flow based on Harman, William, et al. "A Function-based framework for stream assessment and restoration projects." US Environmental Protection Agency (2012).*

[3] *Disciplines, design parameters, and measurement methods based on Harman, William, et al. "A Function-based framework for stream assessment and restoration projects." US Environmental Protection Agency (2012).*

Pre-Design Meeting
Objectives, Strategies (OS)

Design Objective	Site Constraints	Improvement, Strategy, Technique	Additional Improvement, Strategy, Technique (if applicable)
Realign channel to appropriate planform ratios	Sanitary infrastructure, trees, adjacent properties (RPA and easement concerns)	Adjust planform alignment based on appropriately sized channel	
Increase floodplain connection	Adjacent properties/infrastructure	Appropriate channel sizing, bench/overbank grading	
Reduce bed and bank erosion	Tie out locations, channel incision and fill requirements/costs	Resize channel, grade banks/benches, adjust meander geometry, utilize in-stream structures	
Protect infrastructure	trees, private property/easements	design natural stable channel, adjust alignment, raise channel invert, locate in-stream structures at san. crossings	Coordinate stream restoration efforts with sanitary system retrofits/redesign effort
Improve riparian buffer	private property, trees, infrastructure	dense native plantings, overbank grading, improve floodplain connection, minimize tree impacts	
Improve benthic habitat	urban hydrology	create bedform diversity, channel stability, add woody debris, bed material import/reuse	

This plan depicts a stream alignment-based discussion and comments received during the pre-concept plan review process, as well as additional comments by our design partner and County staff after review of a previously submitted draft concept alignment. The resulting alignment specifies sinuosity appropriate for the valley type and stream slope, while utilizing bench grading to improve floodplain connectivity and reduce in-stream stresses. Where possible, the design incorporates large woody debris habitat features and the expansion of overbank wetland habitat. Extensive plantings are planned and will improve the quality of the riparian buffer. Ecological uplift and improvement in macroinvertebrate community is a tertiary, yet desirable goal. These goals are associated with the general health of the stream corridor, and will therefore be achieved to the greatest practical extent as primary and secondary goals are met

Proposed Stream Design

Although this is an urban watershed, a large floodplain coupled with Park Authority property and floodplain easements allows for some design flexibility, especially in the lower portion of the project area. The MD rural curve with enlargement produced a channel sized significantly larger than the cross-sectional area at potential bankfull indicators, whereas the MD urban curve aligned more closely with these features. Using the MD Urban curve is a viable option to avoid an oversized channel based on the high multiplier due to the 35% impervious area. Based on the culmination of all hydrologic and hydraulic data assessed, as well as the existing site conditions, the design team proposes use of the MD Urban curve to size the bankfull channel based on drainage area. Alternative designs were also evaluated as part of the pre-concept plan. A second channel size option was based on a one-third reduction in cross sectional area as computed by the Maryland Urban curve to allow for floodplain access at flows less than bankfull. Likewise, a conceptual alignment was prepared for both channel sizing alternatives (Options 1 and 2, respectively). While a Priority 1 restoration is generally preferred because it results in a larger floodplain than a Priority 2 restoration, a series of 2D hydraulic models have been prepared to estimate floodplain velocities for both a Priority 1 and 2 restorations, routed along each alignment/ channel size for a total of 8 proposed models across Reach 1 and 2. Generally the 2D model results showed less erosive conditions on the floodplain in Priority 1 scenarios.

Based on pre-concept design discussion, site constraints, and design goals, the selected design alternative utilizes Option 1 (alignment and cross section) with a corridor predominantly characterized by a Priority 2 (benched) approach. This approach controls construction costs by allowing a nearly balanced site (cut/fill) and minimizes disturbance/tree removal by utilizing the existing over-widened channel scar for creation

of a bankfull bench. This design strategy also works within existing floodplain easements, minimizing adverse effects to adjacent properties.

The proposed channel dimensions correspond to width/depth ratios of approximately 17. Reference reach data collected throughout the Piedmont physiographic province in Northern Virginia for C-streams shows W/D ratios ranging from 11 to 33, with the average ratio being 18.1.

Regarding the sewer realignment work, the following information was excerpted from the Preliminary Engineering Report regarding Alternative 1:

Alternative 1 extends on the west side of LPR. It begins at existing MH 031-3-006 immediately north of Franklin Park Road and terminates at existing MH 031-2-041, near Kirby Road.

Length	New MH	Interconnections	Stream Crossings Remaining	# of Easements	Construction Schedule
6,500 Feet	15	7	1	22	8 Months

Alternative 1 begins by connecting to existing MH 031-3-006. Existing pipe segment MH 031-3-006 to MH 031-3-353 is abandoned; therefore, eliminating stream crossing X6. Existing sewer service laterals to MH 031-3-006 will remain and be diverted into the new sewer line.

Two options are identified to extend the sewer northward to proposed MH 3 (Sta. 11+90). The two options are denoted Option 1-A and Option 1-B. Several factors in this area resulted in the need to explore these options:

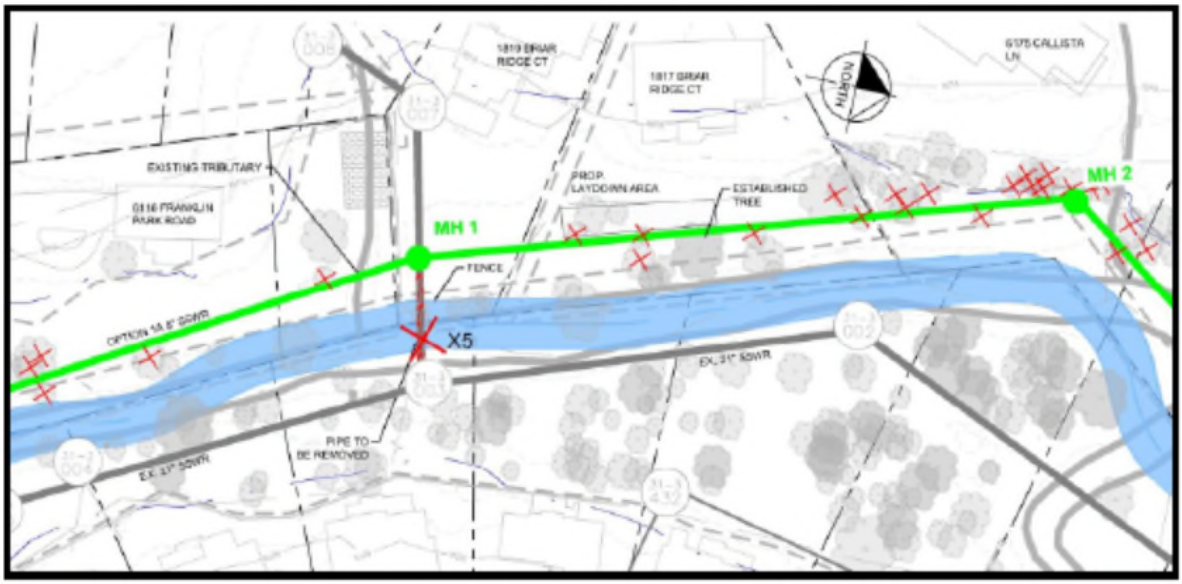
- The presence of steep slopes between the property lines and the top of stream bank.
- The proposed stream realignment shifts the top of the stream bank further west towards the property lines; therefore, limiting available area to construct the new sewer.
- The presence of large trees within this portion of the corridor that may need to be removed to install the new sewer line.

The options have been developed to balance the competing factors of sewer line constructability, easement requirements, and tree preservation.

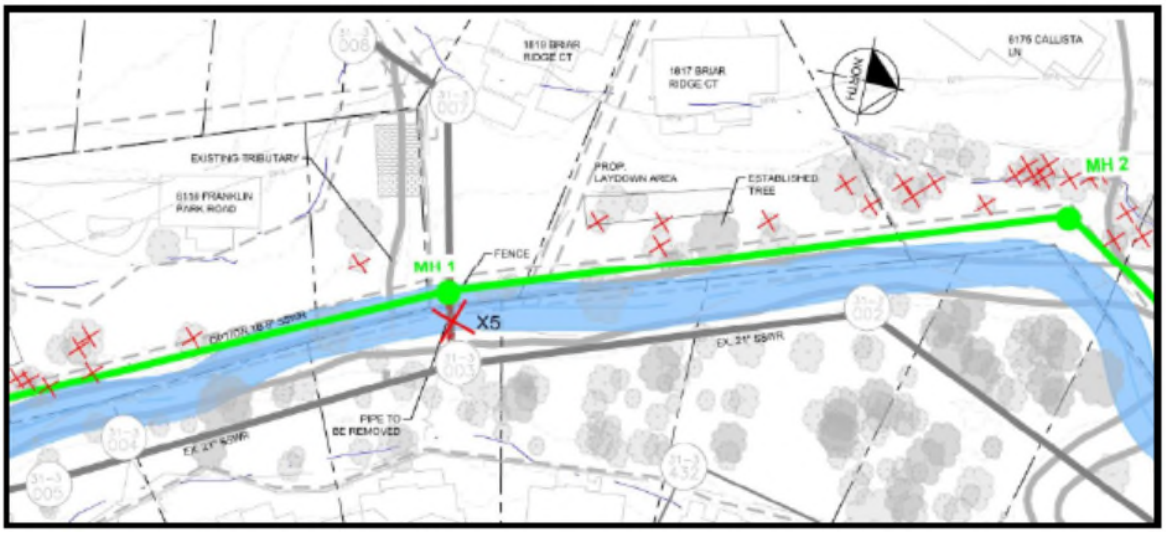
Both options cross an existing tributary of Little Pimmit Run at Sta. 3+80 and will need to connect to the existing 8-inch sewer line between MH 031-3-007 and MH 031-3-003. The new sewer will be installed via open-cut method across the tributary. The existing 8-inch sewer is within an existing easement on the 1819 Briar Ridge Court property. To intercept sewer flows in the existing 8-inch sewer and eliminate crossing X5, a new manhole structure is required. MH 1 will be installed as a precast concrete manhole with a doghouse base. Measures to limit inflow and infiltration (I&I) will be included in the design of MH

1. This portion of pipe was recently CIPP lined. Installing a doghouse manhole within the recently CIPP lined pipe segment will not structurally compromise the pipe. However, it will require a more detailed design in the design phase to determine how the liner will be integrated with the new structure.

Option 1-A (below) maintains the 10-foot buffer separation from the top of bank of the proposed stream realignment and from a large established tree located on 1817 Briar Ridge Ct. that is to remain. However, Option 1-A will encroach further on properties of 1819 Briar Ridge Ct, 1817 Briar Ridge Ct, and 6175 Callista Ln.



Option 1-B (below) seeks to reduce encroachment on the backyards of the properties. However, it does not meet the established design guidelines of a 10-foot buffer separation from the top of stream bank. MH 1 would be installed just outside the fence on the east side of the property as shown in the figure below. The new sewer line would be installed within steep slopes, making access difficult. Furthermore, portions of the new sewer line (approximately from Sta. 2+50 to Sta. 5+50) would be located within the channel of the realigned Little Pimmit Run. The new sewer line would require heavy fortification along this section to protect against erosion. The ultimate design for this fortification may include a variety of measures such as imbricated rock walls, root wads, or soil lifts.



Careful coordination with the Stream Restoration Project team is required to determine the most feasible option at this portion of Alternative 1. There may be a possibility to realign the stream further away from the property boundary lines. This would allow MH 1 (especially in Option 1-A) to shift toward the property line, and thereby reducing the encroachment on private property. Additionally, there is a large established tree near the alignment and shifting MH 1 closer to the property line will directly impact this tree and may require its removal.

Due to the degree of encroachment on the backyard of the properties, easement acquisition for this portion of Alternative 1 may be challenging, especially from MH 1 (Sta. 4+24) to MH 2 (Sta. 8+54). However, if an easement can be secured, Option 1-A is preferred over Option 1-B. It was also communicated during the Alternatives Evaluation and Recommendation Workshop that Option 1-A is the preferred option by the County. Option 1-A will be less complex to install, given the relatively flat grade (outside steep slopes). It will also have more buffer from the Little Pimmit Run stream, increasing the degree of bank protection and reducing the risk of future exposure.

MH 2 and MH 3 are located in the properties at 6175 Callista Lane and 6155 Callista Lane, respectively, due to the established design guidelines. This places the proposed sewer alignment through these properties. In addition, the proposed sanitary sewer alignment crosses the existing stream between approximately Sta. 9+00 and Sta. 10+00. However, the realignment proposed by the Stream Restoration Project pushes the stream east and a minimum of 10-feet from the sanitary sewer. Design development at this location will be closely coordinated with the Stream Restoration Project team. Adequate protection measures will be placed within the existing stream channel on an interim basis until the ultimate stream realignment is complete.

Proposed MH 3 is located within the property of 6155 Callista Lane. From MH 4 (Sta. 13+38) to MH 031-4-204 (Sta. 25+13), the proposed sewer line is located solely within Fairfax County Park Authority (FCPA) property; except for the portion crossing Chesterbrook Road. The sewer line from MH 3 up to approximately Sta. 15+00 is within an area of relatively steep slope. Additional sheeting and shoring will be required during construction to protect slopes and properly brace the pipeline. For the remainder of this portion, the sewer line will be located within a relatively flat area. Additionally, near MH 3 there is grouping of trees that may require removal.

Option 1-A was selected by the County and is currently incorporated into the baseline concept.

Representative drawings of the reviewed plans are included in Appendix C.

SECTION TWO FUNCTION PHASE

A fundamental element of the Value Methodology is the Function Phase. Function is defined as the intended use of a physical or a procedural element using an active verb and measurable noun sometimes augmented with an adjective for clarity. Function analysis is a means of evaluating a project to see if the expenditures perform the requirements of the project or if there are disproportionate amounts of costs spent on support functions or unwanted secondary functions. Elements performing support functions add cost to the project but have a relatively low worth to the basic function. Higher order, basic and secondary functions provide value, while unwanted functions tend to reduce value. The goal of all VE studies is to optimize the value of the basic functions and reduce the impact of unwanted or unnecessary functions and thereby enhance project value.

Having gained some information about the two projects associated with improvements being made in the Pimmit Run Watershed, the VE team proceeded to define the functions provided by the project, identifying key high order functions and basic functions, identifying the costs to provide these functions, and determining whether the value provided by the functions has been optimized. To accomplish the function analysis, the team first looked at each project plan set in its entirety but then divided each project into key functional areas and investigated what the functions are to support those high-cost areas. These functional areas include stream hydraulic improvements, stream habitat improvements, and wastewater conveyance improvements. Then we randomly listed functions per area and looked at the high-cost drivers of the project and evaluated what function those high-cost items provide.

The following table depicts the functions associated with each of the two projects planned based on the above project benefits:

Table 2-1: Stream Restoration Functions

Area of Focus (STREAM)	Function (Active Verb Measurable Noun)	Function Type
OVERALL PROJECT	Improve Water Quality	Higher Order
	Alleviate Bank Erosion	Basic
	Improve Habitat	Higher Order
	Improve Safety	All-time
	Protect Infrastructure	Objective
	Protect Environment	Objective
	Improve Aesthetics	Secondary
	Educate Community	Secondary
	Provide Natural Channel Design	Objective
	Dissipate Energy	Basic
Furnish/Install RBM $$$	Maintain Channel Shape	Secondary
	Stabilize Bed	Basic
	Provide Habitat	Secondary
	Provide Substrate	Secondary

Area of Focus (STREAM)	Function (Active Verb Measurable Noun)	Function Type
Temporary Timber Matting $$$	Supports Construction	One-time
	Protect Root Zones	All-time
	Protect Underground Infrastructure	Basic
	Allow Site Access	Secondary
	Support Stockpile Areas	Secondary
6-inch Topsoil $$	Support Plantings	Secondary
	Protect Riparian Zone	Secondary
Welded Wire Fence $$	Protect Trees	Secondary
	Enhance Safety	Secondary
	Mitigate Deer Browse	Secondary
Site Excavation – Cut to Fill $$	Shape Channel	Basic
	Support Floodplain Connectivity	Secondary
	Reuse On-site Fill	Secondary
	Minimize Imported Fill	Secondary/Unwanted
	Minimize Hauling	Secondary/Unwanted
	Reduce Carbon Footprint	Secondary/Unwanted
Natural Coir Fiber Matting $$	Mitigate Erosion	Secondary
	Stabilize Bank	Bank
Remove Trees $$	Support Access	Secondary
	Clear Space	Secondary
	Facilitate Construction	One-time
Modified Cross Vanes $$	Control Grade	Basic
	Direct Flow	Secondary
	Protect Banks	Secondary
	Improve Aquatic Habitat	Basic
	Dissipate Energy	Basic
Site Excavation – Cut to Haul $$	Remove Excess Soils	Unwanted

Table 2-2: Sewer Realignment Functions

Area of Focus (SEWER)	Function (Active Verb Measurable Noun)	Function Type
OVERALL PROJECT	Protect Environment	Higher Order
	Eliminate Stream Crossings	Activity
	Protect Infrastructure	Higher Order
	Mitigate Sewer Leaks	Secondary
	Improve Stream Hydraulics	Secondary
PVC Pipe	Convey Wastewater	Basic
	Reduce Corrosion	Secondary
	Improve Hydraulics	Secondary
	Protect Environment	Higher Order
Tree Removal	Support Access	Secondary
	Clear Space	Secondary
	Facilitate Construction	One-time
	Prevent Root Intrusion	Secondary
Lateral Service Reconnection	Re-establish Service	Secondary
	Eliminate Grinder Pumps	Activity
	Convey Wastewater	Basic
Mobilization	Support Construction	One-time
	Support Staging	One-time
Restore Disturbed Areas	Prevent Erosion	Secondary
	Return Areas to Pre-Disturbance	Secondary
Excavation	Remove Crossings	Basic

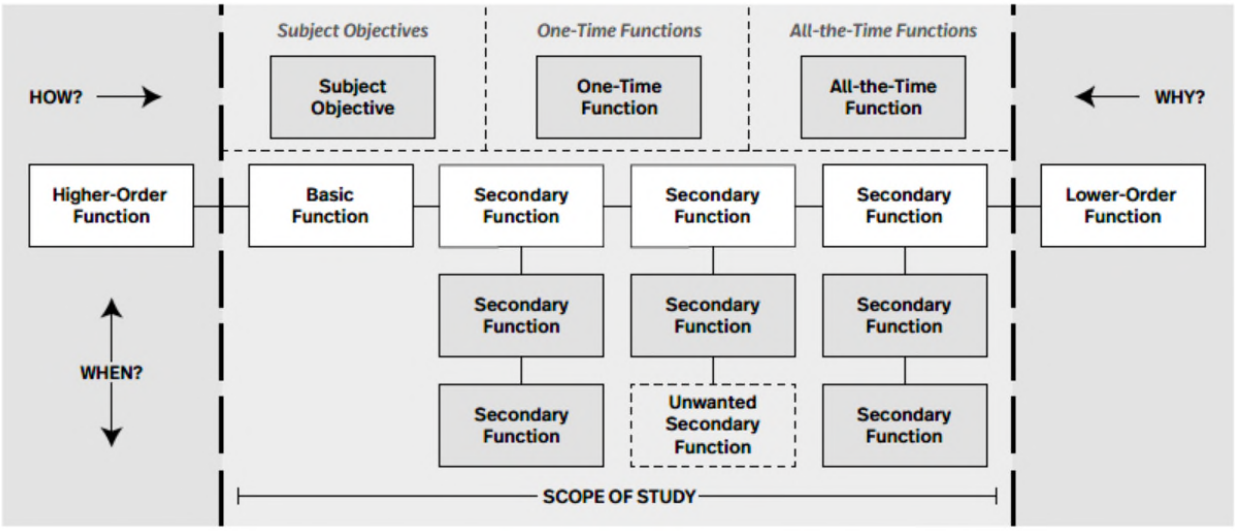
FAST Diagram

The below general diagram (taken from SAVEs 2020 VM Guide – A Guide to the Value Methodology Body of Knowledge) highlights the key functions and how they are linked. Higher-order functions represent the need(s) of the project being evaluated and is the reason why this project exists. Lower-order functions represent the input side of the project that the project must deal with or address. Generally, think of lower-order functions as inputs and higher-order functions as outputs. Basic functions represent the purpose of the project under study and for this and all projects to be a success the basic function has to be achieved to gain a valuable solution to the project being addressed. Secondary functions portray the approach or path of needs to satisfy the basic function. Lastly, one-time functions are secondary functions that, yes, happen once and then that function is completed while all-the-time functions are also secondary functions, but these functions occur continuously.

The main concern that the workshop team is cognizant of is developing functions which have open-ended solutions versus developing activities which are specific and do not lead to further open-ended solutions.

For example, ELIMINATE STREAM CROSSINGS is an activity and not open for creativity in solving the stream restoration / sewer realignment problem, but PROTECT ENVIRONMENT is open-ended allowing various means to do that such as eliminate crossings or bolster and protect crossings in a secondary containment pipe or stream structure. Functions drive solutions, activities drive a prescribed solution with no leeway to recommend alternative approaches.

Figure 2-1: Structure of a FAST Diagram (from SAVE 2020 VM Guide)



COST MODEL

The Cost Histograms (Pareto Table) for this project – stream and sanitary, in both tabular and graphical form, illustrate those construction elements that comprise most of the project's cost. The team used the cost models to seek out areas where the majority of project funds are being directed. The items in bold red letters on the Cost Histogram represent approximately 80% of the project's cost. Because of the absolute magnitude of high-cost elements or functions, these high-cost items also became initial targets for value enhancement. The individual function(s) of the major components of the project depicted on the cost histogram were identified and confirmed on the above function identification table.

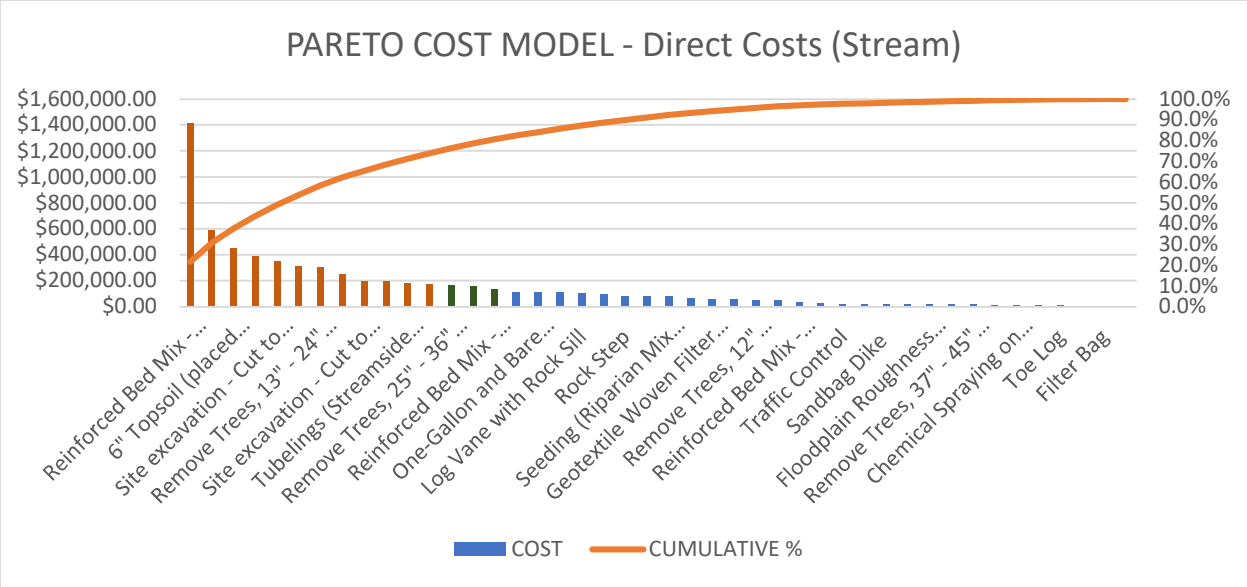
The following cost items are noted as areas that the project design team should address further as the project moves forward:

- Topsoil at $11.40/SY versus normal pricing of $5/SY
- Potentially double-counting the mulch under deck matting (located in two rolled up line items)
- Welded wire tree protection fencing also seems high at $10/LF

Following, is the summary of the stream restoration costs:

COST HISTOGRAM - STREAM RESTORATION

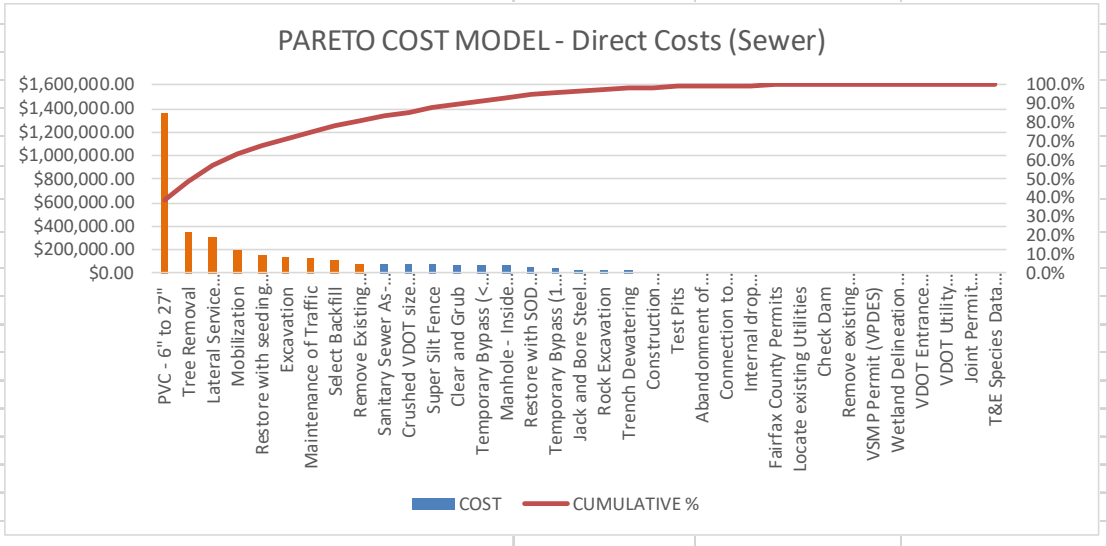
PROJECT ELEMENT	COST	PERCENTAGE	CUMULATIVE %
Reinforced Bed Mix - Class 1	**$1,416,568.35**	**21.7%**	**21.7%**
Access Road Temporary Timber Matting	**$588,583.00**	**9.0%**	**30.8%**
6" Topsoil (placed beneath coir matting)	**$446,880.00**	**6.9%**	**37.6%**
Welded Wire Tree Protection Fence	**$391,000.00**	**6.0%**	**43.6%**
Site excavation - Cut to Fill	**$350,000.00**	**5.4%**	**49.0%**
Natural Coir Fiber Matting	**$314,776.00**	**4.8%**	**53.8%**
Remove Trees, 13" - 24" Diameter	**$303,090.00**	**4.7%**	**58.5%**
Modified Cross Vane	**$251,415.32**	**3.9%**	**62.3%**
Site excavation - Cut to Haul	**$200,284.00**	**3.1%**	**65.4%**
Mobilization	**$200,000.00**	**3.1%**	**68.5%**
Tubelings (Streamside Shrubs)	**$176,265.60**	**2.7%**	**71.2%**
Clear & Grub	**$168,705.30**	**2.6%**	**73.8%**
Remove Trees, 25" - 36" Diameter	**$162,232.32**	**2.5%**	**76.3%**
Wood Chips - 6" Depth (placed beneath deck mats)	**$154,499.80**	**2.4%**	**78.6%**
Reinforced Bed Mix - Class A1	**$132,230.50**	**2.0%**	**80.7%**
As-Built Survey	$111,000.00	1.7%	82.4%
One-Gallon and Bare Root Plantings	$109,224.00	1.7%	84.1%
Live stakes (Streamside)	$107,400.00	1.6%	85.7%
Log Vane with Rock Sill	$99,861.66	1.5%	87.2%
Boulder Pool	$91,451.25	1.4%	88.6%
Rock Step	$80,370.80	1.2%	89.9%
Construction Stakeout	$80,000.00	1.2%	91.1%
Seeding (Riparian Mix or Groundcover)	$77,746.76	1.2%	92.3%
Root Wad Toe Wood	$61,652.36	0.9%	93.2%
Geotextile Woven Filter Fabric (placed beneath deck mats)	$56,680.40	0.9%	94.1%
Silt Fence	$56,000.00	0.9%	95.0%
Remove Trees, 12" Diameter	$50,676.60	0.8%	95.7%
Stream Pump Around	$45,765.00	0.7%	96.4%
Reinforced Bed Mix - Class 2	$32,898.15	0.5%	97.0%
Pool Root Wad	$24,014.10	0.4%	97.3%
Traffic Control	$20,000.00	0.3%	97.6%
Modified Cross Vane Woody Debris	$18,118.70	0.3%	97.9%
Sandbag Dike	$17,959.00	0.3%	98.2%
Trunk Armoring	$17,334.75	0.3%	98.4%
Floodplain Roughness Habitat Rocks	$15,543.50	0.2%	98.7%
Site Grading - Rough	$15,500.00	0.2%	98.9%
Remove Trees, 37" - 45" Diameter	$15,172.78	0.2%	99.2%
Temporary Construction Entrance (With Wash Rack)	$13,576.00	0.2%	99.4%
Chemical Spraying on Vegetation to Kill Invasive Species	$13,210.00	0.2%	99.6%
Log-Boulder Jacks	$12,195.72	0.2%	99.8%
Toe Log	$7,724.61	0.1%	99.9%
Wetland Floodplain Habitat Log	$3,800.00	0.1%	99.9%
Filter Bag	$3,200.00	0.0%	100.0%
Root Pruning	$1,080.00	0.0%	100.0%
SUBTOTAL	$6,515,686		
Contingency	$1,954,706		
OVERALL TOTAL	**$8,470,392**	**Overall Markup:**	**30.00%**



Following, is the summary of the sewer realignment costs:

COST HISTOGRAM - SEWER REALIGNMENT

PROJECT ELEMENT	COST	PERCENTAGE	CUMULATIVE %
PVC - 6" to 27"	**$1,361,750.00**	**38.9%**	**38.9%**
Tree Removal	**$350,000.00**	**10.0%**	**48.9%**
Lateral Service Reconnection	**$305,515.00**	**8.7%**	**57.6%**
Mobilization	**$200,000.00**	**5.7%**	**63.3%**
Restore with seeding and fertilizer	**$146,919.50**	**4.2%**	**67.5%**
Excavation	**$144,910.00**	**4.1%**	**71.7%**
Maintenance of Traffic	**$120,000.00**	**3.4%**	**75.1%**
Select Backfill	**$110,600.00**	**3.2%**	**78.2%**
Remove Existing Sewer Pipe	**$87,725.00**	**2.5%**	**80.8%**
Sanitary Sewer As-builts and video inspection	$84,500.00	2.4%	83.2%
Crushed VDOT size 57, 68 or 78	$77,525.01	2.2%	85.4%
Super Silt Fence	$76,510.00	2.2%	87.6%
Clear and Grub	$70,500.00	2.0%	89.6%
Temporary Bypass (< 1 MGD)	$68,637.00	2.0%	91.5%
Manhole - Inside Diameter 3' to 6' (frame and cover)	$64,650.00	1.8%	93.4%
Restore with SOD (private yards)	$55,576.00	1.6%	95.0%
Temporary Bypass (1 to 5 MGD)	$37,500.00	1.1%	96.0%
Jack and Bore Steel Casing (16 to 30-inches)	$28,890.00	0.8%	96.9%
Rock Excavation	$27,040.00	0.8%	97.6%
Trench Dewatering	$21,000.00	0.6%	98.2%
Construction Entrance/Exit	$13,860.00	0.4%	98.6%
Test Pits	$12,000.00	0.3%	99.0%
Abandonment of existing Sewer Structures	$11,137.16	0.3%	99.3%
Connection to existing Manhole - 8" core bore	$9,737.00	0.3%	99.6%
Internal drop connection to Manhole, 8" PVC	$5,000.00	0.1%	99.7%
Fairfax County Permits	$3,843.00	0.1%	99.8%
Locate existing Utilities	$2,400.00	0.1%	99.9%
Check Dam	$1,668.00	0.0%	99.9%
Remove existing Sewer Structures	$984.00	0.0%	100.0%
VSMP Permit (VPDES)	$308.00	0.0%	100.0%
Wetland Delineation and Confirmation	$300.00	0.0%	100.0%
VDOT Entrance Permit/Temp Constr Entrance (LUP-PE)	$130.00	0.0%	100.0%
VDOT Utility Installation Permit (LUP-UT)	$120.00	0.0%	100.0%
Joint Permit Application	$100.00	0.0%	100.0%
T&E Species Data Collection	$20.00	0.0%	100.0%
SUBTOTAL	$3,501,355		
Contingency	$1,050,406		
OVERALL TOTAL	**$4,551,761**	**Overall Markup:**	**30.00%**



SECTION THREE CREATIVITY AND EVALUATION PHASES

CREATIVE IDEA GENERATION PHASE

This VE study phase involves the creation and listing of ideas to potentially enhance the value of the project. Starting with the functions or project elements with a high absolute cost compared to other elements in the project and secondary functions providing little or no value, the VE team began to generate as many ideas as possible to perform the necessary project functions optimally at a lower total life cycle cost, or at a higher level of performance, or to improve the quality of the project. Ideas for improving design and maintenance, reducing project risks, and simplifying construction were also encouraged. A Creative Ideas and Evaluation Table was generated by project area and is provided below.

Each idea generated was given an idea number to track it through the remaining value engineering process and facilitate referencing among the Creative Ideas and Evaluation table, the proposal write-ups, and the Summary of Value Engineering Proposals table.

EVALUATION OF CREATIVE IDEAS PHASE

Each idea originated during the Creative Idea Generation was then fully evaluated and rated based on how it responds to the project's value objectives. This determined if the idea was worthy of additional research and development before being presented to Fairfax County. The following critical value objectives/project goals (as provided by WSSI and discussed with Fairfax County and KH) were used to evaluate the ideas brainstormed:

- Improve water quality
- Stabilize channel
- Reconnect to floodplain
- Reconfigure channel
- Improve value
- Minimize cross-contamination
- Reduce scour
- Manage flow
- Improve sustainability
- Protect infrastructure/environment
- Improve safety
- Reduce carbon footprint

Based on our understanding of the above value objectives, each idea was compared with the present design concept and the advantages and disadvantages of each idea were discussed. How well an idea met the design criteria was also reviewed. Based on the results of the analysis, the VE team rated the ideas by consensus using a scale of 1 to 5, with 5 or 4 indicating an idea with the greatest potential to be technically sound and provide cost savings or improvements in other areas of the project, 3 indicating an idea that provides marginal value but could be used if the project was having budget problems, 2 indicating an idea with a major technical flaw, and 1 indicating an idea that does not respond even marginally to project requirements. Generally, ideas rated 3 and above are pursued in the next phase and presented to the Fairfax County during the Presentation Phase.

The team also used the designation "DS" to indicate a design suggestion, which is an idea that may not have specific quantifiable cost savings but may reduce project risk, improve constructability, help to minimize claims, enhance operability, reduce maintenance, reduce schedule time, or enhance project value in other

ways. Design suggestions could also increase a project's cost but provide value in areas not currently addressed. DSs are also developed in the next phase of the VE workshop process.

The evaluation of the ideas is recorded in the right column of the Creative Idea Listing and Evaluation table below:

Figure 3-1: Creative Idea Listing and Evaluation Table

Idea No.	Idea Description	Rating
	CONVEY WASTEWATER (CW)	
CW-2	For creek crossings 1, 2, and 3 raise proposed stream bed elevation at existing sanitary sewer crossings and leave the other crossings in lieu of installing 6500 LF of west bank sewer	5
CW-6	Modify proposed sewer along west bank to only include ~3400 LF of sanitary sewer and only eliminate crossings X3 and X2	4
CW-6A	Modify proposed sewer along west bank to only include ~1200 LF of sanitary sewer and only eliminate crossing X3	4
	GENERAL (GL)	
GL-1	Merge stormwater restoration and sanitary sewer work into one construction project over a 2-year period	DS
GL-2	Replace welded wire fence where applicable with orange safety fence (away from residential and trail areas)	3
GL-3	Install chain link fence at all trail access areas (any residential areas)	DS
GL-7	Cover or bury gabion baskets to preserve functionality but improve aesthetics of this structure located near station 29+00 to 30+25 (Phase I)	DS
GL-8	Increase use of salvage material employing vortex or other harvesting device for collecting sediment and cobble	DS
GL-11	Decrease/eliminate timber matting at staging/stockpile areas	4
GL-12	Expand community outreach on topic of stream restoration through signage	DS
GL-13	Replace gabion wall at STA 49+00 (offset) with a permanent retaining wall structure	DS
	IMPROVE HABITAT (IH)	
IH-1	Provide additional woody debris for improved habitat	DS
IH-2	Replace rock sills at downstream ends of boulder pools with log sills	4
IH-3	Add more woody debris to reduce RBM in multiple locations such as areas with slopes lower than 1-percent or area with low stresses	4
IH-4	Utilize Newbury Riffle design to increase quality of habitat and floodplain connection	DS

Idea No.	Idea Description	Rating
	STREAM IMPROVEMENTS (SI)	
SI-1	Replace imbricated rock wall with concrete blocks	3
SI-3	Adjust alignment around meander at STA 71+90 to remove imbricated wall	3
SI-4	Utilize clay plug or instream structure to prevent proposed stream from re-entering the abandoned channel	DS

SECTION FOUR DEVELOPMENT PHASE

During the VE workshop, many ideas for project value enhancement were conceived and evaluated by the VE team for technical feasibility, applicability to the project, implementability considering the project's status, and the ability to meet Fairfax County project and mission value objectives noted in the previous section of the report. Research performed on those ideas considered to have value-enhancing potential resulted in the development of several individual alternatives for change.

The VE alternatives proposed are presented on the following pages. Each proposal is developed by describing the baseline concept to which an alternative concept proposes a change, a listing of advantages and disadvantages in implementing the proposal, discussions of implementation considerations and schedule and risk impacts, changes in performance from the baseline concept, a rough order of magnitude cost comparison, and sketches depicting the proposed change, if applicable. The proposals developed are organized by project or functional area.

Cost Comparison

The capital cost comparisons used unit quantities contained in the conceptual cost estimates prepared by WSSI and KH. If unit costs were not available, published databases, such as the one produced by the RS Means Company, or Arcadis, other team member's or owner's databases were consulted. Direct quotes from vendors for equipment items were also obtained, if applicable. All cost comparisons are made to reflect a true "apple to apples" comparison to the baseline concept.

VE PROPOSAL CW-2

FOR CREEK CROSSINGS 1, 2 AND 3 RAISE PROPOSED STREAM BED ELEVATION AT EXISTING SANITARY SEWER CROSSINGS AND LEAVE THE OTHER CROSSINGS IN LIEU OF INSTALLING 6,500 LF OF WEST BANK SEWER

Alternative Summary	
Total Potential Cost Avoidance:	$3,210,000
Change in Schedule:	See discussion on schedule impacts below

1. **Description of Baseline Concept:** The conceptual design documents show approximately 6,500 lineal feet (LF) of 8-inch sewer line proposed on the west bank side of Little Pimmit Run and the elimination of five creek crossings. Also, crossings 2 and 3 (X2 and X3) are elevated and exposed and no changes are recommended for crossing 1 (X1).

2. **Description of Alternative Concept:** Eliminate the new west side sewer interceptor and leave all six crossings while raising the proposed streambed elevation, where applicable, to minimize pipe exposure of existing gravity sanitary sewer crossings (X1, X2 and X3). Also include replacing the existing sewer at these three locations and installing new pipe inside steel casing pipe or providing a concrete encasement.

3. **Advantages:**
   - Eliminates the need to relocate the sewer main crossings
   - Eliminates the west side sewer interceptor
   - Protects three exposed crossings (currently not encased in concrete)

4. **Disadvantages:**
   - Leaves existing gravity sewer pipe creek crossings in all six locations
   - Low slopes are required to raise the stream bed which would reduce hydraulic function (reduction in sediment transport and an increase in floodplain). These lower slopes are also less ideal for ecological uplift. The culverts under Chesterbrook Road provide a very limiting vertical constraint.

5. **Discussion:** The team acknowledges that Crossing X3 is currently located at a less than ideal elevation relative to the flow path of the creek and is subject to damage from debris during high flow events. Rather than install approximately 6,500 LF of new sewer main along the west bank to eliminate the crossings, the team believes it would be more cost effective to explore raising the elevation of the streambed and encasing and protecting three existing gravity sewer stream crossings (X1, X2 and X3). The other crossings are currently protected.

6. **Discussion of Schedule Impacts:** Schedule is significantly reduced because 6,500 feet of open cut is removed. Potentially reduces the construction time in half from 12-13 months to approximately 6 months.

7. **Discussion of Risk Impacts:** County would still need to maintain existing creek crossings that could potentially be compromised and seep into the stream bed.

8. **Discussion of Operating Cost Impacts:** County would continue to investigate all crossings to ensure crossings are still protected and not exposed or damaged.

VE PROPOSAL CW-2

FOR CREEK CROSSINGS 1, 2 AND 3 RAISE PROPOSED STREAM BED ELEVATION AT EXISTING SANITARY SEWER CROSSINGS AND LEAVE THE OTHER CROSSINGS IN LIEU OF INSTALLING 6,500 LF OF WEST BANK SEWER

9. Assumptions driving Cost Calculations:

- Eliminates 75-percent cost of the west side interceptor
- Assume cut material will be used as fill to raise streambed elevation

Cost Evaluation

Construction Item (Contract Costs)			Original Estimate			Alternative Estimate		
Project Item		Units	Qty	Unit $	Total	Qty	Unit $	Total
Earth Fill (there is cut to haul that can be utilized)		CY				230.0	25.00	$5,750.00
Crossing Structure		EA				5	7500.0	$37,500.00
Furnish and install 18" casing around 8" sanitary sewer		LF				180.0	300.00	$54,000.00
Replace existing 8" sanitary sewer with new 8" DI SS		LF				240.0	209.50	$50,280.00
Core/Connection to Existing Manhole		EA				6.0	1,391.00	$8,346.00
West Bank Sewer Installation (6500 LF of new sewer)		LS	1.0	2,625,000.00	$2,625,000.00			
Subtotal					**$2,625,000**			**$155,876**
Markup Factor (%)	**30.00%**				**$787,500**			**$46,763**
Total					**$3,412,500**			**$202,639**
TOTAL (ROUNDED)					**$3,413,000**			**$203,000**
						Net Cost Avoidance*		**$3,210,000**
		*: Negative number is a cost INCREASE						

VE PROPOSAL CW-2

FOR CREEK CROSSINGS 1, 2 AND 3 RAISE PROPOSED STREAM BED ELEVATION AT EXISTING SANITARY SEWER CROSSINGS AND LEAVE THE OTHER CROSSINGS IN LIEU OF INSTALLING 6,500 LF OF WEST BANK SEWER

Baseline Sketches:

Crossing 3 and 2

Crossing X3
MH 31-4-206 to MH 31-4-007

Crossing X2
MH 31-4-336 to MH 31-4-337

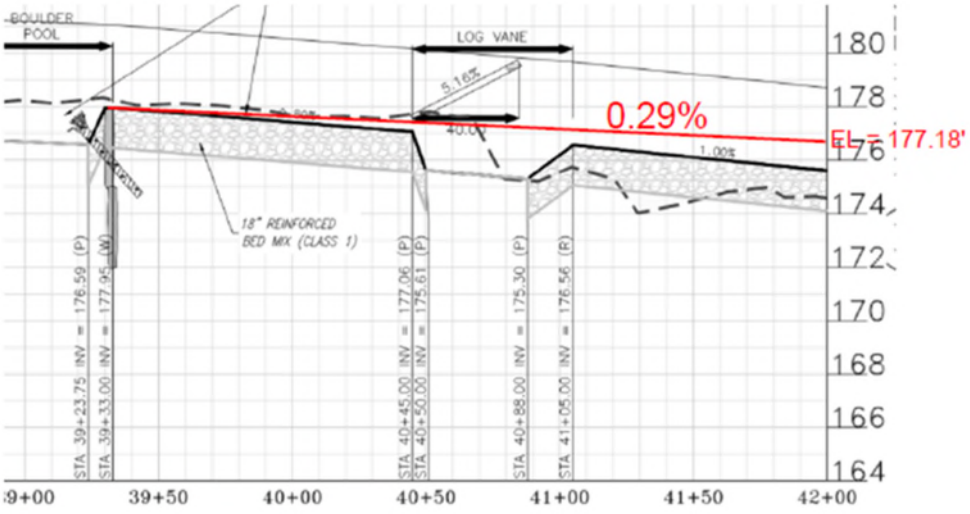
Crossing 1

Exposed Gravity San. Line
between manholes 42 and 41

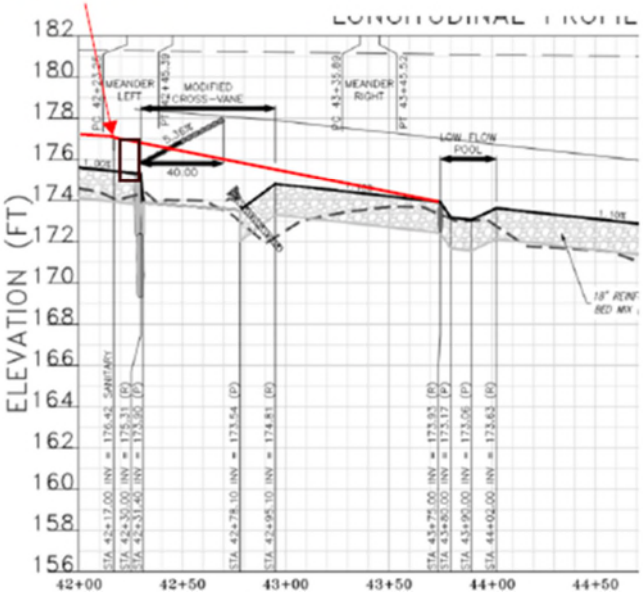
VE PROPOSAL CW-2

FOR CREEK CROSSINGS 1, 2 AND 3 RAISE PROPOSED STREAM BED ELEVATION AT EXISTING SANITARY SEWER CROSSINGS AND LEAVE THE OTHER CROSSINGS IN LIEU OF INSTALLING 6,500 LF OF WEST BANK SEWER

Baseline and Alternative Sketch:



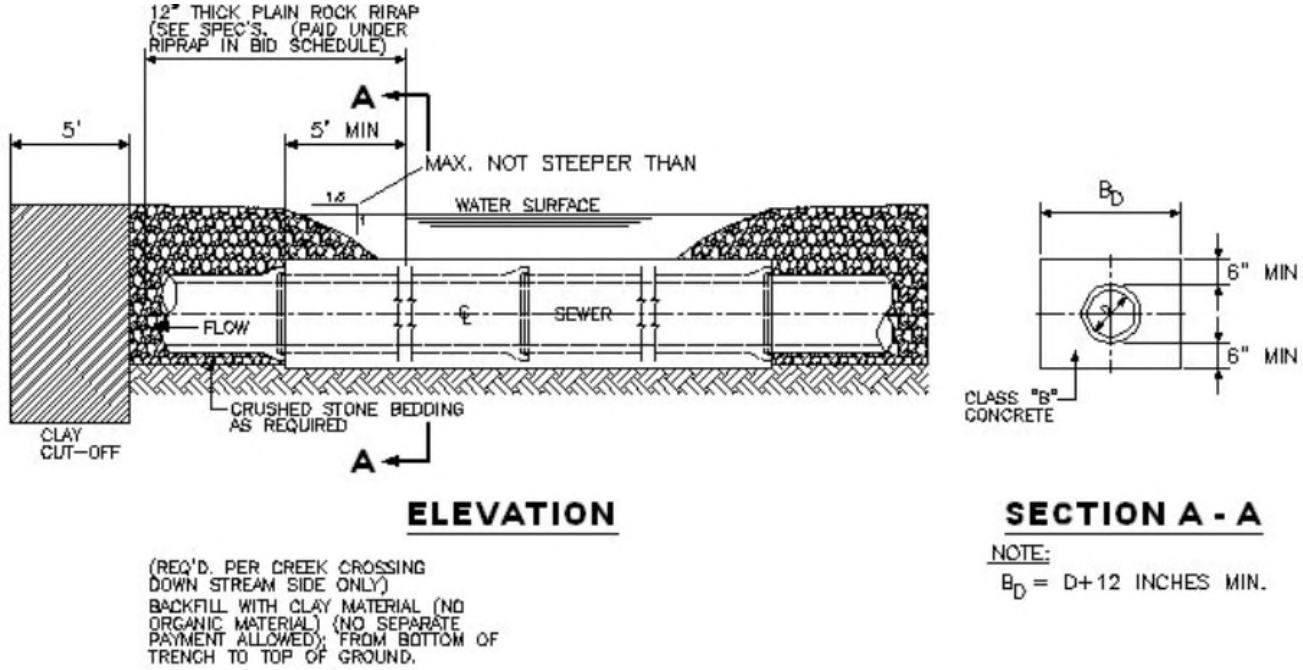
Elevate stream invert to EL =177.12'



VE PROPOSAL CW-2

FOR CREEK CROSSINGS 1, 2 AND 3 RAISE PROPOSED STREAM BED ELEVATION AT EXISTING SANITARY SEWER CROSSINGS AND LEAVE THE OTHER CROSSINGS IN LIEU OF INSTALLING 6,500 LF OF WEST BANK SEWER

Alternative Sketch:



TYPICAL CREEK CROSSING

Note: Protection can either be concrete encasement of steel casing pipe. Steel Casing Pipe would provide flexibility to remove and replace the pipe in the future.

VE PROPOSAL CW-6

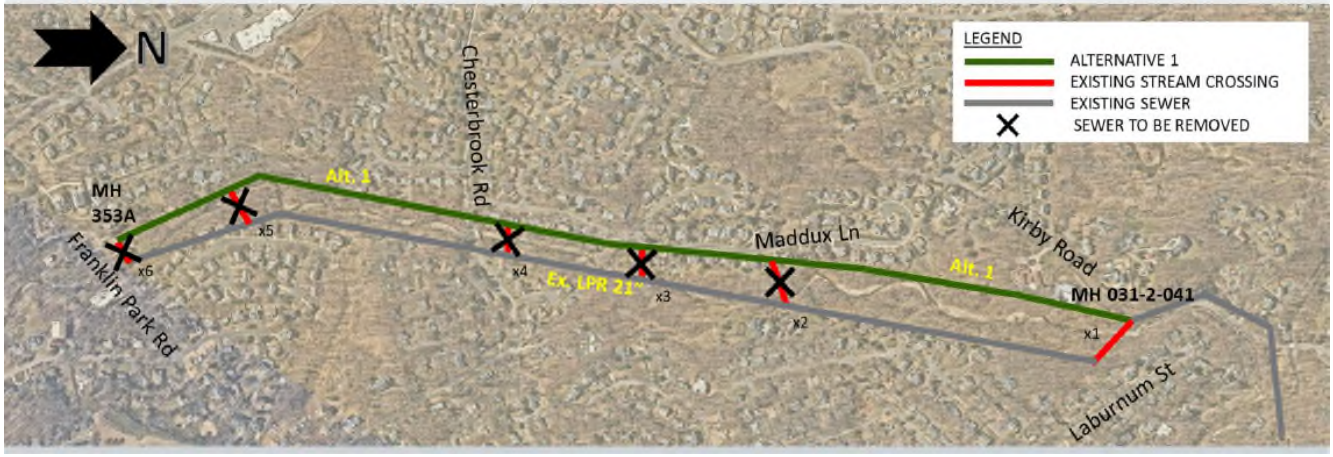
MODIFY PROPOSED SEWER ALONG WEST BANK TO ONLY INCLUDE APPROXIMATELY 3400 LINEAR FEET OF SANITARY SEWER AND ELIMINATE CROSSINGS X3 AND X2

Alternative Summary	
Total Potential Cost Avoidance:	$1,789,000
Change in Schedule:	Significantly shortens sewer construction by months

1. **Description of Baseline Concept:** The conceptual design documents show the installation of approximately 6500 linear feet (LF) of new 8-inch sanitary sewer pipe along the west bank of Little Pimmit Run and removal of five (5) existing gravity sewer pipe creek crossings (see below).

Extends on the west side of Little Pimmit Run, starting at the existing MH 353A immediately north of Franklin Park Road and terminates at the existing MH 031-2-041

Length	New MH	Interconnections	Stream Crossings Remaining	# of Easements
6,500 Feet	15	6	1	22



2. **Description of Alternative Concept:** Install approximately 3429 LF of new 8-inch sanitary sewer pipe along the west bank of Little Pimmit Run (downstream of Crossing No. X3 and remove two existing gravity sewer pipe creek crossings (X3 and X2). Crossings X4, X5, and X6 to remain in place discharging flows to the existing 21-inch interceptor sewer on the east bank.

3. **Advantages:**
   - Decreases easement acquisition costs
   - Decreases amount of sewer main that will need to be maintained in the future
   - Decreases amount of land disturbance/lowers restoration costs
   - Decreases amount of disruption to homeowners

4. **Disadvantages:**
   - Leaves three (3) existing gravity sewer pipe creek crossings in place (X4, X5, and X6).

VE PROPOSAL CW-6

MODIFY PROPOSED SEWER ALONG WEST BANK TO ONLY INCLUDE APPROXIMATELY 3400 LINEAR FEET OF SANITARY SEWER AND ELIMINATE CROSSINGS X3 AND X2

5. **Discussion:** The majority of the existing gravity sewer crossings have been lined with a CIPP liner that essentially creates a jointless pipe inside the existing sewer main. Furthermore, the majority of the crossings that will remain have been armored/encased in concrete. The team's position is to re-route the sewer if a reasonable opportunity exists, but the preference is to leave the crossings in place with additional protection through restoration practices. This is more prudent with the negative cost impacts realized from the installation of a new parallel sewer main for the entire 6,500 LF corridor when one considers construction cost, easement cost, and disruption to homeowners.

6. **Discussion of Schedule Impacts:** Reduction in amount of sewer to be installed would minimize the number of easements which may help accelerate project and shorten the construction duration.

7. **Discussion of Risk Impacts:** The County would still need to maintain four existing creek crossings, which would still be at risk of being damaged by scour and floating debris during high water events. The installation of new sewer along west bank, where it currently does not exist, may lead to homeowner complaints about odors.

8. **Discussion of Operating Cost Impacts:** Project will result in an additional +/- 3,000 LF of sanitary sewer to maintain; however, this should have a minimal impact on life cycle costs.

9. **Assumptions driving Cost Calculations:**
   - Easement acquisition costs not included in analysis

VE PROPOSAL CW-6

MODIFY PROPOSED SEWER ALONG WEST BANK TO ONLY INCLUDE APPROXIMATELY 3400 LINEAR FEET OF SANITARY SEWER AND ELIMINATE CROSSINGS X3 AND X2

Cost Evaluation

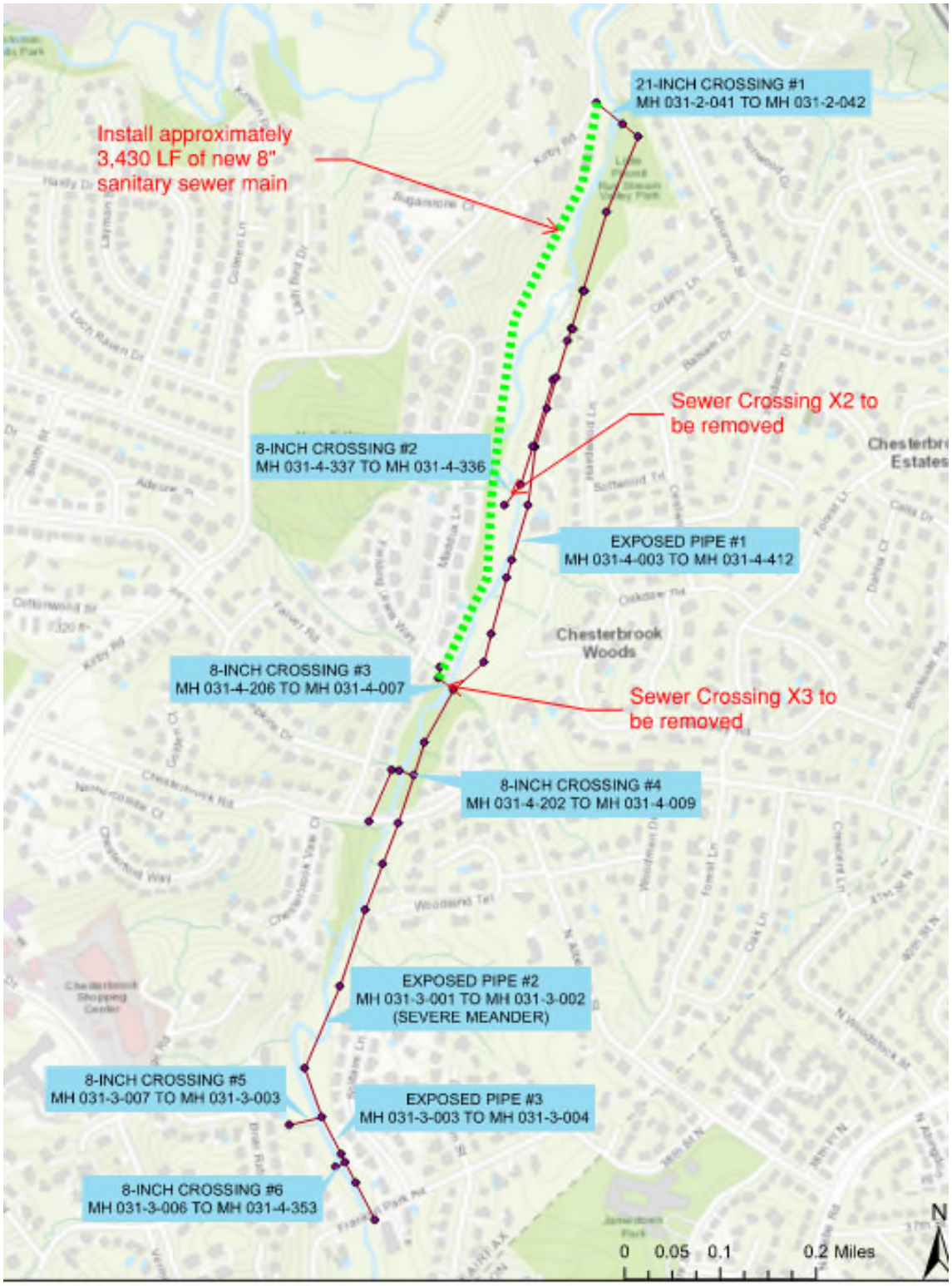
Construction Item (Contract Costs)			Original Estimate			Alternative Estimate		
Project Item		**Units**	**Qty**	**Unit $**	**Total**	**Qty**	**Unit $**	**Total**
Remove Existing Sewer Pipe		LF	1595.0	55.00	$87,725.00	110.0	55.00	$6,050.00
Remove Sewer Structures		EA	2.0	492.00	$984.00			
Abandon Sewer Structures		EA	4.0	2,784.00	$11,136.00			
Tree Removal		EA	140.0	2,500.00	$350,000.00	68.0	2,500.00	$170,000.00
Clear & Grub		AC	5.0	15,000.00	$75,000.00	3.0	15,000.00	$45,000.00
Check Dam		EA	6.0	278.00	$1,668.00	3.0	278.00	$834.00
Construction Entrance		EA	4.0	3,465.00	$13,860.00	2.0	3,465.00	$6,930.00
Seeding		SY	22603.0	6.50	$146,919.50	14520.0	6.50	$94,380.00
Sod		SY	6947.0	8.00	$55,576.00	2889.0	8.00	$23,112.00
Excavation		CY	3370.0	43.00	$144,910.00	1778.0	43.00	$76,454.00
Rock Excavation		CY	169.0	160.00	$27,040.00	89.0	160.00	$14,240.00
Trench Dewatering		LF	7000.0	3.00	$21,000.00	3429.0	3.00	$10,287.00
Select Backfill		CY	2765.0	40.00	$110,600.00	1778.0	40.00	$71,120.00
VDOT #57 stone		CY	927.0	83.63	$77,525.01	489.0	83.63	$40,895.07
Maintenance of Traffic		LS	1.0	120,000.00	$120,000.00	1.0	60,000.00	$60,000.00
PVC 6" - 27"		LF	6500.0	209.50	$1,361,750.00	3429.0	209.50	$718,375.50
Jack & Bore Casing		LF	45.0	642.00	$28,890.00			
Manhole 3' to 6' ID		EA	15.0	4,310.00	$64,650.00	8.0	4,310.00	$34,480.00
Manhole 8" Core Drill		EA	7.0	1,361.00	$9,527.00	5.0	1,361.00	$6,805.00
Temp. Bypass (upto 0.5MGD)		Month	1.5	45,758.00	$68,637.00	0.5	45,758.00	$22,879.00
Subtotal					**$2,777,398**			**$1,401,842**
Markup Factor (%)	**30.00%**				**$833,219**			**$420,552**
Total					**$3,610,617**			**$1,822,394**
TOTAL (ROUNDED)					**$3,611,000**			**$1,822,000**
							Net Cost Avoidance*	**$1,789,000**

*: Negative number is a cost INCREASE

VE PROPOSAL CW-6

MODIFY PROPOSED SEWER ALONG WEST BANK TO ONLY INCLUDE APPROXIMATELY 3400 LINEAR FEET OF SANITARY SEWER AND ELIMINATE CROSSINGS X3 AND X2

Alternative Sketch:



VE PROPOSAL CW-6A

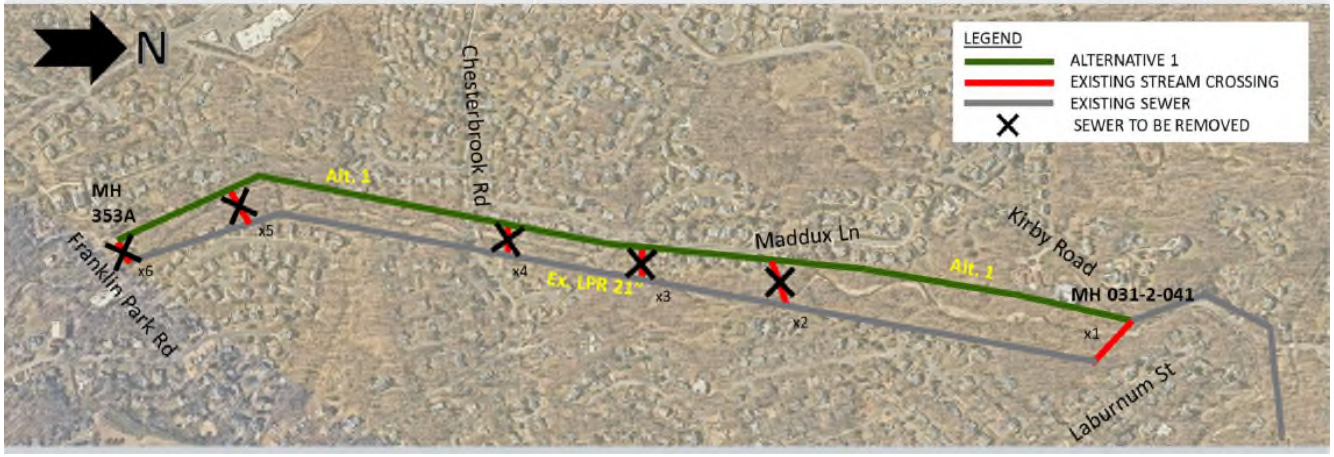
MODIFY PROPOSED SEWER ALONG WEST BANK TO ONLY INCLUDE APPROXIMATELY 1200 LINEAR FEET OF SANITARY SEWER AND ONLY ELIMINATE CROSSING X3

Alternative Summary	
Total Potential Cost Avoidance:	$2,910,000
Change in Schedule:	Significantly shortens sewer construction by months

1. **Description of Baseline Concept:** The conceptual design documents show the installation of approximately 6500 linear feet (LF) of new 8-inch sanitary sewer pipe along the west bank of Little Pimmit Run and removal of five existing gravity sewer pipe creek crossings (see below).

Extends on the west side of Little Pimmit Run, starting at the existing MH 353A immediately north of Franklin Park Road and terminates at the existing MH 031-2-041

Length	New MH	Interconnections	Stream Crossings Remaining	# of Easements
6,500 Feet	15	6	1	22



2. **Description of Alternative Concept:** Install approximately 1200 LF of new 8-inch sanitary sewer pipe along the west bank of Little Pimmit Run (downstream of Crossing No. X3 and remove one existing gravity sewer pipe creek crossing (X3). Crossings X2, X4, X5, and X6 to remain in place discharging flows to the existing 21-inch interceptor sewer on the east bank.

3. **Advantages:**
   - Eliminates Crossing X3 which is higher in the channel cross section and therefore more prone to damage from floating debris
   - Decreases easement acquisition costs
   - Decreases amount of sewer main that will need to be maintained in the future
   - Decreases amount of land disturbance/lowers restoration costs
   - Decreases amount of disruption to homeowners

4. **Disadvantages:**

VE PROPOSAL CW-6A

MODIFY PROPOSED SEWER ALONG WEST BANK TO ONLY INCLUDE APPROXIMATELY 1200 LINEAR FEET OF SANITARY SEWER AND ONLY ELIMINATE CROSSING X3

- Leaves four existing gravity sewer pipe creek crossings in place (X2, X4, X5, and X6).

5. **Discussion:** The majority of the existing gravity sewer crossings have been lined with a CIPP liner that essentially creates a jointless pipe inside the existing sewer main. Furthermore, the majority of the crossings that will remain have been armored/encased in concrete. The team's position is to re-route the sewer if a reasonable opportunity exists, but the preference is to leave the crossings in place with the addition of adding protection through restoration practices. This is more prudent with negative cost impacts realized from the installation of a new parallel sewer main for the entire 6,500 LF corridor when one considers construction cost, easement cost, and disruption to homeowners.

6. **Discussion of Schedule Impacts:** Reduction in amount of sewer to be installed would minimize the number of easements, which may help accelerate project, and shorten the construction duration.

7. **Discussion of Risk Impacts:** The County would still need to maintain five (5) existing creek crossings which would still be at risk of being damaged by scour and floating debris during high water events. The installation of new sewer along west bank, where it currently does not exist, may lead to homeowner complaints about odors

8. **Discussion of Operating Cost Impacts:** Project will result in an additional +/- 1,200 LF of sanitary sewer to maintain; however, this should have a minimal impact on life cycle costs.

9. **Assumptions driving Cost Calculations:**
   - Easement acquisition costs not included in analysis

VE PROPOSAL CW-6A

MODIFY PROPOSED SEWER ALONG WEST BANK TO ONLY INCLUDE APPROXIMATELY 1200 LINEAR FEET OF SANITARY SEWER AND ONLY ELIMINATE CROSSING X3

Cost Evaluation

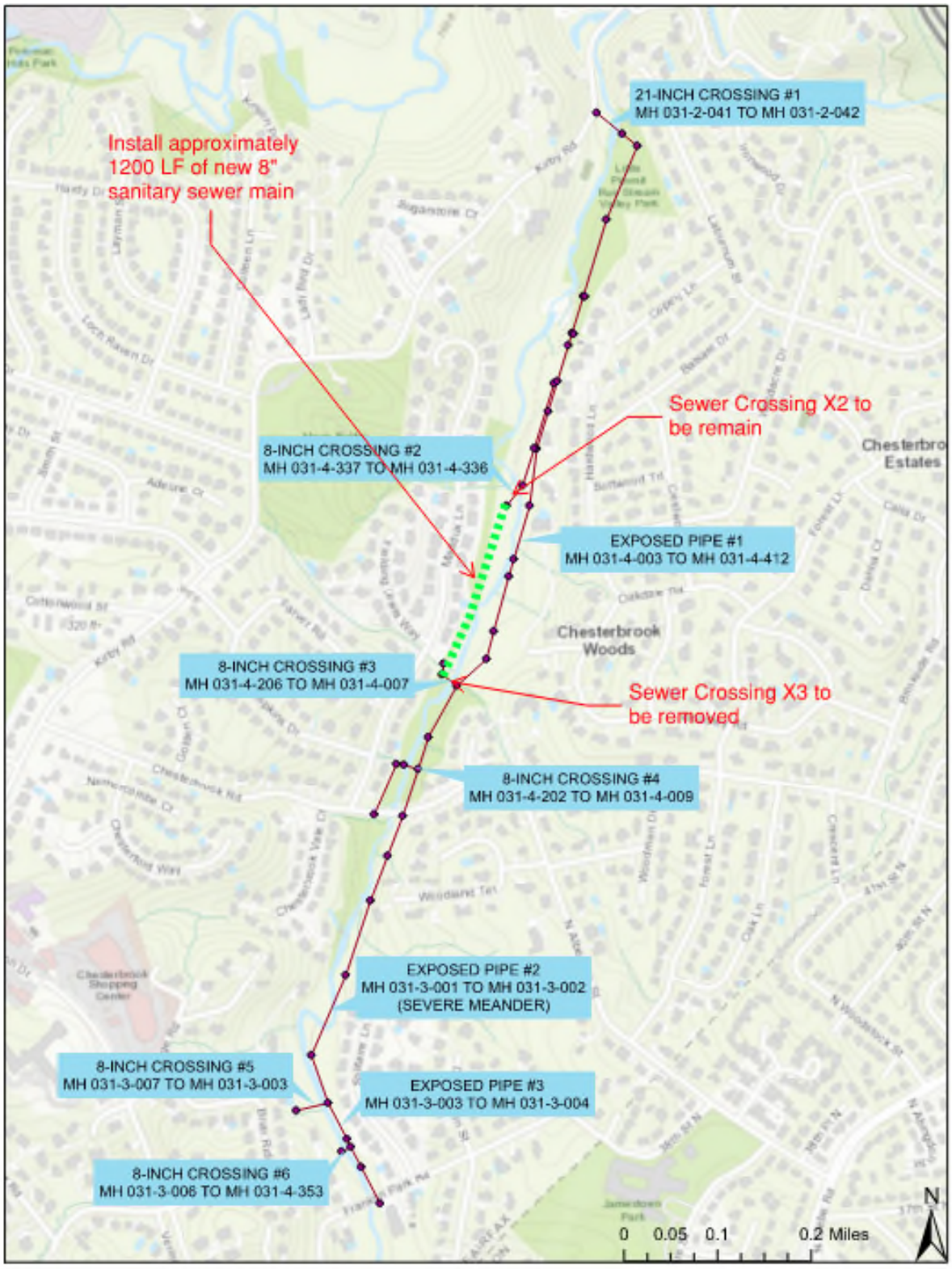
Construction Item (Contract Costs)			Original Estimate			Alternative Estimate		
Project Item		**Units**	**Qty**	**Unit $**	**Total**	**Qty**	**Unit $**	**Total**
Remove Existing Sewer Pipe		LF	1595.0	55.00	$87,725.00	80.0	55.00	$4,400.00
Remove Sewer Structures		EA	2.0	492.00	$984.00			
Abandon Sewer Structures		EA	4.0	2,784.00	$11,136.00			
Tree Removal		EA	140.0	2,500.00	$350,000.00	25.0	2,500.00	$62,500.00
Clear & Grub		AC	5.0	15,000.00	$75,000.00	1.0	15,000.00	$15,000.00
Check Dam		EA	6.0	278.00	$1,668.00	2.0	278.00	$556.00
Construction Entrance		EA	4.0	3,465.00	$13,860.00	1.0	3,465.00	$3,465.00
Seeding		SY	22603.0	6.50	$146,919.50	5300.0	6.50	$34,450.00
Sod		SY	6947.0	8.00	$55,576.00			
Excavation		CY	3370.0	43.00	$144,910.00	622.0	43.00	$26,746.00
Rock Excavation		CY	169.0	160.00	$27,040.00	31.0	160.00	$4,960.00
Trench Dewatering		LF	7000.0	3.00	$21,000.00	1200.0	3.00	$3,600.00
Select Backfill		CY	2765.0	40.00	$110,600.00	622.0	40.00	$24,880.00
VDOT #57 stone		CY	927.0	83.63	$77,525.01	171.0	83.63	$14,300.73
Maintenance of Traffic		LS	1.0	120,000.00	$120,000.00	1.0	60,000.00	$60,000.00
PVC 6" - 27"		LF	6500.0	209.50	$1,361,750.00	1200.0	209.50	$251,400.00
Jack & Bore Casing		LF	45.0	642.00	$28,890.00			
Manhole 3' to 6' ID		EA	15.0	4,310.00	$64,650.00	4.0	4,310.00	$17,240.00
Manhole 8" Core Drill		EA	7.0	1,361.00	$9,527.00	3.0	1,361.00	$4,083.00
Temp. Bypass (upto 0.5MGD)		Month	1.5	45,758.00	$68,637.00	0.3	45,758.00	$11,439.50
Subtotal					**$2,777,398**			**$539,020**
Markup Factor (%)	**30.00%**				**$833,219**			**$161,706**
Total					**$3,610,617**			**$700,726**
TOTAL (ROUNDED)					**$3,611,000**			**$701,000**
							Net Cost Avoidance*	**$2,910,000**

*: Negative number is a cost INCREASE

VE PROPOSAL CW-6A

MODIFY PROPOSED SEWER ALONG WEST BANK TO ONLY INCLUDE APPROXIMATELY 1200 LINEAR FEET OF SANITARY SEWER AND ONLY ELIMINATE CROSSING X3

Alternative and/or Baseline Sketch:



VE PROPOSAL GL-1

MERGE STORMWATER RESTORATION AND SANITARY SEWER WORK INTO ONE CONSTRUCTION PROJECT OVER A 2-YEAR PERIOD

Alternative Summary	
Total Potential Cost Avoidance:	DESIGN SUGGESTION
Change in Schedule:	Potential to significantly reduce schedule by months and eliminate the return of contractors to the same stretch of stream from one year to the next year

1. **Description of Baseline Concept:** The conceptual design documents show two separate projects - a stream restoration project, and a sanitary sewer replacement project. The sanitary sewer project runs along the west bank of the stream restoration project.

2. **Description of Alternative Concept:** Combine the stream restoration project with the sanitary sewer project under one contract. Because the stream project is larger and has stricter experience prerequisites, it would be sensible to use a stream restoration contractor as the prime contractor and utilize a subcontractor for the sanitary sewer work. It is possible that the prime stream contractor could also self-perform the sanitary work in lieu of a subcontractor.

3. **Advantages:**
   - Decreases construction and County administration costs and project time
   - Less impact to the community
   - Improves coordination between stream restoration and sanitary sewer work

4. **Disadvantages:**
   - Possible project start delays while projects are synchronized and all required easements are attained

5. **Discussion:** When a construction site is mobilized, it is logical to perform as much work as possible on the site under the one mobilization. A significant amount of cost and time savings are achieved by eliminating all the tasks that would be duplicated over multiple projects.

6. **Discussion of Schedule Impacts:** The merging of these projects would significantly decrease the overall project's times due to the following: 1) half the permitting and half the manhours to obtain permitting are required; 2) concurrent submittal processing and material procurement will occur; 3) all tree removals can be performed at the same time; 4) shared construction access decreases the amount of access road to be installed and potentially reduces tree removal; 5) stream and sanitary work could be performed concurrently; and 6) higher construction efficiency from easier coordination through one point of contact for the contractor.

7. **Discussion of Risk Impacts:** Acquiring stream easements could be difficult. If the projects are combined, delays in starting the stream work could lead to delays in starting the sanitary sewer work.

8. **Discussion of Operating Cost Impacts:** Operating costs would certainly be lower if the projects are combined. Calculating these costs is not possible within the scope of a 4-day VE study.

VE PROPOSAL GL-1

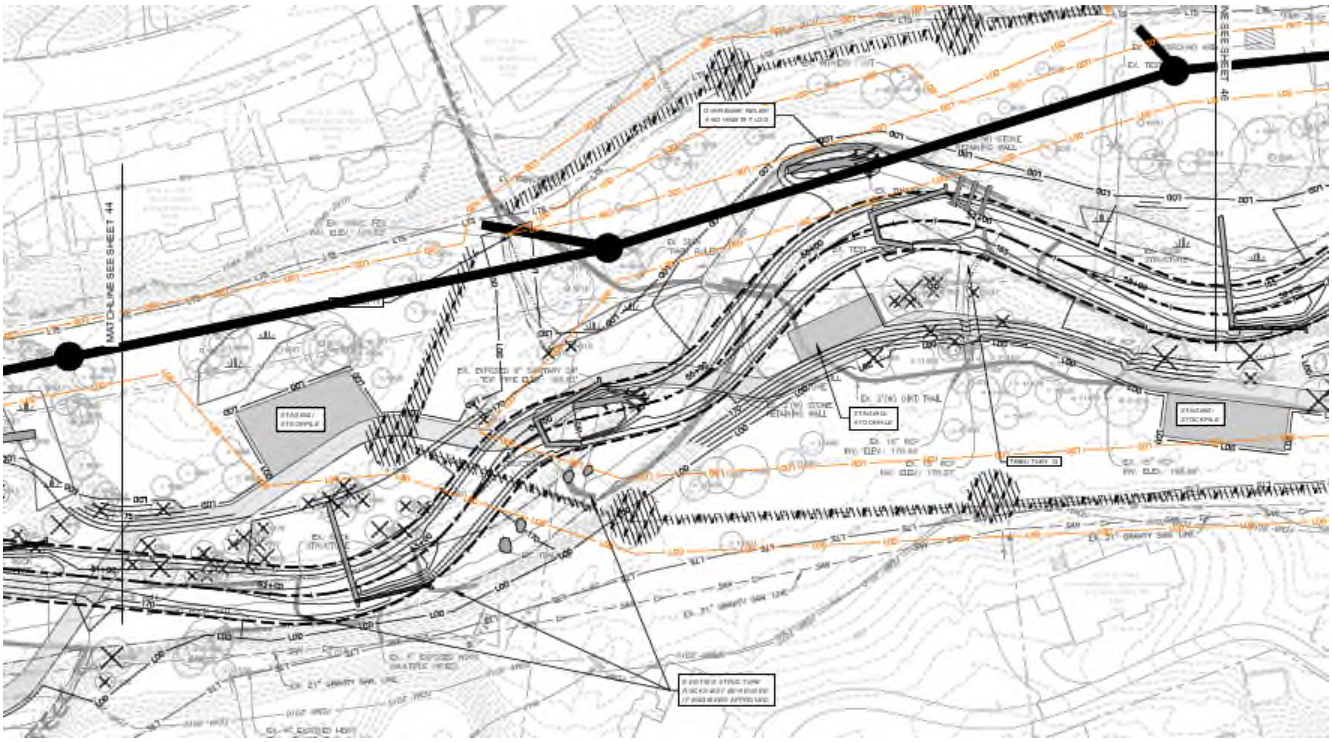
MERGE STORMWATER RESTORATION AND SANITARY SEWER WORK INTO ONE CONSTRUCTION PROJECT OVER A 2-YEAR PERIOD

9. Assumptions driving Cost Calculations:

- The expectation is that the overall cost of the combined projects will decrease when syncing up tree removal and site access (potential overall savings of less than 10% of the overall combined budgets through increased construction delivery efficiencies). However, the biggest impact is reducing the length of construction impacts to the community.

Cost Evaluation: Expectation is that merging both design projects into one construction project will provide cost savings and an easier construction approach eliminating double mobilization, streamline site access, reduce fencing, optimize easements, and improve tree management, at a minimum.

Alternative Sketch (showing an example in Phase II of the interplay between the two projects - the new west-side sanitary sewer installation and the stream restoration work with the caveat that work on the sewer and creek could be done in the same season and lessen impact on neighbors one year for sewer work and the next year for stream restoration work)



VE PROPOSAL GL-2

REPLACE WELDED WIRE FENCE WHERE APPLICABLE WITH ORANGE SAFETY FENCE (AWAY FROM RESIDENTIAL AND TRAIL AREAS)

Alternative Summary	
Total Potential Cost Avoidance:	$22,000
Change in Schedule:	No impact

1. **Description of Baseline Concept:** The plan set shows limits of disturbance (LOD) lines and tree protection (TP) lines that represent the location of where welded wire fence is to be installed.

2. **Description of Alternative Concept:** Replace welded wire tree protection fence along TP lines with orange safety fence.

3. **Advantages:**
   - Lowers cost for fencing material
   - Easy to replace and repair if damaged
   - Less time to replace and repair compared to other fences

4. **Disadvantages:**
   - Dose not prevent people or vehicles from entering area
   - Dose not provide the same level of protection as welded wire fence

5. **Discussion:** On this project site, there is limited space available for the access path and staging area so that the construction vehicles can operate freely without running the risk of damaging any nearby trees and fence. By changing some of the welded wire TP fence within the LOD to orange safety fence, the overall cost for fencing material will be reduced. In addition, the likelihood that the contractor will repair a welded wire fence is low; orange safety fence is more likely to be repaired by the contractor.

6. **Discussion of Schedule Impacts:** This proposed modification has no identifiable schedule impacts.

7. **Discussion of Risk Impacts:** This proposed modification has no identifiable risk impacts.

8. **Discussion of Operating Cost Impacts:** No impact.

9. **Assumptions driving Cost Calculations:**

Cost Evaluation

Construction Item (Contract Costs)			Original Estimate			Alternative Estimate		
Project Item		Units	Qty	Unit $	Total	Qty	Unit $	Total
Welded Wire Fence		LF	39,100	10.00	$391,000.00	35,690	10.00	$356,900.00
Orange Saftey Fence		LF	0.0	5.00		3,410	5.00	$17,050.00
					$0.00			$0.00
Subtotal					**$391,000**			**$373,950**
Markup Factor (%)	**30.00%**				**$117,300**			**$112,185**
Total					**$508,300**			**$486,135**
TOTAL (ROUNDED)					**$508,000**			**$486,000**
							Net Cost Avoidance*	**$22,000**

VE PROPOSAL GL-3

INSTALL CHAIN LINK FENCE AT ALL TRAIL ACCESS AREAS (ANY RESIDENTIAL AREAS)

Alternative Summary	
Total Potential Cost Avoidance:	($92,000)
Change in Schedule:	No impact

1. **Description of Baseline Concept:** The plan set shows limits of disturbance (LOD) lines that represent the location where welded wire fence is to be installed.

2. **Description of Alternative Concept:** Replace welded wire fence with chain link fence along the LOD where trails access the construction site.

3. **Advantages:**
   - Best fence for providing safety and security by preventing people and vehicles from entering site
   - Easy to install, remove, and repair if damaged
   - Can easily attach signs and fabrics to the fence

4. **Disadvantages:**
   - If chain link fence is damaged, complete sections of fencing will have to be replaced
   - Chain link fence is expensive

5. **Discussion:** Because of the proximity of houses and trails to the project site, there is a high risk of people accessing the project site during and after construction activities. By changing the LOD welded wire fence to chain link fence, the overall cost for fencing along the LOD will not change, and there is the added benefit of knowing that the site is safe and secure. In addition, welded wire fence is more likely to be damaged during construction that chain link fence.

6. **Discussion of Schedule Impacts:** This proposed modification has no identifiable schedule impacts.

7. **Discussion of Risk Impacts:** This proposed modification has no identifiable risk impacts.

8. **Discussion of Operating Cost Impacts:** No impact at all.

9. **Assumptions driving Cost Calculations:**
   - Using the costs of welded wire fabric fence as provided in the PDTs cost estimate shows that there is no cost impact, but FFX cost staff believes the final price point for welded wire fabric should be $8 or less and changing to chain link fence will definitely increase the price slightly

VE PROPOSAL GL-3

INSTALL CHAIN LINK FENCE AT ALL TRAIL ACCESS AREAS (ANY RESIDENTIAL AREAS)

Cost Evaluation

Construction Item (Contract Costs)			Original Estimate			Alternative Estimate		
Project Item		**Units**	**Qty**	**Unit $**	**Total**	**Qty**	**Unit $**	**Total**
Welded Wire Fence		LF	39100.0	8.00	$312,800.00	3410.0	8.00	$27,280.00
Chain Link Fence		LF		10.00	$0.00	35690.0	10.00	$356,900.00
Subtotal					**$312,800**			**$384,180**
Markup Factor (%)	**30.00%**				**$93,840**			**$115,254**
Total					**$406,640**			**$499,434**
TOTAL (ROUNDED)					**$407,000**			**$499,000**
						Net Cost Avoidance*		**($92,000)**

*: Negative number is a cost INCREASE

VE PROPOSAL GL-7

COVER OR BURY GABION BASKETS TO PRESERVE FUNCTIONALITY BUT IMPROVE AESTHETICS OF THIS STRUCTURE LOCATED NEAR STATIONS 29+00 TO 30+25 (PHASE I)

Alternative Summary	
Total Potential Cost Avoidance:	DESIGN SUGGESTION
Change in Schedule:	No impact

1. **Description of Baseline Concept:** The conceptual design documents show an existing gabion wall placed by one of the homeowners along Little Pimmit Run that is going to be retained in place per the homeowner's wishes.

2. **Description of Alternative Concept:** Cover or bury the existing gabion basket wall to improve aesthetics in the stream corridor.

3. **Advantages:**
   - Improves aesthetics while the functionality of the baskets remain

4. **Disadvantages:**
   - Additional costs for burying / covering the gabion baskets
   - Requires additional maintenance activities

5. **Discussion:** Members of the VE team have a long history of seeing the impacts of gabion wall systems as in-channel structures to protect property, etc. The critical thing about these gabion baskets is not the function they serve – protecting property and resisting lateral movement – rather the fact that they degrade over time and destroy the natural channel design aspects that Fairfax County endeavors to achieve. This alternative improves the look of the gabion basket system with soil and riparian plantings. Similar work was done at the Indian Run at Columbia Road stream restoration project (see pre- and post-construction photos next pages).

6. **Discussion of Schedule Impacts:** Additional work required, but not a major driver during the construction period.

7. **Discussion of Risk Impacts:** It is not known if this alternative will impact the longevity of the gabion baskets, but it will require more maintenance versus doing nothing.

8. **Discussion of Operating Cost Impacts:** Minor impact if additional soil is required over time.

9. **Assumptions driving Cost Calculations:**
   - N/A

VE PROPOSAL GL-7

COVER OR BURY GABION BASKETS TO PRESERVE FUNCTIONALITY BUT IMPROVE AESTHETICS OF THIS STRUCTURE LOCATED NEAR STATIONS 29+00 TO 30+25 (PHASE I)

Baseline Sketch:

Existing Gabion Wall

VE PROPOSAL GL-7

COVER OR BURY GABION BASKETS TO PRESERVE FUNCTIONALITY BUT IMPROVE AESTHETICS OF THIS STRUCTURE LOCATED NEAR STATIONS 29+00 TO 30+25 (PHASE I)

Alternative Sketch:

Pre-construction

Post-Construction (top row of gabion baskets removed and add additional soil and plantings)

VE PROPOSAL GL-8

INCREASE THE USE OF SALVAGE MATERIAL EMPLOYING A VORTEX OR OTHER HARVESTING DEVICE FOR COLLECTING SEDIMENT AND COBBLE

Alternative Summary	
Total Potential Cost Avoidance:	DESIGN SUGGESTION
Change in Schedule:	Adds 2-3 months for construction and up to 4 months to design if a vortex tube is used

1. **Description of Baseline Concept:** The conceptual design imports 19,150 tons of class A1, Class 1, and Class 2 Reinforced Bed Mix (RBM) to stabilize the stream channel bed throughout the project area.

2. **Description of Alternative Concept:** Augment RBM with salvaged bed material found onsite. The material can be harvested using a vortex or other harvesting devices.

3. **Advantages:**
   - Provides better habitat by increasing the native stone percentage
   - Decreases material haul-off and lowers project cost
   - Improves aesthetics of project

4. **Disadvantages:**
   - The available amount of recovered material can be hard to quantify
   - Requires on-site stockpile and ongoing operation to harvest before use
   - Harvesting requires pre-installation of the device which is difficult, given the site conditions

5. **Discussion:** Replacement of imported bed material with salvaged bed material would decrease cost through reduced imported bed material and haul-off and reduced vehicle trips and associated air quality impacts. It improves both the in-stream habitat and project aesthetics by using native rock, which has unique chemistry and visual characteristics.

   Vortex tube can be used to collect the bedloads from the stream. Sediment transport analysis may be needed to quantify the volume of bedload that can be harvested. This idea was developed by Dave Rosgen back in 1987.

6. **Discussion of Schedule Impacts:** The proposed design has no identifiable schedule impacts if harvesting is done without the use of vortex tube.

   If vortex tubes are employed, then the tubes have to be installed several months in advance at several locations along the main stream before they are actually available for use.

7. **Discussion of Risk Impacts:** This proposed design has no identifiable risk impacts if vortex tubes are not employed.

   If vortex tubes are employed then risks include operation and maintenance of the vortex tube and harvest area. The tube can become clogged and require cleanout. The pond at the harvest area could fill and block/clog the vortex tube. Once installed, the system can be operated continuously or allowed to clog and then cleaned out and operated as needed for specific project needs.

8. **Discussion of Operating Cost Impacts** This proposed design has no operational cost impacts.

9. **Assumptions driving Cost Calculations:** N/A

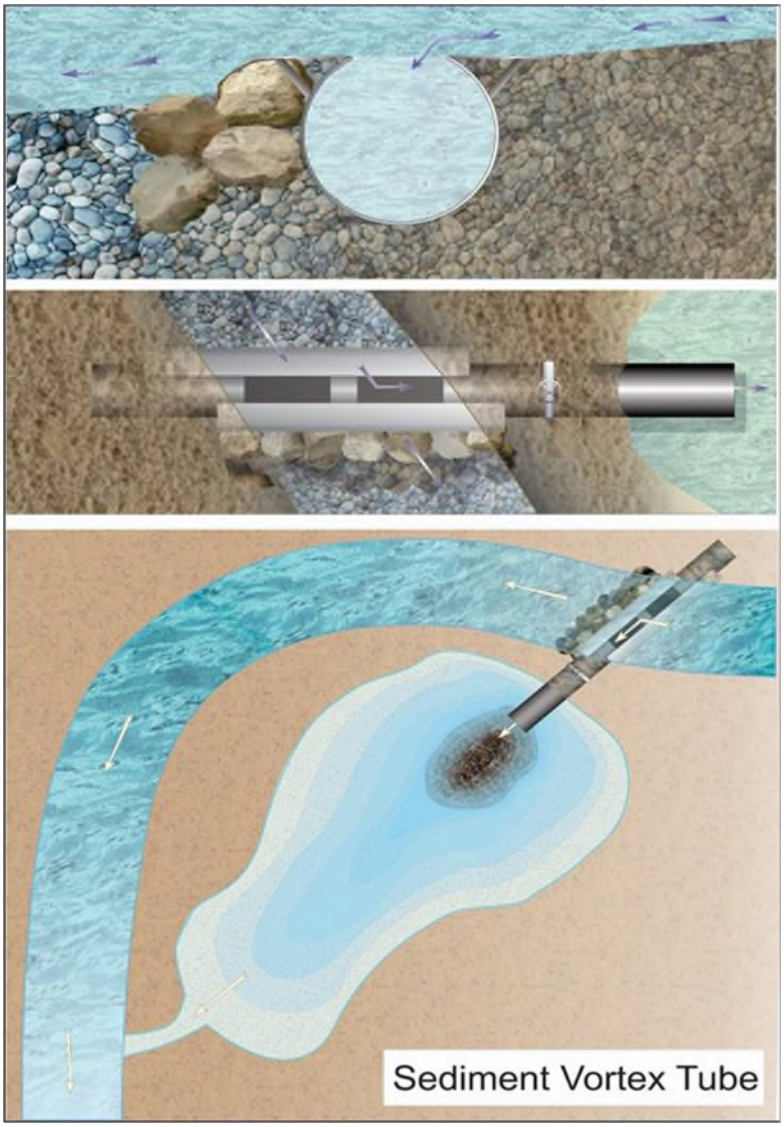


Figure: Sediment vortex tube showing profile and plan views.

VE PROPOSAL GL-8

INCREASE THE USE OF SALVAGE MATERIAL EMPLOYING A VORTEX OR OTHER HARVESTING DEVICE FOR COLLECTING SEDIMENT AND COBBLE

Figure: Typical bedload and suspended sand sizes captured in the sediment detention pond from the Vortex Sediment Tube.

VE PROPOSAL GL-11

DECREASE/ELIMINATE TIMBER MATTING AT STAGING/STOCKPILE AREAS

Alternative Summary	
Total Potential Cost Avoidance:	$249,000
Change in Schedule:	Decrease in Project Time

1. **Description of Baseline Concept:** The conceptual design documents show a total of 17 staging/stockpile areas with a total area of about 6,660 square yards. These areas are covered with 6 inches of wood chips and topped with timber matting.

2. **Description of Alternative Concept:** Remove the timber matting from the staging/stockpile areas, leaving only the woodchips.

3. **Advantages:**
   - Cost Savings

4. **Disadvantages:**
   - Less weight dispersal protection for nearby tree roots or shallow underground utilities

5. **Discussion:** This alternate provides large cost and time savings with negligible risks and no change in functionality.

6. **Discussion of Schedule Impacts:** Less material (timber mats) needs to be moved, installed, and uninstalled, therefore saving project time during setup and demobilization.

7. **Discussion of Risk Impacts:** The removal of the timber mats provides less weight distribution from the heavy construction vehicles. Therefore, any trees close to the staging/stockpile areas or any utilities under the areas have an increased chance of damage. However, upon closer inspection, there are no utilities running under the stockpile/staging areas, and most areas do not have any trees in close proximity. The only identifiable risk is a slight increase in the possibility of damage to the roots of trees t1760 and t1761, whose drip lines overlap the staging area on sheet 43.

8. **Discussion of Operating Cost Impacts:** Removing the temporary timber matting from the staging/stockpile areas creates no impacts to operating costs.

9. **Assumptions driving Cost Calculations:**
   - Timber Matting = $44.93/SY (from Engineer's Cost Estimate)
   - Assumes both material and labor costs are included in this price.

VE PROPOSAL GL-11

DECREASE/ELIMINATE TIMBER MATTING AT STAGING/STOCKPILE AREAS

Cost Evaluation

Construction Item (Contract Costs)			Original Estimate			Alternative Estimate		
Project Item		Units	Qty	Unit $	Total	Qty	Unit $	Total
Access Road Matting - Phase I		SY	3022.0	44.93	$135,778.46	3022.0	16.17	$48,865.74
Access Road Matting - Phase II		SY	3638.0	44.93	$163,455.34	3638.0	16.17	$58,826.46
Subtotal					**$299,234**			**$107,692**
Markup Factor (%)	**30.00%**				**$89,770**			**$32,308**
Total					**$389,004**			**$140,000**
TOTAL (ROUNDED)					**$389,000**			**$140,000**
						Net Cost Avoidance*		**$249,000**
		*: Negative number is a cost INCREASE						

VE ALTERNATIVE GL-12

EXPAND COMMUNITY OUTREACH ON THE TOPIC OF STREAM RESTORATION THROUGH THE INSTALLATION OF SIGNAGE

Alternative Summary	
Total Potential Cost Avoidance:	DESIGN SUGGESTION
Change in Schedule:	No impact

1. **Description of Baseline Concept:** Given the project's direct impact to private property and the need to acquire easements, community engagement and education on stream restoration has been noted as a goal of the project. To this end, community meetings are being held and homeowners who would be directly affected by the project are being contacted.

2. **Description of Alternative Concept:** Take advantage of the pre-existing trail system and major roads that the project crosses or otherwise touches (Franklin Park Rd, Chesterbrook Rd, and Kirby Rd) to provide passive education opportunities, such as permanent signage (temporary signage could be used as well for any trail access that is maintained during the project). There are multiple areas throughout the project where the pre-existing trail is close to the creek and could provide a good view of restoration features.

3. **Advantages:**
   - Opportunity to increase understanding of and expand community education regarding stream restoration needs
   - Provides a passive way to educate the community without using staff time
   - Could provide easier acquisition of easements and less community pushback on future projects

4. **Disadvantages:**
   - None apparent (extremely minimal cost for signage)

5. **Discussion:** Providing passive education, such as educational signage, leads to a more well-educated community at large (not just homeowner's directly adjacent to the project but also those in the community who use the preexisting trail system). The County's Watershed Education and Outreach group is currently in the process of creating educational signage for things such as cross vanes, pocket wetlands, floodplains, etc. and stream restoration as a whole which could be utilized to this effect. Permanent mounted signage could be implemented at points along the trail or at road crossings where the stream/restoration techniques may be visible to the public after the project. For any trail access that is maintained during the project and for which construction or LOD is visible, temporary signage could also be placed. A more educated community could also result in easier acquisition of easements and less community pushback on future projects. Taking sign locations into account before the project is complete ensures areas for this passive education opportunity are accounted for.

6. **Discussion of Schedule Impacts:** This design suggestion does not affect the schedule.

7. **Discussion of Risk Impacts:** The design suggestion has no identifiable risks.

8. **Discussion of Operating Cost Impacts:** N/A

9. **Assumptions Driving Cost Calculations:** N/A

VE PROPOSAL GL-13

REPLACE GABION WALL AT STA 49+00 (OFFSET) WITH A PERMANENT RETAINING WALL STRUCTURE

Alternative Summary	
Total Potential Cost Avoidance:	($280,000)
Change in Schedule:	Increase in Project Time (approx. 1 month)

1. **Description of Baseline Concept:** The conceptual design documents show an existing 125-ft. gabion wall on the east bank of the creek on sheet 44. The current plan intends to leave this structure in place. An existing 21-inch gravity sanitary sewer line is located under the gabion wall.

2. **Description of Alternative Concept:** Remove the gabion wall in its entirety and replace it with a permanent imbricated rock retaining wall offset a minimum of 3-feet away from the existing 21-inch sanitary sewer line.

3. **Advantages:**
   - Imbricated wall structure provides better protection to the sanitary sewer line with a longer life span than the gabion wall
   - More aesthetically pleasing
   - Creates additional planting area

4. **Disadvantages:**
   - Increased project costs and time

5. **Discussion:** Protecting sanitary sewer lines that are near streams is of utmost importance to prevent wastewater discharge into the environment from a damaged pipe. Gabion walls generally have a life span of 50-100 years, and it is unknown when this wall was installed. The fact that gabion walls provide excellent drainage is a negative aspect when protecting sanitary sewers because they provide an easy flow path for water which could lead to ground erosion and pipe corrosion.

6. **Discussion of Schedule Impacts:** This alternative would increase the project completion schedule. The demolition of the gabion wall would take a few days to a week to complete, and the installation of the imbricated wall would take 2-3 weeks to install. Conservatively, it would add about a month to the schedule to complete the construction of this alternative. However, depending on the Contractor's means and methods, it is possible this operation would not affect the critical path if it were performed concurrently by a second crew or subcontractor.

7. **Discussion of Risk Impacts:** The installation of the imbricated wall provides longer, better protection to the sanitary sewer line, thus decreasing the risk of damage to the pipe and wastewater discharge into the stream.

8. **Discussion of Operating Cost Impacts:** As the gabion wire baskets corrode and degrade over time, the cost of maintenance to keep the sanitary sewer pipe protected will increase. A properly installed imbricated rock wall will require virtually no maintenance and will last much longer.

9. **Assumptions driving Cost Calculations:**
   - Volume of gabion wall calculated from plans is approximately 200 CY.
   - Assumes the imbricated rock replacement wall is same volume as removed gabions.

VE PROPOSAL GL-13

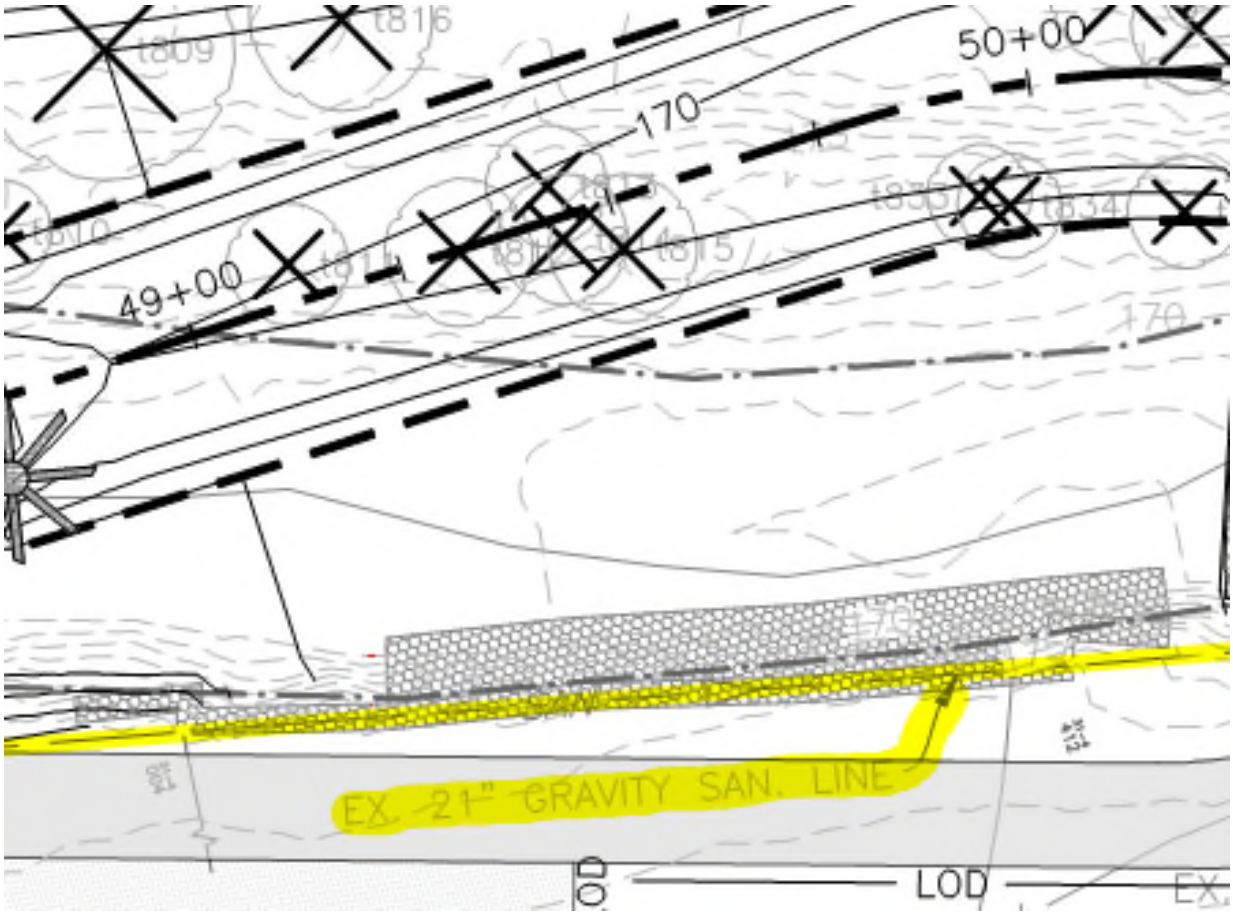
REPLACE GABION WALL AT STA 49+00 (OFFSET) WITH A PERMANENT RETAINING WALL STRUCTURE

- Unit costs obtained from Fairfax County UDCD Estimator. Costs include labor and material.

Cost Evaluation

Construction Item (Contract Costs)			Original Estimate			Alternative Estimate		
Project Item		Units	Qty	Unit $	Total	Qty	Unit $	Total
Demo Gabion Wall		CY				200.0	75.00	$15,000.00
Install Imbricated Rock Wall		CY				200.0	1,000.00	$200,000.00
Subtotal					**$0**			**$215,000**
Markup Factor (%)	**30.00%**				**$0**			**$64,500**
Total					**$0**			**$279,500**
TOTAL (ROUNDED)					**$0**			**$280,000**
						Net Cost Avoidance*		**($280,000)**
		*: Negative number is a cost INCREASE						

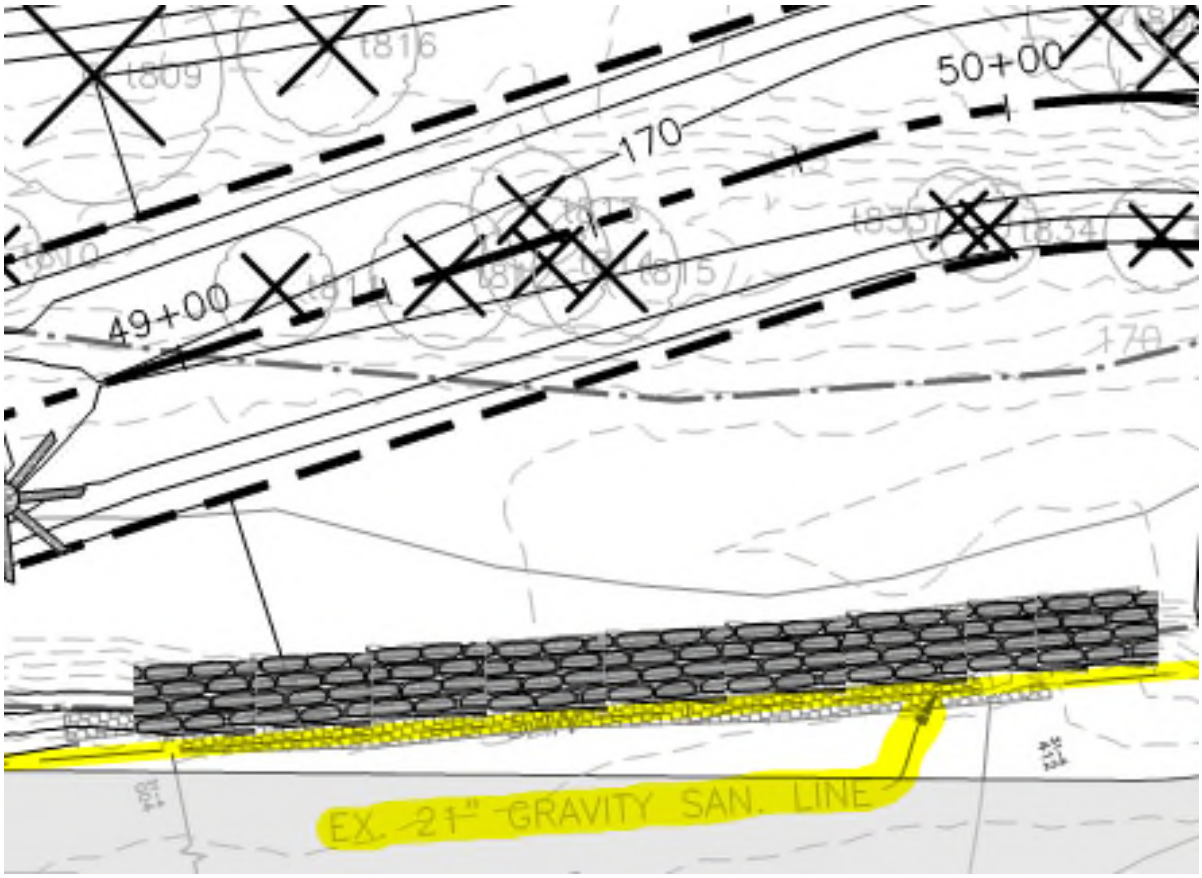
Baseline Sketch: Existing Gabion Wall



VE PROPOSAL GL-13

REPLACE GABION WALL AT STA 49+00 (OFFSET) WITH A PERMANENT RETAINING WALL STRUCTURE

Alternative Sketch: Gabion Wall Replaced with Imbricated Rock Wall



VE ALTERNATIVE IH-1

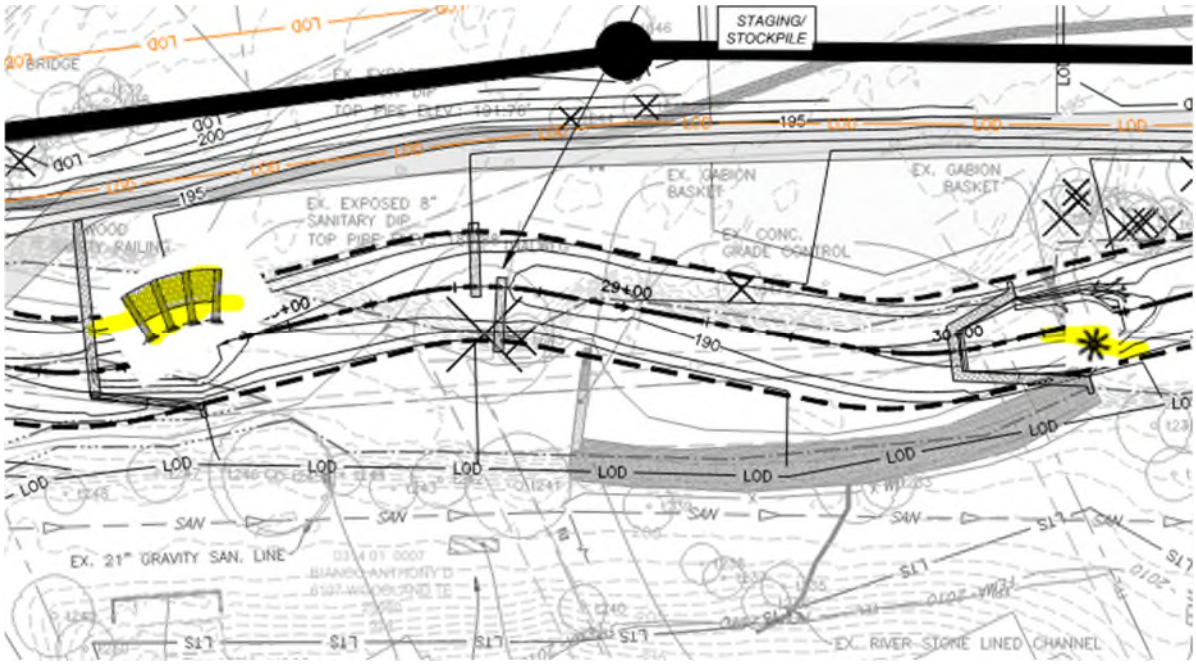
PROVIDE ADDITIONAL WOODY DEBRIS FOR IMPROVED HABITAT

Alternative Summary	
Total Potential Cost Avoidance:	DESIGN SUGGESTION
Change in Schedule:	No Impact

1. **Description of Baseline Concept:** Wood is used throughout the restoration project in structures such as modified cross-vane woody debris and log vanes with rock sills, and as grade control and habitat (toe logs, pool root wads, woody debris, etc.).

2. **Description of Alternative Concept:** Provide additional woody debris, specifically rootwads, to various places along the restoration, to take advantage of trees already being downed onsite to improve habitat quality, and stream stability. Add these root wads to higher flow pools and along various banks for additional support.

   Example of some areas in which root wads could be placed:



3. **Advantages:**
   - Increases habitat diversity in stream
   - Provides bank or bed stability depending on in-stream placement
   - Cost savings from not having to haul off woody debris

4. **Disadvantages:**
   - None apparent

5. **Discussion:** Root wads, both in pools as well as along banks, provide unique habitat for fish and benthic macroinvertebrates. Root wads can be incorporated where walls are already being built to

functionally provide stability and hold the banks in place, while also providing a habitat feature. Root wads facing upstream with the log buried in the bed of a pool also provide bed stability.

6. **Discussion of Schedule Impacts:** This design suggestion does not affect the schedule.

7. **Discussion of Risk Impacts:** The design suggestion has no identifiable risks.

8. **Discussion of Operating Cost Impacts:** N/A

9. **Assumptions Driving Cost Calculations:** N/A

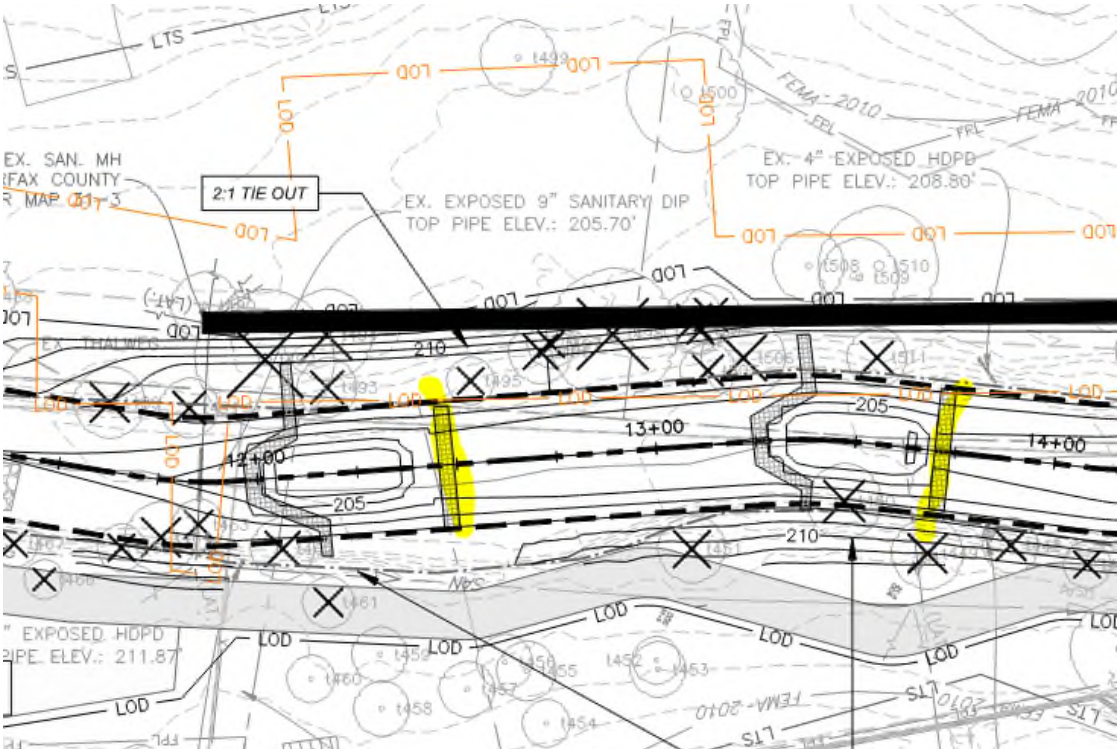
VE ALTERNATIVE IH-2

REPLACE ROCK SILLS AT BOTTOM OF BOULDER POOLS WITH LOG SILLS

Alternative Summary	
Total Potential Cost Avoidance:	$23,000
Change in Schedule:	No Impact

1. **Description of Baseline Concept:** Wood is used throughout the restoration project in structures, such as modified cross-vane woody debris and log vanes with rock sills, and as grade control and habitat (toe logs, pool root wads, woody debris, etc.). Wood is not currently used in any boulder pool structures.

2. **Description of Alternative Concept:** Replace rock sills at the downstream end of the boulder pools with log sills. Highlighted below are two of the five total rock sills recommended to be replaced.



3. **Advantages:**
   - Increases habitat diversity in stream
   - Reduces use of rock in favor of preexisting woody debris onsite
   - Serves same functional purpose as rock sill

4. **Disadvantages:**
   - Wood may not last as long as rock

5. **Discussion:** From the perspective of aquatic life and improving habitat, wood is often preferred in structures over rock. Wood taken from the site introduces natural and local material to the stream. This organic structure provides a natural habitat for various fish and benthic macroinvertebrates. It

also provides the same functionality as a rock sill, though it may not be as durable and long-lasting over time. Using log sills also introduces less foreign rock to the project, reducing costs.

6. **Discussion of Schedule Impacts:** This design suggestion does not affect the schedule.

7. **Discussion of Risk Impacts:** The design suggestion has no identifiable risks.

8. **Discussion of Operating Cost Impacts:** Minimal impact, simple annual inspection to check on the trees

9. **Assumptions Driving Cost Calculations:**
   - The cost of a rock weir is equivalent to that of a rock sill in a boulder pool
   - Trees being felled onsite will be available for use with no additional cost

Cost Evaluation:

Construction Item (Contract Costs)			Original Estimate			Alternative Estimate		
Project Item		Units	Qty	Unit $	Total	Qty	Unit $	Total
Rock Weir		EA	5.0	6,673.10	$33,365.50			
Install Log Sills						5.0	3,000.00	$15,000.00
Subtotal					**$33,366**			**$15,000**
Markup Factor (%)	**30.00%**				**$10,010**			**$4,500**
Total					**$43,375**			**$19,500**
TOTAL (ROUNDED)					**$43,000**			**$20,000**
						Net Cost Avoidance*		**$23,000**

*: Negative number is a cost INCREASE

VE PROPOSAL IH-3

ADD MORE WOODY DEBRIS TO REDUCE REINFORCED BED MIX IN MULTIPLE LOCATIONS WITH SLOPES LOWER THAN 1-PERCENT OR AREA WITH LOW STRESSES

Alternative Summary	
Total Potential Cost Avoidance:	$45,000
Change in Schedule:	No impact

1. **Description of Baseline Concept:** The conceptual design calls for over 19,000 tons of Reinforced Bed Mix (RDM) import for bed stabilization

2. **Description of Alternative Concept:** Use more woody debris in conjunction with RBM in area of low bed stress, specially slopes lower that 1%.

3. **Advantages:**
   - Reduces amount of RBM, hence reduces cost of the project
   - Improves aquatic habitats and benthic because of increased wood presence
   -

4. **Disadvantages:**
   - May reduce stability of channel
   - Enough woody debris may not be available for replacement of RBM

5. **Discussion:** The project utilizes RBM to stabilize proposed channel. Where the channel slope are low and bed stresses are low, employing more woody debris will reduce quantity of the RBM used in the channel. In the part of the stream where stresses are low eliminating them also seems reasonable.

6. **Discussion of Schedule Impacts:** This proposed design has no identifiable schedule impacts.

7. **Discussion of Risk Impacts:** This proposed design has no identifiable risk impacts.

8. **Discussion of Operating Cost Impacts:** (This proposed design has no operational cost impacts.

9. **Assumptions driving Cost Calculations:**
   - Assumes about 10% of RBM can be replaced with woody debris
   - Only assumes riffle segments up to slope 1%

Cost Evaluation

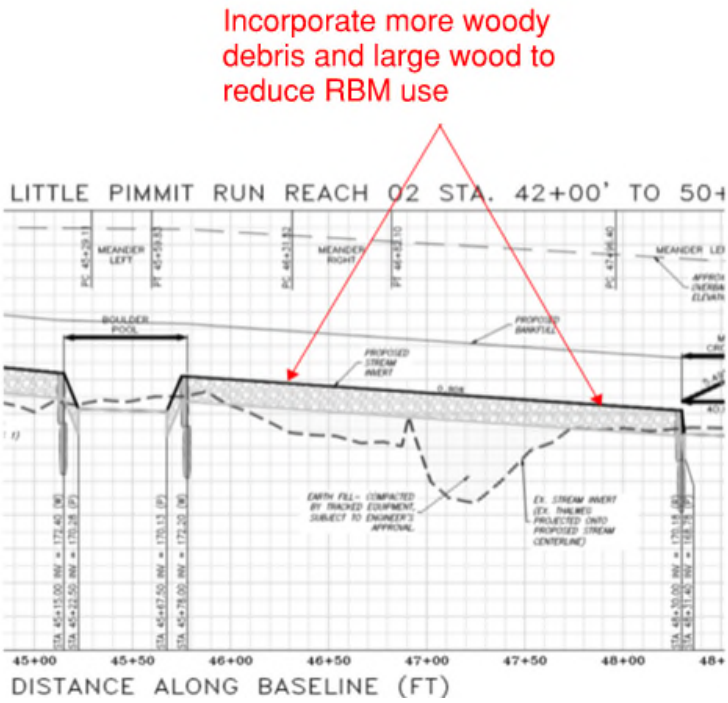
Construction Item (Contract Costs)			Original Estimate			Alternative Estimate		
Project Item		**Units**	**Qty**	**Unit $**	**Total**	**Qty**	**Unit $**	**Total**
RBM		CY	4375.0	159.16	$696,325.00	3937.5	159.16	$626,692.50
Woody Debris (labor/equipment)		CY				437.5	79.58	$34,816.25
Subtotal					**$696,325**			**$661,509**
Markup Factor (%)	**30.00%**				**$208,898**			**$198,453**
Total					**$905,223**			**$859,961**
TOTAL (ROUNDED)					**$905,000**			**$860,000**
						Net Cost Avoidance*		**$45,000**

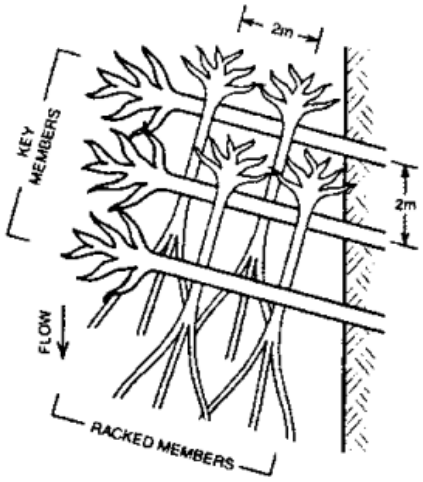
*: Negative number is a cost INCREASE

VE PROPOSAL IH-3

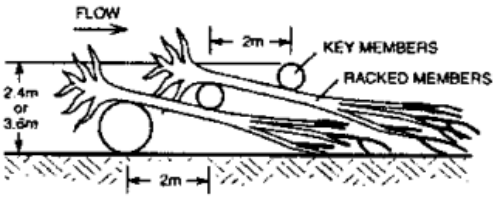
ADD MORE WOODY DEBRIS TO REDUCE REINFORCED BED MIX IN MULTIPLE LOCATIONS WITH SLOPES LOWER THAN 1-PERCENT OR AREA WITH LOW STRESSES

Alternative Sketches:





PLAN



ELEVATION

VE ALTERNATIVE IH-4

UTILIZE NEWBURY RIFFLE DESIGN TO INCREASE QUALITY OF HABITAT AND FLOODPLAIN CONNECTION

Alternative Summary	
Total Potential Cost Avoidance:	DESIGN SUGGESTION
Change in Schedule:	Reduces construction time

1. **Description of Baseline Concept:** Riffles (between 0.5- and 1.32-percent) throughout the project are filled with reinforced bed mix (RBM) Class 1 and A1, earth fill (compacted by tracked equipment—subject to engineer's approval), as well as salvaged bed material. Both Priority 1 and 2 restoration strategies are used to allow more or less flood relief throughout the project, with Priority 1 techniques being limited based on project proximity to private property and flooding concerns.

2. **Description of Alternative Concept:** Installing Newbury riffles in areas where the floodplain is less constricted and overbank relief is more viable. Use this structure in Phase 1 of the restoration at Sta. 23+00, as one example, as well as at various places throughout Phase 2. Installing Newbury riffles at these locations would allow native sediment transport to aggrade the streambed, removing the need for RBM, grading, and structures in these areas. Newbury riffles would also increase floodplain connectivity in these areas.

   Newbury Riffle:

VE ALTERNATIVE IH-4

UTILIZE NEWBURY RIFFLE DESIGN TO INCREASE QUALITY OF HABITAT AND FLOODPLAIN CONNECTION

3. **Advantages:**
   - Reduces amount of and therefore cost of RBM
   - Removes other structures (vanes, pools, etc.)
   - Increases floodplain connectivity
   - Increases habitat diversity in stream and in the riparian zone
   - Increases quality of riparian habitat and water quality
   - Sediment fill aggraded behind the Newbury Riffle could also bury and protect sewer crossings for any left in place

4. **Disadvantages:**
   - May result in an undesirable amount of flooding in some areas
   - May need to be built before rest of project is carried out to let sediment accumulate, which could complicate the project

5. **Discussion:** A significant amount of hauling, fill, and equipment use is eliminated by allowing the Newbury riffles to capture and beneficially reuse the excessive bedload transport. Noting that the spacing throughout the project is similar to Sta. 23+00, the structure removal at each added Newbury riffle would be about the same (removing approximately an average of 2 structures (with a net of 1 because of adding the Newbury riffle) and probably 200-300 ft of channel grading and corresponding RBM). Creating Newbury riffles rather than just using RBM also increases the functionality of these riffles as habitat for fish and benthic macroinvertebrates. In the mid-Atlantic Piedmont, most riffle slopes are greater than 2-percent; Newbury Riffle slopes are significantly steeper than the proposed riffle slopes, aiding in aeration and embeddedness and producing overall better habitat. Newbury Riffles dissipate energy, decreasing bed and bank degradation. The increased floodplain connectivity provided by these structures also results in higher quality riparian habitat and water.

6. **Discussion of Schedule Impacts:** As each Newbury riffle would remove various structures upstream as well as fill, it would reduce the construction time.

7. **Discussion of Risk Impacts:** An increase in flooding in some of these areas may be damaging to nearby properties though this is unlikely to be a problem in the areas noted above where the riparian zone is wide and/or the property is wooded park land.

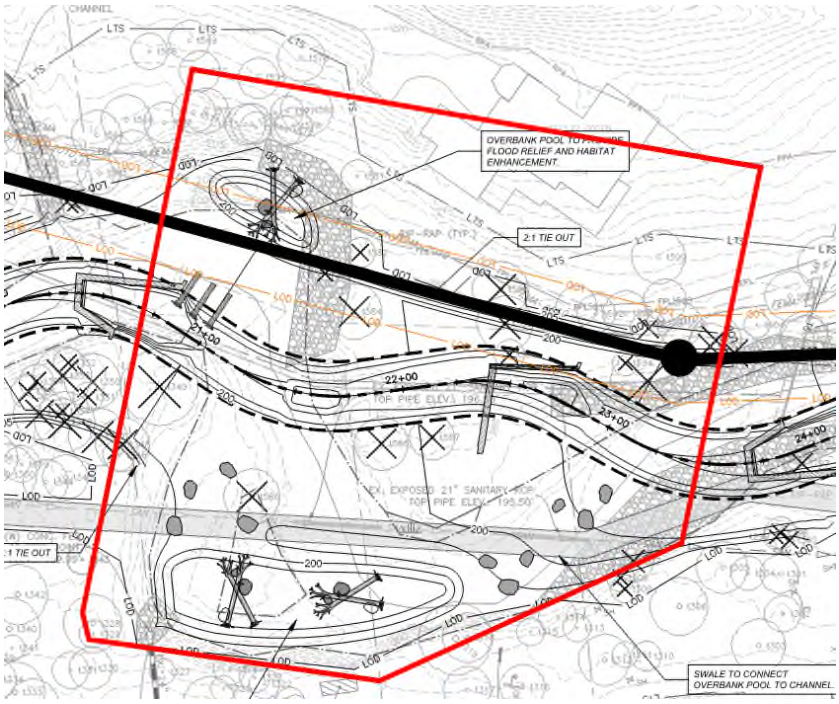
8. **Discussion of Operating Cost Impacts:** N/A

9. **Assumptions Driving Cost Calculations:** N/A

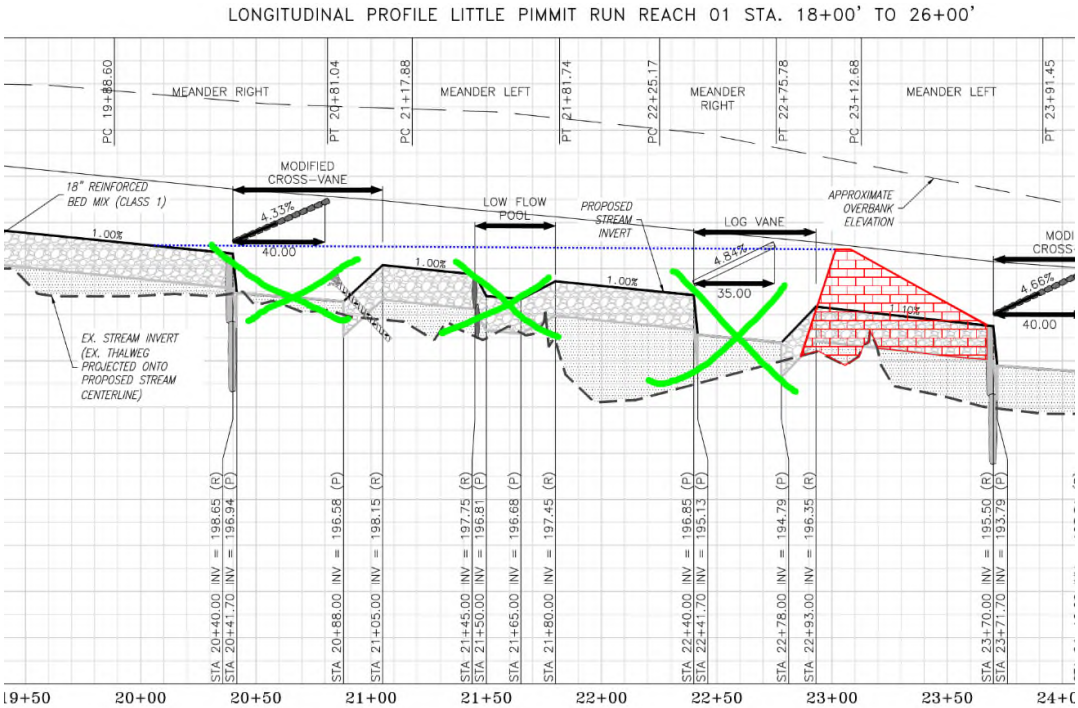
VE ALTERNATIVE IH-4

UTILIZE NEWBURY RIFFLE DESIGN TO INCREASE QUALITY OF HABITAT AND FLOODPLAIN CONNECTION

Alternative and Baseline Sketches (example of riparian area already slated to maximize floodplain connectivity and storage):



How putting a Newbury Riffle at Sta. 23+00 would result in removal of various structures upstream:



VE PROPOSAL SI-1

REPLACE IMBRICATED ROCK WALL WITH CONCRETE BLOCKS

Alternative Summary	
Total Potential Cost Avoidance:	$46,000
Change in Schedule:	No impact

1. **Description of Baseline Concept:** The conceptual design documents show an imbricated rock wall for approximately 115 linear feet (LF) along the left bank of the creek.

2. **Description of Alternative Concept:** Replace the wall structure with an a 0.5 horizontal:1 vertical wall made with concrete blocks in similar shape and size to imbricated rock.

3. **Advantages:**
   - Schedule is less dependent on imbricated rock availability
   - Reduces cost
   - Easier to construct

4. **Disadvantages:**
   - Less aesthetically pleasing
   - Potential building review will add to design/review schedule

5. **Discussion:** The proposed imbricated rock wall requires a significant amount of imbricated rock. Imbricated rock is in limited supply and comes at a high cost. The current proposed rock wall is not providing any habitat uplift; therefore, a switch to concrete would not decrease any biological function. The wall would be constructed in the same manner, just with a different material. Keeping the same design would not cause any detrimental impacts to the floodplain and corresponding proposed easements.

6. **Discussion of Schedule Impacts:** Concrete blocks are easier to place and do not require selection of ideal rocks, this will ease construction with a slight decrease in schedule (construction schedule only). While a positive impact, it is mostly negligible.

7. **Discussion of Risk Impacts:** The use of concrete may be disliked by the landowners. Additionally, its use in stream restoration is a newer technique, some stream contractors may be less familiar with the process. There is less evidence of the long term stability of using concrete blocks for stream restoration.

8. **Discussion of Operating Cost Impacts:** N/A

9. **Assumptions driving Cost Calculations:**
   - A material change is the only design revision, no other impact to cost
   - Concrete block wall cost based on a 45% price reduction per square foot of a brick wall with the same thickness as imbricated rock

VE PROPOSAL SI-1

REPLACE IMBRICATED ROCK WALL WITH CONCRETE BLOCKS

Cost Evaluation:

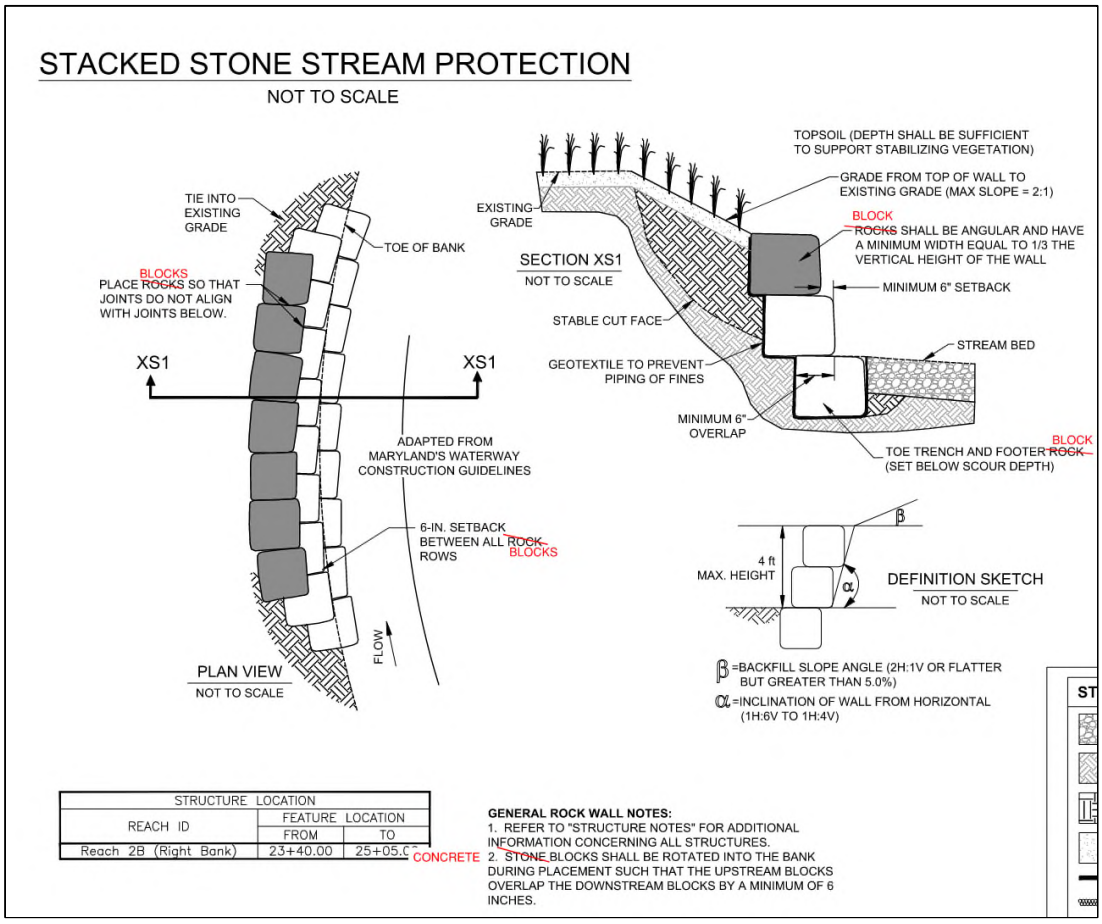
Construction Item (Contract Costs)			Original Estimate			Alternative Estimate		
Project Item		**Units**	**Qty**	**Unit $**	**Total**	**Qty**	**Unit $**	**Total**
Imbricated Rock Wall		EA	1.0	75,000.00	$75,000.00			
Concrete Block Wall		EA			$0.00	1.0	40,000.00	$40,000.00
Subtotal					**$75,000**			**$40,000**
Markup Factor (%)	**30.00%**				**$22,500**			**$12,000**
Total					**$97,500**			**$52,000**
TOTAL (ROUNDED)					**$98,000**			**$52,000**
							Net Cost Avoidance*	**$46,000**
		*: Negative number is a cost INCREASE						

Alternative Sketches:

Photo example - Concrete blocks used for an in-stream structure:

VE PROPOSAL SI-1

REPLACE IMBRICATED ROCK WALL WITH CONCRETE BLOCKS



VE PROPOSAL SI-3

ADJUST ALIGNMENT AROUND MEANDER AT 71+90 TO REMOVE IMBRICATED WALL

Alternative Summary	
Total Potential Cost Avoidance:	$79,000
Change in Schedule:	2 Week Schedule Reduction

1. **Description of Baseline Concept:** The conceptual design documents show an imbricated rock wall structure along the left bank of the creek from station 70+85 – 72+00.

2. **Description of Alternative Concept:** Adjust meander alignment to allow for 3:1 grading along the left bank to replace the proposed structure. Adjust modified cross vane and wood structure as necessary.

3. **Advantages:**
   - Lowers cost of imported material
   - Reduces schedule dependence on imbricated rock availability
   - Increases plantable area

4. **Disadvantages:**
   - Reduction in sinuosity
   - Reduction in right bench that will reduce floodplain volume in this area

5. **Discussion:** A significant amount of rock can be reduced by removing the 50-60 linear feet imbricated rock wall structure. The proposed slope will be plantable, unlike the imbrication section that will increase riparian corridor function and add additional floodplain roughness. The modified cross vane will remain to protect the outer bend, so stability is not negatively impacted.

6. **Discussion of Schedule Impacts:** This will reduce the overall project schedule with one less structure to construct.

7. **Discussion of Risk Impacts:** There is an increased risk of scour along the valley slope without rock, especially before the vegetation is established.

8. **Discussion of Operating Cost Impacts:** N/A

9. **Assumptions driving Cost Calculations:**
   - Area where wall is removed will require matting, planting, and seeding
   - No cost impacts to proposed modified cross vane and root wad toe protection
   - Imbricated wall was not included in the cost estimate, assumed this was unintentional and a price was added here for comparison purposes

VE PROPOSAL SI-3

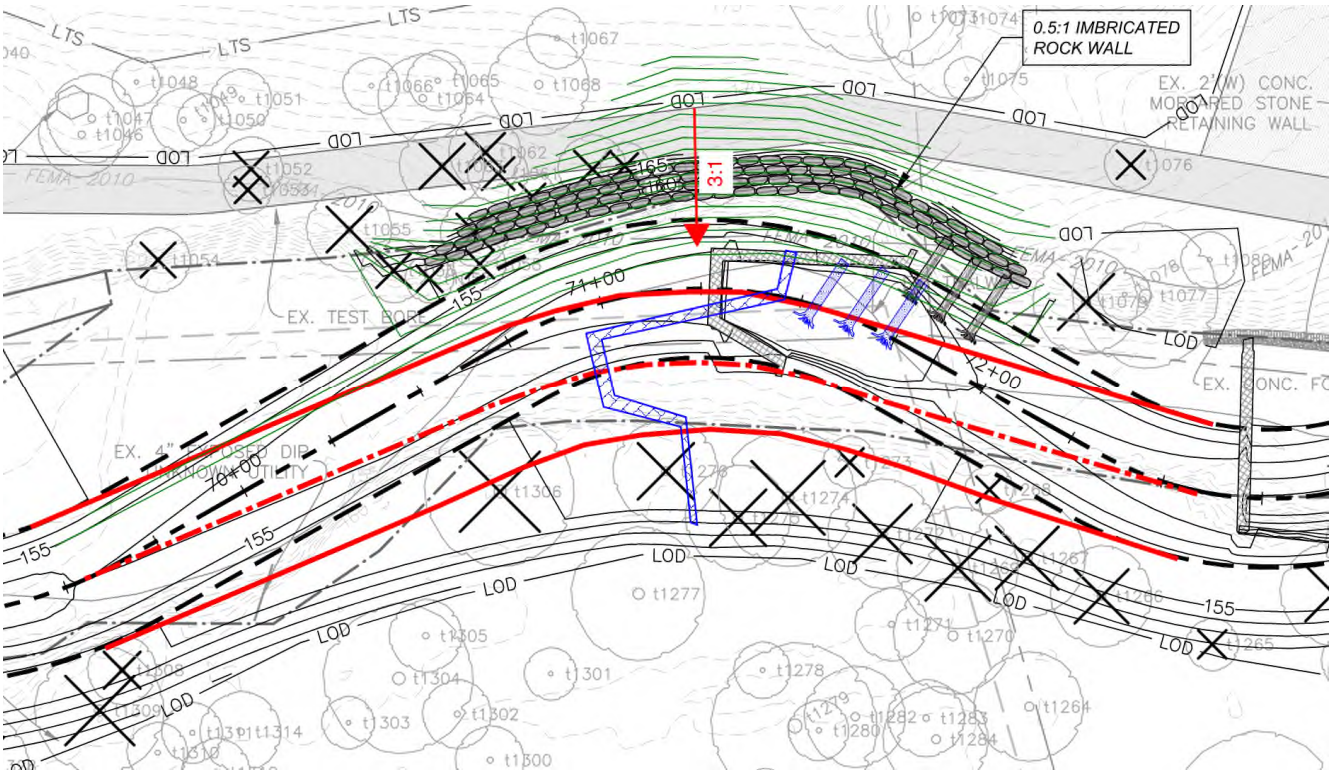
ADJUST ALIGNMENT AROUND MEANDER AT 71+90 TO REMOVE IMBRICATED WALL

Cost Evaluation:

Construction Item (Contract Costs)			Original Estimate			Alternative Estimate		
Project Item		Units	Qty	Unit $	Total	Qty	Unit $	Total
Imbricated Rock Wall		EA	1.0	75,000.00	$75,000.00			
Cut to fill excavation		CY				500.0	25.00	$12,500.00
Rough Grading		SY				150.0	1.00	$150.00
Coir Matting		SY				150.0	8.03	$1,204.50
Riparian Seeding		SY				150.0	2.17	$325.50
One-Gallon Plantings		EA				25.0	18.75	$468.75
Subtotal					**$75,000**			**$14,649**
Markup Factor (%)	**30.00%**				**$22,500**			**$4,395**
Total					**$97,500**			**$19,043**
TOTAL (ROUNDED)					**$98,000**			**$19,000**
							Net Cost Avoidance*	**$79,000**

*: Negative number is a cost INCREASE

Alternative Sketch:



VE PROPOSAL SI-4

UTILIZE CLAY PLUG OR INSTREAM STRUCTURE TO PREVENT PROPOSED STREAM FROM RE-ENTERING THE ABANDONED CHANNEL

Alternative Summary	
Total Potential Cost Avoidance:	DESIGN SUGGESTION
Change in Schedule:	No impact

1. **Description of Baseline Concept:**
   Between Sta 20+25 – 21+50, 21+50 – 23+25, 48+75 – 52+00, 53+00 – 54+75, 54+75 – 57+00, 60+50 – 63+25, and 65+75 – 68+75 the proposed stream alignment shifts away from the existing channel's thalweg. The existing channel will be filled in and converted to an Overbank Relief and Enhanced Habitat Area.

2. **Description of Alternative Concept:**
   Where the proposed channel shifts away from the existing channel, either fortify the bank with a clay plug and/or extend the nearby structure arm so that it connects to the old channel bank.

3. **Advantages:**
   - Protects the new stream channel from erosion when the water overtops the east bank

4. **Disadvantages:**
   - Increases project cost

5. **Discussion:**
   Where the proposed channel shifts away from the existing channel, the water will eat into the new channel's stream bank. When this situation is encountered, a clay plug is usually installed to prevent water seepage. There is a proposed modified cross vane nearby that could also be modified so that there is a sill blocking the abandoned channel alongside the clay plug. The team believes that either installing a clay plug and/or by shifting the modified cross vane downstream and extending the vane arm along the bend should be adequate to prevent the proposed channel from eroding back into the abandoned channel.

6. **Discussion of Schedule Impacts:** This proposed modification has a minimal impact on the construction schedule.

7. **Discussion of Risk Impacts:** This proposed modification has no identifiable risk impacts.

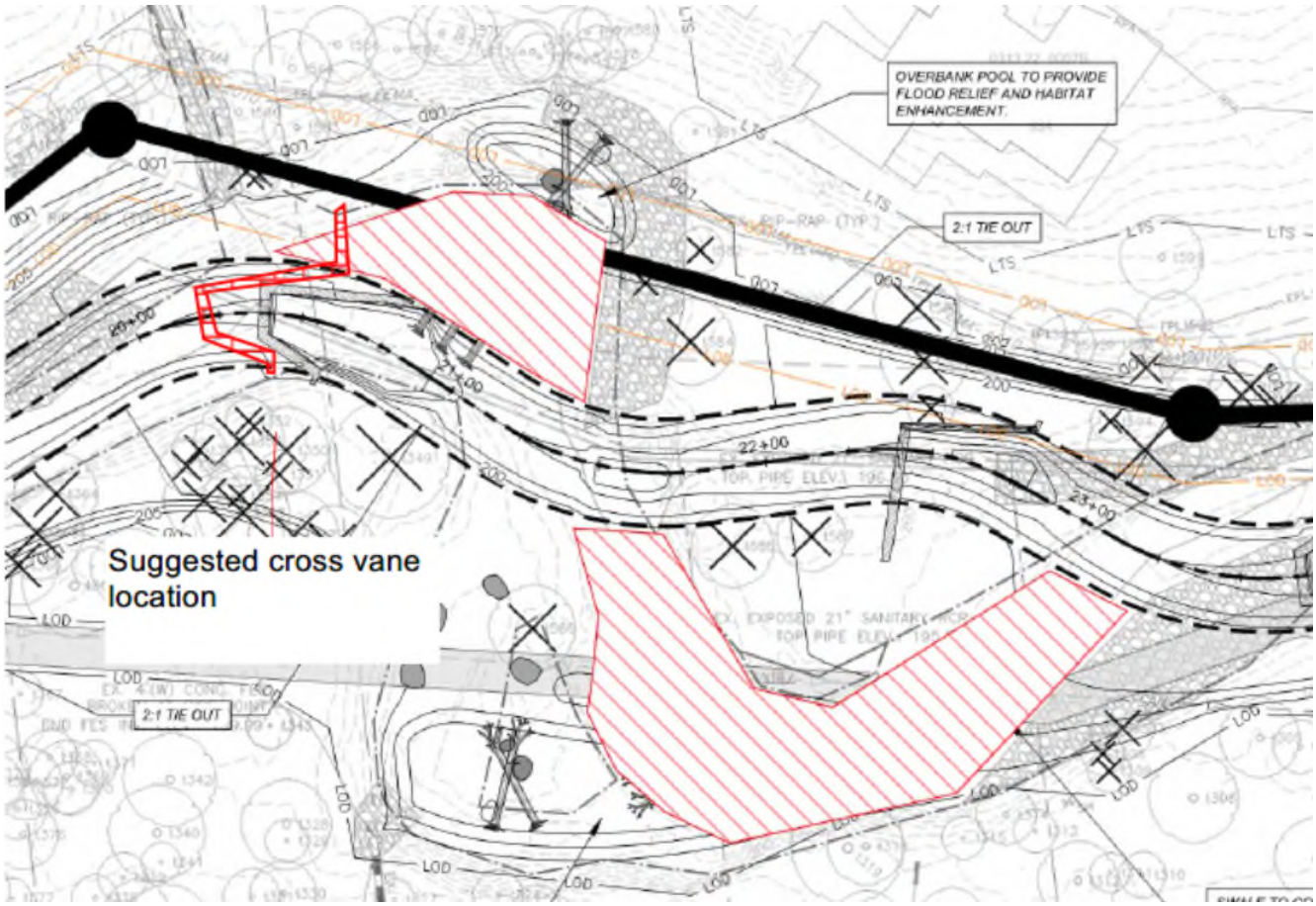
8. **Discussion of Operating Cost Impacts:** No impact.

9. **Assumptions driving Cost Calculations:** N/A

VE PROPOSAL SI-4

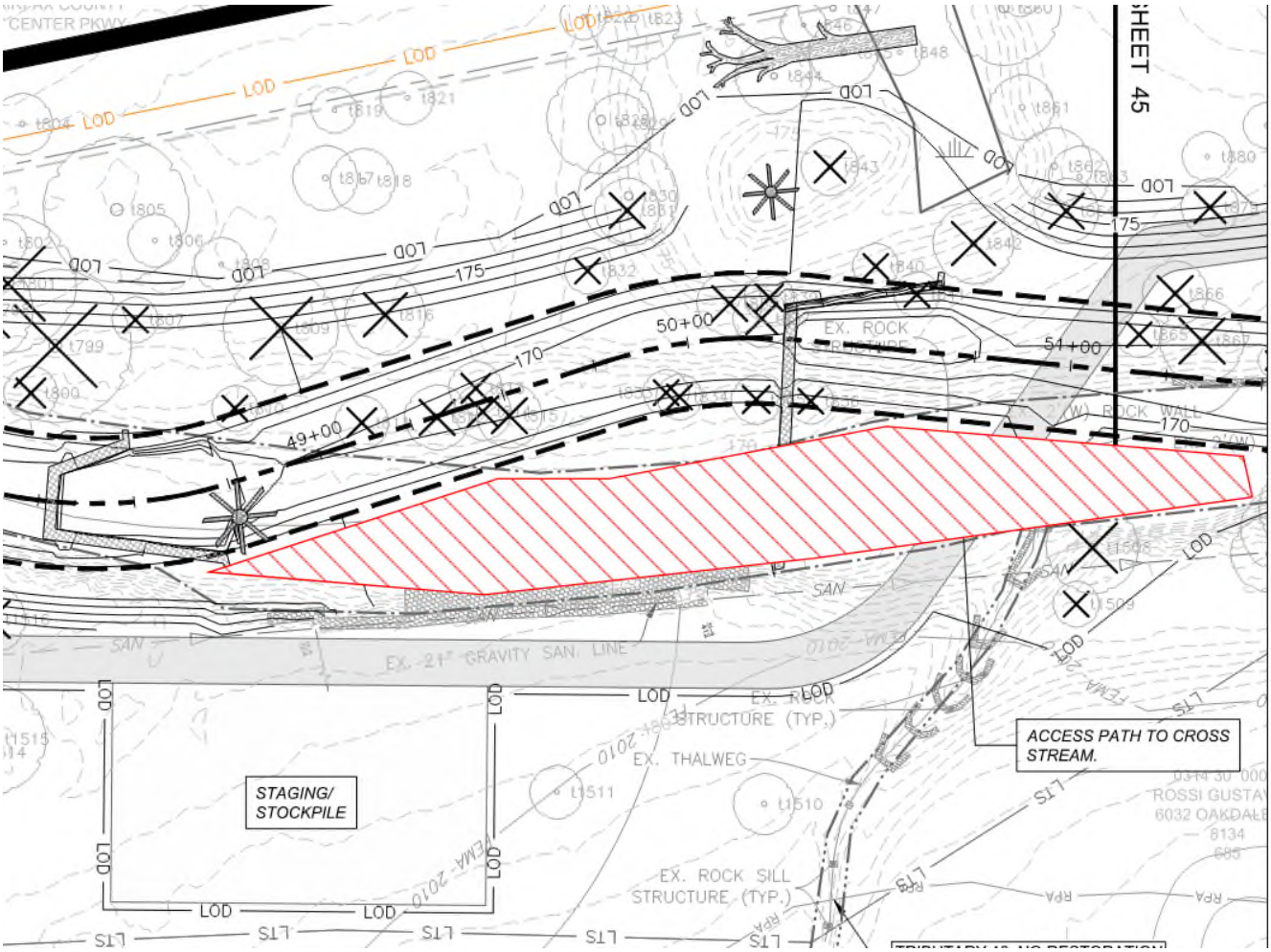
UTILIZE CLAY PLUG OR INSTREAM STRUCTURE TO PREVENT PROPOSED STREAM FROM RE-ENTERING THE ABANDONED CHANNEL

Alternative Sketches:



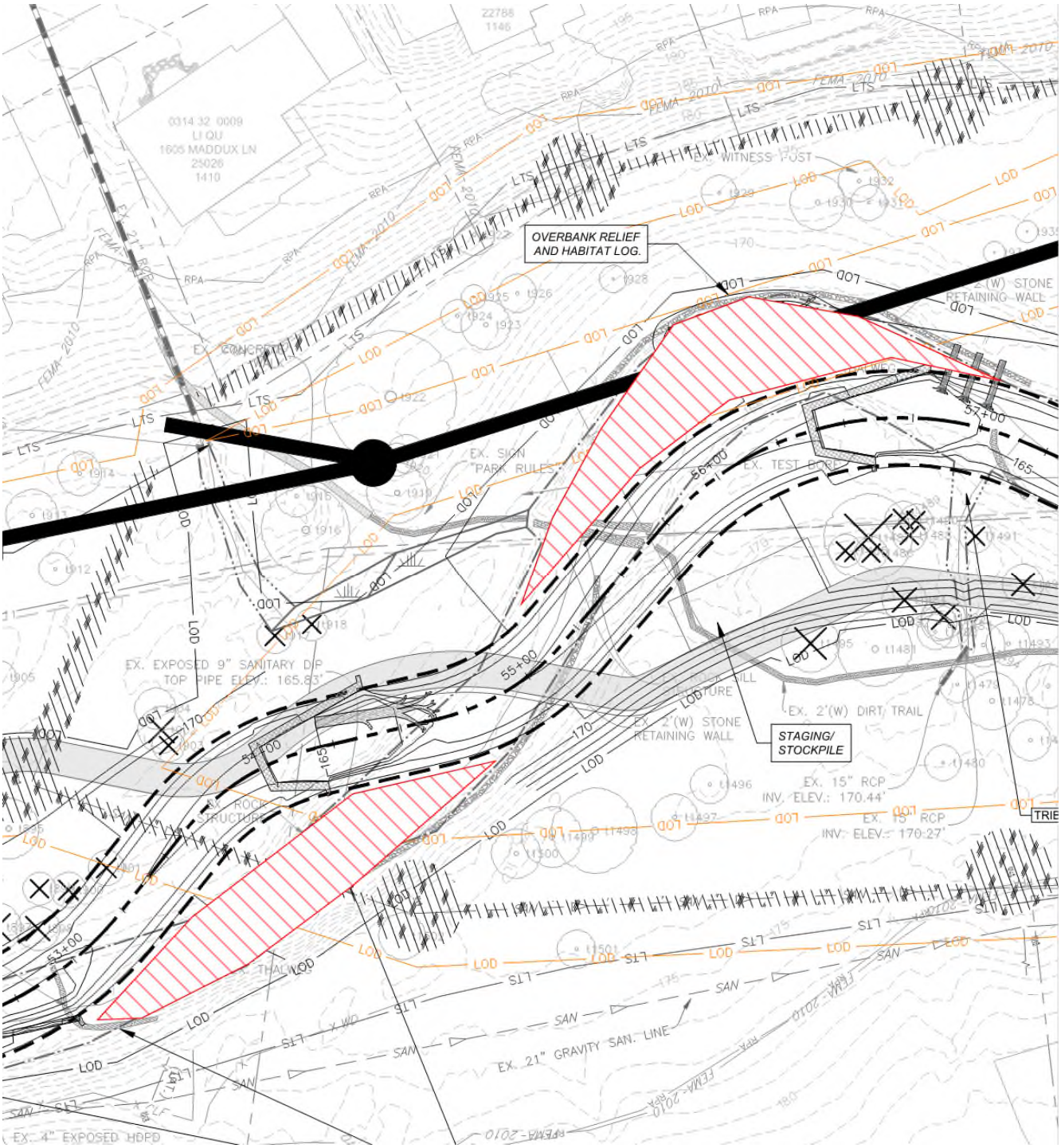
VE PROPOSAL SI-4

UTILIZE CLAY PLUG OR INSTREAM STRUCTURE TO PREVENT PROPOSED STREAM FROM RE-ENTERING THE ABANDONED CHANNEL



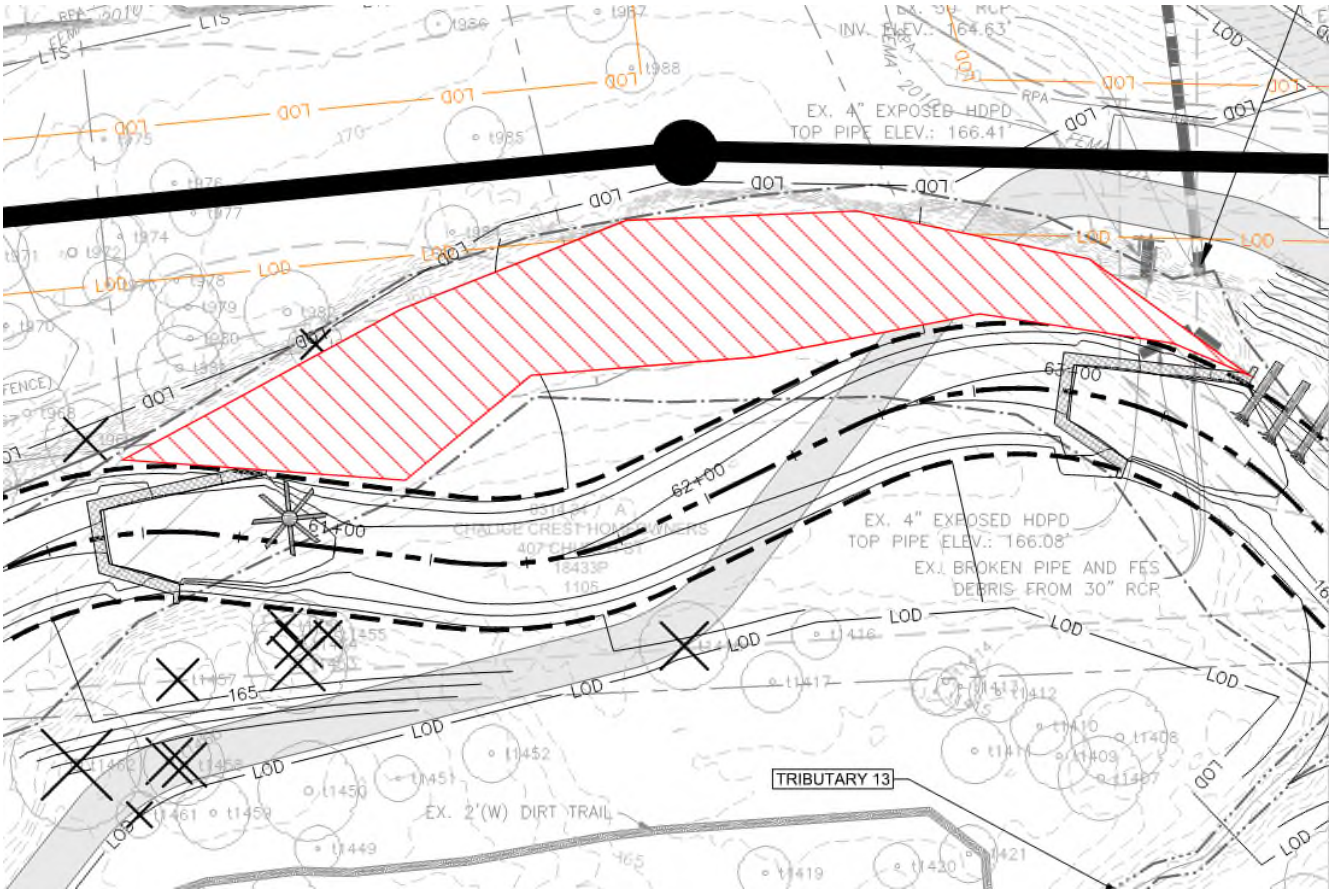
VE PROPOSAL SI-4

UTILIZE CLAY PLUG OR INSTREAM STRUCTURE TO PREVENT PROPOSED STREAM FROM RE-ENTERING THE ABANDONED CHANNEL



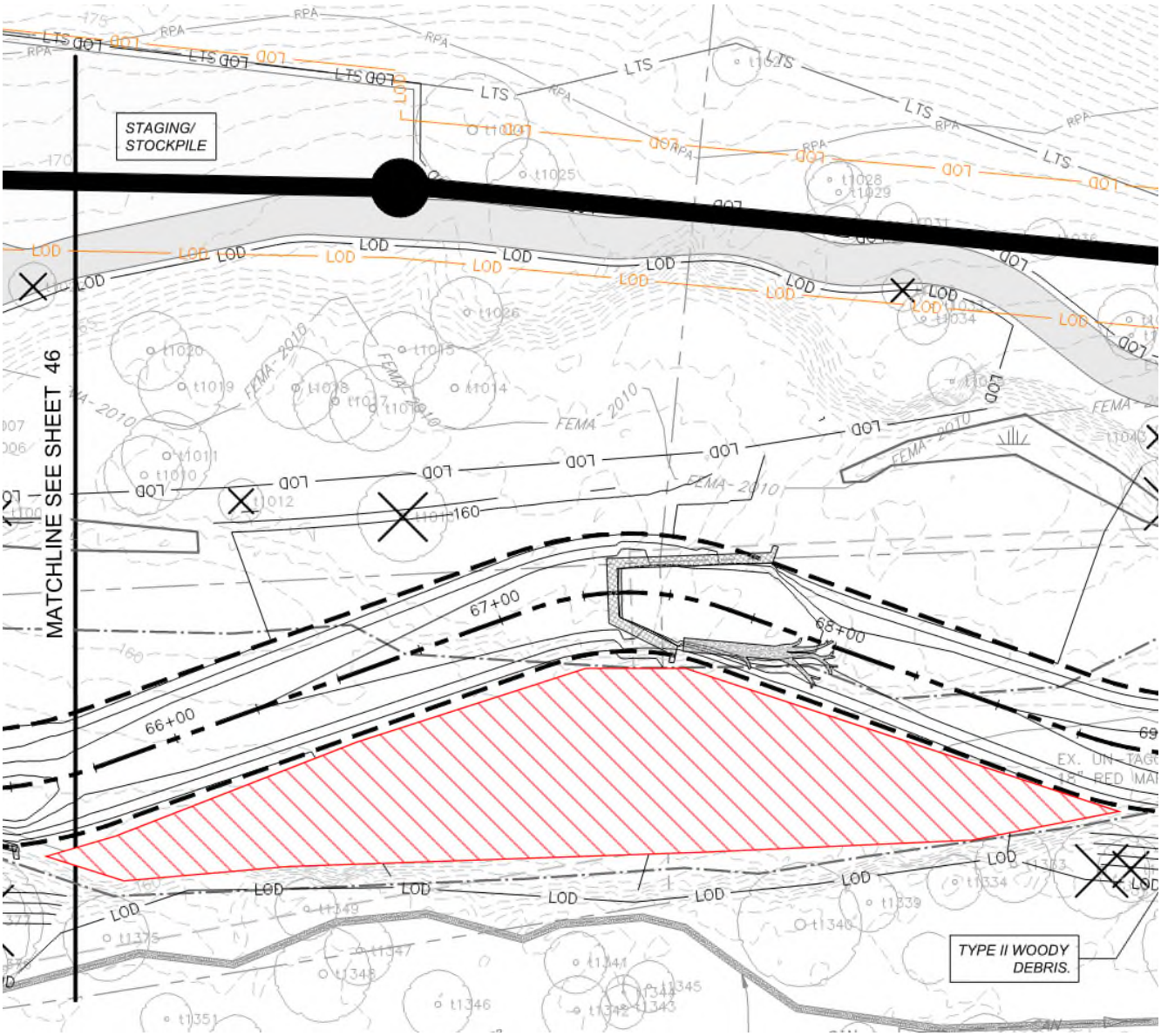
VE PROPOSAL SI-4

UTILIZE CLAY PLUG OR INSTREAM STRUCTURE TO PREVENT PROPOSED STREAM FROM RE-ENTERING THE ABANDONED CHANNEL



VE PROPOSAL SI-4

UTILIZE CLAY PLUG OR INSTREAM STRUCTURE TO PREVENT PROPOSED STREAM FROM RE-ENTERING THE ABANDONED CHANNEL



SECTION FIVE PRESENTATION PHASE AND WAY FORWARD

PRESENTATION PHASE

The hallmark of an effective VE study is the functional evaluation process and the breadth and depth of the VE alternatives brought forth. These results provide alternative solutions for Fairfax County and its design consultants to consider as well as indirectly confirming the validity of the current design for the project. The VE team's results portray the value-added benefits that can be realized by Fairfax County and will provide guidance in optimizing the project's design.

On November 18, 2021, the VE team presented the results of the workshop to representatives from Fairfax County, KH and WSSI. The sign-in sheet for this meeting is provided in Appendix B. The purpose of the meeting was to explain each of the developed VE proposals and design suggestions. The dialogue and cooperative interaction between the VE team, the project design teams, and Fairfax County addressed questions about our analysis so that when reviewing this report, the reviewers have additional insight into the nature of the alternatives and can make a more informed decision as to whether to implement the concepts brought forth.

WAY FORWARD

Value engineering, by its nature, searches for new, unique, and different methods to provide the needed project functions at the lowest total life cycle cost and eliminate those functions that do not benefit the completed work. The alternative design schemes and construction methods presented by the VE team may impact the final scope of work, design documents, budget, schedule, functionality, and appearance of the project. The task of the VE team is to identify possible solutions, whereas the task of Fairfax County and the design teams are to choose the most favorable of the VE alternatives and design suggestions for incorporation into the project, and to integrate these ideas into the remainder of the design.

Therefore, decisions are needed on each of the alternatives and design suggestions presented in this report. During the review of the study results, the reader should consider each part of an alternative on its own merit. Each area within an alternative that is determined to be acceptable should be considered for use in the final design, even if the entire alternative is not implemented. Variations of these alternatives by the design team are encouraged. The ultimate goal is for all participants involved in this project to work towards an improved final product.

Note that all the alternatives were developed independently to provide a broad range of options to consider for implementation. Therefore, some of them are mutually exclusive, so acceptance of one may preclude the acceptance of another. In addition, some of the alternatives may be interrelated, so acceptance of one or more may not yield the total of the cost savings shown for each alternative.

The reader should evaluate all alternatives carefully to select the combination of ideas with the greatest beneficial impact on the project. Once this has been accomplished, the total cost savings resulting from the VE study can be calculated based on implementing a revised, all-inclusive design solution.

Prior to this final report, the draft alternatives report with detailed information on each alternative was submitted. This alternative report, as well as this final report, provide the necessary information to facilitate the process of deliberating on which VE alternatives should be included in the final design.

PROPOSALS FOR IMPLEMENTATION

Based on the fully developed VE proposals prepared after the VE workshop and then provided to Fairfax County and the design teams, Fairfax County and the design teams should hold an implementation decisions meeting to discuss the following proposals presented.

Table 5-1: Recommended Proposals

PRO. NO.	ALTERNATIVE DESCRIPTION	LIFE-CYCLE COST SAVINGS (PRESENT WORTH)	SCHEDULE CHANGE	FUNCTIONAL BENEFIT *
CW-2	For creek crossings 1, 2, and 3 raise proposed stream bed elevation at existing sanitary sewer crossings and leave the other crossings in lieu of installing 6500 LF of west bank sewer	$3,210,000	Reduces schedule by 6 months	C
CW-6	Modify proposed sewer along west bank to only include ~3400 LF of sanitary sewer and only eliminate crossings X3 and X2	$1,789,000	Reduces schedule by months	C
CW-6A	Modify proposed sewer along west bank to only include ~1200 LF of sanitary sewer and only eliminate crossing X3	$2,910,000	Reduces schedule by months	C
GL-1	Merge stormwater restoration and sanitary sewer work into one construction project over a 2-year period	DESIGN SUGGESTION	Reduces schedule by months	C
GL-2	Replace welded wire fence where applicable with orange safety fence (away from residential and trail areas)	$22,000	No impact	C
GL-3	Install chain link fence at all trail access areas (any residential areas)	($92,000)	No impact	S/E
GL-7	Cover or bury gabion baskets to preserve functionality but improve aesthetics of this structure located near station 29+00 to 30+25 (Phase I)	DESIGN SUGGESTION	No impact	S/O
GL-8	Increase use of salvage material employing vortex or other harvesting device for collecting sediment and cobble	DESIGN SUGGESTION	Extends schedule 2-4 months	O/E

PRO. NO.	ALTERNATIVE DESCRIPTION	LIFE-CYCLE COST SAVINGS (PRESENT WORTH)	SCHEDULE CHANGE	FUNCTIONAL BENEFIT *
GL-11	Decrease/eliminate timber matting at staging/stockpile areas	$249,000	Minor reduction	O/C
GL-12	Expand community outreach on topic of stream restoration through signage	DESIGN SUGGESTION	No impact	S/E
GL-13	Replace gabion wall at STA 49+00 (offset) with a permanent retaining wall structure	($280,000)	Extends schedule by a month	S/E
IH-1	Provide additional woody debris for improved habitat	DESIGN SUGGESTION	No impact	E
IH-2	Replace rock sills at downstream ends of boulder pools with log sills	$23,000	No impact	C
IH-3	Add more woody debris to reduce RBM in multiple locations such as areas with slopes lower than 1-percent or area with low stresses	$45,000	No impact	E/C
IH-4	Utilize Newbury Riffle design to increase quality of habitat and floodplain connection	DESIGN SUGGESTION	Minor reduction	E
SI-1	Replace imbricated rock wall with alternative structure	$46,000	No impact	C
SI-3	Adjust alignment around meander at STA 71+90 to remove imbricated wall	$79,000	Slight reduction of a few weeks	E/C
SI-4	Utilize clay plug or instream structure to prevent proposed stream from re-entering the abandoned channel	DESIGN SUGGESTION	No impact	O/E

** In addition to cost implications, funding and regulatory agencies require an evaluation on each approved recommendation in terms of the project feature or features that the recommendation benefits. If a specific recommendation can be shown to provide benefit to more than one feature described below, count the recommendation in each category that is applicable.*

Safety (S): *Recommendations that mitigate or reduce hazards on the facility.*

Operations (O)*: Recommendations that improve real-time service and/or local or regional levels of service of the facility.*

Environment (E)*: Recommendations that successfully avoid or mitigate impacts to natural and or cultural resources.*

Construction (C)*: Recommendations that improve work conditions or expedite the project delivery.*

APPENDIX A

VALUE ENGINEERING WORKSHOP AGENDA

Arcadis U.S., Inc. will conduct a four-day value engineering (VE) workshop on the Pimmit Run Watershed, Little Pimmit Run at Chesterbrook Road Stream Restoration Plan for Fairfax County Department of Public Works and Environmental Services, Stormwater Planning Division in Fairfax, VA. The project addresses two project designs – the stream restoration work is being designed by a team led by Wetland Studies and Solutions, Inc. (WSSI) and is at a Conceptual Design Plan stage of completion and the sanitary sewer realignment work is being designed by a team led by Kimley-Horn (KH) at the time of the study that will be conducted November 15-18, 2021. The workshop will take place virtually using Microsoft Teams as the virtual conference platform.

The project design teams will present the design at the beginning of the VE workshop and will be available to answer questions during the study effort. A suggested outline for the Designers' presentations follows the agenda. Representatives from Fairfax County and other stakeholders are encouraged to attend both the Project Overview (Day One at 830 am) and the Out-brief Presentation (Day Four at 3 pm).

Agenda

Day One	**November 15, 2021** **Objective for the day: Deep dive into the project and the value engineering concepts to be evaluated including function analysis and developing creative function-based solutions**	
8:00 am	**Fairfax County Introductory Comments** **Stakeholder and VE Team Introductions** **VE Process, Workshop Organization and Agenda** **Objectives of the Workshop**	**All**
8:30 am *Information Phase – Designer's Presentation*	**Project Overview - General** • Purpose and Need • Goals and objectives • Constraints • Cost Estimate • Questions and Answers **Project Overview - Specific** • Areas for discussion o Grading and RBM costs o Access and Easements o Floodplain connectivity o Riparian corridor enhancements	**WSSI and KH Project Teams / all Stakeholders**
11:00 am *Function Phase*	**Define and Analyze Functions** • Review project cost model • Define key project and system functions (use verb/noun approach) • Solutions driven from project functions • Define project risks	**VE Team**
12:30 pm	**Lunch – 60 minutes**	
1:30 pm *Function Phase*	**Define and Analyze Functions (cont'd)**	**VE Team**
3:00 pm *Creative Phase*	**Generate Creative Ideas** • Brainstorm alternative ways to perform key functions • Brainstorm ways to improve value of key functions • Identify mitigating strategies to alleviate risks	**VE Team**
4:30 pm	**Adjourn**	

Day Two	November 16, 2021 Objective for the day: Continuing the brainstorming of ideas leading into evaluation. Ideas recommended for development will ensue after the evaluation phase.	
8:00 am *Creative Phase*	**Generate Creative Ideas (cont'd)**	**VE Team**
9:00 am *Evaluation Phase*	**Evaluate Ideas** • Discuss advantages and disadvantages for each idea • Score ideas based on predetermined criteria and risks	**VE Team**
10:00 am	**Break – 60 minutes**	
11:00 am *Evaluation Phase*	**Evaluate Ideas (cont'd)**	**VE Team**
12:30 pm	**Lunch – 60 minutes**	
1:30 pm *Development Phase*	**Develop Ideas into Viable Alternative Solutions** • Assign initial development • Alternatives are supported with sketches, calculations (life cycle costing), and text supporting why the alternative is a viable function-induced solution	**VE Team**
4:30 pm *Development Phase*	**Continue Developing Ideas into Viable Alternative Solutions** • **TEAM CALL AT 400 PM – address status of alternatives**	**VE Team**
5:00 pm	**Adjourn**	

Day Three	November 17, 2021 Objective for the day: Continued development of alternatives	
All Day *Development Phase*	**Continue Developing Ideas into Viable Alternative Solutions** • **TEAM CALL AT 12:00 PM – address status of alternatives/new ideas** • **TEAM CALL AT 4 PM – address status of alternatives**	**VE Team**
5:00 pm	**Adjourn**	

Day Four	November 18, 2021 Objective for the day: Finalize VE alternatives and present findings	
8:00 am *Development Phase*	**Finalize Development of Recommended Alternative Solutions** • Review status / progress check on alternatives • Wrap-up alternative development and peer review all alternatives • **TEAM CALL AT 8 AM – address status of alternatives** • **TEAM CALL AT noon – circulate PDF for team review**	**VE Team**
1:00 pm *Presentation Phase*	**Finalize Materials** • Develop presentation material and Summary Table of Alternatives • PDF review by workshop team completed by 2 pm at the latest • **TEAM CALL AT 230 PM – circulate PDF for team review**	**VE Team**

3:00 pm *Presentation Phase*	**Presentation of VE Findings** • Team presents alternative solutions to Fairfax County • Questions and answers • Workshop closing remarks • Next steps	**VE Team, Project Design Teams, all Stakeholders**
5:00 pm	**Adjourn**	

POST-WORKSHOP PHASE

Upon completion of the value engineering workshop, Arcadis will prepare a draft of the value engineering alternatives and submit an electronic copy of the draft to Fairfax County within seven working days. This will be followed by the preparation of the Value Engineering Study Report for submittal to Fairfax County and the Design Team within 15 working days after the out-brief meeting. The report will include, but not be limited to, the following material:

- Project description and design concept
- Value engineering team members and participants from the owner and designer organizations
- Cost models and function analysis worksheets
- Creative idea listing and evaluation of the ideas generated
- Descriptions of the original design and proposed alternatives, including sketches, description of value gained with the proposed alternative, design calculations and initial and life cycle cost estimates
- Procedures to implement value engineering alternatives
- Potential contract savings (capital construction and life cycle costs)

The Design Teams will review the VE alternatives and identify those they accept, accept in a modified form or rejects, providing a rationale for any ideas rejected. Simultaneously, Fairfax County representatives will review the VE alternatives and formulate their comments. The organizations will meet to finalize implementation decisions and summarize the outcome of the VE effort.

OUTLINE FOR VE TEAM PRESENTATION

The Designers, the Client, and the VE team are all actively involved in the planning and design of the project and are vested in providing the best solutions available to make each project a success. The Designer, WSSI and KH, have spent a great deal of time and effort, on each of their tasks, in developing the design and their insight is invaluable in further evaluating the options and alternatives that could potentially be implemented.

The design, typical for most projects, is influenced by outside input from many sources. To perform our work most efficiently, the value engineering team needs to understand the factors that have influenced the designs to date. The goal is to avoid duplication of efforts and to aid the VE team in becoming familiar with the project.

To achieve this objective, the Designer is asked to give a presentation at the beginning of the VE workshop session on Day One. To assist the Designers, the following information, at a minimum, is listed to guide the discussion:

- Scope of the Designer's effort
- Participating firms
- Existing site conditions
- Regulatory requirements

- Basis of design
- Rationale and steps in development of design
- Design concepts for civil, landscaping, etc.
- Pertinent information from user participation
- Constraints imposed by the Owner
- Appropriate codes
- Explanation of information provided by the Designer to the VE team
- Summary of cost estimate
- Construction phasing
- Challenging design elements that the Designer recommends the VE team review or explore further to validate or improve the existing design

This information is provided as an outline to aid the discussion. The presentation is the Designers' responsibility, and they may conduct the initial presentation in the manner they feel most comfortable.

VALUE ENGINEERING PRIMER

TELECONFERENCE OVERVIEW for VIRTUAL STUDY:

- The daily link for the meeting is (same link for every day of the study using Microsoft Teams and already in your outlook calendar):
- Log in to web conference 5-10 minutes early each day to account for possible connectivity challenges (all connections will be verified at the beginning of each day)
- Day One – plan on being on the web conference for the majority of the day, with breaks and lunch
- Day Two and Three – we will spend the first half of the day together and only a portion of the afternoon including a planned call-in time(s) to regroup and check status on alternative developments and any new alternatives or alternative modifications. Day Three will include 2-3 time periods for the group to join a call to discuss alternatives development status and issues.
- Day Four – we will have 1 or 2 planned call-in times to finalize alternatives and review alternatives as well as the out-brief call currently scheduled for 3 pm on Day Four

WHAT TO PREPARE:

After review of the project documents, please prepare the following:

- Key Issues: Provide a list of key issues, challenges, and risks you encounter during your review.
- Questions for Project Team: Please develop to discuss during the information phase on Day 1.
- VE Alternative Ideas: Provide a list of any ideas for alternatives to the current design, no matter how seemingly small or outlandish.
- Function Analysis:
    - What does the project do and how does it do it? What must the project do, even if it's undesirable?
    - Think about the project purpose and need as functions, such as STABILIZE CHANNEL, REDUCE NUTRIENTS, MITIGATE STREAM IMPACTS, CONVEY WASTEWATER, etc.
    - What else is the project doing?

OTHER ITEMS:

Your full participation is vital throughout this effort – it is critical that the effort moves forward even when the team is not fully engaged in the room or on the phone together.

APPENDIX B

PROJECT: Little Pimmit Run - Stream Restoration / Sewer Realignment Study

VIRTUAL STUDY

Pre-Workshop Planning Meeting: November 12, 2021

In-Brief: November 15, 2021

Out-Brief: November 18, 2021

Implementation Meeting: not held

Pre-Workshop Meeting	In-Brief	Out-Brief	Implementation Meeting	Name	Organization/Title
X	X	X		Fred Wilkins	Fairfax County SWPD Project Manager
X	X	X		Suzanne Harding	Fairfax County Wastewater Design and Construction Division Project Manager
	X	X		Sajan Pokharel	Fairfax County SWPD Stream Restoration Engineer
	X	X		Jasdeep Saini	Fairfax County SWPD Stream Restoration Engineer
	X	X		Brendan Schillo	Fairfax County UDCD Construction Engineer
	X	X		Dionna Bucci	Fairfax County SWPD Stream Restoration Engineer
	X	X		Jon Sanford	Fairfax County UDCD Cost Estimator
		X		Heather Ambrose	
X	X	X		JT Kelley	WSSI Project Manager
X	X	X		Nathan Staley	WSSI Project Manager
	X	X		Susie Hoopes	WSSI Project Engineer - VE Team
X	X	X		Will Schafer	Kimley-Horn Project Manager
	X	X		Mohammed Shammet	Kimley-Horn Project Engineer
	X	X		Scott Funk	Kimley-Horn Project Engineer - VE Teams
		X		Megan Morford	
		X		Alayna Bigalbal	
X	X	X		Anthony Dunams	Arcadis U.S., Inc. - VE Team Leader
		X		Alex Chapla	WSSI Project Engineer

APPENDIX C