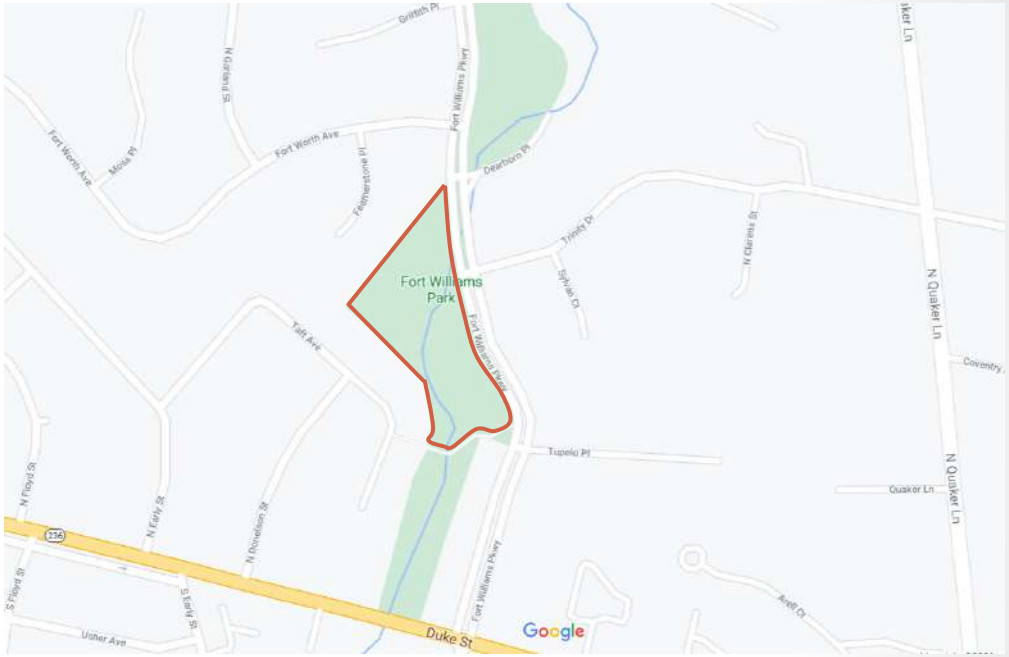
Strawberry Run Stream Restoration Project



October 28, 2020

Virtual Public Engagement Meeting

Tonight's Agenda

- Background and Timeline
- Introduce the Project Team
- Why Stream Restoration?
- Phase III Stream Assessment
- Expert Panel and Design Approach
- Stream Design
- Wildlife and Mosquito Concerns?
- Finished project examples
- Next Steps

Background and Timeline

- 2004 and 2008: Phase I & II Stream Assessments
- 7/1/2013: Municipal Separate Storm Sewer System (MS4) Permit
- 9/08/2015 City Council: City's *Chesapeake Bay TMDL Action Plan for 5% Compliance* (June 2015)
- 9/20/2018 Parks and Recreation Commission: DRAFT *Phase III Stream Assessment: Stream Restoration and Outfall Stabilization Feasibility Study*
- 9/24/2019 City Council: *Chesapeake Bay TMDL Action Plan for 40% Compliance*
- 12/05/2018 Public meeting: Draft *Phase III Stream Assessment*
- 9/25/2018: City Council approved the state stormwater local assistance fund (SLAF) matching grant application
- 10/05/2018: Sent SLAF application to Virginia Department of Environmental Quality (DEQ)
- 12/12/2018: DEQ visited the project site to vet project for SLAF application
- 2/2019: Final *Phase III Stream Assessment*
- 5/03/2019: SLAF matching grant authorization via letter of $.800M

Summary of Outreach Process

- Public Community Meeting
  November 4, 2019 at Douglas MacArthur Elementary School (Library)
- Strawberry Hill Association
  January 8, 2020 at APD Headquarters
- Seminary Hill Association
  February 13, 2020 at 1101 Janney's Lane
- Due to the ongoing COVID-19 pandemic, the City has not held public meetings in the spring/summer.

Project Team

City Departments

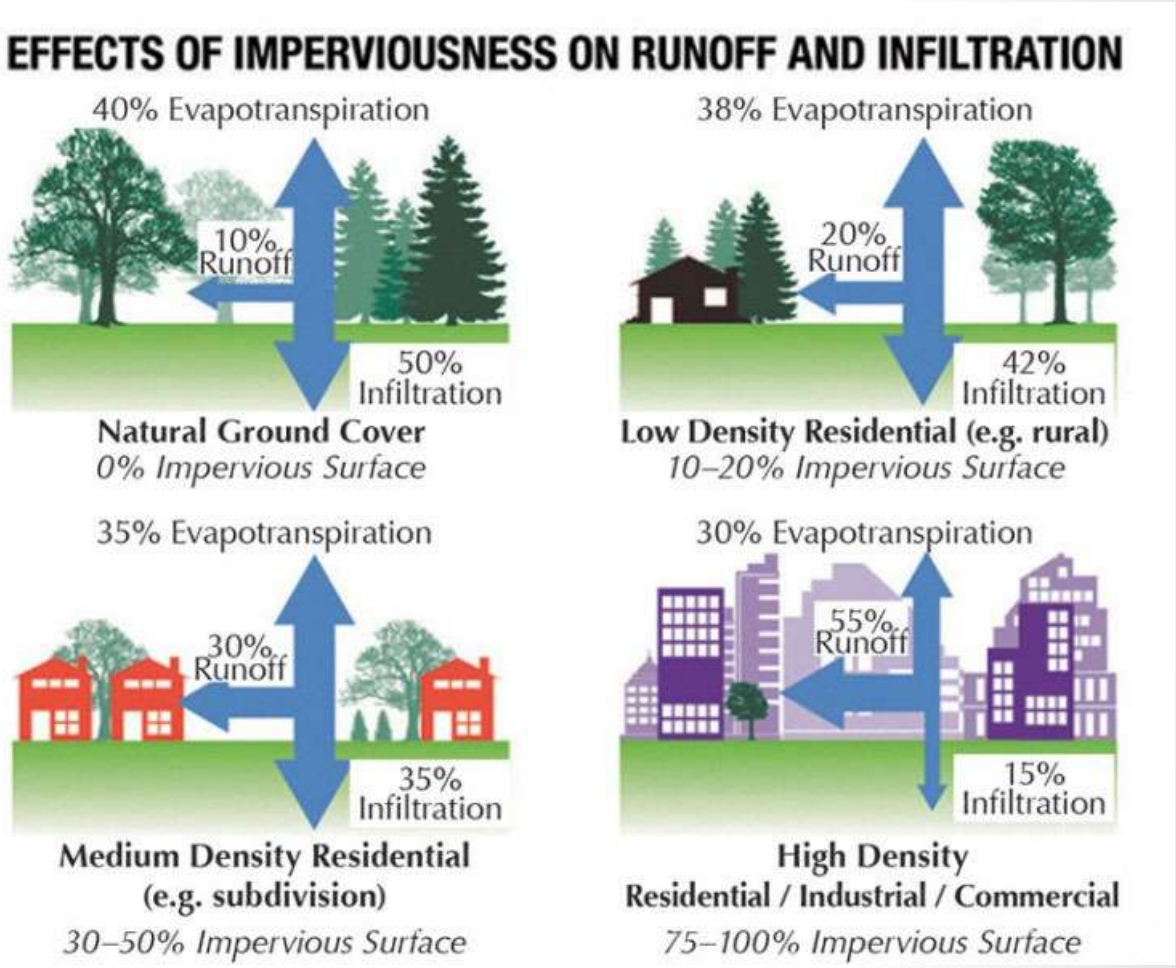
Transportation and Environmental Services (T&ES)	• Environmental Scientists • Civil Engineers • Planners • Project Mangers
Department of Project Implementation (DPI)	• Project Mangers • Engineers • Landscape Architects
Recreation, Parks and Cultural Activities (RPCA)	• Naturalists • Ecologists • Arborists

Wood Environment & Infrastructure Solutions	• Consultant

Transportation and Environmental Services = T&ES
Recreation, Parks, and Cultural Activities = RPCA
Department of Project Implementation = DPI

Development and Runoff

- Most development in the City occurred prior to stormwater requirements
- Redevelopment must improve stormwater runoff: amount and quality



Source: www.bayjournal.com

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Effects of Climate Change: More Frequent, Intense Rainfall Events

Radar, September 10

- 2018: Virginia's wettest year on record
  - 20"+ over normal
- July 8, 2019: Regional flash flood
  July 23, 2020: Local flash flood
  - 60-80% of July monthly average in 30 minutes
- August 28, 2020: Local flash flood
  - 2" in 60 minutes
- September 10: Local flash flood
  - 2.5-4" with rates up to 3"/hr in 10 mins
  - Daily rainfall record at National Airport
- Increase in reported problems of property damage

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Why Stream Restoration?

- Heavy stream flows during rainfall events
- Erosion scours stream and undermines trees on banks
- Sediment loss downstream
- Loss of stability
- Stream blockages
- Further bank erosion
- Preventing private property loss
- Protect Infrastructure
- Safety
- Chesapeake Bay TMDL

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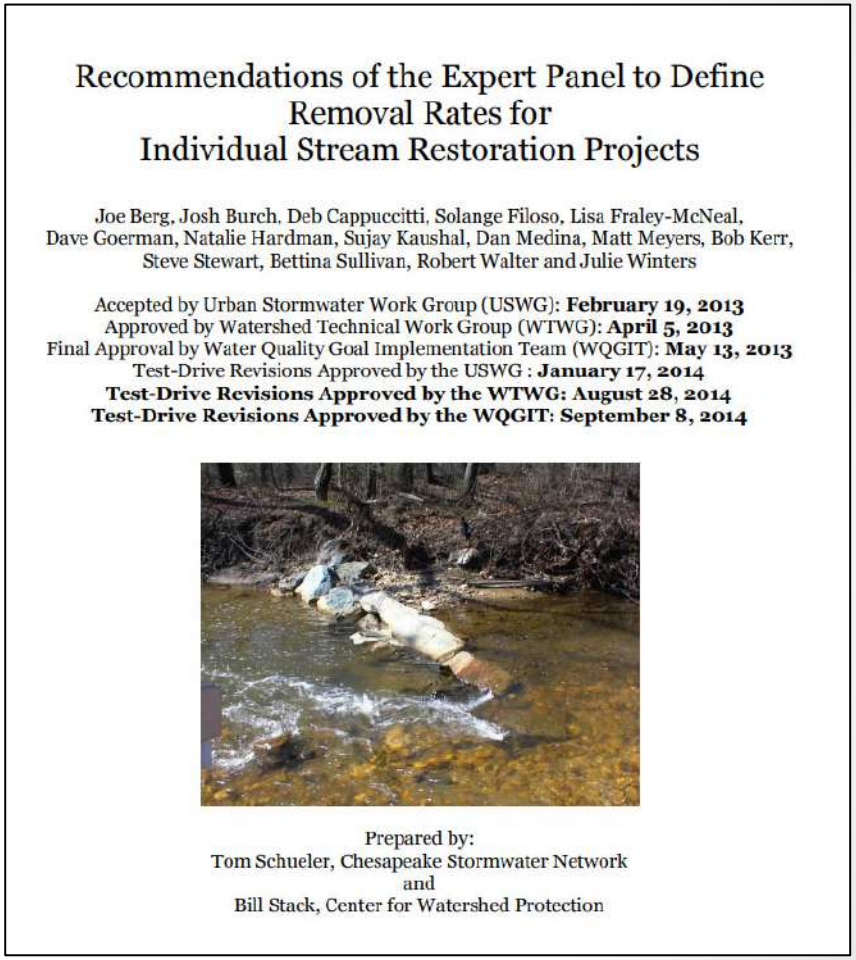
Design Approach

- Chesapeake Bay Program effort: numerous iterations and approval committees
- Environmental scientist, civil engineers, ecologists, naturalists, private industry, academia, local government, environmental groups, non-profits
- Panel reviewed >100 studies leading to development of Nutrient Removal Protocols
- Comprehensive design for long-term stream health and co-benefits
- Natural design techniques
- Site-specific assessment



Recommendations of the Expert Panel to Define Removal Rates for Individual Stream Restoration Projects

Joe Berg, Josh Burch, Deb Cappuccitti, Solange Filoso, Lisa Fraley-McNeal, Dave Goerman, Natalie Hardman, Sujay Kaushal, Dan Medina, Matt Meyers, Bob Kerr, Steve Stewart, Bettina Sullivan, Robert Walter and Julie Winters

Accepted by Urban Stormwater Work Group (USWG): **February 19, 2013**
Approved by Watershed Technical Work Group (WTWG): **April 5, 2013**
Final Approval by Water Quality Goal Implementation Team (WQGIT): **May 13, 2013**
Test-Drive Revisions Approved by the USWG : **January 17, 2014**
Test-Drive Revisions Approved by the WTWG: August 28, 2014
Test-Drive Revisions Approved by the WQGIT: September 8, 2014

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Stream Assessment Program

Phase I Stream Categorization

Mapping of streams, defining limits, and stream categorization

Phase II Assessment of Streams

Stream habitat, infrastructure impacts, problem area, characteristics

Phase III Project Identification

Potential project sites evaluated and ranked. Conceptual designs for top projects.

Phase III Stream Assessment: Site-Specific Data

- City's Phase III Stream Assessment (Feb 2019)
  - Identify and prioritize
  - Priority projects: Strawberry Run stream restoration
  - City must follow using Expert Panel "protocols"
- Restore to healthy stream characteristics
  - Lower flows allow benthic macroinvertebrates (aquatic insects) to thrive
  - Mitigate tree loss from bank undercutting
  - Stabilize banks to reduce erosion
  - Avoid wetland impacts
  - Remove concrete rubble
- Protect Sanitary Sewer infrastructure

Field Assessment

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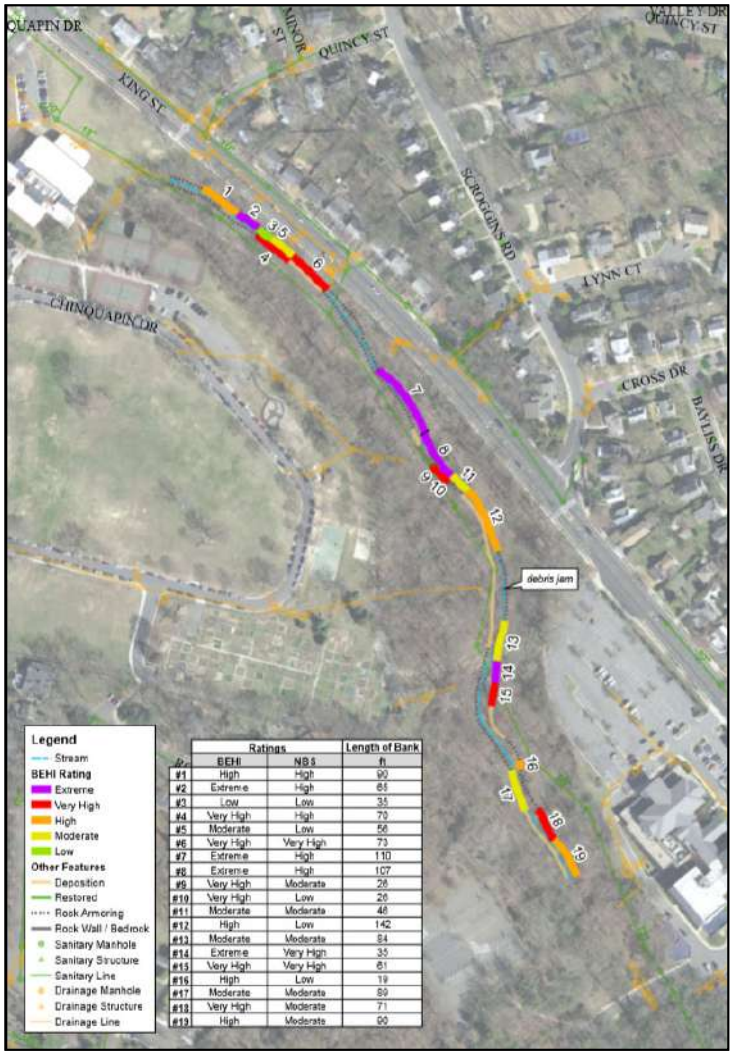
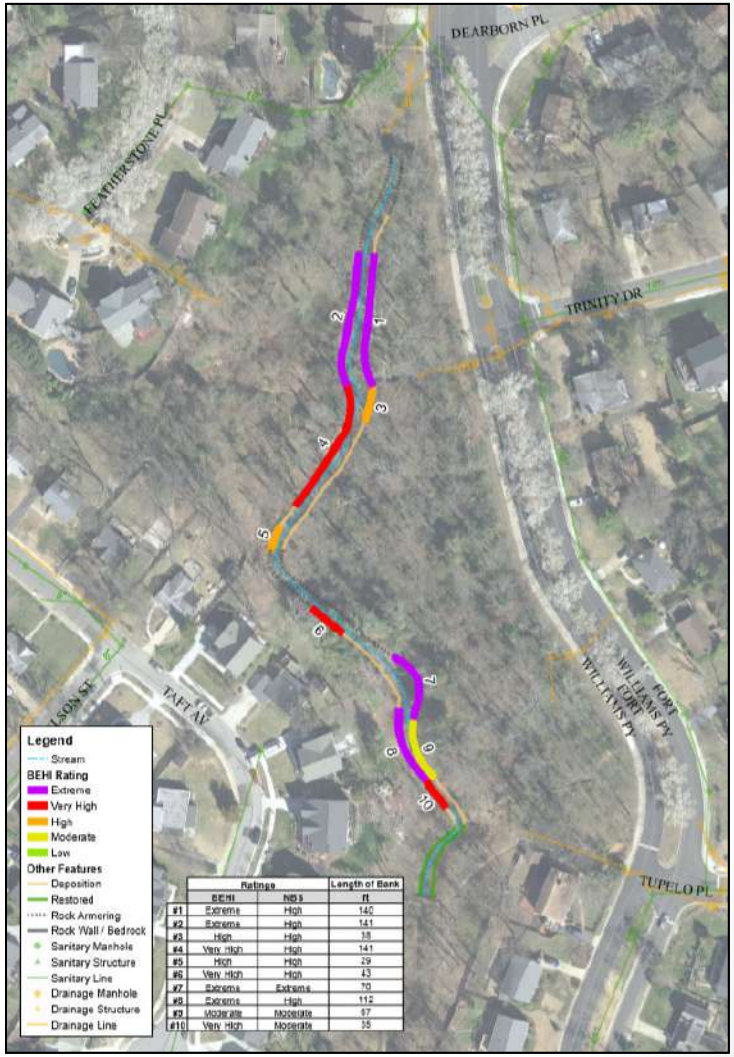
Field Assessment



	Ratings		Length of Bank
	BEHI	NBS	ft
#1	High	High	90
#2	Extreme	High	65
#3	Low	Low	35
#4	Very High	High	70
#5	Moderate	Low	56
#6	Very High	Very High	73
#7	Extreme	High	110
#8	Extreme	High	107
#9	Very High	Moderate	26
#10	Very High	Low	26
#11	Moderate	Moderate	46
#12	High	Low	142
#13	Moderate	Moderate	84
#14	Extreme	Very High	35
#15	Very High	Very High	61
#16	High	Low	19
#17	Moderate	Moderate	89
#18	Very High	Moderate	71
#19	High	Moderate	90



	Ratings		Length of Bank
	BEHI	NBS	ft
#1	Extreme	High	140
#2	Extreme	High	141
#3	High	High	38
#4	Very High	High	141
#5	High	High	29
#6	Very High	High	43
#7	Extreme	Extreme	70
#8	Extreme	High	112
#9	Moderate	Moderate	67
#10	Very High	Moderate	35

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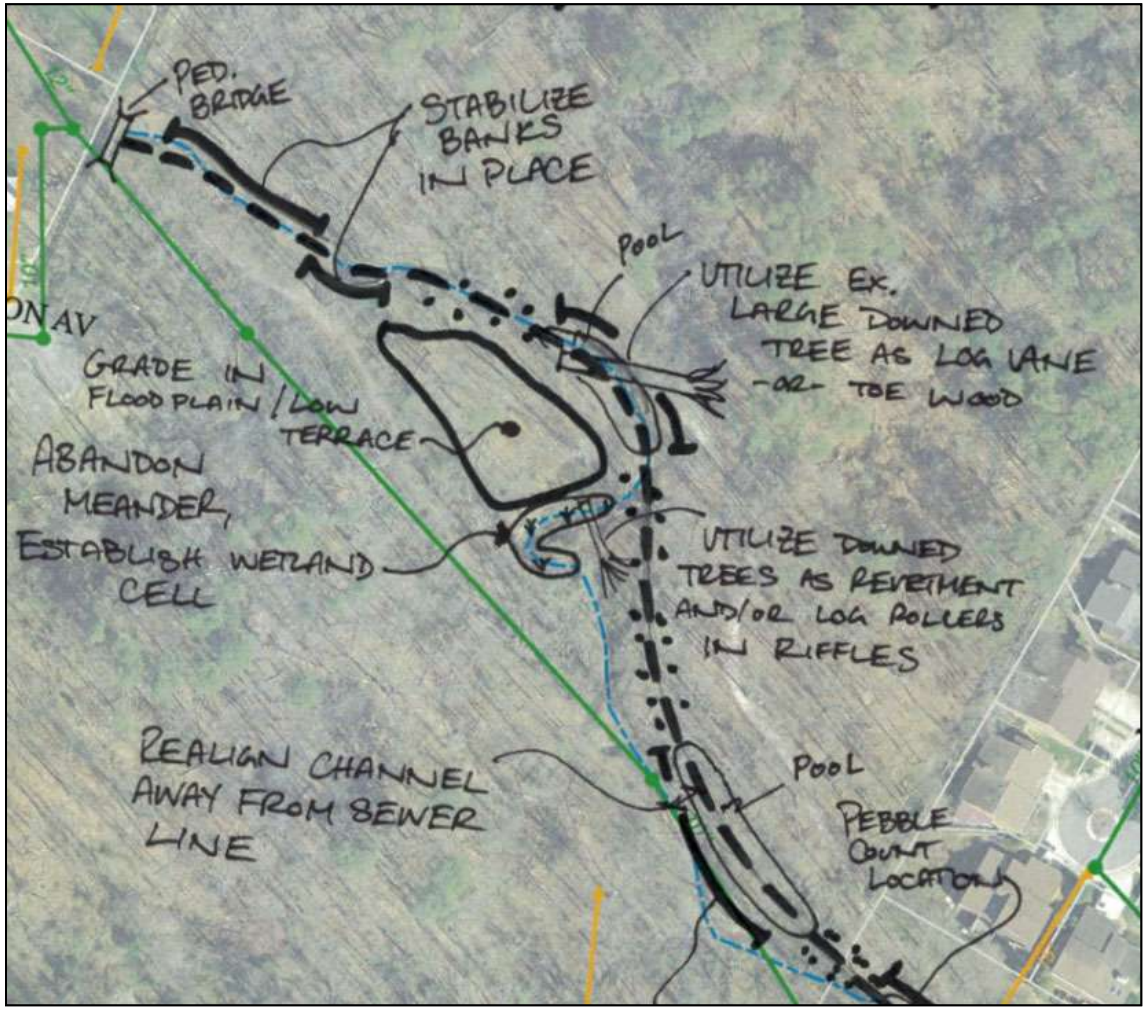
wood.

Recommendations



- Highlight problem areas (system-wide, localized)
- Identify solutions
- In combination with infrastructure fixes (trails, utilities, etc.)

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Decision Matrix and Ranking

Number	Ranking Criteria
1	Channel Dimension at Bankfull Cross-Section
2	Channel Planform Pattern
3	Channel Bed Longitudinal Profile
4	Streambank Stability and Protection from Erosion
5	Presence of Urbanite
6	Channel Obstructions
7	Riparian Vegetation
8	Presence of desirable fish and wildlife
9	Environmentally Sensitive Areas
10	Impacts to Trees
11	Construction Access
12	Property Ownership
13	Utility Conflicts
14	Stakeholders
15	Historically Sensitive Areas
16	Public Education and Outreach
17	Recreation Potential
18	Infrastructure at Risk
19	Public Safety Concerns
20	Associated Infrastructure Project Opportunity
21	Cost per lb. of Phosphorous Removal Interim Rate
22	Cost per lb. of Phosphorous Removal BANCS Model
23	MS4 Draining to Project Site
	Total

wood.

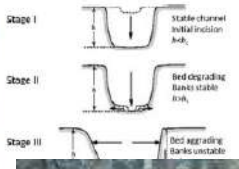
PROJECT COMPARISON DECISION MATRIX CRITERIA & SCORING

Criteria Scoring: Scores range from 1 to 5 and values increase from left to right. Higher score indicates greater restoration potential and expected benefit(s).

I. CHANNEL BED & BANK STABILITY

1. Channel Dimension at Bankfull Cross-Section

Channel dimension is the cross sectional shape of the channel, including channel width, depth, and cross sectional area. The bankfull discharge is considered to be the most effective flow for moving sediment, forming or removing bars, forming or changing bends and meanders, and generally doing work that results in the average morphological characteristics of channels (*Dunne and Leopold, 1978*). Research indicates that the hydraulic geometry substantially increases for urban streams in comparison to rural streams (*Doll et al., 2003*). Channel Evolution Model (CEM – *Schumm & Parker, 1973*) is an approach to explain the complexity of a fluvial system. A fluvial system is constantly changing and evolving, which is the systems attempt to reach equilibrium. A system that is considered stable or in equilibrium is well vegetated, frequently interacts with its floodplain and the sediment is suspended. CEM is used to classify the current stage of the system in order to predict how the system will evolve. Knowing the current stage of a system is incredibly beneficial when alterations to a system are being considered, especially when those alterations are aimed to provide restoration.



(1) Good: Stage I or V of Channel Evolution Model	(3) Fair: Stage IV of Channel Evolution Model

5. Presence of Urbanite

Urbanite is defined as large broken pieces of concrete, such as curb and
City as an attempt to prevent erosion and increase stability. While, it m
detrimental to the stream and provides poor instream and riparian habita

(1) Low: Only natural materials observed. No presence of urbanite located throughout the reach	(3) Moderate: moderate presence of urbanite materials found in 1 or 2 locations throughout the channel.

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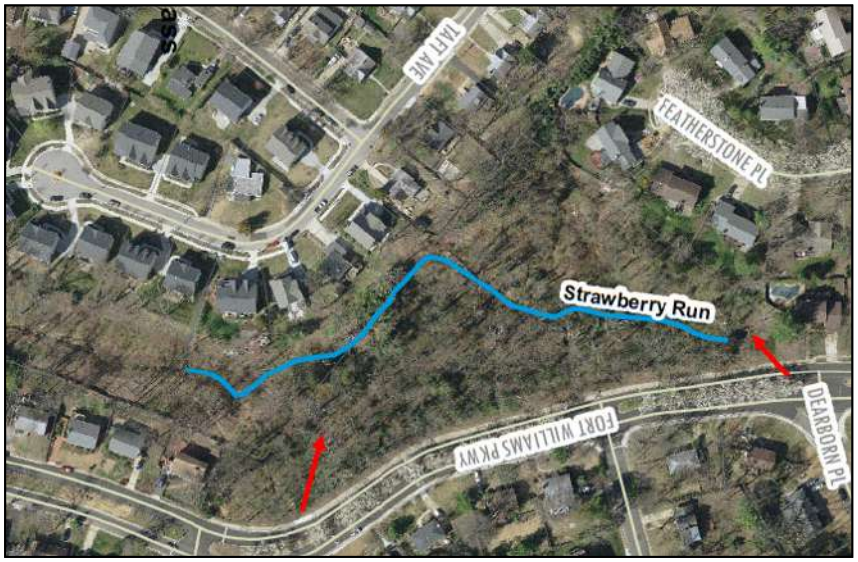
Site Visit

- Potential Construction Access
- Tier impacts



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Strawberry Run Stream Restoration

Source: www.pinclipart.com

Goals and Objectives

- Identify stream resources
- Restore healthy stream characteristics
- Improve the City's waterways and ecology
- Protect and stabilize infrastructure, private property, safety
- Consistent with the Environmental Sustainability Strategic Goal
- Reduce pollution to the Bay, Meet the state and federal regulatory permit requirements and TMDL pollutant reduction
  - Nitrogen, phosphorous, and sediment

Bank and Bed Instability

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Bank and Bed Instability

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Bank and Bed Instability

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Tree Loss

Tree Loss

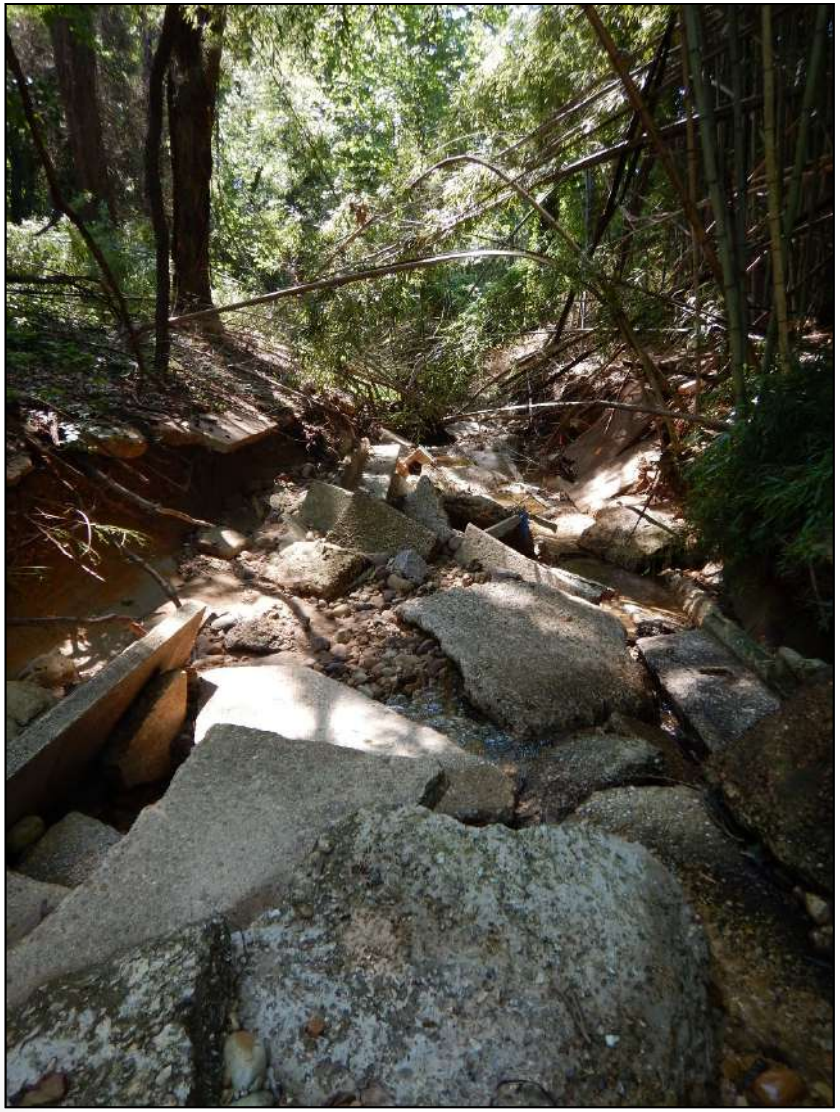
Tree Loss

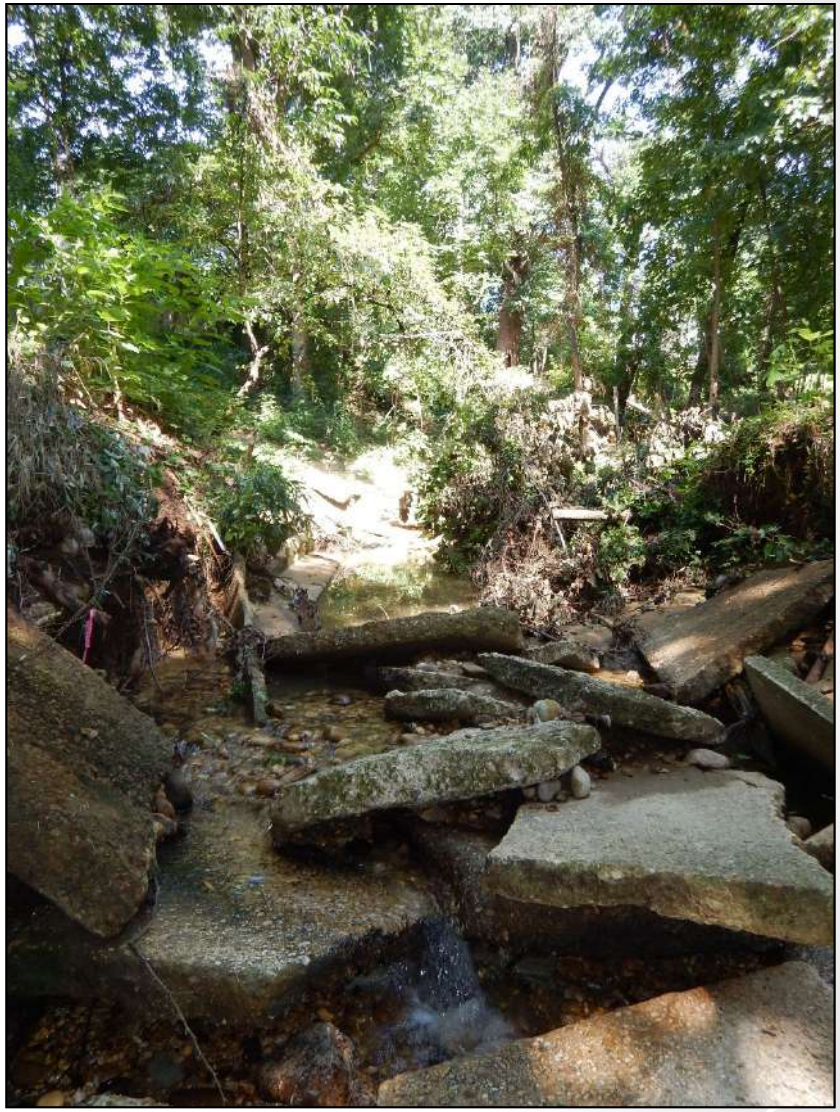
Tree Loss

Tree Loss

Site Debris

Site Debris





Safety/Tree Loss

Safety/Tree Loss

Infrastructure Impacts

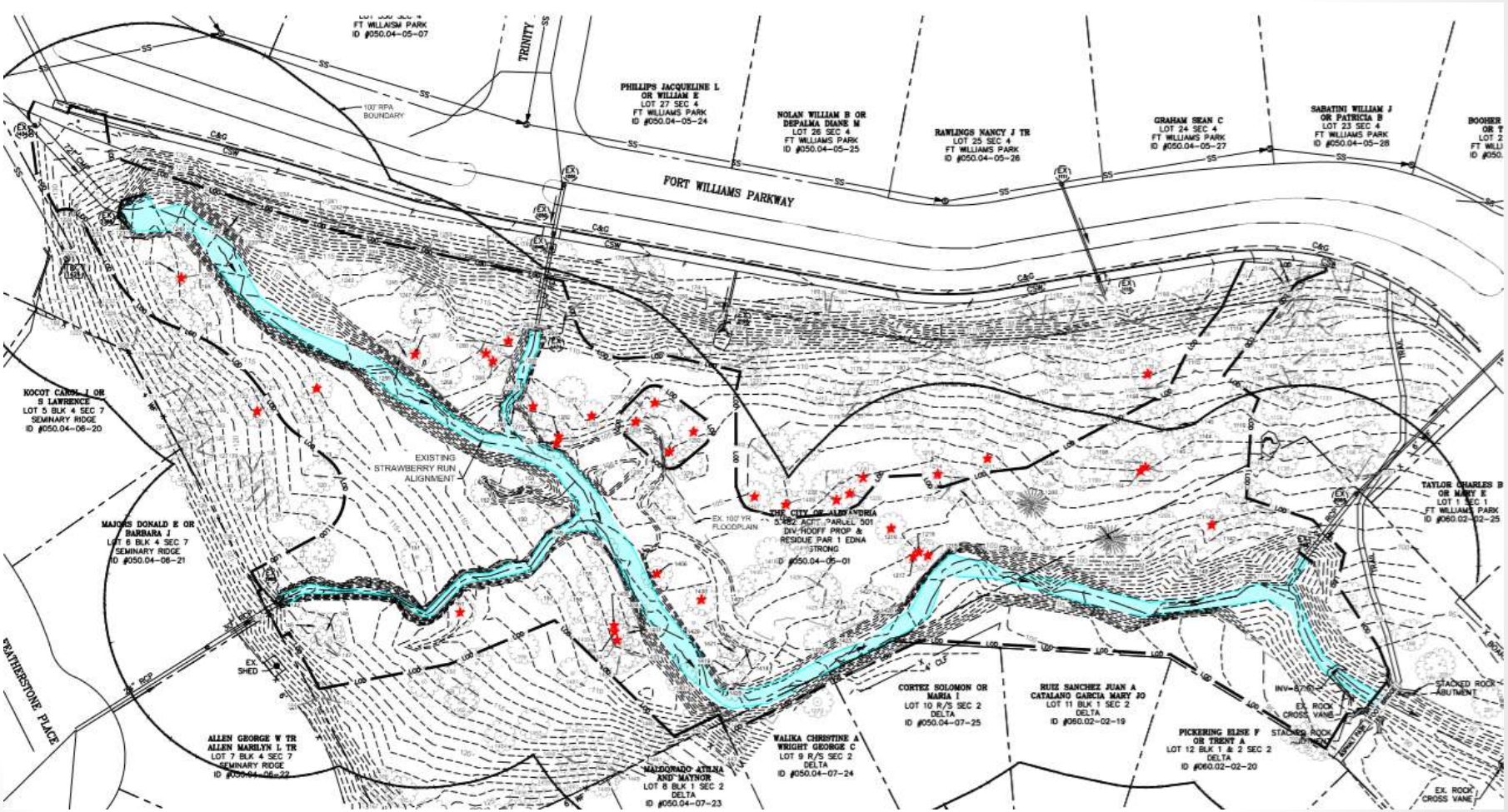
Infrastructure Impacts

Property Loss

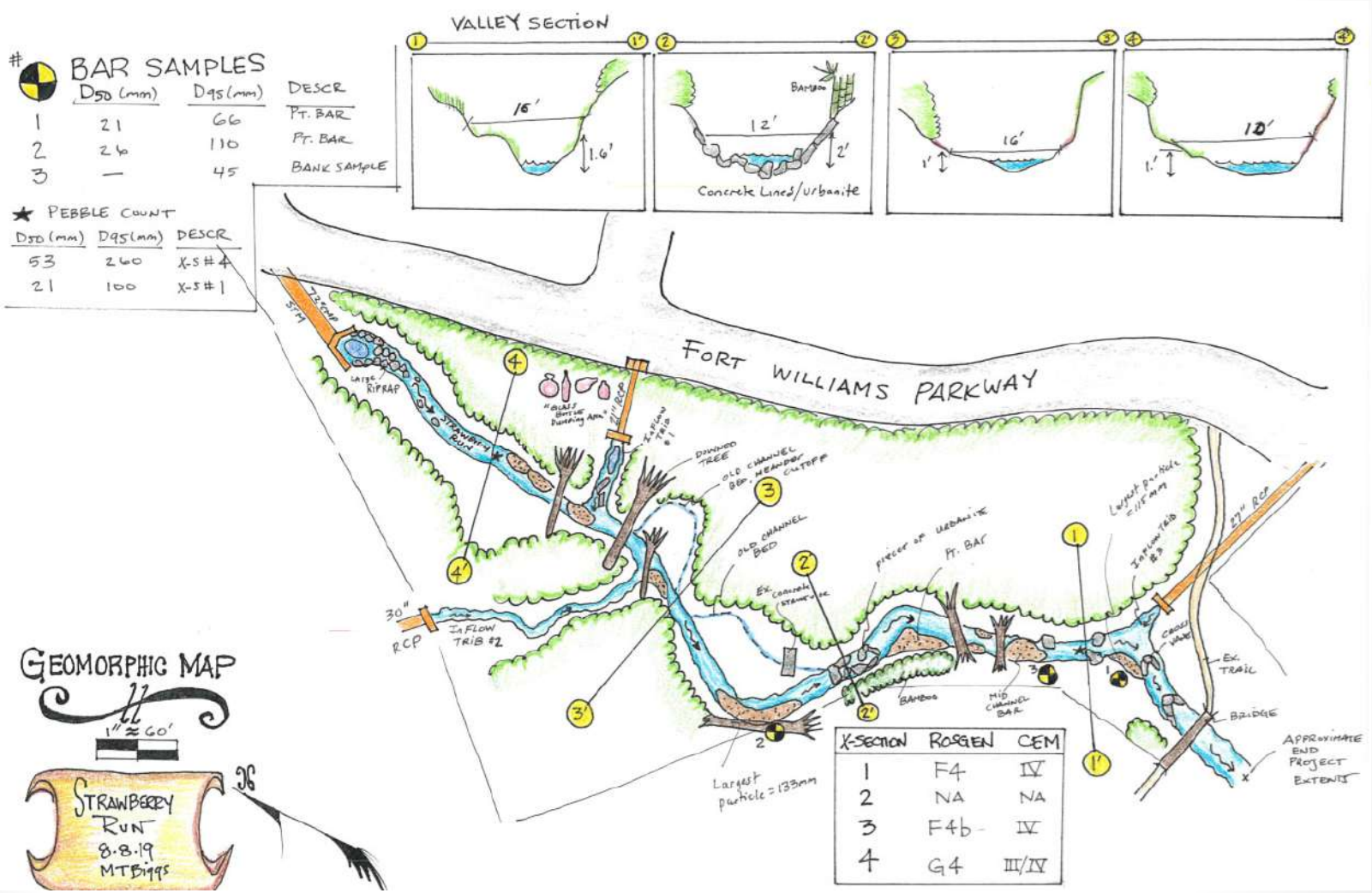
Property Loss

Stream Design

Existing Conditions



Field Work – Existing Conditions



1st Draft Stream Alignment – Dec 2019

Total Trees Surveyed	353
Trees Removed	206

- Preliminary Tree Removal: 58% of Total Trees Surveyed

Meeting with RCPA (12/19/19)

- Field Walk to Identify Notable Trees
- Identified 36 Notable Trees

1st Draft Stream Alignment – Overlay with Notable Trees (Jan)

Total Trees Surveyed	353
Trees Removed	206
Notable Trees Removed	34
Notable Trees Saved	2
Notable Trees Removed Near Top of Bank	8

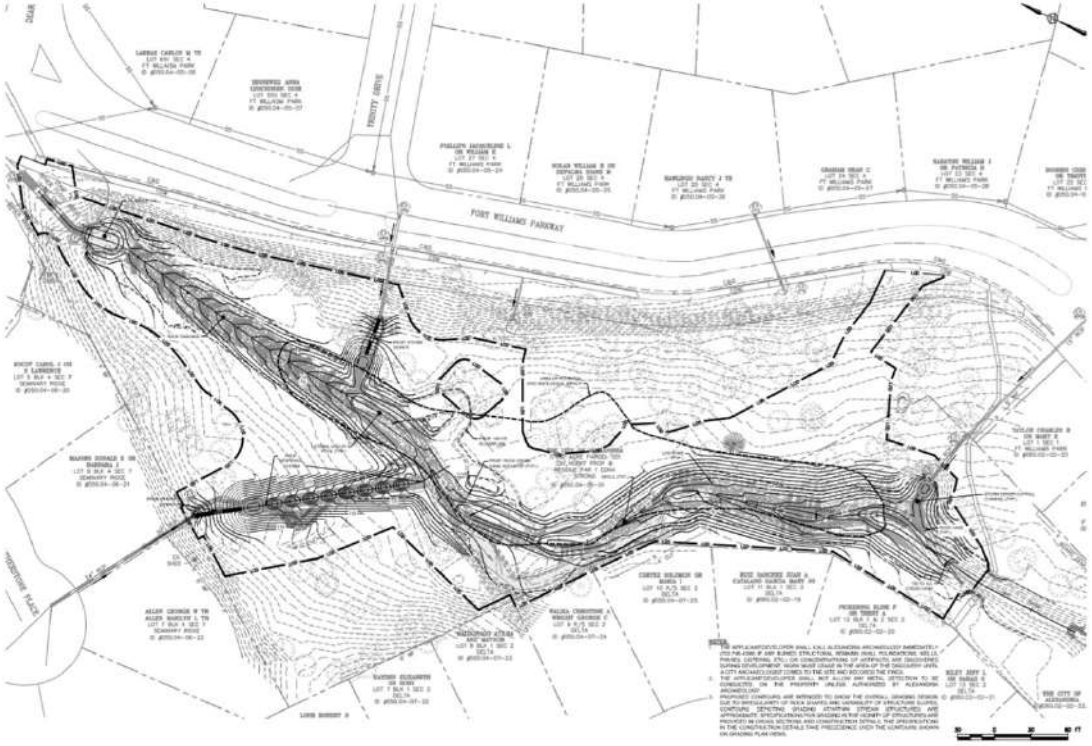
- Preliminary Tree Removal: 58% of Total Trees Surveyed

2nd Draft Stream Alignment (Feb)

Total Trees Surveyed	353
Trees Removed	147
Notable Trees Removed	22
Notable Trees Saved	14
Notable Trees Removed Near Top of Bank	8

- 2nd Draft Tree Removal: 42% of Total Trees Surveyed

Current Stream Alignment (May)



Total Trees Surveyed	353
Trees Removed	89
Notable Trees Removed	13
Notable Trees Saved	23
Notable Trees Removed Near Top of Bank	8

- Current Tree Removal: 25% of Total Trees Surveyed

Current Design Tree Impacts - Iterations

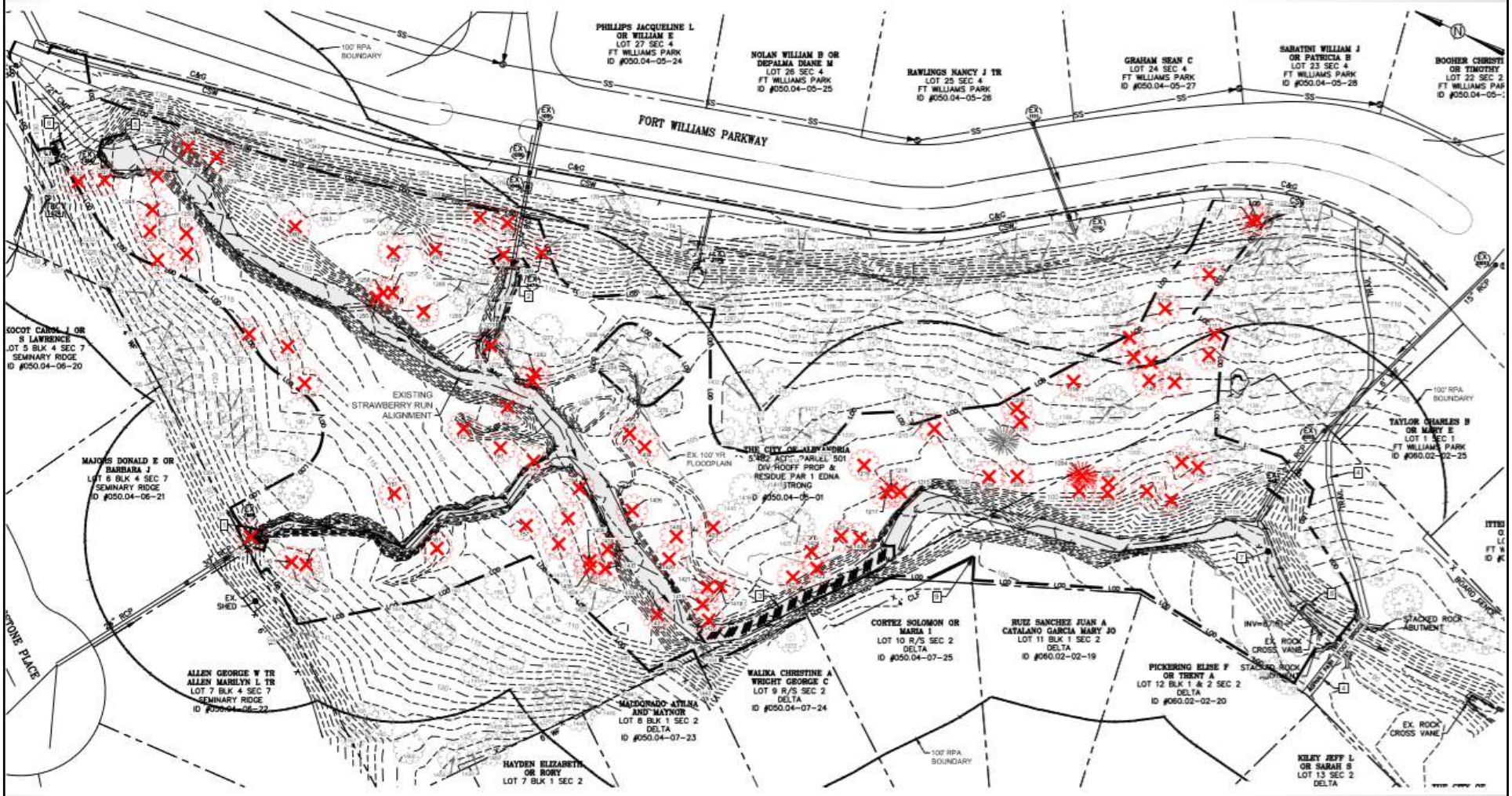
Design	Total Trees Surveyed	Trees Removed	Notable Trees Removed	Notable Trees Saved	Percent of Trees Removed
Jan	353	206	34	2	**58%**
Feb	353	147	22	14	**42%**
May	353	89	13	23	**25%**

Current Design Tree Impacts

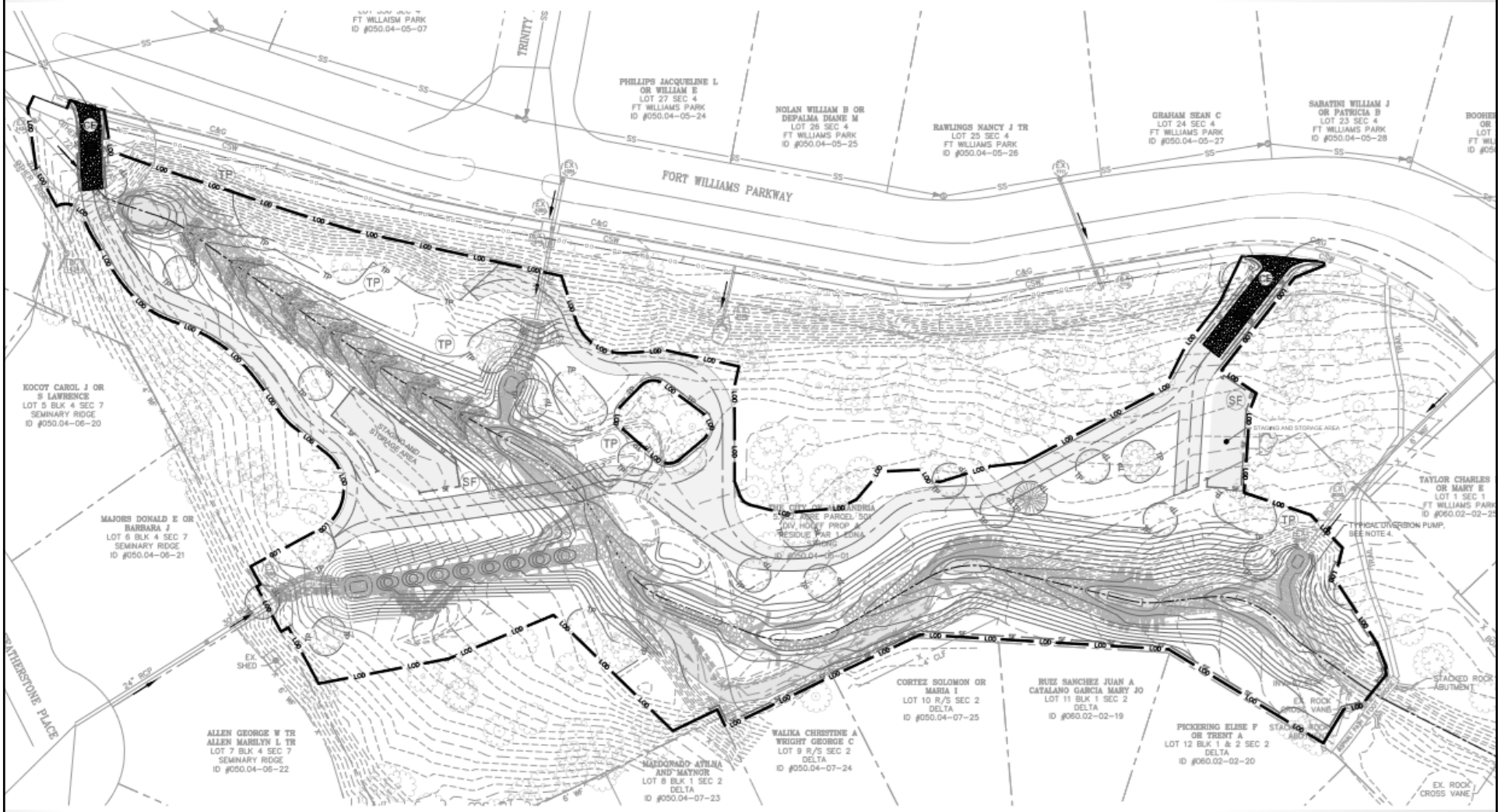
Tree Size (DBH)	Trees Proposed for Removal
Small (6-17”)	68
Medium (18-30”)	15
Large (31”+)	6
Total	89

Tree Condition	# TBR	%
Good	5	6%
Fair	67	75%
Poor	6	7%
Critical	5	6%
Dead	6	7%
Total	**89**	**100%**

Current Design Tree Removal



Construction Entrance



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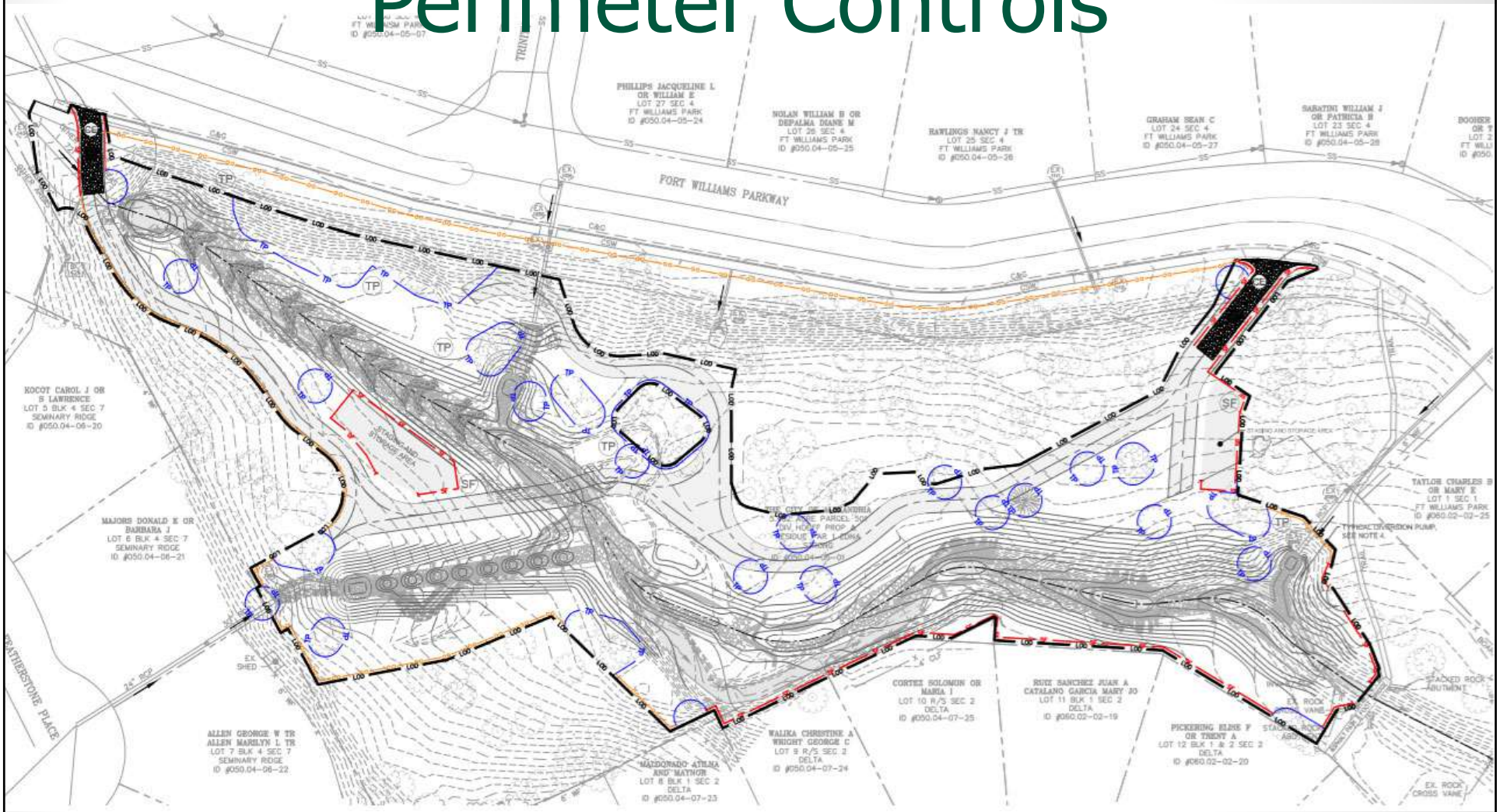
wood.

Limits of Disturbance and Perimeter Controls



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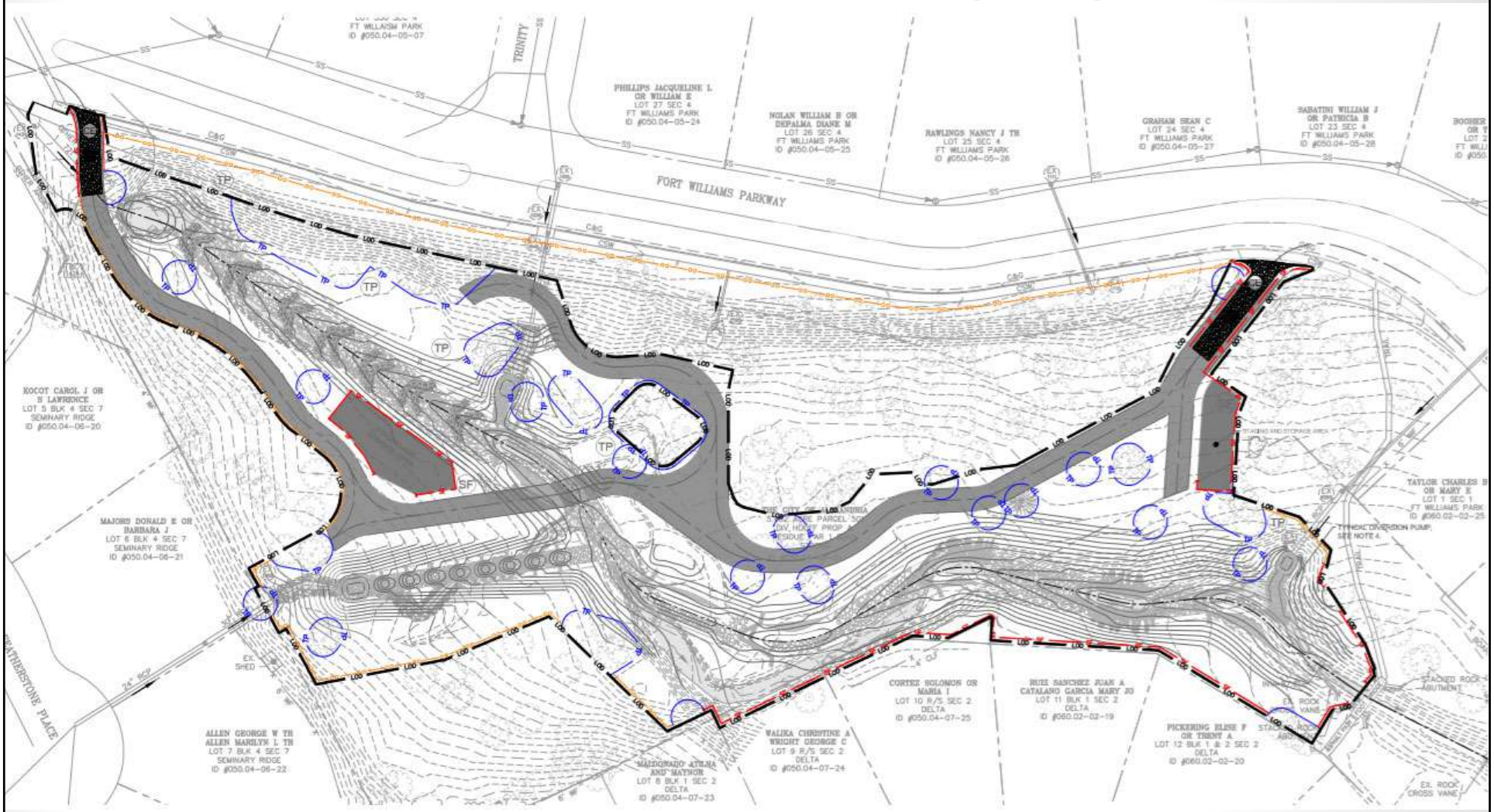
wood.

Access Road and Staging Areas



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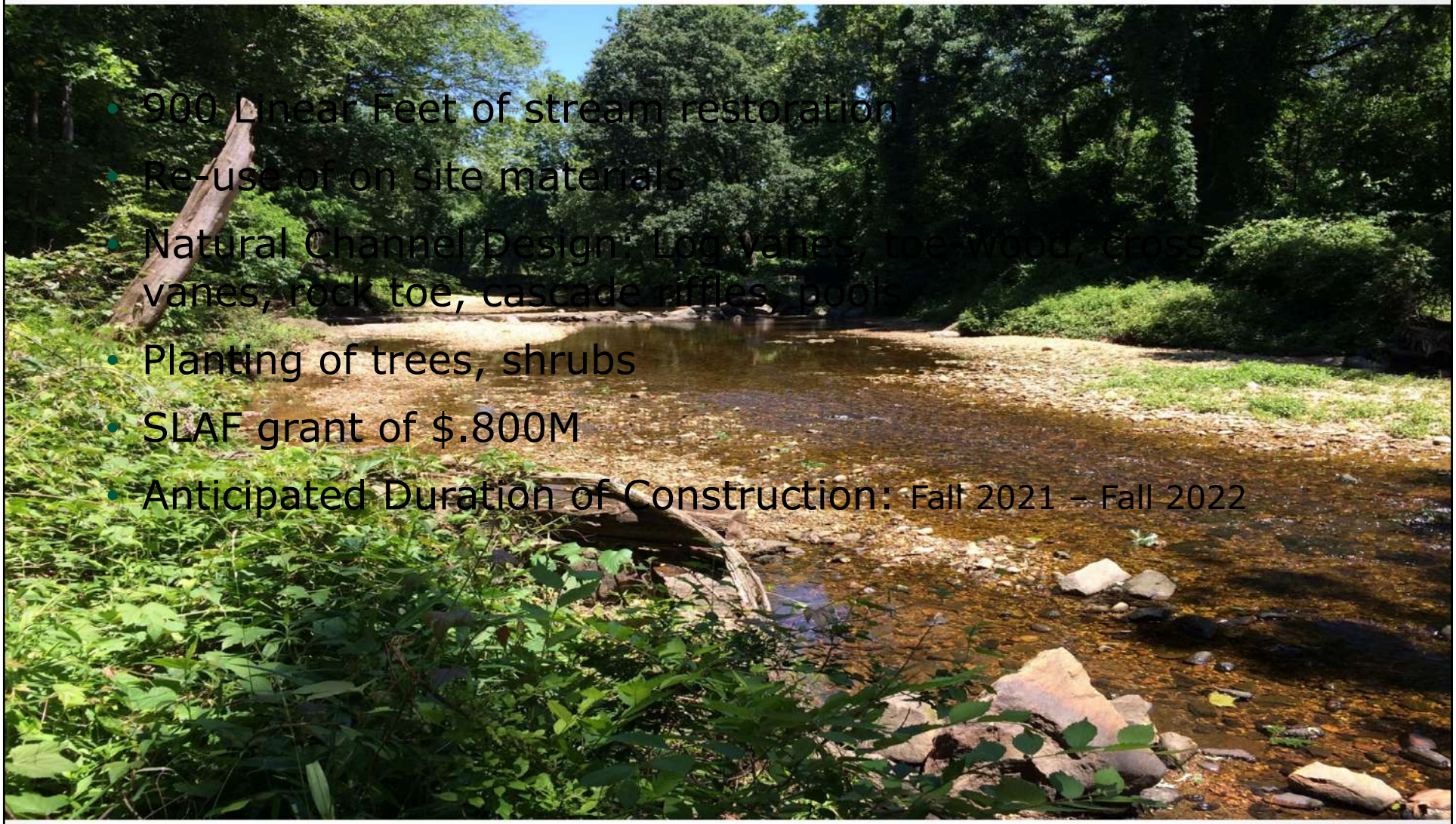
wood.

Design Overview



- 900 Linear Feet of stream restoration
- Re-use of on site materials
- Natural Channel Design: Log vanes, toe-wood, cross vanes, rock toe, cascade riffles, pools
- Planting of trees, shrubs
- SLAF grant of $.800M
- Anticipated Duration of Construction: Fall 2021 – Fall 2022

Natural Channel Design - Techniques

Riffle

Step-Pools

Cascade

Rock/ Log Vane

Design

Cascade

Rock Toe

Riffles

Step Pools

Design

Cascade

Cross Vane

Pools

Toe Wood

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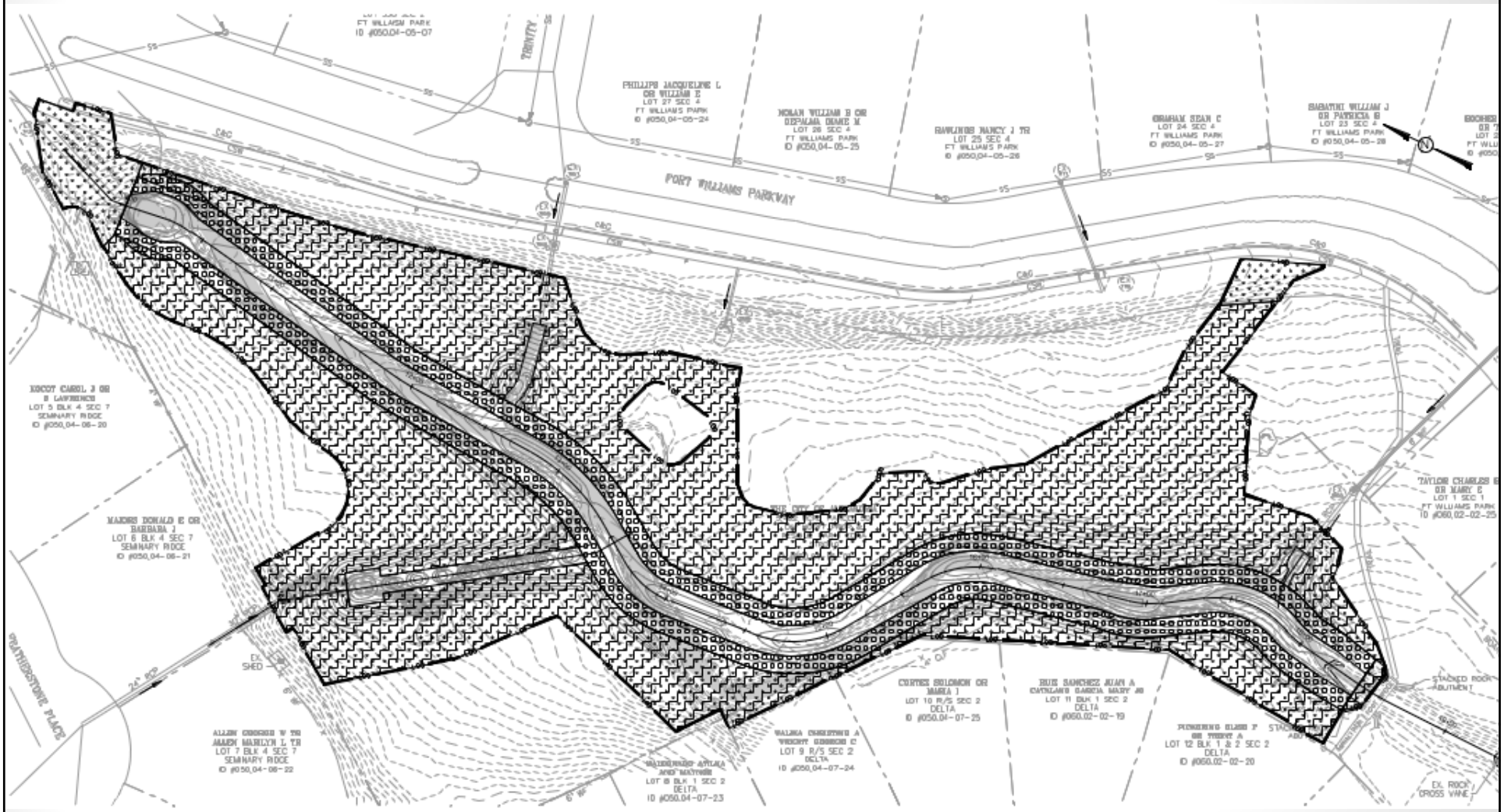
wood.

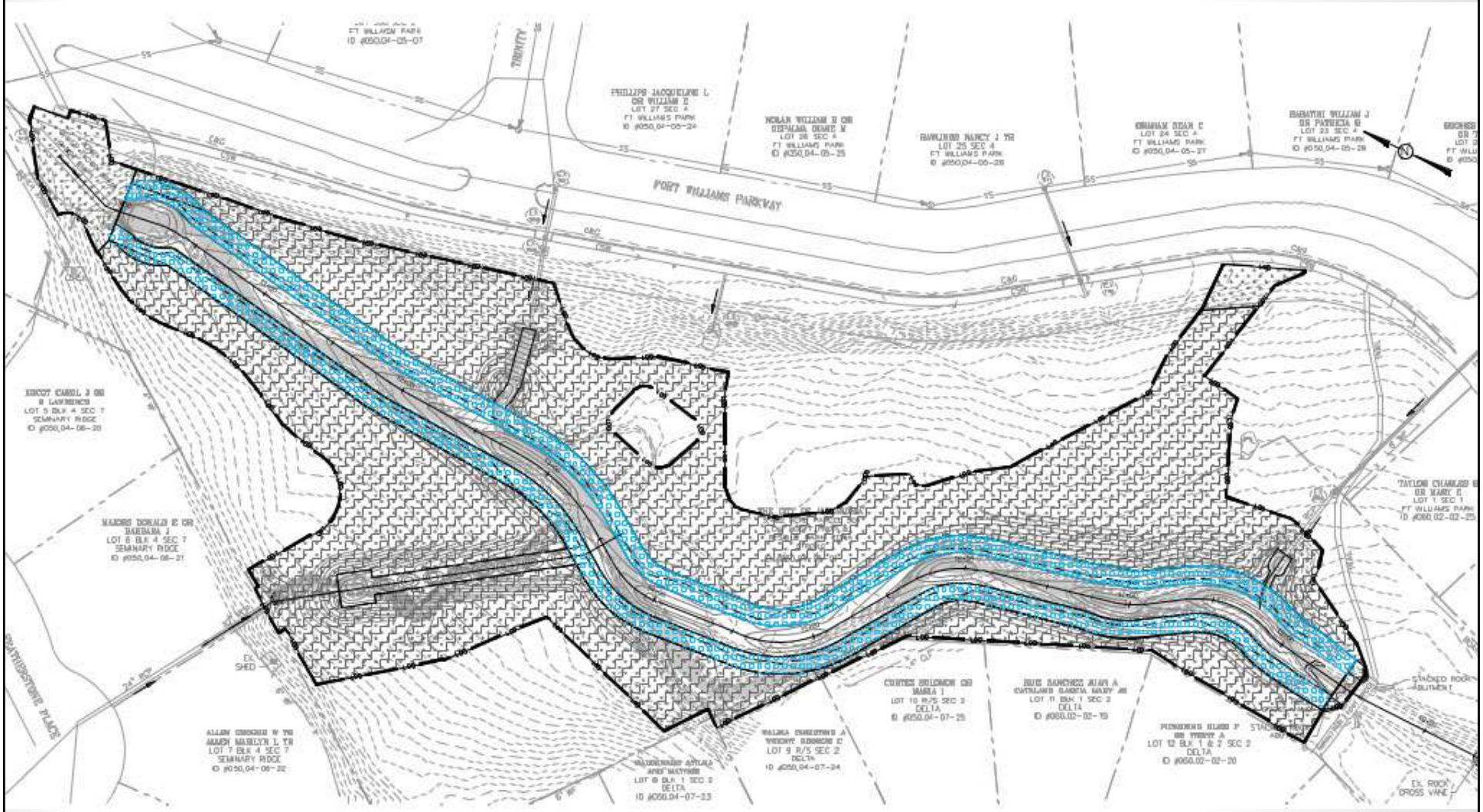
Riparian Plantings

Category	Number	Variety/Diversity	Size
Trees	1,030	10 different native species	3-gal container
Shrubs	350	American Elderberry, Black Willow, Buttonbush, Silky Dogwood, Smooth Alder, Smooth Viburnum, Spicebush	1-gal container
Live Stakes	5,100	Silky Dogwood, Black Willow, Smooth Alder	3-4 ft (1-2” diam)
Plugs	548	Rushes and Sedges	2”

Riparian Plantings



Live Stakes


FORT WILLIAMS PARKWAY
TRINITY
24" RCP
EX SHED
EX ROCK CROSS VANE

Trees & Shrubs

Riparian Seed Mix

Riffle w/ Log Rollers

Pool

Trees Re-used

Trees Re-used

Trees Re-used

Toe Wood

Cascade with Log Rollers

Log Vane Structure

Trees Re-used

Cascade with Log Rollers

Wildlife and Mosquito Concerns?

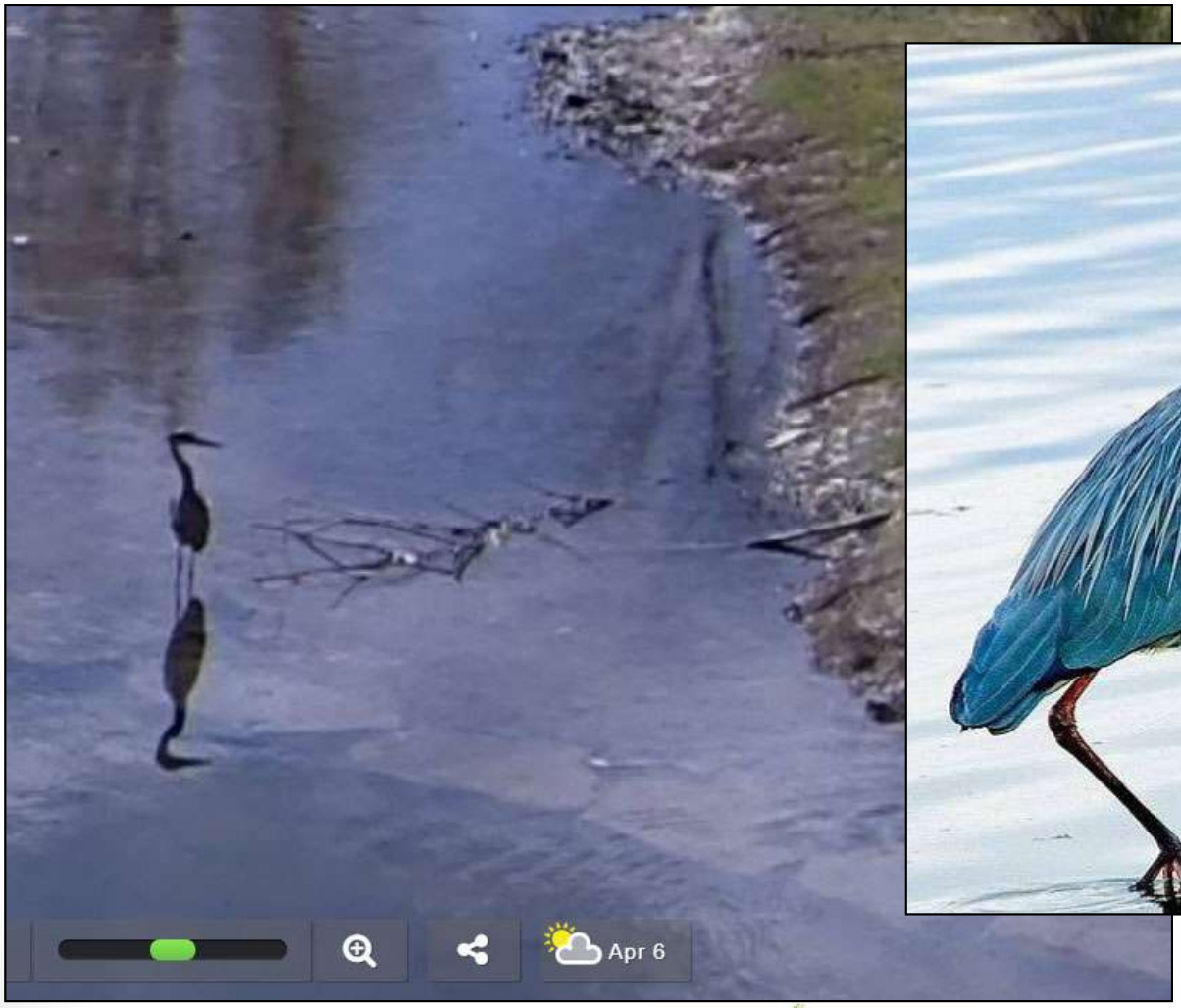
- According to Mosquito Control Association the bridge vector (the main transmitter to humans) of the West Nile Virus is the Culex Pipiens
- Culex pipiens is an urban species that generally prefer to breed in temporary standing water that is mildly to very polluted
  - Tin cans
  - Tires
  - Tarps
  - Other human-made sources of standing water

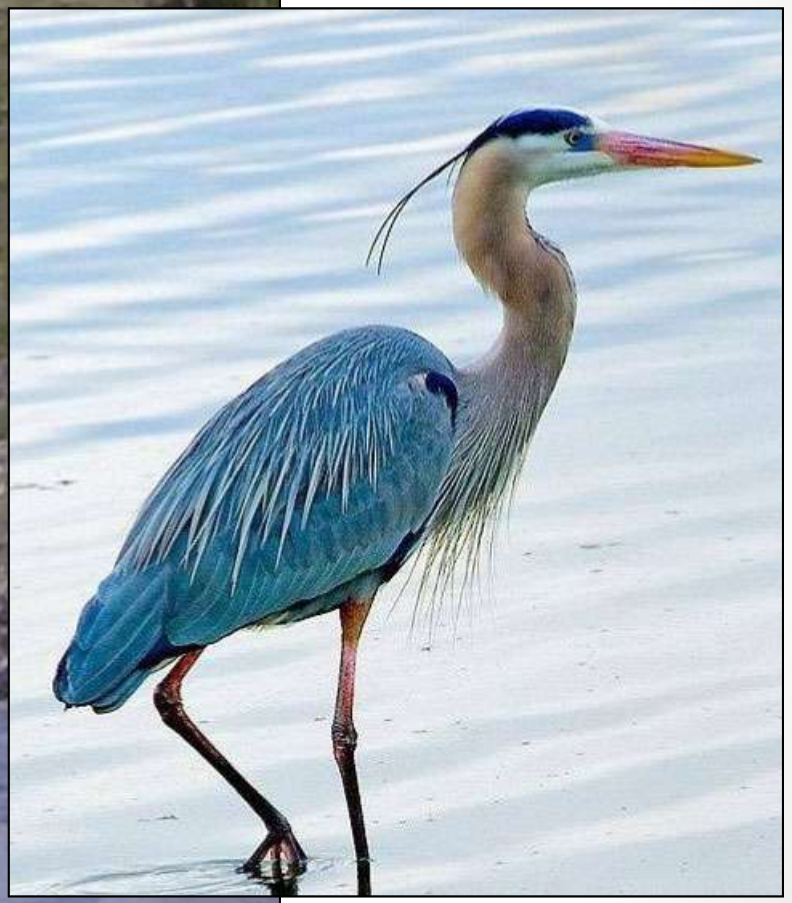
Wildlife and Mosquito Concerns?

- Riffle-pool-glide pattern
- Pools provide habitat for many aquatic and riparian species
- Underdrain for step pool system
- Unlike the existing stream, healthy stream systems with floodlplain connections provide habitat for many unique animals which are the natural enemies of mosquitoes and keep them in check

Source: www.inaturalist.org

Wildlife - Great Blue Heron





Wildlife - Great Blue Heron

Wildlife - White Egret

Source: https://www.photos.com

Wildlife - Greenside Darter

Source: https://www.nas.er.usgs.gov

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Wildlife - Cormorant

Source: https://www.audubon.org

Wildlife - Monarch Butterfly

Source: https://kids.nationalgeographic.com

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Wildlife - Kingfisher

Source: www.inaturalist.org

Strawberry Run - Downstream

Before

After

Big Rocky Run

Before Construction

After - 7-yrs Post Construction

Big Rocky Run

September 18, 2013 – During construction

September 18, 2020

Cullers Run

Before Construction

Post Construction

North Mill Creek US

Before Construction

Post Construction

North Mill Creek DS

Before Construction

Post Construction

Tuscarora Creek

Before

After – 2 months post construction

Piney Branch

Before

During Construction

Recap

Project Identification

- Restoration to reverse past harm and protect against future impacts
  - Builds a foundation for future resiliency
- Phase III Stream Assessment and decision matrix prioritization

Project Goals

- Stable banks and channel (reduced erosion)
- Invasive non-native plants removed, and native plants re-established
- Improve the City's waterways and ecology
- Protect and stabilize infrastructure, private property, safety
- Consistent with the City's Environmental Sustainability Strategic Goal
- Restore Healthy Stream Characteristics

Next Steps

- 21-day project comment period through November 20
- Use online Survey Monkey
- Staff will create a comment/response table
- Comments posted here will be captured
- Incorporate design changes from feedback
- Continue updates to website / FAQs
- Continue public engagement