Resilient Design for a Stormwater / Tidal BMP in Norfolk, VA

THE CITY OF NORFOLK

WETLANDS WATCH

Meet the Team

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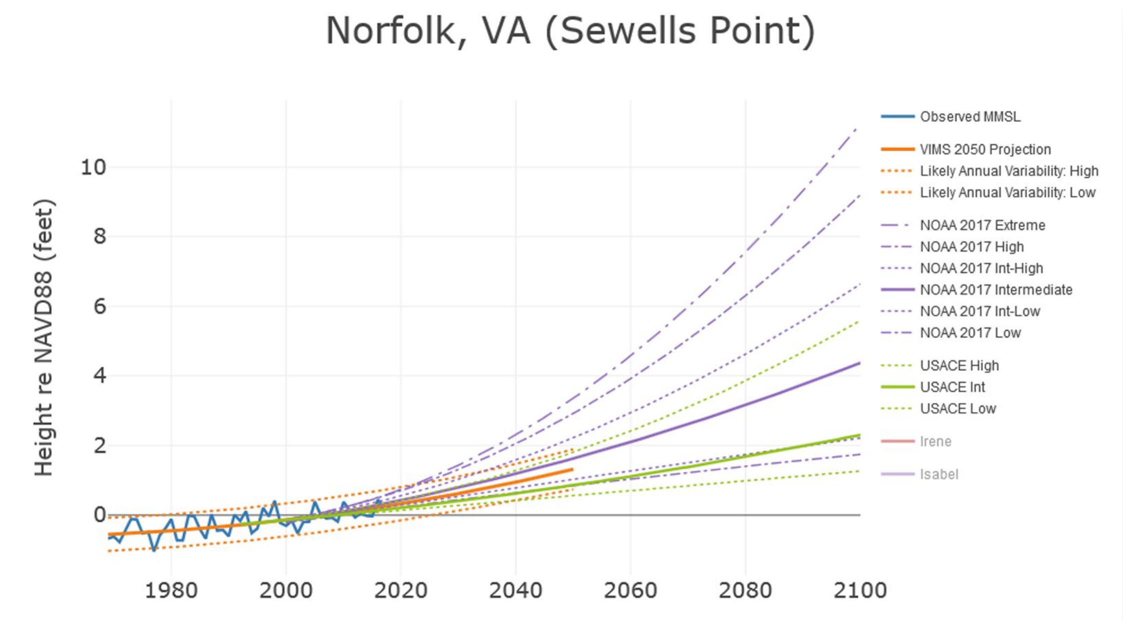
Problem Statement

The South Brambleton neighborhood of Norfolk, Virginia is threatened by both stormwater and tidal flooding.

Norfolk is projected to have a 1.5-ft increase in seawater levels by the year 2050.



Source: VIMS: Recommendations for Sea Level Rise Projections

THE CITY OF NORFOLK

WETLANDS WATCH

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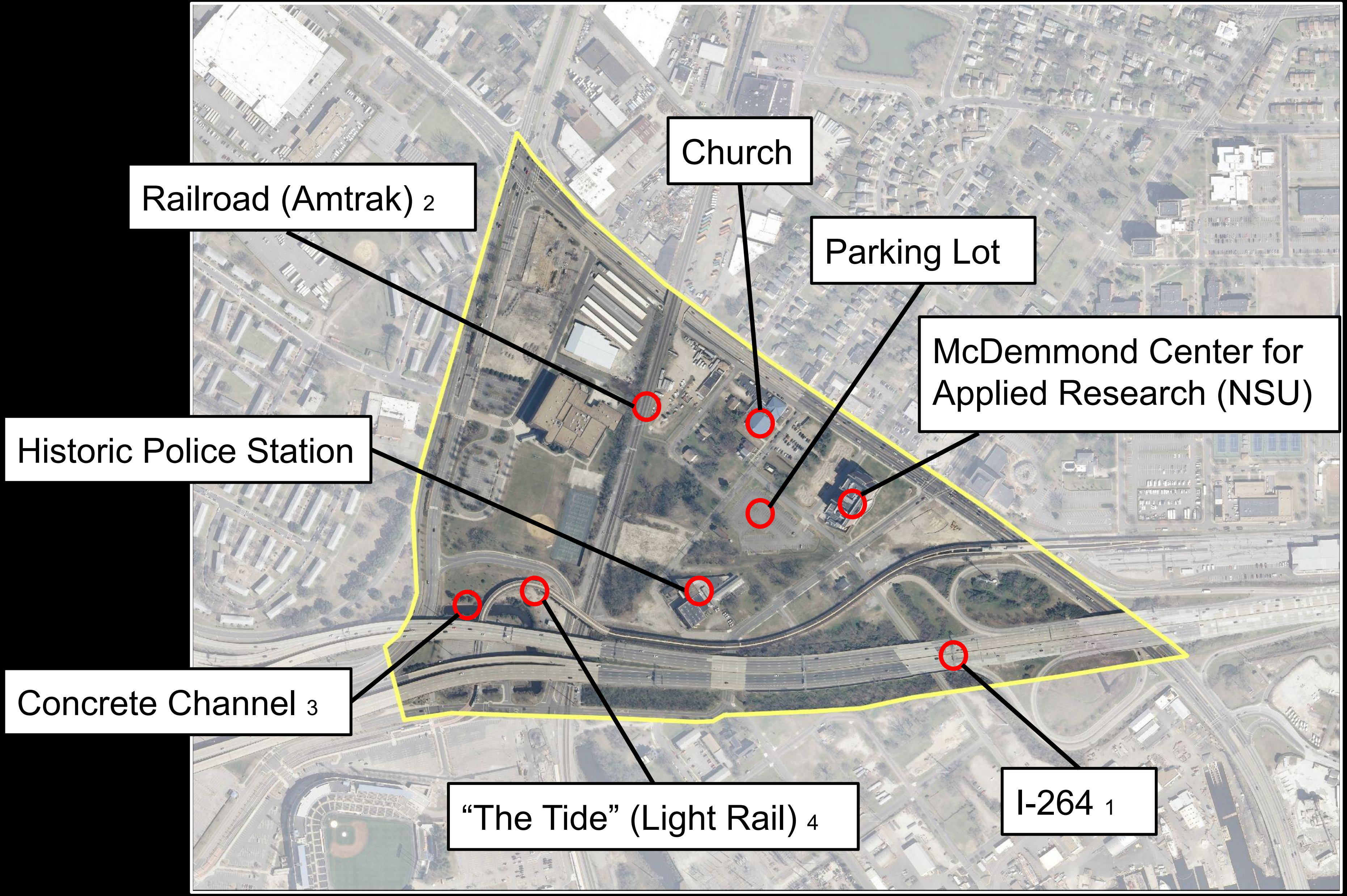

Railroad (Amtrak) 2
Church
Parking Lot
McDemmond Center for Applied Research (NSU)
Historic Police Station
Concrete Channel 3
"The Tide" (Light Rail) 4
I-264 1

Goals & Objectives

Goal:

To design a series of stormwater BMPs that will reduce tidal and stormwater flooding as well as pollutant delivery, while also providing wildlife habitats and usable community green space.

Project Objectives:

- Allow for marshland transition post-design life
- Incorporate community amenities
- Support a diverse, native ecosystem

Design Criteria & Standards

Criteria

- Attenuate stormwater and storm surge peaks by 20% (100-yr flood)
- Reduce sediment load by 20%
- Maintain a functional life of 20 years

Constraints

- Avoid altering existing infrastructure
- Reduce overall flooding on parking lot and adjacent railway
- Stay within a budget of $2 million
- Abide by relevant VA DEQ Stormwater Management Codes

Standards

- *ASCE 45-16:* Standard Guidelines for the Design of Urban Stormwater Systems
- *Virginia DEQ Stormwater Design Specifications*
    - no. 11: Wet Swales
    - no. 13: Constructed Wetlands
    - no. 14: Wet Ponds

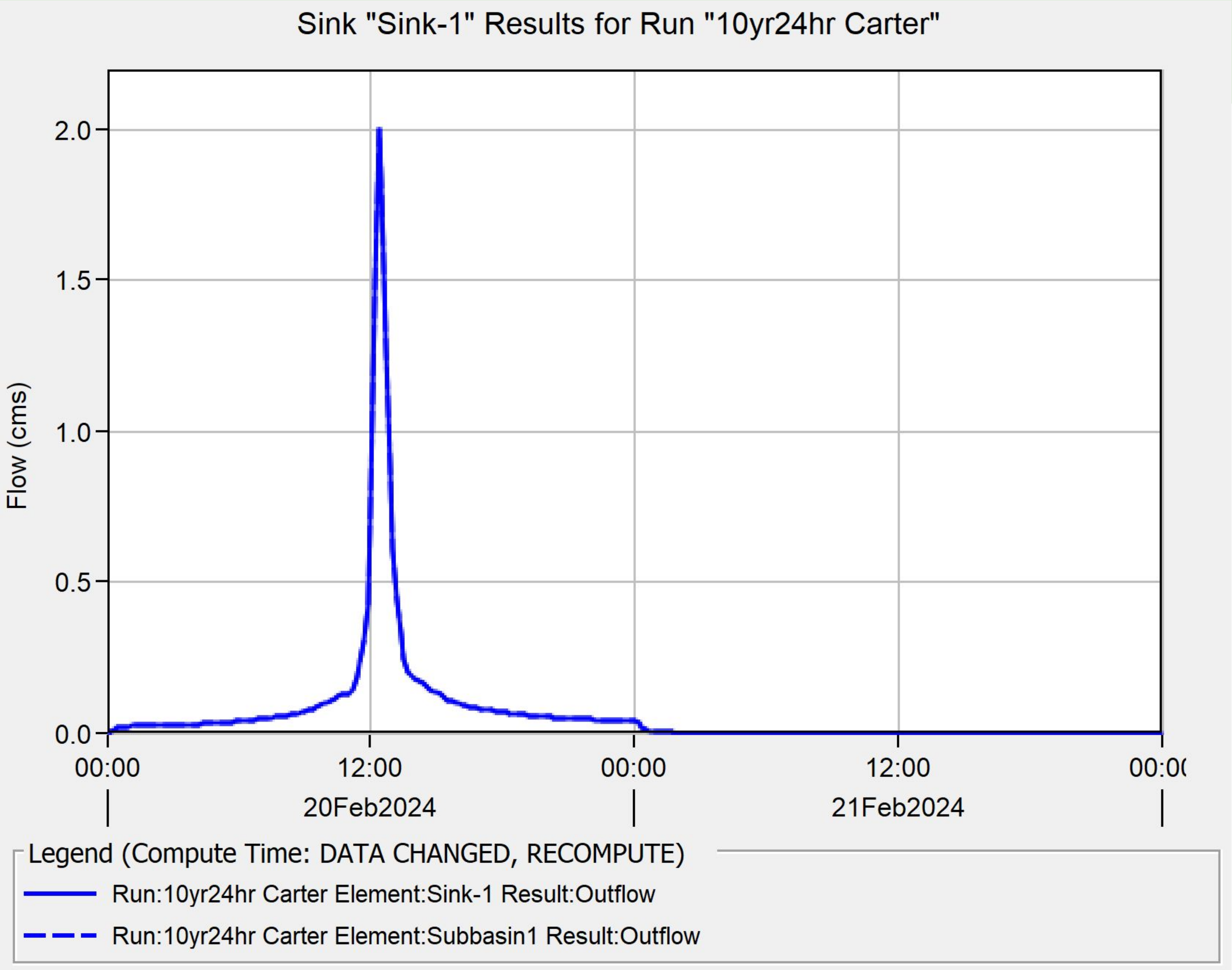
HEC HMS Model

Inputs

- 10 year 24 hour storm event
- Lag time calculated by Carter Method
- SCS Curve Number Method

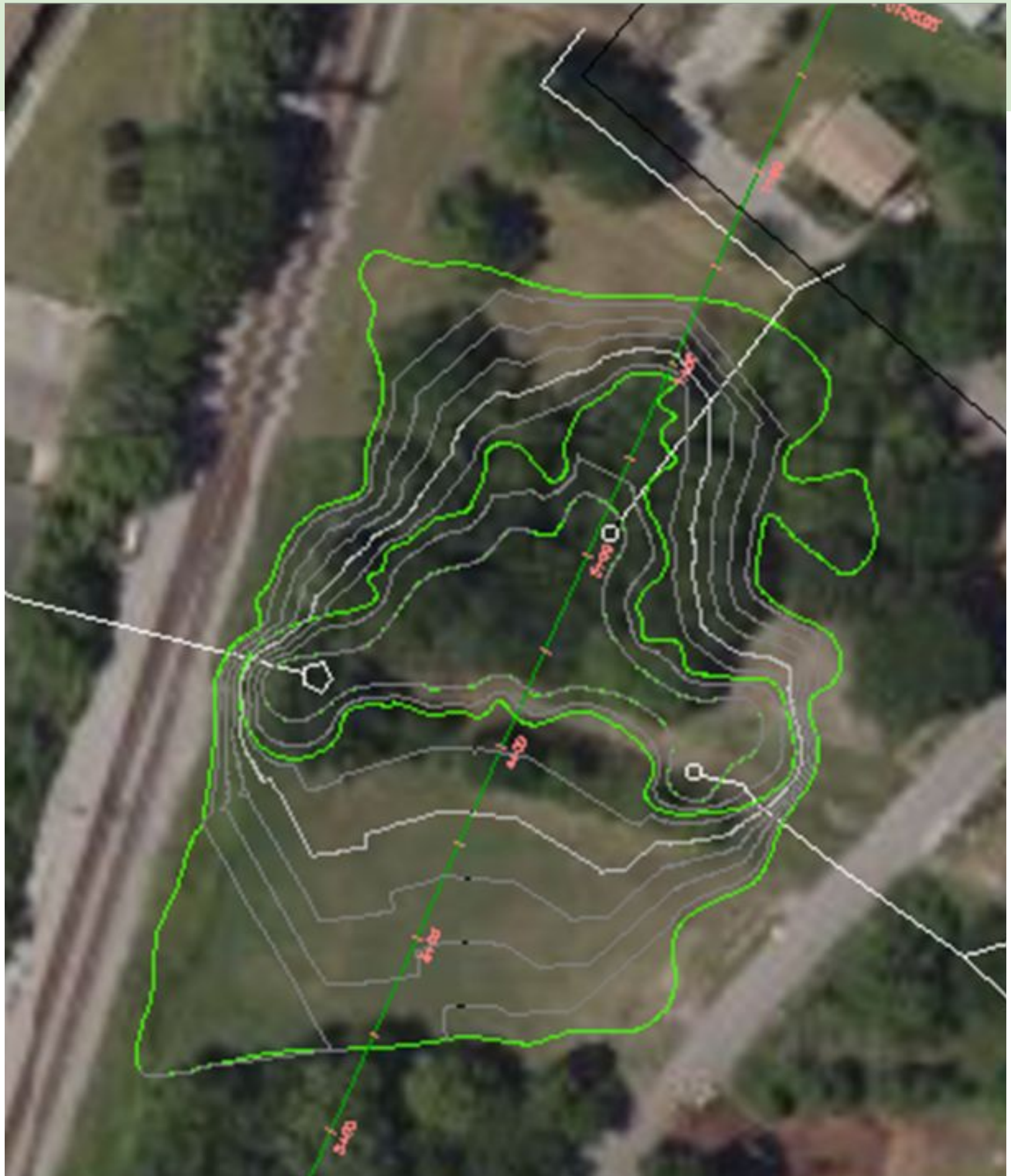
Results

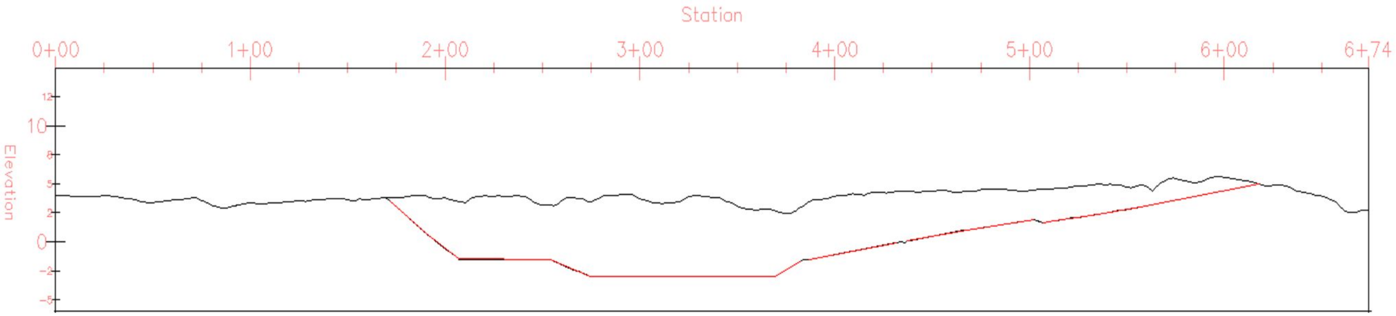
- Peak discharge of 2 m^3/s
- Total volume of 11,500 m^3
- Time of peak 12 hours and 20 minutes after start time



Final Design

Wet Pond

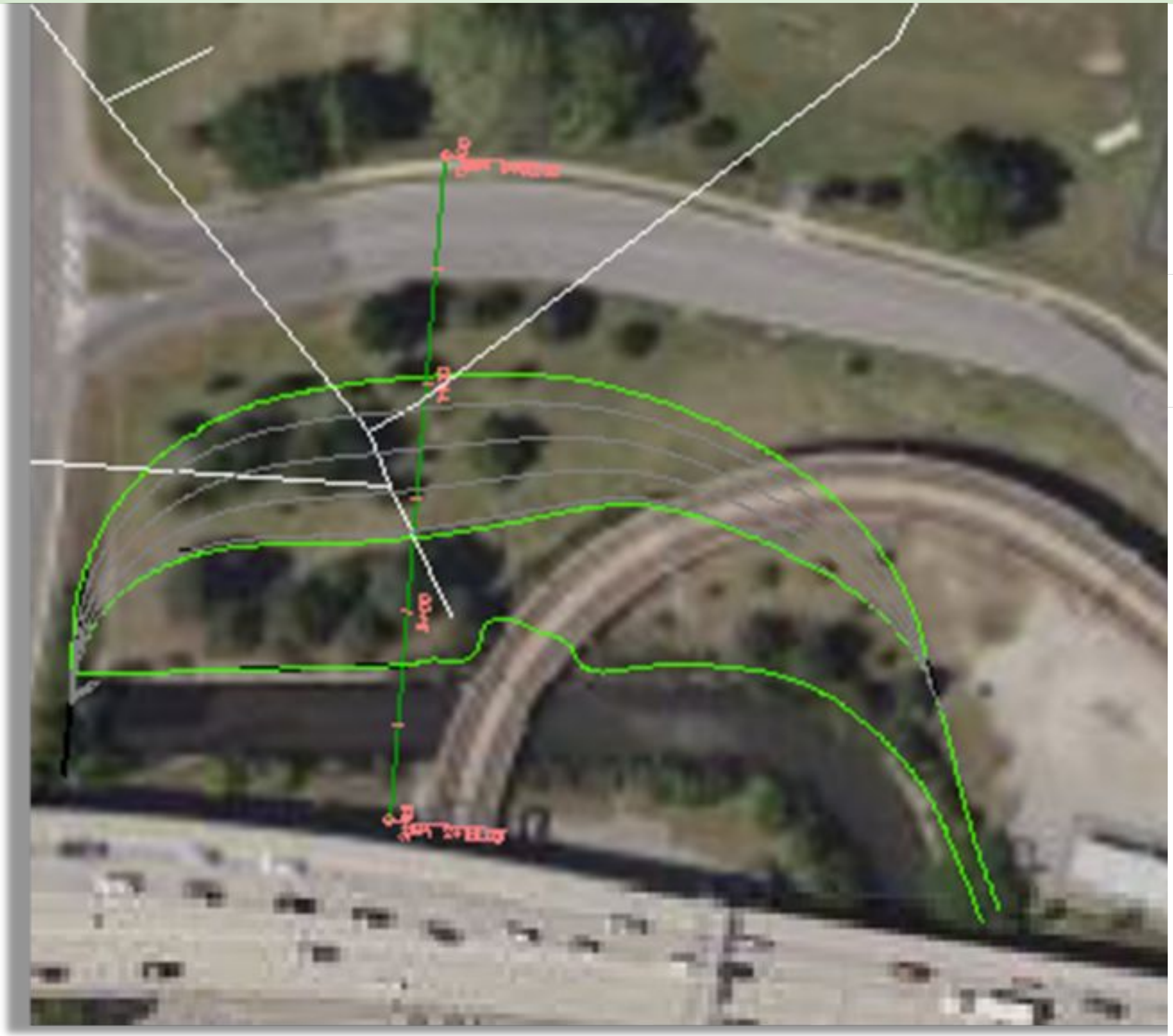


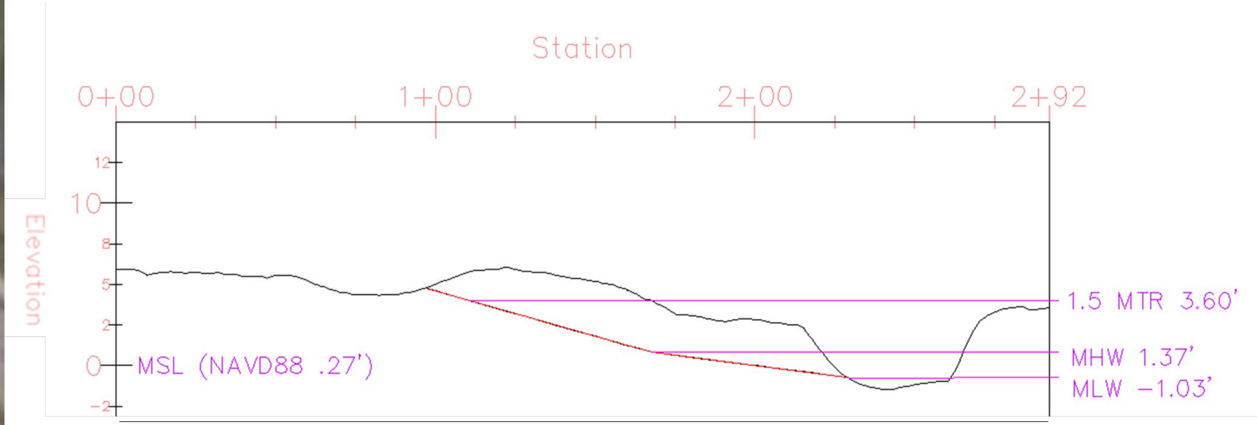


- Provides storage and reduces runoff
- Reduces phosphorus loads by 50%
- Reduces nitrogen loads by 30%

Final Design

Riparian Buffer





- Reduces phosphorus loads by 80%
- Reduces nitrogen loads by 50%
- Reduces TSS by 90%
- Improves wildlife habitat

Final Design

Planting Regime

Classification		Area (ft^2)
Open Water		-
Low Marsh		25,915
High Marsh/Salt Panne		10,571 + 8,512
Upland		37,830

Classification		Area (ft^2)	Storage Volume (ft^3)	Excavation Volume (ft^3)
Open Water		31,397	47,110	-
Emergent		18,666	15,892	-
Freshwater Marsh		22,226	374,477	-
Upland		59,502	-	-
Total		-	437,478	440,692

Economic Analysis

MATERIALS & EQUIPMENT	Unit Cost	Unit	Quantity	Total Cost
Clearing Existing Vegetation	$3,500	/AC	1	$4,022.51
Excavation	$10	/CY	16,322	$163,220
Erosion & Sediment Control	$5.27	/FT	200	$1,053.17
StandPipe/ Riser	$501.80	/U	1	$501.80
Filterra Unit	$25,500	/U	2	$51,000
VEGETATION (Transitional Wetland)				
Low Marsh	$6.38	/SY	2,879 SY	$18,370.86
Salt Meadow	$4.41	/SY	1,175 SY	$5,179.79
Salt Panne	$5.97	/SY	946 SY	$5,646.29
VEGETATION (Wet pond)				
Emergent	$4.62	/SY	2,074 SY	$9,581.88
Peripheral	$1.28	/SY	2,470 SY	$3,161.03
Upland	$.87	/SY	6,611 SY	$5,751.86
MAINTENANCE	**Rate**		**Basis**	**Cost / year**
Landscaping	$27	/HR/person	2	$54
Plant Checkup (annual)	$27	/HR/person	4	$108
Culvert / Inlet Debris Removal	$27	/HR/person	4	$108
			TOTAL	**$269,906.68**

Questions?