

CAT BRANCH STREAM/VALLEY RESTORATION, SWM POND RETROFIT, AND OUTFALL RETROFIT

**National Stream Restoration Conference
Session B: Headwaters and Floodplain Reconnection
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**BayLand Consultants & Designers, Inc.
Sean Crawford, PE
Caitlin Sporik, PE**



PROJECT BACKGROUND

- ▶ Anne Arundel County Bureau of Watershed Protection and Restoration CIP
- ▶ Site identified during 2010 comprehensive assessment of Magothy River Watershed
- ▶ Project included:
 - ▶ 1,490 LF of stream restoration
 - ▶ 3.5 acres non-tidal wetland restoration
 - ▶ Upland BMP retrofit (SWM infiltration facility)
 - ▶ Three outfall retrofits (SWM wetland and rock sill)
- ▶ 200 LF of the project was completed in 2018 as part of an emergency repair for an exposed sanitary sewer line



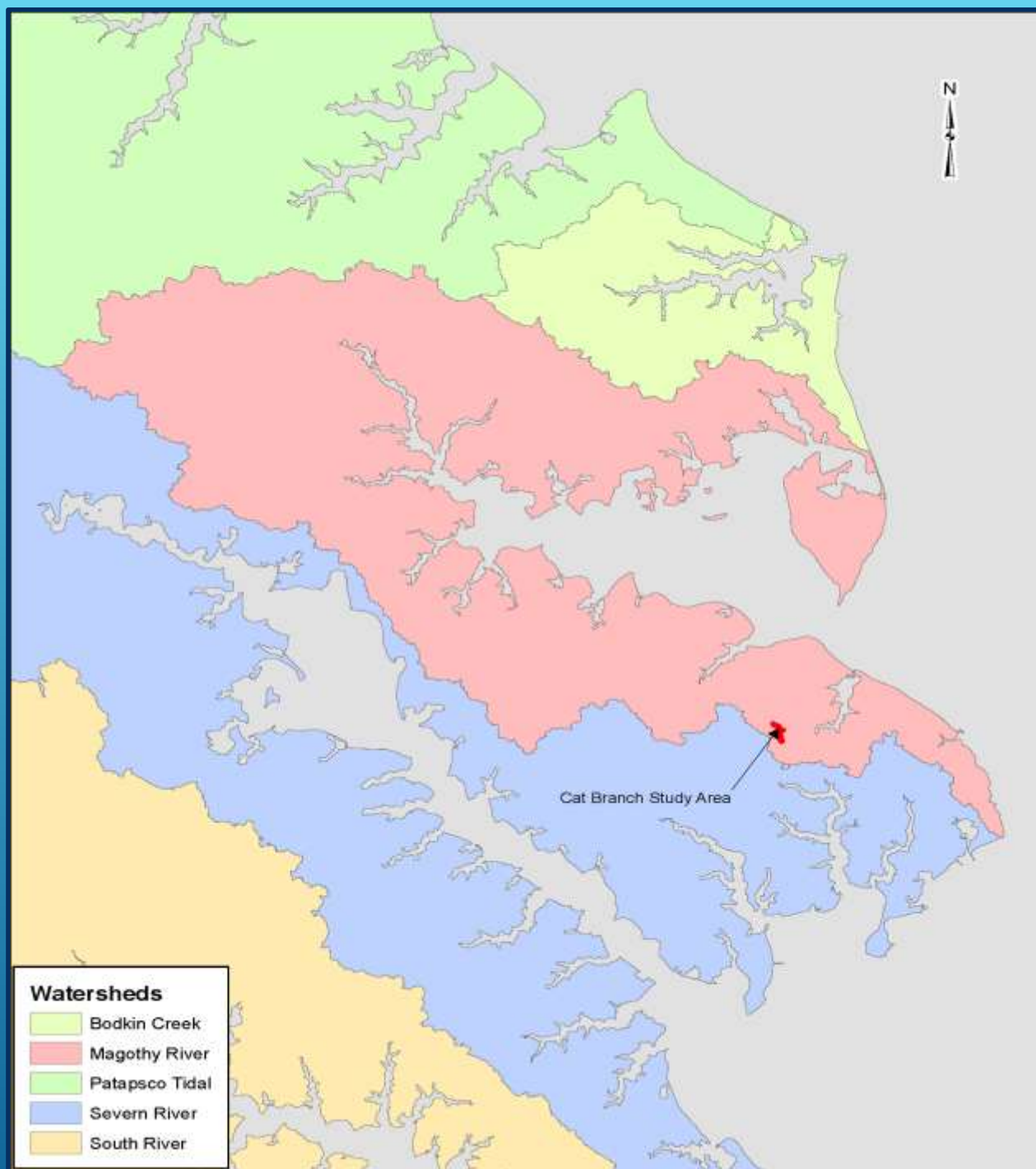
PROJECT GOALS

- ▶ Provide stream valley restoration, including the establishment or reconnection with riparian wetlands and optimizing floodplain reconnection volume.
 - ▶ Maximize surface-groundwater exchange
 - ▶ Promote sediment and nutrient trapping
- ▶ Provide design features that promote denitrification during base flow.
- ▶ Provide significant reduction in annual mass of sediment and attached nutrients originating from on-site channel degradation (i.e. “Prevented Sediment”) and upstream loss being delivered to downstream receiving waters.
- ▶ Enhance stream and riparian ecological functions.
- ▶ Provide an integrated stabilization approach to storm drain outfalls.
- ▶ Document water quality (and/or other) credit towards Anne Arundel County’s NPDES MS4 permit watershed restoration requirement, and assist in meeting Anne Arundel County’s WLA towards the Chesapeake Bay TMDL.

PROJECT LOCATION

Magothy River Watershed

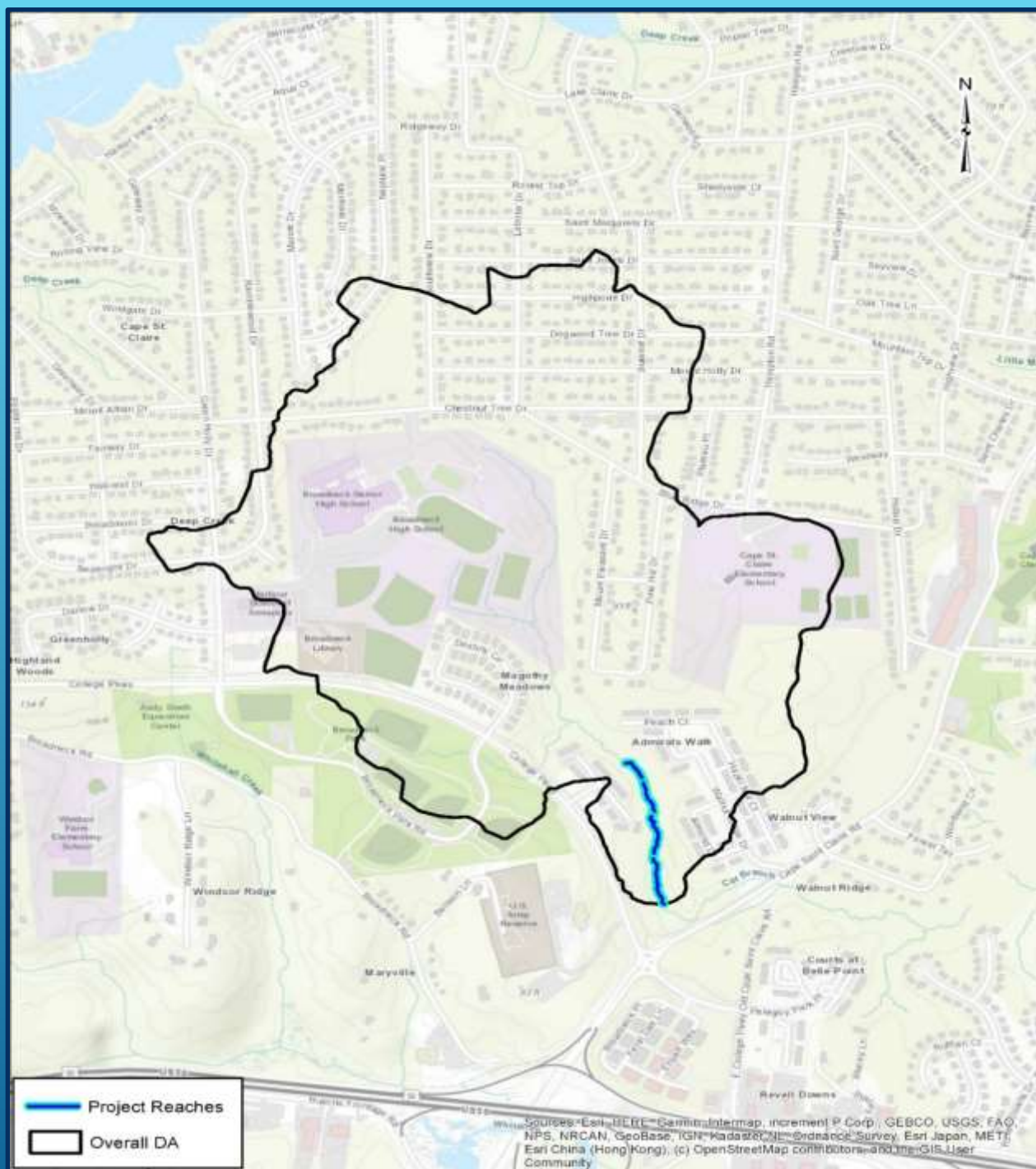
- ▶ 35.6 square miles
- ▶ Mix of urban residential, commercial, and forested land use
- ▶ Part of the Chesapeake Bay TMDL to address Nitrogen, Phosphorus and Sediment



PROJECT LOCATION

Cat Branch Sub-Watershed

- ▶ 285 acres/0.4 square miles
- ▶ 24% Impervious Area
- ▶ Primarily Medium Density Residential and Institutional Land Use





Infiltration Facility
(BMP 110)

Rock Sill

SWM Wetland

Project Reaches

PROJECT LOCATION



EXISTING CONDITIONS – BMP 110



EXISTING CONDITIONS – EXPOSED SS AND UPSTREAM HEADCUTS



EXISTING CONDITIONS – PROJECT REACHES



EXISTING CONDITIONS – PROJECT REACHES

EXISTING CONDITIONS

Bankfull Channel Dimensions at Classification Riffles				
Bankfull Channel Dimension Parameter	R-1	R-2	R-3	R-4
Drainage Area (mi ²)	0.41	0.41	0.44	0.44
Bankfull Discharge (cfs)	16.3	16.3	17.3	17.3
Cross Sectional Area (A_{bkf}) (ft ²)	6.1	6.6	5.0	3.8
Bank Height Ratio	3.7	2.6	3.7	3.5
Bankfull Width (W_{bkf}) (ft)	9.8	6.6	7.6	4.7
Mean Depth (d_{bkf}) (ft)	0.6	1.0	0.7	0.8
Width to Depth Ratio (W_{bkf}/d_{bkf})	15.6	6.7	11.5	5.8
Width of Flood-prone Area (W_{fpa}) (ft)	9.5	5.1	8.2	4.9
Entrenchment Ratio (ER)	1.0	0.8	1.1	1.0
Median Material Size (D_{50}) (mm)	0.120	0.091	0.098	0.068
Channel Sinuosity (K)	1.11	1.11	1.10	1.15
Rosgen Stream Classification	F5	G5c	G5c	G5c
Valley Slope (S_v) (ft/ft)	0.022	0.007	0.007	0.011

EXISTING CONDITIONS

2016 Monitoring

- ▶ **BIBI Score = 2.43/poor**
- ▶ **RBP = 112/partially supporting**
- ▶ **PHI = 65.48/degraded**

Peak Discharges (cfs)							
	1-year	2-year	5-year	10-year	25-year	50-year	100-year
	17.2	41.7	98.4	157.4	251.8	335.5	427.5

RESTORATION APPROACH

Watershed Wide Approach

- ▶ Conversion of a dry detention pond to an infiltration basin.
- ▶ Installation of a SWM wetland downstream of two storm drain outfalls.

Valley Restoration with Base Flow Channel

- ▶ Combination of raising the elevation of the incised stream bed + legacy sediment removal.
 - ▶ Increased runoff volume diverted onto the floodplain during storm events.
- ▶ Installed in-stream and valley wide treatments including log-cobble riffles, valley wide grade controls (log and rock), clay groundwater dams.
- ▶ Restored 200 LF of valley upstream of the project area without any disturbance.
 - ▶ Installed a clay groundwater dam that raised the upstream water table and restored wetland hydrology.
- ▶ Reused trees removed on site to provide grade control, increase floodplain roughness and provide habitat.
- ▶ Establish a functional, diverse riparian zone.

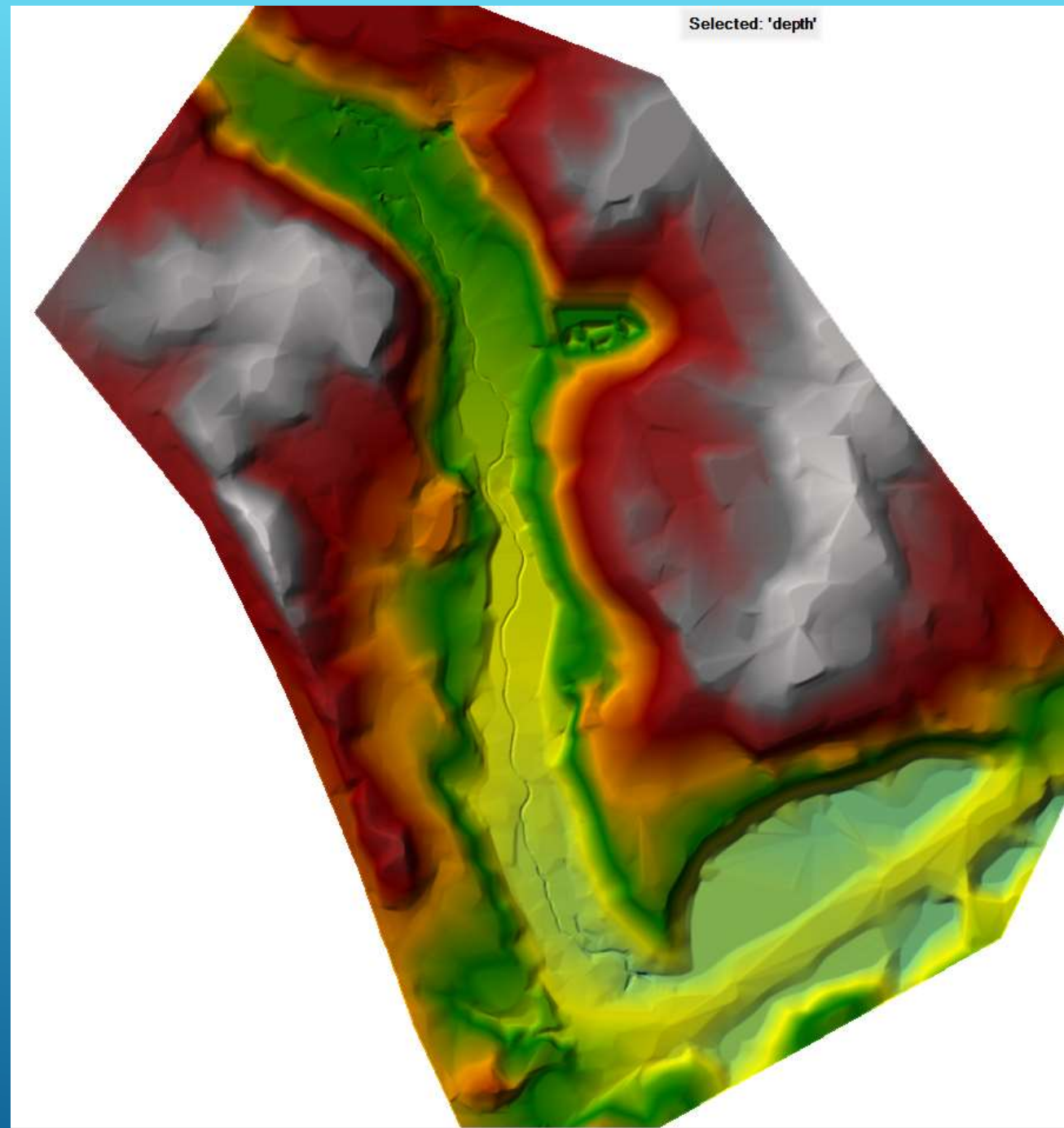


TROPICAL STORM ISAIAS

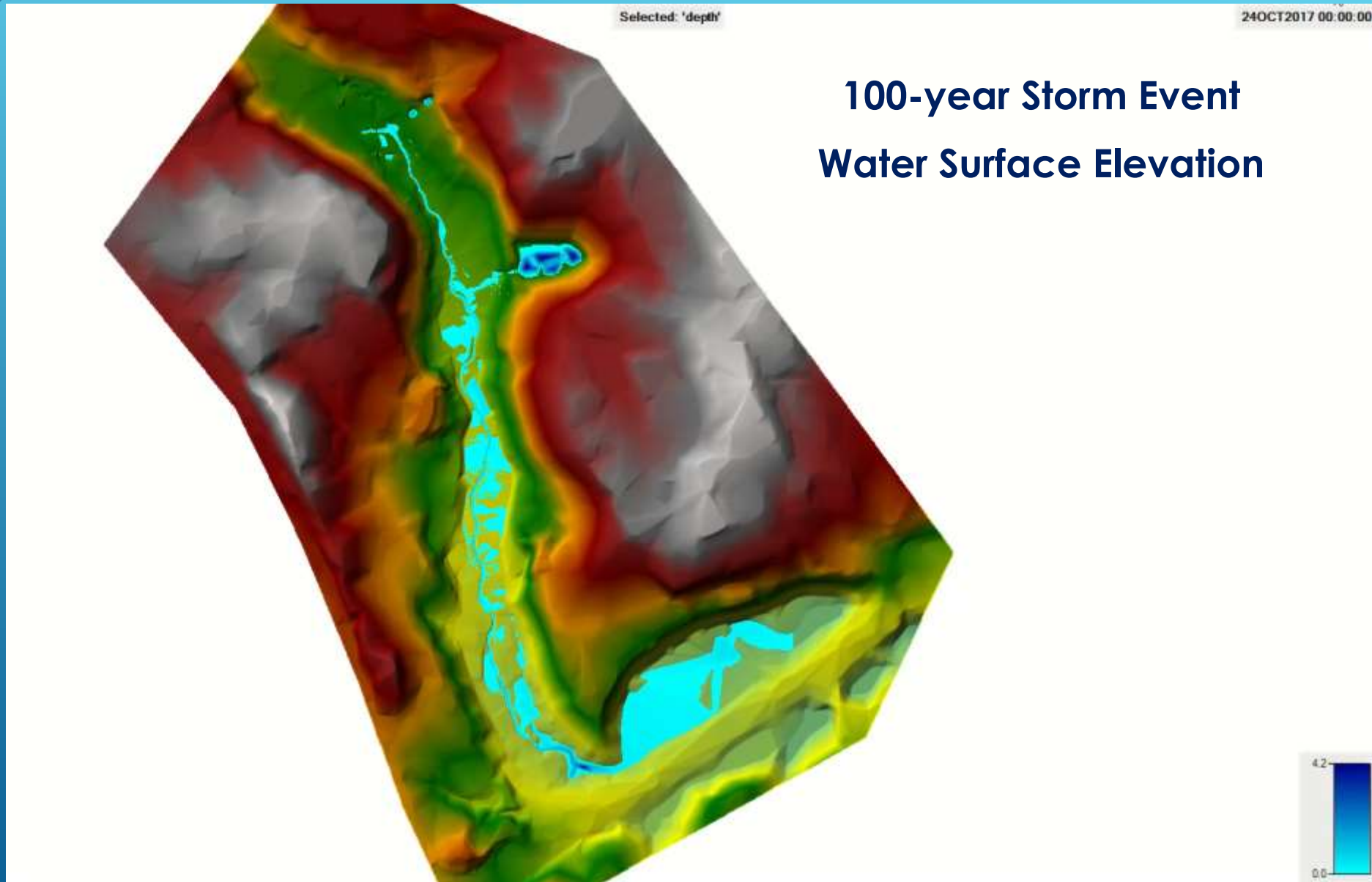
HYDRAULIC MODELING

Two dimensional (2D) unsteady flow modeling conducted to:

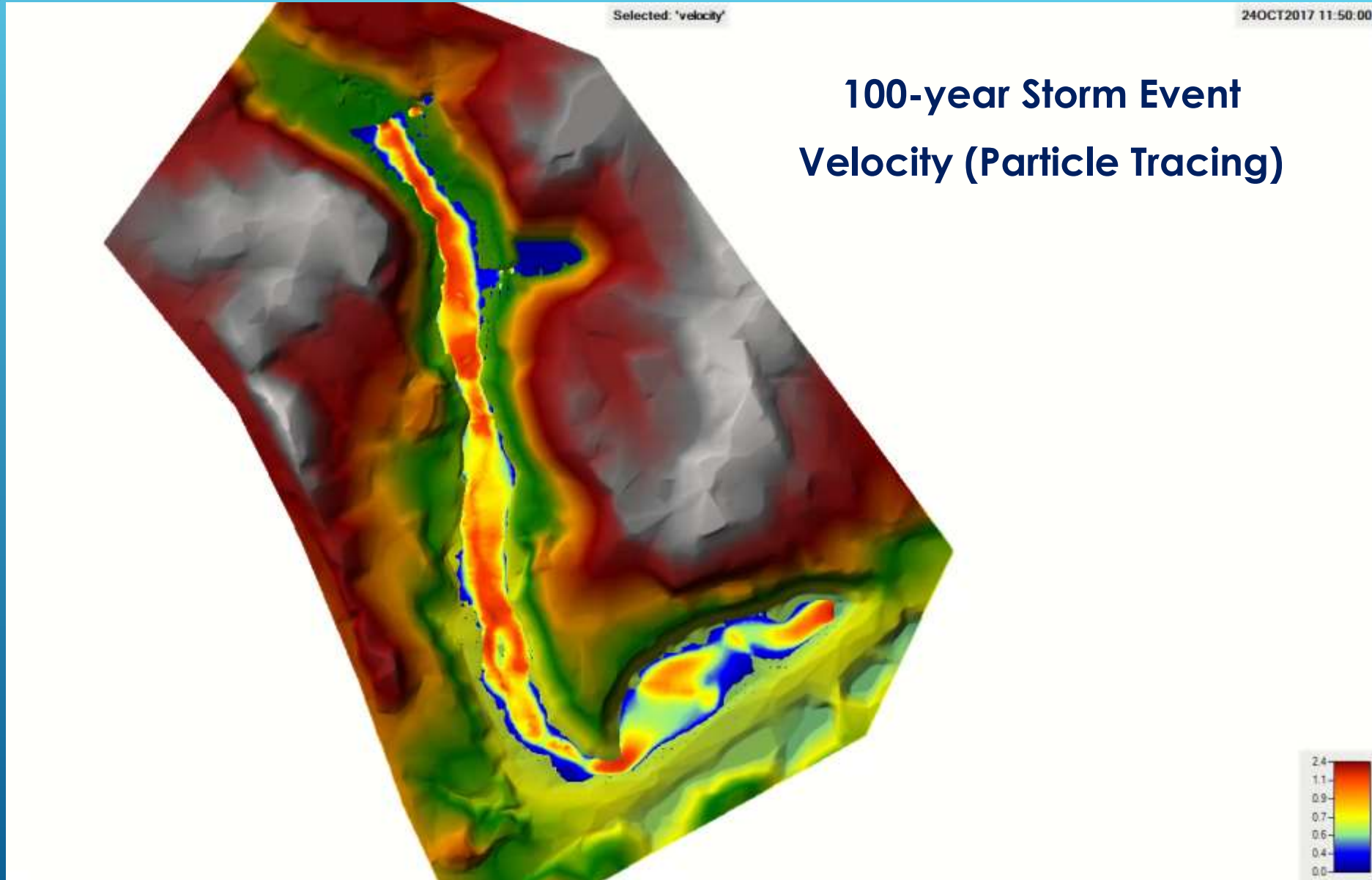
- ▶ Evaluate complex channel/floodplain interactions
- ▶ Determine near-field detail flood patterns
- ▶ Support restoration design



HYDRAULIC MODELING



HYDRAULIC MODELING



CONSTRUCTION



- ▶ **Anne Arundel County On-Call Contractor**
- ▶ **Sewer line emergency repair work completed Fall 2018**
- ▶ **BMP 110 retrofit completed Spring 2019**
- ▶ **Stream restoration/SWM wetland completed Fall 2019**



SEWER LINE EMERGENCY REPAIR- FALL 2018



STREAM – FALL 2019



STREAM – FALL 2019

POST-PROJECT CONDITIONS





SEWER LINE REPAIR – PRE AND POST CONSTRUCTION



SWM WETLAND AND BMP 110 – POST CONSTRUCTION



STREAM-POST CONSTRUCTION



JANUARY 2020





DECEMBER 2020



JUNE 2023



BIOLOGICAL MONITORING

Year	BIBI	FIBI	RBP
2016	2.43 (P)		112 (PS)
2020	1.86 (VP)		93 (NS)
2021	1.57 (VP)		134 (NS)
2022	2.43 (P)	3.00 (F)	151 (C)
2023	TBD	TBD	TBD



WATER QUALITY CREDITS

	TN (lbs/yr)	TP (lbs/yr)	TSS (tons/yr)	WQv (%)	IA (acres)
Stream Restoration	621.0	48.5	38.2	NA	65.0
SWM Wetland	41.8	4.3	1.2	66	2.4
Infiltration Basin	157.6	9.9	2.7	100	3.8
Total	820.4	62.7	42.1		71.2



WETLAND CREATION

	Pre-Restoration (acres)	Post Restoration (acres)	Change (acres)	Change (%)
LOD	0.61	2.05	1.44	338
Valley	1.21	2.78	1.57	231





CHALLENGES/LESSONS LEARNED

Groundwater Table

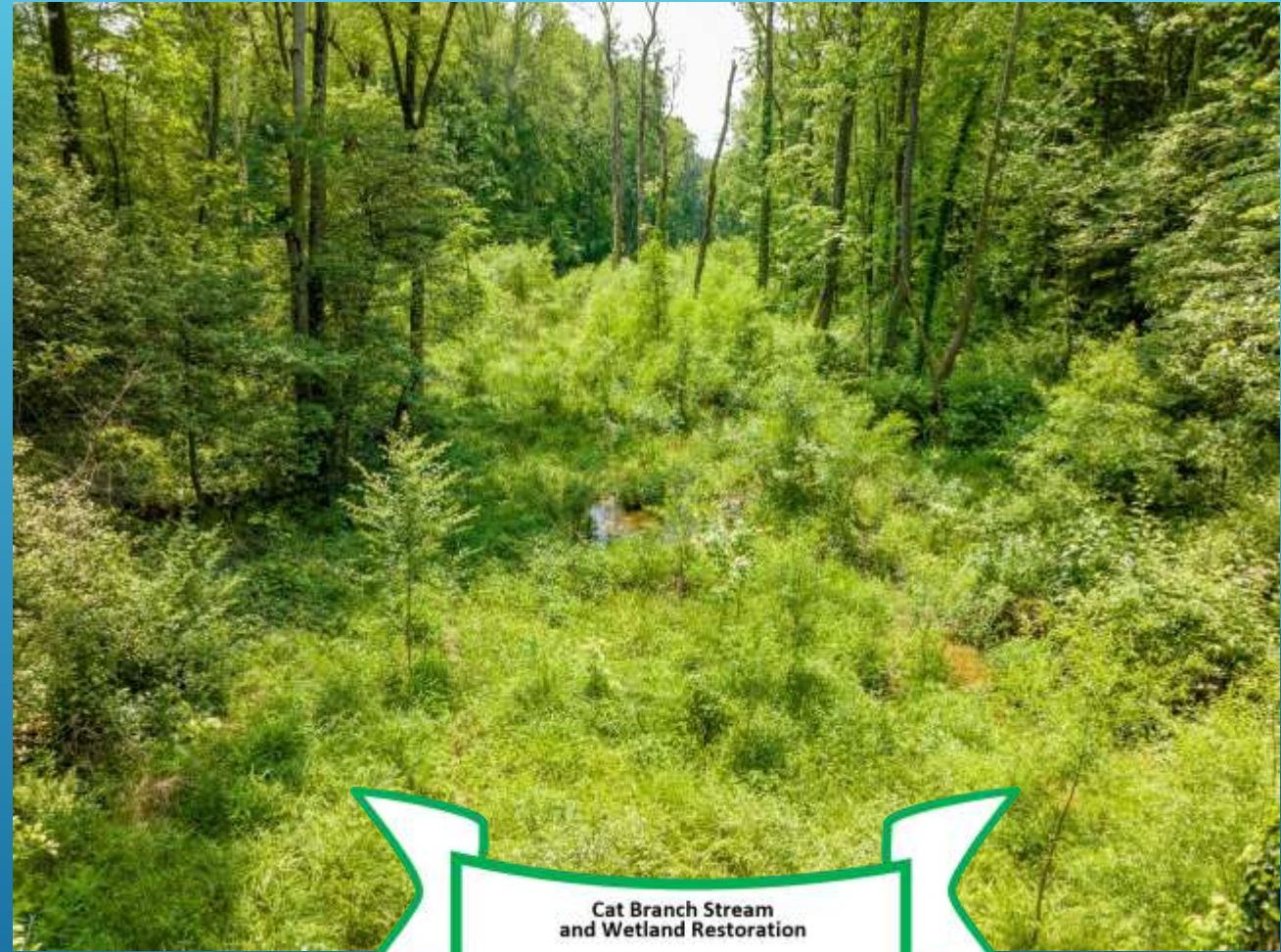
- ▶ Management of groundwater during construction
 - ▶ Include additional dewatering provisions in cost estimate when high water table expected
- ▶ Double layered matting used for access in some locations

Stabilization

- ▶ Rough grading floodplain & properly anchoring soil stabilization matting is difficult
- ▶ Wood chips/mulch for stabilization - buoyant when valley is inundated

Base Flow Channel

- ▶ Smaller, more sinuous



**Cat Branch Stream
and Wetland Restoration**

Honorable Mention by the Chesapeake
Stormwater Network for the Best Urban
BMP in the Bay Award (BUBBA)
2021

ACKNOWLEDGEMENTS

- ▶ **Anne Arundel County Bureau of Watershed Protection and Restoration**
 - ▶ Erik Michelsen
 - ▶ Jens Geratz
 - ▶ Nasrin Dahlgren

- ▶ **PayDirt, LLC**



QUESTIONS