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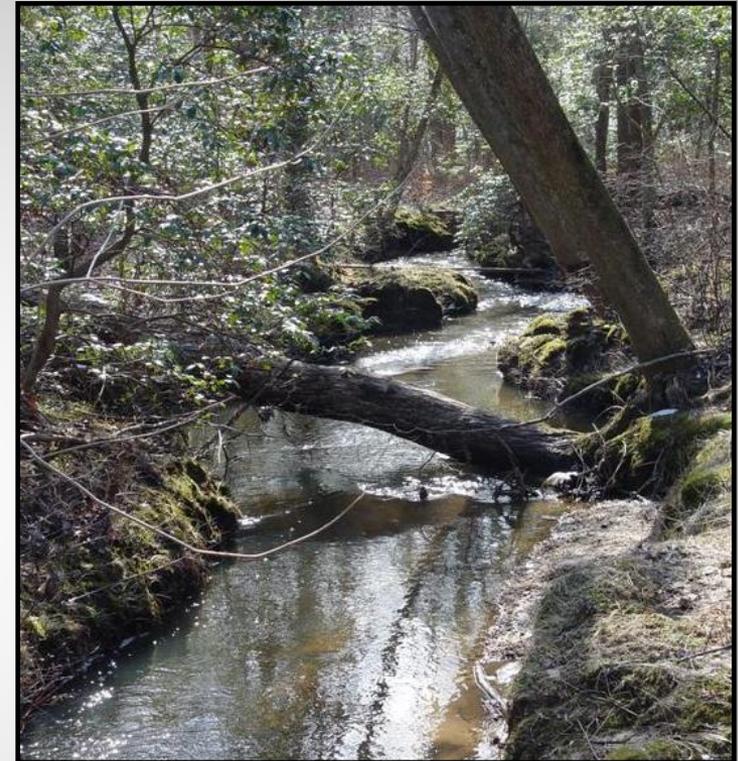
CHESAPEAKE BAY FIELD OFFICE

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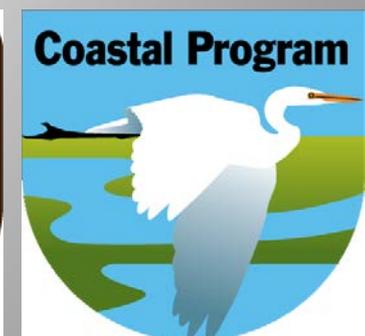


Nanticoke Tax Ditch Restoration Fawn Road to Redden Road

Brian Jennings



U.S. Fish and Wildlife Service
177 Admiral Cochrane Drive
Annapolis, Maryland 21401
www.fws.gov/chesapeakebay





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What is a Tax Ditch?

- Private Drainage Association
- Collect taxes
- Maintain Ditch network



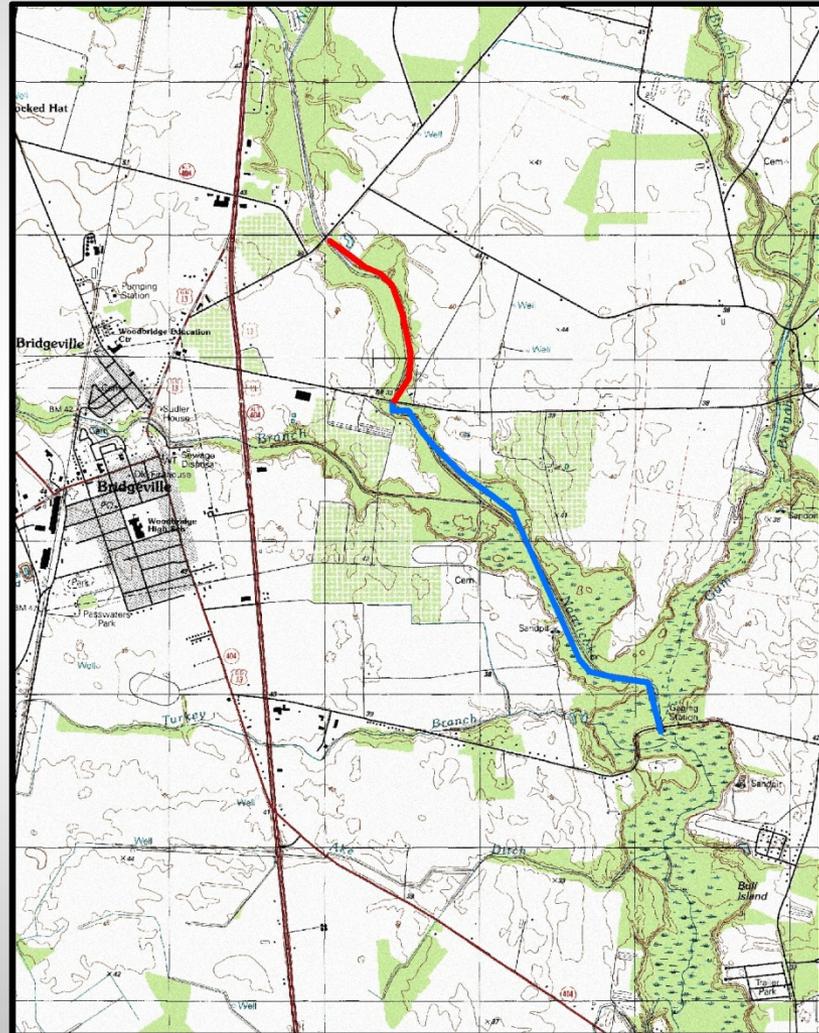
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Project Location





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Fall 2011



Winter 2011-2012





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Current Conditions North of Redden Road





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Natural Channel Design (NCD) Methodology

- Stable and resilient dimension, pattern, and profile
- Appropriate to its landform and valley
- Self-maintaining and sustaining

Stream Functions Framework

- Functional categories and functional statements
- Function-base assessment parameters
- Measurement Methods
- Performance Standards



Project Goals and Objectives

Site Constraints:

- Limited laterally by ditch right of way
- Plan form adjustments limited to existing channel alignment
- Highway Bridges at upstream and downstream end of project

Project Design:

- Continue positive drainage of watershed
- Improve sediment transport
- Apply natural channel design methodology
- Conduct Stream Functions based assessment
- Convert from F5 to B5c
- Improve bedform diversity thru in-stream structures
- Do not increase flooding to usable areas





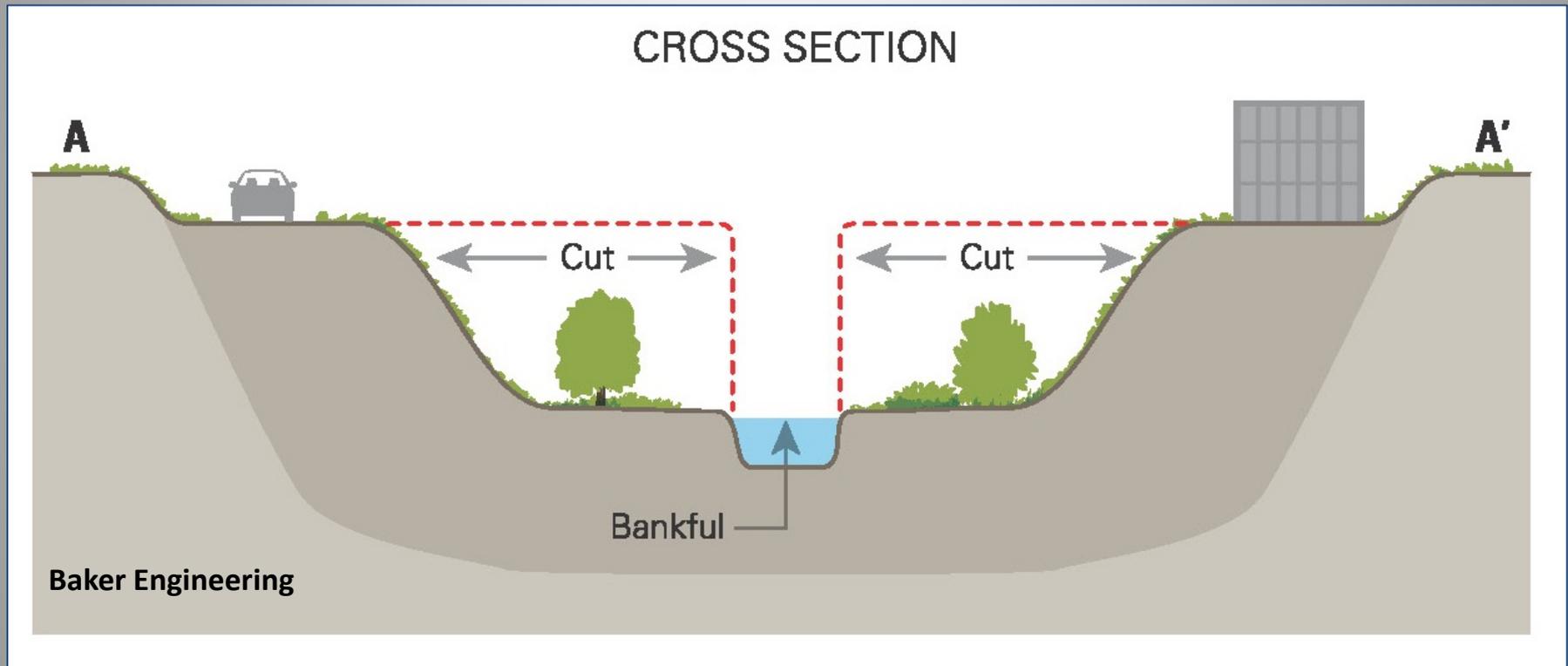
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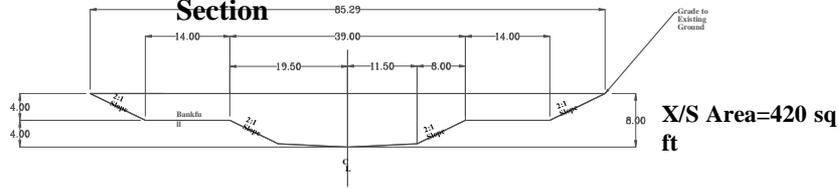


Priority 3 Restoration

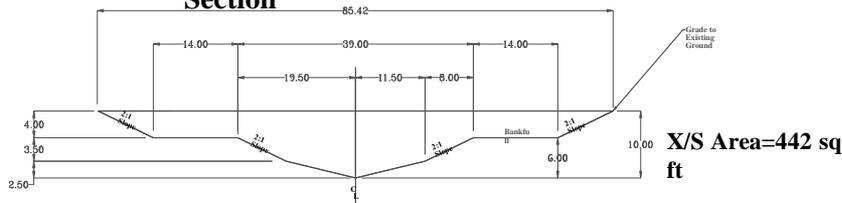


DESIGN CROSS SECTIONS

Proposed Riffle Cross Section



Proposed Pool Cross Section



Not to Scale

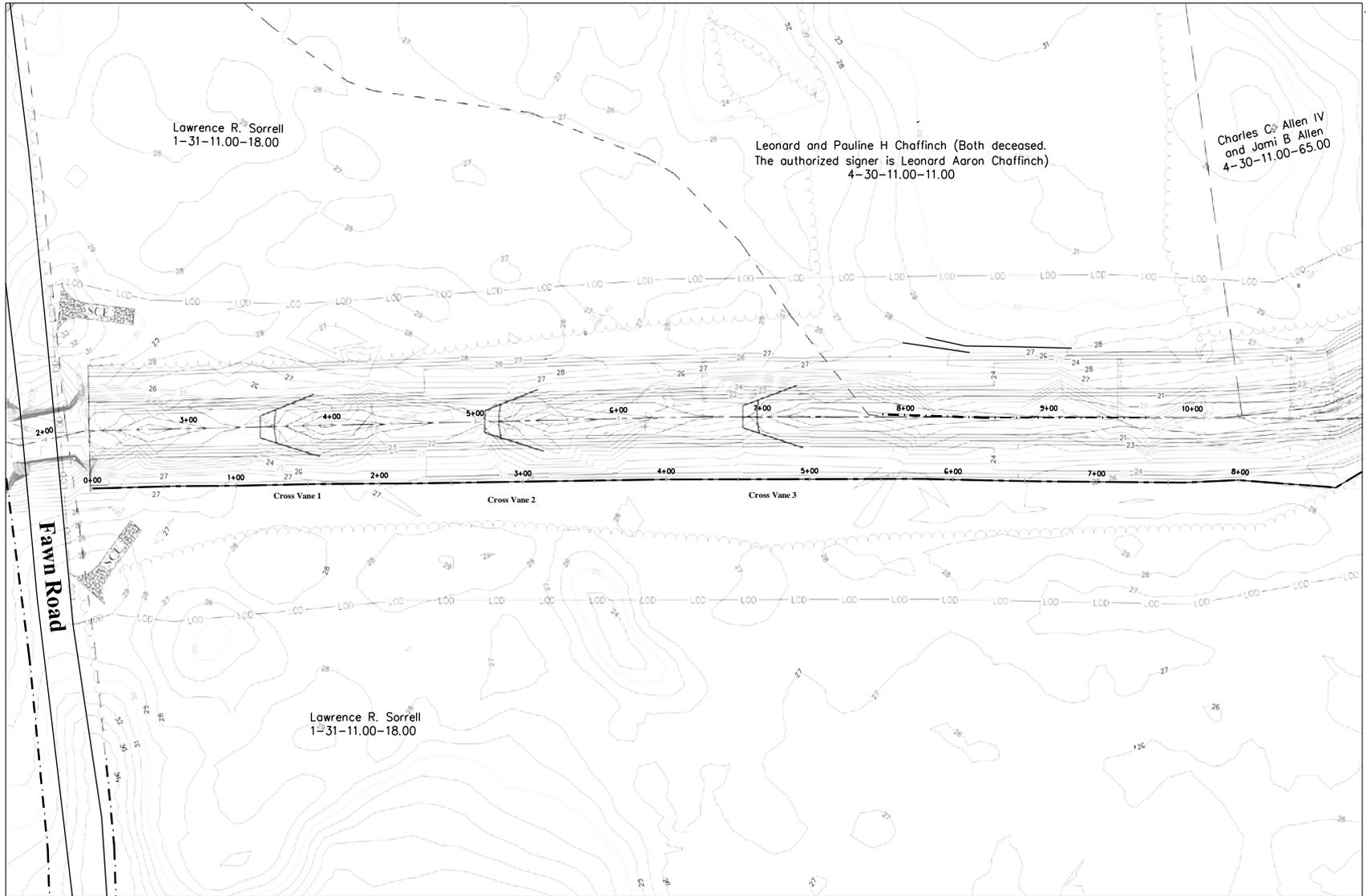
Design Criteria				Nanticoke River	
No.	Variable	Symbol	Units	Proposed Conditions	
1	Bankfull Discharge		cfs	220.00	
2	Stream Type			B4c	
3	Drainage Area		mi ²	Mean	N/A
				Min	32.7
				Max	33.5
4	Riffle Bankfull Width	W _{brf}	ft	Mean	39.00
				Min	38.00
				Max	42.00
5	Width/Depth Ratio	W/d _{brf}		Mean	13.20
				Min	12.00
				Max	14.00
6	Riffle Bankfull Cross Sectional Area	A _{brf}	ft ²	Mean	115.00
				Min	105.00
				Max	125.00
7	Riffle Bankfull Maximum Depth	d _{max}	ft	Mean	4.00
				Min	3.75
				Max	4.25
8	Mean Pool Depth	d _{brf}	ft	Mean	4.03
				Min	3.75
				Max	4.20
9	Pool Width	W _{brf}	ft	Mean	39.00
				Min	38.00
				Max	43.00
10	Pool Bankfull Cross Sectional Area	A _{pool}	ft ²	Mean	157.00
				Min	150.00
				Max	180.00
11	Max. Pool Depth	d _{brf}	ft	Mean	6.00
				Min	5.75
				Max	7.50
12	Low Bank Height	LBH	ft	Mean	4.00
				Min	3.80
				Max	4.20
13	Low Bank Height/Max. Riffle Depth	LBH/d _{brf}		Mean	1.00
				Min	0.95
				Max	1.05
14	Width of Flood Prone Area	W _{brf}	ft	Mean	85.00
				Min	80.00
				Max	N/A
15	Entrenchment Ratio	W _{brf} /W _{brf}		Mean	2.18
				Min	2.05
				Max	N/A
16	Bankfull Mean Velocity	v _{brf}	ft/sec	Mean	1.91
				Min	N/A
				Max	N/A
17	Pool to Pool Spacing/ Bankfull Width	p-p/W _{brf}		Mean	234.00
				Min	195.00
				Max	273.00
18	Average Water Surface Slope	S	ft/ft	0.0006	



NANTICOKE RIVER
STREAM RESTORATION
DESIGN CROSS SECTIONS

SHEET

7 OF



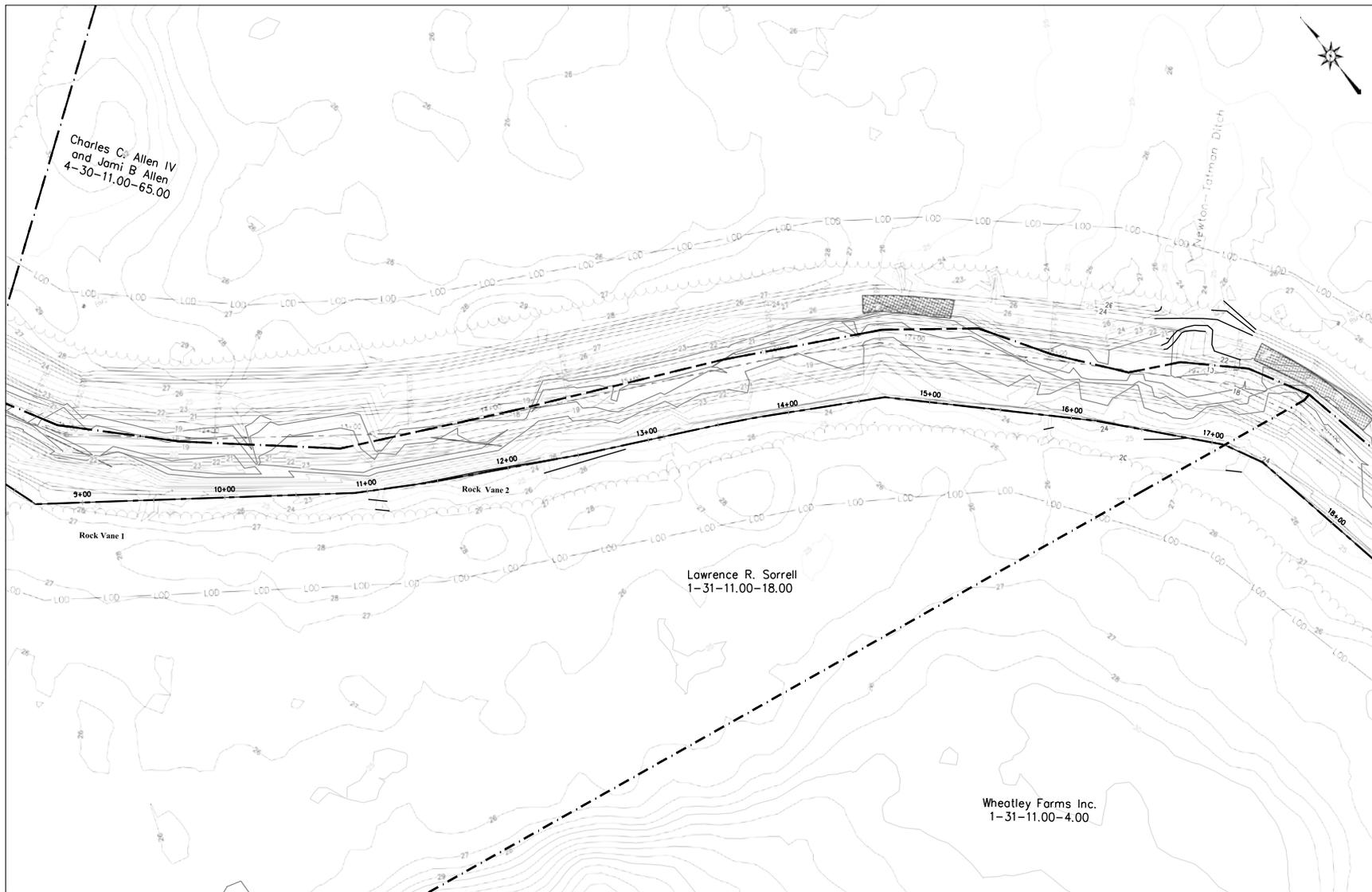
Legend

- Proposed 1' Contour ————
- Existing 1' Contour ————
- Limit of Disturbance — LOD ————
- Vane 
- Cross Vane with Step 
- Toe Wood 
- Property Line - - - - -

DATUM:
HORIZONTAL: NAD83 DE STATE PLANE US
FOOT VERTICAL: NAVD88 US FOOT



		NANTICOKE RIVER		SHEET
		STREAM RESTORATION		17 OF
		PROPOSED CONDITIONS		
REVISIONS	BY			
DA	TE			



Legend

Proposed 1' Contour
Existing 1' Contour
Limit of Disturbance

—
- - -
— LOD

Vane
Cross Vane with Step

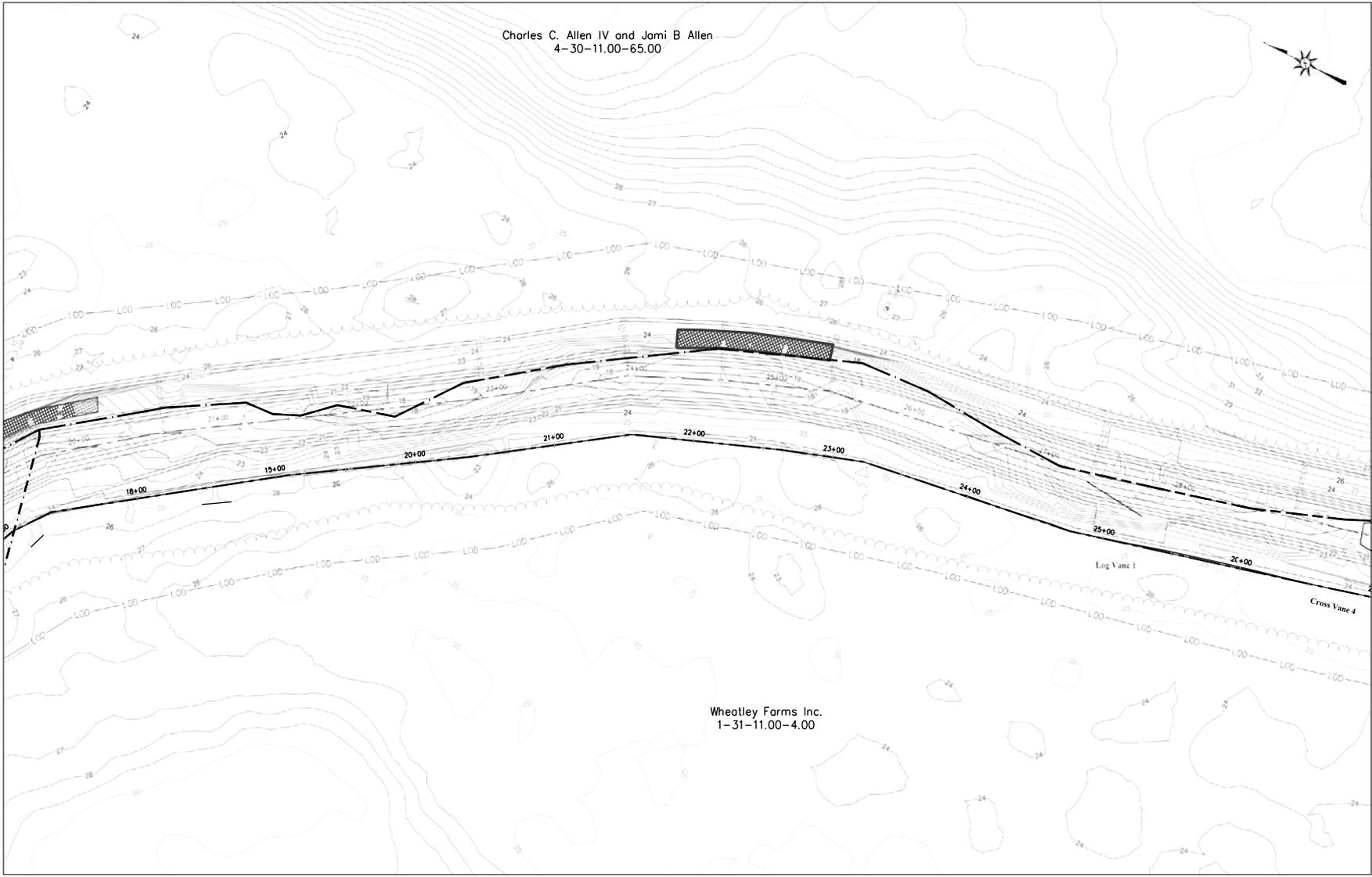


Toe Wood
Property Line



	NANTICOKE RIVER		SHEET
	STREAM RESTORATION		18 OF
	PROPOSED CONDITIONS		
REVISIONS	DA	BY	TR

Charles C. Allen IV and Jami B Allen
4-30-11.00-65.00



Wheatley Farms Inc.
1-31-11.00-4.00



Legend

- Proposed 1' Contour
- Existing 1' Contour
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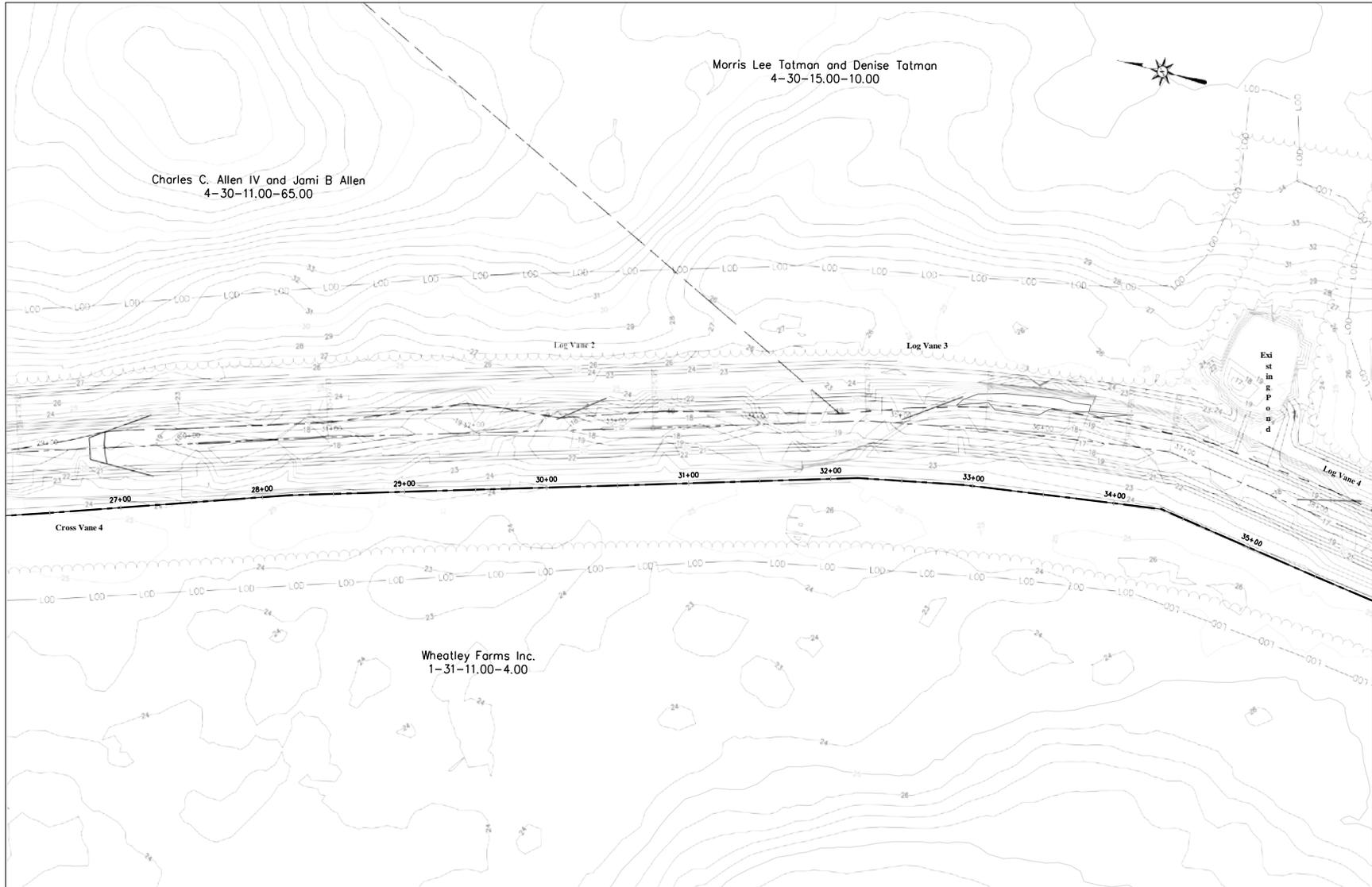


NANTICOKE RIVER
STREAM RESTORATION
PROPOSED CONDITIONS

REVISIONS
DATE BY

SHEET
19 OF

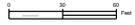
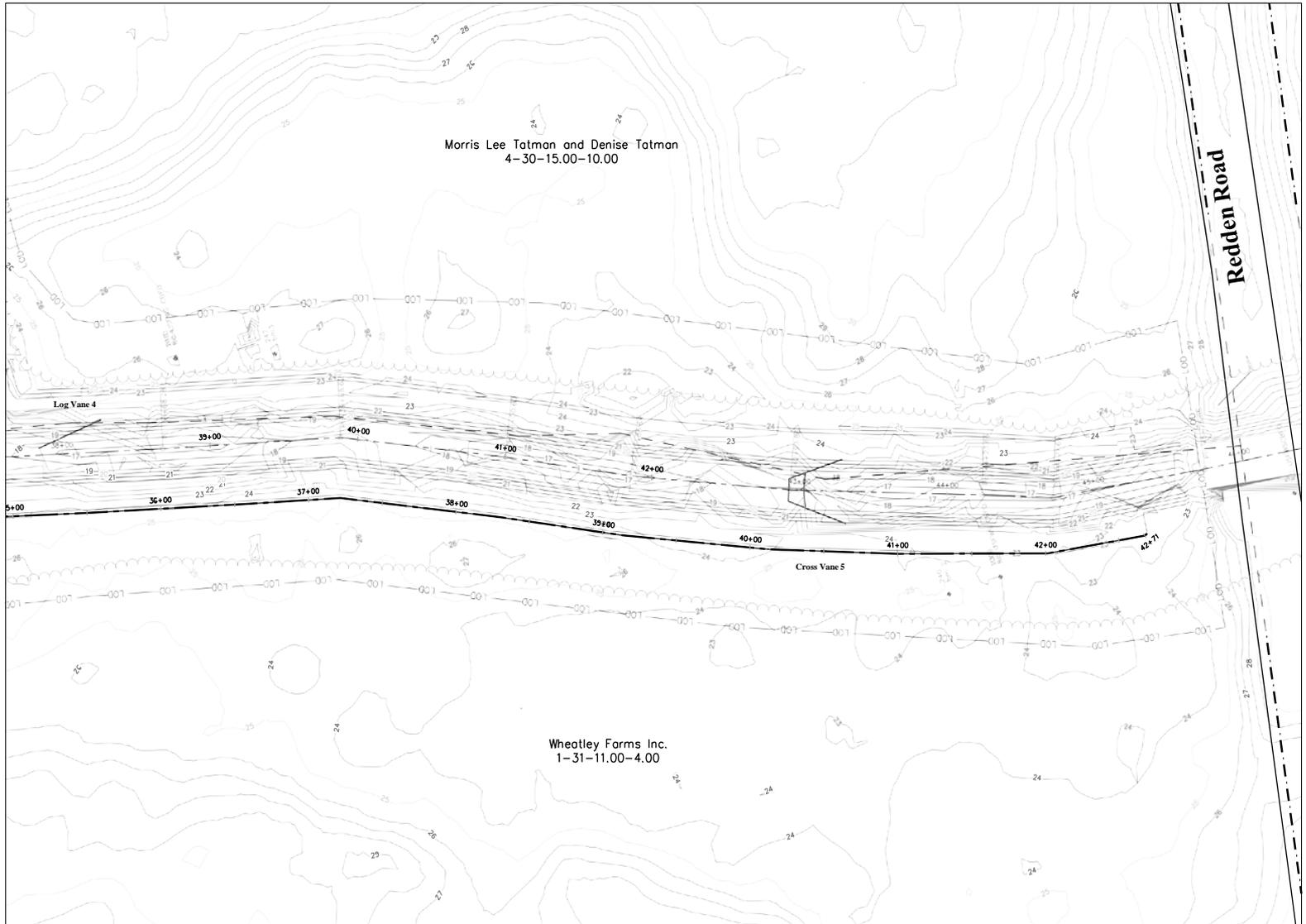
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Legend

- Proposed 1' Contour
- Existing 1' Contour Limit of Disturbance
- Vane
- Cross Vane with Step
- Toe Wood
- Property Line

	NANTICOKE RIVER		SHEET
	STREAM RESTORATION		20 OF
	REVISIONS	PROPOSED CONDITIONS	
DATE	BY		23



Legend

- Proposed 1' Contour
- Existing 1' Contour
- Limit of Disturbance
- Vane
- Cross Vane with Step
- Toe Wood
- Property Line



NANTICOKE RIVER	
STREAM RESTORATION	
REVISIONS	PROPOSED CONDITIONS
DATE	BY
TITLE	TE



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Project Benefits:

- Increased sediment transport
- Reduced maintenance costs
- Reduction of bank erosion – estimated 380 tons per year
- Reestablish riparian corridor with native plant materials
- Improved water quality – sediment reduction, DO, temperature reductions
- Improved bed form diversity
- Improved habitat for American eel, alewife, American shad, glassy darter, shield darter, American brook lamprey, and black banded sunfish





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Questions?



Brian Jennings

U.S. Fish and Wildlife Service
177 Admiral Cochrane Drive
Annapolis, Maryland 21401

brian_jennings@fws.gov

703-501-0593 (cell)