

Esopus Creek Stream Restoration Project

Demonstrating multi-objective stream restoration and monitoring as part of the Esopus Creek Stream Management Plan

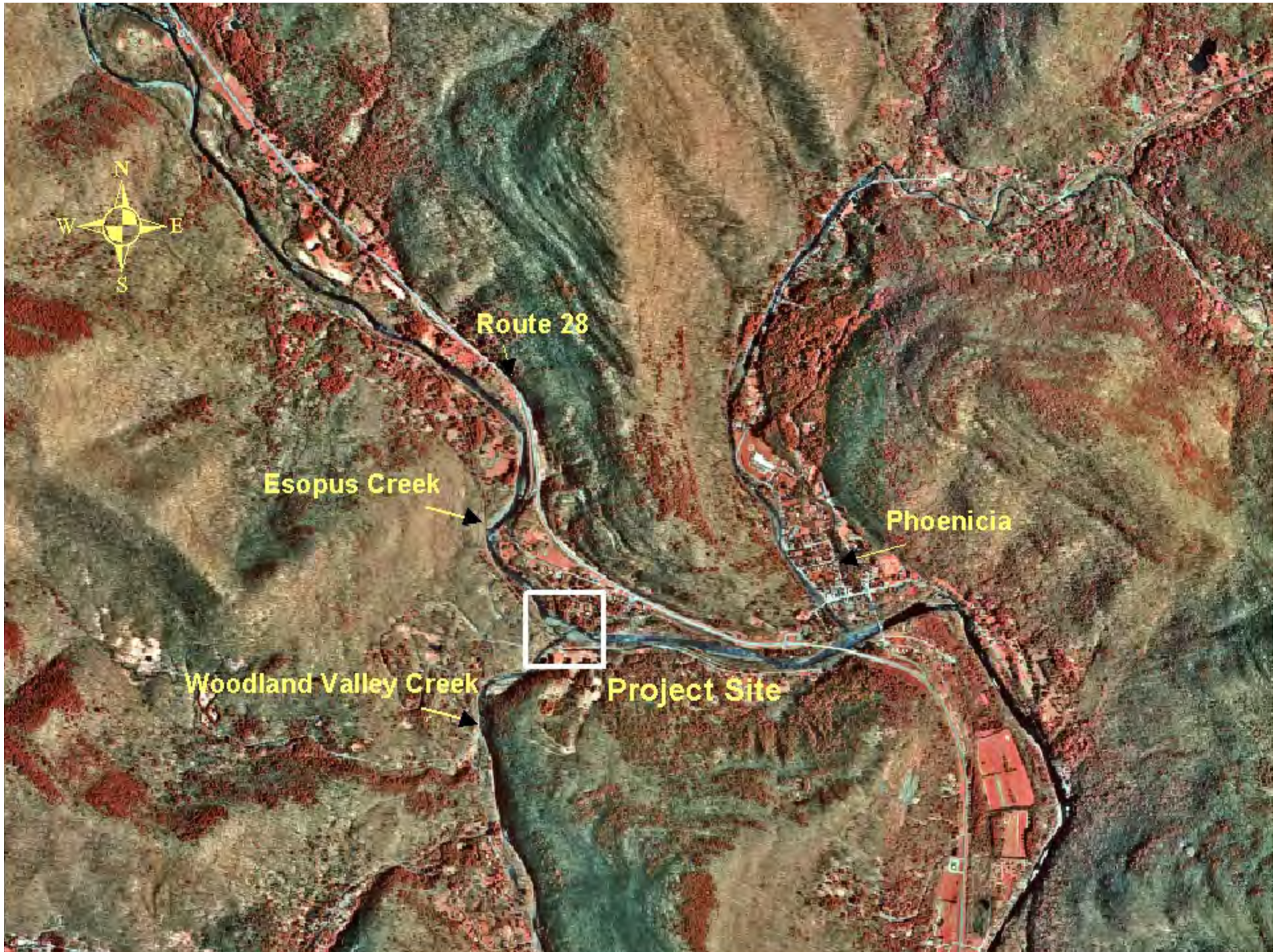


Dan Davis, NYCDEP
Gary Capella, UCSWCD
Craig Fischenich, Ph.D., P.E., FISch Engineering
Kathleen Capella, USDA-NRCS
Quentin Gahan, USDA-NRCS
Jake Wedemeyer, UC SWCD

Project Partners
NYC DEP
Ulster County SWCD
Natural Resource Conservation Service
US Army Corp of Engineers
NYS DEC

Project Background

- **NYCDEP required to develop a stream management plan for Esopus Creek and implement a stream restoration project demonstrating best management practices.**
- **Project location: years of concern about a very unstable reach on the Esopus at the Woodland Valley confluence.**







05.02.03: The eroding bank

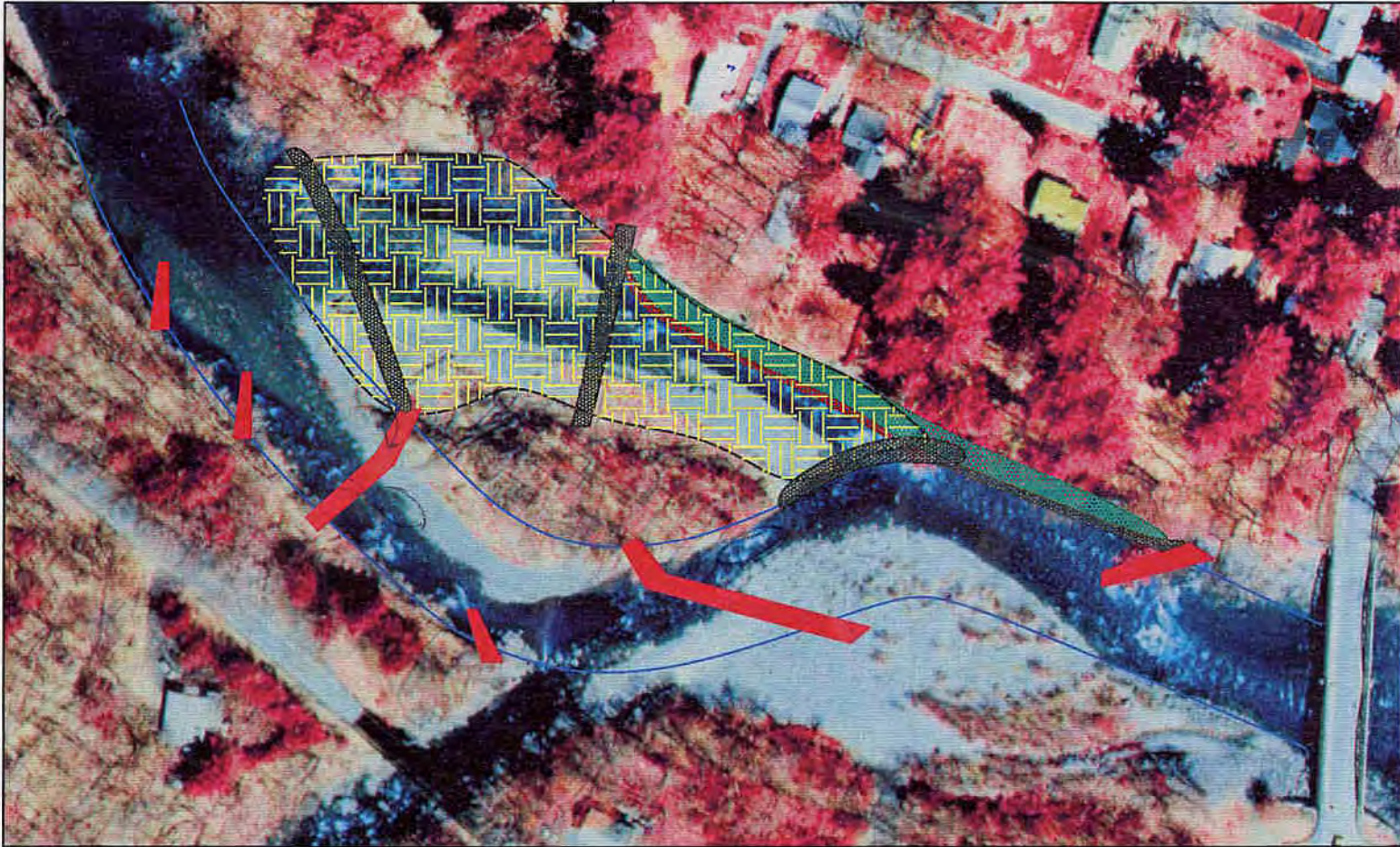
Project Design








- **In 2000 NYCDEP hired FIScH Engineering to assess the stream reach and propose a set of possible solutions to the problem.**
- **The preferred design included a combination of NCD, bioengineering, and traditional engineering approaches.**

Project Goals and Objectives

- **Protect water quality**
 - Stabilize channel to prevent erosion into clay-rich sediments and excavation of septic systems
- **Protect property**
 - Restore reach to single channel away from eroding bank
 - Direct erosive flow away from banks
- **Consider aquatic ecology and recreation**
 - Create more complex habitat than exists
 - Provide good whitewater recreation conditions
- **Test BMP**
 - Implement a set of BMPs
 - Monitor to evaluate performance

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED



-  Fill Zone
-  Stone Channel Block
-  VRSS System
-  Flagstone
-  Apx. Channel Boundary
-  Vane
-  Weir



General Plan
Esopus Creek
New York City DEP

FISch Engineering

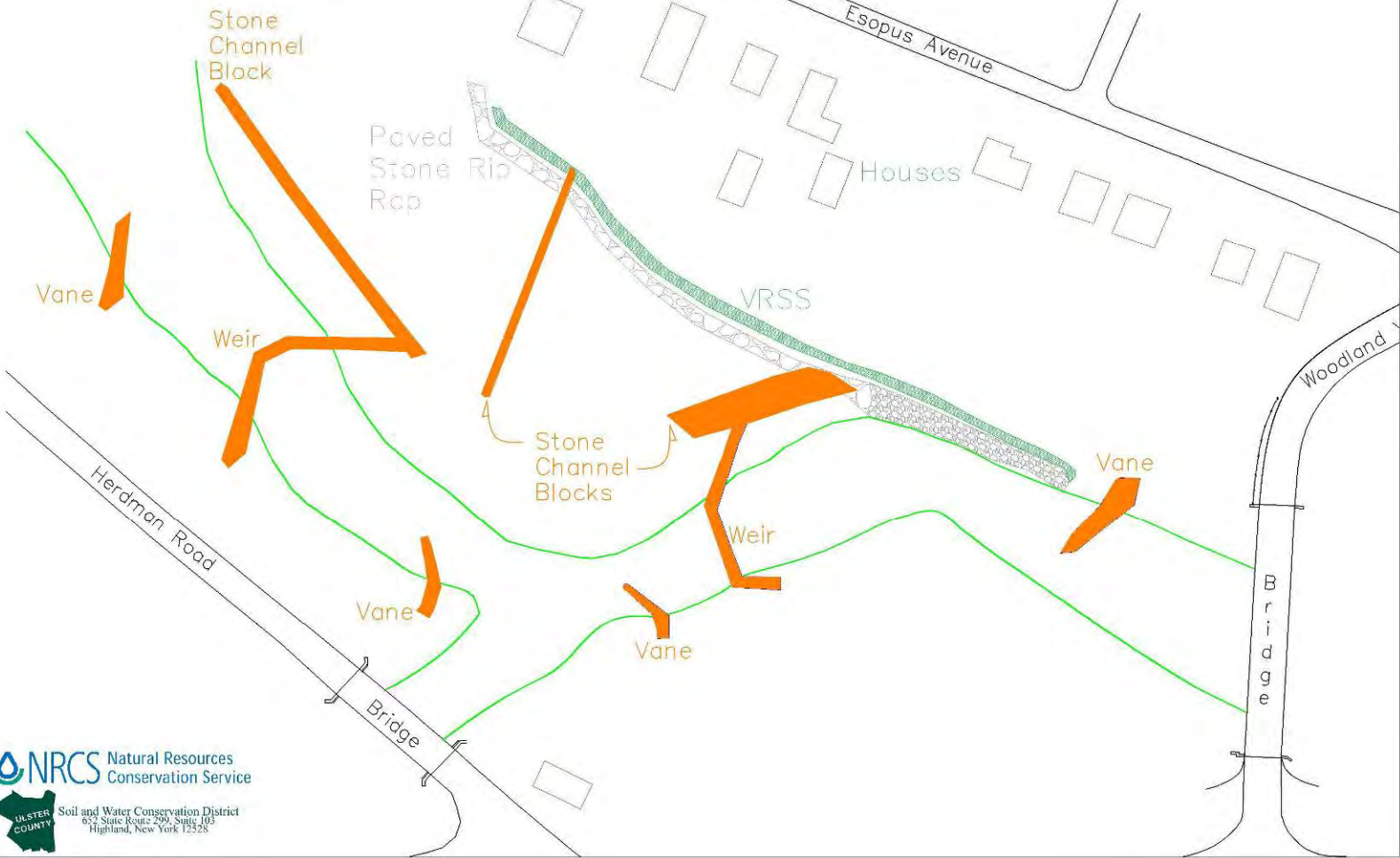
1100 Newit Vick
 Vicksburg, MS 39183

SIZE	FSCM NO.	DWG NO. 2	REV
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SCALE 1" = 125'

SHEET

2003
Waterline —
(Post Construction)



 **NRCS** Natural Resources Conservation Service

 Soil and Water Conservation District
657 State Route 299, Suite 103
Highland, New York 12525

Project Construction

- **In 2003 NYCDEP hired UCSWCD to obtain permits, hire contractors, and manage project construction.**
- **USACE contributed substantial funding and NRCS provided in-kind engineering service.**
- **NYCDEP and UCSWCD will monitor and maintain for 10 years**



View from Woodland Valley Bridge

10.21.02



08.13.03: Pre-construction



08.13.03: Pre-construction



View from Woodland Valley Bridge

08.20.03



Dewatering in a saturated cobble bar

08.22.03



Constructing DS Boulder Weir

08.22.03



View from Woodland Valley Bridge

08.29.03



View from Woodland Valley Bridge

09.02.03



Diverting Esopus Creek high water with jersey barriers and berms 09.02.03



Diverting Esopus Creek flow into north channel

09.11.03



Constructing US boulder weir in glacial lake clay substrate

09.02.03



Glacial lake clay substrate in south channel

09.02.03



Completed US weir/vane

09.03.03



Installing channel blocks (buried rip rap) in flood plain

09.05.03



Constructing DS boulder weir in Esopus yooahoo

09.08.03



Project construction dewatering

09.11.03



Opening up the south channel

09.16.03



First flush of Esopus Creek in new south channel

09.16.03



View from Woodland Valley Bridge

09.17.03



09.17.03



09.17.03



09.17.03



09.18.03



Stream bank armoring with graded rip rap

09.22.03



Flood flows over partially constructed floodplain

09.23.03



NRCS designed and installed “paved” rip rap

09.24.03



View from Woodland Valley Bridge

09.28.03



View from Woodland Valley Bridge

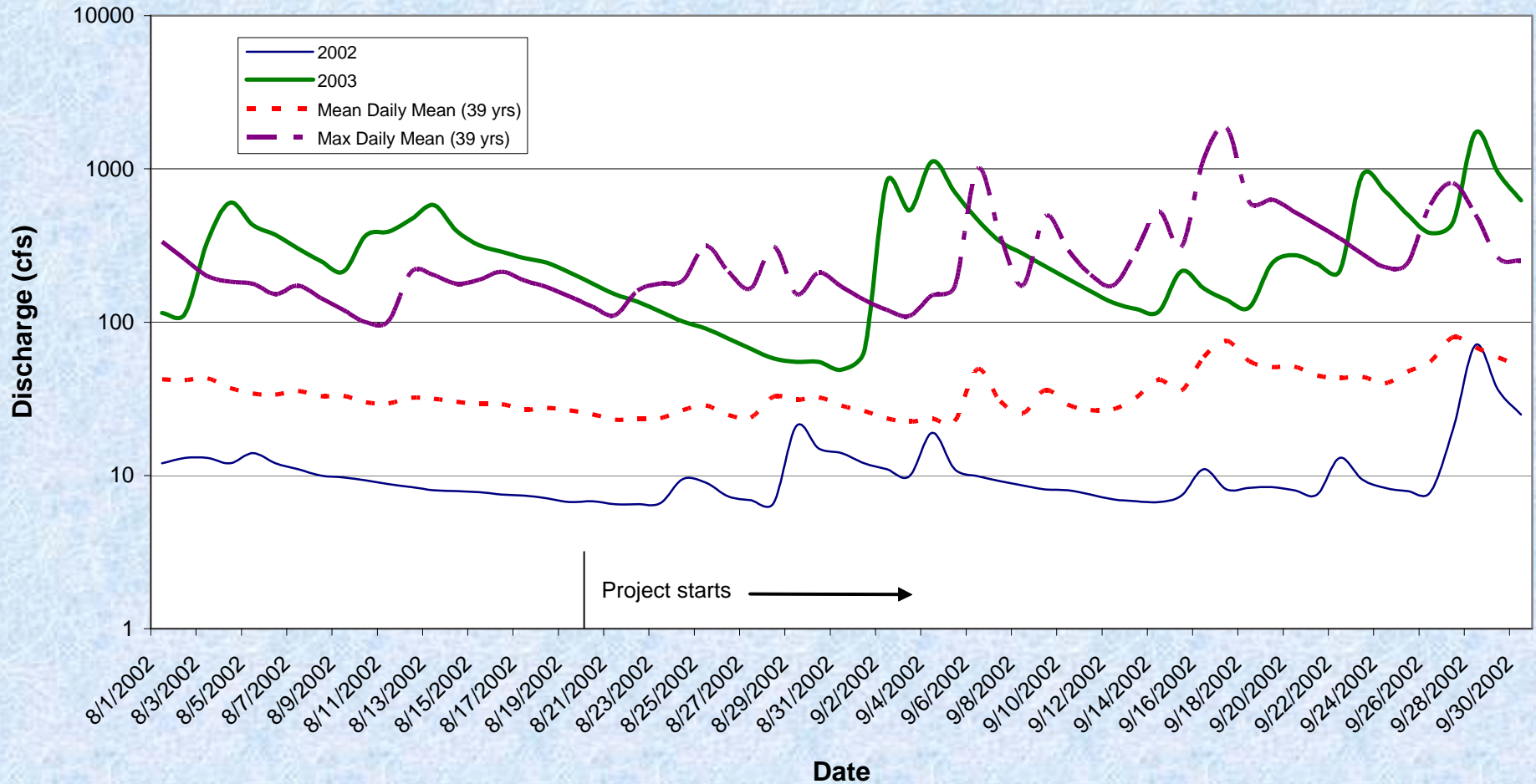
10.01.03



Completed channel work

10.16.03

Comparison of Mean Daily Discharges at the Esopus Creek at Allaben, NY Gage during August-September





View from Woodland Valley Bridge

10.29.03



11.11.03



11.19.03



11.24.03



11.24.03

Bioengineering: constructing VRSS, willow fascines, planting trees



Vegetated Reinforced Soil Slope

12.04.03



Vegetated Reinforced Soil Slope

12.04.03

RESTORATION?



1964

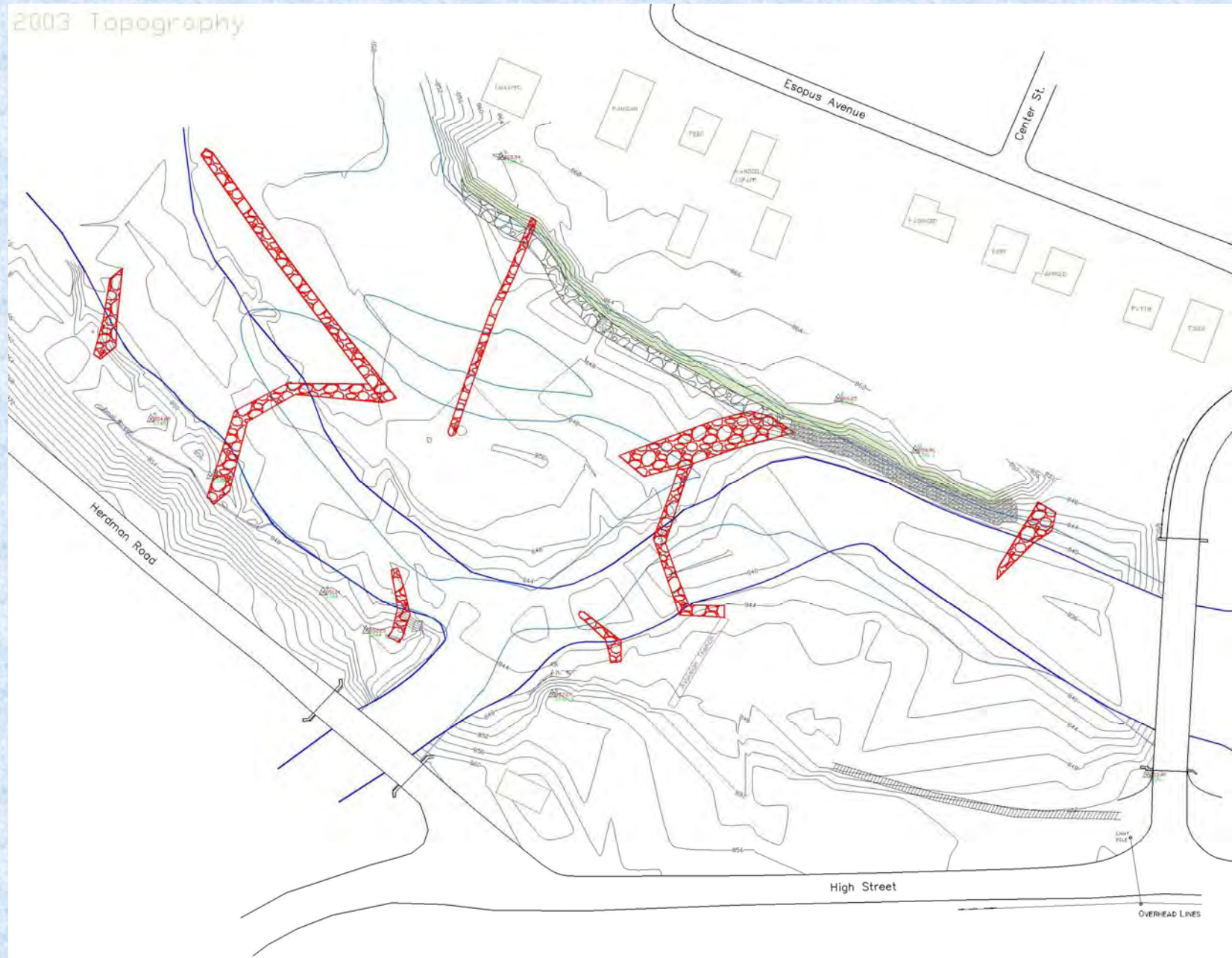


2003

Project Post-Construction Monitoring

- **UCSWCD and DEP perform quarterly visual monitoring visits using a monitoring protocol.**
- **FIScH Engineering has made two post-construction inspection visits.**
- **UCSWCD has completed three post-construction topographic and cross-section surveys**

Post-Construction As-Built Survey





Project one year later

August, 2004



Vegetated Reinforced Soil Slope – first growing season

July, 2004



Willow fascines – first growing season

July, 2004



View from Woodland Valley Bridge

04.03.05



Stream bank and bed erosion

04.03.05



Floodplain deposition

04.03.05



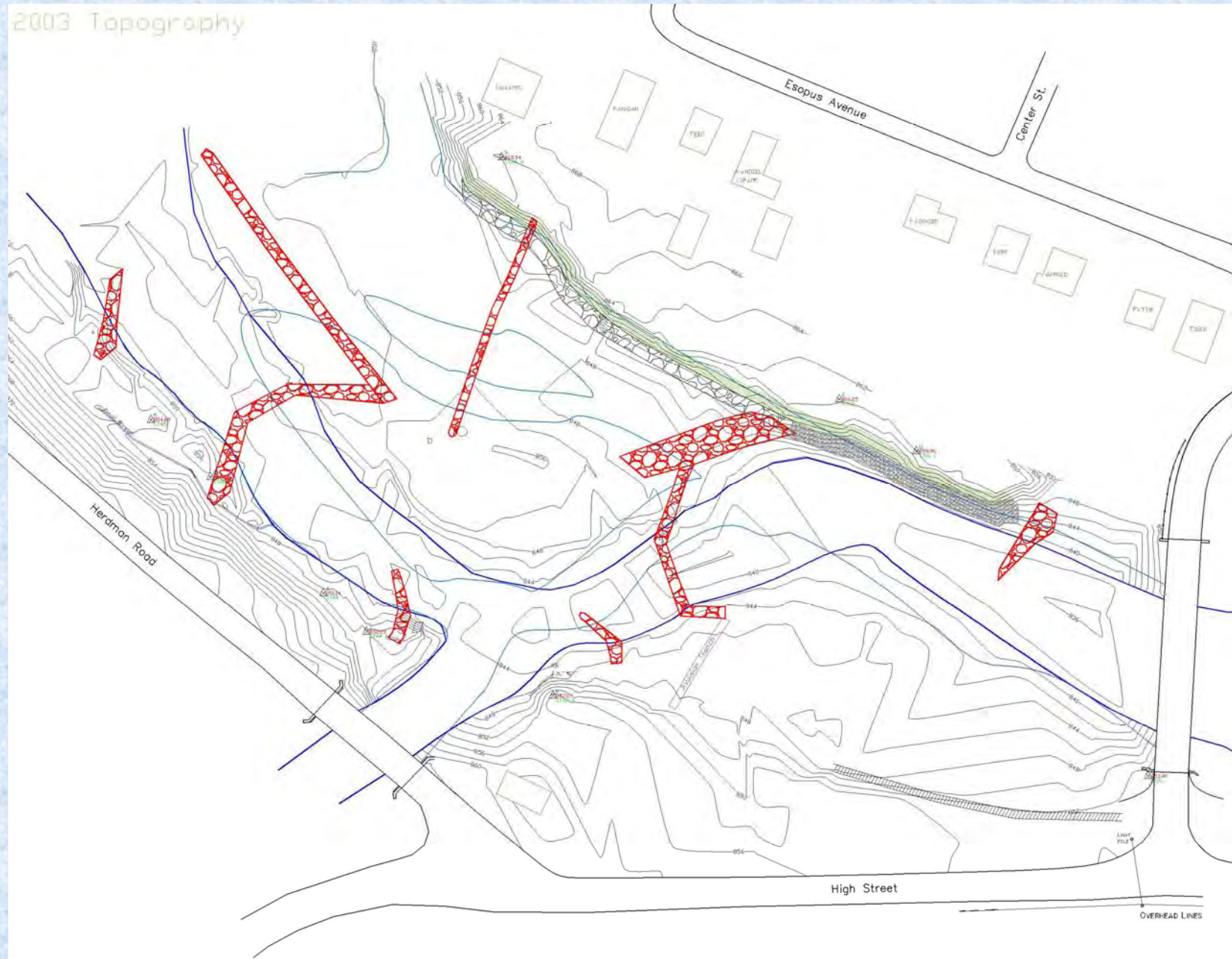
Post-flood project

04.05.05

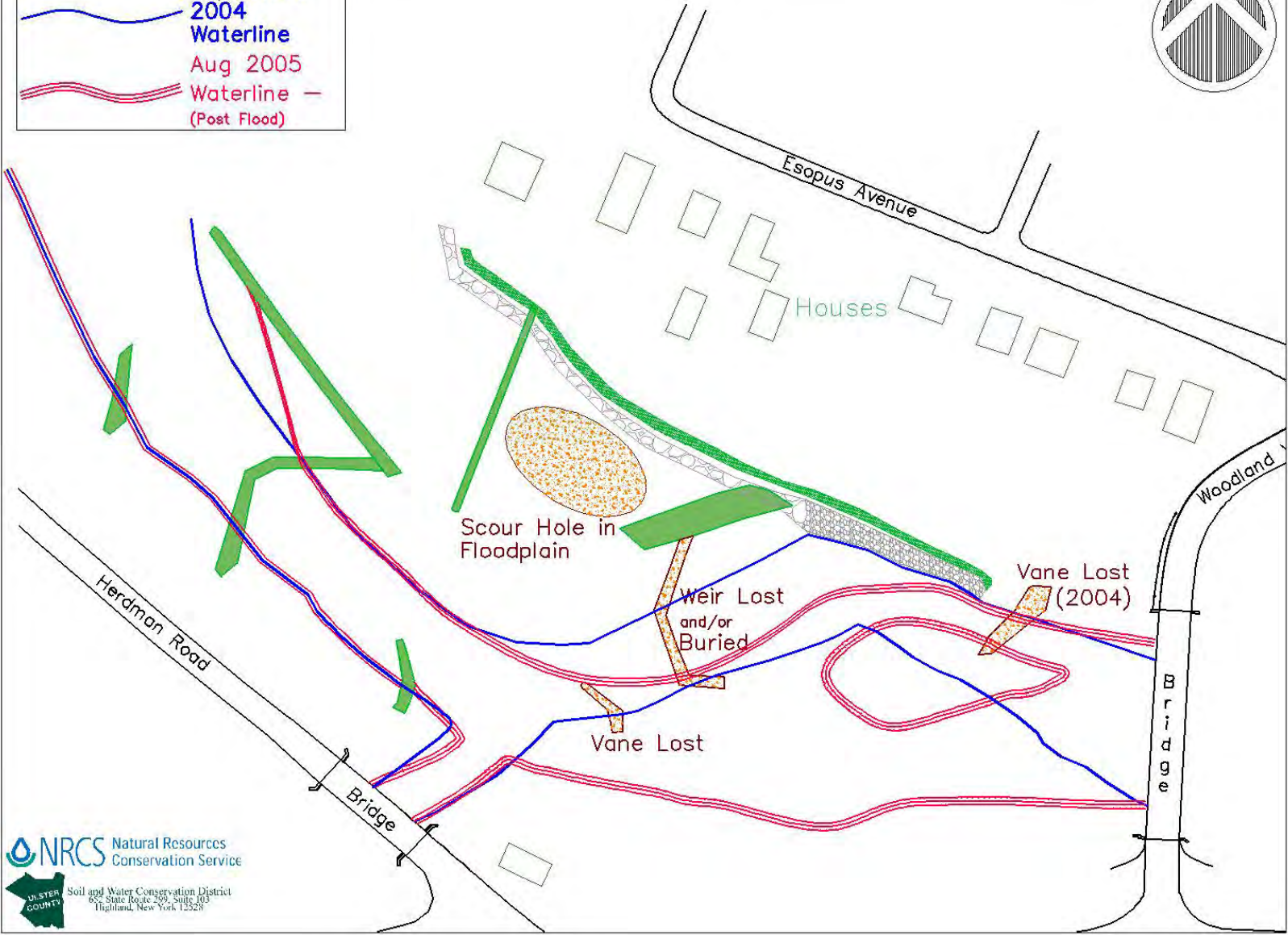
Post-Flood Topo Survey



Post-Construction As-Built Survey

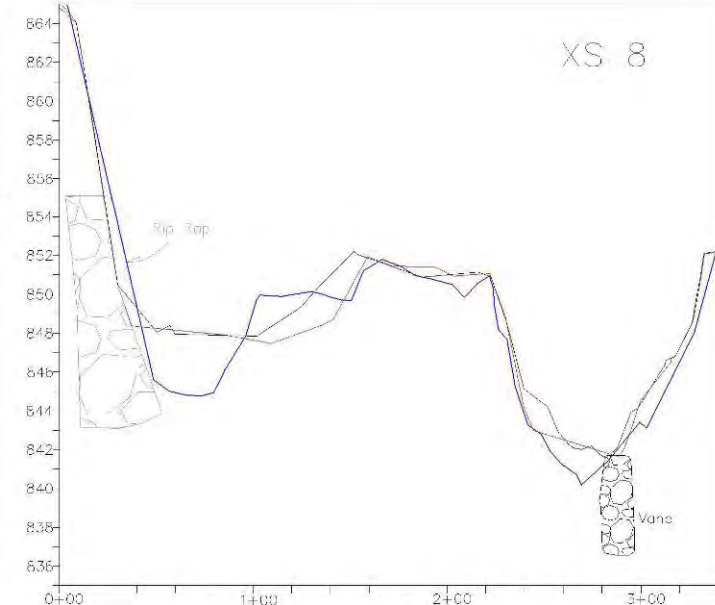
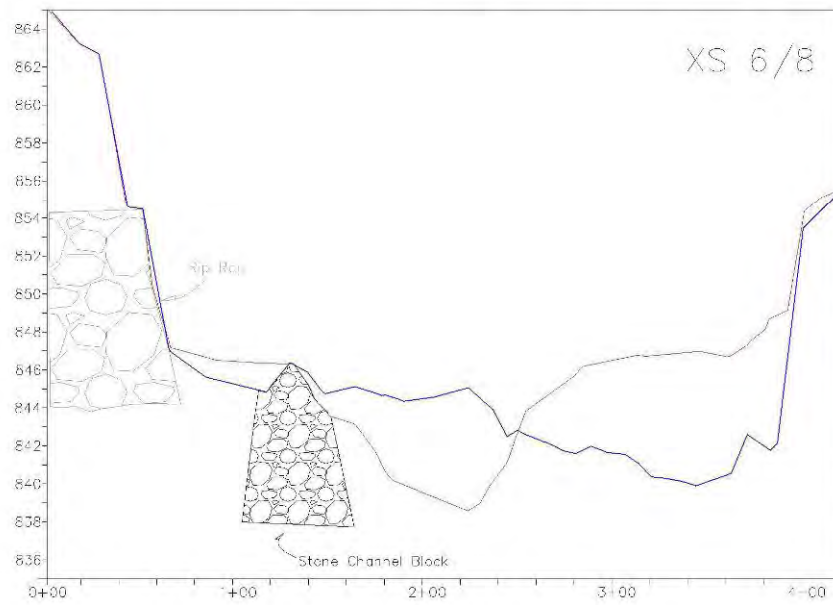
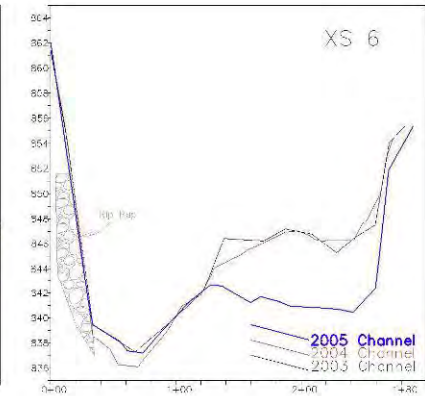
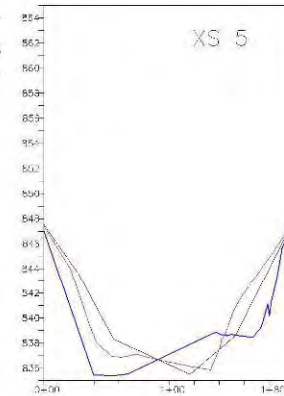
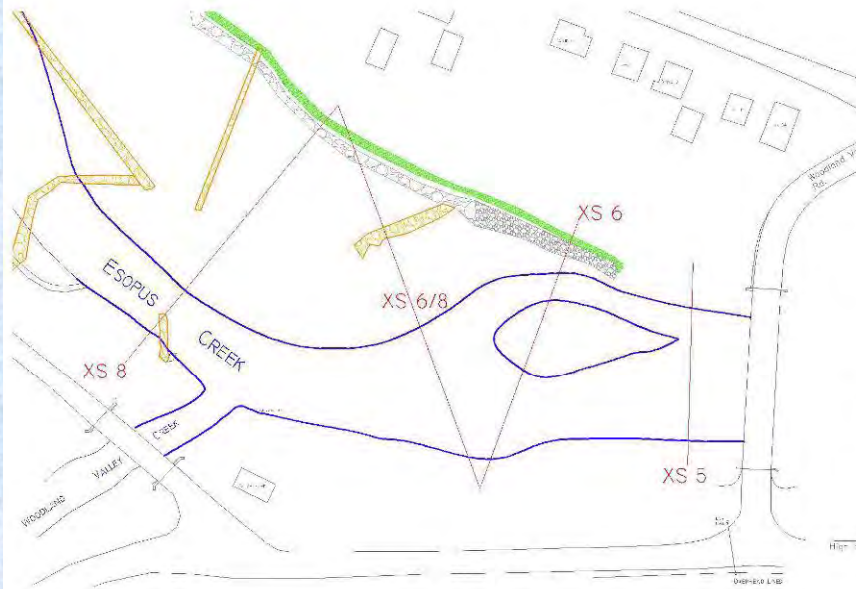


 September 2004 Waterline
 Aug 2005 Waterline — (Post Flood)



 **NRCS** Natural Resources Conservation Service
 Soil and Water Conservation District
 68 State Route 299, Suite 103
 Highland, New York 12529

Post-Flood Hydraulic Geometry Changes



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Conclusions

- **Lessons in fluvial hubris - “The Esopus Creek does not run on paper”**
- **Accommodating mountain river confluence within project reach – implications for planform and hydraulic geometry and bedload transport**
- **Vegetation – key to project stability yet most difficult to get established**
- **Monitoring – key to quantifying project performance in order to improve BMP design**