



wood.

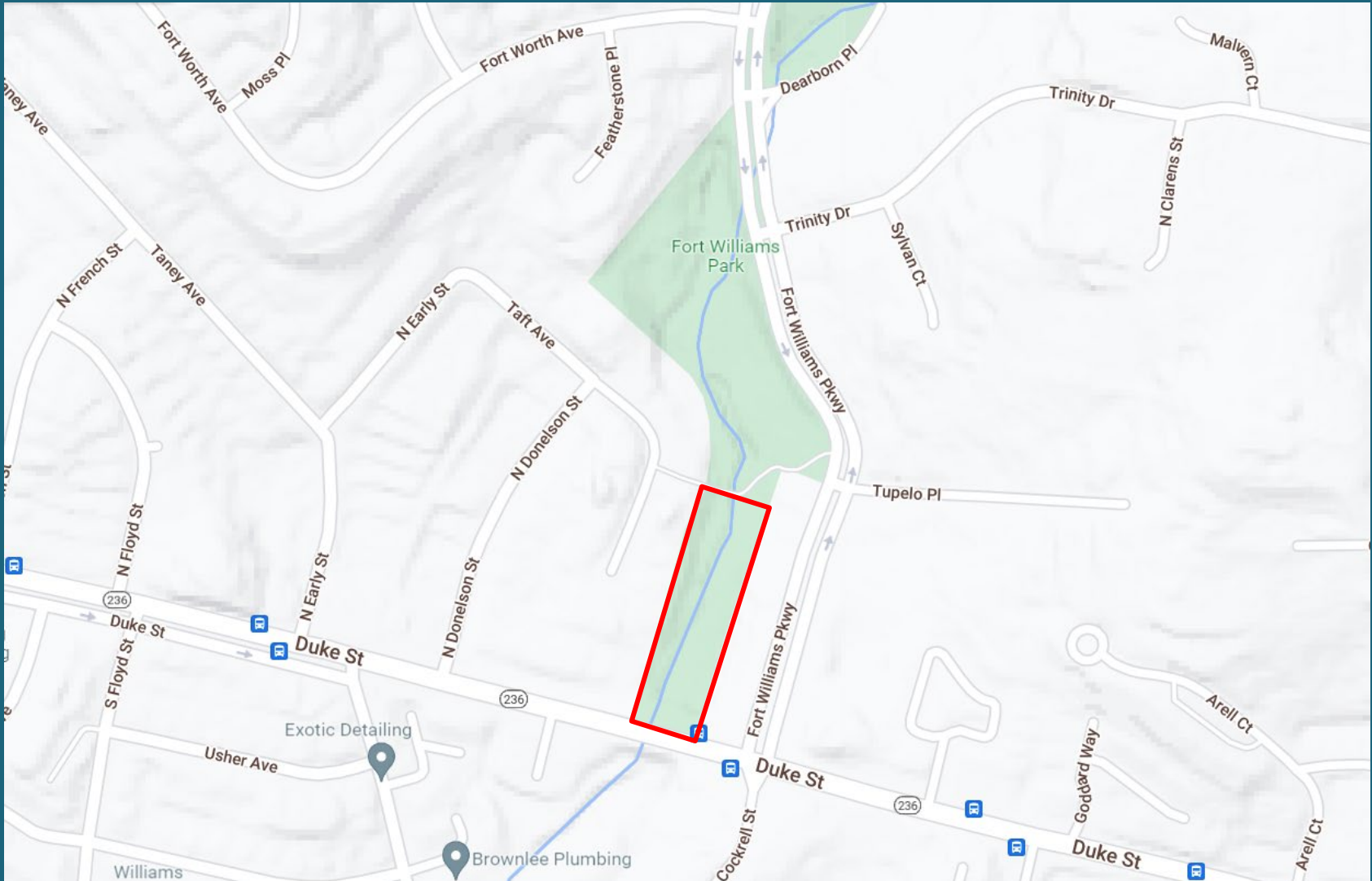
Strawberry Run Downstream Forensic Investigation

JUNE 27, 2022

Environmental Policy Commission

Presented by: Troy Biggs, PE, PH, D.WRE

Study Location



Agenda

- Overview of the problem
- Failures
- Likely contributors to failure
- Recommendations

Overview Of The Problem

- Prior stream assessment (2008) identified the entire segment as having degraded conditions
- Developer led downstream segment stream restoration project performed the work as part of the Taft Avenue subdivision development completed in 2010
- Focused on 600 feet of stream from the bridge to Duke Street of City property
- Recent large storm events in the last three years have impacted the project and accelerated destabilization of the stream
- Forensic investigation to diagnose the nature and causes of bed and bank instability

Consensus Recommendations for Improving the Application of the Prevented Sediment Protocol for Urban Stream Restoration Projects Build for Pollutant Removal Credit (revised 2/27/2020).
(https://chesapeakestormwater.net/wp-content/uploads/dlm_uploads/2020/03/PROTOCOL-1-MEMO_WQGIT-Approved_revised-2.27.20_clean_w-appendices.pdf)

Overview Of The Problem



Overview Of The Problem



Channel
Incision In
Strawberry
Run

2021.11.11

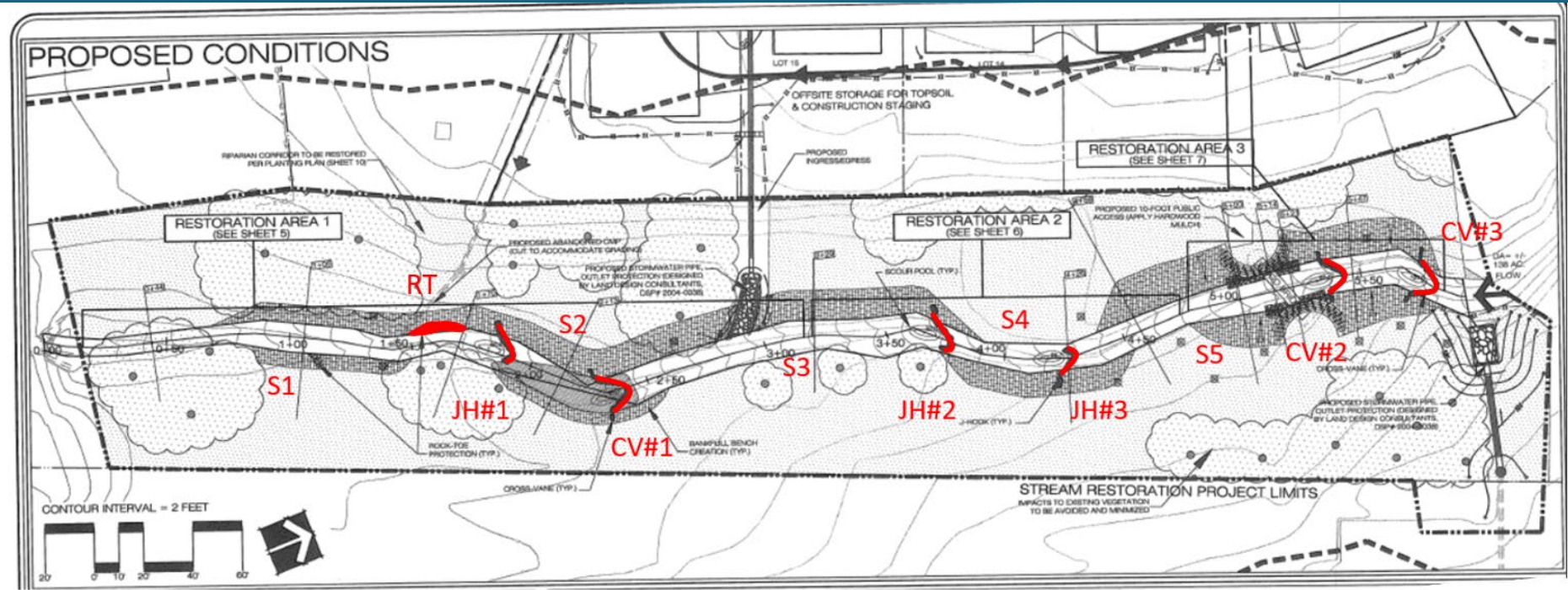
11/11/21 (Looking upstream towards pedestrian bridge)

Overview of the Problem



11/11/21

Solutions Proposed In 2008



Structures deployed:

- Cross-Vanes (CV)
- J-Hooks (JH)
- Rock Toe Retention (RT)

Example: Cross-Vane Structure



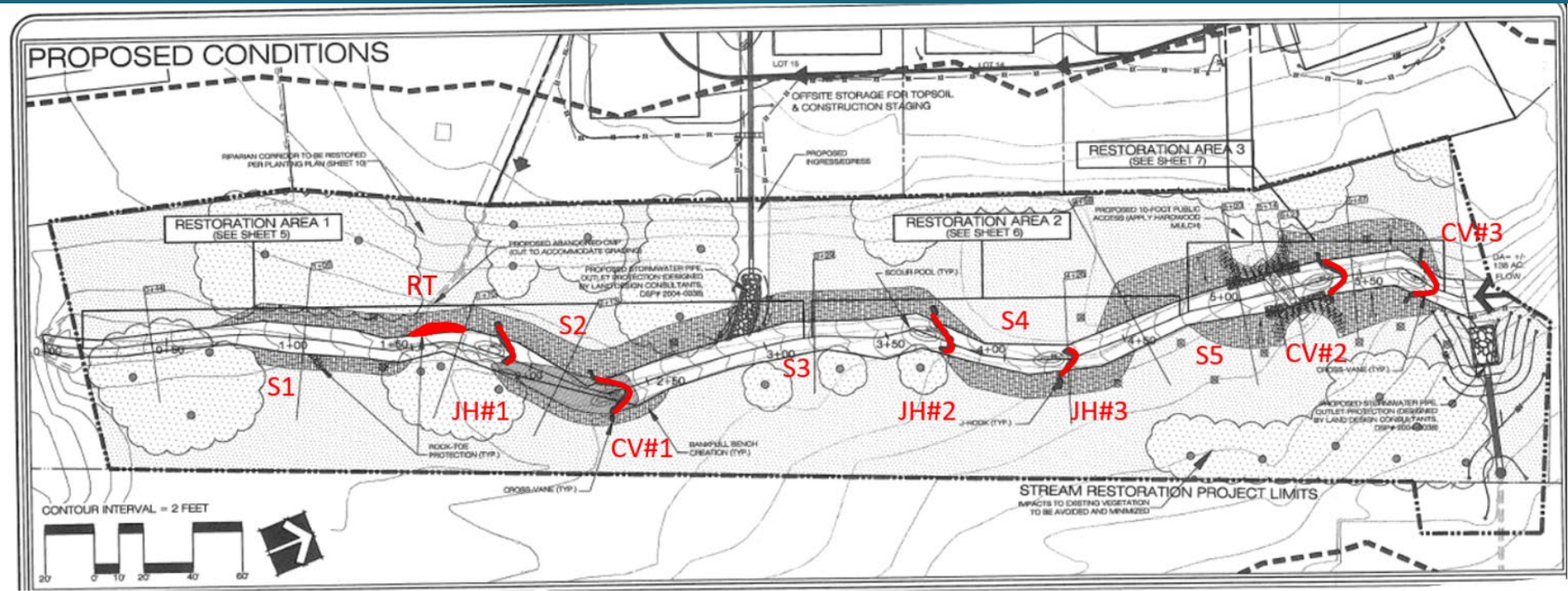
Example: J-Hook Structure



Example: Rock Toe Revetment



Solutions Proposed In 2008



Structures deployed:

- Cross-Vanes (CV)
- J-Hooks (JH)
- Rock Toe Revetment (RT)

J-Hook #3, March 2018



Follow the tree in the yellow circle

J-Hook #3, January 2021



Follow the tree in the yellow circle

J-Hook #3, November 2021



Follow the tree in the yellow circle

Scour Of J-Hook #2



November 2021; Looking Upstream

Scour Of J-Hook #2



November 2021; Looking Downstream

Failure Or Collapse Of Bank Protection Measures



November 2021; Underneath Pedestrian Bridge

Key Contributors To Stream Failure

- Hydraulics And Streambed Rock Size
- Climate Change Induced Intense Storms
- Other Potential Factors

Hydraulics And Streambed Rock Size

Hydraulics - Shear Stress

underwater_views_turbulence_fi



MISSOURI
DEPARTMENT
OF NATURAL
RESOURCES



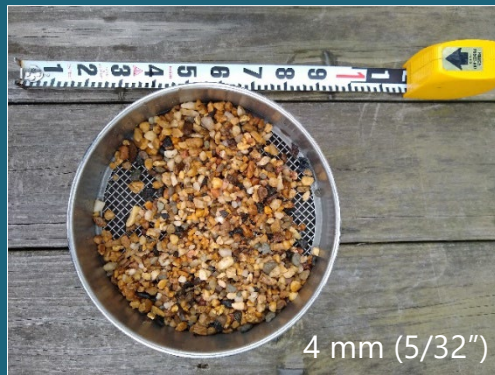
Source: emriver

Size of Streambed Rock Particles

A little more than 1 foot of water in the channel nearly mobilizes the entire bed.



The biggest particle found was 110 mm. The 1-yr discharge moves approximately 200 mm particle.



Climate Change Induced Intense Storms

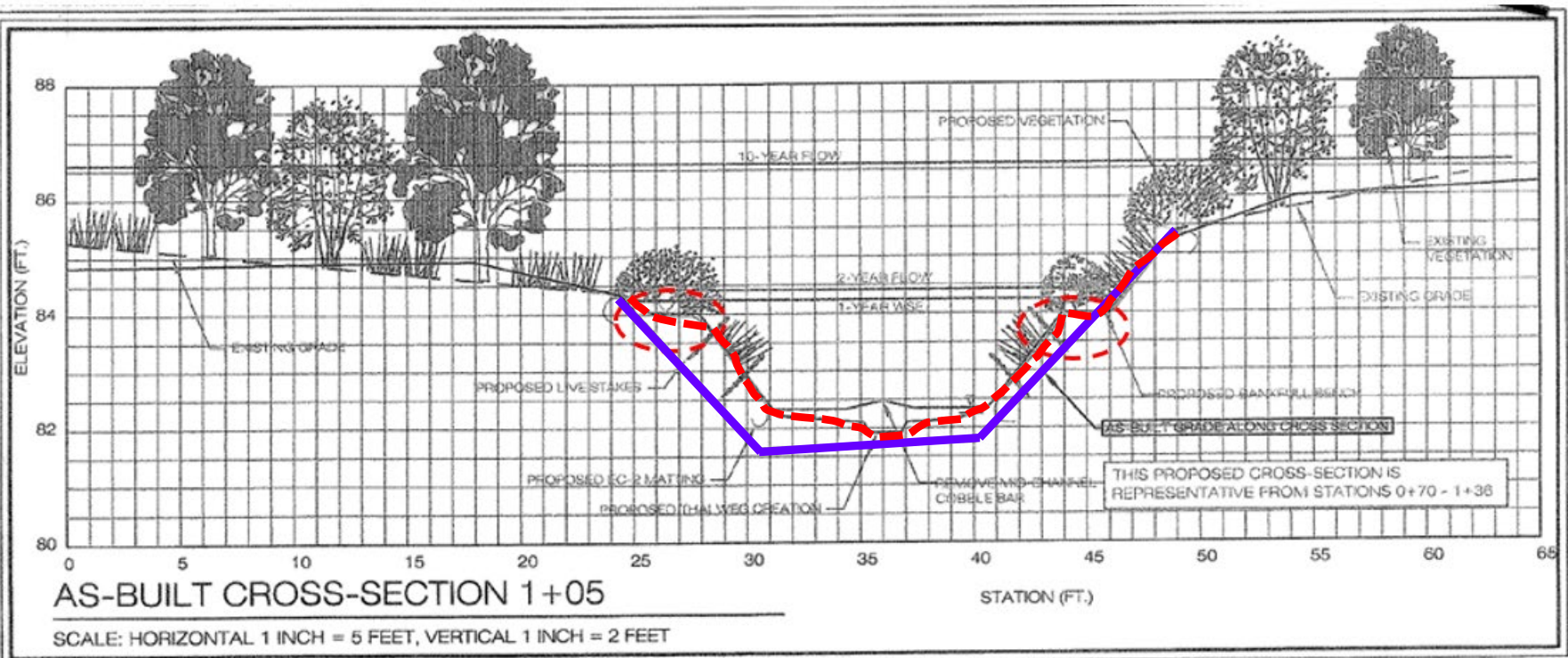
Climate Change: More Frequent, More Intense Storms



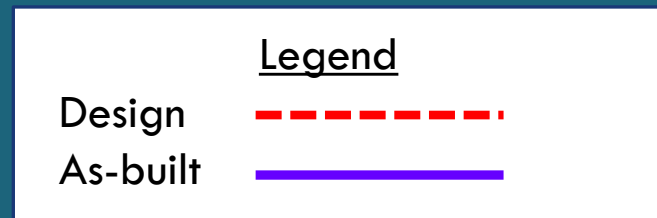
- One month post-construction in 2010, a 5-10-Yr storm event occurred
- Flash floods occurred:
 - July 21, 2018
 - July 8, 2019
 - July 23, 2020
 - September 10, 2020
 - August 15, 2021

Other Potential Factors

Construction As-built



- Constructed channel elevations not matching the design profile (structure elevations too high)
- Constructed cross sections not matching the design sections (no bankfull bench)



Upstream Bedload Supply



Right Overbank
Just Upstream Of Pedestrian Bridge

Aggradation



Downstream
Between J-Hook #1
And Cross- Vane #1

2021.11.11

Lack Of Rock Toe Protection



Downed Trees / Channel Blockages



Downstream
Between J-Hook #1
And Cross- Vane #1

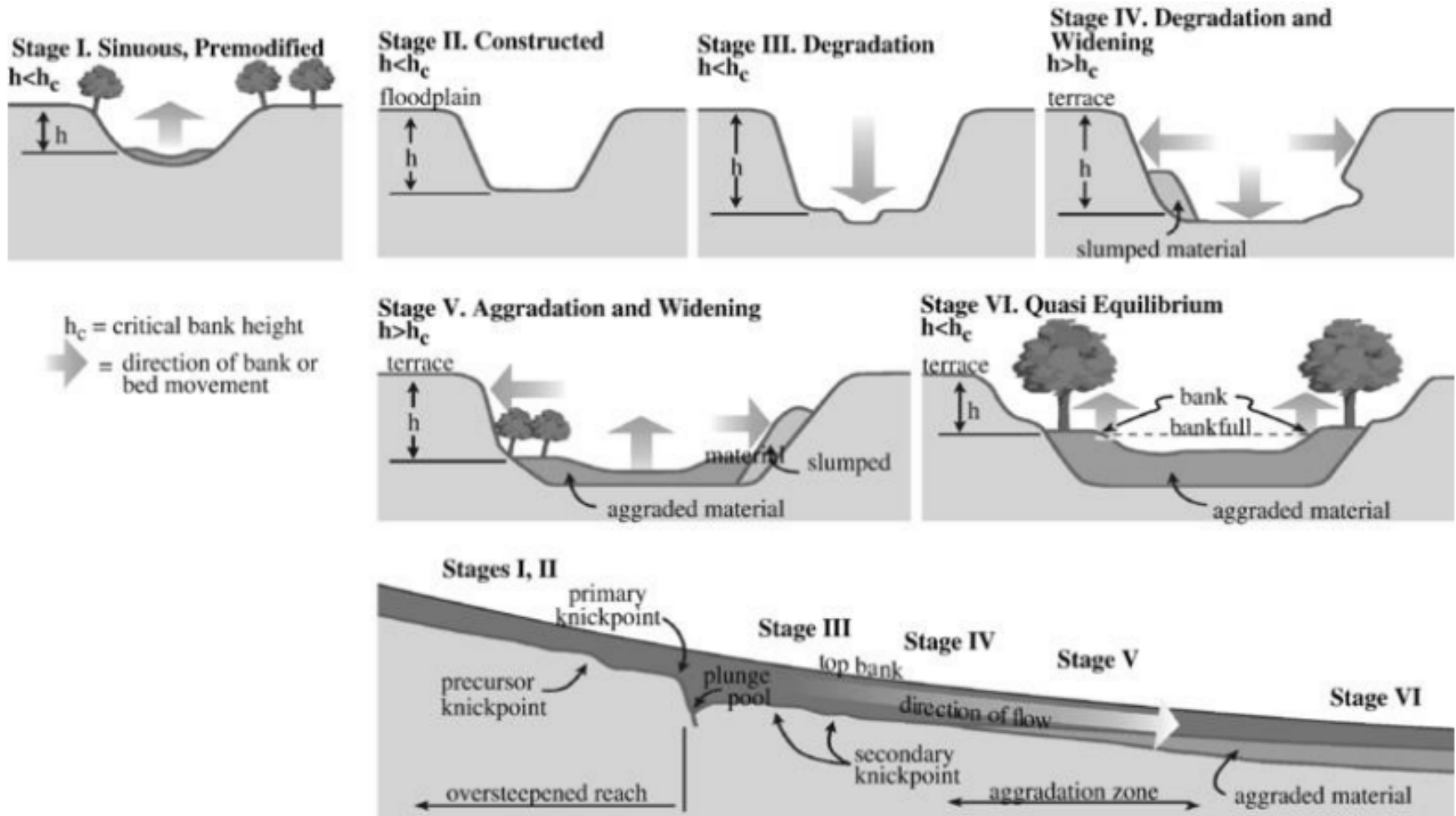
Findings And Recommendations

- Findings:
 - >50% Of Stream Project Failed
 - Lose Credit And Abandon The Project, Or
 - Reconstruct A New Stable Channel
- Recommendations:
 - Short-term
 - Long-term

Reasons Not To Abandon Project

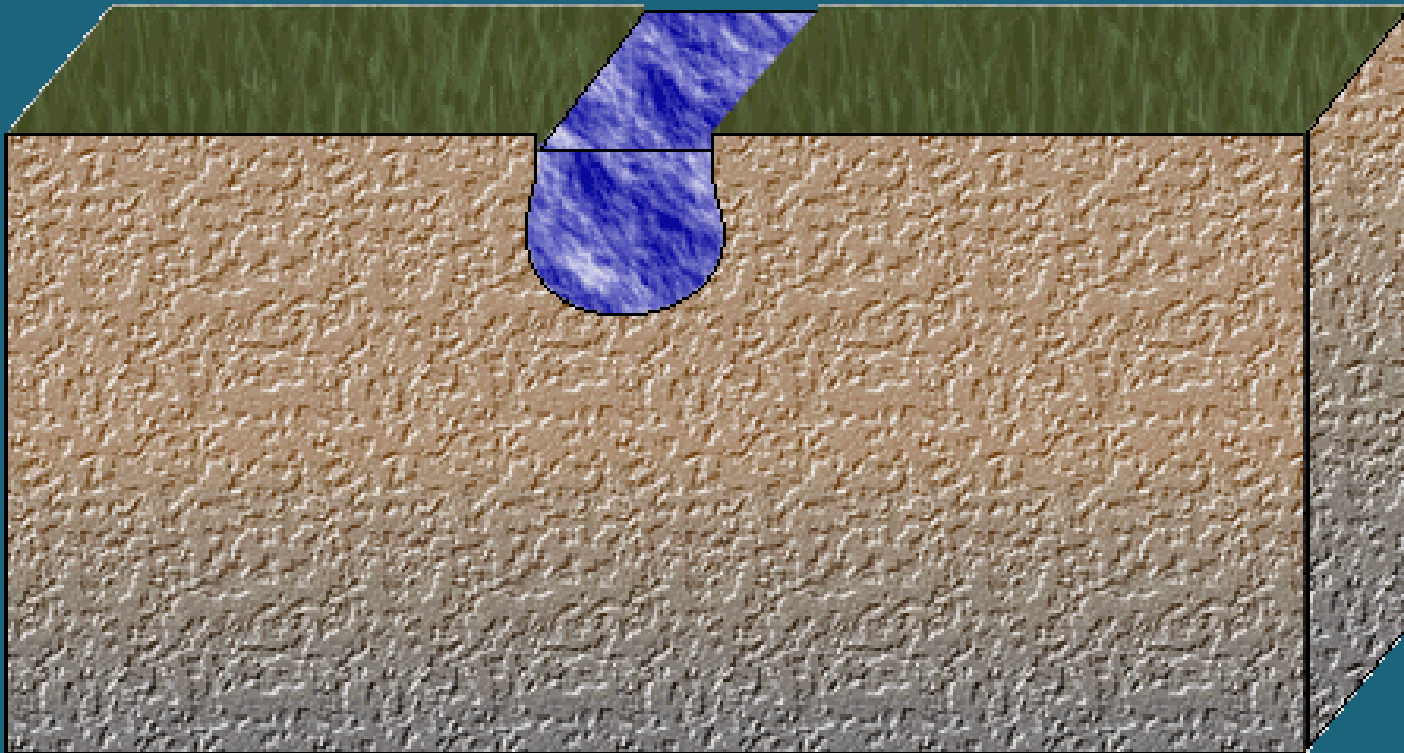
- Risks to infrastructure (pedestrian bridge, storm sewer)
- Public safety concerns (at crossing and along corridor)
- Continued erosion and trend towards lateral instability creating future risk to private property
- Continued erosion and tree loss
- Loss of conveyance capacity
- Increasing/on-going channel maintenance requirements
- Downstream conveyance impacts for the piped portions of the stream
- Sedimentation impacts to the Lake Cook Forebay that may impact the water quality function of the forebay and require frequent, costly maintenance to ensure proper functioning

Channel Evolution Model



Source: Simon and Rinaldi, 2006

Channel Evolution Model



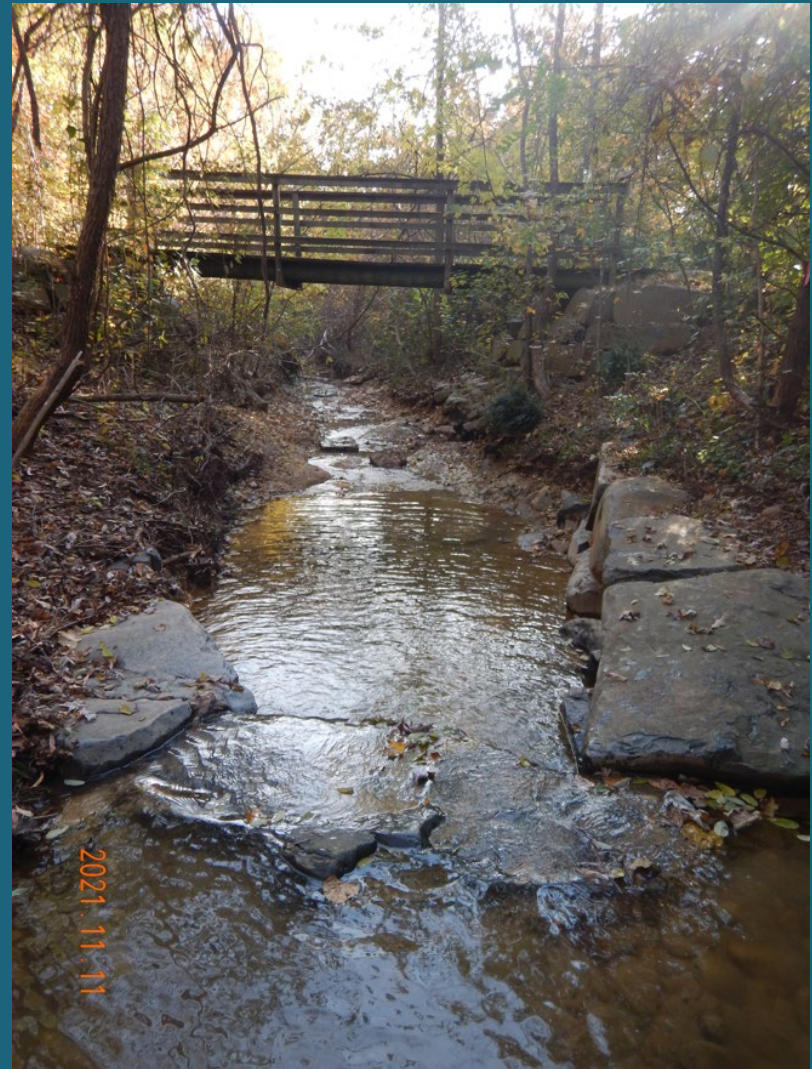
Source: T. Endreny at SUNY ESF

Short Term Recommendation: Protect The Pedestrian Bridge

Protect Pedestrian Bridge

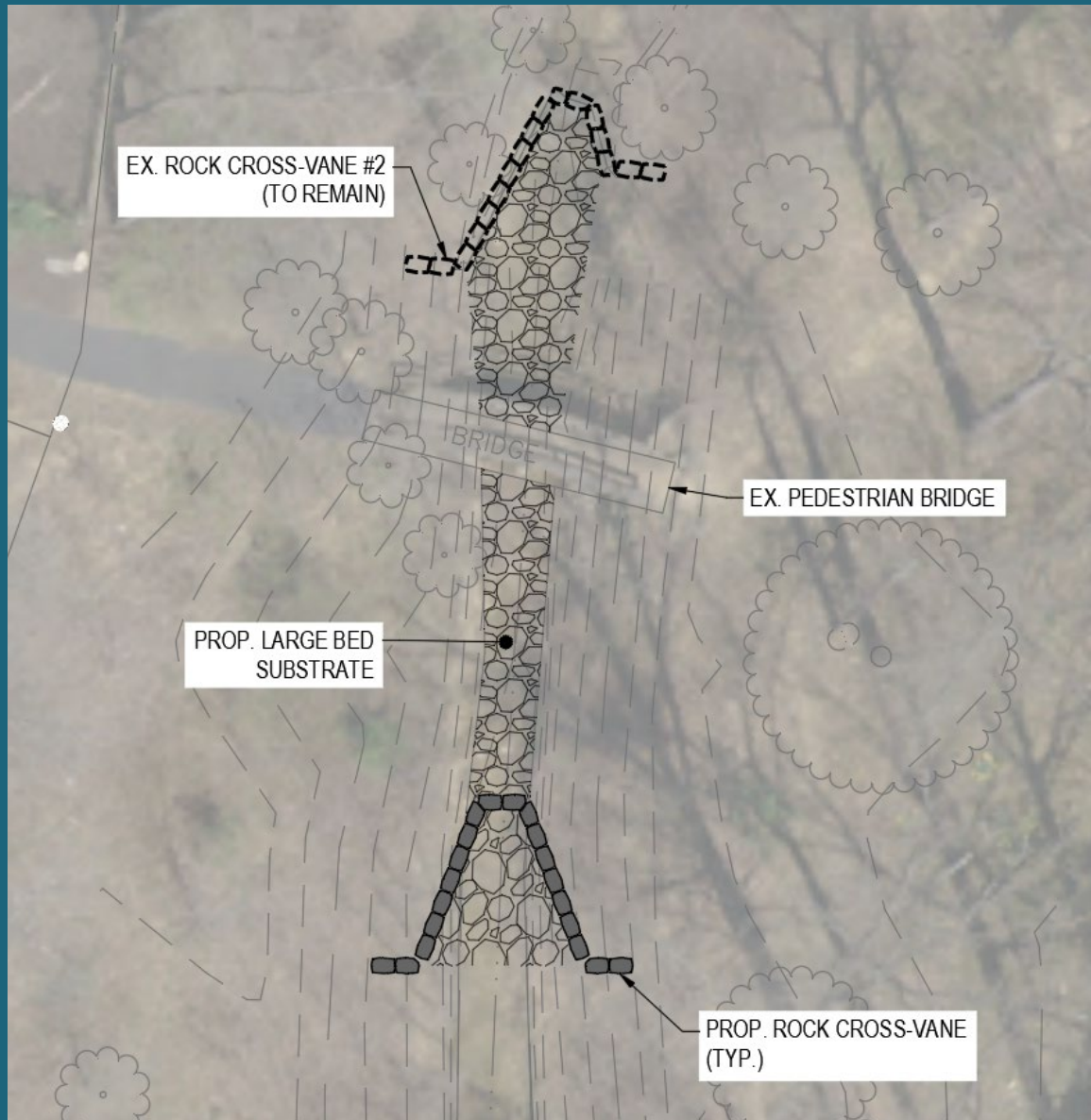


November 2021; Underneath Bridge



November 2021; Cross-Vane #2

Protect The Pedestrian Bridge



Long Term Recommendation:
Design and Build a Stable Channel

Example: Stable Channel

Factors:

- Key-in logs back into the bank
- Import resistant materials
- Channel boundary materials stay in-place
- Structures help redirect flows and dissipate energy
- Direct flows toward center of channel and away from banks



Conclusion And Recommendations

Short Term:

- Protect The Pedestrian Bridge

Long Term:

- Design and Build a Stable Channel

Contact Information

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