Massachusetts Stream Crossing Case Studies

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Case Studies:

Public Benefits:

- Movement of goods and people
- Access to critical locations (food, hospitals, municipal and emergency operations, etc.)
- Provides for continuous free flow of traffic
- Accommodates various vehicle types, sizes, speeds and traffic volumes

Ecological Benefits:

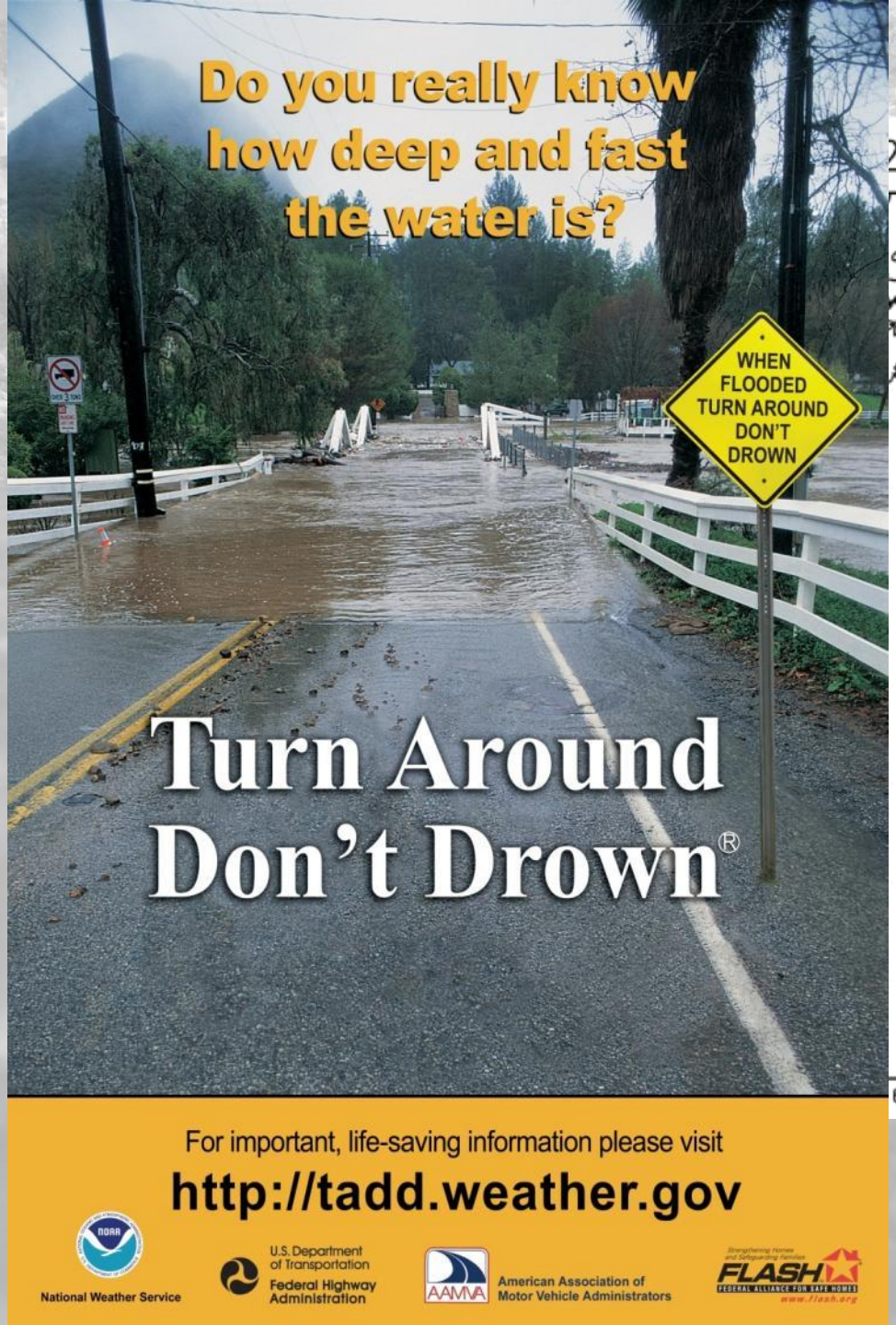
- Movement of fish and wildlife
- Access to critical habitat (feeding, spawning, and shelter)
- Conveys flow of water, sediments and natural materials
- Accommodates full range of wildlife types, life stages and movement abilities

Walker Brook, Becket

Walker Brook, Becket

10/06/05

Minor Fish Passage Barrier


Do you really know how deep and fast the water is?
WHEN FLOODED TURN AROUND DON'T DROWN
Turn Around Don't Drown®
For important, life-saving information please visit
http://tadd.weather.gov
National Weather Service
U.S. Department of Transportation
Federal Highway Administration
AAMVA
American Association of Motor Vehicle Administrators
FLASH
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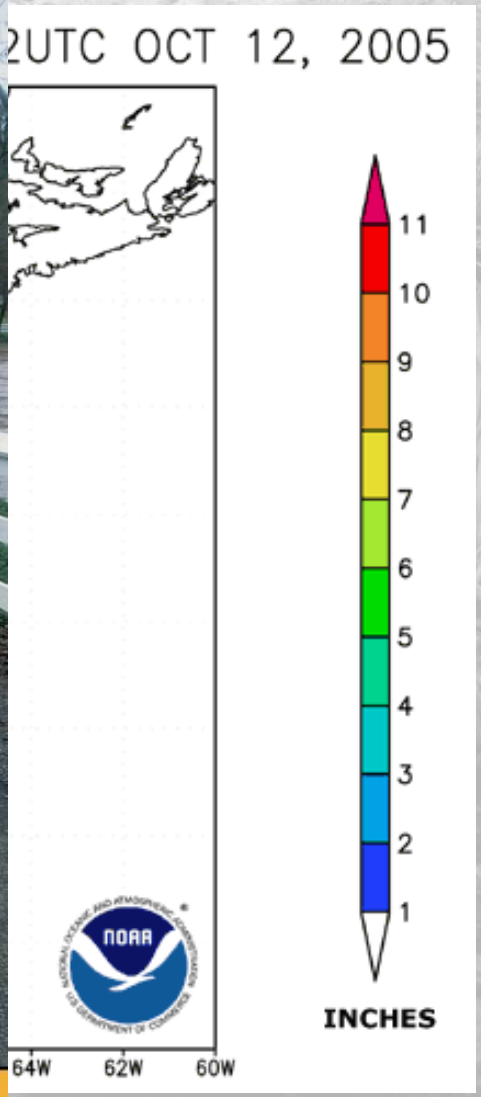
2UTC OCT 12, 2005
11
10
9
8
7
6
5
4
3
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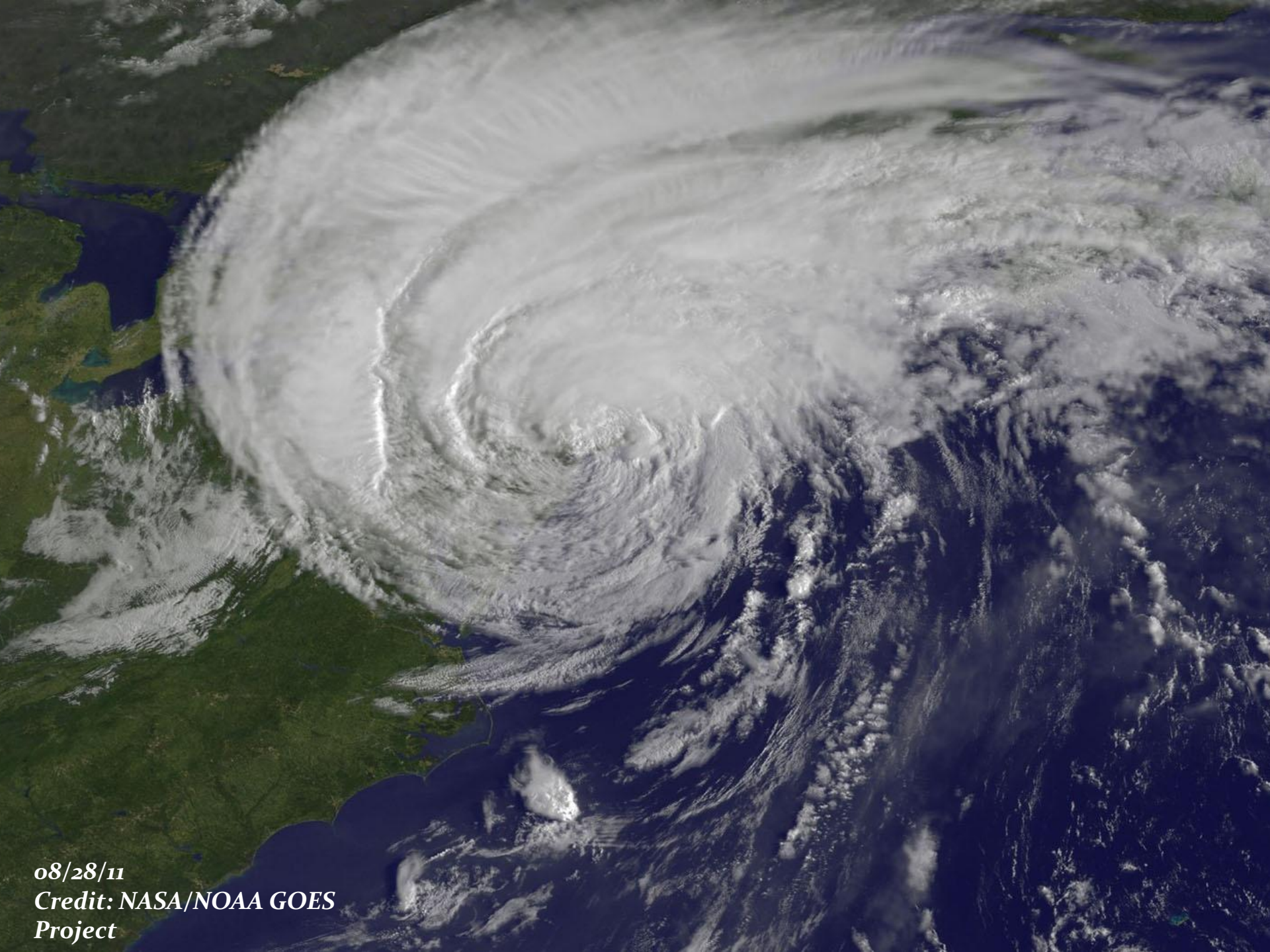
1
INCHES
64W
62W
60W

Walker Brook, Becket

6/30/2011

Moderate Fish Passage Barrier



08/28/11
Credit: NASA/NOAA GOES Project

Walker Brook, Post Tropical Storm Irene

Walker Brook, Post Tropical Storm Irene

9/8/2011

Significant Transportation Barrier

Walker Brook, Post TS Irene

Comparison of Estimated Crossing Lifespan and Costs

Cost of Two Replacements:

10 years

$130k

Estimate for Stream Crossing Span:

10 years | 10 years | 10 years | 10 years | 10 + years

~ $400k

Bronson Brook, Worthington

- Two 10-foot box culverts washed out in 2003. Road was closed to all traffic.
- Culvert had a history of clogging with debris

Culvert replacement 2006

Replaced culvert to meet standards:

- Open-bottom arch with 40-foot span
- Culvert sized to 1.2 times the bankful width
- Open bottom allows for natural river substrate

Bronson Brook Ecological Value

- High quality coldwater tributary
- Provide access to approximately 4.5 mi (7.2 km) of upstream habitat and an estimated 70,000 sq ft (6,500 sq m) of rearing habitat

Bronson Brook Transport

Bronson Brook During Irene

Bronson Brook Transport

Bronson Brook Restoration Project





Project Funders & Contributors
Town of Worthington
Riverways Program/Div. Ecological Restoration
MA Division of Fisheries & Wildlife
Natural Resources Conservation Service
US Fish & Wildlife Service
American Rivers
National Oceanic Atmospheric Administration
Westfield River Wild & Scenic Advisory Committee
The Nature Conservancy
Connecticut River Watershed Council
Corporate Wetlands Restoration Partnership
Inter-Fluve, Inc.
Lockwood Construction

Completion Date
July 2007

Expected Lifespan
75-100 Years

Project Cost (2007)

Engineering & Design	$84,792
Construction	$61,967
Materials	$136,740
Cost Overruns	$60,500
Total:	**$283,499**

Tropical Storm Irene in Vermont

- Over 1,000 culverts failed
- Over 500 bridges damaged
- 13 communities isolated
- 200 miles of state railway impassable and 6 railroad bridges damaged

- 763 Guard troops. Over 170 pieces of equipment from IL, OH, SC, VA, WV, ME, NH, VT
- DOT partners: 150 people, 145 pieces of equipment from ME; NH 75 people, 60 pieces of equipment
- > 200 Private Contractors and Consultants. ~1800 people from the private sector, primarily from Vermont.

Green Mountain National Forest

FR17A/Jenny Coolidge Brook – Bottomless Arch

Competed Channel Construction 2010

Post TS Irene September 2011

Lost largest boulders near outlet and roughness along stem walls. Structure and road undamaged.

Photos: Dan McKinley, USFS

Green Mountain National Forest

FR54/ Sparks Brook Bottomless Arch Inlet and Outlet

Pre-Irene July 2011

Post TS Irene September 2011

Inlet

Outlet

Photos: Dan McKinley, USFS

Lewis Brook, Jay NY

	Annual cost over 15 years	Annual cost over 35 years	Annual cost over 70 years
Double metal pipe culvert	$6,551	$4,446	$2,726
Concrete box culvert	$13,533	$5,800	$2,900
Percentage additional annual cost for concrete box culvert	107%	30%	6%

Culvert failed in Tropical Storm Irene, 2011. Estimates from Jessica Levine, The Nature Conservancy. Estimates assume:

1.) Replacement at the end of design life, not failure due to storm event;

2.) Maintenance estimated based on NRCS study in Maine (Long 2012);

3.) Inflation discount of 2%.

Lewis Brook, Jay, NY

Frequency of extreme precipitation leading to failure of pipe culvert	# of years for concrete box culvert to become cost-effective
Once per 30 years	90
Once per 25 years	69
Once per 20 years	40
Once per 15 years	30
Once per 10 years	20
Once per 5 years	10

Estimates from Jessica Levine, The Nature Conservancy.

If we see storms leading to a culvert failure every five years, the box culvert becomes cost effective in only 10 years.

June 2013

Constructing a Stream Bed: West Brook, Whately, MA

- 36inch CMP
- High quality tributary
- Long-term research site
- Road repair planned

Constructing a Stream Bed: West Brook, Whately, MA

Building stable stream bed at a steep gradient in an open-bottom arch

Reconstructing a streambed channel

Installing weirs underneath bed

Installing cobble bed/fines

Dry Passage

Dry passage fines

Installing culvert over bed

Push dry passage against culvert

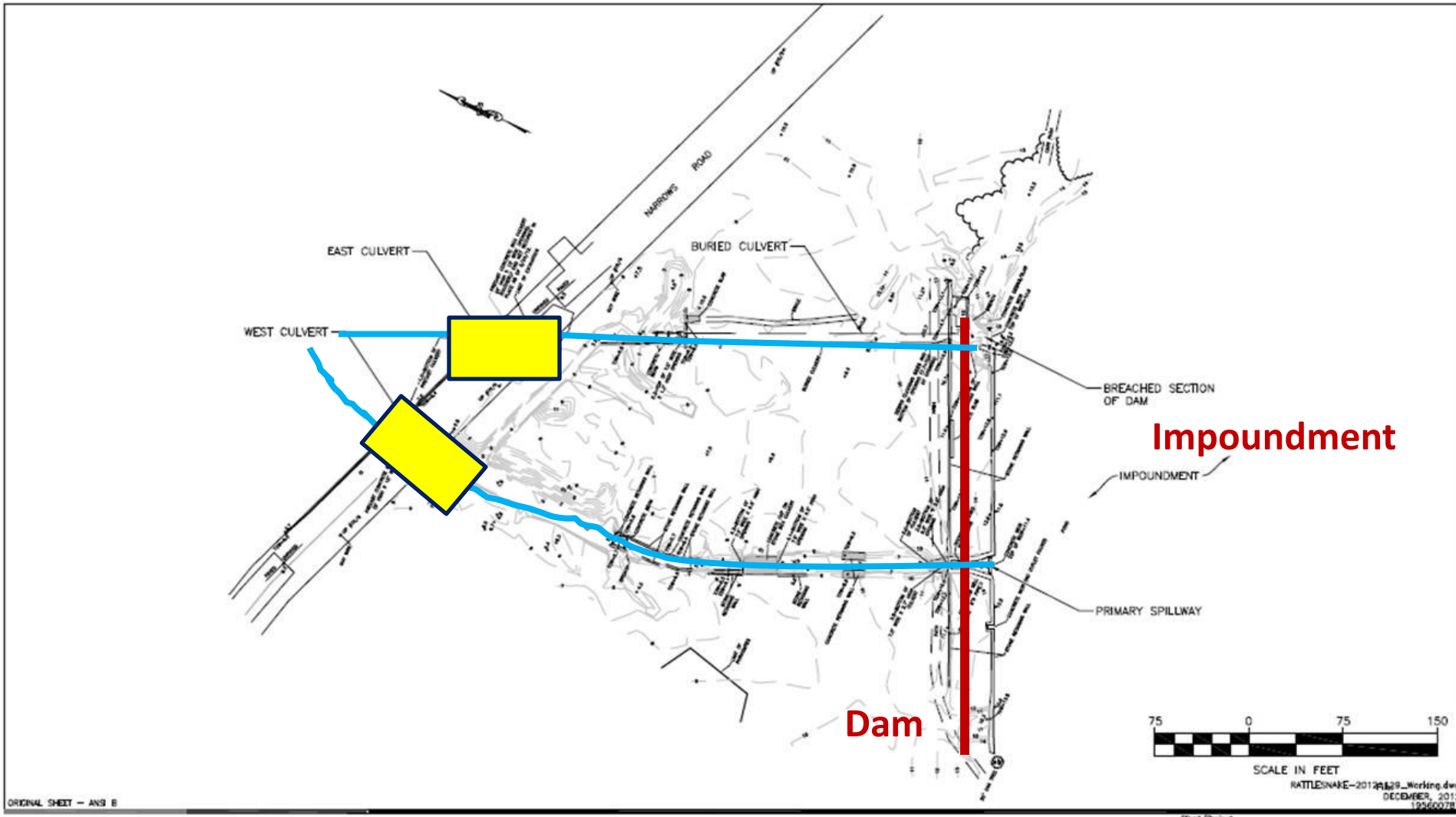
Post Construction

Lessons Learned: Understanding Existing Conditions

Understanding Existing Conditions

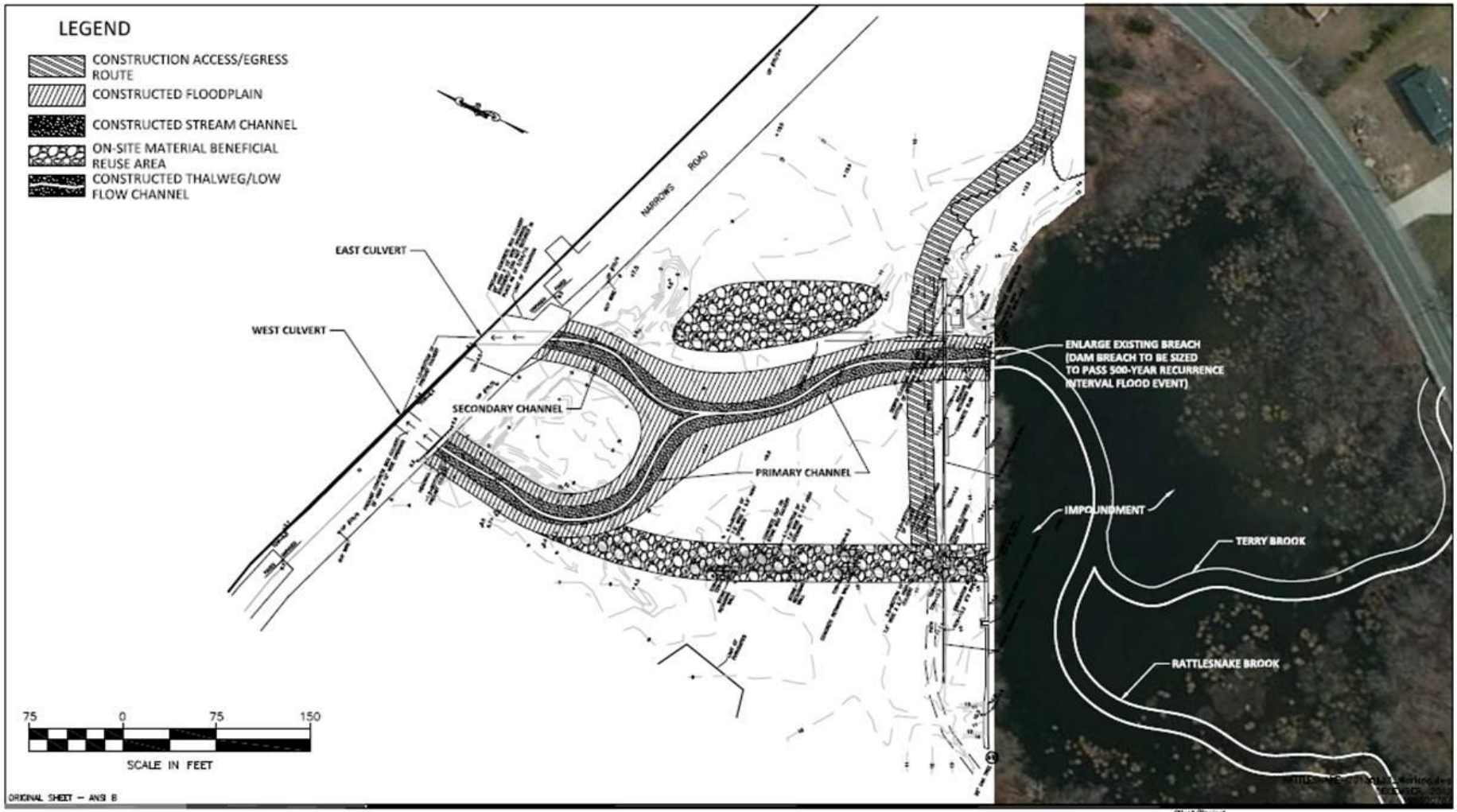
Rattlesnake Brook, Assonet

Understanding Existing Conditions




3 Narrows Road, Freetown, Massachusetts, United States
Address is approximate
« Photos
© 2013 Google Image Date: September 2012
Report a problem

Maintaining unnatural conditions: Proposed split channel with dam removal



Stantec Consulting Services Inc.
30 Park Drive
Topsham ME U.S.A.
04086
Tel. 207.729.1199
Fax. 207.729.2715
www.stantec.com

Legend

Notes

DRAFT
FOR REVIEW ONLY
JANUARY, 2013

Client/Project
THE NATURE CONSERVANCY
RATTLESNAKE BROOK RESTORATION PROJECT
FREETOWN, MA

Figure No.
4

Title
CROSS-COUNTRY CHANNEL

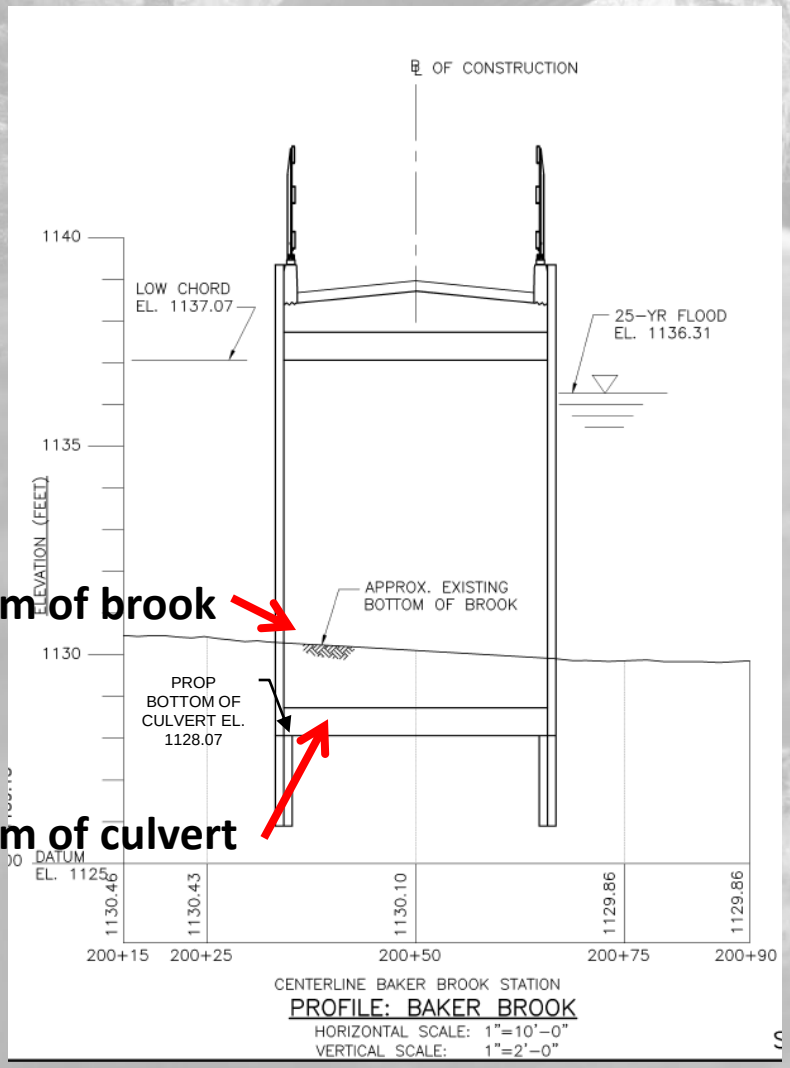
Failures Not Only During Large Storms

May 29, 2013
Williamstown, MA

Photo credit: Jane Win
Berkshire Environmental Action Team

- Measure bankful at unimpacted stream reach
- Communicate with the public on project goals

Constructing a streambed channel



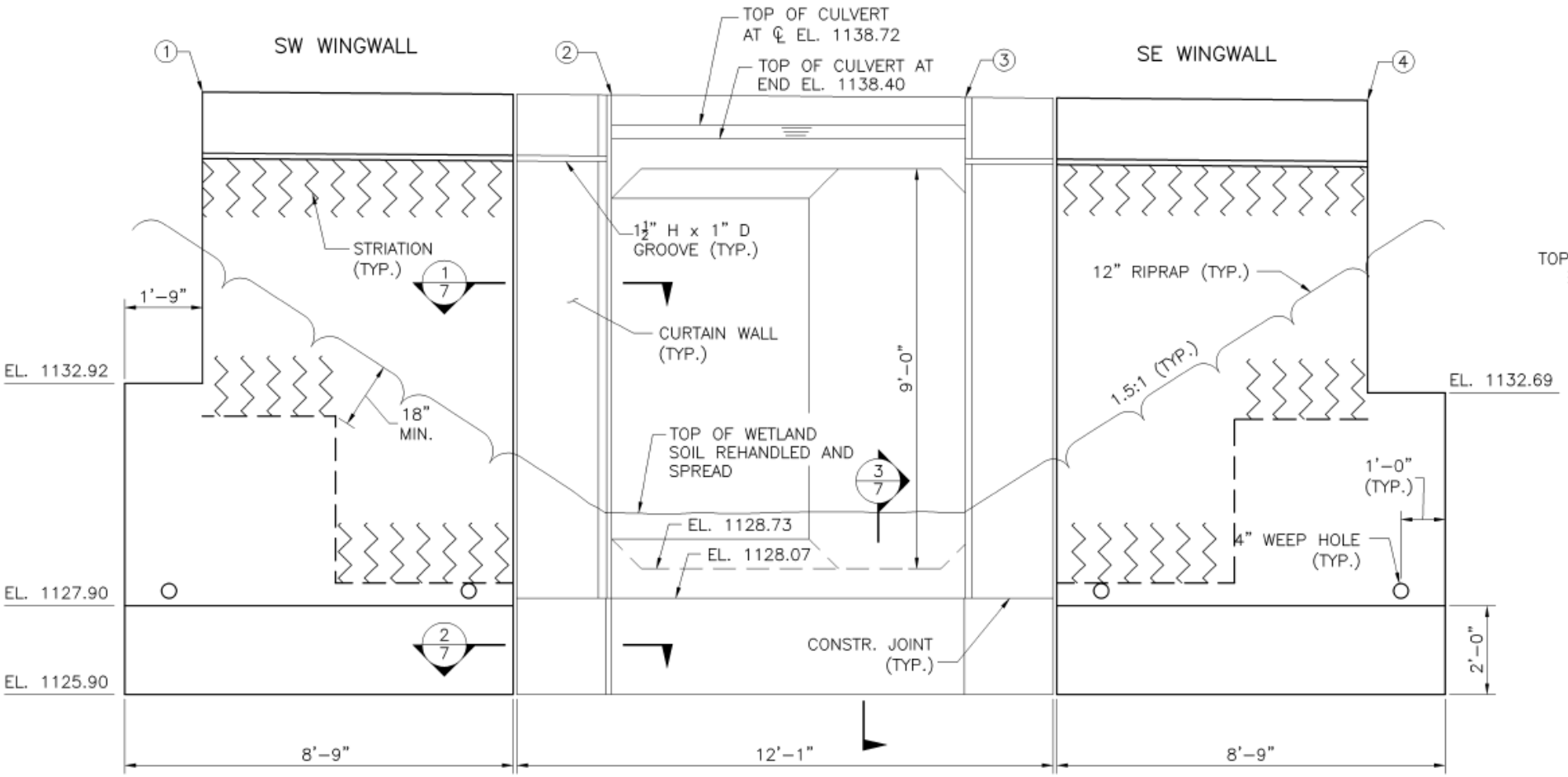
Bottom of brook

Bottom of culvert

- 5-ft round culvert
- Significant Barrier
- Replace with a 8 ft wide x 9 ft high box culvert
- Embedded with 1.5-2 ft of wetland soil

SUBSTRUCTURE PLAN

SCALE: ½" = 1'–0"



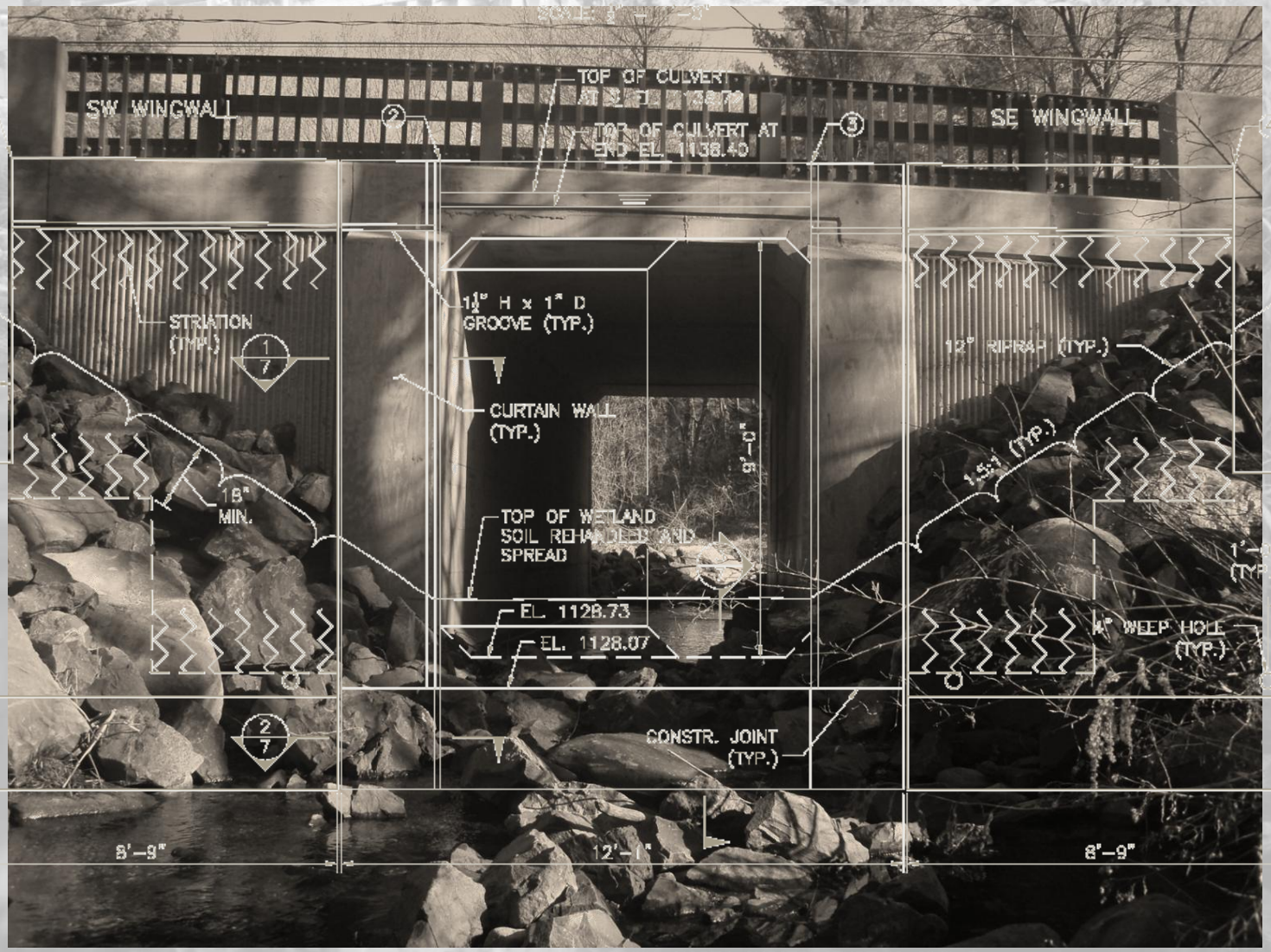
NOTE: SOUTH SUBSTRUCTURE SHOWN, NORTH SUBSTRUCTURE IS SIMILAR.

SUBSTRUCTURE ELEVATION

SCALE: ½" = 1'–0"


No sediment in crossing

SUBSTRUCTURE PLAN



NOTE: SOUTH SUBSTRUCTURE SHOWN, NORTH SUBSTRUCTURE IS SIMILAR.

SUBSTRUCTURE ELEVATION

Understanding Existing Conditions: Utilities

Design and Construction Considerations:

- Utilities
- Bedrock
- Headcuts
- Streambed Materials & Sizing
- Long profiles and bankfull widths
- Construction Sequencing
- Consider the surrounding context and ask questions (dams, roads, etc.)

Value of Case Studies

How can you help?

- Share local examples, successes and failures from storm events and project construction
- Photograph and document failures and required maintenance
- Collect economic costs and impacts
- Work with the River Continuity Partners to identify and advocate for technical resources and funding opportunities