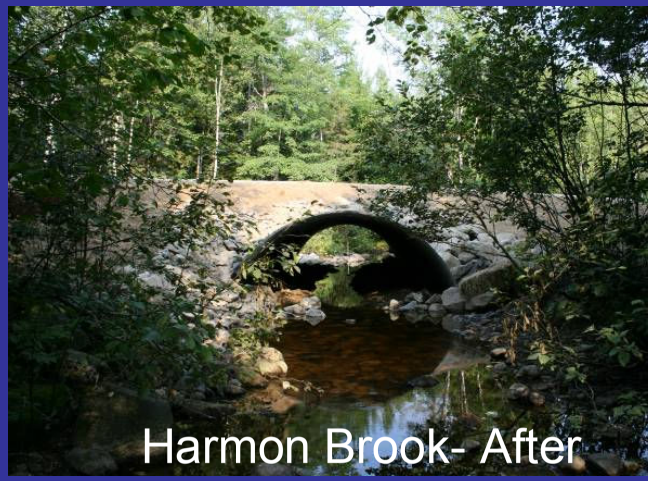
Downeast Stream Connectivity Restoration for Atlantic Salmon

Harmon Brook- Before


Harmon Brook- After

A Working Model of Cooperative Conservation

U.S. Fish and Wildlife Service
Maine Fisheries Resource Office
Scott Craig

Project SHARE
Salmon Habitat And River Enhancement
Steven Koenig

Note:

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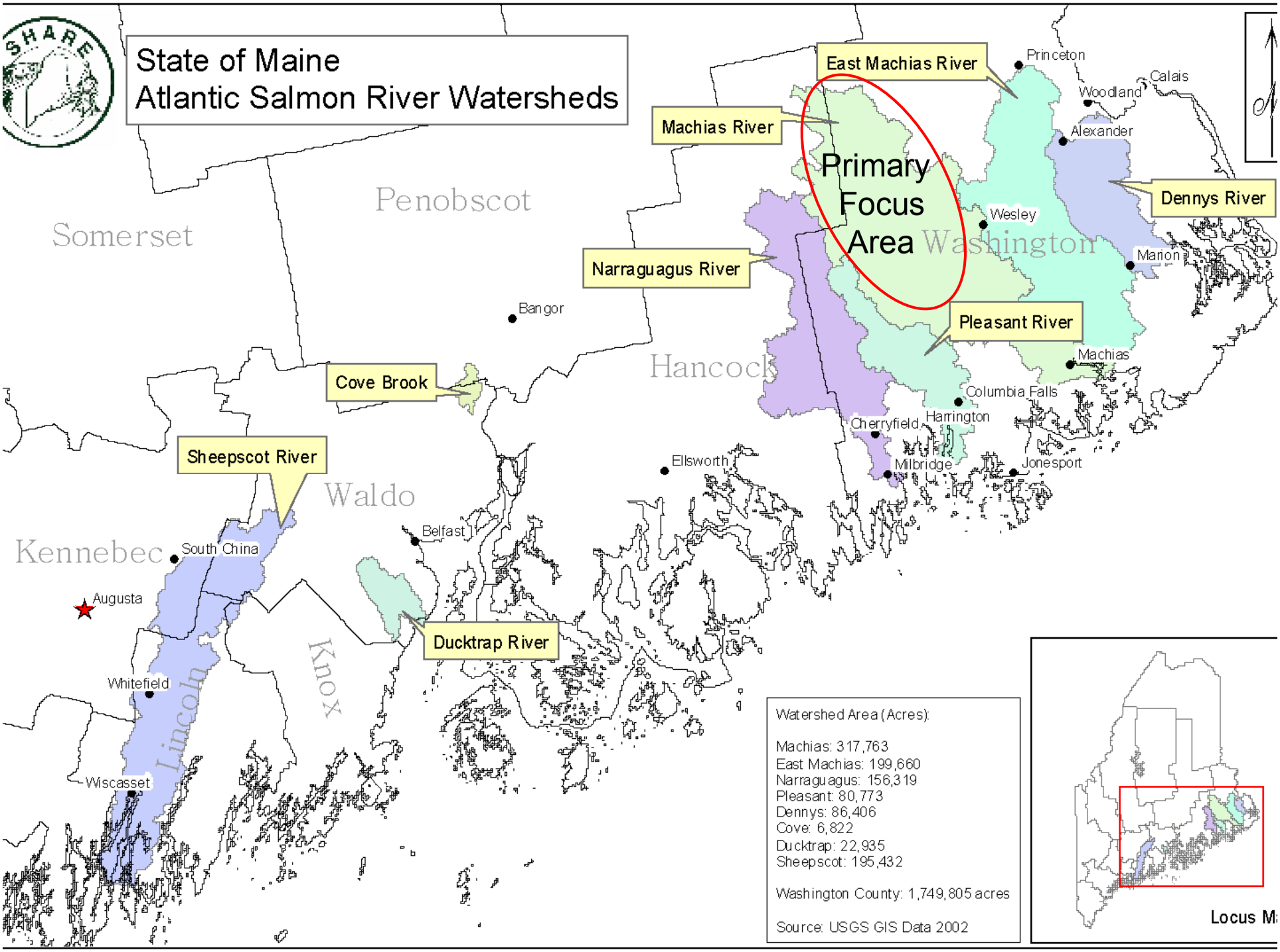
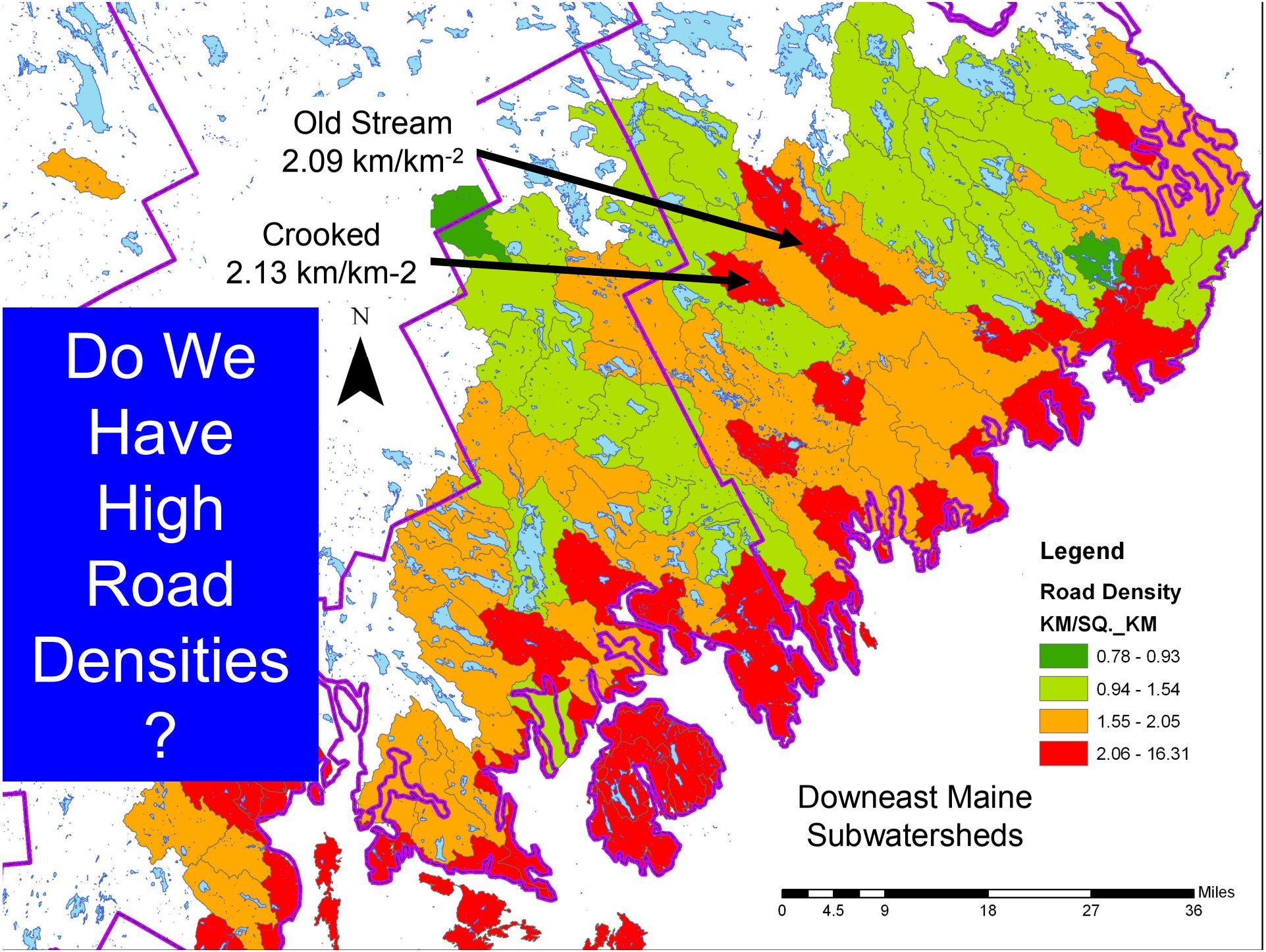
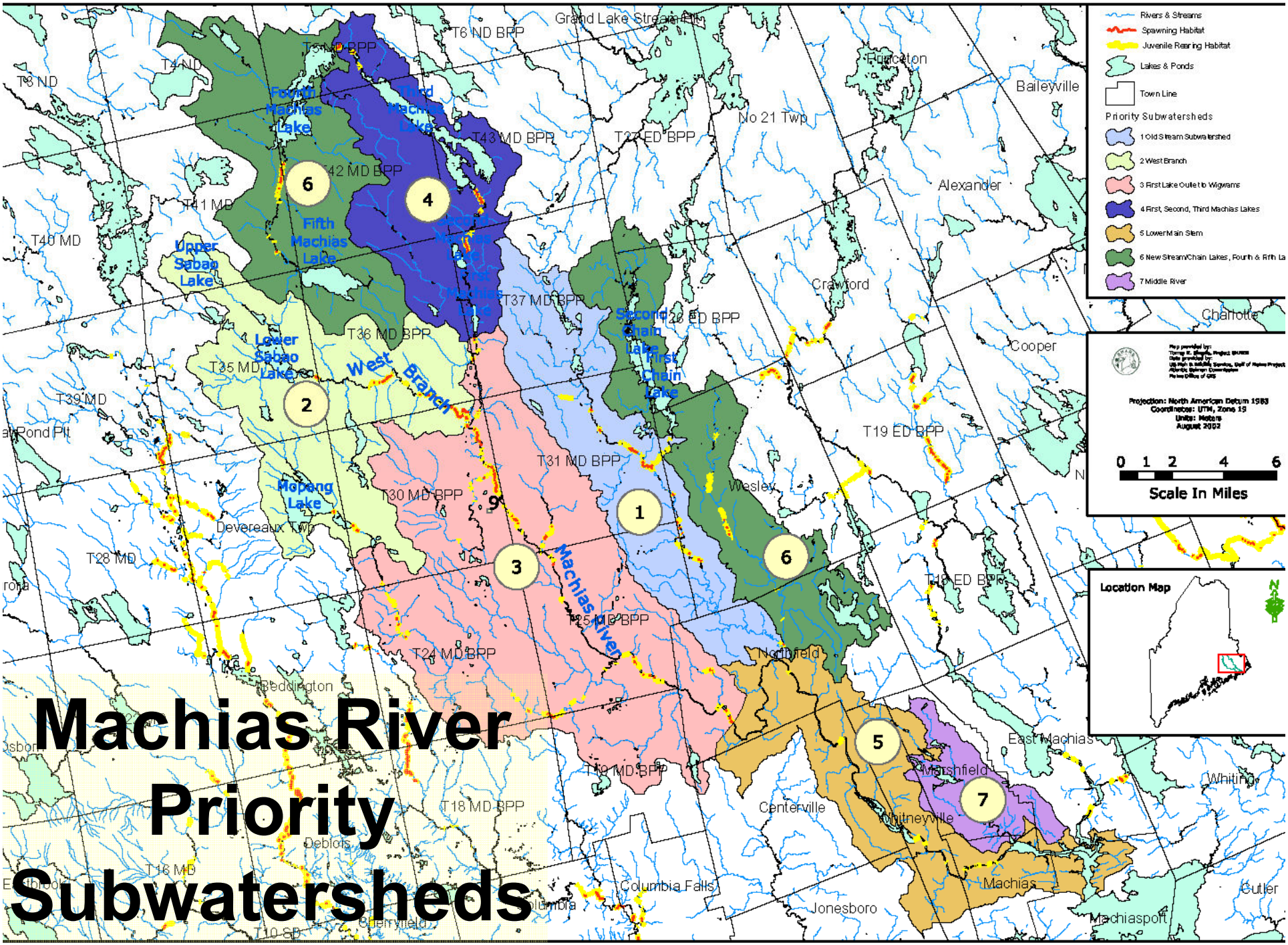
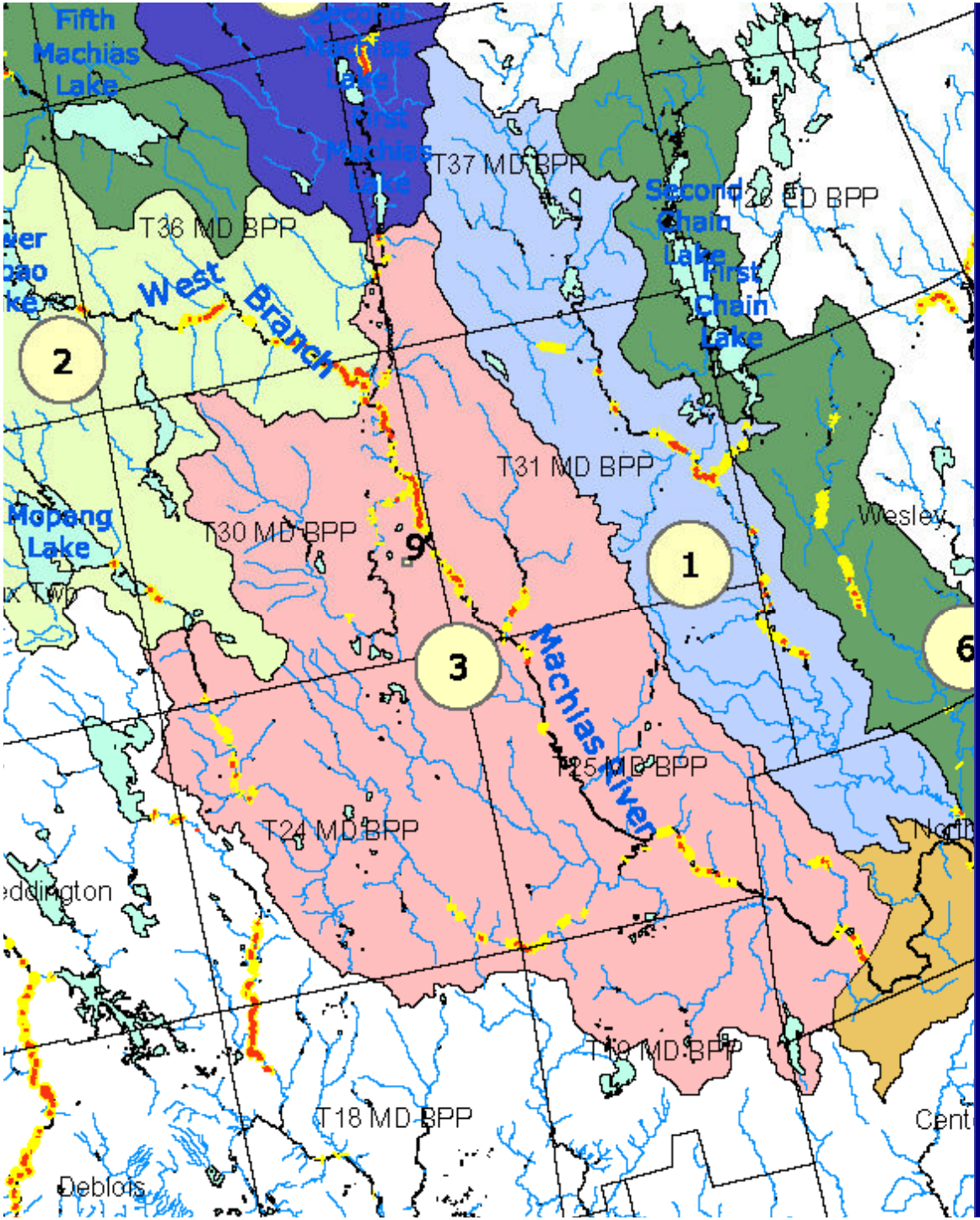

State of Maine
Atlantic Salmon River Watersheds
East Machias River
Machias River
Primary Focus Area
Dennys River
Narraguagus River
Pleasant River
Cove Brook
Sheepscot River
Ducktrap River
Penobscot
Somerset
Washington
Hancock
Waldo
Kennebec
Knox
Lincoln
Princeton
Calais
Woodland
Alexander
Wesley
Marion
Bangor
Machias
Columbia Falls
Harrington
Cherryfield
Milbridge
Jonesport
Ellsworth
Belfast
South China
Augusta
Whitefield
Wiscasset
Watershed Area (Acres):
Machias: 317,763
East Machias: 199,660
Narraguagus: 156,319
Pleasant: 80,773
Dennys: 86,406
Cove: 6,822
Ducktrap: 22,935
Sheepscot: 195,432
Washington County: 1,749,805 acres
Source: USGS GIS Data 2002
Locus M


Old Stream
2.09 km/km-2
Crooked
2.13 km/km-2
N
Do We Have High Road Densities ?
Legend
Road Density
KM/SQ._KM
0.78 - 0.93
0.94 - 1.54
1.55 - 2.05
2.06 - 16.31
Downeast Maine Subwatersheds
Miles
0
4.5
9
18
27
36

Site Specific Prioritization

- Location in watershed
- Proximity to water body
- Proximity to Atlantic salmon habitat
- Type of problem
- Size of problem
- Landowner cooperation
- Landowner history of maintenance issues
- Timing issues

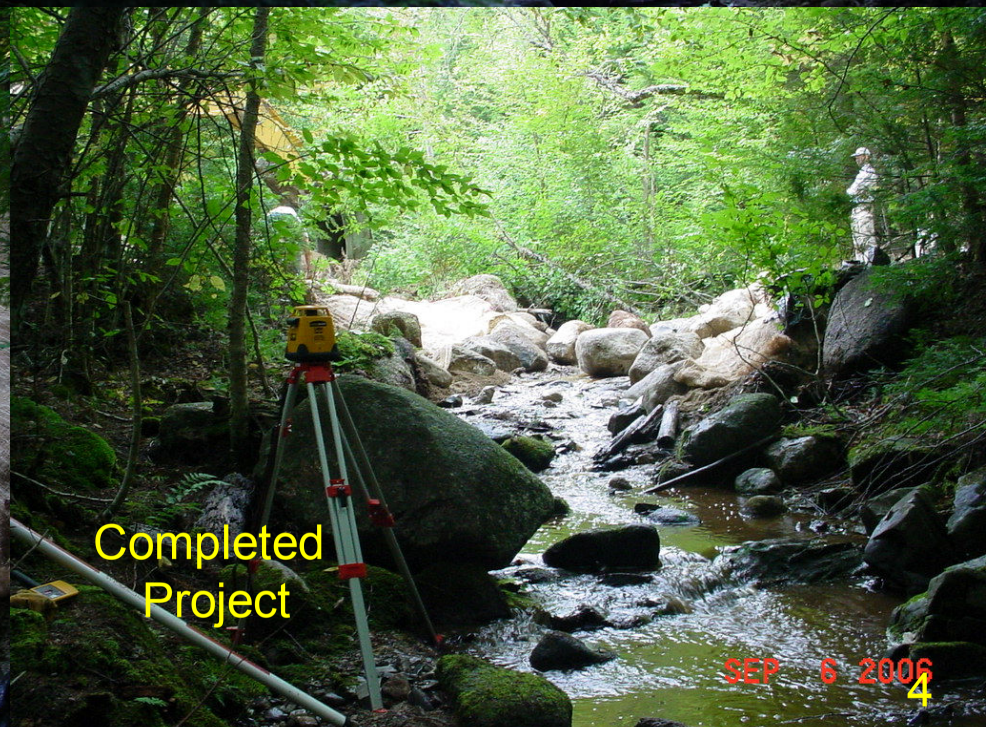

Machias River
Priority
Subwatersheds
Rivers & Streams
Spawning Habitat
Juvenile Rearing Habitat
Lakes & Ponds
Town Line
Priority Subwatersheds
1 Old Stream Subwatershed
2 West Branch
3 First Lake Outlet to Wigwams
4 First, Second, Third Machias Lakes
5 Lower Main Stem
6 New Stream/Chain Lakes, Fourth & Fifth La
7 Middle River
Projection: North American Datum 1983
Coordinates: UTM, Zone 19
Units: Meters
August 2002
0 1 2 4 6
Scale In Miles
Location Map
Fourth Machias Lake
Third Machias Lake
Fifth Machias Lake
Upper Sabao Lake
Lower Sabao Lake
Mopong Lake
West Branch
Second Chain Lake
First Chain Lake
Machias River
Grand Lake Stream Plt
Princeton
Baileyville
No 21 Twp
Alexander
Crawford
Charlotte
Cooper
Wesley
Northfield
Marshfield
Whitneyville
Centerville
Machias
Jonesboro
Machiasport
Cutler
East Machias
Whiting
Columbia Falls
Beddington
Devereaux Twp
Deblois
Cherryfield
T6 ND BPP
T5 ND BPP
T4 ND
T3 ND
T43 MD BPP
T42 MD BPP
T41 MD
T40 MD
T37 MD BPP
T36 MD BPP
T35 MD
T39 MD
T31 MD BPP
T30 MD BPP
T28 MD
T25 MD BPP
T24 MD BPP
T19 MD BPP
T18 MD BPP
T16 MD
T19 ED BPP
T18 ED BPP
1
2
3
4
5
6
7
9



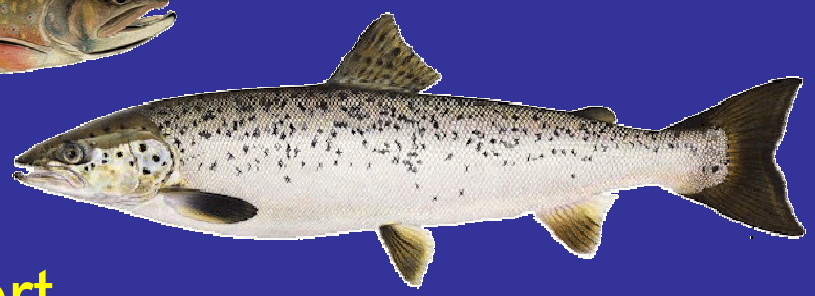
Downeast Maine Restoration Activities

- Outreach- Workshops (7)
  Presentations (15)
- Passage Assessments (580)
- Biological Assessments (125)
- Water Chemistry Surveys
- Restoration Improvements
  - 26 Arch Culverts
  - 5 Road Decommissions
  - 1 Major Bank Stabilization
  - 7 Limestone Additions

The best ecological-cost effective solution is "No Crossing"



Restoring Watershed Connectivity



- Fish passage
- Natural hydrology
- Natural Sediment Transport
- Nutrient transport
  - CPOM
  - LWD
- Continuum of substrate

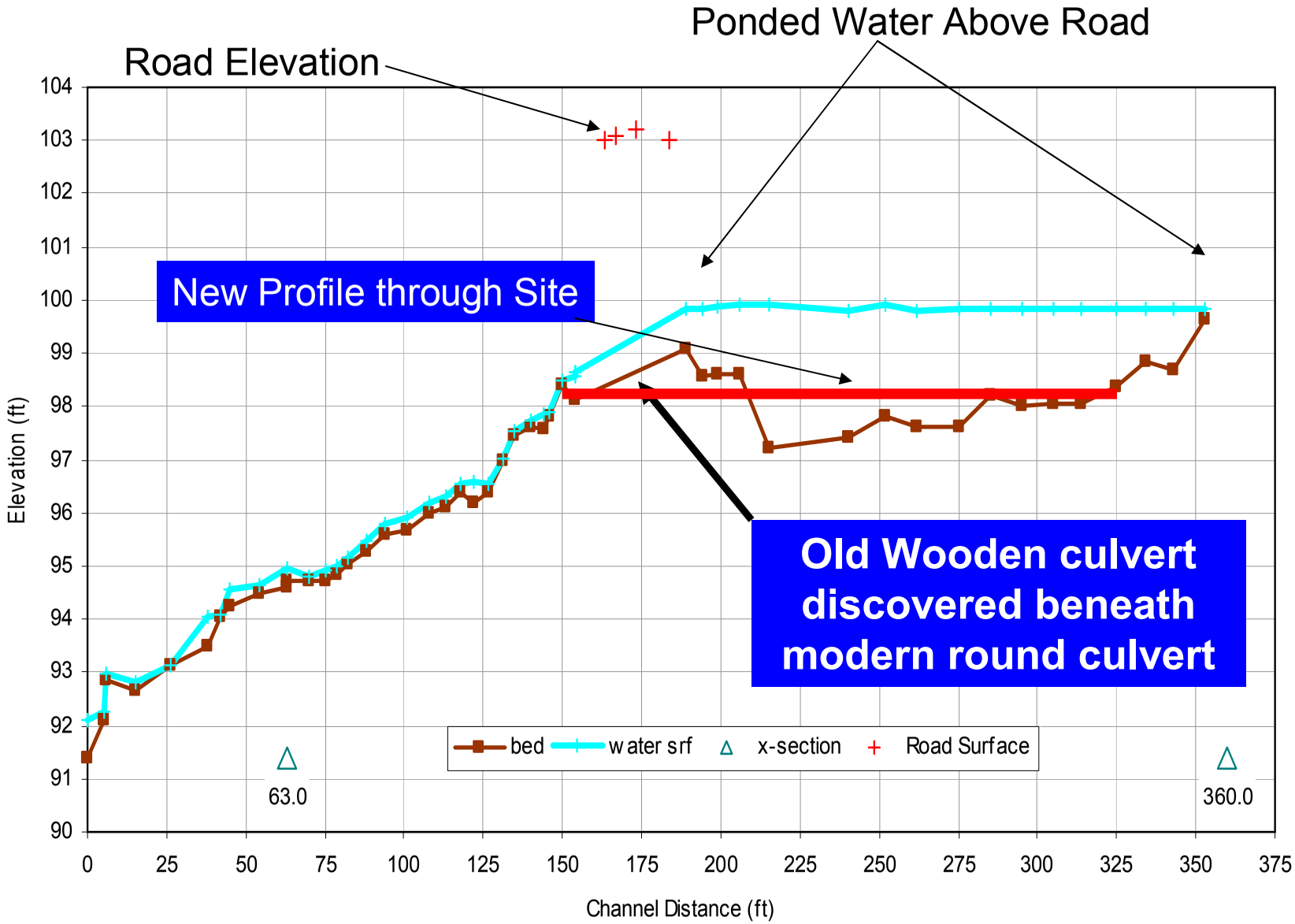
Stream Simulation Design

A channel that simulates characteristics of the adjacent natural channel will present no more a challenge to an organism than the natural channel.

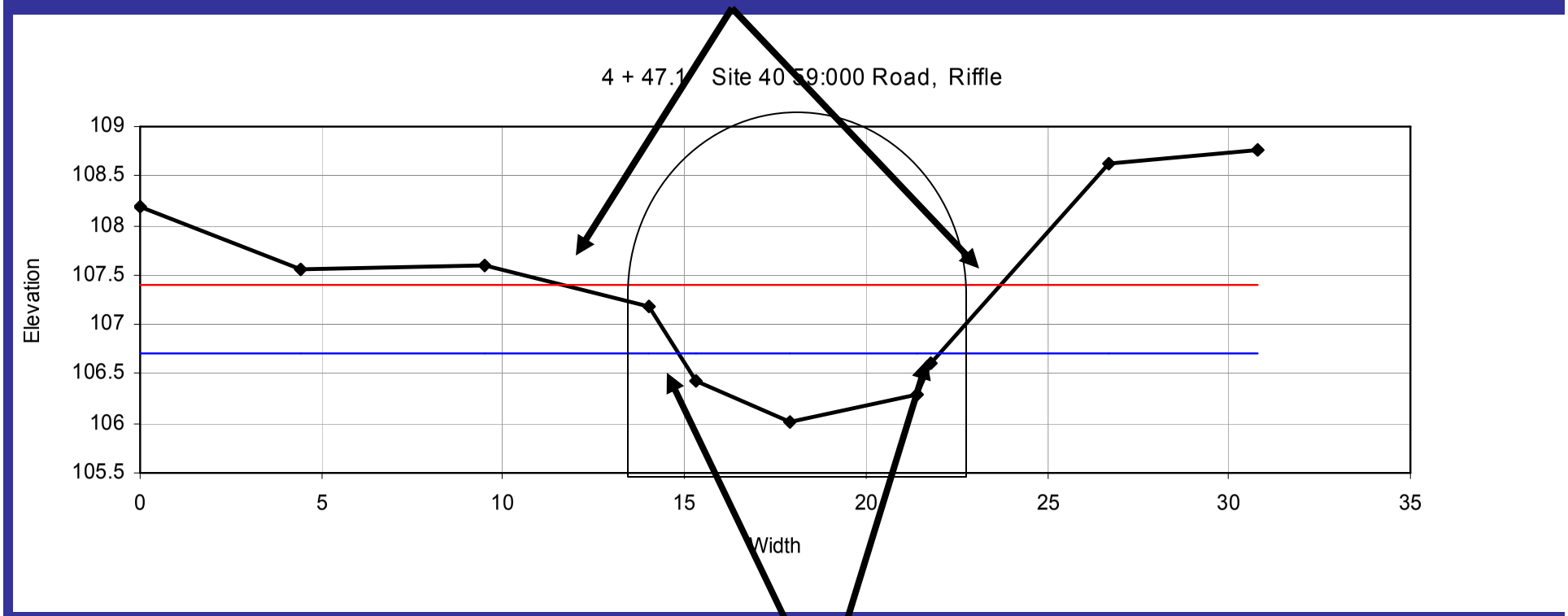
Fundamentals of Simulated Stream Passage Design

- Longitudinal profile
- Simulate reference reach
  - Cross section transect(s)
  - Mimic natural substrate
- Design crossing structure width at 1.2x bankfull width

Longitudinal Stream Profile



Flood Prone= 12.1 ft



Bankfull width= 7.2 ft

7.2 * 1.2= 8.6 ft

We used a 9 foot Open-Arch Culvert

Fish Passage Analysis

- Maine Road/Stream Crossing Survey Manual (May 2007)
- Vermont Protocol Query (Green, Grey, Red)
- Fish Xing V3 Software
  - www.stream.fs.fed.us/fishxing
- USGS Stream Mean Daily Stream Flow
  - Old Stream 01021480 (1998-2006) C.F.S./sq. mile
- USGS Regional Stream Flow Curves
  - Bankfull Width Estimates Dudley (2004) SIR 2004-5042

    http://pubs.usgs.gov/sir/2004/5042/

$$\text{Bkf (ft)} = 7.67 * \text{Watershed Area}^{0.52}$$

U.S. Fish and Wildlife Service
Maine Fisheries Resource Office
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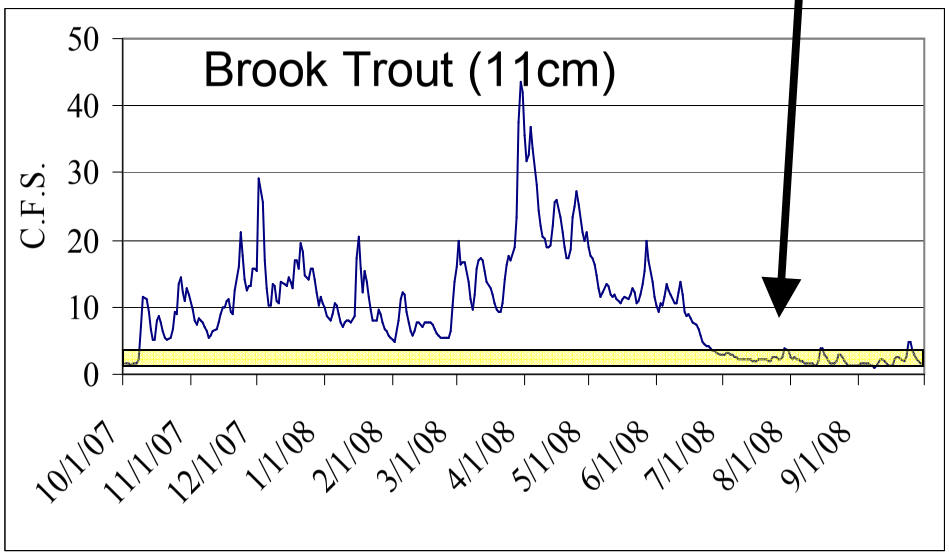
Vermont Protocol Database Query Parameters And Values	Structures Impeding Aquatic Organism Passage		Structures Potentially Impeding AOP	Structures Not Impeding AOP
	Aquatic Organisms (all fish except adult salmonids)	Aquatic Organisms (all fish, including adult salmonids)	Aquatic Organisms (all fish)	Aquatic Organisms (all fish)
	Red (Juv.)	Red (adult)	Gray (if any are true, cannot be a free fall)	Green (if all are true)
# culverts				1
Span/diame channe				75%
Structure ope obstr				none
Culvert outlet				grade
Invert to wa distance				0
Water depth in culvert (at outlet)		< .3 ft.		
material throughout structure?			no	yes
Undermining upstream			culvert	none

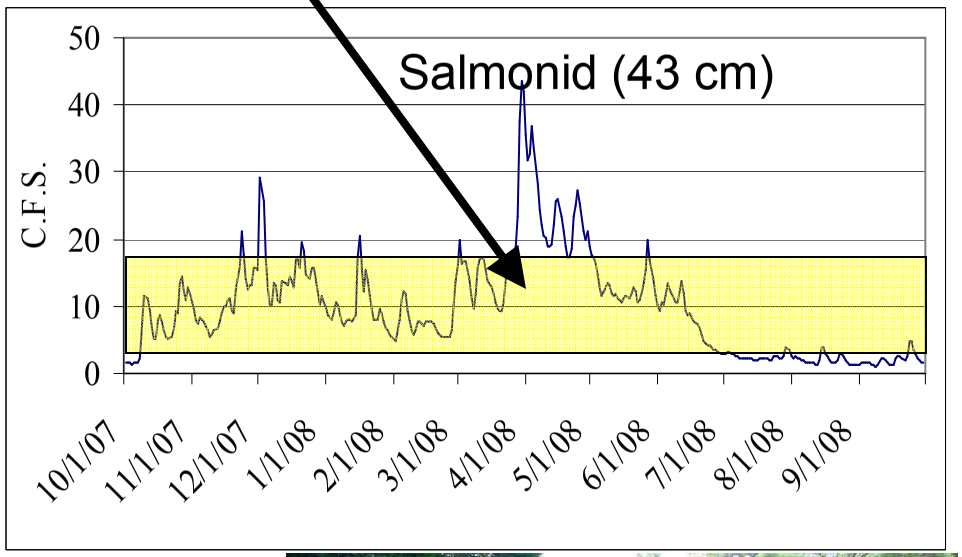
There is also a "Wildlife" Database Query available

Kerwin Brook

Flow Parameter (C.F.S.)	Brook Trout (11cm)	Large Salmonid (43cm)
Flows Passable (%)	6	38
Passable Flow Range	1.0-2.4	3.1-19.6
Depth Barrier	None	<3.1
Leap Barriers	4.8+	None
Velocity Barrier	2.4+	19.6+

Culvert/Bankfull
9.7/17=
57%





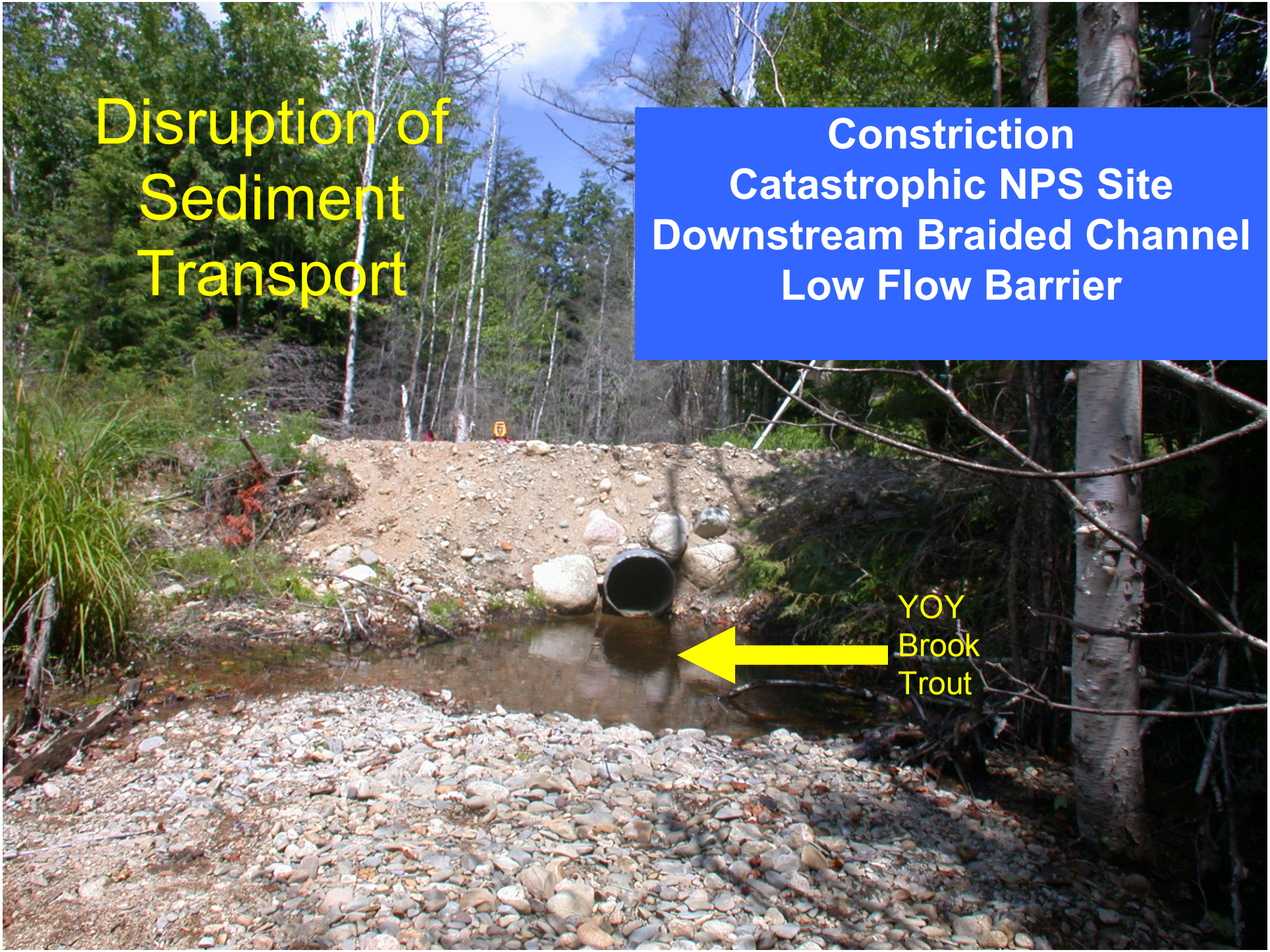
Culvert Metrics	
Length (ft)	57
Width (ft)	9.7
Slope (%)	0.28
Outlet Drop (ft)	0.42

Drainage Area (mi^2)	4.88
Mean Daily Flow (CFS)	1-44
Bankfull Width (ft)	
Measured	16.0
Regional Curve	17.5

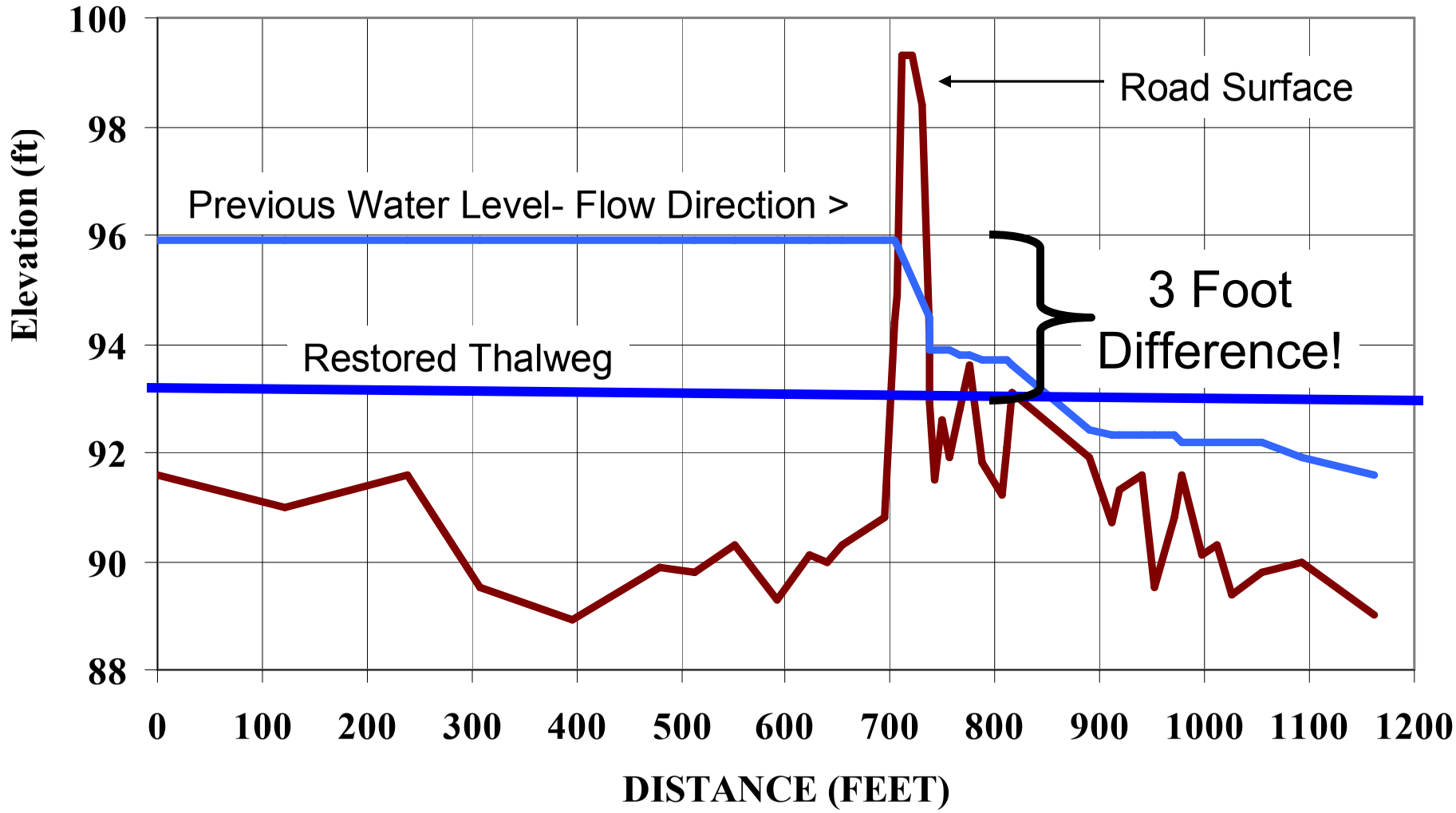
Disruption of Hydrology

- High flow passage barriers
- Absence of bank hinders weak swimmers
- Concentrated current leads to plunge pool
- No substrate inside

Disruption of hydrology

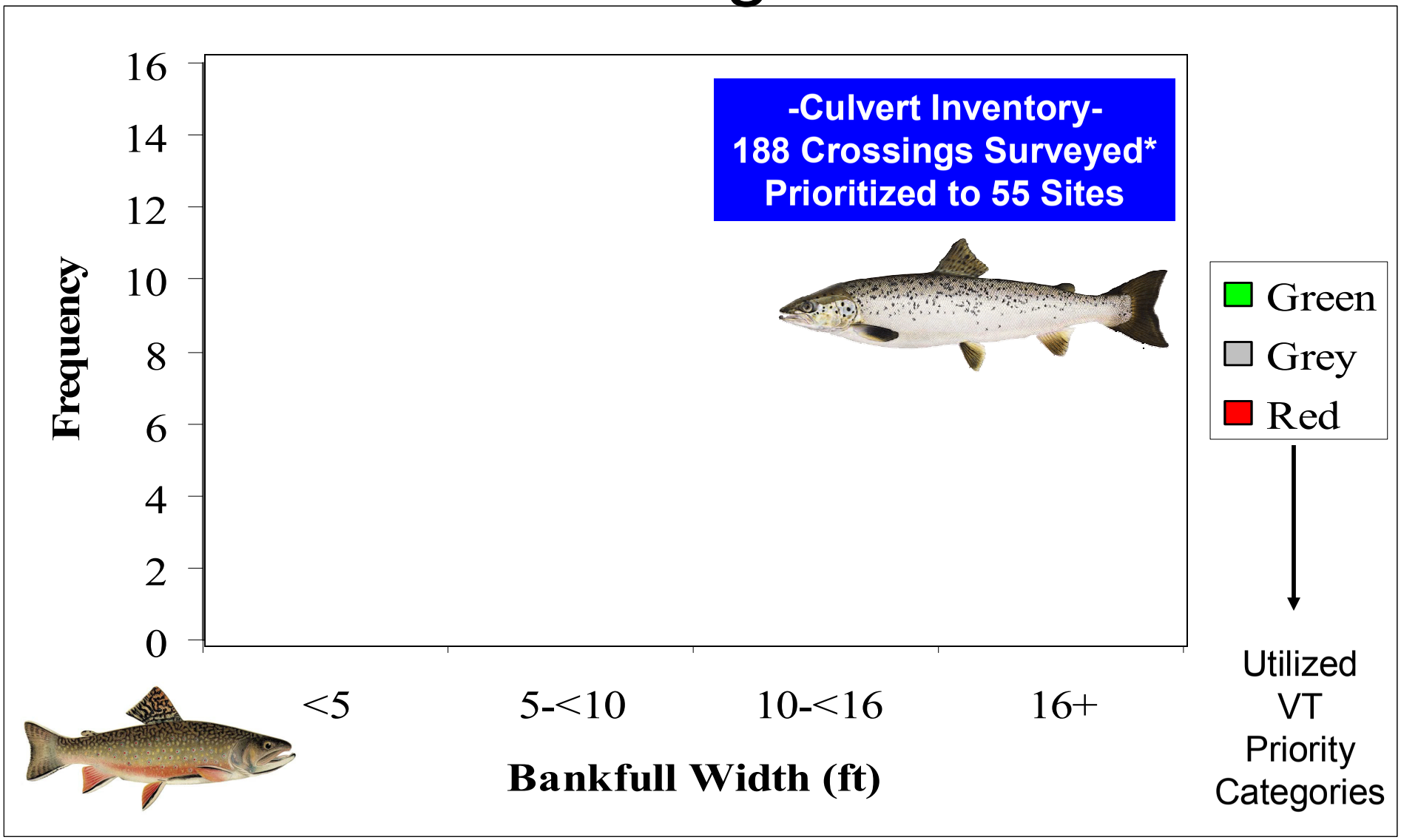

Disruption of Sediment Transport
Constriction
Catastrophic NPS Site
Downstream Braided Channel
Low Flow Barrier
YOY
Brook
Trout

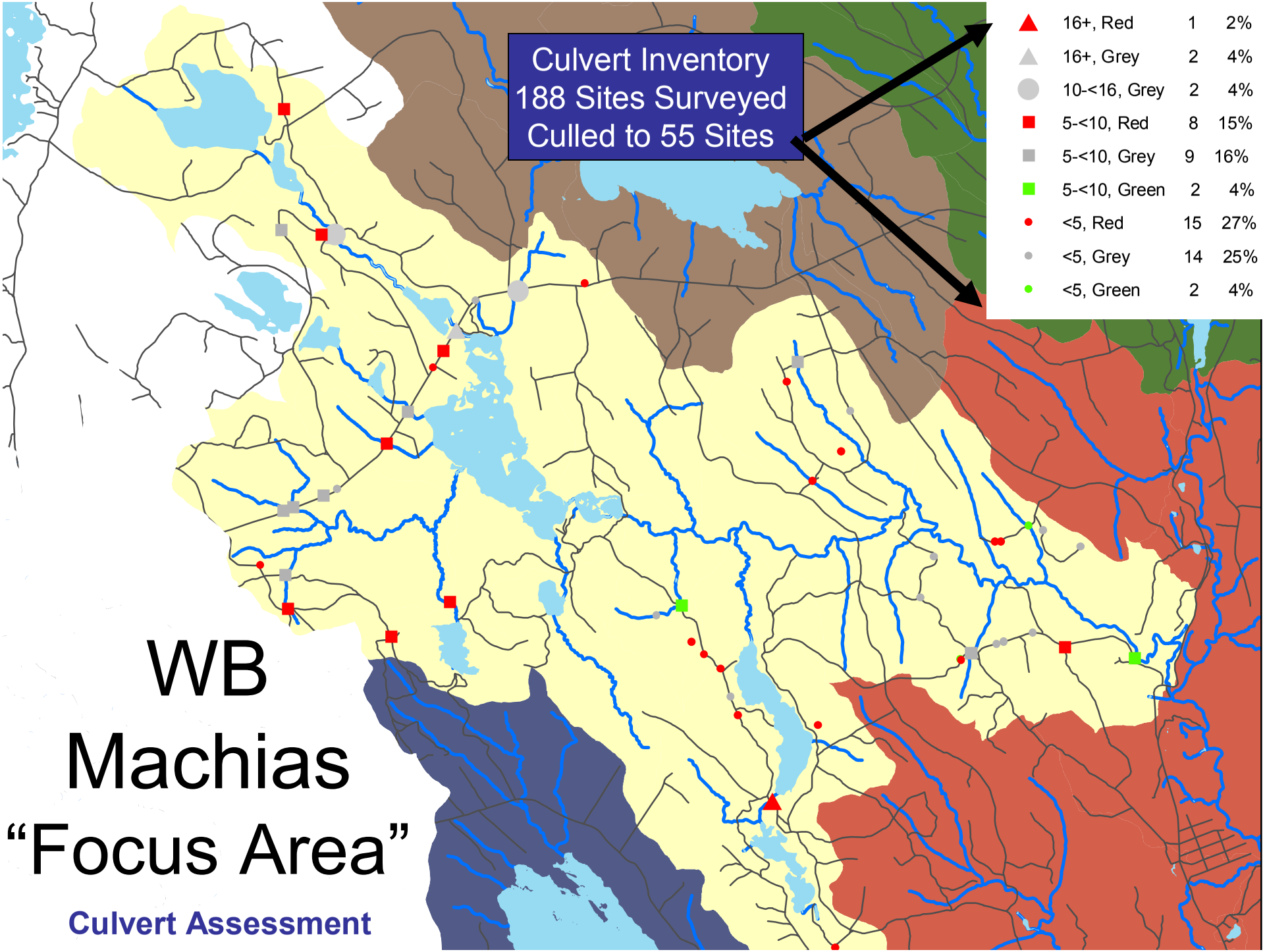
Channel Bottom and Water Line Profile



Restoring Process

WB Machias "Focus Area" Stream Crossing Assessment



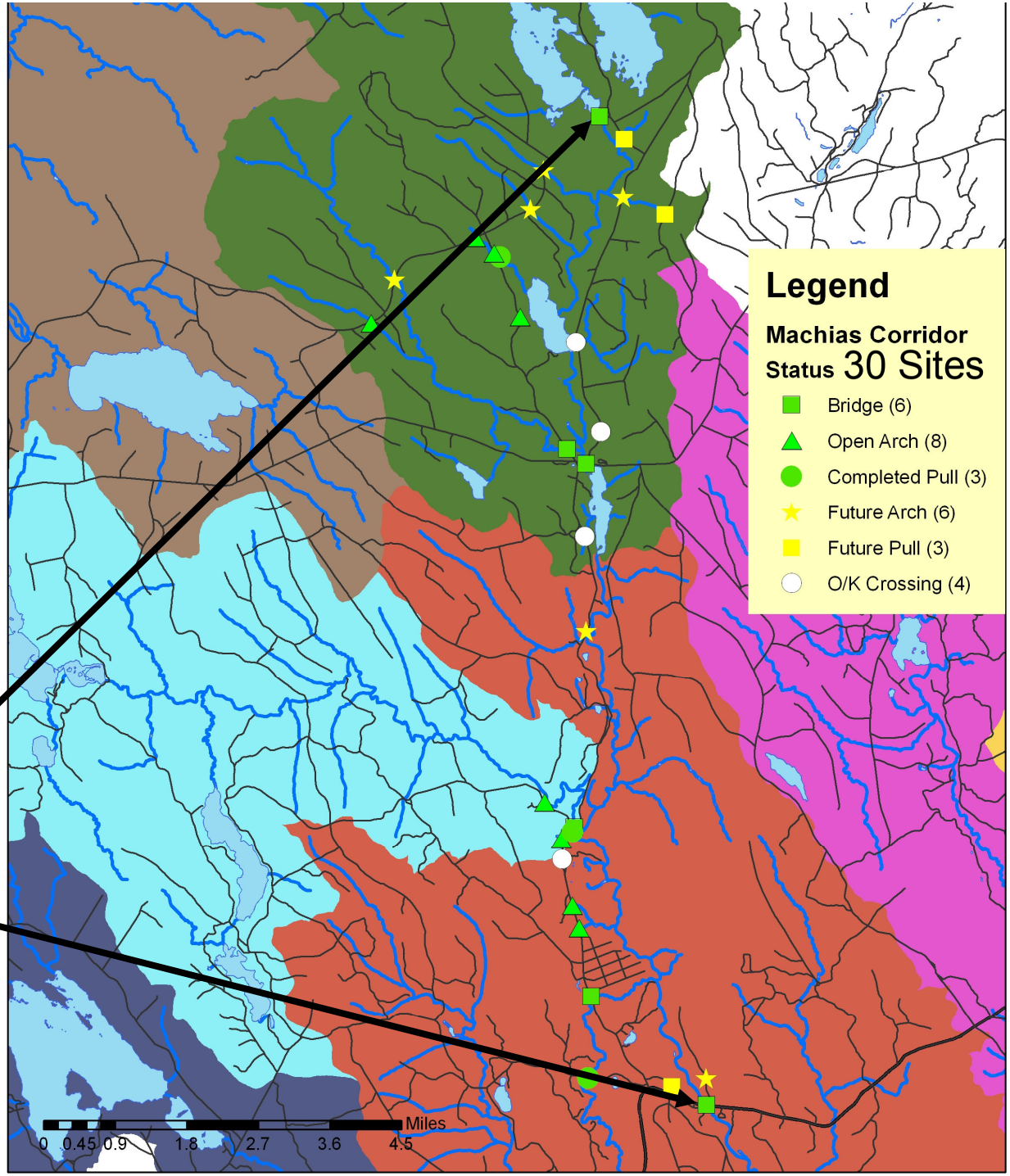

Culvert Inventory
188 Sites Surveyed
Culled to 55 Sites
16+, Red 1 2%
16+, Grey 2 4%
10-<16, Grey 2 4%
5-<10, Red 8 15%
5-<10, Grey 9 16%
5-<10, Green 2 4%
<5, Red 15 27%
<5, Grey 14 25%
<5, Green 2 4%
WB
Machias
"Focus Area"
Culvert Assessment

Machias River Corridor

Route 9
To
3rd Machias Lake

~15
Mainstem
Miles

Total Stream Miles
100+



Thank You

for your support

H.C. Haines
Malcolm French
Maine DOC
Sustainable Forest Technologies
Wagner Forestry Management
Jasper Wyman & Son's
Downeast Lakes Land Trust

Washington County SWCD
Bureau Sea-Run Fisheries & Habitat
Maine DEP
National Fish & Wildlife Foundation
Humboldt Research Station

NRCS

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