



Dam Busters: Engineering and Design

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Fluvial Geomorphologist & Regional Director
Inter-Fluve
March 6, 2024



Rivers Connect

Longitudinally

Laterally

Culturally/Spiritually

Our Place, Our Time, Our Responsibility

Enter the natural world with humility and awe.

-Ramona Peters, Mashpee Wampanoag



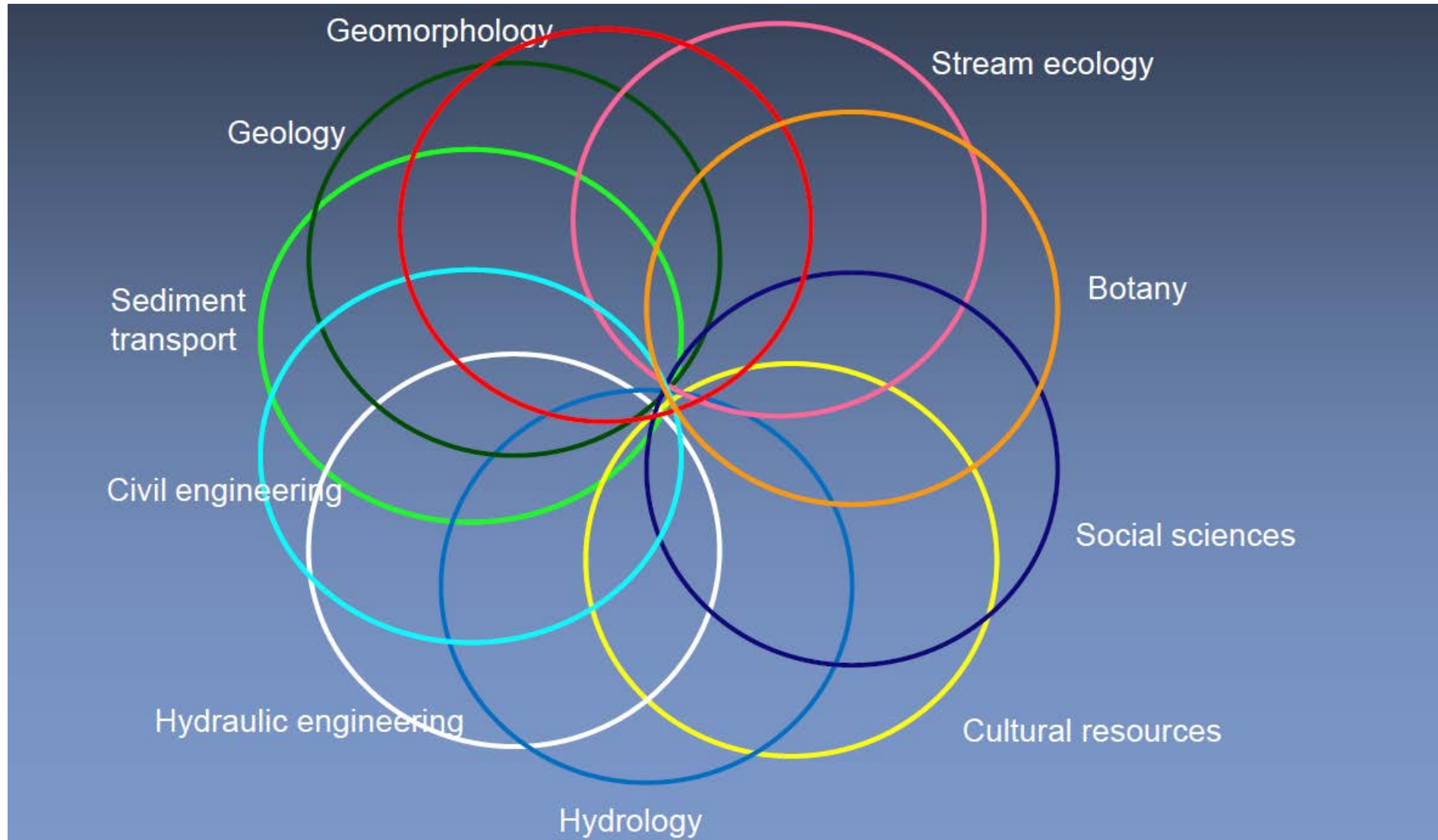


-  1. Assessment and Data Collection
-  2. Data Analyses
-  3. Designs
-  4. Dam Removal Construction

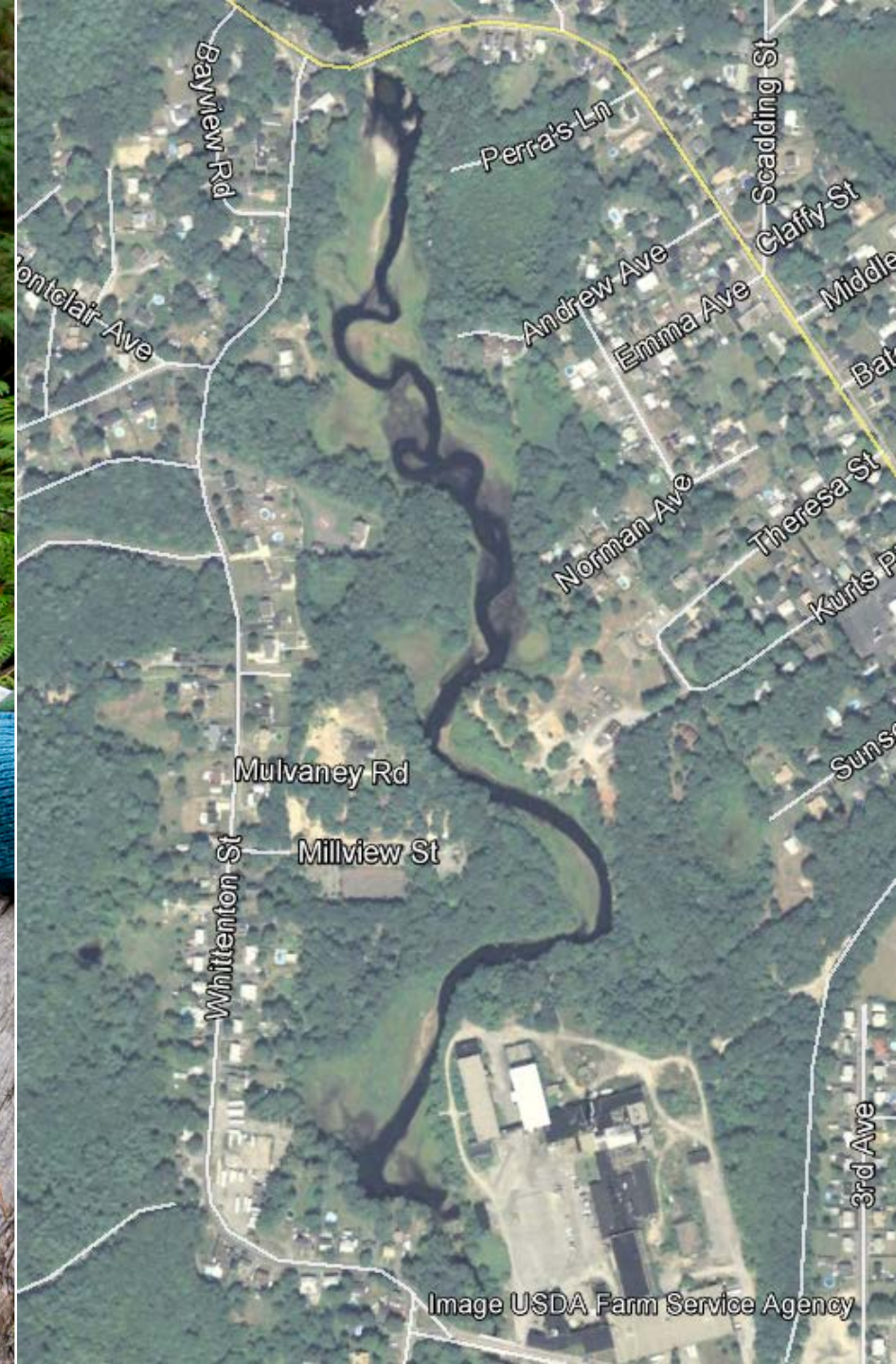
Take Home Messages

- Rivers and dam removals are complex
- Due-diligence is critical
- Uncertainty is real
- End of construction is the beginning of restoration/recovery

Rivers are complex, requiring an understanding of many disciplines



Assessment and Data Collection: Forensic Geomorphology, Habitat Assessment



Assessment and Data Collection: Survey



Whittenton Dam, Mill River, Taunton, MA

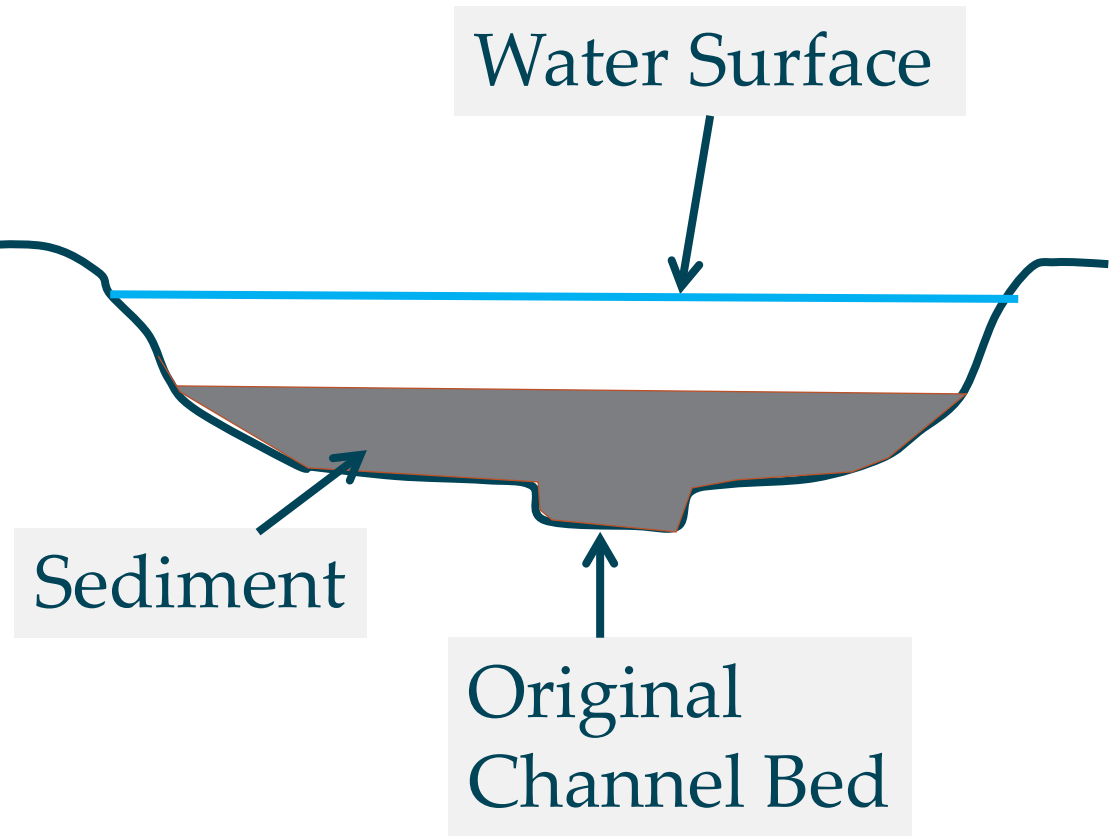
Assessment and Data Collection: Impounded Sediment

- Quantity
- Quality



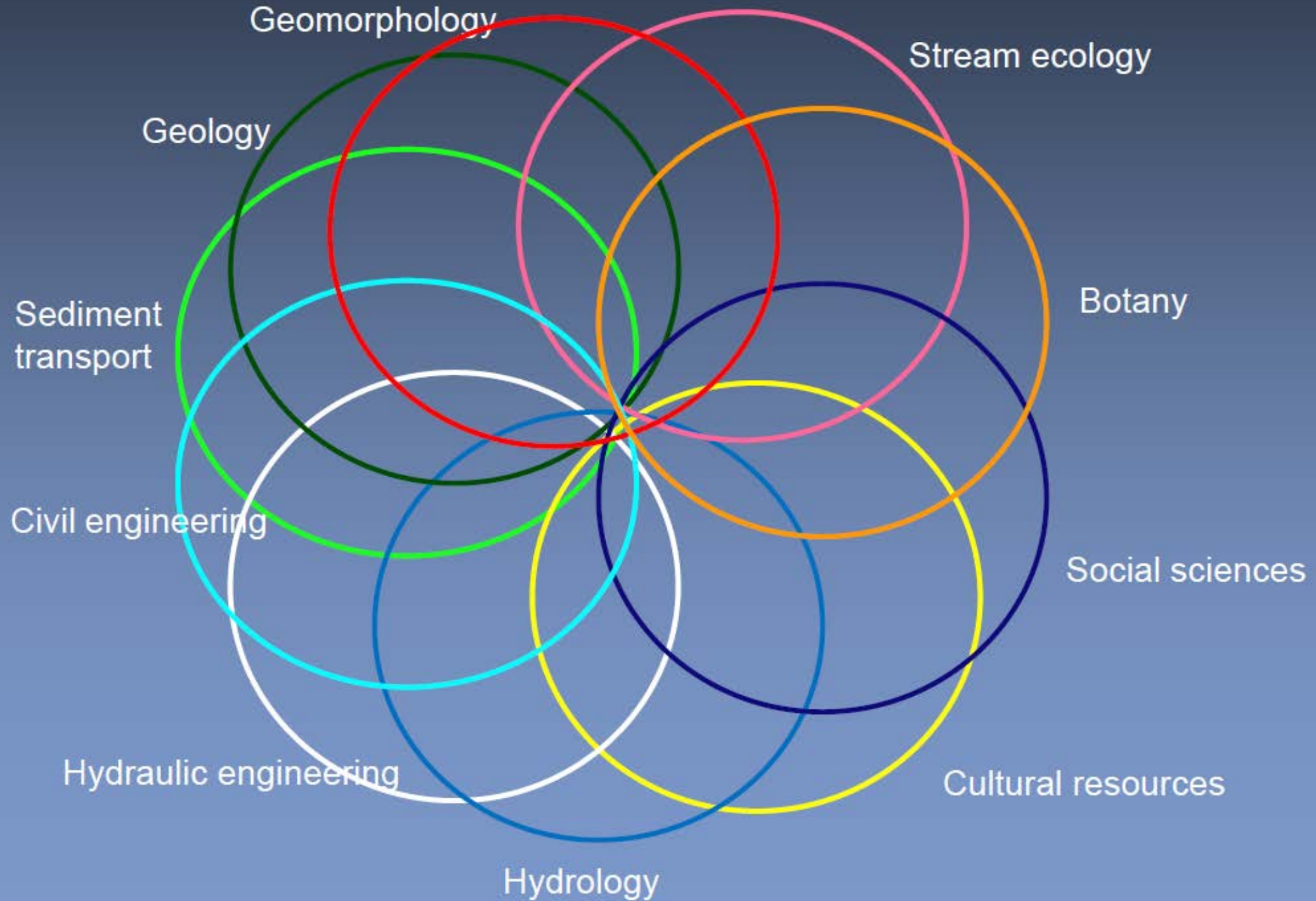
Hopewell Mills Dam, Mill River, Taunton, MA

Impounded Sediment: Estimating Volume



Impounded Sediment: Contaminant Testing

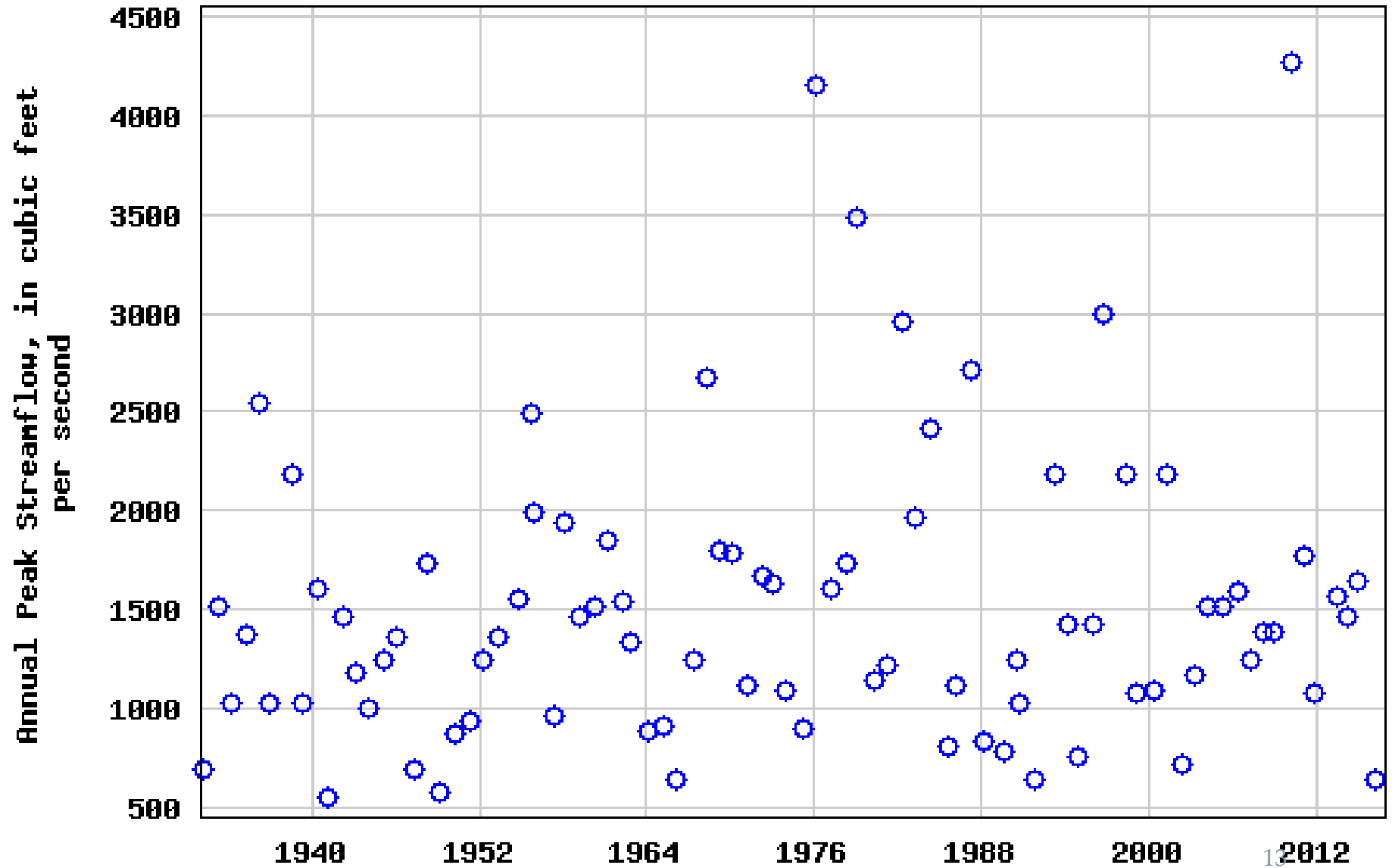




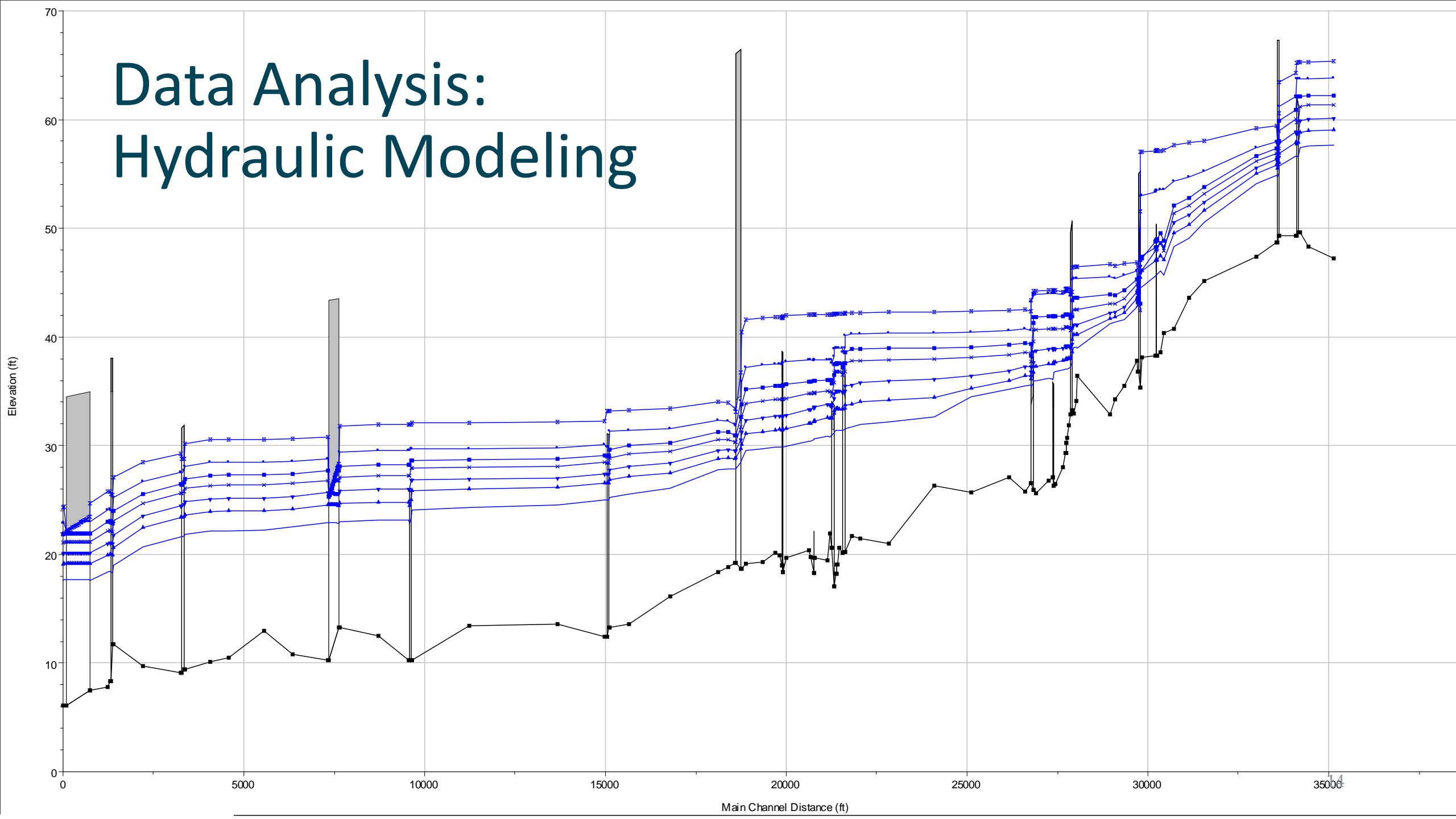
Data Analyses: Hydrology



USGS 01104500 CHARLES RIVER AT WALTHAM, MA



Data Analysis: Hydraulic Modeling



Data Analyses and Dam Removal Design Studies/Calculations

Recreational
Feature Design

Planting
Design

Scour Analysis

Infrastructure
Design

Traditional
Ecological
Knowledge

Channel
Dimensions

Channel Bed
Substrate

Large Wood
Design

Channel
Dimensions

Channel Bed
Structure

Channel Bank
Design

Fabric
Encapsulated
Soil Lift Design

Floodplain
Width

Aquatic
Habitat Design

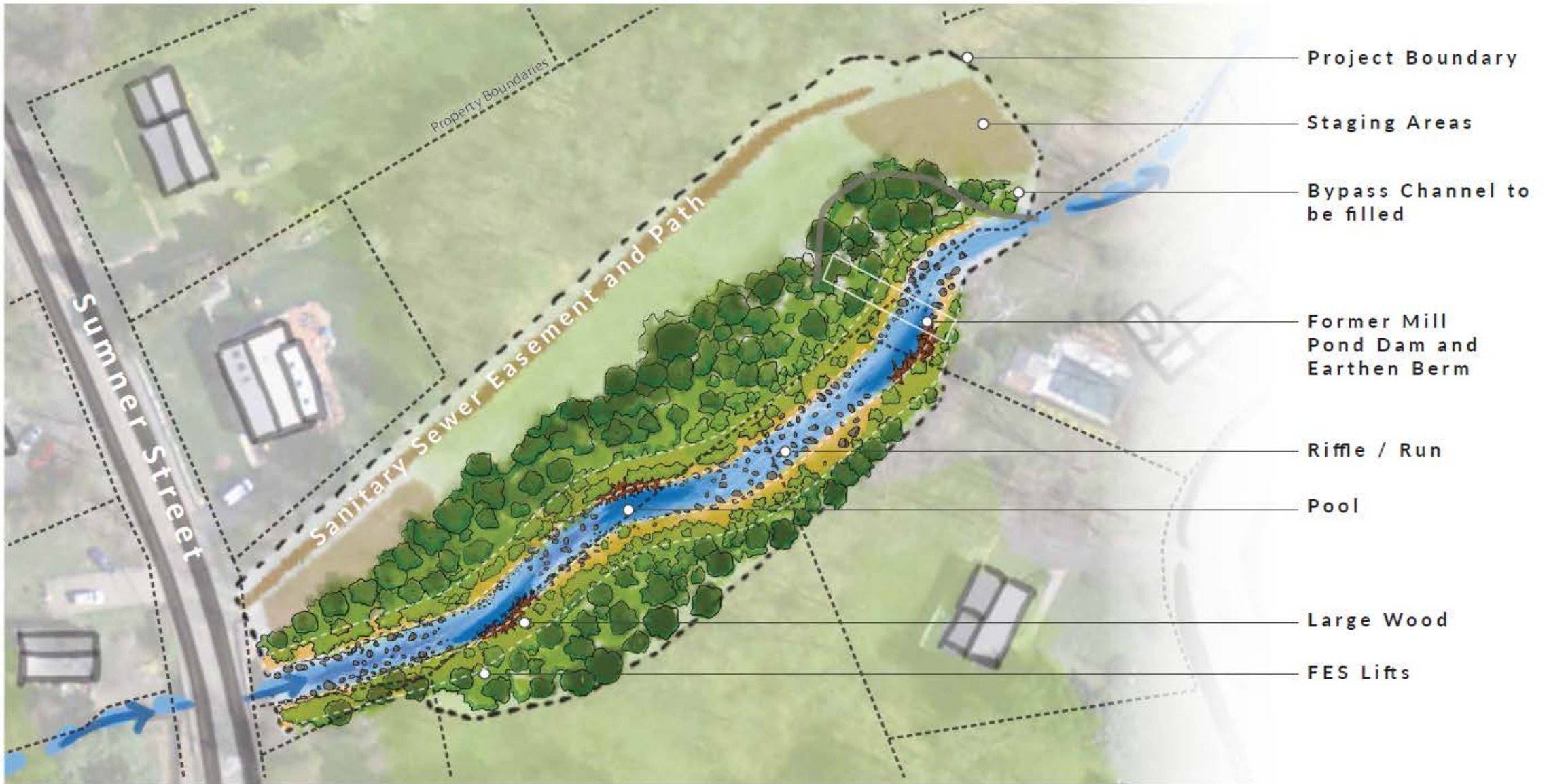
Floodplain
Habitat
Features

Dam Removal Designs

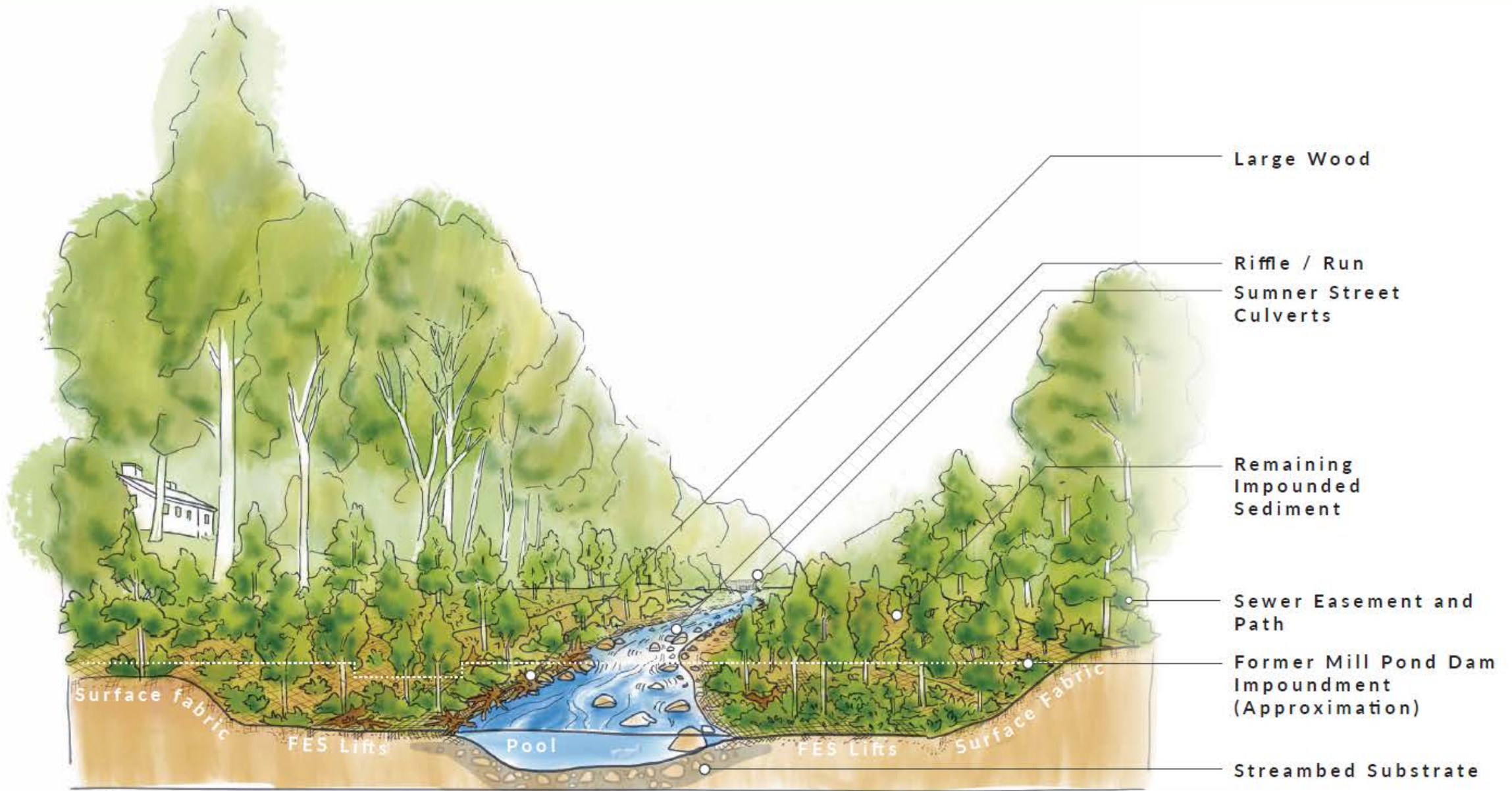
- Design Drawings
 - Basis of Design Report
 - Engineer's Opinion of Probable Cost (EOPC)
-
- Conceptual Renderings
 - 25-50% Complete
 - 60-75% Complete
 - 90% Complete
 - 100% Complete

-
- Project Boundary
 - Staging Areas
 - Bypass Channel to be filled
 - Former Mill Pond Dam and Earthen Berm
 - Riffle / Run
 - Pool
 - Large Wood
 - FES Lifts

Millpond Dam Removal, Traphole Brook, Norwood, MA

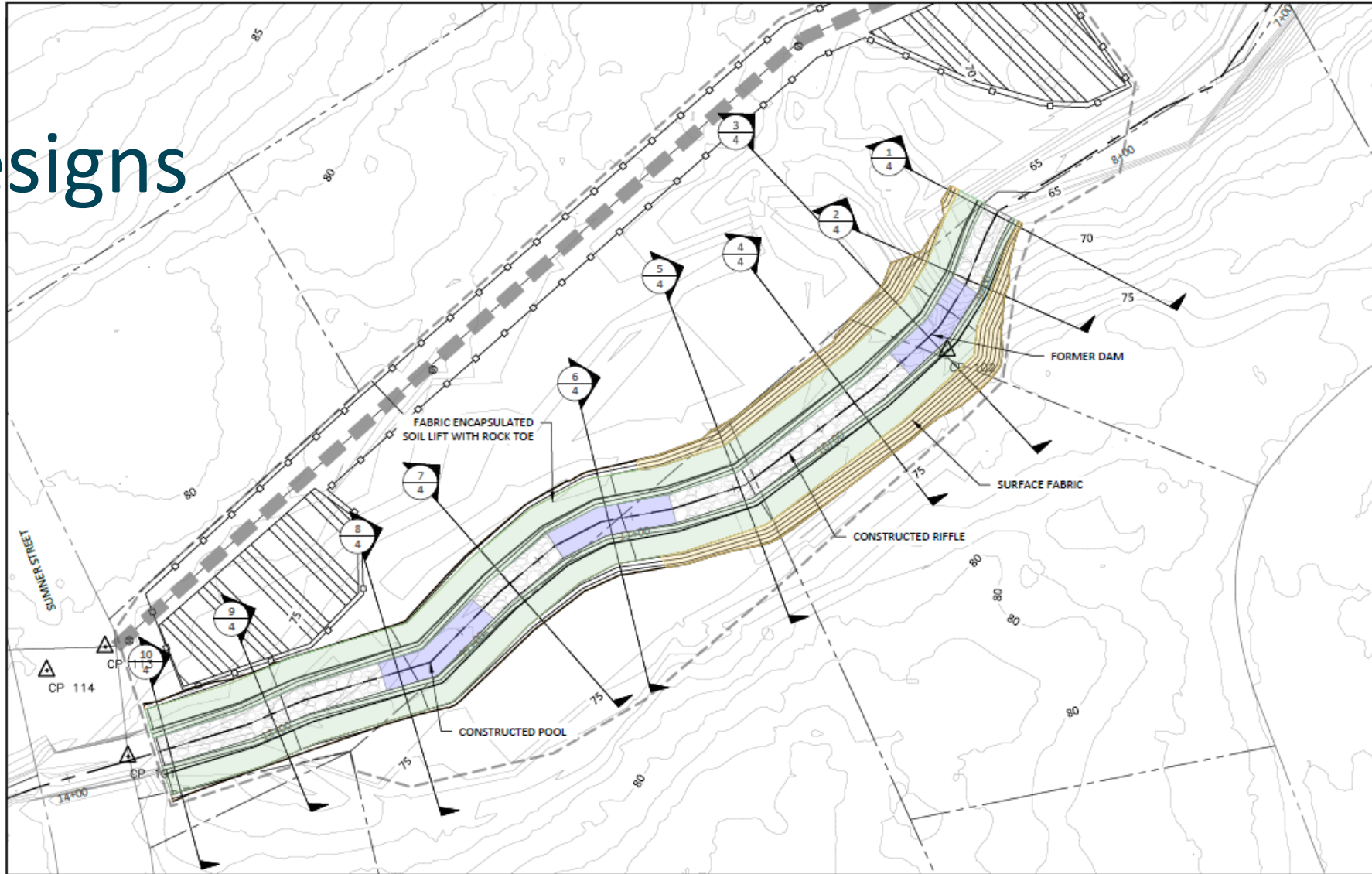


Millpond Dam Removal, Traphole Brook, Norwood, MA

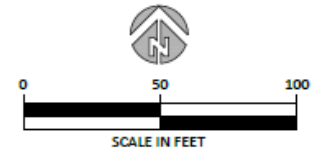
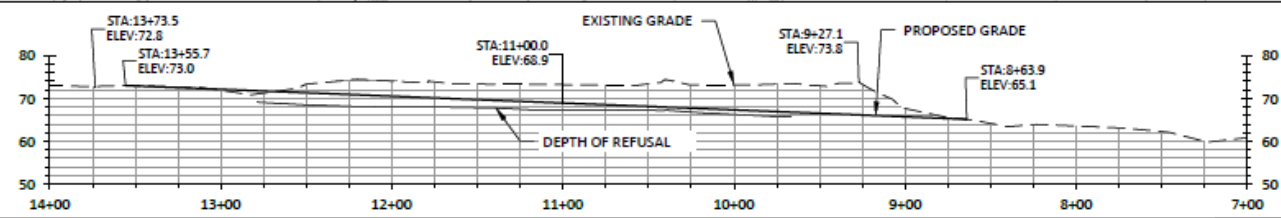


Millpond Dam Removal, Traphole Brook, Norwood, MA

40% Designs



LEGEND	
	CONTROL POINT
	TEMPORARY CONSTRUCTION ACCESS
	LIMITS OF DISTURBANCE
	STAGING AREA
	PROPOSED RIVER CENTERLINE
	PARCEL BOUNDARY
	SILT FENCE
	SEWER LINE
	SEWER MANHOLE
	PROPOSED 1' & 5' CONTOURS
	FES LIFT WITH ROCK TOE
	CONSTRUCTED RIFFLE
	CONSTRUCTED POOL
	SURFACE FABRIC



NO.	DATE	REVISION DESCRIPTION

SL	SW, SL	SW
DRAWN	DESIGNED	CHECKED
---	19-10-25	19-05-06
APPROVED	DATE	PROJECT

Town of Norwood
Norwood, MA
Mill Pond Dam Removal and Traphole Brook Restoration Project

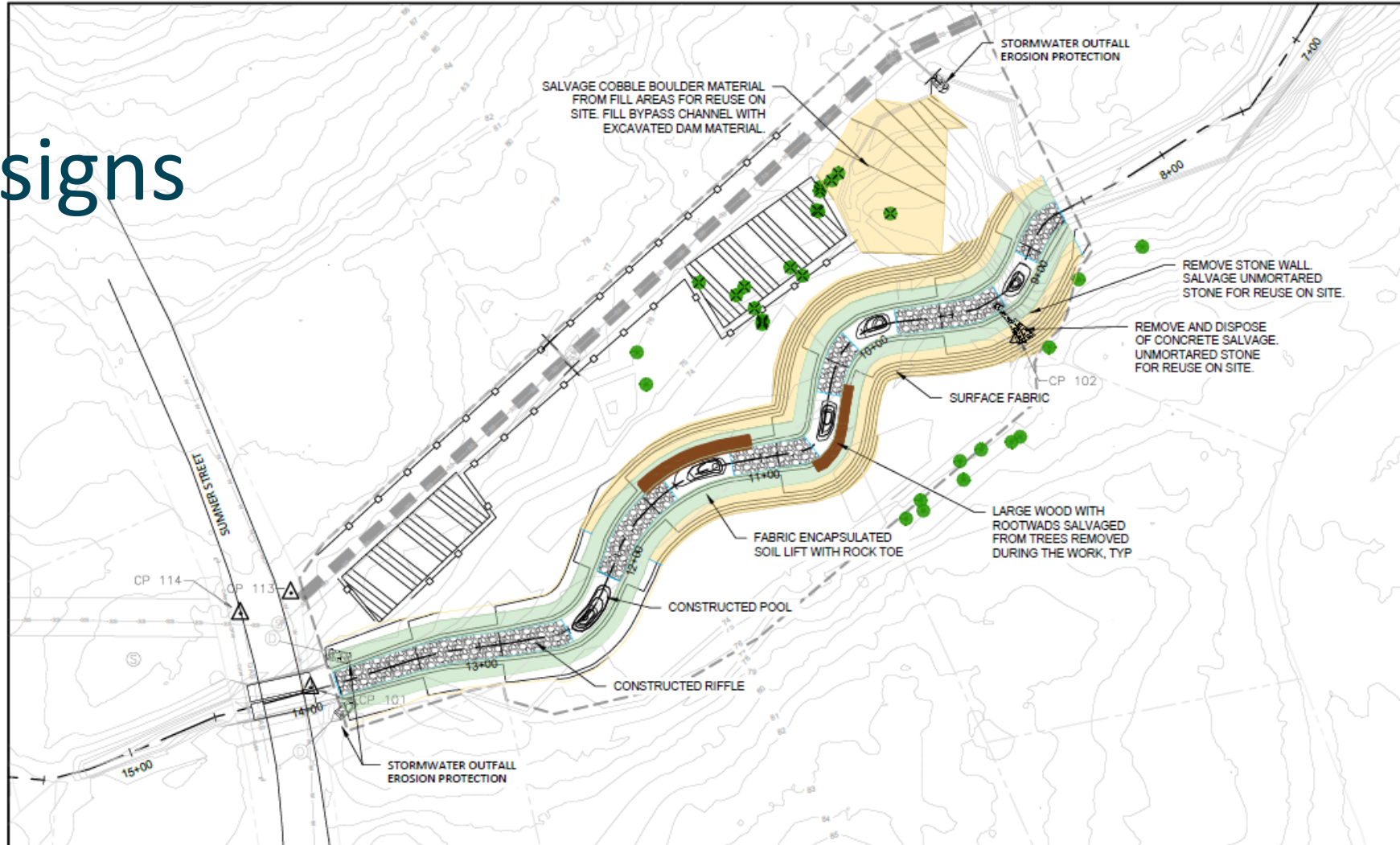
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Cambridge, MA 02138
617.714.2537
www.interfluve.com

Proposed Grading
Plan & Profile

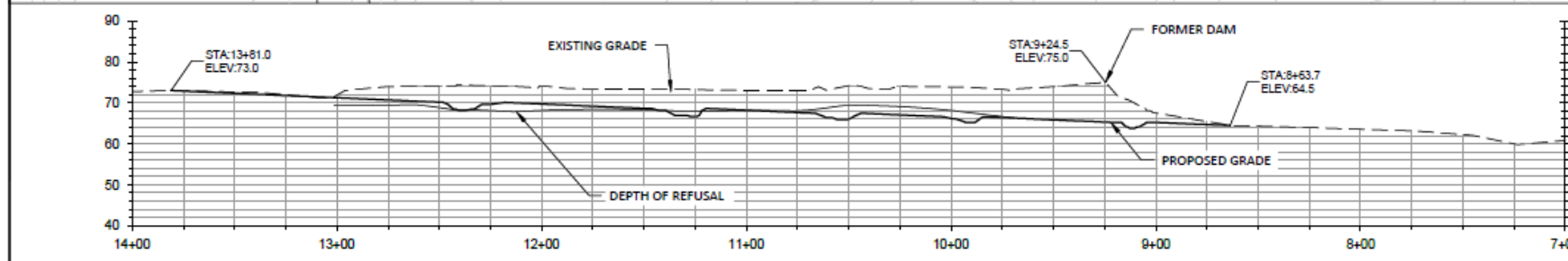
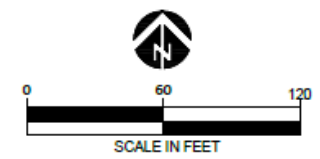
SHEET
3 of 7

DRAFT

75% Designs



LEGEND	
	CONTROL POINT
	TEMPORARY CONSTRUCTION ACCESS
	LIMITS OF DISTURBANCE
	STAGING AREA
	EXISTING RIVER CENTERLINE
	PARCEL BOUNDARY
	SILT FENCE
	DRAIN MANHOLE
	SEWER MANHOLE
	EXISTING 1' & 5' CONTOURS
	PROPOSED 1' & 5' CONTOURS
	OVERHEAD WIRE
	GAS LINE
	WATER LINE
	SANITARY SEWER LINE
	STORM SEWER LINE
	FES LIFT WITH ROCK TOE
	CONSTRUCTED RIFFLE
	SURFACE FABRIC
	EXISTING TREE
	SALVAGE TREES



NO.	DATE	REVISION DESCRIPTION

SL	SW	SL	CHECKED
DRAWN	DESIGNED		

APPROVED	DATE	PROJECT

TOWN OF NORWOOD
NORWOOD, MA

MILL POND DAM REMOVAL AND TRAPHOLE BROOK RESTORATION

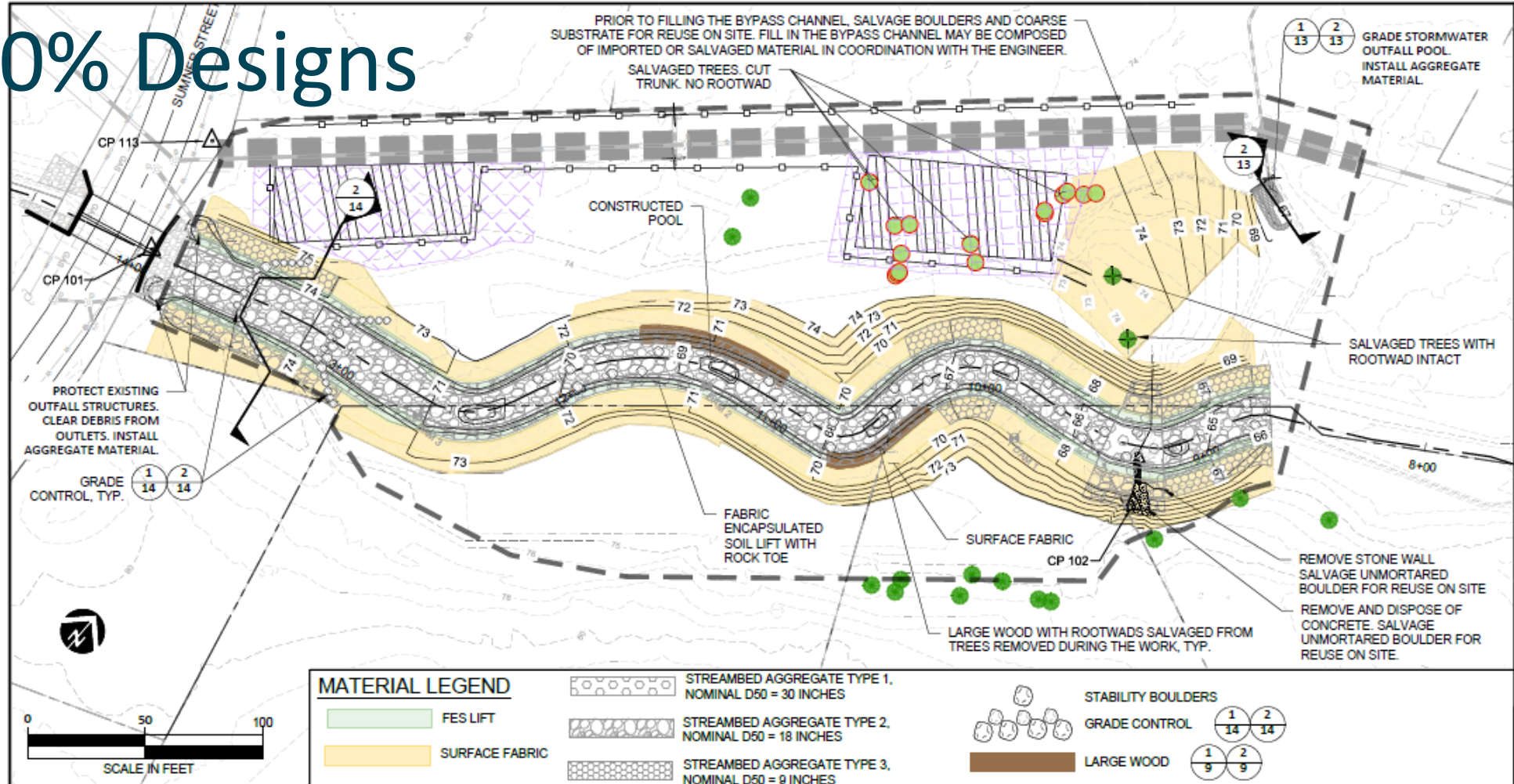


PROPOSED LAYOUT
AND MATERIALS

SHEET
 5 of 11

DRAFT

100% Designs



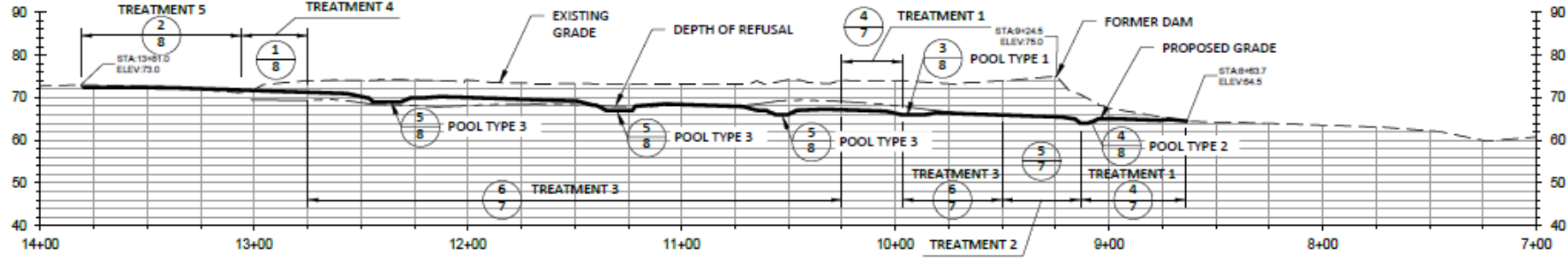
LEGEND

- CONTROL POINT
- TEMPORARY CONSTRUCTION ACCESS
- LIMITS OF DISTURBANCE
- STAGING AREA (NO GRUBBING PERMITTED)
- EXISTING RIVER CENTERLINE
- PARCEL BOUNDARY
- SILT FENCE
- CONTOURS - MINOR (1 FOOT)
- CONTOURS - MAJOR (5 FOOT)
- OVERHEAD WIRE
- GAS LINE
- WATER LINE
- D - STORMWATER PIPE AND MANHOLE
- S - SANITARY SEWER PIPE AND MANHOLE
- EXISTING TREE
- SALVAGE TREE WITH ROOTWAD INTACT
- SALVAGE TREE, CUT TRUNK NO ROOTWAD
- NO GROUND DISTURBANCE (ARCHAEOLOGY)

NOTE:
 VERTICAL DATUM: ALL ELEVATIONS GIVEN IN FEET NAVD88.
 HORIZONTAL DATUM: NAD83 STATE PLANE MAINLAND MASSACHUSETTS, FEET.

MATERIAL LEGEND

- FES LIFT
- SURFACE FABRIC
- STREAMBED AGGREGATE TYPE 1, NOMINAL D50 = 30 INCHES
- STREAMBED AGGREGATE TYPE 2, NOMINAL D50 = 18 INCHES
- STREAMBED AGGREGATE TYPE 3, NOMINAL D50 = 9 INCHES



NO.	DATE	REVISION DESCRIPTION
2	6/17/2021	ADD DETAIL TO ADVANCE DESIGNS TO CONSTRUCTION
1	10/31/2020	MINOR LINEWORK FOR PERMITTING

CP, SW, SL	SAW, SL	NN
DRAWN	DESIGNED	CHECKED
SAW	6/17/21	19-05-08
APPROVED	DATE	PROJECT

TOWN OF NORWOOD
 NORWOOD, MA
 MILL POND DAM REMOVAL AND TRAPHOLE BROOK RESTORATION

220 Concord Avenue, 2nd Floor
 Cambridge, MA 02138
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PROPOSED LAYOUT AND MATERIALS

SHEET
 6 of 14

DRAWINGS PRINT TO SCALE ON 11 X 17 PAPER

Construction Cost Estimates

Traphole Brook Restoration Cost Estimate						
2021 dollars; escalation not included						
Item #	Item	Qty	Type	Unit Price	Total Price	Note
1	Mobilization	1	LS	\$ 77,393	\$ 77,393	10% of remaining items
2	Erosion and Sediment Control	1	LS	\$ 15,000	\$ 15,000	
3	Clearing and Grubbing	1	LS	\$ 10,000	\$ 10,000	
4	Diversion and Dewatering	1	LS	\$ 50,000	\$ 50,000	
5	Earthwork: Excavation (Off-Site Disposal)	3830	yd ³	\$ 70	\$ 268,100	
6	Earthwork: Excavation (On-Site Disposal)	212	yd ³	\$ 18	\$ 3,816	
7	Boulders (owner supplied)	16	Each	\$ 75	\$ 1,200	3-4ft in diameter; install only
8	Boulders (contractor supplied)	26	Each	\$ 150	\$ 3,900	3-4ft in diameter
9	Streambed Aggregate (Type 1)	270	tons	\$ 75	\$ 20,250	
10	Streambed Aggregate (Type 2)	3300	tons	\$ 75	\$ 247,500	
11	Streambed Aggregate (Type 3)	280	tons	\$ 75	\$ 21,000	
12	Fabric Encapsulated Soil Lift	1030	FF	\$ 60	\$ 61,800	
13	Surface Fabric	2450	SY	\$ 15	\$ 36,750	
14	Large Wood Logs/Snags (salvage/owner supplied)	26	Each	\$ 200	\$ 5,200	Either salvaged during clearing and grubbing or delivered by the Town
15	Large Wood Rootwads (salvage/owner supplied)	16	Each	\$ 200	\$ 3,200	Either salvaged during clearing and grubbing or delivered by the Town
16	Potted Plants (5 gallon)	52	Each	\$ 150	\$ 7,800	
17	Potted Plants (1 gallon)	172	Each	\$ 30	\$ 5,160	
18	Live stakes	520	Each	\$ 10	\$ 5,200	
19	Zone 1: Wetland Seed	0.6	acre	\$ 7,000	\$ 4,200	
20	Zone 2: Transitional Seed	0.4	acre	\$ 7,000	\$ 2,800	
21	Zone 3: Upland Seed	0.15	acre	\$ 7,000	\$ 1,050	
	SUBTOTAL				\$ 851,319	
	Contingency				\$ 85,132	10% of Subtotal
	Total				\$ 936,450	



Construction



Elwha Dam Removal: Elwha River, WA



West Britannia Dam Removal: Mill River, MA

Common Design and Construction Challenges: Access



Balmoral Dam, Shawsheen River,
Andover, MA. Photo Credit: Kris
Houle, MA DER

Common Design and Construction Challenges: Water Control



Hopewell Mills Dam, Mill River,
Taunton, MA



Balmoral Dam, Shawsheen River, Andover,
MA

Common Construction Challenges: People



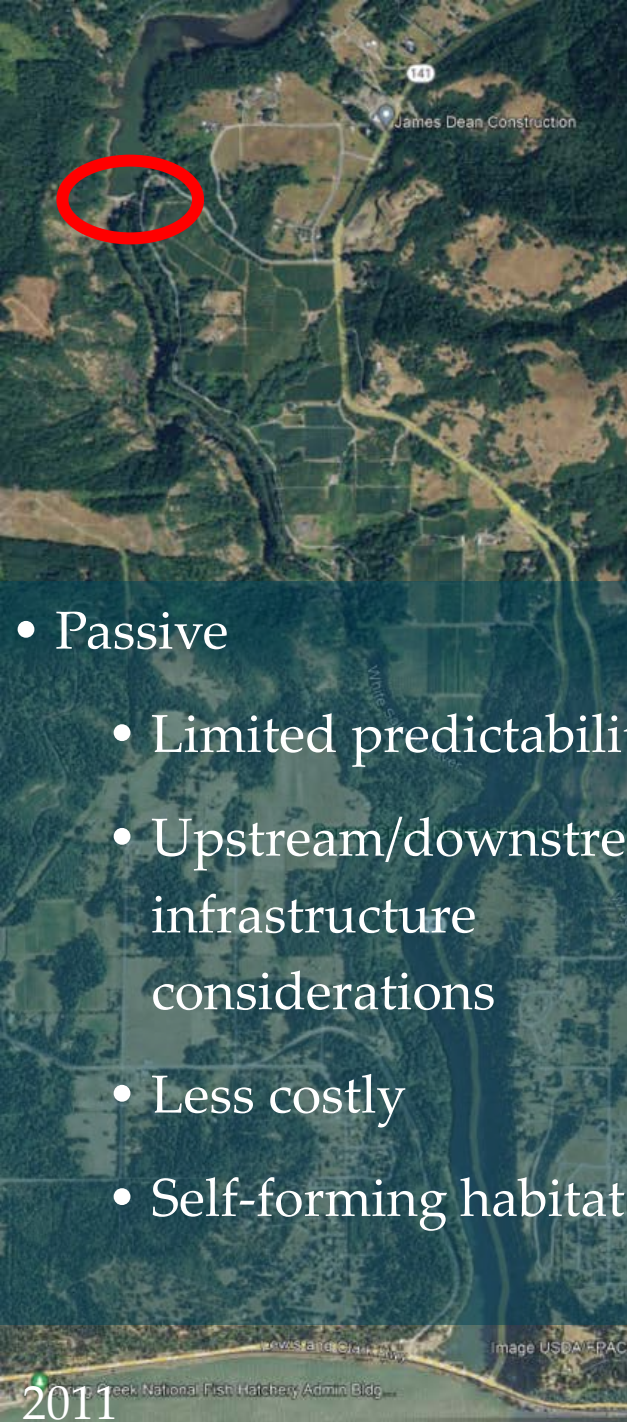
Sediment Management: Active vs Passive



- Active
 - Active channel construction
 - Extensive design and bio-engineering
 - Can be costly
 - Instant habitat is possible
 - Species-specific complex habitat

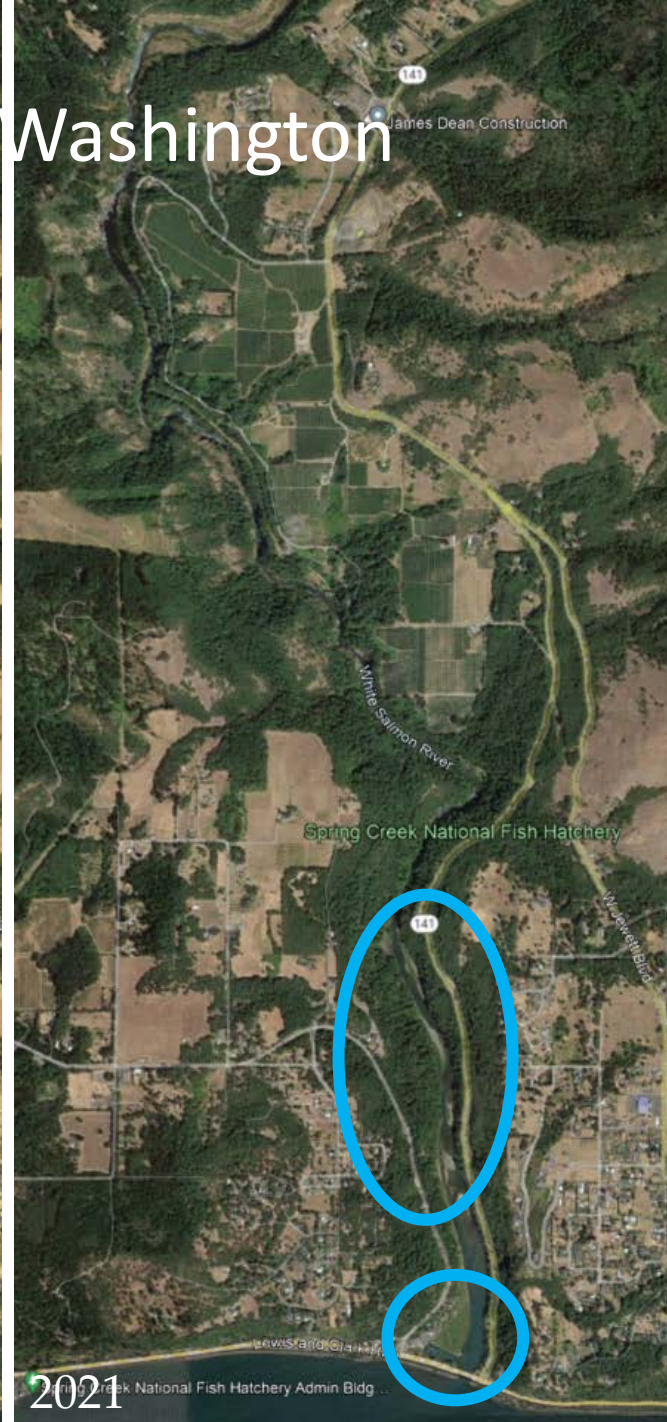
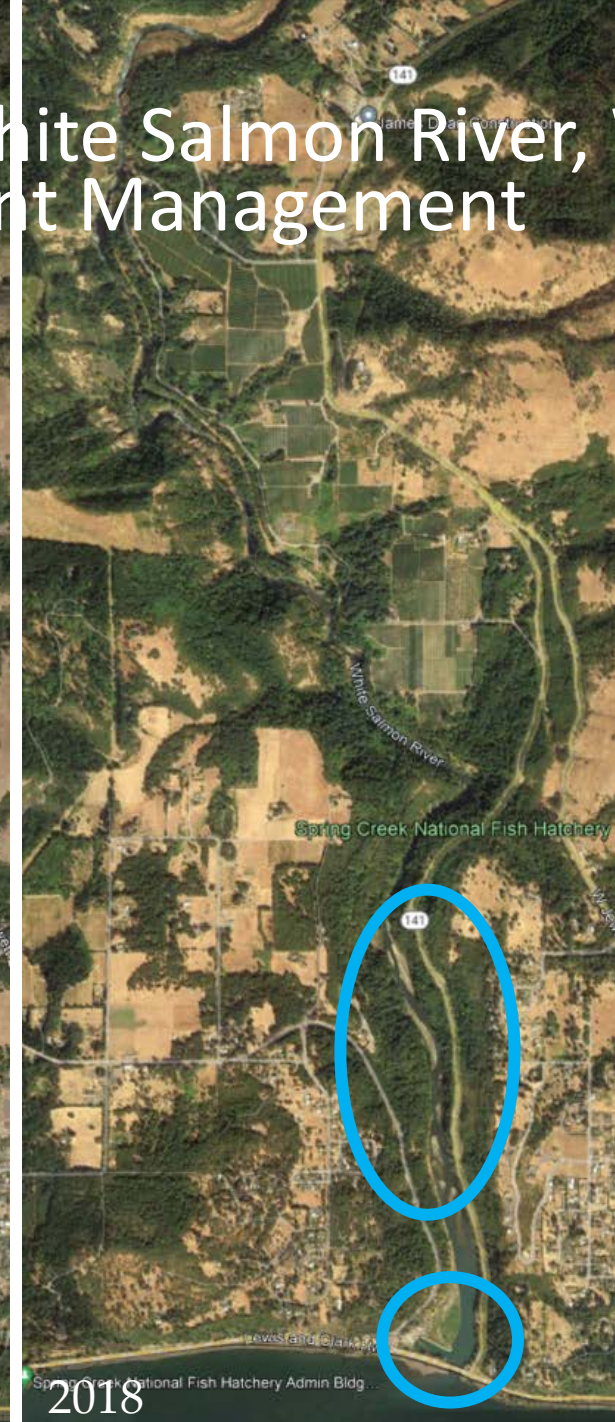


Hopewell Mills Dam, Mill River, Taunton, MA



Condit Dam. White Salmon River, Washington Passive Sediment Management

- Passive
 - Limited predictability
 - Upstream/downstream infrastructure considerations
 - Less costly
 - Self-forming habitat



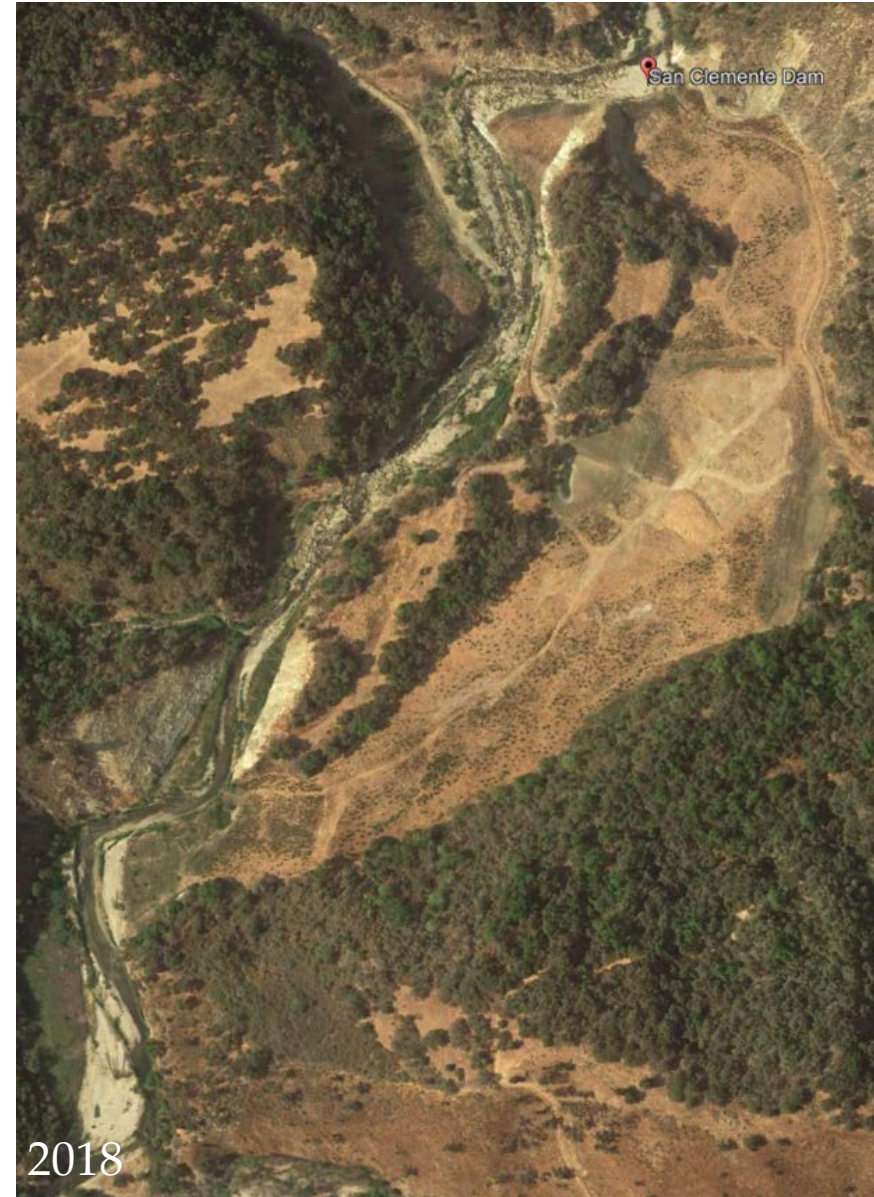
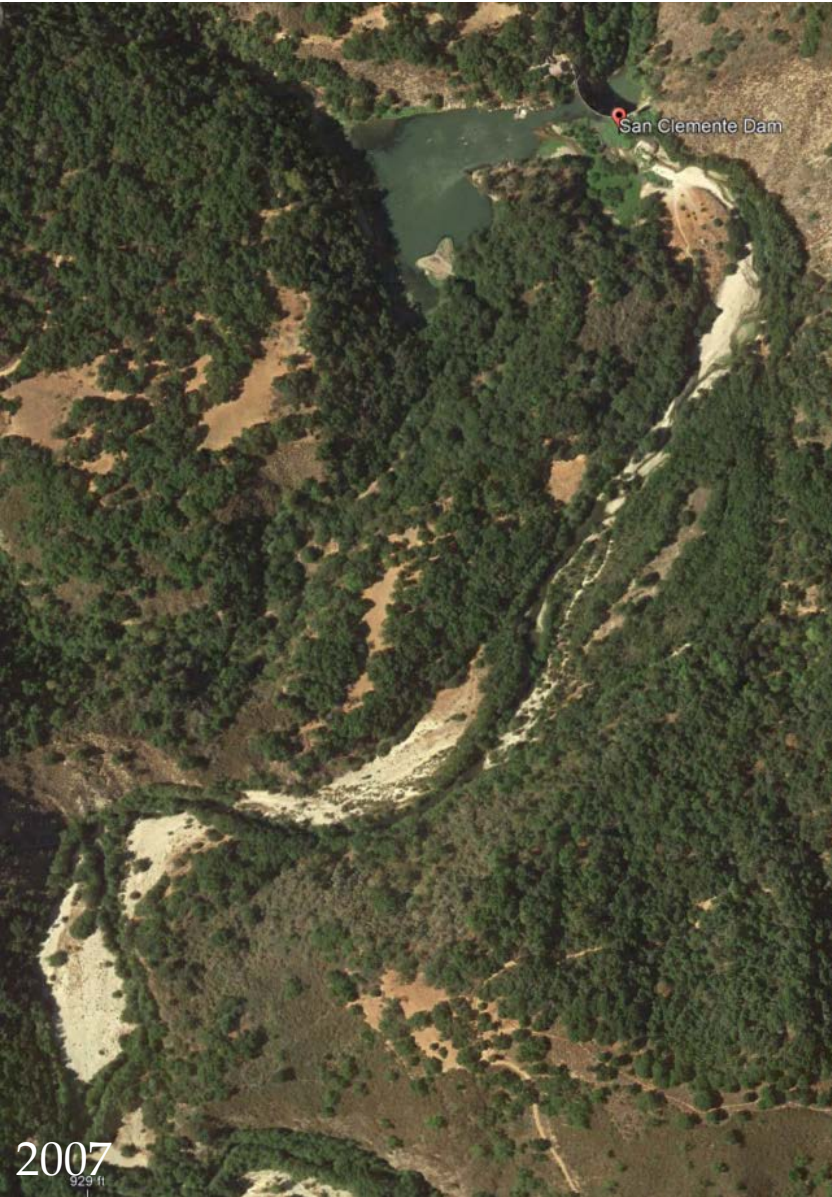
2011

2016

2018

2021

Creative Solutions




Construction Observation



Dam Removal – doesn't have to look engineered





Thank you

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