Payne Branch Dam Removal & Middle Fork of the New River Restoration

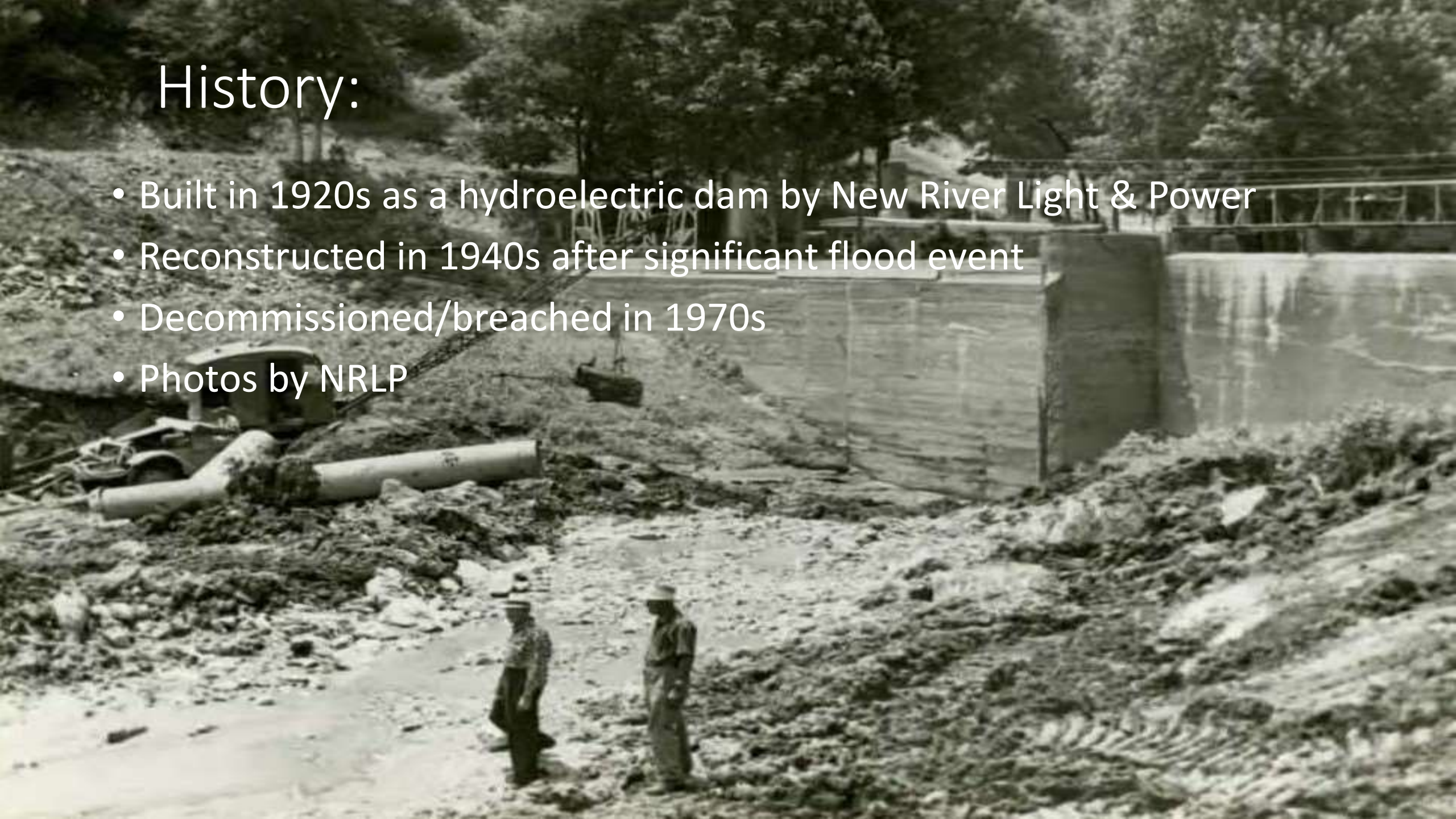
Designed by: Brushy Fork Environmental Consulting, Inc.

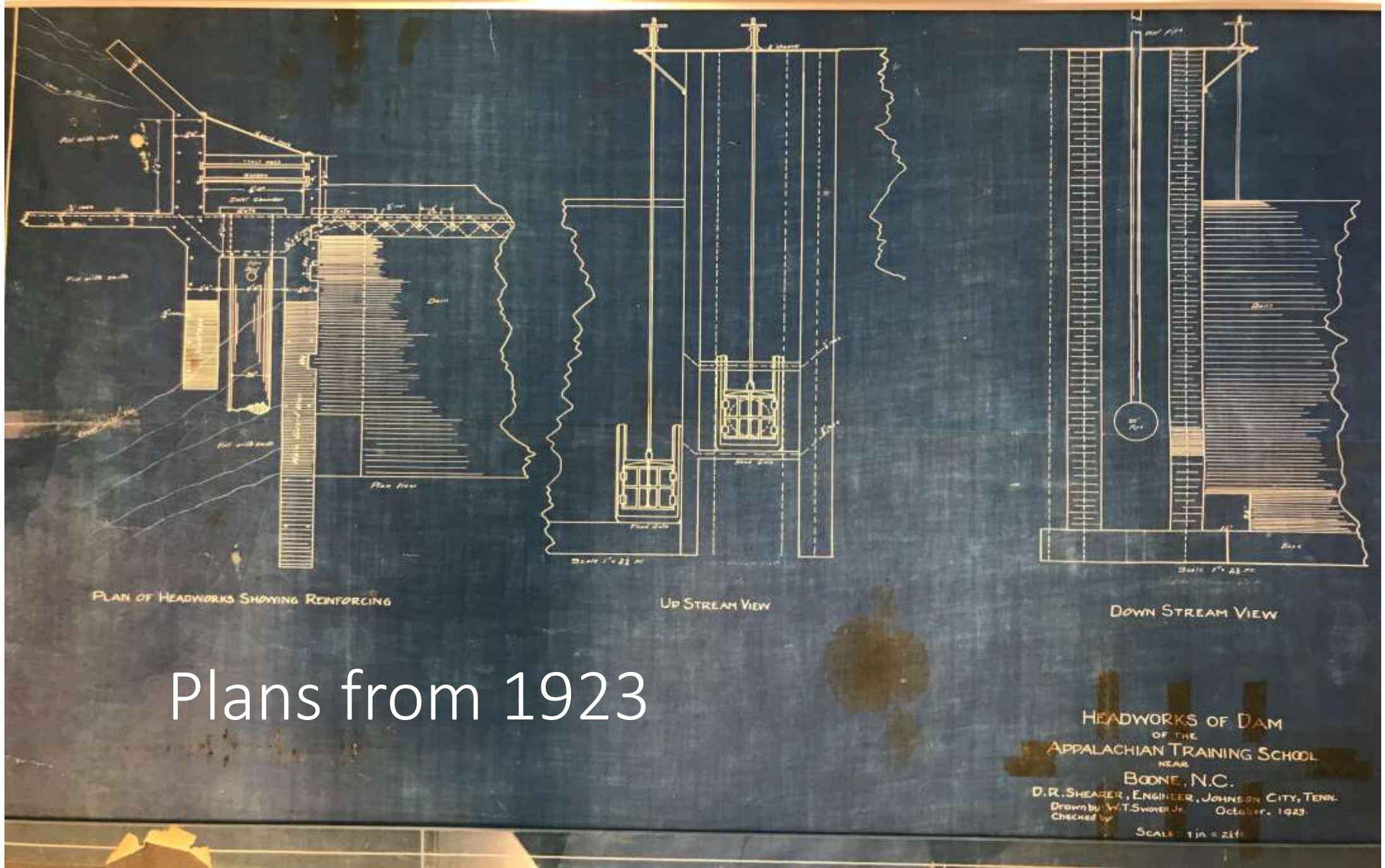
&

Constructed by: Northstate Environmental, Inc.

History:

- Built in 1920s as a hydroelectric dam by New River Light & Power
- Reconstructed in 1940s after significant flood event
- Decommissioned/breached in 1970s
- Photos by NRLP





Plans from 1923

Purpose:

- Remove ugly, non-functioning structure
- Safety – remove structure that was showing signs of failure
- Fish passage
- Water quality – remove impounded sediment upstream Town of Boone water intake

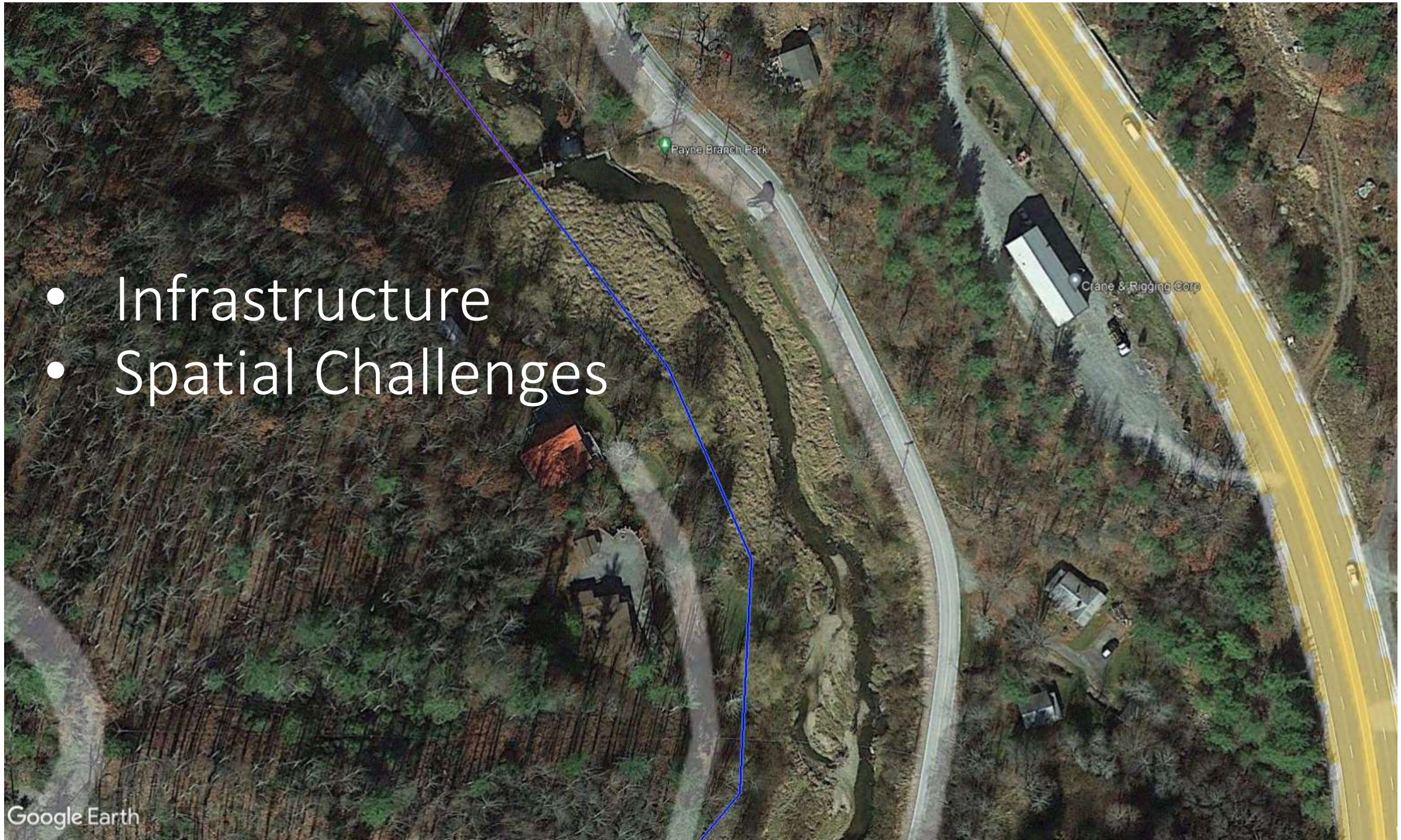
Challenges:

- Phased fundraising: design/construction
- Landowners/stakeholders
- Infrastructure/spatial challenges
- Design challenges – design cost effective project that meets majority of objectives
- Construction Challenges
- Regulatory

Fundraising/Planning:

- Phased funding: 1) design & 2) construction
- Planning/Design funded in 2017
- Construction funded in 2020
- Funding mechanisms:
  - Clean Water Management Trust Fund
  - New River Light and Power (landowner)

Landowers & Stakeholders:



- Infrastructure
- Spatial Challenges

Planning/Design:

- Accomplishing objectives:
  - Cost effective – more sediment removal/more $$
  - Dropping 20 feet in 900 feet (~18 foot @ breach)
  - Fish Passage – big one for funder CWMTF – wanting less than 1 foot drop per structure (with resting pools)
  - Balance fish passage needs for endemic darters with habitat required for game fish (fast flowing cascades). Trout (brown, rainbow) and 5 endemic darters (reference ASU aquatic survey). Needed fast flowing riffles with deep pool habitat, but targeted step height of 0.5’ for darters

5 endemic darters: Kanawha Minnow- *Phenacobius teratulus*, New River Shiner- *Notropis scabriceps*, Appalachia Darter- *Percina gymnocephla*, Kanawha Darter (*Etheostoma kanawahae* and Bigmouth Chub, *Nocomis platyrhynchus.* 4 of these only found downstream; tf, dam is impediment to these species.

- Design challenge became fish passage vs $$
- Provide floodplain connectivity
- Integrate stormwater outfall channels
- Flexibility required to work around/with bedrock

Geophysical Survey

using Electrical Resistivity Tomography (ERT), high frequency Ground Penetrating Radar (GPR) and a 350 MHz hyper-stacking antenna

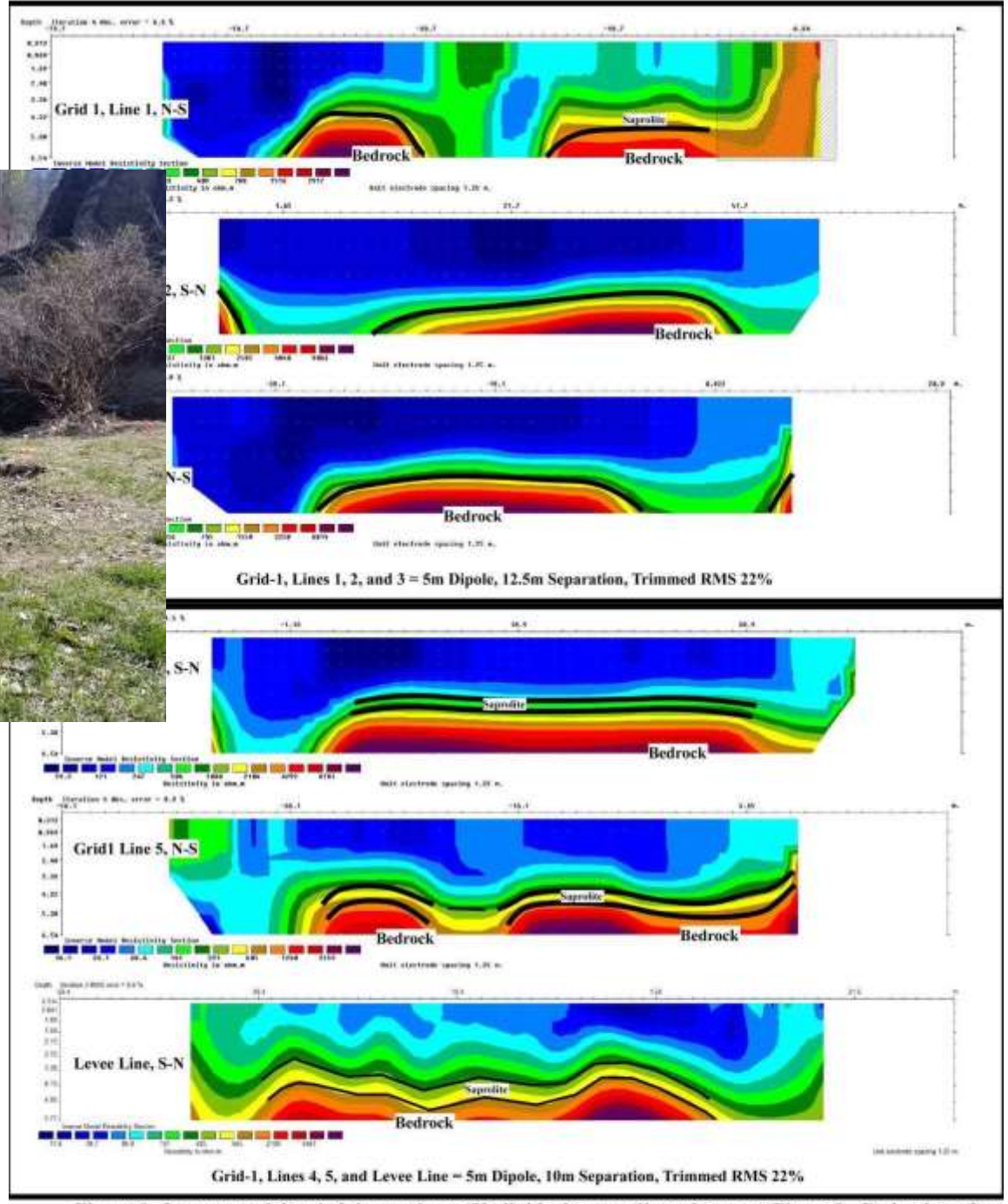
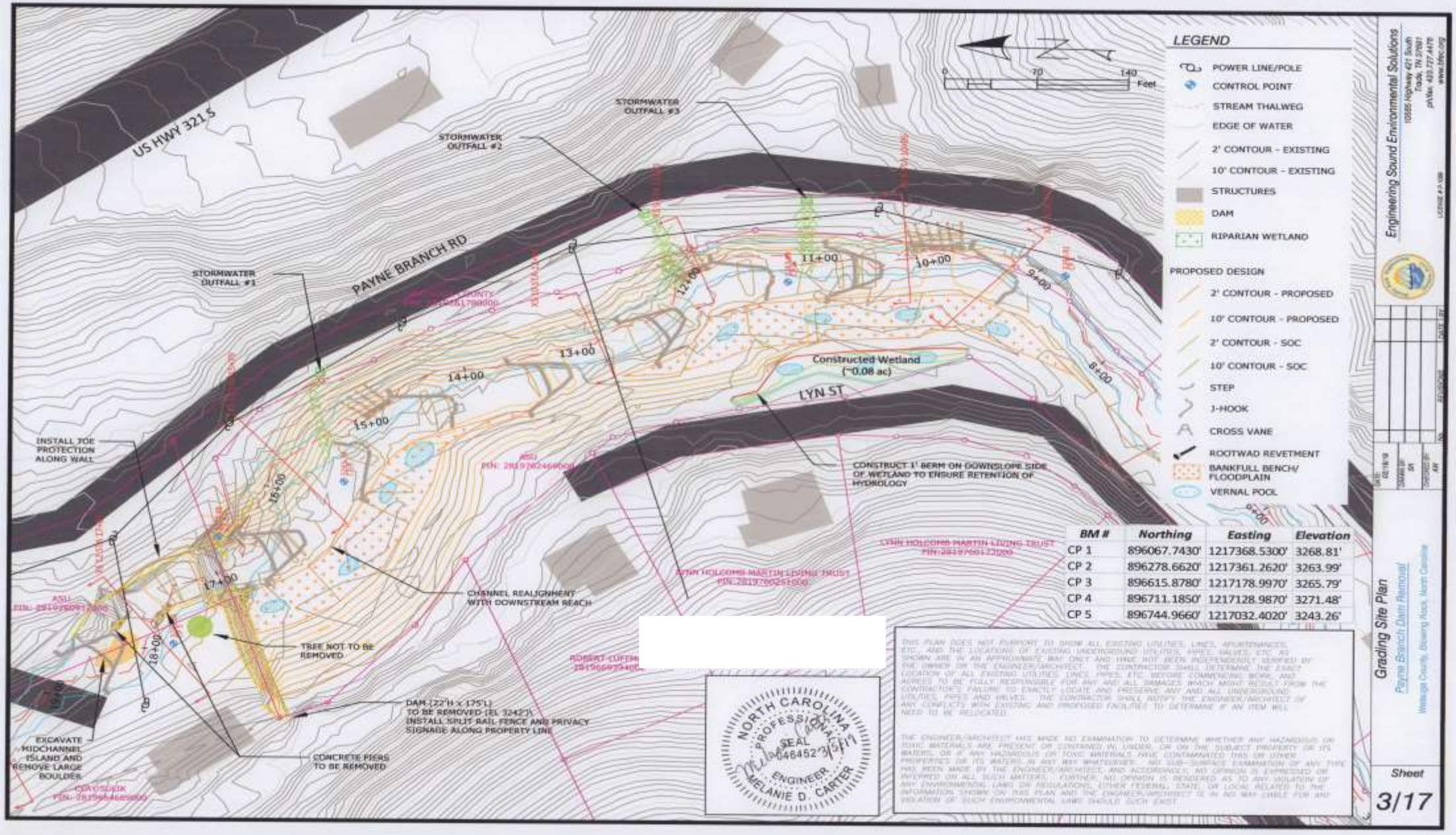


Figure 8. Inverse model resistivity sections of individual survey lines shown on Figure 3. Bedrock surface interpretations shown as solid black lines on sections.



BM #	Northing	Easting	Elevation
CP 1	896067.7430'	1217368.5300'	3268.81'
CP 2	896278.6620'	1217361.2620'	3263.99'
CP 3	896615.8780'	1217178.9970'	3265.79'
CP 4	896711.1850'	1217128.9870'	3271.48'
CP 5	896744.9660'	1217032.4020'	3243.26'

THIS PLAN DOES NOT PURPORT TO SHOW ALL EXISTING UTILITIES, LINES, APPURTENANCES, ETC. AND THE LOCATIONS OF EXISTING UNDERGROUND UTILITIES, PIPES, VALVES, ETC. AS SHOWN ARE IN AN APPROXIMATE WAY ONLY AND HAVE NOT BEEN INDEPENDENTLY VERIFIED BY THE OWNER OR THE ENGINEER/ARCHITECT. THE CONTRACTOR SHALL DETERMINE THE EXACT LOCATION OF ALL EXISTING UTILITIES, LINES, PIPES, ETC. BEFORE COMMENCING WORK, AND AGREES TO BE FULLY RESPONSIBLE FOR ANY AND ALL DAMAGES WHICH MIGHT RESULT FROM THE CONTRACTOR'S FAILURE TO EXACTLY LOCATE AND PRESERVE ANY AND ALL UNDERGROUND UTILITIES, PIPES AND VALVES. THE CONTRACTOR SHALL NOTIFY THE ENGINEER/ARCHITECT OF ANY CONFLICTS BETWEEN EXISTING AND PROPOSED FACILITIES TO DETERMINE IF AN ITEM WILL NEED TO BE RELOCATED.

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NORTH CAROLINA PROFESSIONAL SEAL 046452 ENGINEER MELANIE D. CARTER

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LICENSE # C-1188

DATE	DRAWN BY	CHECKED BY
02/18/19	SH	AW

Grading Site Plan
Payne Branch Dam Removal
Watauga County, Blowing Rock, North Carolina

Sheet
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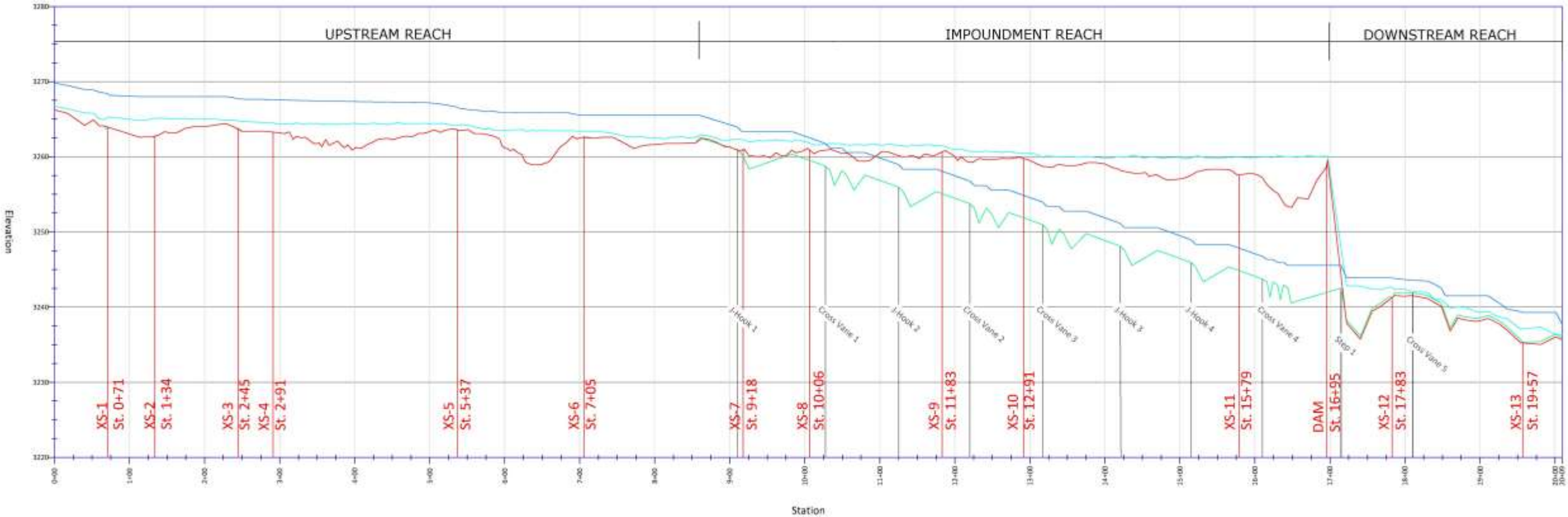
LONGITUDINAL PROFILE (H:V = 1:10)



Construction:

- Unknowns:
  - Bedrock location/elevation
  - Relative soil to be removed – design vs real (related to $)
  - Soil stockpile locations
- Challenges:
  - Diversion channel
  - turbidity


Diversion notch
CAT
CAT
324E


CAT
1465
CAT

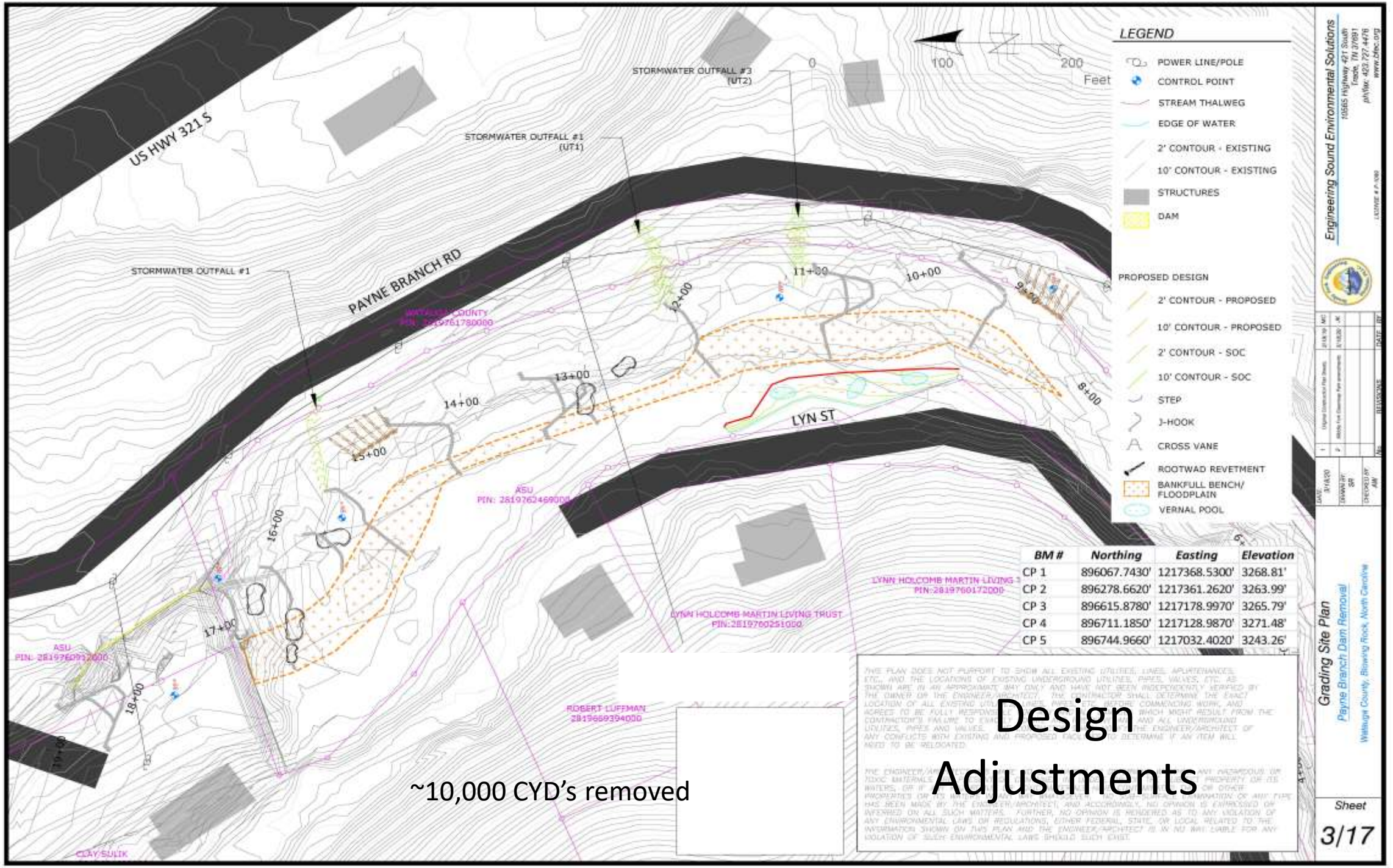

Diversion channel excavation and soil removal
COVERT
Not Set
08/07/2020 09:45:00
Time Lapse
18 20°C 68°F
8

Structures


CAT


CAT
CAT
324E
1426
CAT


KOMATSU



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~10,000 CYD's removed

Design Adjustments

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Grading Site Plan
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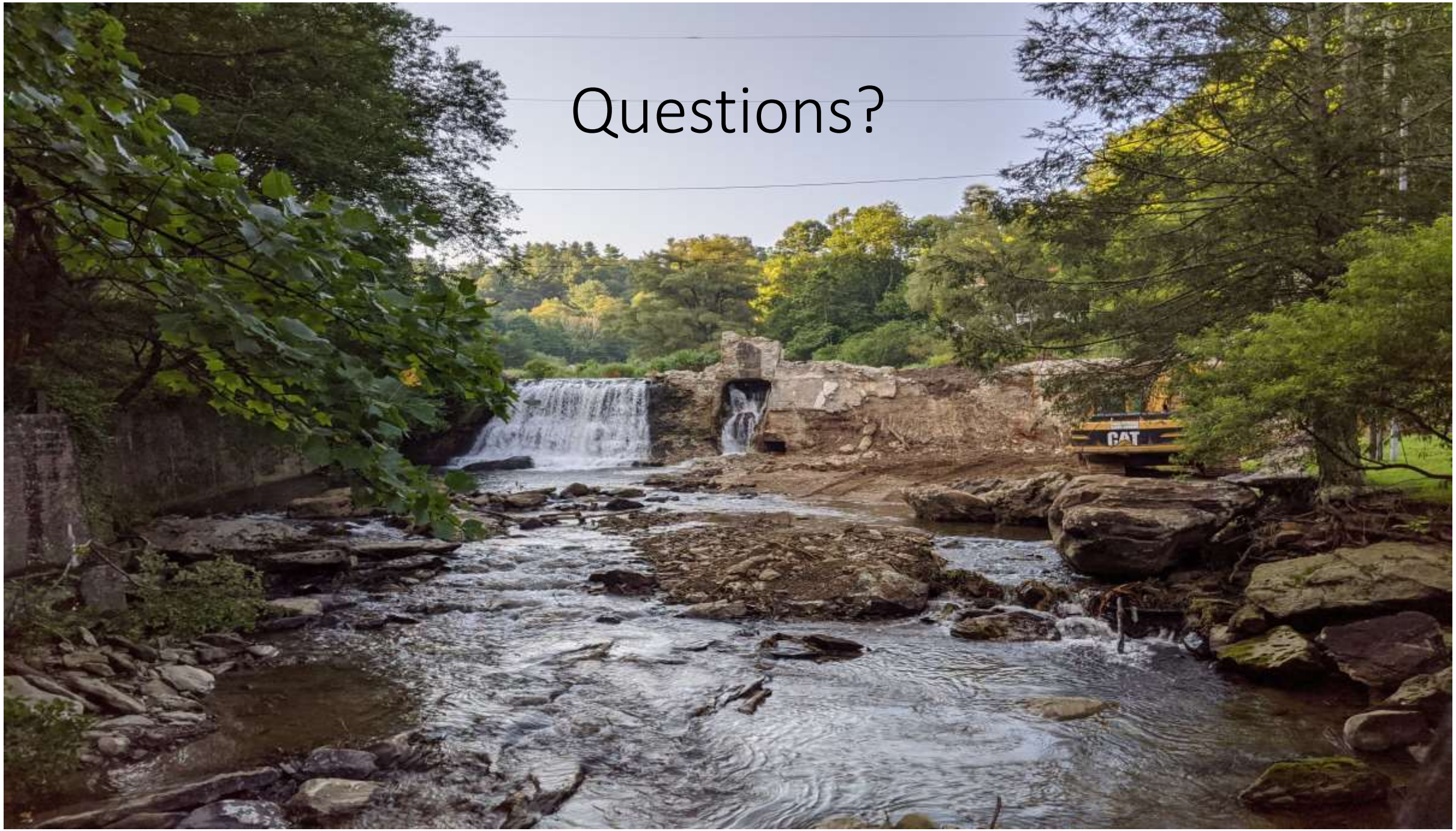
Ex. Conditions vs. Prop. Conditions vs. As-built Conditions
J-Hook
Cross Vane
Rock Step
Cross Vane
J-Hook
Rock Step
Rock Step
Rock Step
Rock Step
Cross Vane
5 ft deviation
6.3 ft deviation
6 ft deviation
6.9 ft deviation
4.8 ft deviation
3.5 ft deviation
3.5 ft deviation
1.8 ft deviation
3280
3270
3260
3250
3240
3230
3220

Cascade-Step-Pool	Reference Reaches (8)	Existing Conditions (Avg)	Proposed Conditions (Avg/Range)
Stream Type	B4, B3, C3b	C4	C4b / B4
Drainage Area (sq mi)	1.3-11.25	11.1	11.1
Reach Slope (ft/ft)	0.022-0.041	0.0035	0.0240
Bankfull Width / Depth Ratio	17.6-25.1	14	19.9
Bankfull Max Depth Ratio	1.4-1.7	1.5	1.3
Riffle/Cascade Length Ratio	0.4-1.8	0.7	1.0 (1.0-1.1)
Riffle/Cascade Slope Ratio	1.0-1.9	9.3	1.4 (1.3-1.5)
Step Height Ratio	0.02-0.07	N/A	0.015 (0.012-0.02)
Pool Length Ratio	0.4-1.3	4.3	0.74 (0.34-1.6)
P-P Spacing Ratio	0.6-2.0	3.5	1.4 (0.5-2.5)
% Cascade	18-58	15	43
% Step	3-12	0	8
% Pool	33-76	85	49


Questions?
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