River Sediment Management in Vermont: Changes in Hydrology and Sediment Loading

Hardwick – Ripple Effects 2026

September 23, 2026

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Fitzgerald Environmental Associates

EPA Climate Indicator Map Viewer

All Indicators | Weather and Climate | Oceans | Snow and Ice

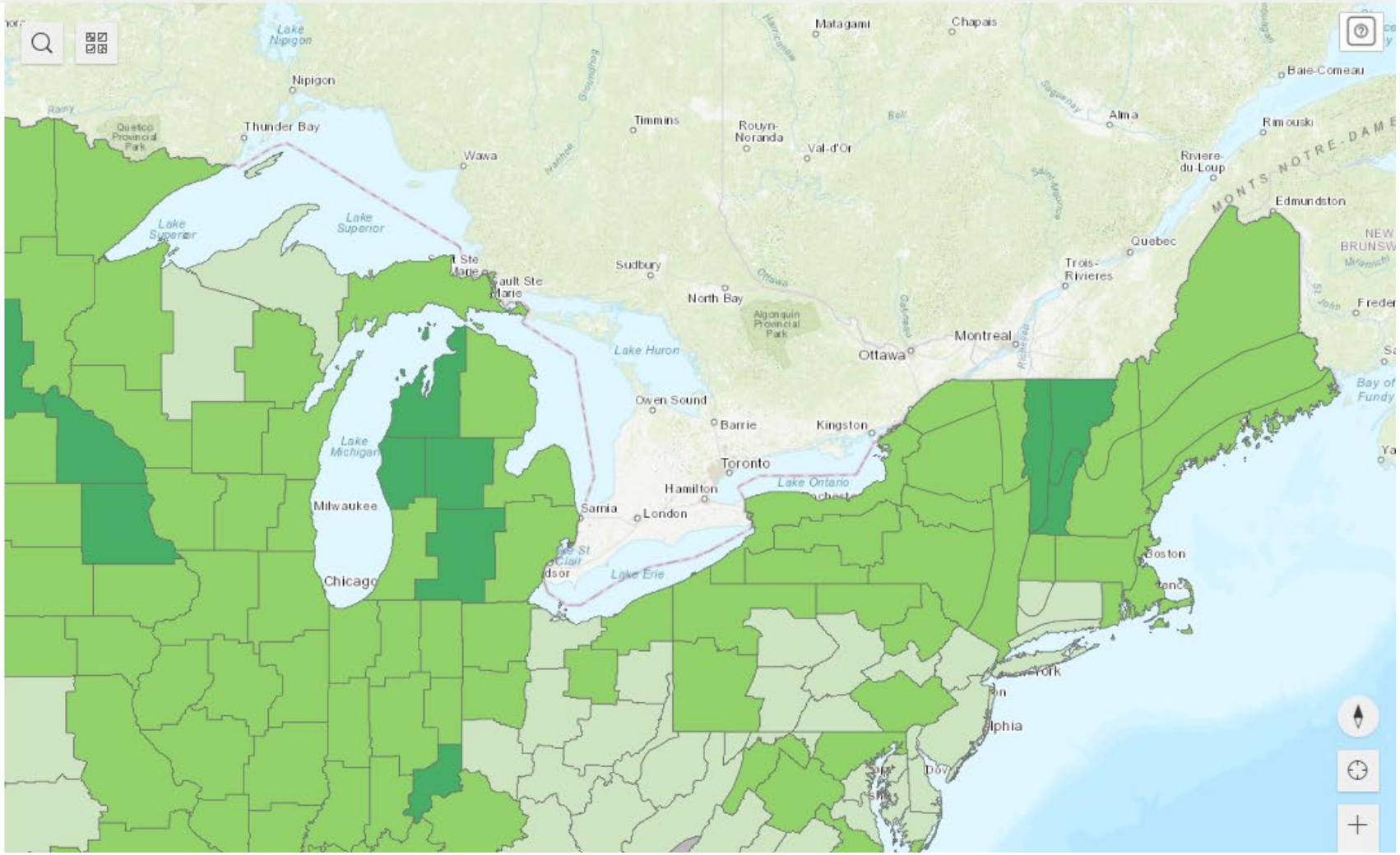
U.S. Temperature | Southwest Temperature | Seasonal Temperature | Heat Waves | Drought | U.S. Precipitation | R

Legend | Map Layers

Change in Precipitation in the United States, 1901-2021

Percent Change

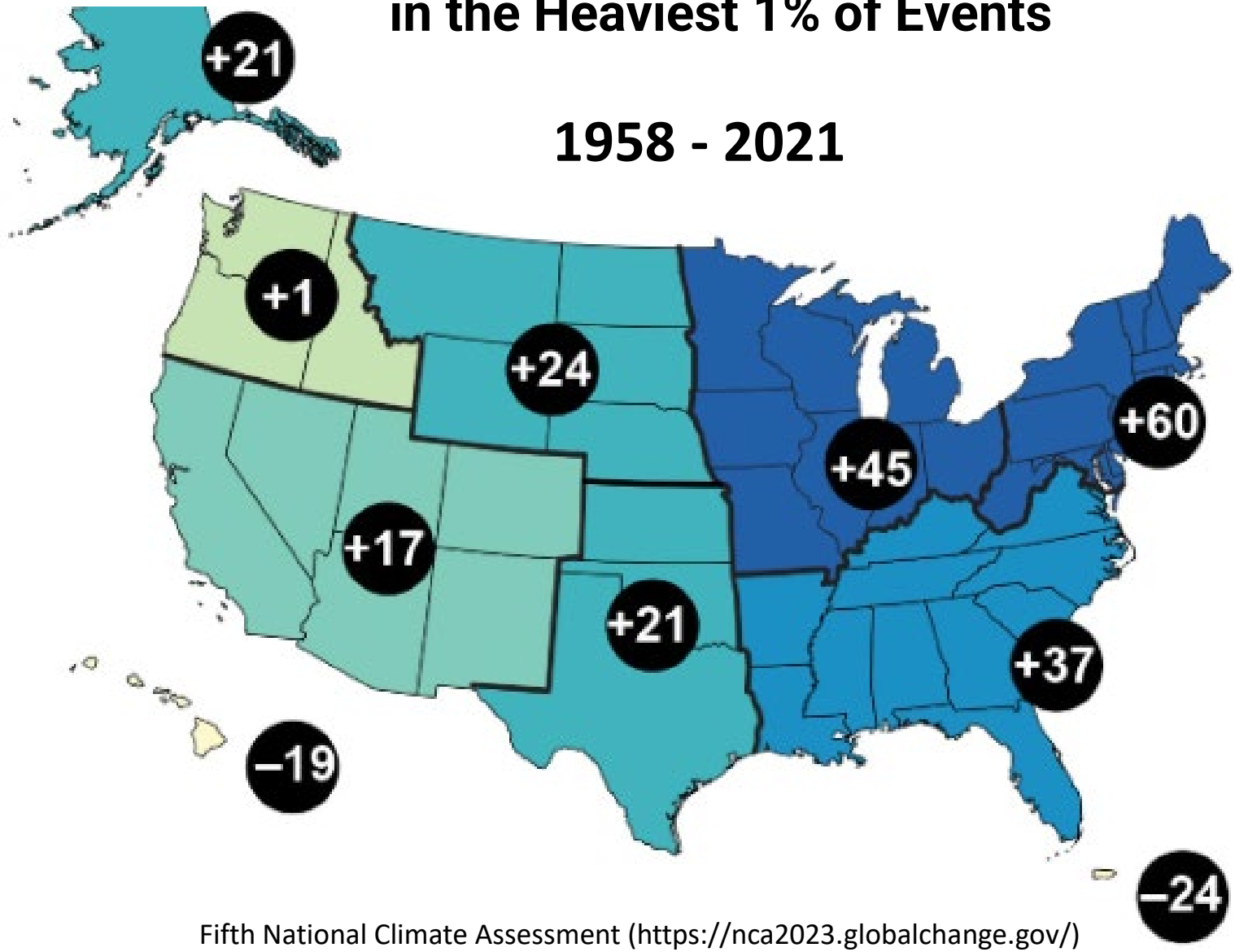
- 20 - 30
- 10 - 20
- 2 - 10
- -2 - 2
- -10 - -2
- -20 - -10



https://www.epa.gov/climate-indicators/dig-data

Observed Change in Total Annual Precipitation Falling in the Heaviest 1% of Events

1958 - 2021



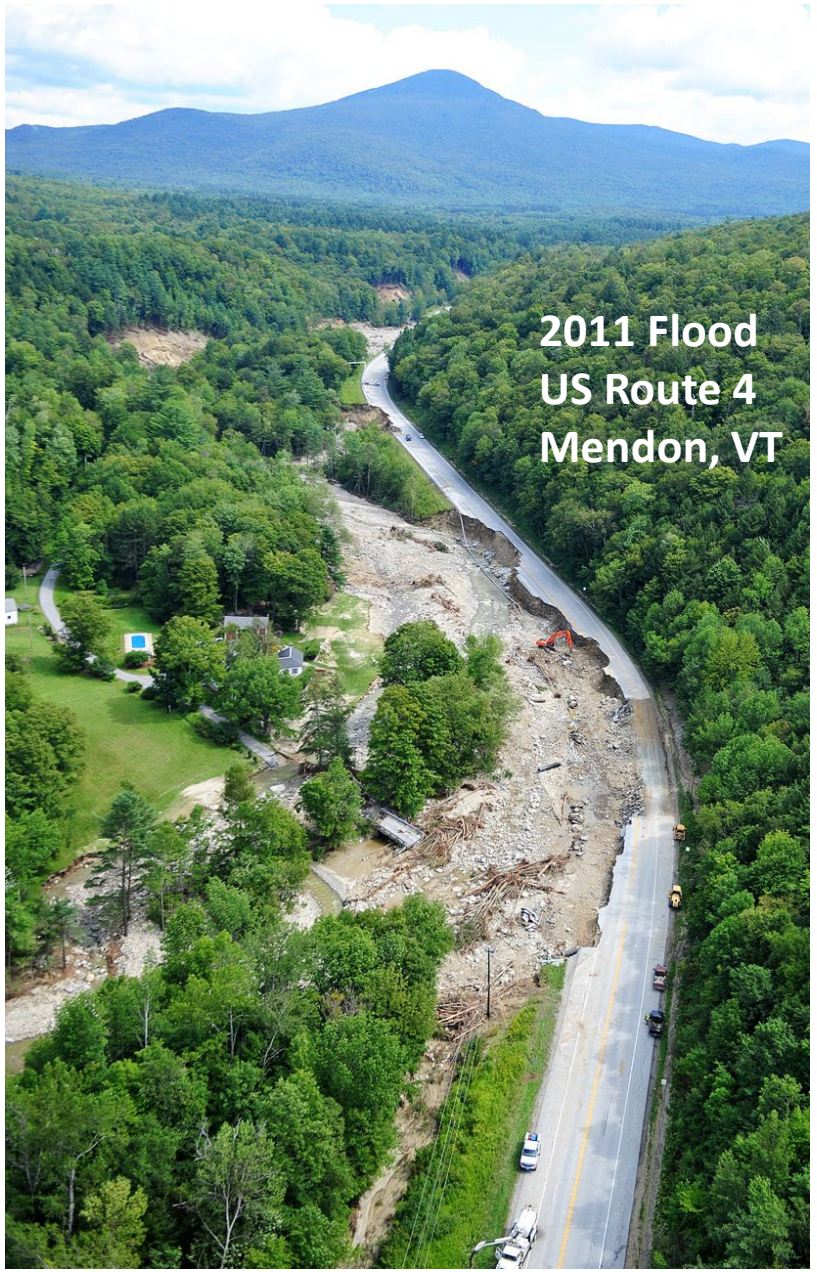
Fifth National Climate Assessment (https://nca2023.globalchange.gov/)

“Jeezum crow, we’ve had three 100-year floods in the past 10 years!”

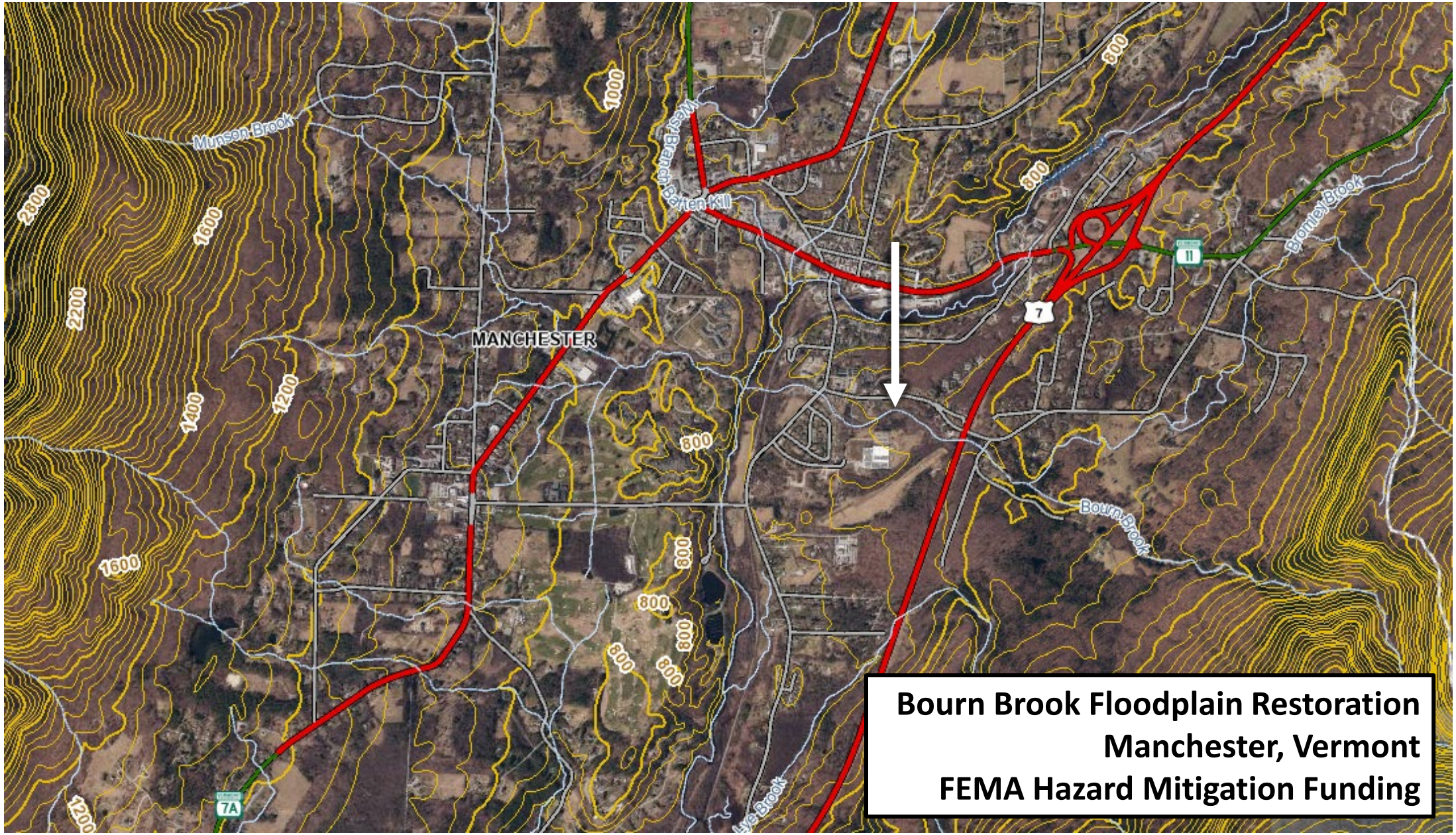
Anonymous Vermonter, 2024


2023 Flood
VT Route 100
Ludlow, VT

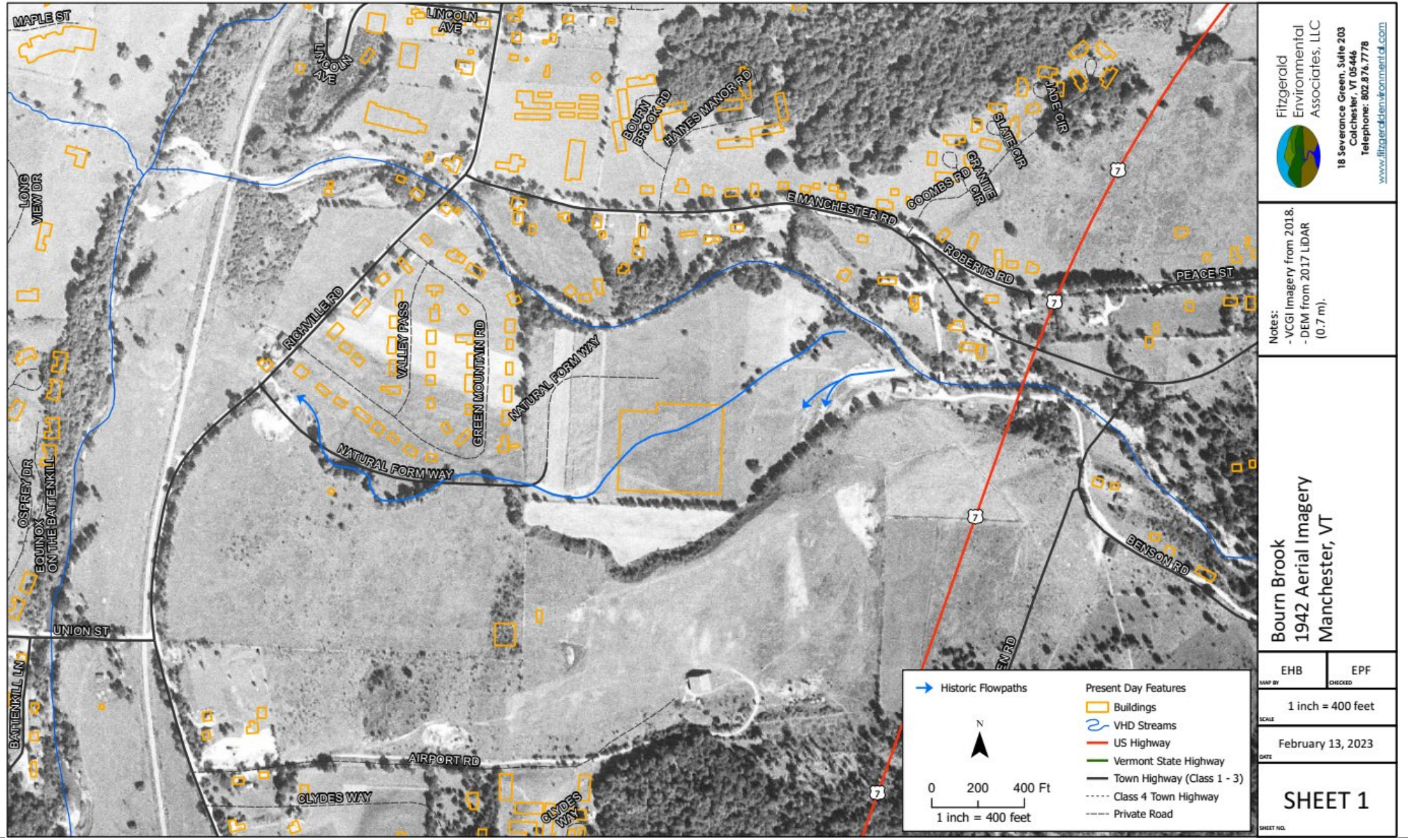

2023 Flood
US Route 4
Woodstock, VT


2011 Flood
US Route 4
Mendon, VT


2011 Flood
US Route 4
Killington, VT



Bourn Brook Floodplain Restoration
Manchester, Vermont
FEMA Hazard Mitigation Funding



Fitzgerald Environmental Associates, LLC
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Notes:
- VCGI Imagery from 2018.
- DEM from 2017 LiDAR (0.7 m).

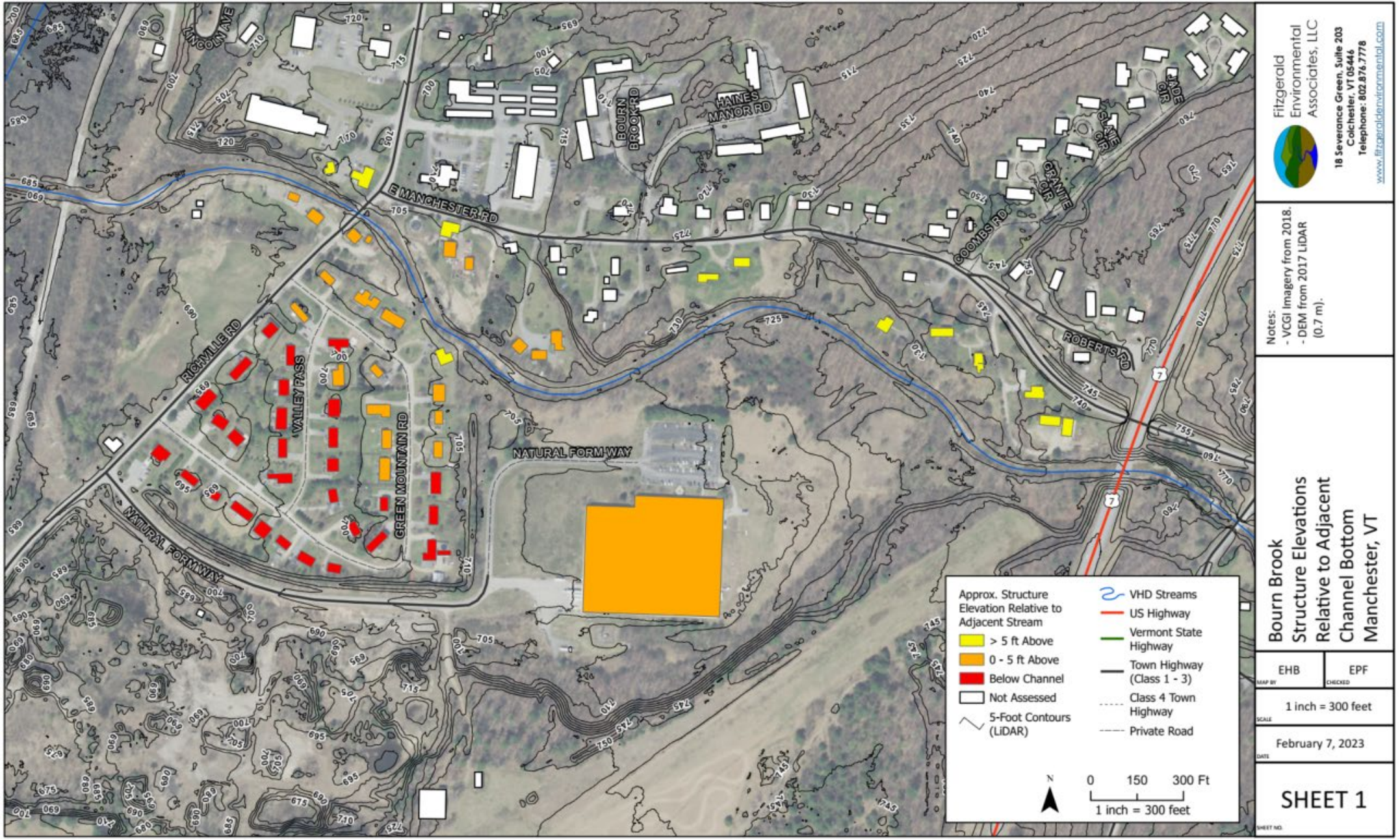
Bourn Brook 1942 Aerial Imagery Manchester, VT

EHB	EPF
MAP BY	CHECKED

1 inch = 400 feet (SCALE)

February 13, 2023 (DATE)

SHEET 1 (SHEET NO.)


LINCOLN AVE
E MANCHESTER RD
BOURN BROOK RD
HAINES MANOR RD
JADE CIR
SLATE CIR
GRANITE CIR
COOMBS RD
ROBERTS RD
RICHVILLE RD
VALLEY PASS
GREEN MOUNTAIN RD
NATURAL FORM WAY
NATURAL FORM WAY
Approx. Structure Elevation Relative to Adjacent Stream
> 5 ft Above
0 - 5 ft Above
Below Channel
Not Assessed
5-Foot Contours (LiDAR)
VHD Streams
US Highway
Vermont State Highway
Town Highway (Class 1 - 3)
Class 4 Town Highway
Private Road
N
0 150 300 Ft
1 inch = 300 feet
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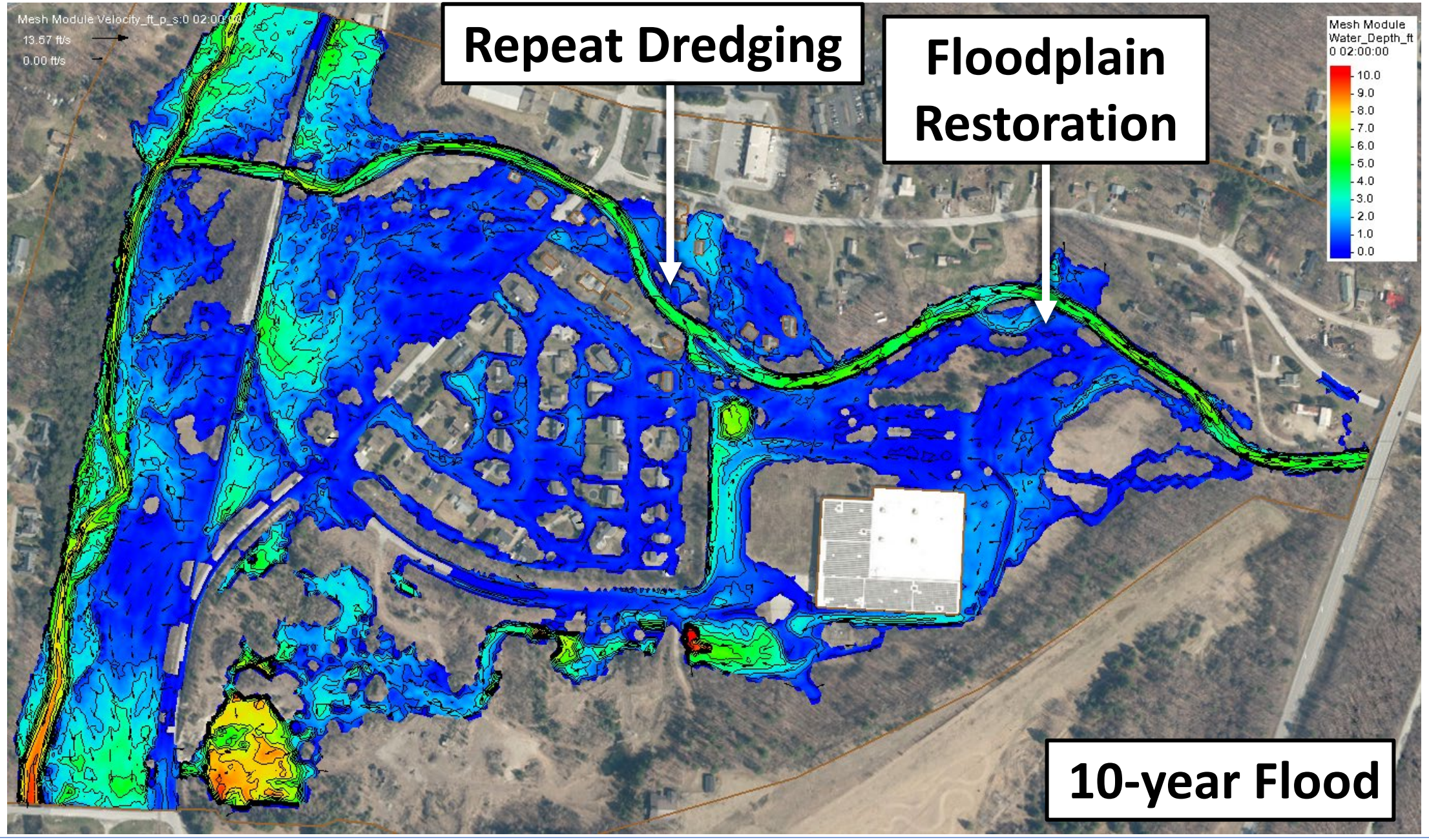
- DEM from 2017 LiDAR (0.7 m).
Bourn Brook
Structure Elevations
Relative to Adjacent
Channel Bottom
Manchester, VT
EHB
MAP BY
EPF
CHECKED
1 inch = 300 feet
SCALE
February 7, 2023
DATE
SHEET 1
SHEET NO.


Upstream
of Fan

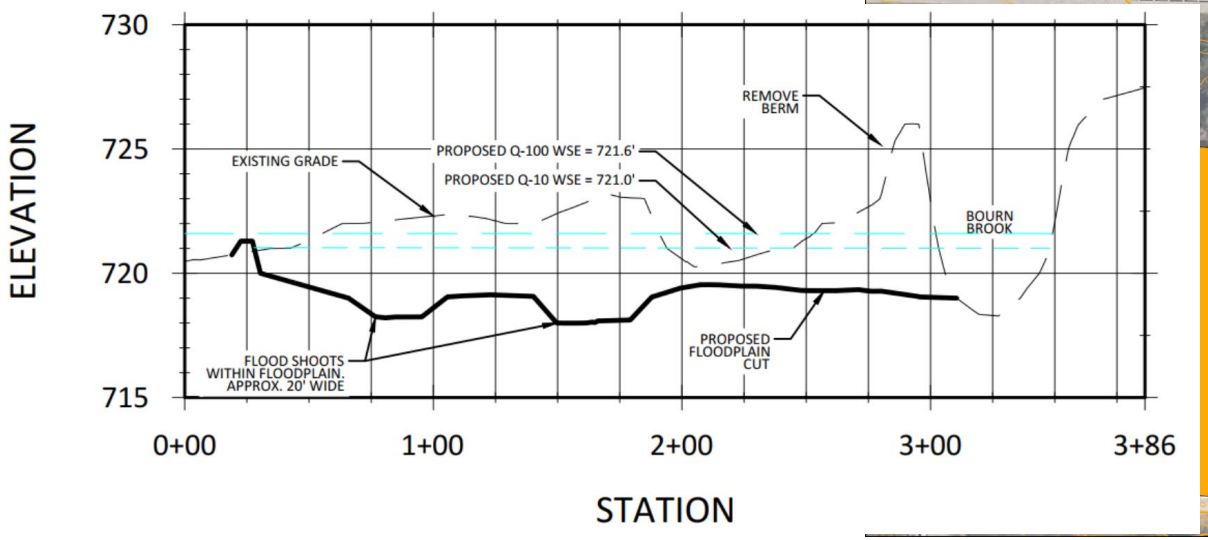

Berms
in Fan

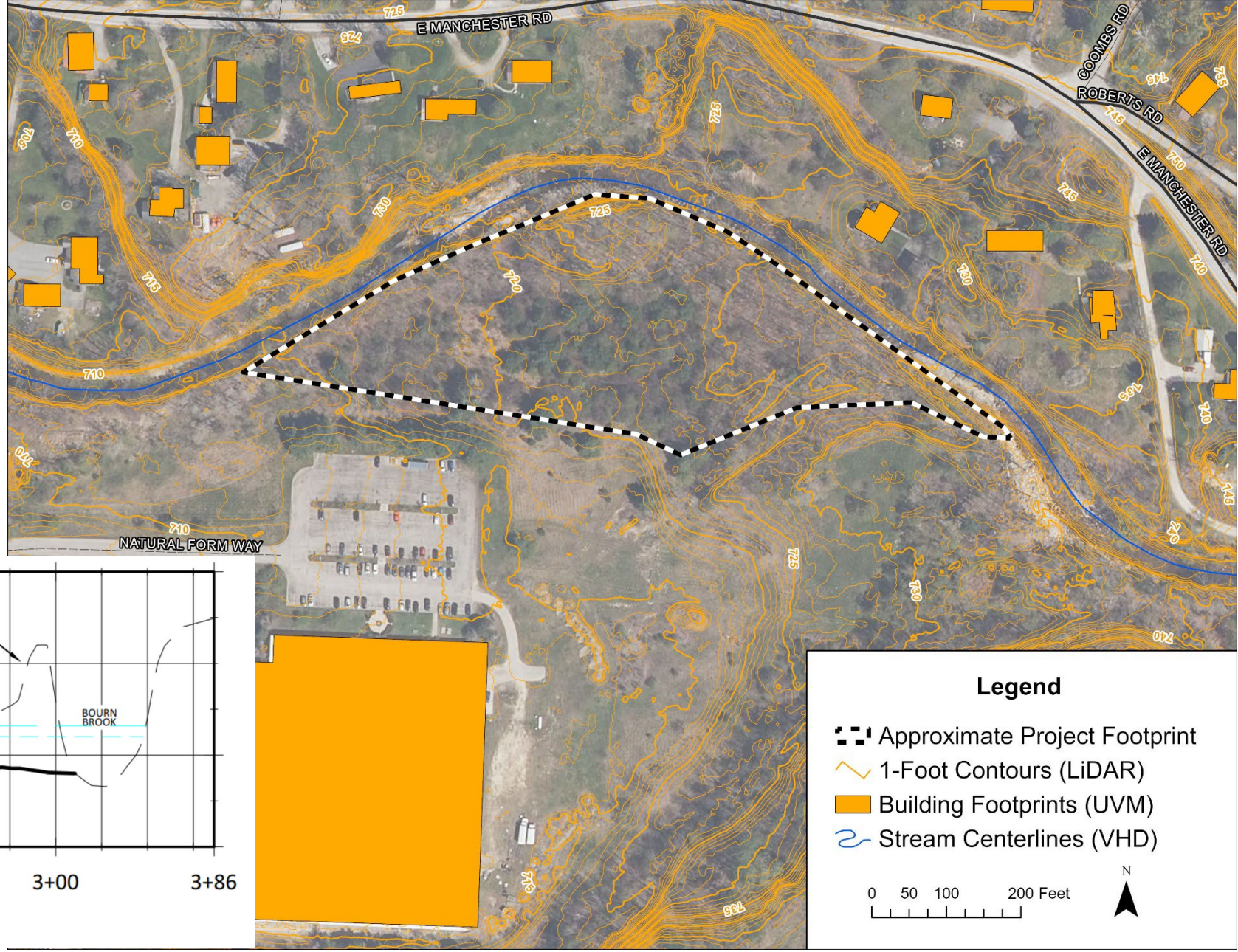

Repeat
Dredging


Repeat Dredging
Floodplain Restoration
10-year Flood
Mesh Module Velocity_ft_p_s:0 02:00:00
13.57 ft/s
0.00 ft/s
Mesh Module
Water_Depth_ft
0 02:00:00
10.0
9.0
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0

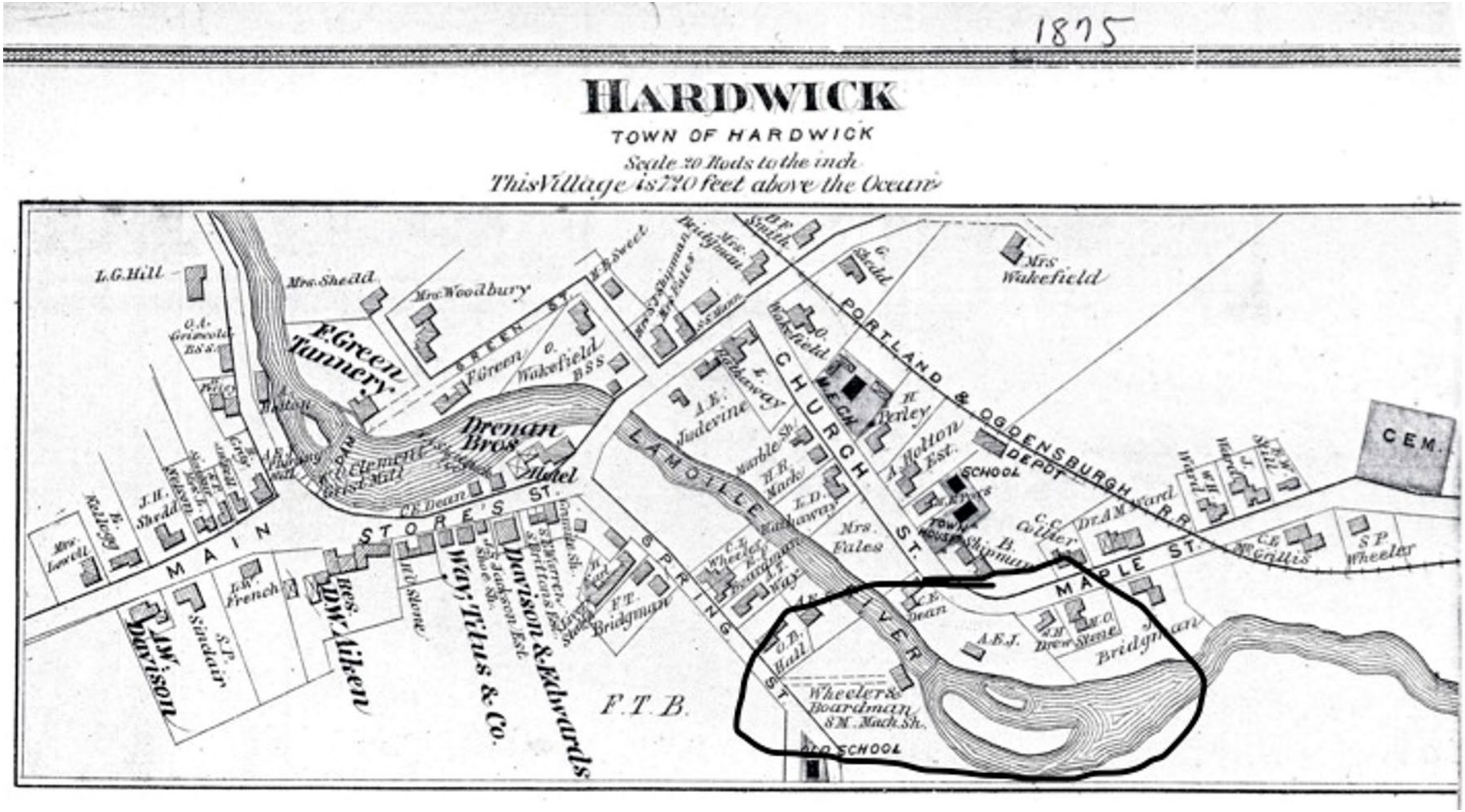
Bourn Brook - Alternative C

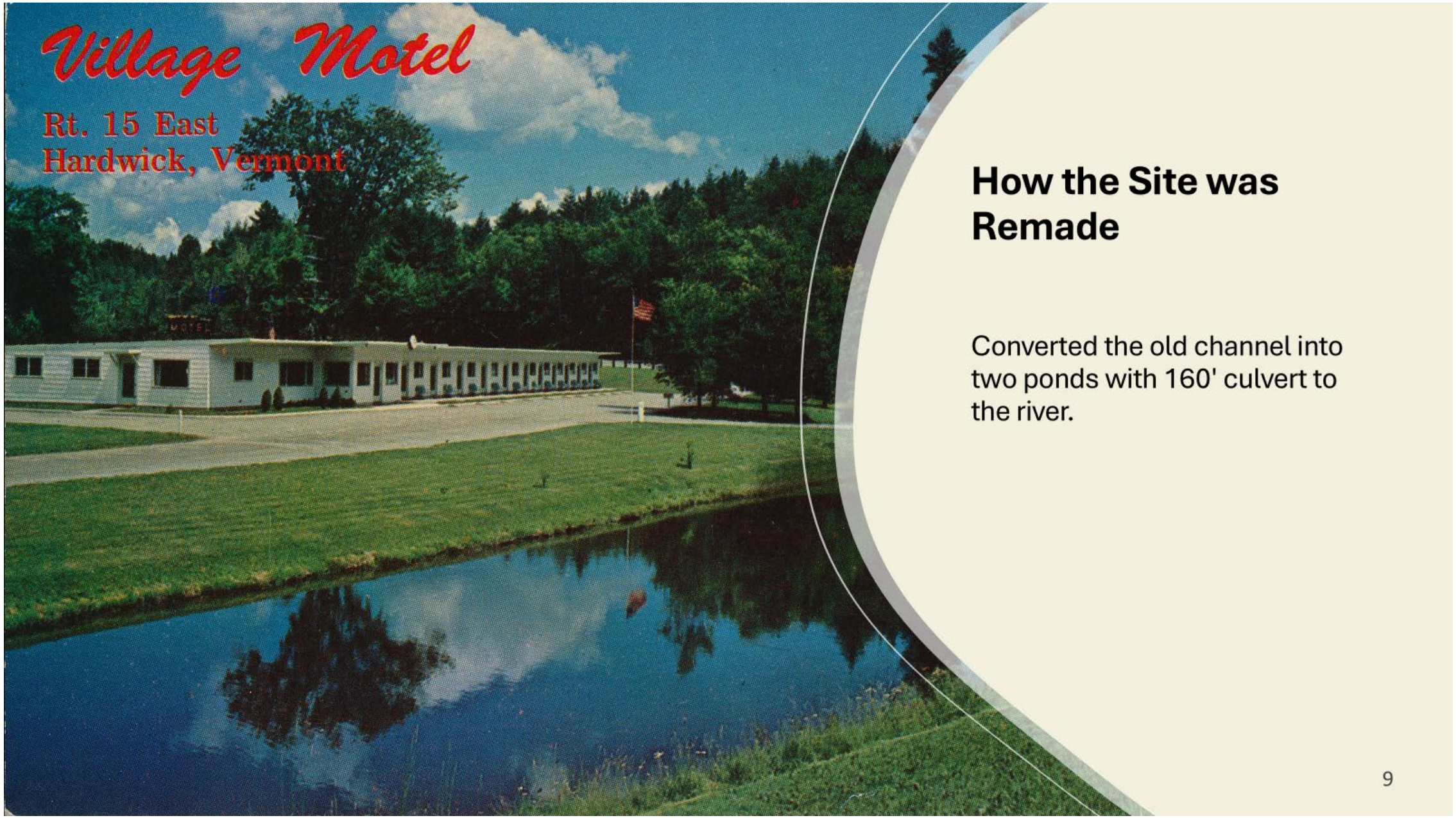
- Berm Removal on Inside Bend
- Floodplain Restoration (4 acres)
- 16,000 CY excavation
- Ballpark Cost $1.3M






MAPLE ST
SUMNER ST
HOLTON HL
GLENSIDE AVE
15

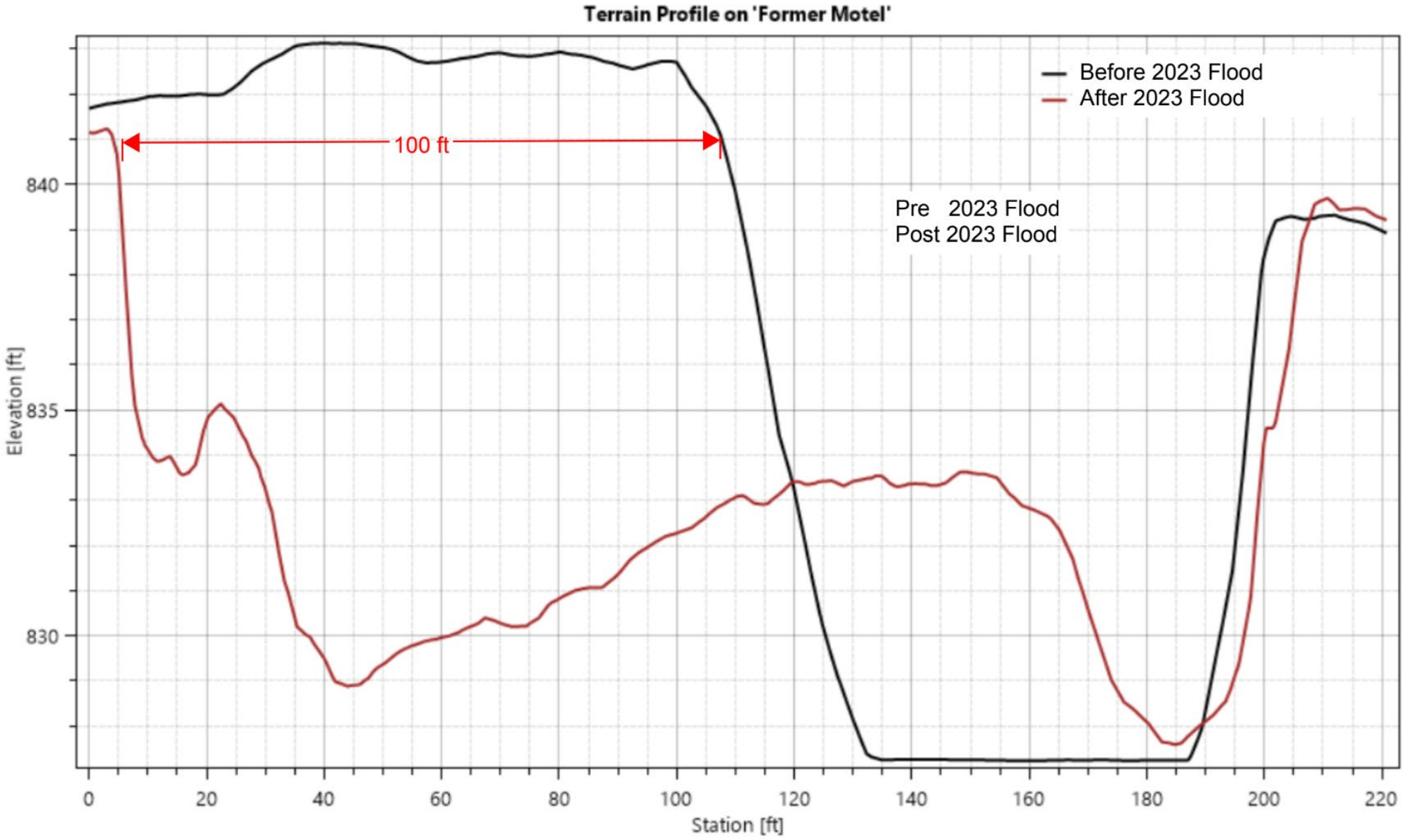

1875
HARDWICK
TOWN OF HARDWICK
Scale 20 Rods to the inch
This Village is 770 feet above the Ocean
L.G.Hill
Mrs. Sheadd
Mrs. Woodbury
E.Green Tannery
Dronan Bros
Hotel
MAIN
STORES ST.
CHURCH
LAMOILLE
SPRING
RIVER
PORTLAND & OGDENSBURGH R.R.
DEPOT
SCHOOL
MAPLE ST.
CEM.
Mrs. Wakefield
Davison & Edwards
Way, Titus & Co.
F.T.B.
Wheelers & Boardman S.M. Mach. Sh.
A.L.O. SCHOOL



How the Site was Remade

Converted the old channel into two ponds with 160' culvert to the river.


MOTEL

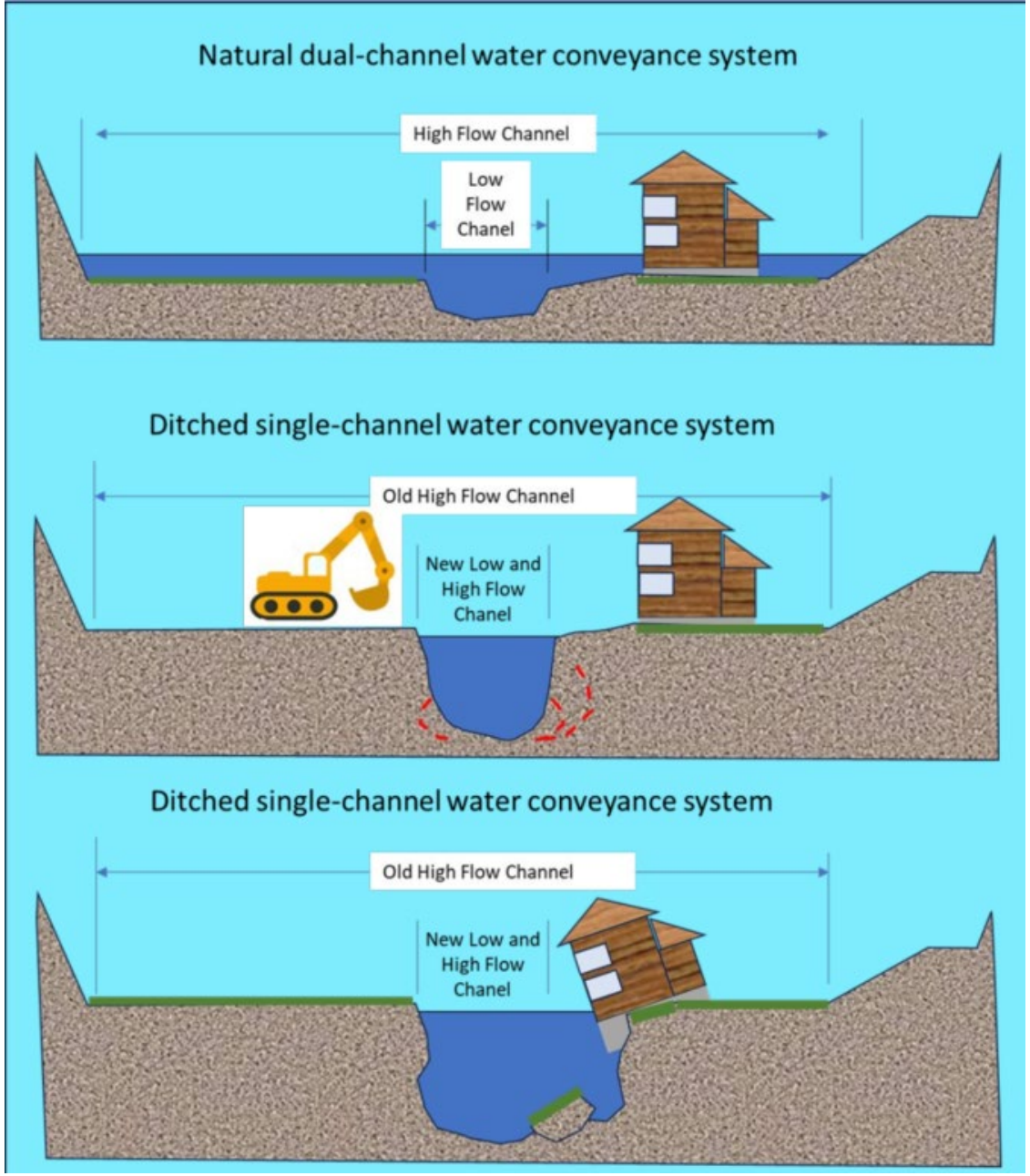


Prepared by SLR

Key Takeaways:

- Flood magnitudes are expected to increase by at least 20-30% over the next 40-50 years.
- Reactivated alluvial fans and depositional river corridors need more space!
- Dredging is not economically feasible.
- Sediment management around infrastructure needs to be prescribed and monitored.
- We need to be realistic about flood management and mitigation expectations (i.e., we're not going to manage the 1% or 100-year flood)

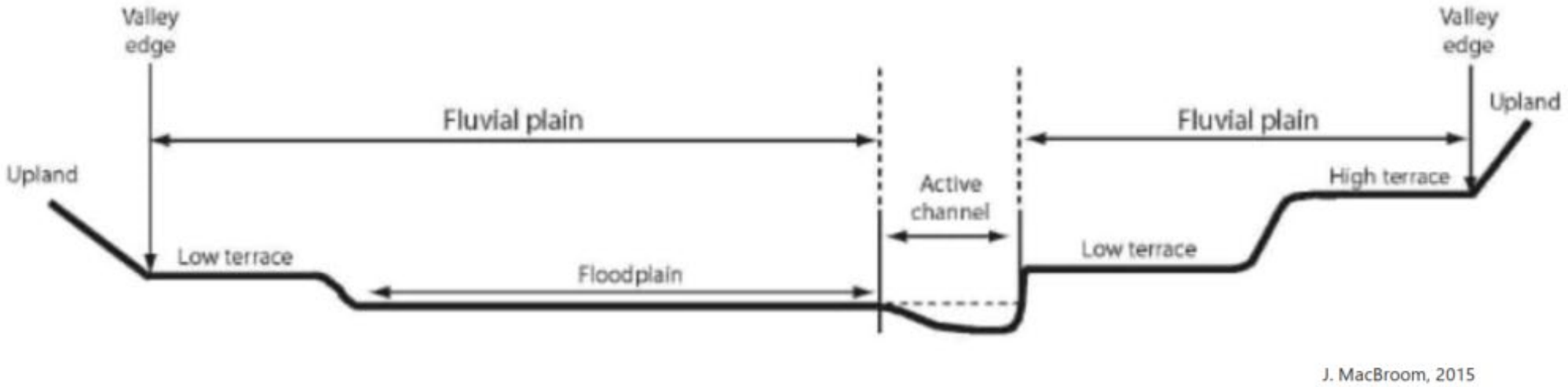
EXTRA SLIDES



Dredging to keep the water in the channel. Trading an inundation problem for an erosion problem.

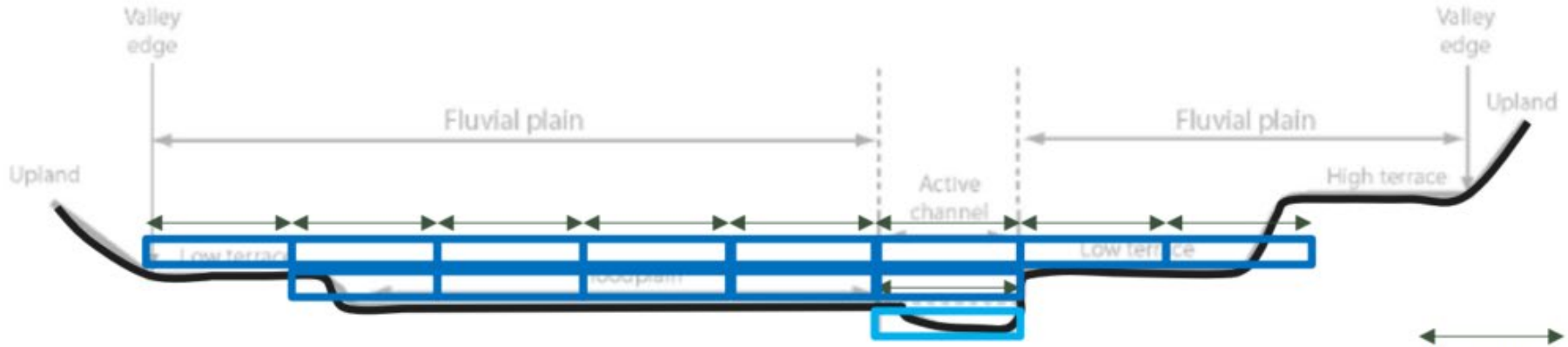
Prepared by TNC

Typical River Valley Cross Section



Prepared by SLR

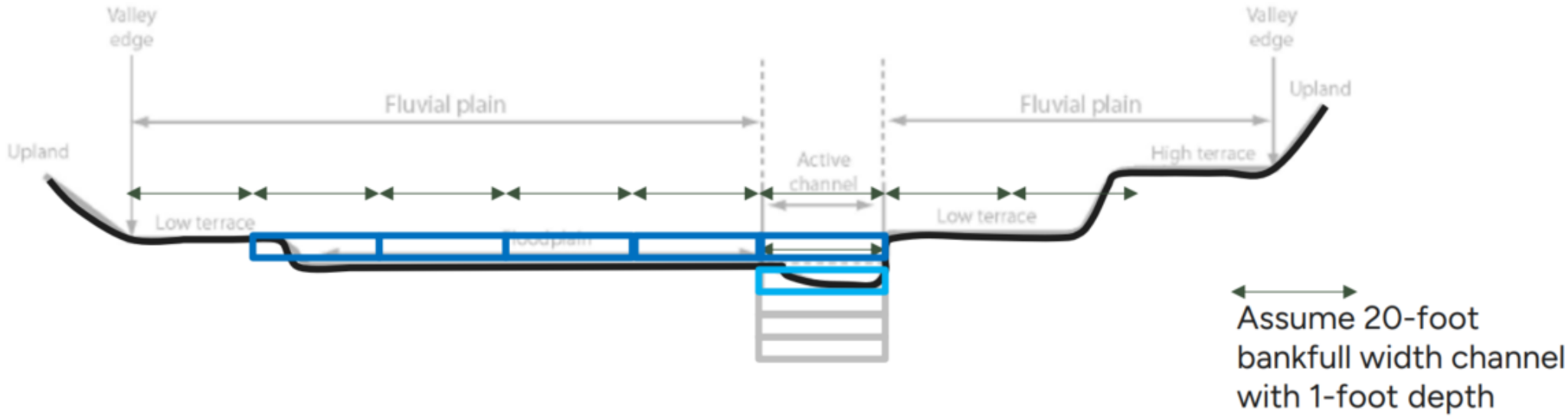
Flood Storage Sketch – No Dredging



- Bankfull Flow = 1 unit of storage (light blue box)
- 100-Year Flood Flow = 14 units of storage
- Flood velocity low due to spreading out on floodplain

Prepared by SLR

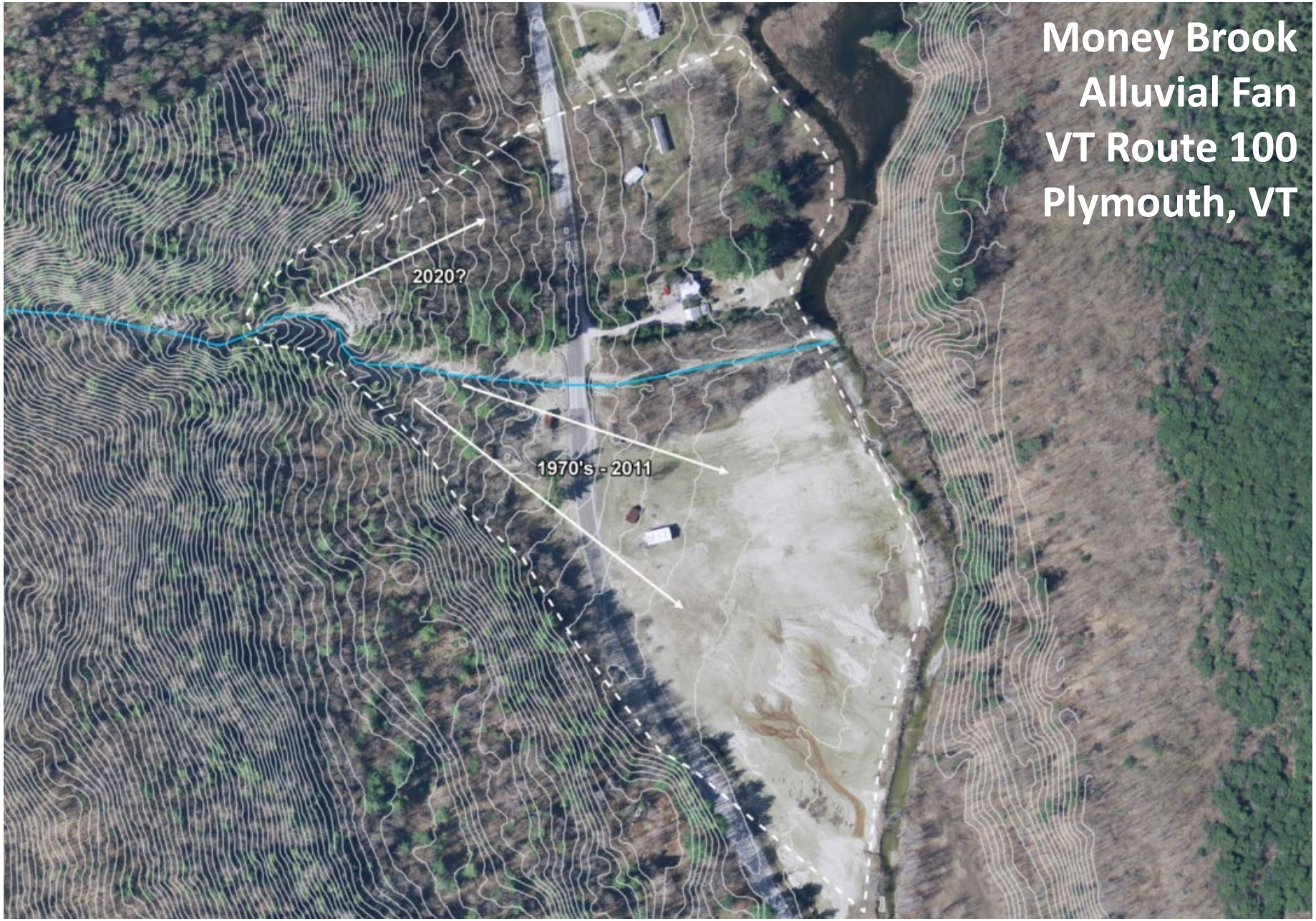
Flood Storage Sketch – With Dredging



- Bankfull Flow = 4 unit of storage (light blue box plus dredged gray boxes)
- Bankfull channel less stable due to confinement of flows and increased erosion
- 100-Year Flood Flow = 9 units of storage due to loss of floodplain access
- Flood velocity higher due to loss of floodplain flow and spreading out
- Less flood storage and higher flood velocity

Prepared by SLR

Money Brook Alluvial Fan, VT Route 100 Plymouth, VT


Money Brook
Alluvial Fan
VT Route 100
Plymouth, VT
2020?
1970's - 2011

Money Brook
Plymouth, VT
July 2023

Statistical Uncertainty in Hydrology