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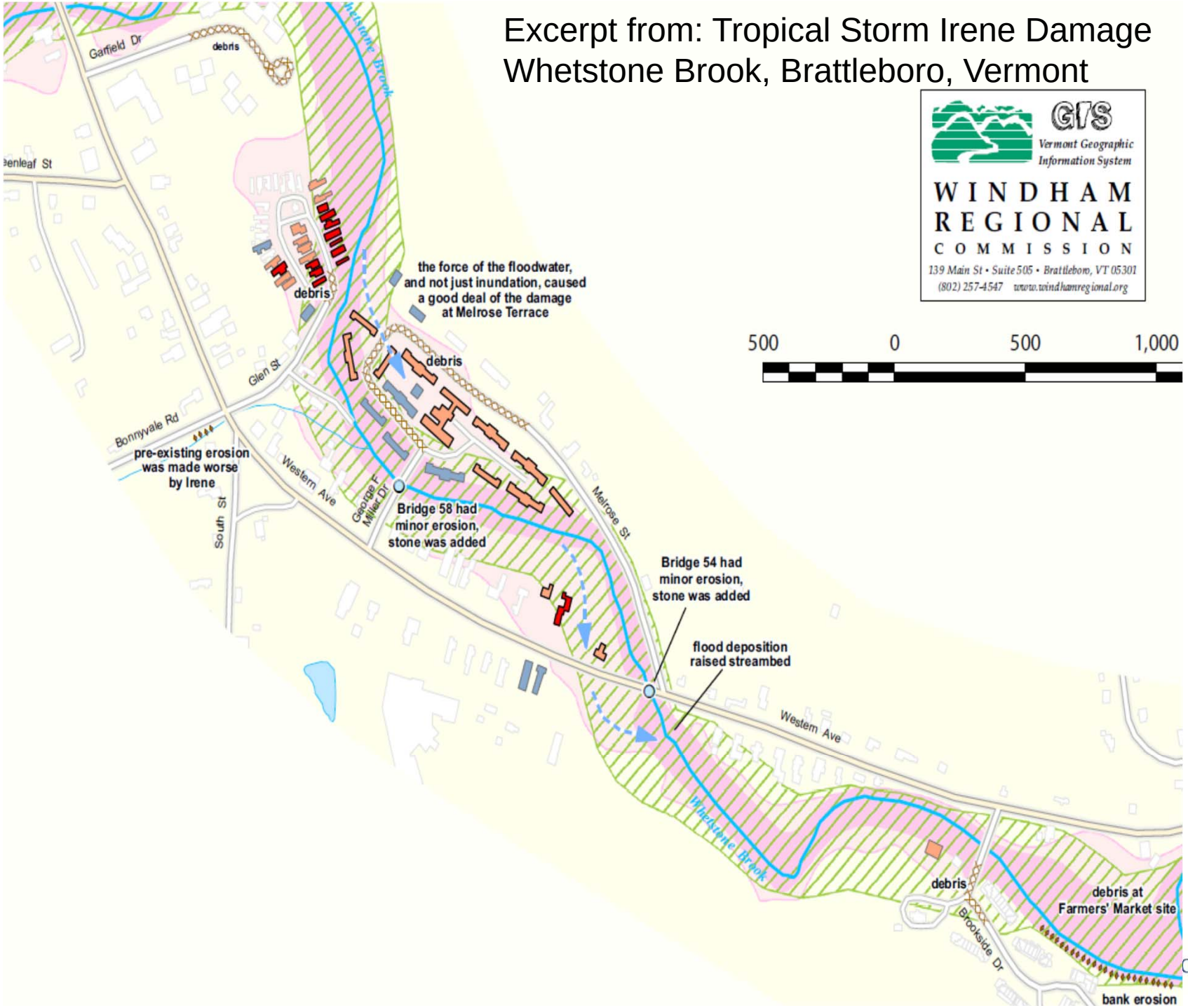
Project Summary

Hydrologic & Hydraulic Analysis of Melrose Terrace

Brattleboro, Vermont

Excerpt from: Tropical Storm Irene Damage Whetstone Brook, Brattleboro, Vermont



Tropical Storm Irene:

- Deeper water farther from river
- Dry buildings close to river in floodway

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Damage from Tropical Storm Irene:

- Water jumped river bank and traveled behind buildings (avulsed)
- Volume and velocity of water caused erosion and scour at buildings

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Floodpath:

FLOODPATH
MELROSE STREET
MELROSE STREET
MELROSE STREET
WHETSTONE BROOK
GEORGE F. MILLER DRIVE
WESTERN AVENUE
37+00
35+00
34+00
33+00
32+00
31+00
30+00
29+00
28+00
27+00
26+00
25+00
24+00
23+00
22+00

George F. Miller Bridge:

- Bridge opening = 55 feet
- Channel bankfull width = 60 feet
- Storms > 25-year overtop bridge, through Melrose Terrace
- Backwatering raises water 5.5 feet from DS to US (Irene)

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Route 9 Bridge:

- Bridge opening = 61 feet, skewed so effective only 47 feet
- Channel bankfull width = 60 feet
- Arch shape and 16 inch water main limit opening
- Storms > 10-year overtop bridge

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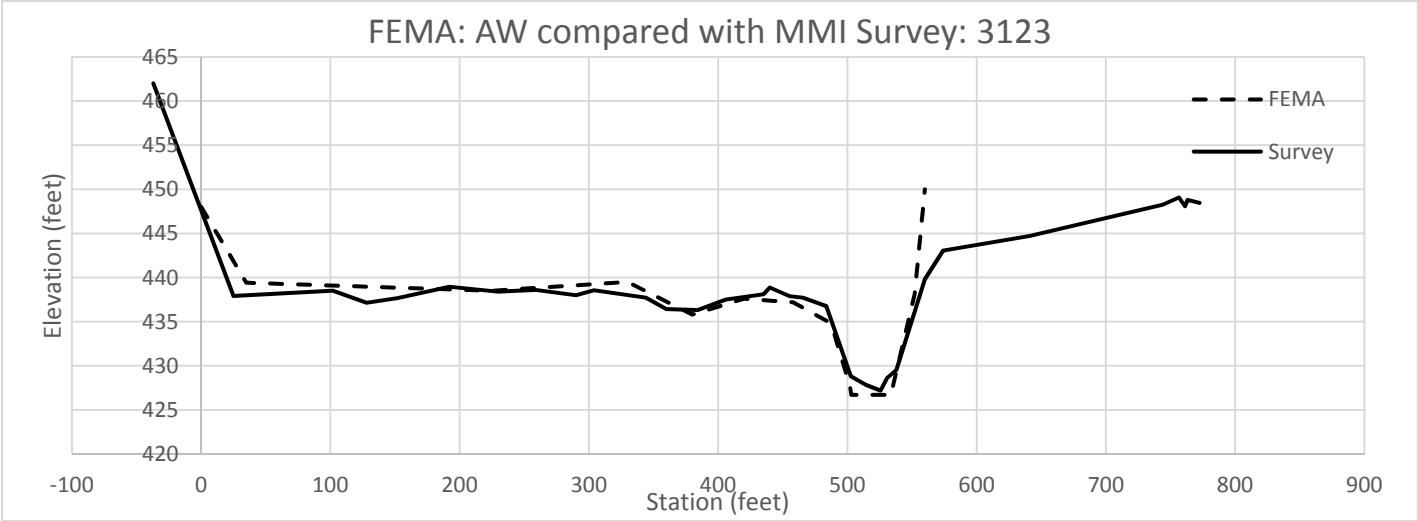
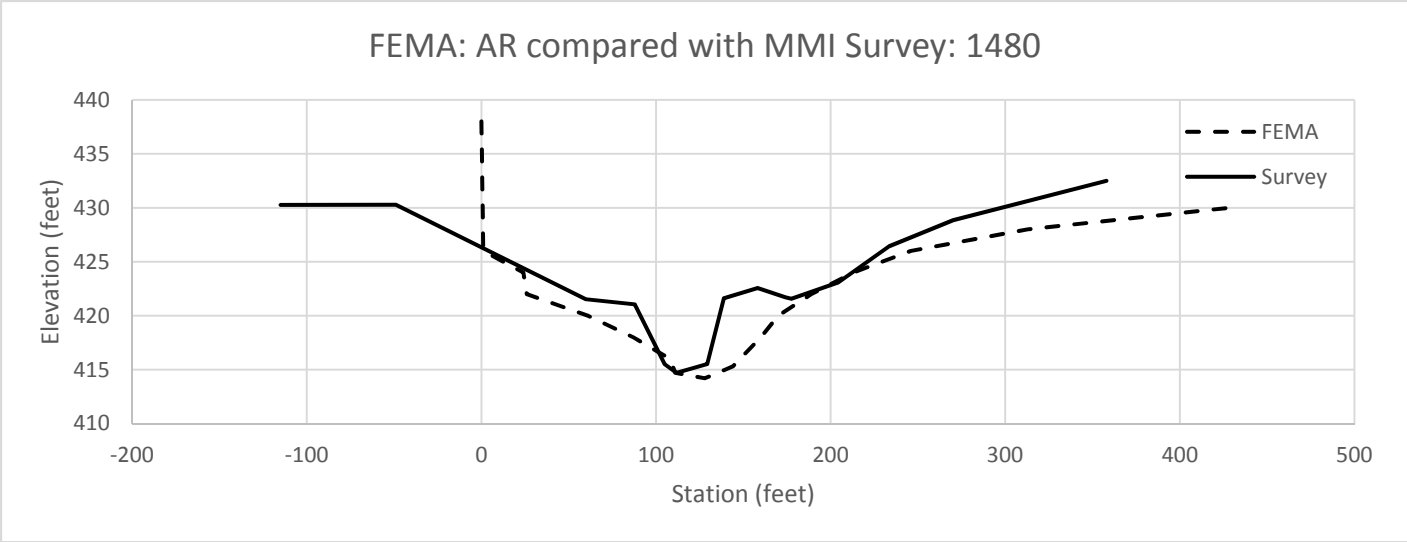
Other Factors:

- BACKWATERING: Water is slowed down or blocked and not able to travel downstream at the rate it is arrive at a location.
  - Occurring at both bridges
  - Ponding upstream, raises water surface
  - Low velocity allows sediment to deposit
- SEDIMENT & DEBRIS: Can cause blockages in the channel, especially bridges, and cause water to flow out of channel.
  - Observed during Irene
  - More likely to occur at constrictions or backwatered areas
  - Not included in modeling

Channel Change Over Time:



Upstream of George F. Miller Bridge



Downstream of VT Route 9

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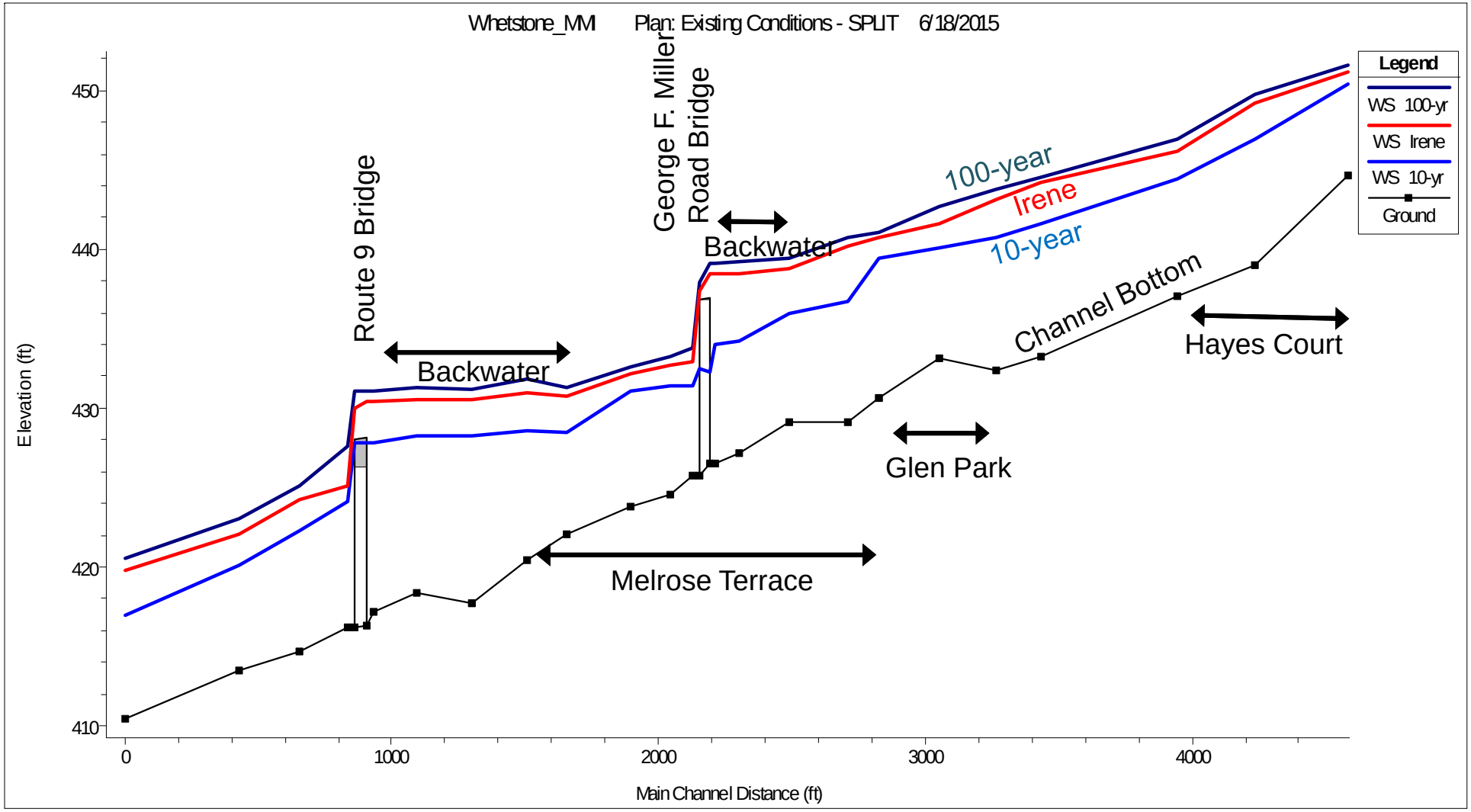
Profile: Existing Conditions



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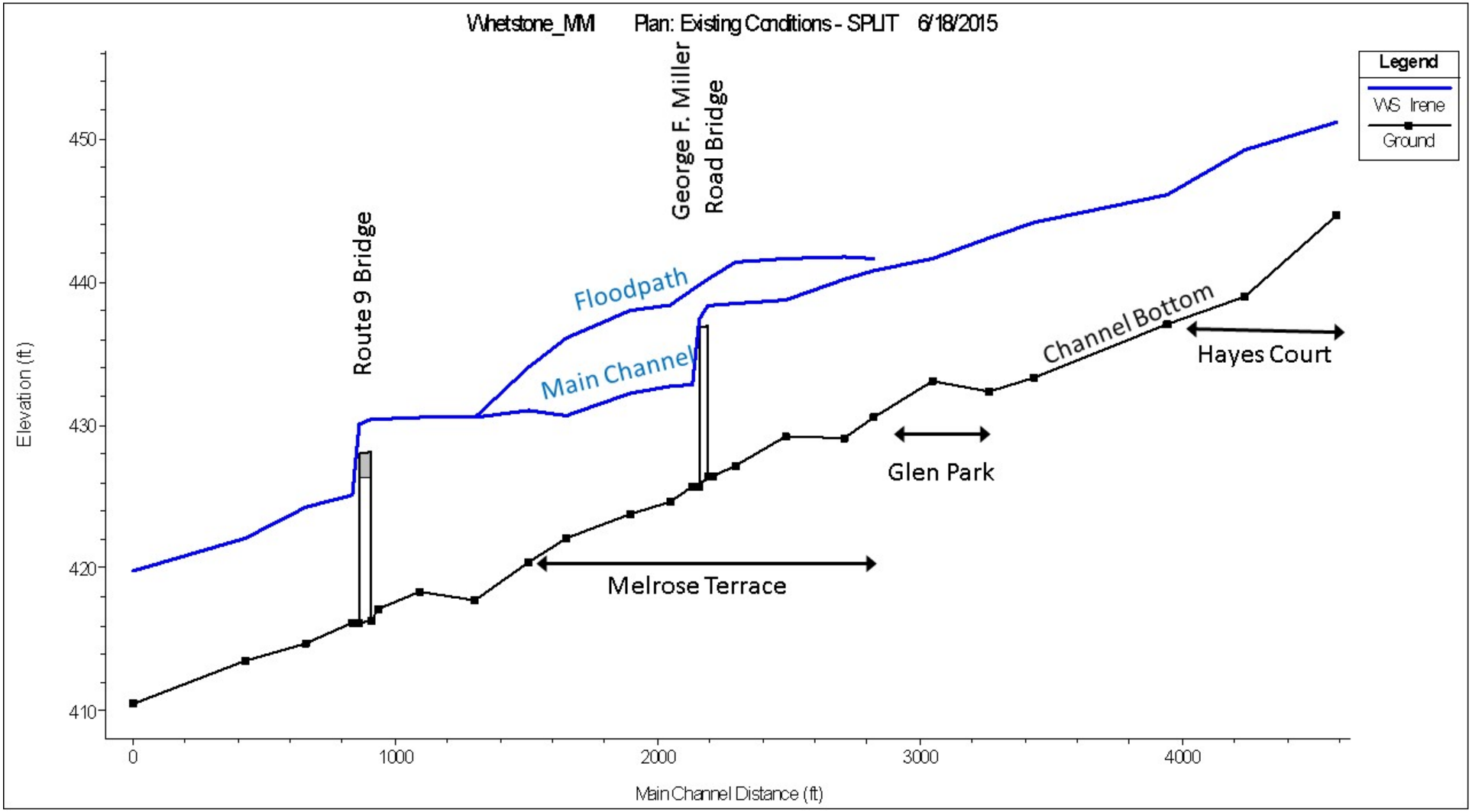
Profile: Existing Conditions, with Floodpath



Water is stuck behind buildings on floodplain and travels at a higher elevation than water in the main channel

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Regulated Areas:

BUILDINGS PER ZONE:

- FEMA Floodway = 7
- FEMA Floodplain = 15
- Fluvial Erosion Hazard (FEH) = 11
- VT River Corridor = 13

Alternatives Analysis:

- Compared hydraulics of proposed alternatives to existing conditions
- Evaluated:
  - No Action
  - Building Removal
  - Floodplain Restoration (excavating to lower elevation)
  - Bridge replacement, removal, and overflow culvert
  - Combinations
- Overview of Analysis Follows
- Examples of Individual Results Included, see report for comprehensive description

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Alternatives Analysis:

			OBJECTIVES						
Group	ID	Alternative	Reduce Flood & Erosion Risks (BHA Property	Reduce Flood & Erosion Risks (Surrounding Properties	Reduce Flood & Erosion Risks (Roads and Bridges	Maintain Usable Building Area	Environmental Benefits	Permitting	Cost
	1	No Action	-	-	-	+	-	+	+
	2	Remove all buildings.	0	-	-	-	0	+	+
Full Floodplain Restoration (River Corridor plus Known Damage Areas) - Remove all buildings and lower land	3a	All natural site. George F. Miller bridge and road also removed.	+	+	+	-	+	+	0
	3b	George F. Miller bridge and road retained.	+	+	+	-	0	+	0
	3c	George F. Miller bridge and road retained. Build wall around upstream portion of site.	+	0	+	-	0	-	-
Partial Floodplain Restoration (FEH Zone) - Remove 11 buildings and lower land	4a	George F. Miller bridge and road also removed.	+	0	+	0	0	+	0
	4b	George F. Miller bridge and road retained.	0	0	-	0	0	+	0
	4c	George F. Miller bridge and road retained. Build wall around upstream portion of site.	0	0	-	0	-	-	-
	5	Floodplain restoration at bend downstream of Melrose Terrace by lowering land elevation.	-	0	0	+	+	+	+

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Alternatives Analysis:

			OBJECTIVES						
Group	ID	Alternative	Reduce Flood & Erosion Risks BHA Property	Reduce Flood & Erosion Risks Surrounding Properties	Reduce Flood & Erosion Risks Roads and Bridges	Maintain Usable Building Area	Environmental Benefits	Permitting	Cost
Bridge Alternatives	6a	Enlarge bridge on George F. Miller Drive.	+	o	+	+	+	o	-
	6b	Remove bridge on George F. Miller Drive.	+	o	+	+	+	o	o
	6c	Overflow Culvert at George F. Miller Drive.	o	o	+	+	+	o	o
	7a	Enlarge bridge at Route 9. Create a 2-yr floodbench at bridge.	-	+	+	+	+	o	-
	7b	Enlarge bridge at Route 9. Create a 10-yr floodbench at bridge.	-	o	o	+	+	o	-
Partial Floodplain Restoration (FEMA Floodway) - Remove 6 buildings and lower land	8a	George F. Miller bridge and road also removed.	+	o	+	o	o	+	+
	8b	George F. Miller bridge and road retained.	-	-	-	o	-	-	+
	8c	George F. Miller bridge and road retained. Build wall around upstream portion of site.	-	-	-	o	-	-	o
	9	Floodwall around Melrose Terrace.	-	-	-	+	-	-	o
Combinations		5 + 7a	-	+	+	+	+	+	-
		3a + 7a	+	+	+	+	+	+	-
		3a + 7a + 5	+	+	+	+	+	+	-
	LEGEND: + good; o moderate; - poor								

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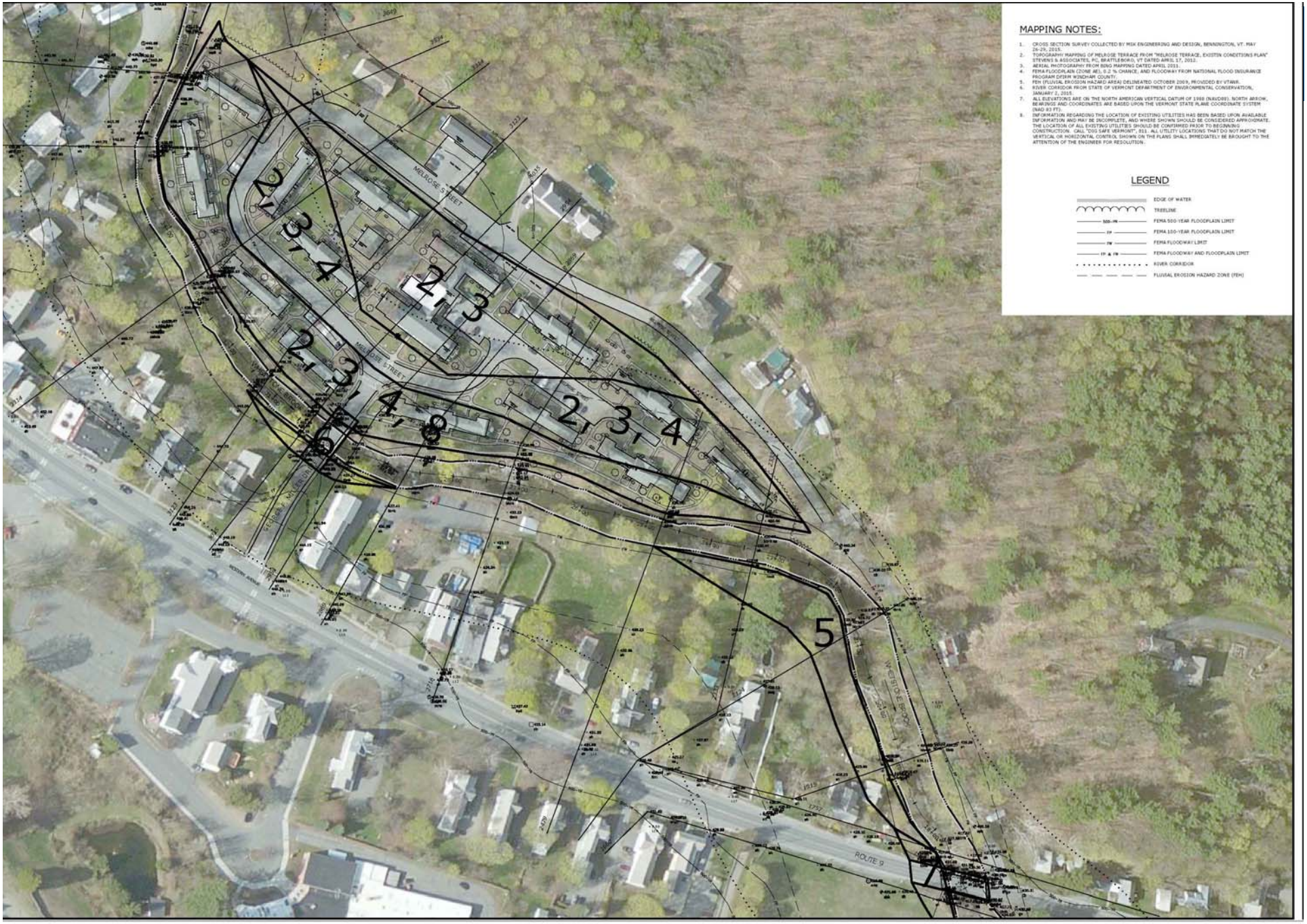


MAPPING NOTES:

1. CROSS SECTION SURVEY COLLECTED BY MSK ENGINEERING AND DESIGN, BENNINGTON, VT. MAY 26-29, 2015.
2. TOPOGRAPHY MAPPING OF MELROSE TERRACE FROM "MELROSE TERRACE, EXISTIN CONDITIONS PLAN" STEVENS & ASSOCIATES, PC, BRATTLEBORO, VT DATED APRIL 17, 2012.
3. AERIAL PHOTOGRAPHY FROM BING MAPPING DATED APRIL 2011.
4. FEMA FLOODPLAIN (ZONE AE), 0.2 % CHANCE, AND FLOODWAY FROM NATIONAL FLOOD INSURANCE PROGRAM DFIRM WINDHAM COUNTY.
5. FEH (FLUVIAL EROSION HAZARD AREA) DELINEATED OCTOBER 2009, PROVIDED BY VTANR.
6. RIVER CORRIDOR FROM STATE OF VERMONT DEPARTMENT OF ENVIRONMENTAL CONSERVATION, JANUARY 2, 2015.
7. ALL ELEVATIONS ARE ON THE NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88). NORTH ARROW, BEARINGS AND COORDINATES ARE BASED UPON THE VERMONT STATE PLANE COORDINATE SYSTEM (NAD 83 FT).
8. INFORMATION REGARDING THE LOCATION OF EXISTING UTILITIES HAS BEEN BASED UPON AVAILABLE INFORMATION AND MAY BE INCOMPLETE, AND WHERE SHOWN SHOULD BE CONSIDERED APPROXIMATE. THE LOCATION OF ALL EXISTING UTILITIES SHOULD BE CONFIRMED PRIOR TO BEGINNING CONSTRUCTION. CALL "DIG SAFE VERMONT", 811. ALL UTILITY LOCATIONS THAT DO NOT MATCH THE VERTICAL OR HORIZONTAL CONTROL SHOWN ON THE PLANS SHALL IMMEDIATELY BE BROUGHT TO THE ATTENTION OF THE ENGINEER FOR RESOLUTION.

LEGEND

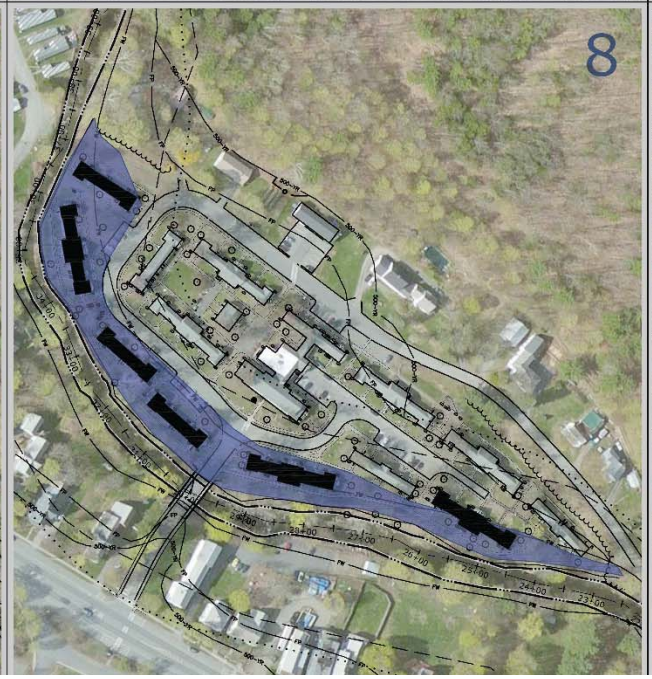
- EDGE OF WATER
- TREELINE
- 500-YR — FEMA 500-YEAR FLOODPLAIN LIMIT
- 1% — FEMA 100-YEAR FLOODPLAIN LIMIT
- FW — FEMA FLOODWAY LIMIT
- 1% & FW — FEMA FLOODWAY AND FLOODPLAIN LIMIT
- RIVER CORRIDOR
- FLUVIAL EROSION HAZARD ZONE (FEH)

2 & 3
BLUE HATCH REPRESENTS FLOODPLAIN RESTORATION AREA, TYP.
HATCHED BUILDINGS WOULD BE REMOVED, TYP.

5

6
BRIDGE EXPANSION AREA

4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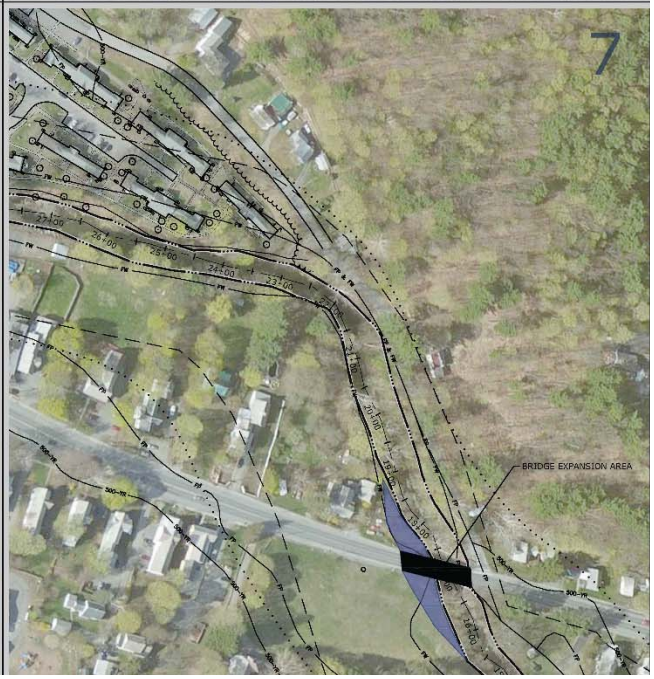
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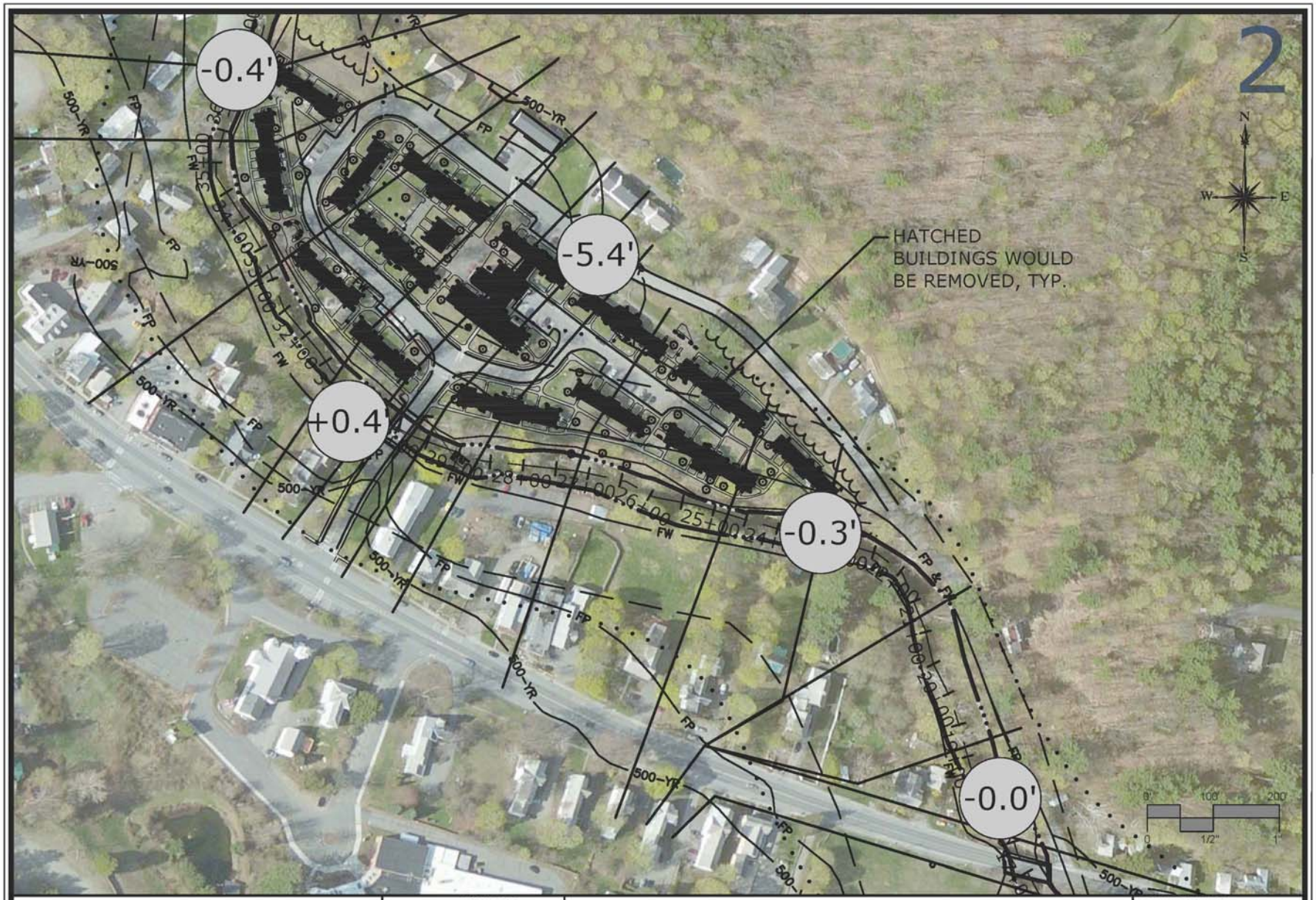
BRIDGE EXPANSION AREA



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DATE	6/30/2015
SCALE	1"=200'
PROJ. NO.	5696-01
DESIGNED	JCL
DRAWN	JCL
CHECKED	RKS

ALTERNATIVE 2

HYDROLOGIC & HYDRAULIC ANALYSIS
WHETSTONE BROOK AT MELROSE TERRACE

BRATTLEBORO HOUSING AUTHORITY
BRATTLEBORO, VERMONT

PROJECT PHASE: CONCEPT

DRAWING NAME: **ALT-2**

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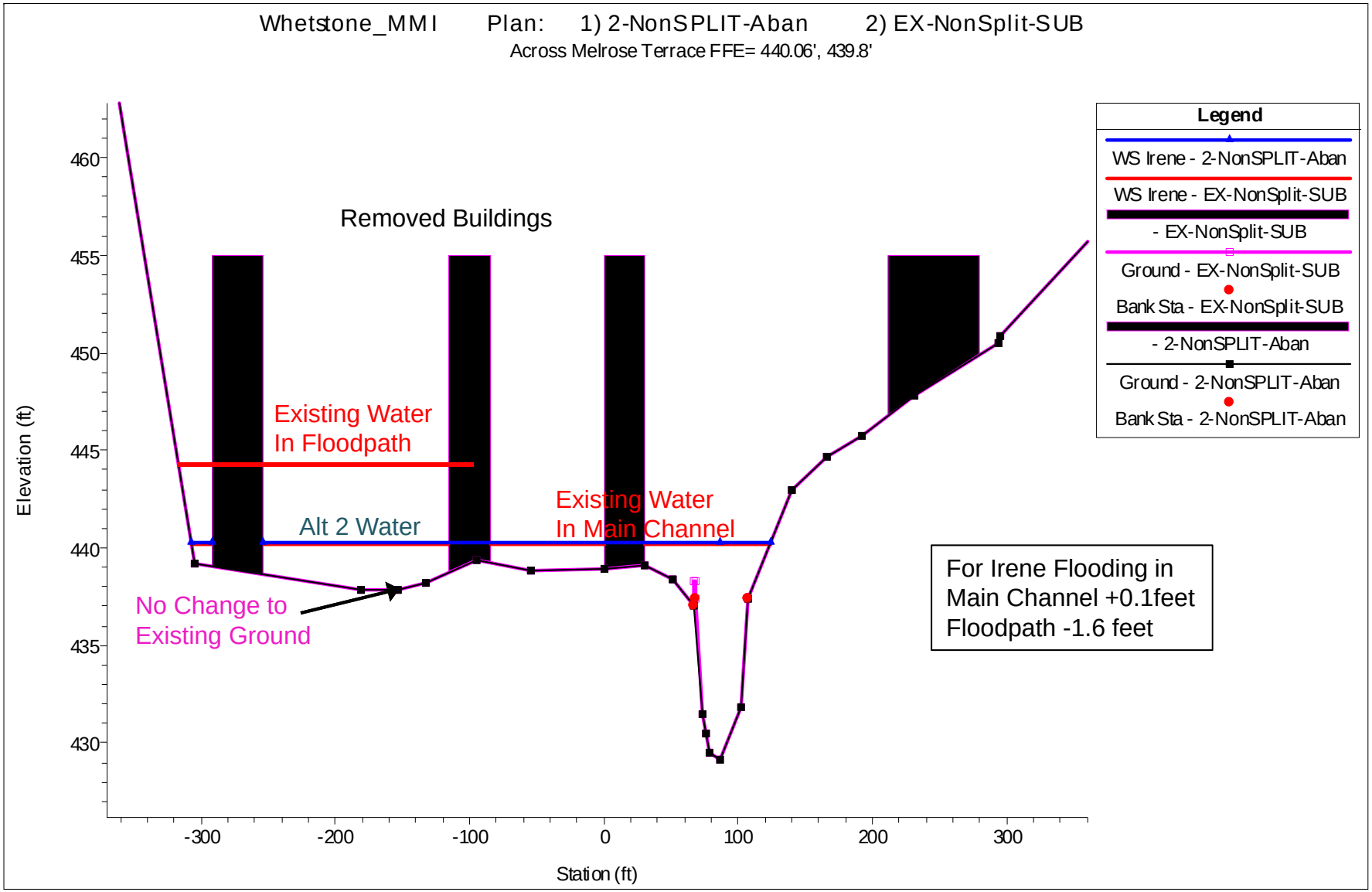

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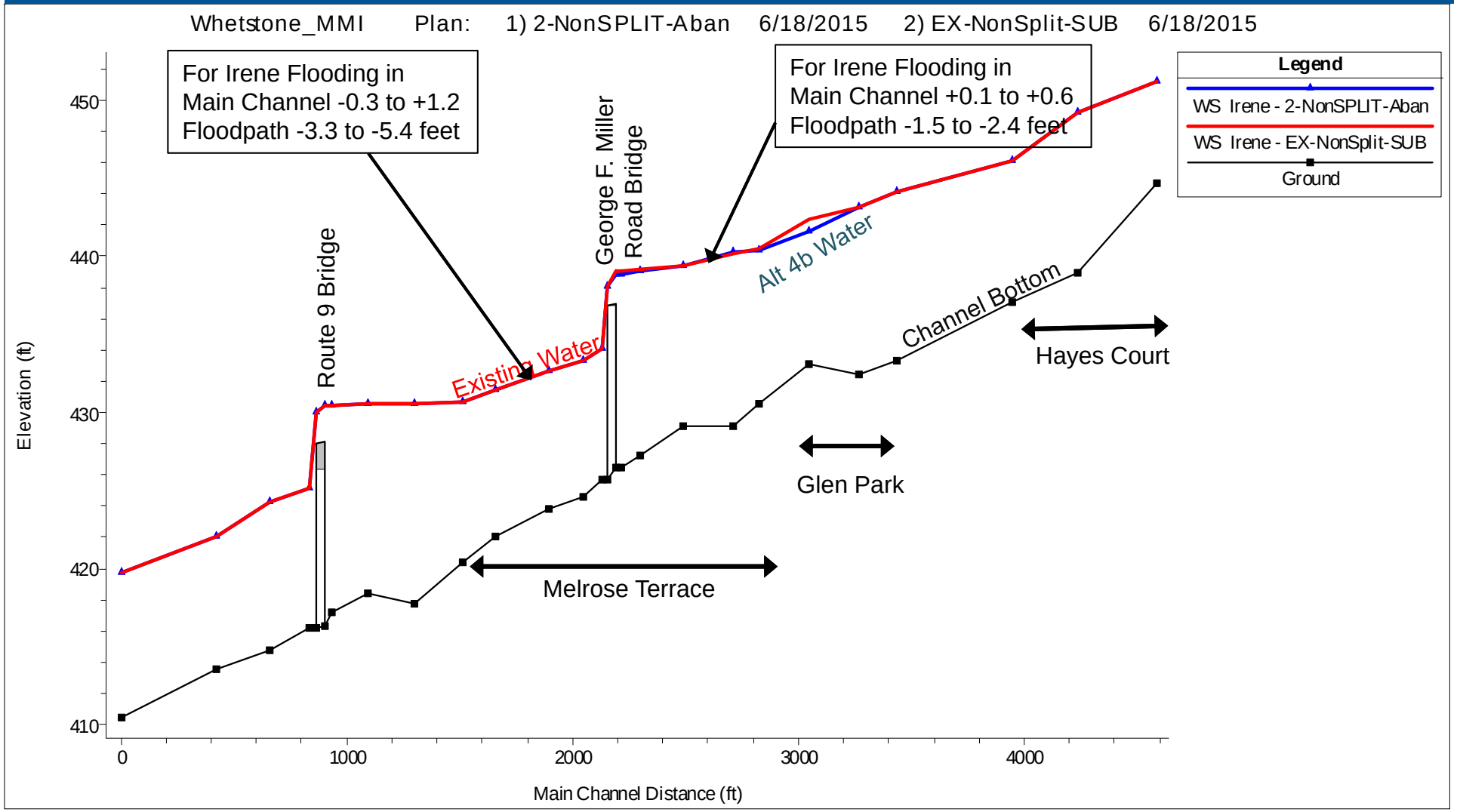
Profile: Alternative 2



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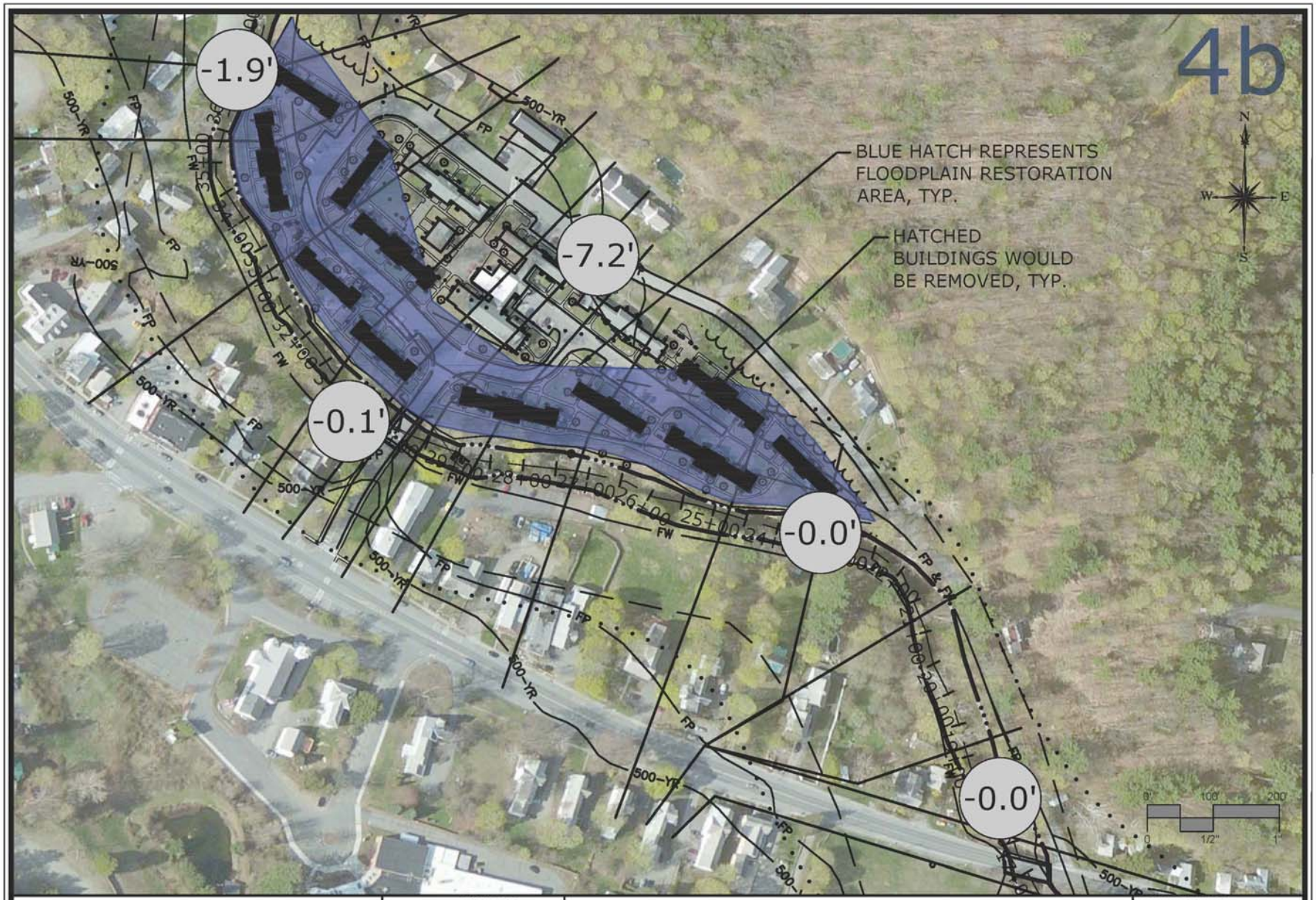

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ALTERNATIVE 4b

HYDROLOGIC & HYDRAULIC ANALYSIS
WHETSTONE BROOK AT MELROSE TERRACE

BRATTLEBORO HOUSING AUTHORITY
BRATTLEBORO, VERMONT

PROJECT PHASE:
CONCEPT

DRAWING NAME:
ALT-4b

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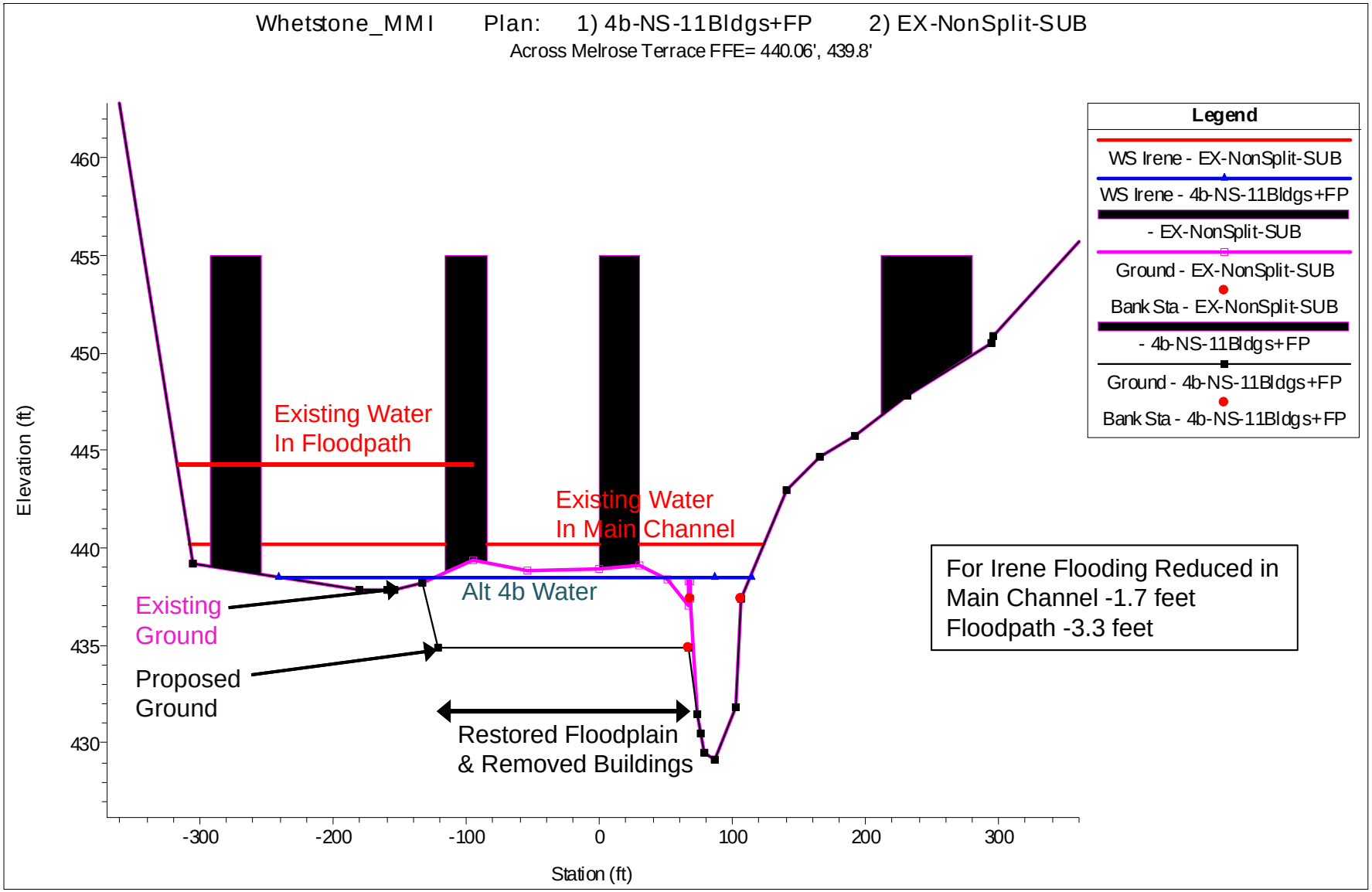

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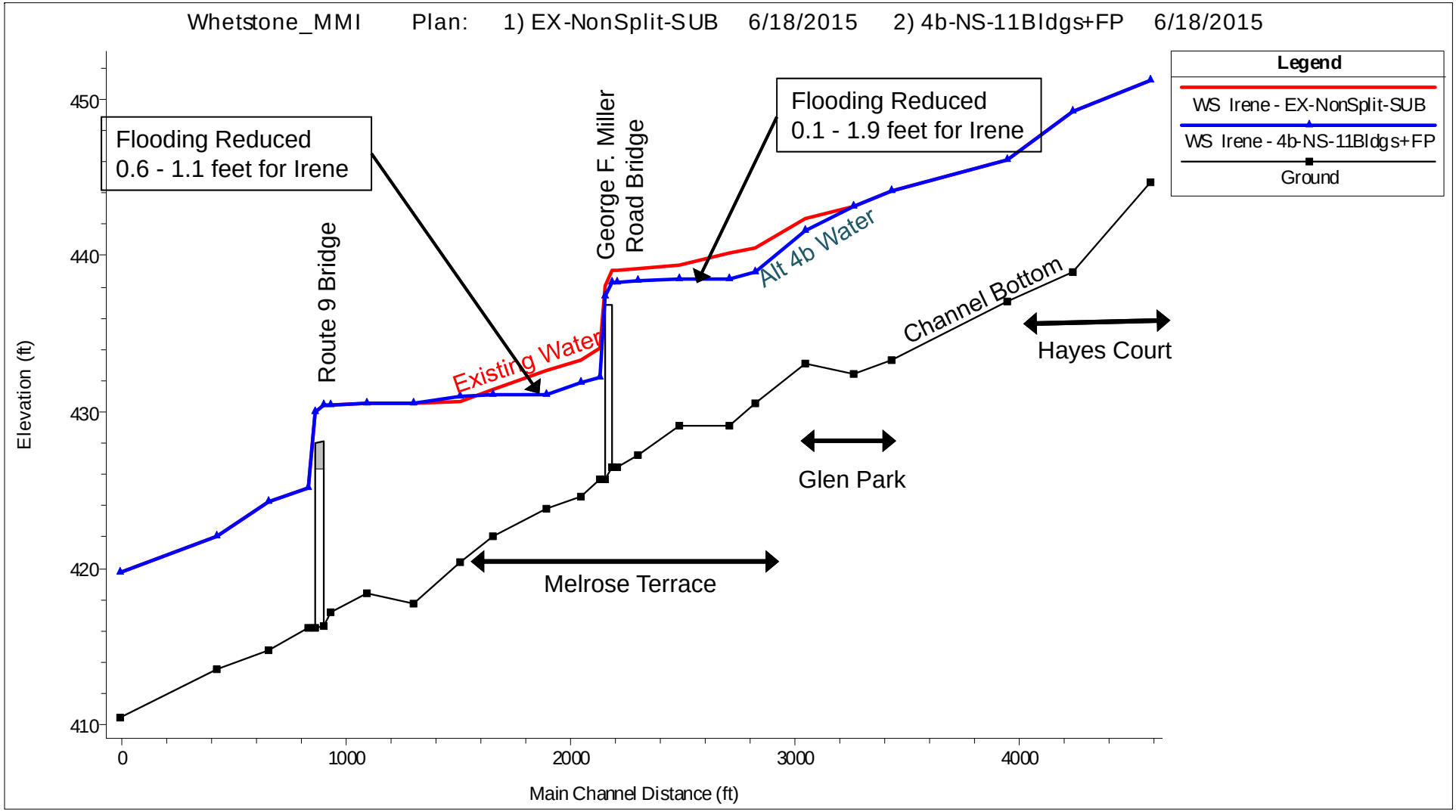

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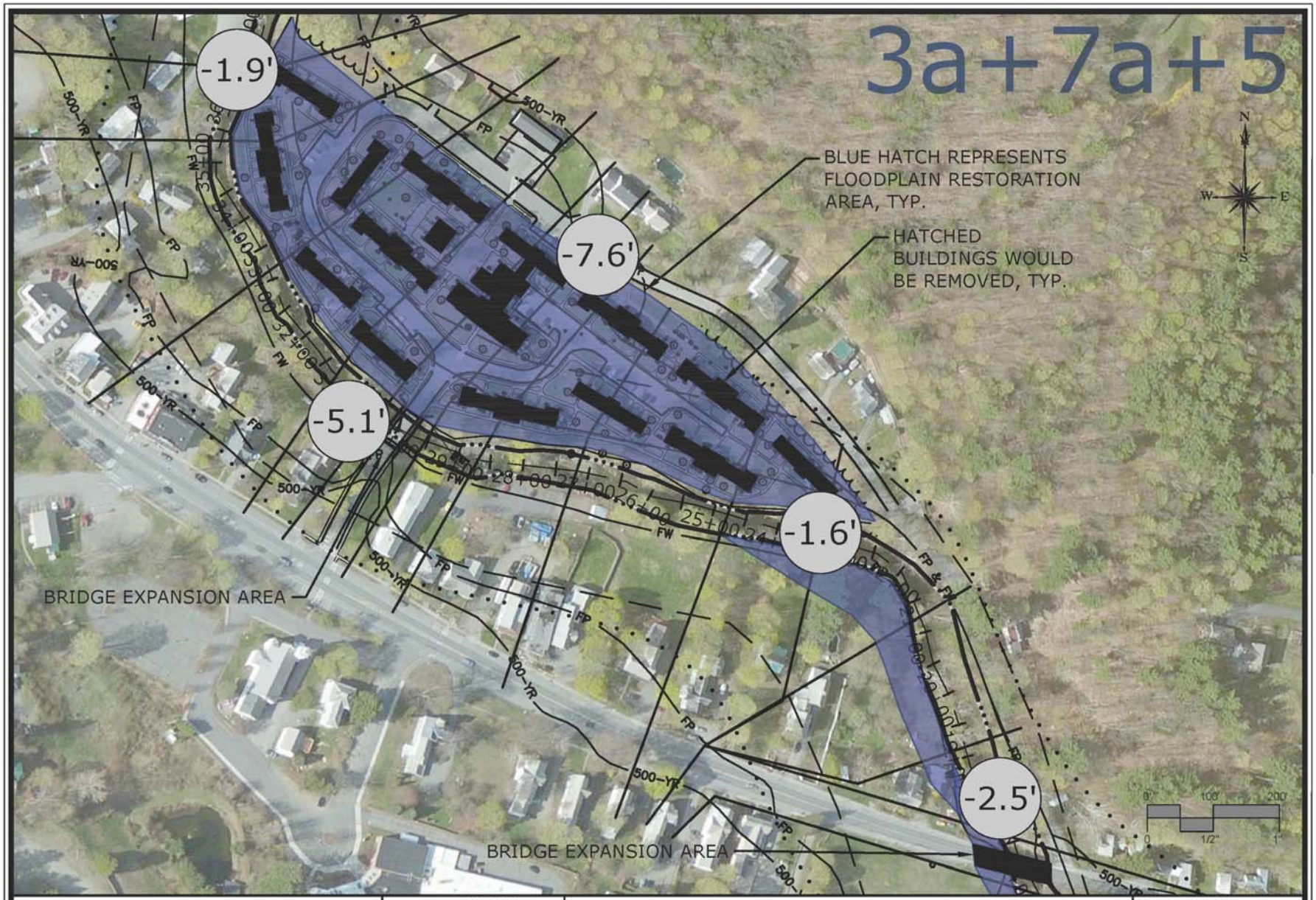

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ALTERNATIVE COMBINATION 3a+7a+5

HYDROLOGIC & HYDRAULIC ANALYSIS
WHETSTONE BROOK AT MELROSE TERRACE

BRATTLEBORO HOUSING AUTHORITY
BRATTLEBORO, VERMONT

PROJECT PHASE:
CONCEPT

DRAWING NAME:
ALT-3a+7a+5

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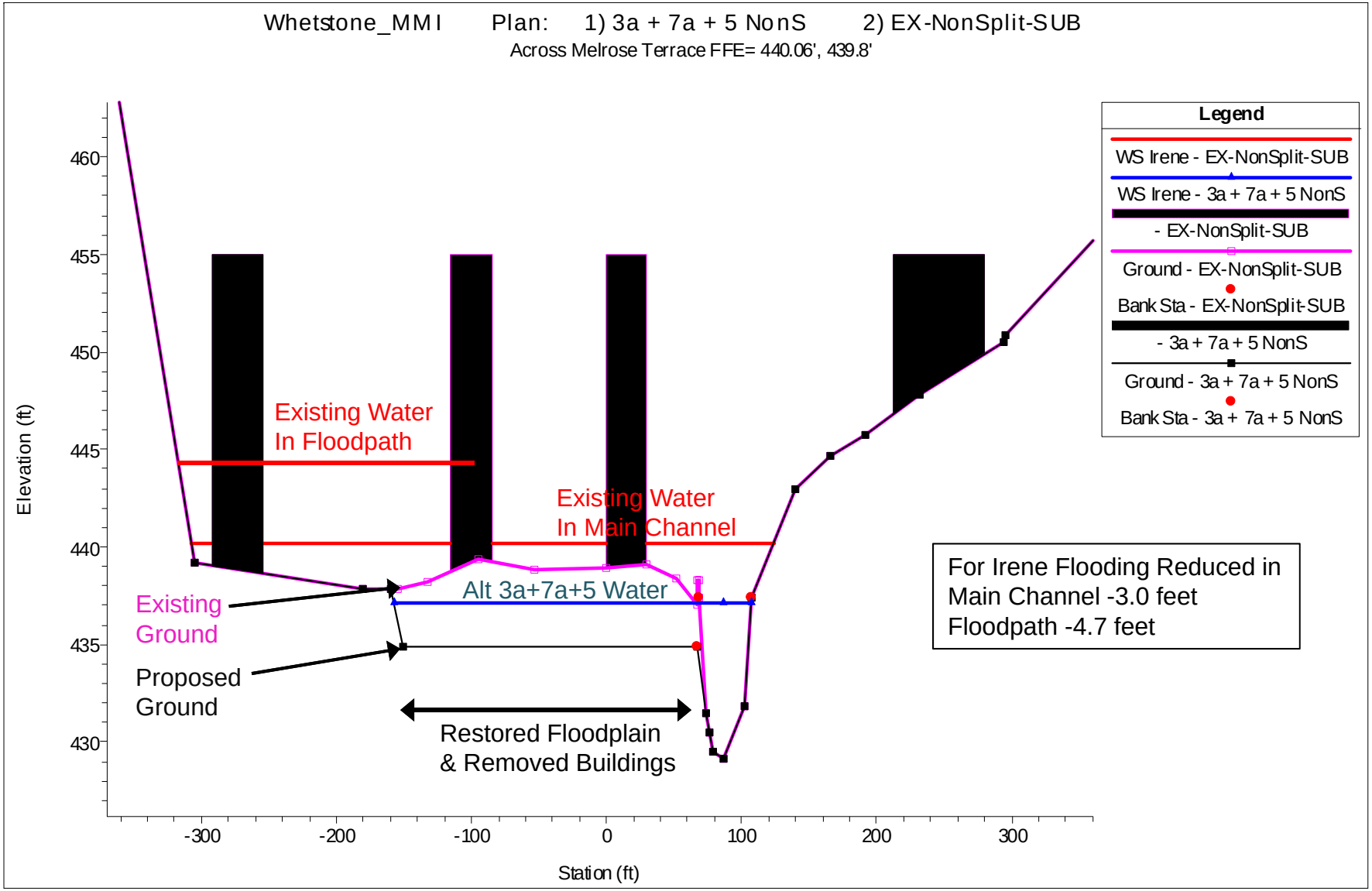

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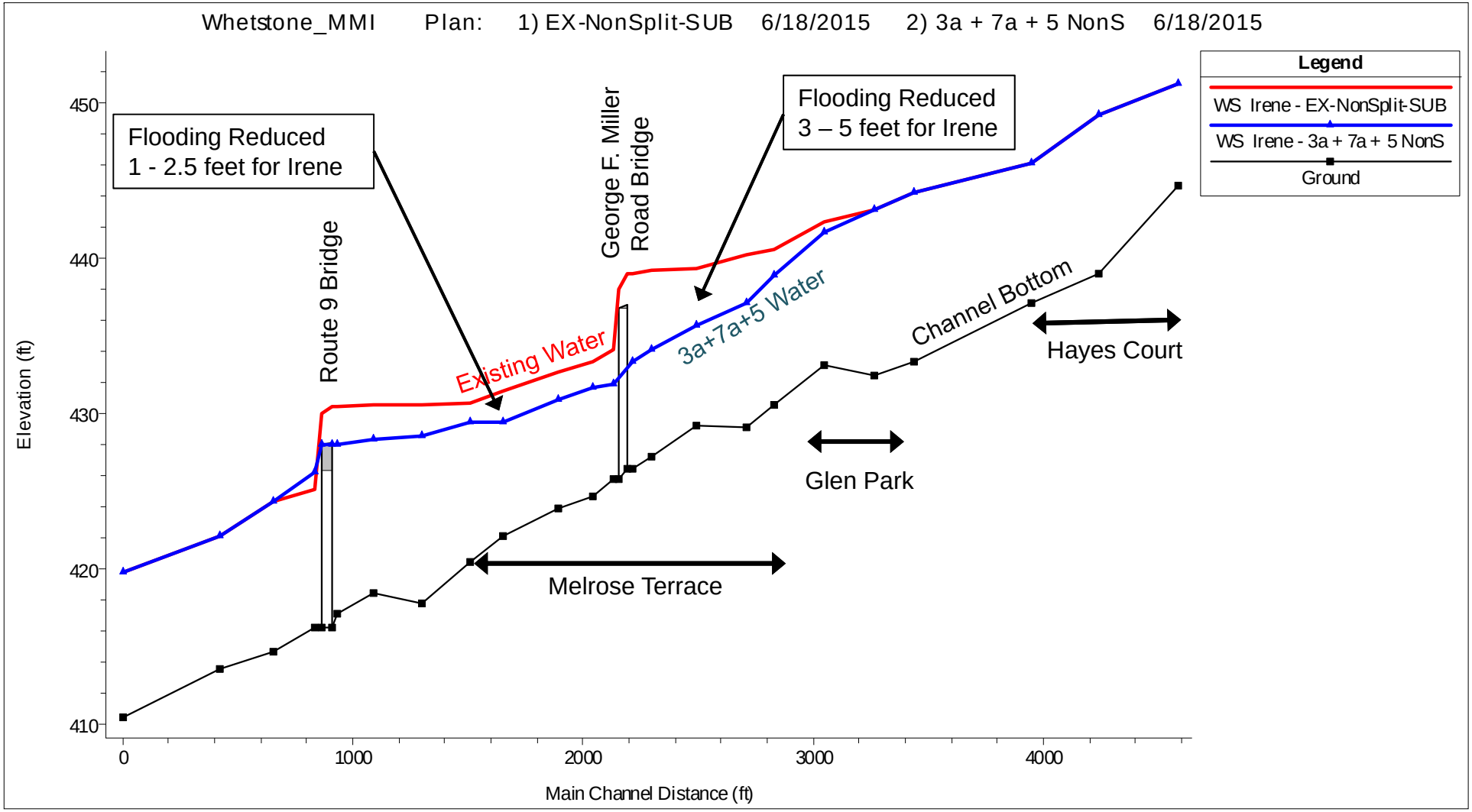
Profile: Combination 3a + 7a + 5



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Next Steps

- Seek consensus for future land use and flood risk reduction project to set priority for phased approach.
- Work with surrounding landowners and potential next property users on project implementation.
- Design, permitting, bidding, construction.
- Seek grant funding to assist with project implementation.