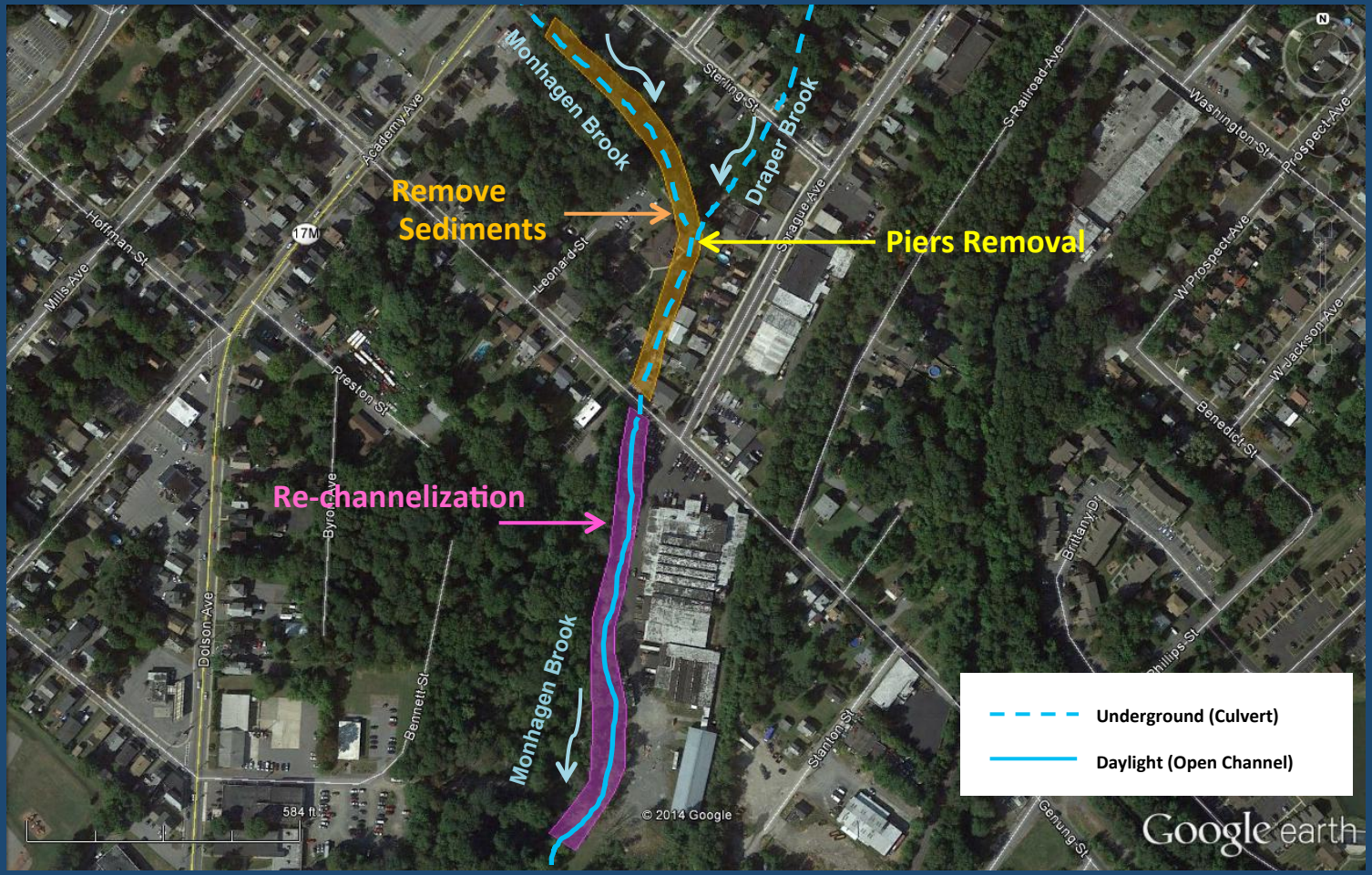
NYRCR
City of Middletown
Preliminary Project Analysis

October 7, 2014

1. Culvert and Streambed Improvement Academy Ave and Genung St.



1. Culvert and Streambed Improvement Academy Ave and Genung St.

Actions

- Remove piers near the Monhagen/Draper Brooks junction
- Remove sediments and debris along the culvert
- Re-channelization of Monhagen Brook off of Genung St.

Preliminary Results

- Limited impacts/benefits downstream in terms of reduced WSE and floodplain extent

1. Culvert and Streambed Improvement Academy St. to south Genung St.

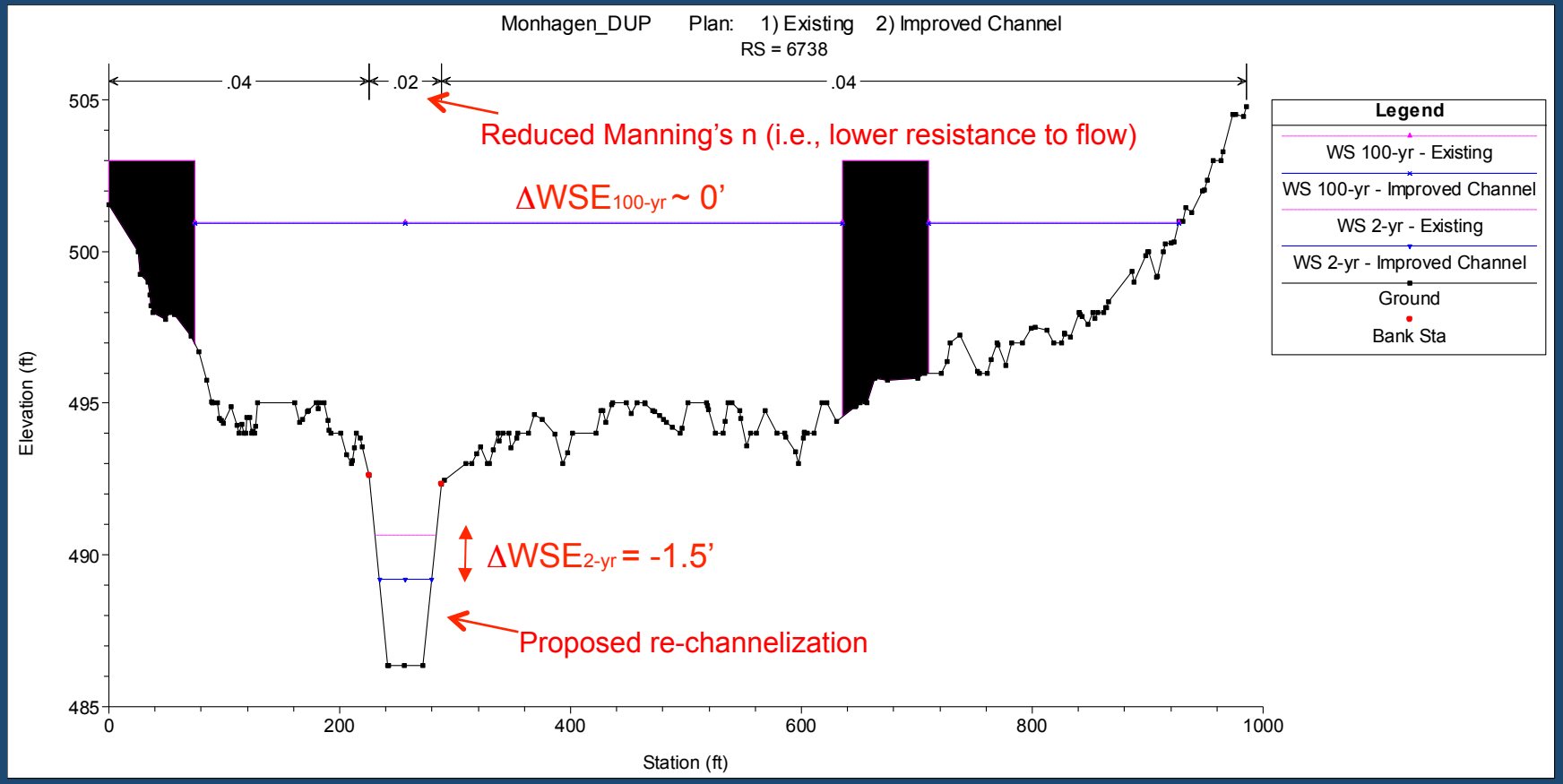
Sensitivity Analysis

- Increase the capacity of the culvert entrance on Fulton St.
  - Evaluate reduction of overland flow between Academy Ave and Genung St.

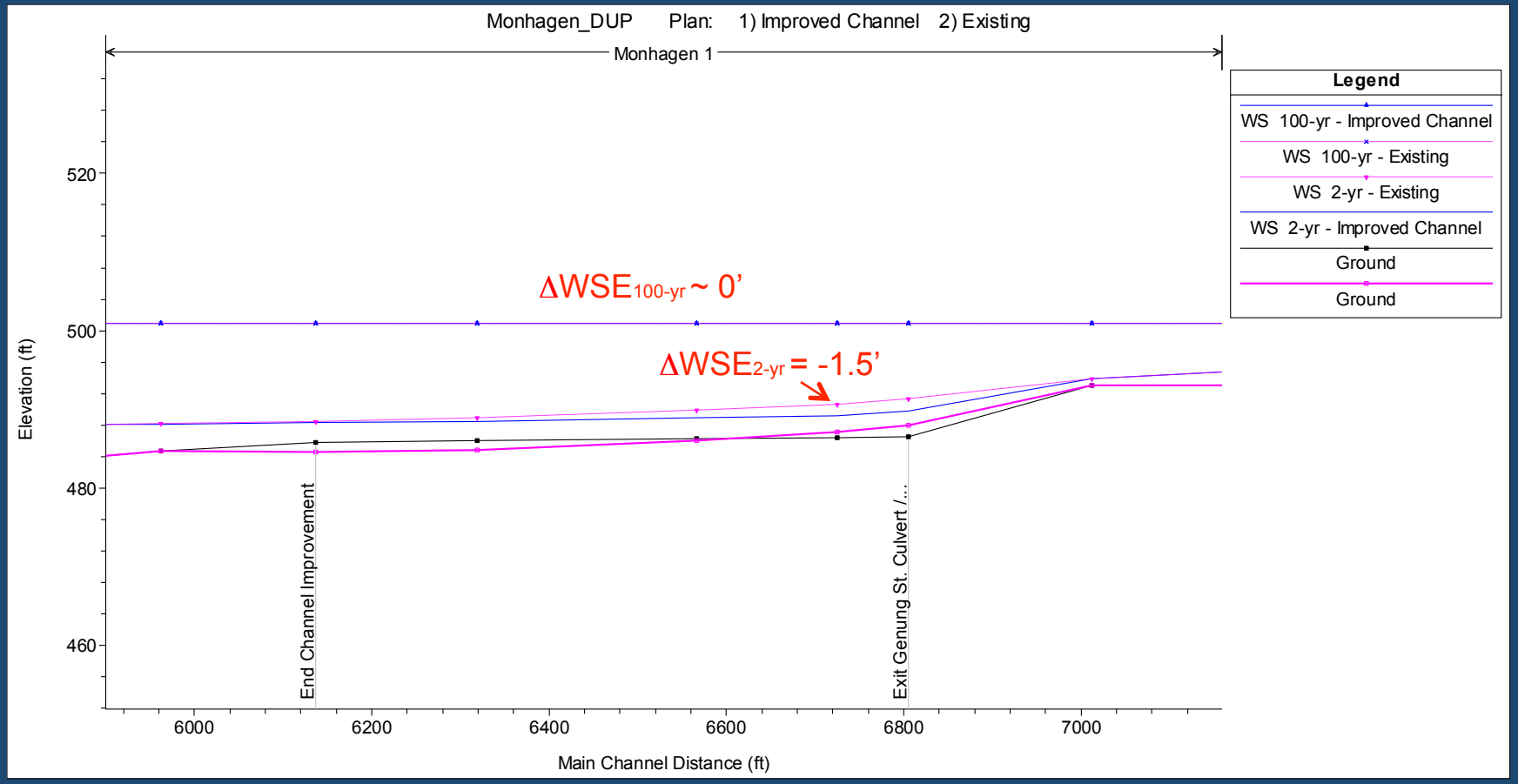
Preliminary Results

- Minimal change in overland flow
- No apparent impacts/benefits in terms of reduced WSE and floodplain extent

1. Culvert and Streambed Improvement Exist Genung St. Culvert (Cross Section)



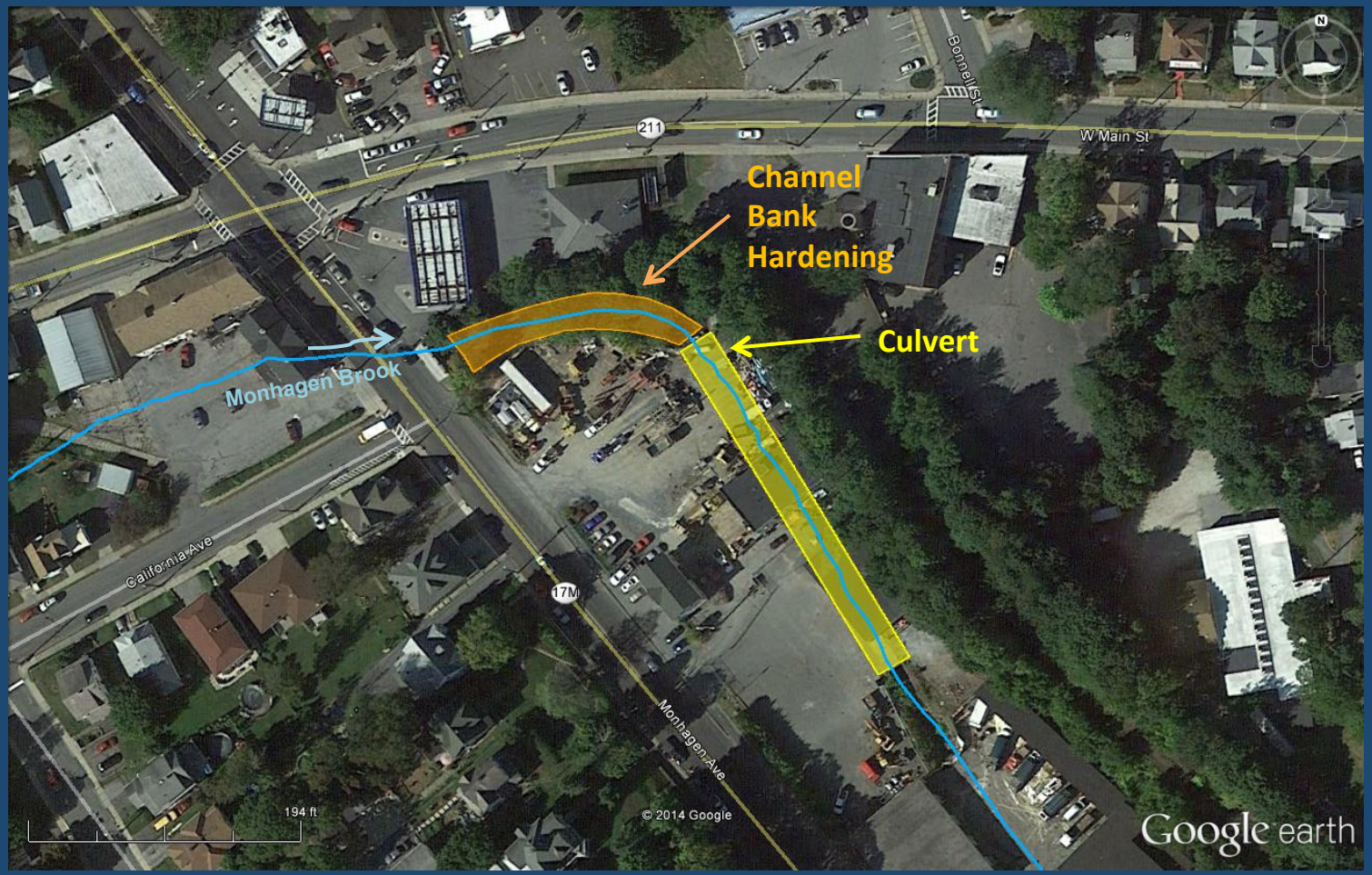
1. Culvert and Streambed Improvement (Water Profile)



1. Culvert and Streambed Improvement Academy St. to south Genung St.

	Max WSE Decrease (ft)				
Fulton St. Culvert Capacity Increase	**2-year**	**10-year**	**25-year**	**50-year**	**100-year**
0 % (Current)	0	0	0	0	0
+ 10%	0.01	0.05	0.02	0.07	0.03
+ 20%	0.02	0.11	0.05	0.16	0.06
+ 50%	0.06	0.32	0.11	0.33	0.14
+ 75%	0.09	0.43	0.17	0.46	0.21

2. Culvert Evaluation
W Main St. and Monhagen Ave



2a. Culvert Evaluation
20'x8' Concrete Box

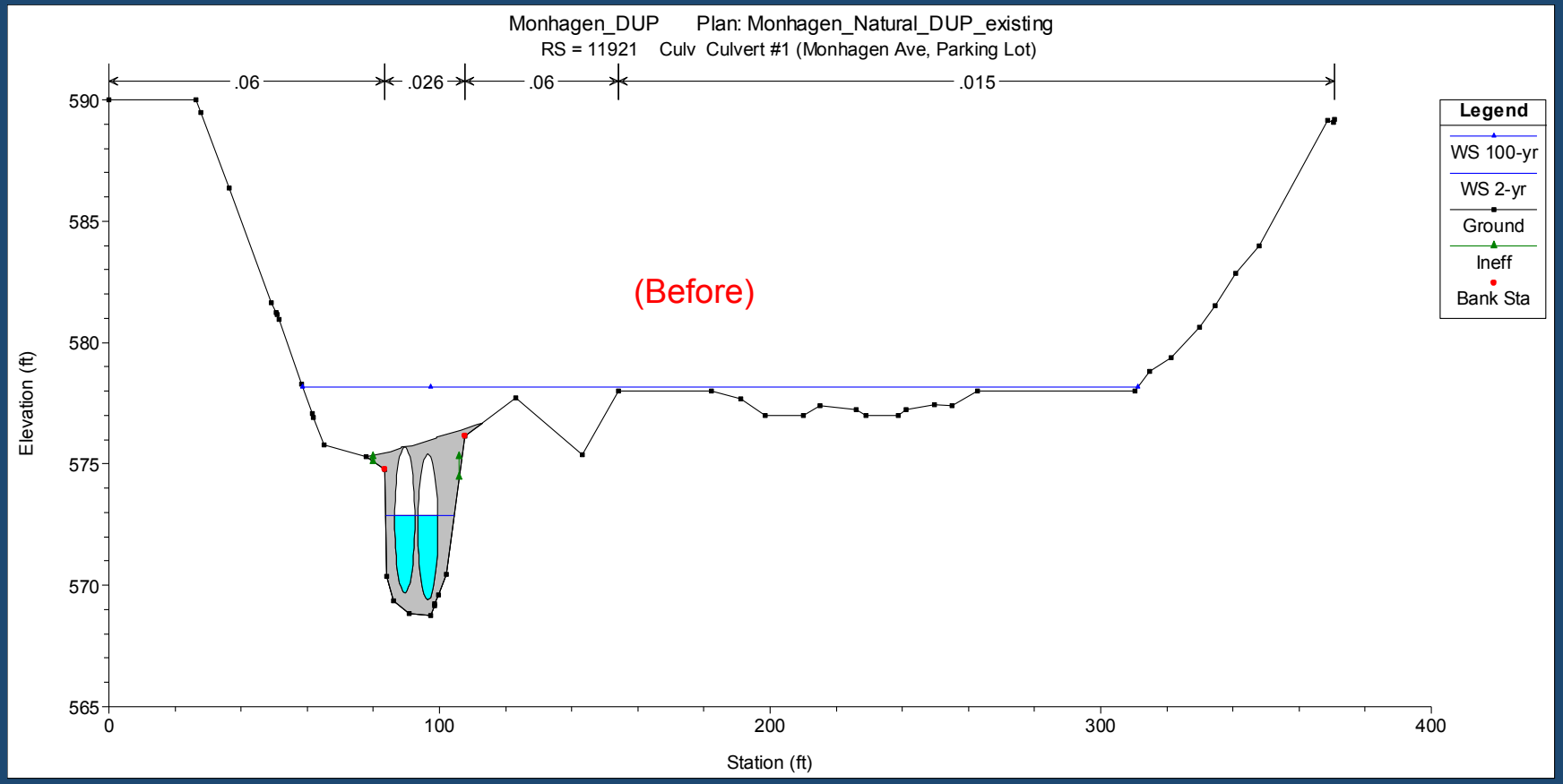
Actions

- Increase culvert capacity to improve conveyance and avoid flooding upstream
  - A 20'x8' concrete box is analyzed
- Dredging and channel improvement to accommodate the new structure

Preliminary Results

- Limited impacts/benefits in terms of reduced WSE and floodplain extent

2a. Culvert Evaluation
20’x8’ Concrete Box (Cross Section)



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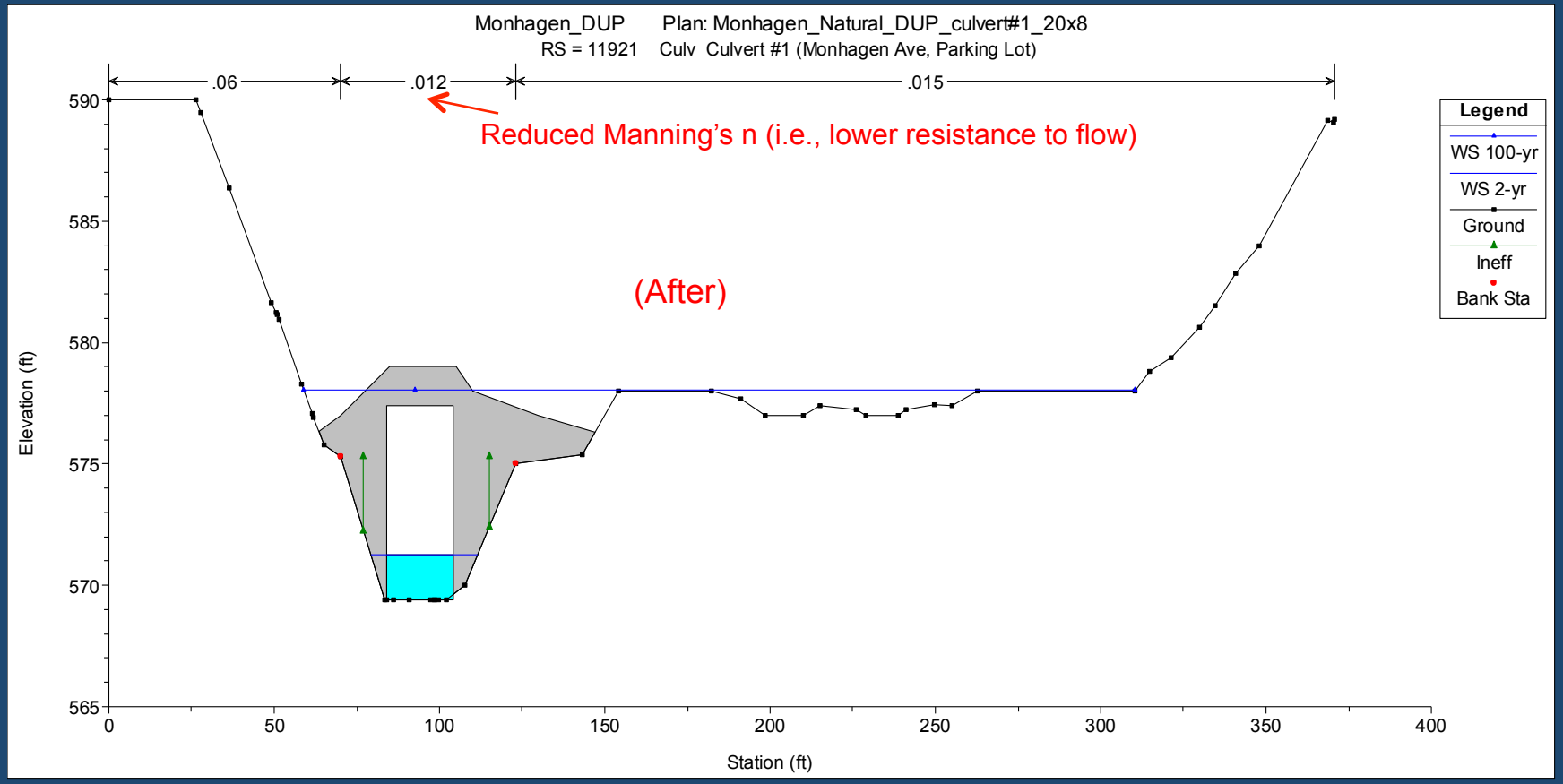

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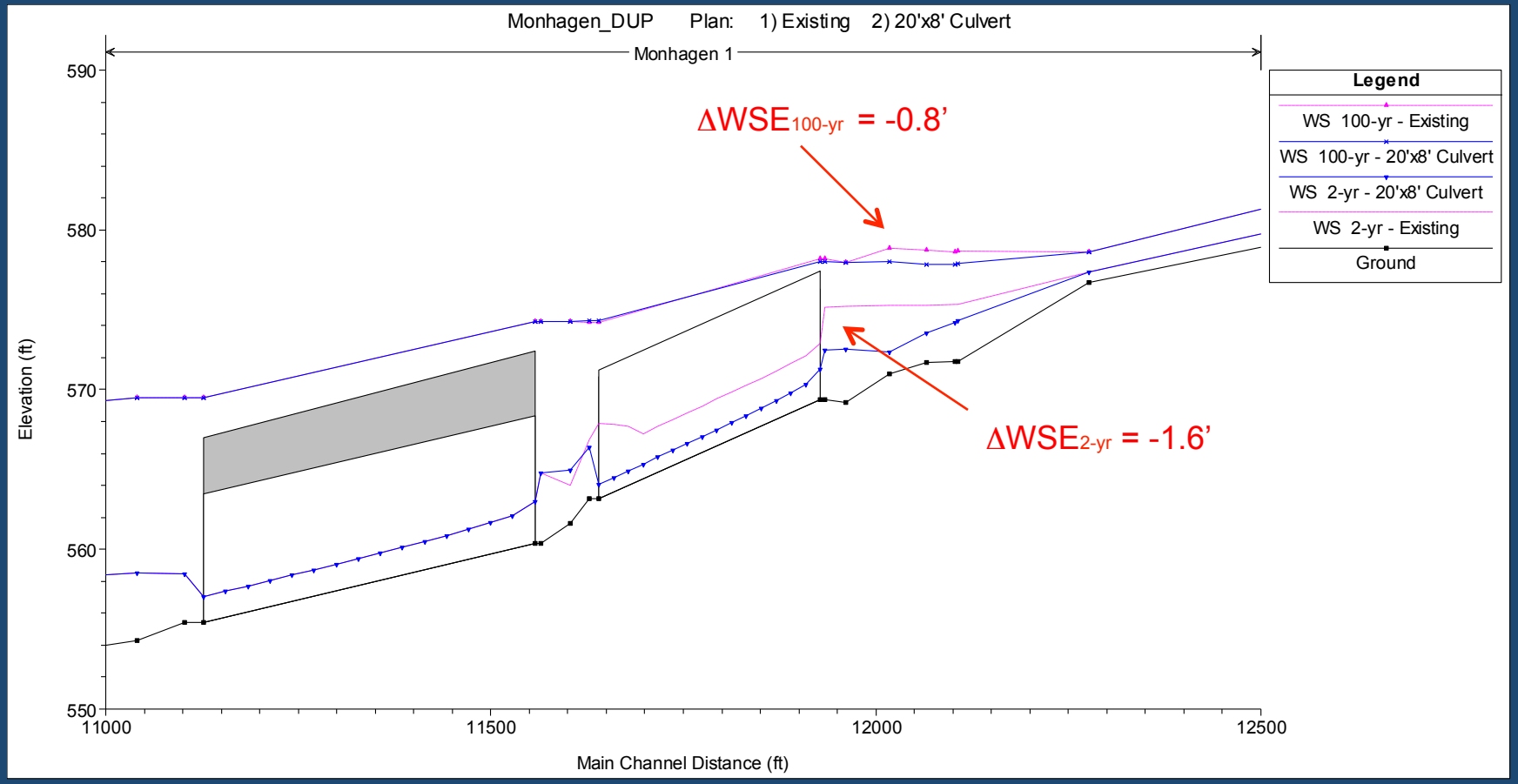


2b. Culvert Evaluation
Channel Bank Hardening

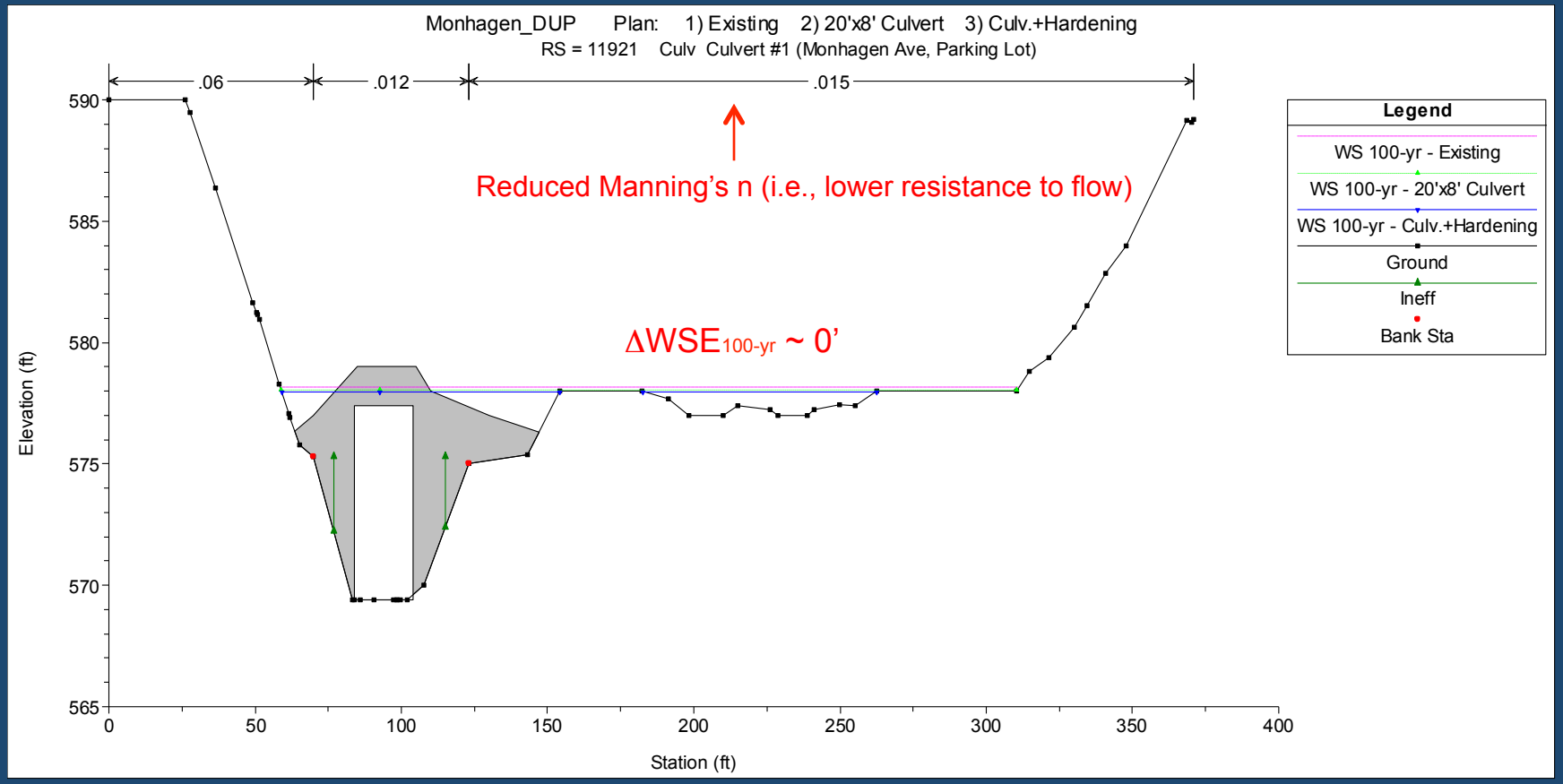
Actions

- Cover streambed and banks with smoother materials (e.g., concrete) to improve conveyance

Preliminary Results

- Positive impacts/benefits upstream in terms of reduced WSE and floodplain extent
  - Limited to approx. 350 ft upstream of the culvert

2b. Culvert Evaluation
Channel Bank Hardening (Cross Section)



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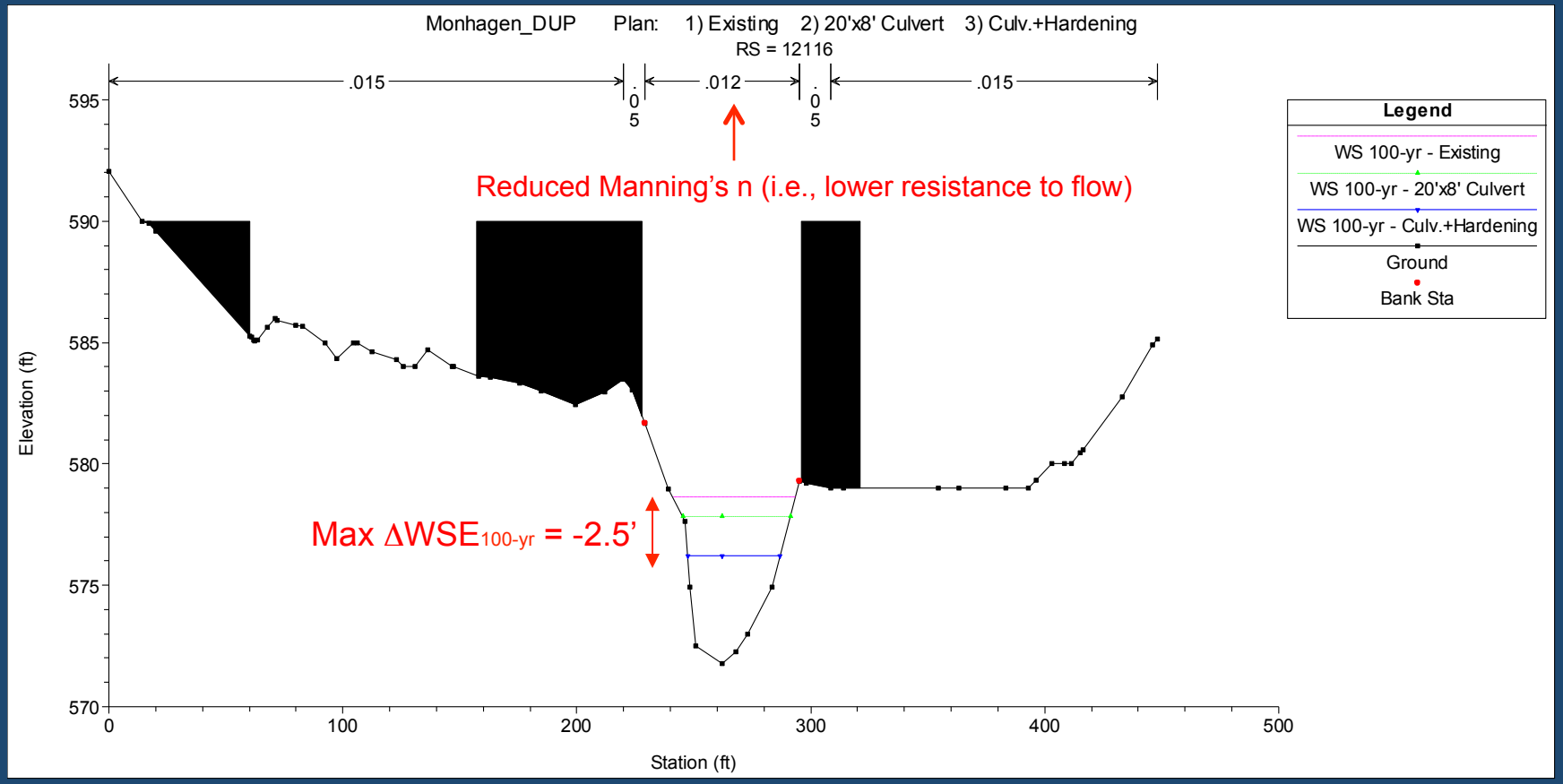

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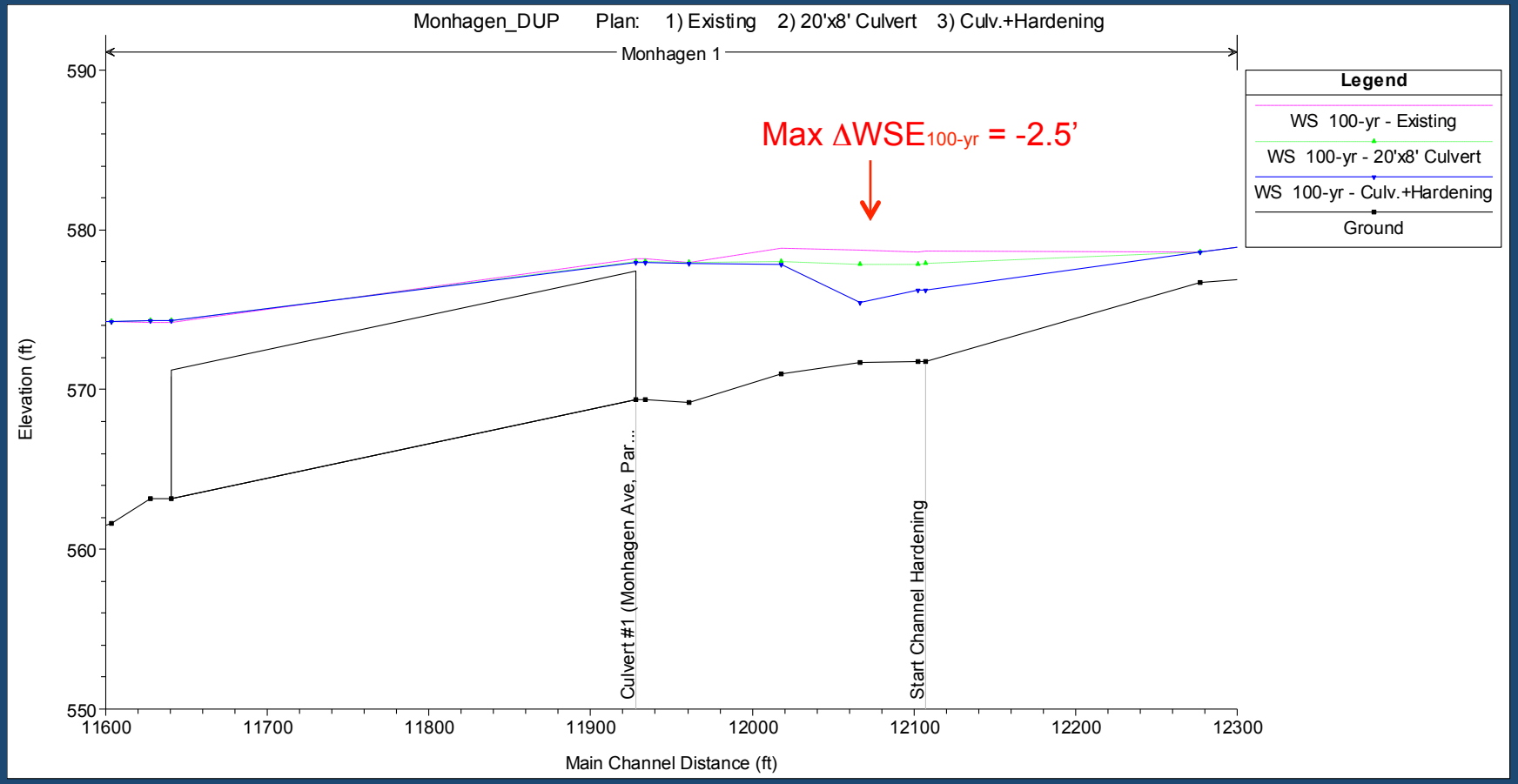


3. NJ Railroad Bridge Evaluation

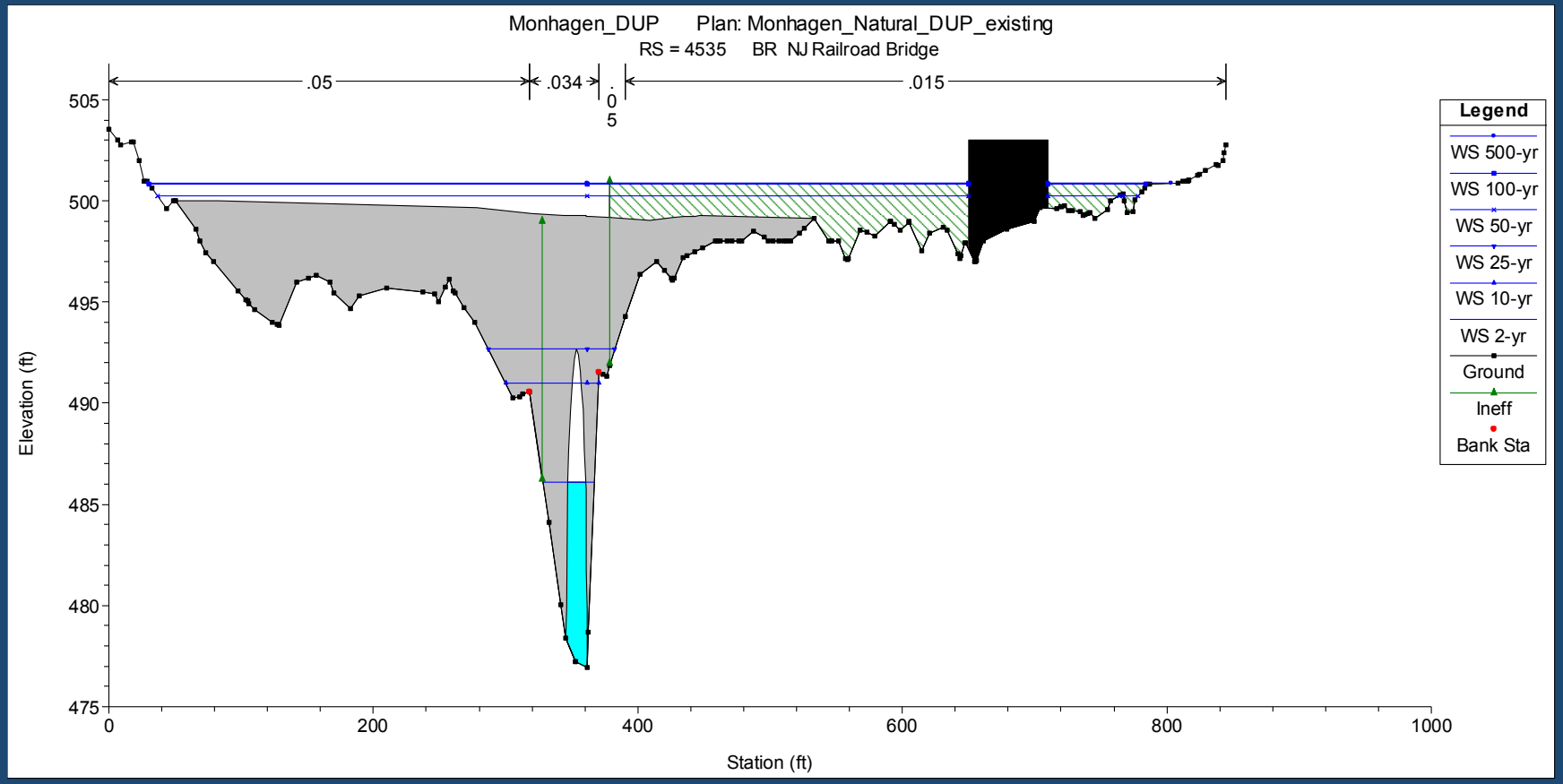
Actions

- Widen the bridge opening to increase conveyance

Preliminary Results

- Significant impacts/benefits upstream in terms of reduced WSE and floodplain extent

3. NJ Railroad Bridge Evaluation (Cross Section)



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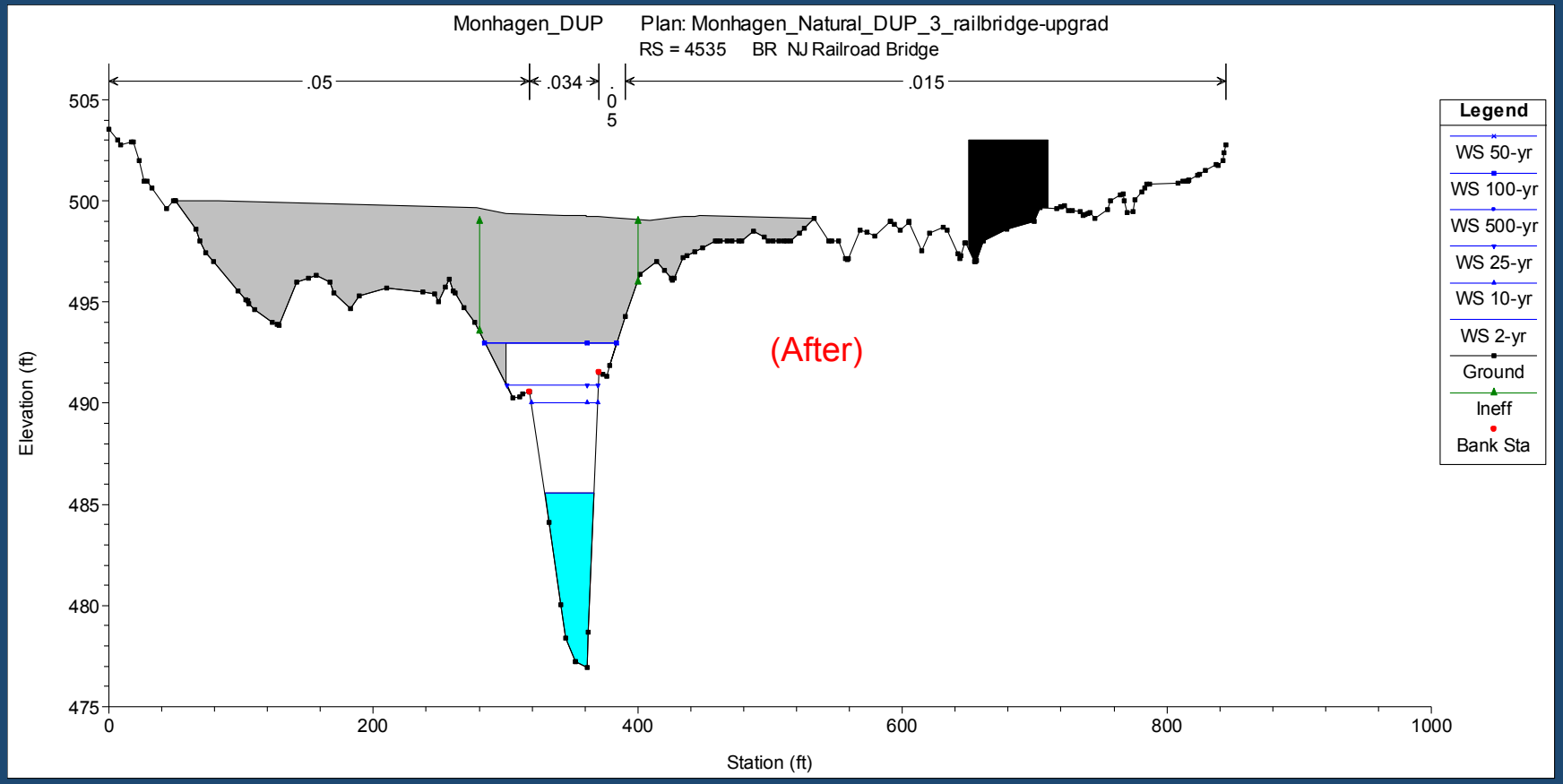
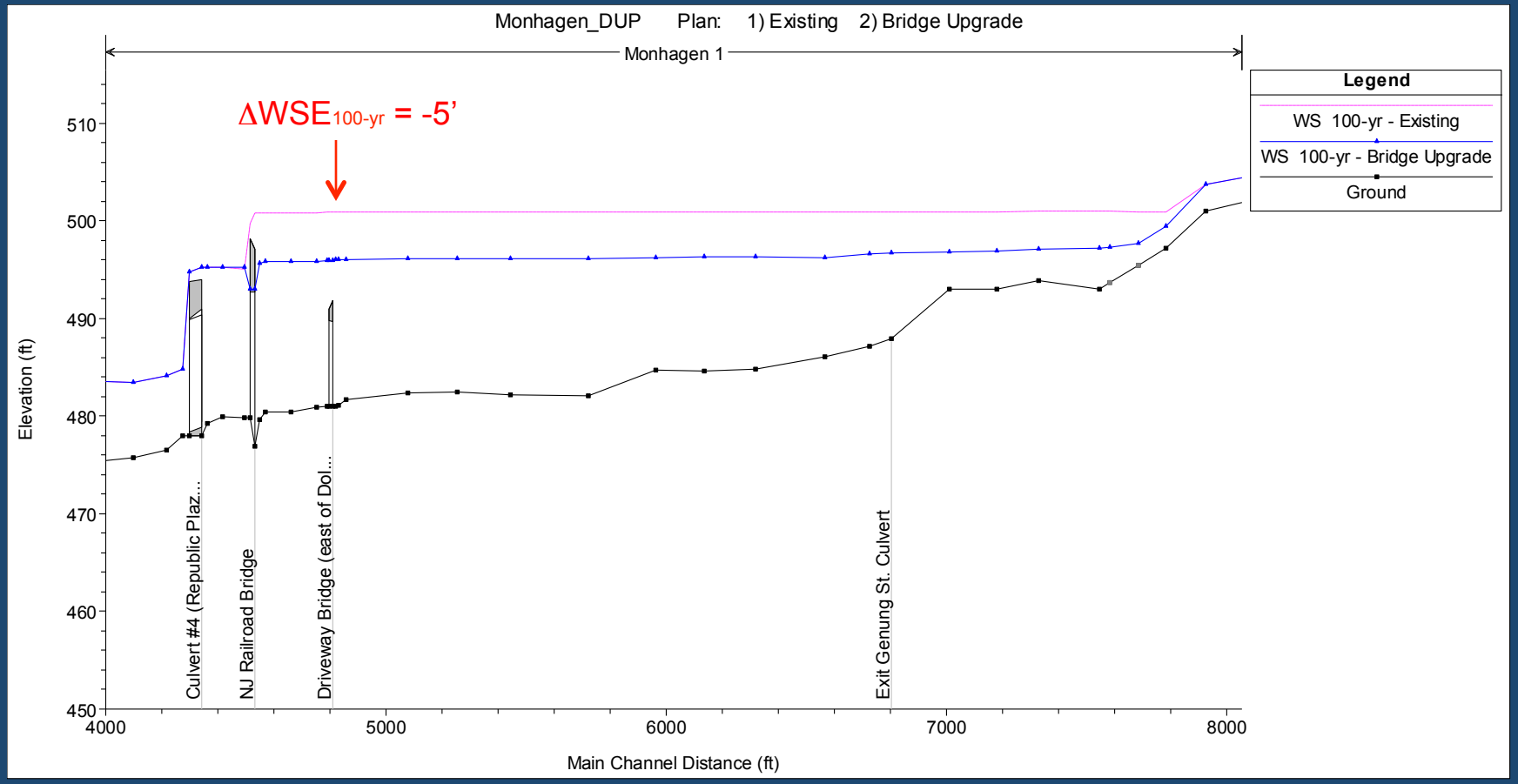
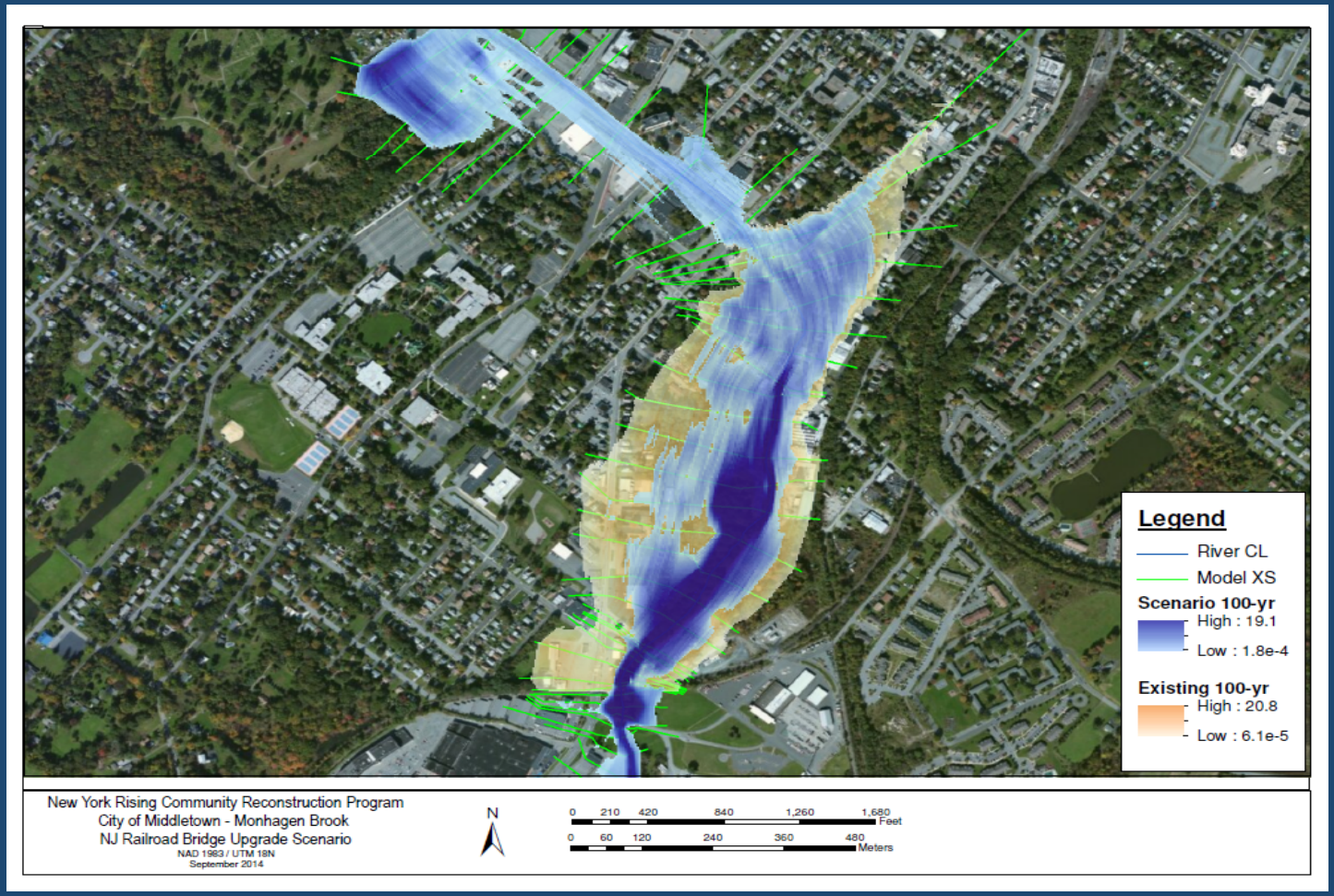


3. NJ Railroad Bridge Evaluation (Water Profile)



3. NJ Railroad Bridge Evaluation (100-year Floodplain)



4. Maple Hill Park – Retention Area

Actions

- Draw down the WSE in existing pond prior to a storm event
  - Evaluate potential runoff volume storage
  - Investigate impacts/benefits downstream in terms of peak flow reduction

Preliminary Results

- Current storage is insufficient for capturing a 2-year (or larger) storm event
  - Maximum storage = 20% of 2-year Runoff Volume
- No apparent benefits/impacts in terms of peak flow reduction

4. Maple Hill Park – Retention Area

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Drainage Area [a]	(acres)	307
Surface Area [a]	(acres)	0.8
Average Depth [a]	(ft)	6
Storage Volume (=*Area x Depth*)	**(acre-ft)**	**5.1**

		2-year	10-year	25-year	50-year	100-year	500-year
Peak Inflow [b]	(cfs)	12.2	28.2	39.6	49.8	61.6	96.5
24-hr Rainfall [c]	(in)	3.5	5.5	5.8	6	7.5	11
Runoff Depth [c]	(in)	1	2.5	2.6	2.8	4	5.5
Runoff Volume (= *Drain. Area * Depth*)	**(acre-ft)**	**25.6**	**64**	**66.5**	**71.6**	**102.3**	**140.7**

[a] Estimated by using GIS

[b] Source: USGS *Streamstats*

[c] Source: USDA *Urban Hydrology for Small Watersheds, TR-55*

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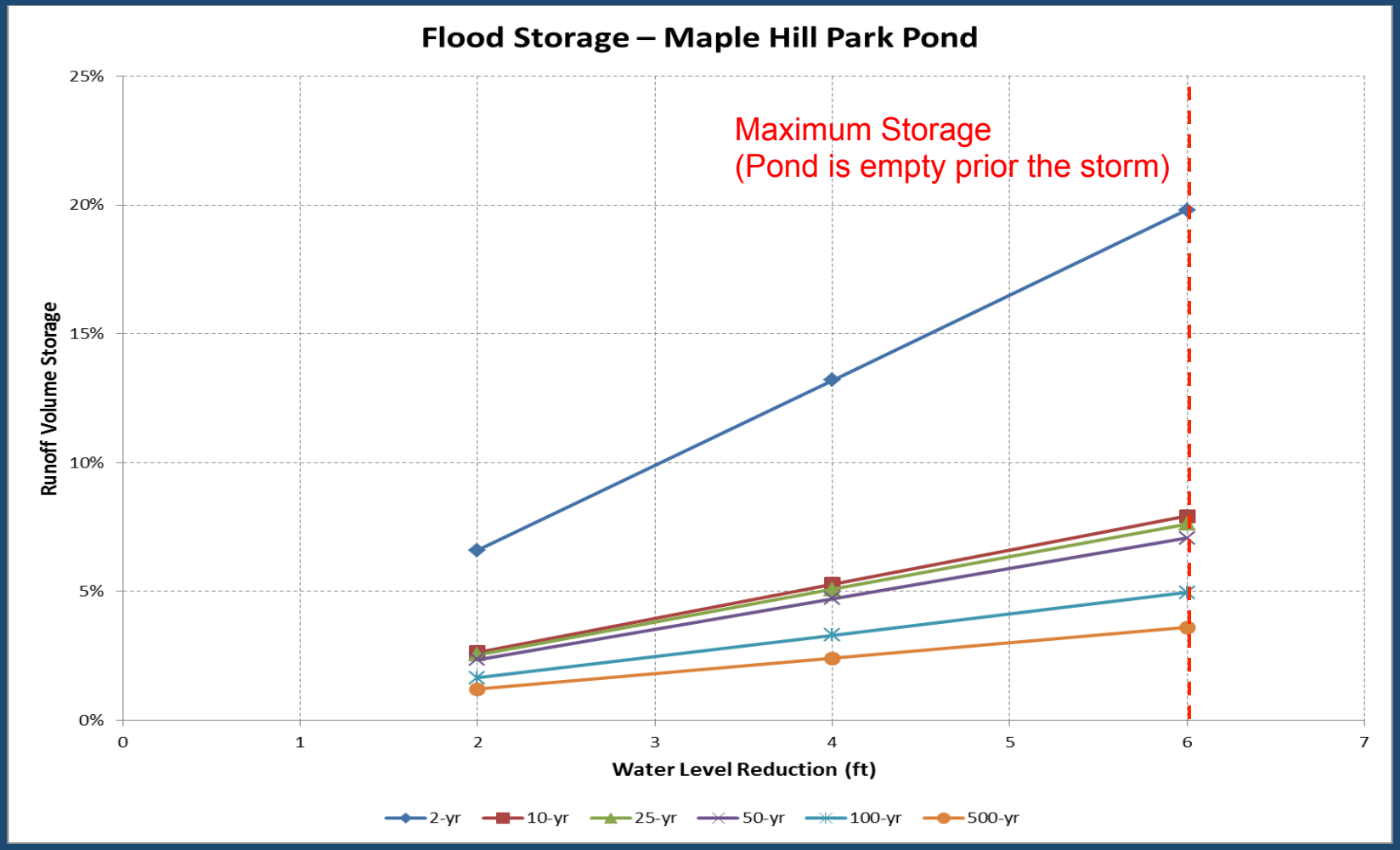

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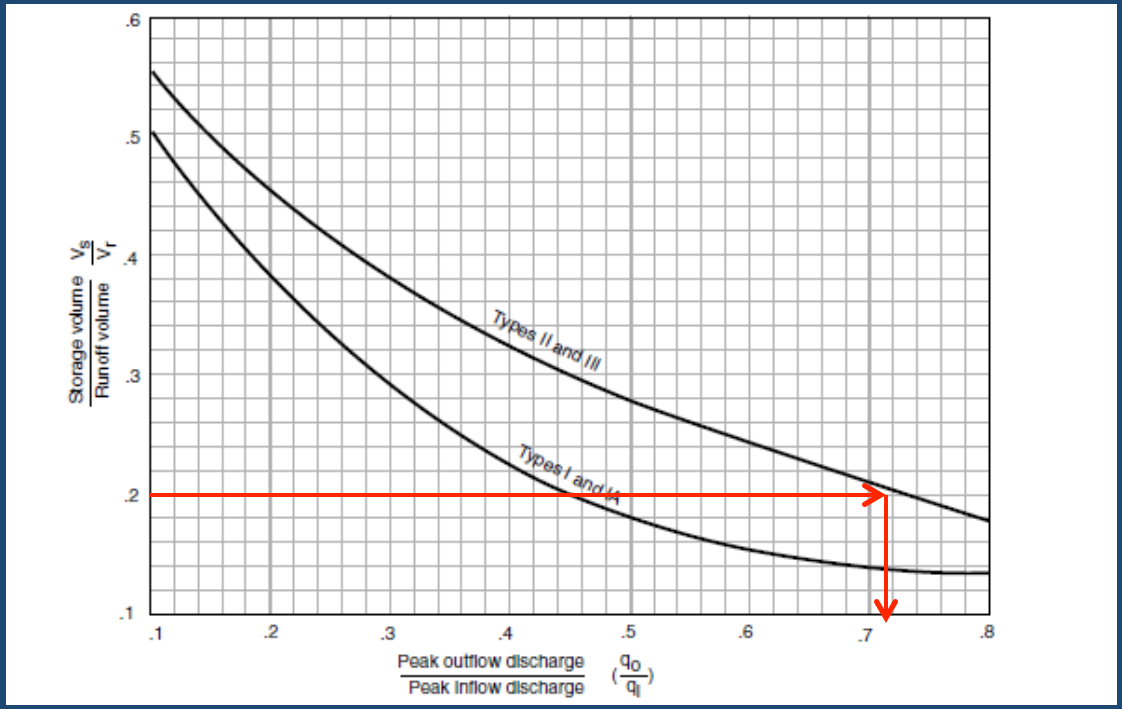


Source: "Urban Hydrology for Small Watersheds, TR-55" United States Department of Agriculture

2-year Storm				
Storage Volume V_s	Runoff Volume V_r	V_s/V_r	Peak Inflow q_i	**Peak Outflow q_o**
(acre-ft)	(acre-ft)	-	(cfs)	**(cfs)**
5.1	141	0.2	12.2	**9**

5. Fancher Davidge Park Retention Area

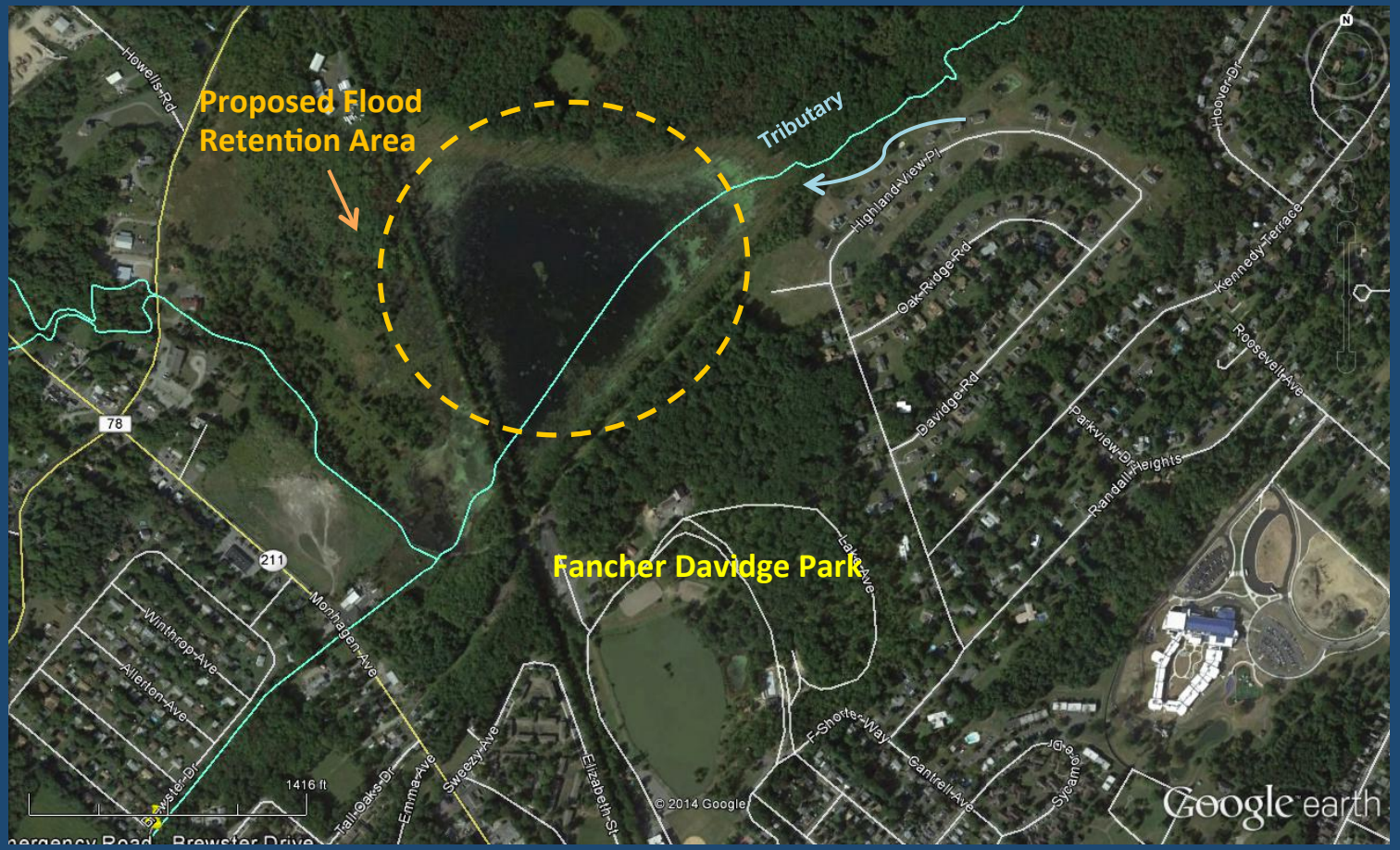
Actions

- Create a flood retention area north of Fancher Davidge Park
  - Evaluate potential runoff volume storage
  - Investigate impacts/benefits downstream in terms of peak flow reduction

Preliminary Results

- Current storage is sufficient for capturing a 100-year storm event
  - Storage Volume > 100-year Runoff Volume
- Positive impacts in terms of peak flow reduction

5. Fancher Davidge Park Retention Area



5. Fancher Davidge Park Retention Area

Drainage Area [a]	(acres)	704
Surface Area [a]	(acres)	46.3
Average Depth [a]	(ft)	6
Storage Volume (=*Area x Depth*)	**(acre-ft)**	**277.8**

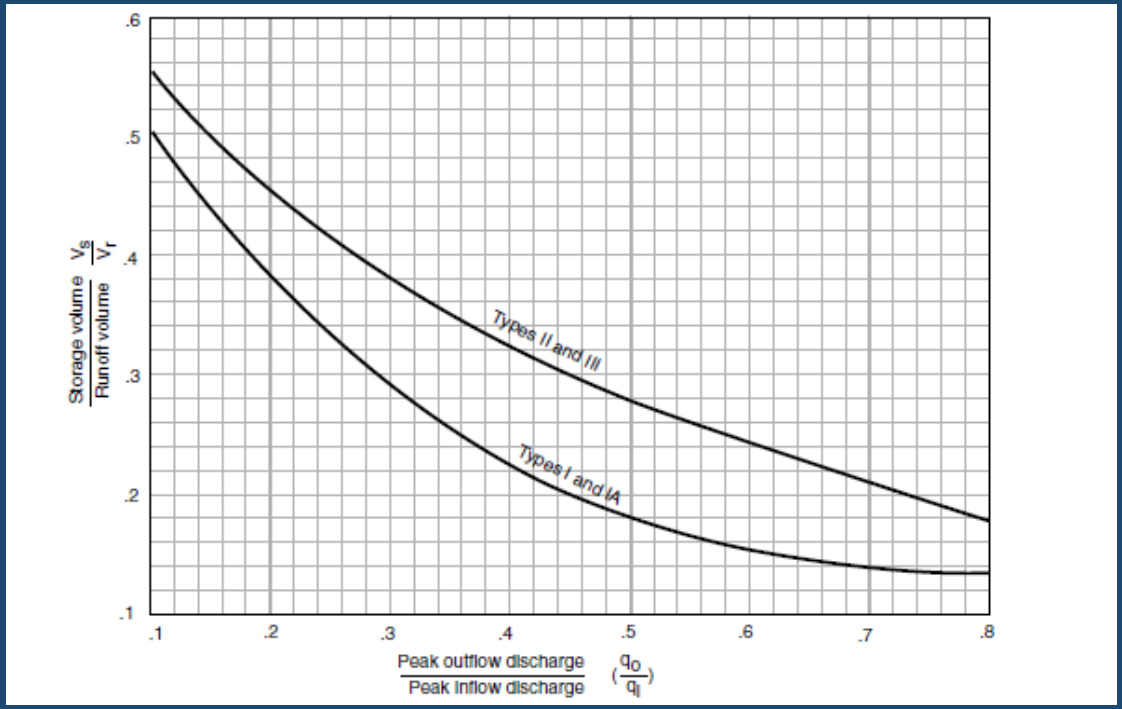
		2-year	10-year	25-year	50-year	100-year	500-year
Peak Inflow [b]	(cfs)	24.1	55.1	77.4	97.4	120	189
24-hr Rainfall [c]	(in)	3.5	5.5	5.75	6.0	7.5	11.0
Runoff Depth [c]	(in)	1.0	2.5	2.6	2.8	4.0	5.5
Runoff Volume (= *Drain. Area * Depth*)	**(acre-ft)**	**58.7**	**146.7**	**152.5**	**164.3**	**234.7**	**323**

[a] Estimated by using GIS

[b] Source: USGS *Streamstats*

[c] Source: USDA *Urban Hydrology for Small Watersheds, TR-55*

5. Fancher Davidge Park Retention Area



Source: "Urban Hydrology for Small Watersheds, TR-55" United States Department of Agriculture

500-year Storm				
Storage Volume V_s	Runoff Volume V_r	V_s/V_r	Peak Inflow q_i	**Peak Outflow q_o**
(acre-ft)	(acre-ft)	-	(cfs)	**(cfs)**
277.8	234.7	1.18	120	**~ 0**

6. Brewster Drive Emergency Road

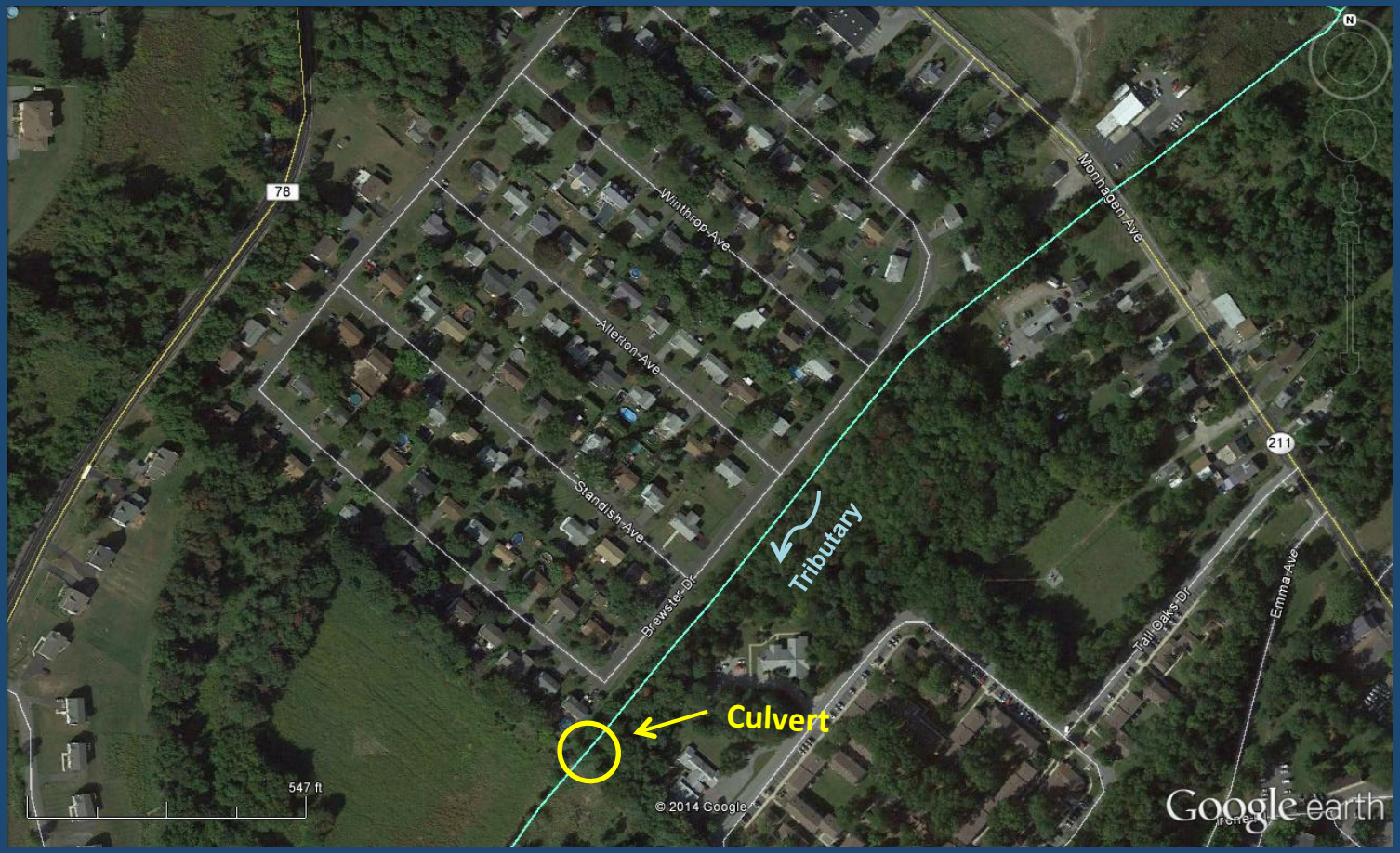
Actions

- Evaluate the capacity of the culvert at the emergency road crossing to Brewster Drive
  - Determine whether structure size or channel should be modified to improve local flooding

Preliminary Results

- Culvert conveys a 100-year (or smaller) storm
  - 100-year flow appears close to capacity
  - Several hydraulic assumptions made
    - More detailed assessment recommended

6. Brewster Drive Emergency Road



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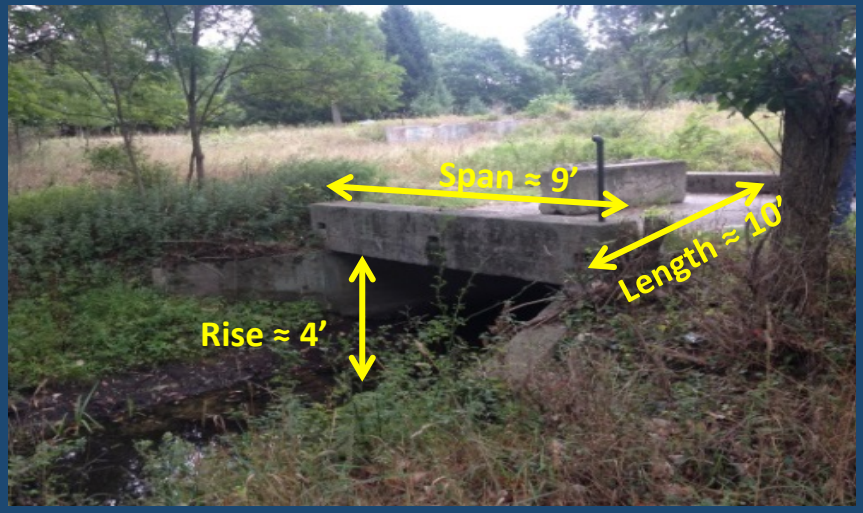
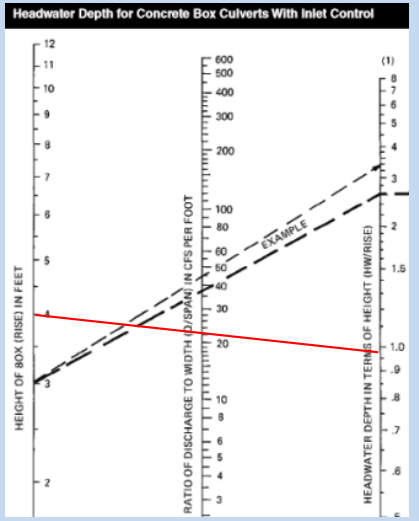


Culvert Max. Design Flow (100-year)		
Cross-Sectional Area	36	ft^2
Wetted Perimeter	26	ft
Hydraulic Radius	1.4	ft
Max. Design Flow (Q_d)	215.7	ft^3/s

100-yr Storm Event

Max. Peak Flow (Q_{p100})	201	ft^3/s	
Max. Design Flow (Q_d)	215.7	ft^3/s	
$Q_{p100} < Q_{d100}$	YES		**Box culvert can convey peak flow**
Ratio of Discharge to Width	22.3	ft^3/ft	Q_{p100}/culvert span
Inlet control head loss (H_e)	0.1	ft	
HW/Rise	1.0		Refer to diagram
Upstream Water Depth (HW_{100})	3.8	ft	
Allowable HW (HW_a)	4	ft	
$HW_{100} < HW_a$	YES		**Upstream water is below culvert rise**



7. Channel Improvement South of W Main St.

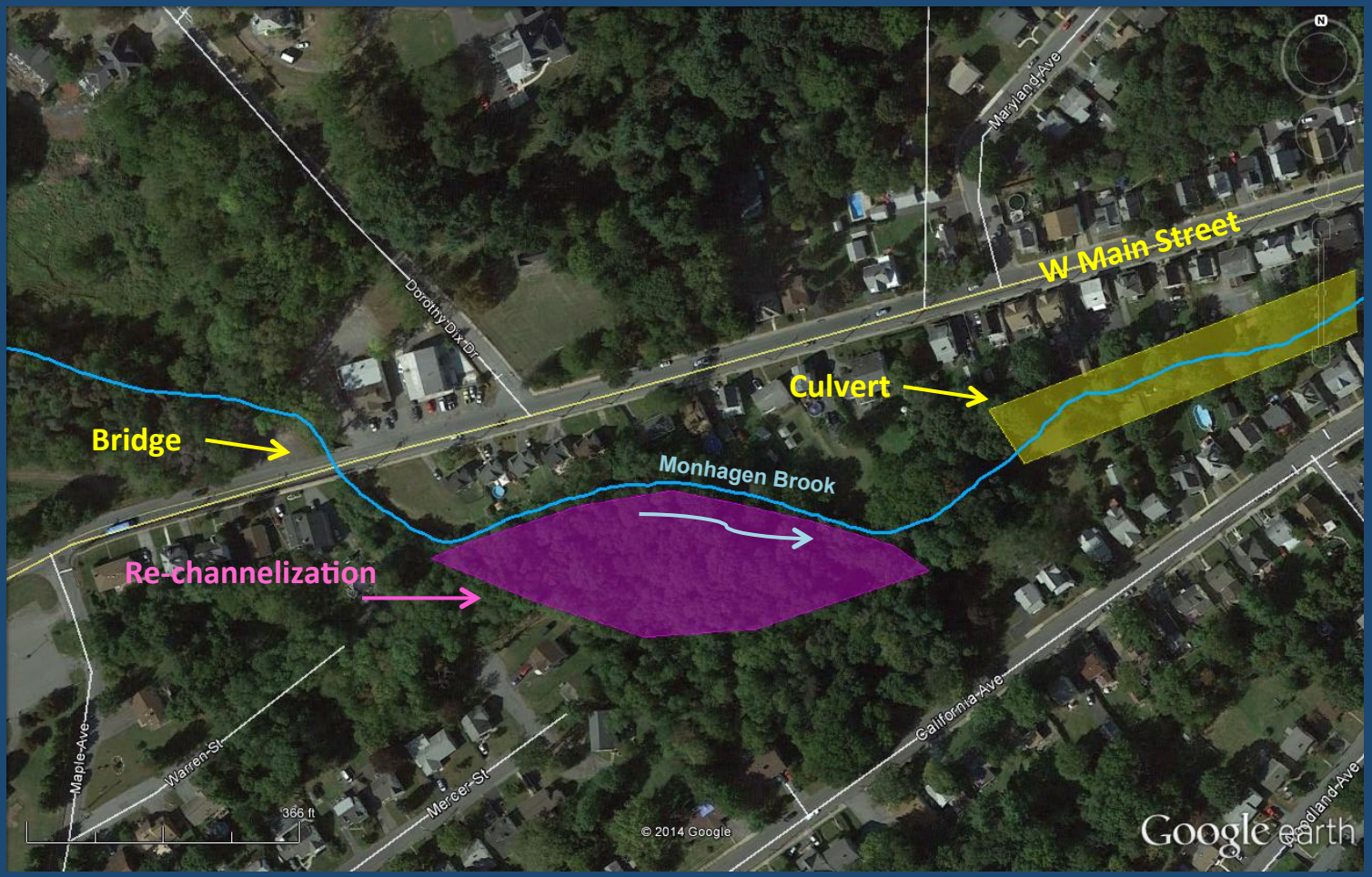
Actions

- Remove sediments and debris along the streambed
- Re-channelization of Monhagen Brook
  - Creation of a bench along the right overbank

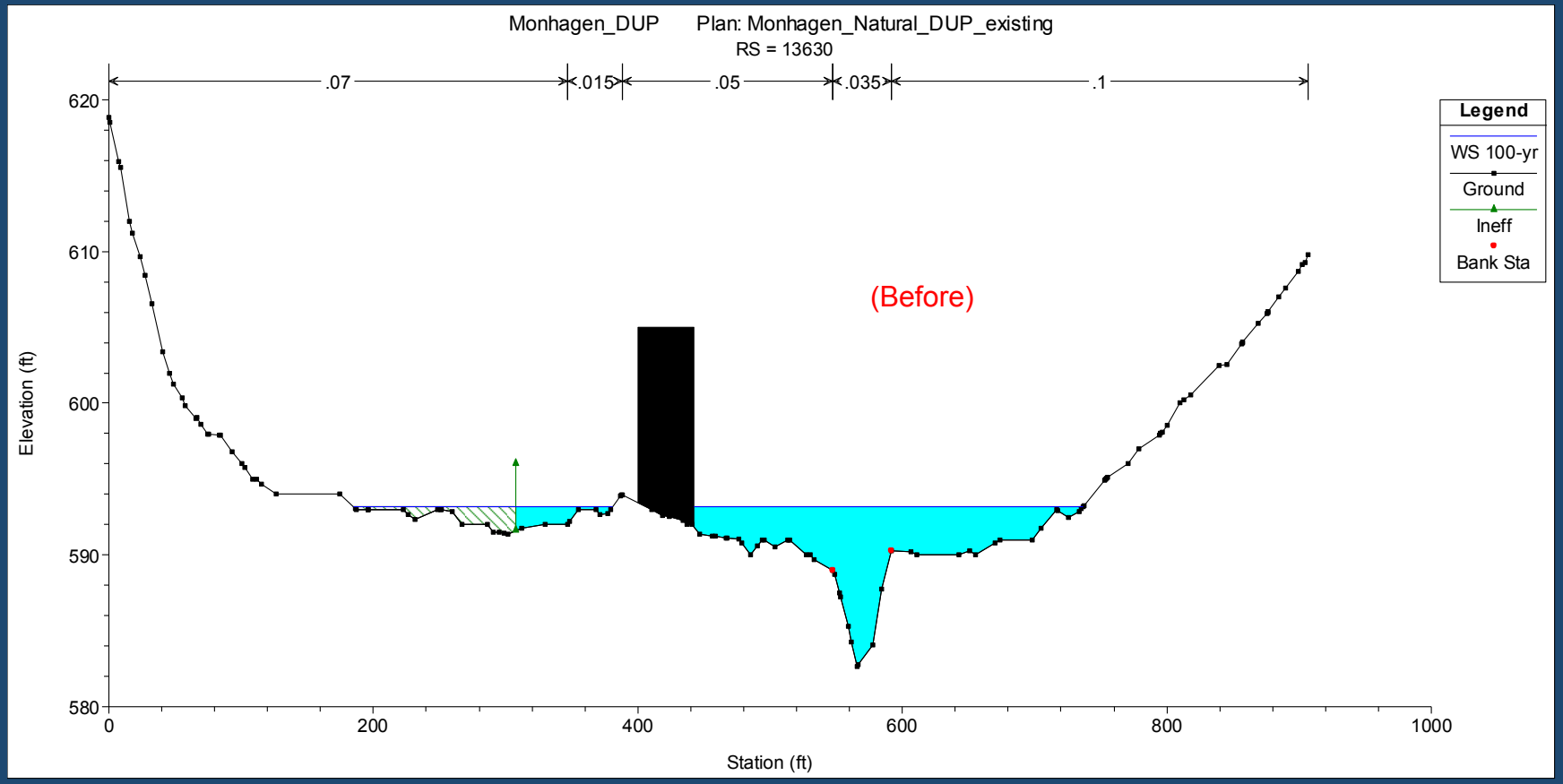
Preliminary Results

- Limited impacts/benefits upstream in terms of reduced WSE and floodplain extent
  - Limited to the area just downstream of the W Main St. Bridge

7. Channel Improvement South of W Main St.



7. Channel Improvement South of W Main St. Proposed Re-channelization (Cross Section)



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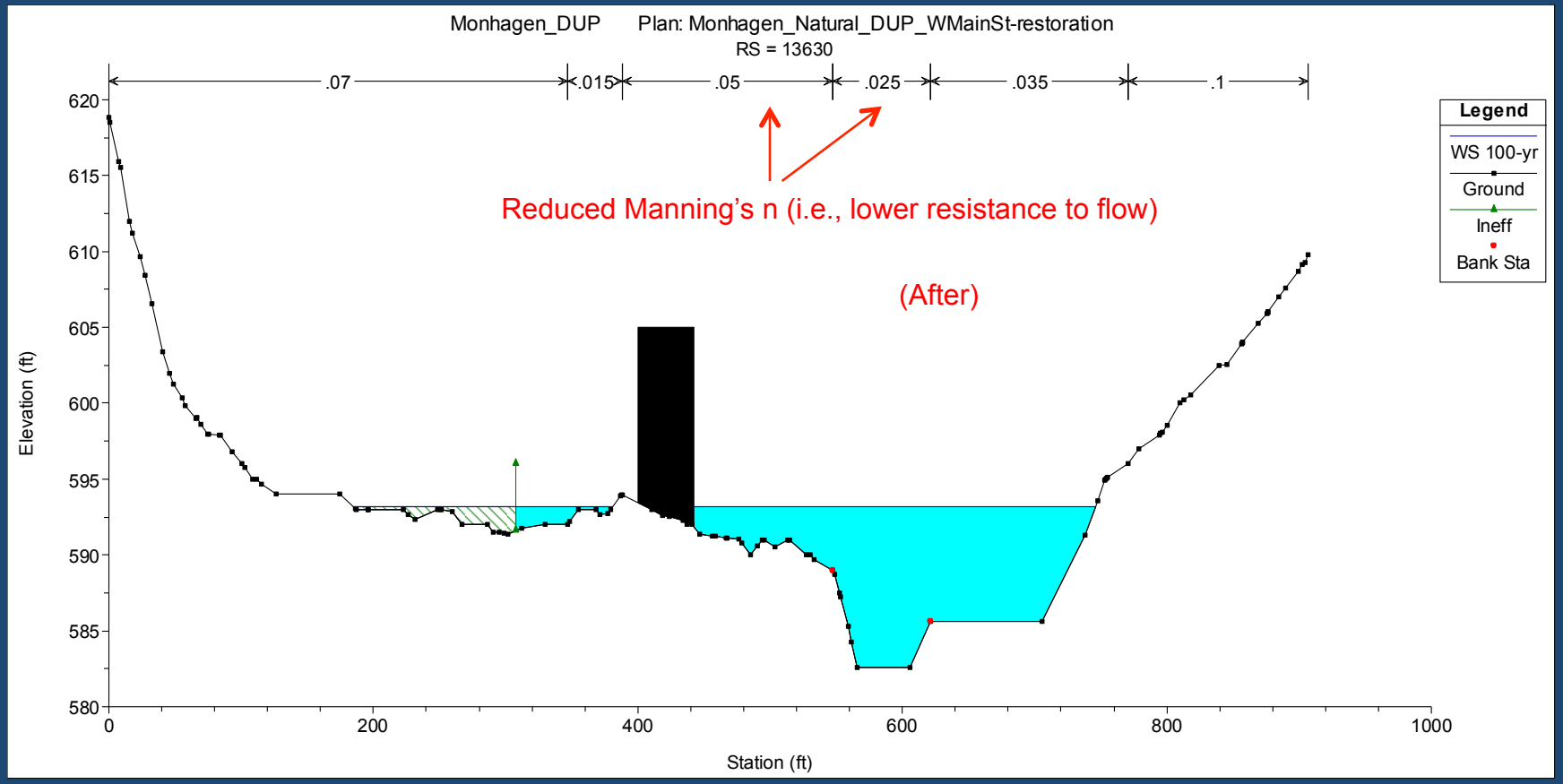
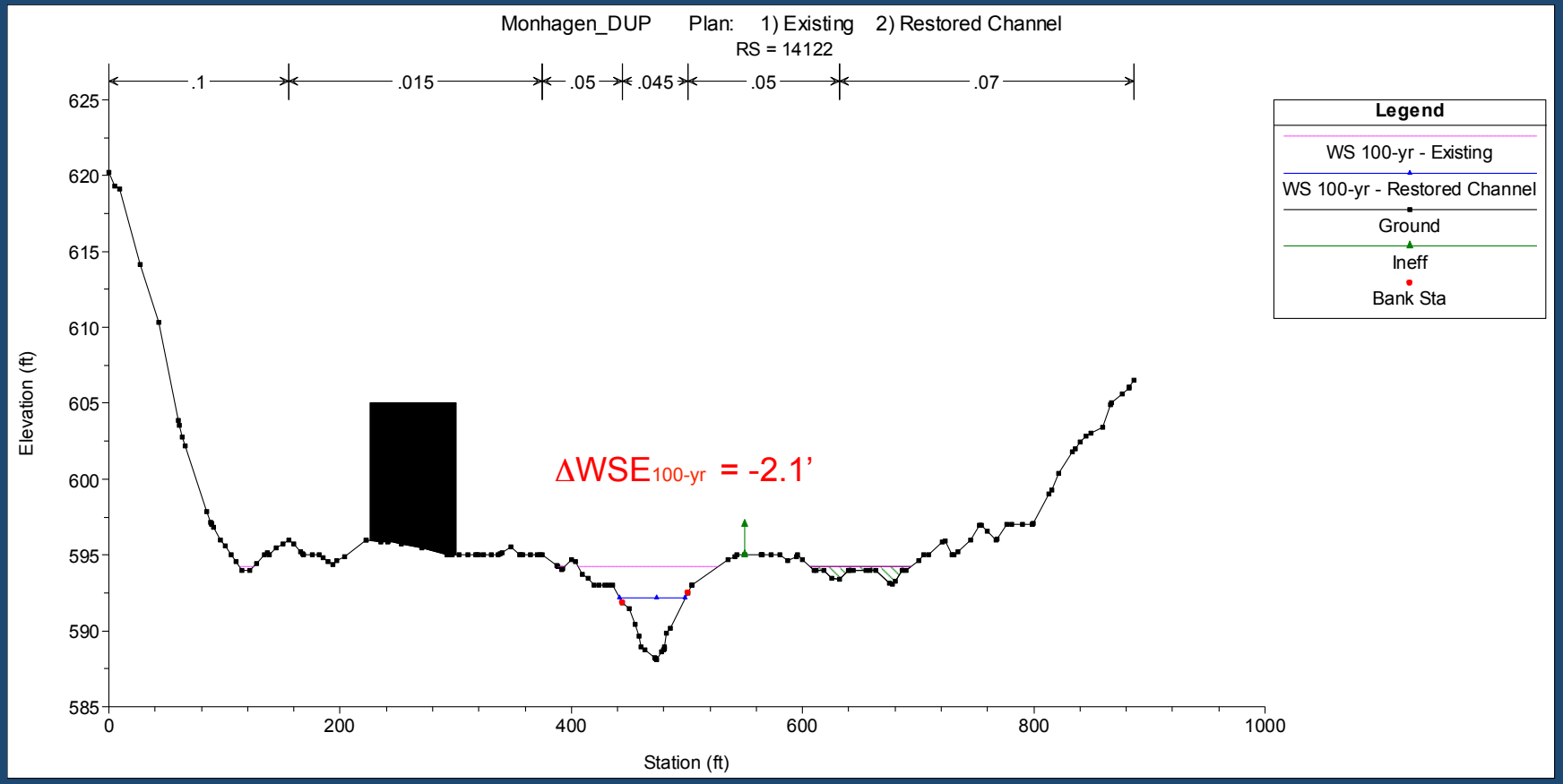
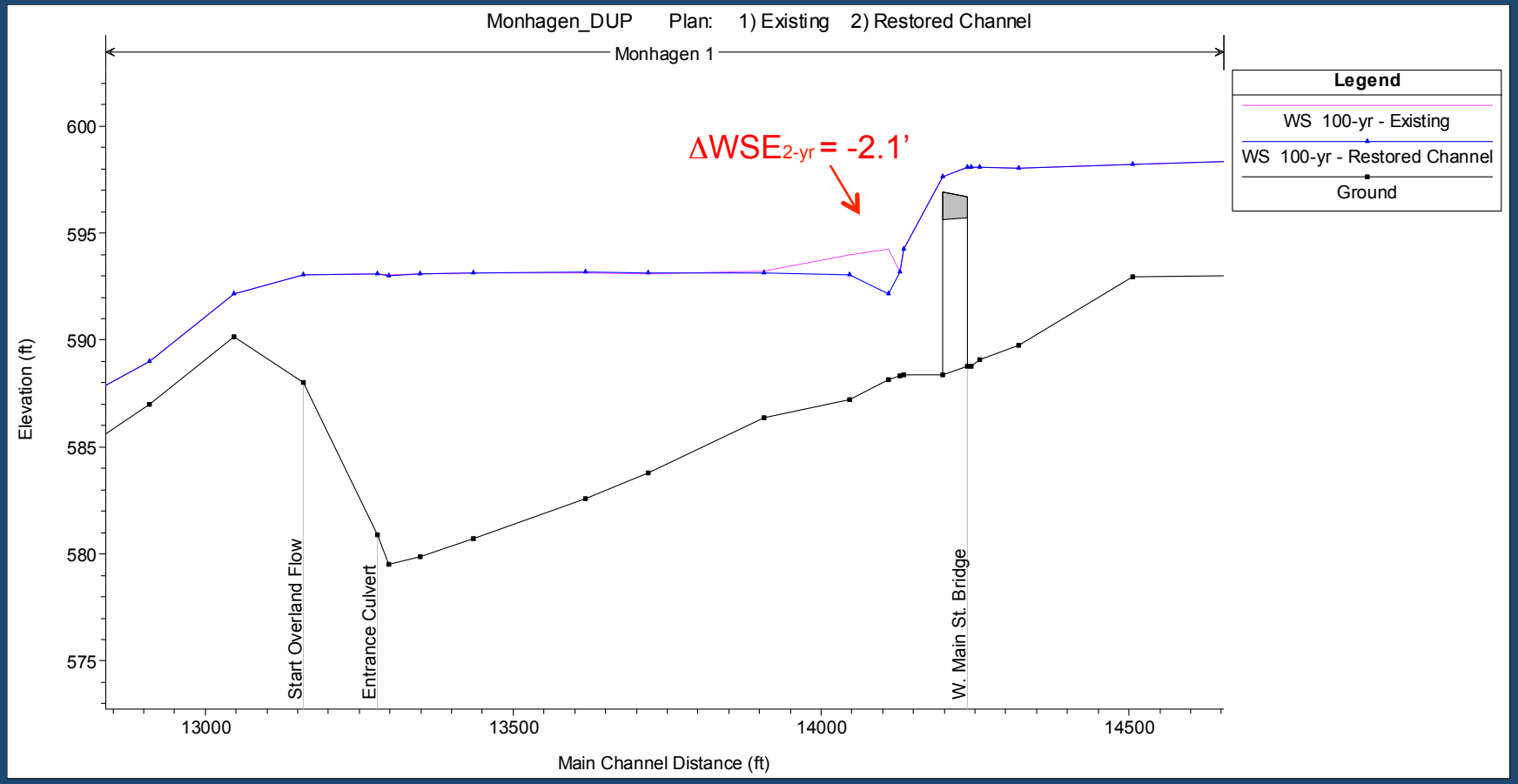


7. Channel Improvement South of W Main St. Downstream of Bridge (Cross Section)



7. Channel Improvement South of W Main St. (Water Profile)



8. Egerton Ave Retention Area

Actions

- Create flood retention areas east of Egerton Ave (next to former hospital facility)
  - Evaluate potential runoff volume storage
  - Investigate impacts/benefits downstream in terms of peak flow reduction

Preliminary Results

- Drainage area >> proposed retention areas
  - Significant basin depth would be required to store runoff volume of small storm (e.g., 2-year)

8. Egerton Ave Retention Area

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		2-year	10-year	25-year	50-year	100-year	500-year
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24-hr Rainfall [c]	(in)	3.5	5.5	5.75	6.0	7.5	11.0
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Runoff Volume (= *Drain. Area * Depth*)	**(acre-ft)**	**58.7**	**146.7**	**152.5**	**164.3**	**234.7**	**323**

DEPTH REQUIRED TO STORE 2-YR RUNOFF VOLUME		**Area 1**	**Area 2**	**Area 3**	**Area 1+2+3**
Drainage Area [a]	(acres)	1530	1530	1530	1530
Surface Area [a]	(acres)	2.8	5.7	5.3	13.8
Depth (= *Area/Runoff Vol.*)	**(ft)**	**45.5**	**22.**	**24.1**	**9.2**

[a] Estimated by using GIS
[b] Source: USGS *Streamstats*
[c] Source: USDA *Urban Hydrology for Small Watersheds, TR-55*

Thank You for Your Attention

Questions?