

**Legend**

- Stream Station (feet)
- Naurashaun Brook

**100-Year Existing Conditions**

**Depths (feet)**

- 0- 0.5
- 0.5 - 1
- 1- 2
- 2- 3
- 3- 4
- 4- 5
- 5- 10
- 10- 15
- 15- 20
- 20- 25

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**HIGH RISK AREA #5 - 100-YEAR EXISTING CONDITIONS**

HACKENSACK RIVER FLOOD & RESILIENCE STUDY  
 SD109  
 ROCKLAND COUNTY  
 NEW YORK

SCALE 1" = 200'

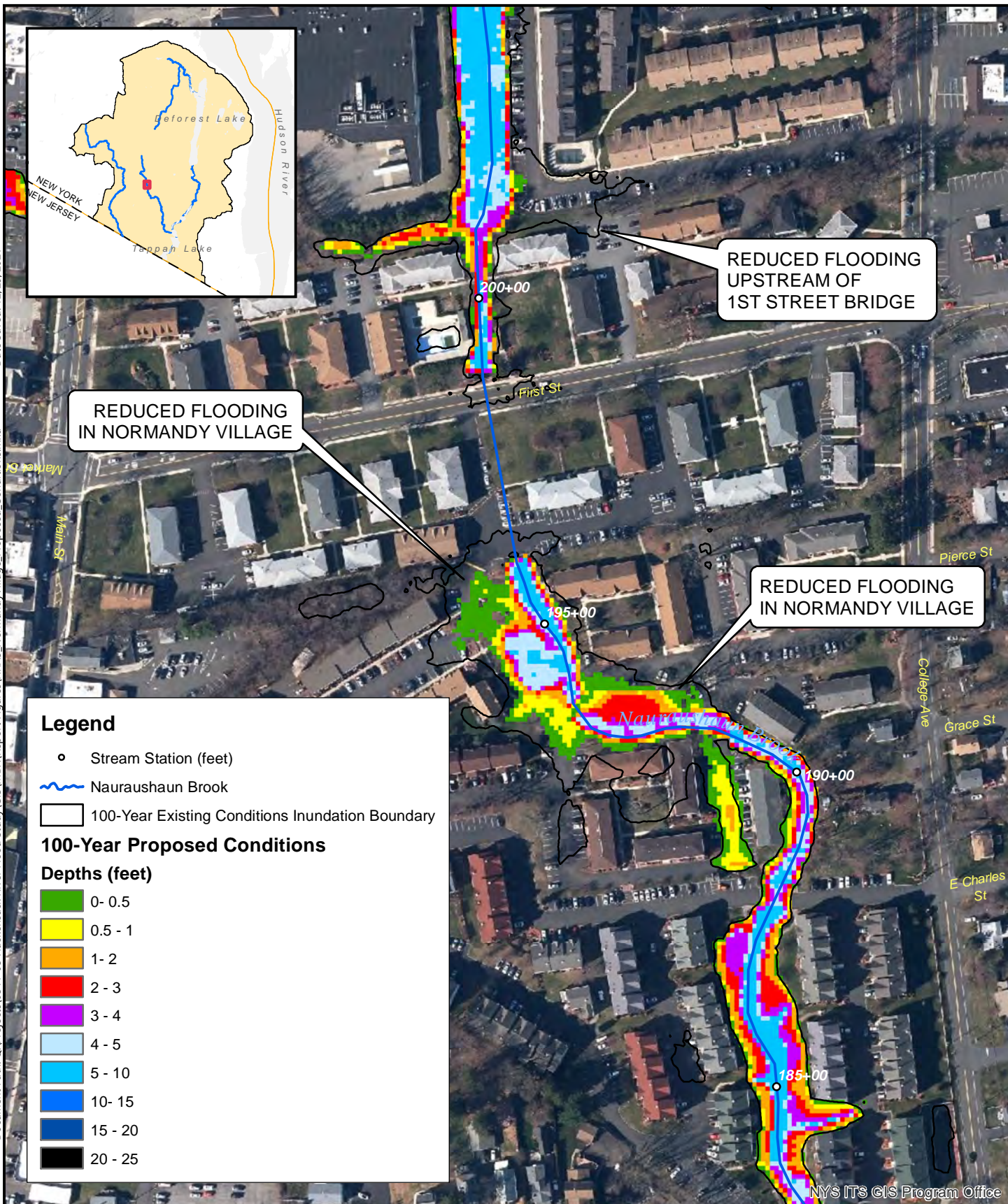
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**FIG. 4-50**

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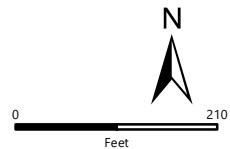
### HIGH RISK AREA #5 - 100-YEAR PROPOSED CONDITIONS

HACKENSACK RIVER FLOOD & RESILIENCE STUDY  
 SD109  
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 NEW YORK

SCALE 1" = 200'

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## FIG. 4-51

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## 4.6 HIGH RISK AREA #6 – STATE ROUTE 59 AND ROCKLAND PLAZA

HRA 6 includes a flood-prone section of Nauraushaun Brook in the hamlet of Nanuet, from STA 200+00 upstream to STA 240+00 as shown in Figure 4-52. In HRA 6, Nauraushaun Brook winds through a wetland area surrounded by residential neighborhoods just south of I-87 and then enters a lengthy culvert that passes under Rockland Plaza and North Middletown Road. Ownership of the culvert is unlisted. The brook resurfaces briefly before passing under State Route 59 and then flows through a narrow corridor between the Stop & Shop and the Sussex Condominiums. FEMA mapping and hydraulic modeling indicate that residential neighborhoods upstream of Rockland Plaza, the Rockland Plaza buildings and parking lot, Route 59, the Route 59/North Middletown Road intersection, and business along West Nyack Road are subjected to flooding during large flood events.

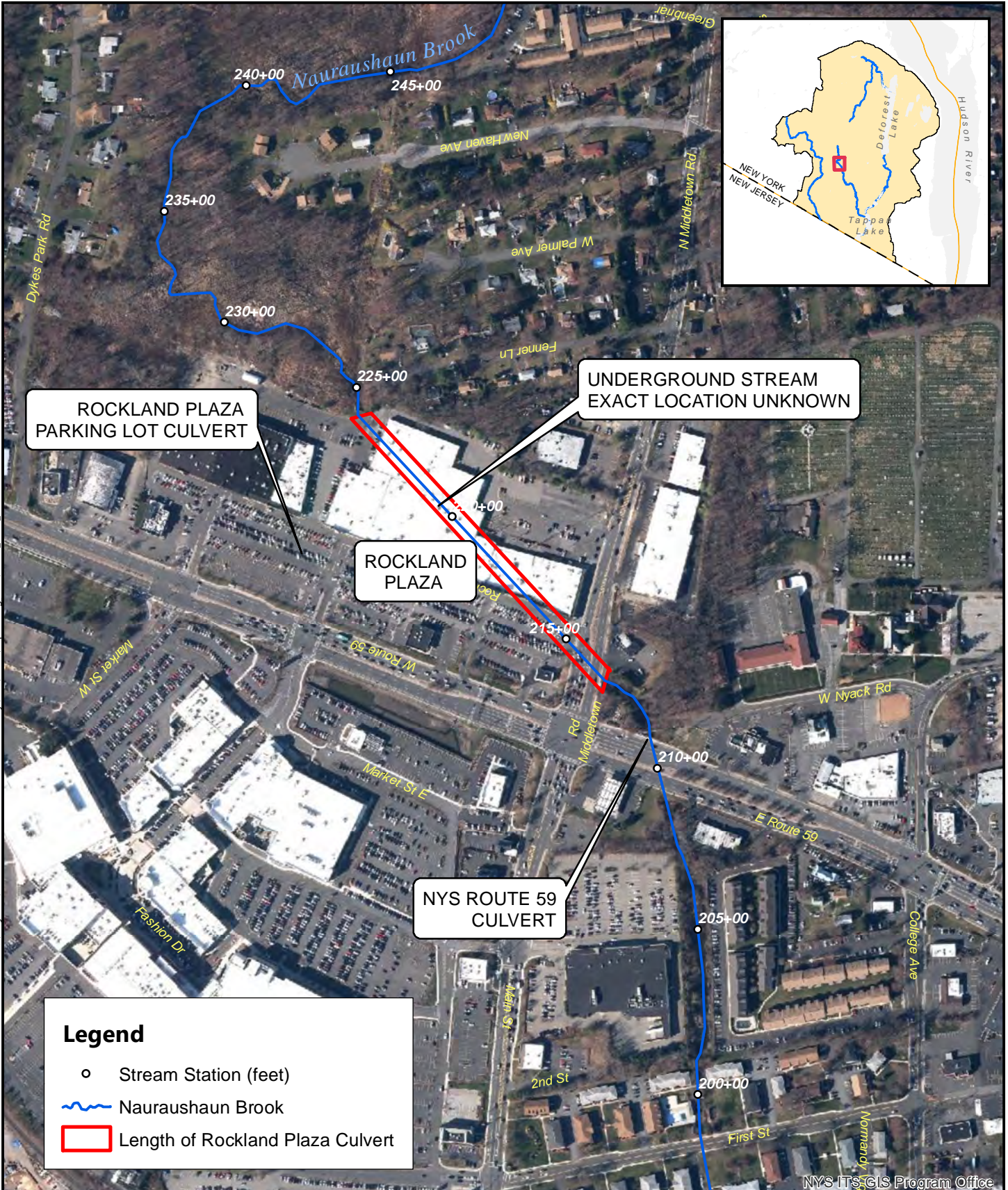
The Route 59 stream crossing at STA 210+00 is a skewed, 16.5-foot by 7-foot box culvert that creates a significant backwater and contributes to the flooding of Rockland Plaza and North Middletown Road. The culvert under Rockland Plaza and North Middletown Road, running from STA 225+00 upstream to STA 214+00, has a 19- by 5.5-foot box culvert at its inlet. The structure stretches for approximately 1,100 feet, under the plaza's commercial buildings and parking lot, and outlets on the eastern side of North Middletown Road. The exact path of the culvert as it passes under the plaza is not known.

Hydraulic analysis was conducted within HRA 6 using current and future flows. Proposed replacement stream crossings were assessed based on the flood flows the structure would be expected to encounter over its design lifetime. When modeling the culverts, the 2050-2074 projections were employed as a 50-year design life is typical for such structures.

Based on hydraulic analysis using field measurements of the Rockland Plaza culvert inlet and outlet, the culvert overtops in the 50-year flood event. However, detailed mapping and measurements for the entire length of the culvert are not available and would be required to accurately model and evaluate the hydraulic capacity of this lengthy and complex underground structure.

The creation of a floodplain bench immediately downstream of the Route 59 culvert was investigated. The modeled floodplain bench measures approximately 760 feet long, from STA 201+40 to STA 209+00. The proposed floodplain has varying widths between 50 to 130 feet, depending on available space, and mainly consumes areas of parking lot along the right overbank. Excavation depths average 12 feet below existing grade and range from 8 feet to 20 feet at its deepest. The floodplain restoration efforts would improve the performance of the Route 59 culvert by reducing upstream water surface elevations by 1.3 feet in the 100-year flood event. These improvements would further improve the capacity of the culvert under Rockland County Plaza to pass the future 50-year storm event.

Replacing the Rockland Plaza culvert with a larger structure or supplementing the existing culvert with a parallel culvert to increase its capacity would provide additional flood reduction benefits at and upstream of Rockland Plaza. It is recommended that detailed mapping and measurements be obtained for the entire length of the culvert. Once this information is obtained, a detailed hydraulic analysis should be undertaken to accurately model and evaluate the hydraulic capacity of the structure and recommend improvements.



**Legend**

- Stream Station (feet)
- ~ Nauraushaun Brook
- ▭ Length of Rockland Plaza Culvert

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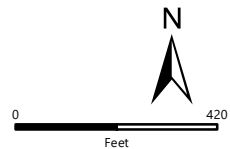
**HIGH RISK AREA #6 - NYS ROUTE 59 & ROCKLAND PLAZA**

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 ROCKLAND COUNTY  
 NEW YORK

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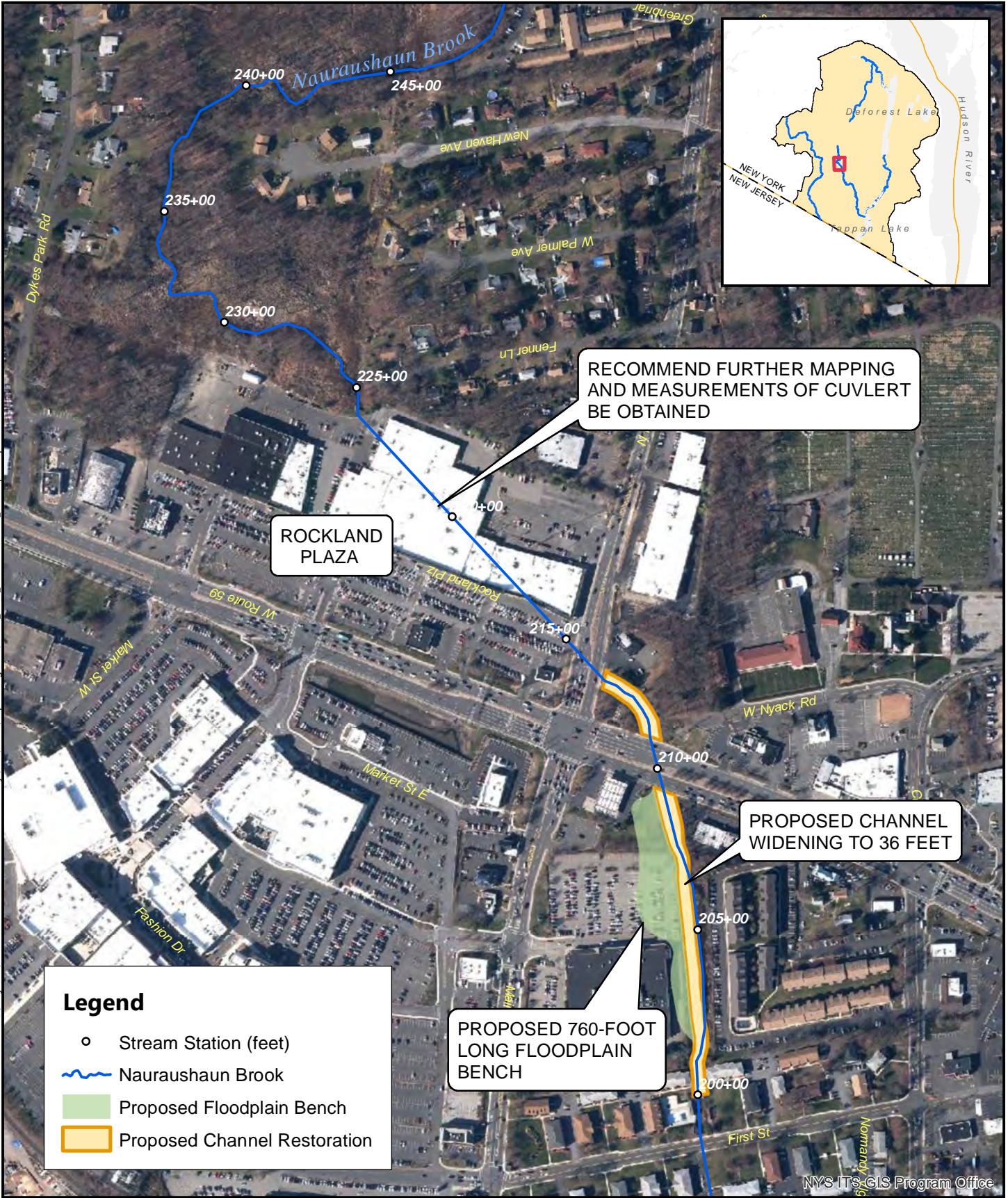
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**FIG. 4-52**

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If further hydraulic analysis determines that replacement of the Rockland Plaza culvert is required, it is recommended that channel restoration be undertaken by daylighting all or portions of the culvert where it currently flows under the Rockland Plaza parking lot (the term "daylighting" is used to refer to the restoration of an originally open-air watercourse, which at some point has been placed into a below-ground culvert, back into a restored, above-ground channel).

Figure 4-53 illustrates a concept map for HRA 6. Longitudinal profiles showing existing and proposed conditions under the 50-year, current and future flood events are depicted in Figure 4-54 and under the 100-year, current and future flood events in Figure 4-55. Flood reduction benefits are illustrated in the existing versus proposed depth grid maps on Figure 4-56 through Figure 4-61 for the current 10-, 50-, and 100-year peak flows.



**Legend**

- Stream Station (feet)
- ~ Nauraushaun Brook
- Proposed Floodplain Bench
- Proposed Channel Restoration


RECOMMEND FURTHER MAPPING AND MEASUREMENTS OF CUVLERT BE OBTAINED

ROCKLAND PLAZA

PROPOSED CHANNEL WIDENING TO 36 FEET

PROPOSED 760-FOOT LONG FLOODPLAIN BENCH

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**HIGH RISK AREA #6 - CONCEPT MAP**

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NEW YORK

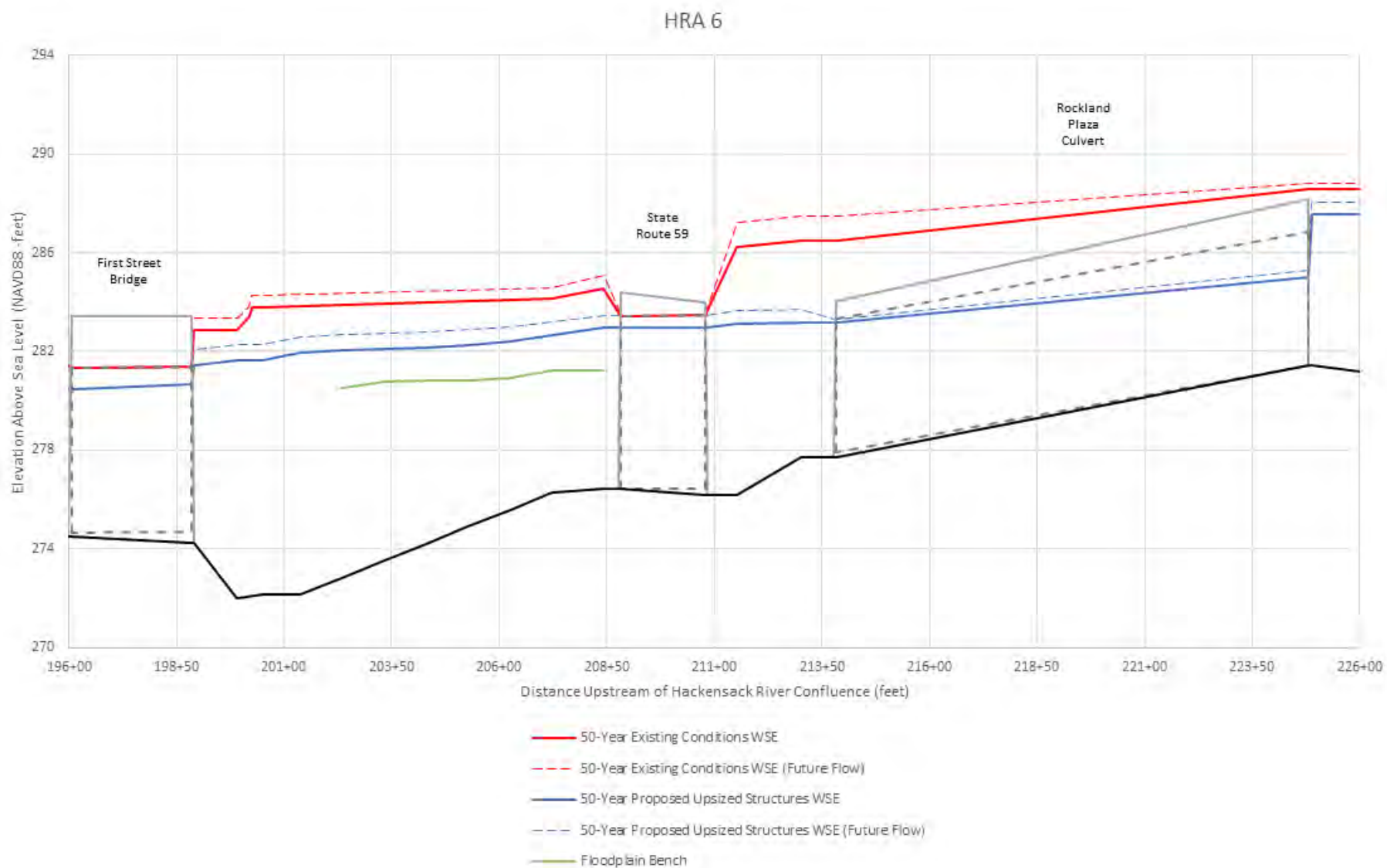
SOURCE: 2016 AERIAL PHOTO, NYS ITS GIS Program Office

SCALE 1" = 400'

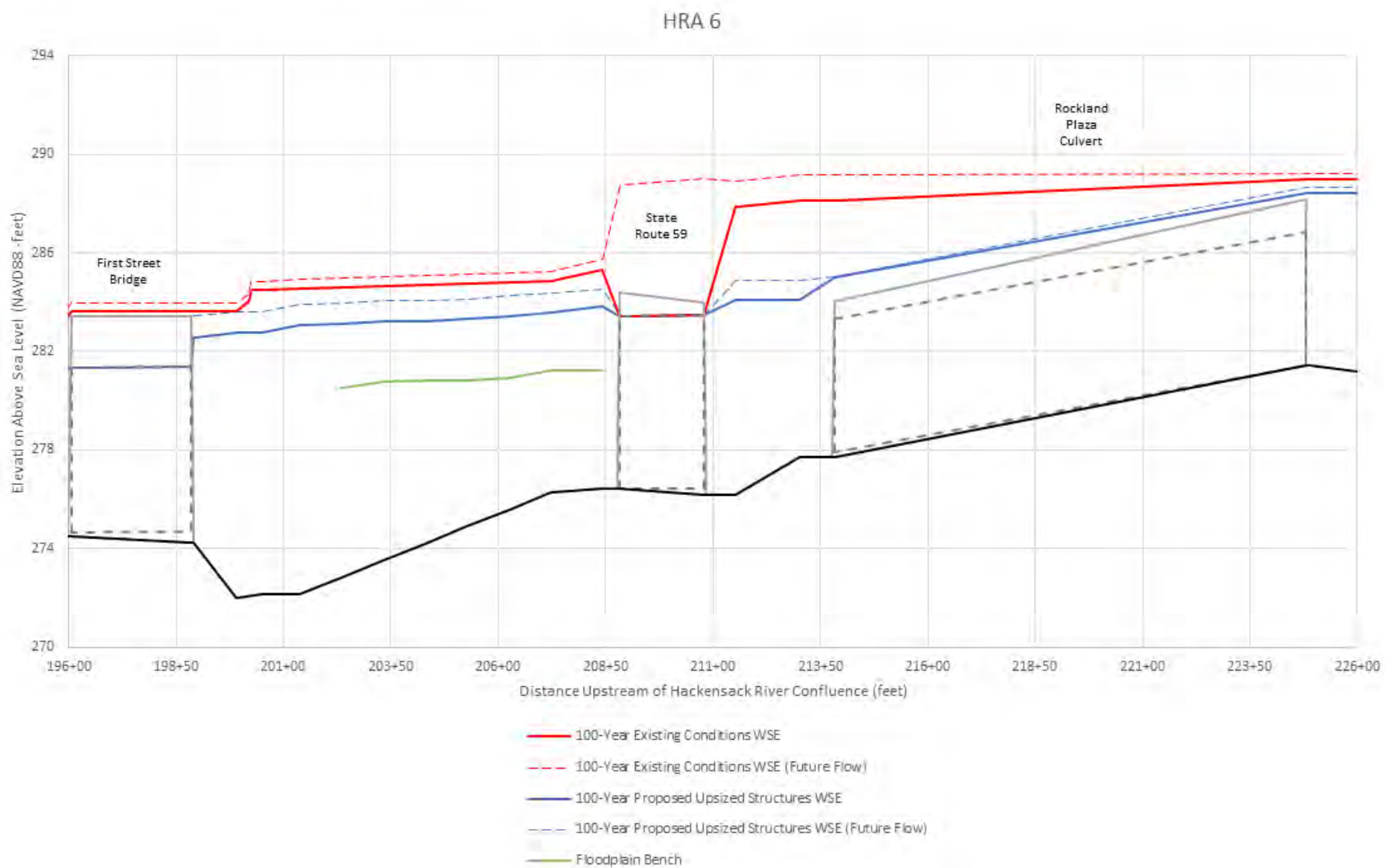
DATE 12/20/2021

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**FIG. 4-53**

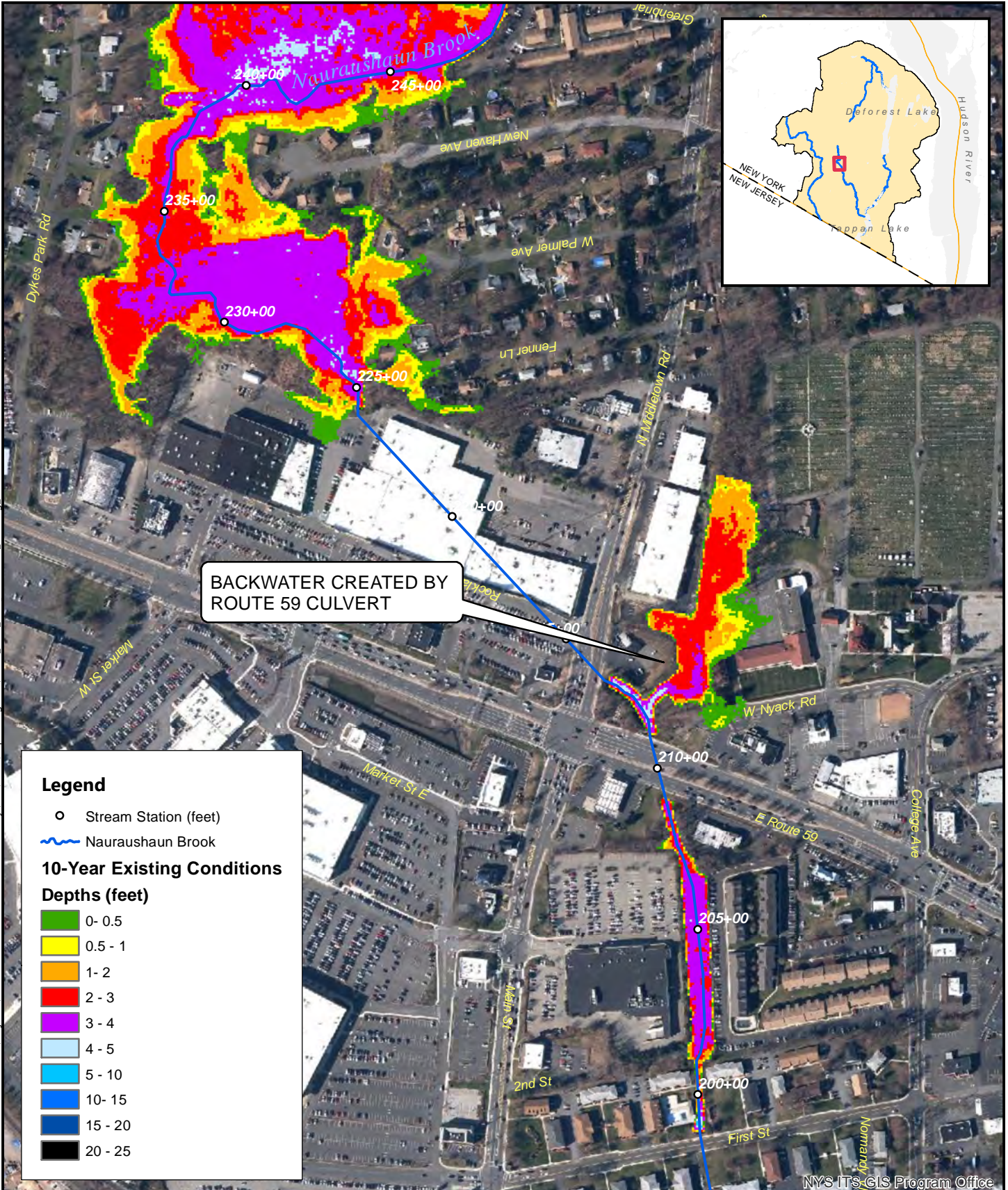


**Figure 4-54: Longitudinal Profile Showing Recommended Improvements in HRA 6 During 50-Year Flood Event**



**Figure 4-55: Longitudinal Profile Showing Recommended Improvements in HRA 6 During 100-Year Flood Event**





**Legend**

- Stream Station (feet)
- ~ Nauraushaun Brook

**10-Year Existing Conditions Depths (feet)**

0 - 0.5
0.5 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 10
10 - 15
15 - 20
20 - 25

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**HIGH RISK AREA #6 - 10-YEAR EXISTING CONDITIONS**

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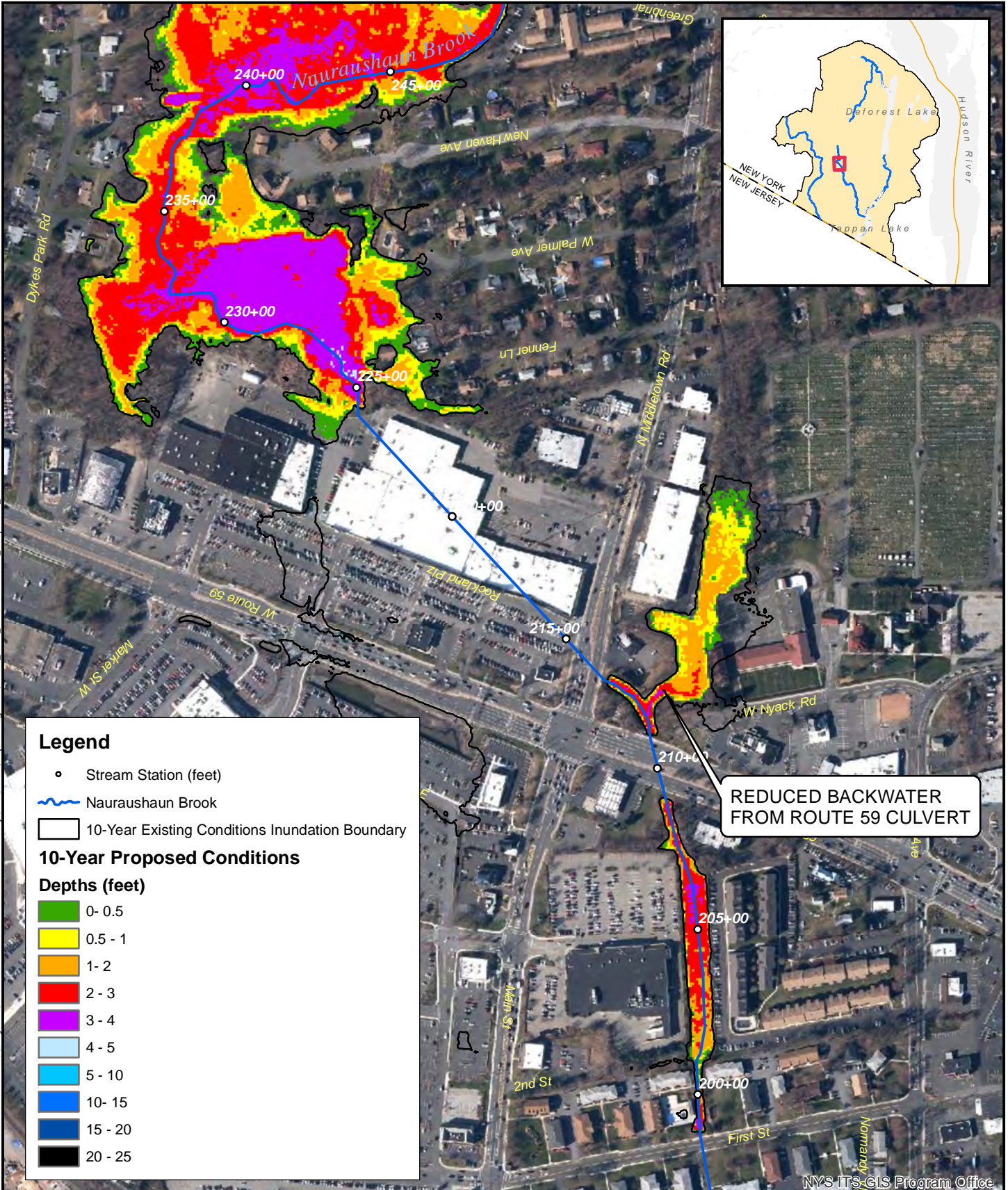
SOURCE: 2016 AERIAL PHOTO, NYS ITS GIS Program Office

SCALE 1" = 400'

DATE 12/28/2021

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**FIG. 4-56**



**Legend**

- Stream Station (feet)
- ~ Naurausshain Brook
- 10-Year Existing Conditions Inundation Boundary
- 10-Year Proposed Conditions**
- Depths (feet)**
- 0 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25

REDUCED BACKWATER FROM ROUTE 59 CULVERT

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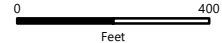
**HIGH RISK AREA #6 - 10-YEAR PROPOSED CONDITIONS**

HACKENSACK RIVER FLOOD & RESILIENCE STUDY  
SD109  
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NEW YORK

SCALE 1" = 400'

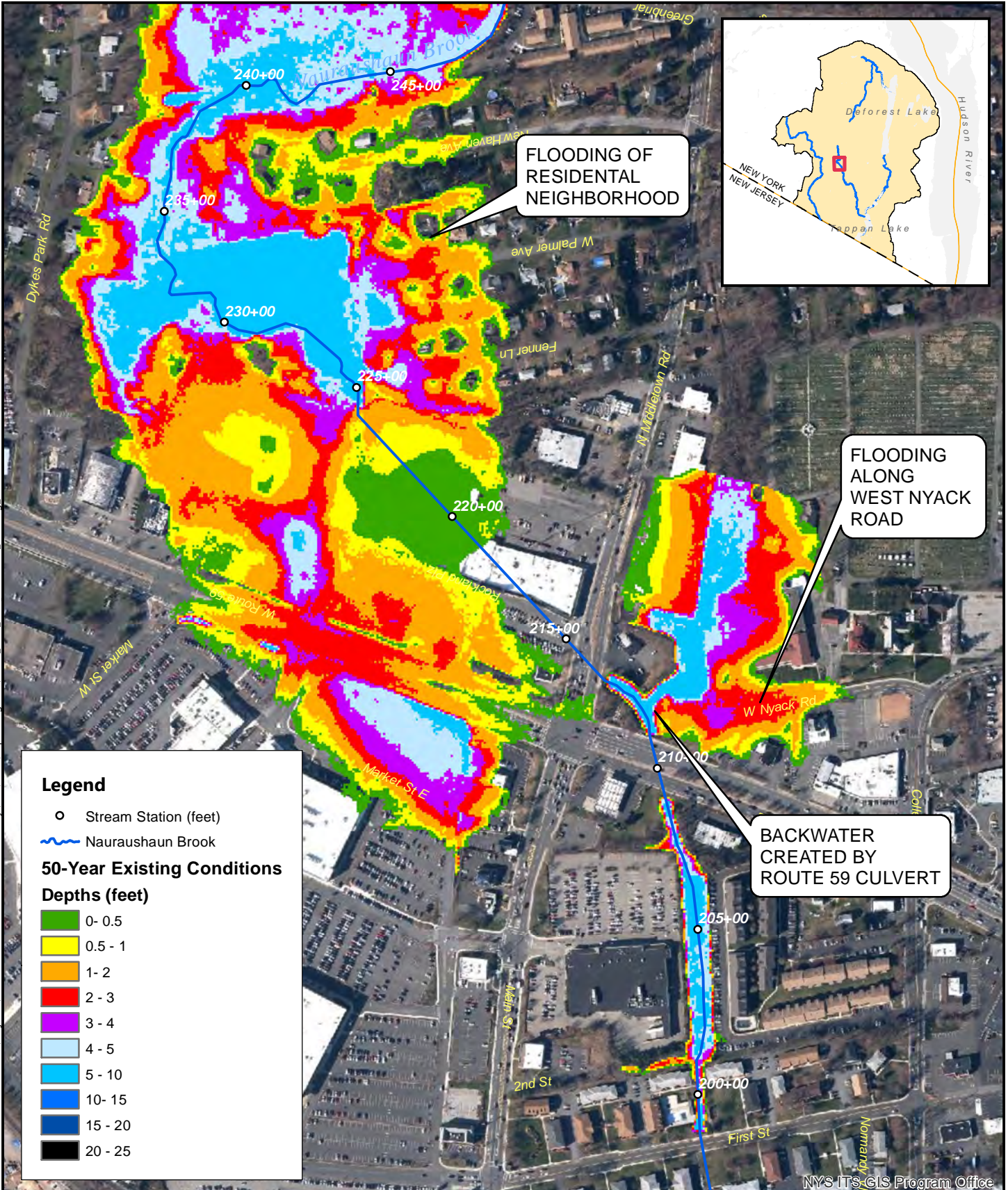
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**FIG. 4-57**

SOURCE: 2016 AERIAL PHOTO, NYS ITS GIS Program Office



**Legend**

- Stream Station (feet)
- ~ Nauraushaun Brook

**50-Year Existing Conditions**

**Depths (feet)**

- 0- 0.5
- 0.5- 1
- 1- 2
- 2- 3
- 3- 4
- 4- 5
- 5- 10
- 10- 15
- 15- 20
- 20- 25

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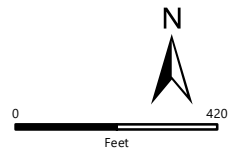
**HIGH RISK AREA #6 - 50-YEAR EXISTING CONDITIONS**

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 ROCKLAND COUNTY  
 NEW YORK

SCALE 1" = 400'

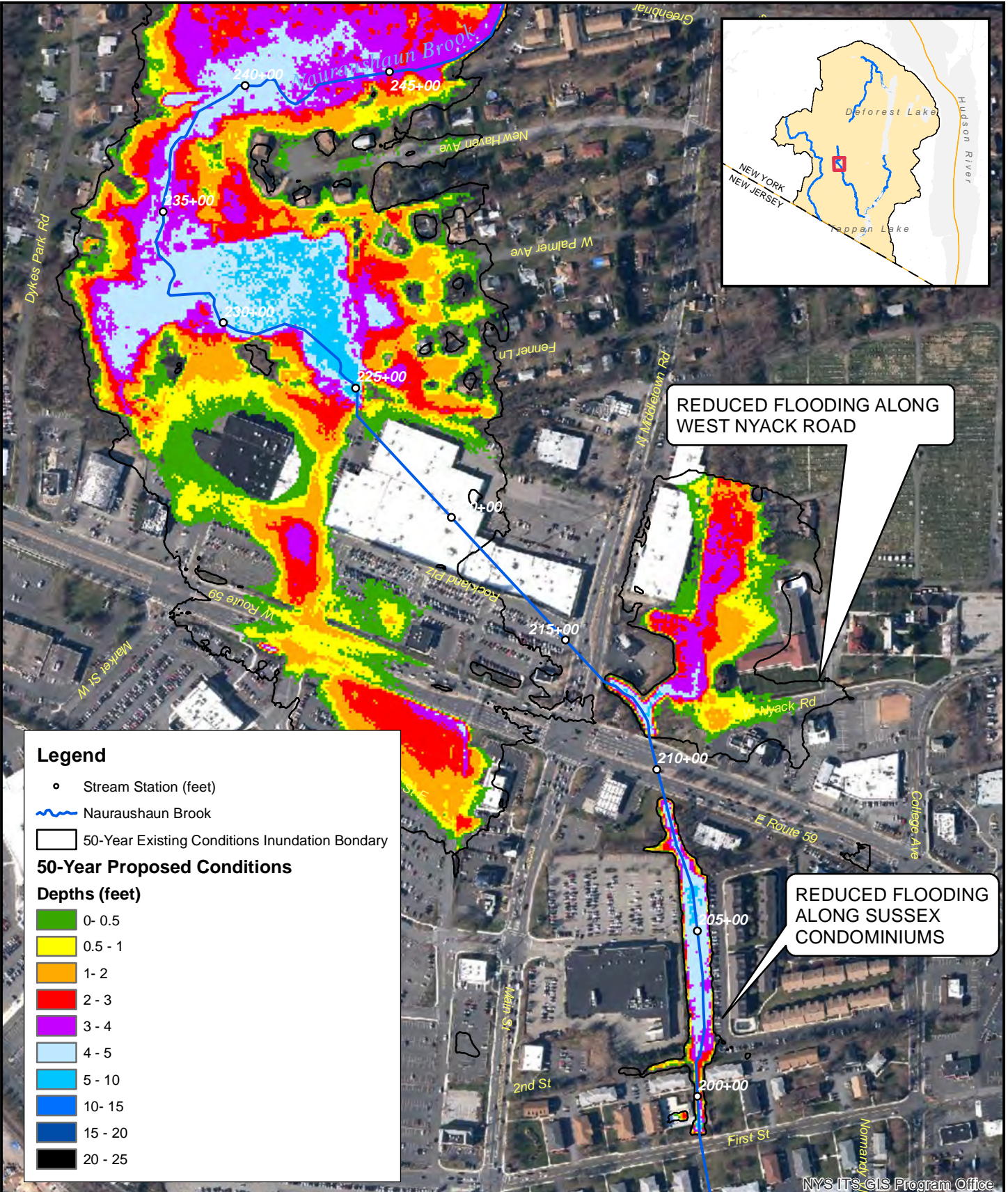
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**FIG. 4-58**

SOURCE: 2016 AERIAL PHOTO, NYS ITS GIS Program Office



### Legend

- Stream Station (feet)
- Nauraushaun Brook
- 50-Year Existing Conditions Inundation Bondary
- 50-Year Proposed Conditions**
- Depths (feet)**
- 0 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25

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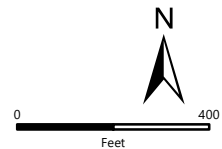
## HIGH RISK AREA #6 - 50-YEAR PROPOSED CONDITIONS

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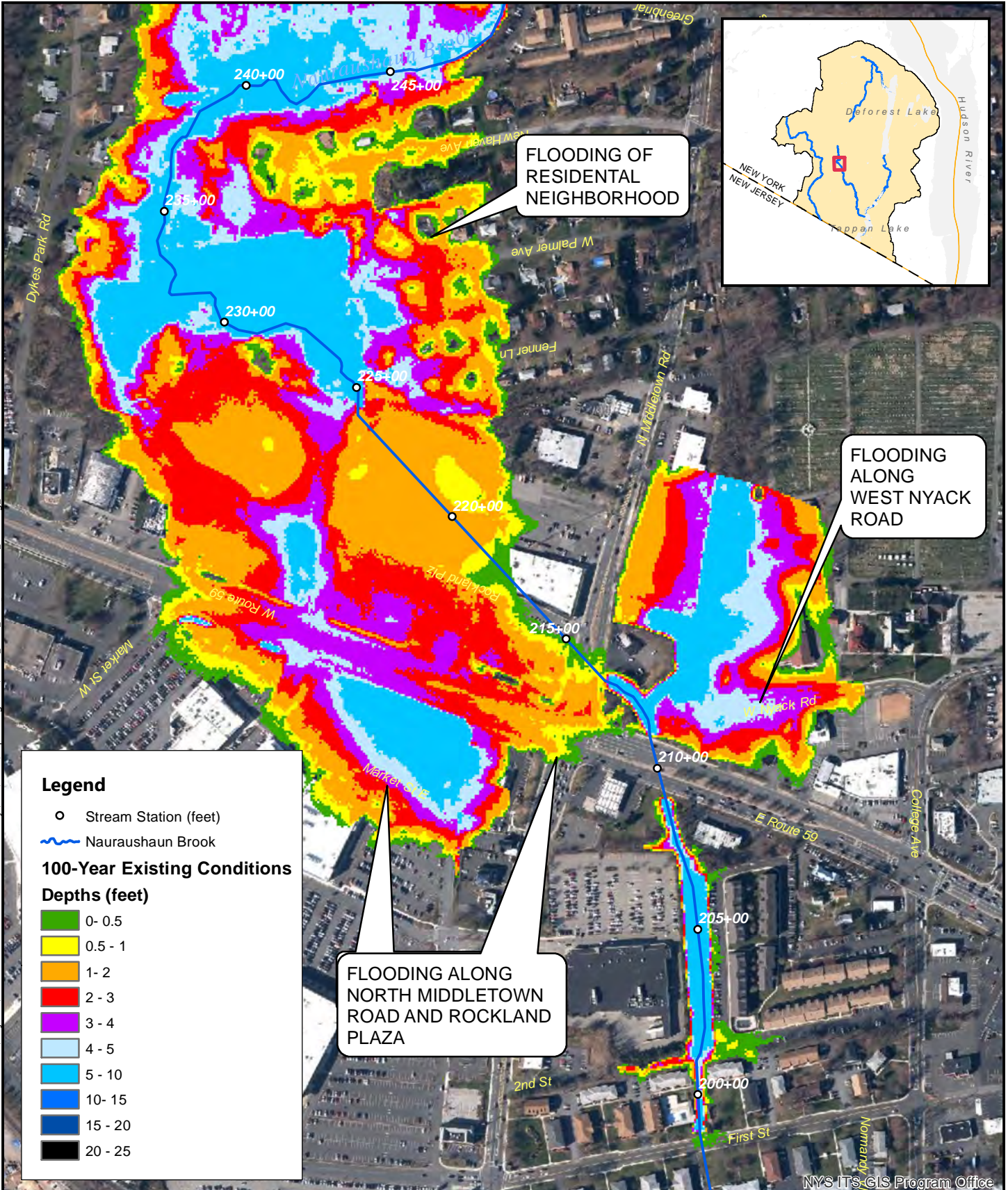
SCALE 1" = 400'

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# FIG. 4-59



**Legend**

- Stream Station (feet)
- ~ Nauraushaun Brook

**100-Year Existing Conditions Depths (feet)**

- 0- 0.5
- 0.5 - 1
- 1- 2
- 2- 3
- 3- 4
- 4- 5
- 5 - 10
- 10- 15
- 15- 20
- 20 - 25

FLOODING ALONG NORTH MIDDLETOWN ROAD AND ROCKLAND PLAZA

FLOODING OF RESIDENTIAL NEIGHBORHOOD

FLOODING ALONG WEST NYACK ROAD

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**HIGH RISK AREA #6 - 100-YEAR EXISTING CONDITIONS**

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SD109  
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NEW YORK

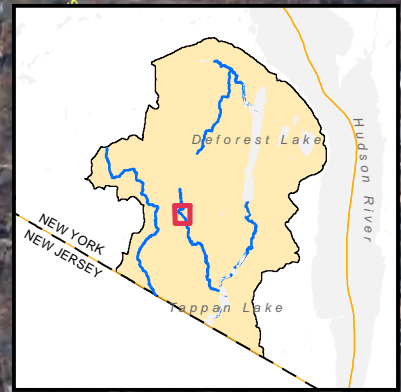
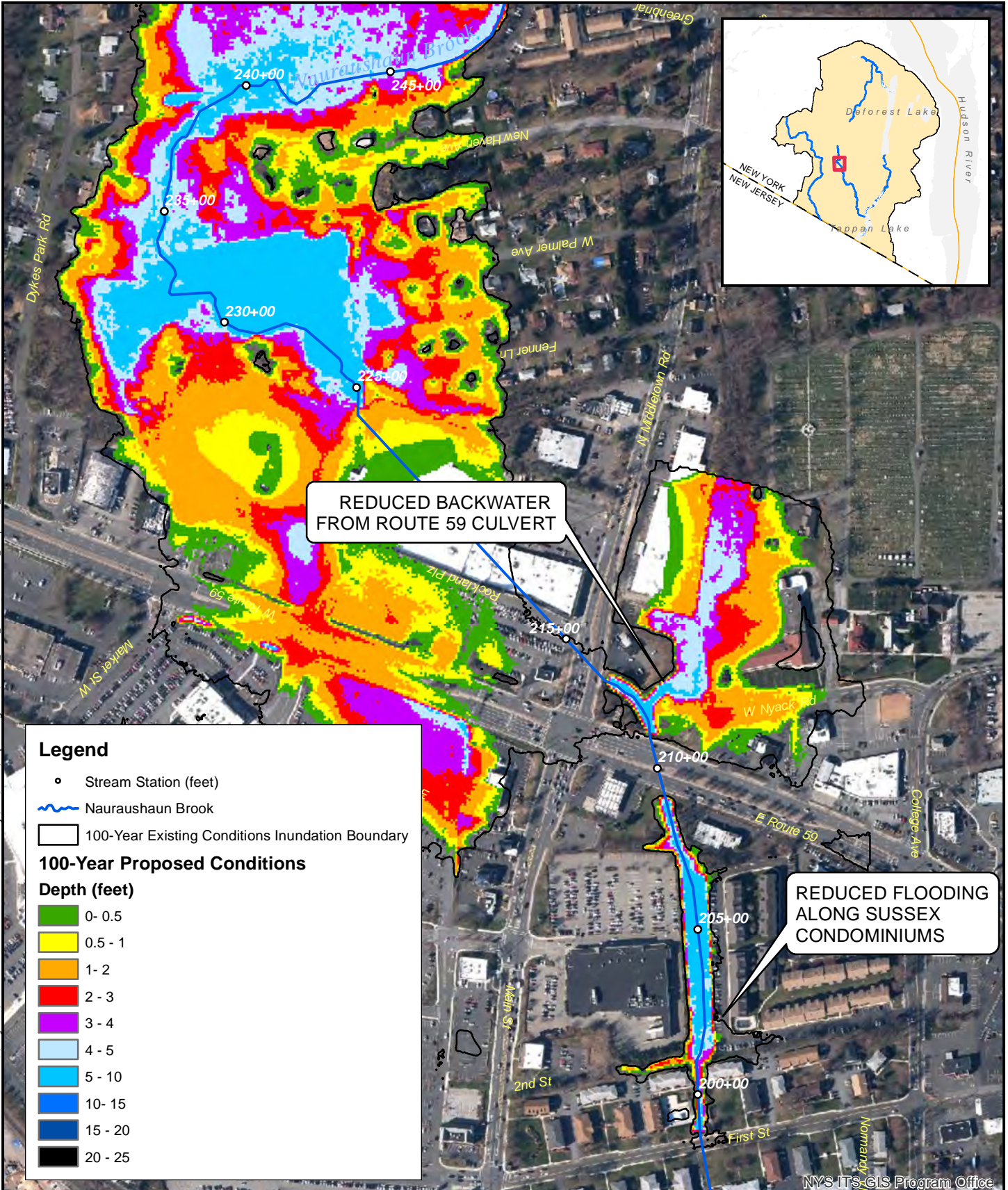
SOURCE: 2016 AERIAL PHOTO, NYS ITS GIS Program Office

SCALE 1" = 400'

DATE 12/28/2021

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**FIG. 4-60**



**Legend**

- Stream Station (feet)
- ~ Nauraushaun Brook
- 100-Year Existing Conditions Inundation Boundary
- 100-Year Proposed Conditions**
- Depth (feet)**
- 0 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25

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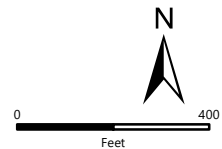
**HIGH RISK AREA #6 - 100-YEAR PROPOSED CONDITIONS**

HACKENSACK RIVER FLOOD & RESILIENCE STUDY  
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**FIG. 4-61**

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## 4.7 HIGH RISK AREA #7 – I-87 AND ALICE DRIVE

HRA 7 runs from STA 250+00 upstream to STA 275+00 along Nauraushaun Brook in the hamlet of Nanuet (Figure 4-62). In this area, Nauraushaun Brook flows through a wooded area before passing under Alice Drive and I-87. According to hydraulic analysis and FEMA mapping, neighborhoods and streets to the east of Nauraushaun Brook, including Norge Avenue, Kelvin Court, and Brookside Drive, are subject to flooding.

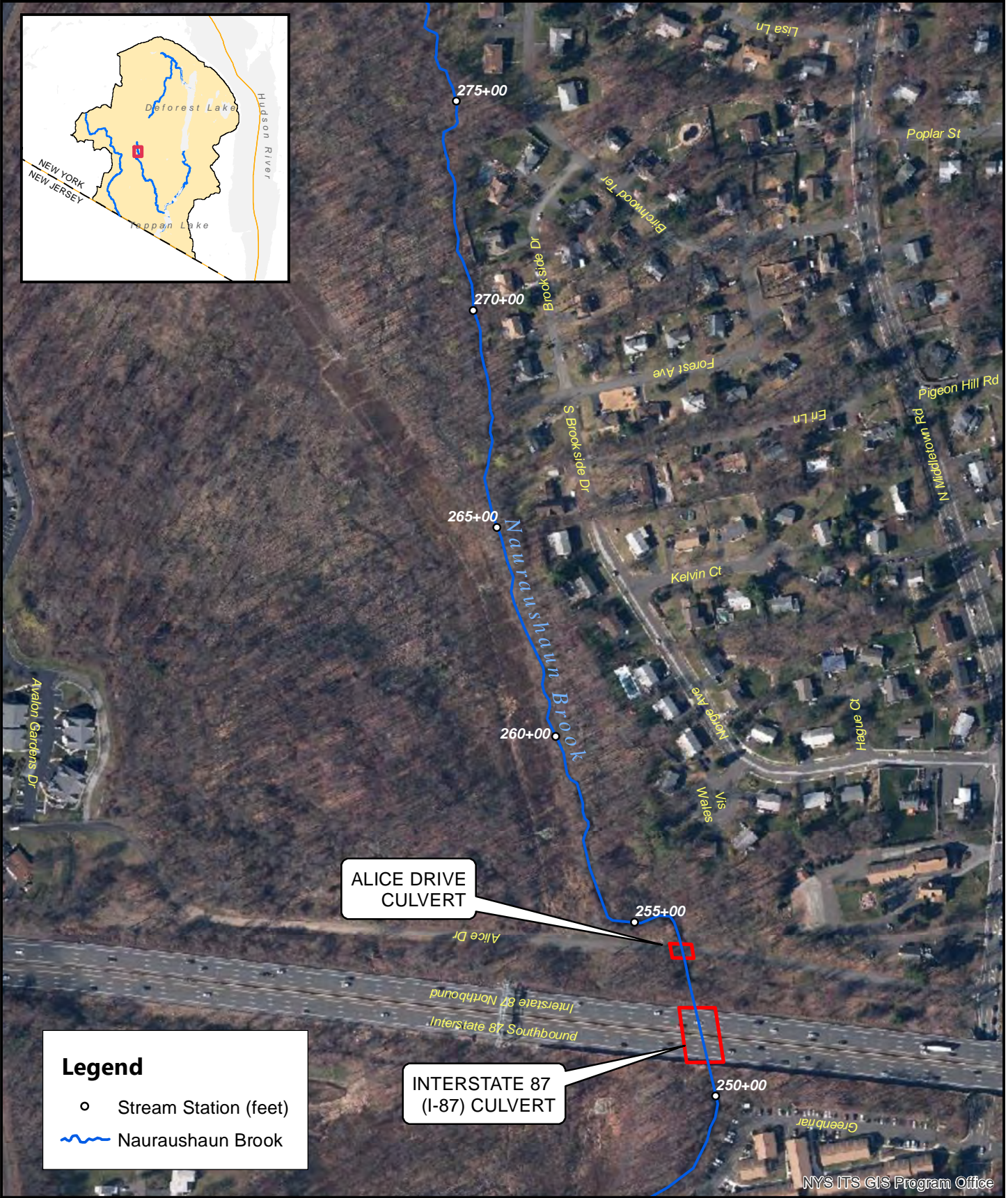
Hydraulic analysis was conducted within HRA 7 using current and future flows. Proposed replacement stream crossings were assessed based on the flood flows the structure would be expected to encounter over its design lifetime, which for culverts encompasses the 2050-2074 time frame.

The crossings assessed include the culverts carrying I-87 at STA 251+40 and Alice Drive at STA 253+37. The I-87 structure is a single 10- by 6-foot box culvert that passes up to the 500-year flood event without overtopping the I-87 roadway. However, the culvert structure and the 20-foot-high road embankment cause a significant backwater that contributes to the flooding of homes upstream at Kelvin Court and Brookside Drive. The Alice Drive crossing (Figure 4-63) is a slightly larger 10.5- by 6.8-foot box culvert, which passes up to the 10-year flood event.

A scenario was modeled that involved the replacement of both the Alice Drive and the I-87 crossings with new structures with a minimum span of 45 feet and the restoration of 1,350 linear feet of Nauraushaun Brook through and upstream of the subject culverts, from STA 249+00 to STA 262+50. Channel restoration would entail widening of the channel to its bankfull width of approximately 36 feet. This scenario would reduce flood depths by 7 feet during the 100-year flood event and pull homes out of the flood extent. An analysis was run widening the Alice Drive culvert alone, which had minimal effects on reducing the flood extents and depths as I-87 is the bigger constriction.

A conceptual schematic of the recommended flood mitigation alternatives is illustrated in Figure 4-64. Longitudinal profiles showing existing and proposed conditions under the 50-year, current and future flood events are depicted in Figure 4-65 and under the 100-year, current and future flood events in Figure 4-66. Existing and proposed conditions flood depth mapping for the 10-, 50-, and 100-year flood events are included in Figures 4-67 through Figure 4-72.

If the above recommendations to replace culverts and undertake channel restoration cannot be implemented, floodproofing and voluntary buyouts of flood-prone homes are recommended in HRA 7.



**Legend**

- Stream Station (feet)
- ~ Naurauschaun Brook

ALICE DRIVE CULVERT

INTERSTATE 87 (I-87) CULVERT

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**HIGH RISK AREA #7 - I-87 & ALICE DRIVE**  
HACKENSACK RIVER FLOOD & RESILIENCE STUDY  
SD109  
ROCKLAND COUNTY  
NEW YORK

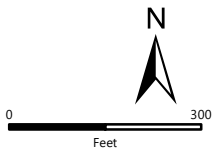
SOURCE: 2016 AERIAL PHOTO, NYS ITS GIS Program Office

SCALE 1" = 300'

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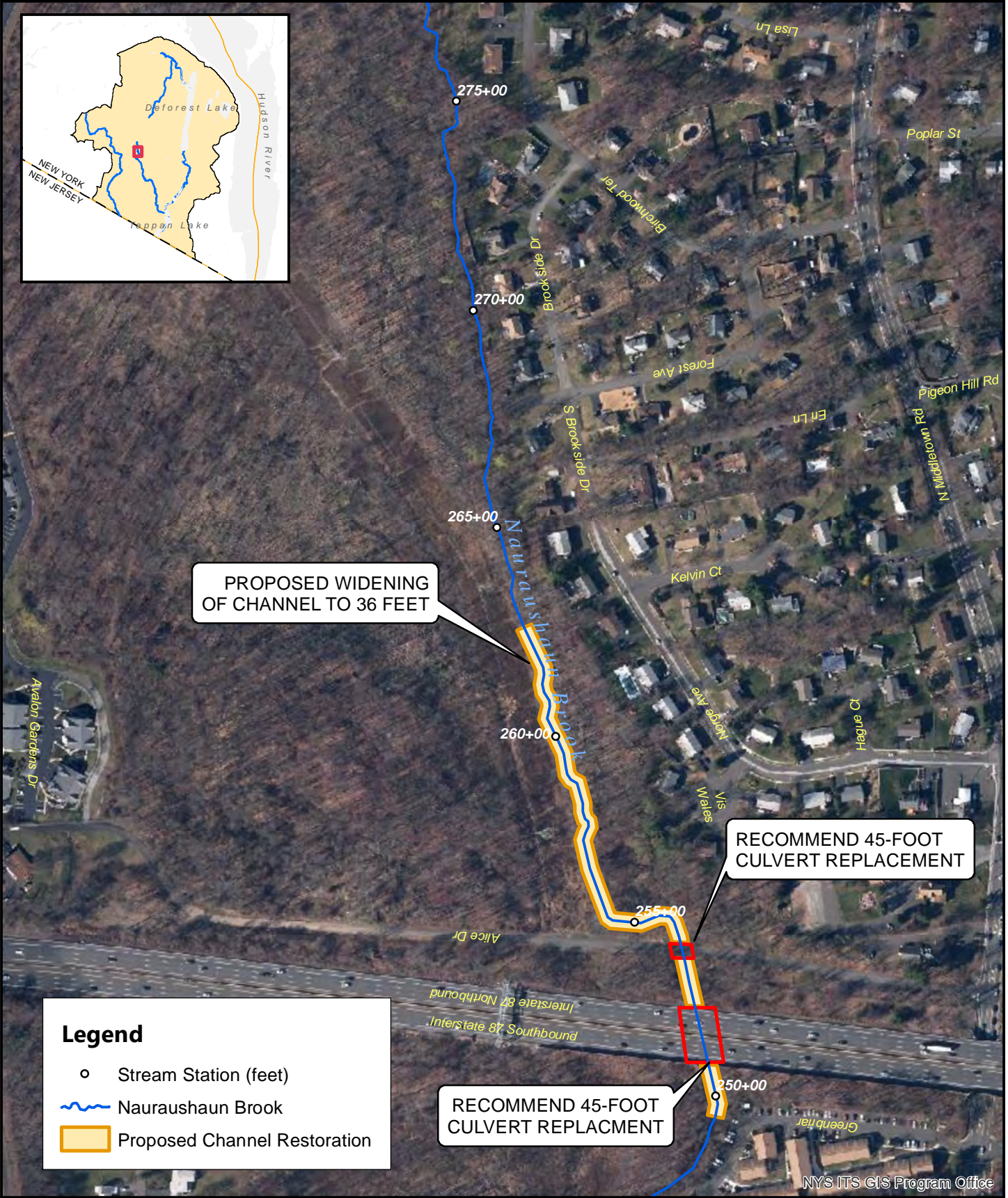
**FIG. 4-62**







**Figure 4-63: Looking Upstream at Nauraushaun Brook from Alice Drive**



**Legend**

- Stream Station (feet)
- ~ Naurausshaun Brook
- ▭ Proposed Channel Restoration

RECOMMEND 45-FOOT CULVERT REPLACEMENT

RECOMMEND 45-FOOT CULVERT REPLACEMENT

PROPOSED WIDENING OF CHANNEL TO 36 FEET

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**HIGH RISK AREA #7 - CONCEPT MAP**

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 NEW YORK

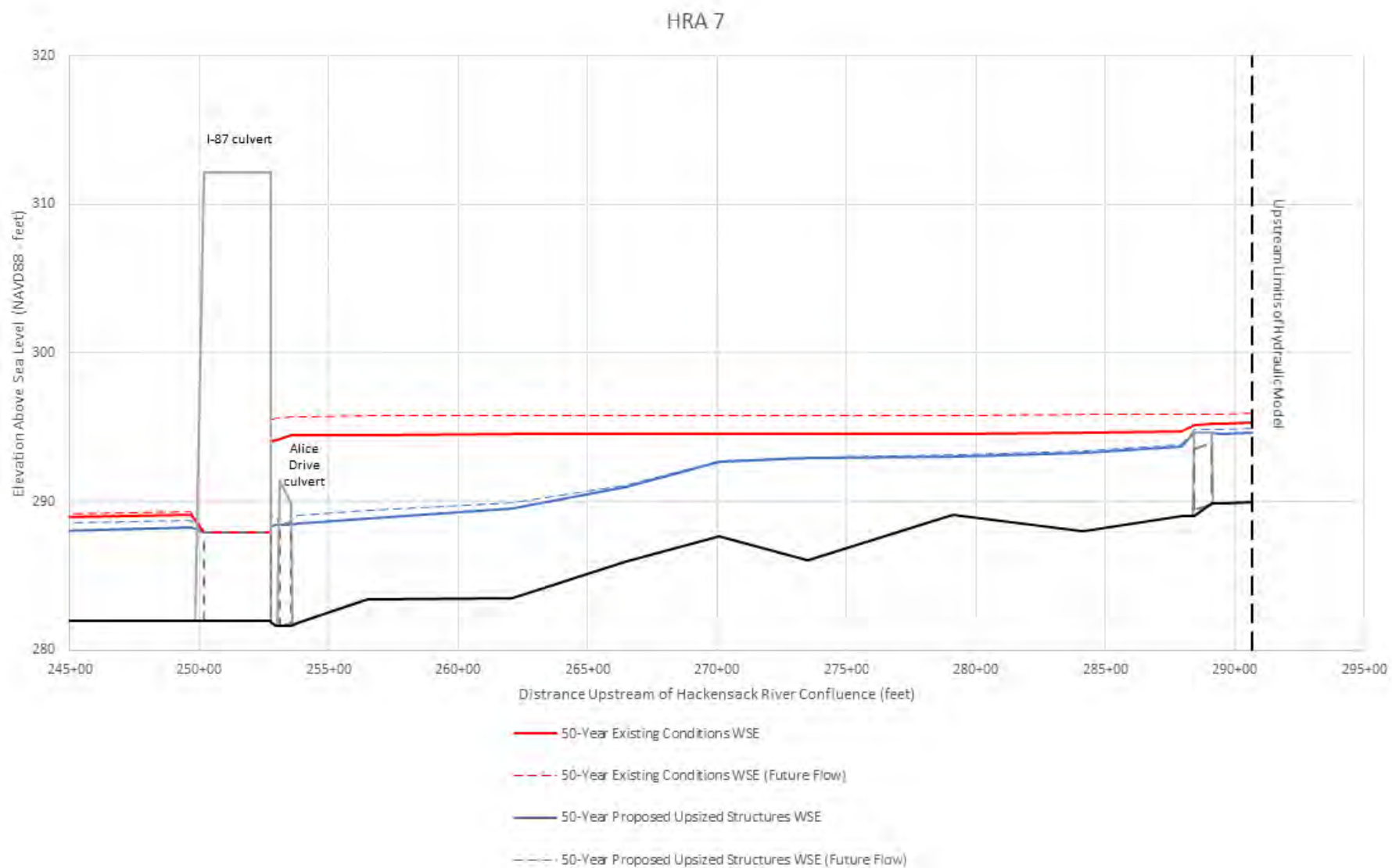
SOURCE: 2016 AERIAL PHOTO, NYS ITS GIS Program Office

SCALE 1" = 300'

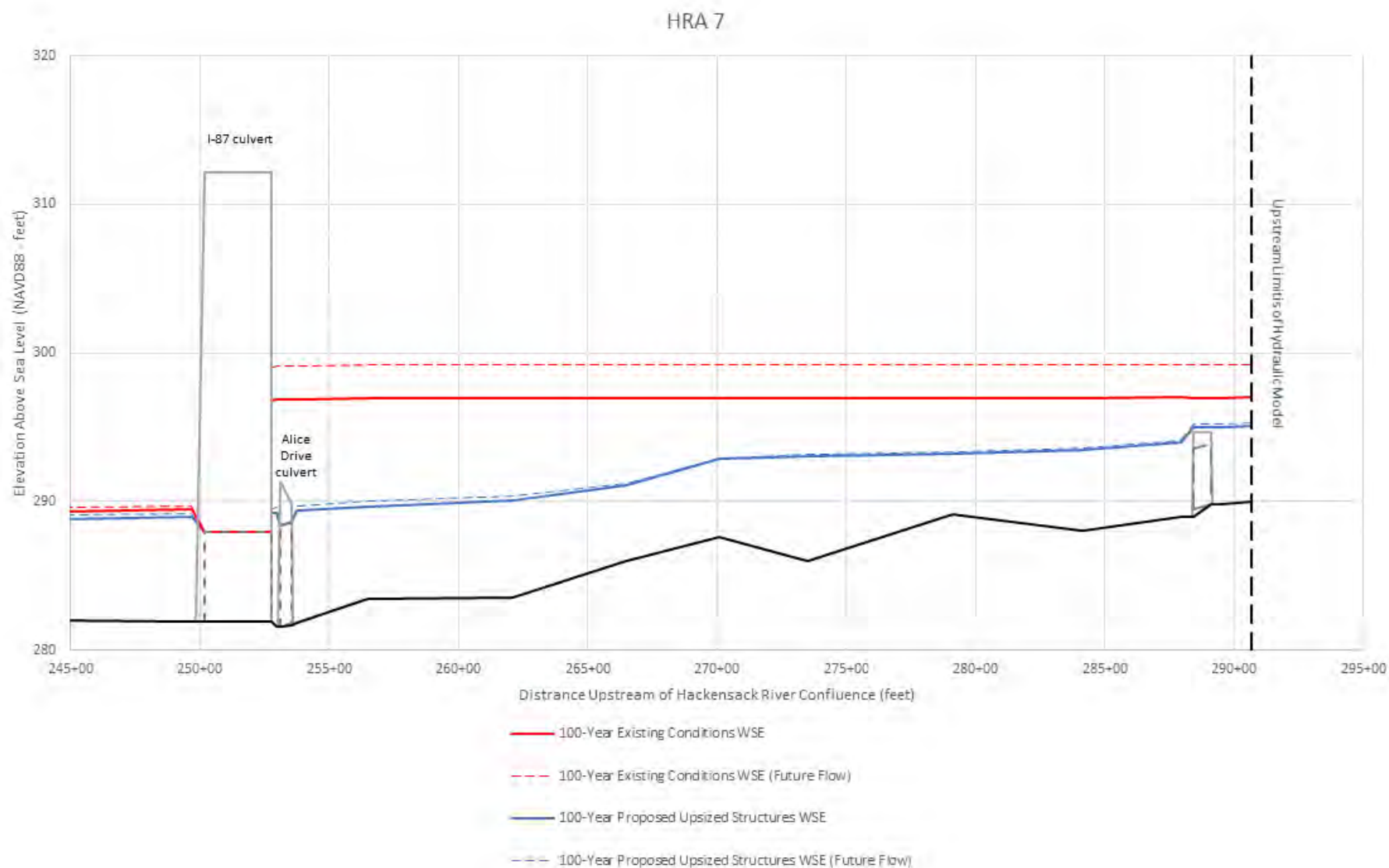
DATE 12/29/2021

PROJ. NO. 16511.00005

**FIG. 4-64**



**Figure 4-65: Longitudinal Profile Showing Recommended Improvements in HRA 7 During 50-Year Flood Event**



**Figure 4-66: Longitudinal Profile Showing Recommended Improvements in HRA 7 During 100-Year Flood Event**



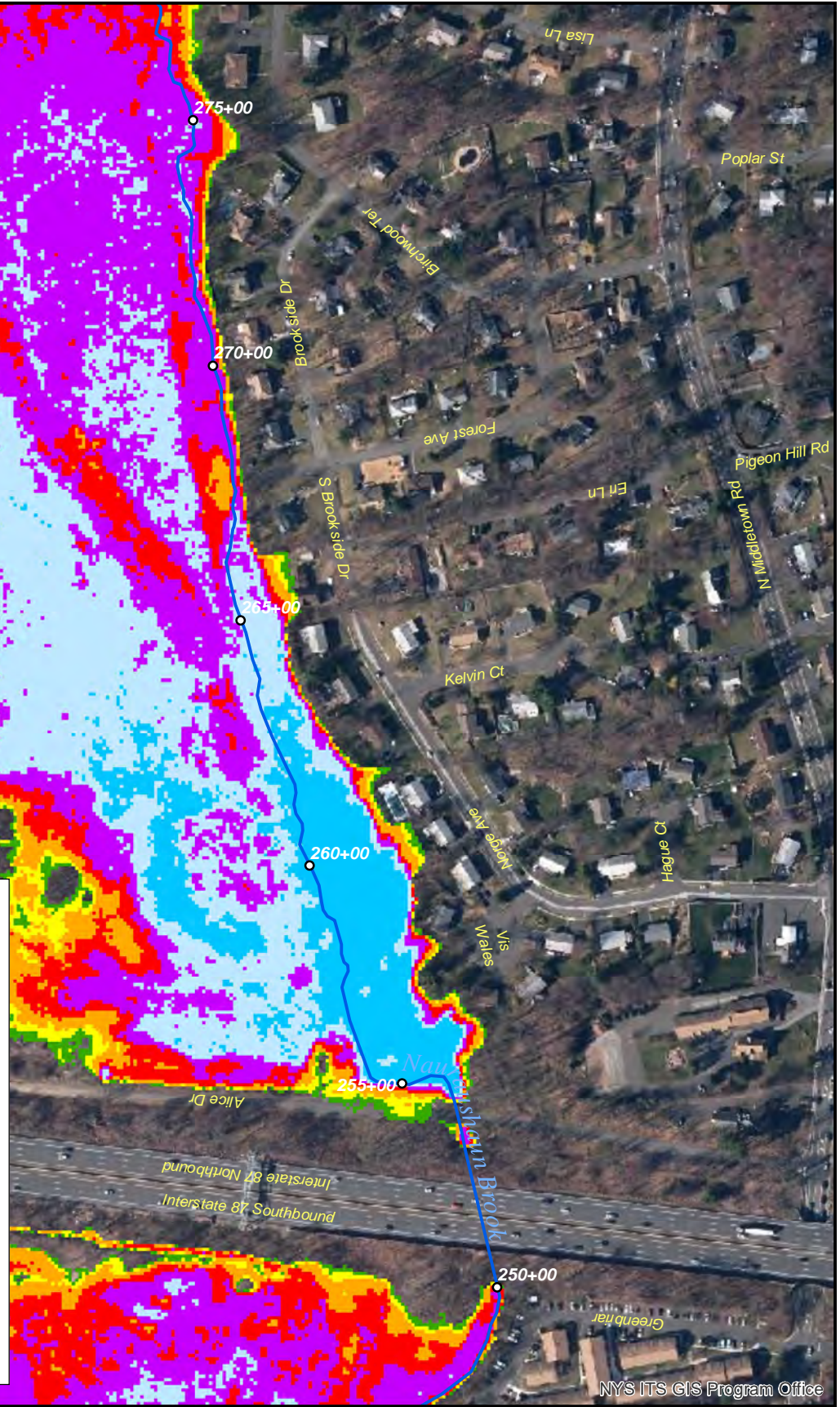
**Legend**

- Stream Station (feet)
- ~ Naurashaun Brook

**10-Year Existing Conditions**

**Depths (feet)**

0 - 0.5
0.5 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 10
10 - 15
15 - 20
20 - 25



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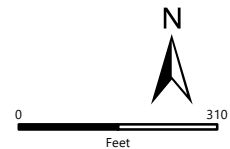
**HIGH RISK AREA #7 - 10-YEAR EXISTING CONDITIONS**

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SCALE 1" = 300'

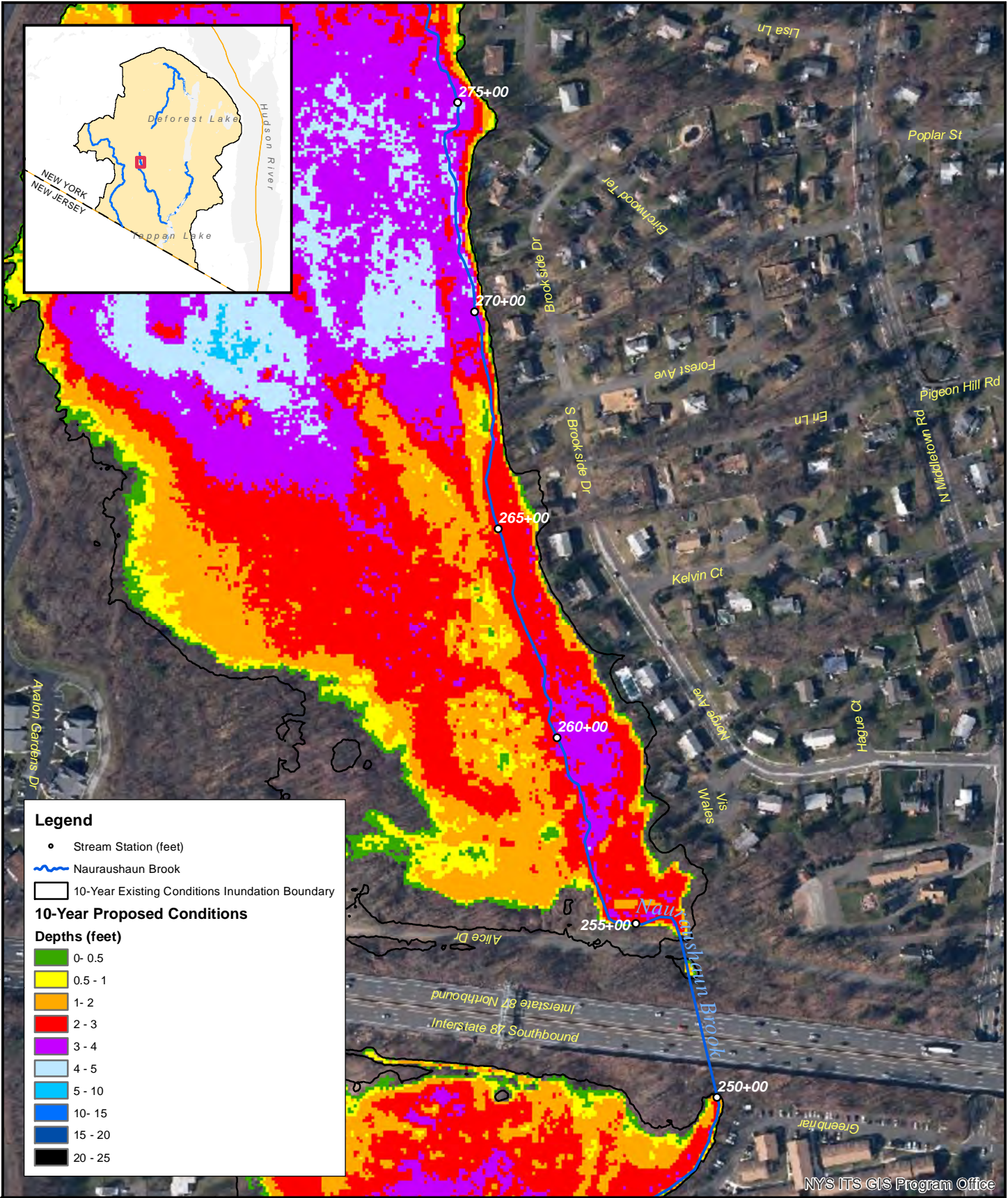
DATE 12/29/2021

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**FIG. 4-67**

SOURCE: 2016 AERIAL PHOTO, NYS ITS GIS Program Office



**Legend**

- Stream Station (feet)
- ~ Nauraushaun Brook
- 10-Year Existing Conditions Inundation Boundary

**10-Year Proposed Conditions**

**Depths (feet)**

0 - 0.5
0.5 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 10
10 - 15
15 - 20
20 - 25

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**HIGH RISK AREA #7 - 10-YEAR PROPOSED CONDITIONS**

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ROCKLAND COUNTY  
NEW YORK

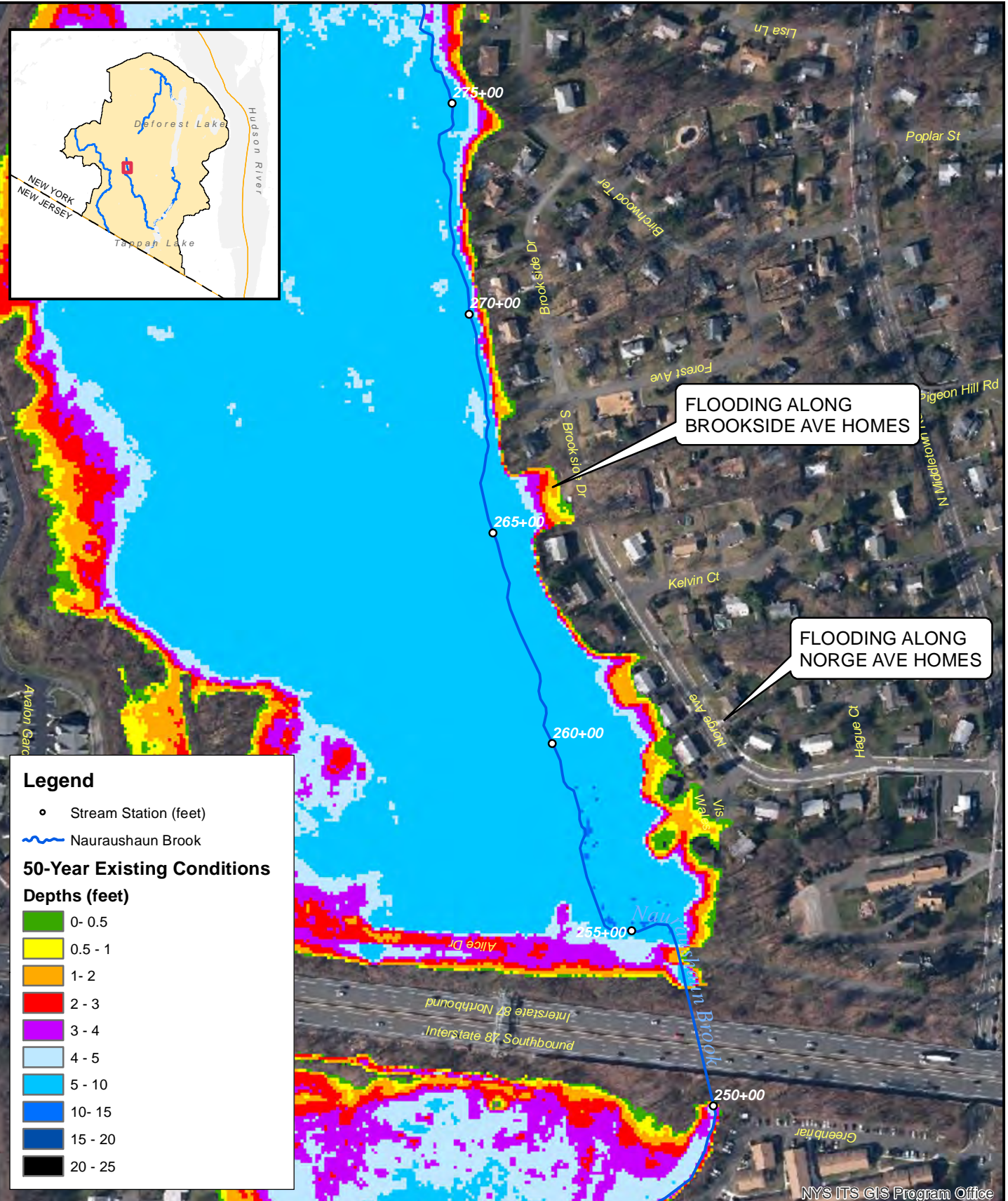
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SCALE 1" = 300'

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**FIG. 4-68**



**Legend**

- Stream Station (feet)
- ~ Nauraushaun Brook

**50-Year Existing Conditions**

**Depths (feet)**

- 0 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25

FLOODING ALONG BROOKSIDE AVE HOMES

FLOODING ALONG NORGE AVE HOMES

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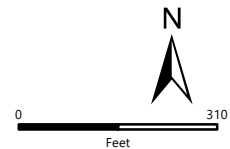
**HIGH RISK AREA #7 - 50-YEAR EXISTING CONDITIONS**

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ROCKLAND COUNTY  
NEW YORK

SCALE 1" = 300'

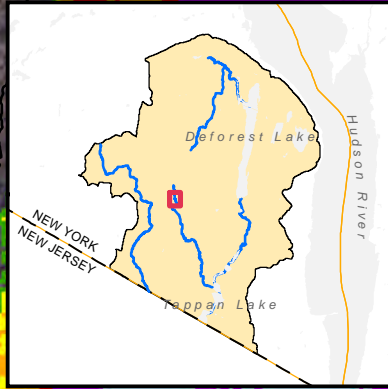
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**FIG. 4-69**

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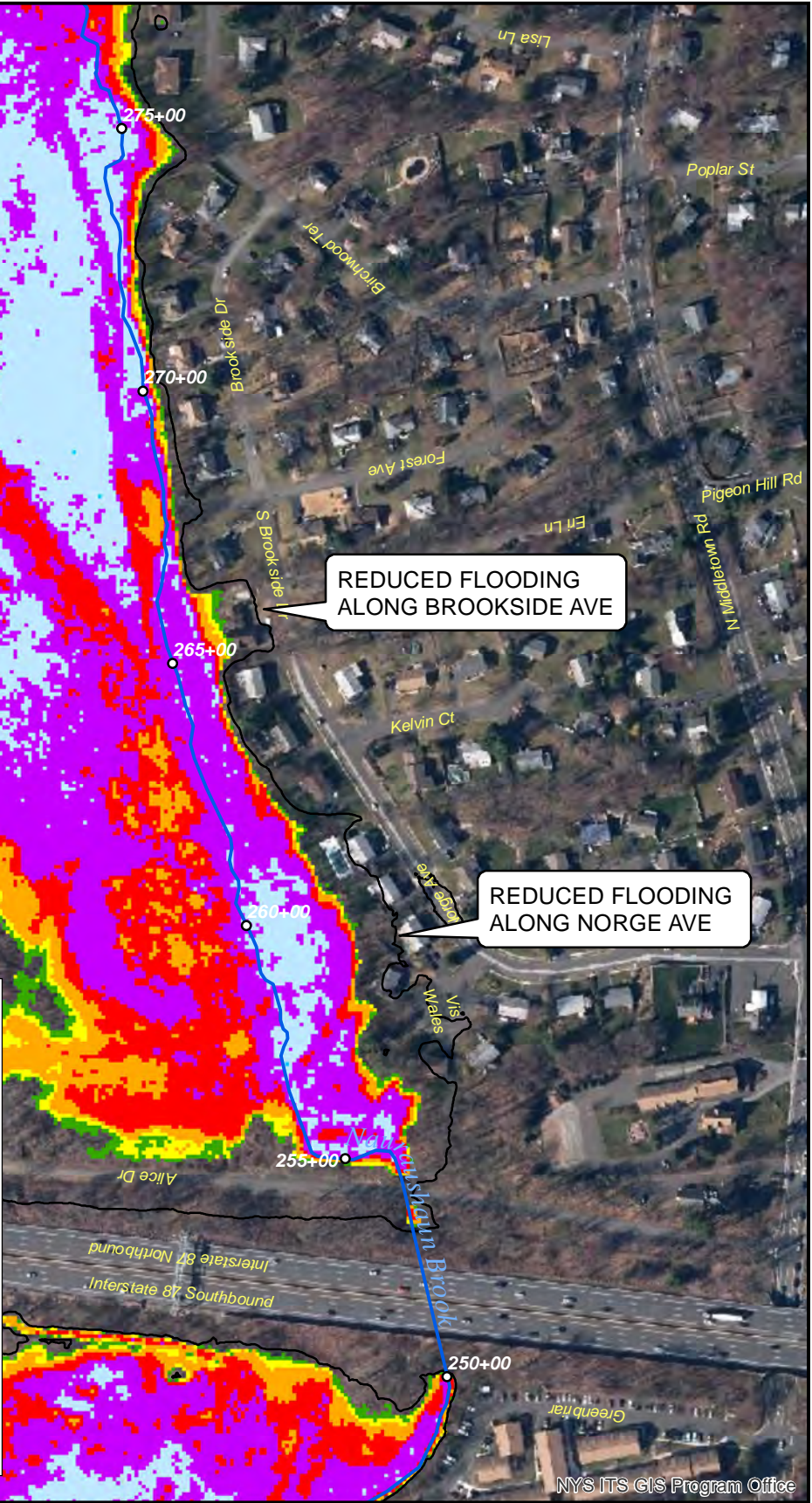
**Legend**

- Stream Station (feet)
- ~ Nauraushaun Brook
- 50-Year Existing Conditions Inundation Boundary

**50-Year Proposed Conditions**

**Depths (feet)**

0- 0.5
0.5 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 10
10 - 15
15 - 20
20 - 25



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231 MAIN STREET  
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**HIGH RISK AREA #7 - 50-YEAR PROPOSED CONDITIONS**

HACKENSACK RIVER FLOOD & RESILIENCE STUDY  
SD109  
ROCKLAND COUNTY  
NEW YORK

SOURCE: 2016 AERIAL PHOTO, NYS ITS GIS Program Office

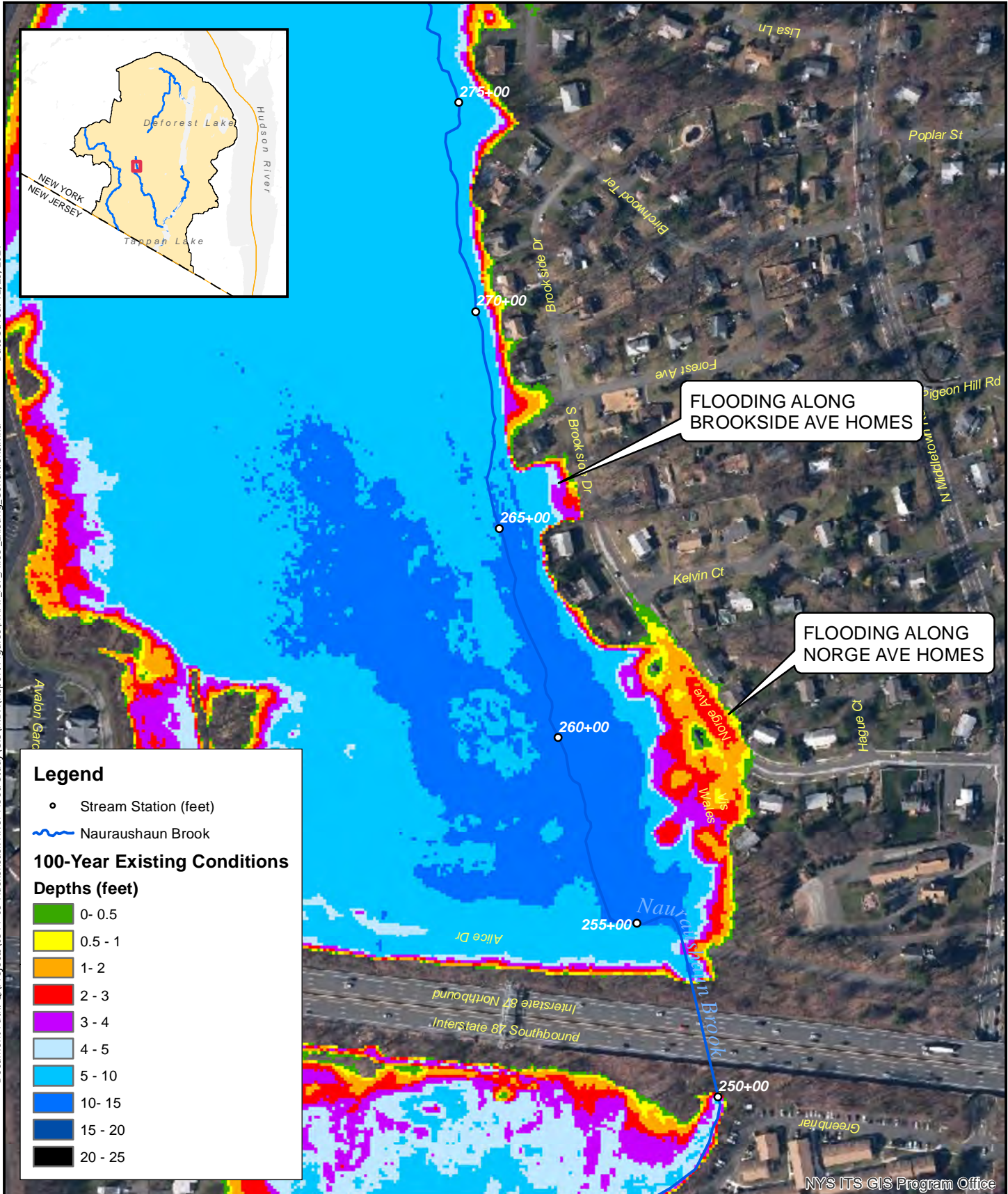
SCALE 1" = 300'

DATE 12/29/2021

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**FIG. 4-70**





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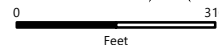
**HIGH RISK AREA #7 - 100-YEAR EXISTING CONDITIONS**

HACKENSACK RIVER FLOOD & RESILIENCE STUDY  
 SD109  
 ROCKLAND COUNTY  
 NEW YORK

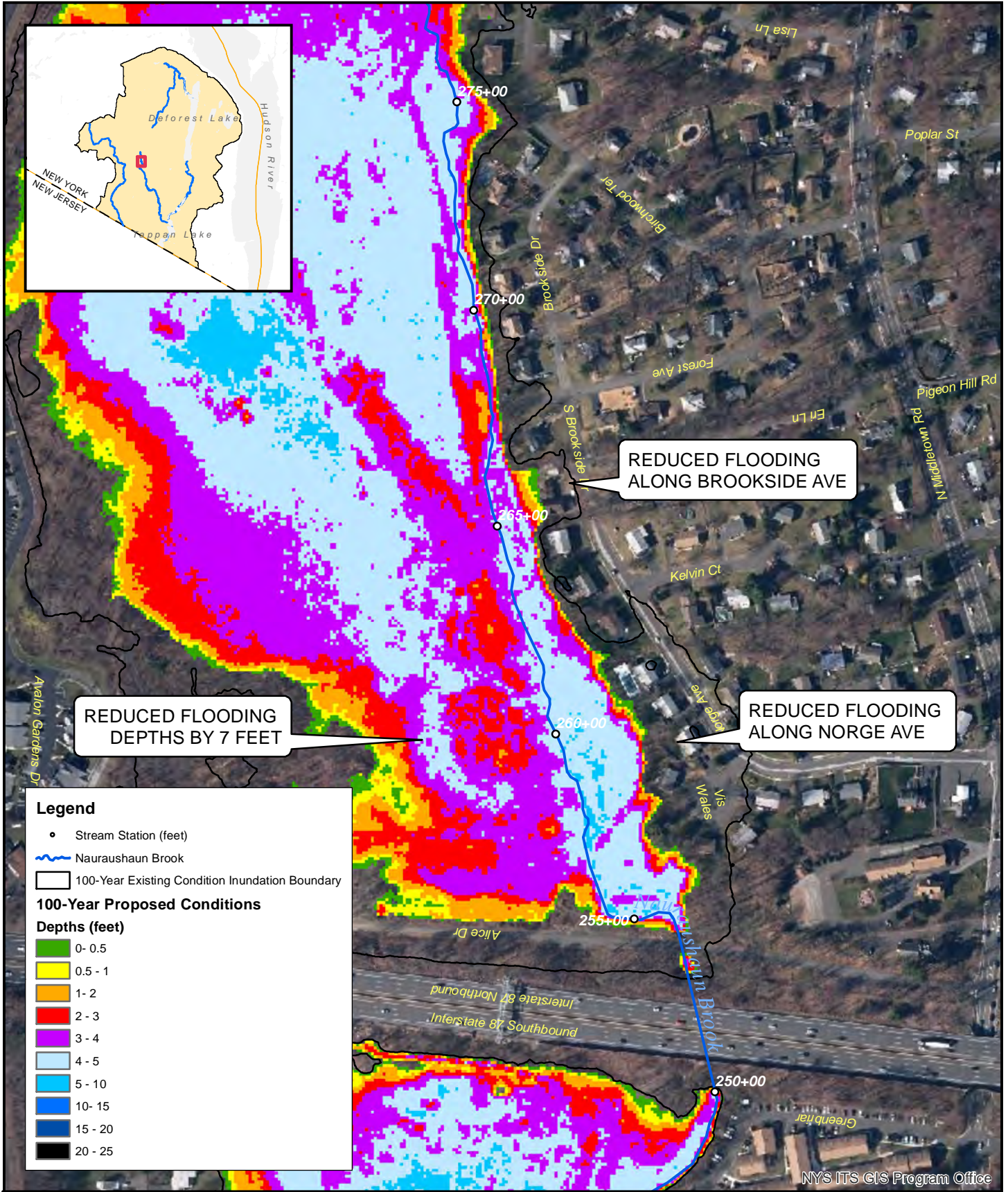
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**FIG. 4-71**



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**HIGH RISK AREA #7 - 100-YEAR PROPOSED CONDITIONS**

HACKENSACK RIVER FLOOD & RESILIENCE STUDY  
SD109  
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**FIG. 4-72**

## 4.8 HIGH RISK AREA #8 – GROTKE ROAD BRIDGE AND MILL DAM

HRA 8 extends along Pascack Brook in the village of Chestnut Ridge between STA 65+00 upstream to STA 95+00 (Figure 4-73) and includes the Grotke Road bridge at STA 74+00 and a privately owned, 17-foot-high mill dam at STA 66+25 (Figure 4-74). The dam is not registered with NYSDEC. Recent repair work on the dam was permitted by the Rockland County Drainage Agency.

Hydraulic analysis was conducted within HRA 8 using current and future flows. Proposed replacement stream crossings were assessed based on the flood flows the structure would be expected to encounter over its design lifetime. The 2075-2099 projections were used for bridges, which are often in service for 75 to 100 years or more.

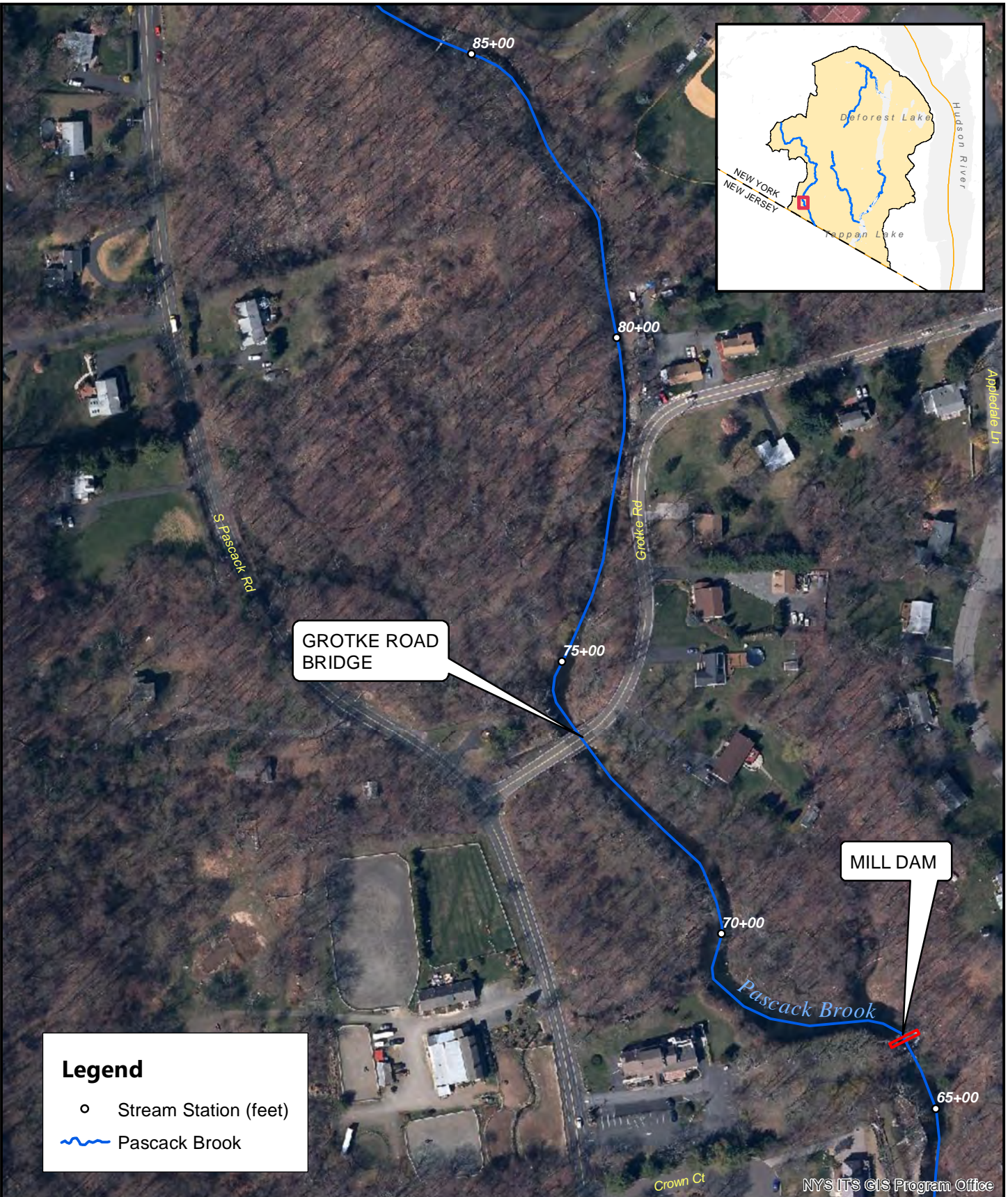
The backwater created by the dam elevates water surface elevations along Pascack Brook upstream of the dam and contributes to flooding of South Pascack Road and several homes during large flood events. Backwater from the dam also has an influence on the hydraulic performance of the Grotke Road bridge. Based on hydraulic analysis, removal of the dam and restoration of the channel through the former impoundment would result in a reduction in water surface elevations of over 9 feet, extending over 700 feet upstream of the dam. Channel restoration would likely consist of, at minimum, removal or stabilization of impounded sediments; excavation of a properly sized, multistage channel and floodplain through the former impoundment; installation of grade control structures and/or scour protection measures along restored channel to prevent channel incision and protect upstream infrastructure; and installation of native plantings. The reduction in water surface elevations would remove sections of South Pascack Road, as well as some homes upstream of the dam, out of the influence of the 100-year flood event. The removal of the dam would improve the performance of the Grotke Road bridge by increasing its capacity from passing less than the 10-year flood event to passing the future 50-year flood event.

The Rockland County-owned Grotke Road bridge is a 38.5-foot-span open-bottom bridge with two piers. The structure's current hydraulic capacity is less than the current 10-year flood event. Hydraulic analysis predicts over 2 feet of water spilling over the roadway in such an event. The structure acts as a severe hydraulic constriction and fails to span the broad floodplain along this section of Pascack Brook, behaving like a bottleneck. Furthermore, the bridge deck is situated relatively low, making the crossing susceptible to overtopping during significant storm events. Hydraulic analysis was used to investigate the benefits of bridge replacement. A new bridge was modeled with a bridge deck at an elevation 6 feet higher than the existing deck, an increase in span to 68 feet, and an elimination of the two piers. The new bridge would pass the 50-year storm with 1.6 feet of freeboard but would overtop in the 100-year storm. Combined with the removal of the downstream dam, which would lower water surface elevations at the bridge, the replacement bridge would pass all modeled storm events including the future 100-year event with nearly a foot of freeboard. Water surface elevation reductions upstream of the bridge range from 2.1 to 1.3 feet for the current 10-year and 100-year flood events.

The mill dam at STA 66+25 is not in the NYSDEC's current dam inventory database (February 2021 Revision), and its inclusion is recommended.

A concept map of the proposed bridge replacement, dam removal, and stream restoration is depicted in Figure 4-75. Longitudinal profiles showing existing and proposed conditions under the 50-year, current

and future flood events are depicted in Figure 4-76 and under the 100-year, current and future flood events in Figure 4-77. Existing and proposed conditions flood depth mapping for the 10-, 50-, and 100-year flood events are included in Figures 4-78 through Figure 4-83.



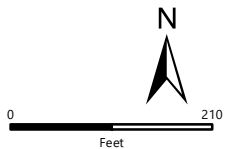
**Legend**

- Stream Station (feet)
- ~ Pascack Brook

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**HIGH RISK AREA #8 - MILL DAM & GROTKE ROAD**  
 HACKENSACK RIVER FLOOD & RESILIENCE STUDY  
 SD109  
 ROCKLAND COUNTY  
 NEW YORK

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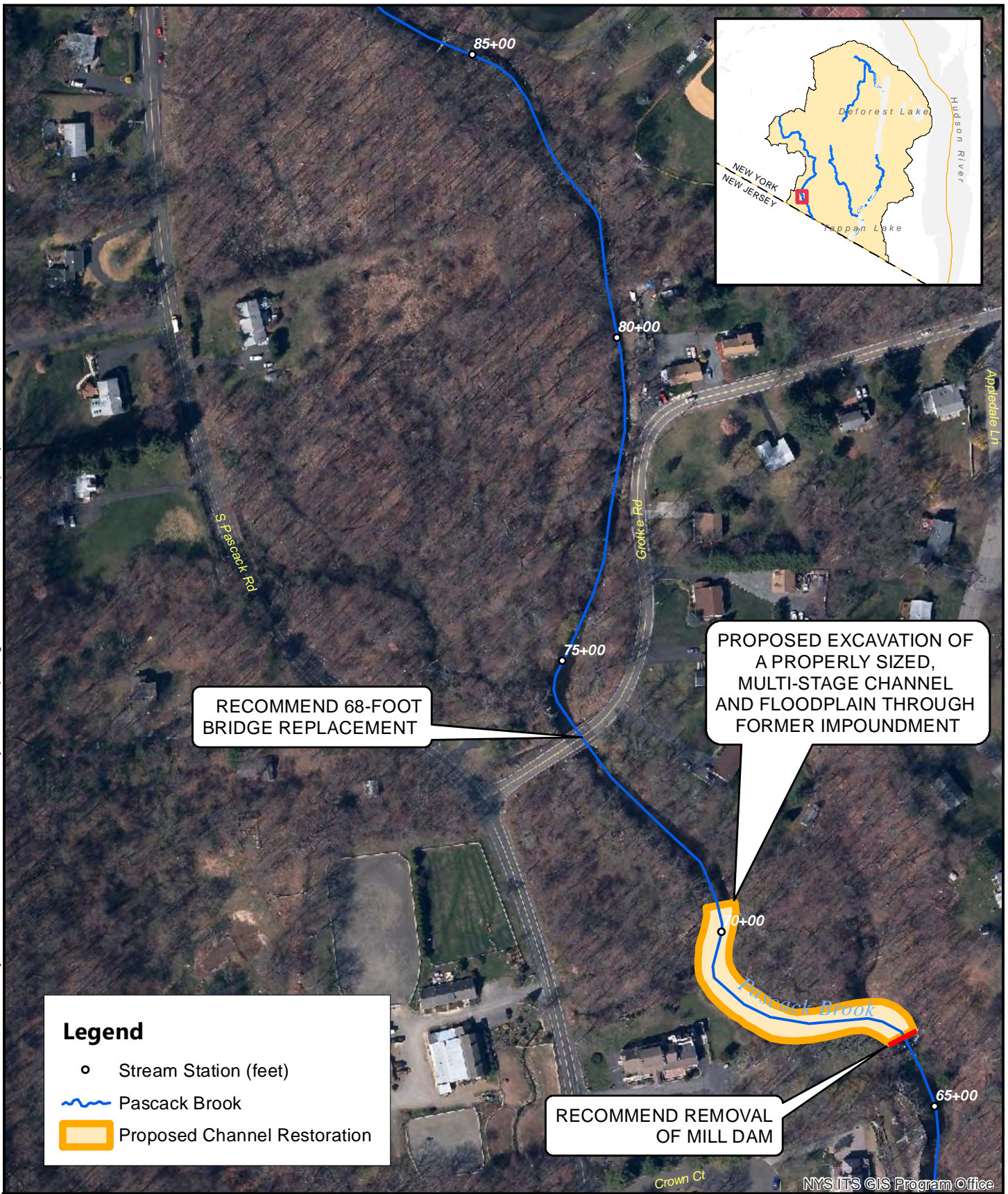


SOURCE: 2016 AERIAL PHOTO, NYS ITS GIS Program Office

**FIG. 4-73**



Figure 4-74: Mill Dam on Pascack Brook (photos provided by Rockland Drainage Authority)



**Legend**

- Stream Station (feet)
- ~ Pascack Brook
- ▭ Proposed Channel Restoration

PROPOSED EXCAVATION OF A PROPERLY SIZED, MULTI-STAGE CHANNEL AND FLOODPLAIN THROUGH FORMER IMPOUNDMENT

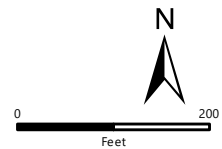
RECOMMEND 68-FOOT BRIDGE REPLACEMENT

RECOMMEND REMOVAL OF MILL DAM

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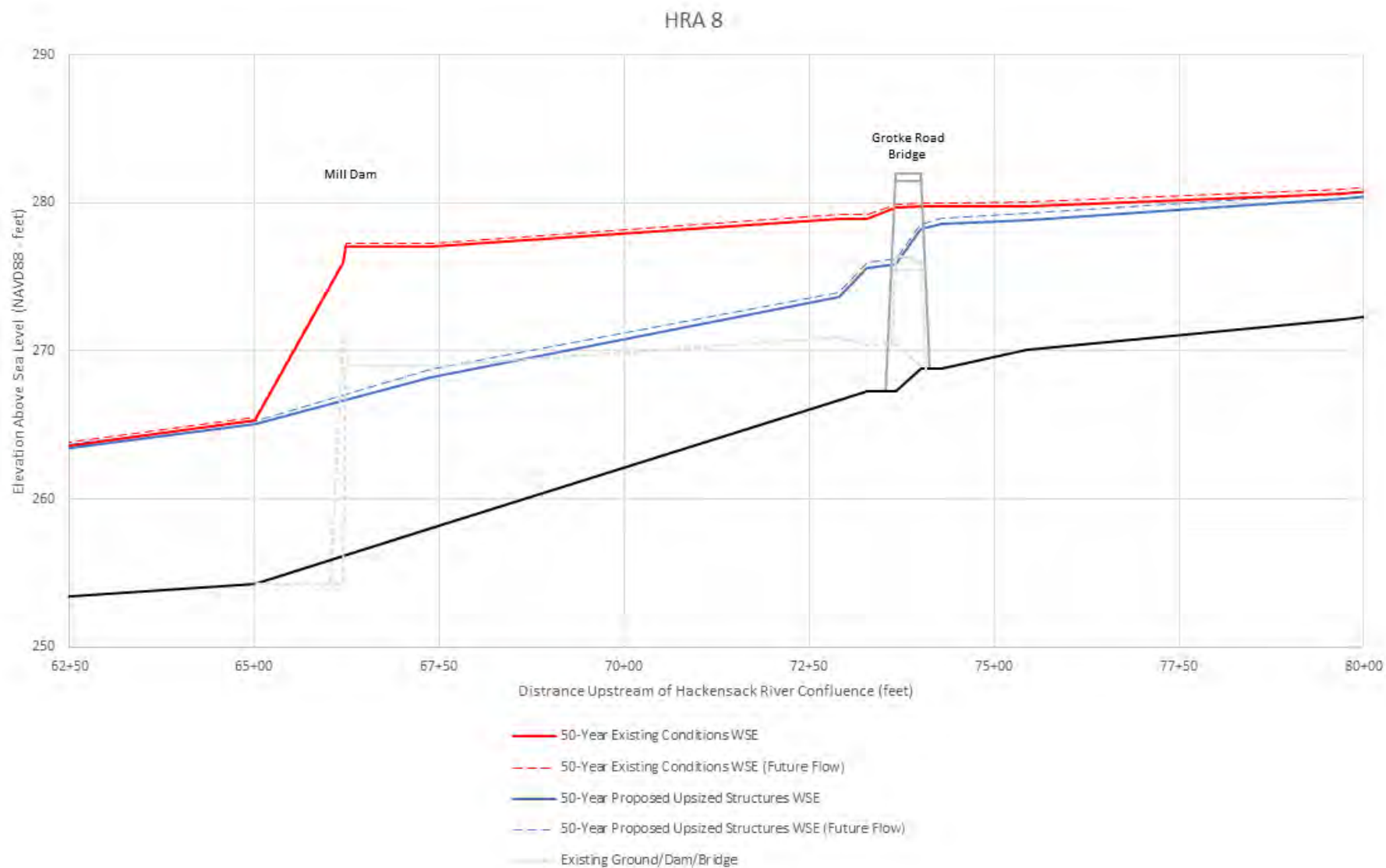
HIGH RISK AREA #8 - CONCEPT MAP  
 HACKENSACK RIVER FLOOD & RESILIENCE STUDY  
 SD109  
 ROCKLAND COUNTY  
 NEW YORK

SCALE 1" = 200'  
 DATE 2/10/2022  
 PROJ. NO. 16511.00005



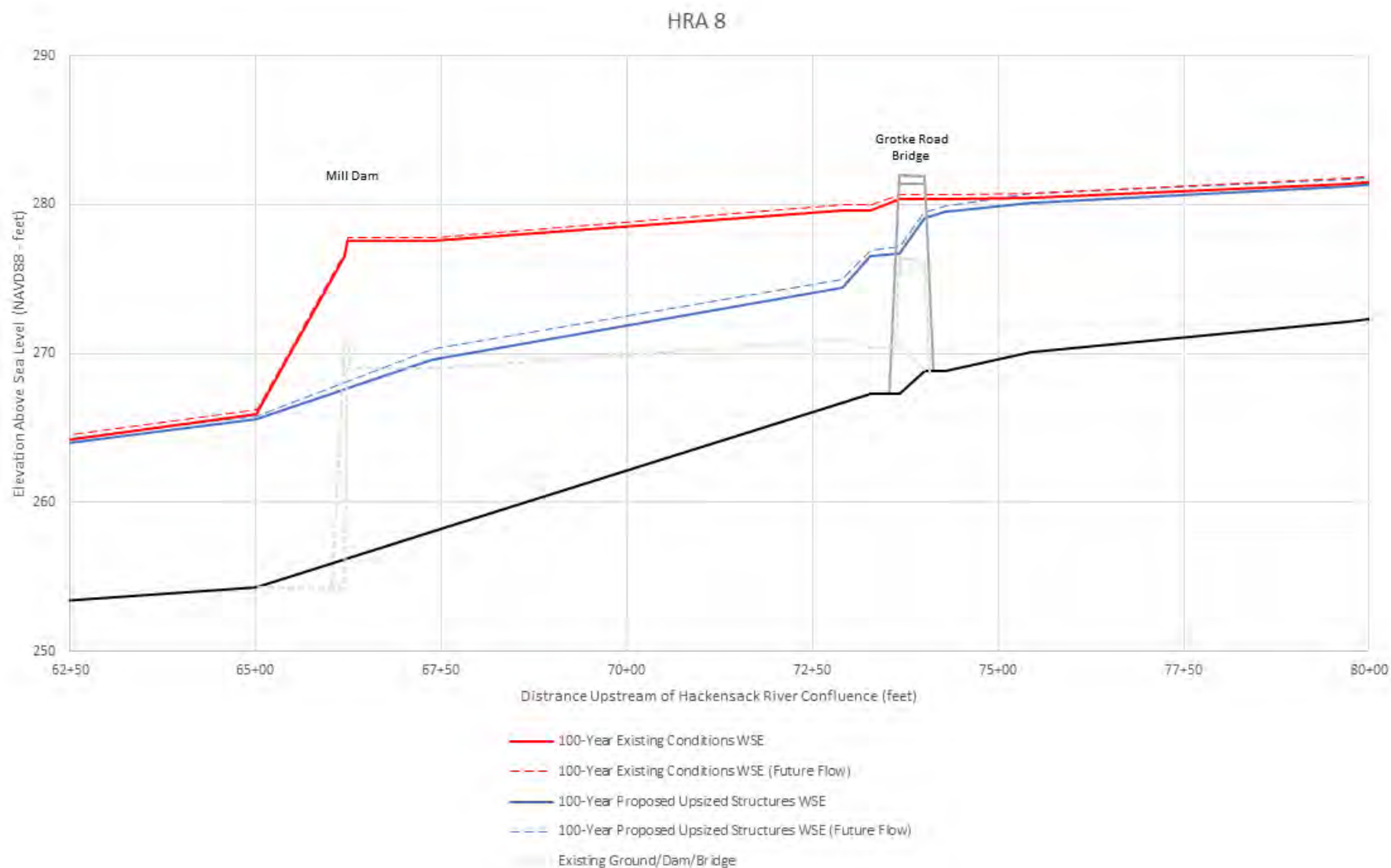
SOURCE: 2016 AERIAL PHOTO, NYS ITS GIS Program Office

**FIG. 4-78**

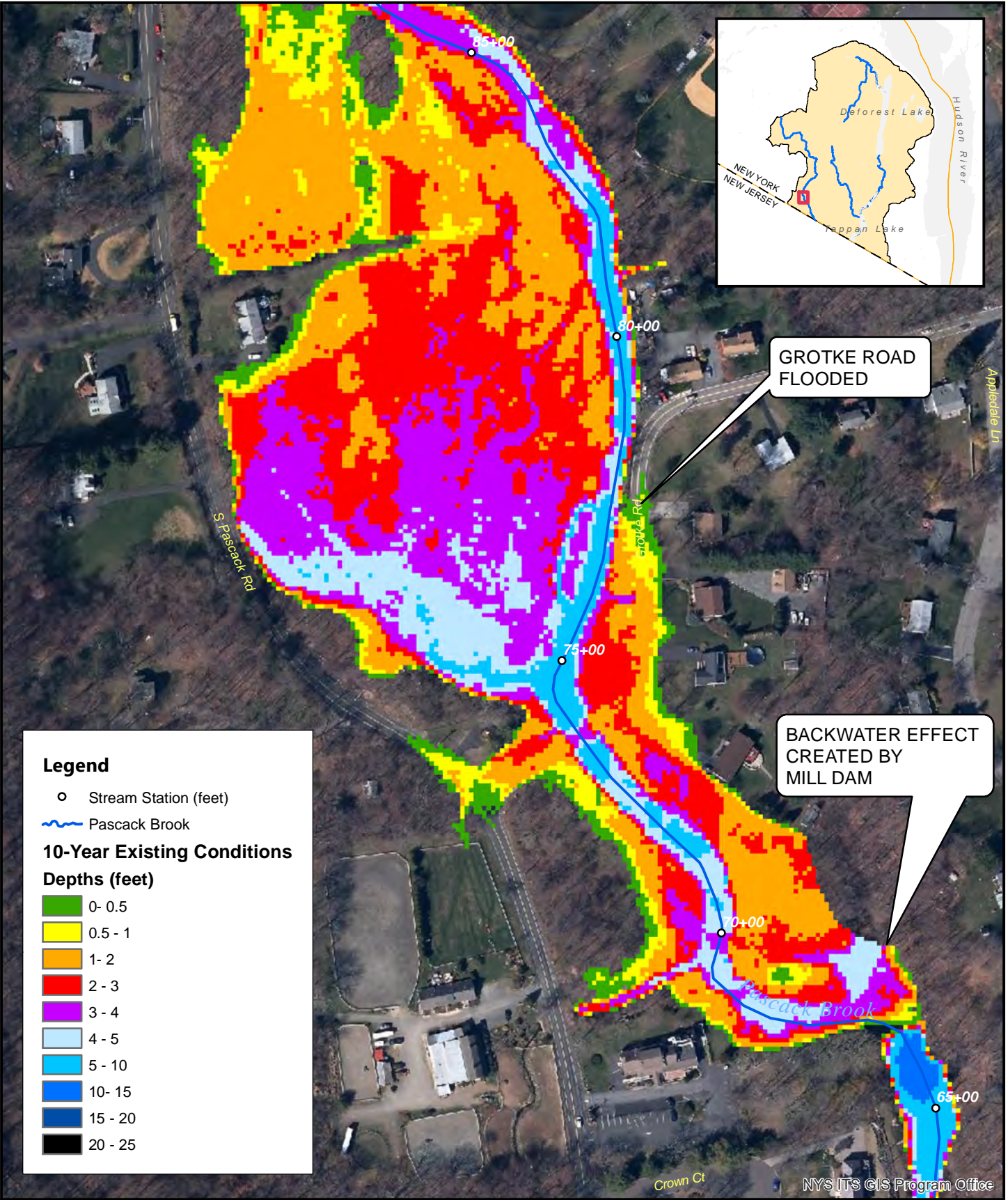


**Figure 4-76: Longitudinal Profile Showing Recommended Improvements in HRA 8 During 50-Year Flood Event**





**Figure 4-77: Longitudinal Profile Showing Recommended Improvements in HRA 8 During 100-Year Flood Event**



**Legend**

- Stream Station (feet)
- Pascack Brook

**10-Year Existing Conditions  
Depths (feet)**

0 - 0.5
0.5 - 1
1 - 2
2 - 3
3 - 4
4 - 5
5 - 10
10 - 15
15 - 20
20 - 25



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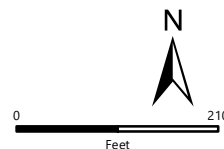
**HIGH RISK AREA #8 - 10-YEAR EXISTING CONDITIONS**

HACKENSACK RIVER FLOOD & RESILIENCE STUDY  
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ROCKLAND COUNTY  
NEW YORK

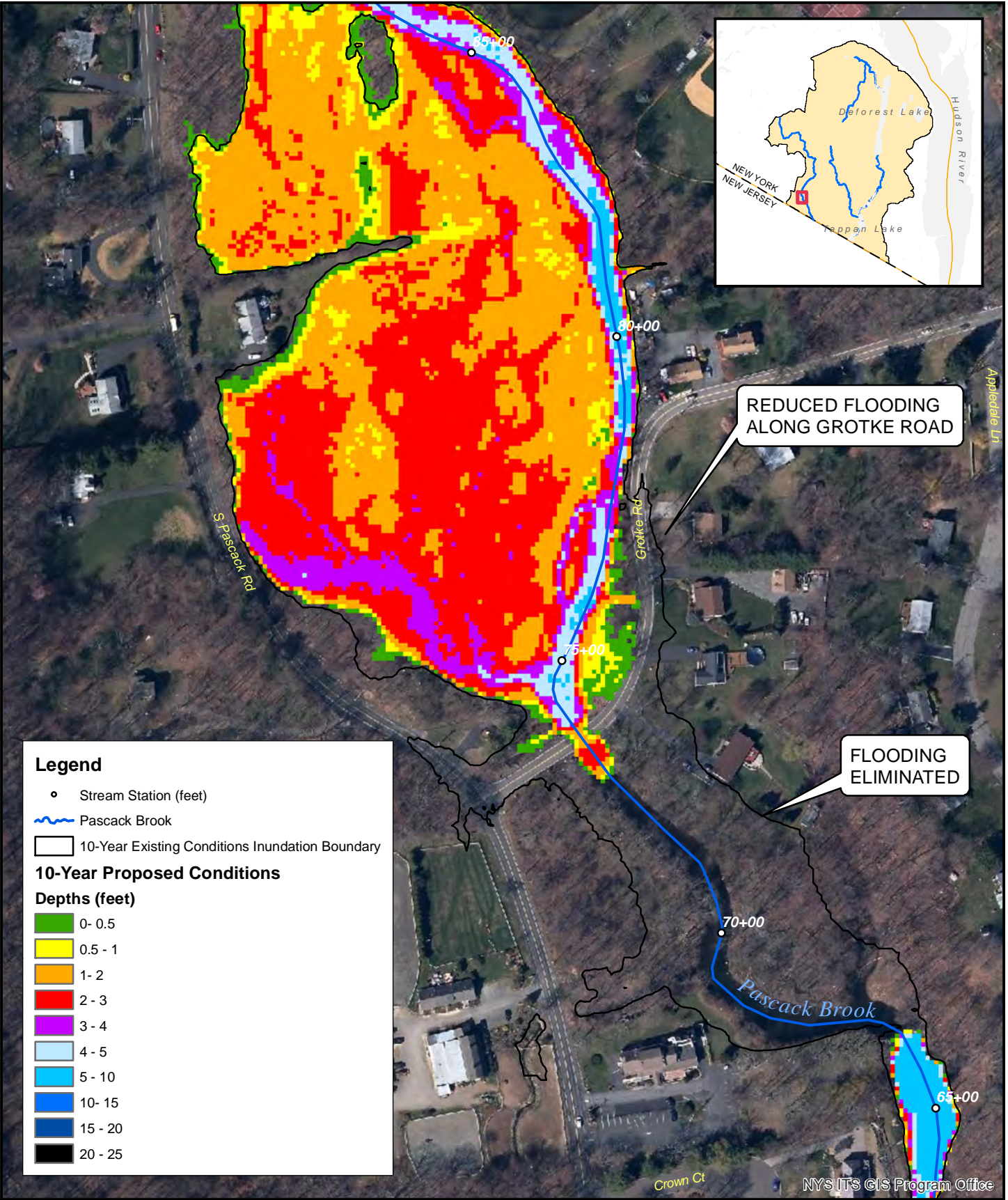
SCALE 1" = 200'

DATE 12/29/2021

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**FIG. 4-78**



**Legend**

- Stream Station (feet)
- ~ Pascack Brook
- 10-Year Existing Conditions Inundation Boundary

**10-Year Proposed Conditions**

**Depths (feet)**

- 0 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25

REDUCED FLOODING ALONG GROTKE ROAD

FLOODING ELIMINATED

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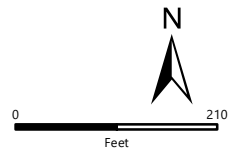
**HIGH RISK AREA #8 - 10-YEAR PROPOSED CONDITIONS**

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SCALE 1" = 200'

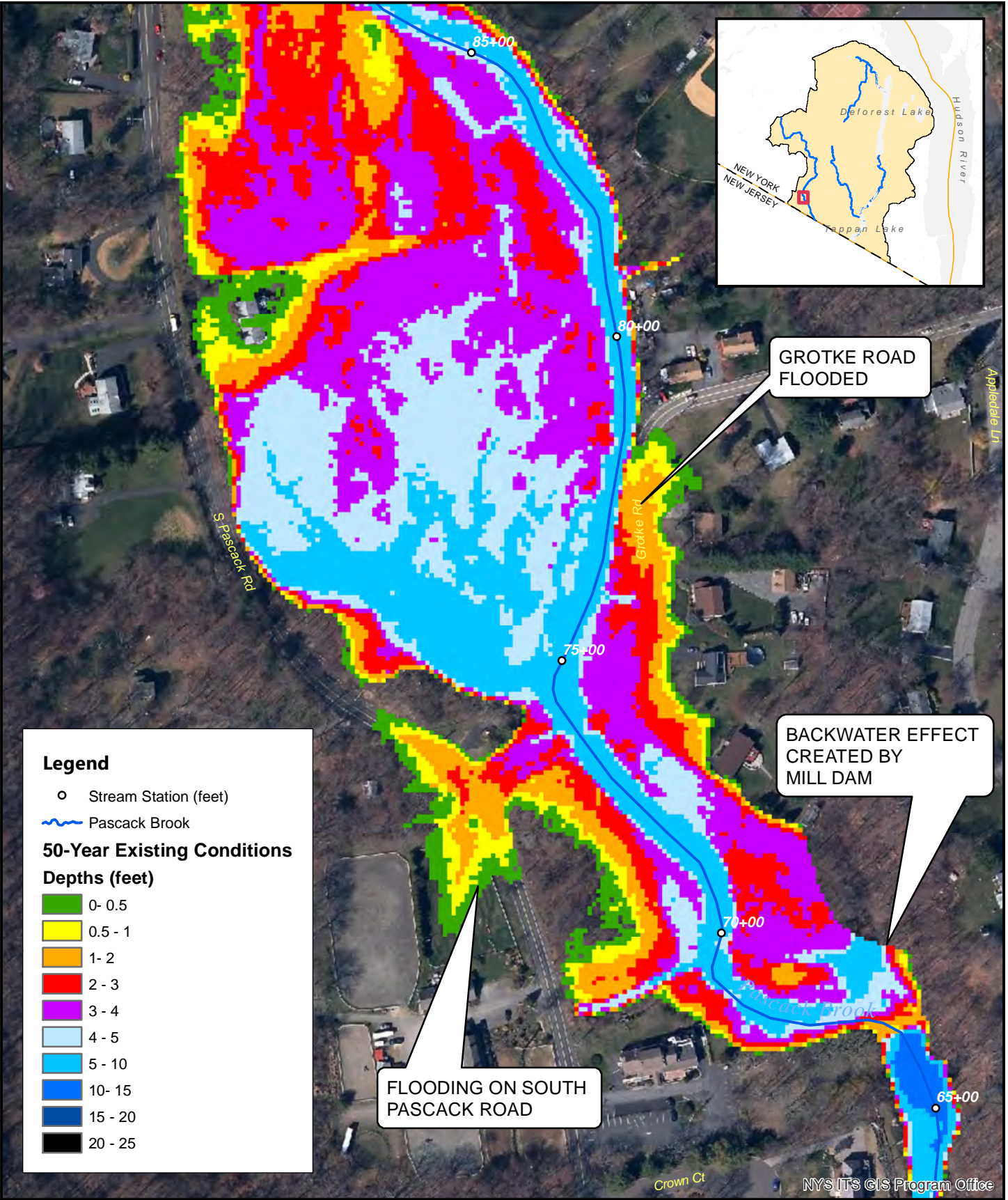
DATE 12/29/2021

PROJ. NO. 16511.00005



**FIG. 4-79**

SOURCE: 2016 AERIAL PHOTO, NYS ITS GIS Program Office



**Legend**

- Stream Station (feet)
- ~ Pascack Brook

**50-Year Existing Conditions**

**Depths (feet)**

- 0 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25

GROTKE ROAD FLOODED

BACKWATER EFFECT CREATED BY MILL DAM

FLOODING ON SOUTH PASCACK ROAD

Appledate Ln

Crown Ct

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**HIGH RISK AREA #8 - 50-YEAR EXISTING CONDITIONS**

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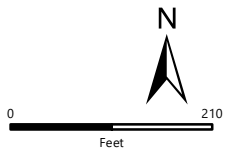
SOURCE: 2016 AERIAL PHOTO, NYS ITS GIS Program Office

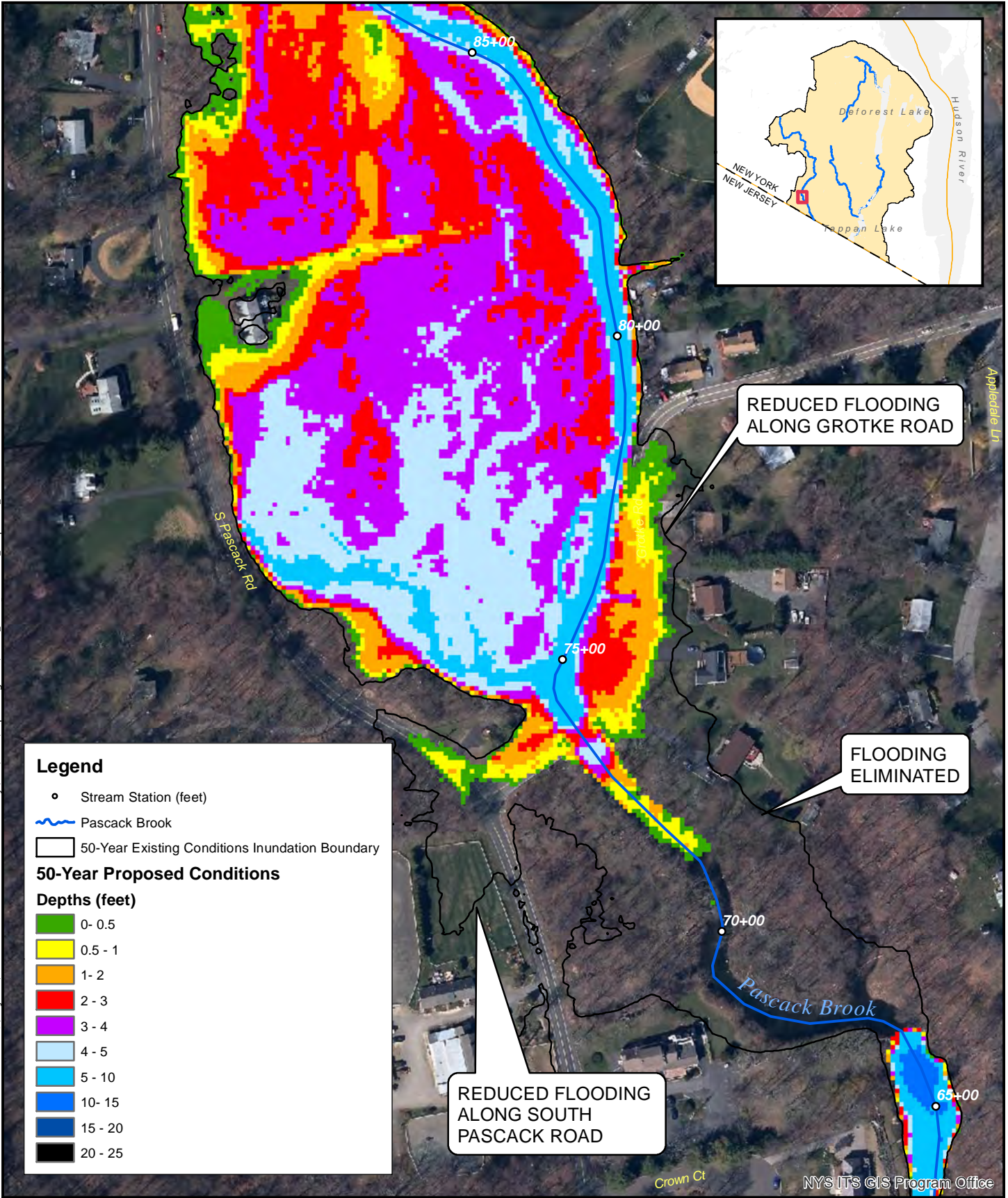
SCALE 1" = 200'

DATE 12/29/2021

PROJ. NO. 16511.00005

**FIG. 4-80**





**Legend**

- Stream Station (feet)
- Pascack Brook
- 50-Year Existing Conditions Inundation Boundary

**50-Year Proposed Conditions**

**Depths (feet)**

- 0 - 0.5
- 0.5 - 1
- 1 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 10
- 10 - 15
- 15 - 20
- 20 - 25

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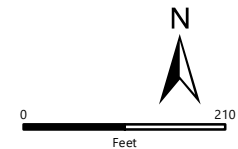
**HIGH RISK AREA #8 - 50-YEAR PROPOSED CONDITIONS**

HACKENSACK RIVER FLOOD & RESILIENCE STUDY  
 SD109  
 ROCKLAND COUNTY  
 NEW YORK

SCALE 1" = 200'

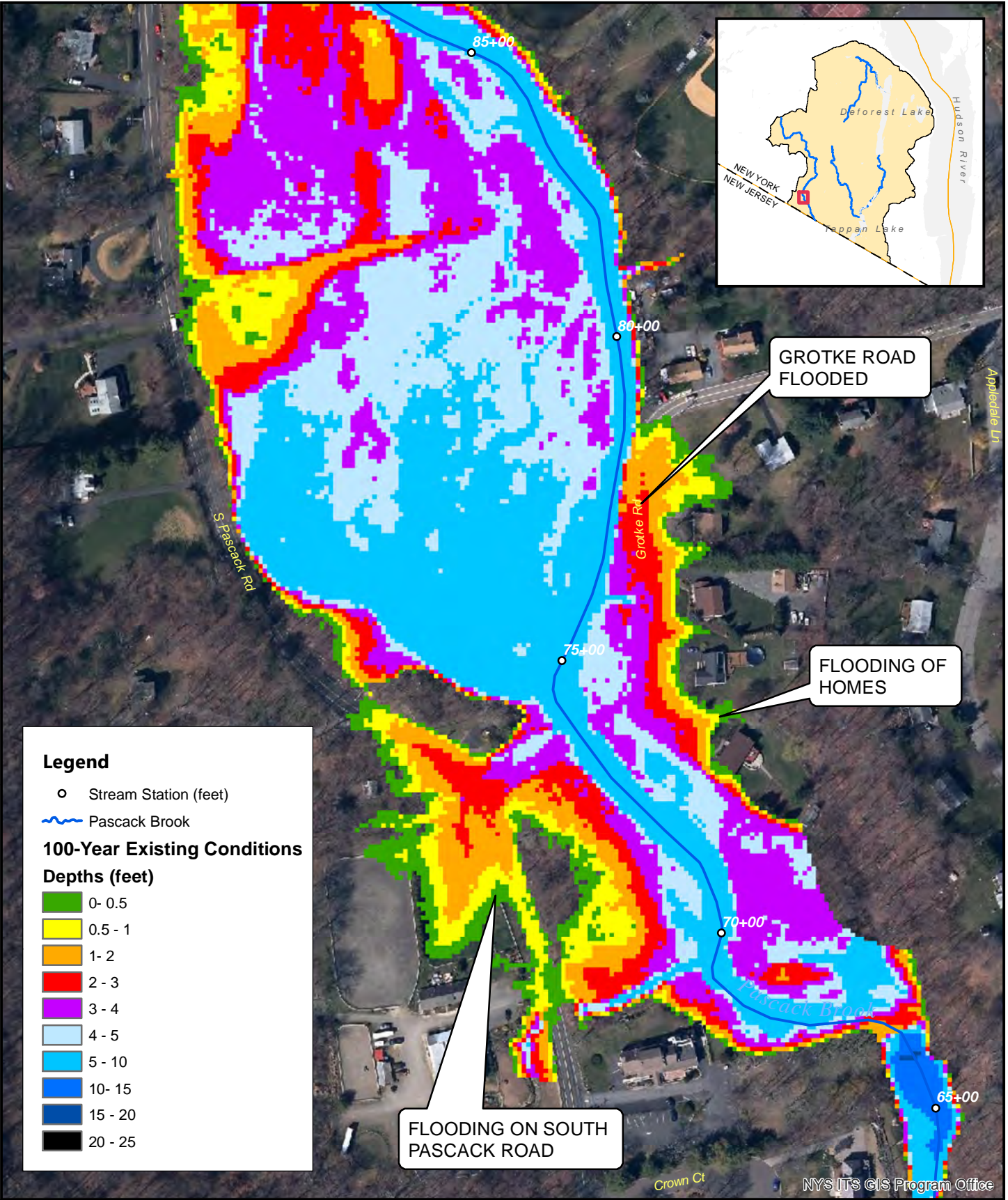
DATE 12/29/2021

PROJ. NO. 16511.00005



SOURCE: 2016 AERIAL PHOTO, NYS ITS GIS Program Office

**FIG. 4-81**



**Legend**

- Stream Station (feet)
- ~ Pascack Brook

**100-Year Existing Conditions**

**Depths (feet)**

- 0- 0.5
- 0.5 - 1
- 1- 2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 10
- 10- 15
- 15 - 20
- 20 - 25

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**HIGH RISK AREA #8 - 100-YEAR EXISTING CONDITIONS**

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 ROCKLAND COUNTY  
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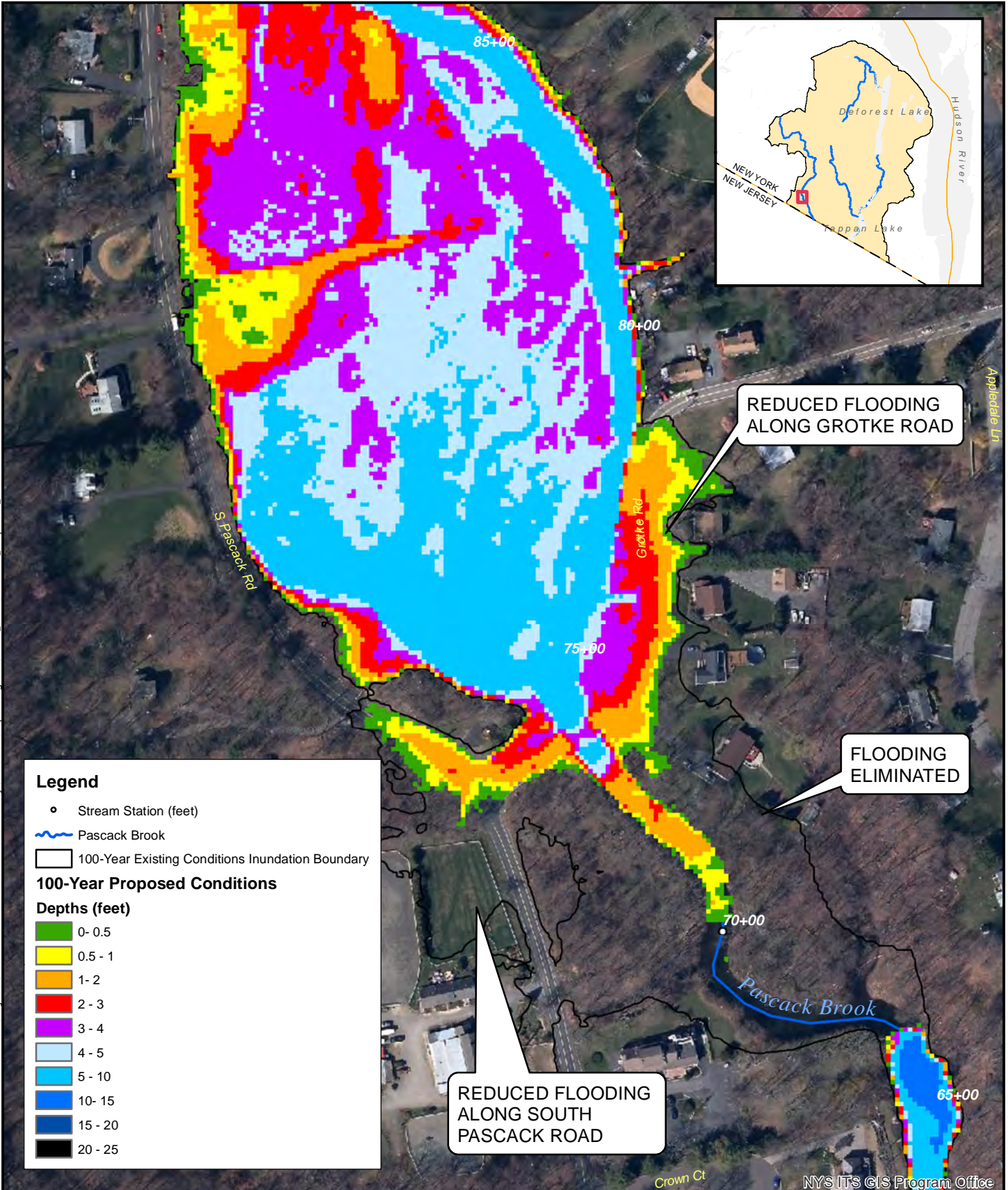
SCALE 1" = 200'

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**FIG. 4-82**

SOURCE: 2016 AERIAL PHOTO, NYS ITS GIS Program Office



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HIGH RISK AREA #8 - 100-YEAR PROPOSED CONDITIONS

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 ROCKLAND COUNTY  
 NEW YORK

SCALE 1" = 200'

DATE 12/29/2021

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**FIG. 4-83**

SOURCE: 2016 AERIAL PHOTO, NYS ITS GIS Program Office

## 5. RECOMMENDATIONS

This report identifies HRAs within the Hackensack River watershed. Flood mitigation recommendations are provided either as HRA-specific recommendations or as overarching recommendations that apply to the entire watershed or stream corridor. Flood mitigation scenarios such as floodplain enhancement and channel restoration, road closures, and replacement of undersized bridges and culverts are investigated and are recommended where appropriate.

### 5.1 HRA 1 RECOMMENDATIONS

The following actions are recommended in HRA 1:

- Replacement of CSX Railroad Bridge #1 with a larger bridge with a minimum span of 85 feet
- Replacement of CSX Railroad Bridge #2 with a larger bridge with a minimum span of 82 feet
- Floodproofing and voluntary buyouts of flood-prone structures in HRA 1

### 5.2 HRA 2 RECOMMENDATIONS

The following actions are recommended in HRA 2:

- Replacement of the town-owned Squadron Drive culvert with a new structure with a span of at least 44 feet
- Replacement of the Calvary Drive culvert (ownership unlisted) with a new structure with a span of at least 44 feet
- Widening the Demarest Kill channel to the bankfull width of 35 feet upstream of Cavalry Drive, between STA 113+00 and STA 122+50, where the channel is tightly confined between Route 304 and commercial buildings and parking lots
- Creation of floodplain benches along the Demarest Kill wherever possible along this section of channel. It is suggested that an approximately 850-linear-foot-long floodplain bench be constructed along the left bank, between STA 114+00 and STA 122+50, measuring 26 feet wide upstream and tapering down to 5 feet wide at its downstream terminus and a 340-foot-long, 16-foot-wide floodplain bench be constructed along the right bank between STA 114+00 and STA 117+40. The floodplain benches would be set at an elevation approximately 2.5 feet below existing grade.



### 5.3 HRA 3 RECOMMENDATIONS

The following actions are recommended in HRA 3:

- It is recommended that detailed mapping and measurements be obtained for the entire length of the county-owned twin box culverts that run 925 linear feet under the bank parking lot, North Main Street, and the shopping plaza parking lot. Once this information is obtained, a detailed hydraulic analysis should be undertaken to accurately model and evaluate the hydraulic capacity of the structure and recommend improvements.
- If further hydraulic analysis determines that replacement of the twin culverts is required, it is recommended that channel restoration be undertaken by daylighting all or portions of the culverts where they currently flow under the parking lots.

### 5.4 HRA 4 RECOMMENDATIONS

The following actions are recommended in HRA 4:

- Replacement of the Blauvelt Road crossing with a new bridge with a span of 45 feet
- Replacement of the State Route 304/Lake Nanuet Drive crossing with a new bridge with a span of 45 feet
- Widening 900 linear feet of channel along Nauraushaun Brook to a bankfull width of 36 feet between STA 130+00 and STA 139+00
- Floodproofing and voluntary buyouts of flood-prone homes in HRA 4

### 5.5 HRA 5 RECOMMENDATIONS

The following actions are recommended in HRA 5:

- Replacement of the Normandy Village bridge at STA 193+00 with a new structure with a span of at least 45 feet
- Replacement of the Normandy Village bridge at STA 191+50 with a new structure with a span of at least 45 feet
- Channel restoration entailing widening of the channel to a bankfull width of approximately 36 feet, for a distance of 300 linear feet as Nauraushaun Brook passes through Normandy Village, between STA 191+50 and STA 194+50
- Floodproofing and voluntary buyouts of flood-prone structures in HRA 5

## 5.6 HRA 6 RECOMMENDATIONS

The following actions are recommended in HRA 6:

- Creation of a floodplain bench immediately downstream of the Route 59 culvert is recommended. The floodplain bench would measure approximately 760 feet long from STA 201+40 to STA 209+00, vary in width between 50 to 130 feet depending on available space, and consume areas of parking lot along the right overbank. Excavation depths would average 12 feet below existing grade and range from 8 feet to 20 feet at its deepest.
- It is recommended that detailed mapping and measurements be obtained for the entire length of the culvert under Rockland Plaza. Once this information is obtained, a detailed hydraulic analysis should be undertaken to accurately model and evaluate the hydraulic capacity of the structure and recommend improvements.
- If further hydraulic analysis determines that replacement of the Rockland Plaza culvert is required, it is recommended that channel restoration be undertaken by daylighting all or portions of the culvert where it currently flows under the Rockland Plaza parking lot.

## 5.7 HRA 7 RECOMMENDATIONS

The following actions are recommended in HRA 7:

- Replacement of the Alice Drive crossing with a new structure with a minimum span of 45 feet
- Replacement of the I-87 crossing with a new structure with a minimum span of 45 feet
- Restoration of 1,350 linear feet of Nauraushaun Brook through and upstream of the culverts, from STA 249+00 to STA 262+50. Channel restoration would entail widening of the channel to its bankfull width of approximately 36 feet.
- Floodproofing and voluntary buyouts of flood-prone structures in HRA 7

## 5.8 HRA 8 RECOMMENDATIONS

The following actions are recommended in HRA 8:

- Removal of the privately owned, 17-foot-high mill dam at STA 66+25 and restoration of the channel through the former impoundment
- Inclusion of the mill dam at STA 66+25 in NYSDEC's dam inventory database
- Replacement of the Rockland County-owned Grotke Road bridge with a new bridge with a deck at an elevation 6 feet higher than the existing deck, a span of at least 68 feet, and the elimination of the piers

## 5.9 REPLACEMENT OF UNDERSIZED STREAM CROSSINGS

Hydraulically undersized stream crossings contribute to flooding and washout of roadways. In addition to the recommendations for the replacement of stream crossings within the HRAs described above, it is recommended that undersized stream crossings elsewhere in the Hackensack River watershed be identified and prioritized for replacement. Guidance for this prioritization should be based on capacity modeling and aquatic organism passage data for culverts in Rockland County that have been assessed through the North Atlantic Aquatic Connectivity Collaborative (NAACC) program. Where multiple stream crossings are slated for replacement along a reach of watercourse, it is recommended that replacements begin at the downstream end and progress sequentially in an upstream direction.

## 5.10 INSTALLATION AND MAINTENANCE OF STREAM GAUGES

The USGS gauge at West Nyack has been recording peak flow data since 1960. At flows greater than about 1,500 cfs, undetermined amounts of flow bypass the gauge as a result of overtopping of the Klein Avenue levee just upstream of the gauge. Therefore, the gauge is not considered reliable for peak-flow analysis. With the current project underway to enhance the Klein Avenue levee, it is recommended that the gauge be recalibrated to accurately represent peak flows on the Hackensack River.

There is currently no stream gauge in the State of New York on Pascack Creek or Nauraushaun Brook, making statistical analysis difficult. Stream gauges provide valuable data that can be used in future hydrologic analyses and to improve flood monitoring and forecasting. Installation of permanent stream gauges along these watercourses is recommended.

## 5.11 INDIVIDUAL PROPERTY FLOOD PROTECTION

A variety of measures is available to protect existing public and private properties from flood damage. While broader mitigation efforts are most desirable, they often take time and money to implement. On a case-by-case basis where structures are at risk, individual floodproofing should be explored. Property owners within FEMA-delineated floodplains should also be encouraged to purchase flood insurance under the NFIP and to make claims when damage occurs. Potential measures for property protection include the following:

Elevation of the structure – Home elevation involves the removal of the building structure from the basement and elevating it on piers to a height such that the first floor is located at least 2 feet above the level of the 100-year flood event. The basement area is abandoned and filled to be no higher than the existing grade. All utilities and appliances located within the basement must be relocated to the first-floor level or installed from basement joists or similar mechanism.

Construction of property improvements such as barriers, floodwalls, and earthen berms – Such structural projects can be used to prevent shallow flooding. There may be properties within the basin where implementation of such measures will serve to protect structures.

Dry floodproofing of the structure to keep floodwaters from entering – Dry floodproofing refers to the act of making areas below the flood level watertight and is typically implemented for

commercial buildings that would be unoccupied during a flood event. Walls may be coated with compound or plastic sheathing. Openings such as windows and vents can be either permanently closed or covered with removable shields. Flood protection should extend only 2 to 3 feet above the top of the concrete foundation because building walls and floors cannot withstand the pressure of deeper water.

Wet floodproofing of the structure to allow floodwaters to pass through the lower area of the structure unimpeded – Wet floodproofing refers to intentionally letting floodwater into a building to equalize interior and exterior water pressures. Wet floodproofing should only be used as a last resort. If considered, furniture and electrical appliances should be moved away or elevated above the 100-year flood elevation.

Performing other home improvements to mitigate damage from flooding – The following measures can be undertaken to protect home utilities and belongings:

- Relocate valuable belongings above the 100-year flood elevation to reduce the amount of damage caused during a flood event.
- Relocate or elevate water heaters, heating systems, washers, and dryers to a higher floor or to at least 12 inches above the BFE (if the ceiling permits). A wooden platform of pressure-treated wood can serve as the base.
- Anchor the fuel tank to the wall or floor with noncorrosive metal strapping and lag bolts.
- Install a backflow valve to prevent sewer backup into the home.
- Install a floating floor drain plug at the lowest point of the lowest finished floor.
- Elevate the electrical box or relocate it to a higher floor and elevate electric outlets.

Encouraging property owners to purchase flood insurance under the NFIP and to make claims when damage occurs – While having flood insurance will not prevent flood damage, it will help a family or business put things back in order following a flood event. Property owners should be encouraged to submit claims under the NFIP whenever flooding damage occurs in order to increase the eligibility of the property for projects under the various mitigation grant programs.

## 5.12 ROAD CLOSURES

Approximately 75 percent of all flood fatalities occur in vehicles. Shallow water flowing across a flooded roadway can be deceptively swift and wash a vehicle off the road. Water over a roadway can conceal a washed out section of roadway or bridge. When a roadway is flooded, travelers should not take the chance of attempting to cross the flooded area. It is not possible to tell if a flooded road is safe to cross just by looking at it.

One way to reduce the risks associated with the flooding of roadways is their closure during flooding events, which requires effective signage, road closure barriers, and consideration of alternative routes.



According to FEMA modeling and anecdotal reporting, flood-prone roads exist within the Hackensack River watershed. In some cases, small, unnamed tributaries and even roadside drainage ditches can cause washouts or other significant damage to roadways, culverts, and bridges. Drainage issues and flooding of smaller tributary streams are generally not reflected in FEMA modeling, so local public works and highway departments are often the best resource for identifying priority areas and repetitively damaged infrastructure.

### 5.13 ROUGH-ORDER-OF-MAGNITUDE COST RANGE OF KEY RECOMMENDATIONS

To assist with prioritization of the above recommendations, Table 5-1 provides an estimated cost range for key recommendations. More specific estimated costs are provided where possible. Due to the conceptual nature of recommended actions and significant amount of data required to produce a reasonable rough-order-of-magnitude cost, it is not feasible to further quantify the costs of all actions. Costs of land acquisition or easements are not included in the costs.

**Table 5-1: Cost Range of Recommended Actions**

Recommendation	< \$100k	\$100k - \$500k	\$500k - \$1M	\$1M - \$5M	> \$5M
HRA 1 - Replacement of CSX Railroad Bridge #1					X
HRA 1 - Replacement of CSX Railroad Bridge #2					X
HRA 2 - Replacement of Squadron Drive culvert			X		
HRA 2 - Replacement of Cavalry Drive culvert			X		
HRA 2 - Widening channel upstream of Cavalry Drive (\$550,000)			X		
HRA 2 - Creation of floodplain benches for 850 linear feet (\$550,000)			X		
HRA 3 - Obtain detailed mapping and measurements of twin box culverts under bank parking lot, North Main Street, and shopping plaza parking lot. Undertake detailed hydraulic analysis to accurately model and evaluate hydraulic capacity of structure and recommend improvements. (\$50,000)	X				
HRA 4 - Replacement of Blauvelt Road crossing			X		
HRA 4 - Replacement of State Route 304/Lake Nanuet Drive crossing					X
HRA 4 - Widening 900 linear feet of channel along Naurauschaun Brook (\$650,000)			X		
HRA 5 - Replacement of downstream Normandy Village bridge				X	
HRA 5 - Replacement of upstream Normandy Village bridge				X	

Recommendation	< \$100k	\$100k - \$500k	\$500k - \$1M	\$1M - \$5M	> \$5M
HRA 5 - Channel restoration for 300 linear feet as Nauraushaun Brook passes through Normandy Village (\$350,000)		X			
HRA 6 - Creation of 760 linear feet of floodplain bench immediately downstream of Route 59 culvert (\$475,000)		X			
HRA 6 - Obtain detailed mapping and measurements of box culvert under Rockland Plaza. Undertake detailed hydraulic analysis to accurately model and evaluate hydraulic capacity of structure and recommend improvements. (\$65,000)	X				
HRA 7 - Replacement of the Alice Drive crossing			X		
HRA 7 - Replacement of the I-87 crossing					X
HRA 7 - Restoration of 1,350 linear feet of Nauraushaun Brook (\$1M)				X	
HRA 8 - Removal of mill dam and restoration of channel through former impoundment <sup>1</sup>				X	
HRA 8 - Replacement of Grotke Road bridge				X	

1 - Cost of dam removal implementation will vary depending on quality and quantity of impounded sediment, need for grade control or scour protection measures at upstream crossings, construction accessibility, and other design considerations.

## 5.14 FUNDING SOURCES

Several funding sources may be available for the implementation of recommendations made in this report. These and other potential funding sources are discussed in further detail below. Note that these may evolve over time as grants expire or are introduced.

### Emergency Watershed Protection Program (EWP)

Through the EWP program, the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) can help communities address watershed impairments that pose imminent threats to lives and property. Most EWP work is for the protection of threatened infrastructure from continued stream erosion. NRCS may pay up to 75 percent of the construction costs of emergency measures. The remaining costs must come from local sources and can be made in cash or in-kind services. EWP projects must reduce threats to lives and property; be economically, environmentally, and socially defensible; be designed and implemented according to sound technical standards; and conserve natural resources.

### FEMA Pre-Disaster Mitigation (PDM) Program

The PDM program was authorized by Part 203 of the Robert T. Stafford Disaster Assistance and Emergency Relief Act (Stafford Act), 42 U.S.C. 5133. The PDM program provides funds to states, territories, tribal governments, communities, and universities for hazard mitigation planning and implementation of mitigation projects prior to disasters, providing an opportunity to reduce the nation's disaster losses through PDM planning and the implementation of feasible, effective, and cost-efficient mitigation measures. Funding of pre-disaster plans and projects is meant to reduce overall risks to populations and facilities. The PDM program is subject to the availability of appropriation funding as well as any program-specific directive or restriction made with respect to such funds.

<https://www.fema.gov/pre-disaster-mitigation-grant-program>



### FEMA Hazard Mitigation Grant Program (HMGP)

The HMGP is authorized under Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act. The HMGP provides grants to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. A key purpose of the HMGP is to ensure that any opportunities to take critical mitigation measures to protect life and property from future disasters are not "lost" during the recovery and reconstruction process following a disaster.



The HMGP is one of the FEMA programs with the greatest possible fit to potential projects recommended in this report. However, it is available only in the months subsequent to a federal disaster declaration in the State of New York. Because the state administers the HMGP directly, application cycles will need to be closely monitored after disasters are declared in New York.

<https://www.fema.gov/hazard-mitigation-grant-program>

### FEMA Flood Mitigation Assistance (FMA) Program

The FMA program was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the NFIP. FEMA provides FMA funds to assist states and communities with implementing measures that reduce or eliminate the long-term risk of flood damage to buildings, homes, and other structures insurable under the NFIP. The long-term goal of FMA is to reduce or eliminate claims under the NFIP through mitigation activities.



The Biggert-Waters Flood Insurance Reform Act of 2012 eliminated the Repetitive Flood Claims (RFC) and Severe Repetitive Loss (SRL) programs and made the following significant changes to the FMA program:

- The definitions of repetitive loss and SRL properties have been modified.
- Cost-share requirements have changed to allow more federal funds for properties with RFC and SRL properties.

- There is no longer a limit on in-kind contributions for the nonfederal cost share.

One limitation of the FMA program is that it is used to provide mitigation for *structures* that are insured or located in SFHAs. Therefore, the individual property mitigation options are best suited for FMA funds. Like PDM, FMA programs are subject to the availability of appropriation funding as well as any program-specific directive or restriction made with respect to such funds.

<http://www.fema.gov/flood-mitigation-assistance-grant-program>

#### NYS Department of State

The Department of State may be able to fund some of the projects described in this report. In order to be eligible, a project should link water quality improvement to economic benefits.

#### NYS Department of Environmental Conservation – Municipal Waste Reduction and Recycling (MWRR) Program

The NYS Department of Environmental Conservation (DEC) administers MWRR funding to local government entities for waste reduction and recycling projects. The overall goal of this funding program is to assist municipalities in expanding or improving local waste reduction and recycling programs and to increase participation in those programs.

The MWRR state assistance program can help fund the costs of the following:

- Capital Investment in Facilities and Equipment

Eligible projects are expected to enhance municipal capacity to collect, aggregate, sort, and process recyclable materials. Recycling equipment includes structures, machinery, or devices providing for the environmentally sound recovery of recyclables including source separation equipment and recyclables recovery equipment.

#### U.S. Army Corps of Engineers (USACE)

The USACE provides 100 percent funding for floodplain management planning and technical assistance to states and local governments under several flood control acts and the Floodplain Management Services (FPMS) Program. Specific programs used by the USACE for mitigation are listed below.

- Section 205 – Small Flood Damage Reduction Projects: This section of the 1948 Flood Control Act authorizes the USACE to study, design, and construct small flood control projects in partnership with nonfederal government agencies. Feasibility studies are 100 percent federally funded up to \$100,000, with additional costs shared equally. Costs for preparation of plans and construction are funded 65 percent with a 35 percent nonfederal match. In certain cases, the nonfederal share for construction could be as high as 50 percent. The maximum federal expenditure for any project is \$7 million.
- Section 14 – Emergency Stream Bank and Shoreline Protection: This section of the 1946 Flood Control Act authorizes the USACE to construct emergency shoreline and stream bank protection works to protect public facilities such as bridges, roads, public buildings, sewage treatment plants, water wells, and nonprofit public facilities such as churches, hospitals, and schools. Cost sharing is similar to Section 205 projects above. The maximum federal expenditure for any project is \$1.5 million.



- Section 208 – Clearing and Snagging Projects: This section of the 1954 Flood Control Act authorizes the USACE to perform channel clearing and excavation with limited embankment construction to reduce nuisance flood damages caused by debris and minor shoaling of rivers. Cost sharing is similar to Section 205 projects above. The maximum federal expenditure for any project is \$500,000.
- Section 206 – Floodplain Management Services: This section of the 1960 Flood Control Act, as amended, authorizes the USACE to provide a full range of technical services and planning guidance necessary to support effective floodplain management. General technical assistance efforts include determining the following: site-specific data on obstructions to flood flows, flood formation, and timing; flood depths, stages, or floodwater velocities; the extent, duration, and frequency of flooding; information on natural and cultural floodplain resources; and flood loss potentials before and after the use of floodplain management measures. Types of studies conducted under FPMS include floodplain delineation, dam failure, hurricane evacuation, flood warning, floodway, flood damage reduction, stormwater management, floodproofing, and inventories of flood-prone structures. When funding is available, this work is 100 percent federally funded.

In addition, the USACE provides emergency flood assistance (under Public Law 84-99) after local and state funding has been used. This assistance can be used for both flood response and postflood response. USACE assistance is limited to the preservation of life and improved property; direct assistance to individual homeowners or businesses is not permitted. In addition, the USACE can loan or issue supplies and equipment once local sources are exhausted during emergencies.

#### New York State Grants

All New York State grants are now announced on the NYS Grants Gateway. The Grants Gateway is designed to allow grant applicants to browse all NYS agency anticipated and available grant opportunities, providing a one-stop location that streamlines the way grants are administered by the State of New York. <https://grantsmanagement.ny.gov/>

#### Environmental Facilities Corporation

The Environmental Facilities Corporation (EFC) helps local governments and eligible organizations undertake water infrastructure projects. EFC provides grants and financing to help ensure projects are affordable while safeguarding essential water resources. EFC administers state and federal grants as well as interest-free and low-cost financing to help minimize the tax burden for communities.

<https://efc.ny.gov>

The EFC's Green Innovation Grant Program (GIGP) supports projects across New York State that utilize unique EPA-designated green stormwater infrastructure design and creates cutting-edge green technologies. Competitive grants are awarded annually to projects that improve water quality and mitigate the effects of climate change through the implementation of one or more of the following green practices: Green Stormwater Infrastructure, Energy Efficiency, and Water Efficiency.

<https://efc.ny.gov/gigp>

### Bridge NY Program

The Bridge NY program, administered by NYSDOT, is open to all municipal owners of bridges and culverts. Projects are awarded through a competitive process and support all phases of project development. Projects selected for funding are evaluated based on the resiliency of the structure, including such factors as hydraulic vulnerability and structural resiliency; the significance and importance of the bridge including traffic volumes, detour considerations, number and types of businesses served and impacts on commerce; and the current bridge and culvert structural conditions.

<https://www.dot.ny.gov/BRIDGENY>.

### Private Foundations

Private entities such as foundations are potential funding sources in many communities. Communities will need to identify the foundations that are potentially appropriate for some of the actions proposed in this report.

In addition to the funding sources listed above, other resources are available for technical assistance, planning, and information. While the following sources do not provide direct funding, they offer other services that may be useful for proposed flood mitigation projects.

### Land Trust and Conservation Groups

These groups play an important role in the protection of watersheds, including forests, open space, aquatic ecosystems, and water resources.

Communities will need to work closely with potential funders to ensure that the best combinations of funds are secured for the proposed alternatives and for the property-specific mitigation such as floodproofing, elevations, and relocations. It will be advantageous for the communities to identify combinations of funding sources in order to reduce their own requirement to provide matching funds.

## 6. LAND USE ANALYSIS

### 6.1 LAND USE AND ZONING REVIEW AND ANALYSIS

Potential changes in land use, particularly development proposals in close proximity to a waterbody or within a riparian buffer, can bring about issues and consequences not only for the impact on those developments should a flood occur but also as a contributor to the flooding problem itself. In New York State, land use is controlled at the municipal level through zoning, subdivision, and other related regulations including wetlands and floodplain ordinances.

A significant amount of work has been conducted by the state, Rockland County, and local municipalities following flood events such as Tropical Storm Irene or Hurricane Sandy. This has emphasized the need for immediate disaster response as well as an understanding that situations surrounding such disasters need to be assessed and plans developed to mitigate likely future repeat events.

One agency in Rockland County that has regulatory jurisdiction over activities within 100 feet of specified streams, including portions of the Hackensack River and its tributaries, is the Rockland County Drainage Agency. <http://rocklandgov.com/departments/highway/drainage-agency/>

This analysis reviewed publicly available project-relevant documents found online to identify recommendations and opportunities identified for communities to address issues related to flooding through land use and zoning. This analysis also provides "best practice" recommendations that communities in Rockland County can review and discuss implementing if not already in the municipal code. A significant and positive finding from this effort is that every community assessed within the Hackensack Watershed has adopted a Flood Damage Prevention Ordinance. These ordinances, generally adopted in 2013 and 2014, go a long way toward addressing potential issues and concerns related to flooding and land use planning.

Our review of the following documents did not find any municipal-specific land use or zoning recommendations to carry forward for this project. We have summarized any potential recommendations related specifically to flooding that may be useful to consider when assessing potential changes to existing zoning, subdivision, and other regulations that could impact flood-related conditions:

- All Rockland County communities have a flood damage prevention ordinance. The standards adopted can vary from community to community, but they all provide construction standards for actions within flood hazard areas.
- All Rockland County communities are under the "umbrella" of the 2011 Rockland County Comprehensive Plan *Rockland Tomorrow: County Comprehensive Plan*. There are only a few specific mentions or recommendations related to flooding and flood prevention for individual municipalities, but where such a mention is made, it is included under that community below. All communities fall within the following recommendations from the Plan:
  - Land Use and Zoning Chapter
    - No key issues are identified.

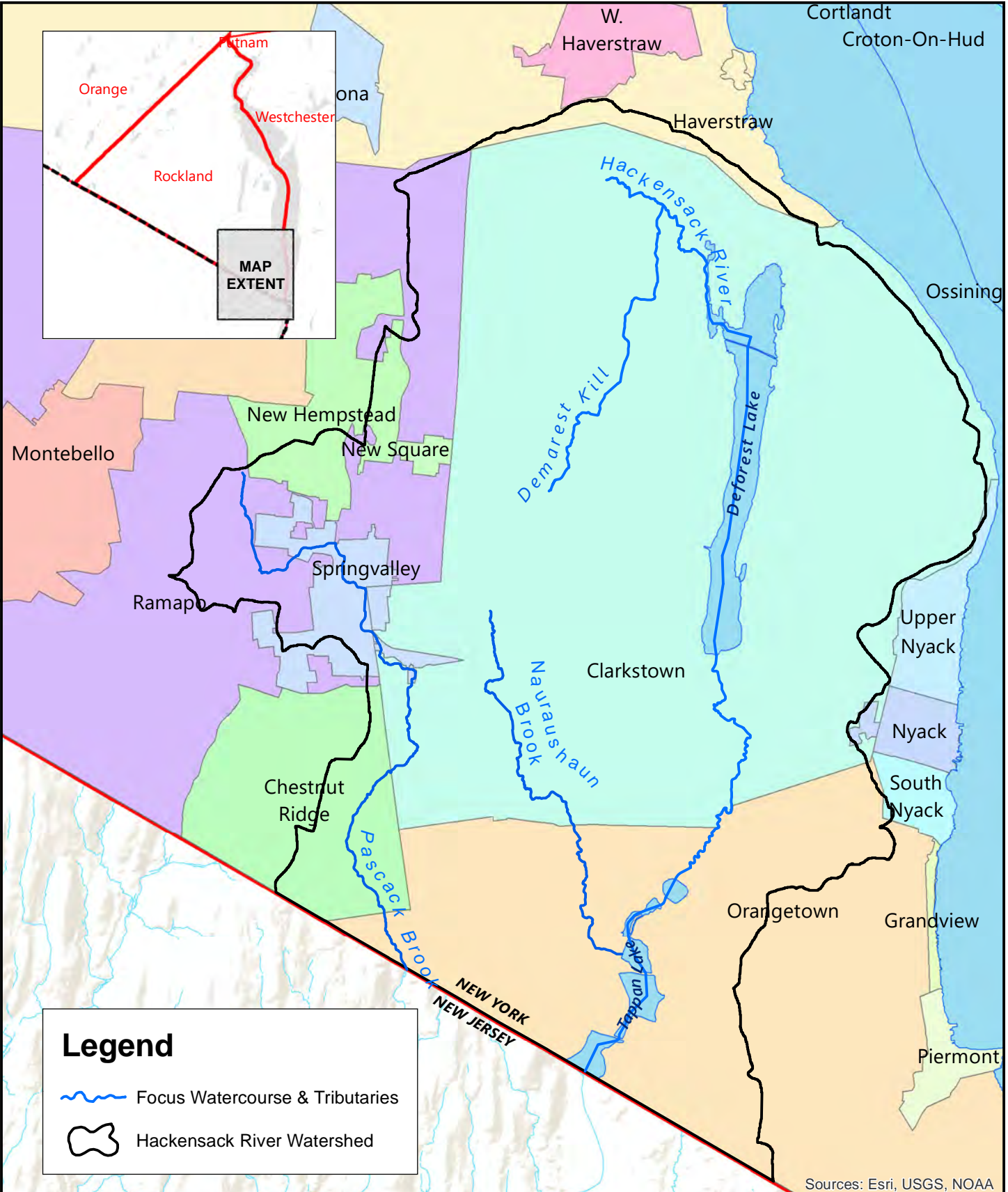
- Natural Resources Chapter - Encourage the municipalities to establish buffers along streams as appropriate, with the specific distance dictated by conditions on the ground and scientific study.
- Infrastructure Chapter - Use planning techniques for green infrastructure and stormwater management, as provided by the NYSDEC.
- *Cleaner, Greener Communities Mid-Hudson Regional Sustainability Plan (Mid-Hudson Planning Consortium) 2013*
  - This plan was developed to "...set realistic yet ambitious objectives for the long term sustainable development of the Region, each of which is supported by initiatives and projects that can be implemented in the short-, medium-, and long-term." The plan lists 218 project ideas, some of which are directed toward Rockland County specifically, but none of those projects is flood or land use/zoning focused. That said, there are Mid-Hudsonwide recommended projects related to flooding that are relevant including the following:
    - Project 6 – Scenic Hudson is working with 16 land trusts and government agencies to save ridgelines with iconic views, forests, and wetlands critical to maintaining the Hudson Valley's extraordinary biological diversity and farmland.
    - Project 44 – Hudson River Greenway Water Trail – a 256-mile, 96-site water trail for kayakers and boaters extending from the Adirondack Park and Lake Champlain to Manhattan
    - Project 63 – Install porous pavement in municipalities.
    - Project 188 – Increases in the extent of riparian buffers
    - Project 203 – Watershed remediation. This project will help identify and target funds to specific vulnerable locations to protect roads and other facilities from flooding.
    - Project 212 – Get municipalities involved in green infrastructure. Enable more green infrastructure projects by removing cost and knowledge barriers.
- Rockland County Hazard Mitigation Plan (HMP)
  - This plan "...demonstrates county and community commitment to reducing risks from all hazards and serves as a guide for decision makers as they commit resources to minimize the effects of hazards. The HMP is the blueprint for reducing the county's vulnerability to disasters and hazards. The HMP is intended to integrate with county and municipal planning mechanisms already in place, such as building and zoning regulations, environmental planning, and long-range planning mechanisms."
    - All Rockland County communities had a Jurisdictional Annex developed detailing information about their community. A summary of the relevant information from these Annexes is provided below.

## 6.2 MUNICIPAL ASSESSMENTS

The following section details individual recommendations for each community being assessed within the Hackensack River Watershed. A map with the boundaries of the Hackensack River watershed and the towns and villages that fall within it is depicted in Figure 6-1. In the recommendations section of this

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report are "best practices" that each community can review to assess whether or not they are already in their municipal code or are an opportunity to enhance the code to further protect municipal resources, residents, businesses, and the natural environment from unplanned and unwanted impacts from flooding.



Sources: Esri, USGS, NOAA

**Legend**

- Focus Watercourse & Tributaries
- Hackensack River Watershed

**SLR**

231 MAIN STREET  
 SUITE 102  
 NEW PALTZ, NY 12561  
 845.633.8153

**HACKENSACK RIVER WATERSHED TOWNS & VILLAGES**  
 HACKENSACK RIVER FLOOD & RESILIENCY STUDY  
 SD109  
 ROCKLAND COUNTY  
 NEW YORK

0 4,000 8,000  
 Feet

SCALE 1" = 7,896'  
 DATE 12/30/2021  
 PROJ. NO. 16511.00005

**FIG. 6-1**

## 6.2.1 TOWN OF CLARKSTOWN

### Zoning & Other Code(s) Analysis

<https://ecode360.com/6709501>

The town has a "Flood Damage Prevention" code (Chapter 146) adopted in 2014. The Town of Clarkstown considers flooding and stormwater management throughout multiple sections of its codes. There are frequent references to discouraging activities that contribute to downstream flooding. This chapter has standards related to elevation and flood-resistant construction.

Chapter 249A, Stormwater Management has a 10,000-square-foot threshold for a SWPPP (which is less than the required 1+ acre). The section on Usable Open Space for multifamily or single-family attached residences requires exclusion of wetlands, floodplain, and natural features.

The Subdivision of Land Ordinance, Chapter 254, states that land that floods shall not be subdivided for residential purposes.

The Tree Preservation Ordinance, Chapter 270, discusses how trees stabilize soil on slopes, preventing flooding.

The Hamlet of Nanuet Transit Oriented Development Zoning also discusses capturing stormwater runoff to mitigate flooding and the use of green infrastructure (Chapter 290-7.8).

#### Other Land Use documents reviewed:

- *Rockland Tomorrow: County Comprehensive Plan 2011*
  - Specific elements detailed in the plan specific to Clarkstown include a reference to the town's 10,000-square-foot threshold for a SWPPP (which is less than the required 1+ acre).
- The Town of Clarkstown NY Rising Community Reconstruction Plan from 2014 proposed a number of stormwater drainage improvement projects including culvert replacements, green infrastructure improvements, and stream bank restoration.
- The Hamlet of Nanuet Transit Oriented Development Plan from 2017 discusses how the study area has experienced significant flooding and noted that any proposed development would have to mitigate flooding.
- The Town of Clarkstown has a Comprehensive Plan from 2009 that is currently being updated. The 2021 Draft Comprehensive Plan includes recommendations about the continued acquisition of open space lands to protect sensitive environmental areas, which includes wetlands, floodplains, and riparian buffers. It discusses continuing to develop zoning and building regulations that "reduce and eliminate potential drainage or flooding problems resulting from new construction." Additional recommendations include establishing stream protection corridors, enacting a wetland protection ordinance, designating Critical Environmental Areas, and requiring stormwater management to "a higher extent than currently applicable where development is proposed in watersheds which experience flooding."

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## 6.2.2 TOWN OF ORANGETOWN

### Zoning & Other Code(s) Analysis

<https://ecode360.com/26866922>

The town has a "Flood Damage Prevention" code (Chapter 14B) that regulates development activities and outlines requirements to prevent flood-related damage. Article XIV of the Town Code provides regulations for the Sparkill Hamlet Center Overlay Zoning District. This section does not include regulations regarding flooding-related issues; however, the Overlay Zoning District does note that said regulations within the Overlay do not impact preexisting structures that are damaged by flood, fire, or other natural disaster. The *Zoning Notes to Use and Bulk Chart* restricts the amount of land that counts toward lot area if said land is under water. The Conservation Easements Section (21-7.1) provides the Planning Board with authorization to require a conservation easement on real property with unique scenic value in the Critical Environmental Area; any land under water; any land within a freshwater wetland; land subject to flooding or within the 100-year-frequency floodplain; land with slopes (unexcavated) of over 25 percent; and on any other real property for the purpose of protecting environmentally sensitive land or to otherwise protect the environment or land due to special characteristics or the character of the neighborhood wherein subdivision is sought. The code allows the Planning Board to require conservation easements for flood-prone areas.

Chapter 42 "Zoning and Building Permits: Moratorium" states that the town *had* a law requiring that building permits for residential and nonresidential construction and subdivisions not be approved in areas designated as 100-year "storm frequency" as set forth in the Weaver Report concerning the Sparkill Creek, the Velzy Report concerning the Nauraushaun Creek, and the Larkin Report concerning the Pascack Creek. These regulations expired in 1974 but are still listed in the code.

## 6.2.3 TOWN OF RAMAPO

### Zoning & Other Code(s) Analysis

<https://ecode360.com/11858832>

The town has a "Flood Damage Prevention" code (Chapter 149). The code has standards related to elevation and flood-resistant construction. Section 376-42 of the Zoning Ordinance requires that not more than 50 percent of a lot be land under water or land in the 100-year floodplain.



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## Other Land Use Documents Reviewed:

The Town of Ramapo has a number of plans that are relevant to this flood study, in addition to the Rockland County Hazard Mitigation Plan, which are summarized below.

- *Rockland County Multi-Jurisdictional Natural Hazard Mitigation Plan Update 2018*
  - Integrate hazard mitigation and hazard areas into the Comprehensive Plan. Action 1B.
  - Hold periodic workshops regarding zoning and planning issues that arise regarding natural hazards and hazard mitigation. Action 4.
  - Review and update existing local codes/ordinances against the identified hazards to determine whether there needs to be any amendments to address identified hazards and, where a need is identified modify/amend the codes/ordinances as applicable. Action 12.

There were no publicly available documents created since 2018 to review related to this recommendation; however, the town adopted a Flood Damage Prevention Ordinance in 2014, and the code has standards regarding lot coverage for floodplains and areas under water.

- *Town of Ramapo Comprehensive Plan 2004*
  - Assess whether or not to enact a wetlands law to provide an additional level of protection for wetlands.
  - Assess whether or not to require vegetation buffer zones along watercourses.
  - Consider reducing the permitted development intensity by:
    - Requiring that the area of the lot without the specified impediments be a contiguous area and in a location on the lot that makes development on it feasible in light of other considerations.
    - Increase the percentage of the lot that must be free of the specified impediments from 50 percent to a higher percentage (e.g., 75 percent).
    - Require that wetland areas be dedicated from minimum lot area requirements.
    - Consider decreasing the percentage of such areas that may be counted toward meeting the lot area requirement from 50 percent to a lower percentage (e.g., 25 percent).
    - Apply these provisions to lots intended for nonresidential use – the first sentence of Section 376-42.A states that these provisions apply only to minimum lot area requirements for residential uses.

Some code changes that relate to these topics have been implemented since the 2004 Comprehensive Plan.

- For Subdivision regulations, consider the following revisions:
  - Identify any standards which are inconsistent with the objective of minimizing overall land disturbance during subdivision development. Examples include reducing roadway widths, required cul-de-sac dimensions, etc. to reduce the amount of land disturbance and impervious surface.

- The Town of Ramapo should protect rivers and streams, including their riparian buffers, banks, and floodplains. Preference should be given to the following:
  - Properties within the 100-year floodplain of rivers and streams
  - Properties adjacent to the water bodies identified as stressed, threatened, impaired, or precluded on the NYSDEC Priority Water Body List
  - Properties adjacent to Class A waters (a water body classified by the NYSDEC as suitable for swimming) rivers or streams, or rivers and streams which support fish
  - Riparian buffers (an area of trees, shrubs, and herbaceous vegetation located adjacent to and upslope from a lake, stream, or other body of water which maintains stream system integrity, protects water quality, and improves the habitat of plants and animals on land and in the water) along stream or river corridors
  - Properties that surround or adjoin springs or intermittent streams

Some code changes that relate to these topics have been implemented since the 2004 Comprehensive Plan.

- The town should protect its watershed. Preference should be given to:
  - ...Wetlands, floodplains, and riparian buffers.
- For Housing...
  - Properties to be considered for multifamily rezoning should be unencumbered by environmental resources such as steep slopes, wetlands, streams, floodplains, and other factors that would suggest that the property is not suitable for the intensity of development proposed.

A Northeast Ramapo Strategic Plan is/was under development.

#### 6.2.4 VILLAGE OF NEW HEMPSTEAD

##### Zoning & Other Code(s) Analysis

<https://ecode360.com/30180572>

The village has a "Flood Damage Prevention" code (Chapter 154). The code has standards related to elevation and flood-resistant construction.

Village of New Hempstead Table of Dimensional Requirements includes the following standards:

No part of any land within an access easement or right-of-way shall be counted toward the minimum lot area. Only 25 percent of any land under water or within land defined as a wetland by Chapter 159, Freshwater Wetlands, of the Code of the Village of New Hempstead or within a 100-year-frequency floodplain or within a drainage easement containing open drainage channels or facilities or within a utility easement containing overhead lines or equipment or with unexcavated slopes over 25 percent shall be counted toward the minimum lot area. Only 75 percent of any land within a conservation easement or within a drainage easement containing only piped drainage facilities or within a sewer easement or utility

easement containing only underground facilities shall be counted toward the minimum lot area. The rules set forth herein shall apply with equal effect to preexisting and proposed easements and rights-of-way.

#### Other Land Use Documents Reviewed:

- *Village of New Hempstead Comprehensive Plan – 2020*
  - The Village Comprehensive Plan is a policy document focused on nine basic land use planning-focused principles. None of the principles specifically lists flooding.
  - There are four areas within the 100-year floodplain and one location within the 500-year floodplain. The Pascack Brook is identified as having some floodplain within the village though it was not detailed in the plan. The floodplain around the New York Country Club contains approximately 55 acres of Zone A Floodplain. The plan notes that such a use would seem ideal for an area within a floodplain; however, golf courses are not specifically exempted from the village's Flood Damage Prevention Law. There is Zone A floodplain around the South Branch of the Minisceongo Creek covering approximately 45 acres of land within the northern portion of the village. There are multiple properties within or partly within the floodplain, including residential structures. There is an approximately 6.5-acre floodplain near Ashlawn Court with at least one dwelling located within the floodplain. The plan recommended that the village "promote" setbacks from a stream and elevation above the BFE for new development and additions.
  - The plan notes that the village is working with others to form a Stormwater Consortium which could, among other objectives, "...attenuate flood risk." *The status of this consortium should be confirmed as this is a positive step toward coordinated efforts that cross municipal boundaries.*
  - Quality Neighborhoods Goal #9 is to "Promote stormwater quality and ensure there is not increased potential flooding from land use layouts which enable rapid flows off-site..."

#### 6.2.5 VILLAGE OF WEST HAVERSTRAW

##### Zoning & Other Code(s) Analysis

<https://ecode360.com/5092559>

The village has a "Flood Damage Prevention" code (Chapter 112) that was adopted in 2014. This section includes standards related to elevation and flood-resistant construction.

#### Other Land Use Documents Reviewed:

The village is located within the town of Haverstraw. The Village of West Haverstraw did not have any readily publicly available municipal planning documents for review.

- *Rockland County Multi-Jurisdictional Natural Hazard Mitigation Plan Update 2018*
  - Update the comprehensive plan to incorporate natural disaster mitigation techniques. This is a high priority initiative. Recommendation VWH-2.

## 6.2.6 TOWN OF HAVERSTRAW

### Zoning & Other Code(s) Analysis

<https://ecode360.com/11795031>

The town has a "Flood Damage Prevention" code (Chapter 87). Section 167-65, Floodplain Buffer, has a 15-foot buffer requirement adjacent to the 100-year floodplain.

Section 167-36, multifamily housing in the Waterfront Redevelopment District (WRD), has provisions to exclude water bodies from the buildable lot area. Additionally, the first-floor elevation for all buildings and parking areas shall be above the limits of the floodplain (adjusted for wave action – no less than 2 feet above the 100-year floodplain). Regarding minimum lot area, no more than 50 percent of any lot may include lands under water or within the 100-year floodplain.

### Other Land Use Documents Reviewed:

The Town of Haverstraw did not have any readily publicly available municipal planning documents for review.

- *Rockland Tomorrow: County Comprehensive Plan 2011*

Elements detailed in the plan specific to the Town of Haverstraw include the following:

- Land Use and Zoning Chapter
  - Key issues identified: The riverfront presents significant opportunities for Haverstraw's revitalization, especially with the existence of the Haverstraw-Ossining ferry service. Constraining issues in the town include the ongoing presence of waterfront industry – which, while important to the town's economic development strategy can affect future redevelopment of the waterfront and impede public access to the Hudson River – and the challenge of providing ways to safely connect isolated commercial and multifamily housing uses.
- Floodplains – High flood risk – large flood zones along Hudson River

## 6.2.7 VILLAGE OF NEW SQUARE

### Zoning & Other Code(s) Analysis

Based on research conducted, the Village of New Square revised its Zoning Code in its entirety in 2019 though a final adopted local ordinance was not located. Local Law No. 1 (as drafted for Rockland County General Municipal Law [GML] comments on 11-19-19) stated that it repealed and amended the original Zoning Code of 1967 and amendments of 2007. The resulting code was drafted, according to the Comprehensive Plan (also updated in 2019), to simplify the Village Zoning Code. The new Zoning Code does not include any direct references to flooding or flood protection though it is included indirectly via general statements regarding public health, safety, and welfare. In reviewing other plans conducted for Rockland County, it appears that the village has a stormwater management plan and Flood Damage Prevention Ordinance per the *Rockland County Multi-Jurisdictional Natural Hazard Mitigation Plan Update*, but these were not readily available online.

**Other Land Use Documents Reviewed:**

- *Rockland County Multi-Jurisdictional Natural Hazard Mitigation Plan Update 2018*
  - Ensure that local comprehensive plans incorporate natural disaster mitigation techniques. This is a high priority Initiative (VP-1).
  - New Square is discussed related to its increase in development (and impervious surfaces).
- The village undertook a Comprehensive Plan update in 2019 through what appears to be a coordinated effort with the rezoning also done that year. The plan discusses the need to provide onsite storm drainage and detention systems and notes that there are two streams running through the village, but nothing specific to flooding is discussed in the plan.

The Village of New Square did not have any other readily publicly available municipal planning documents for review.

**6.2.8 VILLAGE OF SPRING VALLEY****Zoning & Other Code(s) Analysis**

<https://ecode360.com/9395826>

The village has a "Flood Damage Prevention" code (Chapter 126) that was adopted in 1987 with many revisions since that time. The Chapter has standards related to elevation and flood-resistant construction.

The Freshwater Wetlands code (Chapter 130) also provides protections intended to, among other issues, assist in flood and storm control. The standards for permit decisions include the consideration or effects of a proposed activity or action as it relates to public health and welfare...flood, hurricane, and storm damages.

The Village Subdivision Code (Chapter 232) general standards state that land to be subdivided shall be of such character that it can be safely used for building purposes without danger of flooding, among other items. This code also has requirements for how land under water can be subdivided with no more than 25 percent of the minimum lot area required under the Zoning Law being satisfied by land that is under water.

The Village Stormwater Management and Erosion and Sediment Control Code (Chapter 222) includes standards for a SWPPP and requires details on any wetland or drainage patterns that could be impacted by construction activities.

**Other Land Use Documents Reviewed:**

The Village of Spring Valley did not have any readily publicly available municipal planning documents for review.

- *Rockland County Multi-Jurisdictional Natural Hazard Mitigation Plan Update 2018*
  - Ensure that local comprehensive plans incorporate natural disaster mitigation techniques. This is a high priority Initiative (VP-1).

## 6.2.9 VILLAGE OF CHESTNUT RIDGE

### Zoning & Other Code(s) Analysis

<https://ecode360.com/CH3561>

The village has a "Flood Damage Prevention" code (Chapter 158) that was adopted in 1987 with many revisions since that time. The Chapter has standards related to elevation and flood-resistant construction.

The Wetlands code (Chapter 277) provides policies and regulations related to preserving, protecting, and conserving wetlands, water bodies, and watercourses and to implement Article 24 of the NYS Environmental Conservation Law. The purpose statement specifically notes that protecting, preserving, and maintaining wetlands, water bodies, and watercourses can prevent or minimize erosion due to flooding and stormwater runoff.

The Village Subdivision of Land code (Chapter 254) general standards state that land to be subdivided shall be of such character that it can be safely used for building purposes without danger of flooding. This code also has requirements for how land under water can be subdivided with no more than 25 percent of the minimum lot area required under the Zoning Law being satisfied by land which is under water.

The Village Stormwater Management code (Chapter 243) includes standards for a SWPPP and requires details on any wetland or drainage patterns that could be impacted by construction activities.

### Other Land Use Documents Reviewed:

- *Rockland County Multi-Jurisdictional Natural Hazard Mitigation Plan Update 2018*
  - Ensure that local comprehensive plans incorporate natural disaster mitigation techniques. This is a high priority Initiative (VP-1).
- *Village of Chestnut Ridge Comprehensive Plan – Draft October 14, 2020*
  - The village was in the process of updating its Comprehensive Plan in late 2020 and had posted the Draft Generic Environmental Impact Statement information online, but no new information has been posted since.
  - The plan notes that the Hungry Hollow Brook, Pine Brook, and Pascack Brook all have FEMA-designated floodplains but that floodplains (and wetlands) comprise a relatively small area compared to other villages.
  - The Environmental Protection Goal & Objectives (Section 4.2, Goal #2.1) states that an objective is to protect environmentally sensitive stream ecosystems and floodplains, including Hungry Hollow Brook, Pine Brook, and Pascack Brook, and maintain adequate buffers between these systems and adjoining development.

## 6.2.10 VILLAGE OF UPPER NYACK

### Zoning & Other Code(s) Analysis

<https://www.uppernyack-ny.us/building-department/pages/zoning-ordinances>

The village has a Flood Control code (Section 16:63) that was adopted in 1975. If a location has a flood hazard, the code states that it must be designed or modified and anchored, use materials resistant to flood damage, and use methods and practices that minimize flood damage.

The Zoning code requirements for a Special Use permit state that no portion of any land under water shall be counted toward the minimum lot area. No more than 25 percent of any land defined as wetlands or within a 100-year floodplain, a utility or drainage easement, or right-of-way shall count toward the minimum lot area.

The village has a Stormwater Management and Sediment control code (Section 33). This code includes requirements for a SWPPP and details what is required within these plans to, among other items, minimize increases in stormwater runoff from land development activities in order to reduce flooding.

The village has a Stream Conservation Ordinance (Ordinance 8.5) that provides regulations intended to protect wetlands.

#### **Other Land Use Documents Reviewed:**

- *Rockland County Multi-Jurisdictional Natural Hazard Mitigation Plan Update 2018*
  - Ensure that local comprehensive plans incorporate natural disaster mitigation techniques. This is a high priority Initiative (VP-1).
- Comprehensive Plan Update V2
  - Section 11: Natural Resources
    - The village has enacted ordinance provisions (Ordinance 8.5) to regulate the alteration of existing stream channels and have easements secured through the development process, as well as the Stormwater Control regulations in the Zoning Ordinance.
    - The only point of direct access to the Hudson River is Nyack Beach State Park. Although a significant portion of the park is within village boundaries, it is solely under the control of the NYS Department of Parks, Recreation and Historic Preservation.
    - This chapter provides several relevant recommendations to protect streams and watercourses including the following:
      - Undertake stream mapping to more completely identify streams, watercourses, and the drainage network.
      - Provide stream buffers along stream channels.
      - Require new development and renovation projects to install stormwater mitigation measures to maintain predevelopment runoff rates and encourage infiltration and recharge.
      - Daylight streams.
      - Acquire easements over existing streams including protective easements to prevent alterations to a channel or easements to permit the village to make channel improvements to prevent flooding.
  - Section 13: Climate Planning and Resilience

- Protection of stream channels from the adverse effects of increased storm flows is important for stream bank stabilization and minimization of channel bank erosion. Stream channels serve to provide stormflow capacity in the channel or over bank areas...thus reducing storm flooding of surrounding areas or surcharging of "hard pipe" drainage systems.
- The Crumbie Creek is the largest stream traversing the village from west to east and shows signs of bank scour and stream movement as well as higher flows because of the redirection of tributary drainage area by installation of offsite drainage during construction of the Wanamaker Lane subdivision. It would benefit the stream to have the tributary drainage area restored to the Castle Heights outfall, if possible.
- Much of the development of the village occurred prior to any regulations requiring stormwater management, mitigation of increased runoff, or runoff reduction measures. As a result, there are many drainage systems not capable of handling present-day storm flows. This has resulted in surface flow over roads and onto properties and in some cases flooded homes and structures. The following strategies are recommended to help mitigate the negative impacts of stormwater runoff:
  - Map wetlands.
  - Stormwater Storage and Detention Systems: Provide stormwater storage and detention to add resilience to future storm events.
  - Stormwater Runoff Reduction: Recreate the natural drainage pattern of absorption or infiltration of rainfall by revising regulations to require this practice for all levels of development and soil disturbance.
  - Permeable vs. Nonpermeable surfaces: Promote the use of pervious or permeable surfaces and make these part of the consideration during review of land use applications.
- Review site plan regulations and revise to incorporate best practices in sustainable site design.

### 6.2.11 VILLAGE OF NYACK

#### Zoning & Other Code(s) Analysis

<https://ecode360.com/31136157>

The village has a "Flood Damage Prevention" code (Chapter 205). The Chapter has standards related to elevation and flood-resistant construction.

The Natural and Scenic Resource Protection Standards (Section 360-4.4) require floodplains and wetlands, among other features, and require both to be protected to the maximum extent practicable.

The Village Subdivision Code (Section 360-4.13) general standards state that land to be subdivided shall be of such character that it can be safely used for building purposes without danger of flooding.



A unique element in the Village Code is the Watercourses and Ponds regulations (Chapter 338), which prohibit obstructing any watercourse so as to interfere in any way with the free passage of water therein.

The Village Stormwater Management code (Chapter 295) includes standards for a SWPPP.

#### **Other Land Use Documents Reviewed:**

- *Rockland County Multi-Jurisdictional Natural Hazard Mitigation Plan Update 2018*
  - Ensure that local comprehensive plans incorporate natural disaster mitigation techniques. This is a high priority Initiative (VP-1).
- *The Village of Nyack Comprehensive Plan – 2016*
  - The Nyack Brook has a major impact on planning and land use decisions. The brook has been channelized and piped in most locations in the village, reducing the brook's capacity during large stormwater events and thus becoming a major contributor to flooding in downtown Nyack. The Green Infrastructure Report identified many options for improving the condition of the brook, including daylighting parts of it within the village.
  - To remedy flooding issues on Main Street, the village commissioned a hydraulics assessment that resulted in the design of a 680-foot bypass culvert. It was named the Nyack Brook Improvement Project – a high priority infrastructure project. There is no readily available information online regarding the status of this planned project.
  - Small pockets of the Hudson Riverfront as well as the southwestern corner of the village west of I-87/287 are located in areas of moderate flooding (Flood Zone X). With most of the village located on steep topography along the Hudson River, the exposure to flooding along the river is limited. A portion of the marina is in the floodplain, but many riverfront locations have limited exposure. However, many areas with limited flooding exposure experienced damaging flooding during Hurricane Sandy.
  - In severe storm events...flooding and flooded basements are a direct result of uncontrolled stormwater runoff.
  - The Tree Committee should identify properties where increased tree plantings would be most beneficial, including...within floodplain[s].
  - The village should adopt and regularly update sea level rise and flood projections recommended by the state and FEMA for municipal decision-making and planning purposes.
- **Local Waterfront Revitalization Program (LWRP)**
  - According to the Scenic Hudson Sea Level Rise Mapper, the area at risk of coastal flooding in Nyack could increase by approximately 1 acre by 2080. However, due to the topography of the village, it is expected that the number of households impacted by flooding will remain constant. The majority of the village will not be affected by a change in the 100-year floodplain or coastal sea level rise and inundation.
  - Policy 11 – Buildings and other structures will be sited in the coastal area so as to minimize damage to property and the endangering of human lives caused by flooding and erosion.
  - Policy 12 – Activities or development in the coastal area will be undertaken so as to minimize damage to natural resources and property from flooding and erosion by

- protecting natural protective features including beaches, dunes, barrier islands, and bluffs.
- Policy 14 – Activities and development, including the construction or reconstruction of erosion-protection structures, shall be undertaken so that there will be no measurable increase in erosion or flooding at the site of such activities or development or at other locations.
  - Policy 17 – Nonstructural measures to minimize damage to natural resources and property from flooding and erosion shall be used whenever possible.
  - Policy 28 – Ice management practices shall not interfere with the production of hydroelectric power, damage significant fish and wildlife and their habitats, or increase shoreline erosion or flooding.
  - Proposed Projects:
    - Implement the Nyack Brook Improvement Project to alleviate stormwater flooding.
    - Explore resilient infrastructure strategies to protect the Nyack Marina and waterfront development from the impacts of sea level rise and flooding.
  - Nyack Green Infrastructure Report – 2013
    - Create a flood hierarchy plan to identify a priority system for floodable areas such as open space, parking, secondary roads, etc.

### 6.2.12 VILLAGE OF SOUTH NYACK

On December 17, 2020, the electorate of the Village of South Nyack voted for dissolution. This initiated a process specified in Article 17-A of the New York State General Municipal Law, developing a formal Dissolution Plan. Following dissolution, anticipated in spring 2022, the Town of Orangetown will have purview over land use matters.

#### Zoning & Other Code(s) Analysis

<https://ecode360.com/SO0166>

The village has a "Flood Damage Prevention" code (Chapter 172). The Chapter has standards related to elevation and flood-resistant construction.

The Ponds and Reservoirs code (Chapter 237) includes regulations regarding the duty to maintain and repair dams and walls for ponds and reservoirs.

The Watercourses code (Chapter 323) prohibits obstructions of watercourses.

The Subdivision of Land (Chapter 288) has a section on hillside subdivision and development and floodplains.

Article XVII Stormwater Control in the Zoning Ordinance governs stormwater management and SWPPPs.

### Other Land Use Documents Reviewed:

- *Rockland County Multi-Jurisdictional Natural Hazard Mitigation Plan Update 2018*
  - Ensure that local comprehensive plans incorporate natural disaster mitigation techniques. This is a high priority Initiative (VP-1).
- *South Nyack Final Draft Dissolution Plan 2021*
  - Land use decisions will be made going forward by the Town of Orangetown following dissolution of the village in 2022. It is anticipated that the town will incorporate elements of the village's zoning into the Town of Orangetown code.

## 6.3 BEST PRACTICES RECOMMENDATIONS

As a component of this flood analysis, a Flood Resiliency Best Practices Audit was conducted for each watershed community. A map with the boundaries of the Hackensack watershed and the towns and villages that fall within it is depicted in Figure 6-1. Results of the audit are presented in the following tables:

Table 6-1: Town of Clarkstown

Table 6-2: Town of Orangetown

Table 6-3: Town of Ramapo

Table 6-4: Village of New Hempstead

Table 6-5: Village of West Haverstraw

Table 6-6: Town of Haverstraw

Table 6-7: Village of New Square

Table 6-8: Village of Spring Valley

Table 6-9: Village of Chestnut Ridge

Table 6-10: Village of Upper Nyack

Table 6-11: Village of Nyack

Table 6-12: Village of South Nyack

The following details best practices concepts and implementation options identified in several documents including documents assessed from within Rockland County; the American Planning Association Planning Advisory Service (PAS) Report 6 of 2018 and PAS Report 3 of 2016, which summarized flood mitigation actions from across the country; the New York State Department of State (NYS DOS) Model Local Laws Increase Resilience webpage; and New York City Zoning for Flood Resiliency website.

The following divides the best practice recommendations into two categories – zoning and subdivision. As noted in the PAS Reports, the "...zoning code can be used to enable local elevation and mitigate its impacts through design standards and bulk regulations. Design standards can help to encourage a continuity of local character and give developers and home owners a menu of potential options that can mitigate increased height, exposed piers and piles, and open spaces beneath the structure. The zoning and building code can be used to add additional freeboard above the FEMA Base Flood Elevation to account for sea-level rise, and retain and expand existing architectural design elements for raised structures."

These reports note that overlays can be used to protect areas without needing to adjust the underlying zoning. In effect, the Flood Damage Prevention Ordinances already in place essentially act as an overlay

mapped through alternative map resources (FIRM mapping), which provides a specific geographic area within which such regulations apply.

Communities within the Hackensack Watershed have in many cases undertaken the implementation of many positive regulatory actions to help mitigate the impacts of flooding within their communities. Land use planning is an action that is always searching for answers to existing problems and concerns as well as those that are anticipated in the future. Consideration of additional potential best practices to enhance the protection of property, riparian buffers, the Hudson River, tributaries, and other water bodies is essential to continuing the work already undertaken and maximizing its impact now and into the future.

The following Zoning regulatory actions should be reviewed and assessed for potential incorporation into local laws where applicable and feasible.

Resources utilized to develop the best practices audit matrix above included the following:

- <https://dos.ny.gov/model-local-laws-increase-resilience>
- <https://www1.nyc.gov/assets/planning/download/pdf/plans-studies/flood-resiliency-update/zoning-for-flood-resiliency.pdf>
- [https://planning-org-uploaded-media.s3.amazonaws.com/publication/download\\_pdf/Zoning-Practice-2018-06.pdf](https://planning-org-uploaded-media.s3.amazonaws.com/publication/download_pdf/Zoning-Practice-2018-06.pdf)
- <https://planning-org-uploaded-media.s3.amazonaws.com/document/Zoning-Practice-2016-03.pdf>

### **6.3.1 ELEVATION DESIGN AND SCREENING BEST PRACTICES**

Based on the preliminary analysis undertaken through the Flood Resiliency Best Practices Audit Checklist, no communities appeared to have specific elevation design and screening criteria in their zoning code for flood-elevated structures. All communities should consider assessing and revising their codes to incorporate specific elevation design and screening best practices.

### **6.3.2 BULK AND AREA REQUIREMENT FLEXIBILITY**

All communities should consider assessing and revising bulk and area requirements to provide flexibility to allow modifications to setbacks, impervious coverage, and potentially even maximum heights to permit structures to be elevated above the BFE and still provide floor area possibilities that take into account a "loss" of ground floor habitable space. While modifications of such setbacks can be obtained through a Zoning Board of Appeals process and are sometimes waived by a Planning Board, specific regulations permitting deviations from the standard bulk and area requirements, subject to Planning Board approval and proven necessary through the appropriate data and documentation, could bring about more resilient, better designed, and less controversial developments.

### **6.3.3 FLOODPLAIN CONSTRUCTION PERMITTING**

Some codes could benefit from tightening up the regulations permitting construction within a floodplain. Consideration of severely restricting or outright banning construction within significant riparian buffer areas and removing these areas from development could be considered. Areas that continually flood

could be required to be removed from a density calculation. These areas should be assessed and likely mapped with the rationale for such a strict application. If a community is interested in identifying concepts or efforts to compensate landowners for the inability to now utilize these areas for development, likely by providing increased density or smaller lot sizes (thereby resulting in less infrastructure and site preparation cost) or purchase as public open space, that should also be considered.

#### **6.3.4 SUBDIVISION REGULATIONS**

Subdivision codes, where they exist, could use significant assessment for additional flood resiliency revisions. Since subdivisions can be the first step in larger land development applications, assessing potential regulatory changes in this part of the code could provide a significant resiliency benefit to address development-based flooding concerns. While the codes do generally require proposals to minimize flood-related damage and data for projects greater than a certain number of lots or acres when no BFE data is available, there are specific code regulations that could be enacted that provide specific protections and that could increase resiliency without taking away the potential to reasonably develop a property.

<b>Table 6-1: Flood Resiliency Best Practices Code Audit Checklist</b>				<b>Notes</b>
<b>Town of Clarkstown Preliminary Audit</b>	<b>In Existing Code</b>	<b>Consider for Implementation</b>	<b>N/A</b>	
<b>Zoning Code Ordinance Best Practices</b>				
<b>Elevation Design &amp; Screening</b>				
Require design interventions to screen and mitigate elevation impacts on the streetscape for elevated buildings.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Use hedges and fencing to separate private and public realms. Screen on-site parking located beneath a structure with foundation plantings and vegetative screening. Screen piers and columns that have been used to raise structures.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Building entries must face the street on which the building fronts, and walkways should provide direct access from the sidewalk to the front door.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Building fronts, entry porches and similar features must use materials, colors and proportions appropriate for the local architectural context. Large and multi-family building should use treatments similar to ensure local architectural consistency.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Guidelines for specific design elements such as canopies, galleries, and local significant materials, colors and design strategies to mitigate height and size perceptions are encouraged.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>Bulk &amp; Area Requirements</b>				
Ensure that uses below the building Base Flood Elevation are restricted to access, parking and storage.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The code restricts the lowest floor in certain zones to parking, access or storage and to automatically equalize hydrostatic flood forces.
Permit relief from height limits where possible for developers and property owners who wish to go above the Design Flood Elevation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Enact new height limits where possible that are based on the new local design flood elevation (one to two feet over the BFE) where side and rear yard relief is possible.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Given the increased height of buildings due to elevation, turrets, towers and cupolas, ensure total building height does not exceed maximum height(s) desired, but also ensure that maximum building height requirements allow for building elevations without the need for a variance.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Require an additional 3' of freeboard above the base flood elevation for buildings within the Special Flood Hazard Area and 18" of freeboard in the "shaded X" area, which includes buildings between the 100-year and 500-year floodplains. All new single family detached dwellings outside of defined flood hazard areas need to be elevated 16-24". This approach acknowledges the likelihood of more extreme flooding inside of and more extensive flooding outside of the FEMA-defined flood hazard area (based on historic flooding and not sea-level rise).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Standards are included that require between 2' and 3' above BFE in certain zones as well as requirements for drainage paths in other zones for residential structures. For non-residential structures, the lowest floor should be elevated 2' above BFE or be floodproofed so that the structure is watertight below two feet above the base flood elevation, including utilities and sanitary facilities. Within the A, when no base flood data are available, the lowest floor (including basement) shall be elevated at least 3' above the highest adjacent grade.
Permit reduced side or rear yards relative to overall height to allow squatter and more proportional buildings.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Require riparian and/or floodplain buffers - See also Subdivision Regulations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Utilize net density calculations that exclude wetland and floodplain areas in a developable area.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Establish a maximum percentage of impermeable surface coverage on a lot which limits the density of development and addressing stormwater runoff.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

**Table 6-1: Flood Resiliency Best Practices Code Audit Checklist**

Other Code Revisions			
Coastal Resilience Overlays could be applied to areas with the highest flood risk. These areas require higher elevations of the first floor, limit parking and hard pavement, and require additional landscaping and open space.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Upland Resilience Overlays could be applied to lower-risk areas capable of accommodating growth. New construction within an Upland Resilience Overlay is also permitted to reduce its own resilience requirements in exchange for placing conservation easements on higher-risk properties.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Neighborhood Resilience Overlays could be applied to lower-risk areas, and are intended for more typical cases. They allow for customized design standards that are appropriate to the local context.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Permit property owners to reallocate lost floor area from the ground floor and sub-grade spaces to elsewhere in the structure.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ensure that well heads are above the BFE.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Add flood resistant construction (flood-proofing) standards such as ensuring buildings are watertight, utilities and sanitary facilities are above the BFE, enclosed within the building's watertight walls, or made watertight and resistance. Standards should also ensure that the building's structural components are also flood resistant.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Prohibit new development unless effect on flooding is minimal or zero.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Prohibit substantial improvements to nonconforming uses or structures in flood prone areas.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Consider acquisition of flood-prone lands, particularly where they include vital riparian areas and/or could provide a public benefit such as a park or passive open space.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

This exists in a way in the code. Within special flood hazard areas, construction or improvements are prohibited without a meeting the terms of the regulations. For encroachments, assessments and/or a technical evaluation is required and when the Village agrees to apply to FEMA for conditional Firm and floodway revision and approval is received, only then can construction or substantial improvements move forward.

The Code requires anchoring of new structures and substantial improvements as well as the use of materials, utility equipment, and methods and practices that are resistant to flood damage and that minimize flood damage. Utilities must be at least 2' above BFE. Water supply systems must minimize or eliminate infiltration of floodwaters. On-site waste disposal systems must be located to avoid impairment to them, or contamination from them, during flood events.

Code prohibits development encroachment if increases base flood by >1 foot (see encroachment note above). The code requires details of any watercourse alteration or relocation. There are detailed permit application requirements including a technical analysis to determine whether or not proposed development will result in physical damage to any other property.

**Table 6-1: Flood Resiliency Best Practices Code Audit Checklist**

Subdivision Ordinance Best Practices			
Subdivision Ordinance			
Conservation subdivision (cluster development) to encourage development be built in suitable areas of development that protects important natural features.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Prohibit subdivisions in floodprone areas.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Require and maximize the width of riparian buffers. Provide riparian buffer requirements for the following:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Stream stabilization - A few dozen feet to a few hundred feet.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Water quality protection – A few dozen to a few hundred feet (a longer distance if sediment removal is desired)</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Flood attenuation – A few dozen to several hundred feet</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Riparian &amp; wildlife habitat – A few dozen feet up to a mile, though the average minimum is approximately 100’ to several hundred or a few thousand feet.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Protection of cold water fisheries – A few dozen feet to a few hundred feet</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Prohibit development immediately adjacent to streams, rivers, lakes, wetlands and other water bodies.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inventory riparian areas as part of the subdivision process and preserve unimpaired riparian areas in natural conditions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Require restoration of impaired riparian zones as a condition of subdivision approval.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Restrict potentially problematic uses (Hazardous materials uses, for example)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dedicate land for public facilities and services.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Require adequate access where evacuation may be necessary or where emergency vehicle access may be required.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ensure utilities such as electric, natural gas, water and wastewater are hardened. Require electrical components to be mounted above flood levels. Major utility equipment should be considered a critical facility and be required to be located outside of the 500 year floodplain.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Consider the long-term needs of the community when discussing the potential for a homeowner’s association to operate and/or maintain an area prone to flooding.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Require flood hazard information to be provided on a subdivision plat. Require the 100-year floodplain elevation to be shown on all subdivision plats. Information such as finished building pad elevation or proposed lowest finished floor elevation can also be detailed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Any property with a floodplain should be required to show such information on the plan.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Require conservation easements around flood-prone areas or floodplains.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Require green infrastructure or low-impact development techniques, where feasible	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Each proposed lot must have a designated buildable site above the special flood hazard area (SFHA) as shown on the most current Flood Insurance Rate Map.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The Flood Damage Prevention Ordinance requires subdivisions to be consistent with the need to minimize flood damage, utilities and facilities must be located and constructed to minimize flood damage, and adequate drainage needs to be provided to reduce exposure to flood damage. When no base flood elevation data are available from other sources, the permit applicant for a subdivision or other development shall provide the data for projects greater than 2 acres or 5 lots.

The code includes Stormwater Pollution Prevention Plan (SWPPP) requirements.

Code Sections Reviewed:

Flood Damage Prevention - Chapter 146

Subdivision of Land - Chapter 254

Stormwater Management - Chapter 249A

Zoning - Chapter 290



**Table 6-2: Flood Resiliency Best Practices Code Audit Checklist**

Town of Orangetown Preliminary Audit	In Existing Code	Consider for Implementation	N/A	Notes
	<b>Zoning Code Ordinance Best Practices</b>			
<b>Elevation Design &amp; Screening</b>				
Require design interventions to screen and mitigate elevation impacts on the streetscape for elevated buildings.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Use hedges and fencing to separate private and public realms. Screen on-site parking located beneath a structure with foundation plantings and vegetative screening. Screen piers and columns that have been used to raise structures.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Building entries must face the street on which the building fronts, and walkways should provide direct access from the sidewalk to the front door.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Building fronts, entry porches and similar features must use materials, colors and proportions appropriate for the local architectural context. Large and multi-family building should use treatments similar to ensure local architectural consistency.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Guidelines for specific design elements such as canopies, galleries, and local significant materials, colors and design strategies to mitigate height and size perceptions are encouraged.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>Bulk &amp; Area Requirements</b>				
Ensure that uses below the building Base Flood Elevation are restricted to access, parking and storage.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The code restricts the lowest floor in certain zones to parking, access or storage and to automatically equalize hydrostatic flood forces.
Permit relief from height limits where possible for developers and property owners who wish to go above the Design Flood Elevation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Enact new height limits where possible that are based on the new local design flood elevation (one to two feet over the BFE) where side and rear yard relief is possible.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Given the increased height of buildings due to elevation, turrets, towers and cupolas, ensure total building height does not exceed maximum height(s) desired, but also ensure that maximum building height requirements allow for building elevations without the need for a variance.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Require an additional 3' of freeboard above the base flood elevation for buildings within the Special Flood Hazard Area and 18" of freeboard in the "shaded X" area, which includes buildings between the 100-year and 500-year floodplains. All new single family detached dwellings outside of defined flood hazard areas need to be elevated 16-24". This approach acknowledges the likelihood of more extreme flooding inside of and more extensive flooding outside of the FEMA-defined flood hazard area (based on historic flooding and not sea-level rise).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The code includes residential and non-residential structure coastal high-hazard area construction standards. Standards are included that require between 2' and 3' above BFE in certain zones as well as requirements for drainage paths in other zones for residential structures. For non-residential structures, the lowest floor should be elevated 2' above BFE if no FIRM number is specified. Structures are to be floodproofed including utilities and sanitary facilities. Within the A, when no base flood data are available, the lowest floor (including basement) shall be elevated at least 3' above the highest adjacent grade.
Permit reduced side or rear yards relative to overall height to allow squatter and more proportional buildings.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Require riparian and/or floodplain buffers - See also Subdivision Regulations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Utilize net density calculations that exclude wetland and floodplain areas in a developable area.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Note 16 in the Notes to Use and Bulk Tables only permits a percentage of land underwater count toward minimum lot area
Establish a maximum percentage of impermeable surface coverage on a lot which limits the density of development and addressing stormwater runoff.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

**Table 6-2: Flood Resiliency Best Practices Code Audit Checklist**

Other Code Revisions			
Coastal Resilience Overlays could be applied to areas with the highest flood risk. These areas require higher elevations of the first floor, limit parking and hard pavement, and require additional landscaping and open space.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Upland Resilience Overlays could be applied to lower-risk areas capable of accommodating growth. New construction within an Upland Resilience Overlay is also permitted to reduce its own resilience requirements in exchange for placing conservation easements on higher-risk properties.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Neighborhood Resilience Overlays could be applied to lower-risk areas, and are intended for more typical cases. They allow for customized design standards that are appropriate to the local context.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Permit property owners to reallocate lost floor area from the ground floor and sub-grade spaces to elsewhere in the structure.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ensure that well heads are above the BFE.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Add flood resistant construction (flood-proofing) standards such as ensuring buildings are watertight, utilities and sanitary facilities are above the BFE, enclosed within the building's watertight walls, or made watertight and resistance. Standards should also ensure that the building's structural components are also flood resistant.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Prohibit new development unless effect on flooding is minimal or zero.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Prohibit substantial improvements to nonconforming uses or structures in flood prone areas.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Consider acquisition of flood-prone lands, particularly where they include vital riparian areas and/or could provide a public benefit such as a park or passive open space.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Subdivision Ordinance Best Practices			
Subdivision Ordinance			
Conservation subdivision (cluster development) to encourage development be built in suitable areas of development that protects important natural features.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Prohibit subdivisions in floodprone areas.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

This exists in a way in the code. Within special flood hazard areas, construction or improvements are prohibited without a valid floodplain development permit. For encroachments, assessments and/or a technical evaluation is required and when the Village agrees to apply to FEMA for conditional Firm and floodway revision and approval is received, only then can construction or substantial improvements move forward.

The Code requires water supply systems to minimize or eliminate infiltration of floodwaters into the system.

The Code requires anchoring of new structures and substantial improvements as well as the use of materials, utility equipment, and methods and practices that are resistant to flood damage and that minimize flood damage. Utilities must be at least 2' above BFE. Water supply systems must minimize or eliminate infiltration of floodwaters. On-site waste disposal systems must be located to avoid impairment to them, or contamination from them, during flood events.

Code prohibits development encroachment if increases base flood by >1 foot (see encroachment note above). The code requires details of any watercourse alteration or relocation. There are detailed permit application requirements including a technical analysis to determine whether or not proposed development will result in physical damage to any other property.

The Flood Damage Prevention Ordinance requires subdivisions to be consistent with the need to minimize flood damage, utilities and facilities must be located and constructed to minimize flood damage, and adequate drainage needs to be provided to reduce exposure to flood damage. There are code requirements that only a percentage of land underwater count toward minimum lot area (see above). When no based flood elevation data are available from other sources in Zone A, the permit applicant for a subdivision or other development shall provide the data for projects greater than 5 acres or 50 lots.

<b>Table 6-2: Flood Resiliency Best Practices Code Audit Checklist</b>			
Require and maximize the width of riparian buffers. Provide riparian buffer requirements for the following:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Stream stabilization - A few dozen feet to a few hundred feet.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Water quality protection – A few dozen to a few hundred feet (a longer distance if sediment removal is desired)</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Flood attenuation – A few dozen to several hundred feet</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Riparian &amp; wildlife habitat – A few dozen feet up to a mile, though the average minimum is approximately 100’ to several hundred or a few thousand feet.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Protection of cold water fisheries – A few dozen feet to a few hundred feet</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Prohibit development immediately adjacent to streams, rivers, lakes, wetlands and other water bodies.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inventory riparian areas as part of the subdivision process and preserve unimpaired riparian areas in natural conditions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Require restoration of impaired riparian zones as a condition of subdivision approval.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Restrict potentially problematic uses (Hazardous materials uses, for example)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dedicate land for public facilities and services.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Require adequate access where evacuation may be necessary or where emergency vehicle access may be required.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ensure utilities such as electric, natural gas, water and wastewater are hardened. Require electrical components to be mounted above flood levels. Major utility equipment should be considered a critical facility and be required to be located outside of the 500 year floodplain.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Consider the long-term needs of the community when discussing the potential for a homeowner’s association to operate and/or maintain an area prone to flooding.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Require flood hazard information to be provided on a subdivision plat. Require the 100-year floodplain elevation to be shown on all subdivision plats. Information such as finished building pad elevation or proposed lowest finished floor elevation can also be detailed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Any property with a floodplain should be required to show such information on the plan.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Require conservation easements around flood-prone areas or floodplains.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Require green infrastructure or low-impact development techniques, where feasible	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Each proposed lot must have a designated buildable site above the special flood hazard area (SFHA) as shown on the most current Flood Insurance Rate Map.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Code allows Planning Board to require conservation easements for flood-prone areas.  
The code includes Stormwater Pollution Prevention Plan (SWPPP) requirements.

Code Sections Reviewed:

Flood Damage Prevention - Chapter 14B

Land Development Regulations - Chapter 21

Sediment and Erosion Control and Stormwater Management - Chapter 30D

Watercourse Diversion and Pollution - Chapter 41

Conservation Easements - Section 21-7.1

**Table 6-3: Flood Resiliency Best Practices Code Audit Checklist**

Town of Ramapo Preliminary Audit	In Existing Code	Consider for Implementation	N/A	Notes
<b>Zoning Code Ordinance Best Practices</b>				
<b>Elevation Design &amp; Screening</b>				
Require design interventions to screen and mitigate elevation impacts on the streetscape for elevated buildings.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Use hedges and fencing to separate private and public realms. Screen on-site parking located beneath a structure with foundation plantings and vegetative screening. Screen piers and columns that have been used to raise structures.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Building entries must face the street on which the building fronts, and walkways should provide direct access from the sidewalk to the front door.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Building fronts, entry porches and similar features must use materials, colors and proportions appropriate for the local architectural context. Large and multi-family building should use treatments similar to ensure local architectural consistency.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Guidelines for specific design elements such as canopies, galleries, and local significant materials, colors and design strategies to mitigate height and size perceptions are encouraged.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>Bulk &amp; Area Requirements</b>				
Ensure that uses below the building Base Flood Elevation are restricted to access, parking and storage.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The code restricts the lowest floor in certain zones to parking, access or storage and to automatically equalize hydrostatic flood forces.
Permit relief from height limits where possible for developers and property owners who wish to go above the Design Flood Elevation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Enact new height limits where possible that are based on the new local design flood elevation (one to two feet over the BFE) where side and rear yard relief is possible.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Given the increased height of buildings due to elevation, turrets, towers and cupolas, ensure total building height does not exceed maximum height(s) desired, but also ensure that maximum building height requirements allow for building elevations without the need for a variance.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Require an additional 3' of freeboard above the base flood elevation for buildings within the Special Flood Hazard Area and 18" of freeboard in the "shaded X" area, which includes buildings between the 100-year and 500-year floodplains. All new single family detached dwellings outside of defined flood hazard areas need to be elevated 16-24". This approach acknowledges the likelihood of more extreme flooding inside of and more extensive flooding outside of the FEMA-defined flood hazard area (based on historic flooding and not sea-level rise).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Permit reduced side or rear yards relative to overall height to allow squatter and more proportional buildings.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Require riparian and/or floodplain buffers - See also Subdivision Regulations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Utilize net density calculations that exclude wetland and floodplain areas in a developable area.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Establish a maximum percentage of impermeable surface coverage on a lot which limits the density of development and addressing stormwater runoff.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

**Table 6-3: Flood Resiliency Best Practices Code Audit Checklist**

<b>Other Code Revisions</b>				
Coastal Resilience Overlays could be applied to areas with the highest flood risk. These areas require higher elevations of the first floor, limit parking and hard pavement, and require additional landscaping and open space.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<p>This exists in a way in the code. Regulations are subject to specific FIRM maps detailed in the code. This exists in a way in the code. Within special flood hazard areas, construction or improvements are prohibited without a valid floodplain development permit. For encroachments, assessments and/or a technical evaluation is required and when the Village agrees to apply to FEMA for conditional Firm and floodway revision and approval is received, only then can construction or substantial improvements move forward.</p> <p>The Code requires water supply systems to minimize or eliminate infiltration of floodwaters into the system.</p> <p>The Code requires anchoring of new structures and substantial improvements as well as the use of materials, utility equipment, and methods and practices that are resistant to flood damage and that minimize flood damage. Utilities must be at least 2' above BFE. Water supply systems must minimize or eliminate infiltration of floodwaters. On-site waste disposal systems must be located to avoid impairment to them, or contamination from them, during flood events.</p> <p>Code prohibits development encroachment if increases base flood by &gt;1 foot (see encroachment note above). The code requires a details of any watercourse alteration or relocation. There are detailed permit application requirements including a technical analysis to determine whether or not proposed development will result in physical damage to any other property.</p>
Upland Resilience Overlays could be applied to lower-risk areas capable of accommodating growth. New construction within an Upland Resilience Overlay is also permitted to reduce its own resilience requirements in exchange for placing conservation easements on higher-risk properties.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Neighborhood Resilience Overlays could be applied to lower-risk areas, and are intended for more typical cases. They allow for customized design standards that are appropriate to the local context.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Permit property owners to reallocate lost floor area from the ground floor and sub-grade spaces to elsewhere in the structure.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Ensure that well heads are above the BFE.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Add flood resistant construction (flood-proofing) standards such as ensuring buildings are watertight, utilities and sanitary facilities are above the BFE, enclosed within the building's watertight walls, or made watertight and resistance. Standards should also ensure that the building's structural components are also flood resistant.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Prohibit new development unless effect on flooding is minimal or zero.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Prohibit substantial improvements to nonconforming uses or structures in flood prone areas.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Consider acquisition of flood-prone lands, particularly where they include vital riparian areas and/or could provide a public benefit such as a park or passive open space.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>Subdivision Ordinance Best Practices</b>				
<b>Subdivision Ordinance</b>				
Conservation subdivision (cluster development) to encourage development be built in suitable areas of development that protects important natural features.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	There is a cluster provision in the code.
Prohibit subdivisions in floodprone areas.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The Flood Damage Prevention Ordinance requires subdivisions to be consistent with the need to minimize flood damage, utilities and facilities must be located and constructed to minimize flood damage, and adequate drainage needs to be provided to reduce exposure to flood damage. There are code requirements that only a percentage of land underwater count toward minimum lot area. When no based flood elevation data are available from other sources, the permit applicant for a subdivision or other development shall provide the data for projects greater than 5 acres or 50 lots.

<b>Table 6-3: Flood Resiliency Best Practices Code Audit Checklist</b>			
Require and maximize the width of riparian buffers. Provide riparian buffer requirements for the following:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Stream stabilization - A few dozen feet to a few hundred feet.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Water quality protection – A few dozen to a few hundred feet (a longer distance if sediment removal is desired)</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Flood attenuation – A few dozen to several hundred feet</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Riparian &amp; wildlife habitat – A few dozen feet up to a mile, though the average minimum is approximately 100’ to several hundred or a few thousand feet.</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>Protection of cold water fisheries – A few dozen feet to a few hundred feet</i>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Prohibit development immediately adjacent to streams, rivers, lakes, wetlands and other water bodies.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Inventory riparian areas as part of the subdivision process and preserve unimpaired riparian areas in natural conditions.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Require restoration of impaired riparian zones as a condition of subdivision approval.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Restrict potentially problematic uses (Hazardous materials uses, for example)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Dedicate land for public facilities and services.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Require adequate access where evacuation may be necessary or where emergency vehicle access may be required.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Ensure utilities such as electric, natural gas, water and wastewater are hardened. Require electrical components to be mounted above flood levels. Major utility equipment should be considered a critical facility and be required to be located outside of the 500 year floodplain.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Consider the long-term needs of the community when discussing the potential for a homeowner’s association to operate and/or maintain an area prone to flooding.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Require flood hazard information to be provided on a subdivision plat. Require the 100-year floodplain elevation to be shown on all subdivision plats. Information such as finished building pad elevation or proposed lowest finished floor elevation can also be detailed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Any property with a floodplain should be required to show such information on the plan.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Require conservation easements around flood-prone areas or floodplains.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Require green infrastructure or low-impact development techniques, where feasible	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Each proposed lot must have a designated buildable site above the special flood hazard area (SFHA) as shown on the most current Flood Insurance Rate Map.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The code includes a Streams and Watercourses section prohibiting certain actions along these features.

The code includes Stormwater Pollution Prevention Plan (SWPPP) requirements.

Code Sections Reviewed:

Flood Damage Prevention - Chapter 149

Stormwater Management and Sediment and Erosion Control - Chapter 237

Special Bulk Requirements - §376-42

Clustering - §376-43

Streams and Watercourses - Chapter 240

<b>Table 6-4: Flood Resiliency Best Practices Code Audit Checklist</b>				<i>Notes</i>
<i>Village of New Hempstead Preliminary Audit</i>	<i>In Existing Code</i>	<i>Consider for Implementation</i>	<i>N/A</i>	
<b>Zoning Code Ordinance Best Practices</b>				
<b>Elevation Design &amp; Screening</b>				
Require design interventions to screen and mitigate elevation impacts on the streetscape for elevated buildings.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Use hedges and fencing to separate private and public realms. Screen on-site parking located beneath a structure with foundation plantings and vegetative screening. Screen piers and columns that have been used to raise structures.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Building entries must face the street on which the building fronts, and walkways should provide direct access from the sidewalk to the front door.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Building fronts, entry porches and similar features must use materials, colors and proportions appropriate for the local architectural context. Large and multi-family building should use treatments similar to ensure local architectural consistency.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Guidelines for specific design elements such as canopies, galleries, and local significant materials, colors and design strategies to mitigate height and size perceptions are encouraged.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>Bulk &amp; Area Requirements</b>				
Ensure that uses below the building Base Flood Elevation are restricted to access, parking and storage.	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	The code restricts the lowest floor in certain zones to parking, access or storage and to automatically equalize hydrostatic flood forces.
Permit relief from height limits where possible for developers and property owners who wish to go above the Design Flood Elevation.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Enact new height limits where possible that are based on the new local design flood elevation (one to two feet over the BFE) where side and rear yard relief is possible.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Given the increased height of buildings due to elevation, turrets, towers and cupolas, ensure total building height does not exceed maximum height(s) desired, but also ensure that maximum building height requirements allow for building elevations without the need for a variance.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Require an additional 3' of freeboard above the base flood elevation for buildings within the Special Flood Hazard Area and 18" of freeboard in the "shaded X" area, which includes buildings between the 100-year and 500-year floodplains. All new single family detached dwellings outside of defined flood hazard areas need to be elevated 16-24". This approach acknowledges the likelihood of more extreme flooding inside of and more extensive flooding outside of the FEMA-defined flood hazard area (based on historic flooding and not sea-level rise).	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Standards are included that require between 2' and 3' above BFE in certain zones as well as requirements for drainage paths in other zones for residential structures. For non-residential structures, the lowest floor should be elevated 2' above BFE if no FIRM number is specified. Structures are to be floodproofed including utilities and sanitary facilities. Within the A, when no base flood data are available, the lowest floor (including basement) shall be elevated at least 3' above the highest adjacent grade.
Permit reduced side or rear yards relative to overall height to allow squatter and more proportional buildings.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Require riparian and/or floodplain buffers - See also Subdivision Regulations.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Utilize net density calculations that exclude wetland and floodplain areas in a developable area.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Establish a maximum percentage of impermeable surface coverage on a lot which limits the density of development and addressing stormwater runoff.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	