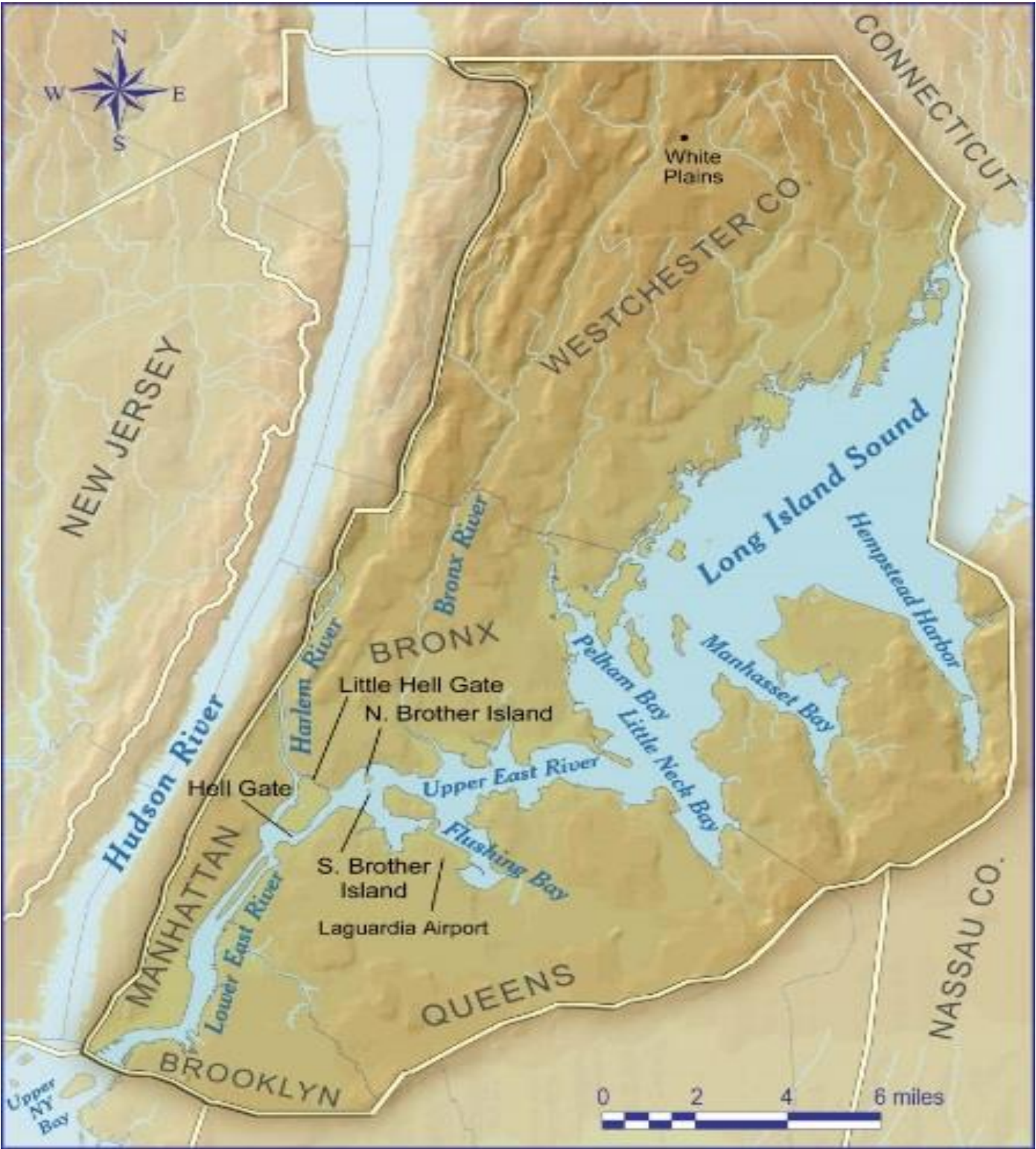


# HARLEM RIVER, EAST RIVER AND WESTERN LONG ISLAND SOUND PLANNING REGION



## Baseline Conditions and Water Resource Problems

- Densely populated urban area
- Limited or fragmented habitat and disturbed natural areas
- Poor benthic habitat
- Dense invasive vegetation
- Continuing shoreline erosion
- Armored and/or eroded shorelines
- Canada Geese fecal matter, Confined Sewer Overflows (CSOs) and sewage odors
- Poor water quality and heavy sediment loads
- Dams, weirs and anthropogenic debris impede fish passage
- High flows during storm events



## Flushing Bay and Creek Ecosystem Restoration “Source” Feasibility Study Background

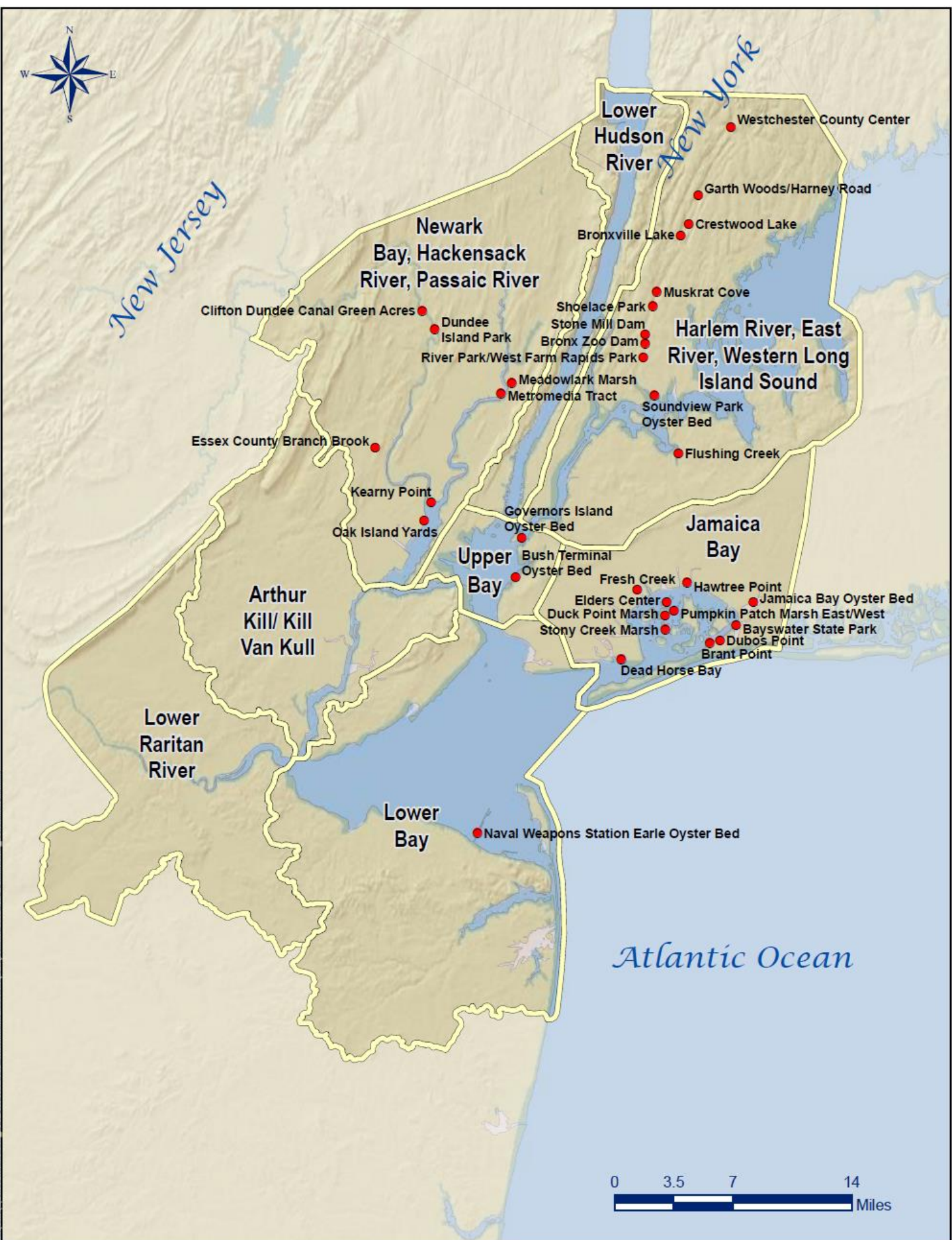
- Study Resolution (1994), Reconnaissance Report (1996), & Feasibility Study Cost Share Agreement executed with NYCDEP and PANYNJ (1996).
- Twelve (12) alternative/sites screened for consideration resulting in two (2) restoration alternatives recommended and evaluated for full feasibility analysis.
- Seventeen (17) alternatives were then developed varying in amounts of dredging, capping and adjacent habitat restoration.
- 2007 Selected Plan focused on Flushing Creek dredging and adjacent marsh restoration for one (1) site.
- Plan optimized through the development of three (3) new alternatives to better coordinate with NYCDEP Long Term Control Plan efforts.

## Bronx River Basin Ecosystem Restoration “Source” Feasibility Study Background

- Study Resolution (1998), Reconnaissance Report (1999) & FCSA executed with NYCDEP and Westchester County Department of Planning (2003).
- Restoration opportunities report identified 330 potential sites.
- Twenty-three (23) sites were considered for further evaluation.
- Ten (10) sites were selected based on their potential to contribute to restoration of the watershed and non-federal sponsor acceptability and two (2) of these sites were combined resulting in a total of nine (9) sites.

## Tentatively Selected Plan within Harlem River, East River and Western Long Island Sound Planning Region

Restoration Site	Measures/Target Ecosystem Characteristic	First Level Costs			Non-Federal Sponsors (Congressional Representatives)
		Federal	Non-Federal	Total	
Flushing Creek	Wetlands; Forest preservation	\$3,835,000	\$2,065,000	\$5,900,000	NYCDEP (Meng, NY-6/Crowley, NY-14)
Bronx River Park/West Farm Rapids Park	Shoreline softening; Emergent wetlands; Bed restoration; Invasive removal/native plantings; Riverbed restoration	\$2,600,000	\$1,400,000	\$4,000,000	NYCDEP, NYC Parks (Crowley & Serrano, NY-15)
Bronx Zoo and Dam	Invasive removal/native plantings; Fish ladder; Sediment trap; Emergent wetlands	\$2,502,500	\$1,347,500	\$3,850,000	
Stone Mill Dam	Fish ladder	\$468,000	\$252,000	\$720,000	
Shoelace Park	Channel realignment w/in-stream structures; Bank stabilization; Invasive removal/ native plantings; Sediment load reduction/ rain gardens/bioretention basins	\$16,256,500	\$8,753,500	\$25,010,000	NYCDEP, NYC Parks (Engel, NY-16 & Crowley)
Muskrat Cove	Channel modification; River bank stabilization; Installation of sediment basins for load reduction; Invasive removal/native plantings	\$5,096,000	\$2,744,000	\$7,840,000	NYCDEP, NYC Parks (Crowley & Serrano)
Bronxville Lake	Native plantings; Rip rap forebay; Channel bed restoration; Emergent wetlands; Forested scrub/shrub wetlands; Modification of rock weir for fish passage; Invasive removal and native plantings; Sediment dredging; Sediment load reduction/ vegetated swales/ retention; Basins/rain gardens	\$10,094,500	\$5,435,500	\$14,530,000	Westchester County Planning (Engel)
Crestwood Lake	Modification of existing rock weir for fish passage; Creation of emergent wetlands; Channel realignment, bed material construction, 11 instream cross vanes; Two (2) riprap forebays; Invasive removal/ native planting	\$17,946,500	\$9,663,500	\$27,610,000	
Garth Woods/Harney Park	Modification of weir for fish passage; River channel modification (15 in-stream cross vanes); Shoreline softening; Rain gardens/ bioretention area; Invasive removal/native planting; Emergent wetlands Garth Woods: forested scrub/shrub; Wetlands	\$4,680,000	\$2,520,000	\$7,200,000	
Westchester County Center	Emergent wetlands; Bank stabilization; In-stream structures; 10 cross vanes and six (6) J-hooks; channel modification; Invasive species removal/ native planting	\$9,438,000	\$5,082,000	\$14,520,000	Westchester County Planning (Lowey, NY-17)
Total		\$72,917,000	\$39,263,000	\$111,180,000	



## Restoration Opportunities/Measures

- Invasive species removal and native plantings
- Channel modifications/realignment with instream structures
- Wetland creation
- River bed restoration
- Sediment load reduction
- Fish ladder installation
- Public access
- Weir modification (fish passage)
- Debris and snag removal
- Shoreline softening and bank stabilization
- Secondary benefits of water quality improvements



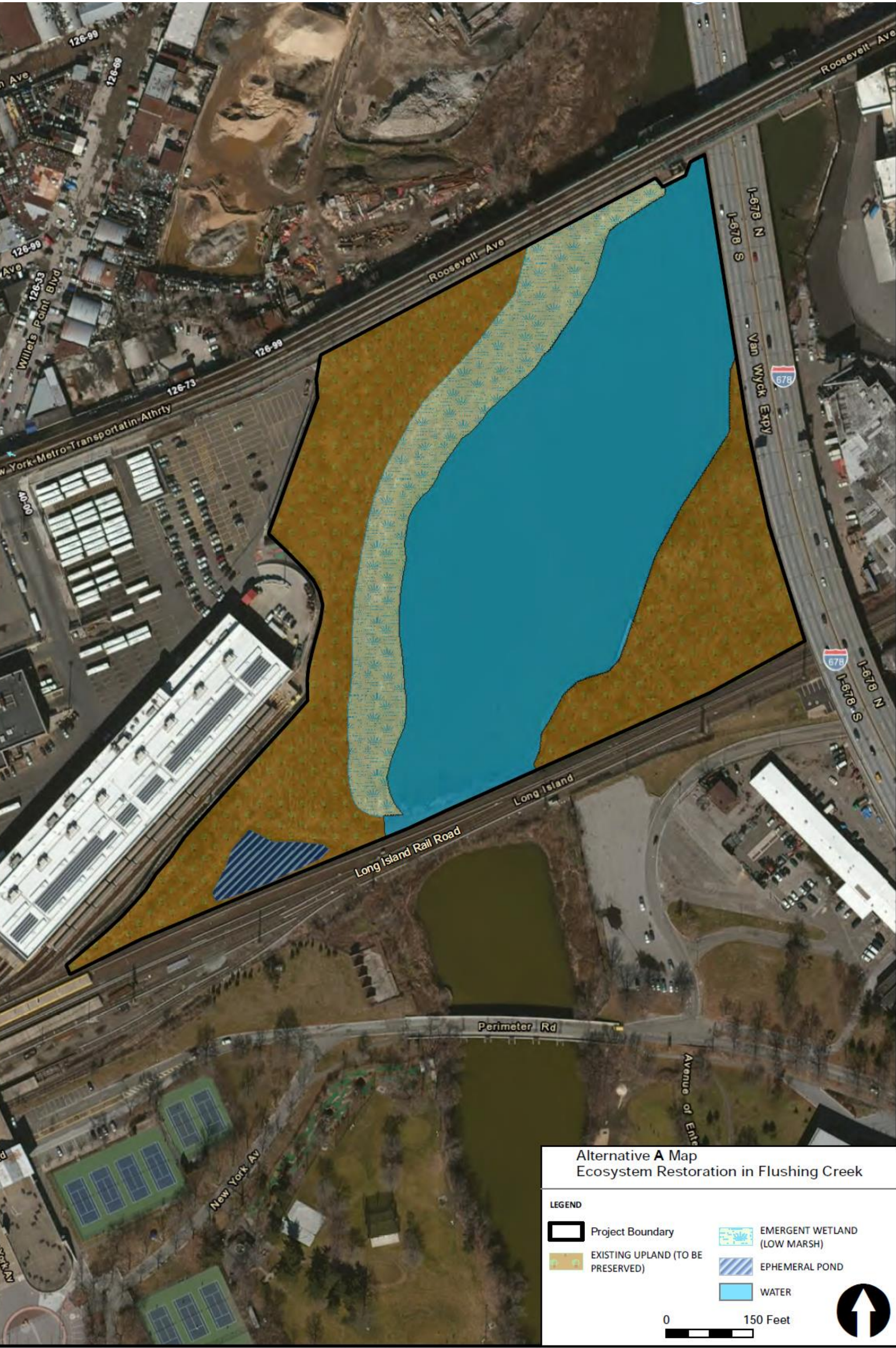


# FLUSHING CREEK RESTORATION SITE

**Flushing Creek Tentatively Selected Plan Design:**

- Re-grade existing common reed-dominated areas to create low salt marsh consisting of saltmarsh cordgrass (2.42 ac).
- Preserving ephemeral pond (0.28 ac).
- Preserve existing upland forest with no re-grading or replanting proposed (6.56 ac).

**PROJECT FIRST COST (Oct 2016): \$5,900,000**

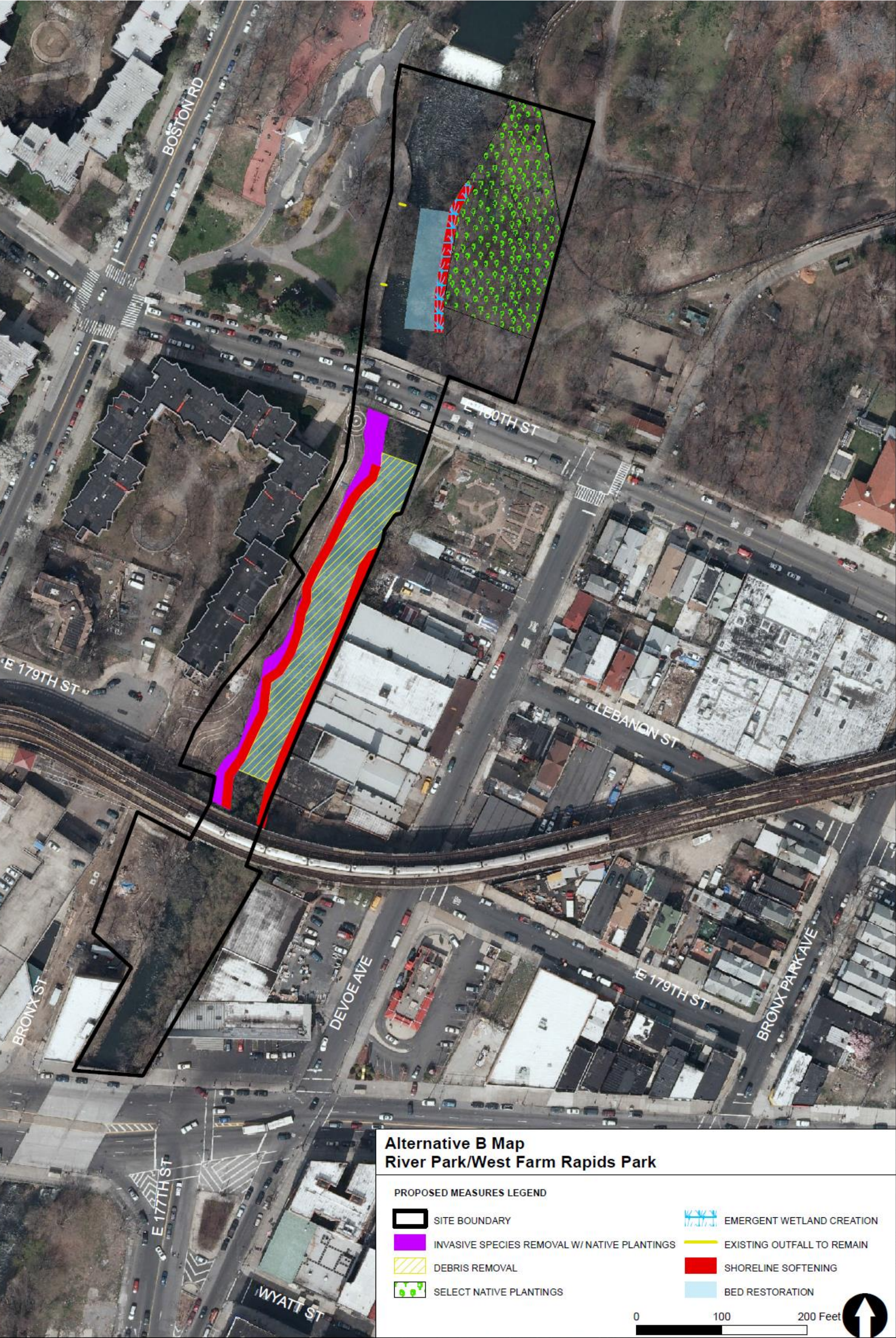


# BRONX RIVER RESTORATION SITES

**Bronx River Park/West Farm Rapids Park Tentatively Selected Plan Design:**

- Creation of woodland area along the east side of the site with native upland trees and shrubs (~0.59 ac).
- Shoreline softening on the east and west channel banks (~0.31 ac) using boulders and facultative plants between the dam and 180<sup>th</sup> Street, stacked rock walls with brush layers along the east bank, and drilling with native plant materials along the west bank down stream of 180th Street.
- Creation of emergent wetlands (~0.04 ac).
- Bed restoration between the dam and 180<sup>th</sup> Street (0.47 ac).
- Removal of invasive vegetation and replacement with native upland shrubs and herbaceous vegetation upslope from both banks of the river down stream of 180th Street (~0.20 ac).
- Removal of debris from river bottom downstream of 180th Street (0.36 ac).
- Restoration of river bed by substrate excavation and replacement with bedding stone (~0.36 ac).
- Improvement of public access to the river.

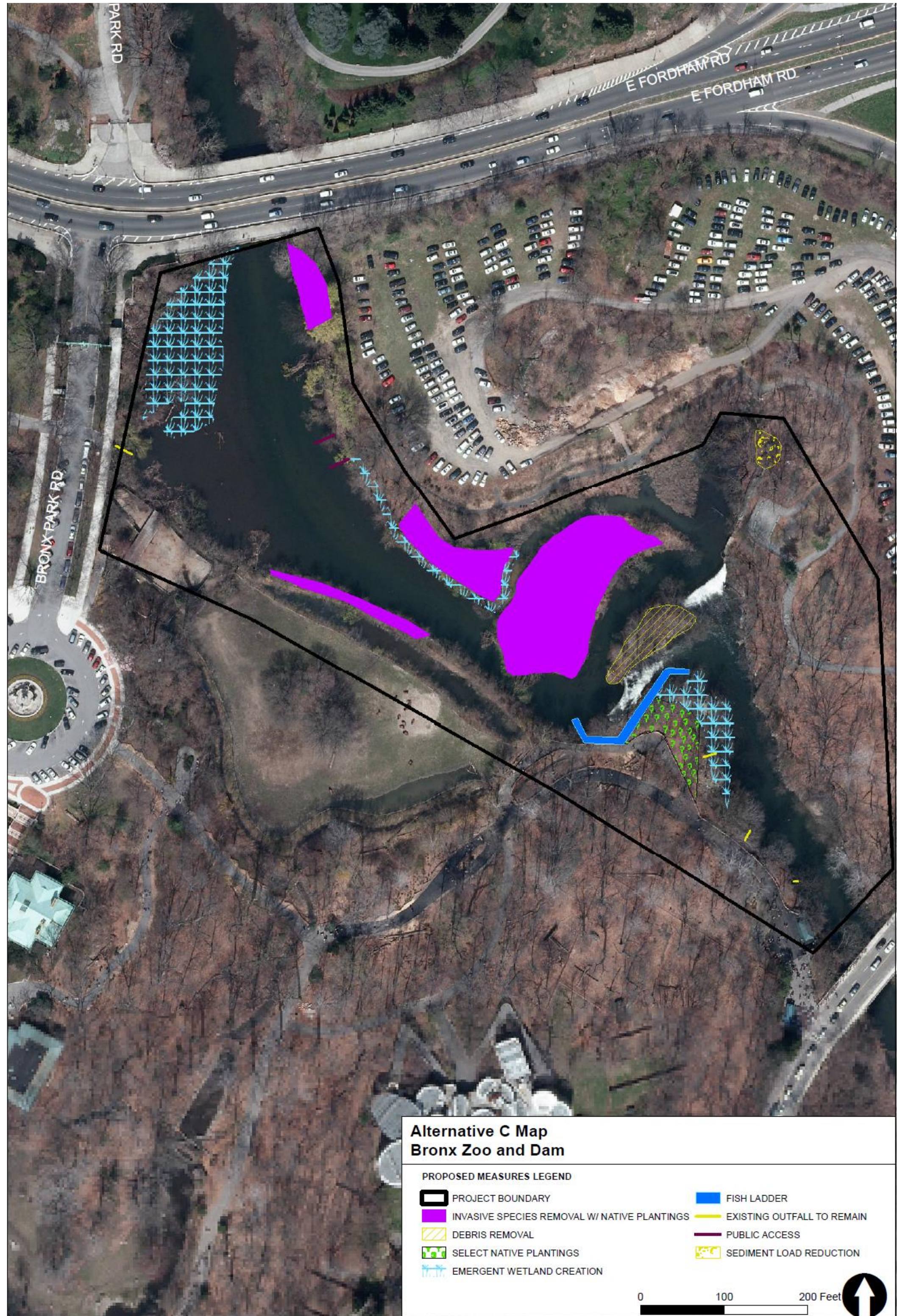
**PROJECT FIRST COST (Oct 2016): \$4,000,000**



**Bronx Zoo and Dam Tentatively Selected Plan Design:**

- Removal of invasive vegetation and native planting (0.56 ac) along both banks, on the upland island upstream of the dams, and additional location downstream of the dams.
- Installation of a fish ladder (0.04 ac) to link the excavated channel area upstream of the dams to the river channel below the dams.
- Creation of emergent wetlands (0.54 ac) along both banks upstream of the dams, and along the west bank downstream of the dams.
- Debris removal between the dams (0.09 ac).
- Installation of a sediment trap to reduce sediment loads reaching the river.
- Improved public access.

**PROJECT FIRST COST (Oct 2016): \$3,850,000**





# BRONX RIVER RESTORATION SITES

## Stone Mill Dam Tentatively Selected Plan Design:

- Installation of a fish ladder to link the slow-flowing pool upstream of the dam and the faster-flowing channel downstream of the dam.
- Placement of clay-pipe fish attractors at both the upstream and downstream ends of the fish ladder to function as refuge habitats for fish.
- Planting of native vegetation along the east bank of the river, abutting the fish ladder (0.03 ac).
- Removal of invasive vegetation from a small area along the west bank, immediately downstream of the dam, and replacement with native vegetation

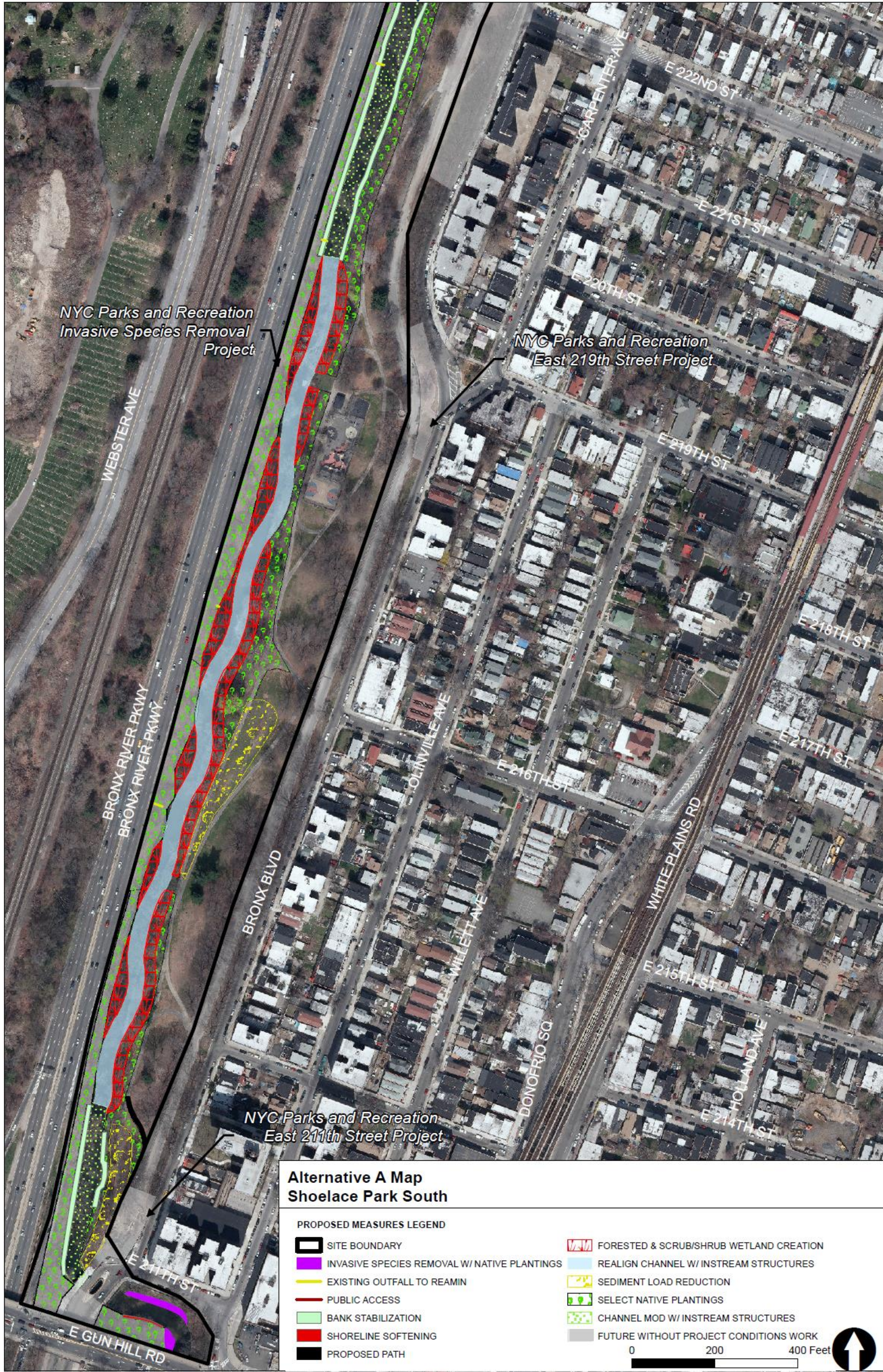
**PROJECT FIRST COST (Oct 2016): \$720,000**



## Shoelace Park (North and South) Tentatively Selected Plan Design:

- Restoration of Bronx River reach to pre-industrialization conditions: realigns channel with natural meanders and restores large tracts of forested wetlands along the banks.
- Entire channel modification with instream structures (6,680 linear ft.): restoration of natural pools, thalweg, riffle complexes, etc., resulting in a substantial increase of aquatic habitat value.
- Bank stabilization with environmental engineering techniques that provide vegetation coverage along the banks (11,620 linear ft., on both sides).
- Select native plantings (6.5 ac) would provide a wooded riparian corridor along the banks of the entire reach. The riparian woodlands and restored forested wetlands would provide habitat resources that are currently very limited in the Bronx urban environment and reduce nutrient inputs to the water.
- Sediment load reduction with bank stabilization and installation of rain gardens, bioretention basins, etc.
- Invasive removal and select native plantings.
- Public access to the river would be maintained.

**PROJECT FIRST COST (Oct 2016): \$25,010,000**





# BRONX RIVER RESTORATION SITES

## Muskrat Cove Tentatively Selected Plan Design:

- Invasive species removal with native plantings on the upland slopes and along both banks throughout the length of the site (~0.49 ac ).
- River bank stabilization between Nereid Avenue and the rail line bridge over the river, construction of vegetated cribwalls, softening using drilling with native plant materials (1,350 linear ft.).
- Removal of debris and log jams from the river (1.24 ac).
- Channel modification along two segments (1.24 ac), excavation and replacement of bed material, and construction of instream cross vanes and J-hooks.
- Installation of a sediment basin at an existing outfall to reduce sediment loads.

**PROJECT FIRST COST (2016): \$7,840,000**



## Bronxville Lake Tentatively Selected Plan Design:

- Channel bed restoration with excavation and bedding stone installation (~1.28 ac).
- Creation of emergent wetlands in narrow strips along the banks of the lake (0.59 ac).
- Creation of forested and scrub/shrub wetlands around sections of lake perimeter and in filled areas (2.90 ac).
- Modification of the existing rock weir at the southern end of the lake to facilitate fish passage.
- Removal invasive vegetation and replacement/addition of native species (1.40 ac).
- Sediment dredging in two small sections of the channel.
- Sediment load reduction with installation of vegetated swales, bioretention basins, and rain gardens at three locations (0.24 ac).

**PROJECT FIRST COST (Oct 2016): \$14,530,000**

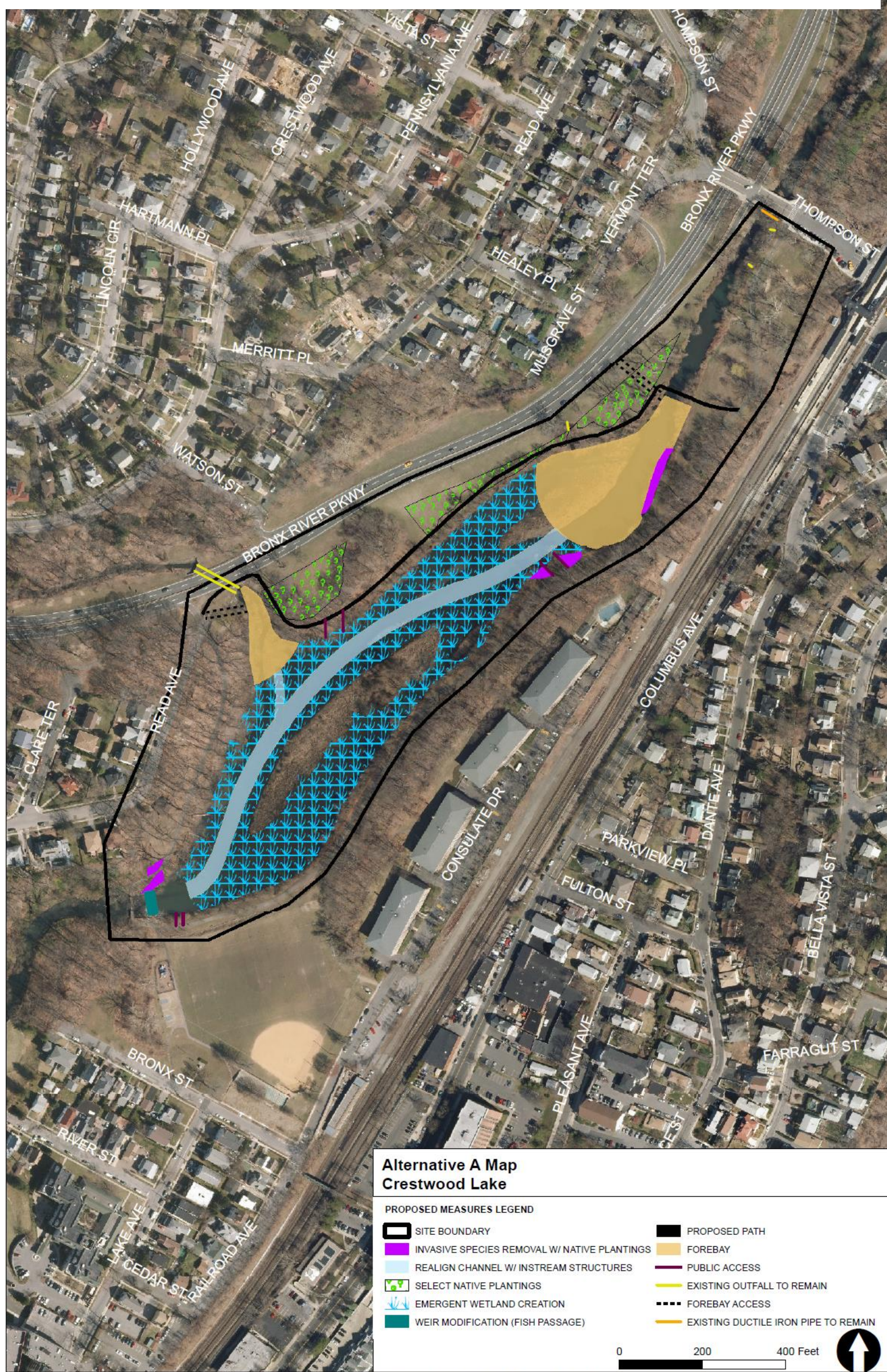


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## Crestwood Lake Tentatively Selected Plan Design:

- Native planting of upland trees and shrubs at three location in the western portion of the site along the Bronx River Parkway areas. Invasive species removal and native planting along the lake shore and at two other locations near the weir (1.3 ac).
- Channel realignment, replacement of bed material and construction of 11 instream cross vanes (1.2 ac).
- Creation of emergent wetlands (4.8 acres) between the channel and the lake banks.

**PROJECT FIRST COST (Oct 2016): \$27,610,000**



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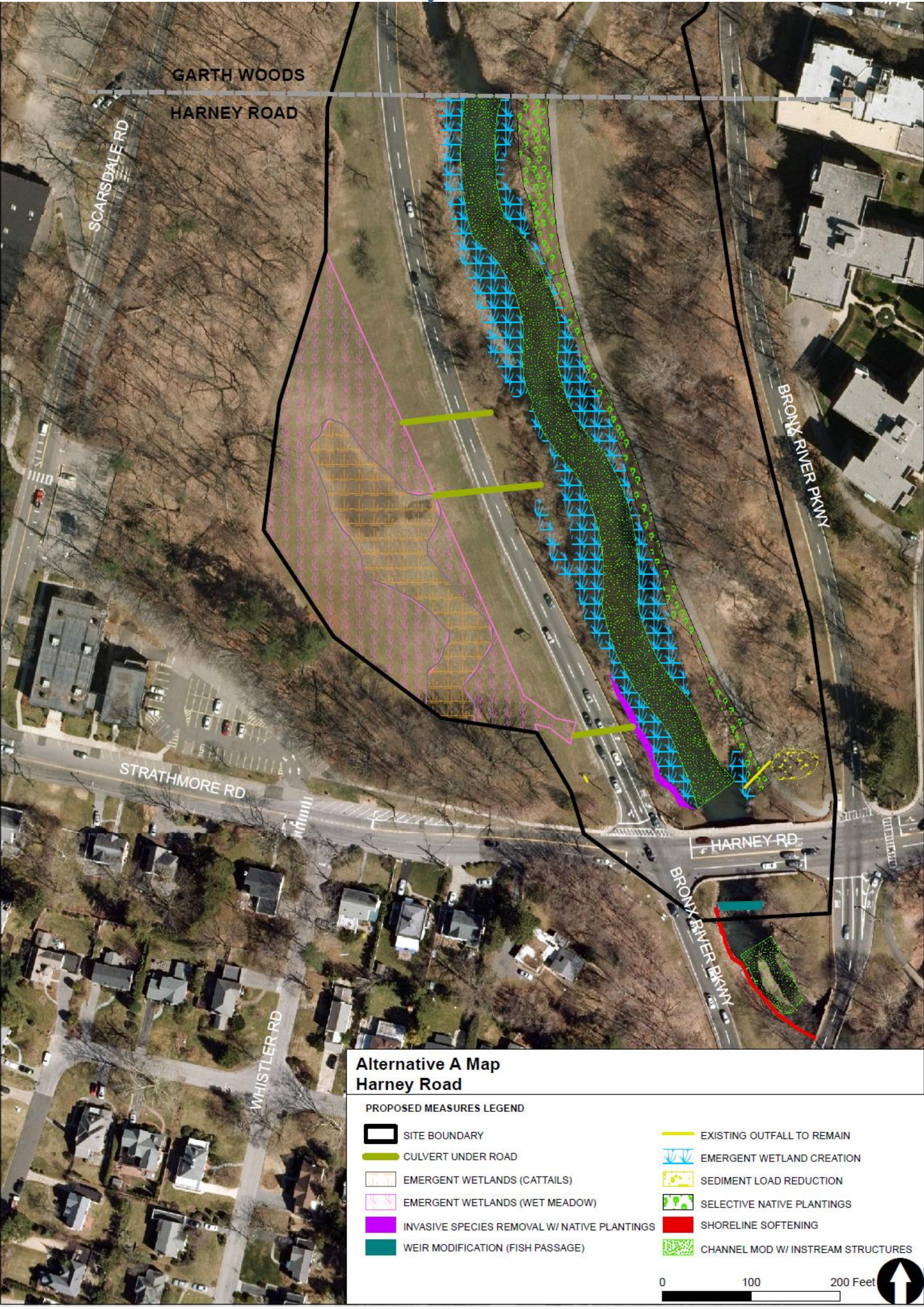
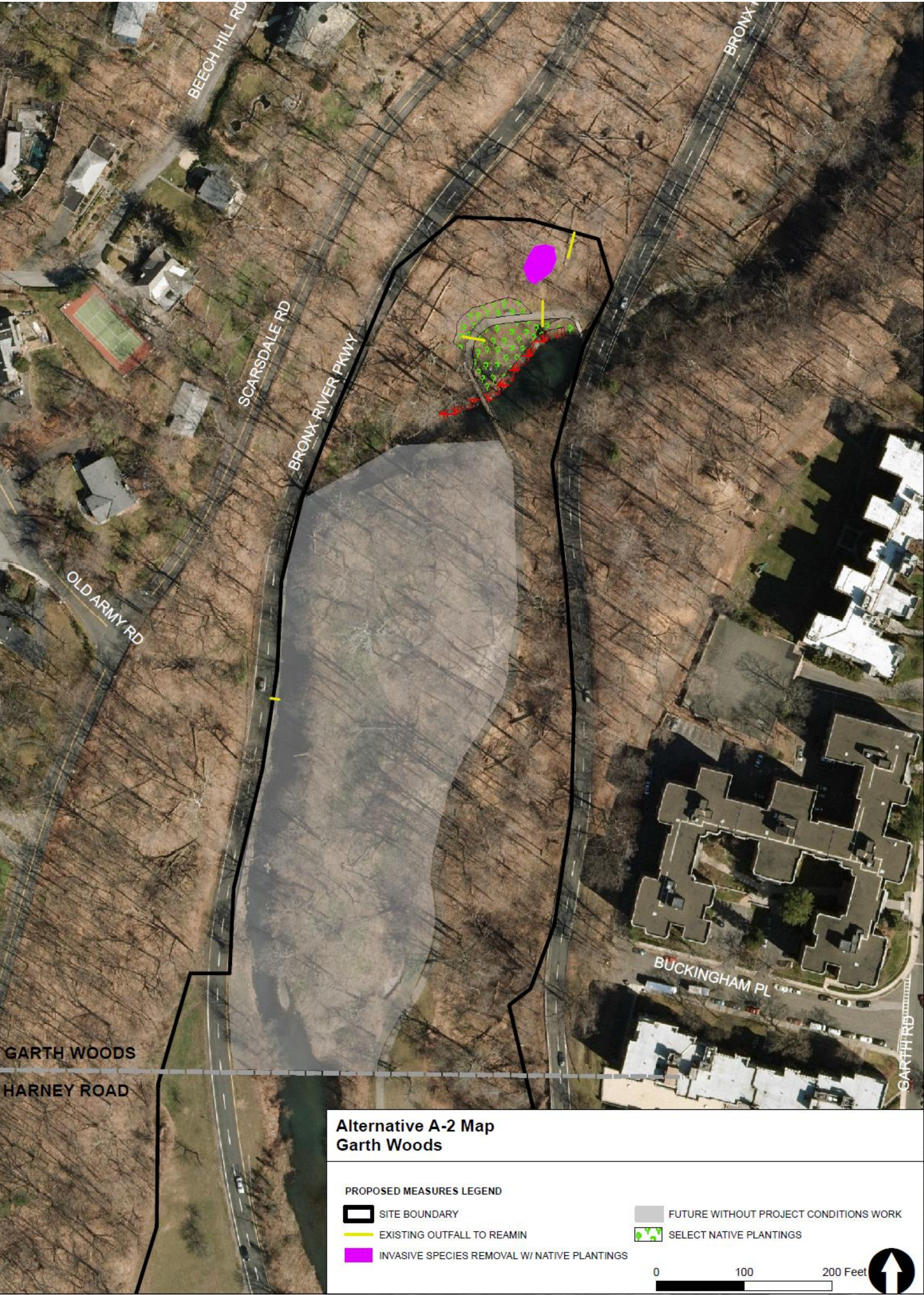


# BRONX RIVER RESTORATION SITES

## Garth Woods/Harney Road Tentatively Selected Plan Design:

- Modification of the existing weir at the southern end of the site to promote fish passage.
- Modification of 0.85 acres of the river channel upstream of Harney Road and a short off-site section of river channel downstream of the weir by replacing the bed material and construction of approximately 15 instream cross vanes.
- Creation of 0.79 acres of emergent wetlands along both shores of the river.
- Installation of native upland trees and shrubs between the created emergent wetlands on the east shore and the paved path.
- Construction of three culverts under the southbound lanes of Bronx River Parkway to transfer river water to emergent cattail-dominated wetlands created throughout most of the maintained lawn area on the west side.
- Removal of 0.03 acres of invasive Japanese knotweed from the west bank of the river, just north of Harney Road, and replacement with native, upland, or wetland shrubs and herbaceous vegetation.
- Installation of a raingarden/bioretention area at the upstream end of the buried storm drain.
- Softening a segment (190 linear feet) of the west bank of the river, down of the weir, by constructing a stacked rock wall with brush layers.
- Creation of forested and scrub/shrub wetlands along the west bank of the river at the upstream end of the site (0.03 ac ).
- Select native plantings in the adjacent lawn, on both sides of the paved path (0.14 ac).
- Removal of invasive species near the northern border of the site and replacement with native upland or wetland shrubs and herbaceous vegetation (0.02 ac).

**PROJECT FIRST COST (Oct 2016): \$7,200,000**

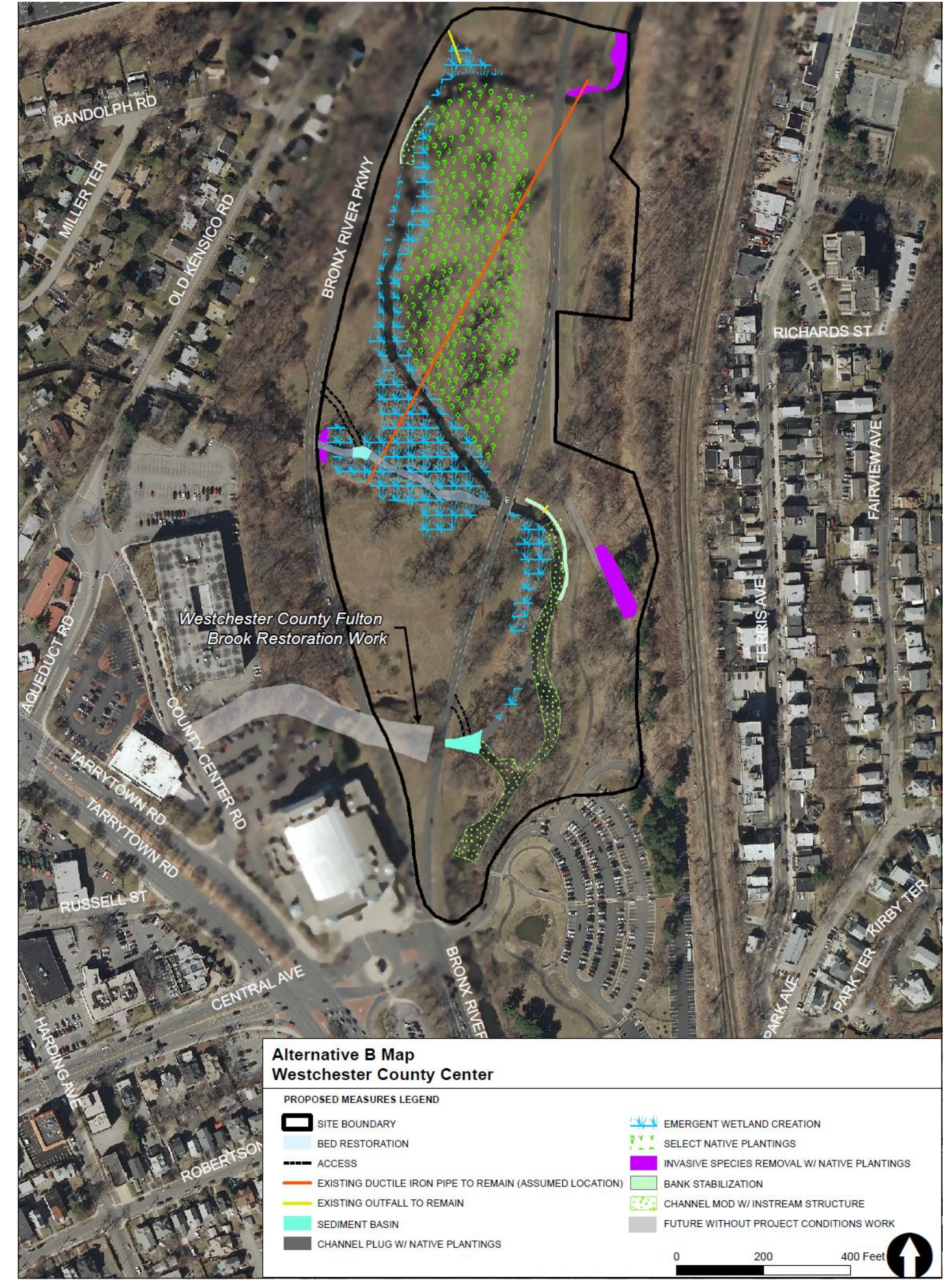


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## Westchester County Center Tentatively Selected Plan Design:

- Channel modification (0.83 ac), excavation and replacement of bed material, and installation of 10 in-stream cross vanes and six (6) J-hooks
- Creation of emergent wetlands along both shores of the Bronx River and Manhattan Brook.
- Construction of in-stream sediment basins in Manhattan Brook and at the Fulton Brook confluence with the Bronx River.
- Construction of channel plugs at the upstream and downstream ends of the channel on the west side of the island will shift the Fulton Brook confluence to the east.
- Native planting of upland trees and shrubs along the west side of the Bronx River Parkway northbound lanes (~3.7 ac).
- Removal of invasive vegetation at two locations along the eastern boundary of the site and Manhattan Brook. Native planting along channel (0.28 ac).
- Creation emergent wetlands along the east and west banks of the channel.
- Construction of a 500-foot-long paved path to divert pedestrian traffic away from emergent wetlands creation.
- Bank stabilization on the west bank with a tiered rock slope, and on the east bank with a stacked rock wall (285 linear ft.).

**PROJECT FIRST COST (Oct 2016): \$14,520,000**



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